MMS Technical Announcement

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

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Deepwater Observations in the Northern Gulf of Mexico from In-situ Current Meters and PIES, Volume I: Executive Summary and Volume II: Technical Report

OCS Study MMS 2003-048 and 2003-049

The Minerals Management Service (MMS), Gulf of Mexico OCS Region, announces the availability of a new study report, Deepwater Observations in the Northern Gulf of Mexico from In-situ Current Meters and PIES, Volume I: Executive Summary and Volume II: Technical Report.

A combination of in-situ and remote-sensing observations were employed to document and study the oceanography of the upper (depths less than 1,000 m) and lower layers (depths greater than 1,000 m) of the deep Gulf of Mexico in a joint effort between MMS and BP Exploration Inc. The observations were made near the Sigsbee Escarpment (about 27.25° N. latitude and 91° W. longitude) in water depths ranging from 1,500 on the top of the Escarpment to 2,100 m away from it beginning in August 1999 and lasting two years. The mooring separations and vertical resolution were designed to detect motions associated with topographic Rossby waves thought to be present in the study area.

The data collected allowed an excellent characterization of the two-layer structure of the current field in the deeper Gulf of Mexico. The upper layer was strongly affected by Loop Current eddies, cyclonic eddies, and cyclonic boundary eddies that occur on the Loop Current and on Loop Current eddies. The migrating eddy fields were a major cause of the time varying velocity and temperature field. In the lower layer (depths ≥ 1,000 m), current shear was often relatively weak, such that in 2,000 m water depths, this lower layer moved almost as a “slab.”

The high-speed events that occur in this lower layer were periodic (8- to 12-day periods are common), and these events persisted from two to six months, based on this two-year time series. The deep currents were such that the highest current speeds occurred near the bottom (bottom intensified). Highest measured currents were approximately 95 cm/s (≈ 2 kn) at 100 m above the bottom and 75 cm/s at 10 m above the local bottom. Currents above 50 cm/s were relatively common with the passage of trains of waves. If, as these data seem to show, these trains of periodic current variations are due to passage of topographic Rossby waves of short periods, their source region is probably relatively close to the measurement sites and do not appear to propagate into the western Gulf basin. Pressure inverted echo sounders (PIES) were employed to obtain vertical profiles of temperature and salinity. PIES is a combination of pressure and acoustic sensors that rest on the ocean floor. This instrument measures the round-trip time of a sound pulse and converts it to temperature and salinity values using the Gravest Empirical Mode (GEM) methodology. The pressure measurements are used to correct the geostrophic velocities determined from the temperature and salinity profiles. Combining the geostrophic velocities with the measured reference current velocities near the seabed resulted in an absolute velocity profile that agreed well with the measured profile.

This report is available only in compact disc format. The discs are available from the Minerals Management Service, Gulf of Mexico OCS Region, at a charge of $15.00 by referencing OCS Study MMS 2003-048 and 2003-049. You will be able to obtain this report also from the National Technical Information Service in the near future. Here are the addresses. You may also inspect copies at selected Federal Depository Libraries.

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