Mesoscale eddies in the South Atlantic Bight

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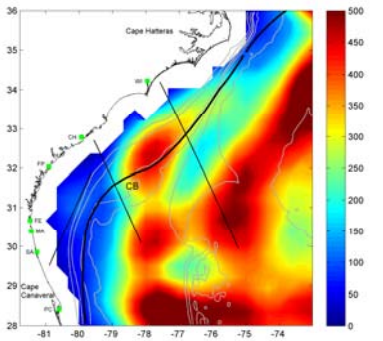


Fig. 1 – Number of eddies observed in 19 years of observations from satellite altimeters. Thick black line is a contour of mean dynamic topography, which shows the long-term average position of the core of the Gulf Stream.

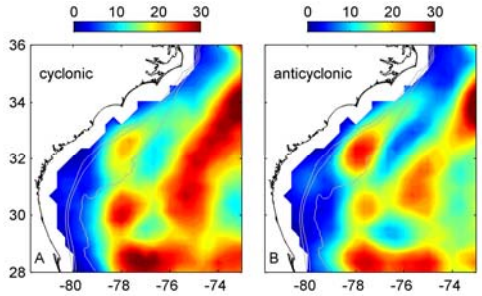


Fig. 2 – Frequency of occurrence (percentage of time that eddies are observed at a given location) of cyclonic and anticyclonic eddies with lifetime ≥ 4 weeks. The 60, 200 and 800 m isobaths are shown.

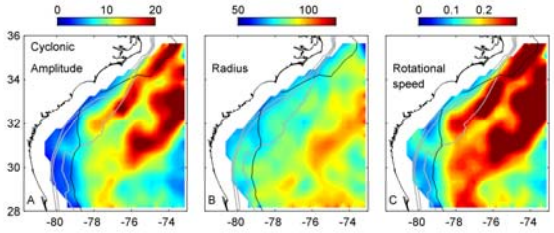


Fig. 3 – Mean amplitude (A, cm), radius (B, km), and rotational speed (C, m s^{-1}) for all cyclonic eddies with lifetime ≥ 4 weeks that passed through each 0.35° × 0.35° region. The 60, 200 and 800 m isobaths are shown in gray. The black line shows the contour where the frequency of occurrence of cyclonic eddies is 10%. Note that since few eddies were observed to the west of the contour, statistics are less reliable in that area. Maximum values in the color scale were chosen to reveal as much as possible of the horizontal structure for each quantity.

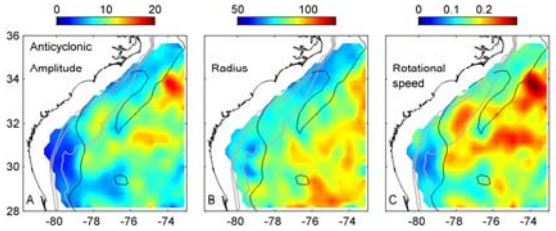


Fig. 4 – Mean amplitude (A, cm), radius (B, km), and rotational speed (C, m s^{-1}) for all anticyclonic eddies with lifetime ≥ 4 weeks that passed through each 0.35° × 0.35° region. The 60, 200 and 800 m isobaths are shown in gray. The black line shows the contour where the frequency of occurrence of anticyclonic eddies is 10%. Note that since few eddies were observed to the west of the contour, statistics are less reliable in that area. Maximum values in the color scale were chosen to reveal as much as possible of the horizontal structure for each quantity.

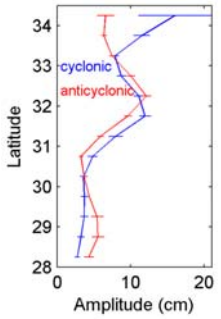
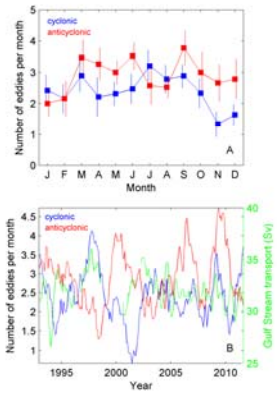


Fig. 5 – Binned scatterplot of amplitude of cyclonic (blue) and anticyclonic (red) eddies with lifetime ≥ 4 weeks as a function of latitude. Only eddies that are found inshore of the 800 m isobath at some point in their history are used in the computation. The error bars represent the ±1 standard error of the mean within each bin.

Fig. 6 – (A) Average number of cyclonic (blue) and anticyclonic (red) eddies with lifetime ≥ 4 weeks found in each month inshore of the 800 m isobath in the SAB. Interannual variability in the number of eddies observed in each month is shown in bottom panel (B). Gulf Stream transport (Sv) at ~26.5°N is shown in green.



Acknowledgments:
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Eddy generation and propagation

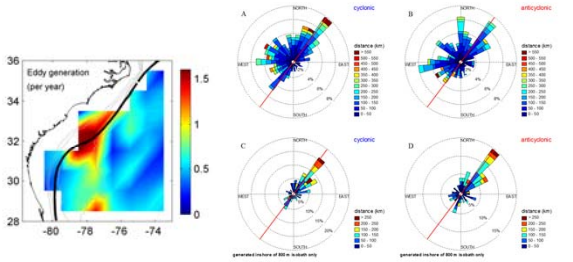

Fig. 7 – Number of eddies generated per year. Direction of propagation of cyclonic (left) and anticyclonic (right) eddies generated in the SAB (A, B) and inshore of the 800 isobath (C, D) is shown on the right. The red line indicates the direction of the mean flow of the Gulf Stream.

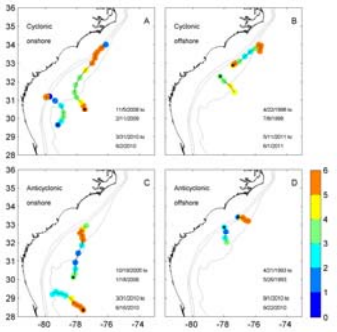

Fig. 8 – Examples of trajectories of cyclonic and anticyclonic eddies in the SAB. Circles are color coded by advective nonlinearity parameter. Initial and end dates of trajectories are shown on each panel.

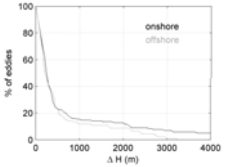

Fig. 9 – Cumulative histogram of bathymetric changes experienced by eddies with lifetime ≥ 4 weeks moving onshore (black) and offshore (gray).

Conclusions

Inshore of the 800 m isobath, eddies are more frequently observed over and just downstream of the Charleston Bump, a major topographic feature where eddy amplitudes are also larger. There is a clear tendency for eddies to propagate toward the west or to the northeast along the main axis of the Gulf Stream. Since most eddies are nonlinear and several of them experience substantial depth changes along their trajectory, they can potentially serve as an efficient cross-isobath transport mechanism in the South Atlantic Bight.

Castelao, R. and R. He (2013), Mesoscale eddies in the South Atlantic Bight, Journal of Geophysical Research – Oceans, in press.