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BACKGROUND: With the addition of environmental assessment responsibilities for State waters, mandated by the Oil Pollution Act of 1990, the MMS is required to analyze oil-spill risks within the inner shelf zone (ISZ), the 3- to 10-mile-wide band of marine waters adjacent to the coast. The ISZ has significant differences in physical circulation from the open shelf, due to (1) overlap of the benthic boundary layer and surface mixed layer, (2) complex lateral boundary geometry, (3) wave energy focusing and concentration, and (4) wind stress shears associated with the marine boundary layer. A successful approach to environmental risk assessment in the ISZ, adopted by the MMS, is the use of actual field measurements (i.e., data, as opposed to model results), blended with regional information from all sources, to provide engineering estimates of long-shore currents. The study effort involves a series of current meter moorings in the northeastern Gulf of Mexico ISZ to develop an adequate database for these assessments. Results of the drifting buoy component of the study have been coming in on a regular basis. The current meter moorings have been deployed.

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OBJECTIVE: To advance our understanding of the nearshore circulation in the northeastern Gulf of Mexico and improve our capabilities of predicting oil-spill trajectories. The field measurements study proposed here will provide the data for ISZ oil-spill risk assessments mandated by the Oil Pollution Act of 1990.

DESCRIPTION: This report presents the results of an experiment involving several hundred satellite-tracked surface drifters used, together with an auxiliary series of moored current meters and meteorological buoys, to measure the nearshore circulation in the coastal waters of the northeastern Gulf of Mexico. The drifter experiment was performed under the direction of Dr. P. P. Niiler of Scripps Institution of Oceanography. In addition to the surface drifter program, a program of moored current meters was carried out cooperatively by Florida State University and the University of South Florida. The mooring program was designed to supplement previous moored current data as well as to complement the drifter study.

SIGNIFICANT CONCLUSIONS: The drifters were deployed from aircraft to 26 stations on the continental shelf by the manufacturer, Technocean, Inc., with a 99% success rate. The average at-sea life of a drifter that survived the air deployment was 73 days. Over a 12-month period, at approximately 2-week intervals, a new drifter was deployed by parachute to one of these 26 stations if no drifter was found within a 5-km distance. In all, 25,100 one-day average displacements were obtained. Abstracts of the scientific publications that have resulted from these data refer to specific dynamical inferences drawn from these data. The report presents a summary of the statistical analyses. The displacements of the drifters on the west Florida shelf were variable in time and occurred principally along bottom topographic contours. The monthly mean currents were the strongest along the shelf break and west of Cape San Blas. Significant mean flows occurred on the shelf break to the south or southeast and nearshore along the Florida panhandle to the west. Across-shelf currents were strongest off Cape San Blas and the Mississippi Sound. The largest excursion from the general oscillating drift pattern occurred in early October 1996 when, during a tropical storm, 35 drifters moved at speeds in excess of 50 cm/sec westward from the west Florida shelf past the Mississippi River delta as far as the Louisiana-Texas shelf. One unexpected finding was a “forbidden” zone that emerged north of the Florida Bay, south of Tampa Bay, suggesting that a region exists where no drifters venture.

About 47% of the velocity variance can be explained by spatial-scale coherent patterns that occupy the entire horizontal extent of the northeast Gulf shelf. The spatial correlation scale of the along-topography currents along isobaths is about 50 km in water depths between 10-30 m and 350 km in water depths of 50-80 m. Both local winds and remote forcing from the Loop Current were shown to produce the observed strong events in the large spatial-scale flow patterns. The region of the shelf between 100-m and 30-m depths exhibited no annual mean velocity, but drifters from that region were ejected to all four corners of the Gulf of Mexico in less than 120 days by short-lived strong events in circulation.

STUDY RESULTS: The measurements taken from the two different observation systems compare well. Also, if the wind blows at a certain speed in a given location, we can then compute the near-surface currents with a reasonable accuracy. The coefficients obtained are presented in the report.

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