

BOEM ENVIRONMENTAL STUDIES PROGRAM: ONGOING STUDIES

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

Title: Dynamics of the Loop Current in U.S. Waters (GM-08-01)

Planning Area: Eastern

Total Cost: \$5,497,000.00

Period of Performance: FY 2009-2013

Conducting Organization: Science Applications International Corporation

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

Description:

Background: The most influential driving force in the Gulf of Mexico is the Loop Current (LC). The Loop 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 Loop Current 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 deepwaters 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 knowledge of this current is through indirect methods or hydrographic surveys, satellite studies, numerical modeling, and a 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 study draft final report) and ray tracing techniques suggest that Rossby waves originated near the Loop Current in the eastern Gulf however, 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 study is to make observation inside the LC for a period of three years and to analyze the data of ocean currents to learn about the dynamics of this current. The observed data will be used to understand and improve predictions of the

shedding mechanism and energy leak from surface to bottom.

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. Satellite data will be needed to provide the synoptic view plus data on other aspects of the LC that are 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.

Products: A dataset of ocean currents measured, technical reports, technical presentations, and scientific publications in peer reviewed journals.

Importance to BOEM: This study will help Bureau of Ocean Energy Management, to better assess the LC dynamics and its importance to the Gulf's oceanography and circulation, and its role in the generation of Rossby waves and eddy shedding mechanism. The study and products should help improve numerical models in the Gulf by incorporating the insights gained in this study that in turn would help make better predictions.

Current Status: The recovery cruise was completed in November 2011 as scheduled. Data analysis will be begin full throttle.

Final Report Due: September 2013

Publications: None

Affiliated WWW Sites: None

Revised date: December 2011

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