The Gulf Stream Near The Rhumb Line - New England to Bermuda May 8, 2025
An Analysis of Conditions

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

Again it has been an interesting couple of months of study with the Stream displaying evident meandering often obscured by cloud cover. I hope all have taken the advice to start study early in the interest of developing optimum routing and race strategy. For those new to task I'd advise reading the *Gulf Stream Primer* posted to the Race websites. This provides a guide to typical Stream characteristics and their evolution and a basis for evaluating the unusual.

By early May the meandering Gulf Stream sea surface temperature (SST) pattern observed throughout March and April had produced a deep meander in the vicinity of the rhumb line New England to Bermuda. The image provided by the U.S. Navy (Fig.1), which has not been regularly updated for some time and, as a result not included in my Gulf Stream and Weather links on the Race websites, is essentially identical to the satellite image provided by Rutgers (Fig.2). Note the three day difference in dates due to clouds obscuring the May 3 Rutgers image. These patterns show the main body of the Stream crossing the rhumb from the southwest to the northeast at a point approximatly 300 nm from Newport or outer Buzzards Bay. The western limb of the meander with dominant currents to the southeast, affecting more than 90nm of ocean, is positioned approximately 45nm to the west of the rhumb line. All things being equal, such a pattern would certainly favor westerly routing entering the Stream in the vicinity of 38^0 N 69^0 50'W, to take full advantage of the southeast going current.

If clouds prevented direct satellite views of the Stream estimates of Stream structure would have to rely on one or more computer models. Of the variety available many navigators rely on NOAA's Global Real Time Ocean Forecast System (GRTOFS) which provides $1/12^{th}$ degree resolution and can be found at found at Global RTOFS High Resolution Oceanic Model . This site provides graphic images of both SSTs and currents over an 18 hour forecast period allowing some evaluation of rates of change. Use of this model GRIB data in Expedition provides more extended forecast periods and is

particularly useful in the evaluation of changes in Stream structure and rates of change.

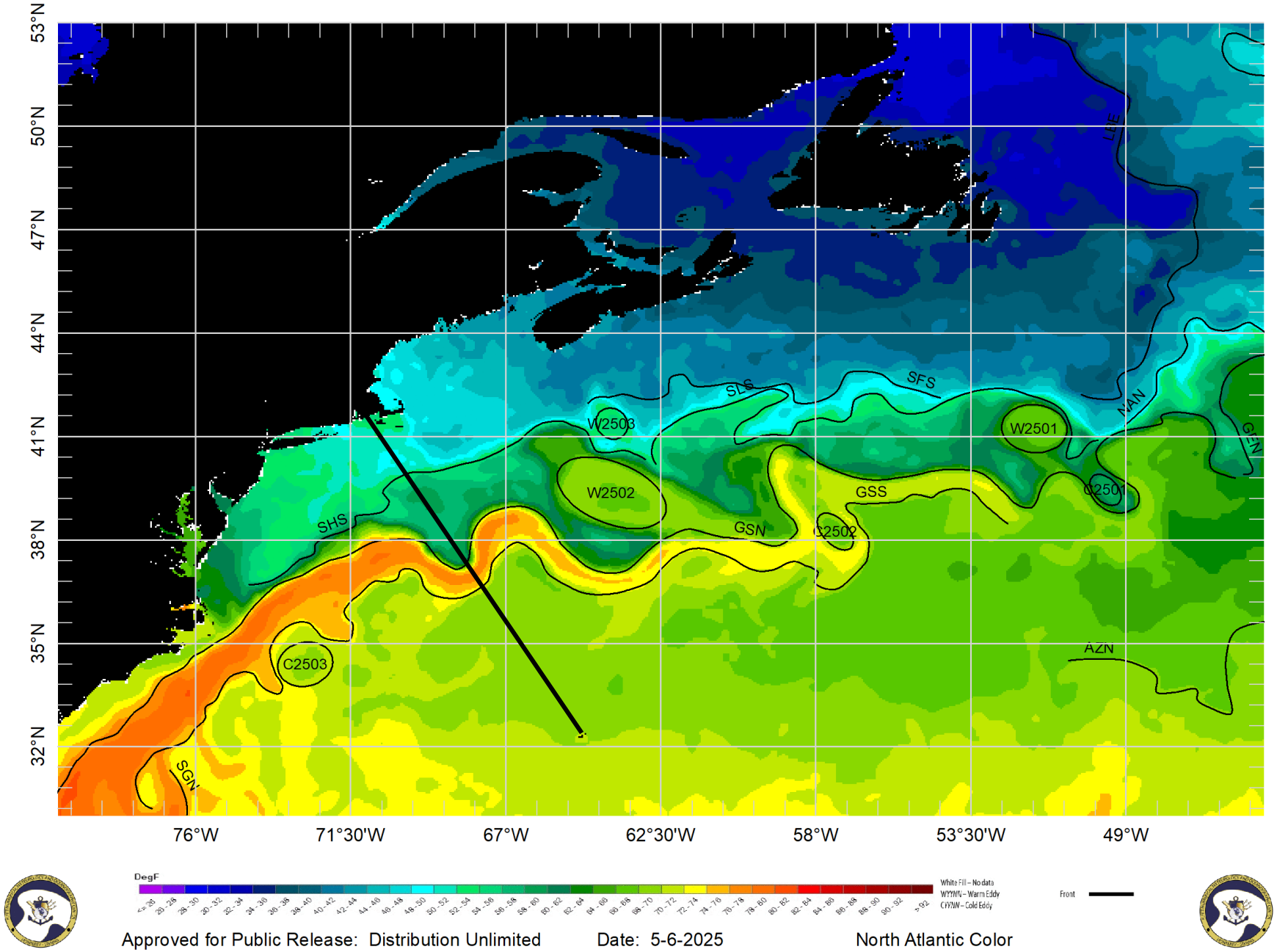
Comparing the direct satellite observation of SST provided by the Rutgers image (Fig.2) to the model result (Fig. 3) shows excellent agreement. Such comparisons on a regular basis are essential to develop confidence in model results. A clear example of the need for and value of this is provided by comparison with the results of the Mercator Ocean model, another product sometimes used for routing (Fig.4). This image seemingly provides more detail on the thermal structure but requires some interpretation to extract the meander i.e. to even believe there is one. A marked difference is clearly shown when the models' current predictions are called up with the GRTOFS showing an evident southeasterly flow as the main body of the Stream crosses 70^0 W (Fig.5) while the Mercator Ocean Model shows near linear continuation of the dominant west to east flow (Fig.6). The reason(s) for this difference cannot be simply defined and is likely the result of multiple factors including differences in model formulation, initial conditions, and sensitivity to winds. Whatever the reason such differences at the very least serve as an alert to the navigator to exercise care in the application of modelled currents (whatever the source) in an optimum routing routine particularly if the noted differences affect a portion of the track to Bermuda.

Well, which model should we use ? Certainly the similarity in SST patterns between the observed and modelled conditions favors the GRTOFS model. At least for the moment. This conclusion is reinforced by the results of the altimetry based current model (Fig.7) showing a clear meander in the main body of the Stream resulting in flows crossing the rhumb line from west to east near 37^0 N. The dimensions of this feature being approximately 200 nm crest to crest differ from those of the SST model which is smaller (~130nm) but the fact that one is SST and the other currents must be kept in mind. These differences are considered minor, favoring selection of the GRTOFS model.

In addition to assisting in model selection and optimum entry point of the main body of the Stream, the altimetry based model provides additional essential data detailing conditions to the south of the main body of the Stream to Bermuda. For the May 8 conditions the model indicates that on departure of the main body, most likely in the vicinity of 37^0 N 68^0 30' W , or slightly west of the rhumb line, boats will be affected by adverse currents for most of the remaining way to Bermuda (Fig.7). These adverse currents are the result of two features, a cold counterclockwise rotating ring to the west of the rhumb line and large and warmer clockwise rotating feature to the east. The effects of this confluence will decrease with distance southeast reaching minima near 34^0 N. Remembering that under normal conditions these features can be

expected to drift to the west at rates of miles/day would suggest that these adverse flow conditions south of the Stream might persist well into early June affecting at least the B1-2. This might very well change however, since the eastern eddy is in close contact with the main body of the Stream near 65^0 W (Fig.7) which might induce more easterly drift or even entrainment in the Stream. It should be clear that these features and their evolution warrant careful monitoring over the next few weeks leading to Race time.

The same must be said of the meander in the main body of the Stream. We might like to believe that it will simply drift to the east – northeast deepening and bringing the westerly limb closer to the rhumb line, consistent with most of the older historical trends. Observations over the past 5-7 years however, provide clear indication that this might be wishful thinking and not at all consistent with present day behavior. Hopefully we will have a much better idea of the stream structure affecting race conditions in the next two weeks, or so.



Approved for Public Release: Distribution Unlimited Date: 5-6-2025 North Atlantic Color

Figure 1 Northwest Atlantic Ocean Sea Surface Temperatures May 6, 2025

https://www.ncei.noaa.gov/jag/navy/data/satellite_analysis/gsncofa.gif?id=75957

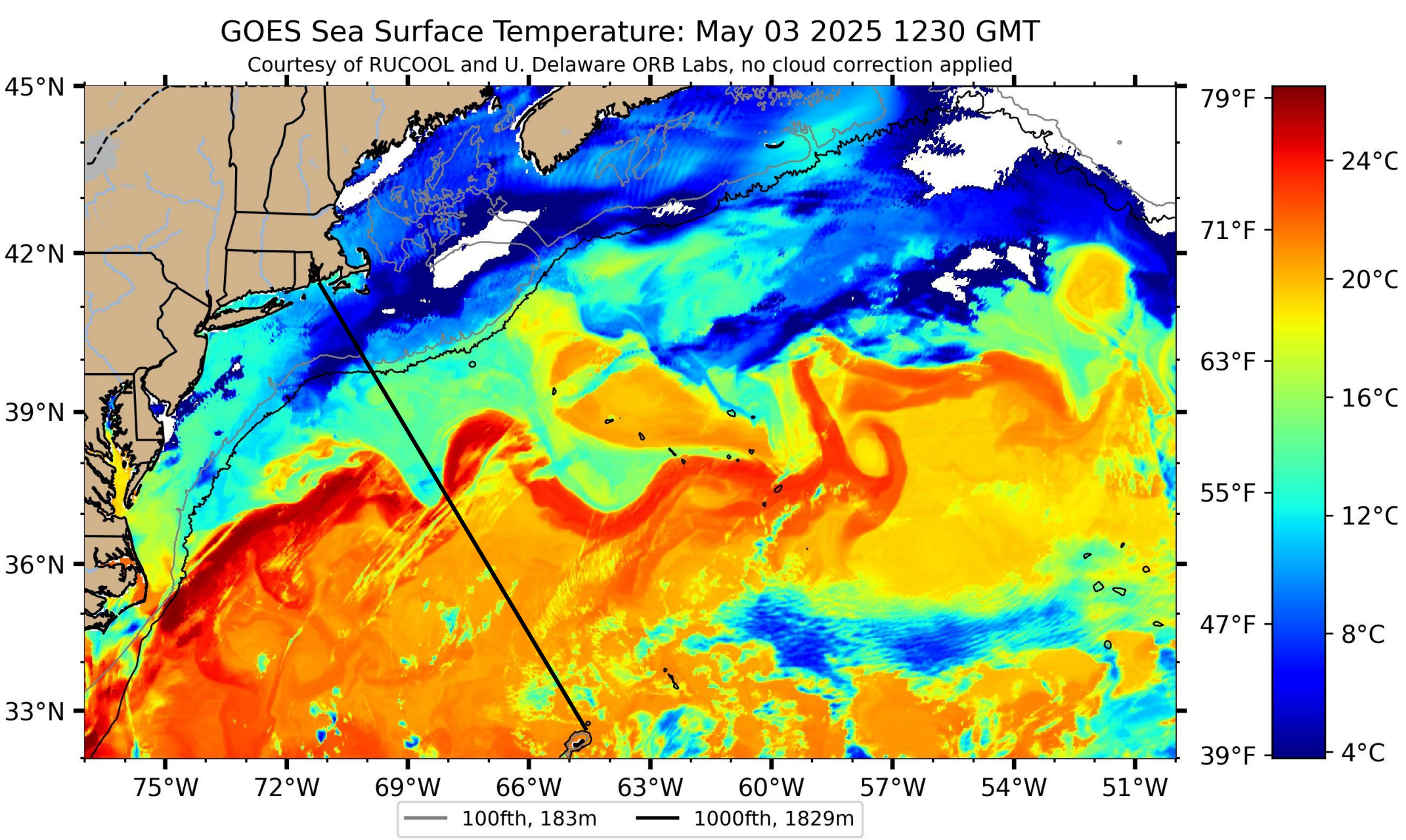


Figure 2 Satellite Image Northwest Atlantic Ocean Sea Surface Temperatures May 3, 2025

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

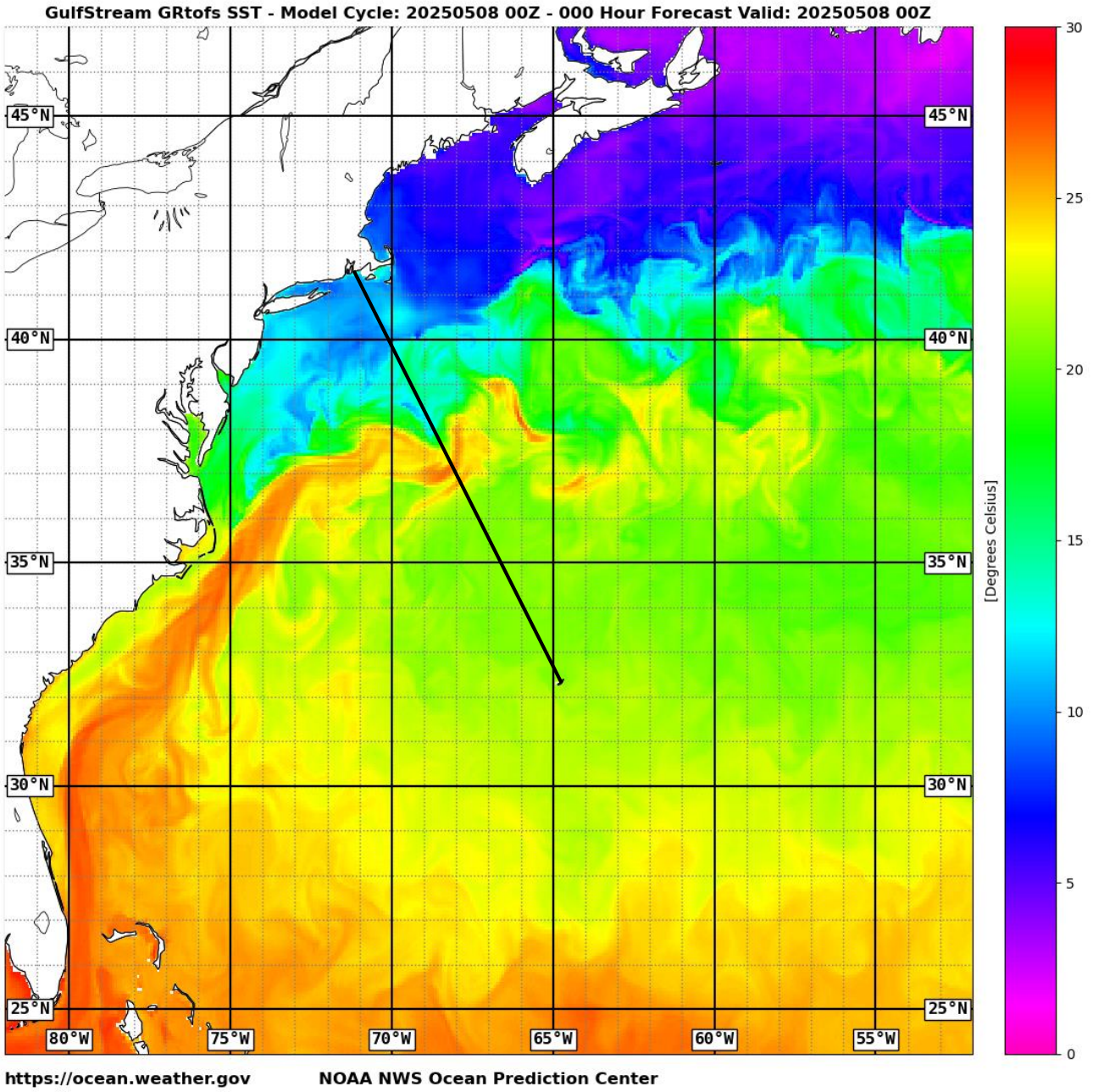


Figure 3 Modelled Sea Surface Temperature - May 8, 2025

Global RTOFS High Resolution Oceanic Model

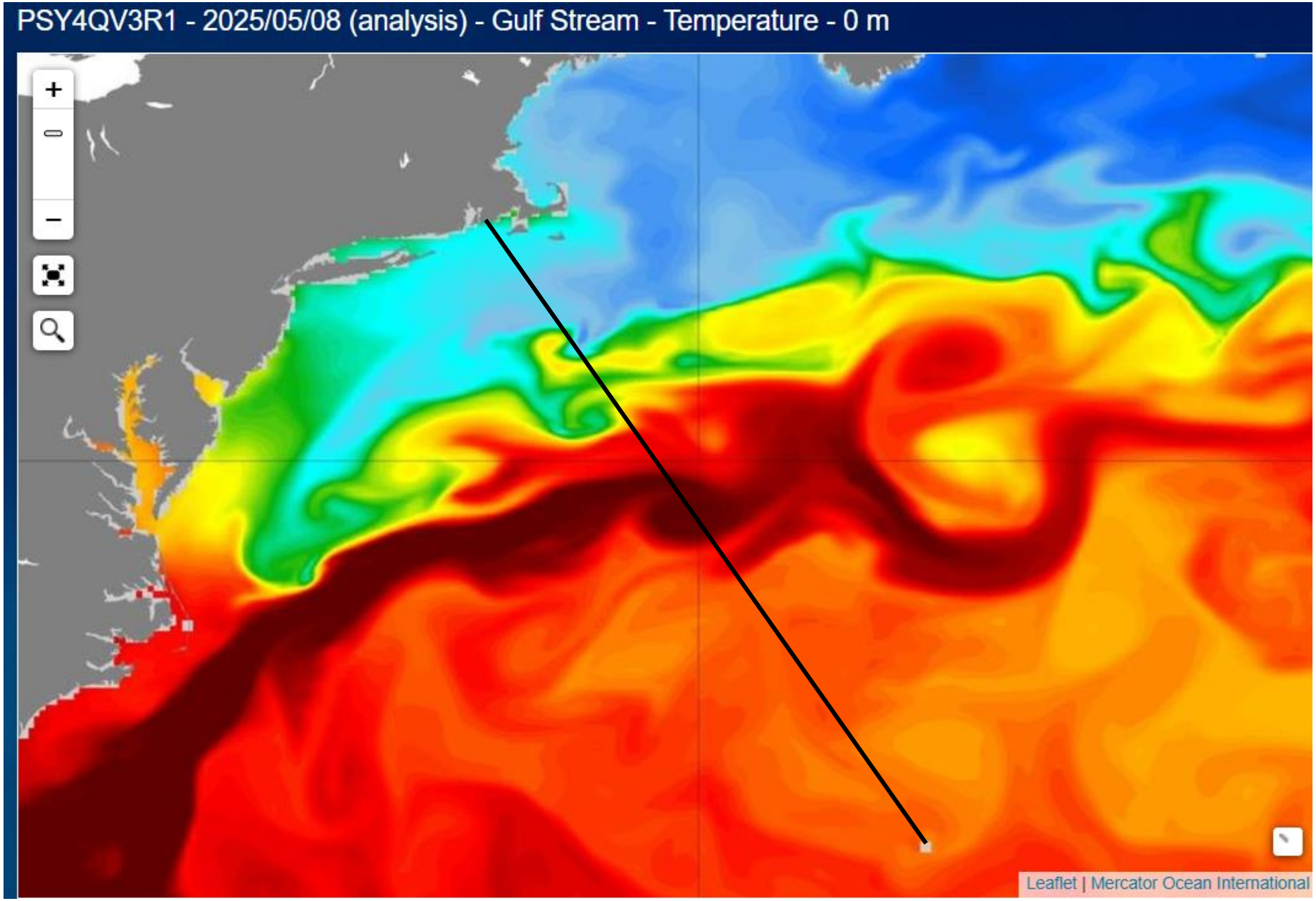


Figure 4 Gulf Stream SST Mercator Ocean Model May 8, 2025

Daily Global Physical Bulletin at 1/12° - Ocean Forecasts - Mercator Ocean

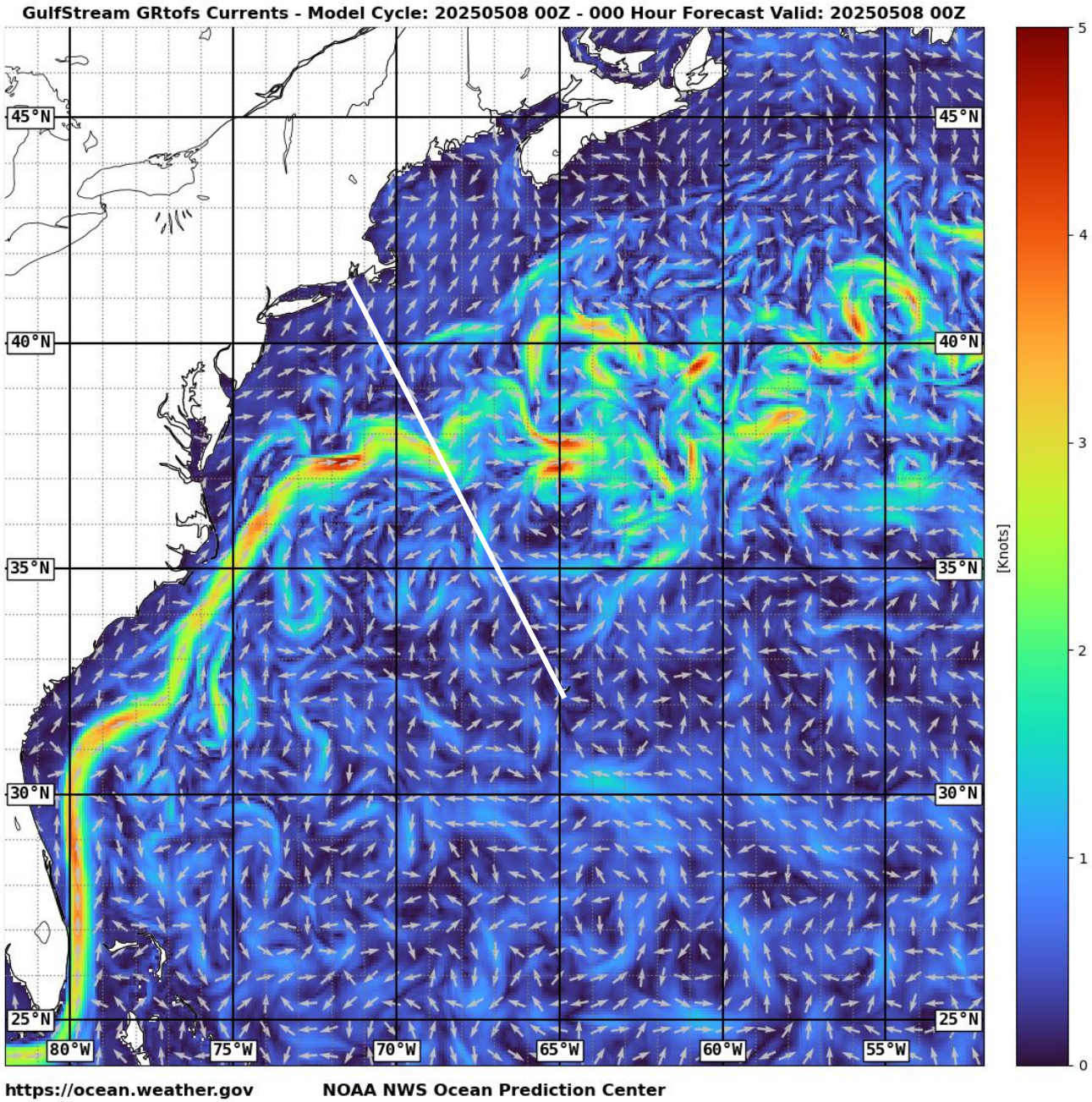


Figure 5 GRTOFS Gulf Stream Currents Model May 8, 2025

GRtofs_GulfStream_currents_f000.png (1100×1100)

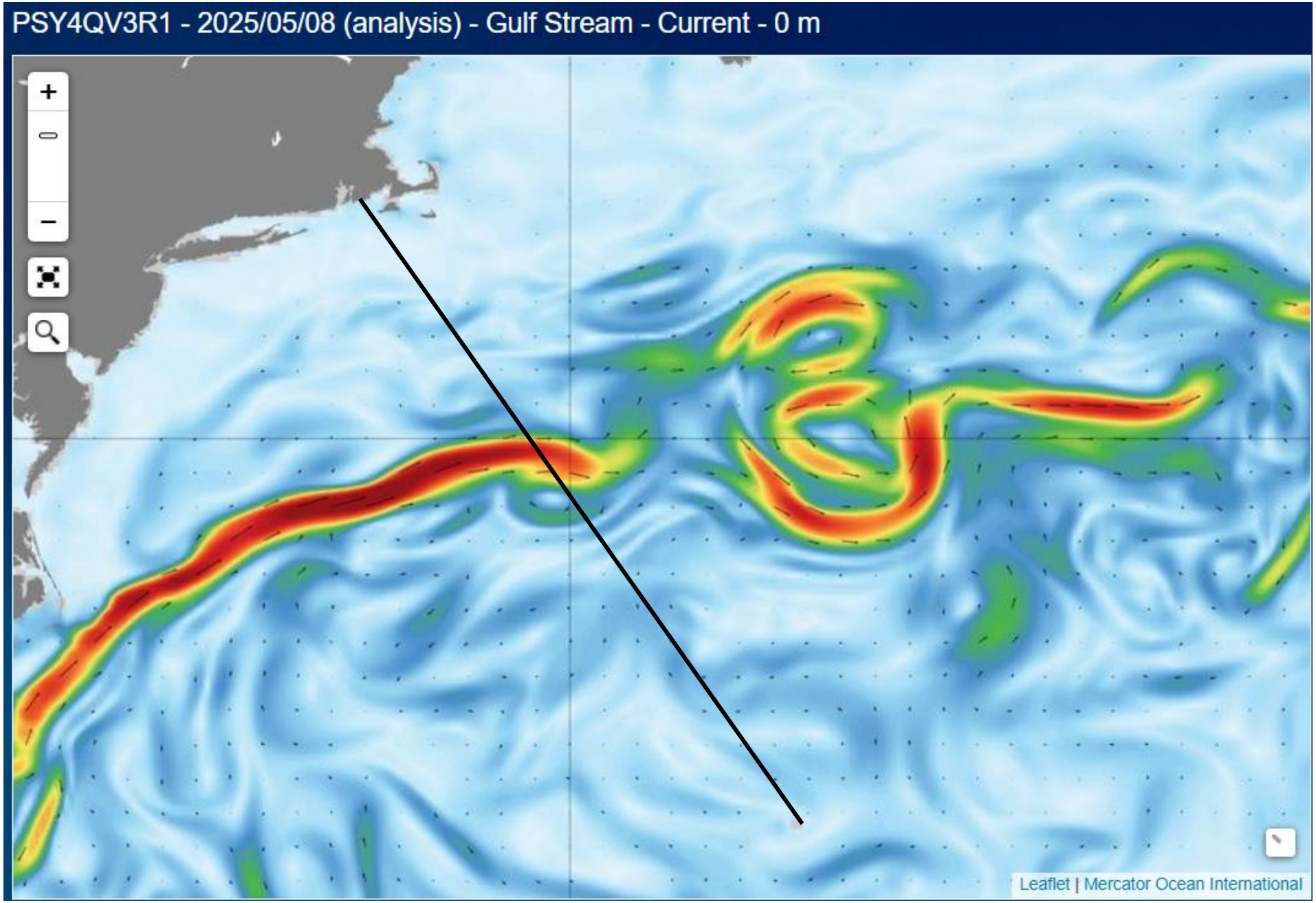


Figure 6 Mercator Ocean Model – Gulf Stream Currents - May 8, 2025

Daily Global Physical Bulletin at 1/12° - Ocean Forecasts - Mercator Ocean

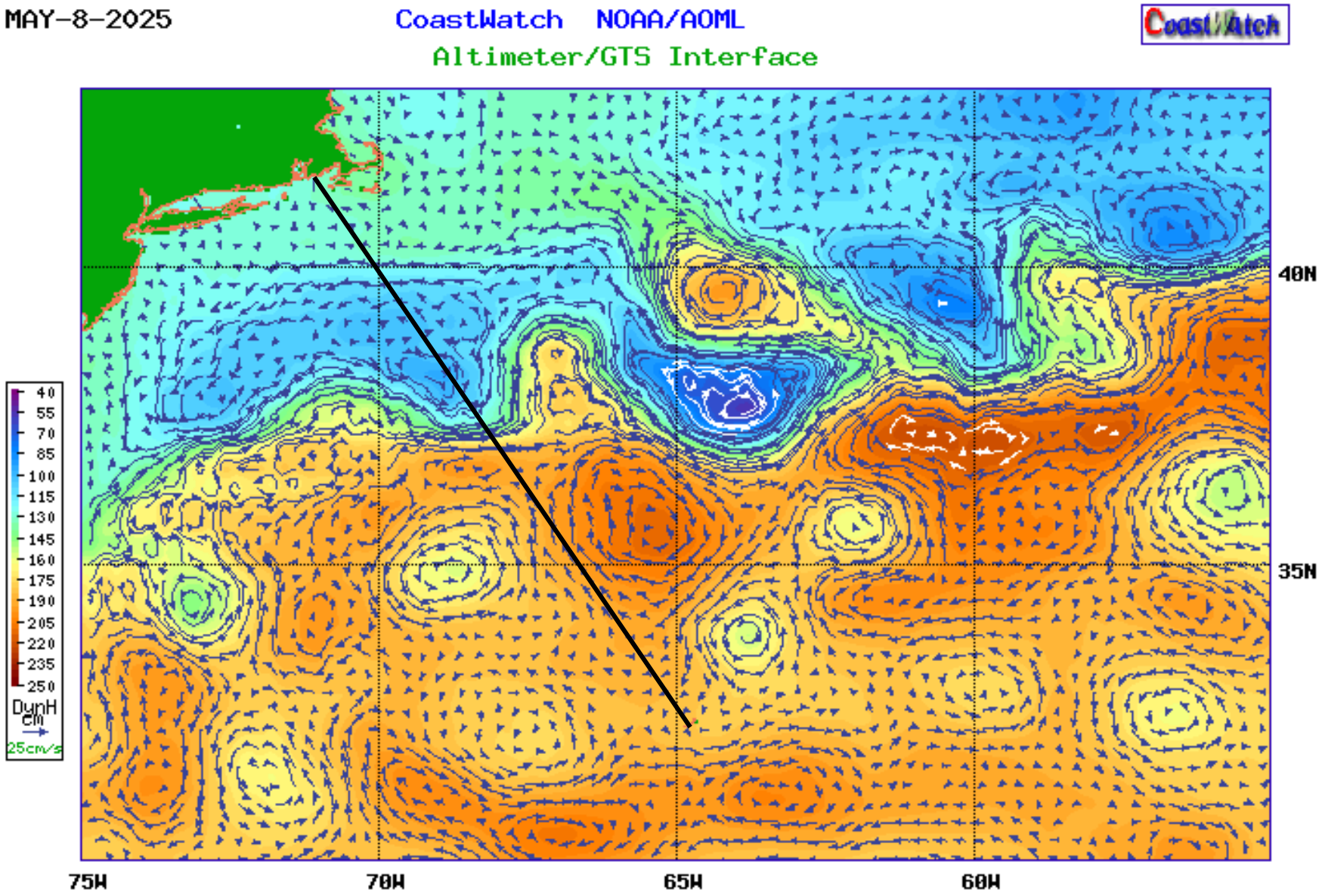


Figure 7 Northwest Atlantic Surface Currents- Altimetry Based Model May 8, 2025
Black Line Represents The New England to Bermuda Rhumb Line

http://tinyurl.com/y93ku8m8