The Gulf Stream Near The Rhumb Line New England to Bermuda May 30, 2023
An Analysis of Conditions

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Since we left the Gulf Stream on May 8 conditions have changed substantially. The relatively linear form of the northern limits of the main body of the Stream and the apparent "relaxation" of the meandering (as discussed in my Note #1) was abruptly replaced around May 22nd by an evident meander which formed, deepened rapidly, progressed to the east and effectively absorbed a warm core ring which had been in place for most of the month. This evolution provides graphic illustration of just how rapidly things can changes in the Stream.

The satellite image of 30 May (Fig.1) shows the main body of the Stream crossing the rhumb line to Bermuda at a point approximately 135 nm from the mouth of Buzzards Bay or Newport. Currents proceed from the west to the east across the line before turning abruptly to the south near 68^0 30' W. The satellite image suggests that the south going currents persist for a distance of 120nm to the trough of the meander near 37^0 30'N 67^0 30'W. This feature developed in little more than 10 days as the result of the easterly migration of a meandering "wave" formed to the northeast of Cape Hatteras (Figs. 2 and 3). The four day composites of Sea Surface Temperatures (SST) (Figs. 4 and 5) provide clear indication of the extent to which this migration affected both the position of the north wall of the main body and the associated currents.

More detailed data regarding the probable flows and their distribution can be obtained using the altimetry based model (Fig.6). Model results provide a more precise indication of the currents associated with the meander impacting the rhumb line than the Satellite SST image (Fig.1). The model shows the core of the currents in the main body of the Stream sited well to the west, nearly 45nm, of the rhumb line on 30 May (remember that the 2 day data processing time makes this image representative of conditions on May 28). The initial southeast flows near 37^0 30'N progressively rotate clockwise to a more nearly southerly flow before turning to the east near 35^0 30'N. These easterly flows continue across the rhumb line and merge with the counterclockwise flow of a cold core ring centered near 36^0 10'N

66^0 20'W. This cold core feature has been progressively drifting to the west and will undoubtedly influence flows across the rhumb line just north of 35^0 for most of the month of June. Its progress should be carefully monitored.

In addition to detailing the flows associated with the meander and cold core ring, the altimetry based model also shows a clockwise rotating feature centered near 34^0 N 65^0 30'W just to the northwest of Bermuda. This results in some amount of adverse current along several hundred miles of the rhumb line favoring a westerly approach to the island. This feature can be expected to drift slowly to the west with the potential to increase adverse current speeds along the rhumb line over the next few weeks.

The observed complexity of the SST patterns and associated currents along and adjacent to the rhumb line has the potential to complicate numerical modeling of the system. This may result in some inaccuracies causing model results to differ from actual observed conditions. We saw some of that in early May. Examination of some recent model results indicate reasonable agreement in both sea surface temperatures (SST) (Fig. 7) and surface currents (Fig.8). Such comparisons are recommended, particularly for those using model data in one of the many optimum routing routines.

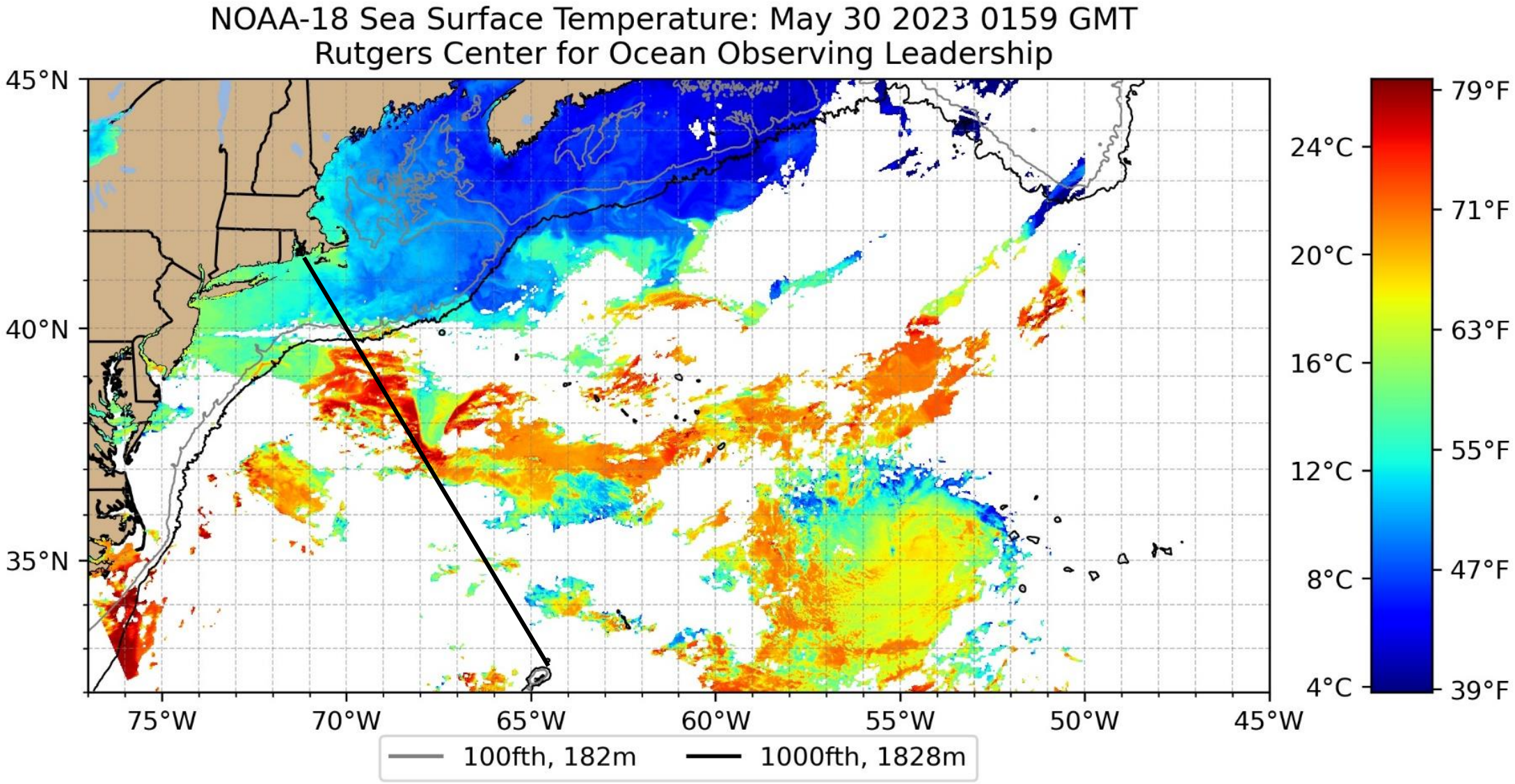

Figure 1 Satellite IR Image of Gulf Stream Surface Temperatures – May 30, 2023

Black Line Indicates Rhumb Line Southern New England to Bermuda

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

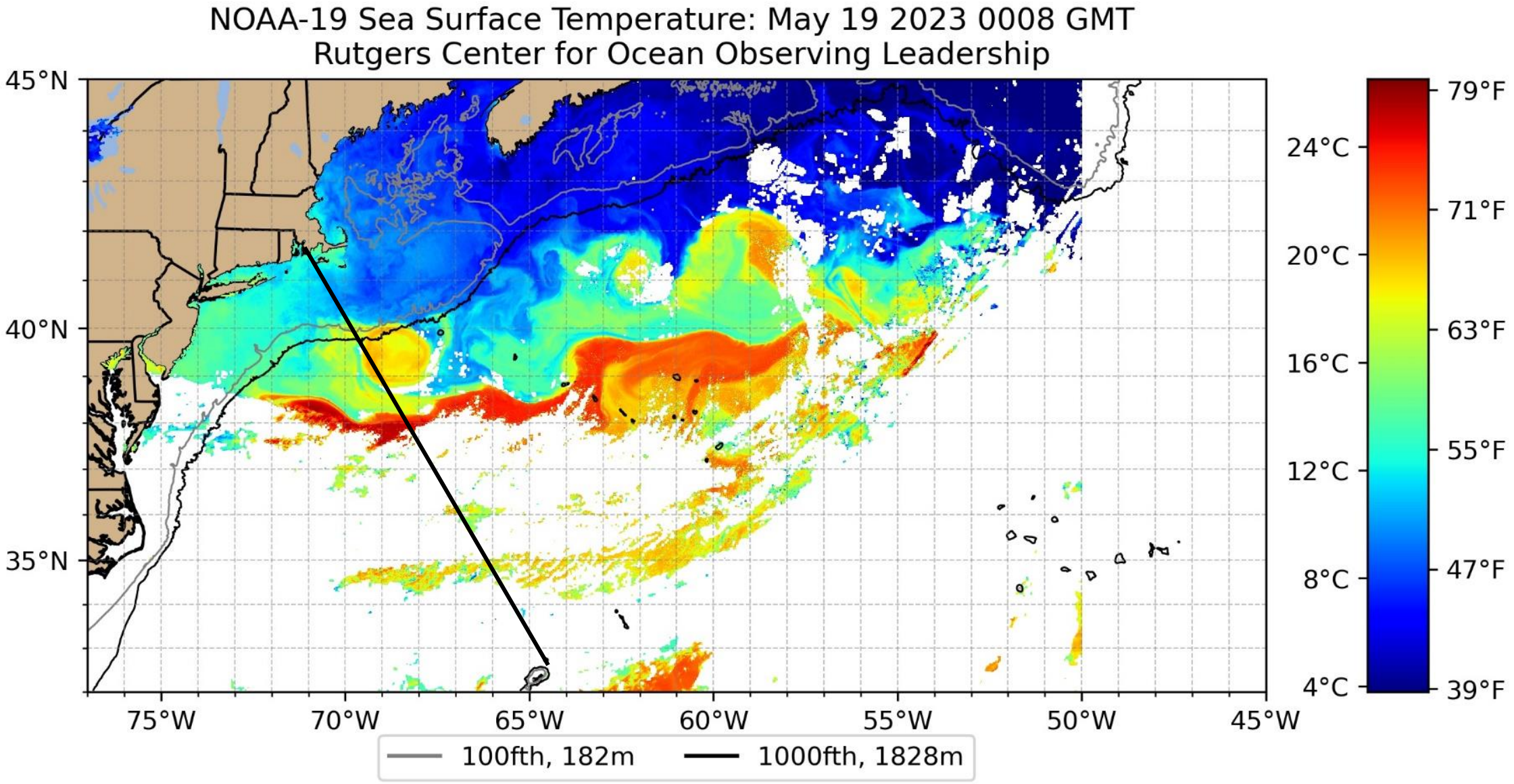

Figure 2 Satellite IR Image of Gulf Stream Surface Temperatures – May 19, 2023

Black Line Indicates Rhumb Line Southern New England to Bermuda

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

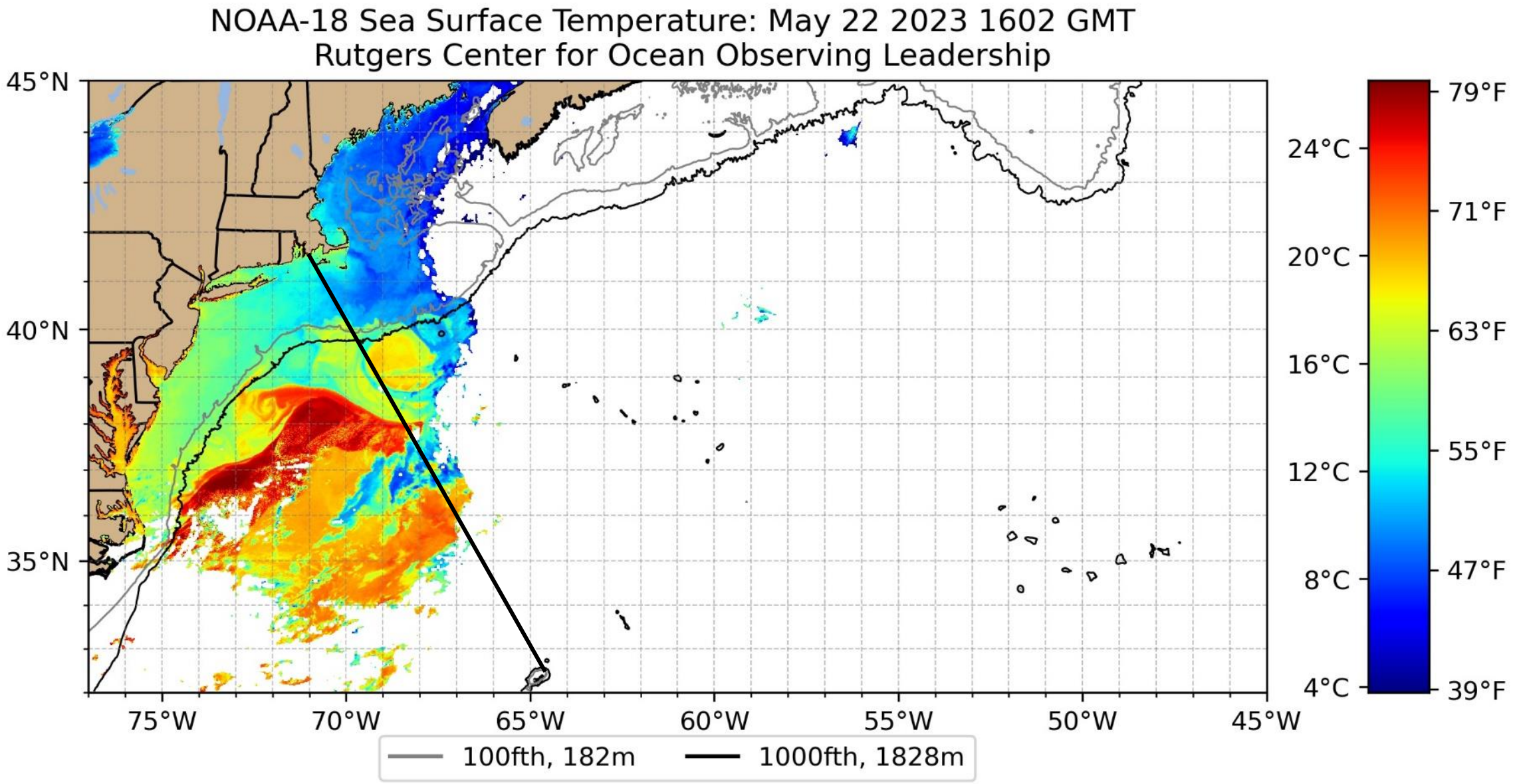

Figure 3 Satellite IR Image of Gulf Stream Surface Temperatures – May 22, 2023

Black Line Indicates Rhumb Line Southern New England to Bermuda

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

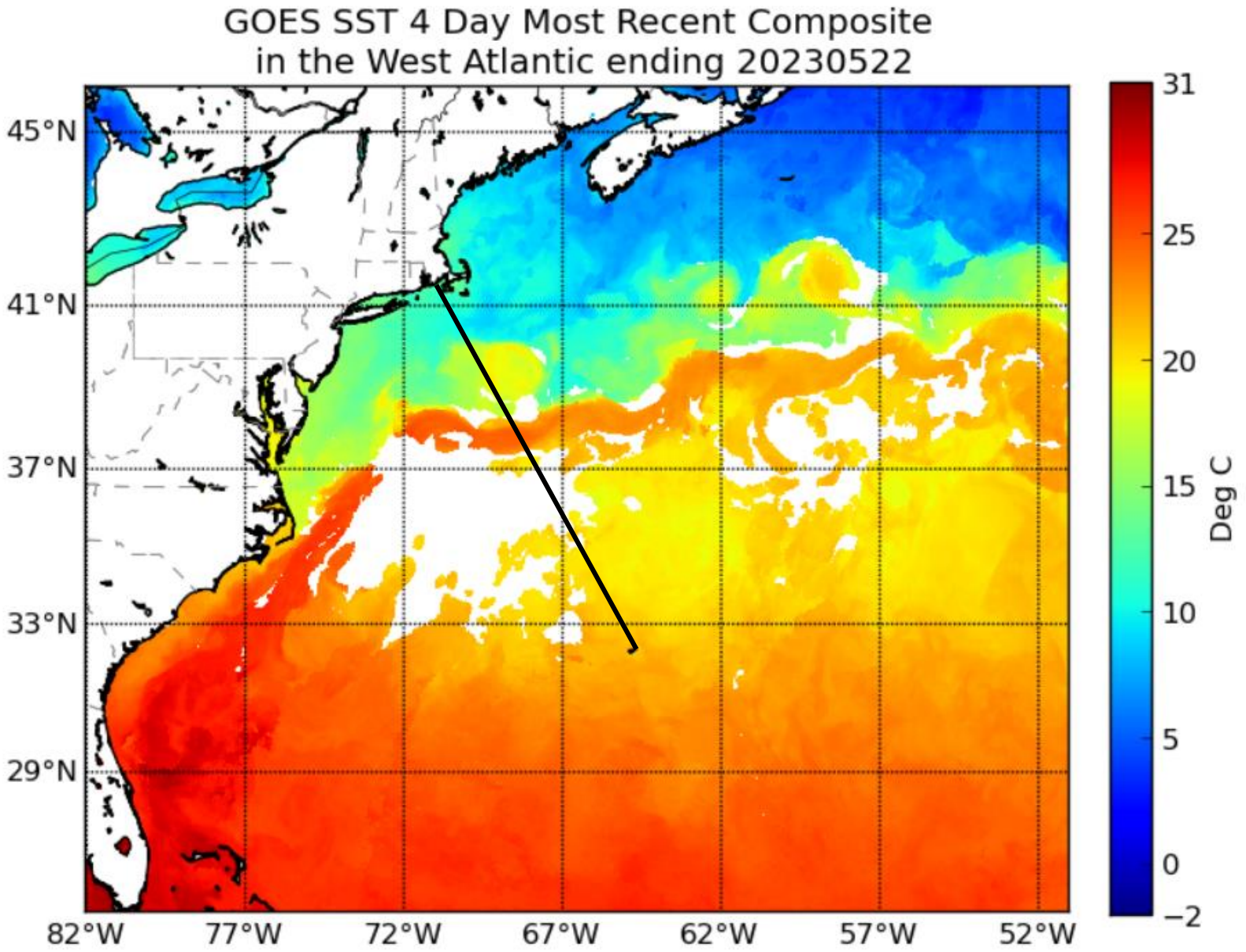

Figure 4 Four Day Composite – Satellite IR Image – Northwest Atlantic – May 22, 2023

Black Line Indicates Rhumb Line Southern New England to Bermuda

Source: https://ocean.weather.gov/

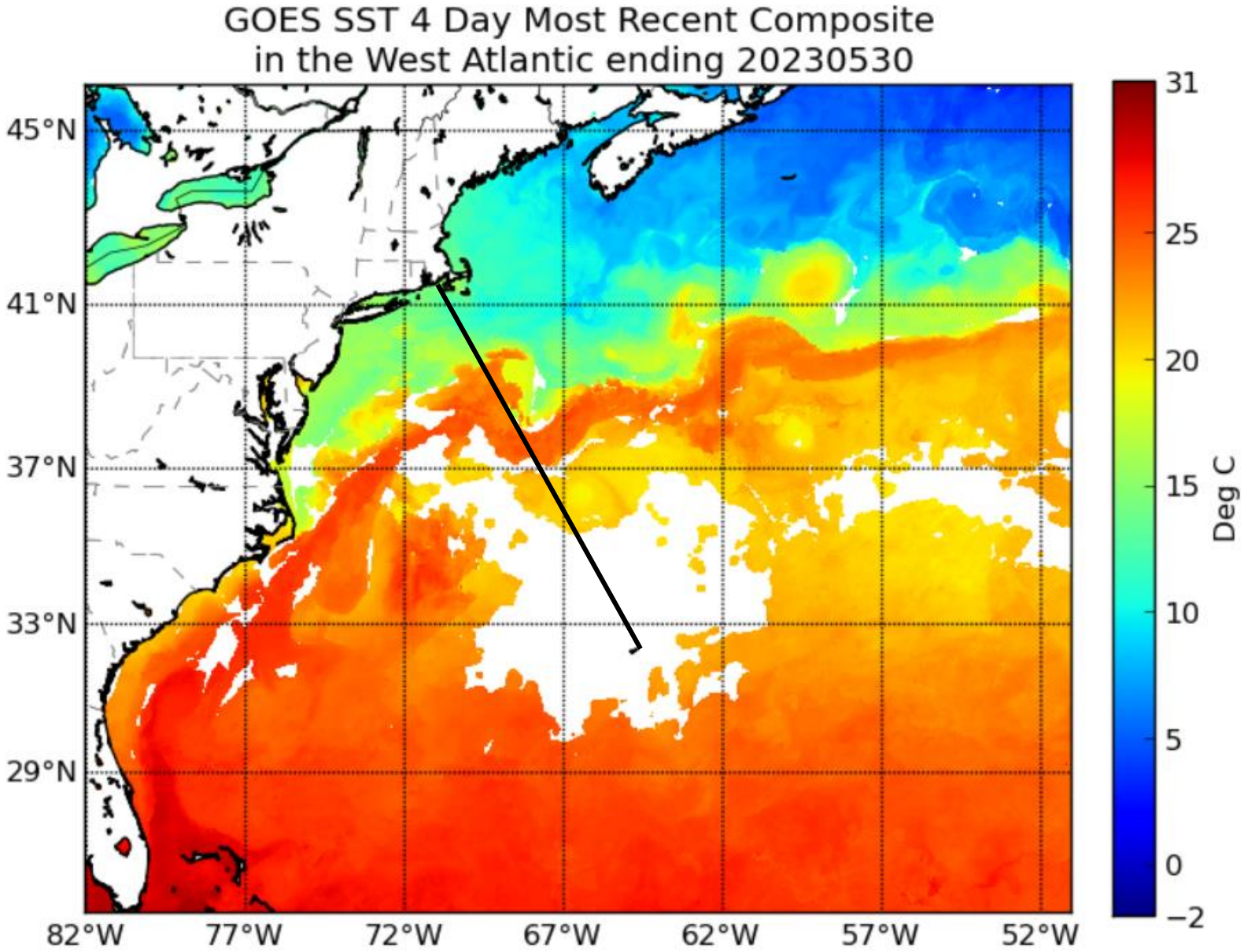

Figure 5 Four Day Composite – Satellite IR Image – Northwest Atlantic – May 30, 2023

Black Line Indicates Rhumb Line Southern New England to Bermuda

Source: https://ocean.weather.gov/

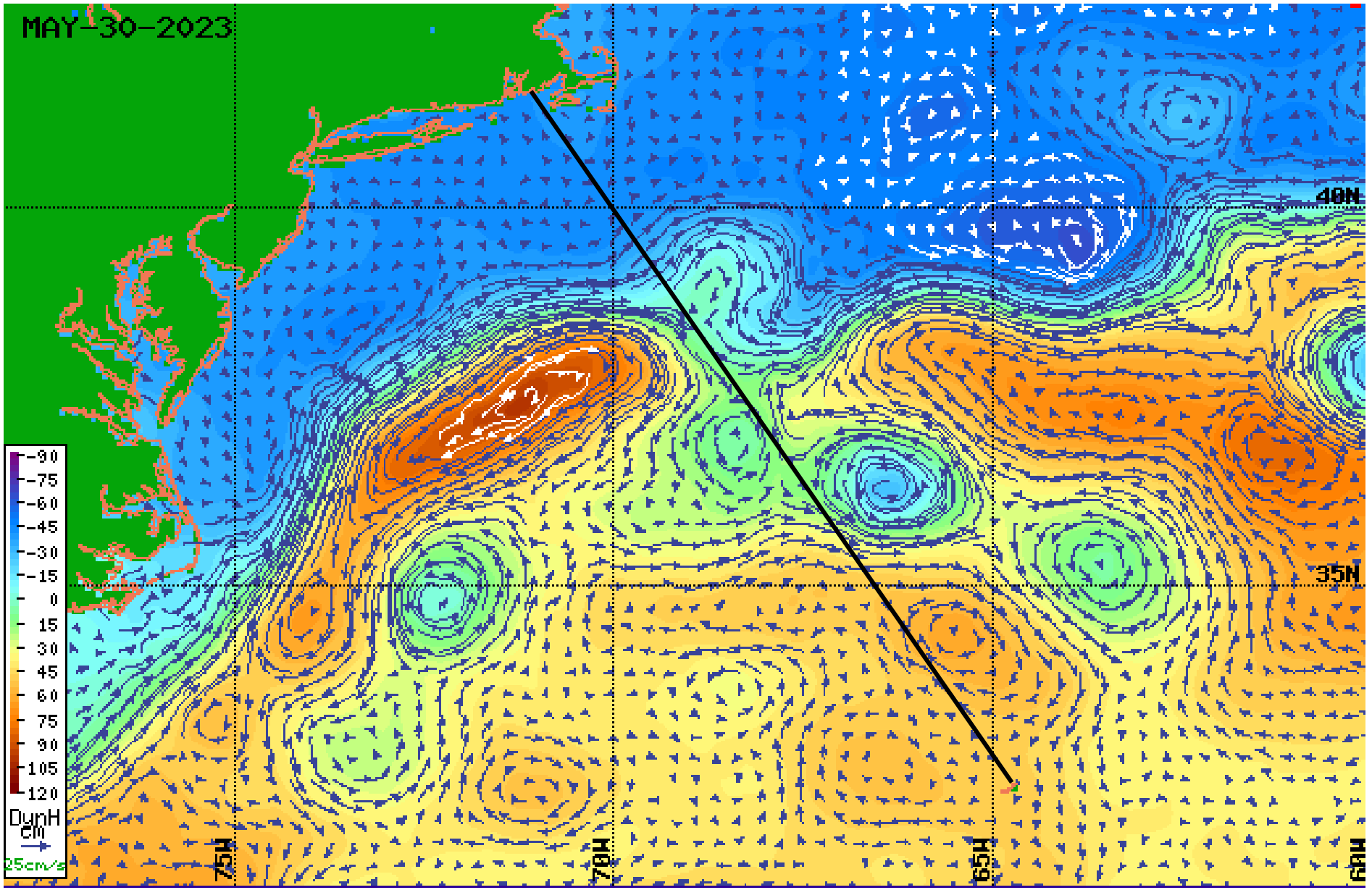

Figure 6 Altimetry Based Model of Northwest Atlantic Ocean Currents – May 30, 2023

Black Line Indicates Rhumb Line Southern New England to Bermuda

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

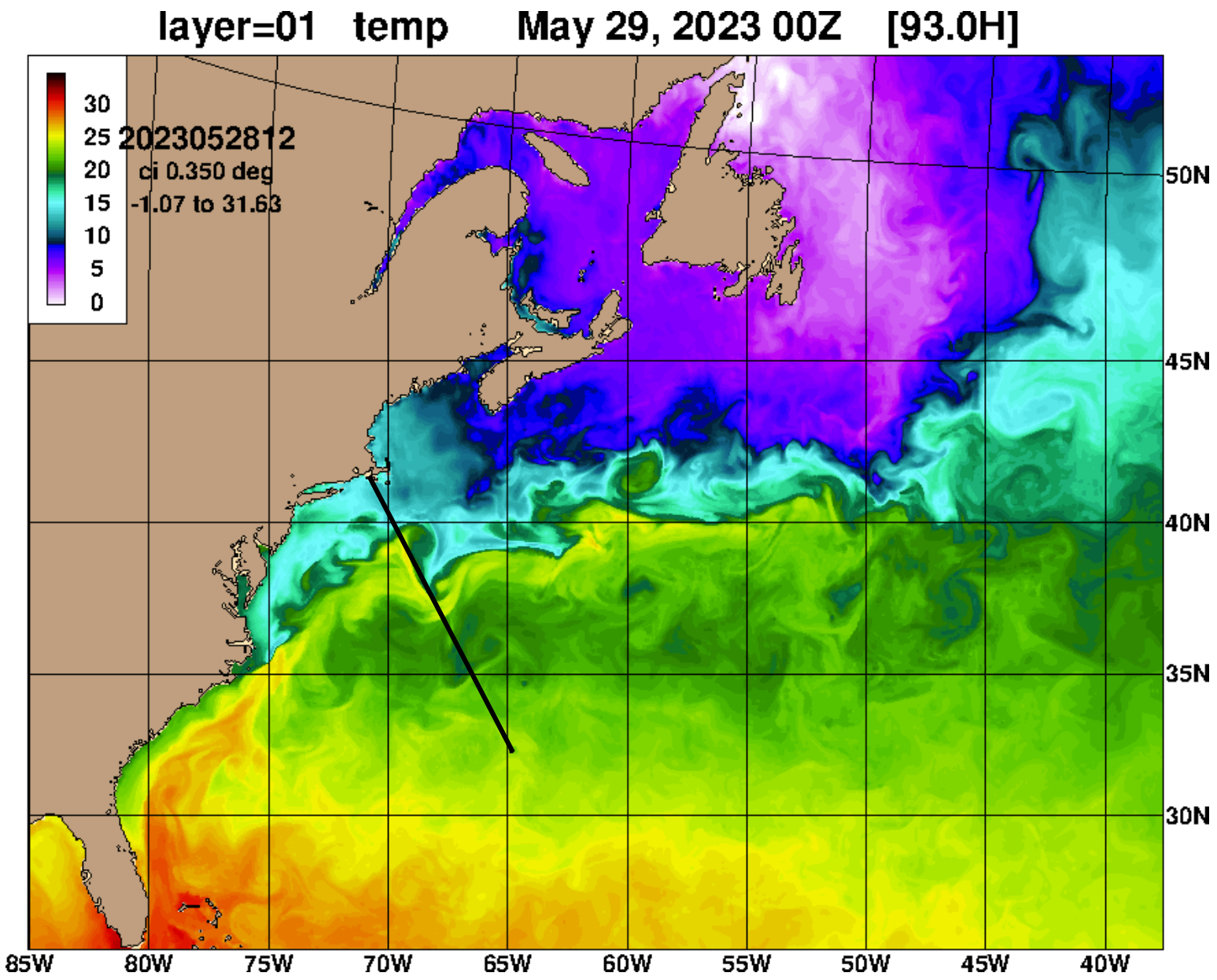

Figure 7 U.S. Navy 1/12^0 Global HYCOM Model of Gulf Stream Sea Surface Temperatures

Black Line Indicates Rhumb Line Southern New England to Bermuda

https://www7320.nrlssc.navy.mil/GLBhycomcice1-12/

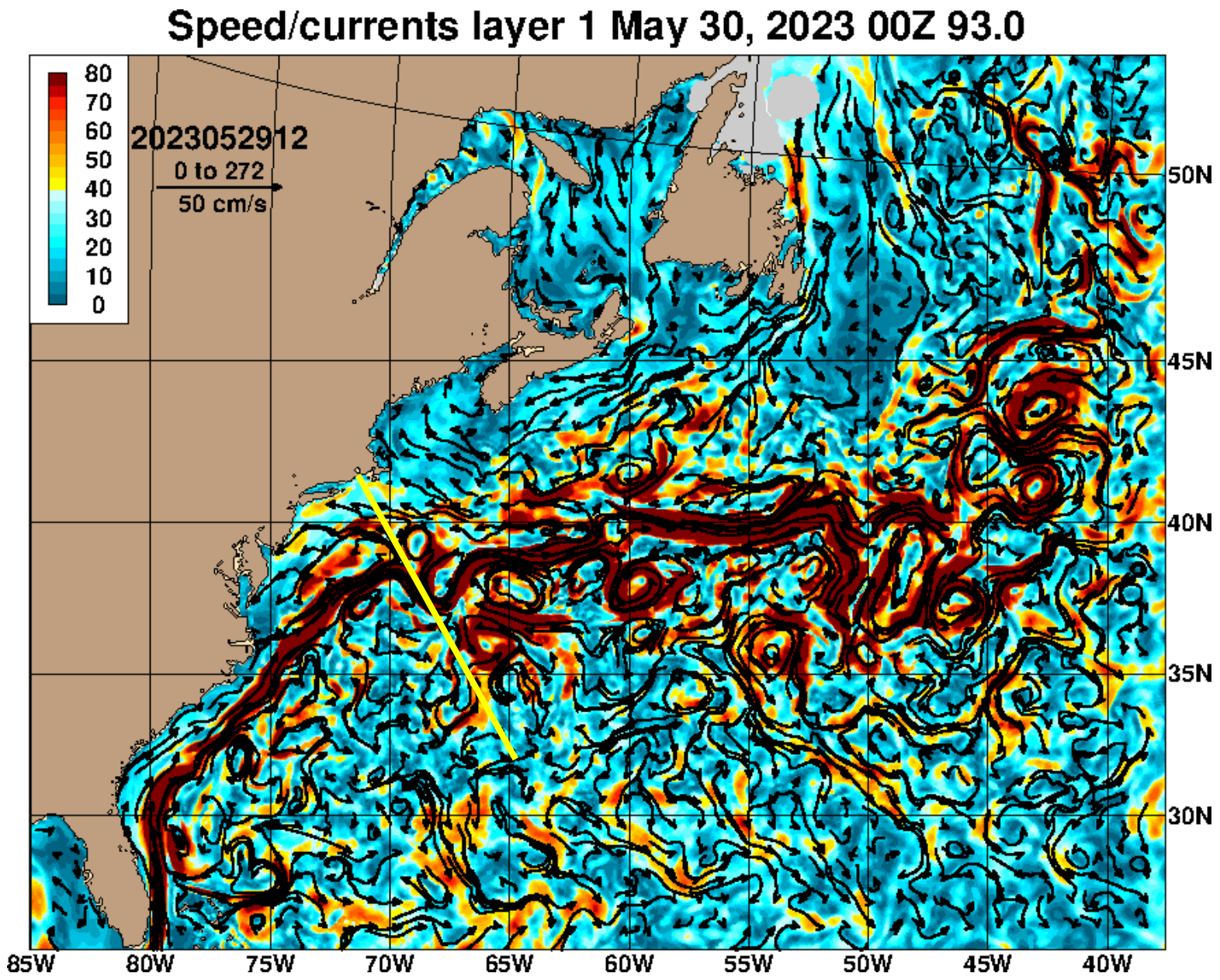

Figure 8 U.S. Navy 1/12^0 Global HYCOM Model of Currents – NW Atlantic Ocean

Yellow Line indicates rhumb line Southern New England to Bermuda

https://www7320.nrlssc.navy.mil/GLBhycomcice1-12/