

The Loop Current and Its Variable Movement

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The Loop Current is a warm ocean current that forms when the Caribbean Current moves northward into the Gulf of Mexico via the Yucatan Channel, which is located between the Yucatan Peninsula of Mexico and Cuba. The loop current then moves east and southward before exiting into the Florida Straits, linking with the Antilles Current to form the Gulf Stream. The Loop current, while a semi-permanent feature of the Gulf of Mexico, is variable in configuration and position. At one extreme, it has an almost direct path to the Florida Current, which runs through the Florida Straits. At the other extreme, the Loop Current intrudes into the Gulf of Mexico, forming an intense clockwise flow as far north as the Mississippi river delta or the Florida continental shelf.

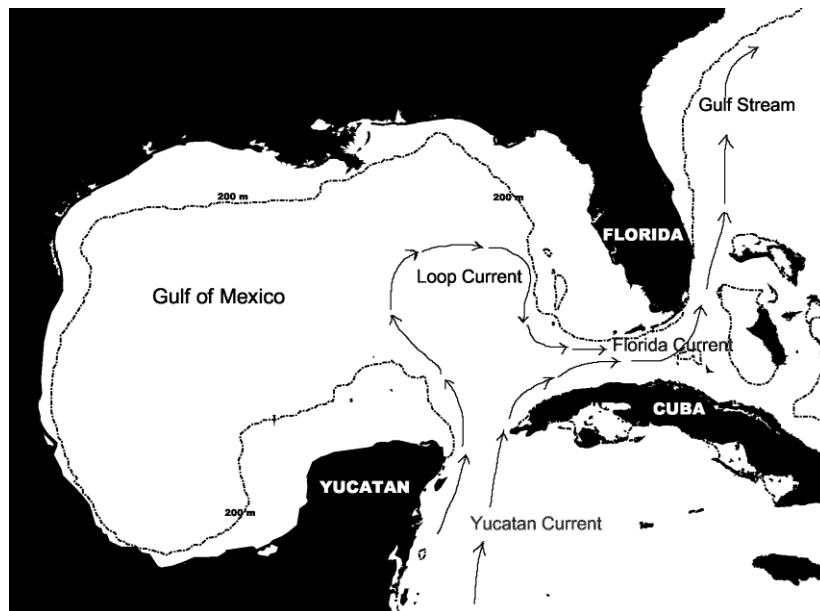


Figure 1. Prevailing ocean currents in the Gulf of Mexico basin.

The Loop Current stretches northward into the Gulf of Mexico over a period of several months. It returns to a direct-flow configuration, flowing almost immediately from the Yucatan Channel through the Florida Straits, by slowly pinching off its extension to form a large, warm-core ring that propagates westward. This ring, called an "Eddy" or "Loop Current Ring," separates from the Loop Current at random time intervals.

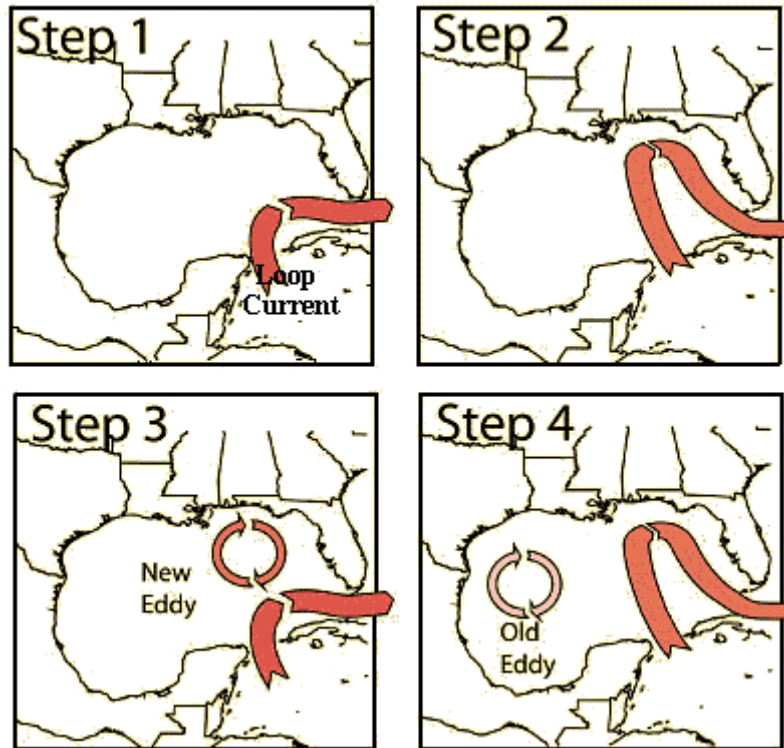


Figure 2. Loop Current Ring Process. www.wunderground.com/hurricane/loopcurrent.gif

The causal circumstances for eddy development and separation is an area of active research, but there is some agreement in the scientific field that the annual fluctuations in Loop Current flow are at least in part due to wind forcing. Also, various small eddies traveling around the Loop Current play a role in the ring shedding process (see below Figure 3).

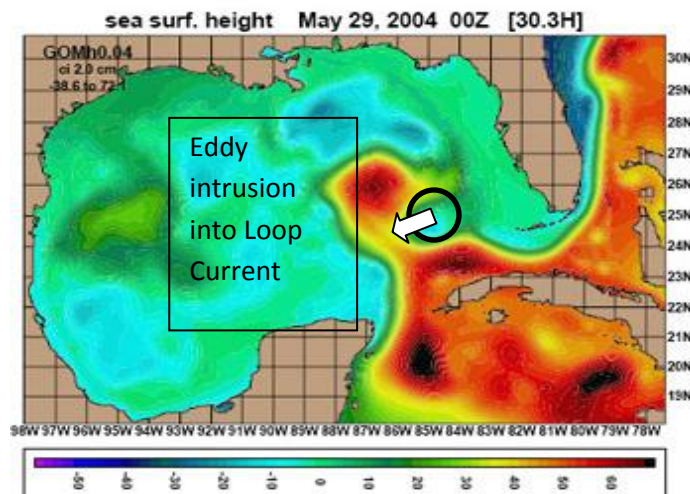
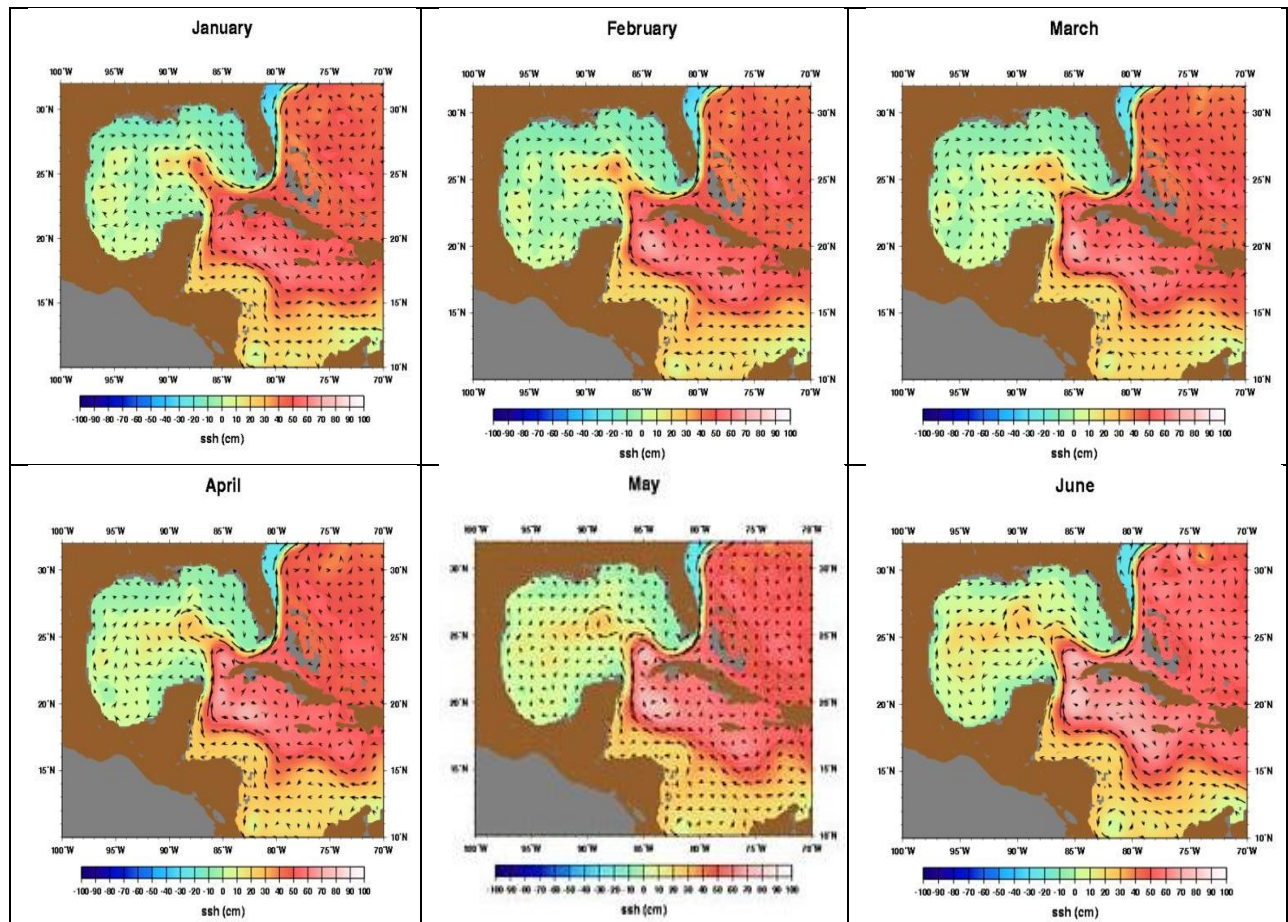
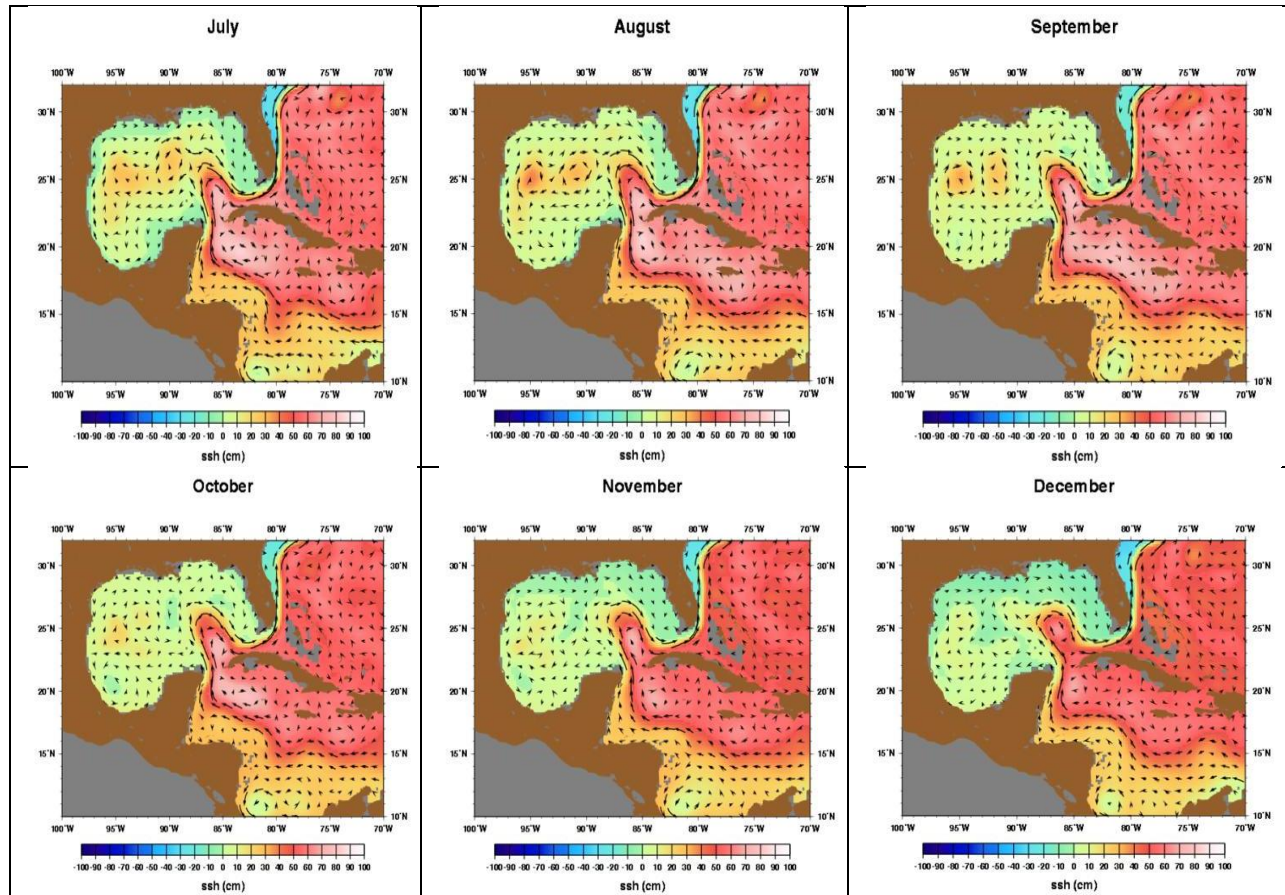


Figure 3. Sea Surface Height analysis from May 29, 2004

Around 1970, it was believed that the Loop Current exhibited an annual cycle in which the Loop feature extended farther to the north during the summer. However, further research over the past few decades has shown that the Loop Current extension to the north and the subsequent detachment of the Loop Current Ring from the main current does not have a significant annual cycle. Although the separation may tend to form more frequently in the spring, it can occur in any season; in fact, ring separations occurred in as little as 6 months or have taken as long as 18 months, with an average time lag between separations around 10.6 months. On average, the loop current surge northward occurs during the late fall through winter seasonal period followed by a ring separation typically during the late spring through mid-summer period. Below is a multi-decadal monthly average of sea surface currents and speed.





<http://oceancurrents.rsmas.miami.edu/atlantic/loop-current.html>

The last “ring separation” occurred in July 2009. In the pictures below, the loop current configuration for June 26th, 2009 (Figure 6) is similar to the current loop current configuration of May 11th, 2010 (Figure 5). This is demonstrated by the small eddy on the northwestern edge of the top of the loop current and the emergence of another eddy on its eastern side facing the Southwest Florida coast. In this case, it took about 14 days to begin the ring separation process (as seen in Figure 7) and another 30 days to complete the ring separation process (Figure 8). However, time between the Loop Current Ring cutoff and separation does not always occur in such a short time period.

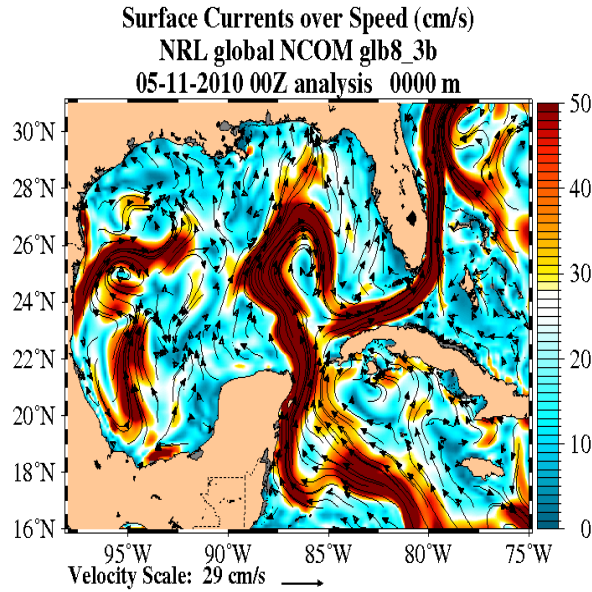


Figure 5. Loop Current position and speed,
 May 11, 2010

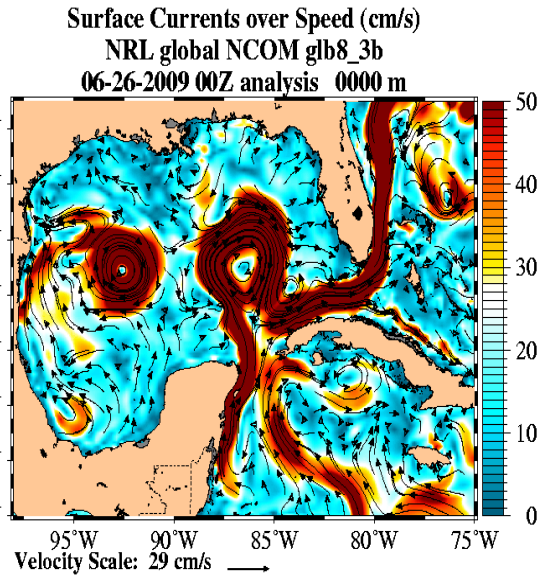


Figure 6. Loop Current position and speed,
 June 26, 2009

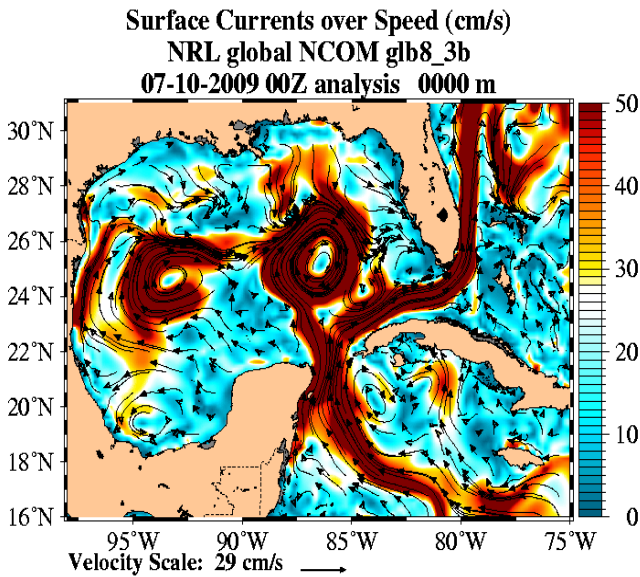


Figure 7. Loop Current position and speed,
 July 10, 2009

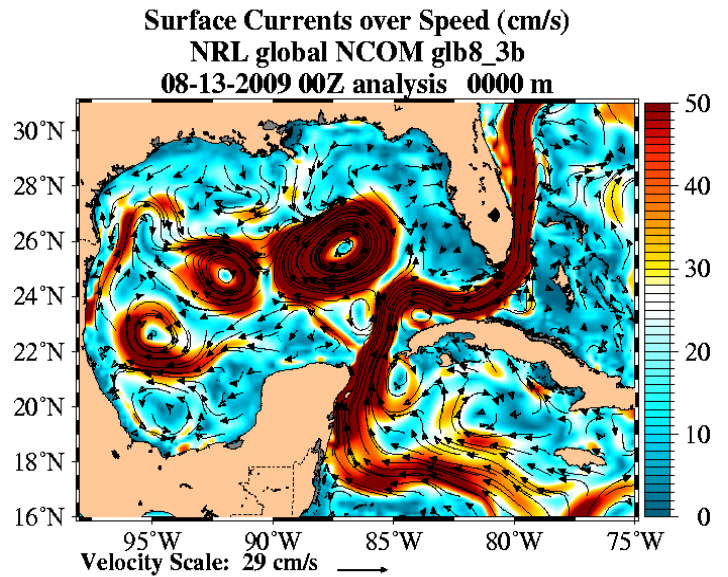


Figure 8. Loop Current position and speed,
 August 13, 2009

Computer modeling of the Loop Current is offered from several entities, including academic, federal and military sources. Initializing computer model data is done using various resources, including but not limited to satellite and drifter buoy observations. Released into the ocean at depths of 15 meters, drifter buoys float freely while taking measurements of temperature and other near-surface ocean properties. These buoys are satellite tracked and can provide real-time data that can be used in the ocean modeling process. (http://www.aoml.noaa.gov/phod/dac/gdp_drifter.html) Despite recent technological and theoretical advances, many of these models cannot sufficiently predict the behavior of the Loop Current. Determining when the Loop Current will expand northward or instead break apart is complex to forecast. As a result, oceanographers and computer models have not been able to predict with much accuracy the Loop Current's future formations.

In conclusion, the understanding and forecasting of the Loop Current is an inexact science as the dominant processes affecting its movement and configuration are not clearly understood. Much like atmospheric phenomena such as hurricanes and tornadoes, scientists are unsure exactly where and when eddies will form. There are clues to help predict an estimate of future conditions, but it is not until the phenomenon actually occurs that actions can be taken to study it.