Gulf Stream Note # 2 - 2019
The Gulf Stream Near the Rhumb Line Newport-Bermuda May 30, 2019
An Analysis of Conditions

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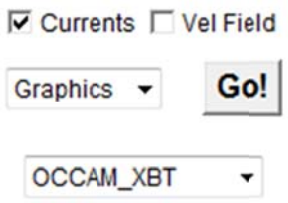
The meander discussed in the first Gulf Stream Note for this year has over the past three weeks shown little evidence of orderly easterly migration similar to a progressive disturbance along a whip. Instead the limb to the west of the Newport-Bermuda rhumb line in the vicinity of 70^0 W on 3 May showed first, some westerly movement causing a southerly shift in the northern edge of the Stream, followed by a progressively deepening and an easterly migration producing a nearly north to south boundary extending for more than 120nm (Figs. 1 and 2). The 4 day composite images compiled by the Ocean Prediction Center (https://ocean.weather.gov/Loops/ocean_guidance.php?model=GOES&area=MidAtl&plot=sstrec&day=0&loop=0#top) provides a useful graphic illustration of the meander evolution and the time rate of change leading to the abrupt N-S boundary. Flows on this boundary along and to the west of the rhumb line proceed from the north to the south before turning to the east in the vicinity of 36^0 30' N 68^0 30'W, a point well to the west of the rhumb line. Beyond this to the east the flows proceed to the north crossing the rhumb line near 37^0 30'N 68^0W or approximately 270nm from Newport. Adverse currents exceeding 3kts affect more than 70nm of the rhumb line. Over the next four days this feature has continued to evolve and currently displays signs of "pinching off" (Fig.3). If this was to occur it would result in the formation of a cold core ring just to the west of the rhumb line. The feature would likely drift to the east for some time since it's in close proximity to the main body of the Stream and likely to be carried by the

Stream flow. The rate of migration is impossible to define at this time. What is clear is that whether as a portion of meander or a discrete ring this feature will clearly affect the Gulf Stream entry strategy of small boats enroute Bermuda over the next two weeks.

In addition to the evolving form of the meandering northern limits of the Gulf Stream the areas to the north and south of the main body of the Stream continue to contain a number of rings with the potential to affect small boat set and drift. To the north of the Stream along the edge of the continental shelf the Navy product of May 30 shows two warm core rings in close proximity to the rhumb line near 39^0 30'N 69^0 15'W (Fig. 4). This location is similar to that observed in early May suggesting relatively slow migration of these features.

To the south of the main body the Navy product (Fig.4) shows a cold core ring centered near 37^0 N 65^0 45'W or approximately 120nm to the east of the rhumb line. This position is also nearly identical to that observed in early May indicating that this ring is influenced to some extent by the structure and currents of the Gulf Stream which in combination are reducing the tendency of the ring to drift to the west.

A more complete view of the flows in and adjacent to the main body of the Gulf Stream is provided by the altimetry based model results from NOAA. (https://cwcaribbean.aoml.noaa.gov/CURRENTS/index.html). Use of this site requires JAVA on your computer. I have recently encountered some problems in using this site on other than an Internet Explorer browser (Windows 10). Also in requesting the current information from the program I prefer OCCAM XBT of the



options provided. I believe that this provides the most accurate results.

The altimetry based model results for the 31st of May (Fig.5) (would prefer to use the 1st of June to compare to 30 May but that's not yet available) provide essentially no indication of the warm core features north of the Stream. There is some distortion of the flow field crossing the rhumb line in the vicinity of 39^0 N

but no adverse current as might be expected at some point from a ring. These data indicate that the warm core features are relatively weak.

The meander crossing the rhumb line is a prominent feature in the model results affecting nearly 180nm of the course to Bermuda. The structure on the 31st favors entry points at or beyond 60nm to the west of the rhumb line with careful attention to the forecast winds. The potential of light winds may favor entry points further west to avoid the possibility of entrainment in the main body of the Stream and transport east to north and east across the rhumbline as the wind dies.

The cold core ring noted in the Navy product is clearly evident in the altimetry based model centered near 36^0 45'N 65^0 30'W. This is essentially identical to the position observed in early May. It seems clear that the meander is actively blocking the westward migration of this feature and might in time entrain it. Maintenance of this position and the observed response to date will effectively limit the influence of this ring on the tracks of boats enroute to Bermuda over the next two weeks.

To the southwest of the cold core ring the altimetry based model shows a relatively large area of clockwise rotating currents similar in structure to a warm core ring. This feature is producing currents to the north throughout an area extending nearly 90nm to the west of the rhumb line along 35^0N (Fig.5). Maximum currents in excess of 1.5kts can be expected in this area. If this feature wasn't enough to complicate the approaches to Bermuda the altimetry based model now also is showing a counter clockwise rotating feature, or cold core ring centered at 33^0 N 66^0 W. This feature should drift west over the next week increasing the possibility of adverse currents over 2kts along the rhumb line within 60nm of Bermuda. This combination of features will be a challenge to navigators and warrants close monitoring as race time approaches.