Separation of Loop Current Eddy in the Gulf of Mexico

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Introduction

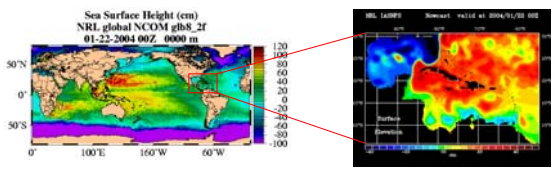
The Yucatan Current enters the Gulf of Mexico from the Caribbean Sea through the Yucatan Strait. After turning north-westward and forming the Loop Current, it turns anti-cyclonically to the south-east and exits through the Straits of Florida. The Loop Current may extend far into the northeastern Gulf. A large anticyclonic eddy periodically pinches off from the Loop Current forming the Loop Current Eddy, which then propagates toward the west. The Loop Current and the Loop Current Eddies have significant effect on the circulation in the Gulf of Mexico not only in the deep water but also on the shelf region.

The evolution of the Loop Current and the Loop Current Eddy separation is complicated and it is often difficult to observe. By the synthesis of satellite remote-sensing data with a dynamic ocean model, a continuous picture of Loop Current evolution and Loop Current Eddy separations emerges.

Data and Ocean Model

The satellite remote-sensing sea surface height anomaly (SSHA) from altimeters (GFO and Jason-1), the multi-channel sea surface temperature (MCSST) from AVHRR, and the chlorophyll field from SeaWIFS are used in the study. The altimeter SSHA and MCSST are assimilated into an Intra America Sea (IAS) ocean model which includes the Gulf of Mexico to produce a dynamically consistent 4-dimensional picture of oceanic variations. The Chlorophyll fields from SeaWIFS provide an independent verification.

The IAS model is based on the Navy Coastal Ocean Model (NCOM). It has a ~5 km horizontal resolution and 41 levels. The lateral boundary conditions are provided by the global NCOM and the surface forcing is from NOGAPS.



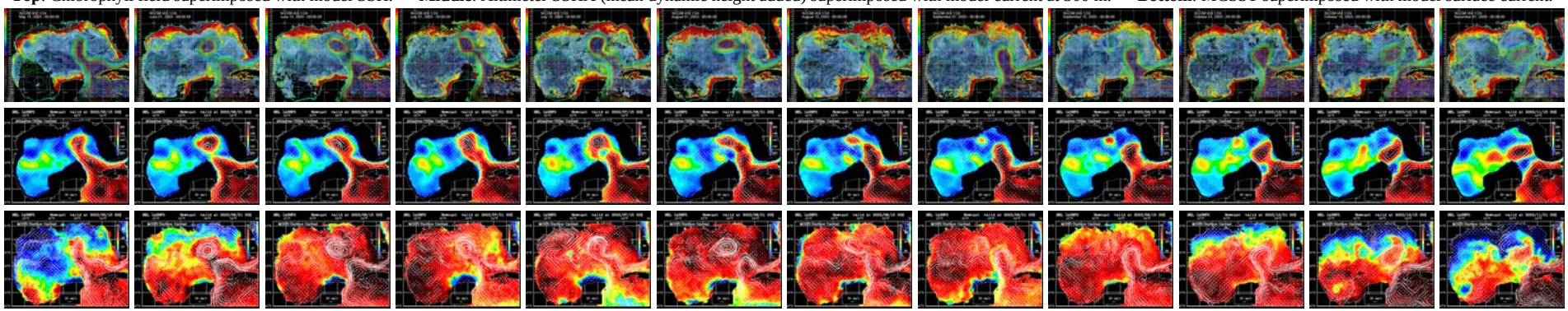
Summary

By the synthesis of the satellite remote-sensing data with a dynamic ocean model, we are able to better track the Loop Current evolution and Loop Current Eddy separations in the Gulf of Mexico.

Our result shows that at the end of May 2003, the Loop Current extended anomalously far northward into the Gulf. Over next 2 months, an anti-cyclonic eddy twice separated from the Loop Current. Each time the eddy re-attached to the Loop Current. Then a small Loop Current Eddy pinched off from the Loop Current at end of August 2003 and propagated to the west. Finally, in October 2003, approximately 4 months from the first separation, a large Loop Current Eddy separated from the Loop Current. The Loop Current retreated totally to the south.

The ocean model and the data assimilation have been applied to a real-time ocean nowcast/forecast system (IASNFS). It provides daily ocean prediction for the IAS which can be viewed at ***http://www7320.nrlssc.navy.mil/internal/IASNFS_WWW/***

Top: Chlorophyll field superimposed with model SSH. **Middle**: Altimeter SSHA (mean dynamic height added) superimposed with model current at 300 m. **Bottom**: MCSST superimposed with model surface current.



a. In May of 2003, the Loop Current extended anomalously far northward into the Gulf.

b. Over next 2 months, an anti-cyclonic eddy twice separated from the Loop Current. Each time the eddy re-attached to the Loop Current.

c. A small Loop Current Eddy pinched off from the Loop Current at end of August 2003 and propagated to the west.

d. A large Loop Current Eddy separated from the Loop Current at October 2003. The Loop Current retreated totally to the south.