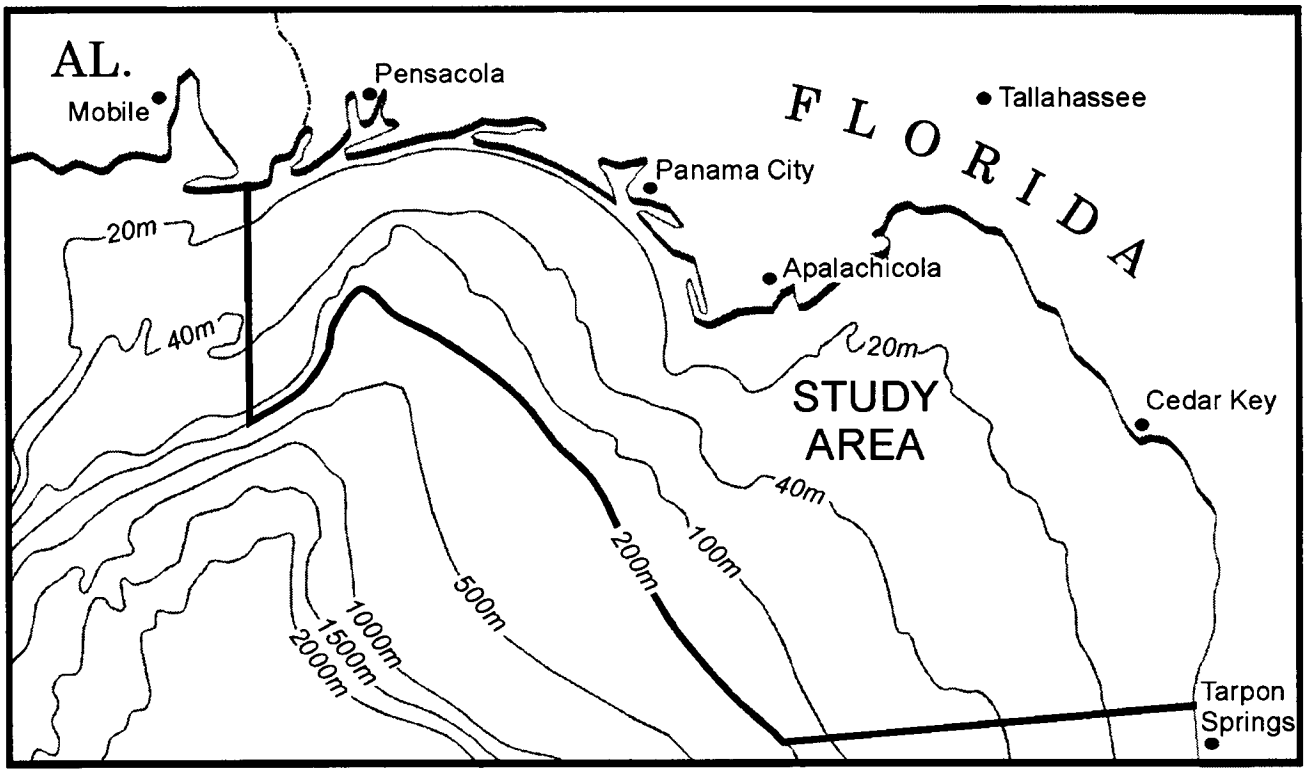
OCS Study
MMS 96-0015
NBS 96-01

Northeastern Gulf of Mexico Coastal and Marine Ecosystem Program: Data Search and Synthesis, Annotated Bibliography

Appendix A: Physical Oceanography



MMS U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Region

NBS U.S. Department of the Interior
National Biological Service
Eastern Region

OCS Study
MMS 96-0015
NBS 96-01

Northeastern Gulf of Mexico Coastal and Marine Ecosystem Program: Data Search and Synthesis, Annotated Bibliography

Appendix A: Physical Oceanography

Compiler

Science Applications International Corporation

September 1996

Prepared under NBS Contract
1445-CT0009-95-002
by
Science Applications International Corporation
Raleigh, North Carolina 27605

Published by

U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Region

U.S. Department of the Interior
National Biological Service
Eastern Region

DISCLAIMER

This report was prepared under contract between the National Biological Service (NBS) and Science Applications International Corporation. This report has been technically reviewed by the NBS and the Minerals Management Service (MMS), and has been approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the NBS or MMS, nor does mention of trade names or commercial products constitute endorsement or recommendation for use. It is, however, exempt from review and compliance with the MMS editorial standards.

REPORT AVAILABILITY

Extra copies of this report may be obtained from:

U.S. Department of the Interior
National Biological Service
Eastern Region
1700 Leetown Road
Kearneysville, WV 25430

Telephone: (304) 725-8461- x675

U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Region
Public Information Unit (MS 5034)
1201 Elmwood Park Boulevard
New Orleans, LA 70123-2394

Telephone: (504) 736-2519 or
1-(800)-200-GULF

CITATION

Suggested citation:

Science Applications International Corporation. 1996. Northeastern Gulf of Mexico Coastal and Marine Ecosystem Program: Data search and Synthesis, Annotated Bibliography. Physical Oceanography. OCS Study NBS 96-01 and MMS 96-0015. U.S. Dept. of the Interior, National Biological Service, Eastern Region, Kearneysville, WV and U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. 181 pp.

ACKNOWLEDGMENT

Thanks are extended to Paul Blankinship whose knowledge of Papyrus was essential to integrating the results of the many different electronic search formats. Those from outside this project who made our job more manageable by locating and sending the requested electronic copies of existing bibliographies include:

- Dr. Worth Nowlin and Maureen Reep, Texas A&M University
- Dr. Allan Clarke, Florida State University
- Steven Wolfe, Dept. of Environmental Regulation, State of Florida
- Carla Langley, MMS
- Michele Tetley, MMS
- Rosalie Shaffer, NOAA/NMFS

All the above are thanked for their efforts. A number of others went to considerable effort in locating and sending printed versions of existing bibliographies. They too are thanked.

Alphabetic Index

Adams, C., D. Swift and J. Coleman. 1987. Bottom currents and fluviomarine sedimentation on the Mississippi prodelta shelf: February-May 1984. J. Geophys. Res. 92(C13):14,595-14,609.

Adams, R.M. 1953. Oceanographic Survey of the Gulf of Mexico. Annual Report for Period June 15 1953 - June 30 1953. ONR Contract N7ONR-48702. Bureau of Ships NE120219-5.
Abstract. This report contains scattered temperature and salinity data along the Alabama and Florida coasts during the summer months.

Adams, R.M. and E.F. Sargent. 1951. Comparison of Summer and Winter Sea Temperatures Gulf of Mexico. Texas A&M University, Department of Oceanography. College Station, TEXAS. 8 pp.
Abstract. This report contains all of the then-available typical bathythermograph tracings for 1° quadrants of the Gulf of Mexico for both winter and summer. The contours of approximate mixed-layer depths in summer and winter are compared.

Alabama Coastal Area Board. 1980. Inventory of Alabama's coastal resources and uses. Alabama Coastal Area Board. Daphne, AL. 169 pp.
Abstract. Alabama's coastal counties are characterized using four categories: (1) biophysical setting; (2) socioeconomic setting; (3) coastal resource uses; and (4) natural resources of coastal Alabama. Emphasis is placed on present and potential development. This document is a compilation of numerous and varied sources valuable for regional and planning purposes.

Alabama Geological Survey. 1975. A bibliography of coastal Alabama with selected annotations. Bulletin 108. Alabama Geological Survey, University of Alabama. Tuscaloosa, AL.

Alexander, J.E., T.T. White, K.W. Turgeon and A.W. Blizzard. 1977. Baseline monitoring studies, Mississippi, Alabama, Florida, outer continental shelf, 1975-1976. Volume 1. Executive Summary. BLM/ST-78/30. Bureau of Land Management. Washington, D.C. 62 pp.
Abstract. Benchmark studies on the Eastern Gulf of Mexico Outer Continental Shelf were conducted seasonally to establish baseline information prior to extensive oil and gas development activity. No crude oil-like hydrocarbons were found in sediments, benthic organisms, zooplankton, suspended particulates nor dissolved phases on the Florida shelf. Moreover the abundance and diversity of organisms suggested that these organisms are living in an essentially pristine and natural ecological state, and show no evidence of stress owing to influx of pollutants.

Alexander, J.E., T.T. White, K.W. Turgeon and A.W. Blizzard. 1977. Baseline monitoring studies, Mississippi, Alabama, Florida, outer continental shelf, 1975-1976. Volume 2. Introduction and Methods. BLM/ST-78/31. Bureau of Land Management. Washington, D.C. 119 pp.
Abstract. This volume contains the introduction, purpose and objectives of the study, description of the study area, and detailed statements of methodology employed for each parameter measured. The geological parameters included: suspended sediment mineralogy, x-radiography, clay mineralogy, and standard sediment size analysis. Chemical parameters included: selected trace elements and hydrocarbons in sediments; biota; and suspended particulate matter. Principal biological analyses included

taxonomy of neuston, zooplankton, macroepifauna, macroinfauna, meiofauna, and microinfauna.

Alexander, J.E., T.T. White, K.W. Turgeon and A.W. Blizzard. 1977. Baseline monitoring studies, Mississippi, Alabama, Florida, outer continental shelf, 1975-1976. Volume 3. Results. BLM/ST-78/32. Bureau of Land Management. Washington, D.C. 484 pp.

Abstract. Benchmark studies on the Eastern Gulf of Mexico Outer Continental Shelf were conducted seasonally to establish baseline information prior to extensive oil and gas development activity. No crude oil-like hydrocarbons were found in sediments, benthic organisms, zooplankton, suspended particulates nor dissolved phases on the Florida shelf. Moreover the abundance and diversity of organisms suggested that these organisms are living in an essentially pristine and natural ecological state, and show no evidence of stress owing to influx of pollutants. Some evidence of hydrocarbon anomalies were found in samples from the Mississippi-Alabama shelf probably due to drainage from the Mississippi River.

Alexander, J.E., T.T. White, K.W. Turgeon and A.W. Blizzard. 1977. Baseline monitoring studies, Mississippi, Alabama, Florida, outer continental shelf, 1975-1976. Volume 4. Discussion. BLM/ST-78/33. Bureau of Land Management. Washington, D.C. 222 pp.

Abstract. Benchmark studies on the Eastern Gulf of Mexico OCS were conducted seasonally to establish baseline information prior to extensive oil and gas development activity. No crude oil-like hydrocarbons were found in sediments, benthic organisms, zooplankton, suspended particulates nor dissolved phases on the Florida shelf. Moreover the abundance and diversity of organisms suggested that these organisms are living in an essentially pristine and natural ecological state, and show no evidence of stress owing to influx of pollutants. Some evidence of hydrocarbon anomalies were found in samples from the Mississippi- Alabama shelf probably due to drainage from the Mississippi River. A study of tissue pathology revealed only parasites in otherwise normal benthic organisms. Major features affecting the study area were the Mississippi River, the Loop Current and Hurricane Eloise. Trace metal (Cd, Cr, Cu, Fe, Ni, Pb and V) concentrations in Eastern Gulf samples were at levels expected for non-polluted areas.

Allen, R.H. and E.L. Spooner. 1968. Annotated bibliography of BEB and CERC Publications. U.S. Army Corps of Engr., CERC. Misc. Paper 1-68:141.

Allen, R.L. and R.E. Turner. 1977. Mississippi Delta Bight studies. Numbers 1-5. Center for Wetland Resources. Louisiana State University. Baton Rouge, LA.

Abstract. These reports present temperature vs. depth, salinity vs. depth, and density (sigma T) vs. depth for stations occupied in waters of the Louisiana, Mississippi, and Alabama continental shelf. Data are presented graphically by individual stations. The five data reports cover separate collection periods: March 11-27, 1975; July 15-24, 1975; October 28-November 7, 1975; January 13-February 5, 1976; and April 27-May 9, 1977.

American Meteorological Society. 1970. Cooperative Investigation of the Caribbean and Adjacent Regions (CICAR). Bibliography on Meteorology,

Climatology, and Physical/Chemical Oceanography. Volume I. American Meteorological Society. Washington, D.C. 391 pp.

Abstract. The abstracted bibliography has been compiled from the files of the Meteorological and Geoastrophysical Abstracts Office of the American Meteorological Society (AMS) and from files of Government libraries in the Washington, D.C., area. Its purpose is to provide the participants of CICAR with a reasonably comprehensive and timely review of the published literature in physical/chemical oceanography and in meteorology/climatology concerned with the Caribbean Sea, Gulf of Mexico, Greater and Lesser Antilles Regions, and the adjacent coastal areas of North, Central, and South America. Articles dealing with weather phenomena outside of this geographical region, but influencing the atmosphere within the area, have been included occasionally. Similarly, references to oceanographic region, but influencing the atmosphere within the area, have been included occasionally. Similarly, references to oceanographic cruise data taken outside of but close to this area were also sometimes included.

Anctil, F., M.A. Donelan, G.Z. Forristall, K.E. Steele and Y. Ouellet. 1993. Deep-water field evaluation of the NDBC-SWADE 3-m discus directional buoy. J. Atmos. Ocean. Technol. 10(1):97-112.

Abstract. Presents the results of an experiment designed to assess the directional spectrum resolution qualities of the pitch-roll-heave National Data Buoy Center-Surface Wave Dynamics Experiment (NDBC-SWADE) 3-m discus wave directional buoy in deep-water conditions. Wave frequency spectra and wave directional spectra measured by the buoy, moored in about 415-m water depth, are compared to similar measurements obtained from a wave staff and a biaxial current meter fixed to the nearby Bullwinkle platform (Gulf of Mexico). Both buoy and platform equipment operated simultaneously from 0000 UTC 29 May 1989 to 0100 UTC 24 June 1989. The analysis revealed that the buoy surface displacement energy spectra (estimated from heave acceleration) agree well with the platform spectra.

Anon. 1973. Supplement to Environmental Statement (MAFLA) for Oil and Gas Lease Sale 32. MMS/GM/ES-74/001. Minerals Management Service. Metairie. 33 pp.

Abstract. The Environmental Impact Statement is a description of the environmental aspects and impacts of oil and gas activities resulting from the lease sale or the states bordering the Gulf of Mexico. It provides a description of the area, affected environment, and environmental consequences; it discusses the proposed action, issues and areas of concern, and the major differences of holding the lease sale.

Anon. 1984. Final Environmental Impact Statement for Proposed Oil and Gas Lease Sales 94, 92, and 102. Gulf of Mexico OCS Region. MMS/GM/ES-84/003; OCS/EIS/MMS-84/0057. Minerals Management Service. Metairie, LA. 812 pp.

Abstract. This EIS is a description of the environmental aspects and impacts of oil and gas activities resulting from these lease sales or the states bordering the Gulf of Mexico. It provides a description of the area, affected environment, and environmental consequences; it discusses the proposed actions, issues and areas of concern, and the major differences of holding these lease sales.

Anon. 1987. GLORIA-mapped atlas released for Gulf of Mexico, Caribbean. Sea Technology. 28:54.

Anon. 1988. Draft Environmental Impact Statement for Gulf of Mexico Sales 118 and 122: Central and Western Planning Areas. MMS/GM-0003; OCS/EIS/EA/MMS-88/0003. Minerals Management Service. Metairie, LA. 415 pp.
Abstract. The Environmental Impact Statement (EIS) is a description of the environmental aspects and impacts of oil and gas activities resulting from this lease sale or the states bordering the Gulf of Mexico. It provides a description of the area, affected environment, and environmental consequences; it discusses the proposed action, issues and areas of concern, and the major differences of holding this lease sale.

Anon. 1988. EPA launches program for the Gulf of Mexico. Enr. 221:25-26.

Anon. 1991. Portraits of Our Coastal Waters. Supplement to the National Water Quality Inventory. Report from the EPA Regions. EPA503291004. Environmental Protection Agency. Washington, DC. 35 pp.
Abstract. Contents: Pathogen Contamination in Great Bay, New Hampshire; Water Quality Problems in the Middle Atlantic Bight; Red Tide in the Eastern Gulf of Mexico; Oxygen Depleted Coastal and Estuarine Waters in Louisiana and Texas; Sediment Deficit and Saltwater Intrusion in Barataria Basin, Louisiana; Toxic Contamination in San Diego Bay, California; Salmon Mortality Problems in Port Townsend Bay, Washington; Multimedia Pollutants Effect Green Bay/Fox River, Wisconsin.

Anon. 1993. The Proceedings of a Workshop on Future Research, Monitoring and Modeling of Coastal Interactions in the Gulf of Mexico. Future Research, Monitoring and Modeling of Coastal Interactions in the Northern Gulf of Mexico; February 1993. NOAA-AMOL. Miami, Florida. 54 pp.

Anon. UNKNOWN YEAR. Sanitary survey on West Fowl River estuary - Mobile, Alabama. Gulf Coast Technical Services Unit.
Abstract. This study was conducted as a sanitary and biological survey of shellfish in west fowl river estuary. Hydrographic data were collected in conjunction with biological sampling.

April, G.C. and D.O. Hill. 1974. Water Resources Planning for Rivers Draining into Mobile Bay, a Hydrodynamic and Salinity Model for Mobile Bay.(Ber Report No, 169-112.) University of Alabama, College of Engineering. Tuscaloosa, Alabama. 304 pp.

April, G.C. and D.O. Hill. 1974. Water Resources Planning for Rivers Draining into Mobile Bay Part I: Hydrodynamic and Salinity Models.(Ber Report No, 168-112.) University of Alabama, College of Engineering. Tuscaloosa, Alabama. 69 pp.

April, G.C. and H.A. Liu. 1975. Water Resources Planning for Rivers Draining into Mobile Bay, Part 2, Non-Conservative Species Transport Models.(Ber Report No. 185-112.) University of Alabama, College of Engineering. Tuscaloosa, Alabama. 185 pp.

April, G.C. and S. Ng. 1976. Water Resources Planning for Rivers Draining into Mobile Bay, a Users Manual for the Two-Dimensional Hydrodynamic

Model.(BER Report No, 203-112.) University of Alabama, College of Engineering. Tuscaloosa, Alabama. 97 pp.

April, G.C. and D.C. Raney. 1979. Mathematical modeling of coastal waters: a tool for managers and researchers. pp. 95-107. *In* Loyacano, H.A. and J.P. Smith, eds. Symposium On the Natural Resources the Mobile Estuary, Alabama. Alabama Coastal Area Board, Daphne, Alabama.

April, G.C., D.C. Raney, L. Chern, J.P. Jarrell, D.J. Lou and Y.C. Wu. 1980. Hydrodynamics of Mobile Bay and Mississippi Sound. Interim Rpt. 00004. Mississippi-Alabama Sea Grant Consortium. Ocean Springs, MS. 98 pp.

Abstract. This report presents the results of Phase I in a three-phase study on the hydrodynamics of Mobile Bay and Mississippi Sound. Using the results of a 7-year study on the hydrodynamics of Mobile Bay as a basis, the authors extend the scope of their mathematical model to include the adjacent Mississippi Sound. Due to the lack of prototype data for model calibration and verification, model applications have basically been limited to establishing trends in the system, and improving graphical output techniques for presenting results using finite-difference and finite-element numerical algorithm techniques. A mathematical model is generated to describe interplay between solid, fluid and physical elements of the system. The models were run for several tidal cycles and produced results which appear reasonable and reflect field observations. Additional data collected over Phases II and III will contribute to the verification and calibration process.

April, G.C., D.C. Raney, L.I.H. Chern, J.P. Jarrell, Der-J. Lou and Y.G.-C. Wu. 1980. Hydrodynamics of Mobile Bay and Mississippi Sound. MASGP-79-020. Mississippi-Alabama Sea Grant Consortium. Ocean Springs, Mississippi.

April, G.C., D.C. Raney and J.P. Jarrell. 1980. Hydrodynamics of Mobile Bay and Mississippi Sound - Pass Exchange Study. MASGP-80-023. Mississippi-Alabama Sea Grant Consortium. Ocean Springs, Mississippi.

Arango, H.G. 1990. A generalized reduced-gravity ocean model: An application for the short-term evolution and prediction of surface mesoscale fields (reduced gravity). Ph.D. Dissertation. Texas A&M University, College Station, TX. 172 pp.

Abstract. Discussed herein is a single mode, equivalent barotropic ocean model with realistic vertical structure for currents that is intended for simulating the temporal evolution of near-surface flow patterns within and near the continental slope boundaries of ocean basins. The model is based on the gravest vertical structure function E for current determined by the global, leveled-state density distribution. The eigenvalue problem employs a rigid lid condition at the sea surface and requires E = 0 (a vanishing current) at the sea bed for each local depth h. The gravest mode has monotonic E and an associated eigencelerity that is typical of a first baroclinic mode. Both the structure function and the celerity (hence the Rossby deformation radius) depend on the local depth h. E, based on realistic leveled-state density stratification, closely resembles the dominant first empirical mode commonly found from observed current structure at mid-latitude. The nonlinear governing equations (admitting both gravity and Rossby waves) are developed using an energy-conserving, Galerkin projection of the primitive equations of motion onto

the adopted vertical structure, taking into account the dependence on h. The resulting governing equations involve two important depth-dependent parameters: these include the celerity and a Flierl-type advection parameter. A sensitivity study is carried out in the Gulf of Mexico to demonstrate the model capabilities in simulating eddy shedding via barotropic instability of an intense current system and topographic influences on mesoscale features of the flow field. Further application of the model to the California Current System, in which the model is initialized using satellite-derived surface flow estimates, gives an overall positional rms of less than 10 km when the model simulated drifters are compared with the surface buoys deployed during CODE-1 experiment, July 8-14, 1981.

Armstrong, R.S. 1966. The subtropical underwater of the eastern Gulf of Mexico. U.S. Department of the Interior, Fish and Wildlife Service Bulletin. 784:46-48.

Armstrong, R.S. 1967. The subtropical underwater of the eastern Gulf of Mexico. Commer. Fish. Rev. 29(3):46-48.

Abstract. Twenty hydrographic stations were occupied over the continental slope off the Florida Gulf coast between June 30 and July 13, 1966 by the R.V. GERONIMO. One month later the area was sampled by the R.V. ALAMINOS. Comparison of these two sets of data shows that separate gyres moved 83-110 km to the southwest and south in the one month period. Possible causes for the change in position are discussed.

Atwood, D.K. 1981. Proceedings of a Symposium on Environmental Research Needs in the Gulf of Mexico (GOMEX), September 30 - October 5, 1979, Key Biscayne, FL, 4 vols. National Oceanic and Atmospheric Administration (NOAA/ERL), Atlantic Oceanographic and Meterological Laboratories. Miami, FL.

Abstract. Proceedings include results and discussions recorded at a meeting of a group of U.S. and Mexican economists, marine scientists, and environmental managers regarding needs for marine-related environmental research in the Gulf of Mexico during the next decade. The workshop was divided into three panel groups entitled: natural setting, anthropogenic input and impacts, and environmental management and public concern. Reports from each of these panels are included in these proceedings as are the panel participants.

Auer, S. 1980. New daily oceanographic analyses. Mar. Weather Log. 24(60):412-414.

Abstract. The numerous inlets connecting Florida's inner waters to the Atlantic Ocean and the Gulf of Mexico are important from consideration of recreational and commercial vessel traffic. In addition, inlets act as flushing agents, providing renewal of bay waters by exchange with outer continental shelf waters. The complexities of the hydraulic and sediment transport mechanics in the vicinity of inlets present a formidable challenge to engineers and scientists. This report on Sikes Cut is one in a 'Glossary of Inlets' series whose purpose is to provide for each inlet a summary of the more significant available information and to list known documentation. Also discusses the availability of oceanographic and isotherm analyses using satellites and SST for the northwest Atlantic, Gulf of Mexico, and the northeast Pacific.

Auer, S.J. 1983. Gulf Stream System Landward Surface Edge Statistics. NOAA/TM/NWS/NMC-67; NOAA-83101201. NOAA, National Environmental Satellite, Data, and Information Service. Washington, DC. 28 pp.

Abstract. This paper represents a statistical evaluation of the mean position, standard deviation, and maximum northward and southward positions of the Gulf Stream System landward surface edge. The surface edge is determined for each 0.5° longitudinal transect from 91 - 44°W measuring the course of the Gulf Stream System from the Yucatan Strait to the Grand Banks. These statistics are derived from the initial year of the daily Oceanographic Analysis, which contains synoptic frontal locations of the Gulf Stream System. The Gulf Stream System can be subdivided into two major regions: The Loop Current, located in the Gulf of Mexico, and the Gulf Stream, located in the Northwest Atlantic Ocean. The Gulf Stream System's edge is named a 'landward surface edge' in this paper to signify that it is the edge nearest to the North American continental landmass.

Auer, S. 1983. A reversal of the normal Loop Current boundary pattern. Oceanogr. Mon. Summ. 3(1):3.

Abstract. Infrared satellite imagery traced warm water to define the Loop Current's (LC) location. In August 1982 satellite imagery showed the LC to be slightly cooler than adjacent Gulf of Mexico waters and it is suggested that this condition may be an annual event. Oceanographic analysts working with infrared satellite imagery use the warmest water (which appears as darker shade of grey on the satellite image) as a tracer for defining the LC's location. Thus, the LC is visualized as containing warmer water than the adjacent Gulf of Mexico waters. However, during the first half of August 1982, this relationship was apparently reversed as satellite imagery showed the Loop to be slightly cooler (1 degree C or less) at the surface. In addition, the Robinson-Bauer climatology suggests that this condition may be an annual event.

Auer, S. and J.W. Clark. 1982. East Coast ocean features September 1982. Oceanogr. Mon. Summ. 2(9):18-19.

Abstract. The end of this month's positions of the Gulf Stream System and its associated eddies are shown for the NW Atlantic and the Gulf of Mexico. The Gulf Stream and Loop Current boundaries are located by prominent sea surface temperatures gradients or by the 15 degree C isotherm at 200m. The Loop Current in the Gulf of Mexico, last observed by satellite infrared imagery on June 9, is partially discernible on September 27 imagery. On the imagery, the Loop appeared slightly cooler than the surrounding surface Gulf water. Prominent Gulf Stream North Wall features in the end-of-September analysis are the two meanders near 59°W and 65°W. Two anticyclonic eddies formed and two were absorbed. Eddy 23 formed around September 1 centered near 41°N, 59°30'W from the pinching-off of a Gulf Stream meander and has since translated 70 km NW.

Austin, G.B. 1954. On the circulation and tidal flushing of Mobile Bay, Alabama. Technical Report No. 12. OCS No. 65. Texas A&M University, Department of Oceanography. College Station, TX. 22 pp.

Abstract. A description of the results gleaned from a hydrographic survey of Mobile Bay, Alabama is presented. A brief oceanographic description of this bay is made also, from the standpoint of the five phases of Oceanography as defined by D.F. Leipper (1950). The presentation and

discussion of the distribution of temperature, chlorinity and fresh or river water, and a description of the currents observed constitute the greater portion of this paper. The author evaluates two ideas or methods of estuarine flushing determination offered by B.H. Ketchum (1950) and H. Stommel (1951) as they apply to Mobile Bay. The observed distributions and variations in chlorinity as affected by tidal changes were used for a control in the above investigation. A flushing time for this estuary for the period of the survey (October, 1952) was found to be fifty days.

Austin, G.B. 1955. Hydrographic survey of Santa Rosa Sound, Alabama. Project 24. Texas A&M Research Foundation Tech. Report. College Station, TX.
Abstract. This report presents the results of a 2-week survey (in May-June, 1950) of the tidal currents around the Bureau of Commercial Fisheries Lab near Pensacola Bay.

Austin, G.B. et al. 1958. Observations from an oceanographic survey conducted off Panama City, Florida, 8 April 1958, on the USS VIGOR. Unpublished. U.S. Navy Mine Defense Lab. Panama City, FL.

Austin, G.B. 1965. Some recent oceanographic surveys of the Gulf of Mexico. AGU Transactions. 36(5):885-892.
Abstract. An apparently semi-permanent, large scale, anti-cyclonic eddy repeatedly observed on four earlier oceanographic surveys was investigated in greater detail during Cruise 54-10 of the A.A. JAKKULA, August-September, 1954. Evidence from the five surveys made in the region of the eddy indicates that the eddy is an integral part of the Gulf Stream system in the Gulf of Mexico. From the single ship survey of Cruise 54-10 an attempt was made (1) to locate and define the eddy and (2) to establish whether or not it was a temporary or permanent feature of the Gulf of Mexico and the Yucatan Current or to determine whether or not it changed physically in space and time or both.

Austin, G.B. and R.H. Payne. 1962. Results of a field study of the tide line mechanism. Research and Development Report 165. U.S. Navy Mine Defense Laboratory. Panama City, FL. 34 pp.
Abstract. An investigation into the properties of this interface between St. Andrew Bay waters and the Gulf.

Austin, G.B. and W.H. Tolbert. 1958. On the results of an oceanographic survey conducted in waters adjacent to Panama City, Florida, May - June 1958. Unpublished. U.S. Navy Mine Defense Lab. Panama City, FL.

Austin, G.B., Jr. 1955. Some recent oceanographic surveys of the Gulf of Mexico. Transactions, AGU (EOS). 36(5):885-892.

Austin, H.M. 1971. The characteristics and relationships between the calculated geostrophic current component and selected indicator organisms in the Gulf of Mexico loop current system. Ph.D. Dissertation. Florida State University, Oceanography Department, Tallahassee, FL. 369 pp.

Austin, R.W. 1980. Gulf of Mexico ocean-color surface-truth measurements. J. Bound. Layer Meteor. 18(1):269-286.

Baer, L., L.C. Adamo and S.I. Adelfang. 1968. Experiments in oceanic forecasting for the advective region by numerical modeling. Part 2: Gulf of Mexico. J. Geophys. Res. 73(16):5091-5104.

Balsillie, J.H. 1975. Analysis and interpretation of littoral environment observation (LEO) and profile data along the western panhandle coast of Florida. U.S. Army Corps of Engineers, Technical Memorandum. 49:104.
Abstract. A 100-mile segment of the Florida panhandle coast was studied, from St. Andrew Bay to Pensacola Bay. Includes information on beach profiles, longshore transport and currents, winds and storms.

Baltz, A.J. 1978. A Climatology of Monthly Sea Surface Temperatures for the Gulf of Mexico. WSAFETACPR-78-0001. USAF Env. Tech. App. Center. Scott AFB, IL. 15 pp.
Abstract. This report presents monthly mean sea surface temperatures for the Gulf of Mexico in one degree quadrangles. It also includes a short discussion of the temperature data and the ocean currents in the Gulf of Mexico.

Banks, T., A.E. Maristany, J.R. Wagner and M. Flemming. 1983. Inventory of water resources data and literature for the Apalachicola River basin, Florida. Northwest Fla. Water Manage. Dist., Havana, Fla. Water Resour. Spec. Rep. 83-7:207.

Barbieri, R.W., C.R. McClain and D.L. Endres. 1983. Methodology for Interpretation of SST Retrievals Using the AVHRR Split Window Algorithm. NASA Tech. Memo. NASA-TM-85100:57.
Abstract. Intercomparisons of sea surface temperature (SST) products derived from the operational NOAA-7 AVHRR-II algorithm and *In situ* observations are made. The 1982 data sets consist of ship survey data during the winter from the Mid-Atlantic Bight (MAB), ship and buoy measurements during April and September in the Gulf of Mexico and shipboard observations during April off the N.W. Spanish coast. The analyses included single pixel comparisons and the warmest pixel technique for 2 x 2 pixel and 10 x 10 pixel areas. The reason for using multi-pixel areas was for avoiding cloud contaminated pixels in the vicinity of the field measurements. Care must be taken when applying the warmest pixel technique near oceanic fronts. The Gulf of Mexico results clearly indicate a persistent degradation in algorithm accuracy due to El Chichon aerosols. The MAB and Spanish data sets indicate that very accurate estimates can be achieved if care is taken to avoid clouds and oceanic fronts.

Barrett, B.B., J.W. Tarver, W.R. Latapie, J.F. Polland, W.B. Mock, G.B. Adkins, W.J. Gaidey, C.J. White and J.S. Mathis. 1971. Cooperative Gulf of Mexico estuarine inventory and study, Louisiana. Phase II, hydrology. pp. 9-130. *In* Cooperative Gulf of Mexico Estuarine Inventory And Study, Louisiana. Phase II, Hydrography and Phase III, Sedimentology. Louisiana Wildlife and Fisheries Commission, New Orleans, LA.
Abstract. Louisiana's estuaries from Sabine Lake to the Pearl River were sampled at 109 stations during 1968 and 1969. Salinity and water temperature were measured at all stations; dissolved oxygen, turbidity, and the nutrients nitrate, nitrite, inorganic phosphate, and total phosphorus were sampled at 82 stations. Tide, barometric pressure,

rainfall and wind speed and direction were measured at one station. Coastwind data on air temperature, precipitation, and stages and discharges of the principal rivers were also collected. Salinities were highest during the fall and lowest during the peak river discharge while water temperatures were seasonal, closely following air temperatures. Dissolved oxygen concentrations were highest during periods of low water temperature and salinity. Turbidities generally fluctuated directly with river discharge and wind speed. The seasonal distributions of nutrients were generally irregular; however, nitrate values were highest at stations near the mouths of the Atchafalaya and Mississippi rivers during periods of peak discharge. In general, Louisiana's estuaries and near offshore waters are low in salinity and high in nutrient concentrations as compared with other states bordering the northern Gulf of Mexico. These characteristics are due primarily to Louisiana's high rainfall and the large volume of river water which makes its way through rich alluvial soils to the Gulf of Mexico. The major contributors of nutrients to the estuaries are the Mississippi and Atchafalaya rivers. These rivers are also responsible for major salt water dilutions within the coastal area and in the near offshore waters.

Barry A. Vittor and Associates. 1985. Tuscaloosa Trend regional data search and synthesis study. Volume 1, Synthesis Report. OCS Report. Minerals Management Service. 506 pp.

Abstract. The report identifies and summarizes important information pertaining to the environmental and socioeconomic characteristics of this area of the Gulf of Mexico. The geographic boundaries of the Trend area are defined by South Pass on the west and by a line from the head of the DeSoto Canyon and the boundary between Alabama and Florida on the east. Information on the natural resources of the Tuscaloosa Trend OCS (south-eastern Louisiana-Mississippi, and Alabama), from coastal marshes to a depth of 200 m, were collected, annotated, and synthesized.

Basta, D.J., M.A. Warren, T.R. Goodspeed, C.M. Blackwell and T.J. Culliton. 1990. Estuaries of the United States: Vital Statistics of a National Resource Base. Special Rpt. National Ocean Service. Rockville, MD. 85 pp.

Abstract. The report describes briefly the Nation's estuarine resource base. It updates information presented in several previous NOAA reports and atlases developed through its National Estuarine Inventory (NEI) Program and provides the environmental characteristics of 102 U.S. estuaries. Each estuary is unique, described by its own set of vital statistics that define its natural processes and the level and impact of human uses. With this information, a factual basis exists for comparing estuaries, placing them in a regional or national context, assessing their condition, and approaching management of the Nation's estuaries on a comprehensive rather than a case-by-case basis.

Bay Environmental Study Team. 1993. Choosing a vision for St. Andrew Bay: a citizen's guide. Bay Environmental Study Team. Panama City, FL. 32 pp.

Abstract. This handbook was prepared for a citizen's forum on the future of St. Andrew Bay and the environmental choices that are available. Includes basic information on the hydrography, biology and ecology of the bay, as well as some economic information.

BCM Converse. 1987. St. Andrew Bay system environmental database. BCM Converse. Panama City, FL. Various pp.
Abstract. A collection of reports on the water quality, hydrography, sediments and biota of St. Andrew Bay.

Bea, R.G. 1983. Wave-height attenuation modeled by computer program for shallow water in Gulf. Oil and Gas Journal. 81:114-118.

Bea, R.G., N.W. Lai, A.W. Niedoroda and G.H. Moore. 1983. Gulf of Mexico shallow-water wave heights and forces. pp. 20. *In* Proceedings, Offshore Technology Conference.
Abstract. Outlines study whose purpose was to develop a procedure for establishing environmental design conditions for platforms in relatively shallow water in the Gulf of Mexico.

Behringer, D.W., R.L. Molinari and J.F. Festa. 1977. The variability of anticyclonic current patterns in the Gulf of Mexico. J. Geophys. Res. 82(B4):5469-5476.
Abstract. A recent 2-fold increase in the number of temperature observations available in the Gulf of Mexico prompted a reappraisal of several ideas regarding the temporal variability of the Loop Current in the eastern gulf and the anticyclonic gyre in the western Gulf. The analysis includes both synoptic data drawn from 47 cruises in the eastern Gulf and monthly maps of temperature at 200m prepared from the observations over the entire Gulf. On average the penetration of the Loop Current into the Gulf increases in winter and spring, reaching a maximum in early summer, at which time a large anticyclonic eddy probably separates from the Loop. There are substantial deviations from this average sequence of events; during the past 12 years the period between eddy separations has been as short as 8 mo and as long as 17 mo. The data coverage of the western Gulf is sparse, but there is evidence for the year-round persistence of the anticyclonic gyre and some indications that the gyre may be strongest in summer and winter.

Bell, A. 1985. East Coast ocean features (Sep. 1985). Oceanogr. Mon. Summ. 5(9):18-19.
Abstract. The end of this month's positions of the Gulf Stream System and its associated eddies are shown for the NW Atlantic and the Gulf of Mexico. Due to the continuation of seasonal decrease in SSTs in the Gulf of Mexico during September, the Loop Current is again clearly discernible as a thermal gradient on moisture corrected satellite infrared imagery.

Bell, A. and J. Clark. 1985. East Coast ocean features (Nov. 1985). Oceanogr. Mon. Summ. 5(11):18-19.
Abstract. The end of this month's positions of the Gulf Stream System and its associated eddies are shown for the NW Atlantic and the Gulf of Mexico. The end-of-November amplitude of the Loop Current in the Gulf of Mexico decreased about 445 km compared to the end-of-October position. This dramatic decrease is due to an eddy formation.

Bell, A. and J. Clark. 1985. East coast ocean features: Sea surface temperature, SST anomaly (June 1985). Oceanogr. Mon. Summ. 5(6):18-23.
Abstract. Due to cloudiness and isothermal conditions the Loop Current in the Gulf of Mexico was last detected on June 4. The end-of-June amplitude of

the Loop Current decreased about 155 km N from the end-of-May position. A warm eddylike feature was first observed near 25°N, 87°W on June 3. Two anticyclonic eddies formed, one anticyclonic eddy was newly detected, and two anticyclonic eddies were absorbed by the Gulf Stream during the month.

Bell, A. and J. Clark. 1985. East coast ocean features: Sea surface temperature, SST anomaly (May 1985). Oceanogr. Mon. Summ. 5(5):18-19.
Abstract. The end-of-May amplitude of the Loop Current in the Gulf of Mexico increased about 110 km N from the end-of-April position. Three cyclonic eddies were newly observed, one cyclonic eddy formed from a Gulf Stream meander, and then apparently dissipated during May.

Bennett, C.M. and F.C.W. Olson. 1971. An assay of environmental data collected off Panama City, Florida from 1962 to 1968. NSRDL/PC 3444. Naval Ship Research and Development Lab. Panama City, FL. 314 pp.
Abstract. Presents oceanographic and meteorological data collected from the offshore research stages off of Panama City.

Biggs, D.C. 1992. Nutrients, Plankton, and Productivity in a Warm-Core Ring in the Western Gulf of Mexico. J. Geophys. Res. 97(C2):2143-2154.
Abstract. Argos drift buoy trajectory data showed that a region of anticyclonic circulation about 100 km in diameter was present over the upper continental slope of the NW corner of the Gulf of Mexico in September-October, 1988. Guided by these data, Texas A&M University scientists joined by colleagues from Mexico's Direccion General de Oceanografia Naval surveyed the area from October 17-22 on R/V GYRE cruise 88G-05 with a dense grid of conductivity-temperature-depth and expendable bathythermograph stations. The presence of a subsurface salinity maximum greater than 36.5 psu within the upper 150 m of this anticyclone indicated that it had originated as a warm-core eddy of the Loop Current; however, a maximum of only 36.54 psu at σ_t = 25.5 in contrast to as much as 36.88 psu at this density surface in a "fresh" ring indicated that this feature had spent many months in the western gulf since its separation from the Loop Current. Biologically, the warm-core ring was oligotrohic: it surface waters were generally depleted in nitrate to depths of more than 100 m, and chlorophyll standing stocks, primary productivity, and zooplankton biomass were all extremely low. By comparison, at ring periphery where there was measurable nitrate at 100 m, chlorophyll standing stocks and primary production in the surface mixed layer were 1.5 to 2 times higher.

Biggs, D.C. 1993. A synopsis of hydrographic data from the TAMU Ship of Opportunity Program, XBT, CTD, and bottle data collected in the Gulf of Mexico from Nov 1989-Sept 1993 by the Technical Support Services Group. Department of Oceanography, TAMU. College Station, TX.

Biggs, D.C. and D.J. Murphy. 1991. Underway measurements of temperature, salinity, chlorophyll, and near-surface currents from R/V GYRE in support of the Texas Institutions Gulf Ecosystem Research Initiative. Marine Technology Society Annual Meeting. New Orleans, LA. 7 pp.

Birchett, J.A.K., III. 1967. Temperature - Salinity Relationships in the Surface Layers of the Eastern Gulf of Mexico in August, 1966. Master's Thesis. Texas A&M University, College Station, TX. 85 pp.

Black, P.G. 1983. Ocean temperature changes induced by tropical cyclones. Ph.D. Thesis. The Pennsylvania State University, Graduate School, Department of Meteorology.

Abstract. Discusses how major Gulf of Mexico storms (in particular storms Frederic, Anita and Allen) interact with the Loop Current and associated mesoscale eddies. Investigates both SST and mixed layer depth (MLD) changes caused by hurricane passage.

Blaha, J.P. and W. Sturges. 1978. Evidence for wind forced circulation in the Gulf of Mexico. Technical Report. Department of Oceanography, Florida State University. Tallahassee. 134 pp.

Blaha, J.P. and W. Sturges. 1981. Evidence for wind-forced circulation in the Gulf of Mexico. J. Mar. Res. 39(4):711-734.

Abstract. A study is conducted into the response of sea level and dynamic height to fluctuations of alongshore wind stress and wind stress curl at periods greater than a few months per cycle. Monthly tide gage data from Key West to Progreso, Mexico, during 1954-1974 are adjusted to remove the effects of local atmospheric pressure and seasonal steric heating. The adjusted mean monthly sea level elevations are significantly greater from Progreso to Port Isabel than they are elsewhere in the Gulf. This observation remains unchanged after the elevations are reduced for the effect of local alongshore winds. Among the tide gages in the western gulf, Galveston is the most coherent, with the local alongshore wind forcing at periods greater than 2 mo/cycle, exhibiting a phase with the winds not significantly different from PI. At the other coastal sites, at least half of the elevation signal remains. This residual signal is presumed to be caused by the geostrophic fluctuations of an offshore boundary current. The available wind data from the western half of the gulf show a negative wind stress curl. A common feature in the sea level elevations from Progreso to Port Isabel and in curl is the sharp transition from summer to fall. It is suggestive of a seasonal component to the Gulf circulation forced by the wind stress curl. This transition occurs from July to Sept. in curl but from Aug. to Oct. in sea level, a one-month lag. The observed 17 cm of change in elevation corresponds to changes in curl. A mean baroclinic circulation in the northwestern gulf is evident, in which the mean difference in dynamic height (relative to 700 db) is about 14 dynamic cm. The total seasonal variation across the flow (after the influence of Loop Current rings has been minimized in the data) is about 5 dynamic cm.

Blain, C.A., J.J. Westerink and R.A. Luettich Jr. 1994. The influence of domain size on the response characteristics of a hurricane storm surge model. J. Geophys. Res. 99(C9):18467-18479.

Abstract. The influence of domain size on boundary condition specification and on computed storm surge response is investigated. Storm surge response along the Florida shelf in the GOM due to Hurricane Kate is examined over three domains using two different open ocean boundary forcing functions, a still water (or zero elevation) condition and an inverted barometer condition which accounts for the atmospheric pressure component of the

meteorological forcing. The first domain is relatively small and is situated primarily on the continental shelf. A second domain includes the entire Gulf of Mexico basin. The third domain covers the Gulf of Mexico, contiguous basins, and extends out into the deep Atlantic Ocean. The computed storm surge response indicates that the small domain is inadequate, since cross-shelf boundaries are in regions of significant storm surge generation where surge and therefore boundary conditions are not known a priori. Also, the behavior of resonant modes that are physically excited within the Gulf of Mexico due to the passage of the hurricane is unknown at the boundaries of this small domain. The domain that includes the entire Gulf of Mexico captures the primary storm surge well but may not correctly model resonant modes. The primary storm surge response as well as resonant modes excited by the storm are best represented using a domain which encompasses the western North Atlantic Ocean, the Caribbean Sea, and the Gulf of Mexico. This domain with deep Atlantic Ocean boundaries facilitates simple boundary condition specification and minimizes the influence of boundary conditions on storm surge generation in coastal regions.

Blumberg, A.F. and G.L. Mellor. 1979. A whole basin model of the Gulf of Mexico. Proceedings of the Sixth OTEC Conference.

Abstract. Describes the development of an ocean model and the results of preliminary tests to assess the feasibility of evaluating environmental impact of many OTEC sites. Results indicate that the model will be useful in establishing oceanographic and engineering parameters such as current shear.

Blumberg, A.F. and G.L. Mellor. 1981. A numerical calculation of the circulation in the Gulf of Mexico. Prepared for the Division of Solar Technology, by Dynalysis. U. S. Department of Energy. 159 pp.

Blumberg, A.F. and G.L. Mellor. 1981. Some results from a three-dimensional Gulf of Mexico circulation model. 8th Ocean Energy Conference, Washington, D.C., 1981:483-494.

Abstract. Development of a three-dimensional, time-dependent prognostic model which can reproduce large scale features of the Gulf of Mexico circulation such as variability, intensity and areal extent of the major current systems.

Blumel, S.M. 1981. Comparison of three major northward-moving Gulf Coast Hurricanes: Camille (1969), Eloise (1975), and Frederic (1979). National Weather Digest. 6(3):21-28.

Abstract. The following report serves to analyze both differences and similarities of three recent major northward-moving hurricanes along the Gulf Coast. Hurricanes Camille, Eloise, and Frederic severely affected the mid-Gulf Coast region, between New Orleans, LA., and St. Marks, FL. The comparative weakening rates of two different intensities of storms traversing the same general geographic and physiographic regions are discussed briefly. All tide data is in feet above mean sea level (m.s.l., National Geodetic Vertical Datum of 1929) and is based primarily on poststorm high water mark surveys. Significant wave heights are based on oil rig and NOAA data buoys and refer to the prevailing wave heights over the sea surface in view. Wave heights were measured from trough to crest.

Bohannon, B.J. 1971. The occurrence of nitrogen fixation in Escambia Bay and Mulatto Bayou. Master's Thesis. University of West Florida, Pensacola, FL. 65 pp.

Abstract. Gas chromatographic determination of acetylene reduction was used to describe the occurrence of nitrogen fixation in Escambia Bay and Mulatto Bayou, Florida. Water and sediment samples were collected at 44 stations from October, 1970 to March, 1971 and analyzed for acetylene reduction and principal nitrogen fixing microbiota.

Bon Secour-Magnolia River Watershed Conservancy District. 1966. Watershed Work Plan for Watershed Protection and Flood Prevention, Bon Secour-Magnolia River Watershed. Bon Secour-Magnolia River Watershed Conservancy District. 34 pp.

Boston, N.E.J. 1964. Observations of tidal periodic internal waves over a three day period off Panama City, Florida. Texas A&M Univ., Dept. of Oceanography and Meteorology Project. 286-D, Ref. 64-20T:49.

Abstract. A report on studies conducted during June 19-22, 1962.

Boudreau, R.D. 1972. Eastern Gulf of Mexico remote sensing study experiment No. 3, May 1972. Part I: surface measurements. Mississippi Test Facility, Report No. 017. NASA Earth Resources Laboratory. Stennis Space Center MS. 94 pp.

Bouma, A.H., W.R. Bryant, D.K. Davies and T.T. Tieh. 1968. Study of the continental shelf of the Gulf of Mexico. Report to the U.S. Geol. Survey. Project 506, Reference 68-2T. Texas A&M University, Department of Oceanography. College Station, TX. 139 pp.

Boynton, W.R. 1975. Energy basis of a coastal region: Franklin County and Apalachicola Bay, Florida. Ph.D. Dissertation. University of Florida. Gainesville, FL. 408 pp.

Breaker, L.C., L.D. Burroughs, J.F. Culp, N.L. Guinasso and R.L. Teboulle. 1993. Surface and Near-Surface Marine Observations during Hurricane Andrew. Technical Note. Also published as Ocean Products Center, Report No. CONTRIB-68. See also PB93-111060. National Meteorological Center. Washington, DC. 42 pp.

Abstract. Documents the impact of Hurricane Andrew on the near-surface marine environment across the Bahamas and the Gulf through observations of sea level pressure, surface winds, surface air temperature, sea surface temperature, water level, near-surface currents, temperature and salinity. These data naturally take the form of time series and thus characterize the intensification and decay of Andrew at specific locations along its track.

Brooks, J.M. 1991. Mississippi-Alabama Continental Shelf Ecosystem Study Data Summary and Synthesis. Technical Narrative. Final Report. Vol. 2 Minerals Management Service. New Orleans, LA. 886 pp.

Abstract. Biological, physical, chemical, and geological characteristics were studied in a series of five cruises between March 1987 to March 1988 along three north-south transects across the continental shelf of Mississippi and Alabama. Four stations in depths of approximately 50, 100, 150 and 200m were sampled along each of these transects. Side-scan,

ROV, and underwater color photographs and video data were collected around topographic features in the study area. Subbottom profiler records indicate that the shelf edge is built upon delta-front forest beds that were truncated by erosion during the last low stand of sea level in the Pleistocene. Topographic features constructed on top of these sediments were generally of three classes: (1) pinnacles; (2) linear ridges; and (3) enigmatic features. Sediments contained a mixture of biological and petroleum hydrocarbons. Biological hydrocarbons were predominantly plant biowaxes with a possible minor planktonic input. Petroleum hydrocarbons were present as polynuclear aromatic compounds (PAH), a complete suite of n-C, and an unresolved complex mixture. Sediments varied greatly in iron and trace metal content, but the variations seem to be largely the result of natural variability in grain size and mineralogy. Deep water sediments were more enriched in iron and trace metals than those in shallow water. Satellite data positioned fronts associated with the Loop Current, warm core eddy, warm intrusions reaching into the region from the top of the Loop, warm intrusions from the Loop, and a cold ridge extending southward from the study area. Biological studies showed polychaetes were the dominant benthic macroinfauna taxon. No species appeared to dominate the community. There were no discernible patterns of diversity or abundance that could be attributed to inshore-offshore or east-west gradients. The largest numbers of species collected in the macroepifauna samples were at stations in 100m depths and the largest numbers of individuals were collected at the 150 and 200m stations. Demersal fish trawls sampled 2,839 specimens representing 98 species and 37 families.

Brown, M., E. Waddell, J. Karpen and R.J. Wayland. 1986. Gulf of Mexico ship-of-opportunity data report, January 1983 - October 1985. OCS Study/MMS. 86-0028. 632 pp.

Abstract. In January 1983 the Minerals Management Service (MMS) began a 5-year program of physical oceanographic measurements in the Gulf of Mexico, including current moorings, drifting buoys, satellite observations, and hydrographic surveys. To provide additional information on the time-varying circulation features in the Gulf, linking the various other data sets which usually emphasize specific processes or limited periods of time, MMS has supported a ship-of-opportunity (SOOP) program. The SOOP observations consist primarily of expendable bathythermograph profiles, usually T-7 probes, obtained by a number of cooperating vessels. The data report contains station charts, temperature sections from all the cruises supported between January 1983 and October 1985.

Brown, M., E. Waddell and R.J. Wayland. 1989. Gulf of Mexico ship-of-opportunity data report, update: October 1985 - March 1988. OCS Study/MMS 89-0013. 598 pp.

Abstract. The Minerals Management Service has conducted a number of physical oceanographic studies in the Gulf of Mexico during the period 1982-present, emphasizing the open ocean basin. The particular program, called the Gulf of Mexico Physical Oceanography Program, has two primary goals: (1) to develop a better understanding and description of conditions and processes governing Gulf circulation and (2) to establish a database that could be used as initial and boundary conditions by a companion MMS-funded numerical circulation modeling program.

Bruno, R.O. 1971. Longshore current system, Panama City to Pensacola, Florida. Master's Thesis. Florida State Univ., Tallahassee, FL. 167 pp.
Abstract. An analysis of the longshore current, based on one year's data from six beach observation stations, including one at St. Andrews State Park. Data is given regarding waves and wind.

Brusher, H.A. and L.H. Ogren. 1976. Distribution, abundance, and size of penaeid shrimps in the St. Andrew Bay system, Florida. Fishery Bulletin. 74(1):158-166.
Abstract. Presents distribution and abundance information regarding eight species of shrimp occurring in the various areas of the bay. Also includes some hydrographic data.

Bruun, P., T.Y. Chiu, F. Gerritsen and W.H. Morgan. 1962. Storm tides in Florida as related to coastal topography. Univ. Fla. Eng. Ind. Exp. Sta. Bull. Series. 109:76.

Bruun, P., W.H. Morgan and J.A. Purpura. 1962. Review of beach erosion and storm tide conditions in Florida, 1961-1962. University of Florida, College of Engineering. Gainesville, FL. 104 pp.

Burch, T. 1981. Significant environmental investigations in the Northwest Florida Water Management District: a bibliography. Northwest Florida Water Management District, Water Resources Special Report. 81-2:56. Northwest Florida Water Management District.
Abstract. Includes published and unpublished reports. Indexed by county and river basin.

Bureau of Land Management. 1977. Draft environmental impact statement. Proposed 1978 outer continental shelf oil and gas lease sale. 2 vols. OCS No. 65. Bureau of Land Management, Gulf of Mexico OCS Regional Office. New Orleans, LA.

Burk, S.D. and W.T. Thompson. 1992. Airmass Modification Over the Gulf of Mexico: Mesoscale Model and Airmass Transformation Model Forecasts. J. Appl. Meteorol. 31(8):925-937.
Abstract. Several numerical models are used to examine strong air-sea fluxes and resultant air mass modification following a cold-frontal passage over the Gulf of Mexico. Data from the Gulf of Mexico Experiment (GUFMEX), which was conducted in February-March 1988, are used for model validation. To provide a benchmark by which to evaluate the role of diabatic processes in air mass modification, the mesoscale model was initially run with surface fluxes deleted. Subsequent full physics runs show profound alterations to the boundary layer due to the diabatic processes. A one-dimensional air mass transformation (AMT) boundary-layer model is also tested and compared with the mesoscale modal and GUFMEX data. The Lagrangian character of the AMT model is a useful compliment to the mesoscale model output. Further, at least in one forecast, the AMT model yields a better forecast of boundary-layer depth. Strong sensible and latent heat fluxes in the vicinity of the cold front, while a subsidence-induced local maximum in latent heat flux appears in the return flow that is established in the western Gulf. The precipitable-water field shows a tongue of moist air returning to the Louisiana coast

and indicates that substantial mesoscale horizontal gradients in the moisture field are to be expected in the return flow.

Bushnell, M. and G.A. Maul. 1982. Ocean optical data from potential OTEC sites in the Gulf of Mexico. NOAA Tech. Memo. ERL AOML-49:232.

Butts, G.L. and L.W. Donelan. 1983. Hydrolab survey of lower St. Andrews Bay - Panama City, Bay County, August 26, 1983. Florida Dept. of Environmental Regulation. 5 pp.
Abstract. A study of water quality in various locations in the lower bay. Data is given for temperature and dissolved oxygen.

Calder, K.L. and K.D. Haddad. 1979. Transmissometry on the eastern Gulf shelves, MAFLA survey 1976-1978. pp. 931-989. *In* Mississippi, Alabama, Florida outer continental shelf baseline environmental survey 1977/1978. Vol. IIB. Compendium of work element reports. Bureau of Land Management, Washington, D.C.
Abstract. Water clarity in the eastern Gulf of Mexico increases away from vertical or horizontal interfaces. In the benthic boundary layer it increases with a decrease in turbulent energy (currents, seiches, internal waves, hurricanes) available to act on the bottom. In the surface layer, turbidity was largely relatable to runoff or biological productivity. Water of a clarity comparable to Sargasso Sea water was measured in the Loop Current, which was found at times at the seaward ends of all transects. This water was 50 to 100 times as clear as water found at the northern winter stations in the nepheloid layer. Near-bottom water clarity was affected by non-periodic (Loop Current) and periodic (internal waves, seiches, inertial currents) bottom currents, with nepheloid layers found at times in all regions of the study area. However, the rapidly shoaling, fine sediment-laden shelf off Mobile resulted in nepheloid layers during all sampling seasons. The Loop Current is the primary transport mechanism for particles in the study areas. The periodic current phenomena do not result in a net transport unless they are superimposed upon a current with a net directionality. However, they do provide significant erosional energy to the bottom which, coupled even with a slow (non-eroding) current, could result in a net sediment transport. In the summer and fall when the Loop Current intrudes furthest into the Gulf of Mexico, a net southward transport of outer shelf sediments should result. During the winter, when northerly or northeasterly winds blows in conjunction with seiche activity, a general westward to northwestward transport of sediments should result. That may explain the presence of sediments suspended in the water column off Mobile, Alabama that were similar to those found on the bottom off Panama City, Florida during DM III.

Cammack, J.H., T.J. Joiner and R.D. Schneefloch. 1971. Bibliography of Offshore and Estuarine Areas of Alabama With Selected Annotations. Alabama Geological Survey Circular. 50:69.

Capurro, L.R.A. and J.L. Reid. eds. 1972. Contribution On the Physical Oceanography of the Gulf of Mexico. Vol. 2 Texas A&M University, Oceanographic Studies. College Station, TX. 288 pp.
Abstract. This book contains a group of related papers directed toward a better understanding of selected aspects of the physical oceanographic

characteristics of the Gulf. The book opens with a description of the Gulf waters and the general circulation. Section 2, a discussion of the major current (the Loop Current) and its variability, follows. The various problems of circulation are examined through both numerical and experimental modeling in Section 3; Section 4 discusses the effects of hurricanes on circulation. The book concludes with a chapter on tides, which presents new information on energy dissipation within the Gulf.

Carder, K., K.A. Fanning, P.R. Betzer and V. Maynard. 1977. Dissolved silica and the circulation in the Yucatan Straits and deep eastern Gulf of Mexico. Deep-Sea Res. 24(4):1149-1160.

Carder, K.L. and F.C. Schlemmer II. 1973. Distribution of particles in the surface waters of the eastern Gulf of Mexico: An indicator of circulation. J. Geophys. Res. 78(C7):6286-6299.

Carder, K.L. and F.G. Schlemmer II. 1973. Distribution of particles in the surface waters of the eastern Gulf of Mexico: an indicator of circulation. J. Geophy. Res. 78(27):6286-6299.

Cardone, V.J. 1978. Forecasting hurricane winds and waves, a pilot study. pp. 1027. *In* United States National Oceanic and Atmospheric Administration. Atlantic Oceanographic and Meteorological Labs., Collected Reprints, 1977. Vol. 2. NOAA, Miami, FL.

Abstract. A directional spectral wave hindcast model developed at the City University of New York Institute of Marine and Atmospheric Sciences for application to Gulf of Mexico hurricanes is modified for implementation on the NOAA Atlantic Oceanographic and Meteorological Laboratories' computer facility for application in real time to forecasting of Gulf and East Coast hurricanes. The results of this model are compared to results from a simpler parametric model developed at the AOML Sea-Air Interaction Laboratory for several severe historical storms that have affected the Gulf and East Coast. The intercomparison indicates that the models produce similar results for slow moving (~15 knots) storms and increasingly divergent results for faster moving storms. A real time forecast of Hurricane Belle is described. The forecast sea states verified at a NOAA data buoy suggest that both models are limited mainly by errors in operational forecasts of hurricane track, intensity, and scale.

Caruthers, J.W. 1972. Water masses at intermediate depths. pp. 53-61. *In* Capurro, L.R.A. and J.L. Reid, eds. Contributions on the Physical Oceanography of the Gulf of Mexico. Gulf Publishing Co., Houston, TX.

Abstract. Detailed analysis of potential temperature-salinity characteristics of the Gulf of Mexico from winter 1962 as related to flow patterns and mixing.

Center for Natural Areas. 1979. Annotated bibliography of coastal zone management work products--a compilation of state, territory, and federal work products produced via funding from the Coastal Zone Management Act of 1972, as amended. National Oceanic and Atmospheric Administration, Office of Coastal Zone Management. Washington, D.C. 391 pp.

Abstract. The Coastal Zone Management Act (CZMA) of 1972, amended in 1976, provided grants to States and Territories to develop and implement coastal management plans. During their activities, coastal programs have produced a total of over 1400 work products on all aspects of the planning process; the Office of Coastal Zone Management (OCZM) in the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA) has published numerous other documents. These work products, funded through the CZMA, represent a substantial amount of invaluable information and experience of use to all professionals and students of the coastal region. This annotated bibliography represents a second edition compilation of the work products published prior to September, 1979. Included are all annotations from the first bibliography prepared by David W. Laist in 1976. This new edition also has an index by key words to help the user locate information in any State or Territory, or by subject. Annotations were prepared directly from the work products or from direct input from the respective State or Territory Program Manager. In an effort to verify each annotation, a copy of the draft bibliography was forwarded to each State or Territory Program Manager for their review. This bibliography represents a best effort to annotate all products. Except for special cases, this bibliography includes all coastal program products funded in part or whole by funds from the Coastal Zone Management Act. Among the exceptions are some draft reports, films, slide shows, grant applications and newsletters. Chermock, R.L., P.A. Boone and R.L. Lipp. 1974. An Environmental Study of Offshore Alabama As Related to Drilling for Gas and Oil. Alabama Geological Survey, Open-File Report. Tuscaloosa, Alabama. 289 pp.

Chew, F. 1955. On the offshore circulation and a convergence mechanism in the red tide region off the west coast of Florida. Transactions, AGU (EOS). 36(6):963-974.

Chew, F. 1964. Sea-level changes along the northern coast of the Gulf of Mexico. Transactions, AGU (EOS). 45(1):272-289.

Chew, F., K.L. Drennan and W.J. Demoron. 1962. On the temperature field east of the Mississippi Delta. J. Geophys. Res. 67(1):271-279.

Abstract. In the winter of 1960-1961, surface temperature fronts of magnitude of 10°F change in 2 to 3 miles were common in the area east of the Mississippi delta. They separated shallow streaks of cold river discharge from surrounding gulf water. The streaks were underlain by a layer of similarly cold but more saline water, forming, together, columns of cold water some 200 ft. deep. The columns are thought to be the result of confluence of cold waters from two sources. The first, the Mississippi estuarine discharge, is composed of the cold river inflow and the cold salt wedge; the second is saline Loop Current water cooled in the area inside the 20-fathom contour, probably mostly in Breton-Chandeleur Sound.

Christmas, J.Y. 1973. Cooperative Gulf of Mexico estuarine inventory and study, Mississippi. Phases I-IV. Gulf Coast Research Laboratory. Ocean Springs, MS. 434 pp.

Abstract. This study is divided into four phases: area description, hydrology, sedimentology and biology. The goal of the inventory is related to management of coastal resources. Information on estuaries, geology,

economics, developmental and political factors associated with them are included.

Christmas, J.Y. and C.K. Eleuterius. 1973. Hydrology. pp. 73-121. *In* Christmas, J.Y., ed. Cooperative Gulf of Mexico Estuarine Inventory and Study Mississippi. Gulf Coast Research Laboratory, Ocean Springs, Mississippi.

Chuang, W.S., W.W. Schroeder and W.J. Wiseman. 1982. Summer current observations off the Alabama coast. Contrib. Mar. Sci. 25:121-131.
Abstract. Results of studies concerning low-frequency variability on the Alabama shelf during 1976, 1978 and 1979 indicated that a permanent summer circulation pattern does not exist and that circulation is strongly affected by wind duration, density stratification and coastal geometry.

Churgin, J. and S.J. Halminski. 1974. Temperature, salinity, oxygen, and phosphate in waters off United States, Volume II: Gulf of Mexico. National Oceanographic Data Center. Washington, D.C. 116 pp.
Abstract. Presents temperature, salinity, oxygen, and phosphate data for oceanic waters along and adjacent to the Gulf Coast. Provides a general picture of the variability of the four parameters over large oceanic areas. Data is presented in formats that can be easily understood by nonphysical oceanographers--by biologists, engineers, and others having responsibilities for the development, utilization, and management of the ocean and its resources, and for planning and managing programs, projects, and surveys that relate to use of the ocean. The data are of value in studies of marine productivity, pollution, corrosion, fouling, waste receiving capacity, and oceanic circulation and in designing instruments and planning structures.

CICAR. 1973. A description of the circulation in the eastern Gulf of Mexico during CICAR survey month II May 1972. U.S. Department of Commerce, NOAA Environmental Data Service. 14 pp.

CICAR. 1976. Distribution of physical and chemical oceanographic data in the CICAR region. Part 2. Computer plot displays. U.S. Department of Commerce, NOAA Environmental Data Service. 94 pp.

CICAR. 1976. Progress in marine research in the Caribbean and adjacent regions; CICAR II Symposium; Caracas Venezuela. U.S. Department of Commerce, NOAA Environmental Data Service. 243 pp.

Clark, J. 1985. East Coast ocean features (Dec. 1985). Oceanogr. Mon. Summ. 5(12):18-19.
Abstract. The end of December's positions of the Gulf Stream System and its associated eddies are shown for the NW Atlantic and the Gulf of Mexico. The Gulf Stream and Loop Current boundaries are located. The end-of-December amplitude of the Loop Current increased 520 km compared to the end-of-November position. The dramatic increase is due to the merging of anticyclonic eddy q with the Loop Current around December 9.

Clark, J. 1985. East Coast ocean features (Oct. 1985). Oceanogr. Mon. Summ. 5(10):18-19.

Abstract. The end-of-October amplitude of the Loop Current in the Gulf of Mexico shows little change compared to the end-of-September position. Anticyclonic eddy o was suspected by ARGOS data near 25°30'N 91°W around August 22 according to the Slidell, Louisiana SFSS. Eddy O seemingly traveled 175 km WSW since August 22. Two cyclonic eddies formed, one anticyclonic eddy was absorbed and one dissipated during the month.

Clark, J. 1986. East Coast ocean features. Oceanogr. Mon. Summ. 6(1):18-19.

Abstract. The end of January 1986, positions of the Gulf Stream System and its associated eddies are shown for the NW Atlantic and the Gulf of Mexico. The Gulf Stream and Loop Current boundaries are located by infrared satellite imagery or XBT (expendable bathythermograph) data.

Clark, J. 1986. East Coast ocean features. February 1986. Oceanogr. Mon. Summ. 6(2):18-19.

Abstract. The end of this month's positions of the Gulf Stream System and its associated eddies are shown for the NW Atlantic and the Gulf of Mexico. The Gulf Stream and Loop Current boundaries are located by infrared satellite imagery or XBT (expendable bathythermograph) data. Anticyclonic eddies are labeled a-z in the Gulf of Mexico and 1-99 in the NW Atlantic. Cyclonic eddies are labeled A-Z. Arrows on eddies indicate direction of circulation.

Cochrane, J.D. 1972. Separation of an anticyclone and subsequent developments in the Loop Current (1969). pp. 91-106. *In* Capurro, L.R.A. and J.L. Reid, eds. Contributions on the Physical Oceanography of the Gulf of Mexico. Gulf Publishing Co., Houston, TX.

Abstract. Documents progress of first observed detachment of an anticyclonic current ring from the Gulf of Mexico Loop Current from May to September, 1969.

Collard, S.B. 1976. Biological, chemical, geological and physical parameters essential to estuarine management in Choctawhatchee Bay. Fla. Sea Grant Proj. R/EM-5 (ann. rep.):15.

Collier, A. 1958. Gulf of Mexico physical and chemical data from ALASKA cruises. U.S. Fisheries and Wildlife Special Scientific Report. Fisheries No. 249:417.

Abstract. This report is principally a list of chemical data collected aboard the U.S. Fish and Wildlife Service M/V ALASKA while she was engaged in a biological and oceanographic survey of the Gulf of Mexico. The tables include observations on salinity, temperature, sigma-t, nitrate-nitrite nitrogen, total phosphorus, inorganic phosphorus, "carbohydrates", and "proteins". Some special data on the uranium and phosphorus content of certain water samples and sediments are included. A brief introduction includes remarks on the physical oceanography of the Gulf of Mexico and the study of organic compounds.

Condrey, R.E., R.E. Turner, L.J. Rouse, R.F. Shaw and W.J. Wiseman. 1982. Evaluation of the Brine Disposal from the West Hackberry Site: The Regional Impact on Menhaden Resources: Final Report: Volume 1, Chapters 1-8, Addenda 1-2. DoE/PO/10313-T-V.1. Louisiana State University, Center for Wetland Resources. Baton Rouge. 157 pp.

Abstract. A complete assessment of the impact of brine discharge from the Strategic Petroleum Reserve project on the menhaden fishery of the Gulf of Mexico requires an understanding of the distribution of menhaden eggs and larvae over the Louisiana shelf as well as a knowledge of the mechanisms that transport the larvae into the estuaries. This study identifies sources of menhaden eggs and larvae and determines the processes controlling larval transport and distribution across the shelf and into the estuaries.

Conner, C., A. Conway, B.A. Benedict and B.A. Cristensen. 1982. Modeling the Apalachicola system: A hydrodynamic and water quality model with a hydrodynamic and water quality atlas of Apalachicola Bay. Technical Paper No. 23. Florida Sea Grant Program. Gainesville, FL. 89 pp.

Abstract. The present report discusses the establishment of a numerical model of the Apalachicola system consisting of the River, its tributaries and the biologically highly productive Apalachicola Bay. Much of the material has been published elsewhere in the form of reports (e.g., Graham, DeCosta, and Christensen, 1978), scientific papers (e.g., Christensen, 1979, Graham and Christensen, 1978) and bulletins of a more general nature (e.g., Hill and Graham, 1980). The present report should therefore be considered as a review of the progress made with special emphasis on the final results that are presented in the form of an atlas depicting the hydrodynamics and pollutant migration in the Apalachicola Bay during an "average" year taking tidal flushing as well as wind and river flow into consideration.

Cook, S.K. and S.P. Matteson. 1985. A description of temperature conditions and Gulf Loop Current variability for the years 1979-1983 utilizing ship of opportunity data. Unpublished Manuscript. (NOAA/AOML) 41 pp.

Abstract. Combines five years of Expendable Bathythermograph data in seventy cruises/vertical temperature sections to show high variability in the Gulf Loop Current system. Demonstrates a lack of an annual cycle in the system with respect to position.

Cooper, C. 1982. Southwest Florida shelf circulation model. Vol. 1. MMS-GM-PT-83-001. Minerals Management Service. Metairie, LA. 336 pp.

Abstract. This report summarizes an 18-month study funded by the Minerals Management Service. Motivation for the study arose from the service's intention to grant leases for oil exploration, and the need to estimate the probable destination of water-borne pollutants originating from drilling and for predicting seasonal water circulation on the southwest continental shelf. Because of modeling considerations, the study area was expanded to include the contiguous west Florida Shelf (WFS) extending from the Florida Keys in the south to Apalachicola in the north and the 200 m isobath to the west.

Cooper, C.K. 1987. Hurricane-generated currents on the outer continental shelf. Ph.D. Dissertation. University of Maine. 204 pp.

Abstract. This work focused on currents generated by hurricanes on the outer continental shelf and slope. Emphasis is on the maximum mixed layer response which restricts the time scales of interest to within a few hours of storm passage. But considerable insight has also been gained about the lower layer response, and the post-storm response including shelf waves. A numerical model is developed using a layered, explicit

finite-difference formulation based on the nonlinear primitive equations including thermodynamics. The problem of topography intersecting the model layer is resolved. Comparisons are given between the model simulations and six test cases in which the solutions either are known, or results are available from other numerical models which have been proven. The favorable comparisons validate the numerical scheme and the model code. The model is configured for the Gulf of Mexico and used to hind-cast three storms using a 0.2 degree grid. In the mixed layer, the model typically reproduces better than 80% of the observed variance with correlation coefficients of greater than 0.8 for the mixed layer. In the bottom layer, the correlation falls, although the predicted variance still compares well. The model simulations suggest that substantial shelf waves can be generated by Gulf hurricanes. Results reveal the most important factors are (in decreasing order): wind speed, storm translation speed, direction of storm approach, asymmetry in the wind field, entrainment parameterization, and advection at slower translation speeds.

Cooper, C.K. 1987. A numerical modeling study of low-frequency circulation on the west Florida shelf. Coastal Engineering. 11(1987):29-56.

Abstract. A numerical model using linearized, diagnostic, primitive equations was applied to the west Florida Shelf to provide estimates of low-frequency (<0.1 cpd) circulation. The model calculated the horizontal and temporal variation of the free surface and velocity fields, including vertical shear. Model testing was accomplished by hindcasting two data sets. Comparisons between modelled and observed current and surface elevation were generally good, although a thorough evaluation was impossible because of an inadequate data base. After the model was tested, it was used to investigate low-frequency circulation patterns attributable to wind, horizontal density gradients, vertical stratification, and the Loop Current. Difficulties were encountered in attempting to include the Loop Current effects on the shelf. Several mechanisms suggested by previous investigators were tested, but failed to give realistic results with reasonable model input parameters. The model results coupled with the available data suggest that 1) the inner shelf region shoreward of the 50-m isobath is primarily wind driven; 2) the deeper, southern section of the shelf is strongly influenced by shelf edge processes and intrusions from the Loop Current; 3) the deeper, northern section of the shelf is primarily wind driven; and 4) modelling of shelf edge processes must include the baroclinic component.

Cooper, C., G.Z. Forristall and T.M. Joyce. 1990. Velocity and hydrographic structures of two Gulf of Mexico warm-core rings. J. Geophys. Res. 95(C2):1663-1679.

Abstract. Results from an extensive survey of two Gulf of Mexico warm-core rings are presented. The data were taken during a 1-week period in December 1983 using a shipboard acoustic Doppler current profiler (ADCP), expendable current probes (XCP), expendable bathythermographs (XBT), and a CTD. Two rings were observed-an older one in the western Gulf adjacent to the west Texas shelf, and one just separated from the Loop Current. The western ring was of order 200 km in diameter with peak currents of 1 m/s at the 100-m level. Water properties were uniform and characteristic of the high-salinity Caribbean subtropical underwater. The eastern ring was of order 300 km in diameter with peak currents of near 2 m/s at the

100-m level. Water below 200 m is of Caribbean origin, while the surface water show more variability suggesting some inflow of Gulf of Mexico common water.

Cooper, C. and J.D. Thompson. 1989. Hurricane-generated currents on the outer continental shelf. I. Model formulation and verification. J. Geophys. Res. 94(C9):12513-12539.

Abstract. A numerical model is developed to simulate currents generated by hurricanes on the outer continental shelf and slope. Emphasis is on the mixed-layer response within a few hours of storm passage; however, some attention is given to the lower layer and shelf wave responses. The model is based on a layered, explicit, finite difference formulation using the nonlinear primitive equations including conservation of heat. The problem of topography intersecting the model layer is resolved by introducing artificial steps of the order of 100 m where the layer intersects the slope. Model comparisons are presented for three Gulf of Mexico hurricanes using a 0.2 degrees grid.

Corcoran, E.F. 1973. Chemical oceanography. *In* Jones, J.I., R.E. Ring, M.O. Rinkel and R.E. Smith, eds. A Summary of Knowledge of the Eastern Gulf of Mexico. State University System of Florida, Institute of Oceanography, St. Petersburg, FL.

Abstract. A review of the chemical investigations made on the waters of the eastern Gulf of Mexico indicates that most studies have been concerned with water mass characterization, structure of the Loop Current, and nutrient distribution. The parameters measured in these studies were primarily salinity, temperature, dissolved oxygen, and inorganic phosphates. More recent research has added the investigation of suspended material, dissolved and particulate carbon, and certain trace metals. Further study of nutrients and trace metal distribution is needed. This report includes materials on chemical data for the estuarine and nearshore environments, including extensive tables onwater quality and constituents in the major bays and estuaries.

Costanza, R., C. Neill, S.G. Leibowitz, J.R. Fruci, L.M. Bahr and J.W. Day. 1983. Ecological models of the Mississippi Deltaic Plain region. Data collection and presentation. FWS/OBS-82/68. U.S. Fish and Wildlife Service, Office of Biological Services. Washington, D.C. 342 pp.

Abstract. This technical report consists of quantified ecosystem models with input-output matrices of the biology, hydrology, geology, and socioeconomics of the major habitats of the Mississippi Deltaic Plain Region. The quantitative framework characterizes the region and provides a data base for future ecological models. The habitats modeled are aggregated from those previously identified in the MDPR by Wicker et. al. (1980) according to the classification system of Cowardin et. al. (1979). Detailed descriptions of the biological, physical, and socioeconomic interconnections within this coastal ecosystem allow coastal managers and decision makers to better assess the impacts of human activity on the region's natural resources. It is hoped that future modeling attempts based on the data collected in this report will help predict human impacts on coastal ecosystems and aid in the arduous task of assessing tradeoffs between nonrenewable resource development and renewable resource preservation. This technical report was designed to supplement the companion narrative description of the Mississippi Deltaic Plain

Region as the final products in the Mississippi Deltaic Plain Region Characterization Study. Together these two volumes provide both general descriptions and detailed data on the region.

Cragg, J. 1974. Wind induced currents and sea surface slopes in the eastern Gulf of Mexico. M.S. Thesis. Florida State University. Tallahassee, FL.

Cragg, J., G. Mitchum and W. Sturges. 1983. Wind-induced sea surface slopes on the west Florida shelf. J. Phys. Ocean. 13(12):2201-2212.
Abstract. Tidal and meteorological records at stations in the eastern Gulf of Mexico have been studied. The sea level response is a maximum for winds along the coast and varies symmetrically with angle. The coherence is maximum at periods of 4-10 days. The horizontal coherence of sea level is high out to 500 km for 4-10- day periods. The horizontal coherence for wind (measured at coastal stations) is high out to at least 500 km. The amplitude of the response of sea level to winds is larger by a factor of 4 here, on a broad shelf, than on the Oregon coast, which is narrower by approximately the same ratio. A response of approximately 16 cm is induced by approx. 4 m/s wind. This reponse, or transfer function, is uniform over the spectral range (4-100 days). The sea level response to the longshore wind stress is not linear, but to the power 0.8 PLUS OR MINUS 0.1, and is attributed to the relatively low tidal currents in this region. The large horizontal coherences of wind and sea level imply broad longshore flows extending 500 km or more along the coast. Over 85% of the variance between 4 days and 3 yr is contained in fluctuations with periods <3 mo. A longshore slope of sea level is observed; in the 4-10-day band, this slope can be explained by longshore variation in the width of the shelf. A mean longshore slope of approxmiately $6x10^{-10}$ and it may be caused by the (weak) mean winds. Freely propagating coastal trapped waves are found in a narrow band approximately 0.18 cpd.

Cragg, J. and W. Sturges. 1974. Wind induced currents and sea surface slopes in the eastern Gulf of Mexico. Technical Report/NSF Grant GA-29734/ONR Grant N00014-67-A-0235-0002. Florida State University, Department of Oceanography. Tallahassee, Florida. 50 pp.

Crance, J.H. 1967. Statement At a Public Hearing On the Establishment of Water Quality Criteria for the Perdido River Basin. Open File Report. Alabama Department of Conservation, Seafoods Division. Montgomery, Alabama. 14 pp.

Crance, J.H. 1969. A selected bibliography of Alabama estuaries. Alabama Mar. Resour. Bull. 2:1-21.

Crance, J.H. 1971. Description of Alabama estuarine areas-cooperative Gulf of Mexico estuarine inventory. Ala. Mar. Resour. Bull. 6:1-85.
Abstract. Physical characteristics of estuarine areas are given; importance as nursery areas are discussed. Maps include: study area, sediment types, pollution sources, oyster beds, isotherms, isohalines, and some economic characteristics. Tabular data include: climate, tides, open water surface area and average depth, tidal marsh, stream discharge, domestic and industrial wastes, navigation channels, and commercial fisheries.

Crawford, M.M. and N. Khazenie. 1990. Monitoring Mesoscale Surface Features of the Ocean via an Automated Analysis; Final Report. NSF/ISI-90162. Remote Information Analysis, Inc. Austin, TX. 45 pp.

Abstract. The research focused on the development, implementation, and evaluation of an automated system to track mesoscale oceanic features. First, the approach applies a rapid automated registration algorithm, which operates on a temporal sequence of multispectral images through a statistical procedure and aligns images of the same target for further analysis. Next, an adaptive statistical spatial-temporal image reconstruction technique is applied to the sequence of images. The reconstruction algorithm compensates for image clutter and for occlusion of features by clouds. Finally, the method applies a flow velocity calculation algorithm, based on artificial intelligence methods, which identifies and tracks oceanic features of interest across the registered, reconstructed temporal sequence of images.

Crisp, C. and J. Lewis. 1992. Return flow in the Gulf of Mexico. Part I: A classificatory approach with a global historical perspective. J. Appl. Meteorol. 31(8):868-881.

Abstract. Return-flow events have been examined with the aid of a classification scheme that identifies each event with cold air masses that invade the Gulf during the cool season (February-March). These air masses were classified as either continental polar (cP), maritime polar (mP), or a mix of two or more of these basic types (MIX in future reference). Each event was viewed as a cycle in which the first phase represented an offshore flow typifying the cold-air outbreak over the Gulf and the second phase was associated with the return of modified air to the continent. Surface data for a 12-yr period, 1978-89, were used to make a statistical analysis of the event and each of its phases. The principal results of the study are 1) a total of 127 events occurred in this cool season over the 12-yr period. The relative percentages of mP, cP, and MIX air masses are 28%, 20%, and 52%, respectively. A median of 10.5 return-flow events occurred in the cool season where the MIX category was the dominant regime. The median duration for a return-flow cycle is 3.3, 5.2, and 6.2 days for mP, cP, and MIX, respectively, for the cool season. 2) The median duration of the offshore-flow phase for the cool season shows a wide range depending on airmass type with 30, 55, and 49 h as median times for mP, cP, and MIX, respectively. 3) The median duration of the return-flow phase for the cool season was significantly longer than the offshore-flow phase when all cases were examined en masse; but when the cases were segregated according to airmass type, the duration of the return flow for the cool season exhibited a wide range with 47, 57, and 62 h as median times for mP, cP and MIX, respectively. In order to view the return-flow events in the Gulf of Mexico from a wider perspective, a historical summary of research on this event and similar events around the world is included.

Crozier, G.F. 1976. Mobile Bay Turbidity Plume Study. Report No.: NASA-CR-144331. Marine Environmental Sciences Consortium. Dauphin Island, Alabama. 44 pp.

Abstract. Laboratory and field transmissometer studies on the effect of suspended particulate material upon the appearance of water are reported. Quantitative correlations were developed between remotely sensed image density, optical sea truth data, and actual sediment load. Evaluation of

satellite image sea truth data for an offshore plume projects contours of transmissivity for two different tidal phases. Data clearly demonstrate the speed of change and movement of the optical plume for water patterns associated with the mouth of Mobile bay in which relatively clear Gulf of Mexico water enters the bay on the eastern side. Data show that wind stress in excess of 15 knots has a marked impact in producing suspended sediment loads.

Crozier, G.F. and W.W. Schroeder. 1978. Mobile Bay Turbidity Study. Marine Environmental Sciences Consortium. Dauphin Island, Alabama. 60 pp.

Abstract. The termination of studies carried on for almost three years in the Mobile Bay area and adjacent continental shelf are reported. The initial results concentrating on the shelf and lower bay were presented in the interim report. The continued scope of work was designed to attempt are finement of the mathematical model, assess the effectiveness of optical measurement of suspended particulate material and disseminate the acquired information. The optical characteristics of particulate solutions are affected by density gradients within the medium, density of the suspended particles, particle size, particle shape, particle quality, albedo, and the angle of refracted light. Several of these are discussed in detail.

Culter, J.K. and S. Mahadevan. 1982. Long-term effects of beach nourishment on the benthic fauna of Panama City Beach, Florida. U.S. Army Corps of Engineers, Coastal Engineering Research Center, Miscellaneous Report. 82-2:94.

Abstract. The long-term effects of beach nourishment on the benthic infauna and surface sediments of Panama City beaches were investigated. Forty-seven stations located on nine transects between West Pass and Philips Inlet, and two nourishment borrow sites were sampled in November-December 1979 and May 1980. The data collected were compared to prenourishment base-line information collected by Saloman (1976). Abiotic parameters, water temperature, dissolved oxygen and salinity were measured. Sediments were analyzed for particle-size distribution, percent organic carbon and percent carbonate. Benthic macroinvertebrates were represented by 162 taxa of 14 major animal phyla. Species composition and faunal densities varied seasonally. Polychaetes and amphipods were the most abundant animal groups; a small number of species were dominant at nearly all stations and highest offshore. Sediment composition was similar to that of Saloman's (1976) study within limits of sampling and processing errors. Faunal composition was found to be different from 1976 but was attributed to normal seasonal and spatial variations. Based on benthic community analyses and sediment parameters, no significant differences were found between nourishment borrow sites and surrounding areas and in the nearshore areas where beach nourishment was conducted. No long-term adverse effects of beach nourishment were detected.

Curl, H. 1959. The hydrography of the inshore Gulf of Mexico. Publ. Inst. Mar. Sci., Univ. Tex. 6:193-205.

Abstract. Thirty sampling trips were made to a distance of twenty-eight miles into the northeastern Gulf of Mexico from Aligator Harbor, Franklin County, Florida, in 1954. Water temperature, salinity, and light penetration were measured. Temperatures in the inshore waters ranged from

14°C to 30°C. Hydrographic profiles gave evidence of intense local cooling in the spring. Density inversions were present on several occasions. The local salinity pattern, of the inshore waters was controlled by stream flow, particularly that of the Apalachicola River. Minimum salinities were found in March and were correlated with high stream flow. Maximum salinities occurred in mid-August.

Curl, H.C., Jr. 1956. The Hydrography and Phytoplankton Ecology of the Inshore, Northeastern Gulf of Mexico. Ph.D. Dissertation. Florida State University, Tallahassee, FL. 285 pp.

Cushman-Roisin, B. 1986. Linear stability of large, elliptical warm-core rings. J. Phys. Ocean. 16(7):1158-1164.

Dagg, M.J. 1988. Physical and biological responses to the passage of a winter storm in the coastal and inner shelf waters of the northern Gulf of Mexico. Cont. Shelf Res. 8:167-178.

Dames and Moore, Inc. 1975. The Louisiana Offshore Oil Port (LOOP) environmental assessment. Louisiana Offshore Oil Port (LOOP), Inc. New Orleans, LA.

Abstract. As part of the LOOP, Inc. environmental assessment, a field study of the offshore mooring site, the onshore storage facility, and the proposed pipeline route was initiated in June, 1973 to continue to May, 1974. The objectives are to describe the ecosystems impacted by the proposed LOOP project, including an environmental inventory. Physical, chemical, and biological parameters are studied. This report deals with the offshore portion of the study.

Dames and Moore, Inc. 1979. The Mississippi, Alabama, Florida, Outer continental shelf baseline environmental survey, MAFLA 1977/1978. Volume 1-A. Program synthesis report. BLM/YM/ES-79/01-VOL-1-A. Bureau of Land Management. Washington, D.C. 278 pp.

Abstract. A third year baseline marine environmental survey was conducted and a synthesis report prepared. Marine geology, physical oceanography, marine biology, trace metal and hydrocarbon chemistry of the water column, sediments and tissues were examined for the Mississippi, Alabama, Florida Outer continental shelf in support of prospective OCS oil and gas development. Physical oceanographic and sediment geology data provided information to better understand the biological and chemical distributions. A data base was created merging data collected from 1974-1978 into a single format.

Dames and Moore, Inc. 1979. The Mississippi, Alabama, Florida, outer continental shelf baseline environmental survey, MAFLA. 1977/1978. Volume 1-B. Executive summary report. BLM/YM/ES-79/02-VOL-1-B. Bureau of Land Management, Washington, D.C. 30 pp.

Abstract. The prime purpose of the MAFLA program was the determination of ongoing or potential impacts on the outer continental shelf (OCS) environment from oil and gas development. The Executive Summary Report is organized along the same lines as the Program Synthesis Report, with sections on methodology, geology, physical oceanography, chemistry and

biology. A brief summary and lists of recommended monitoring parameters and major deficiencies in the data base are also included.

Danenberger, E.P. 1976. Oil spills, 1971-75, Gulf of Mexico outer continental shelf. U.S. Geol. Surv. Circ. 741:47.

Dean, R.G. 1986. Sediment budget principles and applications. University of Florida, Coastal & Oceanographic Engineering Dept. Report. UFL/COEL-86/019:51.

Abstract. A study of beach profiles and shoreline changes due to the action of waves, currents, tides and sediment supply. Among the localities studied was the entrance channel to St. Andrew Bay.

Dean, R.G. and T.Y. Chiu. 1986. Combined total storm tide frequency analysis for Escambia County, Florida. Florida State University, Beaches and Shores Resource Center. Tallahassee, FL. 66 pp.

de la Cruz, A.A. 1981. Differences between South Atlantic and Gulf Coast marshes. pp. 10-20. *In* Carey, R.C., P.S. Markovits and J.B. Kirkwood, eds. Proceedings of the U.S. Fish and Wildlife Service Workshop on Coastal Ecosystems of the United States. Rpt. No. FWS/OBS-80/59. Office of Biological Services, Washington, D.C.

Abstract. The one factor that determines the biological (plant communities), ecological (primary productivity, food web, energy flow), and chemical (salinity, nutrients) differences between the South Atlantic and Gulf Coast marshes is water-the hydrological processes and hydrodynamic regimes that characterize each region. Gulf Coast marshes are developed primarily on deltaic formations constructed on alluvial deposits created by several major river systems, while the South Atlantic marshes are basically formed on estuarine and lagoonal soft silt deposits bridging the barrier islands and the mainland shorelines. Tides in the South Atlantic (a tidal dominated coast) are normally semidiurnal with fluctuations of more than 2.0 m; meteorological phenomena are more stable with fewer events of major storm surges. In the Gulf, tides are generally diurnal with maximum fluctuation of 0.3 m; but during periods of lowest fluctuations, tides can change over to very weak semidiurnal occurrences. Prevailing local weather conditions, the occurrence of seasonally changing major wind directions, high energy summer tropical storms, and Gulf basin natural oscillations complicate the hydrodynamics of the Gulf marsh system. The peculiar hydrology of the Gulf Coast (a wave dominated coast coupled with the great freshwater input dominated by the Mississippi River) influences salinity producing a more diverse vegetation structure and seasonal fluxes of material into the Gulf Coast marsh-estuary.

Dietrich, D., D. Ko and L. Yeske. 1993. On the application and evaluation of the relocatable diecast ocean circulation model in coastal and semi-enclosed seas. Center for Air Sea Technology; TR 93-1. Stennis Space Center. Mississippi. 71 pp.

Abstract. To improve coastal and semi-enclosed seas modeling, a new DieCAST Ocean Model has been developed. In application to the Gulf of Mexico (GOM), this model gives remarkably similar results to that obtained from the Sandia Ocean Model System (SOMS) and at a computational speed much faster than SOMS or other ocean models presently available. The results

are supported by many GOM observations including GEOSAT rms sea-surface-height anomaly data; mean thermocline and empirical orthogonal functions; the evolution of vortex pairs in the western GOM; major Loop Current eddy shedding period; shed eddy size, phase speed, dispersion rate and vorticity; and detailed Loop Current and shed eddy structure. Finally, and a major advantage of DieCAST is its capability to be easily relocated to any geographical region of the globe. Preliminary applications in several regions such as the Mediterranean, South China Sea, Great Lakes, and Labrador Current are described.

Dietrich, D.E. and C.A. Lin. 1994. Numerical studies of eddy shedding in the Gulf of Mexico. J. Geophys. Res. 99(C4):7599-7615.

Abstract. The eddy shedding phenomenon in the Gulf of Mexico is modelled using the Sandia Ocean Modeling System. In the first part of the study a parameter sensitivity study is performed using a rectangular basin two-level model. In particular, the sensitivity of the model eddy shedding to inflow/outflow conditions, horizontal resolution (80, 40, and 20 km), and reduced gravity is examined. The results are interpreted in terms of the quasi-geostrophic vertical motion equation and vorticity conservation. In the second part of the paper the authors include realistic coastlines and bathymetry in the model. A horizontal resolution of 20 km is used together with 16 vertical levels. Various observed features of the eddy shedding are simulated by the model. A boundary current which follows topographic contours is generated around the Gulf because of the splitting of the flows associated with the Loop Current and the shed eddy. This current is likely to be important in the dissipative stages of the eddies in the western Gulf. In addition, the authors' results suggest that higher-order baroclinic modes are important in the dissipation of Loop Current eddies.

DiMego, G.J., L.F. Bosart and G.W. Endersen. 1976. An examination of the frequency and mean conditions surrounding frontal incursions into the Gulf of Mexico and Caribbean Sea. Mon. Weather Rev. 104(6):710-718.

Dinnel, S.P. 1988. Circulation and sediment dispersal on the Louisiana-Mississippi-Alabama continental shelf. Ph.D. Dissertation. The Louisiana State University. 187 pp.

Abstract. The circulation on the LMAS and adjacent regions has been characterized using historical hydrographic data and current meter data. Generalized seasonal circulation patterns have been proposed based on objective data over the inner shelf, outer shelf, and upper slope. Westward flows on the inner shelf, outer shelf and upper slope in the spring and summer are interpreted as the northern and southern portions of closed cyclonic and anticyclonic circulation cells, respectively. Spring and summer midshelf flow is eastward, with offshelf flow over the eastern LMAS shelf break. Upper slope flow continues on westward in front of the Mississippi Delta, while outer shelf flow turns northward onto the shelf just east of the Delta. These two circulating cells are assumed to continue in the fall. Flow in front of the Delta is to east in fall and winter. Winter shelf circulation appears to consist of a single cyclonic cell. There is weak offshelf flow all along the shelf-break in winter. Wave-induced sediment resuspension and advection by subtidal bottom currents are both necessary for net sediment transport on the inner shelf. Long-term hindcast wave statistics for the LMAS, acquired from the

U.S Army Corps of Engineers, were analyzed. Sediment resuspension during high wave conditions can occur in water depths of 40 m or less. Highest wave conditions, with durations on the order of hours per year, may resuspension sediment in up to 80 m water depth. Sediment transport occurs primarily during prefrontal winds conducive to long waves and cyclonic inner shelf flow in the winter and spring. Outer shelf and upper slope sediments are most likely to be resuspended only by hurricane condition waves or, possibly, by direct influence of the Loop Current.

Dinnel, S. and W. Schroeder. 1989. Coastal water level measurements, Northeast Gulf of Mexico. Jour. Coast. Res. 5(3):553-561.

Dinnel, S.P., W.W. Schroeder and W.J. Wiseman Jr. 1990. Estuarine-shelf exchange using Landsat images of discharge plumes. Jour. Coast. Res. 6(4):789-799.

Abstract. Landsat satellite data can provide descriptions of discharge plume morphology, as well as estimates of estuarine-shelf suspended sediment exchange. Thirty-three images, collected over an 11-year period, of the Mobile Bay, Alabama, discharge plume were analyzed in conjunction with environmental data. Plume size was principally controlled by river discharge but modified by the tides. Suspended sediment transport estimates based on plume size suggest that the annual suspended sediment load from Mobile Bay to the adjacent shelf can be exchanged during an average five-month cold front season and an average spring flood. Wind-wave resuspension of Mobile Bay sediments during frontal passage and direct river borne suspended sediments are the two major sources of suspended sediment transported to the shelf.

Douglas, B.C., R.E. Cheney and R.W. Agreen. 1983. Eddy energy of the northwest Atlantic and Gulf of Mexico determined from GEOS 3 altimetry. J. Geophys. Res. 88(C14):9595-9603.

Abstract. From May 1975 to October 1978 the GEOS 3 satellite altimeter made numerous repeated observations of sea surface topography in the northwest Atlantic and Gulf of Mexico. By comparing members of about 1000 collinear pairs of altimeter profiles, we have determined mesoscale sea height variability and eddy kinetic energy in these ocean regions. Our results agree qualitatively with estimates made from traditional oceanographic surveys, but significant quantitative differences exist in certain areas, especially in the Gulf Stream between Florida and Cape Hatteras where the altimetric results show less variability. The reason for this appears to be due to differences in spatial sampling. Historical oceanographic measurements are relatively sparse and must be aggregated into small geographic boxes to compute variability statistics. Results therefore represent a combination of temporal and spatial variability. In contrast, repeated satellite altimeter tracks provide point measurements of changes of sea height and slope. This enables determination of temporal variability alone, a quantity more representative of eddy energy. It is important to make this distinction between space and time because in regions of strong horizontal gradient such as the Gulf Stream, spatial variability can exceed the temporal component. In mid-ocean where spatial variability is negligible, altimetric and oceanographic results are in excellent agreement.

Dowling, G.B. 1966. Low frequency shallow water internal waves at Panama City, Florida. U.S. Navy Mine Defense Lab. Research Report. 313:59.
Abstract. A study of the physical properties of internal waves, at depths of 60 to 100 ft. in Panama City offshore waters. Includes isotherm temperature data.

Doyle, L.J., B. Birdsall, G. Haward, L. Lehman, S. Szydik and Warren. E. 1977. Baseline monitoring studies, Mississippi, Alabama, Florida outer continental shelf, 1975-1976. Bureau of Land Management. Washington, D.C. 14 pp.

Doyle, L.J. and T.N. Sparks. 1980. Sediments of the Mississippi, Alabama, and Florida (MAFLA) continental shelf. J. Sediment. Petrol. 50(3):905-916.
Abstract. The eastern Gulf (MAFLA) continental margin may be conveniently divided into two parts of opposing history and character. West of Cape San Blas lies the eastern limb of the Gulf Coast geosyncline whose surface expression is a clastic sand body, called the MAFLA Sand Sheet, grading westward into the muds of the Mississippi pro-delta. These sediments have a clay mineral suite dominated by smectite. East of Cape San Blas lies the West Florida Margin, a sequence of carbonate and evaporitic rocks which has been cut off from a major clastic source since Jurassic time. Seaward of the carbonate sands lies the West Florida Lime Mud facies, slope sediments composed of planktonic foraminifera and coccoliths. Inshore of the carbonate sands and separated from them by a zone of mixed composition lies a mature quartz sand, which also makes up the beaches of Southwest Florida - West Florida shelf quartz sands appear to have been deposited at lower sea level stands and to have been transported back and forth with no net drift in a longshore current system which changes seasonally from north to south. Clay mineralogy in portions of the MAFLA region shows distinct changes in composition over a period of a year in the benthos and over periods as short as a few hours in the water column. These changes reflect contribution from two distinct provenances. Benthic variation probably results from occasional intrusion of Mississippi River or Loop Current water into the eastern zone.

Dragovich, A. and J.E. Sykes. 1967. Oceanographic Atlas for Tampa Bay, Florida, and adjacent waters of the Gulf of Mexico: 1958-61, Circular 255. U.S. Department of the Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries. Washington, D.C. 466 pp.
Abstract. A physical and chemical oceanographic survey of Tampa Bay and the adjacent shelf (out to 83 km) carried out during 1958-1961 by DOI. They depicted monthly sections of temperature, salinity, density (sigma-t), inorganic phosphorus, total phosphorus, nitrogen, and copper along the occupied transects.

Drennan, K.L. 1963. Surface circulation in the northeastern Gulf of Mexico. Technical Report No. 1. Gulf Coast Research Laboratory, Oceanography Section. Ocean Springs, Mississippi. 116 pp.
Abstract. The general features of the surface circulation in the northeastern Gulf are presented from an analysis of surface density distribution and an extensive drift bottle study. Surface circulation for the area is depicted as follows: an eastward flow during spring and early summer, which diverges into northeast and southeast flow at varying distances east of the Delta depending on local winds and river discharge; a

southwest flow over continental shelf during late summer and fall, which appears to continue westward and into southwest Gulf. The existence of the southeast flowing Loop Current also is indicated in the offshore region southeast of the delta at this time. Flow during winter months is to the southeast and appears to be a result of the northward migration of the loop current.

Drennan, K.L. 1965. Surface circulation in the northeastern Gulf of Mexico, Technical Report No. 1. Gulf Coast Research Laboratory, Oceanography Section. Ocean Springs, MS. 116 pp.

Drennan, K.L. 1966. Airborne Measurements of Infrared Sea Temperature in the Northern Gulf of Mexico, Technical Report 2. Gulf Coast Research Laboratory. Ocean Springs, MS. 10 pp.

Abstract. Quasi-synoptic measurements of the radiation temperature of the sea were conducted over the northern Gulf of Mexico on a near monthly basis during the period November 1963 to June 1965. These data indicate the seasonal and spatial variations of surface temperature, Mississippi River discharge patterns, the effect of the passage of a severe hurricane on the sea surface temperature field, and the major surface features of the circulation in the northern Gulf.

Drennan, K.L. 1968. Hydrographic studies in the northeast Gulf of Mexico. Technical Report 68-0-1. Gulf South Research Institute, Environmental Science and Engineering Laboratories. New Iberia, LA. 111 pp.

Abstract. The major circulatory features and distribution of physical properties are presented from a series of eight quasi-synoptic surveys on the continental shelf and upper slope from Mississippi Delta to Panama City, Florida. Seasonal changes in hydrography and circulation over the continental shelf are shown and discussed in terms of their relationship to the off-shore currents, river discharge, winds, and tides. Surface current speed and direction are determined from an extensive drift bottle study and distribution of density.

Drummond, K.H. and G.B. Austin Jr. 1958. Some aspects of the physical oceanography of the Gulf of Mexico. Special Scientific Report - Fisheries No. 249. Fish and Wildlife Service. U. S. Department of the Interior. 5-7 pp.

Dubois, R.N. 1990. Barrier-beach erosion and rising sea level. Geology. 18(11):1150-1152.

Abstract. For an equilibrium cross-shore profile a kinematic model has been constructed that predicts the rate of shoreline erosion in response to rising sea level. Model predictions are reasonably close to observed erosional rates for several state shorelines bordering the United States coast of the Atlantic Ocean and Gulf of Mexico.

Durham, D.L. and R.O. Reid. 1967. Analysis of tidal current observations over the northeastern shelf of the Gulf of Mexico. Texas A&M Univ., Dept. of Oceanography Project. 286, 67-1T:117.

Abstract. Observations on the currents associated with tides off of Panama City.

Duttman, J.D. 1981. Effects of Loop Current position on sea level at St. Petersburg, Florida and circulation on the west Florida shelf. Master's Thesis. Florida State University, Tallahassee, FL.

Duxbury, A.C. 1962. Averaged dynamic topographies of the Gulf of Mexico. Limnology and Oceanography. 7(3):428-431.

Edwards, N. 1975. Escambia Bay physical oceanography. Master's Thesis. Florida State University, Tallahassee, FL. 100 pp.
Abstract. Data on salinity, temperature and current speed and direction were collected from 18 stations in Escambia Bay, Florida from July, 1973 to November, 1973. Measurements were made at 2-foot intervals from surface to bottom.

Edwards, N.C., Jr. 1976. A Study of the circulation and stratification of Escambia Bay, Florida during the period of low fresh water inflow. Master's Thesis. Florida State University, Tallahassee, FL.

Elder, J.F., S.F. Flagg and H.C. Mattraw. 1988. Hydrology and ecology of the Apalachicola River, Florida: a summary of the river quality assessment. USGS Water Supply Paper. 2196-D:46.
Abstract. During 1979-1981 the USGS conducted a large-scale study of the Apalachicola River in northwest Florida emphasizing the interrelations among hydrodynamics, the flood-plain forest, and the nutrient detritus flow through the river system to the estuary. Water and nutrient budgets based on data collected during the study indicate the relative importance of various inputs and outflows in the system. Analysis of long-term records shows that upstream dam construction has had little effect on total annual flow, but has probably suppressed low-flow extremes (in addition to riverbed degradation and channelization). Management decisions should take into account the impact of the natural flooding cycle.

Eleuterius, C.K. 1976. Delineation of the Tidal Current Regime of Mississippi Sound. MASGC-Q-76-001. Mississippi-Alabama Sea Grant Consortium, Ocean Springs. Ocean Springs, MS. 1 pp.

Eleuterius, C.K. 1976. Mississippi Sound -- temporal and spatial distribution of nutrients. MASGP-76-024. Mississippi-Alabama Sea Grant Consortium. Ocean Springs, MS. 48 pp.
Abstract. The Mississippi Sound is the eventual recipient of the accumulative effluents from activities throughout the drainage basin and is further altered by other direct actions such as dredging and construction. In order to assess the effect of present and future development on the water quality of the Sound, it is necessary to ascertain the existing regime of nutrients through determination of descriptive norms and causal relationships. The estuarine waters are the principal sources of the major elementary components of estuarine organisms: carbonate, phosphate and nitrate ions. On January 1, 1973, the physical oceanography section of Gulf Coast Research Laboratory initiated a three-year investigation of the hydrography of Mississippi Sound. The primary objectives of this research effort were to provide a description of flow patterns; determine the salinity and temperature characteristics; and ascertain the temporal and spatial distribution of nutrients.

Eleuterius, C.K. and S.L. Beaugez. 1981. Mississippi Sound: a hydrographic and climatic atlas. MASGP-79-009. Mississippi-Alabama Sea Grant Consortium. Ocean Springs, MS. 135 pp.

Eleuterius, C.K. and G.A. Criss. 1994. Circulation on the Continental Shelf Between 87°W and 90°W with Data Appendix, Final Report. Vol. 1 Prepared for Minerals Management Service, New Orleans, LA. University of Southern Mississippi Gulf Coast Research Laboratory. Ocean Springs, MS. 147 pp.
Abstract. Knowledge of the circulation of waters over the continental shelf and slope between 87°W and 90°W longitude is essential for judicious management of the region's living and mineral resources and related industrial activities. This region, an integral part of the Fertile Fisheries Crescent, has been in a state of on-going development by the oil and gas industry for over four decades. The increase in activities of all types on the shelf, e.g., offshore oil and gas, maritime commerce, and fisheries with the inherent risks each imposes on the environment, underscores the need for better knowledge of the region's hydrodynamics, biology, chemistry, and geology. Prior to planning and initiating any further physical oceanography studies which require taking additional measurements in this region, the authors believe it prudent to first extract whatever relevant information remains in existing data. This effort entailed the laborious recovery of oceanographic data at the Gulf Coast Research Laboratory which was in a number of disparate forms and formats.

Elliott, B.A. 1979. Anticyclonic rings and the energetics of the circulation of the Gulf of Mexico. Ph.D. Dissertation. Texas A&M University, College Station, TX. 203 pp.

Elliott, B.A. 1982. Anticyclonic rings in the Gulf of Mexico. J. Phys. Ocean. 12(11):1292-1309.
Abstract. Using the historical data set, this study describes the anticyclonic rings that separated from the Loop Current in the eastern Gulf of Mexico. Six quasi-synoptic data sets are used to describe the evolving circulation of the Gulf of Mexico from October 1966 to September 1967, showing the separation and movement into the western Gulf of three anticyclonic rings. The historical data are used to determine that these rings typically translate to the west at a mean speed of 2.1 km/day. Their length scale as defined by their rms radii is 183 km. An estimate of ring life-span, as defined by an e-folding time, is one year.

Ellis, E.E. 1969. Some basic dynamics of the Pensacola estuary (an operations research analysis). Florida Air and Water Pollution Control Commission. Tallahassee, FL. 19 pp.

El-Sayed, S.Z., T. Ichiye and C.C. Trees. 1986. Gulf of Mexico/Cuba. pp. 67-70. *In* Nimbus-7 CZCS, Coastal Zone Color Scanner Imagery for Selected Coastal Regions. (Series eds.: Hovis, W.A., E.F. Szajna and W.A. Bohan.) NASA.

Environmental Consultants, 1974. Environmental and Socio-Economic Baseline On the Gulf of Mexico Coastal Zone and Outer Continental Shelf Vol. 1. Contract 08550-CT3-10. U.S. Bureau of Land Management, Outer Continental Shelf Office. New Orleans, Louisiana. 776 pp.

Environmental Consultants, 1974. Environmental and Socio-Economic Baseline On the Gulf of Mexico Coastal Zone and Outer Continental Shelf Vol. 3. Contract O8550-CT3-10. U.S. Bureau of Land Management, Outer Continental Shelf Office. New Orleans, Louisiana.

Environmental Science and Engineering, 1977. An assessment of water quality in Bay County, Florida. ESE. Gainesville, FL. 185 pp.
Abstract. Assessment of the water quality of various locations in St. Andrew Bay, including its bayous and creeks.

Environment Consultants, 1974. Environmental and socioeconomic baseline on the Gulf of Mexico coastal zone and outer continental shelf: supplemental bibliography on environmental processes and conditions in the Gulf of Mexico Region. Vol. 2 Bureau of Land Management. Washington, D.C.

Environment Consultants, 1974. Environmental and socioeconomic baseline on the Gulf of Mexico coastal zone and outer continental shelf: supplemental bibliography on environmental processes and conditions in the Gulf of Mexico region. Vol. 1 Bureau of Land Management. Washington, D.C.

Etter, P.C. 1975. A climatic heat budget study of the Gulf of Mexico. M.S. Thesis. Texas A&M University. 87 pp.

Etter, P.C. 1983. Heat and freshwater budgets of the Gulf of Mexico. J. Phys. Ocean. 13(11):2058-2069.
Abstract. Monthly mean oceanic heat storage rates (QT) for the upper 200 meters of the Gulf of Mexico are calculated directly from multi-annual vertical temperature data. The annual march of QT exhibits a minimum in January and a maximum in May. Contoured maps of QT elucidate climatic features of air-sea interactions occurring over the Loop Current and also near the shelf edges of the northern Gulf. Three previous climatic heat budget studies are examined to determine the surface heat exchange. While Budyko's values provide a familiar basis for comparisons. The more recent unpublished results of Bunker and Hastenrath and Lamb are averaged together to define the monthly mean radiative (QR) and turbulent (QA) heat exchanges in the Gulf of Mexico. Monthly mean advective heat changes (QV) are then derived as residuals in the heat budget equation and are partially verified by direct computations of the monthly mean vertical and horizontal components of heat advection according to the divergent heat budget equation developed by Emery. The residual QV values reinforce the observations of Elliott concerning the role of detached anticyclonic Loop Current rings in redistributing heat with the Gulf of Mexico. New estimates of the mean hydrologic balance in the Gulf of Mexico are advanced by combining the seasonal oceanic precipitation rates (P) of Dorman and Bourke with the evaporation rates (E) obtained from the averages of Bunker (unpublished) and Hastenrath and Lamb. An annual mean E-P value of 127 cm is obtained. These results are combined with estimates of river discharge rates to evaluate the freshwater continuity of the Gulf of Mexico.

Ewing, G.C. and F.B. Phleger. 1958. Tidal Influences On the Spacing of Inlets into Coastal Lagoons. Trans. Am. Geophys. Un. 39:540.
Abstract. A common type of coastal configuration is one in which a long, narrow tidal lagoon of fairly uniform cross section lies parallel to the coast

separated from the ocean by a low, sandy barrier island. It is frequently found that the barrier island of this type of lagoon is interrupted by inlets at more or less regular intervals of the order of 15 mi. The hypothesis is developed that this characteristic interval is determined by the variation in the hydraulic head which is developed across the barrier by the phase relation between the tide inside the lagoon and on the outer beach. Supporting evidence is presented based on tidal studies of Santo Domingo Lagoon in the arid region of Baja California.

Farrell, D.H. 1970. Ecology and seasonal abundance of littoral amphipods from Mississippi. Master's Thesis. Mississippi State University, Starkville, MS. 62 pp.

Abstract. Monthly sampling for gammaridean amphipods was conducted at seven stations in Mississippi Sound and adjacent waters from October, 1967 through November, 1968. Physical monitoring was accomplished at each station.

Fausak, L.E. 1979. Salinity, temperature, and light penetration observations on the MAFLA Outer Continental Shelf. pp. 889-929. *In* Mississippi, Alabama, Florida (MAFLA) Outer Continental Shelf Baseline Environmental Survey 1977/1978, Chapter 20. Vol. IIB. Dames and Moore, Final Report to the U.S. Dept. of the Interior, Bureau of Land Management, Washington, D.C. (Contract # AA550-CT7-34.)

Fay, T.H., H.V. Miller and R.K. Clark. 1990. Bathymetric Analysis of `In-Water' Upwelling Radiance Data. pp. 641-654. *In* Anon., ed. Ocean Optics X. (Orlando, FL, USA Conference Date: 1990 Apr 16-18; Proceedings of SPIE - The International Society for Optical Engineering v 1302) Int Soc for Optical Engineering, Bellingham, WA.

Abstract. In June 1988, the Naval Ocean Research and Development Activity (NORDA) collected some 'in-water' data using its Towed Underwater Pumping System (TUPS) in the near-shore waters off St. Andrews State Park, Shell Island, Florida. These in-situ data include latitude; longitude; depth in meters; narrow-band upwelling at 465 nm, 507 nm, and 532 nm; broad-band downwelling collected at the surface; temperature; salinity; and transmissivity. In this paper, we investigate the relationship between depth and the normalized upwelling irradiance (upwelling divided by downwelling) in the three bands. Algorithms used to calculate water depth from remotely sensed airborne and satellite multispectral data are applied to the TUPS data and results compared. The TUPS data have the advantage over most aircraft- and satellite-collected data because they were collected over an essentially uniform bottom type (smooth sandy bottom with steady slope) and have no atmospheric contamination. A new algorithm for depth calculation is proposed.

Federal Water Pollution Control Administration. 1970. Effects on pollution on water quality, Perdido River and Bay, Alabama and Florida. Southeast Water Lab. 95 pp.

Abstract. The report evaluates water quality conditions and waste sources in Perdido Bay. An investigation of waste sources and a detailed study of the bay and its major tributaries were conducted during the period of September 9-17, 1969. The report presents an evaluation of the data collected during this study.

Finucane, J.H. and A. Dragovich. 1966. Hydrographic observations in Tampa Bay, Florida, and adjacent Gulf of Mexico waters-1963. U.S. Fish Wildl. Serv., Data Rep. 14

Flierl, G. and R. Mied. 1985. Frictionally induced circulations and spin down of a warm-core ring. J. Geophys. Res. 90(C5):8917-8927.

Florida Department of Administration. 1977. The Apalachicola River and Bay System: Florida resource. DSP-BLWM-5-77. Bur. Land Water Manage. Tallahassee, FL. 52 pp.

Florida Dept. of Natural Resources. 1973. Marine environmental studies of Florida's gulf coast: summary and selected bibliography. Florida DER. Tallahassee, FL. 20 pp.

Florida Game and Fresh Water Fish Commission, L. and S.S. 1957. Report on North Bay and associated waters, Bay County, Florida. Florida GFWFC. Tallahassee, FL. 75 pp.
Abstract. A pre-impoundment survey of North Bay. Includes information on water quality, hydrology, and fish populations.

Florida Institute of Oceanography. 1975. Baseline Environmental Survey of the Mississippi, Alabama, Florida (MAFLA) Lease Areas, CY 1974; Final Report. MMS/GM-74/0002; DI-08550-CT4-11. Minerals Management Service. Metairie, LA. 301 pp.
Abstract. The Gulf of Mexico is a semi-enclosed bas with a surface area of 1,540,000 sq.km. On the north and east sides, the continental shelf makes up 22 percent (340,000 sq km) of this area and is covered by water shallower than 100 fathoms (180 meters). The continental slope, between 100 and 1,700 fathoms (180-3,600 meters), covers 20 percent (310,000 sq km) of the total area. Another 20 percent, below the depth of 1,700 fathoms, covers the Sigsbee and Florida plains. To the southeast are the two connections with other seas-the Straits of Florida with a sill depth of 475 fathoms (860 meters) and the Yucatan Channel with a 1,120-fathom (2,000-meter) sill depth. The subject survey provides quantitative and statistically valid baseline (benchmark) measurements of selected factors that may vary as a direct result of oil and gas exploitation at priority locations within the MAFLA area.

Florida State Board of Health. 1967. Survey of Perdido River and Bay 1966-1967. Florida State Board of Health, Bureau of Sanitary Engineering. 43 pp.

Florida State Environmental Quality Laboratory. 1983. Hydrographic studies of St. Andrew Bay, Florida: a training exercise, March 21-25, 1983. pp. 14.
Abstract. The results of an exercise in the use of hydrographic techniques to monitor the outfall of wastewater treatment plants. Dyes were used to study the velocity, dispersal and dilution of the discharge; salinity measurements were taken.

Folger, D.W. and S. Needell. 1983. U.S. Geological Survey program of offshore resource and geoenvironmental studies, Atlantic-Gulf of Mexico region, from September 1, 1976, to December 31, 1978. U.S. Geol. Surv. Circ. 870:67.

Abstract. Summary of U.S. Geological Survey's environmental programs in the Gulf of Mexico and along the Atlantic coast. Much of the USGS program is in response to anticipated offshore oil and gas sales in these areas and is conducted for the Bureau of Land Management. Emphasis is on the geologic hazards associated with drilling in lease sale areas.

Forristall, G.Z. 1978. On the statistical distribution of wave heights in a storm. J. Geophys. Res. 83(C5):2353-2358.

Abstract. There has been recent controversy over how well the Rayleigh distribution matches the observed distribution of wave heights. Most of this controversy stems from comparisons based on different definitions of the significant wave height. Once consistent definitions are used, all available data support the conclusion that the Rayleigh distribution overpredicts the heights of the higher waves in a record. Analysis of 116 hr of hurricane-generated waves in the Gulf of Mexico permitted the empirical fitting of the data to a Weibull distribution. Statistics developed from the empirical distribution include the prediction that the highest wave in 1000 is only 0.907 times the height predicted by the Rayleigh distribution.

Forristall, G.Z. 1991. A preliminary hindcast model for Loop Current eddies. pp. 1149-1155. *In* MTS '91. An Ocean Cooperative: Industry, Government, and Academia. Proceedings. New Orleans Convention Center, November 10-14, 1991. Marine Technology Society, Washington, D.C.

Abstract. In the Gulf of Mexico, the Loop Current and eddies shed from it can be an important part of the environmental criteria for projects in deep water. Design calculations require estimates of probabilities of current speed and direction at specific sites. In order to compute these probabilities, a kinematic hindcast model has been developed which calculates currents given simple information about the position and shape of an eddy. A number of historical data sources were consulted in order to produce descriptions of the 19 eddies which affected the northern Gulf during the years 1973-1987. Hindcasts of these events showed that the probability of encounter with the Loop Current or eddies decreases from southeast to northwest. Given an encounter, the probability distribution for current speed is approximately uniform to 120 cm/sec, with smaller probability of higher speeds.

Forristall, G.Z., R.D. Larrabee and R.S. Mercier. 1991. Combined oceanographic criteria for deepwater structures in the Gulf of Mexico. pp. 377-390. *In* 23rd Annual Offshore Technology Conference, 1991, Houston, Texas.

Forristall, G.Z., K.J. Schaudt and J. Calman. 1990. Verification of Geosat altimetry for operational use in the Gulf of Mexico. J. Geophys. Res. 95(C3):2985-2989.

Abstract. Geosat altimetry is well suited for locating large eddies shed by the Loop Current in the Gulf of Mexico. The authors have compared the altimeter data with in situ data obtained during a survey of Eddy Murphy in June 1988. Since there is no significant mean circulation in the central Gulf, the authors used the mean sea surface from the first year of altimeter data as a geoid estimate. The dynamic height change due to the eddy closely matched the altimeter data, although the eddy moved about one third of a degree between the survey and the satellite pass. The motion of the eddy was confirmed by the track of an Argos buoy.

Forristall, G.Z., K.J. Schaudt and C.K. Cooper. 1992. Evolution and Kinematics of a Loop Current Eddy in the Gulf of Mexico during 1985. J. Geophys. Res. 97(C2):2173-2184.

Abstract. The large eddy that broke off from the Loop Current in July 1985 was the most extensively studied eddy to appear in the Gulf of Mexico. Other investigators have described its early evolution based on Lagrangian drifters and its later evolution using moored current meters in the western Gulf. This paper provides additional insight on the early evolution of the eddy using results from air dropped expendable bathythermographs and air dripped expendable current profilers in early May, a hydrographic ship survey in mid-July, and a detailed ship survey in August using expendable bathythermographs and a current profiler. The May survey established a center of circulation at about 26°N but showed that the eddy had not separated from the Loop Current. A maximum velocity of 171 cm/s was observed near the northern edge of the feature. The evidence suggests that a large elongated eddy then separated from the Loop Current and later split into two smaller eddies.

Fotheringham, N. and G.H. Weisberg. 1979. Some causes, consequences and potential environmental impacts of oxygen depletion in the northern Gulf of Mexico. pp. 2205-2208. *In* Proceedings of the 11th Annual Offshore Technology Conference. Vol. 4.

Abstract. Biological and water quality changes in the Gulf of Mexico off central Louisiana have been examined during a seasonal period of stratification and oxygen depletion in the water column. Probable causes, observed effects, and potential impacts on the timing of ocean discharges and dumping and onsite selection for offshore industries are described. Apparently an annual phenomenon of variable intensity resulting from discharge of low salinity organic-laden water from the Mississippi and Atchafalaya Rivers at a time of minimal vertical mixing, this midsummer event may be intensified and prolonged by the intrusion of high salinity bottom waters from a Loop Current eddy. In 1978, a widespread low oxygen layer occupied the lower 3 to 8 m of the 6 to 17 m water column for at least 3 weeks. Dissolved oxygen concentration was commonly less than 0.1 ppm in this layer, resulting in the mortality of some polychaetes, mollusks, and crusteceans, including blue crabs, and in the reduction of demersal shrimp and fish populations, probably through emigration offshore. Numerous large bivalves approximately 4 to 5 years old were killed, indicating an intensity not experienced since 1973 to 1974, when Green found toxic bottom water at over one-half of his stations in this area. The temporal and geographic distribution of this condition and its environmental consequences should be recognized by industries engaged in fishing, offshore petroleum production, and offshore dumping and by government agencies providing leases and permits for these activities.

Fox, D.N., M.R. Carnes and J.L. Mitchell. 1992. Characterizing major frontal systems: A nowcast/forecast system for the northwest Atlantic. Oceanography. 5(1):49-54.

Abstract. The U.S. Navy expends a considerable effort to determine the locations and properties of most major ocean frontal systems across the globe. This synoptic picture, called a nowcast, is partly constructed using expendable bathythermographs dropped from ships (XBTs) and airplanes (AXBTs). Such in-situ measurements can give very detailed information, but the cost limits their utility to relatively localized

and short-lived surveys. Fortunately, given an adequate database of earlier measurements, simply knowing the surface location of a front is often sufficient to reconstruct an accurate picture of the three-dimensional thermal structure of the water column to depths of thousands of meters. Satellite infrared-radiometer (IR) images provide locations of important mesoscale features over large areas, but clouds can obscure important fronts for long periods, and the surface thermal structure is not always an accurate guide to the actual location of the predominate currents. Satellite altimetry can provide accurate locations of currents and related features. In many areas of interest, the time and space scales on which the oceans evolve are not adequately sampled. The U.S. Navy's Geodetic Earth Orbiting Satellite (GEOSAT) (Born et al., 1987) with its 17-day repeat cycle and equatorial track separation of less than 150 km was adequate to sample regions such as the Gulf of Mexico, but was not sufficient to provide a synoptic picture for the evolution of the Gulf Stream.

Franceschini, G.A. 1953. The distribution of mean monthly wind stress over the Gulf of Mexico. Reference 53-1. Department of Oceanography. Texas A&M University, College Station. 19 pp.

Abstract. The areal distribution of the mean monthly and annual wind stress on the Gulf of Mexico is presented. Approximate values of the stress were determined for each 2° latitude-longitude quadrangle using mean monthly wind tabulations of ship observations. Calculations were based on the assumption that wind stress is proportional to the square of the wind speed. Prominent features of the stress distribution are noted. Qualitative agreement, according to classical theory, of this distribution which observed mean surface currents in the western half of the Gulf is indicated. A brief discussion of the association in this area between mean surface flow and the mean pattern of surface water temperature is included.

Franceschini, G.A. 1953. The reliability of commercial vessel reports of sea surface temperatures in the Gulf of Mexico. Scientific Report No. 2. Department of Oceanography. Texas A&M University. 9 pp.

Franceschini, G.A. 1955. Reliability of commercial vessel reports of sea surface temperatures in the Gulf of Mexico. Bureau of Marine Science of the Gulf and Caribbean. 5(1):42-51.

Franceschini, G.A. 1961. Hydrologic balance of the Gulf of Mexico. Ph.D. Dissertation. Texas A&M University, College Station, TX. 58 pp.

Franklin, M.A. and L.R. Bohman. 1980. Hurricane Frederic tidal floods of September 12-13, 1979 along the Gulf coast, Oriole Beach, Garcon Point, Holley, south of Holley, and Navarre quadrangles, Florida. US Geological Survey. Hydrologic Investigations Atlas. Map HA-0641. (Scale 1:24,000).

Abstract. Shows the areas flooded along the shores of Santa Rosa Sound and the Gulf of Mexico from Pensacola Beach eastward to The Narrows near Fort Walton Beach, Fla. The areas flooded along the shores of Pensacola, Escambia, Blackwater and East Bays were not delineated; however, floodmark elevations were determined.

Franklin, M.A. and J.C. Scott. 1980. Hurricane Frederic tidal floods of September 12-13, 1979 along the Gulf coast, Gulf Breeze-Fort Barrancas quadrangles, Florida. US Geological Survey. Hydrologic Investigations Atlas. Map HA-0640.Scale 1:24,000.

Abstract. Shows the areas flooded along the shores of Big Lagoon, Pensacola Bay, Santa Rosa Sound and the Gulf of Mexico from Seaglades eastward to Pensacola Beach. Inundated areas along the shores of Pensacola Bay north to a line from Chevalier Field to Fair Point were not delineated; however, floodmark elevations were determined.

Fuglister, F.C. 1947. Average monthly sea surface temperatures of the western North Atlantic Ocean. Massachusetts Institute of Technology, Woods Hole Oceanographic Institute, Papers in Physical Oceanography and Meteorology. 10(2):1-25.

Abstract. This paper contains seasonal isotherms for the Gulf of Mexico.

Futch, C.R. and J. Martina. 1967. A survey of the oyster resources of Bay County, Florida, with special reference to selection of culture planting sites. Florida Board of Conservation, Div. of Salt Water Fisheries, Marine Lab. Special Scientific Report. 16:25.

Abstract. This survey of oyster populations includes hydrographic data for St. Andrew Bay.

Gaby, D.C., D.R. Cochran, J.B. Lushine, S.C. Pearce and A.C. Pike. 1975. Atlantic Tropical Cyclone Classifications for 1974. NOAA-TM-NESS-68; NOAA-75042803. National Environmental Satellite Service, Satellite Field Services Station. Coral Gables, FL. 12 pp.

Abstract. Estimates of the locations and maximum sustained winds of all named tropical cyclones in the North Atlantic Ocean, the Caribbean Sea, and the Gulf of Mexico during 1974 were made using the technique developed by Dvorak. This technique was applied to pictures from the SMS-1 (Stationary Meteorological Satellite) and ATS-3 (Advanced Technology Satellite) geostationary satellites. These estimates were compared with other data to establish the measure of accuracy achieved. The results are presented together with comments on expected future performance.

Gainer, T.H., Jr. 1966. A theoretical investigation of the M_2 constituent of the tide in the Gulf of Mexico. M.S. Thesis. U. S. Naval Postgraduate School. Monterey, CA. 86 pp.

Gallagher, R.M. 1971. Preliminary report on the hydrography of the Pensacola Bay Estuary, Florida. Florida Department of Natural Resources Marine Research Laboratory. Spec. Sci. Rept. 29:36.

Abstract. Temperature, salinity, dissolved oxygen, and pH were monitored from September through December 1970 in the Pensacola Estuary, Florida. Temperatures ranged from 12.3 to 32.0°C, salinities from 0.0 to 34.5 ppt. These values did not fluctuate beyond those normally expected in respect to meteorological influences. Dissolved oxygen values at the surface were generally satured but bottom values during September were generally below 58% of saturation in Escambia Bay, probably because of increased salinity stratification during periods of higher rainfall runoff and elevated temperatures. Analyses of pH values (which approached oceanic conditions except near river mouths) were inconclusive.

Gallaway, B.J. 1988. Northern Gulf of Mexico Continental Slope Study. Final Report (Year 4). Volume 1. Executive Summary; Final Report. MMS/GM-88/0052. LGL Ecological Research Associates, Inc. Bryan, TX. 72 pp.

Abstract. In 1983, the Minerals Management Service initiated a multi-year program to study the continental slope of the northern Gulf of Mexico as part of its outer continental shelf environmental studies program. This particular program, the Northern Gulf of Mexico Continental Slope Program, has three primary goals: (1) to determine the abundance, structure, and distribution of animal communities in the deep sea Gulf of Mexico; (2) to determine the hydrography and bottom conditions at selected sites within the study area and to relate these to faunal variations; and (3) to measure present levels of hydrocarbon contamination in deep-sea sediments and selected animals. Volume I provides an introduction of the study and summarizes field and laboratory methods; the environmental characterization of the area; meiofauna, macrofauna, megafauna; an overview of the chemosynthetic community; the Bush Hill chemosynthetic community, the general conceptual model; depth patterns of standing stocks; faunal assemblages and zonation; conclusions; sampling deficiencies and recommendations; and literature cited.

Gallaway, B.J. 1988. Northern Gulf of Mexico Continental Slope Study. Final Report (Year 4). Volume 2. Synthesis Report; Final Report. MMS/GM-88/0053. LGL Ecological Research Associates, Inc. Bryan, TX. 325 pp.

Abstract. In 1983, the Minerals Management Service initiated a multi-year program to study the continental slope of the northern Gulf of Mexico as part of its outer continental shelf environmental studies program. Volume II of the 3 volume Year 4 report provides an environmental and biological background as a context for the study findings, and a summary of the overall methods and approaches used to meet program objectives; the findings describing the slope environment and habitats; the meiofaunal, macrofaunal, and the megafaunal communities that occur over soft bottom communities and project specific studies at the site known as Bush Hill; and a conceptual model of the slope ecosystem.

Gallaway, B.J. 1988. Northern Gulf of Mexico Continental Slope Study. Final Report (Year 4). Volume 3. Appendices; Final Report. MMS/GM-88/0054. LGL Ecological Research Associates, Inc. Bryan, TX. 381 pp.

Abstract. In 1983, the Minerals Management Service initiated a multi-year program to study the continental slope of the northern Gulf of Mexico as part of its outer continental shelf environmental studies program. The Year 4 report was prepared in three volumes. Volume III contains three massive appendices detailing the results of significant analysis of variance (ANOVA) and orthogonal contrasts comparing the abundance levels of abundant macrofauna species among stations sampled on each cruise; a correlation matrix for the 22 environmental variables considered of importance and the same abundant macrofauna; and figures showing the relative density of the same abundant macrofauna that exhibited significant differences in the ANOVA's on one or more cruises.

Gallegos, S. 1990. Evaluation of the potential of the NOAA-N AVHRR reflective data in oceanography. Ph.D. Dissertation. Texas A&M University, College Station, TX. 203 pp.

Abstract. This study investigates the capabilities of the reflective data of the NOAA-n Advanced Very High Resolution Radiometer (AVHRR) to detect and map features associated with phytoplankton concentrations at the ocean surface. The more accessible data sets from the NOAA AVHRR are examined, and techniques designed to exploit the full sensitivity of the instrument are introduced. These procedures include an editing technique that maintains the full resolution in the low albedoes pertaining to ocean targets and a normalizing procedure to account for atmospheric contributions to the signal. The atmospheric effects are treated as functions of the amount of water vapor in the atmosphere and the position of the individual pixels along the swath width of the instrument. These techniques permit the refinement of the reflective data to 0.1% albedo and the expansion of acceptable data to at least 512 pixels on either side of nadir. Data obtained with these methodologies are compared with near-simultaneous and pigment calibrated Coastal Zone Color Scanner (CZCS) data. Comparisons are also made between AVHRR reflective and emittive data to investigate possible relationships existing between the circulation patterns and phytoplankton distributions.

Garcia, A.W. 1991. On the relationship between the intensity of extratropical frontal cyclone systems and water levels in the Gulf of Mexico. Ph.D. Dissertation. Purdue University. West Lafayette, IN. 138 pp.

Abstract. The effects of winter season frontal cyclone systems on tidal-period Gulf of Mexico water levels are investigated. The passage of a series of hypothetical and observed frontal cyclone systems across the Gulf of Mexico is simulated using a Gulf-wide hydrodynamic model driven by a synoptic-scale, balanced flow wind model. The observed frontal cyclone systems were selected to represent a fast moving front, a slow moving front, and a frontal system which involved Gulf cyclogenesis. Evaluation of the model simulations was based upon comparison of tidal anomalies acquired at National Ocean Service tidal monitoring stations. Results of the model simulations show generally good qualitative agreement with the tidal anomalies. Because the wind model used routinely available meteorological data, forecasts of surge levels in the Gulf may be possible.

Gaul, R.D. 1963. Status of environmental research off Panama City, Florida. A&M Project 286(D)/Reference 63-2T. Texas A&M University. College Station. 82 pp.

Gaul, R.D. 1965. Air-sea environmental studies off Panama City, Florida. Unpublished report. Texas A&M Univ., Dept. of Oceanography and Meteorology. College Station, TX. 11 pp.

Abstract. A description of the projects being conducted from the Navy's offshore stages.

Gaul, R.D. 1966. Circulation over the continental margin of the northeast Gulf of Mexico. Texas A&M Univ., Dept. of Oceanography Project. 286-D, 66-18T:116.

Abstract. The circulation of these waters was determined by measurements taken from the offshore stages, and also from oceanographic vessels.

Gaul, R.D. 1966. Environmental research off Panama City, Florida. Texas A&M Univ., Dept. of Oceanography Project. 286-D, Ref. 66-21F:69.

Abstract. Describes the facilities and general results of the research program conducted from the Navy's offshore stages.

Gaul, R.D. 1967. Circulation over the continental margin of the northeast Gulf of Mexico. Ph.D. Dissertation. Texas A&M University, College Station, TX. 172 pp.

Abstract. The ocean circulation over the continental margin of the northeast Gulf of Mexico has been delineated on the basis of three years of hydrographic and direct current observations. A wide range of measurement techniques was used at two fixed platforms in the nearshore region off Panama City, Florida, and from small vessels during periodic surveys conducted over a larger area. Evidence is presented for a close coupling between circulation over the continental margin and that in deeper water. The Loop Current, which transports water into the Gulf from the Yucatan Channel, is identified on the basis of water mass characteristics as far north as the edge of the northeast continental slope. Lateral mixing with waters over the continental margin is evidenced by smooth transitions of salinity-temperature relations characterizing offshore and nearshore waters. It is suggested that the loop current is the main driving influence for circulation over the continental margin, especially below the seasonal thermocline. Flow over the continental margin is modified markedly by ocean bottom topography. De Soto Canyon, the most prominent single bathymetric feature, appears to have a dominant influence on replenishment of water in the lower layer over the shelf. A zone of horizontal transition in hydrography and currents has been noted along the break between shelf and slope, especially during the spring months when stratification over the shelf is incipient.

Gaul, R.D. and R.E. Boykin. 1964. Northeast Gulf of Mexico hydrographic survey data collected in 1963. A&M Project 286(D)/Reference 64-26T. Texas A&M University. College Station, TX. 81 pp.

Abstract. The survey region extends from the Mississippi Delta to Cape San Blas (about 200 nautical miles) and offshore to the 200 fathom depth contour (50 to 70 nautical miles). The surveys serve two primary purposes. One is to provide 'background' information on the physical environment over the shelf to aid in interpretation of phenomena observed in the vicinity of nearshore platforms off Panama City (Gaul, et al, 1963). The second is to study the distribution of physical properties as related to circulation over and outside the shelf. Studies of environmental influences on the distribution and occurrence of pelagic fishes and 'fouling' organisms.

Gaul, R.D. and R.E. Boykin. 1965. Northeast Gulf of Mexico Hydrographic Survey Data Collected in 1964. REF-65-8T. Texas A and M Univ, Dept of Oceanography. College Station, TX. 85 pp.

Abstract. The report summarizes data collected during periodic hydrographic surveys made in 1964 over the continental shelf and slope of the northeast Gulf of Mexico. The survey region extends from the Mississippi Delta to Cape San Blas (about 200 nautical miles) and offshore to the 1000 fathom depth contour (100 to 110 nautical miles). The surveys serve two primary purposes. One is to provide 'background' information on the physical environment over the shelf to aid in interpretation of phenomena observed in the vicinity of nearshore platforms off Panama. The second is to study the distribution of physical properties as related to circulation over and outside the shelf.

Gaul, R.D., R.E. Boykin and D.E. Letzring. 1966. Northeast Gulf of Mexico Hydrographic Survey Data Collected in 1965. REF-66-8T. Texas A and M Univ, Dept of Oceanography. College Station, TX. 202 pp.

Abstract. This report summarizes data collected during periodic hydrographic surveys made in 1965 over the continental shelf and slope of the northeast Gulf of Mexico. The survey region extends from the Mississippi Delta to Cape San Blas, Florida (about 300 nautical miles) and offshore to about the 1,000 fathom depth contour (100 to 110 nautical miles). Hydrographic observations consisted mainly of vertical profiles of temperature and salinity obtained by means of bathythermographs and salinity determinations of water samples taken at selected depths or by a salinity/temperature/depth (STD) instrument. In addition, several thousand drift bottles were released at selected locations in the survey area.

Gaul, R.D., A.D. Kirwan Jr. and N.E.J. Boston. 1962. Opportunities for environmental research off Panama City, Florida. Texas A&M Project 286(D)/Reference 62-5T. Texas A&M University. College Station, TX. 28 pp.

Abstract. A report on research planned and in progress, using the Navy's offshore stages.

Gelfenbaum, G. and R.P. Stumpf. 1990. Observations of currents and density structure across a buoyant plume front. Estuaries. 16(1):40-52.

Abstract. Observations of the Mobile Bay, Alabama, plume during a flood event in April 1991 reveal significant differences in the current field on either side of a front associated with the buoyant plume. During a strong southeasterly wind, turbid, low salinity water from Mobile Bay was pushed through an opening in the west side of the ebb-tidal delta and moved parallel to the coast. A stable front developed between the low salinity water of the buoyant plume (11 ppt and the high salinity coastal water (>23 ppt) that was being forced landward by the prevailing winds. Despite the shallow water depth of 6 m, measurements of currents, temperature, and salinity show large shears and density gradients in both the vertical and the horizontal directions. At a station outside of the buoyant plume, currents at 0.5 m and 1.5 m below the surface were in the same direction as the wind. Inside the plume, currents at 0.5 m below the surface were parallel to the coast, 45 degree off the direction of the wind and the magnitude was 45% larger than the magnitude of the surface currents outside the plume. Beneath the level of the plume, the currents were identical to the wind-driven currents in the ambient water south of the front. Our observations suggest that the wind-driven surface currents of the ambient water converged with the buoyant plume at the front and were subducted beneath the plume. The motion of the ambient coastal surface water was in the direction of the local wind stress, however, the motion of the plume had no northerly component of motion. The plume also did not show any flow toward the front, suggesting a balance between the northerly component of wind stress and the southerly component of buoyant spreading. In addition, the motion of the plume did not appear to affect the motion of the underlying ambient water, suggesting a lack of mixing between the two waters.

Geo-Marine, 1973. A program of field measurements to define the thermal and dissolved oxygen distribution at the Lansing Smith Plant on West Bay/St. Andrew Bay. Geo-Marine. St. Petersburg, FL. 27 pp.

Abstract. Hydrographic and meteorological data from the vicinity of the power plant.

Geo-Marine, 1976. A program of field measurements to define the thermal and dissolved oxygen distribution at the Lansing Smith Plant on West Bay/St. Andrew Bay. Geo-Marine. St. Petersburg, FL. 45 pp.
Abstract. A continuation of the study in the 1973 report.

Geo-Marine, 1990. Proceedings of the Annual Gulf of Mexico Information Transfer Meeting (10th). Held in New Orleans, (Louisiana) on December 5-7, 1989. Minerals Management Service. Metairie, LA. 422 pp.
Abstract. In 1981, the Minerals Management Service (MMS) held the first Information Transfer Meeting (ITM) to exchange regional, environmental, and socioeconomic information among Federal and State governments, industry, academia, and public interest groups concerned with the effects of oil and gas activities on the Gulf of Mexico. The volume summarizes the presentations given at the Tenth Annual Gulf of Mexico ITM held in December 1989. Eighteen sessions included the following topics: wetlands concerns; oil spill response; Gulf of Mexico issues and initiatives (contributed papers); Mississippi/Alabama shelf marine ecosystems; alternative energy; now and the future; physical oceanography; marine ecosystems; oil spill dispersants; effectiveness and decision making; fisheries; oil spills in tropical environments; current offshore industry technology; environmental monitoring; Gulf of Mexico OCS program; and North American datum changes. In addition, panel discussions on oil spill dispersants, North American datum changes, and oil spill responses were held.

Geo-Marine, 1991. Proceedings: Annual Gulf of Mexico Information Transfer Meeting (11th). Held in New Orleans, LA. on November 13-15, 1990. Minerals Management Service. Metairie, LA. 506 pp.
Abstract. In 1981, the Minerals Management Service (MMS) held the first Information Transfer Meeting (ITM) to exchange regional, environmental, and socioeconomic information among Federal and State governments, industry, academia, and public interest groups concerned with the effects of oil and gas activities on the Gulf of Mexico. The Gulf of Mexico Information Transfer Program has three goals: (1) to provide a forum for scoping topics relative to environmental assessment of offshore oil and gas activities; (2) to present the accomplishments of the MMS Gulf of Mexico Environmental Studies Program and other MMS research programs or study projects; and (3) to foster exchange of information of regional interest among scientists, agencies, regionally-important industries and academia. Session topics included MMS environmental studies for the Gulf of Mexico (active studies progress reports); recent seafloor clearance activities at abandoned oil and gas structure sites; risk and reward; fueling America's recreation, conservation, and preservation programs through OCS leasing; offshore mapping and deepwater operations (contributed papers); Mississippi/Alabama shelf marine ecosystems study; produced waters: findings of recent studies in the coastal waters of Louisiana; MMS offshore technology assessment and research program; advances in telemetry, tagging and tracking of endangered species; naturally occurring radioactive materials; impact of offshore oil exploration and production on social institutions of coastal Louisiana; new developments in oil spill response and response planning; physical

oceanography; Gulf of Mexico Marine Laboratories; an overview of current research; and marine biology (contributed papers).

Gettleson, D.A. 1992. Environmental and economic assessment of discharges from Gulf of Mexico region oil and gas operations. Quarterly technical progress report, 23 June 1992--30 September 1992. DOE/MT/92001-1. Continental Shelf Associates, Inc. Juniper, FL. 16 pp.

Abstract. A Sampling and Analysis Plan was prepared and submitted to a Scientific Review Committee for comment. Substantial comments relative to study objectives, sampling design, and sampling periods coupled with the passage of Hurricane Andrew precluded the scheduled initiation of sampling at offshore and coastal sites (Tasks 3 -- Environmental Field Sampling and Analysis of Naturally Occurring Radioactive Materials (NORM), Heavy Metals, and Organics and 4 -- Monitoring of the Recovery of Impacted Wetland and Open Bay Produced Water Discharge Sites in Coastal Louisiana and Texas). A proposed revised schedule has been prepared for Tasks 3 and 4. Task 5 (Assessment of Economic Impacts of Offshore and Coastal Discharge Requirements on Present and Future Operations in the Gulf of Mexico Region), activities have involved identification and collection of the necessary data for the economic analysis. Task 6 (Synthesis of Gulf of Mexico Region Consumption and Use Patterns), activities have included near completion of the literature review and a reevaluation of the data collection efforts relative to the wholesaler, process plant, and restaurant components. Task 7 (Technology Transfer Plan), work has been delayed due to the Tasks 3 and 4 delay and cancellation of the annual US Minerals Management Service Gulf of Mexico Region Information Transfer Meeting.

Geyer, R.A. 1950. A bibliography on the Gulf of Mexico. Texas Journal of Science. 2(1):44-93.

Abstract. This bibliography was compiled in order to list and to some extent evaluate the available information in the literature dealing with the oceanography, marine biology, geology, geophysics, and meterology of the Gulf of Mexico. It could serve as basic reference material for planning marine biologic and oceanographic studies that might be conducted to gain more information about the marine population, productivity, and oceanographic normals of this area, and about those factors influencing any fluctuations in these quantities. The emphasis in the marine biological references is placed on the ecological phase of this subject rather than on the taxonomic aspects.

Geyer, R.A. 1968. Oceanography of the Gulf of Mexico. A/M-REF-68-8T. Texas A&M Univ, Dept of Oceanography. College Station, TX. 80 pp.

Abstract. The report gives a summary of some of the Texas A&M oceanographic research in the Gulf of Mexico and Caribbean which was carried on during fiscal year 1968. Included are reviews of work in physical oceanography, geophysical research, sedimentary characteristics, geotechnical properties, acoustic characteristics, remote sensing, air-sea interaction, microwave parameters, chemical oceanography, and bio-environmental studies. The field work carried out aboard the R/V ALAMINOS is summarized, and publications, papers, and reports resulting from the work are presented.

Geyer, R.A. 1970. Oceanography in the Gulf of Mexico. A/M REF-70-14F. Texas A&M Univ, Dept of Oceanography. College Station, TX. 25 pp.
Abstract. The report gives a summary of oceanographic research in the Gulf of Mexico supported by the Office of Naval Research during the period 1 May 1961 - 15 December 1969. This research involved theoretical studies in ocean dynamics; currents in the Gulf of Mexico, Cayman Sea, western tropical Atlantic and eastern tropical Pacific; development of geostrophic eddies and associated turbulence phenomena; bio-environmental studies; geophysical research; geotechnical properties; chemistry and air-sea interaction.

Glenn, S.M. and C.C. Ebbesmeyer. 1993. Drifting buoy observations of a Loop Current anticyclonic eddy. J. Geophys. Res. 98(C11):20105-20119.
Abstract. The Loop Current penetrated deep into the Gulf of Mexico in early 1989. After several eddy formation and reattachment cycles, a southwestward propagating anticyclonic eddy was formed during the summer. The Loop Current and subsequent eddy produced strong currents over widespread areas on the Louisiana continental slope, prompting a series of current measurement programs. The trajectories of 53 ARGOS tracked drifting buoys deployed in the Gulf of Mexico in 1989 were assembled to determine the synoptic history of the Loop Current and anticyclonic eddy during this event. Ten of the most critical summertime buoy trajectories are discussed. In addition, the trajectories of three of the buoys simultaneously deployed at different radii in the eddy were chosen for analysis with a kinematic feature model. The model assumes the looping buoy motion is generated by an elliptical orbit around a translating eddy center. The buoy trajectories were used to determine the time series of the feature model parameters, including eddy center, shape and circulation characteristics. The time series results indicate that the eddy actually propagated in a series of shore sprints separated by longer stalls. During the sprints, the eddy propagated as an elliptical but otherwise symmetric solid body. During the stalls, significant asymmetries developed.

Gomes, B.R. and J.E. Matthews. 1994. West Florida Shelf Environment for the Area Characterization Test I (ACT I). Vol. Final Report Naval Research Laboratory Detachment. Stennis Space Center, MS. 90 pp.
Abstract. During 18 through 27 September 1992, a carefully controlled acoustic exercise, Area Characterization Test 1 (ACT 1) was conducted in the shallow-water West Florida Shelf area known as Florida Middle Ground under the auspices of the Undersea Warfare Office of the Advanced Research Projects Agency. The goal is to develop an acoustic detection capability in adverse ocean environments such as shallow-water areas of continental shelves. To accomplish this, environmental data, which includes bathymetry, sediment samples, temperature and salinity of the water column, ocean currents and meteorological conditions, are provided for the interpretation of acoustic measurements. The test area is classified as a sandy-silt or sand-silt-day bottom with low carbonate content. Core and seismic data from other work shows the subbottom to be unconsolidated, comprised of Pleistocene to Recent sediments approximately 129 m thick at array locations. Evaluation of seafloor properties suggest that the area is homogenous, with a smooth water-sediment interface, and a high acoustic impedance. A geoacoustic model is derived from exercise measurements, Hamilton values, and archival seismic

and core records. Potential for oceanographic variability is high due to wind induced circulation and interaction of shelf water with Loop Current water. While a typical summer mixed layer down to 30 m is evident in all profiles, a high temperature gradient at 150 m occurs near the array locations as part of a warm feature. Current data from meters placed on both vertical and horizontal One arrays at 79-m and 188-m water depths, respectively, appear to be dominated by the principal lunar and solar semidiurnal and diurnal components.

Gordon, R.B., S.P. Koch, J.C. Heideman and J.A. Vermersch. 1991. A method for developing Loop Current/storm combinations for Gulf of Mexico deepwater structure design. pp. 600-610. *In* MTS '91. An Ocean Cooperative: Industry, Government, and Academia. Proceedings. New Orleans Convention Center, November 10-14, 1991. Marine Technology Society, Washington, D.C.

Abstract. This paper presents a probabilistic method for developing Loop Current/storm combinations for design of deepwater structures in the Gulf of Mexico. Using existing Loop Current and wave height databases, the method provides an analytical framework from which various combinations of surface current speed and wave height at specified return periods can be estimated. The probabilistic nature of the method also provides a straightforward approach into which improvements in the data and/or industry's understanding of Gulf of Mexico oceanography can be incorporated. The framework of the model is such that estimates of either the environment or of the response of a deepwater structure can be made for desired return periods. Both estimates depend on the type of structure being designed. We illustrate the method by presenting example joint environmental events for a hypothetical compliant piled tower design.

Gorsline, D.S. 1963. Oceanography of Apalachicola Bay, Florida. pp. 69-96. *In* Clements, T., R. Stevenson and D. Halmos, eds. Essays in Marine Geology in Honor of K.O. Emery. University of Southern California Press, Los Angeles, CA.

Gorsline, D.S. 1966. Dynamic characteristics of west Florida Gulf coast beaches. Marine Geology. 4:187-206.

Abstract. During 1962 fifteen beach stations were established along the Florida coast and monitored at monthly intervals. Observations of beach profiles, sediments, wave conditions, water characteristics and wind speed and direction were recorded. Techniques closely followed those of a nearly contemporaneous study on California beaches (Ingle, 1966). This made possible a comparison of beach conditions in a low- and medium-energy environment (Florida) with a high-energy environment (California). Average wave conditions in Florida range from low ripples in the low-energy eastern segment near Keaton Beach, to over 30 cm wave height along the broad arc from Cape San Blas to the Alabama-Mississippi peri-delta region. Maximum wave heights reach 100 cm and more along the Pensacola shore and approach the average condition for high-energy beaches. Longshore current velocities, however, are surprisingly constant and range from 30 to 150 cm/sec in the general area. Statistical studies of the sediment textural parameters confirm the observations of SCHIFFMAN (1965) regarding the greater variation in texture occurring in the swash zone than in other parts of the beach system. Some evidence suggests that sediment composition differences east and west of Cape San Blas reflect

different sources. Volumes of sand transported in longshore drift, however, are directly related to wave height, but show considerable variation from month to month and day to day. Net sand transport is to the west and apparently is actively prograding the large spits of the area from Mobile Bay to Pensacola.

Graham, D.S. 1983. Circulation of two multipass estuaries in the Gulf of Mexico. pp. 2595-2609. *In* Conference on Coastal Engineering, 18th, Cape Town, South Africa, Nov. 14-19, 1982, Proceedings. Vol. 3. American Society of Civil Engineers, N.Y.

Abstract. Studies on the dynamics of the water circulation in estuaries are reviewed. The scope of the Apalachicola and Terminos experiments involving the study of estuarine circulation and its relevance to pollution is discussed. Apalachicola Bay is a large (550 km^2) four-inlet embayment on the Florida Panhandle; Laguna de Terminos is the largest (2000 km^2) estuary on the Gulf of Mexico. The van de Kreke model is discussed, the essence of which is that nonlinear flux terms resulting from periodic tidal motion do not disappear on tidal averaging, and residual flows occur typically. The significance of the van de Kreeke results and results from the aforementioned estuaries are reviewed. It is concluded that flushing and water quality of multi-inlet estuaries of the Gulf of Mexico appear to be dominated by nonlinear wave flux advection and wind forcing, rather than advection from river inflow and tidally enhanced dispersion.

Greatbatch, R.J. and A. Goulding. 1990. A long-time-scale, density-stratified shelf circulation model. Cont. Shelf Res. 12(1):115-141. Proceedings of a Workshop of the Joint Numerical Sea Modelling Group On Mathematical Models of the North Sea and Surrounding Continental Shelf Seas. JONSMOD'90, Birkenhead (UK), Apr 1990.

Abstract. A computationally efficient, finite-difference numerical model for use in understanding circulation and variability in a density-stratified shelf and slope region on seasonal time scales and longer is described. The most important limitation of the model is the requirement to use a linear parameterization of bottom stress. The model also lacks information on coastal, baroclinic Kelvin waves. This restricts its use to shelf regions that are wide compared to the internal radius of deformation. Fortunately, many shelf regions (e.g. the Newfoundland/ Labrador shelf, the Middle Atlantic Bight, the west Florida shelf and the South Australia shelf) satisfy this requirement.

Grijalva, N. 1964. Numerical-hydrodynamical examination in the Gulf of Mexico. Ph.D. Dissertation. University of Hamburg, Hamburg, Germany. 46 pp.

Grimes, C.B., J.M. Foster, J. Fox, L. Fox, J.L. Taylor and K. Watson. 1991. Lake/Baywatch: a citizen volunteer water quality monitoring program for Bay County, Florida. Report no. 1 (1990-91). St. Andrew Bay Resource Management Assoc. Panama City, FL. 57 pp.

Abstract. Report of a comprehensive water quality sampling program for St. Andrew Bay.

Grose, P.L. 1966. The stratification and circulation of subsurface waters of the Gulf of Mexico. Reference No. 1. Department of Oceanography. Florida State University. 84 pp.

Guinasso, N.L., Jr. and D.A. Wiesenburg. 1988. Analysis of nearshore bathymetry and optical data from TUPS. Texas A&M Univ., Dept. of Oceanography Technical Report. 13518E; 88-174:128.

Abstract. An oceanographic study conducted off of Panama City, using a towed underwater pumping system (TUPS). Includes data regarding light measurements and bottom contours.

Gulf Coast Technical Services Unit. UNKNOWN YEAR. Bacteriological studies of commercial shellfish on the Gulf Coast. Gulf Coast Technical Services Unit. Dauphin Island, AL.

Abstract. Bacteriological studies of commercial shellfish were conducted in four areas along the Gulf Coast. Hydrographic data were collected in conjunction with each sampling.

Gulf Universities Research Consortium. 1979. A Final Report On the Alabama Coastal Zone, Ecology and Water Quality Data Information Sources, Existing Benthic Data Evaluation. MESC-9-90060. Marine Environmental Sciences Consortium. Dauphin Island, Alabama. 21 pp.

Haddad, K. 1982. Hydrographic factors associated with west Florida toxic red blooms: an assessment for satellite prediction and monitoring. Master's Thesis. University of South Florida, Tampa, FL.

Haddad, K. and K. Carder. 1979. Oceanic intrusions; one possible initiation mechanism of red tide bloom on the west coast of Florida. pp. 269-274. *In* Taylor, R. and H.H. Seliger, eds. Proceedings of the Second International Conference on Toxic Dinoflagellate Blooms. Elsevier, North Holland, NY.

Hall, C.S. 1969. An investigation of the water balance of the basin of the Gulf of Mexico. Master's Thesis. Texas A&M University. 34 pp.

Halper, F.B., D.W. McGrail and W.W. Schroeder. 1982. The response of shelf waters in the Gulf of Mexico to the passage of tropical storms and hurricanes in 1979. Trans. AGU (EOS). 63:18.

Halper, F.B. and W.W. Schroeder. 1990. The response of shelf waters to the passage of tropical cyclones-observations from the Gulf of Mexico. Cont. Shelf Res. 10(8):777-793.

Abstract. Current meter data obtained from sites on the Alabama, west Florida, and Texas-Louisiana shelves during 1979 coincided with the passage of five tropical cyclones; Hurricane Bob, tropical storm Claudette, tropical storm Elena, Hurricane Frederic and Hurricane Henri, and a sixth storm (Hurricane David) which skirted the west Florida coast. The observations suggest that along the Alabama shelf (25 m water depth), where the isobaths were essentially perpendicular to the path of the storms, Hurricanes Bob and Frederic and tropical storm Claudette caused coastal set-up/set-down, resulting in a complex response. The observations from the west Florida shelf, where storm paths generally paralleled the isobaths, suggest that the flows associated with Hurricanes Frederic, David and possibly tropical storm Claudette were a combination of the storms setting water in motion as they moved through the Gulf of Mexico and local wind forcing.

Hamilton, G.D. 1987. Buoy records: set in 1985 hurricanes. Mar. Weather Log. 31(4):7-10.

Abstract. During the 1985 hurricane season in Sept., a North Atlantic buoy reported the highest significant wave height ever recorded by the National Data Buoy Center (NDBC) in a Hurricane (Gloria): 46.9 ft. The track of Gloria from its development near the Cape Verde Islands, within 55 mi of buoy station 41002, is described. In Oct. in the eastern Gulf of Mexico, an NDBC buoy registered a record wind of 92 knots with a 114-knot peak in Kate. The development of Kate and its track are described. The expected winds are compared by means of a numerical wave prediction scheme. By applying the required values of wind speeds from the times of the most extreme wind/wave conditions at the two buoys, the significant wave height and peak period are computed. The estimates during Kate are reasonably close, as is the peak period for Gloria. There is, however, a large discrepancy in the significant wave height predicted for Gloria. Several characteristics of the storms, which may explain the difference involving the discrepancy between wind speed and wave height in the storms, are considered.

Hamilton, P. 1987. Characterization of Slope Circulations in the Northern Gulf of Mexico. SAIC-87/1071 Submitted to an Oil and Gas Joint Industry Program. Science Applications International Corporation. Raleigh, NC. 240 pp.

Abstract. One purpose of this report is to bring together all available physical oceanographic measurements made on this slope by many different companies, government agencies and academic institutions, and use them to describe the circulation over the slope, its variability, and attempt to determine the important physical processes that govern this circulation. The measurements are fairly sparse in time and space and cover a region from southwest Texas and northern Mexico to the DeSoto Canyon off the Florida Panhandle. Some of the data sets from different studies overlap and a limited synthesis is possible.

Hamilton, P. 1990. Deep currents in the Gulf of Mexico. J. Phys. Ocean. 20(7):1087-1104.

Abstract. Direct current measurements using moored arrays have been made below 1000 m in the eastern, central and western Gulf of Mexico basin. The major low frequency velocity fluctuations in the lower 1000 to 2000 m of the water column in the three regions have the characteristics of topographic Rossby waves (TRWs). Spectral peaks are observed at periods of about 25 days and 40 to 100 days. Motions are highly coherent with depth. Variances increase toward the bottom despite the very weak stratification of the deep waters of the Gulf. Wavelengths are about 150-250 km and phase propagation is offshore with energy propagation westward. A group velocity of about 9 km/day could be directly estimated from significantly coherent signals between eastern and western arrays. This value is consistent with estimates derived from the dispersion relation and is higher than the westward translation speed of 3 to 6 km/day of the large anticyclonic eddies shed from the Loop Current.

Hand, J., J. Col and E. Grimison. 1994. 1994 water quality assessment for the State of Florida; Technical Appendix. Florida Department of Environmental Protection, Bureau of Surface Water Management. Tallahassee, FL. 157 pp.

Abstract. Pp. 130-141 cover water quality information for St. Andrew Bay and its tributaries, including point sources of pollution.

Hannon, L.J., R.P. LaBelle and A.D. Lucas. 1987. Oil-Spill Risk Analysis: Central Western, and Eastern Gulf of Mexico (Proposed Sales 113, 115, and 116) Outer Continental Shelf; Final Report. OCS/MMS-87/0117. Minerals Management Service. Reston. 132 pp.

Abstract. The Minerals Management Service recently released the Oil-Spill Risk Analysis Report for Proposed Gulf of Mexico OCS Oil and Gas Lease Sales 113, 115, and 116 by Lawrence Hannon, Robert LaBelle, and Doreen Lucas. The 132-page report summarizes the results of the oil-spill trajectory analysis which was used to estimate potential oil-spill risks from the proposed sales.

Hanor, J.S. and L.H. Chan. 1977. Non-conservative behavior of barium during mixing of Mississippi River and Gulf of Mexico waters. Earth Planet. Sci. Lett. 37:242.

Hanson, R.B. 1982. Influence of the Mississippi River on the spatial distribution of microheterotrophic activity in the Gulf of Mexico. Contrib. Mar. Sci. 25:181-198.

Abstract. Spatial distribution of microheterotrophic activity in the water column of the Mississippi Delta Bight and the Gulf of Mexico was investigated in April and May 1977. Microheterotrophic activity was determined from the uptake of labeled C14 glucose and the concentration of reactive carbohydrates. Mississippi River water was characterized by particulate organic carbon (POC) concentration and hydrographic data. Microheterotrophic activity decreased with distance offshore and with increasing depth of the water column in the Mississippi Delta Bight. Highest activity was in waters with low salinities and high POC concentrations. Where the salinities were characteristic of open Gulf of Mexico waters, microheterotrophic activities were typically low. Waters with warmest temperatures did not always possess the highest microheterotrophic activity. In surface waters of the Gulf of Mexico, activity was lower than in the Bight and activity decreased with increasing depth. Turnover times of carbohydrates were inversely proportional to the rate of microheterotrophic activity. Reactive carbohydrates did not show any gradients with either distance from shore or depth of the water column. Respiration (C14, CO2) of the labeled glucose was highest in surface waters and decreased with distance from shore. The results suggest that the Mississippi River greatly influences the spatial distribution of microheterotrophic activity in the Mississippi Delta Bight but not in the Gulf of Mexico.

Hardin, J.D., C.D. Sapp, J.L. Emplaincourt and K.E. Richter. 1975. Shoreline and bathymetric changes in the coastal area of Alabama: a remote-sensing approach. Information Series 50. Alabama Geological Survey. University, AL. 125 pp.

Abstract. The shorelines and near-shore bottoms of Alabama's coastal area are in a dynamic state, constantly adjusting to the combined effects of natural processes and man's intervention. Approximately 56 percent of the shoreline is eroding. Small amounts of erosion may become critical in developed areas. In general, erosion is of most concern along the western shore, at Dauphin Island, and along the north shore of Morgan Peninsula

where waterfront residential areas are directly affected. Sediments derived from materials carried by the Mobile River system and by currents eroding the shorelines are gradually filling Mobile Bay. Computer analysis of bathymetry shows that the lower half of the bay is filling most rapidly, but the pattern of deposition is very complex. A NASA computer measurement of a part of the shoreline of Alabama used Landsat images and provided the basis for a preliminary estimate of the total shoreline length. This estimate is 1,313 km (816 mi.), which is considerably higher than map measurements made by conventional means because the technique measures intricate of upper estuaries and other shoreline indentations.

Harding, J.L. and W.D. Nowlin. 1966. Encyclopedia of Oceanography; Gulf of Mexico. Rheinhold Publishing Corporation. New York. 1021 pp.

Haring, R.E. and J.C. Heideman. 1980. Gulf of Mexico rare wave return periods. J. Petrol. Technol. 32(1):35-47.

Abstract. Estimates of rare wave heights and crest heights in the Gulf of Mexico were derived from hindcasts of 22 severe hurricanes since 1900. Results obtained with an industry-sponsored Ocean Data Gathering Program (ODGP) show that rare wave-height estimates are not dependent upon the choice of statistical method and that no practical differences exist over three separate geographical sectors of the Gulf of Mexico.

Harkema, R., G.L. Weatherly, W.C. Burnett and J.P. Chanton. 1994. A compilation of moored current meter data from the Big Bend region of the west Florida shelf. July 1992-October 1992. Florida State University, Department of Oceanography Tech. Rep.

Harkema, R., G.L. Weatherly and D.E. Thistle. 1991. A compilation of moored current meter data from the Big Bend region of the west Florida shelf, November 1989-April 1990. Tech. Rep. CMF-91-01. Florida State University, Dept. of Oceanography. Tallahassee, FL. 85 pp.

Harkema, R., G.L. Weatherly and D.E. Thistle. 1992. A compilation of moored current meter data from the Big Bend region of the west Florida shelf, Nov 1990-Apr 1991. Tech. Rep. CMF-92-01. Florida State University, Dept. of Oceanography. Tallahassee, FL. 30 pp.

Harkema, R., G.L. Weatherly and D.E. Thistle. 1993. A compilation of moored current meter data from the Big Bend Region of the West Florida Shelf, December 1991-April 1992. Tech. Rep. CMF-93- 01. Florida State University, Dept. of Oceanography. Tallahassee, FL. 46 pp.

Harris, D.L. and C.U. Lindsay. 1957. An index of tide gages and tide gage records for the Atlantic and Gulf coasts of the United States. U.S. Department of Commerce, Weather Bureau National Hurricane Research Project, Report 7.

Harrison, C.H. 1972. Water Resources Data in Alabama. Alabama Development Office, Water for Alabama Series. Montgomery, Alabama. 88 pp.

Hart, W.E. 1976. A numerical study of currents, circulation and surface elevations in Chandeleur--Breton Sounds, Louisiana. Ph.D. Dissertation. LSU, Baton Rouge, LA. 140 pp.

Abstract. Numerical methods were used to simulate the tide- and wind-induced circulation in Chandeleur-BretonSounds, which form a bar-built estuary southeast of New Orleans, Louisiana. The study provided sufficient information from which to give a general description of the reponse of the estuary to average, tropic, and equatorial tides. Very low current speed, on the order of 10-20 cm/sec, occurred except in some of the shallow entrances through the Chandeleur Island chain, where speed reaches 50-60 cm/sec for short periods. The entering tidal wave forms were simulated by Kelvin waves, which had a resultant form that was found to be in close agreement with the computer model. The model output agreed well with current observations taken over a 6-month period at 15 widely spaced stations in and around the estuary. Surface elevations were found to have an average tide range of 60 cm at the northwestern end of the estuary and to increase in range to 90 cm during tropic tides. The range in the southern part of the estuary was about 15 cm less at all times. It was also shown that the estuary responds directly to an applied wind force and that the expected set-up of the surface is in the downwind direction. Finally, it was shown that total energy in the estuary is relatively low and is governed primarily by the potential energy of the tide-induced surface elevations.

Hart, W.E. and S.P. Murray. 1978. Energy balance and wind effects in a shallow sound. J. Geophys. Res. 83(C8):4097-4106.

Abstract. Tidal energetics and wind effects in an extensive (3000 km^2) shallow (3.5m) sound with two widely separated entrances were studied numerically with a two-dimensional vertically averaged model. A comparison of current predictions with observation from 15 current meter stations under differing tidal regimes proved the reliability of the model. Evaluation of the instantaneous energy balance equation showed the change in energy content to be nearly balanced by input energy flux, frictional energy dissipation being of secondary importance. In contrast to the equipartition of energy in classical long waves, there is on the average eight times more potential energy than kinetic energy. Input energy flow shows preferential pathways; the wide northern entrance mainly shows energy gain to the Sound, the southern entrance shows equal amounts of gain and loss, while small cuts through the barrier island chain serve mainly as conduits for energy loss. When real tidal input is used, the energy balance time-averaged over a diurnal tidal cycle is not in a steady state, and frictional dissipation is the dominant term. Experiments showed that with winds in the 8 to 9 m/s range, extensive setup can occur (20 cm), strongly dependent on wind direction. Increased speeds through the passages can significantly reduce the residence time in the Sound. Relaxation time of the wind perturbations is only about 3 hours.

Haustein, R. and A.C. Vastano. 1987. Use of sea surface satellite imagery for oil exploration and production in the Gulf of Mexico. pp. 301-348. *In* Nineteenth Annual Offshore Technology Conference Houston, TX 27-30 April 1987. Offshore Technology Conference, Houston, TX.

Abstract. Operators in the Gulf of Mexico are using visible and infrared satellite imagery to investigate transient Loop Current and eddy

circulation features for calculating forces on offshore structures and monitoring ocean current events which may effect offshore operations in deepwater regions. Raw and derived data products utilized include satellite sea surface temperature measurements, ocean frontal analyses based on satellite imagery and current flow fields derived from sequential satellite images.

Hawkins, J.D. 1983. Satellite IR data utilization for qualitative and quantitative observation of the loop current system. Trans. AGU (EOS). 64(52):1055.

Hawkins, J.D., D.A. May, R.L. Pickett and F. Abell. 1990. Benefits of NOAA-11 Channel 3 in Detection of Mesoscale Eddies in the Gulf of Mexico during Summer. pp. 356-361. *In* Proceedings Annual Gulf of Mexico Information Transfer Meeting (11th). Naval Oceanographic and Atmospheric Research Laboratory, Stennis Space Center, MS.

Abstract. Monitoring the Loop Current and mesoscale (50-350 km) warm and cold core eddy positions in the Gulf of Mexico year round has taken on enhanced interest as our understanding of the Gulf's physical oceanography and its impact on a diverse set of industrial and scientific disciplines matures. Early sporadic hydrographic cruises were supplemented in the late 1970's and early 1980's with satellite infrared (IR) imagery from the Geostationary Operational Environmental Satellites (GOES) and various versions of the present NOAA AVHRR. The synoptic IR views helped map major mesoscale features via their sea surface temperature (SST) signatures. The early work was enhanced when imagery filled in the time-space void inherent in Gulf ship surveys. Information pertaining to the cycle of Loop Current penetration, eddy shedding and drift of resultant warm core eddies westward to the Texas shelf revised earlier speculation. Several drawbacks remained while utilizing IR imagery to detect Gulf mesoscale features. Cloud contamination often eliminated this valuable resource for time spans lasting weeks. Summertime conditions, reduced the SST gradients associated with all features, requiring the capability to measure relative and absolute SSTs to the accuracy of 0.25°C and better to view the faint surface signatures.

Henry, V.J. and E.H. Shenton. 1955. Literature survey of Lake Charles, Louisiana, Gulfport and Mobile Bay, Alabama and Pensacola, Florida, and their approaches. Vol. 1: Geological Oceanography, TAMU Project 98, Reference 55-34 Texas A&M College, Department Oceanography. College Station, TX.

Hill, D.O. 1974. A hydrodynamic and salinity model for Mobile Bay. Ph.D. Dissertation. The University of Alabama. 339 pp.

Hill, D.O. and G.C. April. 1973. Adaptation of mathematical modeling techniques to Mobile Bay for water quality management. J. Mar. Sci. 2(2):19-36.

Hill, D.O. and G.C. April. 1976. Planning for rivers draining into Mobile Bay, part 1, hydrodynamic and salinity models. University of Alabama, Bureau of Engineering Research Report,. 209:112.

Ho, F.P. and V.A. Myers. 1975. Joint probability method of tide frequency analysis applied to Apalachicola Bay and St. George Sound, Florida. NOAA-TR-NWS-18; NOAA-76020403. National Weather Service, Office of Hydrology. Silver Spring, MD. 52 pp.

Abstract. Storm-tide height frequency distributions are developed within Apalachicola Bay and St. George Sound, Florida, for the National Flood Insurance Program. This is accomplished by applying Overland's numerical bay model to a full set of climatologically representative hurricanes. Surge computations by the continental shelf SPLASH model are used as the boundary input from the Gulf of Mexico. Tide levels are shown in map form and as frequency distributions at selected points between annual frequencies of 0.10 and 0.002. The report illustrates the application of a joint probability method to assessing storm tides within a bay using a hydrodynamic model.

Ho, F.P. and R.J. Tracey. 1975. Storm tide frequency analysis for the Gulf Coast of Florida from Cape San Blas to St. Petersburg beach. National Oceanic and Atmospheric Administration, NOAA, NWS Technical Memorandum 20:34.

Hofmann, E.E. and S.J. Worley. 1986. An investigation of the circulation of the Gulf of Mexico. J. Geophys. Res. 91(C12):14221-14236.

Hoge, F.E., A. Vodacek and N.V. Blough. 1993. Inherent optical properties of the ocean: Retrieval of the absorption coefficient of chromophoric dissolved organic matter from fluorescence measurements. Limnology and Oceanography. 38(7):1394-1402.

Abstract. The quantitative relationship between the absorption and fluorescence emission of chromophoric (colored) dissolved organic matter (CDOM) has been determined along five cruise tracks in the western North Atlantic Ocean, the Gulf of Mexico, and Monterey Bay, and includes Gulf Stream, Loop Current, slope, shelf, and coastal waters. We present a protocol for the determination of CDOM fluorescence that will allow both interlaboratory comparisons and the calibration of airborne fluorescence measurements. This protocol is based on the use of the water Raman signal as an internal radiometric standard and quinine sulfate as an external standard. This study demonstrates that when an appropriate and consistent procedure is used to standardize fluorescence measurements, the fluorescence per unit absorption exhibits surprisingly little variation for diverse waters. The maximum variability observed between all sites was 36% and within the western North Atlantic the variability was only 12%. Algorithms are presented for retrieval of the absorption coefficient of CDOM at 355 and 337 nm from shipboard or airborne measurements of the water-Raman-normalized fluorescence emission resulting from 355- and 337-nm excitation.

Hogge, E.A. 1966. Recent oceanographic work at the U. S. Navy Mine Defense Laboratory. U.S. Navy Mine Defense Lab. Research Technical Note. 99:4.

Abstract. A summary of current oceanographic research conducted by the Navy in St. Andrew Bay and the nearby coastal waters.

Holmes, J. 1974. Investigation of the Interaction of the Sea Reflected Radiation and the Atmosphere. NOAA-74080610. NOAA/AOML. Miami, FL. 12 pp.

Abstract. The ability to find and monitor oceanic currents, in particular the Loop Current in the Gulf of Mexico, from satellites is examined by gathering ground truth from shipboard measurements and comparing this data to satellite photographs. Results and discussions resulting in part from this work have been published in reports referred to at the end of this report.

Hopkins, C.K. 1990. Ocean Response to Hurricane Forcing. Master's Thesis. Naval Postgraduate School, Monterey, CA. 90 pp.

Abstract. The current meter records collected at three sites in the Gulf of Mexico during the passage of Hurricane Frederic are analyzed to determine the storm-induced flow at various ocean depths, determine the associated energy increase and decay, and compare these observations to similar results from a numerical model. The records at the two deeper sites are rather unique because they are within 100 km of the hurricane track. Pre-storm conditions are controlled by topography, and as the storm passes there is an abrupt change in the direction of flow and initiation of a strong inertial response at all levels of the two deeper sites. After this initial surge, the residual flow tends toward the pre-storm direction. The horizontal kinetic energy associated with inertial motion is calculated. The energy increase and decay is shown to vary with depth. An embedded mixed-layer ocean circulation model is forced with an idealized storm translating at the same speed as Frederic. The abrupt response and strong inertial component predicted by the model is qualitatively similar to the observations.

Hopkins, T.S. 1969. The Escambia River and Escambia Bay during summer, 1969. U.S. Bureau of Commercial Fisheries. Washington, D.C. 54 pp.

Abstract. Pt. I. Physical/chemical studies on Escambia River complex; Pt. II. Physical/chemical/biological studies on Escambia Bay.

Hopkins, T.S. 1973. Zooplankton. *In* Jones, J.I., R.E. Ring, M.O. Rinkel and R.E. Smith, eds. A summary of knowledge of the eastern Gulf of Mexico. State University System of Florida, Institute of Oceanography, St. Petersburg, FL.

Abstract. Zooplankton in the eastern Gulf, a warm temperature-subtropical region, seems to show distinct seasonality in abundance. In estuaries and on the southwest Florida shelf the biomass maximum appears in summer whereas in shelf waters of the central and northeastern Gulf the seasonal maximum occurs in winter. No seasonal trend is as yet evident for the Loop Current. Annually, averages for zooplankton biomass range from 0.88 to 0.80 ml/m^{-3}, 0.02 to 0.10 ml/m^{-3} and 0.01 to 0.10 ml/m^{-3} in estuarine, shelf, and eastern Central Gulf regions, respectively. Locally both on the shelf and in estuaries biomass can be much higher. The principal photoplankton species in terms of biomass in estuaries appears to be Acartia tonsa. In summer meroplankton significantly augments plankton biomass in inshore waters. The principal hydrographic factors regulating zooplankton distribution in the eastern Gulf are the Loop Current, Mississippi River, and runoff from other small rivers. Upwelling generated by the Loop Current appears to be responsible for the maximum on the southwest Florida shelf while the Mississippi and other river discharge along with cool meteorological conditions may be primarily responsible for winter peaks on the northern Gulf shelf. Biological factors in addition to annual temperature and runoff cycles may affect

seasonal abundance of estuarine zooplankton. There is evidence that ctenophores and scyphomedusae play a major role in regulating dynamics of estuarine microzooplankton.

Hopkins, T.S. UNKNOWN YEAR. Circulation of Escambia Bay, Florida. Dauphin Island Sea Lab. Dauphin Island, AL.
Abstract. Temperature, salinity, and dissolved oxygen measurements were made at 42 stations in Escambia Bay at daily to monthly intervals from January to June, 1971. Dye drop studies of circulation patterns were made at 9 stations.

Hopkins, T.S. UNKNOWN YEAR. Study of short term effects of dredging on water quality in Mulatto Bayou. Dauphin Island Sea Lab. Dauphin Island, AL.
Abstract. Measurements of salinity, temperature, dissolved oxygen, and secchi disc depth were made at 7 stations in Mulatto Bayou, Escambia Bay, Florida in order to determine the short term effects of dredging on the water quality of the bayou. Each station was sampled at 4 hour intervals from April 18 to April 23, 12 hour intervals from April 24 to April 28, 48 hour intervals from April 30 to May 30, and then on a weekly basis until August.

Hopkins, T.S. UNKNOWN YEAR. Upper Escambia Bay Marsh Creek stagnation study. Dauphin Island Sea Lab. Dauphin Island, AL.
Abstract. Nine stations in upper Escambia Bay were visited daily at dawn from April to July, 1972 in an effort to document fish kills. Salinity, temperature and dissolved oxygen were measured daily, and fish were identified and counted when kills occurred.

Hopkins, T.S., W.W. Schroeder, T.W.C. Hilde, L.J. Doyle and J.C. Steinmetz. 1981. Florida Middle Ground. pp. 150. *In* Northern Gulf of Mexico Topographic Features Study, Final Report, Technical Report No. 81-2-T. Vol. V. Texas A&M University, Department of Oceanography, College Station, TX. (U.S. Department of the Interior, BLM, OCS Office, New Orleans, LA, Contract No. AA551-CT8-35.)
Abstract. The overall objective was to characterize the topographic high known as the Florida Middle Ground (FMG) using submarine sampling, geophysical profiling, open circuit SCUBA, shipboard instrumentation, and in situ instruments for measuring currents, salinity, and temperature. The characterization was designed to establish ranges of spatial and temporal variation in the chemical, geological, and physical environment of the Florida Middle Ground, and should produce qualitative and quantitative management-oriented biological data describing the lesser known aspects of the fauna and flora of the central portion of the Florida Middle Ground.

Hottman, W.E. and R.A. Geyer. 1976. Analysis of current data from April 1975 cruise. Report for Study of Naturally Occurring Hydrocarbons in the Gulf of Mexico. Department of Oceanography. Texas A&M University. 7 pp.

Howell, K.K. 1977. Gulf of Mexico. Oceans. 10:5.

Hsaio, Shu-C.V. 1978. On the transformation mechanisms and the prediction of finite-depth water waves. University of Florida, Coastal & Oceanographic Engineering Dept. Report. UFL/COEL-78-010:123.

Abstract. The physics of wave action off of Panama City Beach.

Hsueh, Y., G.O. Marmorino and L.L. Vansant. 1982. Numerical model studies of the winter-storm response of the West Florida shelf. J. Phys. Ocean. 12(10):1037-1050.

Abstract. The wintertime, wind-driven ocean circulation on the West Florida Continental Shelf is studied within the framework of a linearized storm-surge model. The model bathymetry incorporates a realistic shelf, extending from New Orleans to the southern tip of Florida, and a deep ocean region. The boundary condition at the coast is that there is no normal flow. At the open boundaries, located off the shelf in deep water, the adjusted sea level is fixed at zero. It is found that 1) a coastally trapped response is achieved within one local inertial period following the imposition of the wind; 2) the curved coast forces a mass exchange between the coastal water and the deep ocean; 3) this exchange leads to the generation of a series of mesoscale eddies along the shelf edge; and 4) these eddies give rise to long-period, shelf-wide oscillations that persist beyond the local spin-up time. A hindcast of the wind-driven flow on the West Florida Shelf for a particular period (11-25 March 1978) that contains the passage of a distinct cold front produces coastal sea-level and current fluctuations that are in reasonable agreement with observations.

Hubertz, J.M. 1967. A study of the Loop Current in the eastern Gulf of Mexico. M.S. Thesis. Texas A&M University, Department of Oceanography, College Station, TX. 91 pp.

Abstract. A physical oceanographic survey was made in June 1966 using an instrument which measures salinity and temperature as continuous functions of depth. Data was gathered using Nansen casts, bathythermographs, and the geomagnetic electrokinetograph. The Loop Current was found to extend to 27°30'N with a smaller secondary loop at its northern tip. Average speeds in the current were 2 knots with associated transports of 45 X 10^6 m^3/sec around the major loop within the Gulf. The Loop Current bounded a water mass, the Eastern Gulf Loop Water, distinct from that found elsewhere in the Gulf of Mexico. The average circulation pattern was found to be less complex than those presented previous to 1967.

Hubertz, J.M. and R.M. Brooks. 1992. Verification of the Gulf of Mexico hindcast wave information. Coastal Engineering Research Center, Vicksburg. Vicksburg, MS. 34 pp.

Abstract. The Wave Information Study (WIS) for the Gulf of Mexico (WIS Report 18) provides a wave climate for the US shorelines of the Gulf of Mexico based on simulation of 20 years of weather data (1956-1975). During these years, few wave data exist with which to evaluate the adequacy of the total hindcast procedure, which includes derivation of pressure charts, translation of these into wind estimates, and then calculation of wave conditions. In 1991, CERC conducted a 1-year hindcast of the Gulf of Mexico for 1988 and evaluated the model results against extensive wind and wave measurements now available in order to provide guidance on the quality of the previous hindcast work. This report provides a summary of that hindcast and guidance on the use of the earlier WIS study.

Hubertz, J.M., A.W. Garcia and R.D. Reid. 1972. Objective analysis of oceanic surface currents. pp. 139-148. *In* Capurro, L.R.A. and J.L. Reid, eds. Contributions on the Physical Oceanography of the Gulf of Mexico. Gulf Publishing Co., Houston.

Abstract. Treating measurements from June 1966 and June 1967 cruises as synoptic, the results were used to approximate the nondivergent part of the surface velocity field in terms of a stream function.

Hughes, J. 1990. St. Andrews State Park Aquatic Preserve Management Plan. Vol. Draft Report Florida Department of Natural Resources, Bureau of Submerged Lands and Preserves. Tallahassee, FL. 83 pp.

Abstract. St. Andrews Bay Aquatic Preserve, located in Bay County, covers 25,000 acres along the entrance to St. Andrews Bay and extends some 3 miles offshore into Gulf waters. The preserve consist largely of high energy zone areas, e.g. gulf sandy beaches, a strong tidal inlet with jetties and sandy bay bottoms. A moderate amount of shallow grassbed communities occur along the bayside of Shell Island. Marine fishes, shorebirds and various invertebrate marine life are prodominant. The preserve lies adjacent to St. Andrews Bay State Park which receives heavy recreational use. Portions of the preserve adjoin exclusive residential development and military facilities. Water quality in and around the St. Andrews Bay area has deteriorated in recent years from sewage discharge and stormwater runoff. The inlet area, the Gulf and the inner bay area also support some of the heaviest boating traffic in northern Florida. The high recreational use, the increases in water pollution, and the continued development of adjoining uplands threaten the long term maintenance of the preserve and necessitate resource planning for the area.

Huh, O.K., L.J. Rouse and G.W. Smith. 1978. Surface temperature and temperature gradient features of the U.S. Gulf coast waters. pp. 1609-1618. *In* Proceedings of the 11th International Symposium on Remote Sensing of the Environment, April 25-29, 1977. University of Michigan, Ann Arbor, MI.

Abstract. Satellite thermal infrared data on the Gulf of Mexico show that a seasonal cycle exists in the horizontal surface temperature structure. In the fall, the surface temperatures of both coastal and deep waters are nearly uniform. With the onset of winter, atmospheric cold fronts, which are accompanied by dry, low-temperature air and strong winds, draw heat from the sea. Penetrative convection and wind-driven mixing lower temperatures, first in the shallowest waters and then, as the winter season progresses, in deeper and deeper portions of the Gulf. A band of cooler water forming on the inner shelf expands, until a thermal front develops seaward along the shelf bread between the cold shelf waters and the warmer deep waters of the Gulf. Digital analysis of the satellite data has been carried out in an interactive mode using a minicomputer and software developed at the Coastal Studies Institute. A time series of temperature profiles illustrates the temporal and spatial changes in the sea-surface temperature field.

Huh, O.K. and K.J. Schaudt. 1990. Satellite imagery tracks currents in Gulf of Mexico. Oil Gas J. 88(19):70-76.

Huh, O.K., W.J. Wiseman and L.J. Rouse. 1981. Intrusion of Loop Current waters onto the west Florida continental shelf. J. Geophys. Res. 86(C5):4186-4192.

Abstract. An intrusion of loop current water up DeSoto Canyon and onto the West Florida continental shelf to within 8 km of the shore occurred in February 1977. Boat, aircraft, and satellite data collected in the area for another purpose were used to estimate the space and time scales of the intrusion and the ultimate fate of the intruded waters. The duration of the event was 18 days. Oceanic waters advanced across the shelf at speeds of 20 cm/s. At maximum intrusion, 6650 km^2 of shelf were affected. Approximately half the intruded water receded off the shelf, and half appears to have been modified in situ.

Huh, O.K., W.J. Wiseman and L.J. Rouse Jr. 1978. Winter cycle of sea surface thermal patterns, northeastern Gulf of Mexico. J. Phys. Ocean. 83(C9):4523-4531.

Abstract. During the winter of 1976-1977 a time series of NOAA satellite data was obtained which documented the seasonal cycle of sea surface temperatures. Data were obtained as both marine-enhanced images and computer compatible tapes. Fall cooling initially affected only lakes and estuaries. A band of cold inner shelf waters then formed along the coast. Which expanded seaward to the shelf break as the winter season progressed. At the extreme of winter cooling, two major thermal fronts remained: one near the shelf edge, separating the shelf from deep gulf surface waters, and the other the cyclonic boundary of the Loop Current. The onset of spring warming was indicated by an increase in surface temperatures in the shallow inshore areas. The seasonal cycle was completed with the formation of nearly isothermal surface waters throughout the region, a condition characteristic of the summer season.

Hurlburt, H.E. and J.D. Thompson. 1980. A numerical study of Loop Current intrusions and eddy shedding. J. Phys. Ocean. 10(10):1611-1651.

Abstract. The dynamics of the eddy shedding by the Loop Current in the Gulf of Mexico have been investigated using three nonlinear numerical models: two-layer, barotropic and reduced gravity. The barotropic and reduced gravity models demonstrate the individual behavior of the external and internal modes, and provide insight into how they interact in the two-layer model. Because of the economy of the semi-implicit free surface models, it was possible to perform over 100 experiments to investigate the stability properties of the Loop Current. Typically, the models were integrated 3-5 years to statistical equilibrium on a 1600 km x 900 km rectangular domain with a resolution of 20 km x 18.75 km. Prescribed inflow through the model Yucatan Channel was compensated by outflow through the Florida Straits.

Hurlburt, H.E. and J.D. Thompson. 1980. A Numerical Study of Loop Current Intrusions and Eddy Shedding, Technical note. NORDA-TN-64. Naval Ocean Research and Development Activity. NSTL Station, MS. 124 pp.

Abstract. The dynamics of the eddy shedding by the Loop Current in the Gulf of Mexico have been investigated using three nonlinear numerical models: two-layer, barotropic, and reduced gravity. The barotropic and reduced gravity models demonstrate the individual behavior of the external and internal modes, and provide insight into how they interact in the two-layer model. Because of the economy of the semi-implicit free surface

models, it was possible to perform over 100 experiments to investigated the stability properties of the Loop Current. Typically the models were integrated 3 to 5 years to statistical equilibrium on a 1600 x 900 km rectangular domain with a resolution of 20 x 18.75 km. Prescribed inflow through the model Yucatan Channel was compensated by outflow through the Florida Straits.

Hurlburt, H.E. and J.D. Thompson. 1982. Dynamics of the Loop Current and shed eddies in a numerical model of the Gulf of Mexico. pp. 243-298. *In* Nichoul, J.C.J., ed. Hydrodynamics of Semi-enclosed Areas. Vol. 34, Elsevier Oceanography Series. Elsevier Scientific Publ. Co., Liege.

Abstract. The dynamics of the circulation in the Gulf of Mexico were investigated with simple, efficient numerical models capable of simulating consistently observed dynamical features, including the Loop Current and the shedding of large anticyclonic eddies from the loop. More than 150 model experiments were integrated to statistical equilibrium, typically 3-5 yr. One popular hypothesis holds that the Loop Current sheds anticyclonic eddies in response to annual variations in the inflow through the Yucatan straits. However, a striking result from the models is their ability to simulate the observed quasi-annual eddy shedding period with no time variations in the inflow. The model-predicted eddy diameters, amplitudes, and westward propagation speeds are also realistic. The dominant instability mechanism in the eddy shedding is a horizontal shear instability of the first internal mode, a barotropic, rather than a baroclinic, instability. Therefore, a reduced-gravity model with one vertical mode can simulate the basic dynamics of the Loop Current eddy system. Rossby-wave theory and a conservation of absolute vorticity trajectory analysis were used to explain the behavior of the Loop Current, including its northward penetration into the gulf, the latitude of westward bending, the shedding period for the eddies and their diameters and westward propagation speeds.

Hyde, W., W. Wallace, W. Stevenson and M.P. Worsham. 1974. Preliminary Supplement to a Bibliography of Offshore and Estuarine Areas of Alabama. Alabama Development Office. Montgomery, AL. 20 pp.

Hydroqual, and Barry A. Vittor & Assoc. 1993. Environmental studies in St. Andrew Bay, Florida. Vol. 4 volumes. Bay County Utilities Dept. Panama City, FL.

Abstract. A thorough examination of the bay's ecology and water quality. The most comprehensive study to date. Includes information regarding water quality parameters, hydrography, seagrasses, benthic invertebrates and sediments.

Hoejerslev, N.K. 1985. Bio-optical measurements in the southwest Florida shelf ecosystem. J. Cons. Int. Explor. Mer. 42:65-82.

Ichiye, T. 1962. Circulation and Water Mass Distribution in the Gulf of Mexico. Geofis. Int. 2(3):47-76.

Abstract. Oceanographic data collected in the Gulf of Mexico from 1951 to 1955 are analyzed. Circulation of the upper layer is greatly influenced by the wind drift as seen in the location of the low salinity water. According to seasonal change of the temperature and salinity, the water mass in the upper layer is classified into five types: three coastal and two off-

shore. The statistical T-S oxygen-density and phosphate-density correlations show little difference between the western and eastern parts in the layer deeper than 1,000 m. In the intermediate layer, however, the difference between two parts becomes more distinct due to the water flowing in the eastern part through Yucatan Channel. Semi-permanent anticyclonic gyres are found in the eastern part on dynamic topography, sigma-t surfaces and isotherm patterns at 200 m depth. These vortices seem to be in contact with the flow through Yucatan Channel occasionally. Three dynamic problems are discussed. Firstly, the wind drift in a circular basin with a shelf is derived and applied to the Gulf of Mexico. The results indicate a good agreement with observed seasonal change of the circulation in the upper layer of the Gulf of Mexico manifested by patterns of isohalines. Secondly, the vertical profiles of the temperature and salinity in the upper layer are explained by solutions of the equation of eddy diffusion and advection of heat and water mass. Thirdly, meandering of the Yucatan Current, and horizontal stability of gyres are discussed.

Ichiye, T. 1962. Some results of oceanographic surveys at Stage II off Panama City, Florida. pp. 406-407. *In* Gorsline, D.S., ed. Proceedings of the First National Coastal and Shallow Water Research Conference. National Science Federation and the Office of Naval Research, Tallahassee, FL.

Abstract. Preliminary results of four hydrographic surveys.

Ichiye, T. 1965. Geostrophic Eddies in the Ocean. Part I. CU-21-65-AT(30-1)2663; CU-14-65-NONR266(48). Lamont Geological Observatory. Palisades, NY. 10 pp.

Abstract. The results of observations of eddies with dimensions of several kilometers to a few hundred kilometers are reviewed. Detailed measurements of an eddy off California revealed the quasi-geostrophic structure of the eddy of intermediate size. Eddies in the eastern half of the Gulf of Mexico are described from hydrographic data collected since 1950. Case histories and dynamical structure of eddies generated by cutoff of increasing meanders of the Gulf Stream and the Kuroshio are discussed. Generation of eddies and perturbations in the ocean due to moving meteorological disturbances are explained from examples in case of extra-tropical cyclones in the ocean polar front of the North Pacific and the one in case of hurricane in the central Gulf of Mexico. Dynamics on development of eddies due to a shearing instability are briefly reviewed.

Ichiye, T. 1971. Circulation Changes Caused by Hurricanes. Oceanographic Studies. 2, Contrib. 509, Chap. 13:229-257.

Abstract. Observations in the Gulf of Mexico of temperature and salinity changes due to passing hurricanes are reviewed. Observations for Hurricane Carla (1961) and for Hurricane Inez (1966) were made on the continental slope in the northwestern and the western Gulf, respectively. The data from the latter case indicate upward displacement and deepening of the thermocline near to and to the left hand side of the hurricane center, respectively. The data from Hurricane Hilda (1964) were obtained on several transects across the track in the central Gulf and are the most comprehensive. Comparison of hydrographic data with those of the undisturbed state indicate upward and downward displacement of the thermocline at and outside the track of the eye, respectively.

Ichiye, T. 1971. The general circulation in the Gulf of Mexico as a two-layer basin. A/M-REF-71-21T. Texas A and M Univ, Dept of Oceanography. College Station, TX. 58 pp.

Abstract. The general circulation in the Gulf of Mexico is treated with two-layer ocean models. Scaling of vorticity equation for the upper layer with the motionless lower layer indicates that the inertia, horizontal eddy viscosity and wind-stress terms are unimportant compared with planetary vorticity and friction (proportional to velocity) terms for time scales longer than a few months and that a non-stationary motion like Loop Current may develop within a few weeks. Analytical solutions of the linearized transport vorticity equation with planetary vorticity and frictional terms are obtained by use of a Green function method for a rectangular, two-ports basin similar to the Gulf. An equation for change of the upper layer depth along a streamline is obtained from the integral relationships of the non-linear equations of motion.

Ichiye, T. 1972. Experimental circulation modeling within the Gulf of Mexico and the Caribbean. pp. 213-226. *In* Capurro, L.R.A. and J.L. Reid, eds. Contributions on the Physical Oceanography of the Gulf of Mexico. Gulf Publishing Co., Houston.

Abstract. Experiments carried out with scale models of Gulf of Mexico used inflow and outflow system as the driving force, showing flow patterns similar with those observed. The driving force for a Caribbean model was wind, and flow patterns agreed with volume transport streamlines computed from hydrographic data.

Ichiye, T. and M.L. Jones. 1961. On the hydrography of the St. Andrew Bay system, Florida. Limnology and Oceanography. 6(3):302-311.

Abstract. A comprehensive study of the temperature, salinity and currents in the various areas of St. Andrew Bay.

Ichiye, T., H.-H. Kuo and M.R. Carnes. 1973. Assessment of currents and hydrography of the eastern Gulf of Mexico. Dept. of Oceanography, College of Geosciences, Texas A&M. College Station, Texas. 217 pp.

Abstract. This volume reviews existing information on currents and hydrography of the deep basin, continental slope, shelf, and estuaries of the Gulf of Mexico between the tip of the Mississippi Delta and Cape Sable, Florida. New analyses of existing data were included, such as computations of surface currents, transport for each month from surface wind stress, and preparation of charts for distributions of water properties from raw hydrographic data. For the near-shore, temperature-salinity relationships were prepared for different estuaries from scattered sources. An annotated bibliography was included.

Ingham, M.C. 1979. Marine environmental conditions off the Atlantic and Gulf Coasts of the US, January 1977-March 1978. Mar. Fish. Rev. 41(5-6):35-47.

Abstract. The predominant atmospheric events influencing the coastal marine environment in 1977 and early 1978 were two severe winters which yielded record or near-record low temperatures along most of the Atlantic and Gulf coasts. The impact of two successive severe winters on fish stocks on nearshore estuarine waters may have been very significant for some species. Reports have been received of high mortalities in both years of juvenile croaker in Chesapeake Bay and white shrimp in South Carolina's coastal waters. The variation of the Eastern Gulf of Mexico Loop Current

apparently did not follow the 'normal' pattern at all in 1977 and early 1978. Maximum northward intrusion of the current occurred in February 1977 and January 1978, not during the spring and summer months as assumed by the 'normal' pattern. The minimum intrusion occurred in the summer and fall of 1977 and continued into the winter period.

Jacobs, G.A. and R.R. Leben. 1990. Loop Current eddy shedding estimated using Geosat altimeter data. Geophys. Res. Lett. 17(13):2385-2388.

Abstract. A method for extracting periodic signals from altimeter data is applied in the Gulf of Mexico using data from the first two years of the Geosat Exact Repeat Mission. The least squares fitting of selected frequencies of sine and cosine functions to the time series of sea surface height at each point of the Geosat ground track is used to estimate the dominant frequency in the gulf for this time period. Optimal interpolation of the sine and cosine coefficients at the dominant frequency to a uniformly spaced grid allows reconstruction of the time series in the gulf and shows eddies shedding from the Loop Current with a period of approximately 10.5 months, consistent with shedding periods determined from numerical models and analysis of satellite infrared data. This technique is a novel method for investigation of periodic signals in Geosat altimetry and is not severely affected by data outages in the time series.

Jaffe, B.E. 1993. Episodic transport of sediment in the nearshore. Ph.D. Dissertation. University of California, Santa Cruz, CA. 185 pp.

Abstract. Sediment transport in the nearshore of the Gulf of Mexico and the Atlantic was investigated at time scales ranging from a fraction of a second to one hundred years. Sediment transport in the nearshore was primarily controlled by transport during infrequent, short-duration, high-energy events. This study is divided into three parts addressing: (1) sediment bypassing on the lower shoreface in Louisiana, (2) episodic suspension in the surf zone, and (3) linear and nonlinear modeling of time-varying sediment suspension in the surf zone.

Jarrell, J.P., G.C. April and D.C. Raney. 1981. Hydrodynamics of Mobile bay and Mississippi Sound - pass exchange studies. University of Alabama Bureau of Engineering Research Report No. 271-112. Mississippi-Alabama Sea Grant Consortium, Ocean Springs, MS. MASGP-80-023. 177 pp.

Abstract. This research was undertaken to develop a mathematical model of Mobile Bay and East Mississippi Sound, Alabama capable of describing the hydrodynamics in Pass aux Herons and Main Pass. The elucidation of the complex interaction of these passes is necessary to further the knowledge of the Alabama coastal system gained through previous modeling efforts. The recently developed WES Implicit Flooding Model, version II (WIFM II) is applied to the Mobile Bay-East Mississippi Sound system. This model is suitable for the indicated purpose because of the implicit solution form and variable grid size capabilities which it possesses. This model is determined to be an effective trend analysis tool for the study of the pass hydrodynamics on the basis of field calibration and verification data.

Jarvela, L.E. and W. McComas. 1975. Aspects of sound speed structure and related water properties in the Gulf of Mexico, June-December 1969. NOO-RP-134-18-5. Naval Oceanographic Office. Washington, D.C. 60 pp.

Abstract. Oceanographic data collected in the Gulf of Mexico during June-December 1969 indicate that the dominant modifier of sound speed structure and related parameters is the East Gulf Loop Current and associated waters. Westerly migration of a detached East Gulf Loop eddy radically altered local sound speed structure in a period as short as one month, while sound speed structure in the eddy remained essentially unchanged during the survey period. Existence of a relic eddy in the western gulf was suggested by temperature-salinity-oxygen relationships. Frequency distributions of sound speed within the thermocline are examined and the existence of two primary sound speed regimes is established. Examples of the effects of the detached eddy on sound ray paths in the thermocline are shown. Use of thermal structure measuring devices to monitor regime movements and to locate their boundaries is discussed.

Jeffrey, L.M. and G. Moskovits. 1955. Literature survey of Lake Charles, Louisiana; Gulfport, Mississippi; Mobile, Alabama; and Pensacola, Florida and their approaches. Reference No. 55-34F, TAMU Project 98. Texas A&M University. College Station, TX. 131 pp.

Abstract. This volume is divided into four sections (water mass characteristics, transparency, currents, sea and swell) relating to the physical oceanography of Lake Charles, LA, Gulfport, Miss., Mobile, Ala., and Pensacola, Florida. With each section a comprehensive bibliography of related topics is given along with a brief discussion of results of data obtained from the given bibliography. Included are charts and tables of salinity, temperature, tides, currents, transparency, and sea and swell information.

Jensen, J.J. 1970. Calculated and observed changes in sea surface temperature associated with hurricane passage. Master's Thesis. Naval Postgraduate School, Monterey, CA. 56 pp.

Abstract. Analyses were made of the sea surface temperatures in the Gulf of Mexico in August for the four years 1965 through 1968. No one pattern was found to predominate. The subsurface temperature profiles were then considered, and a rate of simulated withdrawal of 4000 calories of heat per day was made, until there was no heat in excess of 26°C. This withdrawal represented heat removed during passage of a hurricane. Difference analyses were constructed for the initial sea surface temperature at each station and that after twenty-four hours of simulated withdrawal. The differences ranged from less than one degree to over four degrees. Again, no consistent pattern was found but generally areas of high concentrations of heat experienced smaller decreases. Actual sea surface temperatures collected after two hurricanes were then analyzed and compared to temperature patterns predicted by the computer model. Illustrations of the relative availability of sensible heat energy for different sea surface temperatures are presented and a hypothesis made to account for the greater than average intensities of Hurricanes Betsy (1965) and Camille (1969).

Jin, Kang-R. 1989. A two-layer hydrodynamic and salinity model for estuaries and coastal seas. Ph.D. Dissertation. The University of Alabama. 173 pp.

Abstract. The research described in this dissertation is aimed at developing and testing a two-layer hydrodynamic and salinity model by assuming each layer is homogeneous and vertically integrating the governing equations

over the layer thickness. This model can simulate hydrodynamic and salinity distributions with arbitrary depth in an estuarine environment. The horizontal density gradient terms have been added to a two-layer hydrodynamic and salinity model. The model is applied to Apalachicola Bay, Florida, both with and without the horizontal density gradient terms and a comparison of results presented.

Jin, Kang-R. 1992. The horizontal density gradient in hydrodynamic models of salinity around river mouths. J. Mar. Syst. 3(1-2):1-18.

Abstract. Research described in this paper looks at the effect of horizontal density gradient in the vicinity of a river mouth. The model results based on the measured prototype data in Apalachicola Bay, Florida, indicate that horizontal density in the vicinity of a river mouth. The horizontal density gradient terms have been added to a two-dimensional depth averaged model and a two-layer hydrodynamic and salinity model. The salinity results from model with and without the horizontal density gradient terms are presented and compared with prototype data. The statistical analysis of salinity variance at each gage station around the river mouth also demonstrates the effect of the horizontal salinity gradients.

Jin, Kang-R. and D.C. Raney. 1991. Horizontal salinity gradient effects in Apalachicola Bay.ASCE/J. Waterway Port Coast. Ocean Eng. 117(5):451-470.

Abstract. This research demonstrates that horizontal density gradients approximated by salinity gradient represent an additional forcing term in the equations of motion, which have a significant effect in certain portions of a well-mixed estuary. The horizontal density gradient terms have been added to a two-dimensional depth-averaged hydrodynamic and salinity model that is applied to Apalachicola Bay, Florida. A variable-size finite difference cell is used in the model to allow more efficient resolution of physical details. The estuary system is assumed to be well mixed and boundary conditions are satisfied at the bottom and top of the water column but vertical components of velocity are neglected. A high-resolution numerical model is desirable with particular emphasis on areas near passes, channels, and other critical features.

Jin, K.R. and D.C. Raney. 1991. Numerical computations of a two-layer model for estuaries. NE Gulf Sci. 12(1):1-15.

Abstract. The research described in this paper is aimed at improving the predictive capability of numerical models for estuarine circulation. An improved two-layer model has been developed, which is applicable to the entire estuary including areas near the river mouth and the estuary inlet. This model is applied to Apalachicola Bay, Florida. The calibration and verification of the numerical model is accomplished with available prototype data. The horizontal density gradient terms have been added to the model and provide significantly improved salinity predictions near the river mouths. A theoretical approach to the internal wave boundary condition has been developed in this two-layer model.

Johnson, A.E., J.H. Duke Jr. and F.D. Masch. 1974. Waste allocation study, St. Andrew Bay, Florida. Water Resources Engineers. Austin, TX. 86 pp.

Abstract. This study developed a mathematical model to simulate the estuarine water quality response to waste discharges into St. Andrew Bay.

Johnson, D.J. and R.R. Leben. 1990. Ring Monitoring in the Gulf of Mexico Using GEOSAT Altimetry. Naval Oceanographic and Atmospheric Research Lab., Stennis Space Center. MS. 12 pp.

Abstract. The U.S. Navy's GEOdetic SATellite (GEOSAT) recently completed four and three-fourths years of service, obtaining an unprecedent set of sea level measurements covering the global ocean. Launched in March 1985, with a primary mission (classified) of mapping the marine geoid, this altimetric satellite occupied a non-repeating orbit at approximately 800 km altitude and 1080 inclination. For the following 18 months, GEOSAT sampled a dense network, covering the earth up to ±72° latitudes, with average cross-track resolution of about 4 km and along-track resolution of about 7 km. In October 1986, the satellite was maneuvered into an exactly repeating orbit of 244 revolutions (near 17 days - Exact Repeat Mission, ERM), which continued until January 1990, when the altimeter ceased functioning. In this study, we have used altimeter data from the first (geodetic) mission to determine its utility in monitoring Loop Current-shed rings in the Gulf of Mexico. Comparisons were made between altimeter-derived sea surface height (SSH) anomalies and combinations of Advanced Very High Resolution Radiometer (AVHRR) imagery, satellite tracked drifters and hydrography. Encouraged by the success of this effort, we have begun melding the tie series of SSH from the geodetic mission with SSH from the ERM in order to obtain a data set of SSH topography anomalies in the Gulf of Mexico covering four and one-third years.

Johnson, D.R. 1989. Vector EOF analysis of SSH and wind stress for the GEOSAT pre-ERM mission in the Gulf of Mexico. Naval Ocean Research and Development Activity. NSTL Station, MS. 2 pp.

Abstract. Sea Surface Height (SSH) data collected during the Pre-exact Repeat Mission of the U.S. Navy's GEOSAT satellite were analyzed together with wind stress data from FNOC to determine basin scale patterns of coherent variability. Time series of SSH variations were formed from altimeter cross-over points in 3-degree diamond-shaped grids in the Gulf of Mexico (GOM). Similarly, wind stress time series were formed at selected grid points in the GOM and in the North Equatorial Trade wind region of the Atlantic. The two sets of time series, one year in length, were subjected to Empirical Orthogonal Function analysis. The first EOF mode contained more than twice the variance of the second mode, with the largest amplitudes (sigenvectors) of the pattern occurring just west of the loop current intrusion for SSH and in the western and northern Gulf for wind stress. A comparison is made with similar combined data for the Northern Indian Ocean where ocean response to Monsoon winds is strong, and better understood. In addition to the EOF analysis, events are followed through the Gulf in both wind and SSH records.

Johnson, D.R. 1993. Altimetry in the Gulf of Mexico: An examination of ERS-1 and Topex/Poseidon. Final Report. Naval Research Laboratory Detachment. Stennis Space Center, MS. 7 pp.

Abstract. Over the past year, sea surface height anomaly data from both ERS-1 and Topex/Poseidon altimeters have been posted on a science bulletin board in a unique program to rapidly disseminate data among workers in the Gulf of Mexico. Other contributions to this board from a variety of data sources such as Argos tracked drifters and frontal analysis from AVHRR have enabled good comparisons. Operational time scale submission to

the bulletin board imposes a difficult set of requirements, especially with respect to the altimetric reference surface. In this study we have investigated the use of a single flat track as a reference. Comparisons are made for the Loop Current and its rings and for altimetry in near coastal areas.

Johnson, D.R., J.D. Thompson and J.D. Hawkins. 1992. Circulation in the Gulf of Mexico From GEOSAT altimetry during 1985-1986. J. Geophys. Res. 97(C2):2201-2214.

Abstract. Using altimetry data obtained from the Geosat Geodetic Mission (April 1985 to October 1986), low-frequency sea surface height (SSH) variations are investigated in the Gulf of Mexico. SSH time series are formed using the method of Fu and Chelton and are used to calculate surface geostrophic current vectors. Spatial patterns of SSH and current vector variations enable the tracking of two major rings shed from the Loop Current. The rings drifted southwestward across the gulf and into the western boundary region at an average speed of about 3.4 cm/s. The buildup of the Loop Current was monitored, as well as the appearance of an eddy of uncertain origin in the southwestern gulf. Verification of the Geosat results are provided with surface drifters, AVHRR imagery, and hydrography.

Jones, J.I.et al. 1973. Physical oceanography of the northeast Gulf of Mexico and Florida continental shelf area. pp. 69. *In* Jones, J.I., R.E. Ring, M.O. Rinkel and R.E. Smith, eds. A Summary of Knowledge of the Eastern Gulf of Mexico. State University System of Florida, Institute of Oceanography,St. Petersburg, FL.

Jones, J.I., R.E. Ring, M.O. Rinkel and R.E. Smith. eds. 1973. A Summary of Knowledge of the Eastern Gulf of Mexico, 1973. State University System of Florida, Institute of Oceanography. St. Petersburg, FL. 590 pp.

Abstract. A compilation and evaluation of significant environmental characteristics of the eastern Gulf of Mexico. It provides an overview of knowledge and information on past and ongoing studies significant to the environment and ecology of this area. Major sections of the report include 1) Physical Environment, 2) Biological Environment, 3) Utilization of Marine and Coastal Resources, 4) Recreation and Industry Coastal Resources, 5) Environmental Quality Problems, and 6) Master Bibliography. Writing is somewhat general in nature with few specific data for all but the bays which are considerably more detailed.

Jones, M.L. and T. Ichiye. 1960. Hydrographic data of the St. Andrew Bay system, Florida. Florida State Univ., Oceanographic Institute Contribution. 143:56.

Abstract. Contains information on salinity, temperature, depths, and currents.

Jordan, C.L. 1973. Climate. pp. 22. *In* Jones, J.I., R.E. Ring, M.O. Rinkel and R.E. Smith, eds. A Summary of Knowledge of the Eastern Gulf of Mexico. State University System of Florida, Institute of Oceanography, St. Petersburg, FL.

Abstract. Climatological data from coastal stations and summaries of meteorological observations from ships are used to describe the broad climatic features of the eastern Gulf of Mexico. The seasonal changes in wind, temperature, cloudiness, and precipitation are related in a general

way to the character of the large-scale circulation patterns and the associated seasonal changes in storm tracks and air masses. Statistical information is presented for selected coastal stations and for a summary area in the east-central Gulf for a number of climatological elements including rainfall, thunderstorms, fog, winds, and waves. Information is also provided on the frequency and seasonal distribution of tropical and extra-tropical cyclones in selected areas, and data are given on maximum hurricane surge heights for the region. Data sources and reliability are discussed in relation to the possibility of providing more detailed climatological information for the eastern Gulf.

Jordan, C.L. 1973. The physical environment of the MAFLA shelf. pp. 1-14. *In* Jones, J.I., R.E. Ring, M.O. Rinkel and R.E. Smith, eds. A Summary of Knowledge of the Eastern Gulf of Mexico. Vol. II-A. State University System of Florida, Institute of Oceanography,St. Petersburg, FL.

Joyce, T.M. 1991. Review of U.S. contributions to warm-core rings. Rev. Geophys. 29(suppl., pt.2):610-616.

Abstract. Reviews U.S. research in the period 1987 to 1990 on Gulf Stream warm-core rings, warm-core rings in the Agulhas and Gulf of Mexico, and warm-core ring models.

Kamykowski, D. 1980. Sub-thermocline maximums of the dinoflagellates *Gymnodinium simplex* (Lohmann) Kofoid and Swezy and *Gonyaulax polygramma* Stein. Northeast Gulf Science. 4(1):39-43.

Abstract. A study of the vertical movements of dinoflagellate algae during the day. Includes some hydrographic data. This study was performed from the former research platform Stage I, off of Panama City.

Kelly, F.J. 1991. Physical oceanography/water mass characterization. pp. 862. *In* Brooks, J.M., ed. Mississippi-Alabama Continental Shelf Ecosystem Study: Data Summary and Synthesis, Technical Narrative. Vol. II. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, LA.

Ketchen, H.G. 1979. A hydrographic survey in Pensacola Bay. Master's Thesis. Florida State University, Tallahassee, FL. 117 pp.

Abstract. During the summer and fall of 1974, a study of Pensacola Bay was conducted in an attempt to determine the flushing tendencies and circulation patterns in this estuary. The objectives of this study were to: (a) classify Pensacola Bay as a particular dynamic type and suggest how this classification might charge under various influences, (b) gain some insight into the flow patterns and mechanisms responsible for transporting dissolved or suspended materials from the Bay, and (c) collect a set of hydrographic data and present some findings and interpretations which would prove valuable to other investigators as a base for additional research in the Bay.

Kinder, T.H. 1983. Shallow currents in the Caribbean Sea and Gulf of Mexico as observed with satellite-tracked drifters. Bull. Mar. Sci. 33(2):239-246.

Abstract. Four satellite-tracked drifters released in the southeastern Caribbean Sea during November 1977 revealed features of the shallow (100-m depth) circulation. All drifters showed meanders and loops, and two showed a large counterclockwise eddy in the Golfo de los Mosquitos. Two

drifters passed through the Straits of Yucatan and showed a double-lobed northward penetration of the Loop Current. Within the Caribbean, scales of meanders and loops were about 100 km near inflow passages but scales were larger (200-500 km) farther downstream. Taken together, the drifter tracks showed important spatial and temporal variability that is not part of the classical depictions of the Caribbean circulation.

Kirst, A.J. and R.D. Gaul. 1964. Summary of automated environmental data collected off Panama City, Florida, June 1962 - December 1964. Texas A&M Univ., Dept. of Oceanography and Meteorology Project. 286-D, Ref. 65-2T:54.

Abstract. Summary of the data collected by an automated system, using the Navy's offshore stages.

Kirst, A.J. and C.W. McMath Jr. 1966. Automated environmental data collected off Panama City, Florida, June 1962 - December 1964. Texas A&M Univ., Dept. of Oceanography and Meteorology Project. 286-D, Ref. 66-9T:92.

Abstract. A summary of environmental air-sea data collected off of Panama City.

Kirwan, A.D. 1989. Mesoscale characteristics and the role of deformation on ocean dynamics. Final Report. Old Dominion University. Norfolk, VA. 29 pp.

Abstract. This letter constitutes the revised final report for ONR contract N00014-88-K-0203. The bulk of the research activities conducted under this contract consisted of basic research on ocean flow dynamics as it pertains to the prediction of ocean motion. The following three papers, describing aspects of the research, were published in the adjudicated scientific literature and are included in this report: Genesis of the Gulf of Mexico ring as determined from kinematic analysis, Observed and simulated kinematic properties of loop current rings, and notes on the cluster method for interpreting relative motions.

Kirwan, A.D. 1991. Mesoscale characteristics and the role of deformation on ocean dynamics. Old Dominion University Technical Report. TR-91-7:61.

Abstract. The bulk of the activities conducted under this contract consisted of basic research on ocean flow dynamics as it pertains to the prediction of ocean motions. Results from the research conducted during this period were published in refereed scientific literature. The following articles are included: (1) Evolution of a warm-core ring in the Gulf of Mexico: Lagrangian observations; (2) Fractal drifter trajectories in the Kuroshio Extension; (3) Observed and simulated kinematic properties of loop current rings; and (4) Dynamics of warm-core mesoscale eddies.

Kirwan, A.D., J.K. Lewis, A.W. Indest, P. Reinersman and I. Quintero. 1988. Observed and simulated kinematic properties of Loop Current rings. J. Geophys. Res. 93(C2):1189-1198.

Abstract. Analysis of drifter data from two rings shed in 1980 and 1982 yields estimates of shape and swirl velocities in addition to trajectory paths. Also, based on these observed characteristics, a primitive equation numerical model was evaluated. Two rings, shed by the Loop Current in 1980 and 1982, were observed for several months by satellite-tracked drifters to migrate across the Gulf of Mexico. The drifter path data have been inverted to obtain estimates of the paths of the centers of the two rings, ring shape, and the swirl velocities. Three drifters were deployed

in the 1980 ring, and the analysis of that data set establishes the variability of the above kinematic estimates for one ring. A comparison of the analysis of data from both rings provides some idea on inter-ring variability. Both rings impacted the Mexican continental slope at about 22.8°N, 95.5°W. After a brief adjustment period, both rings reestablished and maintained a vortex character for several months in the slope region while migrating slowly to the north. The paths of the centers of the two rings along the slope are virtually identical.

Kirwan, A.D., Jr., A.W. Indest, J. Liu and N. Clark. 1990. Ring evolution in general circulation models from path analysis. J. Geophys. Res. 95(C10):18057-18073.

Abstract. Discusses the use of path data for comparing primitive equation models with observations. Such comparisons naturally focus on the inversion of path data for fundamental kinematic characteristics and subsequent descriptive interpretations of both models and observations. The analysis focuses on uncertainties that may affect this interpretation. These include random position errors and numerical noise introduced by the nonlinear inversion ansatz as well as dynamical processes that introduce both low- and high-frequency variability in the kinematic fields. After each of these effects is assessed, the inversion ansatz is applied to paths generated from an eddy-resolving general circulation model of the Gulf of Mexico. Observed and simulated ring kinematics inferred from appropriate paths are discussed and compared with observations for the slope region. The paper concludes with a discussion of the potential for using simulated and observed path data for extracting flow physics and quantifying comparisons between models and observations.

Kirwan, A.D., Jr., G. McNally, M.-S. Chang and R. Molinari. 1974. The effect of wind and surface currents on drifters. J. Phys. Ocean. 5(2):361-368.

Abstract. The problem analyzed here is the motion of a drifter acted on by wind, surface and subsurface currents. From the condition of static equilibrium of all drag forces acting on the drifter, the effects of wind and surface current of arbitrary direction and magnitude and drogue characteristics are examined parametrically. Specific application is made to a recently developed drifter with 9.2 and 11.85 m parachute drogues and a window shade drogue. The calculations show that for some environmental conditions the deviation between the magnitudes of the drifter velocity and the water parcel velocity may exceed 50%. Furthermore, the direction of velocity vectors may differ by as much as 45°. Drifter data from an experiment conducted by the Atlantic Oceanographic and Meteorological Laboratories and the NOAA Data Buoy Office in the Gulf of Mexico Loop Current are examined in light of the theoretical results. The wind effects predicted by the theory were observed in the field. Thus wind corrections to the drifter velocity records which are based on the theory can significantly improve the velocity records.

Kirwan, A.D., Jr., W.J. Merrell, J.K. Lewis, R.E. Whitaker and R. Legeckis. 1984. A model for the analysis of drifter data with application to a warm core ring in the Gulf of Mexico. J. Geophys. Res. 89(C3):3425-2438.

Abstract. Model provides estimates of ring translation, swirl velocities and geometry as applied to a warm core ring in the Gulf of Mexico, November 1980.

Kjerfve, B. 1983. Analysis and synthesis of oceanographic conditions in Mississippi Sound, April thru October, 1980. U.S. Army Corps of Engineers, Mobile District. Mobile, AL. 436 pp.

Ko, D.S. 1992. Synthetic temperature profile in the Gulf of Mexico. Part 1. statistical relationship between modal amplitudes and dynamic height at surface. Technical Memo. Institute for Naval Oceanography. Stennis Space Center, MS. 25 pp.

Abstract. The feasibility of estimating temperature profiles (synthetic temperature profiles) from Geodetic Earth Orbiting Satellite (GEOSAT) altimeter-derived sea-surface heights in the Gulf Stream region has been explored. The scheme was based on a statistical relationship between sea surface heights and subsurface temperature profiles derived by deWitt. DeWitt found that the first two empirical orthogonal functions (EOFs) of the temperature profiles represented more than 95 percent of the overall temperature variance. Furthermore, he found that there is a tight relationship between relative dynamic height and amplitude of the first two EOF modes. This relationship was used to generate the synthetic temperature profiles from GEOSAT data. The synthetic temperature profiles compared well with the expendable bathythermograph (XBT) measurements. In this study the temperature and salinity profiles in the Gulf of Mexico were collected and analyzed. Then the deWitt scheme was employed. The feasibility of using sea-surface heights to estimate temperature profiles (synthetic profiles) in the Gulf of Mexico was investigated.

Koblinsky, C.J. 1979. Tides on the west Florida shelf. Ph.D. Dissertation. Oregon State University. 117 pp.

Koblinsky, C.J. 1981. The M_2 tide on the west Florida shelf. Deep-Sea Res. 28(12A):1517-1532.

Abstract. The M_2 tide on the West Florida shelf was analyzed with data from five arrays of current meter and bottom pressure sensors spanning a 2-year period. The observations of the tidal fluctuations are consistent with a linear barotropic flow model. Internal tides do not contribute significantly to the variance. Consequently, the tidal currents do not change substantially (plus or minus 25%) over the course of a year and the temperature fluctuations are caused by horizontal advection of the mean thermal gradients. Estimates of energy flux onto the shelf revealed that energy propagates at an angle oblique to the wave crests. A one-dimensional model was developed to predict tidal sea level and current amplitudes across the shelf.

Koblinsky, C.J. and P.P. Niiler. 1980. Direct measurements of circulation on the west Florida continental shelf. University of Miami, School of Oceanography Data Report 76, Reference 79-13.

Abstract. Data report from an NSF-sponsored cooperative program of direct measurements of shelf circulation west of Florida. There were 6 arrays of instruments deployed on the shelf and this report presents time series of the moored array.

Koch, S.P., J.W. Barker and J.A. Vermersch. 1991. The Gulf of Mexico Loop Current and deepwater drilling. J. Petrol. Technol. 43:1046-1050.

LaBelle, R.P. 1983. An oil spill risk analysis for the central Gulf of Mexico (April 1984) and western Gulf of Mexico (July 1984) Outer Continental Shelf lease offerings. U.S. Dept. of the Interior, Minerals Management Service, Environmental Modeling Group Report, pp. 62.

Landry, G.C. 1974. Analysis of certain aspects of seawater foam. Master's Thesis. University of West Florida, Pensacola, FL. 62 pp.
Abstract. Weekly measurements of lignin, pH, chloride and sea foam tendency and stability were made at 11 stations in Perdido and Blackwater Bays, Florida from July to December, 1972. The purpose of the study was to describe the effects of pulp mill effluent on sea foam.

Lanfear, K.J., R.A. Smith and J.R. Slack. 1979. An introduction to the oil spill risk analysis model. In 11th Annual Offshore Tech. Conf., 1979, Proceedings, Vol. IV. pp. 2173-2181.
Abstract. Describes application of the USGS model to lease areas including the eastern Gulf of Mexico and the Middle Atlantic OCS. Discussion includes incorporating model results into the environmental impact process.

Lasker, R. and F.G.W. Smith. 1954. Red tide. pp. 173-176. *In* Galtsoff, P.S., ed. Gulf of Mexico, Its Origin, Waters, and Marine Life. U.S. Fish Wildl. Serv. Fish. Bull. 89.

Law Engineering Testing Co. 1982. Thermal study of Warren Bayou and West Bay. Law Engineering Testing Co. Marietta, GA. 142 pp.
Abstract. A study of the thermal discharge of the Lansing Smith Electric Generating Plant, and its effects on the ecology of the surrounding waters. Includes water quality, hydrographic information, and lists of species and their abundance.

Law Environmental. 1993. Final report: A thermal plume characterization and environmental assessment: Warren Bayou and West Bay, St. Andrew Bay Lansing Smith Electric Generating Plant, Panama City, Florida. Law Environmental Inc. Kennesaw, GA. 46 pp.
Abstract. A study of the effects of the Lansing Smith Plant's thermal discharge upon the aquatic life in the receiving waters of the bay. Includes data regarding the hydrography of the thermal plume, water quality, the seagrass communities, sediments, and benthic invertebrates. Comparisons are made between this study and previous studies on this discharge.

Lawing, R.J., R.A. Boland and W.H. Bobb. 1975. Mobile Bay model study: effects of proposed Theodore Ship Channel and disposal areas on tides, currents, salinities, and dye dispersion. U.S. Army Corps of Engineers, Technical Report. TR-H-75-13:250.
Abstract. Model tests were conducted to determine the impact of the proposed Theodore Ship Channel and accompanying material disposal islands on tides, currents, salinities and dye dispersion patterns in Mobile Bay, Alabama. Parameters used in the model were verified with actual measurements from the bay.

Leaman, K.D. 1980. Some observations of baroclinic diurnal tides over a near-critical bottom slope. J. Phys. Ocean. 10(10):1540-1551.
Abstract. The time-depth structure of the baroclinic diurnal tide has been examined with the aid of current and temperature profiles on the west Florida continental shelf. Of interest is the fact that the diurnal frequencies (e.g., the K_1 and O_1 tides) are near the 'critical frequency' corresponding to the bottom slope and density stratification at the experimental location. The baroclinic semidiurnal tide was rather weak and most of the semidiurnal tidal energy was contained in the barotropic currents. This large ratio of barotropic-to-baroclinic, semidiurnal tidal energy is in agreement with the results obtained from previous measurements in the same area. In contrast, the baroclinic diurnal tide is quite strong and exhibits appreciable structural variations with time. However, the diurnal structure is modulated in a fashion which seems to be more complicated than can be accounted for by a simple 'beating' effect between the K_1 and O_1 constituents. This relatively rapid modulation in amplitude and vertical structure indicates that there was present a significant transient component in either the generation or propagation of the internal diurnal tide. It is shown that variations in the vertical shear of low-frequency currents which occurred were in the correct sense and were potentially of sufficient amplitude to produce a subcritical bottom slope for the diurnal constituents during one period of the experiment. In this same period, there is clear evidence of near-bottom intensification of the diurnal oscillations. The data also show that the internal diurnal oscillations are propagating up-slope, away from the shelf break.

Leben, R.R., G.H. Born and J.D. Thompson. 1990. Mean sea surface and variability of the Gulf of Mexico using GEOSAT altimetry data. J. Geophys. Res. 95(C3):3025-3032.
Abstract. GEOSAT Exact Repeat Mission (ERM) altimetric measurements of the sea surface height in the Gulf of Mexico are used to determine the mean sea surface height with respect to the ellipsoid and mesoscale variability along GEOSAT ground tracks in the Gulf for the time period from November 8, 1986, to November 25, 1988. The alongtrack mean sea surface is determined using a regional crossover adjustment procedure. A mean surface generated using the GEOSAT ERM alongtrack mean is calculated and contrasted with a previously derived mean surface determined using GEOS 3 and SEASAT crossover differences. This provides a first look at the variability in the mean between the time periods of 1987-1988 and 1975-1978.

Lee, T.N. 1967. Sea surface temperature as related to circulation in the Gulf of Mexico. M.S. Thesis. Florida State University, Department of Oceanography, Tallahassee, FL. 42 pp.

Leipper, D.F. 1952. Physical oceanography of the Gulf of Mexico, a brief review. TAMU Project 24. Oceanography Department. Texas A&M University. 30 pp.

Leipper, D.F. 1954. Physical Oceanography of the Gulf of Mexico. pp. 119-137. *In* Galtsoff, P.S., ed. Gulf of Mexico, Its Origin, Waters, and Marine Life. U.S. Fish Wildl. Serv. Fish. Bull. 89.

Abstract. This paper presents a brief summary of the descriptive physical oceanography of the Gulf. It is emphasized throughout that only meager data were on hand for the writing of this article. Generalizations are presented on currents, sea temperature, and salinity. The paper refers the reader elsewhere for information concerning the shallow water environment.

Leipper, D.F. 1965. The Gulf of Mexico after Hurricane Hilda (preliminary results). TAMU Project 286, Reference 65-12T. Texas A&M University, Oceanography Department. College Station, TX. 19 pp.

Abstract. Hurricane Hilda crossed the Gulf of Mexico in the period September 30 to October 4, 1964, developing to a very severe hurricane in the central Gulf. Sea temperature data available prior to the storm indicated what is probably a typical late summer situation with some surface temperatures running above 30C. Beginning on October 5, a seven-day cruise was conducted over the area where hurricane winds, had been observed. Using the Bureau of Commercial Fisheries vessel GUS III, four crossings of the hurricane path were made, one where the maximum 150 mph winds were observed, one south of that where the winds had first reached 120, one north where they had decreased to 120 and one in shallow water (40 fathoms), where prior data had been collected by the U. S. Fish and Wildlife Service from their Galveston Biological Laboratory. Bathythermograms were taken regularly to depths of 270 meters and hydrographic casts to 125 meters. All four sections of observations indicated similar patterns of upwelling. During the passage of the hurricane it appears that sea surface temperatures over an area of some 70 by 220 miles decreased by more than 5°C, and that a cyclonic ocean current system was established around this area. The data collected on the GUS cruise appear to be the first systematic oceanographic observations available in such a situation.

Leipper, D.F. 1968. Hydrographic station data Gulf of Mexico. A&M Project 286-4, Reference 68-16T ONR Contract 2119 (04). Oceanography Department. Texas A&M University. 120 pp.

Abstract. The series of four cruises was planned in an effort to get synoptic pictures of the temperature-depth structure of the Gulf in the various seasons. The primary emphasis was in the warmest and coldest parts of the year, usually August and February. Cruises were limited by ship time available. This was of the order of 14 to 20 days for each cruise. Because of the short duration of the cruises, primary emphasis was placed upon the observation of the east Gulf Loop Current with only occasional lines of stations in the west Gulf. Standard lines of observations were repeated on successive cruises where feasible and the positions of the lines were chosen to best describe features of the flow at given times. The data represent hydrographic casts obtained either with the standard Nansen bottle and reversing thermometer equipment or with the Bissett-Berman salinity-temperature and depth data acquisition system.

Leipper, D.F. 1968. Hydrographic station data, Gulf of Mexico, Aug. - Nov., Hansen Casts, 1965-67. TAMU Project 286-4, Reference 68-13T. Oceanography Department. Texas A&M University. 108 pp.

Leipper, D.F. 1968. Hydrographic station data, Gulf of Mexico August 17-September 5, 1968 Nanson casts & Hydrographic station data. A&M Project 286-4, Reference 68-17T. Texas A&M University, Oceanography Department. College Station, TX. 109 pp.

Leipper, D.F. 1968. Hydrographic station data, Gulf of Mexico Feb. - Mar., Hansen Casts 1965-68. TAMU Project 286-4, Reference 68-15T. Oceanography Department. Texas A&M University. 153 pp.

Leipper, D.F. 1970. A sequence of current patterns in the Gulf of Mexico. J. Geophys. Res. 75(3):637-657.
Abstract. Basic overview of seasonal changes in Gulf Stream flow using data from eight cruises over 16 months beginning in July 1965.

Leipper, D.F., J.D. Cochrane and J.F. Hewitt. 1972. A detached eddy and subsequent changes (1965). pp. 107-117. *In* Capurro, L.R.A. and J.L. Reid, eds. Contributions on the Physical Oceanography of the Gulf of Mexico. Gulf Publishing Co., Houston.
Abstract. August 1965 studies of an isolated eddy show decreases in volume transport and velocity at the core of the current in the eddy following the passage of Hurricane Betsy.

Leipper, D.P. and D. Volgenau. 1972. Hurricane heat potential of the Gulf of Mexico. J. Phys. Ocean. 2(3):218-224.
Abstract. Presents data suggesting significant influence of the amount of heat initially available in Gulf waters on the ability to sustain a hurricane.

Le Ngoc Ly and L.H. Kantha. 1993. A numerical study of the nonlinear interaction of Hurricane Camille with the Gulf of Mexico Loop Current. Oceanol. Acta. 16(4):341-348.
Abstract. A three-dimensional, primitive equation, ocean general circulation model is used to study the response of the Gulf of Mexico to Hurricane Camille (1969). The free-surface dynamics and the mixed-layer features are included in the model. The numerical model incorporates the realistic coastline and bottom topography. The sigma coordinate model has eighteen levels in the vertical and 0.2°x0.2° horizontal resolution for the entire Gulf. The study focuses on nonlinear interaction between hurricane induced currents and the Loop Current. The numerical simulations show that there is a strong nonlinear interaction between the hurricane and the Loop Current in the southern and central parts of the eastern gulf. The surface currents due to nonlinear interaction obtain a maximum of over 1 m/s in the southern Gulf. The numerical results also show that the hurricane interaction with the Loop Current strongly affects current, mixed-layer depth, and elevation fields.

Lewis, J.K. 1992. The Physics of the Gulf of Mexico. J. Geophys. Res. 97(C2):2141-2142.
Abstract. During the last 10 years, a good deal of research has been conducted in the Gulf of Mexico (GOM). Study topics have included the Loop Current, coastal processes, eddies, tides, and the effects of tropical storms. Scientific contributions have been made by the offshore industry, academia, environmental agencies, and naval research groups. A great deal of information has quietly accumulated concerning the Gulf, most of which

is applicable to other regions in the world. We now know for certain that the GOM is not the quiescent Mediterranean Sea that we had once supposed. Aside from the occasional severe tropical storm, the Gulf is often filled with Loop Current eddies, strong coastal jets, and a rapidly meandering Loop current. All of this is contained in a basin of only 1.5 million km^2. In the spring of 1989 an international conference was convened to allow for an exchange of information and the development of cooperative plans for the future in the Gulf of Mexico.

Lewis, J. and C. Crisp. 1992. Return flow in the Gulf of Mexico. Part II: variability in return-flow thermodynamics inferred from trajectories over the Gulf. J. Appl. Meteorol. 31(8):882-898.

Abstract. A return-flow case study is examined with the benefit of set of observations obtained during the Gulf of Mexico Experiment (GUFMEX). This case represents the return of modified continental air to coastal plain in mid-February. The principal results are 1) the thermodynamic character of the returning air mass exhibits significant differences along the entire Gulf coast, and 2) the mixed-layer modeling theory appears to account for the warming and moistening processes for air the central Gulf that tracks over the Loop Current. The processes determining the character and stratification of the air mass become very complicated, however, as the air approaches neutrally stable conditions and begins its northward track back toward land. The paper concludes with a synopsis of the airmass modification process built upon a composite chart that combines analyses from the various observational platforms.

Lewis, J., C. Hayden, R. Merrill and J. Schneider. 1988. GULFMEX: A study of return flow in the Gulf of Mexico. Bulletin American Meteorological Society. 70(1):24-29.

Lewis, J.K., L. Kantha, A. Gallegos and R. Passi. 1991. Verification and calibration of an eddy-resolving model of the Gulf of Mexico. Technical Report. Science Applications International Corp. McLean, VA. 16 pp.

Abstract. Techniques for verifying and calibrating an eddy-resolving ocean circulation model have been applied to a model of the Gulf of Mexico (GOM). Various kinematic parameters were calculated using drifter data from GOM Loop Current eddies, and from indices of rotational period versus eddy age and swirl velocity versus distance the eddy center were determined. The observed kinematics were then compared to the same parameters calculated from a model eddy. Although the model can simulate the movement and translation velocities of actual Gulf of Mexico eddies, it does not reproduce the interior flow characteristics of such eddies. In particular, the period of rotation about the center of a model eddy is considerably different from what is observed. The first attempt at calibrating the model was the development of more realistic inflow conditions in the Yucatan Straits. A variety of data sets were synthesized to produce the two-dimensional distributions of temperature, salinity, density, and northward velocity as well as the east-west variations of surface height. The data of Cooper et al. (1990) was used to specify the vertical velocity profile while the results of Hall (1989) were used to specify the horizontal structure of the flow field.

Lewis, J.K. and A.D. Kirwan Jr. 1985. Some observations of ring topography and ring-ring interactions in the Gulf of Mexico. J. Geophys. Res. 90(C5): 9017-9028.

Abstract. Trajectory and SST data are used to study movement and interactions of three anticyclonic rings of the Loop Current.

Lewis, J.K. and A.D. Kirwan Jr. 1987. Genesis of a Gulf of Mexico ring as determined from kinematic analysis. J. Geophys. Res. 92(C11):11,727-11,740.

Abstract. Published results of MMS-sponsored Gulf of Mexico physical oceanography study detailing kinematics of Loop Current and associated rings. Drifter trajectories were analyzed and a mechanism for ring generation from strong anticyclonic motion within the current was proposed. The kinematics of the Loop Current are studied using trajectories of drifters in the Gulf of Mexico during mid-June through September 1985. One of the drifters was in the Loop Current proper, while other drifters were in two recently shed Loop Current rings. The drifter in the Loop Current showed strong anticyclonic motion during the study period. Analysis of the Loop Current drifter motion showed that the anticyclone became an integral part of the Loop Current, taking on many of the characteristics of the most recently shed ring. The results of the analysis suggest a process by which Loop Current rings can be generated. Apparently, this mechanism can cause the Loop Current to become reconfigured in 2-3 months for beginning the process of ring separation.

Lewis, J.K., A.D. Kirwan Jr. and G.Z. Forristall. 1989. Evolution of a warm-core ring in the Gulf of Mexico: Lagrangian observations. J. Geophys. Res. 94(C6):8163-8178.

Abstract. During 1985 and 1986, a Gulf of Mexico ring shed by the Loop Current was observed to migrate toward the western Gulf of Mexico. This movement across the gulf was well documented by observations that included drifter data within and outside the ring, sea surface temperature at weekly intervals, expendable bathythermograph surveys at various times, one major hydrographic cruise when the ring was in the northwestern gulf, and currents from moorings over which the ring passed. The drifter data were used to infer the movement of the ring center as well as the eccentricity and orientation of the major axes. The data from the drifters bridge the gaps between detailed surveys to the extent that a daily history of the position and shape of the ring can be constructed.

Lewis, J.K., G.A. Vayda and Y.L. Hsu. 1991. Coupling Regional and Global Tide Models. pp. 418-424. *In* Conference Proceedings of An Ocean Cooperative Industry Government Academia. Vol. 1.

Abstract. A two-dimensional numerical model was used to study appropriate conditions at the open boundaries for a regional model forced by parameters from Schwiderski's (1981, 1983) global tidal model. The open boundary condition of Reid and Bodine (1968) was applied to regional models of the north-central Gulf of Mexico and of the western Florida shelf. A number of tests were conducted to determine how well forcing using the tidal constants from the 1xl Schwiderski global model could reproduce the M_2 and 0_1, tides as determined from observations and the 15'xl5'Gulf of Mexico model of Reid and Whitaker (1981). The Reid and Bodine formulation was quite effective in driving the regional models while still allowing wave energy to propagate through the open boundaries

and out of the model. Tests with one open boundary of the north-central Gulf regional model having just a radiation or a zero-gradient condition (but no tidal forcing which can be quite different from the actual tides. The results indicate that tidal forcing is required at all open boundaries to reproduce observed and model-predicted tidal variations. The western Florida shelf is known to resonate with the M_2 tide. Under such circumstances, the bottom friction becomes quite important in obtaining correct predictions of the observed tidal amplitudes. Several bottom friction schemes with varying drag coefficients were tested for both the central Gulf and Florida models. The results are discussed in light of the fact that we seek one scheme which would be applicable for both resonant and non-resonant situations.

Lewis, J.K., G.A. Vayda and Y.L. Hsu. 1992. Coupling regional and global tide models. Mar. Technol. Soc. J. 26(2):78-87.

Abstract. A two-dimensional numerical model was used to study appropriate conditions at the open boundaries for a regional model forced by parameters from a global tidal model (Schwiderski, 1981; 1983). The open boundary condition of Reid and Bodine (1968) was applied to regional models of the north-central Gulf of Mexico and of the western Florida shelf. A number of tests were conducted to determine how well forcing using the tidal constants from the 1° x 1° Schwiderski global model could reproduce the M_2 and O_1, tides as determined from observations and the 15'x 15' Gulf of Mexico model of Reid and Whitaker (1981). The Reid and Bodine formulation was quite effective in driving the regional models while still allowing wave energy to propagate through the open boundaries and out of the model. Tests with one open boundary of the north-central Gulf regional model having just a radiation of a zero-gradient condition (but no tidal forcing for either) failed to reproduce the known tides.

Ling, T.F.T., G.C. April, D.C. Raney and J.N. Youngblood. 1981. Hydrodynamic and salinity models for Mobile Bay and east Mississippi Sound. MASGP-81-020, University of Alabama Bureau of Engineering Research Report No. 283-112. U.S. Army Corps of Engineers, Mobile District. Ocean Springs, MS. 149 pp.

Abstract. This research undertakes the task of determining numerical solutions to the equations of hydrodynamic change as applied to Mobile Bay and East Mississippi Sound. In doing so, results from the calibrated and verified models can be used to better explain and understand the complex behavior of these water bodies and the interactive forces that occur between them at Cedar Point. The hydrodynamic model is exercised over four tidal cycles, beginning with the estimates from a previous run, until no significant change in the magnitude of the parameter is observed. In addition, an isolated subsystem model of the Cedar Point area was developed for the purpose of obtaining salt concentration profiles in this pass exchange area. The subsystem model for salinity is a valuable tool in determining the influence that Mobile Bay has on East Mississippi Sound under varying meteorologic and hydrodynamic conditions.

Linn, J.B., III. 1975. Sea-surface topography of the Gulf of Mexico, based on ship drift. M.S. Thesis. Texas A&M University. College Station, TX. 56 pp.

Lipp, R.L. and R.L. Chermock. 1975. A Bibliography of Coastal Alabama With Selected Annotations. Alabama Geological Survey, Bulletin. 108:96.

Liu, J. 1992. Some solutions to a lens model with applications to warm-core eddies. Ph.D. Dissertation. Old Dominion University, Norfolk, VA. 158 pp.
Abstract. A model of lens-shaped anticyclonic eddies based on nonlinear shallow water equations is developed. The model is a three-layer fluid and allows for one asymmetric mode as well as specified environmental flows. The solution scheme is a polynomial expansion of the field variables. When inserted into the hydrographic equations, the expansion yields eight first-order differential equations for the time dependent amplitudes. This system of ordinary differential equations is numerically tractable. As long as the initial values meet the requirement of elliptical structure and the prescribed external force is tolerable for the initial values, the numerical solutions are stable. Numerical solutions are developed which show a wide variety of characteristics. Using different assumptions, six analytical solutions are obtained and discussed. For isolated lenses, three special solutions show different oscillations of the amplitudes. One has only the inertial frequency. The other two have superinertial and subinertial frequencies, respectively. For forced lenses, three special solutions are related to different exterior prescribed flows. One is an equilibrium solution having a steady-state external flow. The two other solutions are derived from external flows with subinertial and inertial frequencies, respectively. An attempt is made to apply the special solutions to observations of warm-core eddies in the Gulf of Mexico and other regions of the world ocean. The simulations of warm-core eddies with the special solutions are in general agreement with available data.

Livingston, R.J. 1983. Resource atlas of the Apalachicola Estuary. Report No. 55. Dept. of Biol. Sci., FL. State Univ., Sea Grant College. Gainesville, FL. 64 pp.
Abstract. The colored charts and LANDSAT photographs in this small resource atlas vividly illustrate the environment, ecology, and potential of this unique coastal area of western Florida (where Alabama and Georgia touch on Florida). The public relations information type of presentation gives, on two-page spreads each, pictorial, topographic, and statistical data with textual summaries on the following subjects: 1) general overview of the river and bay system and the National Estuarine Sanctuary; 2) physical and chemical features of the barrier islands: depths, tides, and currents; temperature and salinity of surface and bottom waters; water quality features; rainfall and river flow; and nutrients and organic detritus; 3) biological features, covering emergent vegetation, submergent vegetation, microbial ecology, zooplankton, benthic macroinvertebrates, oysters, crabs, shrimp, anchovies, spot, croaker, sand seatrout, commercial and sport fisheries, food webs, and community organization; and 4) regional economics and planning of resource management. An extensive bibliography is appended. Seasonal and annual rainfall, river flow, and temperature variations are shown on bar charts and explained in the text.

Livingston, R.J. 1984. Ecology of the Apalachicola Bay System: An estuarine profile. FWS/OBS-82/05. Florida State University, Department of Biological Science. Tallahassee, FL. 165 pp.

Abstract. Twelve years of studies in the Apalachicola Bay system are reviewed. Included are data on geography, hydrology, chemistry, geology, and biology. The system is part of a major drainage area including four rivers and associated wetlands in Georgia, Alabama, and Florida. The system is in a relatively natural state, though hardly pristine. But economic development and population growth are beginning to threaten it. The area's economic and ecological importance as a food producer and shelter for diverse species has inspired a movement to protect its natural resources, including State and Federal land-purchase programs, integration of county land-use regulations into a comprehensive development, and creation of the Apalachicola River and Bay National Estuarine Sanctuary.

Livingston, R.J. 1987. field sampling in estuaries: the relationship of scale to variability. EPA/600/J-87/364; EPA-R-812053. Florida State Univ. Tallahassee, FL. 17 pp.

Abstract. The spatial/temporal scaling problem (i.e., fitting a given research question to the dimensions of variability of the study area) is particularly pronounced in highly variable systems such as estuaries. Long-term, multidisciplinary studies in the Apalachicola Bay system were used to evaluate variation of different physical, chemical, and biological factors. Specific limitations of weekly, monthly, and quarterly sampling intervals were directly related to the efficiency of the sampling gear, the range of variation in the study parameters, and specific biological features (motility, recruitment, natural history) of infaunal macroinvertebrates and epibenthic organisms. There are families of spatial and temporal scaling phenomena that should be considered when establishing a given field sampling program.

Livingston, R.J. 1991. Historical relationships between research and resource management in the Apalachicola River estuary. Ecological Applications. 1(4):361-382.

Abstract. A continuous field effort has been carried out in the Apalachicola River estuary since March 1972. The information generated from this interdisciplinary study has been directly applied to the management of the Apalachicola resource by means of close associations among local, state, and federal officials and university scientists. During the early years, scientific data were instrumental in the prevention of the impoundment of the Apalachicola River. A series of regional studies was carried out to evaluate various forms of effects due to forestry activities, pesticides, and stormwater runoff from urban areas. A review was made of fisheries problems associated with dredging, overfishing, and marine pollution. Other initiatives were carried out that were designed to protect the naturally high productivity of the river estuary. Analyses of the long-term scientific data indicated that dominant, commercially important estuarine populations are associated with river flow, local salinity characteristics, and biological (predation, competition) interactions with the salinity regime and food web structure. Such interactions are not straightforward, however; they reflect complex interactions of the freshwater influxes and biological response in the estuary that are not well understood. Species-specific responses to the principal driving factors further complicate the biological relationships of the Apalachicola system.

Loftin, H.G. and D.F. Lott. 1980. A summary of results of the NCSC base survey of water quality: January 1975 to October 1979. Technical Note. U.S. Naval Coastal Systems Center. Panama City, Florida. unpaged pp.
Abstract. The results and discussion of monthly monitoring of selected water quality parameters in the waters adjacent to the Naval Coastal Systems Center. Includes data regarding temperature, salinity, dissolved oxygen, pH, turbidity, coliform bacteria, and biochemical oxygen demand (BOD).

Lott, D.F. and H.G. Loftin. 1982. Water quality conditions in St. Andrew Bay near the Naval Coastal Systems Center. Naval Coastal Systems Center Technical Memorandum. NCSC TM 359-82:39.
Abstract. Hydrographic and water quality information gathered from 1973-1977.

Louisiana Universities Marine Consortium. 1993. Satellite assessment of Mississippi River discharge plume variability. Minerals Management Service. New Orleans, LA. 59 pp.
Abstract. The Mississippi River is the major contributor of sediments, pollutants, and nutrients to the northern Gulf of Mexico continental shelf and slope. The study utilized four years of NOAA Advanced Very High Resolution Radiometer (AVHRR) satellite data to quantify which areas of the continental shelf and slope of the Gulf of Mexico are subjected to Mississippi River discharges. The eighty-three images analyzed revealed that the sediment plume varied greatly in size, from 450 km^2 to 7700 km^2. River discharge was found to exert some control over plume size; however, wind speed and direction were also important controlling factors in determining plume morphology and surface sediment distribution over the continental shelf and slope. Results of a compositing analysis revealed that under medium discharge conditions, the mean composite plume covered 2200 km^2 of the continental shelf. Under high discharge conditions, the area of the mean composite plume doubled.

Lowery, T.A. 1987. Symposium on the natural resources of the Mobile Bay Estuary. MASGP-87-007. Mississippi-Alabama Sea Grant Consortium. Ocean Springs. 218 pp.
Abstract. The symposium was the second in a series to present the results of studies, management activities and related information pertinent to improving the communal stewardship of the Mobile Bay Estuary. The papers presented dealt with: The resources of Mobile Bay; Fisheries research and management; Benthic and wetland resources; Habitat preservation, Restoration and mitigation; Educational efforts; Hydrography, circulation, water quality and pollutants. The primary objectives of the symposium were to bring the information together and to identify a new set of management/research recommendations.

Ly, L.N. 1992. Gulf of Mexico response to Hurricane Frederic simulated with the Princeton Numerical Ocean Circulation Model. Technical Report. Institute for Naval Oceanography. Stennis Space Center, MS. 44 pp.
Abstract. This report is a three-dimensional, nonlinear, primitive equation, ocean general circulation model developed at Princeton University and is used to study the response of the Gulf of Mexico to Hurricane Frederic. The model has surface dynamics and a second order turbulence closure scheme for the mixed layer. The study focuses on nonlinear interaction between Hurricane Frederic and the Loop Current, the hurricane induced current, shelf wave, and sea level response to hurricane forcing.

Ly, L.N. and L.H. Kantha. 1993. A numerical study of the nonlinear interaction of Hurricane Camille with the Gulf of Mexico Loop Current. Oceanol. Acta. 16(4):341-348.

Abstract. A three-dimensional, primitive equation, ocean general circulation model is used to study the response of the Gulf of Mexico to Hurricane Camille (1969). The free-surface dynamics and the mixed-layer features are included in the model. The numerical model incorporates the realistic coastline and bottom topography. The sigma coordinate model has eighteen levels in the vertical and 0.2° x 0.2° horizontal resolution for the entire gulf. The study focuses on nonlinear interaction between hurricane induced currents and the Loop Current. The numerical simulations show that there is a strong nonlinear interaction between the hurricane and the Loop Current in the southern and central parts of the eastern gulf. The surface currents due to nonlinear interaction obtain a maximum of over 1 m/s in the southern gulf. The numerical results also show that the hurricane interaction with the Loop Current strongly affects current, mixed-layer depth, and elevation fields. There is a strong current response to Hurricane Camille in the surface layer on the shelf with a peak velocity approximately 2.2 m/s. There is a definite right hand bias in the mixed-layer depth field with a maximum of about 90m.

Ma, C. 1978. On the estimation of the frictional velocity and roughness parameter on the western Florida shelf. Ph.D. Dissertation. Florida State University, Tallahassee, FL.

Magnoli, M.A. 1969. Hydrobiological and trace metal analysis at selected stations in the Mobile Bay estuary. Master's Thesis. University of Alabama, Tuscaloosa, AL. 89 pp.

Abstract. Samples of water and residue from the Mobile Bay- Mississippi Sound estuarine area were collected over an eight month period from June, 1968 to January, 1969. These samples were analyzed for copper, manganese and zinc content and results were compared with hydrological and biological data collected over this same time period.

Manty, R.E. 1993. Effect of the El Niño/southern oscillation on Gulf of Mexico, winter, frontal-wave cyclones: 1960-1989. (Volumes I and II). Ph.D. Dissertation. The Louisiana State University. Baton Rouge, LA. 806 pp.

Abstract. Seasonal counts of frontal-wave cyclones forming over the Gulf of Mexico and its coastal plain show more storms in the five El Niño winters and fewer storms in the eight La Nina winters, from 1960 to 1989, significant at the .01 level by a rank sum test. This is corroborated by two results. First, during the same period, the frequency of frontal-overrunning weather conditions in the region, indicative of storms, was higher in El Niño winters and lower in La Niña winters, significant at the .05 level. Second, 100 years of precipitation and temperature records show wetter, cooler El Niño winters and drier, warmer La Niña winters at gulf-region land stations and climatic divisions. A threefold explanation, based on National Meteorological Center, upper-air data, is offered for the greater frequency of gulf-region cyclogenesis during El Niño winters between 1960 and 1989.

March, K.L., E.Z. Stakhiv and M. Garstang. 1970. On the relation between the surface temperatures of the Gulf of Mexico and its circulation. Bull. Mar. Sci. 20(4):803-812.

Abstract. Postulates existence of correlation between surface temperature gradients and current speeds in winter, for temperature gradients >0.02°C/km.

Marcus, S.O., Jr. 1973. Environmental conditions within specified geographical regions. Offshore east and west coasts of the United States and in the Gulf of Mexico. National Oceanic and Atmospheric Administration Environmental Data Service, National Data Buoy Center. Report No. COM-73-11775:735.

Abstract. This atlas-type report is a comprehensive, but dated, summary of environmental conditions (many parameters) for continental U.S. coasts. Included are seasonal wave statistics based on ship observations and observations at U.S. Coast Guard east coast light ships. Information includes results from an obsolete 1959 North Atlantic Ocean wave hindcast.

Marine Environmental Sciences Consortium. 1973. The ecological impact of a deepwater port in the northeastern Gulf of Mexico. Marine Environmental Sciences Consortium. Dauphin Island, AL. 26 pp.

Maristany, A.E. and J.H. Carson. 1981. Investigation of temperature anomalies in Choctawhatchee Bay, northwest Florida. Northwest Fla. Water Manage. Dist., Havana, Fla. Water Resour. Spec. Rep. 84-5:89.

Marmarino, G.O. 1982. Wind-forced sea level variability along the west Florida shelf (winter, 1978). J. Phys. Ocean. 12:389-405.

Marmer, H.A. 1942. Tide at Pensacola. Proc. U.S. Naval Inst. 68:1427-1431.

Abstract. On the unusual characteristics of tides in Pensacola waters.

Marmer, H.A. 1954. Tides and sea level in the Gulf of Mexico. pp. 101-118. *In* Galtsoff, P.S., ed. Gulf of Mexico, Its Origin, Waters and Marine Life. U.S. Fish Wildl. Serv., Bull. 89.

Marmorino, G.O. 1982. Wind-forced sea level variability along the west Florida shelf (Winter, 1978). J. Phys. Ocean. 12(5):389-405.

Abstract. Coastal tide gauge and meteorological records from Pensacola to Key West for the period January-April 1978 have been examined for low-frequency fluctuations. The dominant 6-day period signals in sea level, alongshore wind stress, and atmospheric pressure were coherent over the entire shelf and propagated southward, consistent with the movement of cold fronts through the area. Sea level response lagged the local wind stress by 18 h (in the north) to 9 h (in the south). In response to a 1 dyn/cm^2 alongshore stress, sea level amplitudes were largest (similar to 60 cm) where the shelf is widest (200 km) and undergoes an abrupt bend, and were similar to 30 cm elsewhere; large transient alongshore sea level slopes, on the order of 10^{-6}, were thus set up. A linear steady-state shelf circulation model (Hsueh, 1980) is used to explore the sea level distribution that is in frictional equilibrium with a wind stress of given orientation.

Marmorino, G.O. 1983a. Summertime coastal currents in the northeastern Gulf of Mexico. J. Phys. Ocean. 13(1):65-77.

Abstract. Observations of currents and temperature at a mooring on the 18 m isobath, 30 km south of the Florida shoreline, are discussed for the 31-day period 15 August-15 September 1978. Tidal currents, having average amplitudes of similar to 10 cm/s, account for 85% of the observed kinetic energy. Low-frequency currents with maximum speeds of similar to 10 cm/s appear to be at least partly driven by local wind-stress events of magnitude similar to 0.2 dyn/cm^2. Frictional effects give rise to a veering with depth (in the Ekman sense) of both the low-frequency flow and the energetic, counterclockwise-rotating twice-daily tidal currents. Propagation of both the tidal signal and low-frequency coastal sea-level fluctuations (amplitudes < 5 cm) is westward through the study area.

Marmorino, G.O. 1983b. Small-scale variations of the wind-driven coastal sea-level response in the West Florida Bight. J. Phys. Ocean. 13(1):93-102.

Abstract. Records from tide gage stations near Cedar Key, Florida are used to examine the alongshore pressure gradient over length scales much smaller than before possible.

Marmorino, G.O. 1983c. Variability of current, temperature, and bottom pressure across the West Florida continental shelf, winter 1981-1982. J. Geophys. Res. 88(C7):4439-4457.

Abstract. Observations are analyzed from four current meter moorings deployed on the broad continental shelf in the northeastern Gulf of Mexico from November 29, 1981, to February 8, 1982 (71 days). Consistent with recent modeling studies, the shelf circulation responds within an inertial period to the alternating up-and-down-coast synoptic scale wind forcing. Average response to a 0.5 dyn/cm^2 alongshore wind stress (as measured at the coast) is similar to 20 cm/sec off Cedar Key and similar to 40 cm/s in the north where the shelf narrows (off Cape San Blas). Lower layer currents veer counterclockwise with depth, as in a bottom Ekman layer (e-folding scale similar to 8 m). The pressure field decays offshore (e-folding scale similar to 160 km) and yields a geostrophic current in good agreement with the observed alongshelf flow.

Marsh, J.G., R.E. Cheney, J.J. McCarthy and T.V. Martin. 1984. Regional mean sea surfaces based on GOES-3 and SEASAT altimeter data. Mar. Geod. 8(1-4):385-402.

Abstract. Regional mean sea surfaces have been computed for the Bering Sea, N. Atlantic, and Gulf of Mexico based on SEASAT and GEOS-3 altimeter data sets. Provides a basis for studying mesoscale variability and for detailed analyses of the earth's clustral structure. Precision of the regional sea surface relative to the geoid is approximately 15 centimeters with a horizontal resolution of 25 kilometers.

Marvin, K.T. 1955. Oceanographic observation in west coast Florida waters, 1949-52. U.S. Fisheries and Wildlife Special Scientific Report. Fisheries No. 149:32.

Maul, G.A. 1974. The Gulf Loop Current. pp. 87-96. *In* Smith, R.E., ed. Proceeding of Marine Environment, Implications of Offshore Drilling in the Eastern Gulf of Mexico. State Univ. Syst., Fla. Inst. of Oceanography,St. Petersburg, FL.

Maul, G.A. 1974. A one year time series of the Gulf Loop Current. Trans. AGU (EOS). 55(4):283.

Maul, G.A. 1975. An evaluation of the use of the earth resources technology satellite for observing ocean current boundaries in the Gulf Stream system. NOAA, NWS Tech. Rep. ERL 335 AOML-18:125.

Abstract. Remote sensing of ocean color to locate current boundaries has been tested in the eastern Gulf of Mexico. Infrared techniques fail there several months of the year because surface thermal signatures are destroyed by summer insolation. A 1-year time history of the Gulf Loop Current has been made by a ship in synchronization with the Earth Resources Technology Satellite (ERTS). Surface chlorophyll-a, temperature, and scattering observations show that color signature of the current is present when thermal indications are absent, and thus this flow can potentially be monitored by a combination of visible and infrared techniques. The gain settings for the satellite are not optimized for ocean radiances and hence computer enhancement of the data is required. The ship data demonstrate an annual cycle of growth, eddy separation, and decay of the Gulf Loop Current, but this could not be reproduced with ERTS due to the 18-day orbit cycle and because the sensors were not designed for ocean radiance levels or spectral distributions. This research supports the concept that a visible multispectral scanner is capable of providing triweekly pathlines of the Gulf Loop Current.

Maul, G.A. 1977. The annual cycle of the Gulf Loop Current, Part I: Observations during a one-year time series. J. Mar. Res. 35(1):29-47.

Abstract. LANDSAT-1 and surface ship observations showing an annual cycle of growth and decay in the Loop Current accompanied by significant year-by-year variability.

Maul, G.A. 1978. The 1972-1973 cycle of the Gulf Loop Current. Part 2: mass and salt balances of the basin. *In* Symposium on the Progress in Marine Research in the Caribbean and Adjacent Regions, Caracas, Venezuela, 12 July 1976. FAO, Rome, Italy.

Abstract. Hydrographic sections were made across the Yucatan Strait and the Straits of Florida approximately every month from May 1972 to Sept. 1973. These data encompass a cycle of the Gulf Loop Current from eddy separation to eddy separation. The data suggest that the 5°C water near the bottom of the Yucatan Strait is forced out of the Gulf of Mexico when the Loop starts to form. About mid-way through the growth phase, resident Gulf waters advect out the Straits of Florida between the continental shelf of the United States and the Florida Current. After separation of an eddy, the 5°C water flows back into the basin, continuity being maintained by continued flow along the Florida coast. In the upper 700 m, approximately 10% of the water flowing into the basin through the Yucatan Strait is exchanged with resident Gulf waters before flowing out the Straits of Florida. The eddy separation causes an injection of 10^{16} g of salt into the western Gulf, and accounts for approximately 75% of the total salt exchange between the Loop Current and resident Gulf waters. Even though the basin has an excess of evaporation over precipitation, river runoff more than accounted for the atmospheric loss of fresh water during the 1972-1973 cycle.

Maul, G.A. 1978. Locating and interpreting hand-held photographs over the ocean; a Gulf of Mexico example for the Apollo-Soyuz Test Project. Remote Sensing Environ. 7(3):249-263.

Abstract. Comparison of photographs taken from Apollo spacecraft over the Gulf of Mexico in July 1975 with concurrently obtained ship data. Patterns in sun glint were interpreted as indicative of the cyclonic shear zone within the Gulf Loop Current. Other features in photographs could be consistently explained as being atmospheric in nature and not associated with cold core ocean eddies.

Maul, G.A., P.W. DeWitt, A. Yanaway and S.R. Baig. 1978. Geostationary satellite observations of Gulf Stream meanders: Infrared measurements and time series analysis. J. Geophys. Res. 83(C12):6123-6135.

Abstract. The IR capabilities of the Geostationary Operational Environmental Satellite (GOES) are analyzed to obtain multiyear time histories of Gulf Stream meanders. Radiative transfer calculations using monthly mean profiles of atmospheric temperature and moisture overestimate cloud-free equivalent soundings by 2-5°K. A simple relation is derived between temperature at the satellite, sea surface temperature, and transmissivity of the atmosphere at 11.6 micrometers, which allows an observer to determine if a known sea surface temperature gradient is observable from Goes knowing only the precipitable water content along the slant path to the spacecraft. More than 2 yr of GOES observations of Gulf Stream meanders are analyzed as a randomly spaced time series using least squares spectral analysis; the dominant periods in the spectra, based on 1976-78 data, are 250, 65, and 10 days in the Gulf of Mexico; 30 and 6 days off Onslow Bay, North Carolina; and 45 and 5 days off New England. A summary of the meanders between the Yucatan Strait and the Grand Banks shows that the largest latitudinal variability is associated with the Gulf Loop Current. Comparison of meander periods with least squares spectra of historical Florida Current transports suggests that meanders in the Gulf of Mexico are related to variability with 4- to 16-days and 40- to 100-day periods in the flow.

Maul, G.A. and H.R. Gordon. 1975. On the use of the Earth Resources Technology Satellite (LANDSAT-1) in optical oceanography. Remote Sensing Environ. 4:95-128.

Abstract. Observations of the Gulf Stream system in the Gulf of Mexico were obtained in synchronization with LANDSAT-1 passes. Images show that the current system can be observed in both color anomalies associated with sea state effects along the cyclonic boundary even in absence of a surface thermal signature.

Maul, G.A. and A. Herman. 1985. Mean dynamic topography of the Gulf of Mexico with application to satellite altimetry. Mar. Geod. 9(1):27-44.

Abstract. Presents new calculation of mean dynamic topography utilizing all available archived hydrographic, STD and XBT data.

Maul, G.A., D.A. Mayer and S.R. Baig. 1985. Comparisons between a continuous three-year current meter observation at the sill of the Yucatan Strait, satellite measurements of the Gulf Loop Current area, and regional sea level. J. Geophys. Res. 90(C5):9089-9096.

Abstract. Current meter mooring was in place between October, 1977 and November, 1980 providing a continuous long-term time series of flow across the sill of the Yucatan Strait. The mooring in a water depth 1895 meters defines low frequency motions parallel to isobaths oriented at 30° true. Net drift is consistent with other observations with an average velocity of 1.8 cm/sec to the SSW.

Maul, G.A., G.G. Thomas and T.A. Nelsen. 1979. Hydrographic data from the NOAA ship R/V RESEARCHER during the October 1977 ocean color and circulation cruise in the Gulf of Mexico. NOAA. Data Report ERL/AOML-1

Maul, G.A. and F.M. Vukovich. 1993. The relationship between variations in the Gulf of Mexico Loop Current and Straits of Florida volume transport. J. Phys. Ocean. 23(5):785-796.

Abstract. Twelve years of monthly mean positions of the northern boundary of the Loop Current in the eastern Gulf of Mexico from satellite and in situ data have been compared with coincident 1977-1988 estimates of volume transport in the Straits of Florida in the subseasonal frequency band 15 to 5 cycles per month. Volume transport estimated from Cuba minus Florida sea level difference in this frequency band accounts for 69% of the variance in volume transport estimated from the Florida-Grand Bahama Island submarine cable. On average, the Loop Current has a dominant period of 11 months whereas the volume transport is dominated by annual spectral energy; little significant coherence squared occurs between them. The maximum northward penetration of the Loop Current occurs on average in winter when the volume transport is a minimum, but this is an artifact of the sampling epoch. This negative relationship is most pronounced for 1979-1981 when transport is characterized as unimodal, but for 1984-1985 and 1987 the Loop Current and volume transport are more in phase, bimodal, and transport and position tend to have more semiannual energy. In this subseasonal band, the volume transport undergoes a significant change in the phase of its annual cycle after 1985 as compared with 1977-1984.

Maul, G.A., F. Williams, M. Roffer and F.M. Sousa. 1984. Remotely sensed oceanographic pattern and variability of blue fin tuna catch in the Gulf of Mexico. Oceanol. Acta. 7(4):469-479.

Abstract. Data from the Japanese longline bluefin fishery in the Gulf of Mexico for 1979 and 1980 were combined with in situ oceanographic data from four research cruises and with infrared and visible satellite imagery from GOES, TIROS-N and NIMBUS-7. Using GOES infrared data, the boundary of the Gulf Loop Current was located and compared with the CPUE for (Thunnus thynnus thynnus); the high 1980 catch was correlated with proximity to the surface thermal front of the current and appears to reflect a change in fishing strategy between years. Correlations with other environmental factors such as sea surface temperature, temperature differences, time, and configuration of the Loop Current, were generally inconclusive. Operational application of satellite data to fisheries oceanography in the tropics and subtropics requires the high imaging frequency of geostationary vehicles because of cloud abundance, separation, and advection rates.

May, D.A., J.D. Hawkins and R.L. Pickett. 1993. Detecting Gulf of mexico oceanographic features in summer using AVHRR Channel 3. J. Atmos. Oceanic Technol. 10(1):64-75.

Abstract. Efforts to monitor the Gulf of Mexico Loop Current and mesoscale ocean features using IR satellite imagery in the summertime have been significantly hindered by (1) strong surface heating that masks surface frontal gradients and (2) extremely high atmospheric water vapor attenuation that lowers effective satellite brightness-temperature values. These problems can now be addressed, provided high-quality multichannel infrared data are available during nighttime satellite passes, The National Oceanic and Atmospheric Administration (NOAA) Advanced Very High Resolution Radiometer (AVHRR) consists of three IR channels that include channels 3 (3.55-3.93 μm), 4 (10.3-11.2 μm) and 5 (11.5-12.5 μm). Of these, channel 3 is least affected by water vapor attenuation, making it better suited for viewing the ocean through a humid atmosphere. All satellites prior to NOAA-11, however, experienced substantial noise in channel 3 soon after launch, rendering the channel relatively useless for long-term oceanographic monitoring.

May, E.B. 1974. The circulation and tidal flushing of Alabama's estuaries. Alabama Department of Conservation, Marine Resources Division Open File Report. Dauphin Island, Alabama. 88 pp.

McAfee, R.O. 1984. Pensacola Bay water quality monitoring program review and assessment: June 30, 1983 to July 1, 1984. Escambia County Utilities Authority. Pensacola, FL. 98 pp.

Abstract. This twelve month study was conducted to determine the potential environmental effects of treated effluent from the ECUA's Main Street WWTP into Pensacola Bay. The major emphasis was placed on nutrient concentrations, namely total nitrogen and total phosphorous, and the biological information for chlorophyll production and phytoplankton counts. These parameters plus various physical measurements, oxygen concentrations, water temperatures, tidal information, salinity and pH were gathered to determine not only the present effects on the Bay but the limiting factors for future plant effluent guidelines.

McClelland, S.I. 1975. Wind-driven vorticity transport model of the circulation in the Gulf of Mexico and Caribbean Sea: preliminary results. EOS. 56(6):378.

McDonald, G. UNKNOWN YEAR. Water heights associated with various hurricanes. U.S. Army Corps of Engineers, Mobile District. Mobile, AL.

Abstract. Several larger hurricanes occurring in the Gulf of Mexico were investigated and reported on. Water heights associated with each hurricane were included in these reports as well as patterns of movements and dates of occurrence from 1911 to the present time.

McDonald, W.F. 1935. Seasonal variation in North Atlantic surface temperature, AGU 16th Annual Meeting, Pt. 1. Trans. Amer. Geophys. Union. 228-239 pp.

Abstract. This paper discusses temperature variation in Gulf of Mexico, North Atlantic, and Caribbean. Data are based on averages of 63 years of observation (1855-1917). A number of figures showing various aspects of these temperature variations are presented.

McLellan, H.J. 1960. The waters of the Gulf of Mexico as observed in 1958 & 1959. TAMU Projects 205 & 24, Reference 60-14T. Oceanography Department, Texas A&M University. College Station, TX. 156 pp.

McLellan, H.J. and W.D. Nowlin. 1962. The waters of the Gulf of Mexico as observed in February and March 1962. TAMU Project 286, Reference 62-16D. Oceanography Department, Texas A&M University. College Station, TX. 174 pp.

McLellan, S.A. ed. 1993. St. Andrew Bay water quality and biological study. Bay County Utilities Dept. Panama City, FL.
Abstract. Expected to be the most comprehensive study to date.

McPhearson, R.M. 1970. The hydrography of Mobile Bay and Mississippi Sound. J. Mar. Sci. Alabama. 1(2):1-83.
Abstract. Forty-nine hydrographic stations were sampled at least bi-monthly in Mobile Bay and Mississippi Sound, Alabama, from May, 1963 through April, 1964. An additional twenty-seven stations were sampled monthly from November, 1965 through October, 1966. At 671 station sites temperature and salinity (surface and bottom) and turbidity data were taken. Data on mean low water levels, tidal range and flushing, currents, and river discharge are presented and discussed.

Means, S.M. and A.J. McErlean. 1987. An environmental bibliography of northwest Florida, 1900-1985. Florida Dept. of Community Affairs. Gulf Breeze, FL. 314 pp.
Abstract. An annotated bibliography of published and unpublished reports. Indexed by author and keyword. The items included are strongly technical in nature and emphasize biological/ecological source materials. Species accounts, distribution and abundance data and related materials form the bulk of the listed references, although fate, transport and physical processes are included where available.

Mehta, A.J. and T.A. Zeh. 1979. Investigation of the Hydrodynamics of Inlet Plume. pp. 478-485. *In* Proceedings of the Specialty Conference on Conservation and Utilization of Water and Energy Resources, ASCE, held in San Francisco, California on August 8-11, 1979. National Oceanic and Atmospheric Administration, Office of Sea Grant, Rockville, MD. (NOAA-79122613.)
Abstract. Sikes Cut provides an access to the Gulf of Mexico from Apalachicola Bay, which is a large and shallow oyster producing body of water in Florida. Two objectives of the investigation were to determine the extent of tidal influence of Sikes Cut in Apalachicola Bay and to use Landsat satellite imagery in order to interpret the ebb flow pattern from the inlet into the Gulf. The modeled flood plume in the bay compared reasonably well with measurements, and it was shown that the plume deflection was produced by Coriolis and cross-flow.

Mehta, A.J. and T.A. Zeh. 1980. Influence on tides of a small inlet in a large bay. Coast. Eng. Amst. 4(2):157-176.
Abstract. The influence of tidal flow through Sikes Cut, connecting Apalachicola Bay with the Gulf of Mexico, on the present oyster reefs appears to be minimal. Degradation of the oyster reefs in the bay is

likely due to some other factor, perhaps increased salinity as a result of a new Apalachicola River dam.

Merrell, W.J., Jr. 1978. Description of the circulation observed in the eastern Gulf of Mexico during CICAR Survey Month II, May 1972. Food and Agriculture Organization of the United Nations, FAO Reports. 200 (suppl.):51-61.

Abstract. During CICAR survey month 2, May 1972, a coordinated effort to describe the circulation in the eastern Gulf of Mexico was made by four independent research groups. Repeated crossings of the CICAR standard sections at the Yucatan Strait and the Straits of Florida were made, while other data were collected within the gulf. The Loop Current, entering the Gulf through the Yucatan Strait, was observed to penetrate only as far north as 25°N. A large anticyclonic ring, with radius of at least 210 km, is known to have separated from the Loop during April. For both Straits, calculations of volume transport from the sea surface to the isopycnal approximately 400-500 m were made. The transports through the Straits of Florida were determined by the direct method by using dropsondes. Geostrophic transports were referenced to directly measured surface velocities within the Yucatan Straits. When averaged over one month, these transport estimates (with error of 10%) agreed well and gave a mean value of $22x10^6 m^3/sec$. During the month, three sections were occupied across the Loop Current within the Gulf of Mexico. One of these sections was repeated four times. Geostrophic transport estimates were made relative to the bottom, or the greatest depth sampled on a section. These crossings gave an average value of $30x10^6 m^3/sec$ for the Loop Current within the GOM.

Merrell, W.J., Jr., J.M. Morrison, W.D. Nowlin Jr., R.L. Molinari, I.H. Brooks and R. Yager. 1976. A description of the circulation observed in the eastern Gulf of Mexico during CICAR survey month II, May 1972. FAO Fish. Report 200 - Supplement. Food and Agriculture Organization of the United Nations. . 638 pp. (FAO Fish. Report 200 - Supplement)

Michaelov, U.D., V.P. Meleshko and G.I. Shcheveleva. 1969. Estimation of the tides and tidal currents in the Gulf of Mexico and Caribbean Sea. State Oceanographic Institute, USSR, Transactions Issue. 96:146-173.

Michelena, E. 1990. Joint oil industry Meteorological/Oceanographic Measurement System (MOMS). NOAA National Data Buoy Center, Stennis Space Center, MS, Technical Bulletin. 16(1):1.

Abstract. This article discusses a new joint industry project between the NDBC (National Data Buoy Center) and Chevron USA called MOMS (Meteorological/ Oceanographic Measurement System). It is a 3-yr. Gulf of Mexico measurement program that will provide improved environmental information for hurricane evacuation, daily industry operations planning, and design criteria for future deep-water oil platforms. A description is given of the buoy type used, its role in improving modeling capabilities, the functions of the six observation stations, and the measurement instruments installed at the stations. All resulting MOMS data, except for current data and time series data, are acquired and reported hourly via the Geostationary Operational Environmental Satellite (GOES) system and disseminated on NWS communication circuits.

Miller, A.R. 1977. Ranges and extremes of the natural environment related to design criteria for Ocean Thermal Energy Conversion Plants. Technical Report. Energy Research and Development Administration. Washington, DC. 78 pp.

Abstract. The distributions and amounts of the warm water temperature resource in the Caribbean - Gulf of Mexico region are linked with the wind field. Wind-induced 'upwelling' or cooling of surface waters occurs seasonally off the Gulf coast of the United States and perennially off the Caribbean coast of South America, apparently related to the north-south components of wind. Monthly means of temperature and wind fields are presented together with annual averages obtained from Surface Marine Observations representing over thirty years of observations. There is sufficient temperature resource in the area to operate Ocean Thermal Energy Conversion plants but to avoid re-circulation problems, it is suggested that mixed discharge of waste waters to depths of about 200 meters be allowed for in the design of such structures.

Milliman, J.D. and E. Imamura. eds. 1992. Physical oceanography of the U.S. Atlantic and eastern Gulf of Mexico. Final Report. OCS/MMS/920003 Contract: DI-1412-00013-0350. Battelle Ocean Sciences. Herndon, VA. 519 pp.

Abstract. The report provides a summary of the physical oceanography of the U.S. Atlantic and eastern Gulf of Mexico and its implication to offshore oil and gas exploration and development. Topics covered in the report include: meteorology and air-sea interactions, circulation on the continental shelf, continental slope and rise circulation, Gulf Stream, Loop Current, deep-western boundary current, surface gravity-wave climatology, offshore engineering implications, implications for resource commercialization, and numerical models of pollutant dispersion.

Minerals Management Service. 1990. Offshore Environmental Studies Program (1973-1989): A Summary of Minerals Management Service Research Conducted on the U.S. Outer Continental Shelf. Minerals Management Service. Herndon, VA. 226 pp.

Abstract. The report provides an overview of the first 15 years of the Environmental Studies Program (ESP), conducted initially by the Bureau of Land Management and now as part of the Minerals Management Service. From 1973 to 1988, the ESP spent nearly $500 million on studies directed to better understand the U.S. Outer Continental Shelf (OCS) and coastal environment and to use the information to document or predict effects of offshore oil and gas activities. The report organizes the hundreds of completed studies and thousands of resulting documents into 15 study topic chapters. Each chapter (e.g., physical oceanography) cites selected studies and provides a general discussion of program objectives and results. Where appropriate, each topic is discussed by OCS Region (Alaska, Atlantic, Gulf of Mexico, and Pacific). A more comprehensive listing of ESP reports and associated publications can be found in OCSEAP (1988) and Johnson et al. (1989). The goal of the report is to provide readers with a general account of the ESP's technical accomplishments and sources of detailed information. To understand the ESP, however, it is necessary to place the program in perspective with the entire OCS oil and gas program.

Mitchell, D.K. 1969. River Survey, Pensacola Plant: Characteristics and effects of salinity intrusion in the Escambia River. Monsanto Textiles Division, Waste and Water Services Group, Technical Services Section. Pensacola, FL. 25 pp.

Abstract. This is a report of a river survey conducted from May through August, 1968, which characterizes the movement of the salt tongue in the lower Escambia River, and establishes as a natural phenomenon the low dissolved oxygen levels present in the river during periods of high salt concentration.

Mitchum, G.T. 1984. Continental shelf water response to large-scale, low-frequency wind forcing with emphasis on the frictional nearshore region. Ph.D. Thesis. The Florida State University. Tallahassee, FL. 90 pp.

Abstract. Three related problems concerning the response of the continental shelf waters to large-scale, low-frequency (synoptic scale) wind forcing are addressed. Briefly the results are as follows. (i) An understanding is gained to the dynamics of the poorly studied frictional region which lies inshore of the region which has been shown (e.g., Gill and Schumann, 1974 and Clarke and Van Gorder, 1984) to be well described by long wave dynamics. Simple accurate solutions for the pressure and alongshore velocity fields are developed and their domains of applicability are given. (ii) Through use of the knowledge gained in (i), a link is established from the frictional nearshore regions to the wave dynamics region by providing a proper boundary condition for models which strictly consider the latter. Also, a formula is given to predict coastal pressure (generally the best data set) given the boundary pressure prediction from a wave dynamics model. (iii) The above results, together with the model of Clarke and Van Gorder (1984), are applied to a data set on the West Florida Shelf. It is shown that the response there is accurately modeled. Further, the simplicity of the model allows the West Florida Shelf response to be understood as a sum of a forced wave moving with the wind field, a free wave generated at the Florida Keys and a smaller, but significant, free wave flux from the east coast of Florida.

Mitchum, G.T. and A.J. Clarke. 1986. Evaluation of frictional, wind-forced long-wave theory on the West Florida shelf. J. Phys. Ocean. 16(6):1029-1037.

Abstract. Clarke and Van Gorder have recently formulated a model describing the large-scale, low-frequency response of continental shelf waters to synoptic-scale wind stress in terms of a sum of forced waves. The model includes realistic friction and time dependence and provides an efficient method for calculating the response. Evaluation of the model using West Florida Shelf data gave the following results. (i) The model successfully predicts both the coastal sea level and alongshore velocity component. (ii) The West Florida Shelf coastal pressure field is dominated by the first mode and can be understood as the sum of a forced wave which travels with the southward-propagating wind stress and a free wave generated at the Florida Keys. (iii) Almost all the wind-induced energy on the West Florida Shelf is due to the wind forcing acting on West Florida Shelf waters. However, a small but significant energy flux appears to enter the West Florida Shelf from the eastern Florida shelf wave guide.

Mitchum, G.T. and W. Sturges. 1982. Wind-driven currents on the west Florida shelf. J. Phys. Ocean. 12(11):1310-1317.

Abstract. Three weeks of current-meter, wind and sea-level data off Cedar Key, Florida are analyzed. Currents and sea level are found to be coherent with alongshore wind stress in the "synoptic" band (similar to 0.05-0.25 cycle per day) and to lag it by approximately half a day. Little coherence is found with cross-shelf wind stress. At the inshore mooring (22 m depth) currents are nearly barotropic for these winter 1978 data. The dominant momentum balance in the alongshore direction is between wind and bottom stress. The offshore frictional length scale (Csanady, 1978) is estimated to be 75-100 km, which implies a seaward extent to a depth of about 30 m. At the offshore mooring (44 m depth) there is vertical shear between the currents at 9 and 39 m. The upper cross-shelf component, which is large relative to that at the inshore mooring, is consistent with Ekman transport while the lower record shows a return flow. The u, v velocity components correlate significantly at the offshore mooring and lead to an upper layer uv gradient on the order of $10^{-5}cm^2/s^2$ between the arrays (75 km separation).

Mofjeld, H.O. 1974. Tidal currents on the west Florida shelf. pp. 127-130. *In* Smith, R.E., ed. Proceedings of Marine Environmental Implications of Offshore Drilling in the Eastern Gulf of Mexico. State University System of Florida, Institute of Oceanography,St. Petersburg, FL.

Abstract. Much of the water motion on the west Florida shelf is due to the tides. Perhaps the most familiar examples of tidal currents are the currents at the mouths of harbors caused by the differences in water level between the water on the continental shelves outside the harbor and the water within the harbor. On the west Florida shelf and in the deep water beyond, similar tidal currents exist because of differences in sea level caused by the tides. Two other kinds of currents that can make important contributions to the water motions on the shelf are discussed.

Mofjeld, H.O. and M. Wimbush. 1976. Tides in the Gulf of Mexico and Caribbean Sea. NOAA, Environmental Research Lab., Pacific Marine Environmental Lab. Seattle, WA. 79-96 pp.

Mofjeld, H.O. and M. Wimbush. 1977. Bottom pressure observations in the Gulf of Mexico and Caribbean Sea. Deep-Sea Res. 24:987-1004.

Abstract. Data from offshore pressure gages deployed during 1971 to 1974 indicate that the Gulf of Mexico has a Helmholtz resonance with a period of 1.56 day. Observations in the Caribbean Sea are compared with theoretical cotidal charts.

Molinari, R.L. 1974. Data from the NOAA ship R/V VIRGINIA KEY and the SUSIO Ship R/V BELLOWS, collected during CICAR survey month II. NOAA Technical Memorandum ERL AOML-22. NOAA, AOML. Miami, FL. 153 pp.

Abstract. Data collected during May 1972 aboard the R/V Virginia Key and the R/V Bellows are presented. Figures 1-15 include the salinity-temperature-depth (STD) and expendable bathythermograph (XBT) stations occupied by the Virginia Key. The STD measurements were taken on both vessels with Plessey Corp. STD meters, Model Number 9060. The AOML data were reduced by the following procedure. Temperature and salinity values were visually determined from the downtrace at 20-m intervals. Only surface water samples were collected; and from these, surface temperature and salinity

values were obtained. The surface temperature was read from a bucket thermometer. The salinity of the surface sample was determined on an inductive salinometer. These cruises, part of CICAR, were made to map synoptically the circulation in the western Caribbean Sea and the Gulf of Mexico.

Molinari, R.L. 1976. An overview of the Cayman Sea - Gulf of Mexico circulation based on CICAR survey month and other data. pp. 103-118. *In* Symposium on Progress in Marine Research in the Caribbean and Adjacent Regions, Caracas. Food and Agriculture Organization of the United Nations, (CICAR II FAO 200.)

Molinari, R.L. 1977. Synoptic and mean monthly 20°C topographies in the eastern Gulf of Mexico. NOAA Tech. Memo. ERL AOML-27:33.

Molinari, R. 1978. An overview of the circulation in the Gulf of Mexico. *In* Sturges, W. and S.L. Shang, eds. Summary Report: Working Conference on the Circulation in the Gulf of Mexico. Florida State University, Tallahassee, FL.

Molinari, R.L. 1978. The relationship of the curl of the local wind stress to the circulation of the Cayman Sea and the Gulf of Mexico. J. Phys. Ocean. 8(5):779-784.

Abstract. The curl of the annual mean wind stress is proposed as the forcing mechanism for the anticyclonic gyre observed in the Cayman Sea. A simple, wind-driven model is used to illustrate how a steady-state gyre in the Cayman Sea, and another gyre in the western Gulf of Mexico, can be spun-up by the wind. The results indicate that the exchange of mass between the two basins can be enhanced by the wind field. Temporal changes in the upper-layer temperature structure of the Cayman Sea gyre are qualitatively consistent with changes predicted by a simple wind-forcing model. The same model is not applicable to the western Gulf of Mexico.

Molinari, R.L. 1980. Current variability and its relation to sea-surface topography in the Caribbean Sea and Gulf of Mexico. Mar. Geol. 3(3/4):409-436.

Abstract. Complexity and variability characterize the circulation of the Gulf of Mexico and the Caribbean Sea with wind stress, currents, atmospheric pressure, eddies, meanders, streaming, and the seasons all interacting and affecting sea slope. Sea surface topography is reviewed on both climatological and synoptic time scales; the adequacy of dynamic topographies is discussed relative to their use as level surfaces; and the use of satellite leveling to study circulation and sea surface topography is considered. Plots of dynamic topography and loop current positions are included.

Molinari, R.L. 1987. Air mass modification over the eastern Gulf of Mexico as a function of surface wind fields and Loop Current position. Mon. Weather Rev. 115(3):646-652.

Molinari, R.L., D.W. Behringer and J.F. Festa. 1976. Model studies of the circulation in the Gulf of Mexico. NOAA report. Atlantic Oceanographic and Meteorological Laboratories. Miami, FL. 120 pp.

Molinari, R.L., D.W. Behringer and J.F. Festa. 1976. Model studies of the circulation in the Gulf of Mexico. Final Report, BLM inter-agency agreement 08550-IA5-26. NOAA/AOML. Miami, FL. 244 pp.

Abstract. AOML of NOAA have completed the first year of a proposed two-year study for the BLM "to develop the capability to predict the currents in the Gulf of Mexico for use in pollutant trajector computation". The objectives of the study were: (1) to modify an existing numerical model for application in the Gulf of Mexico; (2) to evaluate the ability of the model to simulate the Gulf circulation using various types and distributions of data as input information; and (3) to describe the Gulf of Mexico circulation using the results of the model. The data used by the model as interior and boundary conditions were obtained from the NODC, and from cruises conducted as part of the present study. The manipulations used to put the data into a form suitable for input to the model are described in the section called "Model Studies of the Circulation in the Gulf of Mexico." The ability of the numerical model to simulate the observed circulation is demonstrated through a series comparisons of its solutions with solutions from a geostrophic model. These comparisons are made over a wide range of input and boundary conditions. Therefore, the use of the numerical model results to describe the currents of the region is justified.

Molinari, R.L. and J.D. Cochrane. 1972. The effect of topography on the Yucatan Current. pp. 149-156. *In* Capurro, L.R.A. and J.L. Reid, eds. Contributions on the Physical Oceanography of the Gulf of Mexico. Gulf Publishing Co., Houston.

Abstract. Graphical and numerical methods used to obtain the path of a current core in the Yucatan Current are in close agreement with the observed path.

Molinari, R.L. and J.F. Festa. 1978. Ocean thermal and velocity characteristics of the Gulf of Mexico relative to the placement of a moored OTEC plant. NOAA Tech. Memo. AOML-33:106.

Molinari, R.L., J.F. Festa and D.W. Behringer. 1978. The circulation in the Gulf of Mexico derived from estimated dynamic height fields. J. Phys. Ocean. 8(6):987-996.

Abstract. Monthly mean dynamic ht topographies for the upper 500 m of the Gulf of Mexico, seasonal mean topographies for the upper 1,000 m, and annual topographies for the deep flow are presented. The dynamic height values on a 1°x1° grid were determined from observed temperature values and salinities derived from mean T-S relations. The seasonal intrusion of the Loop Current varies directly with the geostrophic transport through the Yucatan Straits. At the Straits, the transport in the upper 500 m is a maximum in June. The transports in the upper 500 m of an anticyclone in the western gulf are a maximum in winter and summer and a minimum in spring and fall. There is a permanent westerly flow on the Texas Shelf. After turning cyclonically, this flow joins the eastward transport of the northern limb of the anticyclone in the western Gulf of Mexico. Most of this eastward flow recirculates in the anticyclone; however, a portion flows east across the central Gulf to become entrained in the Loop Current. The deep circulation between 1,500 and 3,000 m is dominated by an anticyclonic gyre which fills the entire deep basin.

Molinari, R.L. and G.A. Franceschini. 1972. Bathythermograph sections across the path of Hurricane Celia. pp. 259-264. *In* Capurro, L.R.A. and J.L. Reid, eds. Contributions on the Physical Oceanography of the Gulf of Mexico. Gulf Publishing Co., Houston.

Abstract. Three vertical sections taken across the track of Hurricane Celia using XBTs indicate that the storm may have caused upwelling of colder sub-surface waters, whose effect may be dependent on the length of time strong winds were present.

Molinari, R.L. and D.A. Mayer. 1980. Physical oceanographic conditions at a potential OTEC site in the Gulf of Mexico; 27.5°N, 85.5°W. NOAA Tech. Memo. ERL AOML-42:82.

Abstract. Physical oceanographic data have been collected at the nominal position, 85.5°W, 27.5°N, from March 1978 through June 1979. The position is some 300 km west of Tampa, Florida and was occupied to collect data needed in the OTEC design effort. Site occupations by research vessel and current meter deployments were used to obtain temperature, density and current data. Atmospheric conditions were characterized by an abnormally cold winter during 1977-1978. The Loop Current was within 50 km of the site during April and May 1978 and again during January 1979.

Molinari, R.L. and D.A. Mayer. 1982. Current meter observations on the continental slope at two sites in the eastern Gulf of Mexico. J. Phys. Ocean. 12:1480-1484.

Abstract. Current-meter observations obtained at two sites on the continental slope of the eastern Gulf of Mexico, at nominal positions of 29°N, 88°W (the Mobile site) and 27.5° W (the Tampa site) are presented. Data were collected at three levels at Mobile (90, 190, and 980 m) from July 1977 through August 1978 and at four levels at Tampa (150, 250, 550 and 950 m) from June 1978 through June 1979. At 90 and 190 m, the flow at Mobile was on the average to the east. Sustained periods of flow to the west were observed during the summer 1977 and spring 1978. During the periods of eastward flow the wind was generally out of the north and during the periods of westward flow, the wind was out of the east. The flow at the top meter at Tampa was on the average to the west, in the same direction as the average wind. At both sites, the motions are perturbed by events associated with the Loop Current. These events make it difficult to define any seasonal variability in the upper layers. The flow at the bottom meters is strongly aligned with the bottom topography and lacks a strong seasonal signal. Little barotropic tidal energy was observed at either site. At both sites, maximum diurnal energy occurred near the local inertial frequency at the upper levels. These motions are probably induced by either cold-front passages or other atmospheric events. At the bottom meters, maximum diurnal-band energy occurred near the K1-tidal constituent. These motions are strongly time-dependent and they may be related to internal tides.

Molinari, R.L., D. Mayer and F. Chew. 1979. Physical oceanographic conditions at a potential OTEC site in the Gulf of Mexico; 88°W, 29°N. NOAA Technical Memorandum ERL AOML-41. NOAA. 105 pp.

Molinari, R.L. and J. Morrison. 1988. The Separation of the Yucatan Current from the Campeche Bank and the intrusion of the Loop Current into the Gulf of Mexico. J. Geophys. Res. 93(10):10645-10654.

Abstract. Data collected in the eastern Gulf of Mexico during 1974, 1975, and 1976 show that the penetration of the Loop Current into the Gulf is strongly correlated with the location of the Yucatan Current on the Campeche Bank. The Loop does not penetrate far into the Gulf when the Yucatan Current separates from the Bank in the vicinity of the Catoche Tongue (i.e., the eastern Campeche Bank). Deep Loop penetrations are correlated with separations farther west on the Bank. The angle of the Yucatan Current at separation is also correlated with the location of separation (i.e., smaller angles relative to due east are correlated with separations from farther east on the Bank). Thus small angles at separation are correlated with shallow intrusions of the Loop.

Molinari, R.L. and R. Yager. 1972. Upper layer hydrographic conditions at the Yucatan Strait during May 1972. J. Mar. Res. 35(1):11-20.

Abstract. Second paper in a series presenting results of 1972 experiment conducted in the Eastern Gulf of Mexico. Hydrographic conditions above 800m (T, S, V, and transport) across the Yucatan Strait during May 1972 are summarized. Subsurface countercurrent out of the Gulf of Mexico is found below 600m in the western portion of the Yucatan Strait.

Molinari, R.L. and R.E. Yager. 1977. Upper layer hydrographic conditions at the Yucatan Strait during May 1972. J. Mar. Res. 35(1):11-20.

Abstract. Presents analysis of direct and indirect current measurements in Yucatan Strait. Specifies properties which could force flow in interior of Gulf - velocity, transport, vorticity.

Mooney, K.A. 1978. A barotropic steady-state numerical model of the circulation in the Gulf of Mexico. Ph.D. Dissertation. University of Rhode Island, Narragansett, RI. 119 pp.

Morang, A. 1992a. Inlet migration and hydraulic processes at East Pass, Florida. Jour. Coast. Res. 8(2):457-481.

Abstract. East Pass, a tidal inlet in the Florida Panhandle between Pensacola and Panama City, connects Choctawhatchee Bay to the Gulf of Mexico. From 1983 to 1991, the U.S. Army Corps of Engineers sponsored a monitoring project to measure waves, currents, tidal elevations, bathymetry, and shoreline changes at the site. Based on these data and on historical records, a three-phase model has been developed which describes the inlet's behavior during the last 120 years. The first phase (pre-1928) is of spit development and breaching and covers the period when the pass was oriented in a northwest-southeast direction between Choctawhatchee Bay and the Gulf. From 1928 to 1968, the inlet was characterized by the second phase: stable throat position but with a main ebb channel that migrated over a developing ebb-tidal delta. This phase covers the time after the inlet breached through Santa Rosa Island in a north-south direction and began to migrate to the east. The third phase, spanning 1968, when rubble-mound jetties were built, to the present is characterized by a stable throat and ebb channel, and ebb-tidal shoal growth. Despite the jetties, East Pass has continued to demonstrate a tendency to move eastward.

Morang, A. 1992b. Study of Geologic and Hydraulic Processes at East Pass, Destin, Florida. Vol. 1. Main Text and Appendices A and B. Final Report Coastal Engineering Research Center. Vicksburg, MS. 119 pp.

Abstract. From 1983 to 1991, the Coastal Engineering Research Center and US Army Engineer District, Mobile, monitored waves, currents, tidal elevations, bathymetry, and shoreline changes at East Pass Inlet, Destin, FL. Based on these data and on historical records, a three-phase model has been developed that describes the inlet's behavior during the last 120 years: (a) Phase 1 (pre-1928), spit development and breaching, covering the period when the inlet was oriented northwest-southeast between Choctawhatchee Bay and the Gulf of Mexico. (b) Phase 2 (1928-1968), stable throat position but main ebb channel that migrated over a developing ebb-tidal shoal. This phase covers the time after the inlet breached Santa Rosa Island in a north-south direction and then migrated eastward. (c) Phase 3 (1968-present), after rubble-mound jetties were built, the throat and main ebb channel were stabilized, while ebb-tidal shoal grew. Despite the jetties, East Pass has continued to try to move eastward. The driving forces of the eastward migration are hypothesized to be (a) wave forces--the predominant wave direction measured in 10-m water depth is from the southwest, while the shore trends east-west; (b) backbay tidal channel and flood-tidal shoal geometry direct ebb currents towards the eastern shore of the inlet; (c) because of freshwater inputs, the ebb flow is longer in duration and higher in velocity than the flood. Maximum measured ebb currents in the inlet are over 5.0 ft/sec (1.5 m/sec), producing a discharge of about 90,000 ft^3/sec (500 m^3/sec).

Morang, A. 1992c. Study of Geologic and Hydraulic Processes at East Pass, Destin, Florida. Vol. 2. Appendices C through K Coastal Engineering Research Center. Vicksburg. 168 pp.

Abstract. From 1983 to 1991, the Coastal Engineering Research Center and US Army Engineer District, Mobile, monitored waves, currents, tidal elevations, bathymetry, and shoreline changes at East Pass Inlet, Destin, FL. Based on these data and on historical records, a three-phase model has been developed that describes the inlet's behavior during the last 120 years: (a). Phase 1 (pre-1928), spit development and breaching, covering the period when the inlet was oriented northwest-southeast between Choctawhatchee Bay and the Gulf of Mexico. (b). Phase 2 (1928-1968), stable throat position but main ebb channel that migrated over a developing ebb-tidal shoal. This phase covers the time after the inlet breached Santa Rosa Island in a north-south direction and then migrated eastward. (c). Phase 3 (1968-present), after rubble-mound jetties were built, the throat and main ebb channel were stabilized, while ebb-tidal shoal grew. Despite the jetties, East Pass has continued to try to move eastward. The driving forces of the eastward migration are hypothesized to be (a) wave forces--the predominant wave direction measured in 10-m water depth is from the southwest, while the shore trends east-west; (b) backbay tidal channel and flood-tidal shoal geometry direct ebb currents towards the eastern shore of the inlet; (c) because of freshwater inputs, the ebb flow is longer in duration and higher in velocity than the flood. Maximum measured ebb currents in the inlet are over 5.0 ft/sec (1.5 m/sec), producing a discharge of about 90,000 ft^3/sec (2,500 m^3/sec).

Morang, A. 1993. Geologic and physical processes at a Gulf of Mexico tidal inlet, East Pass, Florida. Ph.D. Dissertation.

Abstract. East Pass, a tidal inlet located in the Florida Panhandle between Pensacola and Panama City, connects Choctawhatchee Bay to the Gulf of Mexico. A three-phase model has been developed which describes the behavior of East Pass inlet during the last 120 years, based on wave, current, tide, bathymetric and shoreline data, and on historical records. The first phase (pre-1928) is of spit development and breaching. This phase covers the period when the pass was oriented in a northwest-southeast direction between Choctawhatchee Bay and the Gulf. From 1928 to 1968, the second phase was characterized by a stable throat position but with a main ebb channel that migrated over a developing ebb-tidal delta. This phase covers the time after the inlet breached Santa Rosa Island in a north-south direction and began to migrate east. The third phase, spanning 1968, when rubblemound jetties were built, to the present, is characterized by a stable inlet throat and ebb channel, and ebb-tidal shoal growth.

Morrison, J.M. 1974. Nutrient and dissolved oxygen distributions in the Gulf of Mexico and adjacent regions. Master's Thesis. Texas A&M University. 116 pp.

Morrison, J.M., W.J. Merrell and W.D. Nowlin. 1973. The waters of the eastern Gulf of Mexico as observed during May 1972. Texas A&M University, Oceanography Department, Reference 73-10-T. Texas A&M University, Department of Oceanography. College Station, TX. 330 pp.

Abstract. Data report for the R/V ALAMINOS cruise. Displays the transect lines along with associated XBT, STD, and bottle data. Plots of T and S vertical profiles are also included. This report is one in a series of contributions to CICAR. This report is the first of a series of reports presenting data collected during May of 1972 in a joint effort by the National Oceanic and Atmospheric Agency/Atlantic Oceanographical and Meteorological Laboratory (NOAA/AOML), Nova University, the State University System Institute of Oceanography/Florida (SUSIO), University of Miami, Instituto de Geofisica/Universidad National Autonoma de Mexico, and Texas A&M University. This joint field effort has been declared a part of the Cooperative Investigations of the Caribbean and Adjacent Regions (CICAR) Program. The basic objective was to simultaneously monitor the Loop Current and the currents in the Yucatan and Florida Straits. In particular, this report presents the data collected during Cruise 72-A-9 of Texas A&M University's R/V ALAMINOS.

Morrison, J.M. and W.D. Nowlin. 1977. Repeated nutrient, oxygen, and density sections through the Loop Current. J. Mar. Res. 35(1):105-128.

Abstract. Based on observations made in May, 1972, the nutrient and dissolved-oxygen concentrations in the offshore waters of the eastern Gulf of Mexico are described and related to the Loop Current and anticyclonic current rings, which are the principal circulation features of this region. The characteristic relationships of oxygen and nutrients to density parameters are presented, and the following water masses are characterized in the Gulf: Subtropical Underwater, 18 C Sargasso Sea Water, upper subtropical oxygen minimum, Antarctic Intermediate Water, and North Atlantic Deep Water. Repeated sections through the Loop Current allow some estimation of variability within a period of weeks, as well as descriptions of spatial variations of properties. The relative geostrophic flow within the Loop is described. Transport estimates are

compared to previous estimates of the Loop and to estimates through the Yucatan and Florida Straits based on measurements also made during May, 1972. The results are in good agreement.

Moser, P.H. and R.L. Chermock. 1977. Geological and hydrologic environmental atlas of Mobile and Baldwin Counties, Alabama, Open-File Report. Alabama Geological Survey. Tuscaloosa, AL. 271 pp.

Moshiri, G.A. UNKNOWN YEAR. Bayou Texar Project. University of West Florida, Water Resources Research Center.

Abstract. Bayou Texar, off Pensacola Bay, Florida, was studied extensively from March, 1971 to May, 1976. Water quality analyses were carried out biweekly at 3 to 6 stations in the bayou. Other analyses include measurements of phytoplankton populations, photosynthetic and heterotrophic rates, and water and sediment microbiota. Generally, water samples were filtered before analyses were made of the various parameters.

Moshiri, G.A., N.G. Aumen and W.G. Swann III. 1980. Water quality studies in Santa Rosa Sound, Pensacola, Florida. U.S. Environmental Protection Agency, Environmental Research Lab. Gulf Breeze, FL. 71 pp.

Abstract. Water samples were collected from six stations in Santa Rosa Sound and Little Sabine Bay, Florida, every two weeks between October, 1977, and June, 1979. The samples, taken at the surface, mid-depth, and bottom of each station, were analyzed for temperature, salinity, pH, transparency, inorganic carbon, 5-day biochemical oxygen demand, dissolved oxygen, orthophosphate, poly-phosphate, ammonia, nitrate, and non-volatile grease and oil; bacteria were enumerated; phytoplankton were identified and enumerated; and the water column primary productivity was measured. Although there were seasonal changes, there were few intra or inter station differences on each sampling day. However, Little Sabine Bay exhibited lower water transparency, higher BOD, higher rates of primary production, higher concentrations of non-volatile grease and oil, and larger numbers of bacteria and phytoplankton than Santa Rosa Sound.

Muller-Karger, F.E., J.J. Walsh, R.H. Evans and M.B. Meyers. 1991. On the seasonal phytoplankton concentration and sea surface temperature cycles of the Gulf of Mexico as determined by satellites. J. Geophys. Res. 96(C7):12645-12665.

Abstract. Monthly climatologies of near-surface phytoplankton pigment concentration and sea surface temperature (SST) were derived for the Gulf of Mexico from multilayer series of coastal zone color scanner (CZCS) (November 1978 to November 1985) and advanced very high resolution radiometer (AVHRR) (January 1983 to December 1987) images. The authors complement these series with SST from the comprehensive ocean-atmosphere data set (1946-87) and Climate Analysis Center (1982-90), and hydrographic profile data from the NOAA National Oceanographic Data Center (1914-85). The CZCS ocean color satellite data provide the first climatological time series of phytoplankton concentration for the region.

Mungall, J.C.H., C.E. Abel and C.R. Olling. 1978. Hydrodynamic model estimates of the M_2 and K_1 currents of the Gulf of Mexico. Technical Report, Reference 78-9-T. Research Foundation, Texas A&M University. College Station, TX. 107 pp.

Murphy, D.L., D.F. Paskausky, W.D. Nowlin and W.J. Merrell. 1975. Movement of surface drifters in the American Mediterranean. J. Phys. Ocean. 5(3):549-551.

Abstract. Returns from 75 drifters during October to December 1973 indicated net westward drift in Caribbean Sea and no flow into Caribbean Sea through Mona and Windward Passages. Between 25 October and 11 December of 1973, 1015 surface drifters were launched at 36 stations in the American Mediterranean. Returns from 75 drifters (7.4%) have been received from 23 (64%) of the 36 stations. No flow into the Caribbean Sea through the Mona and Windward Passages was indicated. A net westward drift in the Caribbean Sea of 0.18 m/s was indicated. Movement in the Gulf of Mexico was consistent with observations and models of the Loop Current.

Murray, S.P. 1972. Turbulent diffusion of oil in the ocean. Limnol. Oceanogr. 17(15):651-660.

Abstract. Estimates value of horizontal eddy diffusivity within the Gulf of Mexico from current measurements and observations of oil slick geometries associated with the March 1970 Chevron oil spill. The effect of surface tension is confined to within the first few hundred meters and the general size and shape of the slick is well represented by Fickian diffusion.

Murray, S.P. 1975. Wind and current effects on large scale oil slicks. pp. 523-533. *In* 7th Annual Offshore Technology Conference, May 5-8, 1975. Offshore Technology Conference, Houston, TX.

Abstract. The relative effect of local winds and near-surface currents in determining the movement of oil slicks in coastal and shelf waters was determined from 39 surveys by Raydist-equipped helicopters during the Main Pass 41C spill off the Mississippi Delta in March 1970. Orientation of oil slicks is closely controlled by local wind direction; slicks usually form 10°-40° to the right of the wind. Wind shifts associated with various sectors of migrating high-pressure cells quickly realign new slicks and actively dissipate old ones. Density fronts, both ambient and quasi-stationary, also play important roles in determining slick movement and size. An easily utilized regression model for slick area and orientation as a function of wind velocity and local conditions is also presented.

Nakamoto, S. 1986. An application of solitary wave theory to meso-scale eddies in the Gulf of Mexico. Ph.D. Dissertation. Texas A&M University, College Station, TX. 67 pp.

Abstract. Application of a non-linear quasi-geostrophic model to an isolated eddy along the continental slope region of the Gulf of Mexico. Correspondence exists between model results and observed translational velocity over the slope region supporting the hypothesis that eddy-topographic interactions along the continental slope behave as solutions.

Nakamoto, S. 1989. Soliton-like solutions in Loop Current eddies. J. Geophys. Res. 94(C10):14567-14574.

Abstract. The application of the nonlinear quasi-geostrophic equations to an isolated eddy in the western continental slope region in the Gulf of Mexico is examined for a two-layer ocean model with bottom topography. In the linear limit, solutions are topographic nondispersive waves. Form-

preserving solutions, or solitons, have been found. The solution is shown to be a limiting form for a nonlinear dispersive system propagating northward along the topographic wave guide in the western continental slope region in the Gulf of Mexico. Using satellite-tracked drifter data, a linear relationship is found between the amplitude of the deduced stream function of the eddy and its observed translational velocity over the continental slope, which supports the hypothesis that some mesoscale eddies interacting with the continental slope behave as solitons.

National Aeronautics and Space Administration. 1981. Gulf of Mexico satellite radar altimetry. NASA Technical Memorandum 73295.

Abstract. Reports on a comparison of in situ observations and sea-surface dynamic height profiles, sea-surface topographic variations, significant wave height and surface wind speed results from SEASAT and GEOS-3. Good comparison was obtained between satellite sensors and ground truth.

National Marine Fisheries Service, Fisheries Engineering Laboratory. 1973. Skylab oceanic gamefish project, Interim Data Report. National Marine Fisheries Service, Southeast Fisheries Center, Fisheries Engineering Laboratory.

Abstract. A joint effort by private, professional fishermen, NASA and NOAA's NMFS took place on August 4 and 5, 1973, in the northern Gulf of Mexico to acquire gamefish data, pigment data, chlorophyll a, b, and c along with carotenoids were measured using color filters.

National Oceanic and Atmospheric Administration. 1989. Project to Characterize Salinity in the Nation's Estuaries. Final Report 1983-1988. National Estuarine Inventory supplement series. National Oceanic and Atmospheric Administration. Rockville, MD. 9 pp.

Abstract. The report describes a new nationwide data collection and synthesis project that is part of NOAA's National Estuarine Inventory (NEI) activities. An extensive effort is underway to develop detailed information on the spatial and temporal characteristics of the salinity patterns within the Nation's estuaries. Present efforts are being concentrated on approximately 30 estuaries in the Gulf of Mexico with eventual application to over 100 estuaries nationally.

National Park Service. 1983. Northern Gulf of Mexico Estuaries and Barrier Islands Research Conference, Program and Abstracts, June 13-14, 1983, Biloxi, MS. Gulf Coast Research Laboratory, J.L. Scott Marine Education Center, Biloxi, MS. National Park Service, Coastal Field Research Laboratory, Ocean Springs, MS. 62 pp.

Abstract. Abstracts are presented from some 44 papers presented at this conference. Subjects include benthic communities, fishes, pelecypods, ground fish surveys, hydrodynamic modeling, geology and oil exploration impacts.

Nelepo, B.A. 1978. Soviet investigations of the dynamics and properties of the waters of the Caribbean Sea and Gulf of Mexico. Food and Agriculture Organization of the United Nations, FAO Reports. 200 (suppl.):119-131.

Abstract. Complex investigations in the Mediterranean Sea were performed as part of the CICAR program by several scientific centers of the U.S.S.R. The material obtained was used for studying hydrophysical and hydrochemical water properties, artificial radioactivity, peculiarities

of formation, spreading, and transformation of water masses, stratification and structure of the water, circulation, and water exchange with the ocean through straits. The results of these circulatory investigations are of special interest in understanding the nature of the Caribbean Sea and Gulf of Mexico. The calculations of geostrophic currents showed that the main Caribbean current is much narrower than was previously thought. To the south of it in the Caribbean Sea, intensive cyclonic revolving of the waters was discovered, and to the north, a weak anticyclonic system. In the Gulf of Mexico, while the cyclonic transfer prevails, separate mesoscale rotations are traced. Such a system of circulation is preserved to the depth of approximately 1000 m. Deeper (corresponding to the bottom relief), weak, independent rotations of water are being formed in separate deep-water hollows. The water interchange through the straits was estimated together with possible transfer of substances, including radioactive nuclei of artificial origin. The results obtained were published in two special volumes of collected articles.

New England Coastal Engineers. 1981. Proceedings of the Gulf circulation studies workshop held May 14-15, 1981 at New Orleans, LA. NTISP-881-248254. Bureau of Land Management, Gulf of Mexico OCS Regional Office. New Orleans, LA. 96 pp.

Abstract. On-going and prospective energy-related uses have supported continued research on the physical processes governing Gulf of Mexico circulation. In particular, the BLM has funded a circulation modeling effort for the southwest Florida shelf, and the Department of Energy has sponsored a circulation model of the entire Gulf system. Accordingly, planning has now begun for a three-year research program to obtain physical oceanographic data in the Gulf. Because the Loop Current is the dominating circulation feature, a primary goal of this measurement program is to improve our understanding of the driving forces of the Loop Current, and the Loop Current's interaction with general Gulf-wide circulation.

Niiler, P.P. 1976. Observations of low frequency currents on the west Florida continental shelf. Mem. Soc. R. Sci. Liege. 6:331-358.

Nof, D. 1981. On the beta-induced movement of isolated baroclinic eddies. J. Phys. Ocean. 11(12):1662-1672.

Abstract. In this paper an analytical method is proposed for calculating the nonlinear beta-induced translation of isolated baroclinic eddies. The study focuses on frictionless anticyclonic eddies with a uniform anomalous density and a lens-like cross section which translates steadily in a resting ocean. The depth of these eddies vanishes along the outer edge so that as they translate westward their entire mass anomaly is carried along with them. The proposed method for calculating the translation speed incorporates the nonlinear equations of motion in an integrated form and a simple perturbation scheme. It relates the translation of the eddy to its intensity, size and volume, but requires only an approximate knowledge of the corresponding numerical values. The proposed method is tested by its application to more complicated anticyclonic eddies representing those shed by the Loop Current in the Gulf of Mexico. For these eddies, the predicted westward translation

speed is 0.32 beta R^2 which agrees very well with both numerical experiments and field observations.

Nowlin, W.D. 1971. Water masses and general circulation of the Gulf of Mexico. Oceanol. Int. 6(2):28-33.

Nowlin, W.D. 1972. Winter circulation patterns and property distributions. pp. 3-52. *In* Capurro, L.R.A. and J.L. Reid, eds. Contributions on the Physical Oceanography of the Gulf of Mexico. Gulf Publishing Co., Houston.

Abstract. Discusses the water masses of the Gulf of Mexico and their vertical stratification, and presents the T-S relationships specific to the region.

Nowlin, W.D. and J.M. Hubertz. 1972. Contrasting summer circulation patterns for the eastern Gulf. pp. 119-138. *In* Capurro, L.R.A. and J.L. Reid, eds. Contributions on the Physical Oceanography of the Gulf of Mexico. Gulf Publishing Co., Houston.

Abstract. First detailed description of an anticyclonic ring detached from the Loop Current occurred June 1966 and June 1967. Waters bounded by the Loop Current and rings are compared to those in the Caribbean. The results of two oceanographic surveys of the eastern Gulf of Mexico in June, 1966, and June, 1967, illustrate two contrasting summer circulation patterns of the area and provide the first detailed description of an anticyclonic ring detached from the Loop Current. This ring was observed in 1967 along with part of an older ring which appears to have moved westward. The potential incipient formation of an eddy is noted in 1966 as a meander of the Loop Current. Water mass analysis indicates that the intermediate and upper waters bounded by the Loop Current and rings are the same as those found in the northwest Caribbean. Water not bounded by these circulations has lesser salinity values at the salinity maximum than the Caribbean water and appears to be formed from the Caribbean mass by vertical mixing along the western edge of the Yucatan Current and over the Campeche Bank.

Nowlin, W.D., J.M. Hubertz and R.O. Reid. 1968. A detached eddy in the Gulf of Mexico. J. Mar. Res. 26(2):185-186.

Abstract. This note presents some preliminary results of a still-incomplete detailed analysis of observations on the property distributions and currents in the eastern part of the Gulf of Mexico, with primary emphasis on the Eastern Loop Current.

Nowlin, W.D., Jr., D.L. Durham and R.O. Reid. 1965. A preliminary program of direct current measurements over the northeastern shelf of the Gulf of Mexico. Texas A&M Project 286, Reference 65-25-T. Department of Oceanography, Texas A&M University. College Station, Texas. 18 pp.

Nowlin, W.D., Jr. and J.M. Hubertz. 1971. Contrasting summer circulation patterns for the eastern Gulf. Oceanographic Studies. 2, Chap. 6:119-137. Texas A&M Univ, College Station, Dept of Oceanography Report No.: CONTRIB-509-CH-6.

Abstract. The results of two oceanographic surveys of the eastern Gulf of Mexico in June, 1966, and June, 1967, illustrate two contrasting summer circulation patterns of the area and provide the first detailed description of an anticyclonic ring detached from the Loop Current. Water

not bounded by these circulations has lesser salinity values at the salinity maximum than the Caribbean water and appears to be formed from the Caribbean mass by vertical mixing along the western edge of the Yucatan Current and over the Campeche Bank.

Nowlin, W.D., Jr. and H.J. McLellan. 1967. A characterization of the Gulf of Mexico waters in winter. J. Mar. Res. 25(1):29-59.

Abstract. The results of a rapid survey of the Gulf of Mexico in the winter of 1962 are presented. Variations in the characteristics of the water in several core layers are described. Circulation has been examined on the basis of dynamic computations and G.E.K. measurements. In the eastern Gulf, water enters through Yucatan Strait and leaves through Florida Strait, flowing in an anticyclonic loop that extends well into the Gulf. In the western Gulf, circulation is anticyclonic around an elongated cell oriented NE-SW over the Gulf Basin. Sufficient similarities are seen in data obtained in other years to suggest that this pattern is typical of the circulation in winter. The complexity of the circulation pattern deduced from this survey is considerably less than that of patterns presented by others.

Nowlin, W.D., Jr. and C.A. Parker. 1974. Effects of a cold-air outbreak on shelf waters of the Gulf of Mexico. J. Phys. Ocean. 4(3):467-486.

Abstract. Two surveys of the waters over an area of the continental shelf in the northwestern Gulf of Mexico were made during January 1966. The first observation period was just before a major outbreak of cold, dry air; the second was about 15 days later with the region still under the influence of this outbreak. Waters were well mixed to 100 m, or the bottom in shallower depths. During the 15-day period temperature decreased nearly 5°C and salinity increased near the shore. Some 150 mi offshore, temperature decreased only 1-2°C and salinity showed no significant change.

Nummedal, D. 1982. Future sea level changes along the Louisiana coast. pp. 164-176. *In* Boesch, D.F., ed. Proceedings of the Conference on Coastal Erosion and Wetland Modifications in Louisiana: Causes, Consequences, and Options. October 5-7, 1981. Rpt. No. FWS-OBS-82/59. U.S. Fish and Wildlife Service, Office of Biological Services, Washington, D.C.

Abstract. The relative elevation of sea and land has been changing throughout time in response to two fundamentally different groups of factors. Global factors include changes in the volume of the ocean basins due to tectonic processes and changes in the total amount of ocean water due to glaciation. Local factors include subsidence of continental margins and the compaction of recent sediments. During this century, global sea level (eustatic) appears to have been rising at a rate of 1.2 mm/yr. Along the southcentral Louisiana coast the land surface appears to be sinking at a rate of about 8 mm/yr. Recent global climatic modeling strongly suggests that we are about to enter a period of rapid warming due to increased amounts of carbon dioxide (CO_2) in the atmosphere. As a consequence, eustatic sea-level rise is predicted to accelerate both because of steric expansion of the ocean water and continued melting of polar ice caps. For the next 40 years the eustatic sea-level rise may average 10 mm/yr. The local relative sea level in coastal Louisiana would therefore rise at about twice its present rate over this time period. At this rate local sea level will, in the year 2020, stand some 70 to 75 cm higher than now.

Nummedal, D., S. Penland, R. Gerdes, W. Schramm, J. Kahn and H. Roberts. 1980. Geologic response to hurricane impact on low profile Gulf coast barriers. Trans,. Gulf Coast Assoc. Geol. Soc. 30:183-195.

Abstract. Hurricane Frederic made landfall near Pasagoula, Mississippi at midnight September 13, 1979. At the time of landfall the central pressure had dropped to 946 mb, onshore winds in excess of 200 km/hr were lashing the Alabama coastline and the open coast storm tide peaked at 365 cm at Gulf Shores, Alabama. Vertical aerial photography obtained in 1976 and again 9 days after Frederic made landfall, combined with multiple reconnaissance overflights and ground surveys by the authors provided the data base for determination of shoreline erosion and the distribution of hurricane scour and sedimentary deposits. Erosion of the Gulf beach at Dauphin Island proved to follow a predictable pattern controlled by nearshore bathymetry whereas retreat of the shoreline of the Mississippi Sound margin was an unexpected occurrence, apparently due to a hydraulic jump as washover currents entered the deep water of Mississippi Sound. Large scale sediment redistribution on Dauphin Island proper was a consequence of the storm surge flood. However, the ebb surge was responsible for the reopening of three inlets across Little Dauphin Island. Hurricane Frederic also had a major impact on the Chandeleur Islands, Louisiana. Even though the maximum surge height on the left side of the hurricane track was only 1.3 m, pre-existing hurricane channels and washovers acted as conduits for the flood and ebb surge.

O'Brien, J.J. and J. Kurdle. eds. 1971. An annotated bibliography of the physical circulation of the eastern Gulf of Mexico. Florida State University. Tallahassee, FL. 10 pp.

Ocean Data Systems. 1977. OTEC Thermal Resource Report for Central Gulf of Mexico. Ocean Data Systems, Inc., Monterey, CA. Department of Energy. 111 pp.

Abstract. Most probable monthly temperature profiles from surface to 1500-meter depths were developed for nineteen one-degree latitude-longitude squares in the central Gulf of Mexico for Ocean Thermal Energy Conversion (OTEC) purposes. This part of the Gulf of Mexico is the site of a semi-permanent current system. The inflow is northward through the Yucatan Channel. Then the water turns eastward at variable latitudes from 23°N to 29°N, and then exits through the straits between Key West and Cuba. The Loop Current is accompanied by warmer water in the center and cooler water outside the current. This temperature variability is reflected in the thermal resource. Also, the northern part of the region undergoes surface cooling in winter and spring. Consistent ΔT's of 20°C are available throughout the year in some of the southern squares but in only 6 months in the northern part of the area. An inventory summary of the temperature observations available in the area is included as well as overall bathymetric information. The monthly temperature data are provided in tabular form and as plots of ΔT versus depth for each latitude-longitude square.

O'Connor, D. 1981. The thermal anomaly in the Gulf of Mexico observed during May 1980. Gulf Stream. 4:6-8.

Oey, L.-Y. and Y.H. Zhang. 1993. Loop current and eddies: 3-D model experiments and analyses. Report No. 15. Stevens Insti. Tech. Ocean Modeling Group. Hoboken, NJ. 42 pp.

Ogburn, R.W. 1976. Short term changes in inorganic nitrate and phosphate in Dauphin Island Bay, Alabama. Master's Thesis. University of Alabama, Tuscaloosa, AL. 51 pp.

Abstract. Dauphin Island Bay was sampled over eight tidal cycles in August and September, 1975. Of the samples taken during each tidal cycle, nitrate and phosphate analysis, water temperature and conductivity were measured. Additional physical parameters were also monitored.

Ostapoff, F. 1971. Ocean-atmosphere interaction in the Caribbean Sea: viewed from the oceanographic side. pp. 137-145. *In* Symposium on Investigations and Resources of the Caribbean Sea and Adjacent Regions, Willemstad, Curacao, Netherlands Antilles, Nov. 18-26, 1968, Papers on physical and chemical oceanography, marine geology and geophysics, and marine biology. UNESCO, Paris.

Abstract. A brief review is given of the large-scale circulation and distribution of water masses once formed under specific climatological conditions at the sea surface, in far removed and widely departed areas, and advected into the Caribbean Sea. The heat and water budget in the area on a seasonal basis is described, and its impact on the oceanic conditions, in particular, on the sea-surface temperature and salinity distribution. A numerical model on time scales of a few days, combining the atmospheric and oceanic boundary layers, is described with emphasis on the ocean layer. Examples are given with climatological atmospheric and oceanic data input from the area east of Barbados at about 13°N and 56°W. The model includes the simulation of eddy fluxes in stratified flow, mixing due to wind-generated waves on the sea-surface, and cloud-dependent radiative heating. Results will be discussed in terms of diurnal current variations, temperature variations, and salinity variations. An important aspect of ocean-atmospheric interaction in the area is the effect on the ocean of extreme atmospheric forces of short duration, such as a hurricane moving through the Caribbean. An example is presented of the sea-surface temperature distribution as measured in the Gulf of Mexico with IR instrumented aircraft, after a hurricane. Cold water upwelling in the wake of the storm leaves a temperature signature at the sea-surface. The temperature depression may amount to 5°C. With the help of available technology and the use of aircraft, important problems of time response of the ocean to atmospheric forces may be studied under partially controlled conditions. The Caribbean may be an ideal place where such a complex process may be carried out.

Overland, J.E. 1975. Estimation of hurricane storm surge in Apalachicola Bay, Florida. United States National Oceanic and Atmospheric Administration, National Weather Service, Technical Report. NOAA TR NWS-17:66.

Abstract. A vertically integrated two-dimensional numerical hydrodynamic model is developed for simulation of hurricane surge in Apalachicola Bay. Standard explicit time differencing is used in conjunction with a single Richardson lattice. Model features include finite-amplitude effects, space-variable wind velocities, parameterization of flooding of terrain, overtopping of barrier islands, and flow through narrow passes. The model

uses the results of C. P. Jelesnianski's SPLASH model computation for open coast surge as input seaward of the Bay and continues the same storm track and wind field as used in the SPLASH computation across the Bay. The Bay model was calibrated for the astronomical tides and verified against Hurricane Agnes. The response of Apalachicola Bay has been determined from numerical computations for a variety of hypothetical hurricanes as specified by various storm parameters. Surge heights in the Bay increase with hurricane central pressure depression in a nearly linear fashion as does the open coast surge. An important parameter is the duration that the open coast surge remains high, a function of the forward speed of the storm and, to a lesser extent, the radius of maximum winds. Surge heights in the Bay increased relative to open coast surge values for slow moving storms. For bays of the extent of Apalachicola Bay, basin orientation relative to wind direction, headlands, and marsh areas can produce significant local variations in surge heights.

Pacheco, P.A., D.R.G. Farrow, T. Manuelides and S.O. Rohmann. 1989. Point source discharges in coastal areas of Alabama: A Summary by estuarine watershed for 1987. Final Report. National Ocean Service, Strategic Environmental Assessments Division. Rockville, MD. 38 pp.

Abstract. The report presents an inventory of the 38 major and 153 minor direct-discharge point sources in the National Coastal Pollutant Discharge Inventory (NCPDI) study area in Alabama. It also summarizes estimates of annual wastewater and pollutant discharges from these facilities for 16 pollutants. The estimates reflect discharges for December 1986 through November 1987, and are organized by the five estuarine drainage areas (EDAs) in the study area.

Paluszkiewicz, T., L.P. Atkinson, E.S. Posmentier and C.R. McClain. 1983. Observations of a Loop Current frontal eddy intrusion onto the west Florida shelf. J. Geophys. Res. 88(C14):9639-9651.

Abstract. Hydrographic and satellite data from the west Florida shelf between April 1-7, 1982 showed the intrusion of a Loop Current frontal eddy onto the shelf. Data were examined to describe the structure of this feature and study effects of its intrusion on water masses in the outer shelf region. A frontal eddy, consisting of a warm filament separated from the main current by a region of cooler water, propagated southeastward at 30 cm/s intruding onto the shelf near 26°N between April 4 and 6. Temperature-salinity (T-S) properties revealed that water in the filament was Loop Current water that had been contiguous with 80 m deeper Loop Current water in the main body of the current; water in the cold region was Continental Edge water, a transitional water mass with cooler, fresher T-S characteristics. Upwelling of deeper Loop Current water occurred under this region, and elevated nutrient concentrations were found in the upwelled dome under the cold region.

Parker, R.D., J.M. Morrison and W.D. Nowlin. 1979. Surface drifter data from the Caribbean sea and Gulf of Mexico, 1975-1978. Texas A&M University, Dept. of Oceanography Reference. 79-8-T:57.

Abstract. Data report listing the launch and recovery positions of a large number of Woodhead surface drifters, which are not continuously tracked but contain information logs to be sent in by individuals who happen to find them. Since only the release and recovery locations are known, the

data is of limited usefulness, but the large number of deployment over several years makes the data noteworthy.

Parrish, P.R. 1966. Seasonal occurrence of marine and freshwater fishes in relation to salinity and temperature in the lower Ochlockonee River, FL. Master's Thesis. Florida State University, Tallahassee, FL. 79 pp.

Parungo, F., C. Nagamoto and S. Hoyt. 1990. The investigation of air quality and acid rain over the Gulf of Mexico. Atmospheric Environment. Part A, General Topics. 24A(1):109-123.

Paskausky, D.F. 1969. A barotropic prognostic numerical model of the circulation in the Gulf of Mexico. Ph.D. Dissertation. Texas A&M University, College Station, TX. 87 pp.

Paskausky, D.F. 1971. Numerically predicted changes in the circulation of the Gulf of Mexico accompanying a simulated hurricane passage. J. Mar. Res. 29(3):214-225.

Paskausky, D.F. and R.O. Reid. 1972. A barotropic prognostic numerical circulation model. pp. 163-176. *In* Capurro, L.R.A. and J.L. Reid, eds. Contributions on the Physical Oceanography of the Gulf of Mexico. Gulf Publishing Co., Houston.
Abstract. Model using variable input flow in the Yucatan Strait to represent seasonality agrees with observed circulation patterns in Gulf of Mexico.

Passi, R.M., K. Goodrich, J.C. Derber and M. Limber. 1993. efficient data assimilation algorithm with a gaussian covariance structure. Technical Report. University of Southern Mississippi. Stennis Space Center. 44 pp.
Abstract. Details are provided of our attempts to develop computationally efficient and widely acceptable data assimilation algorithms. Our initial data assimilation work was done with a scheme which was developed by Derber and Rosati (1989) for their global data assimilation application. The scheme is quite efficient: but when it was combined with a primitive equation, numerical model of the Gulf of Mexico. The nowcasting step took too much computer time for it to be useful in real-time applications. So, after an initial implementation and test of the scheme. our obvious thrust was to enhance and make it more efficient. Most of the computation resources while using the Derber-Rosati scheme are required in approximating a matrix product Sigma mg, where Sigma m is the covariance matrix of the model output error having a Gaussian spatial covariance structure that stays fixed, and g is a varying vector. They approximate this product by repeated applications of a Laplacian operator. A new algorithm is developed that, while maintaining the accuracy, approximates Sigma mg far more efficiently than the Laplacian algorithm. It also admits a wider class of covariance structures with equal ease and efficiency. The new algorithm approximates Sigma mg by applying a product of two operators that are polynomials in simple averaging operators. The algorithm is efficient and general with the only restriction that Sigma m be based on a covariance function that is a product of factors, which are even functions in a single dimension.

Pattulo, J., W. Munk, R. Revelle and E. Strong. 1955. The seasonal oscillation in sea level. J. Mar. Res. 14:88-155.

Abstract. Compiles the monthly departures of sea level from recorded means. Notes semi-annual fluctuations in the Gulf of Mexico and at adjoining Gulf Stream stations.

Paul, J.F., K.J. Scott, A.F. Holland, S.B. Weisberg and J.K. Summers. 1992. Estuarine Component of the US E.P.A.'s Environmental Monitoring and Assessment Program. Chemistry and Ecology. 7:93-116. Science Applications International Corp., Narragansett, RI. Performer: Versar, Inc., Columbia, MD. Performer: National Oceanic and Atmospheric Administration, Rockville, MD. Funder: Environmental Research Lab., Narragansett, RI.

Abstract. The report monitors the status and trends in the condition of the nation's near coastal waters, forests, wetlands, agro-ecosystems, surface waters, deserts and rangelands. The program is also intended to evaluate the effectiveness of Agency policies at protecting ecological resources occurring in these systems. Monitoring data collected for all ecosystems will be integrated for regional and national status and trends assessments. The near coastal component of EMAP consists of estuaries, coastal waters, and the Great Lakes. Near coastal ecosystems have been regionalized and classified, and an integrated sampling strategy has been developed. EPA and NOAA have agreed to coordinate and, to the extent possible, integrate the near coastal component of EMAP with the NOAA National Status and Trends Program. A demonstration project was conducted in estuaries of the mid-Atlantic region (Chesapeake Bay to Cape Cod) in the summer of 1990. In 1991, monitoring continued in mid-Atlantic estuaries and was initiated in estuaries of a portion of the Gulf of Mexico.

Pedrick, R.A., M.C. Ingham, D.R. McLain, F. Favorite and R.J. Lynn. 1979. Marine environmental conditions off the coasts of the United States, January 1977-March 1978. Mar. Fish. Rev. 41(5-6):31-69.

Abstract. The marine environmental conditions off the US coasts were examined by oceanographers to determine climate relationship to marine fisheries resources. In the analysis marine environmental conditions off the Atlantic and Gulf coasts, Jan. 1977-Mar. 1978 include the following: atmospheric variations circulation and air temperature, river runoff, wind-driven transport, oceanographic variation on Gulf of Maine, Georges Banks, Middle Atlantic conditions, South Atlantic conditions, Gulf of Mexico, Eastern Gulf Loop Current, and Mississippi River Discharge.

Penland, S. and R. Boyd. 1982. Assessment of geological and human factors responsible for Louisiana coastal barrier erosion. pp. 14-38. *In* Boesch, D.F., ed. Proceedings of the Conference on Coastal Erosion and Wetland Modifications in Louisiana: Causes, Consequences, and Options. October 5-7, 1981. Report No. FWS-OBS-82/59. U.S. Fish and Wildlife Service, Office of Biological Services, Washington, D.C.

Abstract. Louisiana's coastal barrier systems are experiencing severe shoreline erosion and land loss. Between 1880 and 1980, total coastal barrier area decreased from 98.6 km^2 to 57.8 km^2, an overall loss of 41%. Coastal barrier land loss results from the natural processes of deltaic transgression and marine erosion, combined with the impact of human development. A three-stage model for the evolution of abandoned Mississippi deltas describes deltaic transgression. Sand bodies deposited during delta building are successfully transformed after abandonment into an erosional headland and flanking barriers (Stage 1), a transgressive

barrier island arc (Stage 2), and a subaqueous inner-shelf shoal (Stage 3). Barrier erosion trends closely correspond to the pattern of sediment dispersal identified for each barrier evolutionary stage. Barrier islands in the erosional headland and flanking barrier stage are essentially in a state of dynamic equilibrium, due to the presence of a deltaic headland sand source. Transgressive barrier island arcs do not contain such a sediment source, and hence suffer net erosion. The principal mechanisms of transgression are subsidence combined with repeated erosion by extra-tropical and tropical cyclones. Coastal barrier sediment loss, hence land loss, can be attributed to the following mechanisms: (1) longshore loss into spits and tidal deltas, (2) landward loss through overwash into a subsiding lagoon, (3) offshore loss due to an inequality in offshore/onshore transport capacity, and (4) subsidence of the deltaic sand sources.

Penland, S. and K.E. Ramsey. 1990. Relative sea-level rise in Louisiana and the Gulf of Mexico: 1908-1988. Jour. Coast. Res. 6(2):323-342.

Abstract. Louisiana is experiencing the most severe wetland loss and barrier island erosion in North America. Rapid sea-level rise induced by delta-plain subsidence and a deficit of terrigenous wetland sediment are the primary factors driving the rapid deterioration of the Louisiana coastal zone. Within the Mississippi River delta plain, the Houma tide gage documented a relative sea level rise rate of 1.09 cm/yr from 1946 to 1988. On the coast, the Eugene Island tide gage documented a relative sea level rise rate of 1.19 cm/yr. Relative sea level appears to rise faster in the Terrebonne Parish area than anywhere else in Louisiana. On the average, relative sea level is rising 10 times faster in Louisiana than in the rest of the world. The rapid rate of relative sea level rise observed in Louisiana can be attributed to subsidence of the Mississippi River delta plain due to sediment compaction.

Pequegnat, W.E. 1972. A deep bottom current on the Mississippi Cone. pp. 65-87. *In* Capurro, L.R.A. and J.L. Reid, eds. Contributions on the Physical Oceanography of the Gulf of Mexico. Gulf Publishing Co., Houston.

Abstract. Cameras and current meters are used to study a swift bottom current discovered from biological evidence in the eastern Gulf of Mexico.

Pequegnat, W.E. 1983. The ecological communities of the continental slope and adjacent regimes of the northern Gulf of Mexico. Minerals Management Service, Gulf of Mexico OCS Regional Office. Metairie, LA. 398 pp.

Abstract. This report deals in part with the macrofaunal assemblages that exist in that part of the offshelf Gulf of Mexico that lies north of the 25th parallel and west of the eastern wall of DeSoto Canyon. The study was based on 264 oceanographic stations occupied by R/V ALAMINOS in depths ranging from 150 to 3850 m. Statistical analyses support subdividing the principal megabenthic components (echinoderms, crustaceans, and demersal fishes) of the assemblages into five well-defined faunal zones, four of which (Shelf-Slope Transition, Archibenthal, Upper Abyssal, and Mesoabyssal) are on the continental slope, and the fifth, the Lower Abyssal, occupies the continental rise and abyssal plain. The faunal assemblages comprising the zones are described in considerable detail and the numerically dominant species among important systematic groups are designated within each zone and its subdivisions. The geological, physicochemical, and biological bases for existence of zones and zonal

subsets are discussed in detail, including an attempt to account for faunal differences between the eastern and western parts of the Gulf. Taking the area of the study as the deep Gulf ecosystem, the report also deals with the energy relationships among the biotic components of the system. Tentative explanations of the sources of energy that can balance the energy budget on the abyssal plain are advanced and discussed. The report contains three substantial appendices.

Pequegnat, W.E., R.M. Darnell, B.M. James, E.A. Kennedy, L.H. Pequegnat and J.T. Turner. 1976. Ecological aspects of the upper continental slope of the Gulf of Mexico. PB80-201684. Bureau of Land Management. Washington, D.C. 360 pp.

Abstract. This report describes the faunal assemblages of the deep-water benthic communities associated with the upper continental slope of the northern Gulf of Mexico, primarily in the area between Brownsville, Texas, and Cape San Blas, Florida.

Pequegnat, W.E. and L.H. Pequegnat. 1968. Ecological aspects of marine fouling in the northeastern Gulf of Mexico. Texas A&M Univ., Dept. of Oceanography Project. 286-6, Ref. 67-22T:80.

Abstract. A study conducted off of Panama City of fouling organisms as ecological communities--their growth and diversity, and the effects of anti-fouling compounds. Includes lists of invertebrates, temperature and salinity data.

Pickett, R.L. and D.A. Burns. 1987. Currents of Pensacola, Florida. Technical Report. Naval Ocean Research and Development Activity. NSTL Station, MS. 164 pp.

Pickett, R.L. and D.A. Burns. 1988. A summary of the currents off Pensacola, Florida: Final Report. Submitted to Physical Oceanography Division, Stennis Space Center Station, MS. 6pp.

Abstract. Eight months of current meter observations in shallow water off Pensacola showed nearshore currents were wind driven, parallel to the coast and attained peak speeds up to 62 cm/s. A numerical current model showed that over long time periods, currents should be directed westward and parallel to the coast with speeds greater than those measured.

Pickett, R.L. and A.C. MacAdam. 1990. U.S. Navy Tests of Sonobuoy-Size Oceanographic Buoys. Final Report. pp. 346-355. *In* Proceedings: Annual Gulf of Mexico Information Transfer Meeting (11th).

Abstract. The Navy is developing sonobuoy-sized, air-deployed, satellite-tracked, drifting data buoys. The buoys send 10-min averages of air pressure, air temperature, and water temperatures. Water temperatures are at O, 5, 10, 20, 30, 50, and 100 m below the surface. The buoys have two purposes. First, they collect and relay data from remote or violent-weather areas. Second, they help interpret near-surface current patterns by their drift tracks. Last year, the Navy tested 60 of these buoys. Tests were in the Gulf of Mexico, Mediterranean, Northwest Pacific, and Northeast Atlantic. Results showed buoy sensors are reasonable accurate. However, subsurface sensors do not survive for the three-month design lifetime. Although surface sensors rarely failed within three months, one-third of subsurface sensors typically failed within one month.

Pitts, F.H. 1976. A three-dimensional, time-dependent model of Mobile Bay. (Volumes I and II). Ph.D. Dissertation. The Louisiana State University, Baton Rouge, LA. 446 pp.

Pokryfki, L. and R.E. Randall. 1987. Nearshore hypoxia in bottom water of the Northwestern Gulf of Mexico from 1981 to 1984. Mar. Environmental Res. 22:75-90.

Provost, M.W. 1973. Mean high water mark and use of tidelands in Florida. Fla. Sci. 36(1):50-66.

Abstract. An analysis of ocean tide patterns is used to explain the difficulties in determining the mean high water mark in Florida. Seasonal oscillations of the sea are so related to tide intervals that a submergence periodicity on the tidelands is created which is unique to the state. The high marsh remains dry during one part of the year and is almost continuously tide-flooded during the other. Important differences between Atlantic and Gulf coasts are demonstrated. The high marsh, located between mean neap high and mean spring high tide levels, occupies more of the tidelands in Florida than the low marsh. For the protection of tidelands it is recommended that they be delineated by their vegetation until more tidal bench marks are available.

Quinn, H., J.P. Tolson, C.J. Klein, S.P. Orlando and C. Alexander. 1989. Susceptibility and status of Gulf of Mexico estuaries to nutrient discharges. Strategic assessment of near coastal waters. Summary Report. Environmental Protection Agency. Washington, DC. 42 pp.

Abstract. The report summarizes the estimated relative susceptibility and estimated status of 23 estuaries in the Gulf of Mexico with respect to nutrient-related pollution. It is the second of a series of reports being developed to assist the U.S. EPA implement its Near Coastal Waters Program and National Estuary Program. The report is intended to increase understanding of coastal environmental problems and to serve as a tool for coastal resource decision-making.

Qureshi, Z. 1978. Surface water resources of northwest Florida. Water Resources Bulletin. 14(3):710-718.

Abstract. Of the 1700 streams in Florida, the state's northwest area contains approximately 1000 of them and three of the five largest rivers (the Apalachicola, the Choctawhatchee, and the Escambia). This 11,200-mi SUPER 2 area contains 11 drainage basins, and its average annual rainfall ranges from 53 in. in the east to 67 in. in the west. Basin water yields range from 3376 cfs (2180 mgd) to 672 cfs (434 mgd). Individual basin outflows range from 25,743 cfs (16,630 mgd) to 844 cfs (545 mgd). Approximately 67% of the total northwest Florida basin outflows to the Gulf of Mexico (36,805 cfs or 23,766 mgd) are received in the form of surface water inflows from Alabama and Georgia. Without an interstate mechanism for water management for Alabama, Florida, and Georgia, the basin outflow estimates presented depend greatly upon the upstream usage in neighboring states. The establishment of a tristate water management program could eliminate the uncertainty involved in predicting water availability in northwest Florida and ensure sufficient quantities of flow in the streams.

Rabalais, N.N., R.E. Turner, W.J. Wiseman and D.F. Boesch. Submitted. A brief summary of hypoxia on the northern Gulf of Mexico continental shelf, 1985-1988. J. Geol. Soc. London.

Racal-Decca Survey, 1982. A pre-drilling site specific benthic survey within State of Alabama lease tract 115 for Exxon Company, U.S.A. Racal-Decca Survey, Inc. Houston, TX. 51 pp.

Abstract. The objectives of this present study were to qualitatively and quantitatively document the distribution of the benthic epibiota, benthic infauna and fishes in the vicinity (300 m) of the proposed drill site within the State of Alabama Lease Tract 115. The intent of this study is to provide a physical and biological description of the proposed surface location and to document whether any unique or significant biological assemblages are present.

Rajan, S.D. and G.V. Frisk. 1992. seasonal variations of the sediment compressional wave-speed profile in the Gulf of Mexico. J. Acoust. Soc. Amer. 91(1):127-135.

Abstract. The seasonal variation of the sediment compressional wave-speed profile due to temperature variability in the water column is investigated for shallow-water regions, where large temperature fluctuations can occur during the course of a year. For example, in water depths of less than 30 m in the Gulf of Mexico, field observations indicate that the annual fluctuation of the ocean bottom temperature is approximately sinusoidal with a peak-to-trough value of about 15°C. The heat flow across the water/sediment interface results in the variation of the pore water temperature with season. It is shown that the compressional wave speed varies approximately linearly with pore water temperature, an effect which is, to first order, independent of both the porosity and given sediment type. Further, the velocity ratio (ratio of sound speeds in the water and the sediment at the water/sediment interface) is shown to be independent of temperature but dependent on sediment type. The effect of variations in water column temperature on sediment compressional wave speed is demonstrated by inversions of two data sets. The data were obtained at the same location in the Gulf of Mexico but at different seasons. Finally, the importance of these variations is studied by considering their effect on (a) the prediction of the pressure field in the water column and (b) the errors introduced in source localization by matched-field processing.

Ramsdell, J.V. and J.D. Thompson. 1981. Surface stress estimation for study of the circulation dynamics of the Gulf of Mexico. NORDA Technical Report 113. Naval Ocean Research and Development Activity. NSTL Station, MS. 20 pp.

Abstract. This report presents the results of a literature search concerning estimation of wind stress over large bodies of water and an evaluation of several sets of stress estimates for the Gulf of Mexico. Wind stress can be estimated directly from wind observations or indirectly from atmospheric pressure by using the pressure gradients and the geostrophic relation. In regions where wind data are sparce, as in the Gulf of Mexico, the use of the indirect method is more practical. The major problems considered in stress estimation are: treatment of the drag coefficient that relates wind to stress, spatial and temporal averaging

of the data before and after making stress estimates, and empirical corrections to be applied to winds computed from pressure gradients.

Ramsey, R.C. 1971. Marine resources spectrometer experiment. TRW Systems Group. Redonda Beach, CA. 85 pp.

Raney, D.C. 1980. Study of methodology for evaluating water quality problems at Bayou Texar, Florida. University of Alabama Bureau of Engineering Research Report No. 263-112. U.S. Army Corps of Engineers, Mobile District. Mobile, AL. 155 pp.

Raney, D.C., G.C. April and J.N. Youngblood. 1984. Hydrodynamics of Mobile Bay and Mississippi Sound. pp. 6-7. *In* Skupien, L., ed. Mississippi Alabama Sea Grant Consortium Annual Report. January 1, 1980 June 30, 1981. (Annu. Rep. Miss. Ala. Sea Grant Consort.) Mississippi Alabama Sea Grant Consort., Ocean Springs, MS.

Abstract. The mathematical model developed earlier in this project has been used to examine the hydrodynamics of Mobile Bay's outlets to East Mississippi Sound and the Gulf of Mexico. During the project's second year, investigators have also begun preliminary work on development of a water-quality model for Mobile Bay.

Raney, D.C., I. Huang and H. Urgun. 1985. Hydrodynamic and Salinity Model for Apalachicola Bay, Florida. MASGP-84-020; NA81AA-D-00050. Mississippi-Alabama Sea Grant Consortium. Ocean Springs, MS. 190 pp.

Abstract. A hydrodynamic and salinity model has been developed for the Apalachicola Bay System, Florida. The numerical model is based upon a two-dimensional implicit finite difference formulation of the governing equations with a variable size finite difference cell. The model has been calibrated and verified using extensive tidal elevation, velocity, salinity, river inflow and wind prototype data collected in September 1983 and March 1984. The model appears capable of being used as a predictive tool for most normal conditions in the bay despite areas near passes and rivers being stratified at least for certain times in the tidal cycle.

Raney, D.C. and J.N. Youngblood. 1982. Hydrodynamics of Mobile Bay and Mississippi Sound - net cross channel flows in Mobile Bay. MASGP-82-011. Mississippi-Alabama Sea Grant Consortium. Ocean Springs, MS. 75 pp.

Abstract. Approximately 5.5 million tons of sediment are carried into Mobile Bay each year from the 43,000 square mile drainage basin of the Mobile River System. Maintenance of navigation channels in Mobile Bay requires yearly dredging by the Corps of Engineers. The sediment dredged from the main channel is placed in disposal areas adjacent to and on both sides of the channel. Recent seismic surveys have indicated a possible redistribution of spoil material far outside the contract disposal area. Considerable eastward spreading has occurred and only a slight spreading westward. This study was undertaken to determine if a numerical hydrodynamic model would produce circulation patterns consistent with this asymetric spreading of dredged material. The results of the numerical hydrodynamic model indicate a possible asymetric deposition pattern rather than net cross-channel flows as the mechanism for the asymetric spreading of dredge spoil.

Reid, D.F. 1979. The near-surface distribution of radium in the Gulf of Mexico and Caribbean Sea: Temporal and spatial variability and hydrographic relationships. Ph.D. Dissertation. Texas A&M University, College Station, TX. 226 pp.

Reid, R.O. and R.D. Gaul. 1964. Installation of wave staff at shore site near Panama City, Florida. Texas A&M Univ., Dept. of Oceanography and Meteorology Project. 360, 64-23F:15.
Abstract. This report describes the wave measuring system installed at St. Andrews Pier, Panama City.

Reid, R.O. and R.E. Whitaker. 1981. Numerical model for astronomical tides in the Gulf of Mexico. Vol. I: theory and application. Tech. Report, Department of Oceanography, Texas A&M University.

Reid, R.O. and R.E. Whitaker. 1981. Numerical model for astronomical tides in the Gulf of Mexico, Vol. II: Program Documentation. U.S. Army Corps of Engineers, Waterways Experiment Station. Vicksburg, MS. 90 pp.

Reidenauer, J.A. 1988. Port Panama City deepwater port master plan environmental assessment for Panama City Port Authority, Panama City, Florida. BCM Converse, Inc. Panama City, FL. 33 pp.
Abstract. A study of the water quality, sediments, and biological resources in the vicinity of Port Panama City. Includes extensive water and sediment chemistry data, including the presence of pesticides, PCBs, hydrocarbons, and metals.

Reinhardt, J.L., R.M. Rouse and V. Reggio. 1986. Draft Environmental Impact Statement for proposed oil and gas lease Sales 110 and 112, Gulf of Mexico OCS (Outer Continental Shelf) Region. MMS/GM/ES-87/001; OCS/EIS/MMS-86/0013. Minerals Management Service. New Orleans. 611 pp.
Abstract. The Environmental Impact Statement is a description of the environmental aspects and impacts of oil and gas activities resulting from these lease sales for the states bordering the Gulf of Mexico. It provides a description of the area, affected environment, and environmental consequences; it discusses the proposed actions, issues and areas of concern, and the major differences of holding these lease sales.

Rezak, R. and T.J. Bright. 1981. Northern Gulf of Mexico Topographic Features Study: Executive Summary. TR-81-2-T; BLM-YM-P/T-81-006-3331. Sponsor: Bureau of Land Management, New Orleans Outer Continental Shelf Office. New Orleans, LA. 140 pp.
Abstract. The main purpose of the study was to gather data in order to characterize selected topographic features in the Gulf of Mexico. Geological, chemical, physical, geophysical, and biological oceanographic data were collected from the Florida Middle Ground, off the west Florida coast, and from twelve topographic features off the Louisiana-Texas coast.

Rezak, R. and T.J. Bright. 1981. Northern Gulf of Mexico Topographic Features Study. Volume Five: Florida Middle Ground. TR-81-2-T; BLM-YM-P/T-81-011-3331. Bureau of Land Management, New Orleans Outer Continental Shelf Office. New Orleans, LA. 268 pp.

Abstract. This chapter provides an integrated multidisciplinary overview of the Florida Middle Ground. The overview has been designed to integrate complete geophysical mapping with site specific submarine ground truthing, geological sampling, physical oceanographic in situ and time series recording, and biological and chemical sampling. The geophysical, physical, and geological data are used to describe the setting for biological data. The collection of biological data itself was designed around management concepts to address two diverse management objectives.

Rezak, R. and T.J. Bright. 1981. Northern Gulf of Mexico Topographic Features Study. Volume One: Management, Geology, Biology, Water and Sediment Dynamics, Summary and Bibliography. TR-81-2-T; BLM-YM-P/T-81-007-3331. Bureau of Land Management, Outer Continental Shelf Office. New Orleans, LA. 135 pp.

Abstract. The main purpose of the study was to gather data from selected areas and topographic features in the Gulf of Mexico, and then reduce, map, analyze, synthesize, integrate, and report findings and conclusions. Geological, chemical, physical, geophysical, and biological oceanographic data were collected from the Florida Middle Ground (off the west Florida coast) and from twelve topographic features off the Louisiana-Texas coast. This report presents the findings of the work performed during the period August 1978 to November 1980 and extends the efforts begun in 1961 by researchers from TAMU on a cruise to the West Flower Garden Bank conducted by R. Rezak on the R/V HIDALGO.

Rhodes, R.C., J.D. Thompson and A.J. Wallcraft. 1989. Buoy-calibrated winds over the Gulf of Mexico. J. Atmos. Oceanic Technol. 6(4):608-623.

Abstract. The large variability of the Gulf of Mexico wind field indicates that high-resolution wind data will be required to represent the weather systems affecting ocean circulation. The report presents methods and results of the calculation of a corrected geostrophic wind data set with high temporal and spatial resolution. Corrected geostrophic wind was calculated from surface pressure analyses compiled by the Fleet Numerical Oceanography Center. The correction factors for wind magnitude and direction were calculated using linear regressions of observed Gulf buoy winds and geostrophic winds derived at the buoys. The regressions were performed for each month to determine the seasonal variability of the correction factors. The corrected geostrophic wind was calculated twice daily from 1967-1982 on a spherical grid over the Gulf, together with the corresponding wind stress and wind stress curl fields.

Richards, W.J., T. Leming, M.F. McGowan, J.T. Lamkin, S. Kelley-Fraga, J.H.S. Blaxter, J.C. Gamble and H.von Westernhagen. 1989. Distribution of fish larvae in relation to hydrographic features of the Loop Current boundary in the Gulf of Mexico. pp. 169-176. *In* The Third ICES Symposium on the Early Life History of Fish Bergen (Norway) 3-5 Oct 1988. Vol. 191. ICES,Copenhagen.

Abstract. As part of a Gulf-wide ichthyoplankton survey of the Gulf of Mexico, eight transects were made across the Loop Current boundary at different locations and times during April and May of 1987. On one transect along 86°W Thunnus thynnus larvae were present in 8 of 11 bongo and 6 of 11 neuston tows in the boundary portion of the transect. The boundary stations had higher displacement volumes of plankton and higher densities

of fish larvae. The eight bongo stations with T. thynnus larvae had one larva each and of the six neuston stations with T. thynnus larvae, one had 19 larvae, one had two, and the rest had one each. T. thynnus larvae are associated with the boundary of the Loop Current in surface water from 24°C to 26°C with large numbers of myctophid larvae especially Myctophum nitidulum.

Richards, W.J., M.F. McGowan, T. Leming, J.T. Lamkin, S. Kelley, H.G. Moser, P.E. Smith and L.A. Fuiman. 1993. Larval fish assemblages at the Loop Current boundary in the Gulf of Mexico. Bull. Mar. Sci. 53(2):475-537.

Abstract. As part of a Gulf-wide ichthyoplankton survey of the Gulf of Mexico in the spring of 1987, eight transects were made across the Loop Current boundary using bongo nets fished to 200 m depth and neuston nets fished at the surface. The boundary was determined by satellite images of the Loop Current and the ship was positioned to make a transect across the boundary whenever it approached a boundary during its normal survey operations. Eight transects were made and the composition and abundance of the fish larvae were determined for each tow. Eight to 10 tows were made at 2 to 4-km intervals. Taxonomic diversity of the ichthyoplankton was higher than previously reported for the Gulf of Mexico or Caribbean (100 families). Cluster analysis of families produced two major groups, oceanic and continental, but our hypothesized frontal assemblage is not coequal with the oceanic and shelf groups. Cluster analysis of stations also supported the hypothesis of contrasting oceanic and shelf assemblages. Principal-components analysis found more than one-half of the variance in the data to be summarized by three independent patterns. The high diversity of larval fishes is due to the mix of faunas from tropical and warm temperate oceanic, mesopelagic, and coastal demersal and pelagic species which is enhanced by the dynamics of the oceanographic system of the Loop Current.

Rinkel, M.O. 1975. Compilation and Summation of Historical and Existing Physical Oceanographic Data from the Eastern Gulf of Mexico, Final Report. Contract No. 08550-CT4-16. State University System of Florida. St. Petersburg, FL. 97 pp.

Rinkel, M.O. and J.I. James. 1973. ESCAROSA I. An oceanographic survey of the Florida territorial sea of Escambia and Santa Rosa Counties. A report by SUSIO in cooperation with the Florida Coastal Coordinating Council under Contracts No. CCC-04-71 and CCC-04-72. SUSIO and Florida Coastal Coordinating Council. 366 pp.

Abstract. This coastal zone pilot study contains five parts. The first three parts (the biophysical environment, the cultural characteristics, and the environmental quality) are an inventory of the situation in 1973 whereas the last two parts are the coastal management plan and the administrative system to implement it. A summary of the data collected through the limited sampling program includes the following parameters: physical (STD, surface temperature, wind speed and direction, sea and weather state); physical-chemical (hydrocast, optical); and currents (drogues and drift bottles). Sediment characterization is comprised of only selected, gross parameters due to the inherent limits imposed by method of collection with an Ekman dredge. Biological data, collected with various nets, are not included in this report. Probably the most important

coastal management conclusion drawn from the study is that the estuary consisting of Escambia, Pensacola, and East Bays is not flushed out into the Gulf of Mexico by tidal currents. Indications are that the dominant influencing environmental attributes are derived from a westerly source, most probably from Mobile Bay outflow, or possibly from the Mississippi River.

Ritchie, A.E. and H.G. Loftin. 1984. A summary of results of the NCSC base survey of water quality, May 1980 to December 1983. Naval Coastal Systems Center Technical Note. NCSC TN 711-84:116.

Abstract. The results of quarterly monitoring of selected water quality parameters in the waters of St. Andrew Bay adjacent to the Naval Coastal Systems Center.

Ritchie, T.P. 1961. Preliminary report on the hydrography and oyster growing conditions in the Choctawhatchee Bay, July 11-13, 1961. Florida State Board of Conservation. Rept. OD-61-1:5.

Robinson, M.K. 1973. Atlas of monthly mean sea surface and subsurface temperature and depth of the top of the thermocline, Gulf of Mexico and Caribbean Sea, Ref. 73-8. Scripps Institute of Oceanography. LaJolla, CA. 45 pp.

Abstract. Large-scale temperature atlas of the Gulf of Mexico presents monthly mean SST and temperature at 5 subsurface levels based on bathythermograph data. Also presents the monthly topography of the thermocline.

Rocha Curto, C.A. 1992. On the effect of alongshore variations in continental shelf topography on shelf sea level and current fluctuations with application to the west Florida shelf. Ph.D. Dissertation. The Florida State University. Tallahassee, FL. 89 pp.

Abstract. A model is formulated to study the influence of large coastline and shelf topography variations on the dynamics of stratified, low-frequency wind-driven frictional shelf waters. At low frequencies, currents nearly follow the isobaths. Therefore, the coordinate system should be a curvilinear system in which the coordinate lines are parallel and perpendicular to the isobaths. Writing the low frequency problem for stratified, frictional, time-dependent linear wind forced shelf flow in these coordinates, it is found that, even when the topography varies alongshore on scales comparable to the shelf width, the solution can be expressed as a sum of curvilinear coastally trapped waves (CCTW) scattered by alongshore variations in bottom topography and bottom friction. The CCTW amplitudes satisfy coupled, forced-wave equations of the same form as those of the straight coast case. The unforced CCTWs speed up when the shelf forms an embayment and when there is no curvature and the shelf is wider. Calculations show that changes in topography and coastline affect both velocity and sea level, especially the velocity. For example, for frictionless flow and a mode 1 CTW incident to a narrowing shelf, the alongshore velocity amplitude changes markedly in the bend region. In this case curvature and conservation of relative vorticity explain the changes in amplitude of the alongshore coastal velocity at the bend. When friction is included the same qualitative changes occur but the changes in velocity amplitude are smaller because of damping. Similar dynamics apply when a shelf widens. Calculations were also done with measured wind forcing and results compared with measured

sea level on the west Florida shelf. Since the sea level observations were made at the coast, a formula was derived to estimate sea level at the coast given sea level at the model coast. The model successfully calculated the wind-driven West Florida Shelf sea level fluctuations even in the Big Bend region where coastline and bottom topography vary rapidly alongshore.

Rodriguez, J.A. and Tien-S. Wu. 1990. Initial analysis of circulation and flushing characteristics of the St. Andrew Bay system. Northwest Florida Water Management District, Water Resources Special Report. 90-1:105.
Abstract. The hydrodynamics of St. Andrew Bay. Includes an inventory of point sources of water pollution.

Ross, B.E. 1973. The hydrology and flushing of the bays, estuaries, and nearshore areas of the eastern Gulf of Mexico. pp. 1-45. *In* Jones, J.I., R.E. Ring, M.O. Rinkel and R.E. Smith, eds. A summary of knowledge of the eastern Gulf of Mexico. State University System of Florida, Institute of Oceanography,St. Petersburg, FL.
Abstract. This paper presents pertinent data concerning drainage areas, fresh-water flow, and tidal range for the bays, estuaries, and nearshore areas of the eastern Gulf of Mexico. The paper suggests that tidal prisms, tidal exchange, and fresh-water replacement times are not sufficient criteria upon which to judge the flushing of a bay, estuary, or near-shore area. The existence of gyres within a bay or estuary or nearshore area is shown to be the important factor in the capability of a body of water to flush a contaminating substance to the open Gulf. A demonstration of the use of mathematical models in the understanding and quantifying of phenomena for the Tampa Bay System is given in this paper. Results are shown for the calculation and confirmation of salinities, temperature, hurricane tides, normal tide heights, current flows, water quality, and the effects of mechanical changes in Tampa Bay.

Rouse, L.J. and J.M. Coleman. 1976. Circulation observations in the Louisiana Bight using LANDSAT imagery. Remote Sensing Environ. 5:55-66.
Abstract. A method for quantifying the turbidity of offshore water masses using LANDSAT imagery is discussed and the results of a laboratory experiment correlating radiance with concentrations of suspended Mississippi River sediment are presented. The results of the experiment are used to plot suspended sediment contours on eight LANDSAT images of the Louisiana Bight. These contours are observed to depend on the speed and direction of the wind as well as the amount of fresh water discharged by the Mississippi River. The presence of a clockwise circulation in the bight is also indicated by the contours.

Rouse, L.J., Jr. and O.K. Huh. 1989. Exchange among waters of the estuaries, shelf and open Gulf of Mexico, a satellite perspective. Chapman Conference on the Physics of the Gulf of Mexico, June 4-7, 1989, St. Petersburg, FL.

Rucker, J.B., R.P. Stumpf and W.W. Schroeder. 1990. Temporal variability of remotely sensed suspended sediment and sea surface temperature patterns in Mobile Bay, Alabama. Estuaries. 13(2):155-160.
Abstract. Distribution patterns of suspended sediments and sea surface temperatures in Mobile Bay were derived from algorithms using digital

data from the visible, near infrared, and infrared channels of the Advanced Very High Resolution (AVHRR) on the NOAA-TIROS-N satellite. Closely spaced AVHRR scenes for Jan. 20, 24, and 29, 1982, were compared with available environmental information taken during the same period. A complex interaction between river discharge, winds, and astronomical tides controlled the distribution patterns of suspended sediments. These same variables, coupled with air temperatures, also governed the distribution patterns of sea surface temperatures.

St. Andrew Bay Resource Management Association. 1992. Lake/Baywatch: a citizen volunteer water quality monitoring program, Bay County, Florida. Report no. 2 (1991-92). St. Andrew Bay RMA. Panama City, FL. 180 pp.
Abstract. The second report on the water quality of the bay, with data from 61 sampling station. Parameters include turbidity, temperature, salinity, dissolved oxygen, pH, chlorophyll, nitrogen phosphorus, visibility, and fecal coliform bacteria.

Salas de Leon, D.A., M.A. Monreal-Gomez and J.C.J. Nihoul. 1986. The role of the Loop Current in the Gulf of Mexico fronts. pp. 295-300. *In* Seventeenth International Liege Colloquium on Ocean Hydrodynamics Liege (Belgium) 1986. Vol. 42. Elsevier Science Publishers, Amsterdam.
Abstract. The role of the Loop Current on the fronts of the Gulf of Mexico is studied using the results of the Monreal-Gomez and Salas de Leon (1985) Gulf of Mexico numerical model. The horizontal thermal structure can be depicted with the pycnocline anomaly. Assuming that biological processes take place in the frontal areas, the thermal boundaries at the cyclonic and anticyclonic eddies, as well as the Loop Current have an effect on the chlorophyll-a concentration in the Gulf Mexico.

Saloman, C.H. 1975. Annotated bibliography of the St. Andrew Bay system and adjacent Gulf of Mexico, including manuscripts on file at the National Marine Fisheries Service, Gulf Coastal Fisheries Center, Panama City Laboratory, Panama City, Florida. Unpublished manuscript, National Marine Fisheries Service. Panama City Beach, FL. 18 pp.
Abstract. Contains 52 references, arranged alphabetically by author.

Saloman, C.H. 1975. A selected bibliography of the nearshore environment: Florida west coast. U.S. Army Corps of Engineers, Coastal Engineering Research Center, Miscellaneous Paper. 5-75:268.
Abstract. A broad collection of works on the oceanography and biota of western Florida. While most of the citations refer to the Tampa Bay area, many are pertinent to the Panhandle.

Saloman, C.H. 1976. The benthic fauna and sediments of the nearshore zone off Panama City Beach, Florida. U.S. Army Corps of Engineers, Coastal Engineering Research Center, Miscellaneous Report. 76-10:256.
Abstract. A comprehensive study of the hydrography, sedimentology and benthic fauna of Panama City Beach. Includes information on the effect of Hurricane Eloise on the benthic fauna.

Saloman, C.H., S.P. Naughton and J.L. Taylor. 1982. Benthic community response to dredging borrow pits, Panama City Beach, Florida. U.S. Army Corps of Engineers, Coastal Engineering Research Center, Miscellaneous Report. 82-3:138.

Abstract. An ecological study of the beach invertebrate populations before and after dredging for beach nourishment. Includes hydrographic and sediment data.

Salsman, G.G. 1962. A note on periodic temperature variations in the Gulf of Mexico off Panama City, Florida. pp. 442. *In* Gorsline, D.S., ed. Proceedings of the First National Coastal and Shallow Water Research Conference, October 1961, Baltimore, MD. National Science Foundation and the Office of Naval Research, Tallahassee, FL.
Abstract. Bathythermograph observations indicated the existence of a thermocline off of Panama City Beach.

Salsman, G.G. 1962. Temperature variations in the Gulf of Mexico off Panama City, Florida. J. Phys. Ocean. 67(9):3595.
Abstract. The water temperature off of Panama City was studied from November 1959 to August 1961.

Salsman, G.G. and A.J. Ciesluk. 1978. Environmental conditions in coastal waters near Panama City, Florida. Naval Coastal Systems Center Technical Report. NCSC-TR-337-78:89.
Abstract. A comprehensive summary of information regarding the coastal waters. Includes topics such as: hydrography, meteorology, bottom characteristics, tides, currents, waves, and biofouling.

Salsman, G.G. and W.H. Tolbert. 1963. Surface currents in the northeastern Gulf of Mexico. U.S. Navy Mine Defense Lab., Research and Development Report. 209:43.
Abstract. A study of the ocean currents off of Panama City, during Sept. 1960 - Dec. 1962, using drift bottles released from the offshore research platform (Stage I). Includes information regarding winds and sea surface temperature.

Sanders, N. and T. Van Devender. 1990. Seamap environmental and biological atlas of the Gulf of Mexico 1986. Gulf States Marine Fisheries Commission. 328 pp.

Sanders, N., Jr., D.M. Donaldson and P.A. Thompson. 1991. SEAMAP environmental and biological atlas of the Gulf of Mexico, 1988. 23. Gulf States Marine Fisheries Commission. Mississippi. 319 pp. (23)

Sapp, C.D., J.G. Emplaincourt and J.D. Hardin. 1975. Remote sensing of shoreline dynamics, Mobile Bay area. Trans,. Gulf Coast Assoc. Geol. Soc. 25:153-165.
Abstract. The shoreline of Alabama is constantly adjusting to the combined effects of winds, waves, tides, currents, hurricanes, tropical storms and man, Approximately 56% of the shoreline is eroding and an average erosional trend of 1.93 m per year for the Gulf shoreline of Dauphine Island has been documented. Accretion of the shoreline in Mobile Harbor, caused by spoil disposal and landfill from 1917 to 1974, shows a resultant of 1,650 acres having been built up by man.

Schlemmer, F.C. 1971. Concentrations of particulate matter in the eastern Gulf of Mexico: an indicator of surface circulation patterns. Master's Thesis. University of South Florida, St. Petersburg, Florida.

Schmalz, R.A. 1981. Numerical modeling of Mississippi Sound and adjacent areas. pp. 66-75. *In* Kelly, J.R., ed. Symposium on Mississippi Sound. Mississippi-Alabama Sea Grant Consortium, Ocean Springs, MS.

Schneider, M.J. 1969. A description of the physical oceanographic features of the eastern Gulf of Mexico, August 1968. Master's Thesis. Texas A&M University, College Station, Texas. 105 pp.

Schomer, N.S. 1974. Systems models and simulations of the recovery of Escambia Bay. Master's Thesis. University of West Florida, Pensacola, FL. 91 pp.
Abstract. The purpose of this investigation is to develop and simulate system models of Escambia Bay that will be useful in evaluating the potential for recovery of the bay subsequent to the abatement of pollution sources. These models will be used to assess the responses of certain critical variables to alterations in flows from various sources from both within and outside of the study parameter.

Schroeder, W.W. 1975. Meteorological and oceanographic observations made during Hurricane Carmen (September 1974) at Dauphin Island, Alabama. Dauphin Island Sea Laboratory, Technical Report. 75-003

Schroeder, W.W. 1975. Meteorological and oceanographic observations made during Hurricane Eloise (September 1975) at Dauphin Island, Alabama. Dauphin Island Sea Laboratory, Technical Report. 75-004

Schroeder, W.W. 1976. Dynamic Characterization of the Waters of the Mobile Bay Passes. Mississippi-Alabama Sea Grant Consortium. MASGC-Q-76-001:1.

Schroeder, W.W. 1976. Physical environment atlas of coastal Alabama - supplement. Mississippi-Alabama Sea Grant Consortium. Ocean Springs, MS. 99 pp.
Abstract. This publication is an atlas in the truest sense in that data are presented as facts without any interpretation. The great majority of this atlas presents data on East Mississippi Sound and Mobile Bay. Data presented include wind, tide, temperature, salinity, dissolved oxygen and currents. The part on the offshore environment presents current measurements collected with a taut-line buoy system anchored adjacent to a Liberty Ship reef some 14 nautical miles south of Dauphin Island. The last part of the atlas presents meteorological data collected at Dauphin Island. Supplements to the atlas are compiled yearly beginning with 1977.

Schroeder, W.W. 1976. Physical environmental atlas of coastal Alabama. MASGP-76-034. Mississippi-Alabama Sea Grant Consortium. Ocean Springs, MS. 275 pp.
Abstract. This is an atlas of physical oceanographic data, meteorological data, and hydrologic data for Mobile Bay, eastern Mississippi Sound, and selected nearshore Gulf locations of coastal Alabama. The data were collected from 1973 to 1976. This publication is an atlas in the truest sense in that data are presented as facts without any interpretation. The great majority of this atlas presents data on East Mississippi Sound and Mobile Bay. Data presented include wind, tide, temperature, salinity, dissolved oxygen and currents. The part on the offshore environment presents current measurements collected with a taut-line buoy system anchored adjacent to a Liberty Ship reef some 14 nautical miles south of

Dauphin Island. The last part of the atlas presents meteorological data collected at Dauphin Island. Supplements to the atlas are compiled yearly beginning with 1977.

Schroeder, W. 1977. The impact of the 1973 flooding of the Mobile River system on the hydrography of Mobile Bay and east Mississippi Sound. NE Gulf Sci. 1(2):68-76.

Schroeder, W. 1977. Sea truth and environmental characterization studies of Mobile Bay, Alabama, utilizing ERTS-1, data collection platforms. Remote Sensing Environ. 6:27-43.

Schroeder, W.W., L. Berner Jr. and W.D. Nowlin Jr. 1974. The oceanic waters of the Gulf of Mexico and Yucatan Strait during July 1969. Bull. Mar. Sci. 24(1):1-19.

Schroeder, W.W. and G.F. Crozier. 1974. Hydrographic and current structure on

Schroeder, W.W. and W.R. Lysinger. 1979. Hydrography and circulation of Mobile Bay. pp. 75-94. *In* Loyacano, H.A. and J.P. Smith, eds. Symposium On the Natural Resources of the Mobile Estuary, Alabama. Alabama Coastal Area Board, Dauphin, Alabama.

Schroeder, W.W. and W.J. Wiseman. 1985. Analysis of the winds (1974-1984) and sea level elevations (1973-1983) in coastal Alabama. MASGP-84-024; NA81AA-D-00050. Alabama Marine Resources Laboratory. Dauphin Island. 112 pp.

Abstract. Monthly and annual wind roses, constructed from 10.5 years of data collected on Dauphin Island, Alabama, exhibit a high degree of variability. However, monthly composite roses present a recognizable seasonal pattern: northerly winter winds; easterly to southerly spring winds; southerly to westerly and back to easterly winds in the summer; and in the fall a return to northeasterly and northerly winds. Mean monthly wind speeds ranged from a high of 8.1 k in January to a low of 5.2 k in July. On a directional interval basis the highest mean speed, 9.5 k, occurred during northerly winds while the lowest mean speed, 4.9 k, occurred during westerly winds. Sustained wind speeds of 30 k or greater were recorded during tropical cyclones, a winter 'cold front' storm and a thunderstorm.

Schropp, S.J., F.D. Calder, G.M. Sloane, K.O. Swanson and J.C. Carlton. 1991. Report on physical and chemical processes affecting the management of Perdido Bay: Results of the Perdido Bay Interstate Project. Final Report. Florida Department of Natural Resources. Tallahassee, FL. 333 pp.

Abstract. Resource managers need system-wide water chemistry, circulation and sediment information on estuaries to judge effects of present activities and future coastal development. The study describes physical and chemical processes affecting dissolved and particulate nutrients and suspended solids transport in the Perdido River basin and the fate of these materials in Perdido Bay. The study also includes analysis of sediments for metals and organic compounds. The following questions were addressed by the study: How do tide, wind, and runoff affect water movement in Perdido Bay and to what extent is circulation confined in the upper bay; what pollutants are entering the bay and from where; is Perdido Bay silting up due to man's activities in adjacent watersheds; how can we summarize the present condition of Perdido Bay; what is the rate of supply of nutrients to Perdido Bay and what is man's influence on this rate; how prevalent are hypoxic conditions in Perdido Bay and what are the causes; and does Perdido Bay trap nutrients.

Science Applications International Corp. 1984. Proceedings of the summer ternary Gulf of Mexico Studies Meeting held at Tampa, Florida, June 1984. OCS/MMS-85/0003. Minerals Management Service, Gulf of Mexico OCS Regional Office. Metairie, LA. 109 pp.

Abstract. Southwest Florida benthos study; Marine research and resource management programs of South Florida parks; Past and present; Surface resource protection and oil and gas development in the Big Cypress National Preserve; Gulf of Mexico Continental Slope study; Overview of the Florida Department of Natural Resources Bureau of Marine Research Program; Update on red tide and ciguatera studies; Population dynamics of stony corals in Biscayne National Park patch reefs, Florida, USA; Community structure of stony corals (Scleractinia and Milleporina) in

Southeast Florida reef communities; Tuscaloosa trend regional data search and synthesis study; The Florida ecological atlas; MMS/Gulf of Mexico/Physical oceanography program; Gulf of Mexico circulation modeling study.

Science Applications International Corp. 1987. Gulf of Mexico Physical Oceanography Program Final Report: Year 4. Volume 1. Executive Summary. SAIC-87/1026; MMS/GM-87/0006. Minerals Management Service. New Orleans. 23 pp.

Abstract. The particular program, the Gulf of Mexico Physical Oceanography Program, has two primary goals: (1) develop a better understanding and description of conditions and processes governing Gulf circulation; and, (2) establish a data base which could be used as initial and boundary conditions by a companion MMS-funded numerical circulation modeling program. The area to be studied emphasizes the deeper Gulf and those shallower regions where conditions may be directly or indirectly affected by patterns associated with or originating in the deeper Gulf. The multi-year, phased program will investigate the eastern and western Gulf separately. The report presents results from 3 years of observations in the eastern Gulf.

Science Applications International Corp. 1988. Gulf of Mexico Physical Oceanography Program. Final Report: Year 3 Volume II: Technical Report. OCS Report/MMS 88-0046. Minerals Management Service. New Orleans, LA. 241 pp.

Science Applications International Corp. 1989. Gulf of Mexico Physical Oceanography Program Final Report: Year 5. Volume 1. Executive Summary. Final Report. Minerals Management Service. New Orleans. 21 pp.

Abstract. In October 1982, the Minerals Management Service (MMS) initiated a multiyear, regionally-phased physical oceanographic field program with the long-term goal of developing an improved understanding of the characteristics and influence of circulation patterns and processes in and adjacent to the deeper regions of the Gulf of Mexico. In the Year 5 Program, the objective was to look at physical oceanographic conditions along a transect normal to the north-central slope and shelf (92 deg W) extending from the inner shelf to the deep Gulf offshore Louisiana. As reflected in the experimental design and the suite of observations, Year 5 involved documenting and developing an improved understanding of circulation on the Louisiana shelf just west of the major estuaries, identifying the characteristics and causes of adjacent slope circulation, continuing multiyear documentation of Loop Current eddy dynamics and kinematics during evolution and westward translation, and initiating documentation of optical properties of the west Louisiana shelf waters. Measurements made to support the above objectives included moored current/temperature arrays, periodic hydrographic CTD/XBT/AXBT surveys, satellite thermal imagery, Lagrangian drifters, inverted echo sounders, and a suite of measurements characterizing the optical absorption and transmission characteristics of the shelf water.

Science Applications International Corp. 1989. Gulf of Mexico Physical Oceanography Program. Final Report: Year 5. Volume II: Technical Report. OCS Report/MMS-89-0068. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office. New Orleans, LA. 333 pp.

Abstract. In 1982, the Minerals Management Service (MMS) initiated a series of regional physical oceanographic field measurement programs in the Gulf of Mexico which have had as an objective the development of an improved documentation and understanding of important current patterns and processes. These insights are to be used to make informed management and operational decisions relating to offshore oil and gas activities. Since its beginning, the overall program has emphasized three regions: west Florida shelf and slope as well as the adjacent Loop Current during Years 1, 2 and 4; western Gulf with particular emphasis on the mid- to lower slope during Year 3; and north central Gulf from the inner shelf to the deep Gulf during Year 5.

Science Applications International Corporation. 1986. Gulf of Mexico physical oceanography program, final report: years 1 and 2. Volume II: technical report. OCS Report/MMS 85-0094 (SAIC Report No. SAIC-86/1023). Minerals Management Service. New Orleans, LA. 378 pp.

Abstract. In 1982, Minerals Management Service (MMS) initiated a multi-year program under contract with Science Applications International Corp. (SAIC) to study the physical oceanography of the Gulf of Mexico as part of its outer continental shelf environmental studies program. The program has two primary goals: (1) develop a better understanding and description of conditions and processes governing Gulf circulation; and (2) establish a data base which could be used as initial and boundary conditions by a companion MMS-funded numerical circulation modeling program. The report presents results from the first two of three years of observations in the eastern Gulf.

Science Applications International Corporation. 1987. Gulf of Mexico physical oceanography program, final report: year 4. Volume II: technical report. OCS Report/MMS 87-0007 (SAIC Report No. SAIC-87/1027). Minerals Management Service, OCS Regional Office. New Orleans, LA. 226 pp.

Abstract. The particular program, the Gulf of Mexico Physical Oceanography Program, has two primary goals: (1) develop a better understanding and description of conditions and processes governing Gulf circulation; and, (2) establish a data base which could be used as initial and boundary conditions by a companion MMS-funded numerical circulation modeling program. The program participants undertook the following primary scientific efforts during Program year 4: (1) kinematic and hydrographic characterizations of Loop Current boundary features, e.g., waves, filaments, or perturbations; (2) comparative kinematics and dynamics of the Loop Current and a Loop Current eddy as indicated by drifting buoy trajectories; and (3) further discrimination and characterization of West Florida Shelf circulation patterns, e.g., inertial currents, wind, and Loop Current forced currents. (Sponsored by Minerals Management Service, New Orleans, LA. Gulf of Mexico OCS Regional Off.).

Science Applications International Corporation. 1988. Summary of Meteorological Conditions Affecting Oceanographic Processes in the Gulf of Mexico, Final Report, MMS Meteorology Study, Contract No. 10-1001-303, 173p.

Abstract. This meteorological summary consists of a compilation of data from a number of sources and a statistical description by month, season and year of the pertinent meteorological variables affecting oceanographic operations in the Gulf of Mexico region. The primary data sets utilized in this study are as follows: National Weather Service (NWS) coastal

station data; National Data Buoy Center (NDBC) moored-buoy and marine platform network; a segment of the Ocean Currents Measurement Program (OCMP) data; National Hurricane Center 101-year storm track data (HURDAT) and the University of Virginia Cyclone data set. The coastal data covers the period 1970-1986, while the buoy data exists for only 1976-1986. The hurricane and cyclone climatologies are for 101 and 100 years, respectively. In addition, a ship-based sea surface temperature (SST) climatology is analyzed by 1° quadrangles for the period 1854-1973. The analyses included in this report should provide useful information on the variability of meteorological conditions in the Gulf of Mexico.

Science Applications International Corporation. 1994. Louisiana/Texas Shelf Physical Oceanography Program: eddy circulation study. Annual Report: Year 1; OCS Study MMS 9400027. Science Applications International Corporation. North Carolina. 53 pp.

Scruton, P.C. 1956. Oceanography of Mississippi Delta sedimentary environments. Am. Assoc. Pet. Geol. Bull. 40(12):2864-2952.

Abstract. The Mississippi transports a vast quantity of sediment to the Gulf of Mexico. Understanding the oceanography around the Mississippi's mouth increases our understanding of the sediments which have formed there and also the oceanography of other similar areas where fresh water meets and flows into the sea. Despite the size of the Mississippi, it is small relative to the entire Gulf of Mexico, and ocean currents off its mouth can be compared with currents in a large tank off a very small rubber hose. The large body of water flows first one way and then another and carries with it the minor volume of hose discharge. Currents due to hose discharge are relatively small swirls localize about the orifics. The regional gulf current pattern provides the background on which are superimposed local conditions off the delta. Regional or semi-permanent currents are produced both by winds blowing over the entire gulf and by regional density differences acted upon by gravity. Density differences are due to fresh water input at many places and to gulf-wide evaporation, heating, and cooling. The semi-permanent current flows northward in the central gulf, and on approaching land south of the delta, apparently divides into two tongues. These tongues diverge and flow eastward and westward away from the delta.

Shaffer, R.N. 1993. Bibliography of research on St. Andrew Bay, its tributaries, and the nearby coastal waters of Bay County, Florida. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Technical Memo. NOAA-TM-NMFS-SEFSC-320:67.

Abstract. The indexed bibliography is one of a three-part project, the goal of which is to collect and to make available the research that has been performed on St. Andrew Bay. Many of the publications are considered 'gray literature'--they have not appeared in professional, refereed journals. As a result, much of the literature is difficult to access by means of the traditional scientific indexes. It is hoped that the compendium will serve as a guide to what has been accomplished so far in understanding the biota and ecology of St. Andrew Bay, its tributaries, and the nearby coastal waters.

Shah, K.R. and R.C. Farmer. 1976. Quasi-steady mathematical model of Mobile Bay. Louisiana State University, Department of Chemical Engineering. Baton Rouge, LA. 284 pp.

Abstract. A quasi-steady, three-dimensional flow field model for Mobile Bay was developed. The data which describe Mobile Bay were collected and synthesized. Appropriate boundary conditions were developed for the model from these data. The basic transport equations which were used to describe the interaction of the fresh and saline water were solved numerically on a digital computer. This numerical procedure may be classified as an asymptotic, time-dependent, finite-difference technique. The effect of wind shear on the bay was predicted. Physical model data and field data were analyzed and compared to the mathematical results. Flow patterns and wind effects were qualitatively correct, but the magnitude of predicted velocities were less than that expected. Salinities were accurately modeled.

Shay, L.K., P.G. Black, J.D. Hawkins, R.L. Elsberry and A.J. Mariano. 1991. Sea surface temperature response to Hurricane Gilbert. Final Report. pp. 8. *In* Conference on Hurricanes and Tropical Meteorology (19th), 6-10 May 1991. (Naval Oceanographic and Atmospheric Research Laboratory; Stennis Space Center, MS.)

Abstract. From 14-19 Sept 1988, and air-sea interaction experiment was conducted in the Gulf of Mexico from NOAA WP-3D research aircraft by successfully deploying 78 Airborne expendable current profilers (AXCPs) and 60 bathythermographs (AXBTs) prior, during and subsequent to the passage of Hurricane Gilbert. The sampling strategy was designed to understand the coupled response between the oceanic and atmospheric planetary boundary layers during and subsequent to a hurricane. The oceanic response discussed here sought to measure the near-inertial evolution of the 3-dimensional ocean current and temperature structure over the scales of the strong atmospheric forcing to assess vertical mixing and advective processes. This airborne experimental effort differed from previous experiments in hurricanes (Sanford et al., 1987) by not only measuring the current and temperature structure before the hurricane, but also the air craft revisited the same area one and three days following storm passage. The SST response was also measured by the Airborne InfraRed Thermometer (AIRT), which provides continuous measurements along the flight track between the AXCP observations. Several AVHRR images over the Gulf of Mexico were acquired prior, during and subsequent to Gilbert's passage.

Shay, L.K., P.G. Black, A.J. Mariano, J.D. Hawkins and R.L. Elsberry. 1992. Upper Ocean Response to Hurricane Gilbert. J. Geophys. Res. 97(C12): 20227-20248.

Abstract. The evolving upper ocean response excited by the passage of Hurricane Gilbert (September 14-19, 1988) was investigated using current and temperature observations acquired from the deployment of 79 airborne expendable current profilers (AXCPs) and 51 airborne expendable bathythermographs from the National Ocean and Atmospheric Administration WP-3D aircraft in the western Gulf of Mexico. The sea surface temperatures (SSTs), mixed layer depths, and bulk Richardson numbers were objectively analyzed to examine the spatial variability of the upper ocean response to Gilbert. Net decreases of the SSTs of 3°-4°C were

observed by the profilers as well as by the airborne infrared thermometer (AIRT) along the flight tracks and advanced very high resolution radiometer (AVHRR) imagery. The AXCPs indicated a marked cooling from 29°C to about 25.5°C on September 17, 1988, which was about 1.2 inertial periods (IP) following storm passage. This pool of cooler water (3.5°C) was located further downstream in the hurricane wake by September 19 (2.7 IP following the storm) as a result of the near-inertial currents in the mixed layer.

Shay, L.K., S.W. Chang and R.L. Elsberry. 1990. Free surface effects on the near-inertial ocean current response to a hurricane. J. Phys. Ocean. 20(9):1405-1424.

Abstract. During the passage of Hurricane Frederic in 1979, four ocean current meter arrays in water depths of 100-950 m detected both a baroclinic and a depth-independent response in the near-inertial frequency band. The origin of the depth-independent component of velocity is investigated using a linear analytical model and numerical simulation from a 17-level primitive equation model with a free surface. In an analytical model, the Green's function (K_0) is convolved with the wind stress curl to predict a sea surface depression of approximately 20 cm from the equilibrium position. The barotropic current velocities rotate inertially, and the maximum amplitude of 11 cm/s is displaced to the right of the track at $x=2R_{max}$ (radius of maximum winds). The free surface depression simulated by the primitive-equation model is also about 18-20 cm. The primitive equation model simulations indicate that the vertical mean pressure gradient excites 10-11 cm/s depth-averaged currents at $x=3R_{max}$.

Shay, L.K. and R.L. Elsberry. 1983. Observations of inertio-gravity waves in the wake of Hurricane Frederic. Trans. AGU (EOS). 64(45):739.

Abstract. Hurricane Frederic passed within 80 to 130 km of a U.S. Naval Oceanographic Office current meter array. The transient response detected in the DeSoto Canyon region is dominated by inertial wave excitation in the mixed layer with vertical propagation of energy at about 3 cm/s. The corresponding horizontal propagation of energy is 3 m/s. The observations were demodulated at the inertial frequency. The demodulated series show that inertial waves in the mixed layer maintain a constant energy level over one to two inertial periods (IP) after the relaxation of the wind stress, and then decay over e-folding time scales of 4 IP. The horizontal scales of 100 km or roughly twice the radius of deformation. Vertical phase differences are consistent with the subsequent generation of inertio-gravity waves in the thermocline. These waves spin up with the horizontal scales of the deformation radii (50 km) and reach secondary maxima 6 to 10 IP following storm passage. After these maxima, energy decays over e-folding scales of 4 IP as well. Vertical scales are of the order of the water depth. The vertical structure of 3-dimensional velocity fields was determined using a Brunt-Vaisala profile computed from the AXBT data collected by Black (1983).

Shay, L.K. and R.L. Elsberry. 1987. Near-inertial ocean current response to Hurricane Frederic. J. Phys. Ocean. 17(8):1249-1269.

Abstract. Hurricane Frederic passed within 80 to 130 km of the U.S. Naval Oceanographic Office current meter arrays in water depths ranging from 100 to 470 m near the DeSoto Canyon region, and within 150 km of an Ocean

Thermal Energy Conversion (OTEC) mooring in 1050 m of water. Excitation of near-inertial waves by the moving hurricane was observed throughout the water column along the canyon walls and at the OTEC site. The vertical modes of the ocean current field are determined based on AXBT data. Solutions with a flat bottom and with a sloping bottom are compared to illustrate the effect due to bottom topography in the DeSoto Canyon region. The horizontal velocity eigenfunctions are fit to the velocity amplitudes derived from the ocean current time series to estimate the time-dependent modal amplitudes.

Sheres, D. 1992. SAR observations in the Gulf of Mexico, *In* Summaries of the Third Annual JPL Airborne Geoscience Workshop. Jet Propulsion Laboratory. 3:30-31. University of Southern Mississippi, Bay Saint Louis. Center for Marine Science. Funder: National Aeronautics and Space Administration, Washington, DC.

Abstract. The Gulf of Mexico (GOM) exhibits a wealth of energetic ocean features; they include the Loop Current with velocities of about 2 m/s and strong shear fronts, mesoscale eddies, double vortices, internal waves, and the outflow of the Mississippi River. These energetic features can have a strong impact on the economies of the states surrounding the Gulf. Large fisheries, oil and gas production as well as pollution transport are relevant issues. These circulation features in the Gulf are invisible to conventional IR and visible satellite imagery during the Summer months due to cloud cover and uniform surface temperatures. Synthetic Aperture Radar (SAR) imagery of the Gulf does penetrate the cloud cover and shows a rich assembly of features there year-round. Below are preliminary results from GOM SAR imagery taken by SEASAT in 1978 and by the AIRSAR program in 1991.

Shier, C.F. 1965. A taxonomic and ecological study of shallow water hydroids of the northeastern Gulf of Mexico. Master's Thesis. Florida State University, Tallahassee, FL. 170 pp.

Abstract. Monthly samples of shallow water hydroids were collected from 6 station in the northeastern Gulf of Mexico for one year beginning in July, 1963. Environmental notes on temperature, salinity, abundance, and bottom type were kept.

Shipp, R.L. and T.S. Hopkins. 1978. Physical and biological observations of the northern rim of the DeSoto canyon made from a research submersible. NE Gulf Sci. 2(2):113-121.

Abstract. During June, 1978, the research submersible DIAPHUS completed 27 dives in the north central Gulf of Mexico. Fourteen of these were concentrated on and around the high relief, northern ledge or rim of the De Soto Canyon, located at depths of 50-60 m, and approximately 25 km south of Navarre, Florida. The ledge is composed of limestone outcroppings. The invertebrate fauna is characterized as two principle assemblages, one associated with a sand-shell-coraline-algae slope and the other with a limestone block ledge. The ichthyofauna is dominated by deep water reef species, thirty of which are identified and their habitat and abundance described.

Signorini, S.R., J.S. Wei and C.D. Miller. 1992. Hurricane-induced surge and currents on the Texas-Louisiana shelf. J. Geophys. Res. 97(C2):2229-2242.

Abstract. This study consists of numerical model simulations of hurricane-induced surge and currents on the Texas-Louisiana shelf. The numerical experiment includes the simulation of multiple hurricane tracks with landfalling points along the Texas-Louisiana coast. A parallel storm that traverses the entire Texas-Louisiana coastline is also modeled to assess the difference in shelf response between landfalling and parallel storms. The grid extends from the Texas-Mexico border to the Gulf Coast of Florida, with the ocean open boundary seaward of the shelf break. Along-shelf and cross-shelf surge and current variability are assessed as a function of shoreline geometry and bottom topography. A complementary one-dimensional mixed layer model is used to evaluate the vertical structure of the currents and the maximum depth of hurricane influence.

Simmons, A.T. 1972. The dynamics of nitrogen and phosphorus in a bayou estuary. Master's Thesis. University of West Florida, Pensacola, FL. 46 pp.

Abstract. The nitrogen and phosphorus cycles and dynamics were described for Bayou Texar, Florida, by monitoring levels of nitrate, nitrite, ammonia, orthophosphate, organic nitrogen, organic phosphorus at five stations from June, 1971 to February, 1972.

Slocum, G. 1934. Sea surface temperature summaries for various sections of the Gulf of Mexico. Mon. Weather Rev. 62

Abstract. This paper gives monthly averages of sea surface temperatures during 1912-1933 for the north central Gulf.

Slocum, G. 1935. Sea surface temperature summaries for various sections of the Gulf of Mexico. Mon. Weather Rev. 63

Abstract. This paper gives monthly averages of sea surface temperatures during 1912-1933 for the north central Gulf.

Slocum, G. 1936. Sea surface temperature summaries for various sections of the Gulf of Mexico. Mon. Weather Rev. 64

Abstract. This paper gives monthly averages of sea surface temperatures during 1912-1933 for the north central Gulf.

Small, C.S. 1993. Applications of satellite altimetry to global studies of mid-ocean ridges and continental margins. Ph.D. Dissertation. University of California, San Diego. 184 pp.

Abstract. The increased resolution and coverage of satellite altimeter missions in recent years has had a significant impact on marine geophysics. The works contained in this dissertation use these advances to address questions which had been previously considered using only underway gravity and bathymetry measurements. The first three chapters address the question of spreading rate dependence of mid-ocean ridge structure. Two of these chapters use altimetry measurements to investigate intermediate spreading rate transitions in ridge axis structure. The third of these chapters uses a collection of underway bathymetry profiles to verify the findings of previous studies which used only altimeter data. We find that the spreading rate dependence which characterizes slow spreading ridge structure is not present at higher spreading rates and that the transition from rate dependence to rate independence coincides with the transition from axial valley structure to axial ridge structure. The final two chapters consider the feasibility of using satellite altimeter data for studies of continental margin structure. In a comparison of

shipboard and satellite gravity measurements in the Gulf of Mexico we find that individual satellite gravity profiles accurately resolve features as short as 25 km wavelength when low degree spherical harmonic models are used to constrain the long wavelength components of the field. In the final chapter we apply a new method for computing terrain corrections to satellite gravity data in the Gulf of Mexico in order to constrain deep basin structure. Terrain corrected gravity data remove the effects of the extreme topography in the gulf and provide constraints on the extent of oceanic crust in the poorly explored southern Gulf.

Smith, P.M. 1981. Measurements of whitecap coverage and surface winds over the Gulf of Mexico Loop Current. NORDA-43. Naval Ocean Research and Development Activity. NSTL Station, MS. 28 pp.

Abstract. The fraction of the ocean surface covered by whitecaps has long been thought to be some monotonically increasing function of the prevailing wind velocity at least for large fetches. In order to determine the extent to which other factors such as air column stability or water mass type can influence the areal coverage of whitecaps, photographic data was collected over the Loop Current from a NAVOCEANO P-3 aircraft. The variation of whitecap coverage along a line of closely spaced (25 km) stations was determined and compared with other aircraft and data buoy information. The data indicates that, on the day of the flight, white-capping within the boundaries of the Loop Current depended little on the local wind, but demonstrated a noticeable dependence on air column stability. The strength and nature of this dependence varied over mesoscale distances. These results indicate that microwave radiometric measurements can be sensitive to variables other than surface wind since microwave brightness is quite sensitive to sea foam. The value of areal whitecap coverage as a measurable geophysical variable is also examined.

Sonu, C.J. 1972. Field observation of nearshore circulation and meandering currents. J. Geophys. Res. 77:3232-3247.

Soong, Y. 1978. A study of the northward intrusion of the Loop Current in the Gulf of Mexico. Ph.D. Dissertation. Florida State University, Tallahassee, FL.

Southwest Research Institute. 1981. Ecological investigations of petroleum production platforms in the central Gulf of Mexico. Volume I. Pollutant fate and effects study. Bureau of Land Management, Gulf of Mexico OCS Regional Office. New Orleans, LA. 223 pp.

Abstract. Twenty-four sites on the continental shelf of the Louisiana coast have been studied for long-term cumulative effects of petroleum production in the region of offshore platforms. Four primary study platforms and four control sites were visited in May, 1978, August/September, 1978 and January 1979. Sixteen secondary platforms were sampled August/September, 1978. Sampling and analysis included hydrography and hydrocarbons of the water column; sediment physical characterization, hydrocarbons, trace metals, and contamination with depth; and populations of the meiofauna, macroinfauna, macroepifauna, demersal fishes and species associated with the "artificial reef" brought about by the platform. Bottom studies extended from 100 to 2000 m away from platforms and were therefore indicative of regional as opposed to localized contamination. Sites were located from 5 km (3mi) to 115 km (73

mi) from shore and extended from the west shore of the Mississippi delta (89°32'W) to a line south of Marsh Island (91°44'W). Results confirm widespread, chronic contamination with hydrocarbons and metals with some apparent incorporation of pollutants into biota found at platforms. Over the entire study area absolute amounts of contaminants vary widely showing a general concentration in the nearshore and eastern portions where the Mississippi River apparently contributes more contaminants than petroleum production platforms. Platforms vary widely in the types and amounts of pollutants traced to them. A distinctive pattern of expected contamination with platform operating type is not seen. Benthic populations are indicative of a stressed environment caused from high freshwater and sediment loading from the Mississippi and periodic cyclonic storms. There are also localized platform influences on benthos in isolated cases. A few platforms are conclusively indicated as contributing to pollution in sediments up to a 2000-m distance.

Spain, C.M. and S.A. McLellan. 1987. Impacts of Bay County aerated lagoon discharge on St. Andrew Bay water quality from Redfish Point to DuPont Bridge. Bay County Wastewater System (Bay County Utilities Dept.). Panama City, FL. 51 pp.

Abstract. A study of the water quality in the area of the bay impacted by the Bay County Wastewater Treatment Plant's lagoon discharge. Parameters are given for salinity, temperature, dissolved oxygen, chlorophyll a, color, suspended solids, BOD, nitrogen, phosphorus, fecal coliform bacteria, and ammonia; current velocity readings are also given.

Speed, D.C. 1973. Coastal zone water quality monitoring in the Pensacola Area. 68-01-0160. Interstate Electronics Corp. Anaheim, CA. 80 pp.

Abstract. This report was prepared for the U.S. Environmental Protection Agency. It presents the findings of a field case study of the Pensacola, Florida area. Purpose of the study was to determine the extent of, and need for, coastal zone water quality monitoring in the area. The report is a compendium of information including tabulations of organizations engaged in coastal zone water monitoring, their laboratory capabilities, data needs and internal organization. Separate sections are devoted to discussions of socio-economic problems associated with coastal zone water quality and recommendations for design and implementation of a coordinated coastal zone water quality monitoring network. A selected bibliography and list of personnel concerned with coastal zone water quality monitoring in the area is included.

Sperber, K.R. and S. Hameed. 1992. Coupled ocean-atmosphere GCM simulation of Southern Oscillation phenomena. pp. 5. *In* Brazilian Meteorological Congress: Climate Change and the Environment (7th), Sao Paulo (Brazil), 28 Sep-2 Oct 1992. Department of Energy, Washington, D.C. (Lawrence Livermore National Lab.)

Abstract. The Oregon State University coupled upper ocean-atmosphere GCM has, been shown to qualitatively simulate the Southern Oscillation. A composite analysis of the warm and cold events simulated in this 23-year integration has been performed. During the low phase of the SO, when warm anomalies occur in the Eastern Pacific the model simulates for the Atlantic region during March--May (1) a deficit of precipitation over the tropical South American continent (2) Caribbean and Gulf of Mexico sea-

level pressure and sea-surface temperature are in-phase with the Eastern Pacific anomalies, while those East of the Nordeste region are out-of-phase (3) northeast trade winds are anomalously weak and southwest trade winds are anomalously strong (as inferred from surface current anomalies). During the high phase of the simulated Southern Oscillation conditions in the atmosphere and ocean are essentially the reverse of the low phase. Thus the model produces a response in the South American region during the opposing phases of the Southern Oscillation which is in general agreement with observations.

Spring, W. 1978. An investigation of the distribution of hurricane generated wave heights. Ph.D. Dissertation. New York University, School of Engineering and Science. New York, NY. 172 pp.

Abstract. A method described by Borgman (1973), to determine wave data fit to a probability distribution was used to test the Rayleigh, Forristall and a mean height distribution with Gulf of Mexico hurricane and tropical storm data. The mean height distribution employs empirically determined shape and exponential coefficients and the record mean wave height is used to normalize wave heights. The poorest fit was shown to be the Rayleigh Distribution with the mean height distribution slightly worse than the Forristall distribution. When shape coefficients were not specified and exponential coefficients tested, the best results were found by using a mean height distribution which allowed the exponential coefficient to vary with each record. Attempts to use this distribution with significant wave height dependent shape and exponential coefficients resulted in a slightly worse fit than the Forristall Distribution. Plots of the variation of the shape and exponential coefficients with significant wave height are presented and a recommendation for the use of significant wave height dependent coefficients in future attempts to determine wave height distributions is made.

Stakhiv, E. 1968. The dependence of the circulation in the Gulf of Mexico upon the horizontal distribution of surface temperature. Master's Thesis. Florida State University. Tallahassee, FL.

Stapor, F.W., Jr. 1975. Shoreline changes between Phillips Inlet and Pensacola Inlet, northwest Florida coast. Trans,. Gulf Coast Assoc. Geol. Soc. 25:373-378.

Abstract. Topographic and hydrographic surveys were used to measure erosion and deposition along the northwest Florida Gulf coast between Phillips Inlet and Pensacola Inlet. No significant net shoreline change was measured. Some erosion was noted on Santa Rosa Island.

Starr, R.B. and G.A. Maul. 1982. Physical oceanographic observations in the eastern Gulf of Mexico during 1979-1980 for potential OTEC site. NOAA Tech. Memo. NOAA ERL. Miami, Fl. 210 pp.

Abstract. Physical oceanographic data forms the basis for decisions on OTEC plant site selection in several ways. The data discussed in this report was collected over a two year period in the vicinity of the proposed site west of Tampa, Florida near 27.7°N and 85.5°W. Each time the current meter moorings were serviced, expendable bathythermograph (XBT) observations and some salinity-temperature-depth (STD) profiles were acquired. In addition, optical oceanography measurements were made to study the

natural optical properties from ship and satellite; those data are reported separately. Finally, three cruises designed to study the effect of infrared satellite-observed cold tongues on a plant site were conducted.

State University System of Florida, Institute of Oceanography. 1975. Compilation and summation of historical and existing physical oceanographic data from the eastern Gulf of Mexico in support of the MAFLA sampling program. BLM/YM/ES-75/1. Bureau of Land Management. Washington, D.C. 292 pp.

Abstract. Physical oceanography has a dual role in determining the environmental implications of development of the Outer Continental Shelf (OCS). It is intrinsically important to determine physical parameters to predict dispersion of materials in OCS waters, but the role of physical oceanography is equally important in the support it must give to other oceanographic disciplines. In fact, it is highly unlikely that meaningful interpretations of biogeochemical data, or the ecosystem structure can be made without adequate knowledge of the advective field, for instance. Cognizant of the importance of understanding the circulation of the eastern Gulf of Mexico, the Bureau of Land Management (BLM) commissioned a group of oceanographers familiar with the area: (a) to "assemble the historical and contemporary physical and associated meteorological data of the northeast Gulf of Mexico. for submission to the National Oceanographic Data Center (NODC)"; (b) to "construct a zero-order synthesis of oceanographic conditions in the northeast Gulf of Mexico and have them graphically displayed"; (c) to "describe the general circulation and oceanographic conditions on the continental shelf area of the northeast Gulf of Mexico and in the Loop Current of the deeper Gulf areas"; (d) to "describe qualitatively the interaction between the shelf circulation of the northeast Gulf of Mexico and the Loop Current"; (e) to "describe the seasonal distribution of the intensity of fish spawning and zooplankton productivity on the western Florida continental shelf and relate these to temperature and salinity data"; (f) to "develop a first-order understanding of the trajectory of a pollutant in the northeast Gulf of Mexico; (g) to provide recommendations on sampling locations for future biological, geological, chemical, and physical oceanographic investigations". Objective (a) was required because at the inception of this program a considerable portion of the data collected in the Gulf of Mexico had not been submitted to NODC. Phase 1 of this study therefore consisted of an accelerated reduction of existing data, and submission of the data to the national repository.

State University System of Florida, Institute of Oceanography. 1978. Baseline environmental survey of the MAFLA lease areas. BLM/YM/ES-78/02. Bureau of Land Management. Washington, D.C. 201 pp.

Abstract. The Bureau of Land Management deemed it necessary to conduct a baseline environmental survey on the MAFLA shelf of the eastern Gulf of Mexico, extending from approximately 89°W, south to Pascagoula, Mississippi, to a tract west of Clearwater, off Tampa Bay, Florida. This task included designing and conducting a field sampling program for geological, biological, chemical, and physical oceanographic samples; analysis of samples, including establishment of analytical quality

control procedures; archiving of samples for future analysis; development of data management procedures; and a comprehensive final report.

Steidinger, K.A. and K. Haddad. 1981. Biologic and hydrographic aspects of red tides. Bioscience. 31(11):814-818.

Stelzenmuller, W.B. 1965. Tidal characteristics of two estuaries in Florida. J. Waterw. Harbors Div. Proc. Am. Soc. Civ. Eng. 91(WW3)

Stone, G.W. 1984. Mathematical modeling of the nearshore and implications for coastal management, northwest Florida. Master's Thesis. University of West Florida, Pensacola, FL. 182 pp.

Stone, G.W. 1984. Nearshore simulation of shoaling waves and their response to channel and jetty construction at the proposed Navarre Pass, Santa Rosa County, Florida. University of West Florida. Pensacola, FL. 106 pp.

Stone, J.H. 1972. Preliminary assessments of the environmental impact of a superport in the southeastern coastal area of Louisiana--Louisiana superport studies. Report 2. Center for Wetland Resources, Louisiana State University. Baton Rouge, LA. 345 pp.

Abstract. Two offshore sites for a proposed Superport, off southeastern Louisiana, are evaluated for potential environmental impact on the coastal region. The most vulnerable areas along the coast are the estuaries. Oil drift projections indicate that the site more distant from shore would have less effect because a potential spill there would probably not reach the estuarine areas. Oil drift projections of hypothetical oil spills are based on a hydrodynamical numerical model using wind conditions, local tides, and bathymetry. At the closest site oil spills moved either northwest toward Timbalier Bay or northeast toward Barataria Bay. Oil spills at the farther site did not impinge on the shorelines nor into the estuaries. Oil spills at both sites usually assumed an east-west orientation and moved somewhat faster than drift projections based solely on winds. Potential adverse effects resulting from an oil spill would be most severe in the estuaries. Oil could damage or kill extensive areas of marsh grass, thereby reducing or eliminating the most important food source for the major consumers, which are fishery species. This damage could be by direct contact with the top of the plants, the root system, or the microbes which initiate the breakdown of grass into detritus. Regardless of the final location of the superport, research should be initiated on the detailed hydrography and meteorology of the proposed site, the toxic effects of various crude oils on planktonic stages of fishery species, and the effects of oil on marsh grasses and microbes.

Stone, J.H. 1976. Environmental factors relating to Louisiana menhaden harvest. LSU-T-76-004. Center for Wetland Resources, Louisiana State University. Baton Rouge, LA.

Abstract. The relationship between selected environmental factors of coastal Louisiana to Louisiana menhaden harvest and effort was studied by analyzing the factors separately, by factor analysis, by multiple regression, and by cross correlations. The environmental factors were air temperatures, water temperatures, rainfall data, tide data, and wind speeds and directions applicable to coastal Louisiana from 1950 through

1971; these data were reduced to weekly and monthly statistics. The menhaden catch and effort data were for the Louisiana harvest during 1950 through 1971 expressed as weekly and monthly totals. Only tide range data showed significant changes during the last 20 years, namely an increase of mean tide range, which is probably related to the rise in sea level noted by other Louisiana researchers. Factor analysis and multiple regressions both indicate that the same general type of data have a significant relationship to menhaden harvest, namely effort, time effects, water or air temperature, and some interactions among them. Significant relationships still exist between menhaden catch and selected environmental data when the effects of effort and time are removed; however, time effects are probably masking important environmental effects. A variety of variables can be used to produce a significant predictive relationship; examples are effort; minimum air temperature interacting with month, both not lagged and lagged for 12 months; wind direction at New Orleans interacting with month; wind direction at Baton Rouge interacting with minimum air temperature and lagged for 12 months; wind direction at New Orleans; mean air temperature; and maximum water temperature. The resulting coefficient of determination (R^2) is 86 percent and is significant at $p < 0.0001$. The harvest data were fitted to a sine curve adding the significant environmental variables, and the coefficient of determination (R^2) is 89 percent.

Story, A.H., R.M. McPhearson Jr. and J.L. Gaines. 1974. Use of fluorescent dye tracers in Mobile Bay;. J. Water Pollut. Control Fed. 46(4):657-665.

Abstract. The purpose of this study was to determine current velocity and patterns of current flow from the Mobile River throughout Mobile Bay to oyster reefs downstream. Data were collected for one year beginning in March, 1970. Dye studies were done and notes on wind speed and direction were taken to indicate routes of possible pollutants to these oyster reefs. Different types of dyes were evaluated as to their suitability to a specific study area.

Stumpf, R.P., G. Gelfenbaum and J.R. Pennock. 1993. Wind and tidal forcing of a buoyant plume, Mobile Bay, Alabama. Cont. Shelf Res. 13(11):1281-1301.

Abstract. AVHRR satellite imagery and in situ observations were combined to study the motion of a buoyant plume at the mouth of Mobile Bay, Alabama. The plume extended up to 30 km from shore, with a thickness of about 1 m. The inner plume, which was 3-8 m thick, moved between the Bay and inner shelf in response to tidal forcing. The tidal prism could be identified through the movement of plume waters between satellite images. The plume responded rapidly to alongshore wind, with sections of the plume moving at speeds of more than 70 cm/s, about 11% of the wind speed. The plume moved predominantly in the direction of the wind with a weak Ekman drift. The enhanced speed of the plume relative to normal surface drift is probably due to the strong stratification in the plume, which limits the transfer of momentum into the underlying ambient waters.

Sturges, W. 1992. The spectrum of Loop Current variability from gappy data. J. Phys. Ocean. 22(11):1245-1256.

Abstract. The goal of this work was to understand the rate at which large anticyclonic rings are shed from the Loop Current in the Gulf of Mexico. The northward penetration of the Loop Current is used as a surrogate variable. Data are primarily from satellite IR maps and are supplemented

with XBT sections and older hydrographic data. The IR data have gaps from poor summertime visibility, bad weather, and the ambiguity of not knowing exactly when a ring separates. A least-squares method is developed for computing the spectrum. The computations are performed in the time domain to avoid problems wit explicit calculation of the Fourier transform. The slightly smoothed spectrum can be recovered to high accuracy at low frequencies for the case of long segments of continuous data separated by large gaps. The method requires choosing an appropriate smooth data window to widen the spectral window, determining the effective Nyquist frequency of the method, filtering the continuous data segments to remove power at frequencies higher than the Nyquist, and inverting a matrix for the cosine and sine terms of the traditional Fourier frequencies.

Sturges, W. 1993. The annual cycle of the western boundary current in the Gulf of Mexico. J. Geophys. Res. 98(C10):18053-18068.

Abstract. It has been known for decades that the mean circulation in the western Gulf of Mexico is a large anticyclone. This flow is driven both by wind stress curl and detached rings from the Loop Current. This paper is an attempt to examine their relative importance by focusing on the annual cycle of the observed flow. A new compilation of ship drift data shows that the flow along the western boundary is strongest in July and weakest in October. It appears physically plausible that the annual variation of this western boundary current is driven by the annual variation in wind curl augmented by Ekman pumping over the western gulf. Because the maximum in wind curl is so close to the western boundary, the phase delay between the annual cycles of curl and current is only approximately 1 month. The magnitudes of the curl and resulting current seem physically plausible. The response is baroclinic and penetrates to approximately 1000 m, the bottom of the main thermocline. The change in velocity at the sea surface is consistent with the cross-stream pressure gradient as determined by the changes in sea level at the coast and dynamic height changes offshore. The annual cycle is relatively large. This flow could be driven by wind curl. Consequently, the contribution of Loop Current rings turns out to be relatively small. The reason for this is that when rings reach the western wall, the steep bottom topography intersects the sloping fluid contours of the rings. The rings decay slowly by normal deepwater processes until they reach the edge of the continental shelf.

Sturges, W. 1994. The frequency of ring separations from the Loop Current. J. Phys. Ocean. 24(7):1647-1651.

Abstract. In two recent papers, the frequency of separation of rings from the Loop Current in the Gulf of Mexico was studied; the authors used similar data but obtained remarkably different results for the primary rate of ring shedding. In this paper the time between successive rings for the last 22 known ring events since 1973 are examined. Using a histogram like technique that does not involve a surrogate variable but deals directly with the ring events themselves, two primary modes are found. The one at a period near 8-9 mo has slightly (but not significantly) more power than the one near 13-14 mo. The uncertainty in the periods of these peaks is estimated to be similar to 0.3 mo from measurement uncertainties and an additional similar to 0.3 mo from the natural variability of the process. If the high resolution available from a 20-year record were not maintained, it would be possible to smooth the present result heavily (in

frequency space) and obtain the similar to 11 mo peak reported by Maul and Vukovich.

Sturges, W. and J.C. Evans. 1983. On the variability of the Loop Current in the Gulf of Mexico. J. Mar. Res. 41(4):639-653.

Abstract. The extent to which offshore currents may drive flows on the continental shelf was studied. The primary finding was that the N-S fluctuations in Loop Current position are correlated with sea level at the coast and with coastal currents. The authors used the northernmost position of the Loop Current, from hydrographic data, to piece together a time series 13 years long. This record samples the lowest frequencies well but undersamples the amplitude of variations with periods of similar to 8 months by a factor of 2. The "annual" variation of the Loop Current appears to be a relatively broad spectral peak rather than a sharp spectral line. They found as much power at periods near 30 months as at periods near a year; this was a new result. Both bands seem to be, at least in part, wind forced. There are also fluctuations having periods near 8 months, and this may be a beat frequency. As the 30-month and annual signals drift in and out of phase over similar to 5 years, the envelope of the 8-month signal varies from zero to a maximum of similar to 2.5° of latitude, peak-to-peak, which is the same as the range of the 30-month signal. The authors' primary finding is that the north-south fluctuations in Loop Current position are correlated with sea level at the coast and presumably with coastal currents.

Sturges, W., J.C. Evans, S. Welsh and W. Holland. 1993. Separation of warm-core rings in the Gulf of Mexico. J. Phys. Ocean. 23(2):250-268.

Abstract. The separation of anticyclonic rings is studied using a 12-level primitive equation numerical model of the western North Atlantic. The 'Gulf Stream Formation Region' model is based on the Bryan-Cox-Semtner code, and uses 1/4 degree horizontal resolution. The eastern boundary of the model, near the Mid-Atlantic Ridge, is forced by a 'pumps and baffles' region to have the appropriate temperature and salinity structure, vertical shear and total transport. The model is closed by a solid northern wall at 36°N and is forced by steady winds. Large rings separate from the Loop Current in the Gulf of Mexico at periods near 30 weeks. The separation of a single typical ring is shown in detail. The most striking feature is that the separation is not a single spectacular event but a long, gradual process involving recirculation between the ring and the main flow for many weeks after the time at which one would, on the basis of standard observational evidence, normally believe the ring to be completely separated.

Sturges, W. and C. Horton. 1981. Circulation in the Gulf of Mexico. pp. 41-48. *In* Atwood, D.K., ed. Proceedings of a Symposium On Environmental Research Needs in the Gulf of Mexico GOMEX, Key Biscayne, Florida, 30 September-5 October 1979.

Abstract. The strongest single feature in the Gulf of Mexico is the Loop Current. This flow enters the Caribbean and eventually becomes the Gulf Stream. The path that it takes, however, is highly time-dependent, and this portion of the pre-Florida Current is known as the Loop Current. This current is important, not only in its own regard, but also in that it injects pinched-off rings to the interior of the Gulf. These rings

carry with them momentum, salt, and nutrients, which are major contributions to the balances of the interior and western portions of the Gulf. The Loop Current and its variability is likely to be important to understanding the exchange of deep water between the Gulf and the Caribbean. The Loop Current also may act as a significant external driving mechanism for adjacent areas of the west Florida shelf. It is not well known what forcing mechanisms control the position, growth, or decay of the Loop Current. But the information required for a real understanding of Loop Current variability is enormous. A summary is provided on recent and ongoing programs in which the data is not yet in the open literature.

Sturges, W. and S. Welsh. 1990. Wind-driven response of ocean surface infrared signals. J. Phys. Ocean. 20(12):1842-1848.

Abstract. In the course of archiving positions of the edge of the Loop Current from satellite infrared (IR) data, the authors have found a substantial amount of energy at periods in the 'wind-driven band'. Using a technique patterned after that of Price et al. (1987) the authors constructed a series of new datasets of IR positions at a variety of angles relative to the daily wind. Using data for a period of November-May, the authors find that the IR fluctuations are coherent with wind, and are at an angle of 80° to the right. The IR data do not resolve periods shorter than approximately 10 days reliably, but motions of approximately 12-16 days are well resolved. These findings show that the wind-coherent motion of the surface IR signal is associated with the Ekman transport of the upper mixed layer.

Sturges, W. and S. Welsh. 1991. Numerical modeling studies of the Gulf of Mexico and the Caribbean Sea using the Bryan-Cox Model. Final Rept. (See also PB90-222779, Florida State Univ., Tallahassee. Dept. of Oceanography.) Minerals Management Service, Gulf of Mexico OCS Region. New Orleans, LA. 109 pp.

Abstract. A numerical model of the Gulf Stream formation region has been developed, based on the Bryan-Cox-Semtner, or 'GFDL,' primitive equation formulation. It is fully nonlinear with 12 levels and has realistic topography in each level. It includes the western north Atlantic from the mid-Atlantic ridge into the Caribbean Sea, the Gulf of Mexico, and the east coast of the United States to Cape Hatteras. A new feature of the model is the manner of forcing along the boundary. The vertical shear is set by the historical (observed) mean density field at the eastern boundary, and the total transport by the curl of the wind stress, extending previous work of Holland. The model was initialized with the mean density field and is forced by mean winds. The following seven years of model runs are the basis of the work reported here, when the model appears to have reached statistical equilibrium and the flow in the Straits of Florida is no longer increasing.

Subrahmanyam, C.B. and S.H. Drake. 1975. Studies on the animal communities in two north Florida salt marshes. Part I. Fish communities. Bull. Mar. Sci. 25(4):445-465.

Abstract. A study of the seasonal fluctuations of temperature, salinity, numerical abundance, and biomass of fish in three tidal creeks located in northern Florida provided data for community diversity indices which were

used to interpret the temporal changes in the compositions of fish communities.

Sugimoto, T. and T. Ichiye. 1988. On seasonal and year-to-year variations of the Loop Current and eddy formation in the Gulf of Mexico based on rotating model experiments. Deep-Sea Res. 35(4):569-593.

Suhayda, J.N., J.M. Coleman, T. Whelan and L.E. Garrison. 1982. Oscillation of continental shelf sediments caused by waves. pp. 57-76. *In* Fanning, A.K. and F.T. Manheim, eds. The Dynamic Environment of the Ocean Floor. Lexington Books, Lexington, MA.

Abstract. Measurements have been made of the oscillations of bottom sediments on the continental shelf induced by the passage of surface waves. A wave staff and pressure sensor were placed 45 m from a bottom-emplaced accelerometer in East Bay, Louisiana. Measurements were made in 20 m of water in an area where bottom sediments were composed of clay and silts. A sediment core was taken to a depth of 40 m. The results of the experiments indicate that these fine-grained bottom sediments move in a wave-like fashion under surface-wave action. Bottom oscillations on the order of 2 to 3 cm occurred under waves having a height of 1 m and a period of 5 seconds. The bottom motion appears to be an elastic-like response to wave pressure. Estimates of the amount of wave energy lost in forcing the mud wave indicate that the interaction can significantly affect surface-wave characteristics and the stability of bottom sediments.

Summers, J.K. and V.D. Engle. 1993. Evaluation of sampling strategies to characterize dissolved oxygen conditions in northern Gulf of Mexico estuaries. Environmental Monitoring and Assessment. 24:219-229.

Abstract. Dissolved oxygen was continuously monitored in eight sites of northern Gulf of Mexico estuaries in August, 1990. Monte Carlo analyses on subsamples of the data were used to evaluate several commonly used monitoring strategies. Monitoring strategies which involve single point sampling of dissolved oxygen may often misclassify an estuary as having good water quality. In the case of shallow, often well-mixed estuaries that experience diurnal cycles, such monitoring often does not occur at night, during the time of lowest dissolved oxygen concentration. The authors' objective was to determine the minimum sampling effort required to correctly classify a site in terms of the observed frequency of hypoxia. Tests concluded that the most successful classification strategy used the minimum dissolved oxygen concentration from a continuously sampled 24-hour period.

Sweet, W.E., Jr. 1971. Water circulation study in the Gulf of Mexico; a review. Report for the Texas A&M University Study of Naturally Occurring Hydrocarbons in the Gulf of Mexico. Texas A&M University. College Station. 142 pp.

Tan, C.L. 1990. Characterization of Underwater Sound Produced by Heavy Precipitation. Master's Thesis. Naval Postgraduate School, Monterey, CA. 70 pp.

Abstract. An experiment by the Naval Postgraduate School and the National Data Buoy Center was performed in the Gulf of Mexico to investigate the underwater sound generated by heavy precipitation under a variety of

conditions. During the first stage of the experiment, nine data sets were obtained with rainfall rates up to 300 mm/hr. The characteristic fifteen kilohertz peak in the underwater sound spectrum generated by small raindrops in light rain is absent during heavy rain. These data sets show a good correlation between rainfall rate and underwater sound levels, suggesting that acoustic measurement of rainfall rate at sea is possible. The correlation is best at lower frequencies (2-10 kHz). At higher frequencies (12-22 kHz) low spectral levels are observed in conditions of high wind (>10 m/s), presumably due to sound absorption by ambient bubble clouds from breaking waves. At very high rainfall rates (>200 mm/hr), low levels at higher frequencies are also observed suggesting that the rain itself is capable of producing large populations of bubbles which absorb the sound radiated form the surface.

Tannehill, I.R. 1944. Hurricanes. Princeton University Press. Princeton. 269pp.
Abstract. In this book Tannehill records the highest tides of record on the Gulf coast and a chronological account of hurricanes on record on the Gulf coast.

Tanner, W.F. UNKNOWN YEAR. Florida Gulf coast surf zone wave power data. Department of Geology. Florida State University. Tallahassee, FL.
Abstract. Surf zone wave power data along the Gulf coast of Florida, has been collected by the Geology Department of Florida State University since 1971. Measurements of surf zone waves have been made along the coast at intervals of approximately 800 meters or less. These data have been correlated with ocean wave data for the same time periods, and computer models have been generated. Associated sediment data, including size analysis and mineralogy for 60 stations along the coast, has been collected to verify computer model theorized areas of erosion and deposition.

Taxonomic Associates, 1985. Mixing zone analysis, Bay County Water and Wastewater Systems. Taxonomic Assoc. Mobile, AL. 29 pp.
Abstract. An analysis of water mixing and dilution in the vicinity of the sewage outfall in East Bay. Includes water quality and hydrographic data.

Taylor, J.G. 1966. An approach to the analysis of sea surface temperature data for utilization in hurricane forecasting in the Gulf of Mexico. Master's Thesis. Texas A&M Univ., Dept. of Oceanography, College Station, TX. 106 pp.
Abstract. Sea surface temperature (SST) patterns have been analyzed for four major hurricanes in the Gulf of Mexico in an effort to determine if routinely available SST data might be more fully utilized as an aid to the hurricane forecaster. SST data reported by merchant vessels are the primary data used in this study. Mean daily SST charts were prepared for approximately ten to twelve days prior to the time when each hurricane moved inland. Also, a series of 3-day, 5-day, and 7-day mean SST charts were prepared for Hurricane Hilda. The SST charts for Hurricanes Audrey, Carla, and Hilda were plotted and analyzed with the point of hurricane landfall known. In an attempt to stimulate realistic conditions and to insure an objective analysis, a series of daily mean SST charts for Hurricane Betsy were plotted while the storm was in progress. The conservative nature of ocean temperature is discussed, and it is stressed that a great amount of energy is required to make a significant change.

It is pointed out that the SST data used are taken at varying depths in the first few meters below the surface, and that the values obtained are not necessarily the same as surface temperatures measured by radiation devices. It is suggested that even though there are obvious limitations to available SST data, it is possible that the data might be more fully utilized as an aid to the hurricane forecaster.

Taylor, J.L. and C.H. Saloman. 1969. Sediments, oceanographic observations and floristic data from Tampa Bay, Florida, and adjacent waters, 1961-65. U.S. Fish Wildl. Serv., Data Rep. 34:562.

TechCon, 1980. Environmental monitoring program for the Mobile Oil Exploration and Producing Southeast, Inc. test well in Mobile Bay, Alabama, 7 vols. Mobil Oil Exploration and Producing Southeast, Inc. New Orleans, LA.
Abstract. Mobil Oil Exploration and Producing Southeast, Inc. acquired four oil and gas leases in Mobile Bay, Alabama in 1969. Applications for drilling permits were filed in 1970 but the State of Alabama did not provide water quality certification and clear the way for drilling until 1978. The Mobile Bay Environmental Monitoring Program performed for Mobil Oil Southeast Exploration and Producing, Inc. by TechCon, Inc. has furnished both a clear demonstration of the clean operation of the test well and an excellent baseline for important characteristics of the Mobile Bay estuary Based upon the results of these studies, it is evident that natural environmental variability induced by seasonal changes and periodic climatological extremes exceeds by far any effects which the drilling operation might have had on this estuary. Much better predictions can now be made of the impacts of additional test drilling and production in Mobile Bay. And finally, examination of this database identifies those aspects of the ecosystem which will provide meaningful information at a realistic cost during monitoring of future development of oil resources in the Bay.

TerEco Corporation. 1979. Literature review of Mississippi Sound and adjacent area. U.S. Army Corps of Engineers, Mobile District. Mobile, AL. 251 pp.
Abstract. The present report summarizes published and pertinent unpublished information relative to environmental and biological characteristics of the nearshore sea bottom of the northeastern Gulf of Mexico. The study area extends from the East Pearl River, Mississippi to a point 14 miles east of Pensacola, Florida and from the shoreline to a depth of 22 fathoms. Preparation of the present report has entailed an extensive search of the available literature, including articles published in technical journals, a variety of reports to and by government agencies, and university dissertations (as listed in Dissertation Abstracts). All significant sources have been examined and abstracted for the pertinent information. Where major data gaps existed in the published literature, unpublished information was sought by telephone or by visitation. From the published and unpublished information the narrative section of this report and the supportive maps have been prepared. The annotated references and an index have also been included.

Tester, P.A., R.P. Stumpf, F.M. Vukovich, P.K. Fowler and J.T. Turner. 1991. An expatriate red tide bloom: Transport, distribution, and persistence. Limnol.-Oceanogr. 36(5):1053-1061.

Abstract. In November 1987, the toxic dinoflagellate Gymnodinium breve bloomed in North Carolina nearshore waters. This occurrence was the first record of G. breve north of Florida, a range extension of >800 km. We propose the (Gulf of Mexico) Loop Current-Florida Current-Gulf Stream system as the transport mechanism for G. breve cells from a late summer bloom off the southwest coast of Florida (Charlotte Harbor-Sarasota). The estimated transit time for cells around the peninsula and northward to the continental shelf off North Carolina is 22-52 d. About 30 d after the Charlotte Harbor-Sarasota bloom, satellite images of sea-surface temperature substantiated the shoreward movement of a filament of Gulf Stream water onto the narrow continental shelf between Cape Hatteras and Cape Lookout. This filament, the likely source of G. breve cells, remained in nearshore waters and was identifiable in satellite images for >19 d. Once the bloom was inshore, both windspeed and direction were important in determining its distribution.

Tetley, M. and K. Wells. 1993. Bibliography: Scientific journal articles based on MMS environmental research. MMS 93-0069. Minerals Management Service, Environmental Studies Branch. Herndon, VA. 312 pp.

Abstract. The Environmental Studies Program (ESP) developed a database of ESP research in professional scientific journals. This bibliography is divided into several sections alphabetically by author and by title, and by region. The time period covered extends from the mid-1970's to Fall 1993.

Tetra Tech, 1982. Southwest Florida shelf circulation model. Volume 3. Data Report. MMS-GM-PT-83-014. Minerals Management Service, Gulf of Mexico OCS Regional Office. Metairie, LA. 91 pp.

Abstract. The report describes a more comprehensive understanding of circulation in the eastern Gulf of Mexico. The report also assembles a large body of data and related literature with which to tune the numerical circulation model and perform sensitivity analyses so that appropriate driving mechanisms and boundary conditions could be implemented.

Texas A&M University. 1992. Hydrographic Data from the Continental Shelf and Slope of the NW Gulf of Mexico: R/V GYRE Cruise 93G-01. Final Report. Minerals Management Service, LA. Gulf of Mexico OCS Region. New Orleans. 200 pp.

Abstract. Research was in support of an NSF- and DOE-sponsored biogeochemical study of the NW Gulf of Mexico. Cruise 93G-01 departed Galveston at 22:00 CST on January 5 and returned to Galveston at 15:30 CST on January 14. The principal scientific goal was to collect samples to investigate dynamics and mechanisms of colloidal organic carbon transformation and transport on the continental shelf. Supporting tasks consisted of water and sediment sampling for selected radionuclides, biomarkers and pigments, trace and nutrient elements, oxygen, DOC, and colloids. Hydrodynamic conditions near the sediment-water interface and benthic respiration rates were measured at Station 1 by a free-vehicle lander and by diver-placed benthic flux chambers, respectively. The horizontal and vertical extent of a warm-core eddy (Loop Current Eddy 'V') that was centered at Sta 05 was also investigated, and the summary data from that survey (depth of the 15°C isotherm) were shared with the principal

investigators of the MMS-sponsored LATEX physical oceanography program while cruise 93G-01 was still at sea.

Texas A&M University. 1992. Hydrographic Data from the Louisiana-Texas Continental Shelf of the Gulf of Mexico: Texas Institutions Gulf Ecosystem Research (TIGER) Cruise 92G-04 in Cooperation with NOAA-NECOP. Final Tech. Rpt. Minerals Management Service. College Station, TX. 56 pp.

Abstract. GYRE cruise 92G-04 was supported by the Dept. of Oceanography at Texas A&M University for the purpose of research and training. The research was a part of the continuing NOAA initiative for Nutrient Enhanced Coastal Ocean Productivity (NECOP) that is coordinated by NOAA's Coastal Ocean Program. The principal focus was on the areas of the continental shelf that are seasonally hypoxic or that are subjected to intense accumulation of material from the Mississippi River. The specific studies included a comparison of sediment oxygen demand (Row and Boland) with sulfate reduction (Morse), estimates of benthic photosynthesis using light and dark chambers (Rowe and Boland), and dissolved organic matter distribution and turnover rates in relation to water column microbial activities (Cifuentes and Coffin). Anchor stations were occupied during the daylight hours, during which experiments were conducted in situ on the seafloor, with extensive coring and water sampling conducted adjacent to these sites. During the night, CTD stations were made to characterize the water column.

Texas A&M University. 1992. Ship-of-Opportunity hydrographic transect of Warm-Core Eddy Triton: 27-29 January 1992. Technical Report. Minerals Management Service. New Orleans. 181 pp.

Abstract. From 27-29 January 1992, three TAMU technicians made a 16 XBT + 8 CTD transect of the central Gulf of Mexico, as R/V GYRE returned to Galveston from contract work off west Africa. They also ran GYRE's ADCP and thermosalinograph to collect data on near-surface currents, temperature, and salinity while underway. From ARGOS-tracked buoy trajectories and AVHRR imagery provided shortly before the cruise by colleagues in industry and at Stennis Space Center, the authors knew that a large warm-core eddy 'Triton', which had separated in fall 1991 from the Loop Current, was passing across the central Gulf, and that it was centered approximately 26°N and 92°W. Because they wanted to sample the eddy to continue/extend previous observations of rings in the central and western Gulf, they vectored R/V GYRE so that its homeward bound course from Grand Cayman Island to Galveston passed through the point.

Texas A&M University. 1993. GulfCet Cruise 02 hydrographic data: XBT, CTD, and niskin bottle data from August 10-25, 1992 Cruise on R/V PELICAN. Final Report. Minerals Management Service. New Orleans, LA. 129 pp.

Abstract. The Materials Management Service (MMS) program, named GulfCet, includes aerial, acoustic, visual, and hydrographic surveys, a sperm whale tagging and tracking program, and a remote-sensing program. GulfCet is designed to ascertain the distribution, abundance, seasonality, and movement patterns of cetaceans along the continental slope from the Florida-Alabama border to the Texas-Mexico border between the 100- and 2,000-meter isobaths. The GulfCet program participates in four TAMU-sponsored cruises per season, for 2 of the 3 years of the contract period. These data were collected on the second TAMU GulfCet cruise, a

14-day summer cruise (8/10-24/92), aboard the LUMCON ship R/V Pelican. This cruise had a threefold purpose: a visual survey of marine mammals, a continuously recording acoustic survey, and a hydrographic survey. Data from the hydrographic survey are presented in this report. A transect consisting of 14 north-south track lines was followed during the cruise. Due to inclement weather, a track line one was not done on this cruise. The stations were surveyed in reverse order, beginning with station 143 on track line 14.

Texas A&M University. 1993. Hydrographic data from a June 1993 transit-of-opportunity aboard R/V GYRE from Key West, Florida, to Galveston, Texas. Technical Report. Minerals Management Service. New Orleans, LA. 196 pp.

Abstract. From 1-4 June several types of underway hydrographic data were collected while R/V Gyre transited the Gulf of Mexico from Key West, FL, to Galveston, TX, after finishing cruises 93G-06 and 93G-07 off the US East Coast. Doug Biggs (TAMU), Ken Schaudt (Marathon Oil Company), and 4 volunteers joined Gyre at the sea buoy off Key West to piggyback these underway hydrographic measurements during what otherwise would have been a deadhead run. Using Sippican T-7 XBT's that were provided by the Eddy Joint Industry Project (EJIP), we deployed 33 XBT's from 84° 00'W to 91°15'W as Gyre transited the central Gulf. At each of the deployment sites, we took a discrete sample for post-cruise measurement of surface salinity. Surface salinity (and surface temperature) was also monitored continuously with Seabird temperature and conductivity sensors that were placed in line in an uncontaminated sampling stream that was pumped from the bow of the vessel aft to the main science laboratory. Driven by a pump rated to deliver 60 gallons/minute, water in this stream had a residence time of 30-60 seconds. The underway T, S data were logged every 5 minutes on Gyre's SAIL system; underway currents monitored with Gyre's 150 kHz ADCP were also logged at 5-minute intervals.

Texas A&M University. 1993. Hydrographic data from the Louisiana-Texas continental shelf of the Gulf of Mexico. Texas Institutions Gulf Ecosystem Research (TIGER) Cruise 92G-10: Galveston, TX., to Pensacola, FL. Final Tech. Rpt. Minerals Management Service. New Orleans, LA. 197 pp.

Abstract. GYRE cruise 92G-10 was supported by the Department of Oceanography at Texas A&M University for the purpose of graduate student training and geochemical research. From 2-5 October 1992, 20 CTD casts were made at 5 + 4 + 5 + 3 stations along 4 cross-shelf transects as GYRE proceeded east from Galveston, TX, to Atchafalaya Bay, LA. Additional CTD casts were made at 6 stations, in the vicinity of the Mississippi River delta on 5-6 October, before the cruise terminated at Pensacola, FL. Bottles tripped at 2-12 depths at these CTD stations were analyzed on board for salinity, dissolved oxygen, autoanalyzer nutrients, and chlorophyll + phaeopigments.

Texas A&M University. 1993. Ship-of-Opportunity Hydrographic Transect of Warm-Core Eddies 'U' and 'V': October 28-31 1992: Texas Institutions Gulf Ecosystem Research (TIGER) Cruise 92G-13: Marco Island, FL, to Galveston, TX. Final Report. Minerals Management Service. New Orleans. 337 pp.

Abstract. GYRE cruise 92G-13 was supported by the Department of Oceanography at Texas A&M University as part of its ongoing program of graduate student training and basic research on Loop Current Eddies. The principal

objective of this transit back to Texas after the completion of NSG-sponsored research in the Bahamas (cruise 92G-11) and in the Florida Everglades (cruise 92G-12) was an XBT + CTD transect of the Loop Current warm-core ring 'Unchained Eddy.' A combination of Argos drifter and AVHRR SST analyses indicated that this feature had detached in the summer of 1992 and then separated in September into two regions of mesoscale anticyclonic circulation, Eddy 'U' and Eddy 'V'. From 28-31 October 1992, 32 XBT drops and 10 CTD casts were made between the shelf-slope break off west Florida and the shelf-slope break off SE Texas as GYRE proceeded back to Galveston, TX, from Marco Island, FL. ADCP and thermosalinograph data were also logged while underway to map the along track near-surface currents, temperature, and salinity. Bottles tripped at 12 depths at the CTD stations were analyzed on board for chlorophyll + phaeopigments, and aliquots from each bottle were also saved for post-cruise analysis of bottle salinity and nutrients.

Texas University (Austin). 1990. Project Summaries. National Aeronautics and Space Administration. Washington, D.C. 4 pp.

Abstract. Lunar base projects, including a reconfigurable lunar cargo launcher, a thermal and micrometeorite protection system, a versatile lifting machine with robotic capabilities, a cargo transport system, the design of a road construction system for a lunar base, and the design of a device for removing lunar dust from material surfaces, are discussed. The emphasis on the Gulf of Mexico project was on the development of a computer simulation model for predicting vessel station keeping requirements. An existing code, used in predicting station keeping requirements for oil drilling platforms operating in North Shore (Alaska) waters was used as a basis for the computer simulation. Modifications were made to the existing code. The input into the model consists of satellite altimeter readings and water velocity readings from buoys stationed in the Gulf of Mexico. The satellite data consists of altimeter readings (wave height) taken during the spring of 1989. The simulation model predicts water velocity and direction, and wind velocity.

The Energy Research and Development Administration. 1976. Proceedings. pp. 52. *In* Workshop on Environmental Oceanography of the Gulf of Mexico. Texas A&M University, College of Geosciences, College Station, TX.

Thompson, J.D., G.H. Born and G.A. Maul. 1982. Collinear-track altimetry in the Gulf of Mexico from SEASAT: Measurements, models and surface truth. NORDA-TN-57. Naval Ocean Research and Development Activity. NSTL Station, MS. 36 pp.

Abstract. From 17 September to 10 October 1978 SEASAT made collinear passes over the Gulf of Mexico. Altimeter data for eight, three-day repeat passes over the eastern Gulf were examined using an arc-segment fitting technique to determine the mesoscale temporal variability of the sea surface. The pattern of sea height variability was then compared with sea height data generated by a numerical model of the Gulf (Hurlburt and Thompson, 1980) from the simulation of a complete cycle of Loop Current intrusion and shedding of an anticyclonic eddy. The model data was found to match that from the SEASAT altimeter when an anticyclonic eddy separated from the Loop Current and the Loop began to repenetrate into the eastern Gulf. Analysis of sparse ground truth data from ship-of-opportunity XBT's, satellite infrared imagery of the Loop Current

boundary, and synthetic aperture radar (SAR) imagery, also from SEASAT, tend to confirm the circulation patterns deduced from the altimeter data and the numerical model.

Thompson, J.D., H.E. Hurlburt and A. Wallcraft. 1990. Loop Current and its role in the dynamics and circulation of the Gulf of Mexico. Naval Oceanographic and Atmospheric Research Laboratory. Stennis Space Center, MS. 1 pp.

Abstract. The Gulf of Mexico is an ideal basin to study ocean dynamics since it contains many features of much larger mid-latitude domains. A major current system, the Loop Current, dominates the circulation of the basin. Large anticyclonic rings, cross-shelf exchanges, a highly energetic western boundary regime, and smaller cyclonic and anticyclonic eddies are at least in part energized by the Loop Current. The relatively small size of the Gulf and the relatively constrained inflow of the Loop Current makes the basin attractive from both a modelling and an observational perspective. Our basic understanding of the dynamics of the Gulf of Mexico, developed in the last two decades from observations and detailed numerical model studies, has shown that barotropic and baroclinic instability processes, potential vorticity conservation, and transport distributions through the Yucatan Straits are key elements in understanding the Loop Current in carrying momentum, vorticity, heat, and salt into the western Gulf. It is made clearer from modelling studies. The need to measure the deep flow in the Gulf at inflow and outflow boundaries in the Gulf at inflow and outflow boundaries is also underscored by model experiments. Requirements for better model resolution, both horizontal and vertical, improved model physics, including proper interaction between the deep Gulf and the shelf/slope region, and new observational data for more extensive model/data intercomparisons are also discussed.

Thompson, P.A. and T.D. Leming. 1978. Seasonal description of winds and surface and bottom salinities and temperatures in the northern Gulf of Mexico, October 1972 to January 1976. NOAA Tech. Rep. NMFS SSRT-719:44.

Abstract. Seasonal surface and bottom salinities and temperatures in the northern Gulf of Mexico are described. The area surveyed, from October 1972 to January 1976, was between Mobile Bay, Alabama (88°00'W), and Atchafalaya Bay, Louisiana (long. 91°30'W), from 5 to 50 fathoms (9 to 91 m). The changing of seasons in the northern Gulf of Mexico between Mobile Bay, Alabama and Atchafalaya Bay, Louisiana from 5 to 50 fm, is recognized when surface and bottom temperatures are similar. The summer begins in Mar. and Apr. at all depths. This change is correlated with changing meteorological conditions as the wind shifts from a northerly to a southerly direction. This shift in direction is accompanied by a decrease in intensity of wind speed and an increase in air temperature. Water and air temperatures reach a peak in July and Aug. accompanied by frequent calm winds. Little wind-mixing during the period, coupled with solar heating, results in a large difference between surface and bottom temperatures. The summer season begins to disappear in Sept. and Oct. with a drop in air temperature and a wind shift. By Nov. and Dec. the winter season has begun with southeasterly winds shifting to a more northerly direction. This change in direction and intensity causes the mean air temperature to drop 9°C from the July and Aug. high. The wind

generally remains out of the N to NW in Jan. and Feb. bringing colder temperatures within the survey area. By Mar. and Apr. the winter season ends with a general warming of air temperature and a wind shift to the SE, completing the annual cycle. Bottom salinities at all depths in 3 survey areas are similar and relatively constant because of the influence of the Loop Current. Surface salinities vary within each survey area, indicating seasonal changes that can be attributed to the discharge from the Mississippi River and calm weather during the summer months.

Thompson, W.T. and S.D. Burk. 1991. Investigation of Boundary Layer Modification during GUFMEX. Proceedings reprint. pp. 86-90. *In* Preprint Volume of the Fifth Conference on the Meteorology and Oceanography of the Canal Zone. Naval Oceanographic and Atmospheric Research Laboratory, Stennis Space Center, MS.

Abstract. Transformation of continental polar air tranversing the Gulf of Mexico has been documented by few authors. Dimego et al. (1976) provide a climatology of cold frontal incursions into the Gulf and return flow of warm, moist tropical air into midlatitudes. Their results indicate that the maximum mean monthly frequency of frontal systems occurs in February. Molinari (1987) discusses air mass transformation over the loop current in the eastern Gulf. The Loop Current causes relatively warm water to move northward through the Yucatan Channel into the eastern Gulf. Changes in the position of the Loop Current contribute to significant variability in surface latent and sensible heat fluxes and, therefore, variability in air mass transformation (AMT). Boundary layer (BL) modification associated with AMT is discussed by Henry and Thompson (1976). Using soundings from a station in southern Mississippi and from one on the Yucatan Peninsula 24 hours later, they estimate the average total surface heat flux during the 24 hours required for air parcels reaching Yucatan.

Thompson, W.T. and S.D. Burk. 1993. Postfrontal Boundary-Layer Modification over the Western Gulf of Mexico during GUFMEX. J. Appl. Meteorol. 32(9):1521-1537.

Abstract. Cold-frontal passages over the Gulf of Mexico in late winter or early spring are frequently followed by return-flow episodes in which modified polar air and warm, moist tropical air move toward the Gulf coast. While both advection and airmass modification due to boundary-layer physics are important in this sequence of events, the relative roles of these processes are unclear. In the present study, the authors utilize data from the Gulf of Mexico Experiment and two distinctive numerical models in addressing this issue. In forecasts of a return-flow event, trajectory computations are performed using a mesoscale numerical weather prediction model to determine the source regions of air arriving on the coast at several different levels. A one-dimensional airmass transformation model is also used in order to delineate boundary-layer physical processes. Simulations were conducted at two sites along the Gulf coast to investigate geographic variability in this return-flow episode, including the effect on boundary-layer structure of sea surface temperature variations in shelf waters. By careful examination of temporal variations in surface flux and advective forcing and by examining changes due both to surface heat flux and differential advection in the forecast vertical profiles of potential temperature and specific humidity, the authors demonstrate that surface fluxes are important in heating and moistening the boundary layer as the air moves south across the Gulf.

Tisdale, W.E. 1969. Report of investigations into pollution of Pensacola area waters. Florida State Board of Health, Bureau of Sanitary Engineering. Jacksonville, FL.
Abstract. A study of the physical, chemical and biological characteristics of Escambia River, Escambia Bay, Pensacola Bay, Bayou Chico, Perdido Bay, and adjacent bodies of water.

Tolbert, W.H. and G.B. Austin. 1956. Oceanographic data collected off Panama City Beach, Florida, during period 12 April 1955 through 28 December 1955. U.S. Navy Mine Defense Laboratory Data Report. 5602(GX-14):175.
Abstract. The data were collected from two offshore stations and one in St. Andrew Bay.

Tolbert, W.H. and G.B. Austin. 1959. On the nearshore marine environment of the Gulf of Mexico at Panama City, Florida. U.S. Navy Mine Defense Laboratory Technical Paper. 161:104.
Abstract. Hydrography, sedimentology and weather data for the Panama City region.

Tolbert, W.H. and G.B. Dowling. 1962. Review of the oceanographic program at the U.S. Navy Mine Defense Laboratory. pp. 436-441. *In* Gorsline, D.S., ed. Proceedings of the First National Coastal and Shallow Water Research Conference, October 1961, Baltimore, MD. National Science Foundation and the Office of Naval Research, Tallahassee, FL.
Abstract. A summary of the research conducted from the offshore stages.

Tolbert, W.H. and G.G. Salsman. 1964. Surface circulation of the eastern Gulf of Mexico as determined by drift bottle studies. J. Geophys. Res. 69(2):223-230.
Abstract. During the 28-month interval from September 1960 through December 1962, drift bottles were released periodically from a stationary platform located 20.4 km offshore from Panama City, Florida. Of the 951 bottles released, 276 or 29 per cent, were recovered. Approximately 67 per cent of the returns have been found along a 350-km section of coastline extending from Cape St. George west to the Florida-Alabama line; 20 per cent of the returns were from the Florida east coast and keys, and 12 percent were found along the coasts of Alabama, Mississippi. Louisiana, and Texas. Comparison of the drift-bottle data with local wind information indicates that the primary mechanism of surface water transport in the vicinity of the release point is wind-induced currents, which either transport the bottles to local beaches or to regions where permanent or semipermanent currents can displace them to western or southern shores. The results of this study are also compared with other drift-bottle studies conducted in the Gulf of Mexico.

Toler, L.G. 1965. Use of specific conductance to distinguish two base-flow components in Econfina Creek, Florida. U.S. Geological Survey, Professional Paper. 525-C:206-208.
Abstract. A mathematical formula is used to distinguish between the two water sources for Econfina Creek.

Toler, L.G., R.H. Musgrove and J.B. Foster. 1964. Freshening of Deer Point Lake, Bay County, Florida. Journal of the American Water Works Assoc. 56(8):984-990.

Abstract. A study of the salinity changes brought about by the construction of the dam in North Bay.

Tomas, C.R. 1994. Influence of Mississippi River water on the west Florida shelf. *In* Dowgiallo, M.F., ed. Coastal Oceanographic Effects of the 1993 Mississippi River Flooding. NOAA Coastal Ocean Office/National Weather Service, Silver Spring, MD.

Trees, C.C. 1985. Remote sensing of ocean color in the northern Gulf of Mexico. Ph.D. Dissertation. Texas A&M University. College Station, TX. 270 pp.

Abstract. Remote sensing of ocean waters, using the Nimbus-7 Coastal Zone Color Scanner (CZCS), in the northern Gulf of Mexico during a 17-month period (November 1978 - March 1980) showed large variability in the spatial and temporal distributions of pigment fronts. Twenty-nine atmospherically- and geometrically-corrected CZCS orbits were processed into total pigment images. A factor of 1.67 was applied to correct for the tendency of the standard fluorometric method to underestimate chlorophyll-a concentrations. Entrainment of coastal waters offshore was a dominant feature. Intrusion of the Loop Current and its effect on surrounding waters was observed in the pigment imagery. The mean pigment concentration for the 17-month survey was 3.30 ± 1.45 mg/m^3. Both the spring (March) and the fall (October) phytoplankton blooms were documented in the imagery, although precise dates for these maxima could not be determined due to the spacings between usable CZCS orbits. A comparison was made between 7 thermal (CZCS channel 6) and pigment images. At times, the sea surface temperature expressions coincided with pigment gradients. In general, pigment imagery showed structural features not readily discernible in the thermal imagery. Development of a primary productivity algorithm was investigated using historical ground truth data on primary productivity, chlorophyll-a concentration, sea surface temperature, and day length. Results indicated that, using these variables, a multiple regressions model could only describe 15% of the variability in production; therefore, a productivity algorithm was not applied to the remotely sensed pigment and thermal data.

Trees, C.C., S.Z. El-Sayed and M.A. Blizard. 1986. Remote sensing of chlorophyll concentrations in the northern Gulf of Mexico. pp. 328-334. *In* Proceedings of SPIE -- The International Society for Optical Engineering: Ocean Optics VIII Orlando, FL (USA) 31 Mar-2 Apr 1986. Vol. 637. SPIE, Bellingham, WA.

Abstract. During a 17-month period (November 1978 - March 1980) phytoplankton pigment concentrations were remotely sensed in the northern Gulf of Mexico using the Coastal Zone Color Scanner. A total of 29 CZCS orbits were processed into pigment (chlorophyll-a + phaeopigments) images and then geometrically warped to a mercator projection. A correction factor of 1.67 was applied to the pigment concentrations to correct for the tendency of the standard fluorometric method to underestimate chlorophyll a concentrations. The spatial and temporal distribution of pigment fronts were quite variable during this time series. Constant features observed throughout the pigment imagery were the entrainment of coastal waters offshore. The most extensive entrainments occurred during intrusions of the Loop Current. For the 17 month survey, the mean HPLC-corrected pigment concentration was 3.30 ± 1.45 mg/m^3.

Trump, C.L. 1993. Green Sheet Project: Dye sheet evolution. Interim Rept. Dec. 91-Dec. 92. Naval Research Lab. Washington, D.C. 54 pp.

Abstract. A 300-kHz Acoustic Doppler Current Profiler (ADCP) was used aboard the USNS Bartlett as part of the Green Sheet 91 experiment during June 1991 in the Gulf of Mexico. The purpose of the experiment was to lay out a sheet of dye at the bottom of the mixed layer for later sampling by an airborne LIDAR system. Ship's tracks relative to targeted depths were calculated that reconstructed the dye deployment and sampling process. During the practice deployment, a small front was found between the second and third leg which adversely affected the location and geometry of the dye sheet. During the first LIDAR test, currents rotating strongly in depth and weakly in the horizontal also adversely affected the character of the final dye sheet. A shear-advection model was developed, using ADCP data and concurrently recorded navigation data, to predict the dye sheet evolution. The results of the model helped understand the evolution of dye sheets and were in agreement with the results of the LIDAR sampling during Flight One. For future Green Sheet experiments the ADCP should be used to provide real-time ship's tracks relative to a given water depth to aid dye deployment. The shear-advection model should be used in near-real-time to aid the vectoring of the plane over the evolved dye sheet.

Turner, R.E. 1991. Tide gauge records, water level rise, and subsidence in the northern Gulf of Mexico. Estuaries. 14(2):139-147.

Turner, R.E., W.W. Schroeder and W.J. Wiseman Jr. 1987. The role of stratification in the deoxygenation of Mobile Bay (Alabama) and adjacent shelf bottom waters. Estuaries. 10(1):13-19.

Abstract. Oxygen depletion in the shallow bottom waters of Mobile Bay, Alabama, and in adjacent near shore and continental shelf waters, is shown to be directly related to the intensity of water stratification. Low winds speeds are coincidental with the onset of water column stratification and the occurrence of hypoxic events. Hourly, daily, and seasonal changes in the relationship between percent oxygen saturation or oxygen concentration in the bottom waters and surface-bottom density differences indicate that the oxidized materials are recently formed, and not relic or over wintering carbon sources. The influence of density structure (water column stratification) in other oxygen-depleted coastal water masses is compared to Mobile Bay.

University of Florida, Coastal and Oceanographic Engineering Lab. 1972. Hurricane surge analysis for Choctawhatchee Bay, Florida. University of Florida, Coastal and Oceanographic Engineering Lab. Gainesville, FL. 13 pp.

Abstract. A study of projected storm tides in the area.

University of Florida, Coastal Engineering Laboratory 1958. Model study for the improvement of the jetties of the St. Andrews Bay entrance channel. Univ. of Florida. Gainesville, FL. 11 pp.

Abstract. This project studied ways of dealing with the erosion of the western bank of the channel entrance. Includes information on waves and tides.

University of West Florida. 1974. Baseline study of physical, chemical, biological, and socio-economic parameters of Navarre Beach. University of West Florida. Pensacola, FL. 156 pp.

Abstract. Bar built barrier islands parallel the northwestern coast of Florida for several miles. Santa Rosa Island extends from Pensacola to Destin, a distance of about 50 miles. Near the midpoint of the island is the community of Navarre Beach. There is great local interest in re-opening a pass through the island at this point to connect Santa Rosa Sound and the Gulf of Mexico. A pass was built there in 1965 but was not protected by jetties and so was closed by drifting sand within a few months. This study was promoted by a desire to gather baseline information on the chemical, physical, biological and socio-economic environment of the area prior to construction of the pass. This information could be useful in assessing the effect of re-opening the pass.

U.S. Army Corps of Engineers. 1957. Hurricane wave statistics for the Gulf of Mexico. U.S. Army Corps of Engineers, Technical Memorandum. 98:94.

Abstract. This report contains the results of a statistical hindcast study of the heights and periods of significant waves generated by hurricanes in the Gulf of Mexico in the period 1900 to 1949. Results are presented in a series of polar plots of frequencies of occurrence of waves of given height and period at deep-water (100 fathoms depth) stations at different bearings offshore from five coastal stations.

U.S. Army Corps of Engineers. 1979. Mississippi Sound and adjacent areas - reconnaissance report. Appendix A -resource inventory. U.S. Army Corps of Engineers, Mobile District. Mobile, AL. 273 pp.

Abstract. Information presented herein will give the reviewer, not familiar with the study area, available data with which to determine future study needs and to establish a baseline from which to assess potential project impacts on the study region's economic, social and environmental elements. For more detailed information the reader is referred to the selected bibliography at the end of this appendix.

U.S. Army Corps of Engineers. 1979. Mississippi Sound and adjacent areas reconnaissance report. Appendix E. Mathematical modeling. U.S. Army Corps of Engineers, Mobile District. Mobile, AL. 30 pp.

U.S. Army Corps of Engineers. 1979. Mississippi Sound and adjacent areas, reconnaissance report: Main Report. U.S. Army Corps of Engineers, Mobile District. Mobile, AL. 170 pp.

U.S. Army Corps of Engineers and Coastal Ecology Branch. 1994. A general investigation of St. Andrew Bay, Florida. U.S. Army Corps of Engineers. Mobile, AL. 39 pp.

Abstract. This report supplies a characterization of the marine environment in the vicinity of the navigation channel for Panama City Harbor. Includes information regarding water quality (temperature, salinity, pH, dissolved oxygen), chlorophyll a concentration, light transmission, zooplankton abundance and dominant taxa, sediments, benthic invertebrates, fishes, seagrass distribution and abundance, and current velocities.

U.S. Bureau of Commercial Fisheries. 1963. Inventory of oceanographic data for the western north Atlantic Ocean and the Gulf of Mexico. U.S. Bureau Comm. Fish. Circ. 176:39.
Abstract. Oceanographic station data, bathythermograph observations, and sea-surface temperature observations.

U.S. Department of Commerce and National Oceanic and Atmospheric Administration. 1978. Ocean thermal and velocity characteristics of the Gulf of Mexico relative to the placement of a moored OTEC plant. NOAA Tech. Memo. ERL AOML-33
Abstract. Historical review of data and literature, including some preliminary results of data reanalysis and recommendations for a measurement program for the OTEC site evaluation.

U.S. Department of Commerce and National Oceanic and Atmospheric Administration. 1979. Physical oceanographic conditions at a potential OTEC site in the Gulf of Mexico; 88°W, 29°N. NOAA Tech. Memo. ERL AOML-41
Abstract. This position off Alabama was occupied to obtain temperature, density and current data for a potential OTEC site. Neither the Loop Current nor eddies detached from the loop were observed within 100 km of the site. A temperature front separating colder coastal water from warmer deep basin water moved from north to south past the site during winter. Lower temperatures were associated with the frontal passage.

U.S. Department of Commerce and National Oceanic and Atmospheric Administration. 1979. Wind-driven transport, Atlantic coast and Gulf of Mexico. NOAA Tech. Rep. NMFS Circ. 427:175-208.
Abstract. Surface waters were found to respond to the surface wind stress by flowing in a direction 45° to the right of the stress direction. The net water transport is 90° to the right of the surface stress direction.

U.S. Department of Commerce and National Oceanic and Atmospheric Administration. 1980. Physical oceanographic conditions at a potential OTEC site in the Gulf of Mexico; 27.5°N., 85.5°W. NOAA Tech. Memo. ERL AOML-42
Abstract. Temperature, salinity and current data were collected at a proposed OTEC site in the eastern Gulf of Mexico from March 1978 to June 1979. The study focused on vertical density differentials as a measure of expected efficiency in ocean thermal energy conversion. A cold temperature anomaly characterizing the winter of the previous year had returned to normal in March 1978.

U.S. Department of Commerce and National Oceanic and Atmospheric Administration. 1982. Ocean optical data from potential OTEC sites in the Gulf of Mexico. NOAA Tech. Memo. ERL AOML-49
Abstract. Coastal Zone Color Scanner imagery are calibrated with in situ measurements obtained as part of regular hydrographic cruises to the OTEC site off Tampa, Florida.

U.S. Department of Commerce and National Oceanic and Atmospheric Administration. 1982. Physical oceanographic observations in the eastern Gulf of Mexico during 1979-1980 for a potential OTEC site. NOAA Tech. Memo. ERL AOML-50

Abstract. Presents results of a two year field study near the Tampa OTEC site. Short term events were attributed to wintertime cold fronts, tropical storms and the Loop Current.

U.S. Department of Commerce and National Oceanic and Atmospheric Administration. 1983. An environmental guide to ocean thermal energy conversion (0TEC) operations in the Gulf of Mexico. NOAA Tech. Rept.

Abstract. Provides general description of flow features in Gulf of Mexico with focus on two prominent flow features: the Loop Current and a permanent anticyclonic gyre in the western and central Gulf.

U.S. Department of Commerce, National Oceanic Atmospheric Administration and U.S. National Oceanographic Data Center. 1970. CICAR - Bibliography on Meteorology, Climatology and Physical/Chemical Oceanography. Vol. 1 NODC. Washington, D.C. 380 pp.

U.S. Department of Commerce and National Oceanographic Data Center. 1978. NODC inventory of XBT data along transects in U.S. Atlantic and Gulf coastal waters from NMSF/MARAD ship of opportunity program for 1976. 24pp.

Abstract. Data catalogue.

U.S. Department of Defense and Department of the Navy. 1977. Dissolved silica and the circulation in the Yucatan strait and deep eastern Gulf of Mexico. Office of Naval Research, N00014-75-C-0539.

Abstract. Deep waters in Gulf of Mexico (below 1250m) were found to be richer in dissolved silica than same depth water in northwestern Caribbean. This disparity allows silica to be a useful natural tracer for the circulation patterns in the Yucatan Strait. It was also used to help select reference levels for geostrophic currents in Yucatan Strait for December 1982. With this reference level, the flow patterns derived from steric height generally match previously described patterns.

U.S. Department of Defense and Department of the Navy. 1978. Gulf of Mexico-OTEC far-field numerical studies: description and results of a two-layer model. Final report, Numerical Modeling Division, Environmental Models Branch Code 322, NORDA, NSTL Station, Mississippi. Gulf Stream. 7(4)

Abstract. Presents results of a two-layer primitive equation model with U.S. Department of Defense.

U.S. Department of Defense and Department of the Navy. 1981. Surface stress estimation for study of the circulation dynamics of the Gulf of Mexico. NORDA Technical Note 113.

Abstract. Evaluates the available wind data on a fine enough mesh to be of use in forecast models of ocean circulation. Because of the fine grid, more accurate horizontal derivatives can be obtained to estimate wind stress curl as boundary condition forcing in numerical models.

U.S. Department of Defense and Department of the Navy. 1985. USS AMERICA emergency breakaway environmental conditions. Naval Ocean Research and Development Activity Report 105.

Abstract. This investigation was prompted by the occurrence of highly energetic currents experienced during refueling operations in the Gulf of Mexico. The study ascribes these intense currents to the presence of the Loop Current extending onto the shelf region. The position of the Loop Current

is determined from satellite imagery in December 1984, and a brief summary of general oceanographic properties of the current is presented.

U.S. Department of Defense and United States Air Force. 1978. A climatology of monthly mean sea surface temperatures for the Gulf of Mexico. Final Report USAFETAC-PR-78-001. United States Air Force Air Weather Service (MAC), Environmental Technical Applications Center, Scott Air Force Base, Illinois.

Abstract. Presents charts of monthly mean SST values in 1° quadrangles for the entire Gulf of Mexico. A brief discussion of the SST data as it relates to prevailing ocean currents is also included.

U.S. Department of Defense 1986. 100-year hurricane wind, tide, wave and current characteristics and wave-current force. United States Air Force Headquarters Armament Division (AFSC). Contract F00635-86-M-0319, ANG/Gulfport, ACMI Storm Wave Study.

Abstract. Summarizes results of an analysis of 100 year hurricane wind, tide, wave and current characteristics and wave and combined wave-current forces at two tower locations of the proposed ANG/Gulfport Air Combat Maneuvering Instrumentation Range in the offshore Mississippi area of the Gulf of Mexico in the vicinity of 29°52'N, 88°27'W.

U.S. Department of Energy. 1978. Sea-surface temperature variability analysis of potential OTEC sites utilizing satellite data. Prepared by Vukovich, et al. for DOE under Contract No. EG 77-0-05-5444.

Abstract. The Gulf of Mexico is among the various potential OTEC regions studied by the use of four years of satellite infrared data for SST. Variability in the SST observed in the Gulf of Mexico OTEC region was attributed to surges in river water runoff and intrusions of Loop Current water. Hence the study provides some limited statistics on the position of the Loop Current over four years.

U.S. Department of Interior and Bureau of Land Management. 1975. Compilation and summation of historical and existing physical oceanographic data from the eastern Gulf of Mexico in support of the creation of a MAFLA sampling program. Submitted to BLM under Contract No. 08550-CT4-16.

Abstract. Describes MAFLA, a BLM-commissioned study to synthesize physical oceanographic and meteorologic data in the northeast Gulf of Mexico to develop an understanding of pollutant trajectories. Summarizes knowledge of atmospheric conditions, tides, river run-off, hydrography, and circulation of the shelf and deep basin. Mechanisms for inducing shelf motions are explored.

U.S. Department of Interior and Bureau of Land Management. 1976. A numerical modeling and observational effort to develop the capability to predict the computation. Prepared for BLM 08550-IA5-26.

Abstract. Numerical current simulation capability is demonstrated through a series of comparisons of observations with solutions of a numerical model. Solutions are consistent with the results from previous investigations including recognition of large-scale features such as the Loop Current, and a gyre in the Western Gulf. Documents temporal variability of circulation features in the western Florida, MAFLA region, and on the Texas-Louisiana shelf.

U.S. Department of Interior. 1982. Final Report: Southwest Florida Shelf Circulation Model. Minerals Management Service Contract No. AA851-CTO-72.
Abstract. Summary of shelf circulation model results of 18-month study to estimate the probable destination of water-borne pollutants. Study area extends from the Florida Keys to Apalachicola within the 200 meter isobath. Results indicate a composite fall-winter circulation with a dominant southerly flow at all levels.

U.S. Department of Interior. 1982. Southwest Florida Shelf Circulation Model. Volumes 1-3. Minerals Management Service Report No.: MMS-GM-PT-83-001, -013, and -014.
Abstract. Three volumes, including the final report, model documentation, and data report, summarize 18-month MMS study to estimate destination of water-borne pollutants originating from drilling and for predicting seasonal water circulation on the southwest continental shelf.

U.S. Department of Interior. 1983. Gulf of Mexico physical and chemical data from M/V ALASKA cruises. Minerals Management Service Special Scientific Report - Fisheries No. 249.
Abstract. The report is largely a tabulation of chemical data collected aboard the U.S. Fish and Wildlife Service M/V ALASKA when she performed a biological and oceanographic survey in the Gulf of Mexico. Tables include observations on salinity, temperature, sigma-t, nitrate, total phosphorus, inorganic phosphorus, carbohydrates, and proteins. It includes a brief introduction remarking on the physical oceanography of the Gulf of Mexico and its relation to organic compounds.

U.S. Department of Interior. 1986. Gulf of Mexico Circulation Modeling Study, Annual Progress Report: Year 2. Minerals Management Service OCS Study, MMS 85-0027. 94p.
Abstract. Second report in multi-year numerical modeling effort. Follow-up to U.S. Department of the Interior, 1984, citation. The intent of this study is to serve as and upgrade to the earlier model and attain a horizontal resolution of about 10 km. These second year modeling efforts resulted in computations on a 0.1° grid.

U.S. Department of Interior. 1986. Gulf of Mexico Physical Oceanography Program final report: Years 1 and 2. Vol. I: Executive summary. Minerals Management Service OCS Study, MMS 85-0093, U.S. DOI, 16p.
Abstract. Introductory overview to Volume II technical report.

U.S. Department of Interior. 1986. Gulf of Mexico Physical Oceanography Program final report: Years 1 and 2. Vol. II: Technical report. Minerals Management Service OCS Study, MMS 85-0094, U.S. DOI, 378p.
Abstract. Crucial reference for summarizing the major components of eastern Gulf of Mexico physical oceanographic features. Reports on interim result of a multi-year field program.

U.S. Department of Interior. 1986. Gulf of Mexico Ship-of-Opportunity data report, January 1983-October 1985. Minerals Management Service OCS Study, MMS 86-0028, U.S. DOI, 623p.
Abstract. Compendium of XBT observations obtained from several years of ship transects.

U.S. Department of Interior. 1986. Southwest Florida shelf ecosystem study, Year 2, Volumes 1 through 7. Minerals Management Service MMS 85-0066.
Abstract. Presents some of the most applicable results of a three-year multidisciplinary study of the processes and conditions on the shelf. Water column samples include temperature, salinity, transmissivity, chlorophyll and nutrients. Distributions were mapped by seasons.

U.S. Department of Interior. 1987. Gulf of Mexico Physical Oceanography Program final report: Year 4. Vol. I: Executive summary. Minerals Management Service OCS Study, MMS 85-0093. 14p.
Abstract. Introductory overview to Volume II technical report (U.S. Department of the Interior, 1987).

U.S. Department of Interior. 1988. Gulf of Mexico ship-of-opportunity data report, October 1985-March 1988. Science Applications International Corporation report submitted to the DOI/MMS Gulf of Mexico OCS Region.
Abstract. Second of two reports which document the MMS ship-of-opportunity program (SOOP) in the Gulf of Mexico for the time period from January 1983 through March 1988.

U.S. Dept. of Commerce and NOAA, National Ocean Service. 1993. Salinity characteristics of Gulf of Mexico estuaries. National Estuarine Inventory Program. NOAA. Silver Spring, MD. 197 pp.
Abstract. Pages 51-56 give information regarding the salinity of St. Andrew Bay, one of the 26 Gulf of Mexico estuaries covered in this report. Includes tables and maps.

U. S. Dept. of Commerce, NOAA/NOS 1985. National estuarine inventory data atlas: vol. 1: Physical and hydrologic characteristics. NOAA. Rockville, MD. various pp.
Abstract. Includes information concerning St. Andrew Bay.

U.S. Environmental Protection Agency. 1971. Circulation and benthic characterization studies: Escambia Bay, Florida. Southeast Water Quality Laboratory. Athens, Ga. 32 pp.

U.S. Environmental Protection Agency. 1982. Draft environmental impact statement for the Pensacola, FL, Mobile, AL, and Gulfport, MS dredged material disposal site designation. Environmental Protection Agency. Washington, D.C. 184 pp.
Abstract. The purpose of the action is to provide an environmentally acceptable ocean location for the disposal of dredged materials, which complies with the environmental impact criteria of the Ocean Dumping Regulations (40CFR220-229). Adverse environmental effects of the proposed action may include: (1) mounding, (2) smothering of some members of the benthos, and (3) increases in suspended sediment concentration. Adverse impacts within the site are unavoidable, but the disposal operation will be regulated to prevent unacceptable environmental degradation outside the site boundaries. The existing sites fulfill all criteria for site selection and are preferred over the alternative sites and areas based on evaluation of EPA's 11 site-specific criteria, and historical use. However, because potential impacts to the benthic community may be lessened at a larger Pensacola site it is recommended that this site be selected instead of the existing site. The Pensacola nearshore

alternative site is a geographic extension of the existing site and covers as area previously used for disposal of dredged material.

U.S. Environmental Protection Agency and Surveillance and Analysis Div. 1973. Effects of heated discharges from Gulf Power on the temperature regime and biota of the lower Escambia River. U.S. Environmental Protection Agency, Surveillance and Analysis Div. 71 pp.

Abstract. The report presents temperature studies of the Lower Escambia River. Studies of the invertebrate fauna and flora and in situ fish bioassay studies were conducted during September and October 1972. On July 20, 1972, discharges from the Gulf Power steam electric facility flowing into the Escambia River increased surface water temperature to 93F, 100 yards downstream from the point of discharge (POD). This represented and 11F increase over ambient temperatures recorded upstream from the point of discharge.

U. S. Environmental Protection Agency. 1975. Water quality study, St. Andrew Bay, Florida. EPA Report. 330/2-75-003:94.

Abstract. A comprehensive bacteriological, water quality, and remote sensing study of St. Andrew Bay.

U. S. Fish and Wildlife Service. 1954. Gulf of Mexico: Its origin, waters, and marine life. Fish. Bull. 55(89)

U.S. Geological Survey. 1963. Compilation of records of surface waters of the United States, October 1950 to September 1960, Part 2-B, south Atlantic slope and eastern Gulf of Mexico basin, Ogeechee River to Pearl River. U.S. Geological Survey, Water-Supply Paper. 1724:458.

U.S. Geological Survey. 1965. Quality of surface waters of the U.S. Parts 1 and 2: North Atlantic slope basins and South Atlantic and eastern Gulf of Mexico basins. U.S. Geological Survey, Water-Supply Paper. 1961:779.

U.S. National Environmental Satellite. 1985. NODC's water temperature guide to the Gulf coast. National Ocean Service. Riverdale, MD.

Abstract. This guide is based on monthly averages computed by the National Oceanographic Data Center. The coastal water temperatures were taken at the National Ocean Service tide stations. The buoy data was collected by the NOAA Data Buoy center.

Van Vleet, E.S., W.M. Sackett, S.B. Reinhardt and M.E. Mangini. 1984. Distribution, sources and fates of floating oil residues in the eastern Gulf of Mexico. Mar. Pollut. Bull. 15:106-110.

Abstract. Pelagic tar was monitored over a two-year period in the eastern gulf. Tar concentrations were substantially higher than values reported for other areas around the world. Tar is primarily associated with the Gulf Loop Current; continental shelf areas are relatively uncontaminated. Grounding of significant amounts of tar occurs primarily along SE Florida. Approximately 10-50% of the tar is transported from the Caribbean via the Yucatan Straits; the remainder originates within the gulf. About half of the tar samples appear to have originated from tankers.

Vastano, A.C., C. Barron, C. Lowe and E. Wells. 1991. 11.0 Satellite oceanography. pp. 862. *In* Brooks, J.M., ed. Mississippi-Alabama Continental Shelf Ecosystem Study: Data Summary and Synthesis. Volume II: Technical Narrative. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, LA. (OCS Study MMS 91-0063.)

Vidal, V.M.V., F.V. Vidal and J.M. Perez-Molero. 1989. Atlas Oceanografico del Golfo de Mexico, Vol. I. Grupo de Estudios Oceanograficos, Instituto de Investigaciones Electricas.

Vittor and Associates. 1983. Characterization and development of valuation methodology for Mobile Bay and offshore area. U.S. Army Corps of Engineers, Mobile District. Mobile, AL.

Abstract. This report summarizes the various studies conducted in Mobile Bay and the near shore area from the perspective of oil and gas development. Topics include geological resources, water resources, flora and faunal resources and ecosystem values. Data gaps for the Mobile Bay area are discussed as well as an annotated bibliography.

Volgenau, D. 1970. Hurricane heat potential of the Gulf of Mexico. Master's Thesis. Naval Postgraduate School, Monterey, CA.

Abstract. An analysis of the 'hurricane heat potential' of the Gulf of Mexico early in the hurricane seasons for the individual years 1965 to 1968 was conducted. Results show that if the heat content of water at 26°C is taken as zero, then the amount of heat available per cm^2 in the Gulf varies from approximately 700 to 31,600 calories. The areas of high heat content are found to vary yearly. Further, since the sea surface temperature decrease during a storm depends upon the near surface vertical temperature gradient, the temperature differences between the surface and 30m depth were also studied. Vertical temperature differences were found to vary from 0°C to 11.6°C, depending upon location. Computations based on ranges of heat content and vertical temperature structure showed that a passing hurricane with an assumed flux from the sea of 4,000 $cal/cm^2/day$ would cause the sea surface temperature to decrease some 3.1°C per day in some regions but only 0.8°C in others.

Vukovich, F.M. 1982. A comparison of surface temperatures from HCMM infrared data with field measurements. Cont. Rep. to NASA. 58 pp.

Abstract. Heat Capacity Mapping Mission surface temperatures were compared to field data obtained in the Mississippi River, in the Atlantic Ocean in the vicinity of the Nantucket Shoals, and in the eastern Gulf of Mexico. The absolute and relative accuracies of the infrared data were determined.

Vukovich, F.M. 1986. Aspects of the behavior of cold perturbations in the eastern Gulf of Mexico: A case study. J. Phys. Ocean. 16(1):175-188.

Abstract. Between 2 March and 13 May 1983, while using in-situ and satellite data, three cold perturbations observed off the west Florida shelf moved southward along the boundary of the Loop Current at speeds of about 4 to 10 km/day. Geostrophic currents and current meter data indicated a cyclonic circulation associated with the cold perturbations. The geostrophic current indicated northward flow on the west side of the warm filaments that formed on the shoreward side of the cold perturbation, and weak southward flow on the east side. However, the current meter data

only gave indications of northward flow in the filaments. The current meter array may not have been able to discriminate the entire flow pattern in the filaments.

Vukovich, F.M. 1986. Loop Current boundary variations. EOS, Trans. AGU. 67(44):1049.

Abstract. Analysis of satellite imagery defines two types of fluctuations in the Loop Current boundary including that associated with excursions deep into the eastern Gulf of Mexico and separation of major rings. Also, meso-scale cyclonic perturbations on the current boundary are characterized in terms of spatial extent.

Vukovich, F.M. and B.W. Crissman. 1986. Aspects of warm rings in the Gulf of Mexico. J. Geophys. Res. 91(C2):2645-2660.

Abstract. Satellite infrared and Ship-of-Opportunity data from 1973 to 1984 show three characteristic paths of ring movement, all of which eventually lead the ring to the northwestern portion of the Gulf of Mexico.

Vukovich, F.M. and B.W. Crissman. 1986. Ocean Front Analysis in the Northern Gulf of Mexico Using CZCS Data, Final Report. Prepared for SOHIO Petroleum Company, Contract No. NT-HEM-1941. Research Triangle Institute. Research Triangle Park, NC. 53 pp.

Abstract. The purpose of this project was to develop frontal analyses of major ocean features in the Gulf of Mexico, North of 25°N, and west of 85°W, using Coastal Zone Color Scanner (CZCS) data. The frontal analyses were derived for the period of June through October and for the years 1980 through 1983. the major features in the Gulf of Mexico that were the focus of this study were the Loop Current, warm rings, and shelf fronts. Because there is generally a small thermal contrast at the surface and an increase in the atmospheric noise (mostly brought about by increased water vapor) in the period of June through October, the frontal analyses required for this study could not be determined using satellite infrared (IR) sea-surface temperature data.

Vukovich, F.M., B.W. Crissman, M. Bushnell and W.J. King. 1979. Aspects of cold intrusions in the eastern Gulf of Mexico near the Mississippi Delta and Mobile Bay. Gulfstream. V(9):3,6-7.

Abstract. Infrared images from NOAA and NIMBUS satellites for a 5-year period (1973-77) were used to study cold-water intrusions in the Eastern Gulf of Mexico near Mobile Bay and the Mississippi Delta. The NOAA Very High Resolution Radiometer (VHRR) images were analyzed for meso-scale variations in sea-surface temperature at the shelf break in the region of interest. (The 200-m bathymetric contour was used as the shelf break.) Relative temperature variations in the VHRR imagery are displayed in contrasting densities on a calibrated gray scale; the relative variation in surface ocean temperatures can be used to define surface thermal boundaries, called fronts..

Vukovich, F.M., B.W. Crissman, M. Bushnell and W.J. King. 1979. Some aspects of the oceanography of the Gulf of Mexico using satellite and in situ data. J. Geophys. Res. 84(C12):7749-7768.

Abstract. Satellite infrared data and in situ data were combined to study synoptic-scale and mesoscale fronts in the Gulf of Mexico in the period 1973-1977. Deep northward penetrations of the Loop Current were noted in

the winter, and a major warm gyre developed in the winter, 1974. Other major warm gyres were seen to develop in the early spring (1974 and 1977). In all cases, a very large meander developed off the southern part of the west Florida shelf prior to the development of the major warm gyre. Smaller meanders were seen to move along the Loop Current boundary at an average speed of 28 km/day and with an average wavelength of 210 km.

Vukovich, F.M., B.W. Crissman and D. Erlich. 1980. Sea-surface temperature variability analysis of potential OTEC sites in the eastern Gulf of Mexico utilizing satellite data. Interim Report, Contract No. 03-78-B01-72, National Oceanic and Atmospheric Administration, 37 pp.

Vukovich, F.M. and G.A. Maul. 1985. Cyclonic eddies in the eastern Gulf of Mexico. J. Phys. Ocean. 15(1):105-117.

Abstract. Cold-domed cyclonic eddies juxtaposed to the cyclonic shear side of the Loop Current are observed in simultaneously obtained hydrographic, current meter mooring, and satellite infrared data. The cyclones are initially observed in the satellite data as cold perturbations on the northern extreme of the current and grow either into a cold tongue or a quasi-stable meander off the Dry Tortugas, Florida. Areal shipboard surveys show closed isopleths of temperature and salinity, and surface geostrophic current speeds relative to 1000 db are in excess of 100 cm/s. The diameter of the cold domes varied from 80 to 120 km.

Waddell, E. 1984. Loop Current temperature and velocity fields. EOS, Trans. AGU. 65(45):968.

Abstract. Report of the results of an extensive survey of the Loop Current in May 1984 that produced nearly-synoptic fields relative to major fluctuations in the current. Documents regions of strong vertical shear near the boundaries of the current. Also, describes locally strong horizontal shear zones near inflow/outflow regions to the Gulf of Mexico.

Waddell, E. 1986. Gulf of Mexico Physical Oceanography Program Final Report Years 1 and 2, Volume II Technical Report. Prepared for Minerals Management Service under Contract No. 14-12-0001-2915 by Science Applications International Corporation, Raleigh, NC, 378 pp.

Wade, T.L., E.L. Atlas, J.M. Brooks, M.C. Kennicutt II, R.G. Fox, J. Sericano, B. Garcia-Romero and D. DeFreitas. 1988. NOAA Gulf of Mexico Status and Trends Program: Trace organic contaminant distribution in sediments and oysters. Estuaries. 11(3):171-179.

Wagner, J., G.R. Fisher, J.W. McCartney, R.G. McWilliams, R.S. Dawdy, B. Kranzer, M. Drake, R.A. Mills and D.E. Barr. 1984. Northwest Florida Water Management District. pp. 198-217. *In* Fernald, E.A. and D.J. Patton, eds. Water Resources Atlas of Florida. Florida State University, Tallahassee, FL.

Wahl, R.J. 1993. Observed currents from the entrance of Pensacola Bay to the Vvcinity of the Allegheny Pier. Technical Note. Naval Oceanographic Office. NSTL Station, MS. 21 pp.

Abstract. In July 1992, the Naval Oceanographic Office received a request to provide real-time current measurements in support of USS FORRESTAL prior

to and during several docking evolutions between late July 1992 and early September 1992. This report summarizes the development of a measurement system that collects and forwards current measurements in real time and describes the data collected from the Pensacola Bay entrance to the Allegheny Pier at the Naval Air Station, Pensacola, Florida.

Wallace, D.W. 1980. Distribution of Mississippi River water under high flow conditions in the Gulf of Mexico. Florida Dept. of Natural Resources Marine Research Laboratory, Florida Marine Research Publications.
Abstract. Examines the occurrence of coherent low salinity lens, formed by anomalously high river outflow rates. The lens can be transported intact to various portions of the Gulf of Mexico or western Atlantic. A recurrence rate for this event is hypothesized.

Wallcraft, A.J. 1984. Gulf of Mexico Circulation Modeling Study, Annual Progress Report, Year 1. OCS Study, MMS 85-0025. U.S. Department of Interior, Minerals Management Service. New Orleans, LA. 106 pp.
Abstract. Results of the first year of the modeling component for a major multi-year investigation of large-scale flow field in the Gulf of Mexico. These initial modeling computations are on a 0.2° grid, with future, finer-resolution modeling planned.

Wallcraft, A.J. 1986. Gulf of Mexico circulation modeling study, Annual Progress Report: Year 2. Progress report by JAYCOR submitted to the Minerals Management Service, Metairie, La. MMS Contract No. 14-12-0001-300073. 94 pp.

Wallcraft, A.J. 1991. Gulf of Mexico circulation modeling study, Annual Progress Report: Years 3 and 4. Final Report. 1982-90. Minerals Management Service. Metairie, LA. 226 pp.
Abstract. This is the final report of a four-year numerical ocean circulation modeling program for the Gulf of Mexico. The aim of the program was to progressively upgrade an existing model of the Gulf of Mexico to provide the most realistic long-term simulation possible of Gulf circulation. The NOARL/JAYCOR multi-layer hydrodynamic and thermodynamic primitive equation circulation models of the Gulf of Mexico on a 0.2° and a 0.1° grid were used in the program. They were forced by constant inflow through the Yucatan Straits compensated by outflow through the Florida Straits, and by wind stresses from the Navy Corrected Geostrophic Wind data set for the Gulf of Mexico. The most realistic simulation produced by the program was a blending of one- and two-layer experiments, augmented by a perturbation analysis to extract surface currents from the vertically averaged ocean model velocities. Actual wind stresses from 1967-1982 were used to force the simulation, but the resulting currents are intended to be representative of Gulf circulation rather than a hindcast of the actual state of the Gulf over this time period. Wind stress, surface current, and geostrophic surface current fields from this simulation, sampled every three days for 10 years, have been delivered to MMS. Current fields at 100, 300, 750, and 1600 meter depths, sampled every six days for the same 10-year period, have also been delivered. Also, detailed vertical current profiles have been delivered to the locations of all moored buoys used in Years 1 through 5 of MMS's recently concluded Gulf of Mexico Physical Oceanography Program.

Wallcraft, A.J. 1991. Navy layered ocean model users guide. Planning Systems, Inc. Slidell, LA. 28 pp.

Abstract. This report is a users guide to the Navy's hydrodynamic (isopycnal) nonlinear, primitive equation, layered ocean circulation model. The model retains the free surface and uses a semi-implicit time scheme that treats all gravity waves implicitly. It can handle full-scale bottom topography, provided it is confined to the lowest layer, and an arbitrary coastline geometry. The model has been in use at the Naval Oceanographic and Atmospheric Research Laboratory for more than 10 years for simulations of the ocean circulation in the Gulf of Mexico, the Caribbean Sea, the Alboran Sea, the western Mediterranean Sea, and the global oceans. In conjunction with the issuance of this report, the model code is being made available to the ocean modeling community. The vertically integrated equations of motion and their finite difference discretization on a C-grid is presented, as is a description on the semi-implicit time scheme, the boundary conditions, and the external forcing. The model code contains internal documentation that fully describes the user-specified model parameters and data sets. This report also contains general information about how to use the model, in particular, how to set it up for a new ocean region and how to port it to a new computer system.

Wallcraft, A., T. Townsend and D. Grant. 1985. Wind-driven ocean modeling and ocean model development; Final Rpt. J665-85-006/6251. Jaycor. Alexandria. 89 pp.

Abstract. Numerical simulations were performed with a 0.2°, two-layer, free surface, primitive equation, ocean circulation model of the Gulf of Mexico with a realistic bottom topography and coastline. As in previous simulations, with idealized bottom topography and coastline, realistic Loop Current behavior could be obtained without wind forcing and with constant inflow through the Yucatan Straits. However, simulations with both wind and port forcing showed significantly more variation than those with port forcing alone. A similar two-layer model was set up for a North Atlantic region, from 20°N, 82°W to 48°N, 30°W, on a 0.25° by 0.2° grid. A 'Black Box' multigrid package was prepared for solving finite-difference Helmholtz's equations with staggered grid Neumann boundary conditions in nonrectangular regions. In semi-implicit free surface primitive equation ocean models, it is competitive with other powerful iterative methods but slower than the direct Capacitance Matrix Technique. Several wind stress data sets were prepared for use in ocean models, based on global analysis products from FNOC and NMC, regional analysis products from FNOC, and ship observations. These data sets have been used to drive ocean circulation model of the World Ocean, the Indian Ocean, the North Atlantic, and the Western Mediterranean Sea.

Walsh, J.J., D.A. Dieterle, W.W. Gregg and J.R. Pribble. 1989. Simulation analysis of moored fluorometer time series from the Mid-Atlantic Bight: Progress Report, FY 1988-1989. Department of Energy. DOE/ER/60285-6:122.

Abstract. A two-layered baroclinic circulation model and a 21-layered biochemical model are used to explore the consequences of Loop Current-induced upwelling and terrestrial eutrophication on 'new' production within the Gulf of Mexico. During a quasi-annual penetration and eddy-shedding cycle of the Loop Current, the simulated seasonal changes of incident radiation, wind stress, and surface mixed layer depth induce an annual cycle of algal biomass that corresponds to in situ and satellite

time series of chlorophyll. The simulated nitrate fields match those of shipboard surveys, while fallout of particulate matter approximates that caught in sediment traps and accumulating in bottom sediments. Assuming an f ratio of 0.06 to 0.12, the total primary production of the Gulf of Mexico might be 105 to 210 g $C/m^2/yr$ in the absence of anthropogenic nutrient loadings, i.e., 2 to 3 fold that of oligotrophic regions not impacted by western boundary currents. Less than 25% of the nitrogen effluent of the Mississippi River may be stored in bottom sediments, with most of this input dispersed in dissolved form beneath the pycnocline, after remineralization of particulate detritus within several production cycles derived from riverine loading. At a sinking rate of 3 m/day however, sufficient phytodetritus survives oxidation in the water column to balance estimates of bottom metabolism and burial at the margins.

Walsh, J.J., D.A. Dieterle, M.B. Meyers and F.E. Muller-Karger. 1989. Nitrogen exchange at the continental margin: a numerical study of the Gulf of Mexico. Prog. Oceanogr. 23(4):245-301.

Abstract. A two-layered baroclinic circulation model and a 21-layered biochemical model are used to explore the consequences of Loop Current-induced upwelling and terrestrial eutrophication on new production within the Gulf of Mexico. During a quasi-annual penetration and eddy-shedding cycle of the Loop Current, the simulated seasonal changes of incident radiation, wind stress, and surface mixed layer depth induce an annual cycle of algal biomass that corresponds to in situ and satellite time series of chlorophyll. The simulated nitrate fields match those of shipboard surveys, while fallout of particulate matter approximates that caught in sediment traps and accumulating in bottom sediments. Assuming an f ratio of 0.06-0.12, the total primary production of the Gulf of Mexico might be 105 to 210 g $C/m^2/yr$ in the absence of anthropogenic nutrient loadings, i.e. 2-3 fold that of oligotrophic regions not impacted by western boundary currents. Less than 25% of the nitrogen effluent of the Mississippi River may be stored in bottom sediments, with most of this input dispersed in dissolved form beneath the pycnocline, after remineralization of particulate detritus within several production cycles derived from riverine loading. At a sinking rate of 3m/d, however, sufficient phytodetritus survives oxidation in the water column to balance estimates of bottom metabolism and burial at the margins.

Wang, X. 1992. Interaction of an eddy with a continental slope. Ph.D. Dissertation. Massachusetts Institute of Technology. Boston, MA.

Abstract. This study concerns the barotropic interactions between a mesoscale eddy and a straight monotonic bottom topography. Through simple to relatively complicated modeling effort, some of the fundamental properties of the interaction are investigated. In chapter two, the fundamental aspects of the interaction are examined using a simple contour dynamics model. With the simplest model configuration of an ideal vortex and a step topography, the basic dynamical features of the observed oceanic eddy-topography interaction are qualitatively reproduced. The results consist of eddy-induced cross-topography exchange, formation of topographic eddies, eddy propagation and generation of topographic waves. In chapter three, a more complicated primitive equation model is used to investigate a mesoscale eddy interacting with an exponential continental shelf/slope topography on both f and beta-planes. The f-plane model recasts the important features

of chapter two. The roles of the eddy size and strength and the geometry of topography are studied. It is seen that the multiple anticyclonic eddy-slope interactions strongly affect the total cross-slope volume transport and the evolution of both the original anticyclone and the topographic eddy. Since a cyclone is trapped at the slope and eventually moves on to the slope, it is most effective in causing perturbation on the shelf and slope. It is found that the straight eddy incident is more effective in achieving large onslope eddy penetration distance than the oblique eddy incident. A weak along-slope current near the edge of the slope is found, which is part of a outer slope circulation cell originated from the Rossby wave wake trailing the propagating eddy. Model-observation comparisons in chapter four show favorable qualitative agreement of the model results with some of the observed events in the eastern U.S. continental margins and in the Gulf of Mexico

Wanstrath, J.J. 1976. Storm surge simulation in transformed coordinates, Vol. 1, Theory and application. Technical Report No. 76-3. United States Army Corps of Engineers, Coastal Engineering Research Center. Ft. Belvoir, VA. 166 pp.

Abstract. A two-dimensional time-dependent, numerical storm surge model using orthogonal curvilinear coordinates is presented. The curvilinear coordinate system is based on a conformal mapping of the interior region, bounded by the actual coast, the seaward boundary (taken as the 180-m depth contour), and two parallel lateral boundaries, into a rectangle in the image plane. Three regions of the Continental Shelf of the Gulf of Mexico and two regions of the eastern seaboard of the U.S. are mapped. Since the transformation is conformal, the associated modifications of the vertically integrated equations of motion and mass continuity are minimized. The coast, seaward boundary, and the lateral boundaries of the computing grid are straight lines in the image plane, thus facilitating the application of the boundary conditions. The final coordinates allow for the greatest resolution near the coast in a central area of principal storm surge development and modification. The model is used in the simulation of the storm surge induced by Hurricanes Carla (1961) and Camille (1969), which crossed the gulf coast of the United States, and Hurricane Gracie (1959), which crossed the east coast. Analytical interpretations of the wind and atmospheric pressure-forcing functions are used in the computations.

Wanstrath, J.J. 1976. Storm surge simulation in transformed coordinates. Volume II. Program Documentation. CERC-TR-76-3-Vol-2. Coastal Engineering Research Center. Ft. Belvoir, VA. 178 pp.

Abstract. A two-dimensional time-dependent numerical storm surge model using orthogonal curvilinear coordinates is presented. The curvilinear coordinate system is based on a conformal mapping of the interior region bounded by the actual coast, the seaward boundary (taken as the 180-meter depth contour) and two parallel lateral boundaries into a rectangle in the image plane. Three regions of the Continental Shelf of the Gulf of Mexico and two regions of the eastern seaboard of the United States are mapped. Since the transformation is conformal, the associated modifications of the vertically integrated equations of motion and mass continuity are minimized. The coast, seaward boundary, and the lateral boundaries of the computing grid are straight lines in the image plane thus facilitating the application of the boundary conditions. The final

coordinates allow for the greatest resolution near the coast in a central area of principal storm surge development and modification. The model is employed in the simulation of the storm surge induced by Hurricanes Carla (1961) and Camille (1969) which crossed the gulf coast of the United States and Hurricane Gracie (1959) which crossed the east coast. Analytical interpretations of the wind and atmospheric pressure-forcing functions are used in the computations.

Ward, E.G. 1974. Ocean data gathering program, an overview. Shell Development Company.

Abstract. The ocean data gathering program resulted in the collection of oceanographic and meteorological data at six offshore sites in the Gulf of Mexico from 1968-1971. The primary goal of the program was to obtain data on extreme conditions generated by severe hurricanes in the Gulf of Mexico. Parameters continuously recorded are wave amplitude, wind speed and direction, and barometric pressure.

Ward, E.G., L.E. Borgman and V.J. Cardone. 1979. Statistics of hurricane waves in the Gulf of Mexico. J. Petrol. Technol. 31(5):632-642.

Abstract. By using hurricane data from 1900-1974, an historical wave data base was produced by hindcasting. A model was then applied to estimate the cumulative probability distribution function for the largest wave in a given number of years.

Warsh, K.L., E.Z. Stakhiv and M. Garstang. 1970. On the relation between the surface temperatures of the Gulf of Mexico and its circulation. Bull. Mar. Sci. 20(4):803-812.

Wartha-Clark, J. and A. Bell. 1983. East Coast ocean features - July 1983. Oceanogr. Mon. Summ. 3(7):18-20.

Abstract. A significant feature in the end-of-July Gulf Stream is the large amplitude trough near 38°N 59°W. During July, one anticyclonic eddy was formed and two anticyclonic eddies were newly observed. An anticyclonic eddy was formed from a Stream meander near 41°N 53°W on June 18. Near isothermal SST conditions have prevailed since early July in the Gulf of Mexico. The Loop Current was last partially discerned on July 5 by the Miami Satellite Field Service Station using geostationary satellite data.

Wartha-Clark, J. and A. Bell. 1983. East Coast ocean features - May 1983. Oceanogr. Mon. Summ. 3(5):18-19.

Abstract. The end-of-May amplitude of the Loop Current in the Gulf of Mexico increased about 30 km north from the end-of-April position. Due to seasonal heating, thermal features in the Gulf of Mexico are becoming less discernible. The southwestern edge of the Loop was last clearly observed on May 15. One anticyclonic eddy formed and one was absorbed by the Gulf Stream during May. Two newly observed cyclonic eddies were detected and at least one eddy was absorbed. Additional information on eddy movements are included.

Wartha-Clark, J. and A. Bell. 1983. East Coast (USA) ocean features. Oceanogr. Mon. Summ. 3(10):18-19.

Abstract. October 1983 positions of the Gulf Stream System and its associated eddies are shown for the NW Atlantic and the Gulf of Mexico. The Gulf Stream and Loop Current boundaries are located by infrared satellite

imagery or XBT (expendable bathythermograph) data. One anticyclonic eddy was formed, one anticyclonic eddy was absorbed by the Gulf Stream and two apparently dissipated during October.

Wartha-Clark, J. and A. Bell. 1984. East Coast ocean features, February 1984. Oceanogr. Mon. Summ. 9(2):18-19.

Abstract. The end of this month's positions of the Gulf Stream system and its associated eddies are shown for the NW Atlantic and the Gulf of Mexico. The Gulf Stream and Loop Current boundaries are located by infrared satellite imagery or XBT (expendable bathythermograph) data. Anticyclonic eddies are labeled a-z in the Gulf of Mexico and 1-99 in the NW Atlantic. Cyclonic eddies are labeled A-Z. Arrows on eddies indicate direction of circulation. Warm-core or anticyclonic eddies rotate clockwise; cold-core or cyclonic eddies rotate counterclockwise. The line to the eddy center shows the net translation since last months or since last observed.

Weissman, D.E. 1983. The Dependence of the Radar Modulation Transfer Function on Environmental Conditions and Wave Parameters. DEW-83-1. David E. Weissman. Northport, NY. 27 pp.

Abstract. Recent measurements of ocean wave-radar modulation transfer function (MTF) from fixed ocean platforms, over a period of several years, have demonstrated that the local hydrodynamic modulation of short centimetric waves is affected by the air-sea interaction. Results from widely separated ocean regions also show different individual properties, that make detailed measurements necessary. An X-band radar with vertical polarization was mounted on a platform in the Gulf of Mexico during Nov.-Dec. 1978. The data set is computer stored and was processed. A selective study of this data has been conducted on the separate, independent influence of wind speed, air-sea temperature difference and wave slope on the MTF and the average radar cross section. Dependence on all these parameters was observed. Data from other experiments agree with these results. Variations of the coherence function for the modulation transfer function imply that other mechanisms must be found for these modulation effects other than hydrodynamic (wave-wave) interactions. An important conclusion of this study is that the surface stress depends not only on wind speed, but also on air-sea temperature difference and wave slope.

Wennekens, M.P. 1959. Water mass properties of the Straits of Florida and related waters. Bull. Mar. Sci. Gulf Carib. 9:1-52.

Abstract. Demonstrates the importance of Gulf water in the Gulf Stream System by identifying its high-salinity signature. Also, low salinity Antarctic Intermediate Water is tracked through the Gulf of Mexico and Straits of Florida.

Wert, R.T. 1970. A baroclinic prognostic numerical model of the circulation in the Gulf of Mexico. Ph.D. Dissertation. Texas A&M University, College Station, TX. 75 pp.

Westerink, J.J., R.A. Luettich, A.M. Baptista, N.W. Scheffner and P. Farrar. 1992. Tide and storm surge predictions using finite-element model. Journal of Hydraulic Engineering, New York. 118(10):1373-1390.

Abstract. A finite-element (FE) model is used to study tides and hurricane storm surge in the Gulf of Mexico in the region ranging from the Mississippi Sound to the northwest coast of Florida. Issues that are

emphasized include the use of large domains, the importance of a high degree of grid resolution in coastal regions of interest, the use of meshes with highly varying nodal densities to minimize the size of the discrete problem, and the use of the generalized wave-continuity equation (GWCE) for FE-based solutions to the shallow-water equations. The computations presented are unprecedented in their scope, level of localized detail, and degree of grid-size variability. The GWCE-based FE model leads to very accurate and efficient flow solutions.

Westerink, J.J., R.A. Luettich and N. Scheffner. 1993. ADCIRC: An Advanced Three-Dimensional Circulation Model for Shelves, Coasts, and Estuaries. Report 3. Development of a Tidal Constituent DataBase for the Western North Atlantic and Gulf of Mexico. Technical Rpt. See also Report 1, AD-A261 608. Prepared in collaboration with Dept. of Civil Engineering and Geological Science, University of Notre Dame, Notre Dame, IN and University of North Carolina at Chapel Hill, Institute of Marine Sciences, Morehead City, NC. Coastal Engineering Research Center. Vicksburg, MS. 151 pp.

Abstract. This report describes the application of model ADCIRC-2DDI, a two-dimensional, depth-integrated, finite-element-based hydrodynamic circulation code, to the western North Atlantic, Gulf of Mexico and Caribbean Sea in order to develop a tidal constituent database. Issues that are emphasized in the development of the Western North Atlantic Tidal (WNAT) model include the definition of hydrodynamically simple open ocean boundaries; the use of large domains; the importance of a high degree of grid resolution in coastal regions; and the use of finite element meshes with highly varying nodal densities in order to minimize the size of the discrete problem. The development of an optimal graded finite element mesh is based on regular and graded grid convergence studies using an M_2 tidal forcing function on the boundary and within the domain. The optimal graded mesh is then forced for eight diurnal and semidiurnal astronomical tidal constituents (K_1, O_1, P_1, Q_1, M_2, S_2, N_2, and K_2) on the open ocean boundary by coupling to Schwiderski's (1979; 1981 a-g) global model results as well as within the interior domain using a tidal potential forcing function. The structure of the various tides is examined and results are compared to field data at 77 stations.

Whitaker, R.E. 1971. Seasonal variations of steric and recorded sea level of the Gulf of Mexico. Vol. 71-14T Texas A&M University. College Station, TX. 110 pp.

Abstract. Monthly mean steric sea levels (geopotential) relative to 150 db are computed for the Gulf of Mexico from monthly mean temperature fields and a constant salinity. The temperature distributions for the upper 150 m of the Gulf are determined from some 17,000 BT observations. The monthly topographies of the 22°C surface, which are roughly expended mirror images of sea-surface geopotential relative to a deep reference pressure, exhibit a set of regular annual changes. The Loop Current and its seasonal variation and the western high-pressure region are clearly indicated. The monthly steric sea levels (relative to 150 db) are found to agree with the known, large-scale, persistent features of the surface circulation although the indicated Loop Current is less intense than it is known to be. However, when the geopotential is taken relative to 1000 db for months with sufficient data, February and August, the topography

gives velocities which agree quantitatively with known current velocities. The ranges of recorded sea level at nine tide stations around the Gulf are accounted for to the extent of 42-57% by the steric sea levels for regions of 150 m depth or more.

Wieckowicz, R.P. 1977. Thermal plume surveys of Gulf Power Scholz Plant September 14, 1977. Florida Department of Environmental Regulation. Tallahassee, FL.

Williams, J., W.F. Grey, E.B. Murphy and J.J. Crane. 1977. Drift bottle analyses of eastern Gulf of Mexico surface circulation. Prog. Oceanogr. 4(Pt. 3):1-134.

Abstract. Some 4,460 drift bottles was released in continental shelf waters between Tampa Bay and Ft. Myers, Florida, during Project Hourglass, a 28-mo (1965 to 1967) systematic sampling program. The number of recoveries was 1,415 or 31.73% of those released. Coastlines where bottles were recovered were divided into 5 geographic areas for analyses. Winter releases resulted in the greatest number of returns from the Florida east coast and Keys. Spring and summer releases resulted in high percentages of returns from the lower west Florida coast (Area I). The greatest number of returns from the western Gulf of Mexico (Area IV) was from summer and fall releases. A sequential pattern of Loop Current development (intrusion, spreading, eddy formation, decay) was well documented by hydrographic and satellite data. Recent monitoring via satellite imagery has shown, that a well established seasonal pattern cannot always be anticipated and that short term variation in its position can be very significant. Anticyclonic and cyclonic eddy complexes are presented as important features which may have influenced circulation of surface waters from the Hourglass sampling area toward the western Gulf. A northerly longshore current frequently observed in spring and summer is attributed to small scale cyclonic eddies associated with the Loop Current. Wind rose data for selected periods suggest that local winds can strongly influence surface circulation in nearshore areas, and may also serve as a mechanism for transport of surface waters into areas dominated by the Loop Current.

Williams, S.A. 1981. Salinity differences between a high and low marsh of northwestern Florida. Fla. Sci. 44(4):224-228.

Abstract. An analysis of soils from a high marsh and low marsh in northwestern Florida showed that they contained large amounts of sand, and were low in cation exchange capacity and exchangeable cations. The soils examined contained high levels of soluble salts. Soils from the low marsh had higher cation exchange capacities than did the layers below.

Wilson, C.R. 1972. A vitamin B_{12} study in portions of Escambia and Blackwater Bays, Florida. Master's Thesis. University of West Florida, Pensacola, FL. 70 pp.

Abstract. Vitamin B_{12} was measured by the lactobacillus and ochromonas assays from 5 stations in Mulatto Bayou and Catfish Basin, Florida between August and October, 1978. Other measurements included depth, temperature, pH, salinity, turbidity, and bacterial counts.

Wilson, R.J. 1967. Amount and distribution of water masses in February and March 1962 in the Gulf of Mexico. Master's Thesis. Texas A&M University, College Station, TX. 54 pp.

Winchester, B.H. 1985. Correlations of benthic macroinvertebrate diversity and salinity in northwestern Florida estuaries. Estuaries. 8(2B):87A.
Abstract. Data collected over a 10-year period as part of a statewide monitoring program are examined to quantify the relationship between salinity and benthic macroinvertebrate diversity. Nine Florida estuaries in the northeastern Gulf of Mexico were studied in an area bounded by Apalachee Bay on the east and Perdido Bay on the west. Regression analysis showed a correlation of 0.96 between average salinity and average macrobenthic diversity. The implications of using diversity indices as indicators of environmental health or as standards for regulating water quality are discussed.

Wiseman, W.J., S.P. Murray, J.M. Bane and M.W. Tubman. 1982. Temperature and salinity variability within the Louisiana Bight. Contrib. Mar. Sci. 25:109-120.
Abstract. Describes seasonal T-S variations of waters from three different sources which mix to form water of Louisiana Bight.

Wiseman, W.J., Jr. and S.P. Dinnel. 1989. Subtidal flows over Gulf of Mexico shelves. Presented at AGU Chapman Conference on the Physics of the Gulf of Mexico, 5-7 June 1989, St. Petersburg, FL.

Wolfe, M.A. and G.C. April. 1978. Estimation of Hurricane Storm Surge in Mobile Bay, Alabama. University of Alabama, Olin Summer Project. 37 pp.

Wolfe, S.H., J.A. Reidenauer and D.B. Means. 1988. Ecological Characterization of the Florida Panhandle. Biological-88(12); OCS/MMS-88/0063. Florida State Department of Environmental Regulation. Tallahassee, FL. 299 pp.
Abstract. The study provides a concise description of the Florida Panhandle, which extends from the Ochlockonee River basin west to the Florida-Alabama border and north to the Georgia and Alabama borders. It identifies alterations in terrestrial and aquatic habitats caused by increased urbanization, industrialization, sewage and effluent discharge, river flow alteration, stormwater runoff, and dredge and fill activities. The report is an extensive review and synthesis of available literature on the local physical setting and ecology and provides a discussion of important impacts on the habitats within the region.

Woodward-Clyde Consultants. 1983. Southwest Florida Shelf Ecosystem Study - Year 2, Modification, Hydrography. Volume 1. MMS-GM-PT-83-009. Minerals Management Service, Gulf of Mexico OCS Regional Office. Metairie, LA. 418 pp.
Abstract. Results of the third phase of the Southwest Florida Shelf Ecosystem Study demonstrated the importance of Loop Current frontal eddies to the primary production of the outer continental shelf region off western Florida. A generalized Gulf of Mexico Loop Current eddy system consists of a relatively warm filament of Loop Current Water extending off the main body of the Loop Current front enclosing a cooler tongue of Continental Edge Water. Upwelling generally occurs beneath the cooler water. The surface length scale of this phenomenon is on the order of 200

km. Waters affected by these eddies have been shown to exhibit primary production values of about six times higher than unaffected waters. A study of the characteristics and effectiveness of these eddies will play an important part in determining recovery rates in case of accidental contamination by oil and gas development activities in this outer continental shelf area.

Work, P.A. 1992. Sediment transport processes at a nourished beach (Perdido Key, Florida). Ph.D. Dissertation. University of Florida, Gainesville, FL. 227 pp.

Abstract. Data describing the evolution of a large beach nourishment project on the Gulf of Mexico at Perdido Key, Florida, are analyzed to describe the sediment transport processes governing the behavior of the beach. Analytical and numerical techniques for prediction of the response of the nourished beach to physical forcing arising from incident wind waves are tested. Repetitive bathymetric and topographic surveys indicated placement of 4.1 million m^3 of sand in the nearshore zone between November, 1989, and August, 1990, and a net loss of 7% from the monitored area after one year. Directional wave data, sediment samples, tide, and weather data were collected. Cross-shore sediment transport rates and longshore gradients of longshore sediment transport were computed. Results indicate that cross-shore sediment transport dominated much of the early evolution of the project. Longshore gradients of longshore sediment transport were found to be strongest on the "shoulders" of the beachfill, where shoreline curvature changes most rapidly. Longshore and cross-shore sediment transport processes were assumed independent to allow separate investigations. Beach profile changes at the site were modeled by application of two previously developed numerical models that simulate cross-shore sediment transport. One approach reasonably estimated the volumetric redistribution of sediment for the first post-nourishment survey interval but yielded poor results for profile recovery events. Performance of the second model was poor despite a more detailed description of the cross-shore sediment transport rate.

Wright, L.D., J.M. Coleman and J.N. Suhayda. 1973. Periodicities in interfacial mixing. Center for Wetland Resources, Louisiana State University, Baton Rouge, LA. Bull. No. 7:127-135.

Abstract. Freshwater effluents from river outlets spread and diffuse into ambient marine water; the interactions which take place between these water masses at and immediately seaward of the river mouth are critical in controlling the dissemination of sediment and water transported by the river. Mixing between these water masses, each characterized by differing properties, takes place in many ways and is affected by various mechanisms. These mechanisms control the outflow patterns and hence fundamentally determine the pattern of sediment dissemination, accumulation, and distribution of the bars that form at river mouths. Thus greater understanding of the behavior of the effluent plume would significantly aid charting navigation, and similar operations in these constantly changing areas of strategic importance. In addition, several types of density gradients occur between the water masses which drastically affect acoustical transmission and reflections in various search operations, swimmer defense techniques, and mining operations. If the density contrasts are understood, they can be favorably utilized as an acoustical barrier for hiding or to provide safe upstream penetration

for swimmers. This paper utilizes various remote-sensing techniques to analyze the behavior of the river plume under varying conditions.

Wright, L.D. and C.J. Sonu. 1975. Processes of sediment transport and tidal delta development in a stratified tidal inlet. pp. 63-76. *In* Estuarine Research. Vol. 2. Geology and engineering. Academic Press, New York, NY.

Abstract. Flood-tidal and ebb-tidal deltas in East Pass, on the northwestern coast of Florida, contrast sharply in form and absolute size. The flood-tidal delta, the more extensive, is characterized by a broad middle-ground shoal separating two diverging flood channels, whereas the ebb-tidal delta consists of a single seaward-narrowing channel flanked by subaqueous levees and having a symmetrical, crescentic, subaqueous bar at the outlet. Form differences result partially from variations in the intensities of different effluent expansion and deceleration mechanisms arising from vertical density stratification. Over the flood-tidal delta, bayward flood flow is concentrated near the bottom beneath lighter bay water. This inflow expands as a hyperpycnal effluent under the influence of bottom friction to produce the observed configuration of the flood-tidal delta. Because flood currents attain their velocity and duration maxima in the lower layer near the bottom, bed-load transport in the channels of the flood-tidal delta is flood-dominated.

Wright, L.D., C.J. Sonu and W.V. Kielhorn. 1972. Water-mass stratification and bed form characteristics in East Pass, Destin, Florida. Mar. Geol. 12:43-58. TR-107.

Abstract. Density contrasts between the water of Choctawhatchee Bay and the Gulf of Mexico result in sharp vertical and horizontal stratification in the northern part of East Pass near Destin, Fla., during flood and a portion of the ebb tidal phases. As a consequence of this stratification, flood tide currents are swiftest and of longest duration in the deeper layers within dredged channels. Ebb currents attain their velocity and duration maxima in the upper layers of the water column. Accordingly, bed form asymmetries indicate that bedload transport is flood dominated in the channels and ebb dominated over shoals. Vertical density homogeneity resulting from greater mixing in the seaward reaches and at the mouth of the inlet channel is accompanied by bidirectional sand transport.

Wunderly, W.L., Jr. 1970. Indicated geostrophic velocities and volume transports, central and eastern Gulf of Mexico, warmest and coldest months. Master's Thesis. U.S. Naval Postgraduate School. 76 pp.

Abstract. To make comparisons to seven similar cruises, the geostrophic method of volume transport and velocity analysis was applied to ALAMINOS cruises 67-A-6 of 4 to 22 August 1967 and 68-A-2 of 13 February to 6 March 1968. An average velocity of 83 cm/sec and a volume transport of 27.5 Sverdrups was found in the Yucatan Channel in August and an average velocity of 79 cm/sec and a volume transport of 26.6 Sverdrups was found in the channel for February to March. A subsurface westward flow occurred in August along the southern coast of Cuba providing input into the Loop Current north of the Yucatan Channel. The Loop Current never crossed 25°N latitude. A cold ridge extended from the Florida shelf to the Campeche Bank. An analysis of East-West volume transport in the central Gulf indicated a merging of east and west Gulf waters between 87°50'W and 89°30'W longitude for the MABEL TAYLOR cruise of 1932 and the ATLANTIS

cruise of 1935. The GERONIMO cruise of February-March 1967 and cruise 68-A-2 indicated a merging of east and west Gulf waters between 89°30'W and 91°00'W longitude.

Yentsch, C.S. 1986. Florida west coast/central Gulf of Mexico. pp. 63-65. *In* Nimbus-7 CZCS, Coastal Zone Color Scanner Imagery for Selected Coastal Regions. (Series eds.: Hovis, W.A., E.F. Szajna and W.A. Bohan.) W. A. Bohan Company,

Yobbi, D.K. and L.A. Knochemus. 1988. Effects of river discharge and high-tide stage on salinity intrusion in the Weeki Wachee, Crystal River, and With Lacoochee River estuaries, southwest Florida. USGS Water Res. Investigations. 88-4116:36.

Young, N. and J. Crew. 1973. Physical and biological parameters, Deer Point Lake. Florida Game & Fresh Water Fish Commission, Northwest Region. DeFuniak Springs, FL. 11 pp.

Abstract. A summary of information on the lake, including fish populations and the hydrography of its tributaries.

Zeh, T.A. 1980. Sikes Cut Glossary of Inlets Report No. 7. Report No. 35. Dept. of Coastal and Oceanographic Engineering, University of Florida. Gainesville, FL.

Abstract. Sikes Cut is a man-made inlet on St. George Island which separates the Gulf of Mexico from Apalachicola bay. The inlet is located five miles south across the bay from Apalachicola, on Florida's panhandle. Collected information and computed data in this report are summarized.

Zervas, C.E., (ed.). 1993. Tampa Bay Oceanography Project: Physical Oceanographic Synthesis. NOAA Tech. Rep. NOS OES 002:184.

Abstract. NOS's Tampa Bay Oceanography Project (TOP) collected a large and diverse set of physical oceanographic and meteorological data between June 1990 and September 1991. This report presents the results of the data analysis and synthesizes these results in order to characterize the hydrodynamics of Tampa Bay. The TOP data set includes: (1) current meter data from 40 fixed stations (20 occupied by acoustic Doppler current profilers (ADCPs) and 20 occupied by electromagnetic current meters), (2) current meter data from a downward-facing towed ADCP along five transects in the Bay, (3) water levels at 16 stations along the shores of the Bay and the Gulf of Mexico, (4) meteorological (wind, temperature, and atmospheric pressure) data at five stations in the Bay, (5) time series of salinity and temperature data at 36 fixed sites, and (6) salinity and temperature profiles over depth along six transects.

Zetler, B.D. and D.V. Hansen. 1970. Tides in the Gulf of Mexico - A review and proposed program. Bull. Mar. Sci. 20(1):57-69.

Abstract. A study of tides in the Gulf of Mexico is proposed as part of the program for Gulf Science Year (1970). There are several existing hypotheses explaining the diurnal tides in the gulf. These are described and discussed and a new hypothesis is suggested. The semidiurnal tides are generally small, and therefore have had less attention; nevertheless, there are several hypotheses that are quite contradictory. A program of

tide and tidal current observations is proposed which should permit discrimination among the various hypotheses.

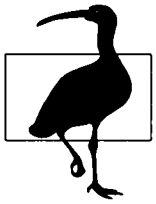
Zetler, B.D. and D.V. Hansen. 1972. Tides in the Gulf of Mexico. pp. 265-275. *In* Capurro, L.R.A. and J.L. Reid, eds. Contributions On the Physical Oceanography of the Gulf of Mexico. Vol. 2. Texas A&M University, Oceanographic Studies, College Station, TX.

Abstract. The diurnal tides in the Gulf are due to co-oscillations with the Atlantic Ocean with amphidromic points in the Florida Strait near Miami and in the Yucatan Channel, because harmonic constants for the tide and tidal current of principal diurnal constituents show co-oscillation. The volume continuity yields observed value of 15 cm for K_1 tide within the Gulf under an assumption that the diurnal tidal current has the same amplitude and phase in the Florida Strait and in Yucatan Channel. The semi-diurnal tides have an amphidromic point between the Mississippi Delta and the Yucatan Peninsula. Tidal energy dissipation in the entrances to the Gulf is estimated as 2×10^{17} ergs/sec. The mean amplitudes of the tidal currents on the shelf is estimated as 1/2 knot which explains larger current amplitudes observed in the passes of the estuaries bordering the Gulf.

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The National Biological Service Mission



As a bureau of the Department of the Interior (DOI), the National Biological Service's (NBS) primary mission is to provide the scientific understanding and technologies needed to support sound management and conservation of our Nation's biological resources. Independence from regulatory and management decision making greatly lessens the chance that scientific results will be viewed as less than objective science or subservient to the needs of policy makers. NBS provides credible, objective, and unbiased information needed by resources managers in the Department of the Interior in a form that allows them to assess, predict, and manage the biological consequences of various policies and management practices. Although the primary focus of the biological research is to meet DOI needs, the activities undertaken with natural resource research funding will also serve the science needs of a wide range of partners, including State governments, other Federal agencies, and private landowners.

The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The MMS **Royalty Management Program** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.