



Gulf Stream Note # 3 - 2019

The Gulf Stream Near the Rhumb Line Newport-Bermuda June 6, 2019

An Analysis of Conditions

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Over the past week the structure of the Gulf Stream in the vicinity of the Newport-Bermuda rhumb line has continued to evolve resulting in a complex pattern of water temperatures and associated currents. The sea surface temperature (SST) composite satellite image (Fig.1) provides clear indication of a warm core (clockwise rotating) ring centered near $39^{\circ} 30'N$ $70^{\circ}35'W$ or approximately 35nm to the west of the rhumbline. Maximum currents from this feature approaching 3kts can be expected in area 15-20nm west of the rhumb line. This feature has slowly drifted to the west over the past month and is likely to slow further and dissipate over the next few weeks due to contact with the shallower waters of the continental shelf.

To the southeast of the ring the composite SST image shows a prominent tongue of warm water extending to the southeast from the ring for 120nm before making contact with the main body of the Gulf Stream (Fig.1). This feature appears to be real and not an artifact of the compositing process. The sharp temperature contrast will directly affect water column densities resulting in measurable currents. Maximum speeds approaching 1- 2kts could occur with flows proceeding to the northwest along the western edge of the feature and to the southeast along the eastern edge. The combination of the warm core ring and this thermal tongue favors a track to Bermuda in this area sited approximately 30nm to the west of the rhumb line (if currents were the only consideration).

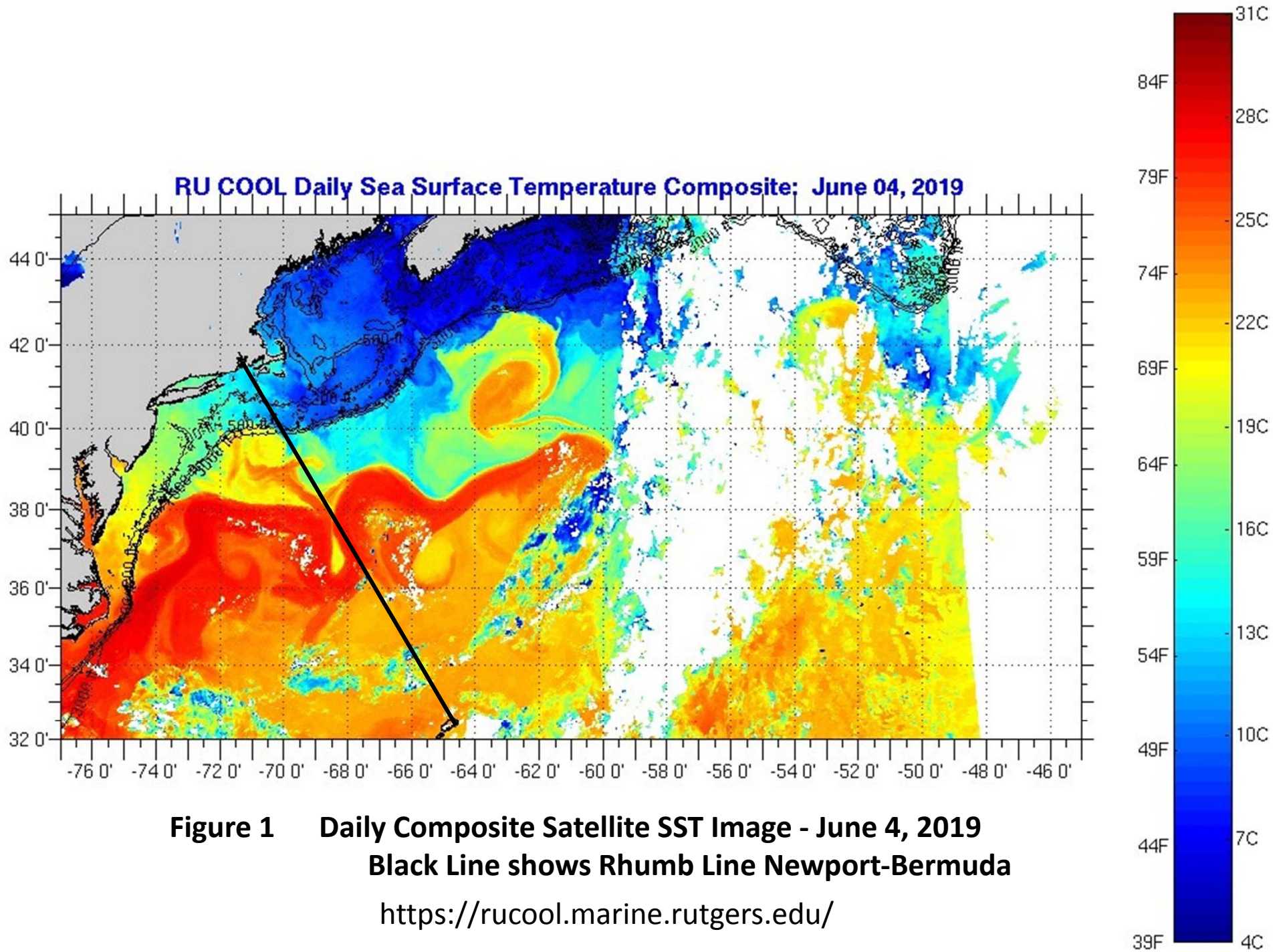
The northern edge of the main body of the Stream is encountered in an area located approximately 240 nm from Newport. The rhumb line very nearly bifurcates the deep meander discussed in the last Note. This feature continues to show signs of “pinching off” but as of June 4th remained simply a very deep meander affecting more than 120nm of the track to Bermuda (Fig.1). Again, it is useful to study the rate of evolution of this feature using the OPC website (https://ocean.weather.gov/Loops/ocean_guidance.php?model=GOES&area=MidAtl&plot=sstrec&day=0&loop=0#top). All indications at this time suggest that this feature will “pinch off” to form an independent cold core ring. That may not affect the start of the Races to Bermuda over the next week or so but may very well influence routing and/or race strategy for those sailing from Bermuda back to New England after that.

Both the Navy SST data (Fig.2) and the altimetry based current model (Fig.3) show the meander as a deep U-shaped feature with a western limb having south to southeasterly flows sited well west of the rhumb line. The eastern limb is east of the rhumb line and appears dominated by north to northwesterly flows. This pattern affects nearly 180nm of the route to Bermuda. The connecting limb is dominated by west to east flows and crosses the rhumb line at a point approximately 380nm from Newport (Fig.3). In navigating the meander care must be exercised to avoid entrainment during periods of light winds. Difficulties in leaving the Stream near its southern limits could result in significant easterly drift followed by northerly displacements and an increasing distance to Bermuda. This has occurred in past races.

To the south of the meander the altimetry based model results (Fig.3) show a large area of clockwise flow centered to the west of the rhumb line near 35^oN 67^oW affecting approximately 90nm of the track. The northern edge of this feature will set boats, exiting the influence of the meander at points within 50nm west of the rhumb line, to the east. Significant north going adverse current will only be encountered by boats leaving the meander further west of this point. This feature has drifted slightly to the west over the past week and this drift is expected to continue. At the moment a near rhumb line course through the feature appears favored.

Just to make things interesting however, the altimetry based model shows a counterclockwise rotating ring immediately south of the above clockwise

feature. This ring is centered near $33^{\circ} 40'N$ $66^{\circ} 30'W$ or approximately 50nm west of the rhumb line (Fig.3) and influences an area of more than 120nm right to Bermuda. Throughout much of this area the ring is producing adverse north going currents in excess of 1-2kts. Avoidance for boats proceeding to Bermuda will require tracks to the west of the rhumb line. Again this feature is expected to drift to the west. This combination of features from the meander through the rings is expected to provide a unique navigational challenge for boats racing to Bermuda this year. Each feature has the potential to directly affect elapsed time.



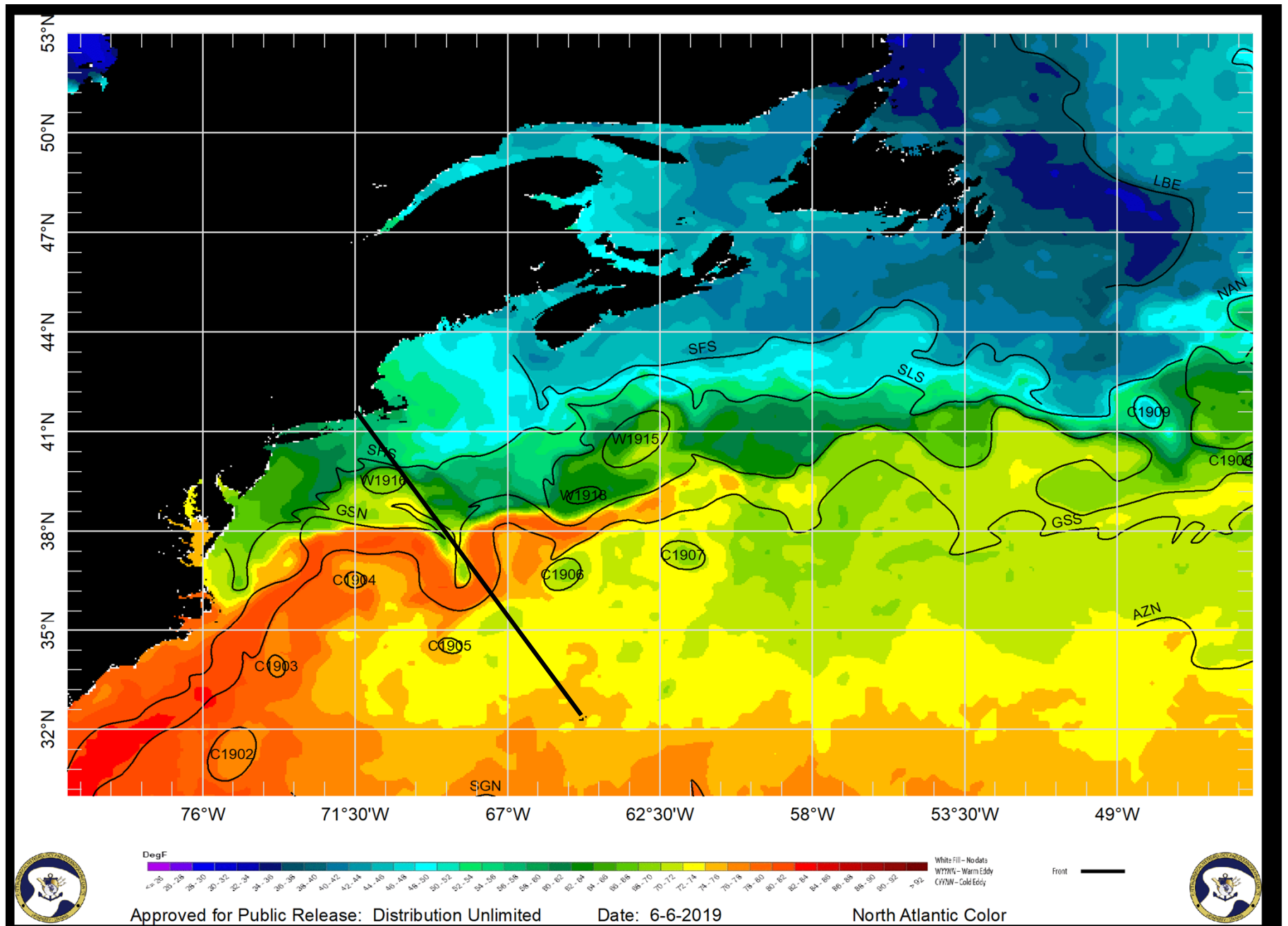


Figure 2 Sea Surface Temperatures NW Atlantic Ocean (Black Line Newport Bermuda Rhumb Line)
http://ecowatch.ncddc.noaa.gov/JAG/Navy/data/satellite_analysis/gsncofa.gif?id=51425

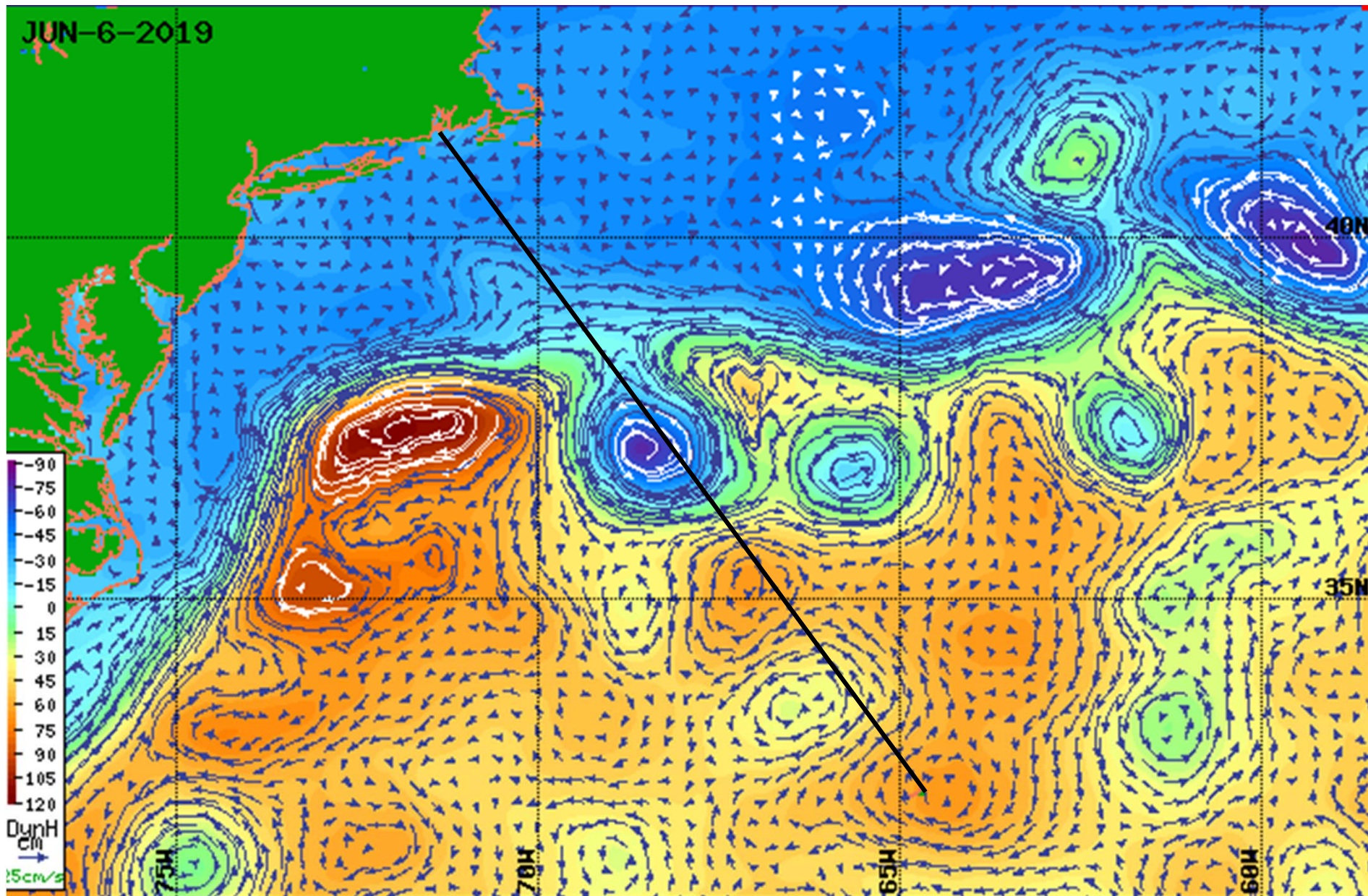


Figure 3 Satellite Altimetry Derived Surface Currents- NW Atlantic Region- June 6, 2019

Black Line shows Rhumb Line Newport-Bermuda

<https://cwcaribbean.aoml.noaa.gov/CURRENTS/index.html>