

Interactive comment on “Characterization of “dead-zone” eddies in the tropical Northeast Atlantic Ocean” by Florian Schütte et al.

Anonymous Referee #2

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Main Comments

Based on a set of data from different platforms, the authors analyze the impact of mesoscale eddies in the formation of the shallow oxygen minimum in the eastern tropical North Atlantic (which differs from the deepest minimum located below 400 m, that characterize the oxygen minimum zone of that region). Another central idea of the work is that the shallow oxygen minimum (~ 80 m depth) observed in some kind of eddies, is not due to the transport of waters with low oxygen carried by the eddies from the coastal regions, but is generated by the internal dynamics, particularly in cyclonic and sub-surface anticyclonic eddies (or anticyclone modewater eddies). Within both types of eddies, the shallow isopycnal surfaces (located about 70-100 m depth) rise, favoring biological productivity near the surface (documented by positive chlorophyll anomalies estimated from satellite observations). The export of organic matter back into the sub-

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surface would, thus, result in a relatively high rate of respiration leading to the formation of a shallow minimum of dissolved oxygen. Eddies effectively may "accumulate" this effect by transporting the water as they move.

I think the paper is an important contribution to the understanding of the dynamics of the biogeochemistry in the study region and highlights the effects of a special class of eddies (ACME), which is possibly relevant to other regions where the presence of sub-surface anticyclonic eddies is frequent. The work is fairly well structured and in general, the argument is consistent and can be followed easily. It seems that the authors have done a good job and in my opinion is an important contribution to understanding the hydrography and the biogeochemistry in that region, and it is also a contribution on the role of mesoscale eddies in the ocean. However, there are two issues that seem to me that should be discussed:

(1) Subsurface anticyclonic eddies may not have a proper manifestation in satellite altimetry. For example, contrasting Figure 5a for the cyclonic eddy and that for the ACME (Figure 5b), the latter has very small speed anomalies near the surface, and thus the sea level (and geostrophic velocity) anomalies should be small. This should be a relatively major problem if geostrophic velocities, based on altimetry, are used to identify, define the contours of these eddies and to position oxygen profiles.

2) The authors argue that the water remains fairly isolated within eddies. Although several studies (based on observation, numerical modeling and theoretical models) have shown that this phenomenon is correct, this is generally true for high latitude or subtropical eddies. Eddies ability to trap and transport water could be lower in the more linear equatorial region. This should be an issue to consider, at least for the southern part of the study area, located south of 12 ° N.

Another (positive) comment is that given the extensive data set used in the study, the authors present quantitative information and in some cases, allows them to estimate statistical errors based on the standard deviation. In general, dissolved oxygen data

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is relatively scarce in large areas of the open ocean, this work is undoubtedly also a contribution in this regard.

Other minor comments

In the first paragraph of the introduction, the references to support some general sentences do not seem to me the most appropriate (for example, lines 6, 7 and 8). I do not mean that the argument is fallacious (magister dixit), but I think there are other studies that might have greater authority to support what is mentioned.

P4. L 1-6. Time lag for optode sensors is rather long given important differences between glider dives and climbs. How were the optode data from gliders corrected.

Page 4 lines 14-15 and 22-23. Aanderaa optodes were really calibrated (I mean to change the calibration constants) using CTD cast or the casts were used to estimate the accuracy of the optodes.

P7. L24 (and 16). Salinity in the core of ACME is mentioned as an important variable, why did you decided not to show it.

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