Gulf Stream Characteristics

June 15, 2006

Note No. 3

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Over the past week direct satellite views of the sea surface temperatures in the vicinity of the rhumb line have been limited by nearly continuous cloud cover. The weather forecast suggests that this condition is likely to continue through the start of the Race. Under these conditions we are fortunate that the major features associated with the Gulf Stream and most of the organized flows south of the Stream to Bermuda are likely to change very slowly over the next ten days.

Beginning a piecewise construction of the flow field associated with the sea surface temperature (SST) distributions along and adjacent to the rhumb line with an examination of the U.S.Navy analysis for 6/14 (Fig.1) continues to show warm waters in close proximity to the outer limits of the continental margin, or approximately 120nm from Newport.

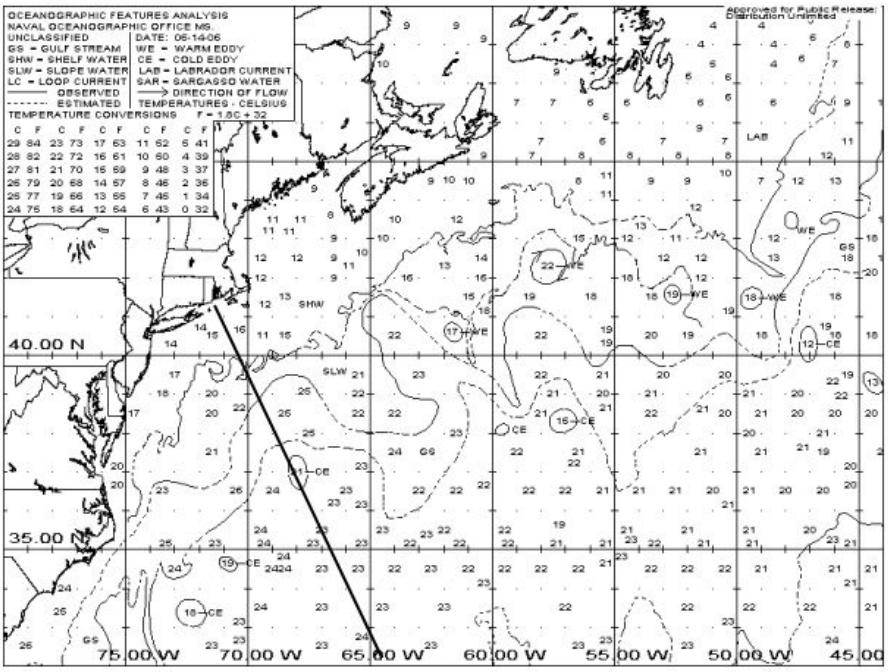


Figure 1 U.S. Navy – Sea Surface Temperature Analysis June 14, 2006

The temperature gradients in this area appear sufficient to cause a northeasterly going current . The main body of the Stream is to be found approximately forty to fifty nm beyond this point with flow proceeding from southwest to northeast across the rhumb line. The angle between the Stream flows and the rhumb line continues to approach the perpendicular as the main body meander to the northeast of the rhumb line continues to slowly move to the east.

The core of the current (i.e. the area of maximum velocities) is to be found approximately 30nm to the southeast of the boundary or front between the 20-21 deg. C water and the 25 deg. C water. Proceeding southeast, along the rhumb line, Stream conditions persist for approximately 100nm before the temperatures begin to decrease to 23 deg. C. This decreasing temperature gradient favors generation of a counter current to the west along the southern limits of the Stream.

To the southeast of the main body of the Stream the Navy image (Fig.1) shows a discrete pooling of cold water in the vicinity of 37 N 68 W. It's labeled as a cold eddy (CE). We've observed this before and consider it more properly a cold core feature since its slow eastward migration suggests that it is not yet free of Stream influence.
Beyond the cold core feature, the Navy data show little in the way of organized flows with temperatures nearly constant at 23 deg. C to Bermuda. Each of these characteristics is made more visually apparent in the color version of the Navy image (Fig.2).

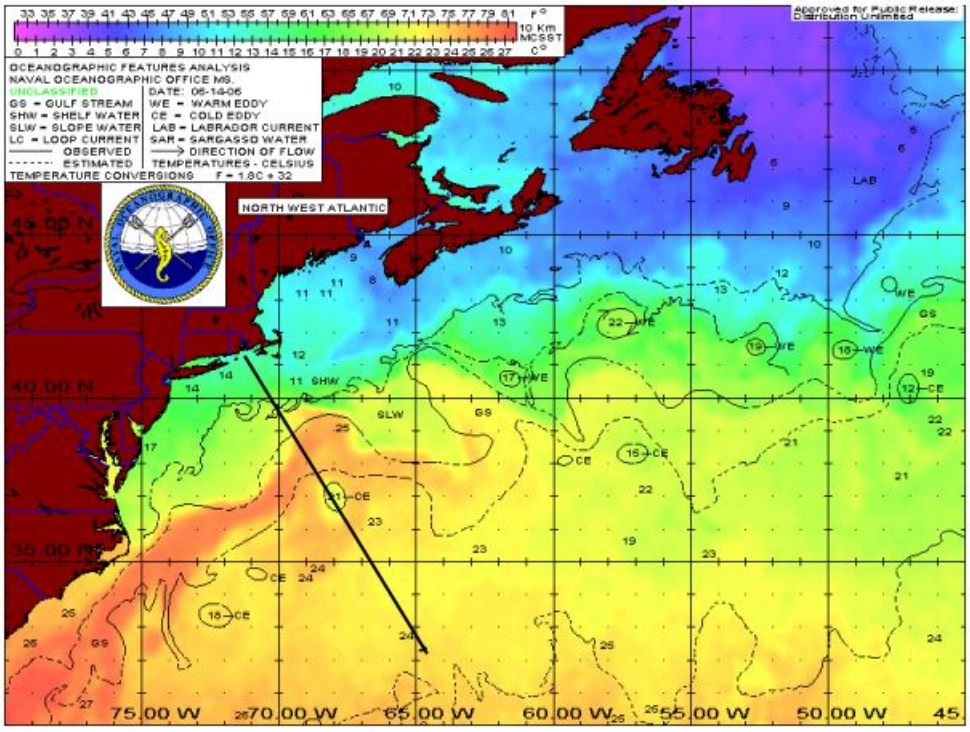


Figure 2 U.S. Navy Color Enhanced Sea Surface Temperature - June 14, 2006

An examination of a 2.4 day composite allows us to add some detail to the Stream structure implied from the Navy data. The image from Johns Hopkins University (Fig.3) shows that the flows associated with the thermal front near 40 N to be quite variant in space with north going flows located approximately 30 nm to the west of the rhumbline.

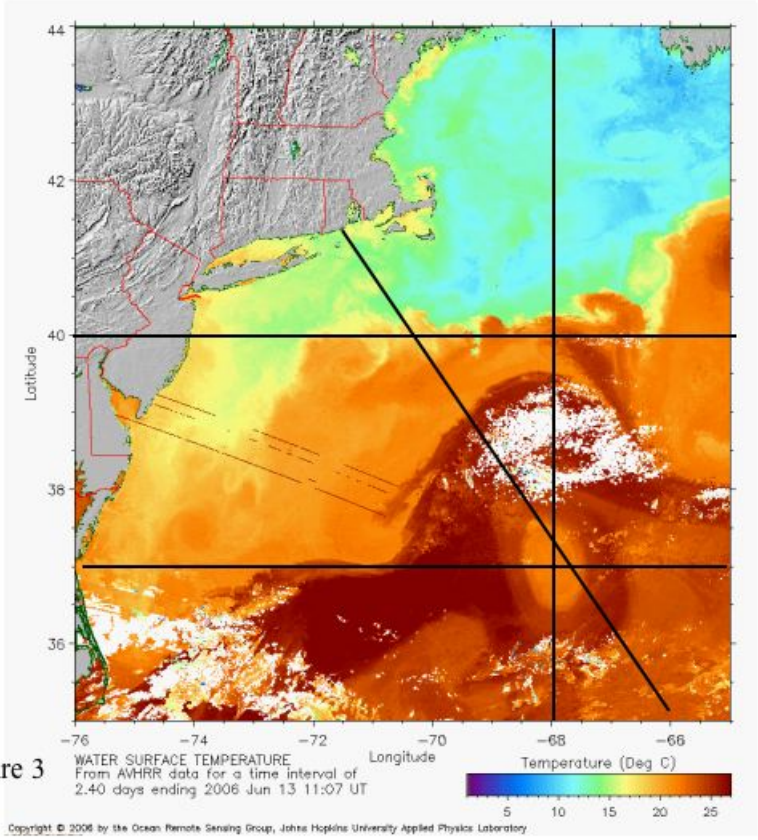


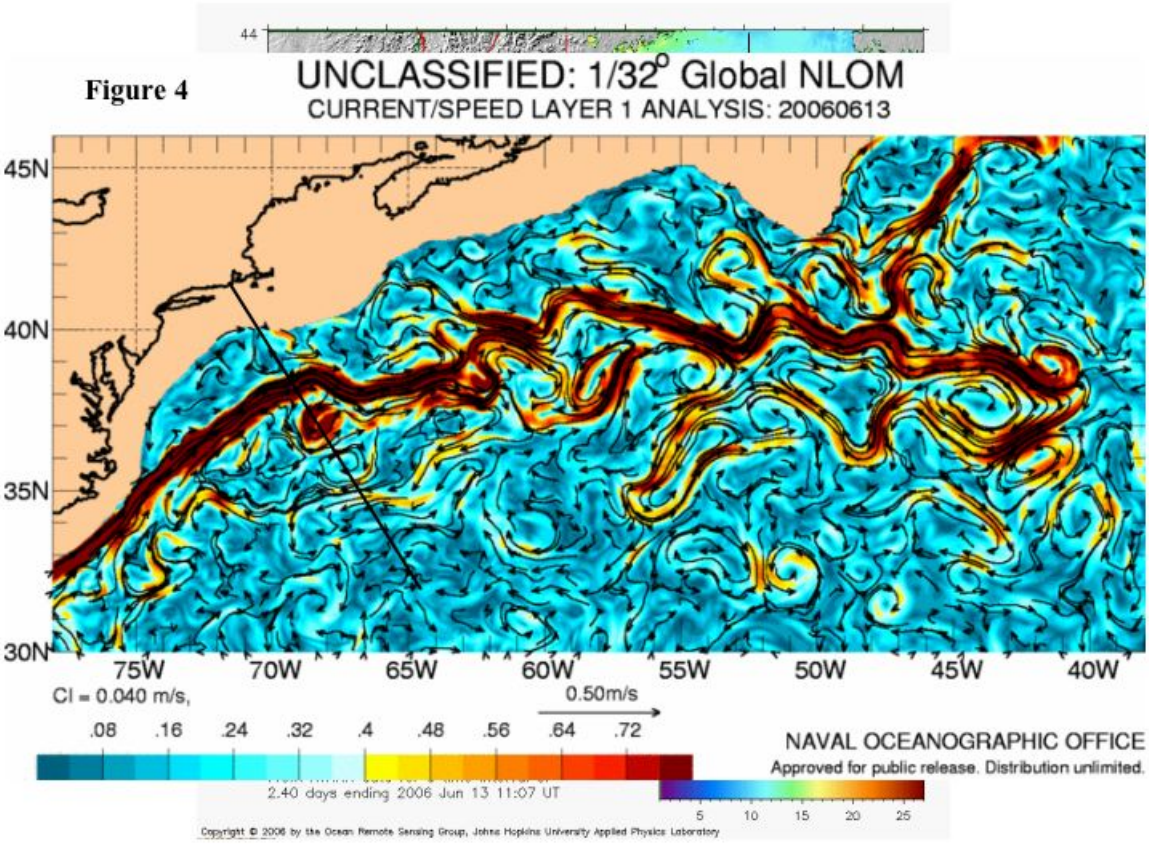
Figure 3

This feature is expected to migrate slowly to the east over the next few days.It's likely that the region from 40 N to the main body of the Stream will be dominated by a flow field displaying a high degree of spatial and temporal variability.
The main body of the Stream and the associated core crosses the rhumb line in the vicinity of 39 N 69 30 W with the core proceeding very nearly along a perpendicular track This should change only slightly over the next few days.

To the south of the Stream the cold core feature shown on the composite image appears located slightly west of the location shown on the Navy image. Comparisons based on the composite shown in Note #2 indicates that this difference is most likely the result of errors associated with the presence of cloud cover and/or the interpretative methods used by the Navy. The structure indicated on the composite image (Fig.3) is expected to be the more accurate.

Analysis of the SST distributions suggests that the flow field in the area north of 35 N along and adjacent to the rhumb line is relatively complex displaying a variety of

directions and speeds. Quantitative estimates of these characteristics can be developed using the results of the USN numerical model for June 13th (Fig.4).



This output provides clear indication of the expected features given the SST field and adds two additional features not particularly evident in either the Navy image of the composite satellite image, a clockwise gyre south of the counterclockwise cold core feature and a west going flow along the southern limits of the Stream. Further south the model data provide no indication of a major organized flow such as that encountered by many racers in the 2004 Race. The similarity between the satellite based thermal data and the distributions provided by the Navy model results in increased confidence in the model simulations of flow.

The last nearly complete instantaneous view of the SST distributions along the rhumb line was obtained on June 11th (Fig. 5). This provides reasonably comprehensive coverage of the shelf region to the cold core feature. Comparison with the composite image suggests some slight northerly migration of the northern limit of the main body of the Stream over the period 11-13 June and some slight westerly migration of the cold core feature. Rather than actual movement, these difference might more likely be the result of the compositing process with the difference providing a measure of the probable accuracy of the instantaneous image relative to the composite. Consideration of this factor should be part of any plan to take advantage of Gulf Stream flow in the development of a Race strategy.

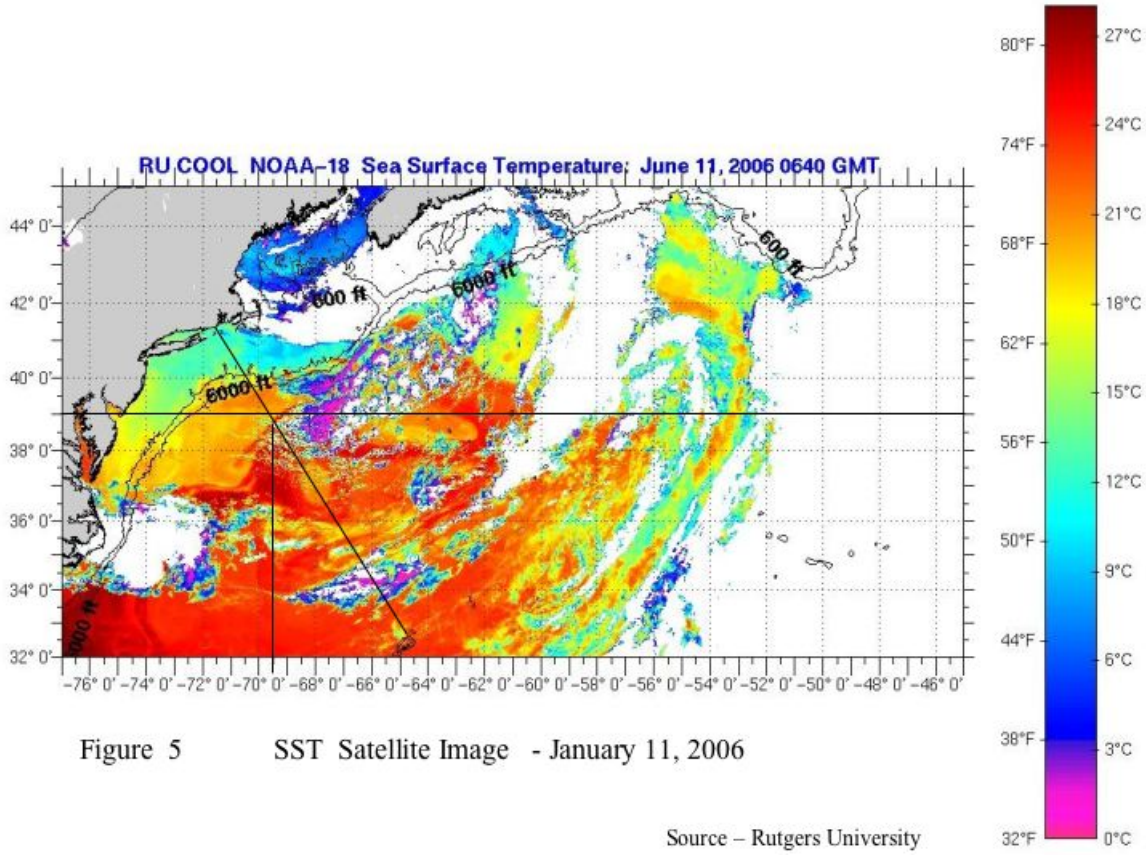
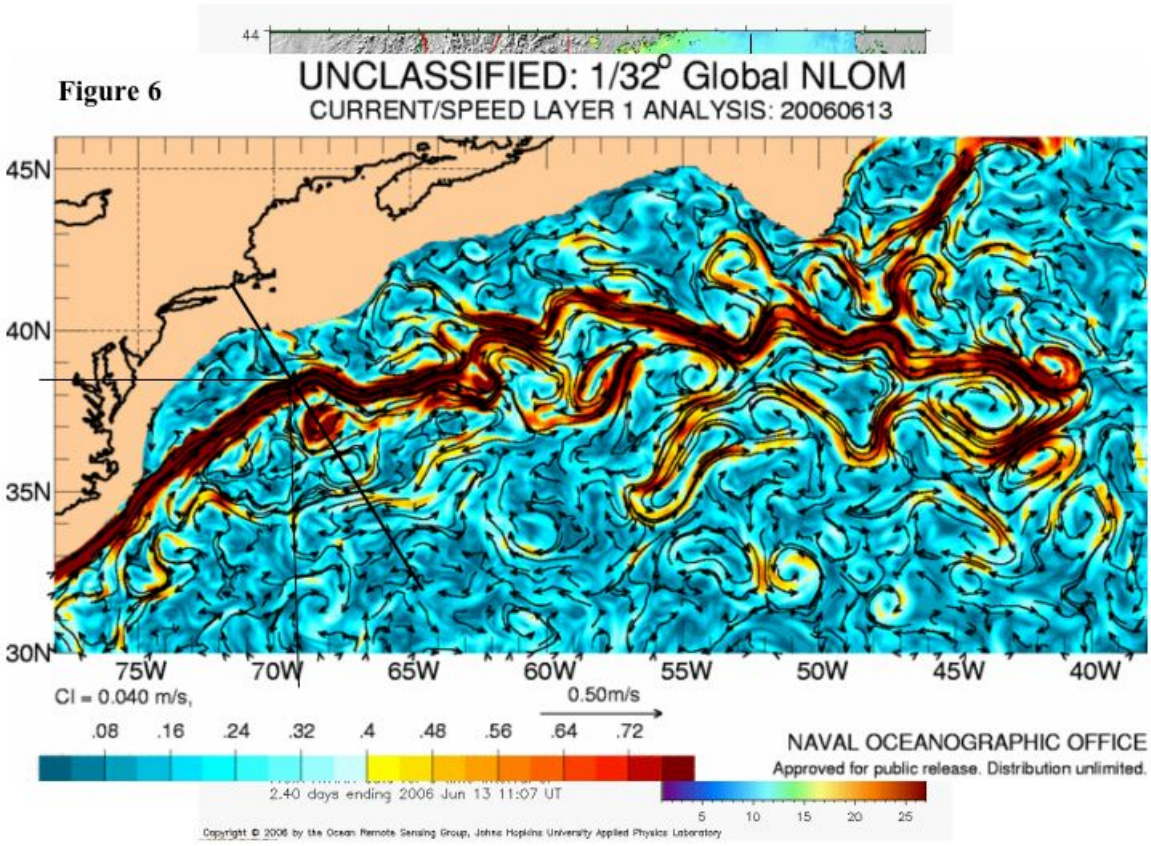


Figure 5 SST Satellite Image - January 11, 2006

Source – Rutgers University

Finally, the developing confidence if the modeling results (Fig.6) would benefit from actual field validation. Navigators are encouraged to pay particular attention to the actual flows in the area south of 35 N where the model presently indicates no well ordered flows or flows that must be included in a strategic plan.



Careful measurement and logging of water temperatures and water temperature gradients in combination with set and drift data would be of value to both the racer's strategic planning and the Navy in their model development. This combination of data would benefit future racers and contribute to an increased understanding of Gulf Stream and Sargasso Sea flows.

Here's to a great Race !