The Gulf Stream in the Vicinity of the Rhumb Line Marion to Bermuda June 9,2011
An Analysis of Conditions

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Since the middle of May, 2011 the Gulf Stream in the vicinity of the Marion to Bermuda rhumb line has changed substantially and now appears as a nearly west to east going current which crosses the rhumb line near 38° N (Fig.1). To the north a large mass of warm water remains from the migration of the meander so evident in the sea surface temperature (SST) images provided in my last Analysis (please see Race homepage). This mass extends to 40°N or to within approximately 100 nm of Buzzards Bay. Water temperatures at this point will increase abruptly from approximately 60°F to 70°F. Such a change can be expected to have associated with it some amount of current or flow due to the associated spatial changes in water densities. The presence of cold water to the north and warm water to the south would suggest flows proceeding to the east or southeast favoring a set across the rhumb line and/or some amount of favorable current for boats heading to Bermuda. However despite initial appearances, this may not be the case here. Satellite altimetry over the past several weeks have been indicating that this feature is similar in form to a cold core ring but produced by the breakdown of the meander rather than a classic instability in the main body of the Stream. This feature has persisted in the model analyses showing very little change in strength despite the potential for entrainment and dissipation in the area between the main body of the Stream and the shallow edge of the continental shelf. These results have been showing a counterclockwise flow in this area resulting in northwest rather than southeast going currents and generally less than favorable conditions to the west of the rhumb line in the vicinity of 39° N. The characteristics and extent of the feature are best viewed using altimetry which we will come to in a moment.

Following the initial encounter with the warm water mass, temperatures remain nearly constant for a distance of approximately 150nm until the main body of the Stream is entered near 37° 45'N (Fig.1). On the 7th of June the composite image showed an abrupt change in temperature distributions this point suggesting that currents near the rhumb line would likely also change abruptly from west to east to south to north flows (the Rhumb Line is broken on the Fig. to show this area). By the 8th of June the composite satellite image shows some easterly movement in this feature with flows across the rhumb line proceeding from the southwest to the northeast (Fig.2). This allows some amount of departure east or west of the rhumb line without concern for adverse flows. This progression continues on June 9th (Fig.3).

To the south of the main body of the Stream flows generally parallel the rhumb line proceeding from the northwest to the southeast. The satellite altimetry indicates that these flows are dominated by a combination of features including the intrusion of a cold water tongue to the east of the line and what appears to be another unique clockwise rotating feature to the west of the line in the vicinity of 35° N 70°W. Both of these features are hard to define using the SST images (compare Figs 1-3) but are particularly evident in the altimetry based model results

(Fig.4). The altimetry also provides clear indication of the counterclockwise rotation in the area north of the main body of the Stream The combination appears to favor a near rhumb line course to Bermuda (wind permitting) and obviously bears close watching and study if possible over the next week.

On approach to Bermuda flows along the rhumb line will be influenced substantially by a cold core ring located on June 9 near 33º 30'N 64º 30'W (Fig.4). This feature can be expected to drift slowly to the west and to be in even closer contact with the rhumb line by Race time. This too bears close watching.

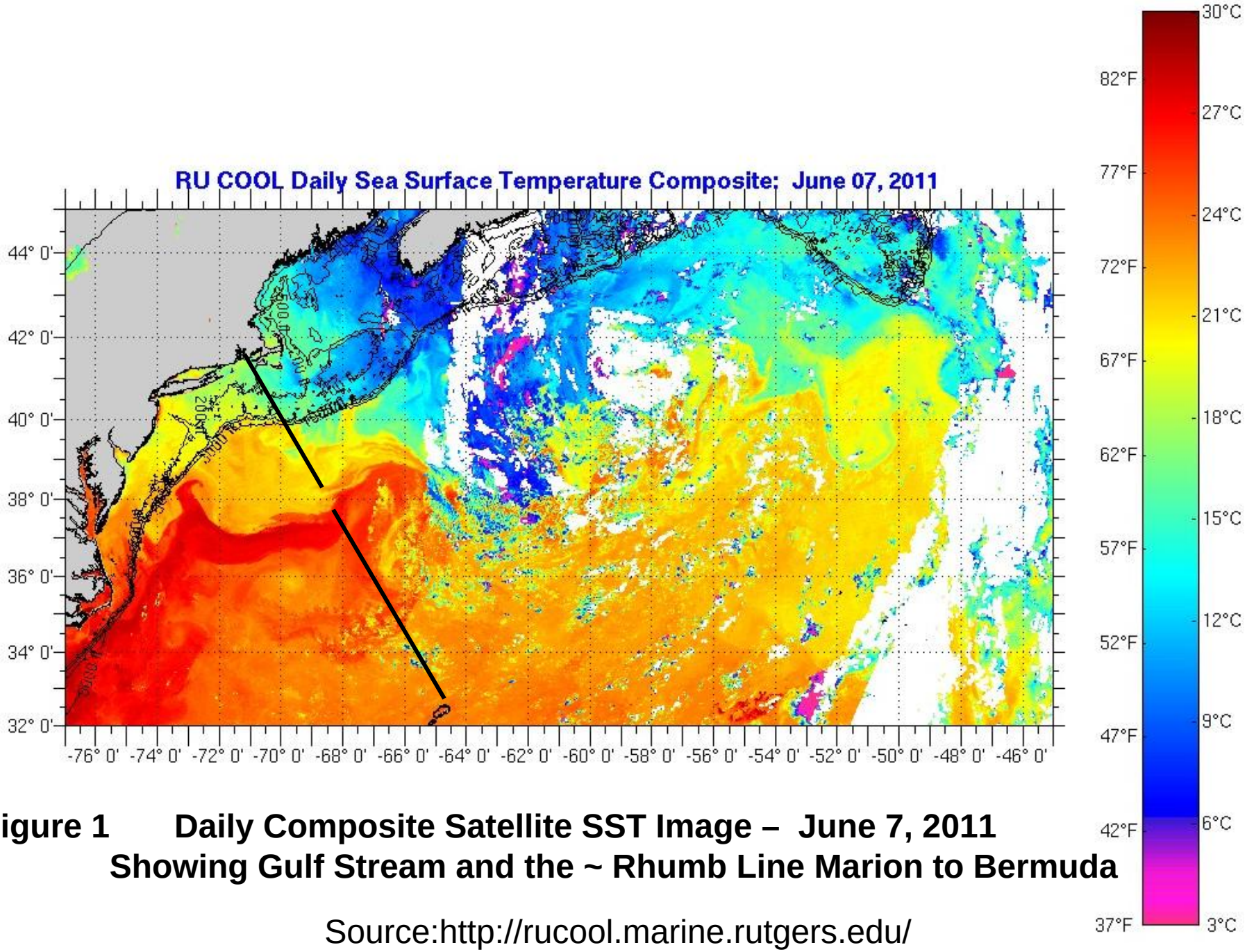

Figure 1 Daily Composite Satellite SST Image – June 7, 2011
Showing Gulf Stream and the ~ Rhumb Line Marion to Bermuda

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

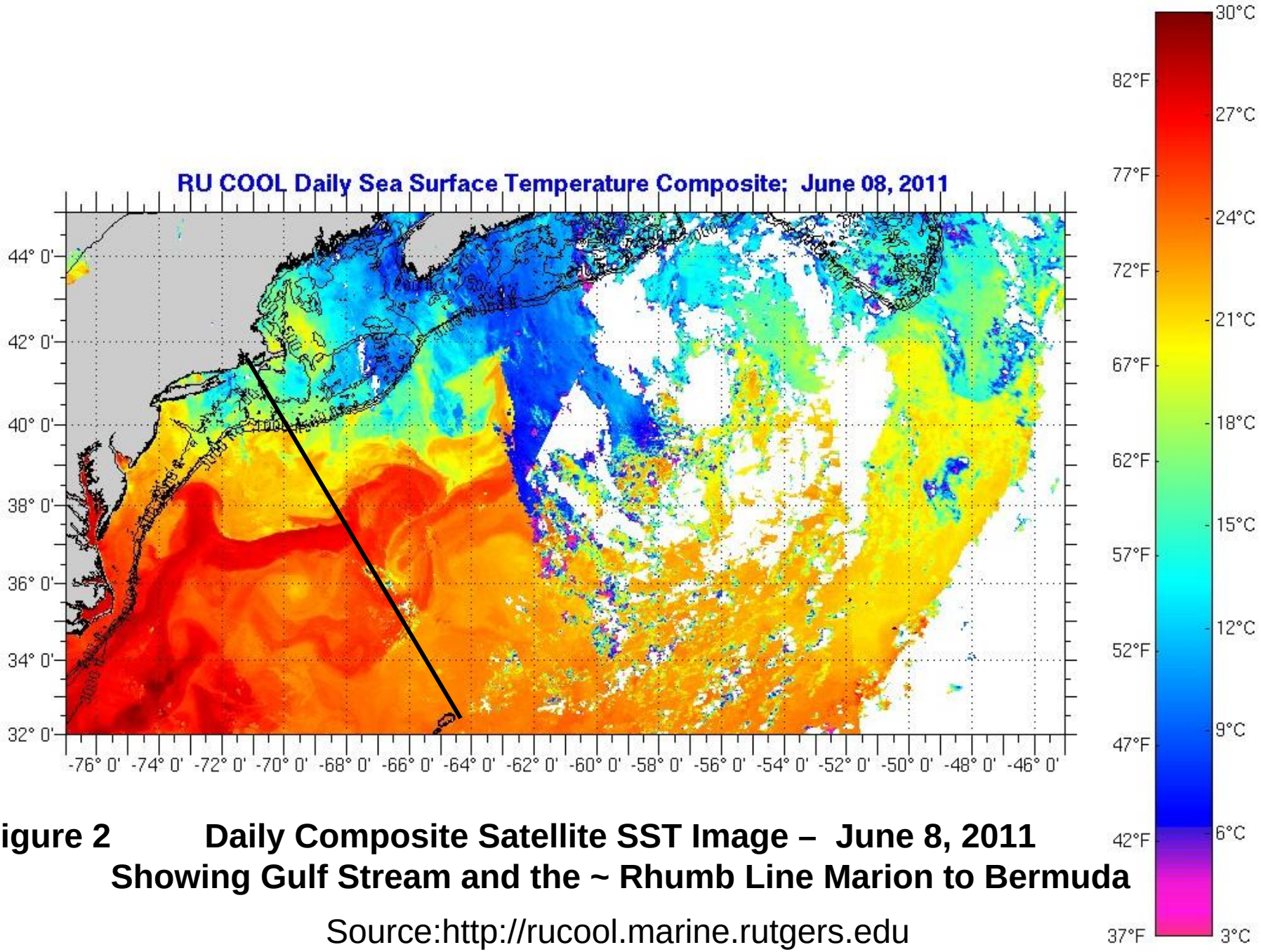

Figure 2 Daily Composite Satellite SST Image – June 8, 2011
Showing Gulf Stream and the ~ Rhumb Line Marion to Bermuda

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

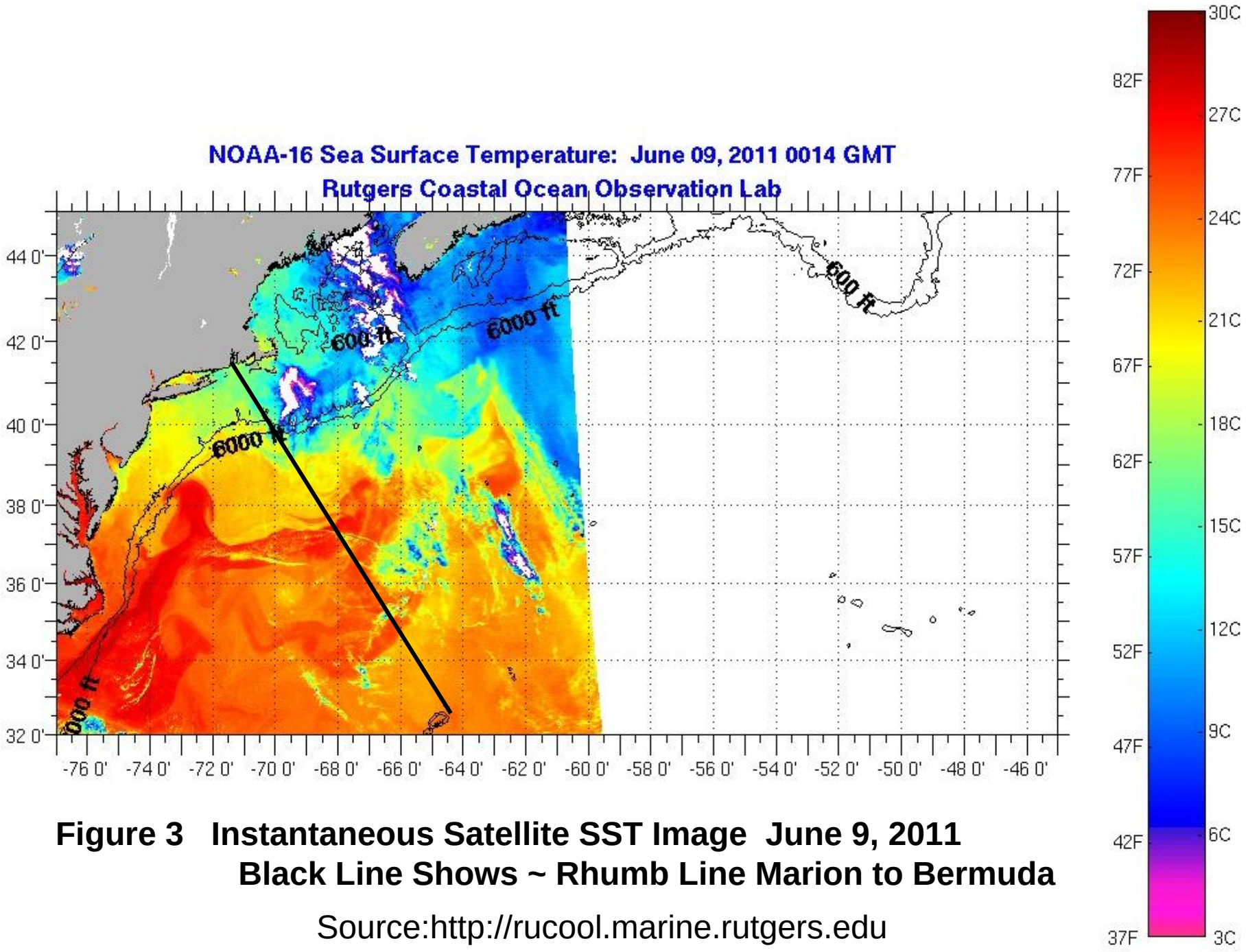

Figure 3 Instantaneous Satellite SST Image June 9, 2011
Black Line Shows ~ Rhumb Line Marion to Bermuda

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

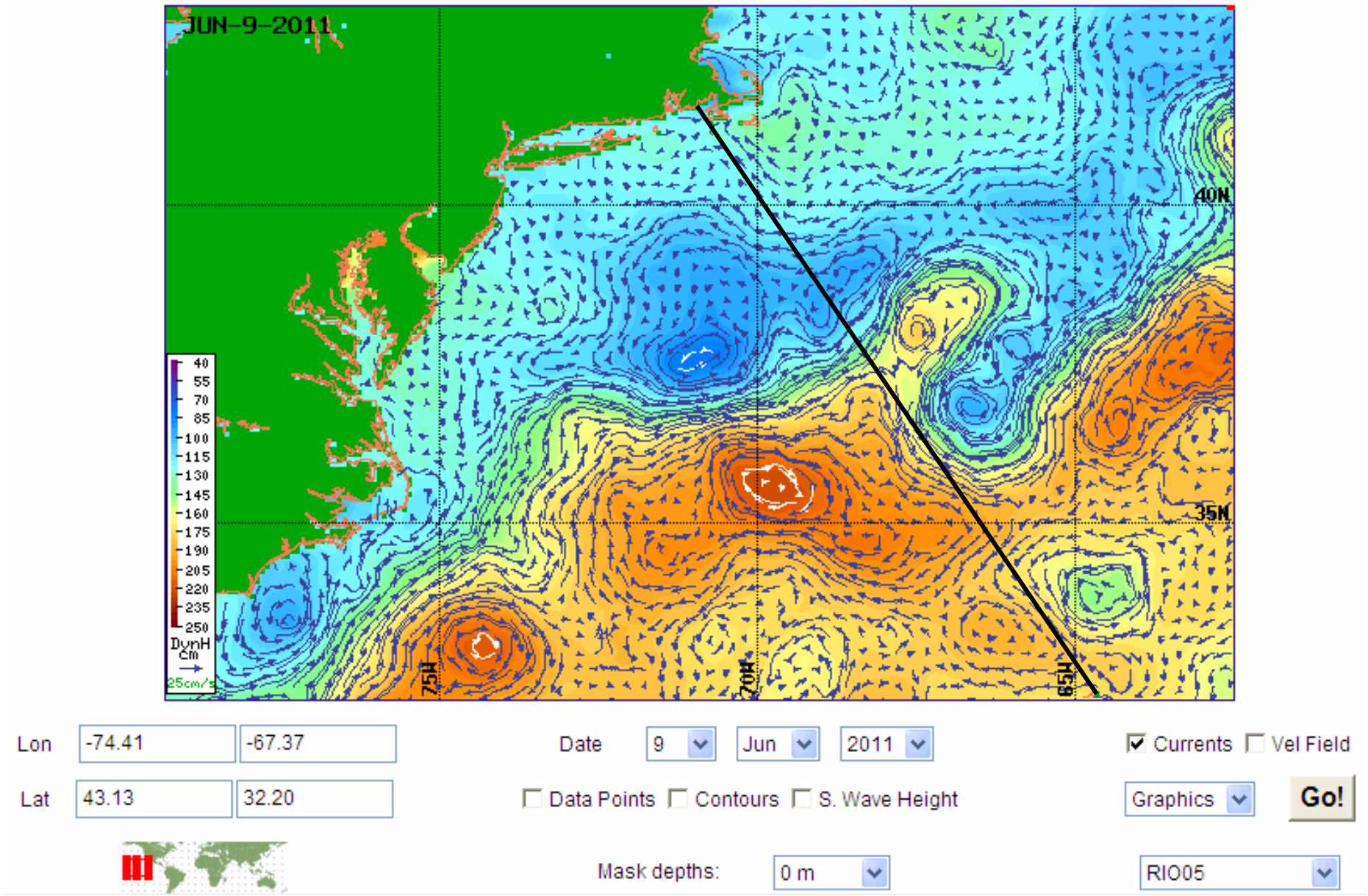

Figure 4 Satellite Altimetry Derived Surface Currents – NW Atlantic Region

Black Line Shows ~ Marion to Bermuda Rhumb Line

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