The Gulf Stream Near the Rhumb Line Newport-Bermuda May 13, 2024
An Analysis of Conditions

W. Frank Bohlen (Bohlen@uconn.edu)
Mystic, Connecticut

Well, with slightly more than a month to go until the start of the 2024 Newport Bermuda Race it's none too early to begin careful evaluation of existing Gulf Stream conditions and the rate and form of their probable evolution over the next four to five weeks. For those just starting this process I'd recommend reviewing my Gulf Steam Primer posted on the Race website https://bermudarace.com/ . This provides an introduction to the basics of Stream structure and dynamics. The referenced links are updated on the Race website.

In addition to Gulf Stream considerations, with the starting area likely to be off Fort Adams, it seems advisable to pay more attention to tidal currents than we have in past years. Tidal currents in the East Passage adjoining Newport near Bull Point will be on the flood after approximately 1430 edst. This will be a full moon period so the higher range of currents can be expected. Tidal currents will first decrease on leaving the passage before increasing with distance offshore to approximately 0.5kt to the edge of the continental shelf. The presence of warm core rings shed from the Stream can, of course, significantly affect the current patterns across the shelf. More on that later.

For the past four months the position of the north wall of the main body of the Gulf Stream crossing the rhumb line has varied significantly due to meandering with distance to Newport ranging between 200 and 300nm. This has been a particularly active period of meander development. The majority of these features migrated to the east with slight indication of deepening and cutoff or the formation of warm core rings. Throughout this time images have also shown a cold core ring immediately west in contact with the rhumb line in March (Fig.1) which migrated progressively to the west during April and early May. It is currently centered near 36^0N $69^0$30'W Of particular note was the rate at which the main body meanders formed and migrated. In mid-April the Stream crossing the rhumb line was essentially linear in form as the March meander migrated to the east (Fig.2). Within 13 days another meander had formed west of the rhumb line (Fig.3) which rapidly deepened and migrated over the next 10 days. From initial formation to 12 May the meander trough sited 50mi to the west of the rhumb line moved to a point approximately 20nm to the east of the rhumb line resulting in flows crossing the rhumb line from the northwest to the southeast or near parallel to the rhumb line (Fig.4). The drift rate of approximately 6-10nm/day is consistent with historical rates which relative to recent years is higher than what we have observed. Conditions over the past five to ten years have favored lower rates and at time even regression. Whether this historical rate will be maintained for this Race remains open to question that is best resolved by careful observation over the next month or so.

The field of currents associated with the meandering main body displays several interesting characteristics at this time. To the north of the main body the altimetry based computer model from NOAA (Fig 5) shows a region of weak clockwise flow along the rhumb line between 38^0N and 40^0N. Speeds are generally low and should have limited effect on routing. South of 38^0N the north wall of the Stream associated flow turns progressively to the south paralleling the rhumb line before intersecting near 37^0 30'N and turning counterclockwise towards the northeast (Fig.5) This pattern is more or less consistent with the temperature patterns (Fig. 4 e.g.). Continuing south, the cold core ring observed several months ago is well to the west of the rhumb line west of 70^0 W. There is, however, an area of counterclockwise flow just east of the rhumb line centered near $36^0$30" N 67^0 W in close contact with the rhumb line. At the moment this feature is producing a region of south going current along the rhumb line. Over the next few weeks, however, it may drift to the west favoring some adverse north going currents. This is another feature worth observation.

To the south towards Bermuda there is only a single area of organized flow, a counterclockwise rotation centered near $33^0$30' N $65^0$30' W just east of the rhumb line (Fig.5). Currents in this ring could exceed 2 kts and it is expected to drift to the west. It represents another area of interest.

Over the past few months it has been interesting to compare the results of two additional computer models of the Gulf Stream, Mercator Ocean and the RTOFS , and their similarities or differences relative to the sea surface temperature (SST) patterns. Qualitatively the model results are essentially similar with the Mercator version (Fig.6) perhaps providing a slightly better simulation of the meander pattern. The RTOFS (Fig. 7) tends to yield a fragmented flow pattern which can produce significant differences in route course and speed and overall elapsed time. These differences can also affect estimates of risk/reward associated with various strategic decisions. The importance of these estimates will of course, tend to vary as a function of boat type and even particular weather conditions. All of these reasons make care in the selection and use of any particular model in optimum routing programs, such as Expedition, absolutely essential. Comparisons between individual models as well as comparisons of models to observed SST patterns over time will serve to increase confidence and provide some indication of probable error(s) associated with the use of any one scheme. This information directly complements improved strategic/tactical decisions.

The past few months have represented something of a "poster child" illustrating the importance of early study of Gulf Stream and weather prior to a Newport Bermuda Race. The period has seen an abundance of dense cloud cover often limiting satellite observation. Weather patterns are displaying characteristics differing substantially from the historic most probably associated with increasing water temperatures and relative humidity. These have tended to affect forecast accuracy. The combination complicates a variety of strategic decisions ranging from sail inventory to optimum routes. It seems clear that early preparation will be particularly important this year. Should be interesting to see what the next few weeks provides.

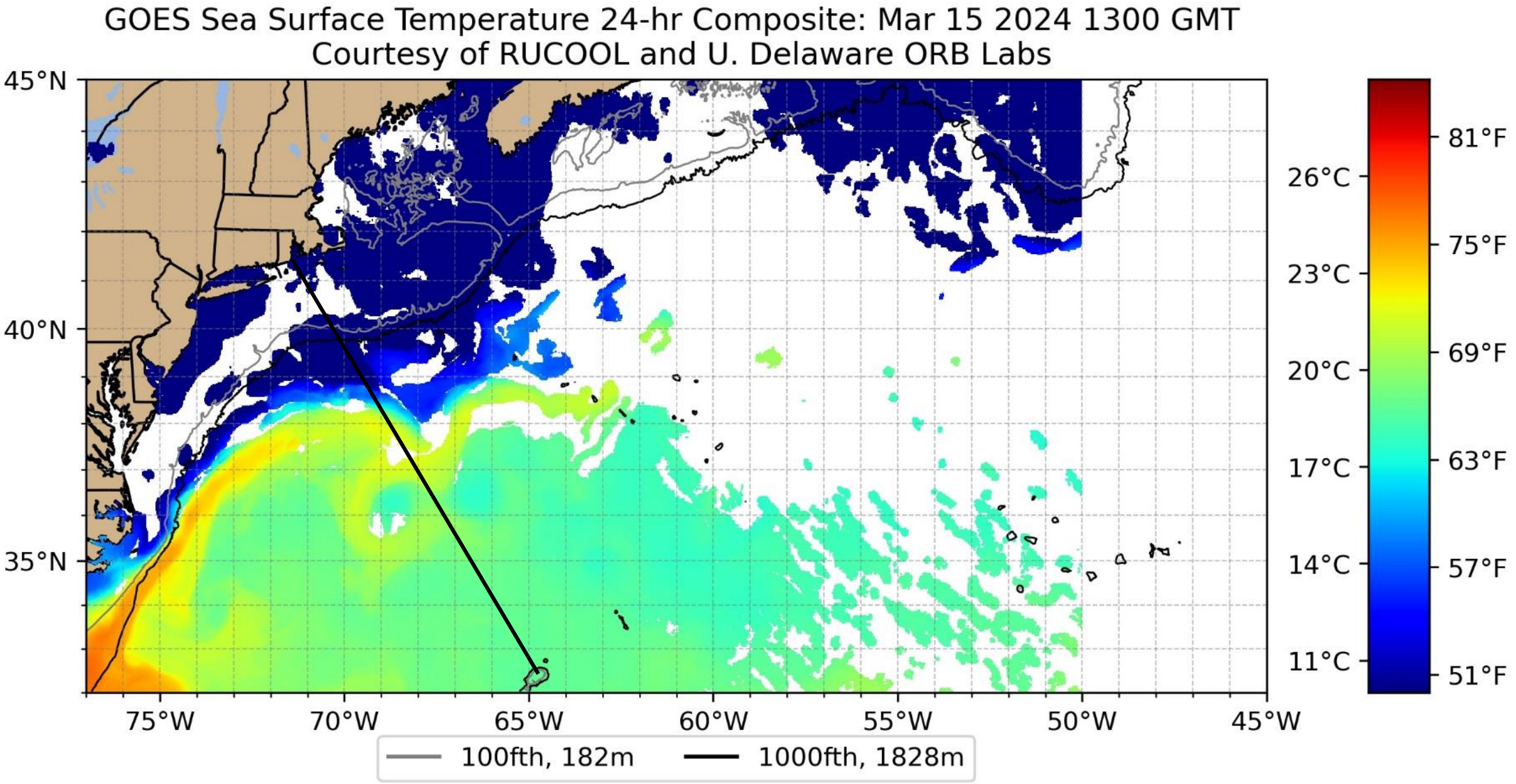

Figure 1 **Gulf Stream Sea Surface Temperatures Showing Meander and Cold Core Ring**

Black Line Represents The Newport to Bermuda Rhumb Line

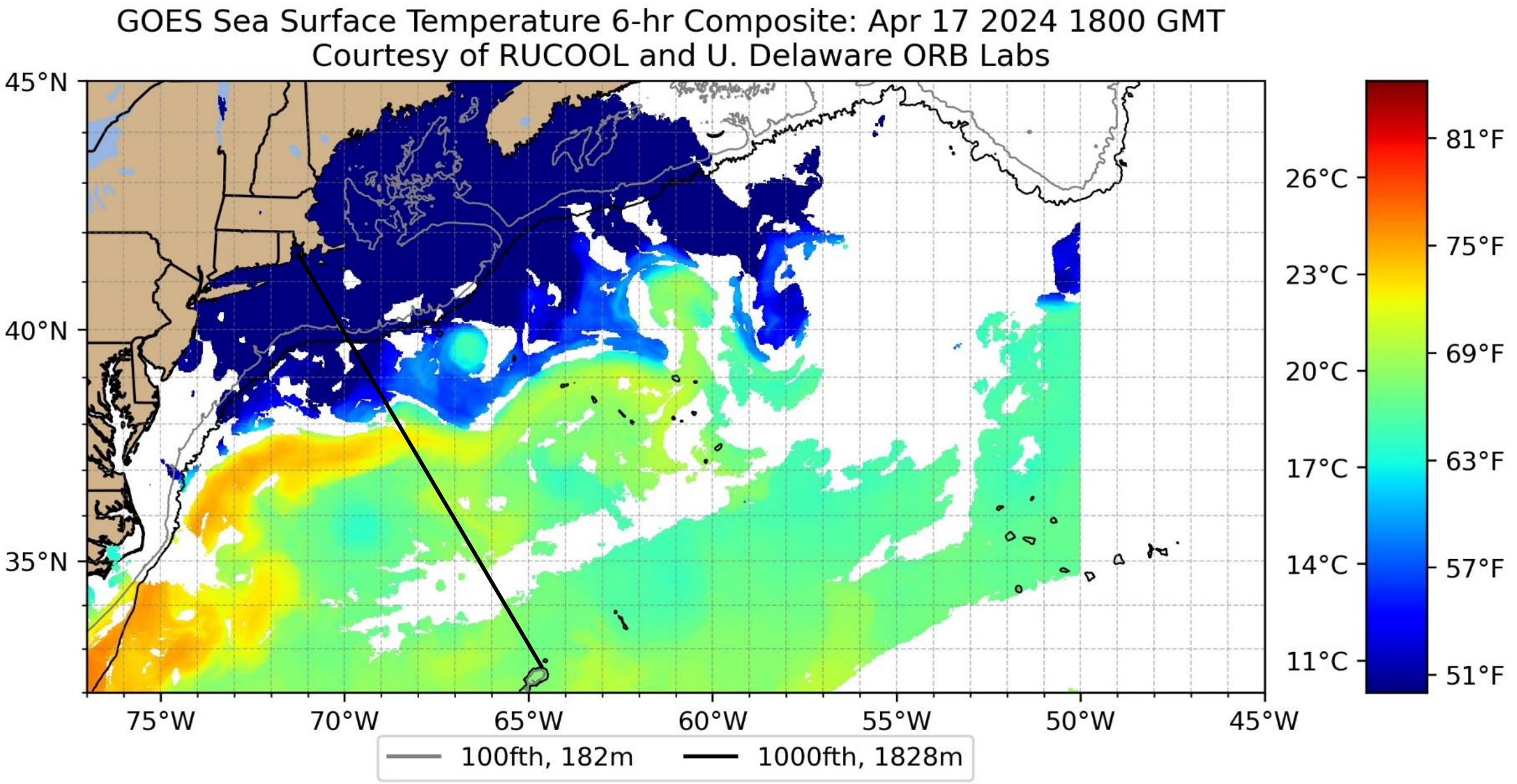

Figure 2 **Gulf Stream Sea Surface Temperatures Showing Meander Migration Over Month**
Black Line Represents The Newport to Bermuda Rhumb Line

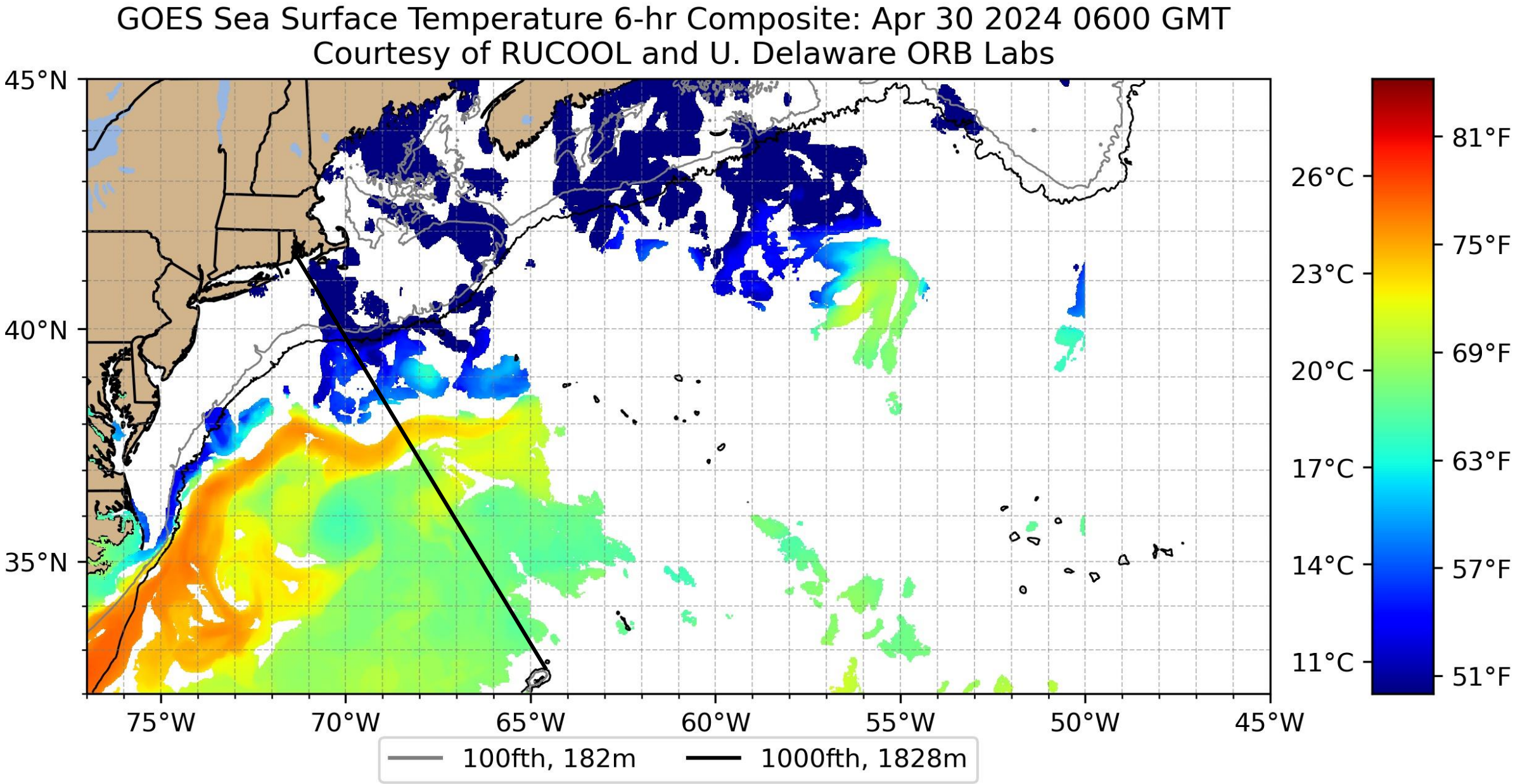

Figure 3 **Gulf Stream Sea Surface Temperatures Showing Meander Development Over Two Weeks**

Black Line Represents The Newport to Bermuda Rhumb Line

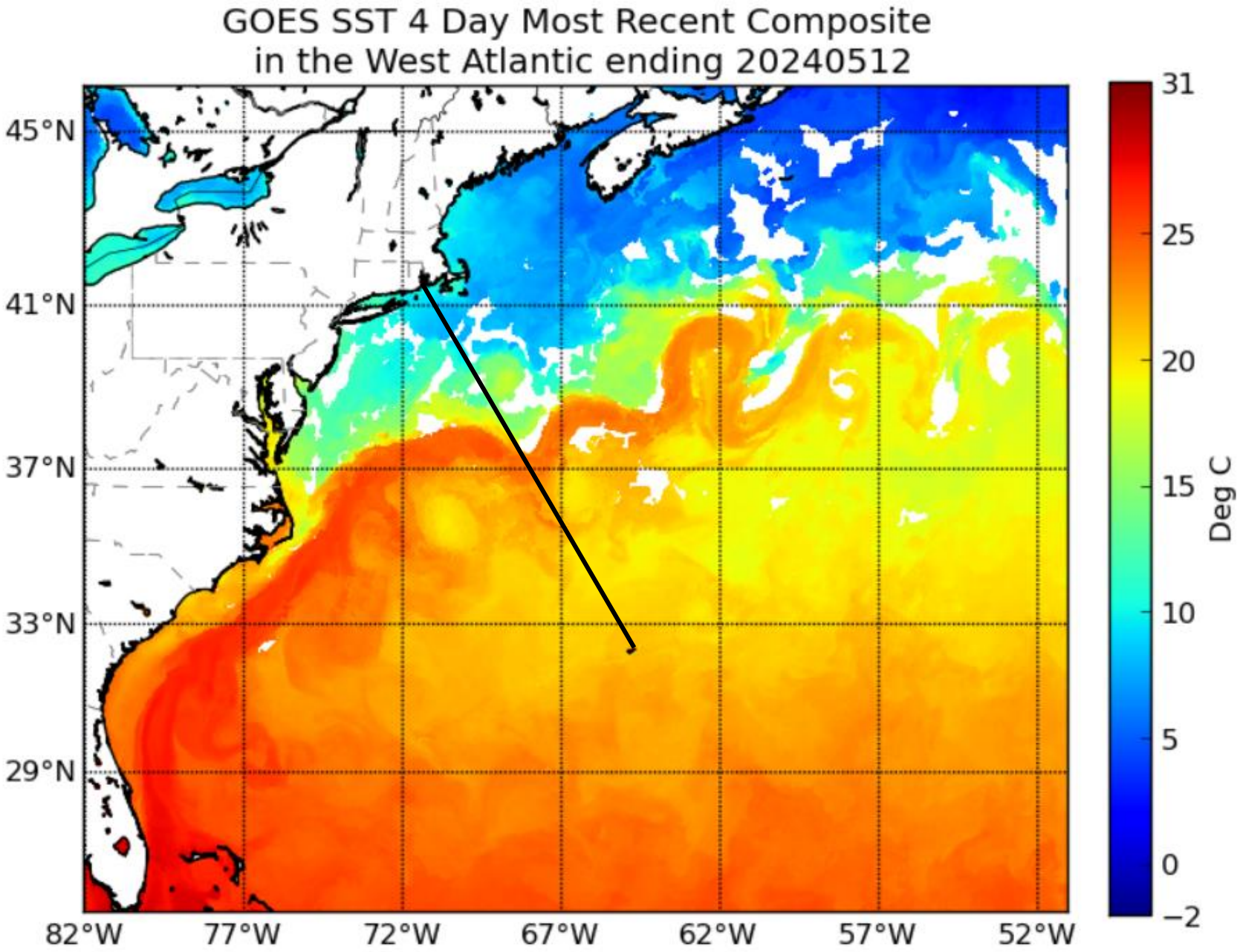

Figure 4 **Ocean Prediction Center Gulf Stream 4-Day Composite SST Image**

Black Line Represents The Newport To Bermuda Rhumb Line

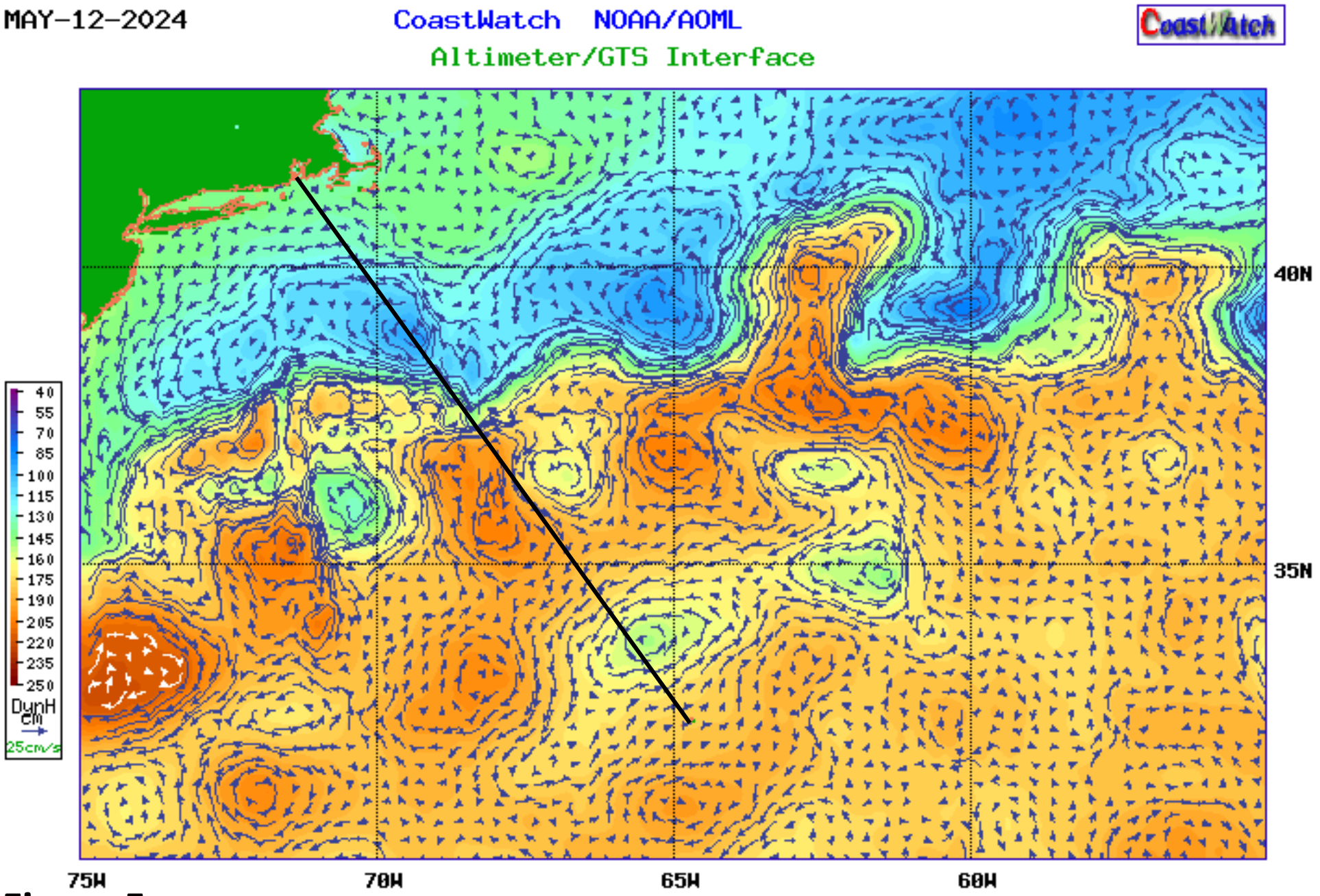

Figure 5 Northwest Atlantic Surface Currents- Altimetry Based Model May 12, 2024

Black Line Represents The Newport to Bermuda Rhumb Line

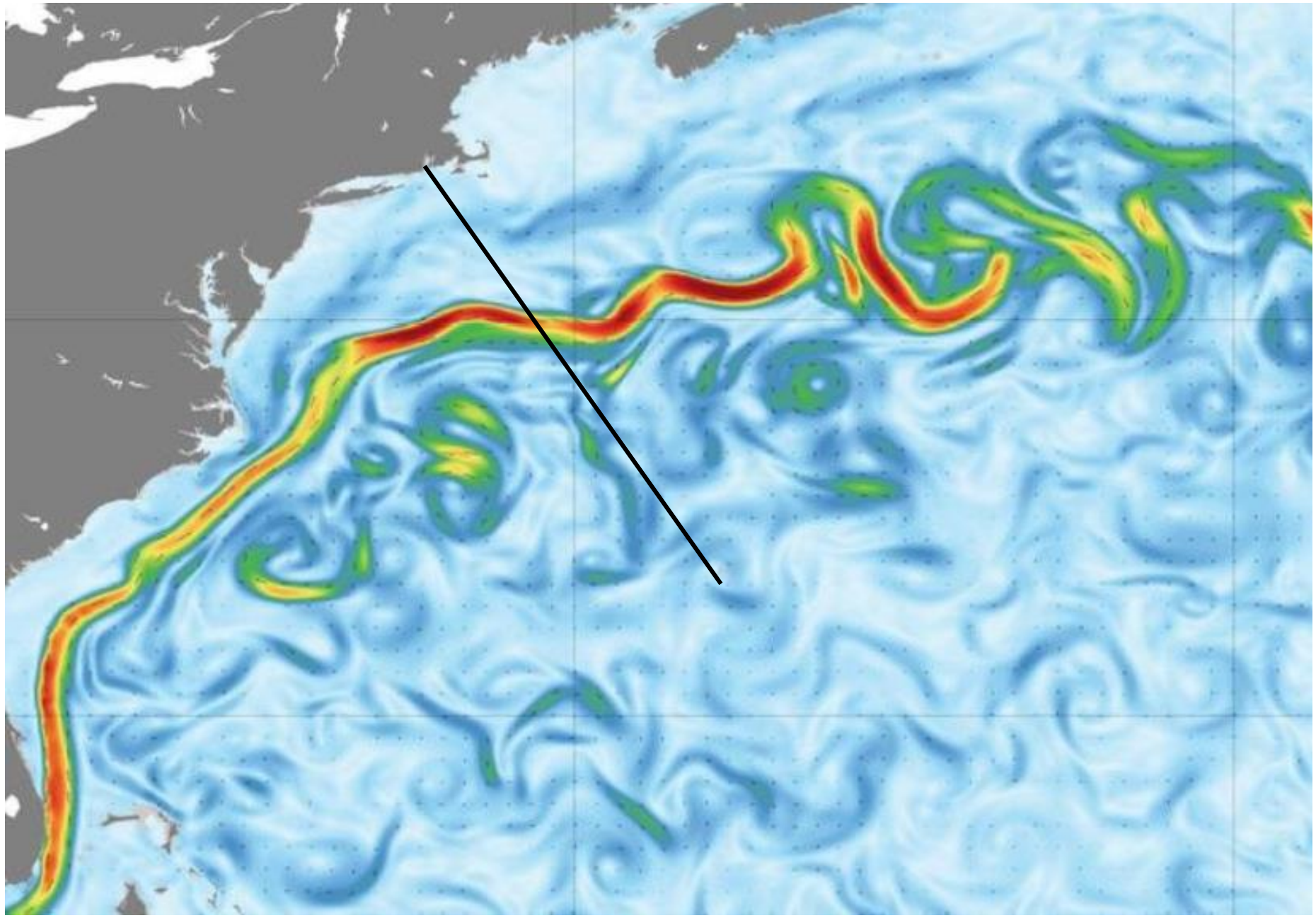

Figure 6 **Mercator Ocean Computed Gulf Stream Currents May 13, 2024**

Black Line Represents The Newport to Bermuda Rhumb Line

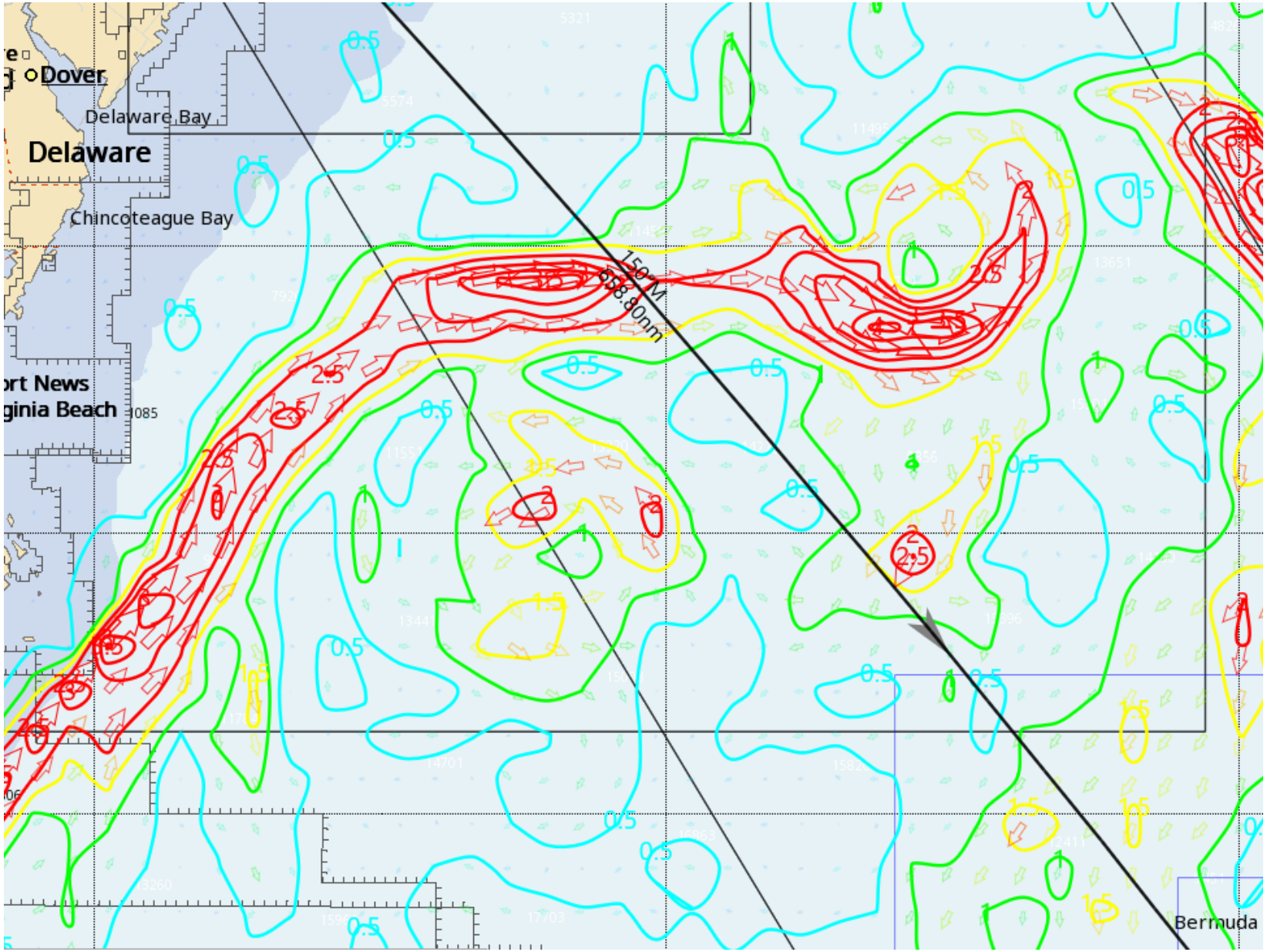

Figure 7 **NOAA RTOFS Computed Gulf Stream Currents** **May 13,2024**