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EARTH SYSTEM MONITOR

New lakefloor maps of the Great Lakes

New topographic lakefloor features emerge from NGDC data rescue project

A guide to NOAA's data and information services

INSIDE

David L. Divins[1]
CIRES
University of Colorado - Boulder

Troy L. Holcombe[2]
National Geophysical Data Center
NOAA/NESDIS

David Reid[3]
Great Lakes Environmental Research Laboratory
NOAA/OAR

Patricia W. Viets[4]
Public and Constituent Affairs
NOAA/NESDIS

Scientists from NOAA's National Geophysical Data Center (NGDC) and Great Lakes Environmental Research Laboratory (GLERL) who have been studying the Great Lakes are developing bathymetric maps of the Lake floors, beginning with Lake Michigan. Bathymetric compilations are also being carried out in cooperation with scientists at the Canadian Hydrographic Service for the four international lakes (Lakes Superior, Huron, Erie, and Ontario), and with scientists at the University of Minnesota, Duluth, for Lake Superior.

The new bathymetry shows lakefloor features more accurately than ever before, and demonstrates some bottom features that are being seen for the first time. The scientists, conducting a NOAA-sponsored data rescue project of Great Lakes lakefloor data, are using the entire historic hydrographic database from the United States and Canada to complete accurate and detailed descriptive maps of the surface of lake floors (bathymetry). Consequently, new reconstructions of lakefloor topographic features and bedrock geology are emerging as more and more data are rescued.

The new bathymetry is being compiled at

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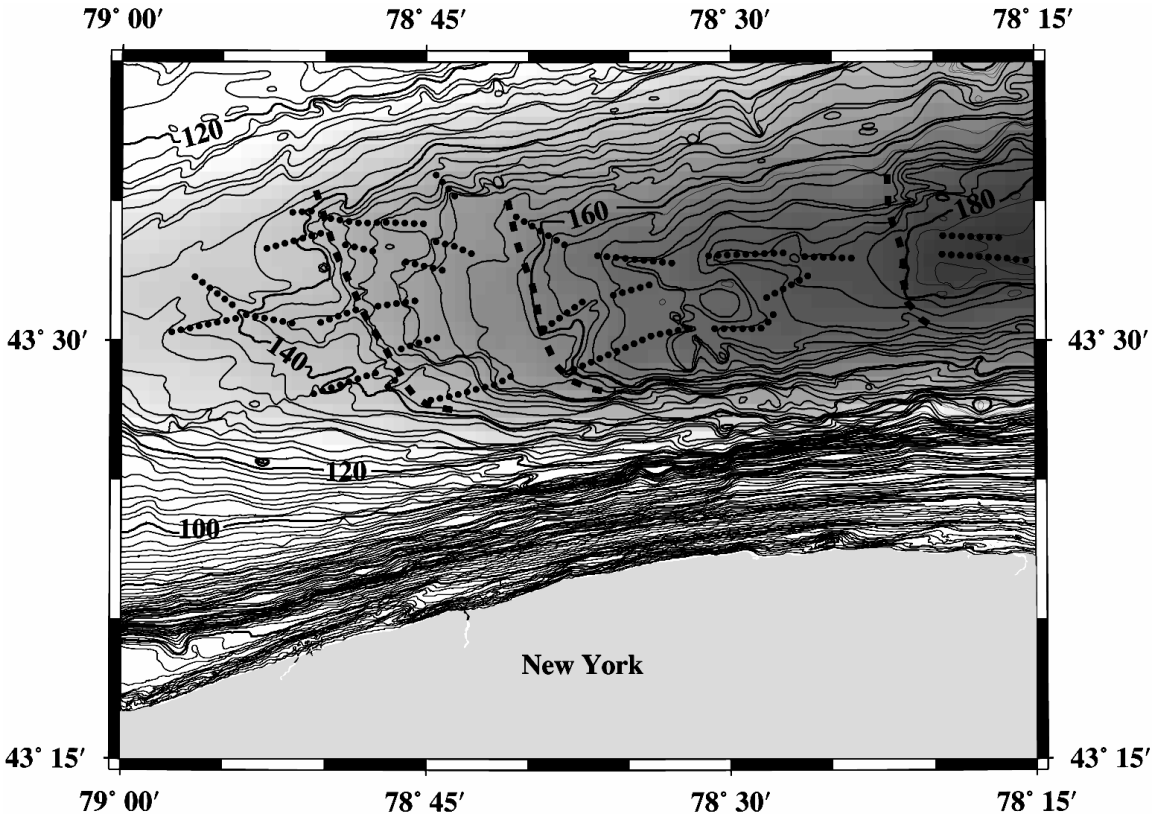

▲ **Figure 1.** New bathymetry of western Lake Ontario. Note the coalescing drainage channels (dotted lines) in the deep basin. Dashed lines mark the locations of presumed bedrock ledges. Contour interval is 2 meters.

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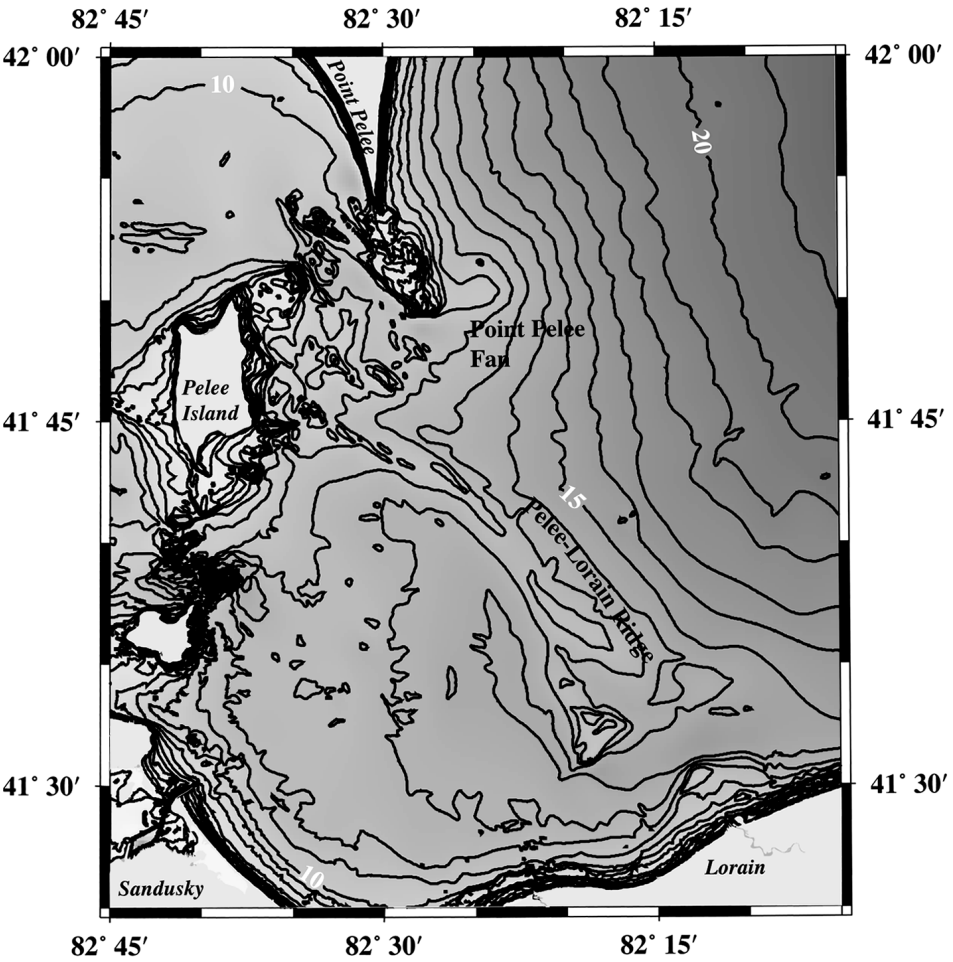

▲ **Figure 2.** Bathymetry of western Lake Erie showing the Point Pelee Fan and the Pelee-Lorain Ridge. The contour interval is 1 meter.

New bathymetry, *from page 1*
contour intervals of 1 to 5 meters and at compilation scales ranging from 1:50,000 to 1:250,000. Bathymetry for Lake Michigan and western Lake Erie is completed, and bathymetry for other lake areas is either completed or in progress. Final products include posters, screen imagery, digital bathymetric contours in vector form, and digital bathymetry in raster grids at 3, 9, and 30 arc-second grid resolution.

Examples of features seen for the first time include:

• *Coalescing drainage channels in the deep basins of Lake Ontario.* It would appear that postglacial lake muds being deposited beneath the relatively quiet waters of the deep lake are being redistributed downslope via gravity-flow deposition, because a distinct system of channels (Figure 1) has been formed which coalesce downslope toward the deepest points in the basins of western Lake Ontario.

These channels have a relief of no more than a few meters and are seen in

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[1]*CIRES*
University of Colorado
Campus Box 216
Boulder, CO 80309
E-mail: ddivins@ngdc.noaa.gov

[2]*National Geophysical Data Center*
NOAA/NESDIS E/GC3
325 Broadway
Boulder, CO 80303
E-mail: holcombe@ngdc.noaa.gov

[3]*NOAA/OAR/GLERL*
2205 Commonwealth Blvd.
Ann Arbor, MI 48105
E-mail: reid@glerl.noaa.gov

[4]*Public and Constituent Affairs*
NOAA/NESDIS
Suitland Federal Center
FB#4, Room 0124
Washington, DC 20233
E-mail: pviets@nesdis.noaa.gov

EARTH SYSTEM MONITOR

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The mailing address for the *Earth System Monitor* is:

National Oceanographic Data Center
NOAA/NESDIS E/OC1
SSMC3, 4th Floor
1315 East-West Highway
Silver Spring, MD 20910-3282

EDITOR
Sheri Phillips
Telephone: 301-713-3279 ext.127
Fax: 301-713-3302
E-mail: sphillips@nodc.noaa.gov

U.S. DEPARTMENT OF COMMERCE
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D. James Baker,
Under Secretary and Administrator

News briefs

Workshop explores environmental data use in fisheries

A July 1996 ESDIM (Environmental Services Data and Information Management)-sponsored workshop organized jointly by NOAA's National Marine Fisheries Service (NMFS) and Office of Oceanic and Atmospheric Research (OAR) examined how environmental data are applied to fisheries research and management. Convened at the NMFS Pacific Fisheries Environmental Group in Pacific Grove, Calif., the workshop objectives were:

- to assess the current and future needs for environmental databases (oceanographic, atmospheric, remote sensing, model output, geological) in fisheries and fisheries-related ecosystem research;
- to identify data sources and formats;
- and to recommend ways to facilitate access to data.

Participants included fisheries scientists, physical scientists, and environmental data specialists from NOAA, other agencies, and academia. Presentations were complemented by demonstrations and a poster session; five working groups addressed specific topics and developed more than 40 recommendations. A common theme among the working groups was the need for improved communication among fisheries scientists, oceanographers, and the physical and computer scientists who provide model and environmental data.

Workshop proceedings will be published as a NOAA Technical Memorandum; a short workshop report with the recommendations is available on the World Wide Web at *http://www.pfeg.noaa.gov/workshop*.

NCDC hosts Data Management Working Group Meeting

The National Climatic Data Center (NCDC) hosted the Second Annual Data Management Working Group Meeting at the Center on November 12-14, 1996. The theme of this workshop was "Developing Effective Internet Access to Data and Information." Presentations and discussions were structured to address three major topics:

- Web technologies, including trends and impacts of these technologies;
- the structuring of Web pages;
- access to data and information.

Participants included members of the Department of Energy, the U.S. Department of Agriculture, the U.S. Department of the Interior, the University of Computer and Atmospheric Research, the National Center for Atmospheric Research, the U.S. Environmental Protection Agency, the Consortium for International Earth Science Information Network, the National Atmospheric and Space Administration, the U.S. Department of Defense, and members of several line offices from NOAA.

Antarctic Data Coordination Center funded at NSIDC

The National Snow and Ice Data Center (NSIDC) received notification from the National Science Foundation's (NSF) Office of Polar Programs that it intends to fund NSIDC's proposal to function as the U.S. Antarctic Data Coordination Center. The activities of the Antarctic Data Coordination Center will comprise of identifying existing Antarctic data sets from all disciplines, locating points of contact and preparing data descriptions for these data, and coordinating description submittal.

Descriptions will be submitted to the Antarctic Master Directory at the International Centre for Antarctic Information and Research in New Zealand, and the Global Change Master Directory in the United States. Data descriptions would also be obtained from researchers as they prepare or return from field work in Antarctica.

NSIDC developed the proposal for this effort based on the involvement of R.G. Barry and C.S. Hanson in the Scientific Committee for Antarctic Research—Council of Managers of National Antarctic Programs and its *ad hoc* Planning Group on Antarctic Data Management, and after similar efforts for the Arctic (e.g., the Arctic Environmental Data Directory).

NGDC participates in new NSF committee

The National Geophysical Data Center's (NGDC) Allen Hittelman has been appointed to the National Science Foundation's "Committee for the Advancement of Strong Motions Programs." Formed in August 1996, the purpose of the committee is to encourage advancements in the collection, dissemination, and utilization of strong motion data as a tool for improving public safety in earthquakes.

Distributed node of the NOAA Data Directory coming to NCDC

The National Climatic Data Center (NCDC) will become one of the several distributed nodes of the NOAA Directory during fiscal year 1997. The node will be pointed to from the NOAA Data Set Catalog software on the ESDIM computer in Silver Spring, Maryland.

Staff at the NCDC node will be responsible for the maintenance and updating of existing data descriptions for the node, and for locating and describing new data sets using the NOAA Federal Geographic Data Committee Metadata Standard Template format. NCDC currently has approximately 2,500 data sets described in the NOAA Directory.

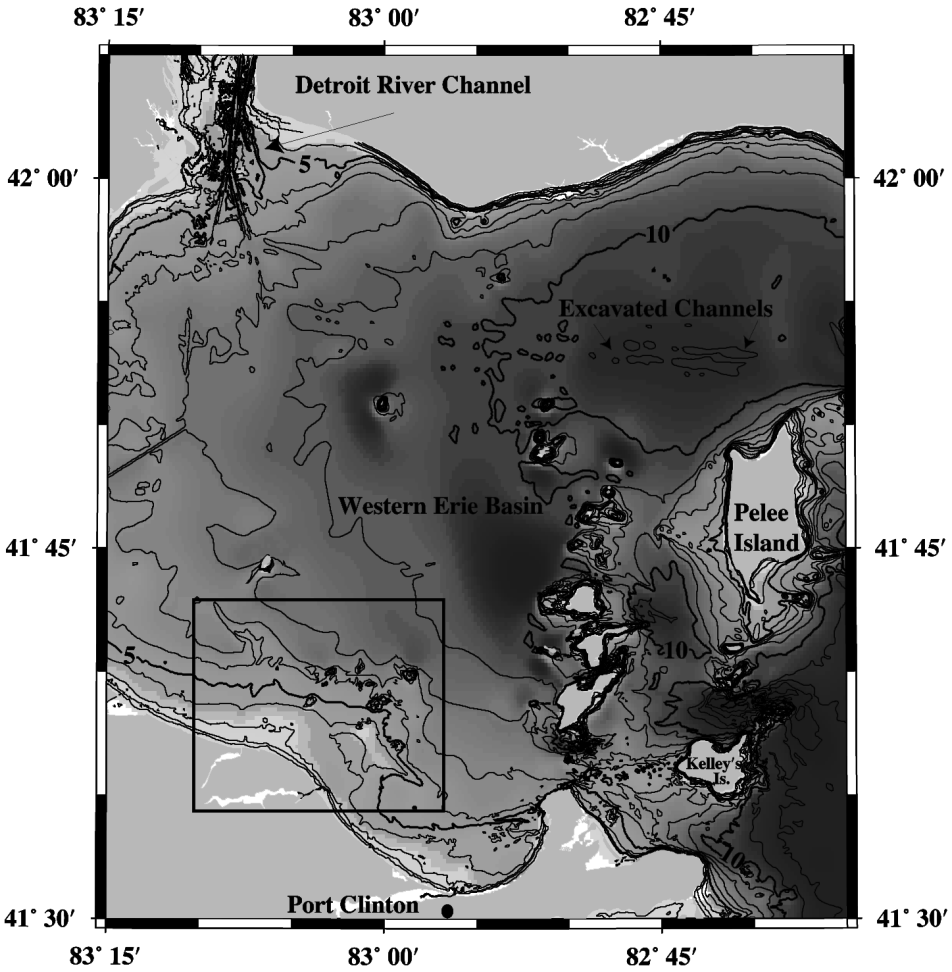
NSIDC attends international lake ice workshop

The Center for Limnology, University of Wisconsin, hosted an international workshop on "Lake Ice and Climate" in Wisconsin on October 6-10, 1996. Dr. Roger G. Barry, director of the National Snow and Ice Data Center (NSIDC), was one of 25 invited participants from Canada, Finland, Germany, Hungary, Russia, the United Kingdom, and the United States.

The participants formed a Lake Ice Analysis Group (LIAG) which has assembled over 500 records of freshwater ice from around the Northern Hemisphere, and carried out a series of preliminary data and modeling analyses. The LIAG also developed a database protocol and planned several papers to be based on more comprehensive analyses of the data. The group plans to transfer the database to established national and international archive centers by October 1998.

NGDC scientist visits Rice Research Institute

The National Geophysical Data Center's (NGDC) David Hastings visited the International Rice Research Institute (IRRI) in the Philippines, where he presented a seminar on "Integrated global/regional spatial data sets and their applications" and reviewed IRRI's rice database, one of the finest environmental thematic datsets on Asia. Topics discussed included data exchanges, compatibility of missions, and the possibility of the IRRI conducting research related to the climatic aspects of rice production (and thus famine for much of the world's population).



▲ **Figure 3.** Bathymetry of the Western Erie Basin at a contour interval of 1 meter. The boxed region in the figure is the location of a drowned headland and spits in western Lake Erie. An interesting feature seen for the first time are the channels excavated by propeller wash.

New bathymetry, *from page 2*

this bathymetry for the first time. Post-glacial mud thickness is in the range of a few meters but the sediments are apparently being preferentially deposited in the lowest areas. It is unlikely that this drainage pattern developed subaerially, considering its occurrence in the deepest axis of Lake Ontario.

• *Presumed bedrock ledges in the deep basin of Lake Ontario.* The main lake basin of Lake Ontario has resulted from the work of glacial erosion on easily eroded upper Ordovician shale formations (Figure 1). These strata dip gently southward beneath the lake, and are sandwiched between the resistant limestones of the middle Ordovician Trenton and Black River Groups below and the resistant dolomites of the lower Silurian Clinton, Cataract and Lockport Groups above.

Across the deep axis of the lake, the succession of ledges which step down to the east could be the eroded edges of relatively resistant beds occurring either in the Trenton and Black River limestones, or in the lowermost section of the upper Ordovician shales.

• *New structure of the Pelee-Lorain Ridge.* In previous literature it has been assumed that the Pelee-Lorain Ridge (Figure 2) within Lake Erie is continuous between Point Pelee and its southern terminus near the Ohio Shore. This new bathymetry shows clearly, however, that the Pelee-Lorain Ridge is not continuous with Point Pelee but is instead continuous with Pelee Island, 20 kilometers to the southwest! The name Pelee-Lorain Ridge is still valid because the Island has the same name as the Point.

The southern part of the Ridge is capped with sand and gravel deposits, overlying a foundation of till deposits. Its broad, hummocky crest increases to about 2-2.5 m relief toward its southern end, where a northwest-southeast trending valley separates the main ridge from a delta-shaped broad swell lying southwest of the main ridge.

The Pelee-Lorain Ridge has been interpreted as end moraine probably associated with a readvance of the retreating Wisconsin Ice Sheet. Having 10-12 meters crestal depth, the Ridge was probably at or near zero depth some time prior to 4000 years bp. Deposits of sand and gravel were probably concentrated on the Pelee-Lorain Ridge when rising lake level exposed the ridge for a time to a shore and shallow water regimen.

• *A former delta of the Detroit River.* A delta-shaped feature cresting at depths of 11-12 meters below present lake level (Figure 2) is inferred in the bathymetry southeast of Point Pelee in Lake Erie. Apparently sediments were brought onto this now-submerged delta at a point directly east of the southern tip of the Point Pelee when lake level was 10-15 meters lower than present. This feature must have formed about 4000 years before present, when the Lake Huron-to-Lake Erie outlet was first opened, and the newly formed Detroit River was eroding its channel and bringing a heavy load of sediment into Lake Erie.

• *Channels excavated by propeller wash in Lake Erie.* The floor of western Lake Erie is underlain by unconsolidated muds which lie only a few meters below the displacement depth of large lake freighters that ply the sea lanes of the Great Lakes. Sediments are brought into suspension by propeller wash and entrained into the wake. Before sediments can be redeposited, currents typically move the entrained sediments away from the sea lanes; the resulting excavation of the twin sea lane channels (Figure 3) is apparent in the bathymetry.

Location of the main Detroit River Channel coincided with a trough in the till surface extending through the western basin of Lake Erie (this trough no longer exhibits topographic expression but it has been mapped in the subsurface). Active fan deposition would have ceased here when rising water levels flooded the Western Basin, extending the Lake Erie outlet of the Detroit River westward.

• *Drowned headland and spits in Lake Erie.* A region of bedrock reefs lies off

the southern shore of the western Lake Erie basin between Toledo and Sandusky. Sculptured sediment drift-like features extend both northwestward and southwestward away from the bedrock reefs. These features are probably relict spits (Figure 3) which formed in the last 4000 years when rising water brought Lake Erie water levels up to 4 to 7 meters below the present lake level, at which time the reefs and surrounding shallow areas formed a headland which was subject to erosion by wave action.

Once water level rose sufficiently to drown the reef area headlands and remove them from the zone of intense wave action, spit formation ceased. The adjacent headland on the present Lake Erie shore is still a site of coastal erosion and divergence of longshore sediment drift.

Other previously identified features of the Great Lakes are seen more clearly in the new bathymetry than ever before. These features include:

• *Flat-topped ridges (Figure 4) in the islands area of Lake Michigan.* In the islands area of northern Lake Michigan, a series of distinct north-south trending ridges and valleys characterize the lake floor. Many of the ridges are relatively flat top features bounded by steep escarpments and relatively deep, flat-floored valleys. Sediment cover of glacial drift and lacustrine sediments is thin over much of this area, and bedrock outcrops are known to occur or may be expected on the ridge-tops, the escarpments, and some shallower areas of the lake floor. The valleys apparently are areas where glacial erosion has cut through one or more of the hard Devonian carbonates and exposed underlying upper Silurian or Devonian shales or redbeds which are not as resistant to erosion.

• *"Paleokarst" topography in northeastern Lake Michigan (Figure 4) and northern Lake Huron.* Irregular and hummocky topography underlying much of the northeastern lakefloor apparently gained its shape from glacial erosion acting on Silurian and Devonian bedrock, which varies locally in its resistance to erosion. The north-south oriented ridges and troughs probably owe their alignment to a primary joint pattern in the bedrock, along which planes of weakness developed over time.

The late Silurian and early Devonian strata which were exposed on the lakefloor by glacial erosion had been broken and brecciated, due to collapse following dissolution of underlying late Silurian salt beds (stratigraphically equivalent salt beds still underlie most of the lower peninsula of Michigan). Burial of this paleokarst terrane began with the deposition of Dundee Limestone and continued through later Paleozoic time.

• *Mackinac Channel "A river ran through it."* The now-submerged Mackinac Channel (Figure 4) was an active river channel draining Lake Michigan during early postglacial time, when drainage through the isostatically depressed North Bay outlet lowered the level of Lake Huron below the sill depth of Lake Michigan. The new Lake Michigan bathymetry provides an integrated view of the Mackinac Channel and the adjoining lakefloor topography. Least channel depths of about 35 meters occur northwest of Waugoshance Point, and at a point north of Garden Island, both being areas where the main channel crosses what may by fall lines formed by resistant bedrock.

A line of ridges, probably coinciding with bedrock highs, extends through this area striking mostly east-west and flanking the main channel. To the east, hummocky topography along this presumed resistant bedrock lineation is on strike with remnants of the resistant Mackinac Breccia of lower Devonian age, which crop out on Saint Helena Island and on the peninsula just north of the Straits of Mackinac.

• *Drainage from Lake Superior during the Chippewa Lowstand.* A large submerged channel, the Whitefish Channel (Figure 5), extends across the floor of Green Bay and around Washington Island. The downslope end of the Whitefish Channel leads to a large drowned and abandoned delta, the Whitefish Fan, which has a top depth in the range of 50 to 55 meters. The Au Train-Whitefish Valley, together with the submerged channel extending across Green Bay, was probably the site of the main outlet of Lake Superior into Lake Michigan during certain early postglacial times when Lake Michigan level was low.

Formation of the Whitefish Channel and Fan has been attributed to drainage, possibly catastrophic at times, of Lake Superior into Lake Michigan at the period when western Lake Superior was open water, and eastern Lake Superior was filled with ice blocking the St.

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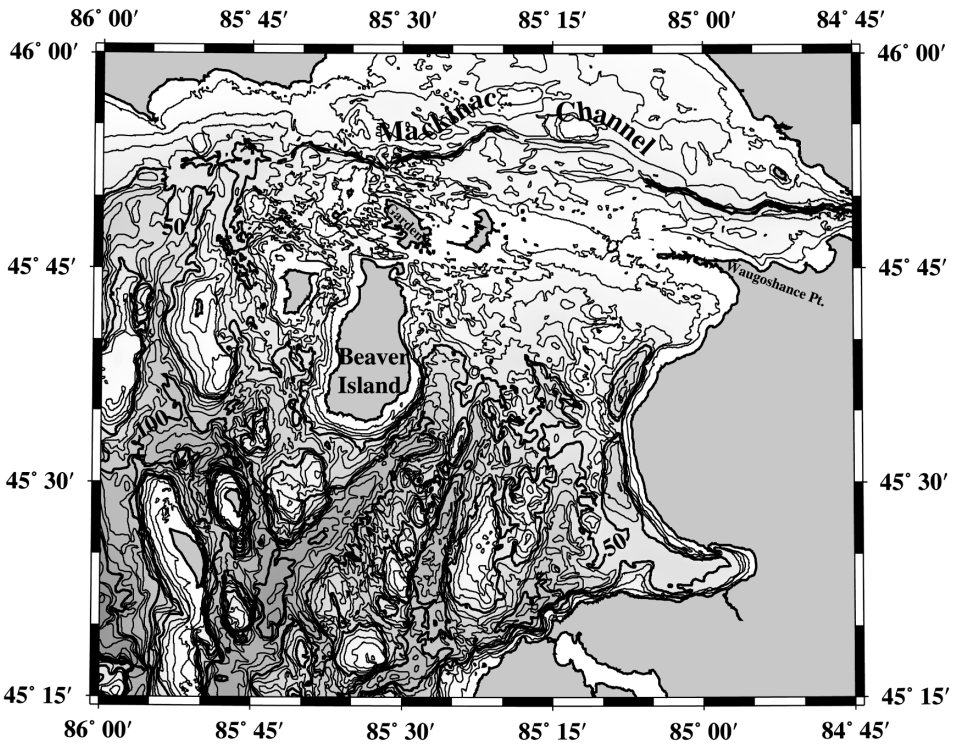


▲ **Figure 4.** Bathymetry of northeastern Lake Michigan; note the paleokarst or irregular topography in this area. Also shown is the now-submerged Mackinac Channel and several flat-topped ridges. The contour interval is 10 meters.

NOAA Environmental Services Data Directory

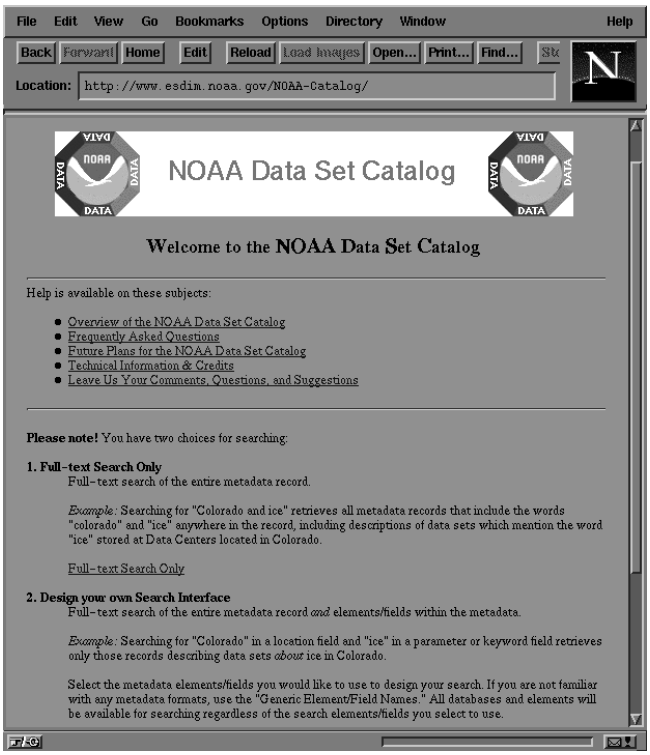
Data directory is the keystone for data and information management within NOAA

Gerald Barton
Environmental Information Services
NOAA/NESDIS

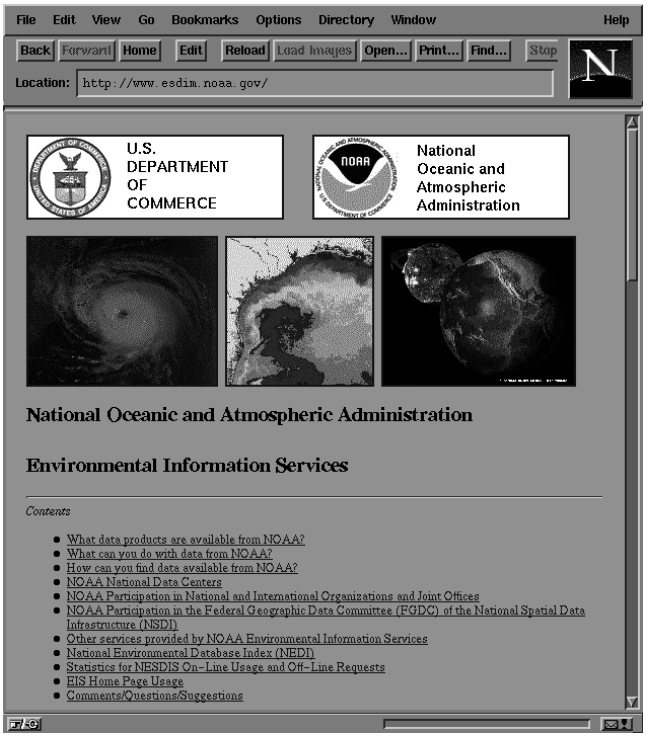
The NOAA Environmental Services Data Directory is the NOAA tool that documents NOAA data sets. All levels of users may learn about NOAA data by using this tool, from the grade school student to the scientific researcher. The NOAA Directory is the keystone for data and information management in NOAA. It was developed under the Environmental Services Data and Information Management Program (ESDIM) in the NESDIS Environmental Information Services Office (Figure 1).

The NOAA Directory is an online catalog (Figure 2) containing descriptions of over 8100 NOAA data sets. It allows a user to search for data held in NOAA data centers and offices. Access is via World Wide Web pages on the Internet (*http://www.esdim.noaa.gov*) and search and retrieval is done via a Wide Area Information Server (WAIS-sf Ver 2.0) that allows search by any word in the data descriptions. The descriptions point the user to the holder of the data. The prototype NOAAServer system (*http://www.esdim.noaa.gov/NOAAServer/*) allows the user to connect to the data system being described and will allow browsing and ordering of the data.

Environmental Information Services
NOAA/NESDIS
SSMC3, Room 15448
1305 East–West Highway
Silver Spring, MD 20910
E-mail: barton@esdim.noaa.gov



▲ **Figure 2**. The NOAA Data Directory is an online catalog containing descriptions of over 8100 NOAA data sets.

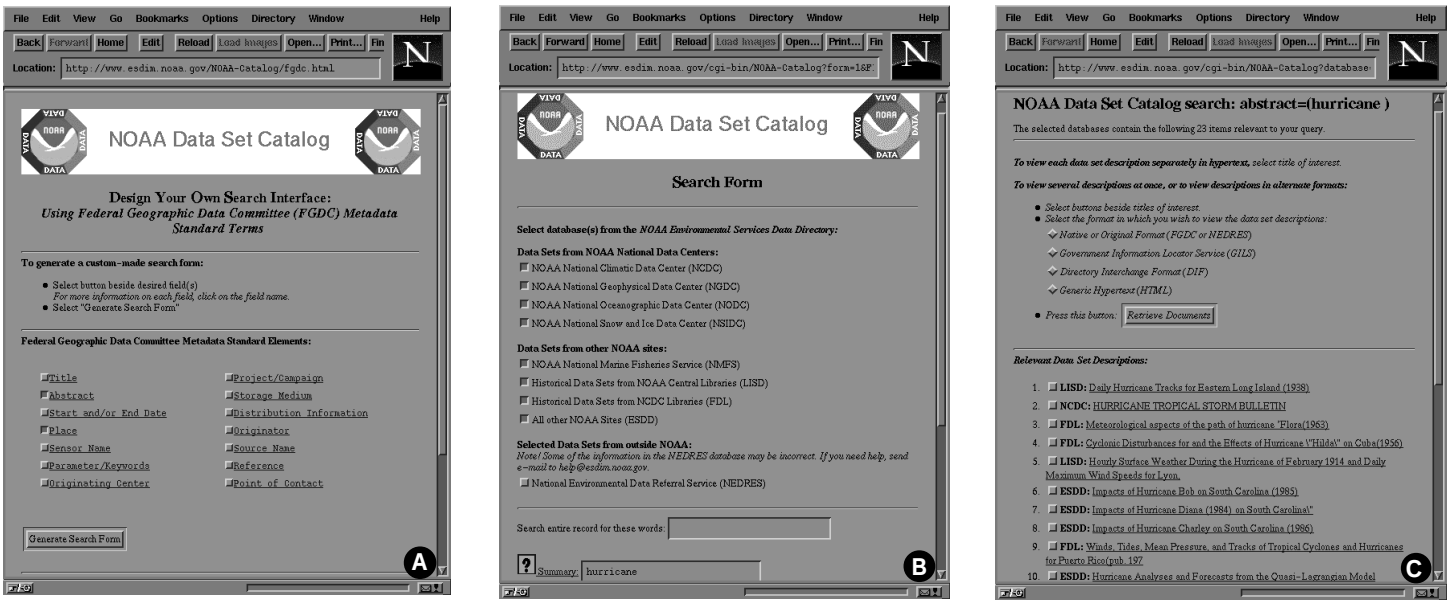


▲ **Figure 1**. NOAA's Environmental Information Services Home Page on the World Wide Web, which provides access to the NOAA Data Directory.

Executive Order 12906, April 13, 1994, requires that government agencies use the Federal Geographic Data Committee (FGDC) Metadata Standard to document data sets. Until 1996, the NOAA Directory used the Global Change Master Directory Interchange Format to describe over 8000 NOAA data sets. In mid-1996, in order to comply with the Executive Order, all data descriptions were reformatted to the FGDC Metadata Standard and the new version of the NOAA Directory was implemented on the ESDIM Home Page (*http://www.esdim.noaa.gov/*). The manual for the FGDC Metadata Standard is *Content Standards for Digital Geospatial Metadata Workbook Version 1.0* by the FGDC (March 24, 1995). The manual is available from the FGDC Secretariat, c/o U.S. Geological Survey, 590 National Center, Reston VA 22092, Phone: 703-648-5514, Fax: 703-648-5755, by e-mail to the FGDC committee (*fgdc@fgdc.er.usgs.gov*), or via Anonymous FTP. You can also access the FGDC home page for more information about the FGDC and the FGDC Metadata Standard (*http://fgdc.er.usgs.gov/*).

The distributed NOAA Environmental Services Data Directory

The NOAA Environmental Services Data Directory is physically distributed at several computer sites in the United States. The main nodes are located on the Environmental Information Services Sun computer in Silver Spring, Maryland. The main nodes include the WAIS data bases for the National Climatic Data Center (NCDC), the NOAA Central Library Data Publications, the



▲ **Figure 3**. Users can search any or all of the nodes of the NOAA Directory by using a single WWW page to compose a search (A-B). The third graphic (C) illustrates data descriptions found from a search on the word "hurricane".

NCDC Library Publications, and a data base for other parts of NOAA including the National Weather Service, the Office of Oceanic and Atmospheric Research, and the National Ocean Service. Distributed nodes include the National Oceanographic Data Center, the National Geophysical Data Center, and the National Snow and Ice Data Center.

The user may search any or all of the nodes of the NOAA Directory by using a single WWW Page to compose the search (Figure 3). The search directive is then sent to all nodes of the NOAA Directory. Results of the search are displayed on a common page that shows the title of the data description and the node where it is located. Each title may be selected and the contents of the data description displayed in several formats. The user may view the data description in a generic format that has a well-organized presentation format.

The data description may also be viewed in exchange formats associated with the FGDC Metadata Standard, the Government Information Locator System (GILS), and the Global Change Master Directory Interchange Format (DIF).

Utilizing the FGDC Metadata Standard within NOAA for data descriptions

NOAA will now use the FGDC Metadata Standard to describe new data sets (see the FGDC section on the ESDIM WWW Page). Because of the complexity of the FGDC Metadata Standard, NOAA has several tools to describe data sets:

1. NOAA FGDC Metadata Standard ASCII Text Character Template

The NOAA FGDC Metadata Standard Template was developed as a simplified tool that can be used to describe most NOAA data sets. This template is based on a template developed by the NASA Global Change Master Directory team with national and international coordination. National coordination is with U.S. federal agencies and international coordination is with the Committee for Earth Observation Satellites (CEOS) that coordinates the International Directory Network. We corrected and modified the GCMD template for NOAA use. The NOAA FGDC Template is available on the NOAA ESDIM home page or it can be obtained on PC diskette from NOAA Environmental Services Data Directory Office at 301-713-0572.

The NOAA FGDC Metadata Standard Template can be used to describe most NOAA data sets. The NOAA FGDC Metadata Standard ASCII Text Template for Use with Word Processing Programs can be copied and used with word processors. The line numbers on the template refer to fields described in the FGDC Metadata Standard Workbook. Completed data descriptions should be sent to the NOAA ESDD Office as a text file or by e-mail to the NOAA Environmental Information Services Data Directory Office (*help@esdim.noaa.gov*).

The Mapping of Directory Interchange Format (DIF) to FGDC Metadata Standard was used to convert NOAA DIF descriptions to the FGDC Metadata Standard format. It is available on the ESDIM WWW page, which shows corresponding FGDC Metadata Standard and DIF fields with new (non-DIF) fields added by NASA and NOAA.

2. WWW-based NOAA FGDC Metadata Standard Entry Tool

During FY-97, the NOAA Directory Office will develop a WWW-based tool for the description of NOAA data sets. It will allow online entry of data descriptions in the NOAA FGDC Metadata Standard format that can be transferred to disk files and can be sent directly to the ESDD Office as e-mail messages.

3. NOAA/NOS Toolkit Software Package for PCs using a database management system

The "Toolkit" was developed by the NOAA National Ocean Service as an ESDIM-funded project. The Toolkit is a PC application that uses pull down menus for all the fields available in the FGDC Metadata Standard. It operates using a PC DBMS. This software requires at least a 386 or 486 PC with 16K memory and much free disk space. It will accommodate all the fields in the FGDC Metadata Standard. It should be used for detailed descriptions of carto-

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Data directory, *from page 7*
graphic and GIS data sets such as charts, GIS applications, and GIS data sets. The records are stored by fields in a data base management system on the PC Output descriptions from the Toolkit can be saved as text files and as printed listings. Toolkit software may be downloaded from NOS.

Submitting NOAA data descriptions to the NOAA ESDD Office

Data descriptions (Figure 4) should be sent to the NOAA ESDD Office for review and input into the NOAA Directory. Output should be saved as an ASCII text file and sent on diskette or by e-mail to the NOAA Environmental Information Services Data Directory Office.

Contact the NOAA Environmental Information Services Data Directory Office at 301-713-0572, 301-713-0575, or *help@esdim.noaa.gov* for more information or for help using the FGDC Metadata Standard.

Future plans for the NOAA Environmental Services Data Directory

Future plans call for the implementation of the NOAA node of the FGDC Clearinghouse and direct linkage of the NOAA Directory to the NOAAServer system. The NOAA FGDC Metadata Standard data descriptions have successfully passed through the FGDC Metadata Parser program and a test implementation of the ISITE full text search program has been implemented. In early 1997, we plan a complete implementation of all 8100 NOAA data descriptions into the full NOAA FGDC Clearinghouse node.

The NOAAServer is a prototype system that involves NOAA Data Directory descriptions as pointers to fourteen NOAA data systems located in many NOAA organizations. The NOAAServer allows search of directory descriptions, and then allows the user to link to the NOAA browse or order system referred to in the description. In 1997 the NOAAServer operational design will be completed and will incorporate the NOAA Environmental Services Data Directory. ■

1 Identification Information
1.1 Citation 1.1.8.1
Originator: 1.1.8.2
Publication Date: 1.1.8.4
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1.1.8.8.1 Publication Place:
1.1.8.8.2 Publisher:
1.1.8.10 Online Linkage:
1.2 Description
1.2.1 Abstract: These publications of tropical cyclones were prepared by and are archived on microfiche at NCDC. 1871-1963 and subsequent historical publications are on microfiche. In addition, the historical data are on magnetic tape TD-9697 for the years 1886 to present. These tropical cyclone charts depict cyclone tracks for each year 1871 through 1986. Also available are charts of 'all' tropical cyclones by months, May through December and by 10 or 11 day periods June 1 through November 30. Periods of record and titles available are: 1886-1958: U.S. Weather Bureau Technical Paper No. 36, 'North Atlantic Tropical Cyclones.' Paper No. 55, 'Tropical Cyclones of the North Atlantic Ocean'. 1871-1977: 'Tropical Cyclones of the North Atlantic Ocean'. 1871-1980: 'Tropical Cyclones Of the North Atlantic Ocean'. (Updated periodically).

Additional Fields:
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StopDate: 19860101
1.2.2 Purpose:
1.2.3 Supplemental Information:
1.2.3.1 Entry ID: FA00397
1.2.3.5 Originating Center: NOAA/NESDIS/NCDC
1.2.3.6 Storage Medium: Microfiche
1.2.3.6 Storage Medium: Paper Copy
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1.4 Status
1.4.1 Progress:
1.4.2 Maintenance and Update Frequency:
1.6 Keywords
1.6.1 Theme: Keyword
1.6.1.1 Theme Keyword Thesaurus: None; uncontrolled keywords as used in GCMD DIF
1.6.1.2 Theme Keyword: CHART
1.6.1.2 Theme Keyword: CYCLONE
1.6.1.2 Theme Keyword: CYCLONE TRACK
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1.6.1.2 Theme Keyword: MAP
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1.6.1.2 Theme Keyword: OCEAN
1.6.1.2 Theme Keyword: PUBLICATION
1.6.1.2 Theme Keyword: STORM TRACK
1.6.1.2 Theme Keyword: SURFACE MAP
1.6.1.2 Theme Keyword: TROCYC
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1.6.2.2 Place Keyword: ATLANTIC OCEAN
1.6.2.2 Place Keyword: EQUATORIAL
1.6.2.2 Place Keyword: MID-LATITUDE
1.6.2.2 Place Keyword: SEA SURFACE
1.6.3 Stratum
1.6.3.1 Stratum Keyword Thesaurus:
1.6.3.2 Stratum Keyword:
1.6.4 Temporal
1.6.4.1 Temporal Keyword Thesaurus:
1.6.4.2 Temporal Keyword:
1.7 Access Constraints:
1.8 Use Constraints:
1.9 Point of Contact: Technical Contact
1.9.10.1 Contact Person Primary
1.9.10.1.1 Contact Person: THOMAS F. ROSS
1.9.10.1.2 Contact Organization:
1.9.10.2 Contact Organization Primary
1.9.10.2.1 Contact Organization:
1.9.10.2.2 Contact Person:
1.9.10.3 Contact Position:
1.9.10.4 Contact Address
1.9.10.4.1 Address Type: Mailing and physical address
1.9.10.4.2 Address: EASC E/CC32
151 PATTON AVE
1.9.10.4.3 City: ASHEVILLE
1.9.10.4.4 State or Province: NC
1.9.10.4.5 Postal Code: 28801-5001
1.9.10.4.6 Country: USA
1.9.10.5 Contact Voice Telephone: (704) 271-4994
1.9.10.6 Contact TDD/TTY Telephone:
1.9.10.7 Contact Facsimile Telephone:
1.9.10.8 Contact Electronic Mail Address: INTERNET > tross@ncdc.noaa.gov

6 Distribution Information
6.1 Distributor
6.1.10.2 Contact Organization Primary
6.1.10.2.1 Contact Organization: NOAA/NESDIS/NCDC > National Climatic Data Center
6.1.10.2.2 Contact Person: THOMAS F. ROSS
6.1.10.3 Contact Position:
6.1.10.4 Contact Address
6.1.10.4.1 Address Type: Mailing and physical address
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151 PATTON AVE
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6.2 Resource Description: TROCYC
6.3 Distribution Liability:
6.4 Standard Order Process
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6.4.2 Digital Form
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6.4.2.2 Digital Transfer Option
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6.4.2.2.2.4 Compatibility Information:
6.4.3 Fees:

7.2 Metadata Review Date: 19960730
7.3 Metadata Future Review Date:
7.4 Metadata Contact
7.4.10.1 Contact Person Primary
7 Metadata Reference Information
7.1 Metadata Date: 19901109
7.4.10.1.1 Contact Person: PETER M. STEURER
7.4.10.1.2 Contact Organization:
7.4.10.3 Contact Position:
7.4.10.4 Contact Address:
7.4.10.4.1 Address Type: Mailing and physical address
7.4.10.4.2 Address: EASC E/CC23
151 PATTON AVE
7.4.10.4.3 City: ASHEVILLE
7.4.10.4.4 State or Province: NC
7.4.10.4.5 Postal Code: 28801-5001
7.4.10.4.6 Country: USA
7.4.10.5 Contact Voice Telephone: (704) 271-4445
7.4.10.6 Contact TDD/TTY Telephone:
7.4.10.7 Contact Facsimile Telephone:
7.4.10.8 Contact Electronic Mail Address: INTERNET > psteurer@ncdc.noaa.gov
7.5 Metadata Standard Name: FGDC Content Standards for Digital Geospatial Metadata
7.6 Metadata Standard Version: June 8, 1994

▲ **Figure 4**. Sample data description in FGDC Metadata Standard Format: *Tropical Cyclones: North Atlantic, 1871-1986.*

The Office of NOAA Corps Operations

Research and survey vessels play vital role in bringing data to NESDIS centers

Jeanne Kouhestani
NOAA Public Affairs
NOAA/Office of the Under Secretary

At first glance, the uniformed officers and civilian contingent of the Office of NOAA Corps Operations (ONCO) might not seem to have much of a connection to NESDIS' national environmental data centers. But as managers and operators of the NOAA fleet of ships and aircraft are used to gather research data, ONCO personnel are indeed vital links in the chain that ultimately brings data into the NESDIS centers.

NOAA has the largest fleet of research and survey vessels operated by a federal civilian agency. The fleet supports a wide range of operational and research missions to accomplish fisheries, charting, and oceanographic and atmospheric research programs. NOAA Corps officers—all of whom hold science or engineering degrees (many of them advanced)—command and operate the ships and help implement the research being conducted on board.

The following is a brief overview of the important role played by ONCO and the fleet of NOAA ships across the NOAA spectrum as the agency strives to fulfill its environmental mandate (NOAA aircraft and personnel will be overviewed in a future issue of the *Earth System Monitor*).

Hydrographic surveys

The NOAA hydrographic survey ship *Rude* shone under the national spotlight this past summer when its NOAA Corps officers and crew diverted the ship to aid in search and recovery operations after the tragic crash of TWA Flight 800. Their relentless efforts day and night under horrendous conditions resulted in the speedy identification of the aircraft's major wreckage in less than 48 hours (Figure 1). Through the efforts of a quickly assembled on-site National Ocean Service (NOS)/NOAA Corps team that interpreted and plotted the sonar data, customized charts showing the exact location of the wreckage were provided each day to Navy divers, which enabled the divers to precisely pinpoint their dive targets to recover victims and wreckage as quickly as possible.

▲ **Figure 1.** The crew aboard the *Rude* transfers debris from the crash of TWA Flight 800 to a Coast Guard vessel.

That the *Rude* and its on-site team of hydrographers were able to immediately respond to and assist in a national crisis is a testament both to the flexibility and responsiveness of NOAA Corps officers and to the highly evolved skills and capabilities that have been developed as they fulfill NOAA's mission to survey and chart the nation's waterways. The *Rude*, along with the *Whiting* and the *Rainier*, conduct NOS hydrographic surveys for the creation and updating of nautical charts and bathymetric maps (Figure 2).

Aboard the ships are side-scan sonar and SEABAT multi-beam sounding systems that function to locate debris, submerged wreckage, shoals, and other navigational hazards (called contacts) along the seafloor. Each ship travels back and forth along imaginary track lines—called "mowing the lawn"—and methodically scans every inch of the seafloor within a defined area. The sonar data records and accompanying contact plots are interpreted and turned into the nautical charts that are essential to mariners for safe navigation.

Oceanographic and atmospheric research

The largest of NOAA's ships provide deep-ocean support to national and international global climate change and ocean and atmospheric research programs. These programs help implement seasonal to interannual climate forecasts and assess decadel-to-centennial change. They are essential to such efforts as predicting the effects of El Niño and global warming on the nation.

NOAA recently acquired a new addition to its fleet that will be used to help scientists better understand the forces in the equatorial Pacific Ocean that drive the world's climate.

Based in Hawaii, the *Ka imimoana*, or "Ocean Seeker", will help NOAA continue its important research on the El Niño phenomenon and other seasonal climate variations. The ship, a 224-ft. converted U.S. Navy T-AGOS vessel, has replaced the recently decommissioned *Discoverer*. *Ka imimoana* will

– continued on page 16

NOAA Public Affairs
NOAA/Office of the Under Secretary
HCHB 6013/PA
14th and Constitution, NW
Washington, DC 20230
E-mail: jkouhestani.rdc.noaa.gov

▲ **Figure 2.** While charting Alaska's coastal waters, NOAA Corps officers and crew work from both the rocky shore and a specialized hydrographic survey launch from the *Rainier*.

NOAA Corps, *from page 1*

be used primarily to deploy, recover and service approximately 70 deep-ocean buoys that measure wind direction and speed, air temperature and humidity, and temperature of the ocean in the equatorial Pacific.

The *Ka imimoana* carries modern computer and laboratory facilities that will enable NOAA and collaborating scientists to conduct additional investigations and collect oceanic and atmospheric data for climate studies while underway to the buoy arrays. The ship's computer systems collect data from a multitude of ship and mission sensors, then integrate and store the data for presentation.

High-speed communications between the ship and shore facilities allow datasets to be transferred ashore on a near-real-time basis. These data and other information about the ship's current activities are also available via the Internet at *http://rho.pmel.noaa.gov/atlasrt/kaimi.html*.

The first NOAA ship to be launched in 16 years became the *Ronald H. Brown* amid a glistening spray of champagne as the late Secretary's widow Alma Brown cracked a ceremonial bottle across the vessel's hull last May (Figure 3).

The *Brown* is a 274-ft., AGOR 24 class oceanographic research vessel that possesses the laboratories, scientific equipment, and other capabilities needed by NOAA to effectively carry out its research mission at sea. The launching of the ship was the last milestone in the shipbuilding process before the ship is delivered and commissioned in May 1997. The *Brown*'s home port will be in Charleston, S.C.

The *Brown* will replace the 26-year-old, 278-ft. *Malcolm Baldrige*, which was decommissioned in August shortly after it successfully completed a year-long, around-the-globe scientific research expedition.

Throughout this final cruise, the *Baldrige* gathered data on the ocean's role in global climate change and the El Niño phenomenon. This research was aimed at providing a scientific base for understanding ocean-atmosphere exchange processes and their effects on climate in the Atlantic, Indian, and Equatorial Pacific oceans.

Another proud veteran of NOAA s oceanographic research fleet, the *Discoverer*, was also decommissioned in August after sailing more than a million nautical miles—roughly equivalent to two round trips to the moon—through-out 30 years of service in the Atlantic and Pacific oceans. The 303-ft. *Discoverer* most recently completed a study of undersea volcanic activity and hydrothermal venting processes off the Washington-Oregon coast. Using the same side-scan sonar technology that the *Rude* used to locate the TWA wreckage, this final survey produced images with unprecedented detail of seafloor characteristics and sub-seafloor structures.

During her final field season, Discoverer also provided the platform for two of the largest oceanographic experiments ever conducted—the first Aerosol Characterization Experiment (ACE-1) and the final Pacific cruise for the World Ocean Circulation Experiment (WOCE)—to determine the effects of atmospheric pollution on global climate, and to understand the physics of climate change on Earth.

Shipboard scientific computer system

In 1988, the *Baldrige* became the first NOAA ship outfitted with an upgraded oceanographic unit, called the Scientific Computer System, that was developed by ONCO as a standard data acquisition system for the collection of sensor data from a wide variety of shipboard and deployed sensors.

SCS consists of two computer systems networked to provide for data acquisition as well as data processing functions. One is dedicated to acquire, log and display data in real time and perform real-time data quality assurance functions. The other is dedicated to shipboard scientists for data analysis and research direction, enabling them to make real-time decisions based on visualization of real-time data and the way the data relates. SCS has evolved since its initial installation aboard the *Baldrige*, and is currently installed on nine NOAA vessels—including the *Ka imimoana* and *Ronald H. Brown*—conducting oceanographic and fisheries research.

▲ **Figure 3**. NOAA's *Ronald H. Brown* was launched into the Intercoastal Waterway last May. The ship is expected to begin operations deep sea oceanographic and atmospheric research in the spring of 1977.

Support of fisheries research and coastal monitoring

In support of building sustainable fisheries, NOAA ships based on the Atlantic, Pacific, Gulf, and Hawaiian coasts conduct stock-status surveys, through a time-line data collection series, that provide to fisheries management councils the data on which fisheries resource-management plans are based. This directly impacts the multi-billion-dollar fishing industry. The Northeast Fisheries Science Center at Woods Hole, for example, claims the longest time series of scientific fisheries sampling data in the world for the National Marine Fisheries Service's (NMFS) groundfish survey database.

It is critical that all factors that go into performing the survey be equal. This means, essentially, that the vessel (in this case, the *Albatross IV* and the *Delaware II*), gear and fishing method have to be the same from year to year —or else precisely calibrated with previous systems—so that this year's data can be accurately compared with data collected through the time series. This, of course, can be complicated, as new equipment and methods are continually developed, and as government makes more use of private vessels to do some of the work (Figure 4).

The fleet is also the principal source of ship support to NMFS for research and living-marine resource assessment, including collection of marine mammal survey data required under the Marine Mammal Protection Act and Endangered Species Act, and program support of an international treaty to conserve marine living resources in the Antarctic. In addition, the fleet is also instrumental in developing and testing new fishing technology designed to reduce the damaging effects of bycatch on protected species.

NOAA's fleet enables joint research efforts by NMFS and the Office of Oceanic and Atmospheric Research (OAR), such as the Fisheries-Oceanography Cooperative Investigation for simultaneous acoustic, oceanographic and trawling studies to assess and forecast fisheries resources populations. The fleet also supports various coastal environmental research programs that have implications for economic development and amelioration of natural hazards, and supports research within NOS' National Marine Sanctuaries Program.

▲ **Figure 4**. Scientists sort fish aboard one of NOAA's fisheries research vessels to provide the data needed by fisheries managers to make decisions affecting the multi-billion dollar fishing industry.

Teacher at Sea Program

The enthusiasm for learning generated between teachers and students is the biggest payoff of ONCO's Teacher at Sea program, where teachers from kindergarten through college go aboard NOAA ships to work under the tutelage of scientists and NOAA Corps officers and crew. Now in its sixth year, the program has enabled 180 teachers—44 in 1996—to gain first-hand experience in science and data collection at sea. Teachers can enrich their classroom curricula with a depth of understanding made possible by living and working side-by-side, day and night, with those who contribute to the world s body of scientific knowledge.

According to ONCO Director Rear Admiral William Stubblefield, the program offers a win-win situation where teachers gain valuable field experience and research skills, and ships gain eager volunteers who, through their enthusiasm for learning, boost the morale of everyone on board. ■

Future products in the *World Ocean Atlas 1994* series

A progress report from the NODC Ocean Climate Laboratory

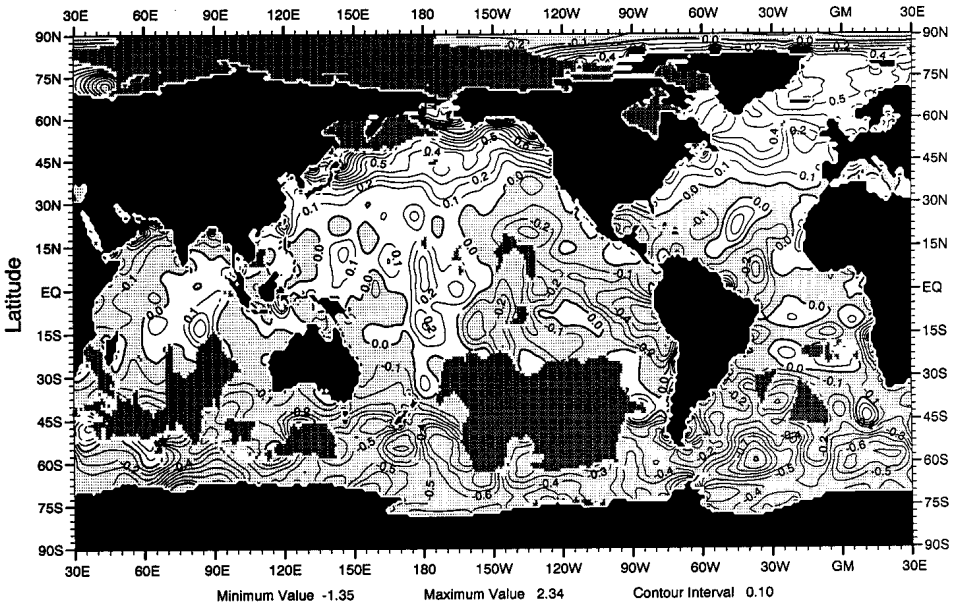
M.E. Conkright, T.P. Boyer, G.I. Monterey, J. Antonov, and S. Levitus
Ocean Climate Laboratory
National Oceanographic Data Center
NOAA/NESDIS

The Ocean Climate Laboratory (OCL) at the National Oceanographic Data Center (NODC) is supported by the NOAA Climate and Global Change and Environmental Services Data and Information Management Program (ESDIM) programs to produce scientifically quality controlled oceanographic databases and products based on these databases. Work to date includes quality control of historical *in situ* temperature, salinity, oxygen, phosphate, nitrate, and silicate data and the preparation of one-degree latitude-longitude mean fields for each of these parameters using objective analysis techniques.

Specifically, this project has produced five ocean atlases describing the global distributions of these parameters and two technical reports describing the quality control and processing procedures (Conkright *et al.*, 1994a, 1994b; Boyer *et al.*, 1994; Levitus and Boyer, 1994a, 1994b; Levitus *et al.*, 1994a, 1994b). Observed and standard level profile data (along with quality control flags), objectively analyzed one-degree latitude-longitude mean fields for each parameter, and five-degree square statistics of standard level values have been made available to the international oceanographic community as part of the *World Ocean Atlas 1994* (WOA94) CD-ROM series.

This article describes future data products and atlases based on the WOA94 data and analyses. These products will be released in 1997. Announcements will be made on the NODC World Wide Web site (URL *http://www.nodc.noaa.gov*) as these products become available.

National Oceanographic Data Center
NOAA/NESDIS
SSMC3, 4th floor
1315 East-West Highway
Silver Spring, MD 20910
E-mail: mconkright@nodc.noaa.gov



▲ **Figure 1.** Winter (January-March) minus Summer (July-September) distribution of surface phosphate (micromoles). The figure depicts general features in the seasonal distribution of phosphate in the oceans.

1. Seasonal distribution of phosphate in the World Ocean *(by M.E. Conkright and S. Levitus)*

Seasonal objectively analyzed mean fields of phosphate for the world ocean are nearly completed. The analyzed fields are being prepared using the phosphate data in CD-ROMs 4-7 of the WOA94.

Figure 1 shows Winter (Jan.-Mar.) minus Summer (Jul.-Sep.) differences in phosphate concentrations. This figure summarizes some of the general features in the seasonal distribution of phosphate. Stippled areas in this figure represents negative values (e.g., summer mean values are less than winter mean values). Positive seasonal phosphate differences (e.g., higher concentrations during the winter than summer) are observed primarily in the temperate and high latitudes of the Northern Hemisphere. The reverse is observed through most of the Southern Hemisphere.

The greatest concentration difference is observed in the subpolar North Pacific. There is a transition from waters with low phosphate content (associated with the central gyres) to waters with high phosphate content around 40° N in this basin. Upwelling regions along eastern boundary currents in the Northern Hemisphere have positive phosphate differences (e.g., Cape Blanc in Africa and the California coast); upwelling areas in the Southern Hemisphere (e.g., Peru and SW Africa) have negative phosphate differences. Negative differences are also found in high southern latitudes and in the western Indian Ocean.

2. *Quarter-degree objective analysis of temperature and salinity for the World Ocean (by T. Boyer and S. Levitus)*

This atlas (Boyer and Levitus, 1997) will present analyses of temperature and salinity annual mean fields on a quarter-degree grid. The quarter-degree mean values are analyzed over a radius of 134 kilometers; the one-degree mean values were analyzed over a radius of 551 kilometers. The advantage of the quarter-degree analysis over the one-

degree analysis is that it better resolves smaller scale features such as the Loop Current in the Gulf of Mexico. Also, small isolated regions, such as the Sulu Sea below 500 meters, are more clearly delineated on the higher-resolution grid.

A major drawback in the quarter-degree analysis is the significant lack of data in many areas of the ocean, particularly high latitudes. Bias from lack of data is magnified in the quarter-degree analysis since a much smaller area, and hence number of points, is used to analyze each separate grid point.

Figures 2a and 2b show a comparison between the one-degree and quarter-degree temperature analyses in the northern North Atlantic and the Norwegian Sea at 500 m depth. These figures show there is more penetration of North Atlantic water north of the Faroe Islands in the quarter-degree analysis. The pool of less than 0° C water is limited to an area well north of Iceland in the one-degree analysis, whereas this cold pool extends all the way south to Iceland in the quarter-degree analysis results. This area of the ocean is extremely important as a source of cold dense waters. The improved resolution may help correct problems found in models using the one-degree analysis as boundary conditions.

3. *Variability of temperature and heat storage in the upper 400 m of the World Ocean* *(by S. Levitus, J. Antonov, and T.P. Boyer))*

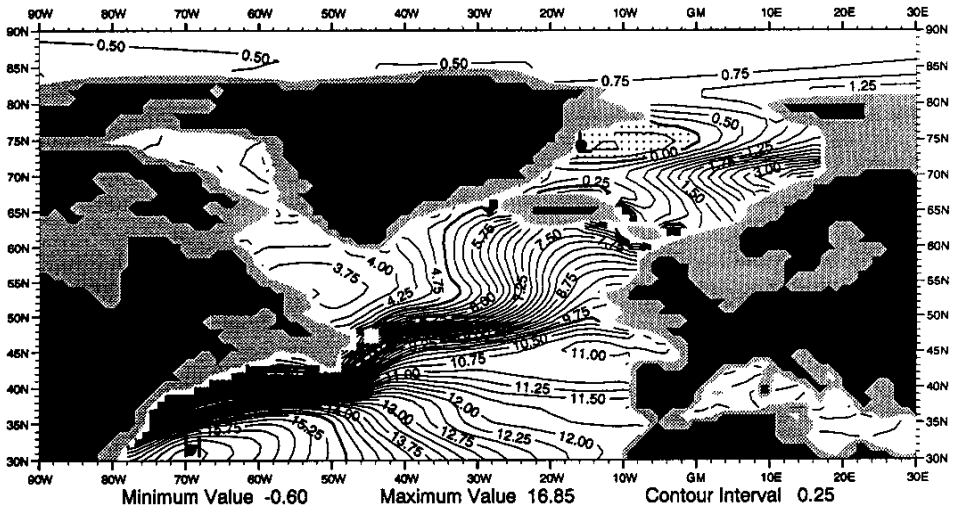
This professional paper (Levitus *et al.*, 1997a) will focus on the oceanic component of the global heat balance. Estimates of the oceanic heat storage, based on objectively analyzed one-degree temperature fields, were obtained for the upper 275 m layer of the ocean. These results were used to study the annual and interannual variability of the upper ocean heat storage and the rate of heat storage. This paper also presents a revised version of the monthly mean temperature fields (published in WOA94) and its annual and semi-annual harmonics from the sea surface to 400 meters depth.

4. *Climatological seasonal cycle of mixed layer depth in the World Ocean* *(by S. Levitus and G. I. Monterey)*

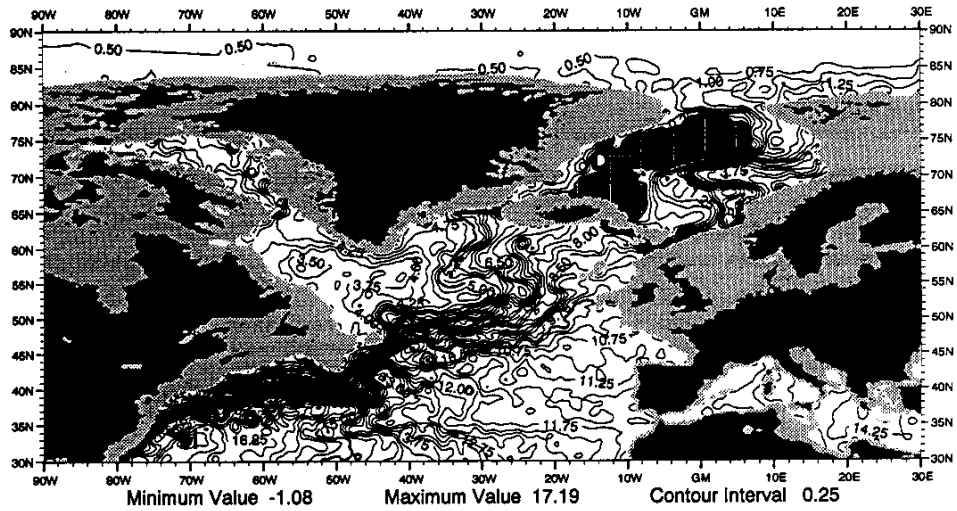
This atlas (Levitus and Monterey, 1997) will present maps of the climatological mean mixed layer depth (MLD) for the World Ocean as well as deviations from the climatological annual mean. The MLD is computed from the climatological monthly mean vertical profiles of potential temperature and potential density based on three different criteria: the temperature change from the ocean surface of 0.5°C; the density change from the ocean surface of 0.125 in sigma units; and the variable density change from the ocean surface corresponding to temperature change of 0.5°C. The variable density criterion is introduced to account for the effects of salinity on the MLD indicating areas where there is a halocline located above the thermocline.

Analysis of the MLD based on different criteria all show strong seasonality in mid- and high latitudes. The MLD gradually deepens during the summer-fall seasons and abruptly shallows during one month in the spring season. However, the MLD based on the temperature criterion and the MLD based on the variable density criterion exhibit significant differences. The MLD based on the variable density criterion is shallower than the tempera-

– continued on page 16

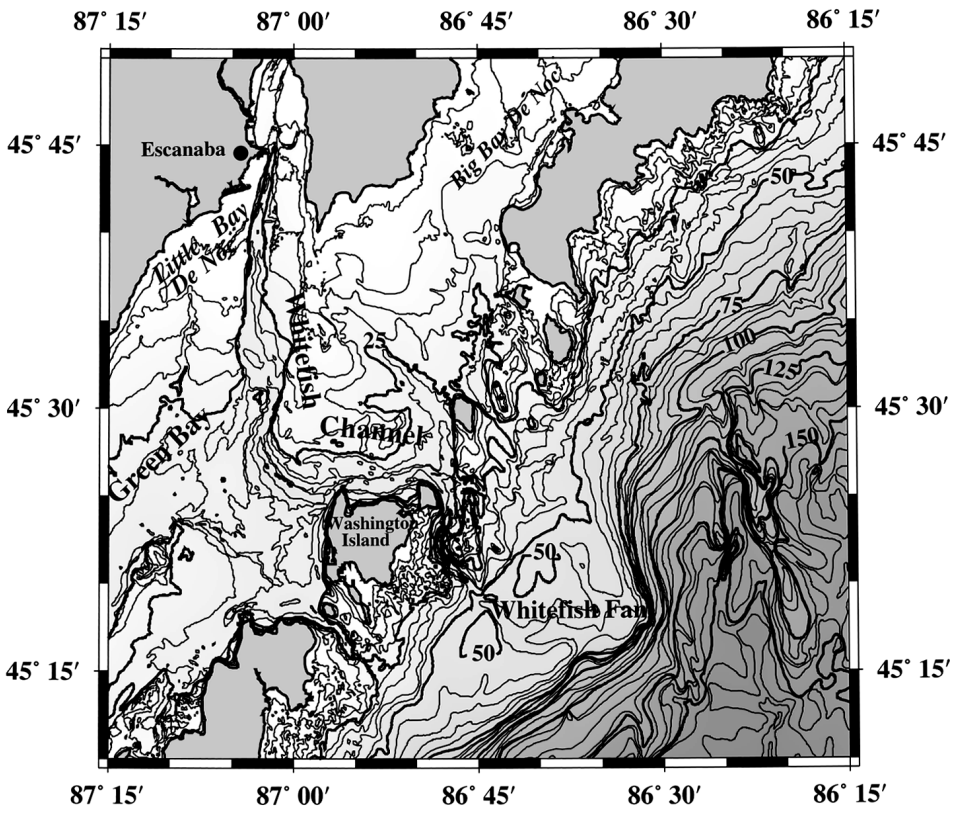


A **Low resolution temperature at 500 meters in the northern North Atlantic**



B **High resolution temperature at 500 meters in the northern North Atlantic**

▲ **Figure 2.** These two figures show a comparison between a one-degree and quarter-degree temperature analysis in the northern North Atlantic and the Norwegian Sea at a 500 m depth.



▲ **Figure 5**. Whitefish Fan and Channel, (whose formation has been attributed to drainage from Lake Superior into Lake Michigan at a time when the level of Lake Michigan was low), are a good example of features seen more clearly in this new bathymetry. The contour interval is 5 meters.

New bathymetry, *from page 5*

Marys River outlet. The level of the top of the fan constitutes a record of the level of Lake Chippewa at this location.

Compilers of bathymetry include Tezz Niemeyer and Bill Virden of the University of Colorado's and NOAA's Cooperative Institute for Research in Environmental Sciences (CIRES), and Reuben De la Sierra of the University of Michigan's and NOAA's Cooperative Institute for Limnology and Ecosystems Research (CILER), for Lake Michigan; John Warren of the Canadian Hydrographic Service, Lisa Taylor of NGDC, and Peter Vincent of CILER, for Lake Erie; Todd Berggren of NGDC and John Warren, for Lake Ontario; Peter Vincent and John Warren, for Lake Huron; and Keri Anderson of the University of Minnesota's Large Lakes Observatory, for Lake Superior.

A poster of the new bathymetry of Lake Michigan, and a CD-ROM containing digital bathymetric data and screen images, are currently available from NGDC. Posters, digital data sets, and geological summaries are scheduled for release in the near future. For more information concerning these products and data on the Great Lakes, contact Robin Warnken, NGDC, 325 Broadway, Boulder, CO 80303, Phone: 303-497-6338, e-mail: *rwarnken@ngdc.noaa.gov* or the NGDC Information Services Group at (303) 497-6826, e-mail: *info@ngdc.noaa.gov* or see the NGDC WWW site at URL: *http: www.ngdc .noaa.gov/*. ■

PRC-U.S. Joint Coordination Panel for Data and Information Cooperation

In accordance with Annex XII to the People's Republic of China-U.S. Protocol, the fifth meeting of the PRC-U.S. Joint Coordination Panel for Data and Information Cooperation was held at the National Oceanographic Data Center (NODC) in Silver Spring, Maryland during October 15-17, 1996. Dr. Henry Frey, Director of the NODC, and Mr. Liu Fakong, Deputy Director of China's National Marine Data and Information Service (NMDIS), were meeting co-chairs. During the meeting, a workshop on networking and distributed databases was held and technical experts from both countries gave informal presentations on recent developments at their respective Centers.

Both sides also provided the other with data sets and information from their archives. The completion of the digitized portion of the highly successful Joint PRC-U.S. Implementation Plan to Digitize the Maury Collection was reported upon; it was noted that the NMDIS overcame extremely difficult conditions in digitizing these data and produced a very high quality product from this work. Additionally, ongoing digitization efforts at NMDIS with surface marine observations, bathythermograph data, and biological data are expected to result in significant contributions to the Global Oceanographic Data Archeology and Rescue Project (GODAR).

Presentations were given on various aspects of ongoing efforts in coastal research, with specific emphasis on coastal forecasting. The U.S. Side agreed to receive one or two Chinese scientists to conduct joint research. The two groups agreed to cooperate on possible joint development of a Global Ocean Current Database, that would combine drifting buoy, Acoustic Doppler Current Profiler (ADCP), and current meter data. In the area of publications exchange, the U.S. has invited a Chinese librarian to work at the NOAA Central Library.

—Ronald Moffatt
Associate Director
World Data Center-A for Oceanography
NOAA/NESDIS
SSMC3, 4th Floor
1315 East-West Highway
Silver Spring, MD 20910
E-mail: rmoffatt@nodc.noaa.gov

World Data Center-A/NSIDC implement Global Geocryological Database and new CD-ROM

The National Geophysical Data Center's (NGDC) World Data Center-A for Glaciology/National Snow and Ice Data Center (WDC-A/NSIDC) has been funded by the National Science Foundation to implement a pilot "Global Geocryological Database " (GGD). This effort provides start-up funding for the assembly of priority permafrost and frozen ground datasets in Russian archives, and for WDC-A/NSIDC to inventory, retrieve, and organize priority datasets identified by other members of the International Permafrost Association (IPA).

A planned CD-ROM will be entitled CAPS—Circumpolar Active-Layer Permafrost System: A Contribution to Global Change Research. IPA Adhering Members are being asked to contribute at least one long-term dataset for the CD-ROM, and individuals and IPA Working Groups are also invited to contribute important data to the project. Nominations for inclusion were required by December 1, 1996.

Further information on the GGD project is given in the IPA Newsletter *Frozen Ground*, no.18, December 1995, p.12; also see the IPA Home Page at URL: *http://www.geodata.soton.ac.uk/ipa*. Information on contributing to the GGD project can be obtained from the WDCA-A/NSIDC at:
World Data Center-A for Glaciology
GGD/CAPS Project
CIRES, Campus Box 449
University of Colorado
Boulder, CO 80309-0449 USA
Phone: R.G. Barry; 303-492-5488 or
C. Hanson; 303-492-1834
Fax: 303-492-2468
E-mail: *nsidc@kryos.colorado.edu*.
Contact: NSIDC

NODC releases update of moored ADCP data CD-ROM

The National Oceanographic Data Center (NODC) is pleased to announce the availability of a new Naval Surface Warfare Center (NSWC) Moored ADCP Data CD-ROM, which includes a database comprised of Acoustic Doppler Current Profiler (ADCP) data collected at ten-minute intervals from a site on the eastern shelf of Florida from 1994-1995. This release is the second in a series of CD-ROMs containing ADCP data from this location released by the NODC.

Data products and services

The bottom-mounted 300 KHz RD Instruments ADCP is located offshore Ft. Lauderdale, FL at 140 meters, positioned approximately 26 04.0° N and 80 03.5° W. The unit is supported by the NSWC, which receives binary data directly from the ADCP by way of a submerged cable.

Data and information on the single CD-ROM is in ASCII format with the exception of the original binary data files. A corresponding set of processed ADCP files is included in ASCII format. The CD-ROM contains Hovmueller plots of the interpolated current velocity averages in GIF format which are viewable through Netscape or other browsers.
Contact: NODC

NGDC's SDTS-compliant geodetic framework data prototype

The National Geophysical Data Center (NGDC) has created a prototype of Spatial Data Transfer Standard (SDTS)-formatted geodetic framework data, which is under evaluation by the National Geodetic Survey (NGS). The CD-ROM contains geodetic data for all published control points in the state of Hawaii and has been prepared through a joint effort by NGDC and NGD (funded by the Environmental Services Data and Information Management (ESDIM) program).

In addition to developing procedures to port NOAA's geospatial data into SDTS compliant-format, NGDC and NGS are working with the Federal Geographic Data Committee (FGDC) and vendors of commercial GIS software to improve and correct a standard and software that are still in need of development. NGDC has provided leadership in the development of a new SDTS Point Profile which will make possible the transfer of high-precision scientific point data. The Point Profile is currently under review by the FGDC. Following FGDC approval, approval from the American National Standards Institute will be sought. Through this process NOAA, via NGDC, will become a leader in guiding SDTS into handling scientific, as opposed to strictly cartographic, spatial data.
Contact: NGDC

NCDC adds satellite data web page to the Center's WWW site

The National Climatic Data Center (NCDC) has added a Satellite Data, Products, and Services page to its home page under the Products, Publications, and Services section. Twenty new Hypertext Markup Language (HTML) pages were included in this section. Pages include: high-level information on Polar-Orbiting Environmental Satellites (POES), Geostationary Operational Environmental Satellites (GOES), and the Defense Meteorological Satellite Program (DMSP); detailed listings of available satellite data and products; a pricing and ordering guide; and many examples of retrospective image products created using the Man-computer Interactive Data Access System (McIDAS).

This new Web page can be accessed directly at URL: *http://www.ncdc.noaa.gov/psguide/satellite/sathome.html* or via the NCDC Home Page at the URL listed.
Contact: NGDC

CONTACT POINTS

National Climatic Data Center (NCDC)
704-271-4800
Fax: 704-271-4876
E-mail: *Climate Services - orders@ncdc.noaa.gov*
Satellite Services - satorder@ncdc.noaa.gov
WWW: *http://www.ncdc.noaa.gov/*

National Geophysical Data Center (NGDC)
303-497-6419
Fax: 303-497-6513
E-mail: *info@ngdc.noaa.gov*
WWW: *http://www.ngdc.noaa.gov/*

National Oceanographic Data Center (NODC)
301-713-3277
Fax: 301-713-3302
E-mail: *services@nodc.noaa.gov*
WWW: *http://www.nodc.noaa.gov*

NOAA Environmental Services Data Directory
301-713-0572
(Gerry Barton)
Fax: 301-713-1249
E-mail: barton@esdim.noaa.gov
WWW: *http://www.esdim.noaa.gov/#data-products*

NOAA Central Library
Reference Services:
301-713-2600
Fax: 301-713-4599
E-mail: *reference@nodc.noaa.gov*
WWW: *http://www.lib.noaa.gov/*

WOA94 products, *from page 13*

ture criterion in several areas located in the equatorial and subpolar latitudes due to the formation of a strong halocline above the thermocline.

5. *Climatological seasonal cycle of steric sea level in the World Ocean*

(by S. Levitus, G.I. Monterey, and T. Boyer)

This atlas (Levitus *et al.*, 1997b) will present maps showing climatological monthly mean dynamic height (dynamic centimeter) of sea surface relative to 1000 m depth, the mean dynamic height (MDH) deviation from the climatological annual mean, and results of the MDH Fourier analysis. The latter includes geographic distributions of amplitudes and phases of the first and second Fourier harmonics, and percent variance contributed by these harmonics to the climatological annual cycle. Zonal averages of these quantities over one-degree latitude belts for the global ocean and for the individual ocean basins are presented.

Results from the Fourier analysis show that the first harmonic is the dominant contributor to the annual cycle for most of the world ocean. The second harmonic plays an important role in the tropical Indian Ocean and in some regions of the tropical Atlantic and Pacific Oceans.

The data products and atlases described in this article are expected to be available by mid-1997. For information on the *World Ocean Atlas 1994* series and accompanying CD-ROMs already available, please contact the NODC User Services Group at: National Oceanographic Data Center, NOAA/NESDIS, E/OC1, SSMC3 4th Floor, 1315 East-West Highway, Silver Spring, MD 20910; Phone: 301-713-3277; Fax: 301-713-3302; E-mail: *services@nodc.noaa. gov*; WWW: *http://nodc.noaa.gov*.

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