

BOEM ENVIRONMENTAL STUDIES PROGRAM: ONGOING STUDIES

BOEM OCS Region: [Gulf of Mexico](#)

Title: Current Measurements in the Yucatan-Campeche Area in Support of Loop Current Dynamics Study (GM-09-07)

Planning Area: Eastern Gulf of Mexico

Total Cost: \$1,100,00.00

Period of Performance: FY 2009-2013

Conducting Organization: CICESE, Mexico

BOEM Contact: [Dr. Alexis Lugo-Fernández](#)

Description:

Background: The most influential driving force in the Gulf of Mexico is the Loop Current (LC). The LC is the main source of water for the Gulf, transporting relatively warm and salty waters from the Caribbean Sea at a rate of 25-30 Sv. During its north-south incursion cycle, the LC sheds large warm or anticyclonic eddies (diameters of 200-400 km) that propagate to the western Gulf at speeds of 4 to 8 km-day⁻¹. This strong jet, with surface velocities on the order of 150 cm·s⁻¹ dominates the mesoscale variability of the Gulf, especially in deep waters where it is believed to influence the current field through frontal eddies, and the source of Topographic Rossby waves and near bottom-trapped eddies. This strong current is also the beginning of the Gulf Stream Current, which is part of the meridional circulation of the Atlantic Ocean. Despite these superlatives, very few studies of this potent current have been completed in the past. Most of our current knowledge of this current is through indirect methods or hydrographic surveys, satellite studies, numerical modeling, and few moorings (about five) placed on this feature. Based on statistical analysis of satellite data, we know that it penetrates into the northern Gulf in a nearly chaotic mode at intervals of 0.5-18 months. Once it reaches its most northerly position, it breaks and sheds a large warm Loop Ring.

Recently, strong and nearly barotropic currents have been observed below mid-depth in depths > 2000 m. These strong currents are associated with large bathymetric gradients and the presence of topographic Rossby waves with periods of 10 to 30 days. Also, strong currents are associated with near bottom eddy-like features in the neighborhood of the steep topography. Recent observations (Exploratory draft final report) and ray tracing techniques suggest that Rossby waves originated near the LC in the eastern Gulf, but we lack unequivocal data on this and even the mechanism(s) to generate these Rossby waves. Recommendations in the exploratory study draft report suggest the analyses of the detachment processes, the vertical coupling, and effects of LC frontal eddies in eddy shedding to better understand the role of the LC on the overall Gulf oceanography.

Objectives: The purpose of this proposed study is to leverage ongoing measurements by Mexican scientists of the Yucatan-Loop Current in Mexican waters for a period of three

years and to analyze the data of ocean currents to learn about the dynamics of this current. This was a suggestion from our past workshop in US-Mexico Deepwater Oceanography in New Orleans. The observed data will be used to:

- Complement our LC dynamics study in US waters and improve the accuracy of our analyses and advance the knowledge;
- Extend the database of transport in the Yucatan Channel and provide realistic boundary condition for LC dynamics; and
- Leverage the ongoing program of current measurements in Mexican waters sponsored by Government agencies in Mexico. In the absence of such leverage data availability for our study could be minimal to none.

Methods: Standard oceanographic methods (moorings, PIES, and hydrographic surveys) will be employed to collect ocean current data and to analyzed the resulting data to extract as much information and knowledge as possible from it. Satellite data will be needed to provide the synoptic view plus data on other aspects of the LC available only through this technology. The accompanying figure presents the government's conceptual design of the mooring array, consisting of nine locations in the study area. The performance period will be divided into three years of field work and data collection, and two years for data analyses and report completion. The BOEM is taking advantage of ongoing measurement campaigns by Mexican oceanographers in the Yucatan-Campeche area to improve the results of our \$5 million investment in US water.

Products: Database, reports, and scientific publications.

Importance to BOEM: The data and results of the study will supplement our LC dynamics study by providing the upstream conditions in the LC. This enhanced database should help improve forecasting of eddy shedding and intrusions of the LC in the Gulf of Mexico. Improved forecasting capability will be employed by BOEM and industry to prepare for and avoid high currents during exploration and production activities, that such reduced among others things downtime, losses or accidental releases, and material fatigue all which are of concern to BOEM.

Current Status: All moorings were retrieved as scheduled and data analysis is in full throttle. While BOEM is still pursuing this, it seems highly unlikely that BOEM will acquire the entire data between Yucatan and Cuba.

Final Report Due: October 2012

Publications: None

Affiliated WWW Sites: None

Revised date: December 2011

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