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Biogeosciences Discussions

Interactive comment on "Sea-to-air and diapycnal nitrous oxide fluxes in the eastern tropical North Atlantic Ocean" *by* A. Kock et al.

Anonymous Referee #1

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Kock et al. report nitrous oxide fluxes during three cruises in the upwelling area between the Cape Verde Islands and the coast of Mauritania. Fluxes across the atmosphere/water interface and diapycnal fluxes were highest closest to the shelf break. They report sea-to-air nitrous oxide fluxes approximately 3-4 times greater than diapycnal fluxes. In addition, the mixed layer budget could not be closed even when the authors include vertical and horizontal advection estimated and biological N2O production. When the sea-to-air flux is calculated using a parameterization that accounts for the decrease in gas exchange in the presence of surfactants, it falls within the same range as diapycnal flux. Thus, they conclude that in highly productive areas, like upwelling zones, common parameterizations for gas transfer velocities might be overestimating air-sea gas exchange.

Overall this is an interesting and timely manuscript reporting relevant results. The final conclusion of the abstract focuses on the finding of Tsa and Liu (2003) that surface ocean surfactants appear to decrease air-sea gas exchange. However, in the actual text very little time and discussion is spent on this topic. In fact, it comes across almost as a default. That is they discuss advection and biological production and when neither of those seem to be they answer they conclude that surfactants might be it. It would be helpful to have more discussion on this topic - especially if they want it to be the main conclusion of the paper. In the discussion section on this topic they seem very uncertain that surfactants can account for what they observe and conclude that "...quantitative estimates of the surfactant effects on gas exchange reveal large uncertainties, and most field studies report smaller effects of surfactants on gas exchange.." If this is their final conclusion then why do they feel comfortable and compelled to say that surfactants are the explanation here? I don't doubt that they are important - but the argument presented here is not yet convincing. Can they explore the relationships between surfactants and gas exchange more in the text? Perhaps including a discussion of where it seems important and where the relationship falls apart would help the readers have a better understanding.

Several times the manuscript refers the readers to other papers for more detail. This can be an effective method - especially when text space is limited. However, I found that the details needed to understand this paper were missing and thus I had to read other papers to more fully understand this one. In this case- I had the time to do so - but others might not and it is critical that papers can stand on their own. Thus, it would be helpful for the authors to include a few more details on their method (instead of just referring us to Walter et al.), more information on the diapycnal diffusivities reported in Schafstall et al., and, as I say above, on the surfactant/gas exchange issue.

A quick question about the nitrification N2O production. In Clark et al. (2008) they report NH4 oxidation of 1-10 nmol L-1 d-1 and NO2- oxidation of 1-30 nmol L-1 d-1; yet in this paper they use 5 nmol L-1 d-1. I did not read anything more of Clark et

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al. but the abstract. However, it would be helpful to know more about the nitrification measurements. For example, I am guessing the 5 nmol value must come from the site closest to the one studied here. But nitrification rates can vary widely both spatially and temporally. Including some more discussion on these rates would be helpful and would help convince the reader they are or are not relevant to these findings.

Finally- figure 2 - is hard to see. The grey stars barely show up and the black dots are too tiny.

Overall I like this manuscript and think it will be a helpful addition to the literature.

Interactive comment on Biogeosciences Discuss., 8, 10229, 2011.