

**Gulf Stream Note #4**  
**The Gulf Stream in the Vicinity of the Rhumb Line Newport to Bermuda June 17,2015**  
**An Analysis of Conditions**

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Since the 4th of June when we last looked at Gulf Stream structure and position relative to the Newport-Bermuda rhumb line the prominent deep, u-shaped, meander in the main body of the Stream that had been essentially unchanged since early May experienced a substantial change in form with the eastern limb rotating from a south to north trajectory to a west to east track (Fig.1). The western limb retained its north to south course nearly paralleling the rhumb line at a distance of 20-30nm before crossing the line near 37° 30'N 68° W or approximately 300nm from Newport. Currents in the vicinity of the crossing would be proceeding from the northwest to the southeast.

To the north of the main body of the Stream the large mass of warm water observed in early June remained in place extending to the edge of the continental shelf. Water temperatures along this margin increased by more than 10° F in the vicinity of 40° N. This contrast can be expected to produce sufficient changes in water column density to produce flows from west to east approaching 1kt. In addition such a large mass of warm water may also influence local weather producing conditions that are often not well represented in the marine forecasts.

Temperature contrasts within the warm water mass in the area east of the rhumb line appear sufficient to produce a clockwise rotation over a relatively large area. The U.S. Navy analysis for the 16<sup>th</sup> of June (Fig.2) believes this pattern is coherent and shows the feature as a warm core ring with a diameter of approximately 120 nm and a western edge separated from the rhumb line by 30 nm. Under normal circumstances this ring would drift slowly to the west at a rate of 2-3 nm/day. Currents associated with the surrounding warm water mass may however slow or even reverse this drift. Due to its proximity to the rhumb line and the fact that it will likely sustain maximum currents of 2-3 kts this ring clearly has the potential to affect routing to and from Bermuda so bears watching.

The observed complex pattern of water temperatures can be expected to produce complex flows. The extent of this is clearly shown in the altimetry based model results for the 17<sup>th</sup> of June (Fig.3). Allowing two days for data processing these results show that the sea surface temperature (SST) patterns for the 15<sup>th</sup> of June (Fig.1) resulted in evident west to east flows along the edge of the continental shelf in the area north of the main body of the Stream. Supplementary analyses which include factors not considered in the altimetry model suggest these currents might approach 1kt.

Proceeding south along 70° W the main body of the Stream is found near 38° N or approximately 60nm west of the rhumb line. This position is approximately 30 nm from the easternmost margin of the western limb of the meander, a separation consistent with previous observations. Currents from this point proceed to the south and southeast for the most part for approximately 90 nm before turning to the east and across the rhumb line. Consistent with past observations the width of the main body of the Stream in this area is approximately 60 nm.

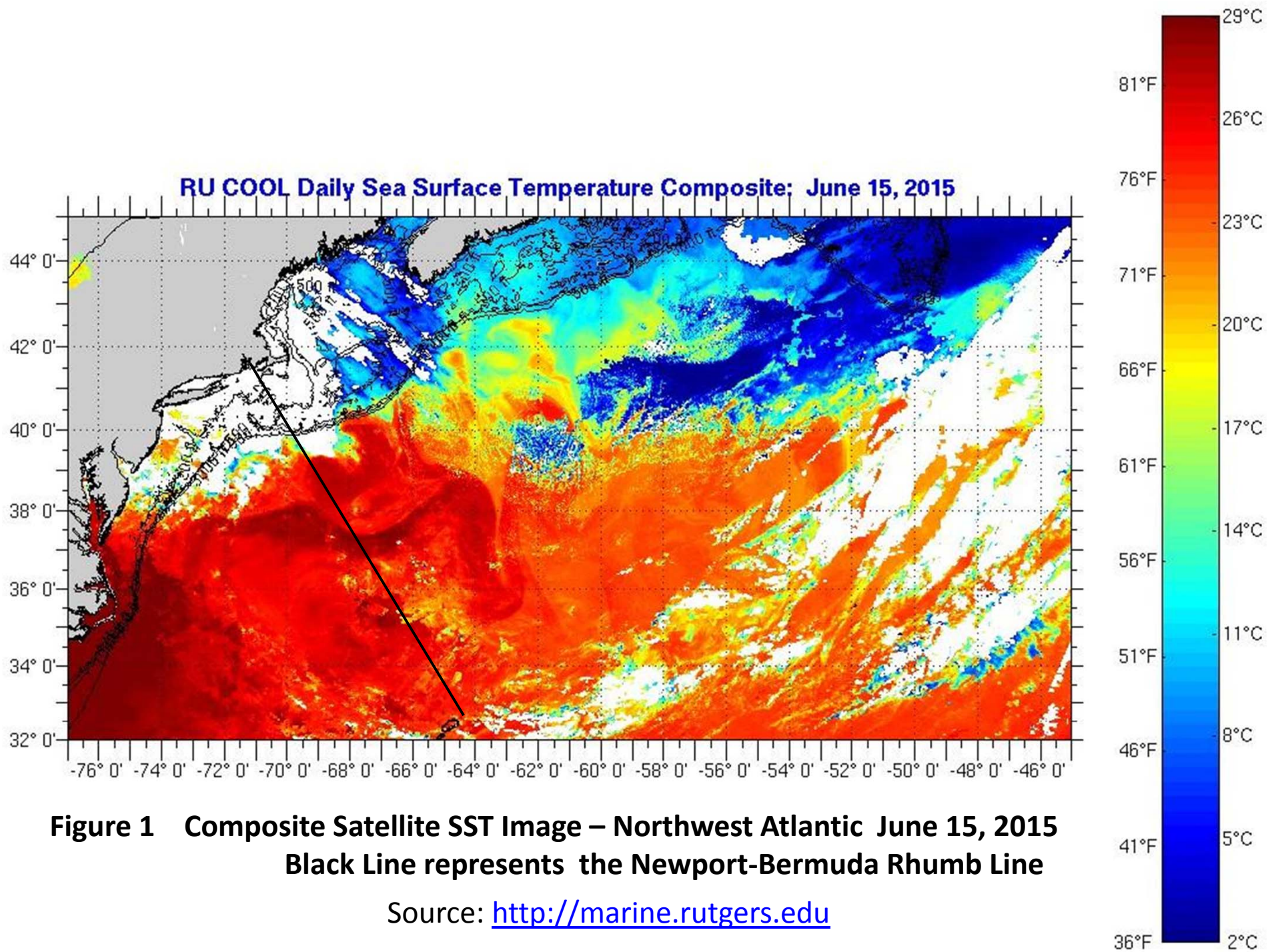
To the north of the main body of the Stream the altimetry based model shows a warm core feature centered near 39° N 68° W. The feature is elliptical in form with a 150nm major axis lying along a west to east line. Circulation associated with the ring is shown affecting the rhumb line near 38° 30' N. Flows in this area proceed from the south to the north.

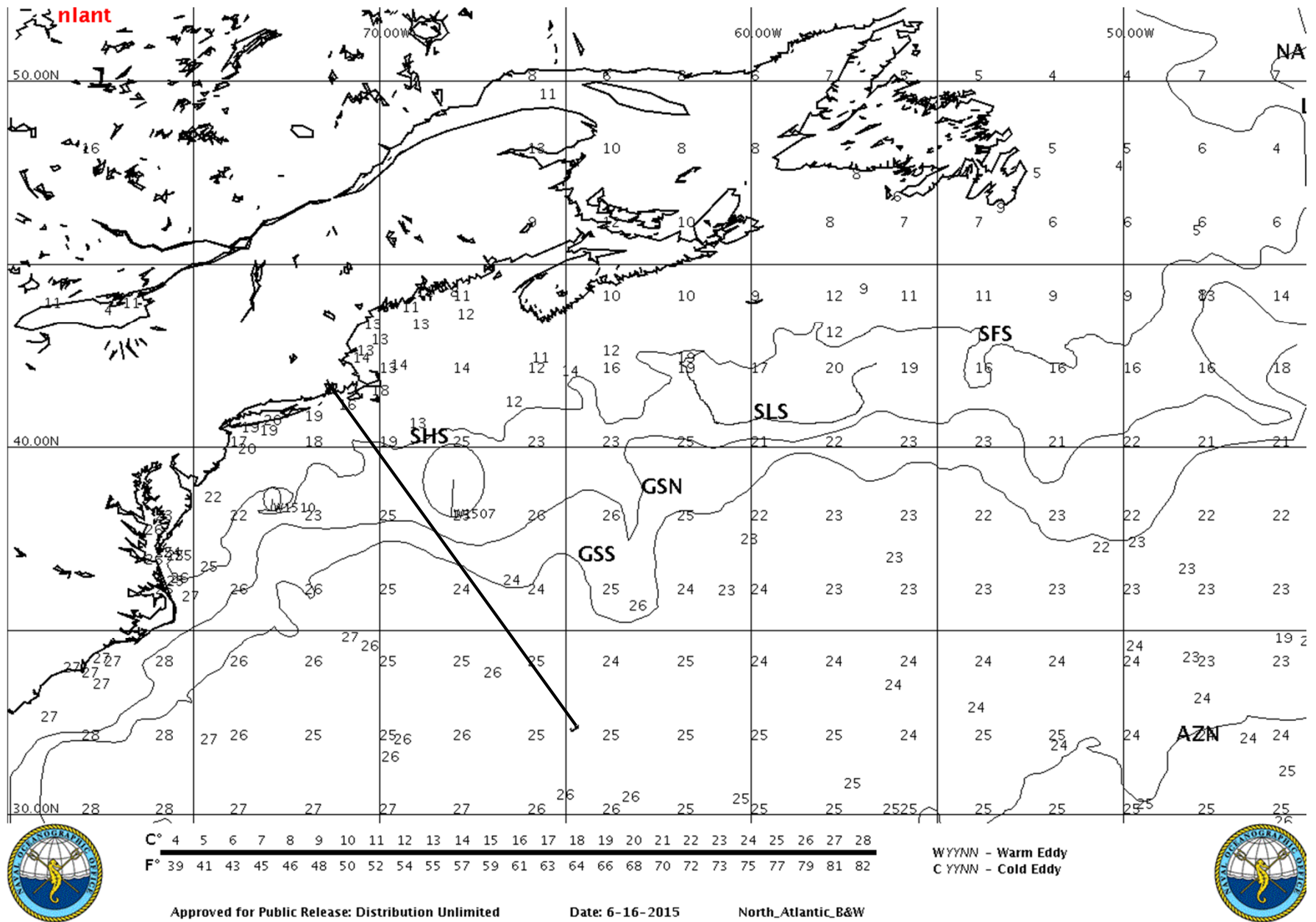
To the south of the main body of the Gulf Stream to Bermuda the altimetry based model shows several areas of organized flow but no classic cold core ring development. Clockwise rotating flows are shown near 35° 20' N 68° 20 W and 34° N 66° W and appear to be sufficiently well organized to affect routing.

For those using routing programs that include the NOAA model of sea surface temperatures and circulation in the western Atlantic (RTOFS), it's advisable to compare this model to the altimetry based model results (Fig.3) as well as the satellite SST data (Fig.1). The results for the 16<sup>th</sup> of June (Fig.4) suggest that the RTOFS provides reasonable indication of the position of the northern limits of the main body of the Stream west of the rhumb line but fails to capture the extent of the effects associated with the western limb of the meander. To the east differences are yet more substantial. Care must be exercised in the use of models.

To summarize, flows for a significant portion of the rhumb line Newport to Bermuda continue to be influenced by a large meander in the main body of the Stream and to a lesser extent by flows associated with a warm core ring. For boats proceeding from Newport to Bermuda there appears to be little reason from an oceanographic standpoint to route east of the rhumb line. For boats coming from Bermuda however, the choice is more complex with legitimate reasons for considering courses both west (possibly reaching points more than 80-90 nm west of the line) and east ( 60-80 nm) of the rhumb line. The ultimate determinant will very likely be the winds prevailing during the period of the respective races.

Enjoy !!

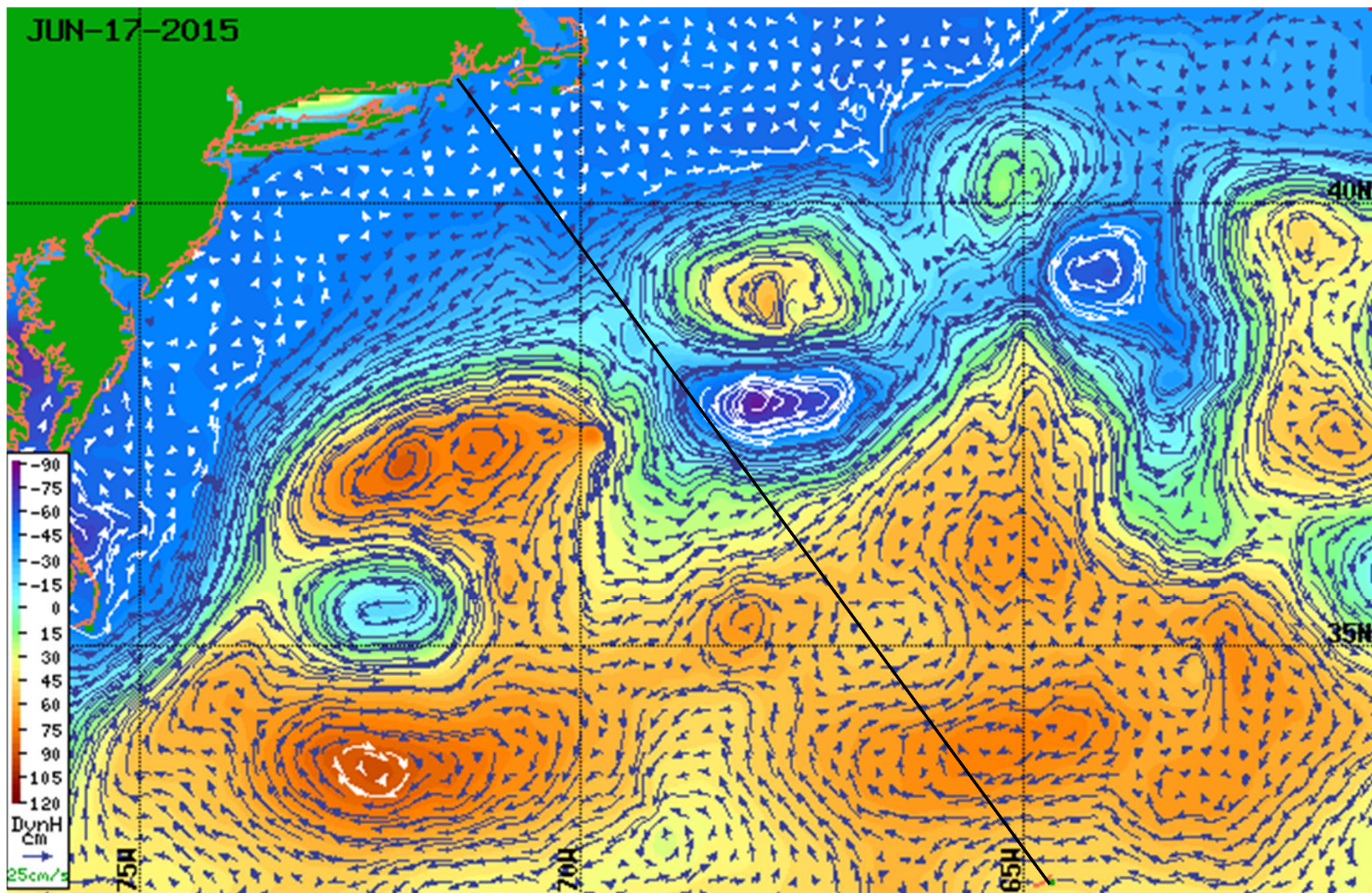




**Figure 2 Northwest Atlantic Sea Surface Temperatures – June 16, 2015 – USN Product**  
**Black Line Represents the Newport-Bermuda Rhumb Line**

[http://ecowatch.ncddc.noaa.gov/JAG/Navy/data/satellite\\_analysis/gsnofa.gif?id=3110](http://ecowatch.ncddc.noaa.gov/JAG/Navy/data/satellite_analysis/gsnofa.gif?id=3110)





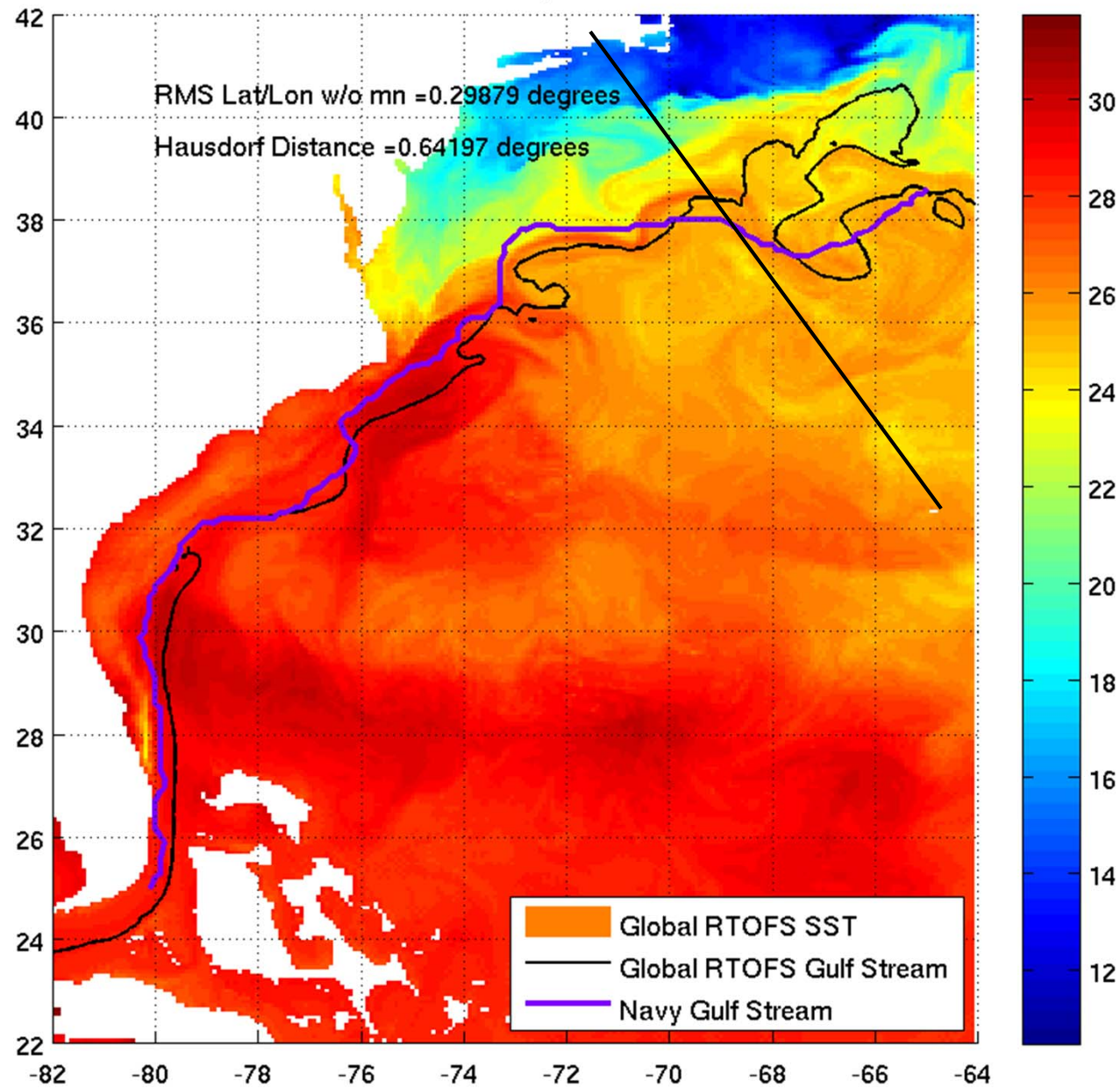
**Figure 3 Satellite Altimetry Derived Surface Currents – NW Atlantic Region – June 17, 2015**

**Black Line Represents the Newport-Bermuda Rhumb Line**

<http://www.aoml.noaa.gov/phod/dataphod/work/trinanes/INTERFACE/index.html>



Global Rtofs SST Hi-res in the West Atlantic with Navy Gulf Stream and 400 12C isotherm for 06162015



**Figure 4 NOAA Comparative Computer Model Results – RTOFS SST- June 16, 2015**