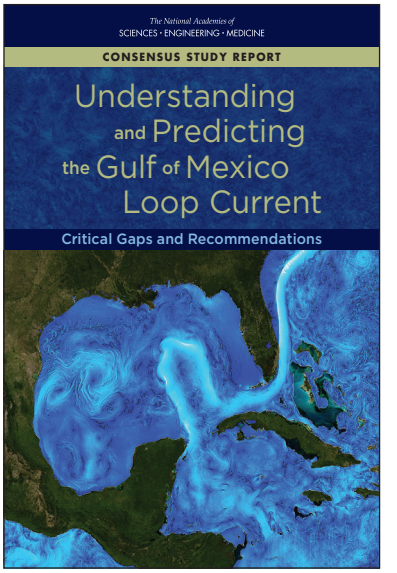
Consensus Study Report

January 2018

HIGHLIGHTS

Understanding and Predicting the Gulf of Mexico Loop Current

Critical Gaps and Recommendations



The Loop Current System is the dominant ocean circulation feature in the Gulf of Mexico, influencing all types of ocean processes. Its behavior has implications for a variety of human and natural systems. However, knowledge about the underlying dynamics that control the Loop Current System's behavior is limited. This undermines capability to accurately model and forecast it, which limits capability to prepare for and react to changes in its behavior over time. Improved understanding of the Loop Current System would provide invaluable information for a variety of human activities as well as for the overall understanding of the Gulf of Mexico as a whole.

This report identifies existing knowledge gaps about the Gulf of Mexico Loop Current System and provides recommendations for a suite of complementary efforts that could be undertaken to fill these gaps. In addition, the report is intended to help guide future funding investments by the Gulf Research Program of the National Academies of Sciences, Engineering, and Medicine working together with federally-operated and federally-sponsored organizations, international agenies (namely Mexican and Cuban entities), and private institutions and industry.

WHAT IS THE LOOP CURRENT SYSTEM?

The Loop Current System (see Figure 1) includes the Loop Current, a warm ocean current that flows northward through the Yucatán Channel up into the Gulf of Mexico where it eventually meanders eastward and southward before exiting out through the Florida Straits and feeding into the Gulf Stream; it also includes Loop Current eddies, which are circular currents that occasionally separate from the main flow of the Loop Current and move westward. The position of the Loop Current varies from a retracted state, where it flows from the Yucatán Channel nearly directly east to the Florida Straits, to an extended state, where it flows into the northern and western Gulf before exiting through the Florida Straights. The Loop Current eddies that occasionally shed from the main flow of the Loop Current can extend over large areas (~300 km diameter) and can persist for months as they drift slowly west toward Texas and Mexico. As this system of the Loop Current and its eddies moves through the Gulf of Mexico, it brings with it large, deep masses of warmer water and strong currents that influence all types of ocean processes, including oil and gas exploration and production.

FIGURE 1 The flow patterns of the Gulf of Mexico Loop Current System. *Sources: UCAR and NASA*

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WHY THIS REPORT?

The Loop Current System is the dominant ocean circulation feature in the Gulf of Mexico. Hurricane intensity, harmful algal blooms, shallow water nutrient supply, Gulf of Mexico ecology, offshore safety, oil spill response, the fishing industry, tourism, and the Gulf Coast economy are among the various things affected by its behavior.

Despite the major impact of the Loop Current System on human and natural systems, though, knowledge about the underlying dynamics that control its behavior is limited. Scientists have dedicated over half a century of attention to understanding the Loop Current System, yet it is still not known what causes the Loop Current to change position or shed an eddy, nor can the timing of when these events might occur be predicted accurately. As such, it remains challenging to prepare for and react to changes in Loop Current System behavior and subsequent impacts over time.

Improved knowledge about the dynamics of the Loop Current System would provide invaluable information to help promote safer offshore operations, better understand the Gulf's complex oceanographic systems, facilitate disaster response, protect coastal communities, protect and manage ecological resources, and predict and forecast weather and climate impacts. This study by the National Academies of Sciences, Engineering, and Medicine was undertaken to identify existing knowledge gaps about Loop Current System dynamics and develop a list of recommended efforts that could be undertaken to fill those knowledge gaps.

RECOMMENDATIONS

The 30 recommendations included in this report outline a comprehensive campaign of research, observation, and analysis activities that would help improve understanding, modeling, and forecasting of the Gulf of Mexico Loop Current System. The recommendations are divided into observational components, technology enhancements, analyses and theory, and data assimilation and numerical modeling techniques needed to fill knowledge gaps about the Loop Current System. In addition, the recommendations indicate whether activities should start in the near term or can begin later, building on the near-term activities. The campaign outlined is envisioned as an international, multi-institutional, collaborative effort expected to take approximately ten years to complete at a total cost in the range of $100-125 million.

COMMITTEE ON ADVANCING UNDERSTANDING OF GULF OF MEXICO LOOP CURRENT DYNAMICS

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For More Information . . . This Consensus Study Report Highlights was prepared by the Gulf Research Program based on the Consensus Study Report *Understanding and Predicting the Gulf of Mexico Loop Current: Critical Gaps and Recommendations* (2017). The study was sponsored by the Gulf Research Program of the National Academies of Sciences, Engineering, and Medicine. Any opinions, findings, conclusions, or recommendations expressed in this publication do not necessarily reflect the views of any organization or agency that provided support for the project. Copies of the Consensus Study Report are available from the National Academies Press, (800) 624-6242; http://www.nap.edu.

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