The Gulf Stream Near The Rhumb Line Newport-Bermuda June 1, 2012
An Analysis of Conditions

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When we last viewed the sea surface temperature (SST) patterns in the vicinity of the rhumbline from Newport to Bermuda in mid- May the northern edge of the main body of the Gulf Stream was marked by an abrupt, and evident, increase in water temperatures. This thermal boundary was relatively linear in form with associated flows proceeding from the west to the east across the rhumb line (see GS Note #1). Over the past two weeks the SST patterns have become more complex and in combination with abundant cloud cover which affects image quality and resolution have effectively obscured the northern edge of Gulf Stream. Careful examination of the variety of satellite images of SST however, indicates that the inshore, northern edge of the Stream has moved very little and continues to cross the rhumb line at a distance of approximately 240nm SE of Newport near 38^{o} N (Fig.1) . Flows continue to be essentially west to east crossing the rhumb line at near right angles. The development of a meander to the east of the rhumbline can be expected to induce some southeast to south flows in the area between the meander and the rhumbline. This influence should decrease over the next two weeks as the meander migrates to the east, towards Europe.

To the north of the main body of the Stream the SST patterns show two “interesting” features with the potential to affect surface current speeds and directions. To the west of the rhumb line the evident “C” shaped feature centered near 39^{o} N 71^{o} 30' W appears to be the remnants of the warm core eddy observed in mid May (again look at GS Note #1). This feature has moved to the west over the past two weeks and expanded in area now displaying a diameter of approximately 120 nm. The temperature pattern favors clockwise flows with maxima approaching 3kts. Its location in close proximity to the shallower waters of the continental shelf will tend to result in progressive mixing and eventual breakup. The rate of change over the past two weeks however, suggests that this feature will retain sufficient integrity to affect flows over the upcoming Race period.

In addition to the warm core feature the composite images show a complex of water temperatures on and to the east of the rhumbline, along the northern edge of the main body of the Stream (Figs. 1 and 2). This feature appears to be the result of the easterly migration of the

meander observed in mid-May (GS Note#1)and the associated entrainment or mixing of waters along its crest much in the manner of a breaking wave. This distribution again favors clockwise flows with speeds governed by the magnitude of the temperature gradient. A minimum speed of 1 to 2 knots can be expected in this area crossing the rhumb line at near right angles (i.e. flows to the northeast). Given its probable origin, the evolution of this feature is difficult to predict. If it retains integrity it may break free of the influence of the main body of the Stream and form as a warm core eddy. If so it would be expected to drift to the west at rates of 2-3nm per day potentially inducing currents along the rhumbline sufficient to affect set and drift for some period of time. This feature bears watching over the next few weeks.

To the south of the main body of the Stream the SST data show no well defined eddies in the areas suggested in the analysis of mid-May conditions (i.e. GS Note#1). This may be the result of a number of factors including the influence of cloud cover and the resulting image compositing process and/or the sinking of the higher density cold water features below the less dense warm waters of the Sargasso Sea. Under these conditions the availability of altimetry based models of ocean currents provides a particularly useful analytical tool. These model results again show the main body of the Stream to the west of the rhumbline affected by a prominent clockwise rotation sufficient to induce flows to the southwest in the vicinity of 37º N 70º W (Fig.3). This feature has displayed minimal migration over the past two weeks (see GS Note #1). The model also shows the extent of the southeast to south going flows along the rhumbline near 38º N as the Stream meanders from its initial west to east track.

To the east of the rhumbline, the altimetry based model indicates that the cold core feature observed in mid-May centered near 37º N 66º W has been effectively eroded by an intruding Gulf Stream and now resides within the trough associated with the main body meander. In this form it should migrate slowly to the east and no longer influence flows along the rhumbline.

Continuing southeast towards Bermuda, the altimetry based model shows an area of adverse current along the rhumbline between approximately 36º and 35º N. Further south the counterclockwise feature observed mid-May appears to have migrated to the west and no longer affects flows along the rhumbline (Fig.3) .

This analysis suggests that, with regard to ocean currents, the favored tracks from Newport to Bermuda remain in close proximity if slightly west of the rhumbline. It will be interesting to see if this pattern remains in place on the 15th of June and the start of this year's Race

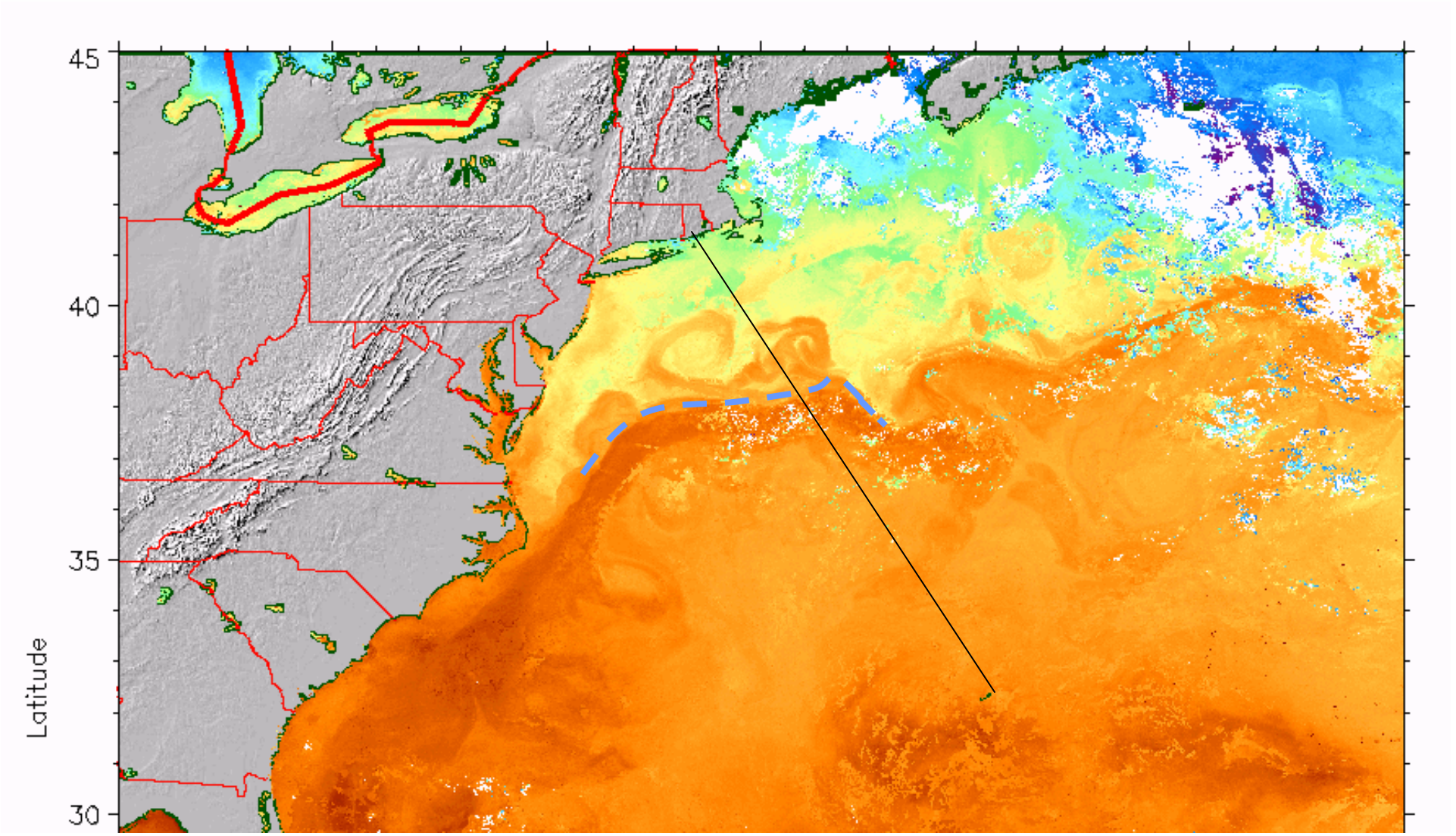

Figure 1 Three Day Composite Image of Satellite Sea Surface Temperatures

Solid Line – NB Rhumb Line Dashed Line - Approx. Gulf Stream Main Body

From :http://fermi.jhuapl.edu/avhrr/gs/averages/12may/gs_12may31_2150_multi.png

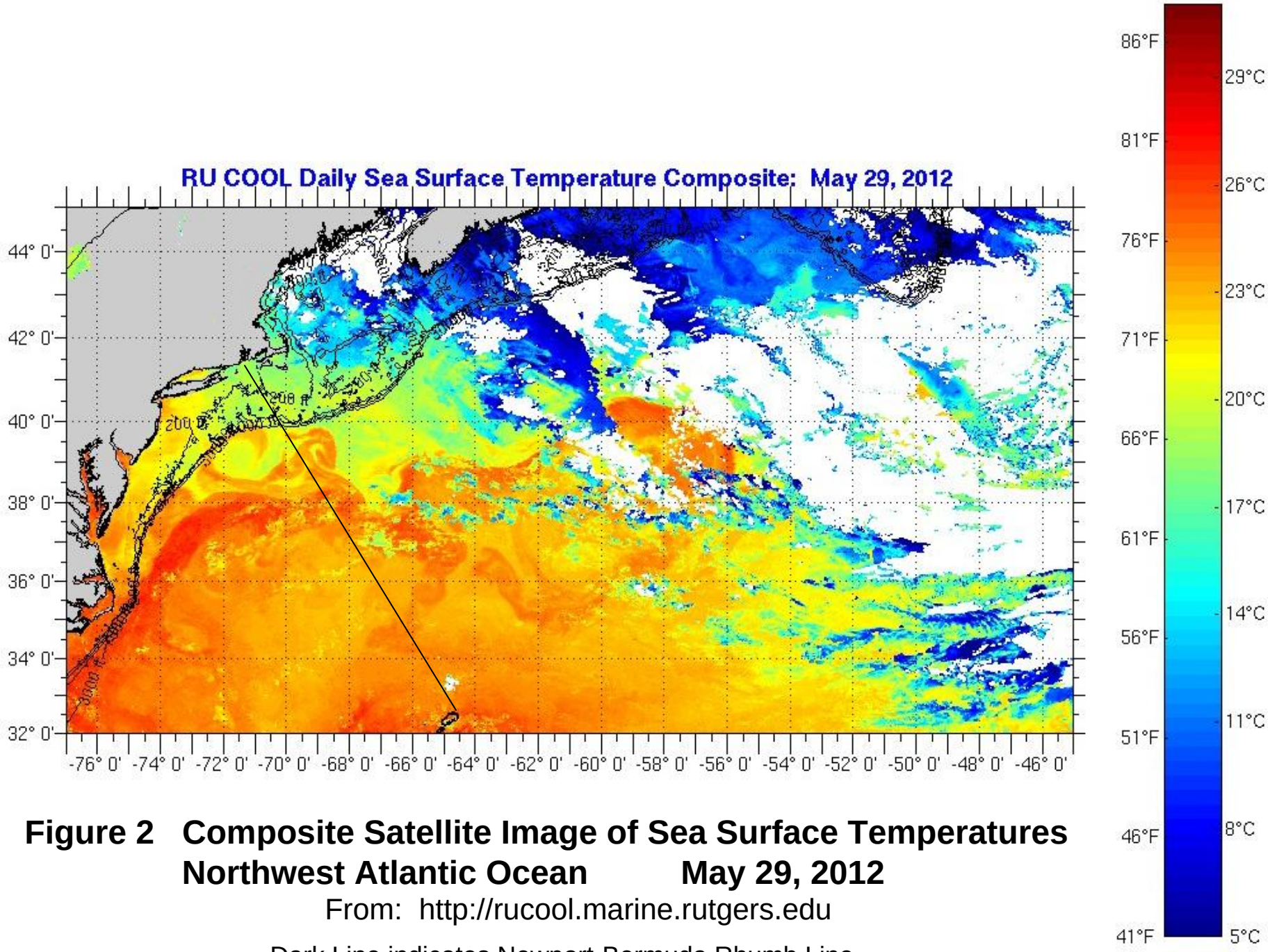

Figure 2 Composite Satellite Image of Sea Surface Temperatures Northwest Atlantic Ocean May 29, 2012

From: http://rucool.marine.rutgers.edu

Dark Line indicates Newport-Bermuda Rhumb Line

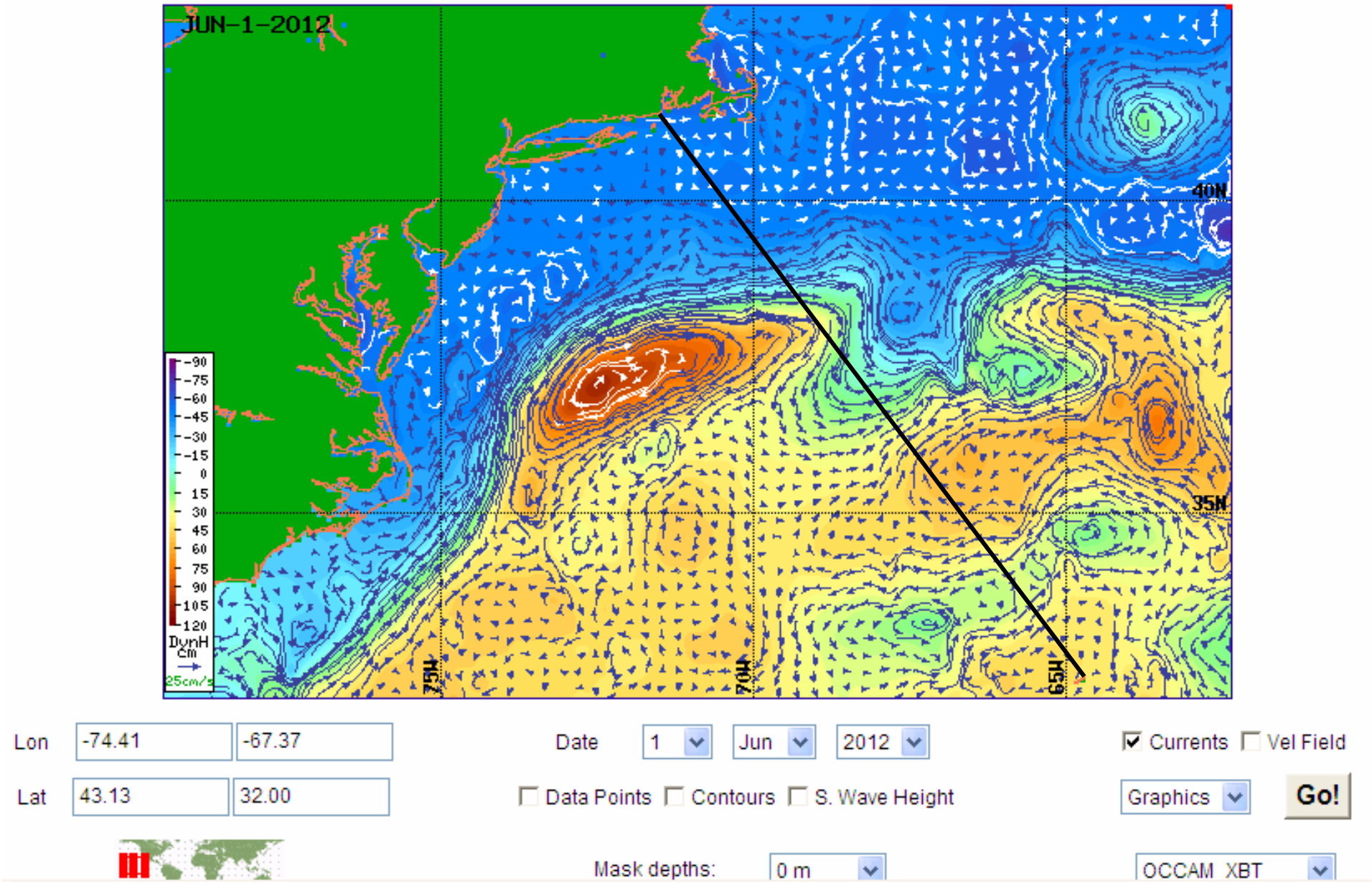

Figure 3 Altimetry Based Model Results Showing currents and Sea Surface Heights in The Vicinity of The Newport-Bermuda Rhumb Line

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