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Biogeosciences Discussions



# *Interactive comment on* "Oxygen, carbon, and nutrients in the oligotrophic eastern subtropical North Atlantic" *by* P. Kähler et al.

**Anonymous Referee #2**

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Review of:

P. Kähler, A. Oschlies, H. Dietze, and W. Koeve. Oxygen, carbon, and nutrients in the oligotrophic eastern subtropical North Atlantic

These authors are presenting results from a cruise in the Eastern North Atlantic Ocean, conducted in an area reported by others to be one of imbalances in production and consumption of organic matter, and of unaccounted-for nutrient fluxes. It appears to be an area of carbon overconsumption, or, where the oceans seems to be operating heterotrophically – producing more carbon than can be explained by nutrient fluxes, and therefore, releasing more carbon dioxide to the atmosphere that there is (apparently) being taken up from the atmosphere. I am not familiar with this body of literature or this part of the world ocean, and thus my comments below should be viewed accordingly.

Their approach, which is at the heart of their paper, of course, seems to me to be a good one. Instead of laboratory incubations to measure rates of organic matter production and respiration, etc., they are taking a large-scale field approach. They purport to follow changes in targeted variables (AOU, TOC, and dissolved organic and inorganic nutrients, etc.) along what they presume to be a "flow continuum" in the ocean (a current system) and to look for changes downstream that have occurred over a time-space scale of months and hundreds of miles. They present their results as plots of each variable for waters of constant density anomaly (sigma-t), along a transect at 30âĄřW longitude, from about 31âĄřN to about 18âĄřN, a distance of roughly 800 nmi. And they perform linear regressions of those variables with distance. So far so good, except that the slopes of their regressions seem to be quite small and are given without confidence limits, and thus they may not be significant.

But, what jumped out for me was that their most important assumption may not have been met – that they may not, in fact, have been following a streamline in a current system. Their plots of sigma-t show that this was probably not the case, in that the vertical density structure is very different between the northern and southern ends of their transect. The southern end is more stratified, with much higher nutrient concentrations below ca. 200m, whereas the northern end is not as well stratified, and deep nutrient levels are half those in the south. But even more striking is the fanning outward of sigma-t isopycnals toward the north, which would signal a change in the character and direction of the geostrophic current field there. That is, wouldn't there be a current at the northern end of their transect that flows out of the page (e.g., top panel in Figs 2-6)? That is, hasn't their transect in the north begun to bisect the Azores Current (e.g., their Fig.1) that flows perpendicular to the transect?

The authors have not attempted to reconcile this possible flaw in their thinking; there is no discussion or presentation of the hydrography in this region. I would suggest they recruit the assistance of a physical oceanographer and reconsider this aspect. From what I could follow re: their biogeochemical arguments, they know what they're talking



BGD

6, C2848–C2850, 2009

about, and they may in fact have a case to present. But I believe it all hinges on their supporting the physical basis of their most important underlying assumption – that they are following a bolus of water in a current system.

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Interactive comment on Biogeosciences Discuss., 6, 8923, 2009.