Ocean Science Discussions

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Comment on os-2021-38

Anonymous Referee #2

Referee comment on "Geophysical and biogeochemical observations using BGC Argo floats in the western North Pacific during late winter and early spring. Part 1: Restratification processes of the surface mixed layer" by Ryuichiro Inoue et al., Ocean Sci. Discuss., https://doi.org/10.5194/os-2021-38-RC2, 2021

The authors use Argo data to look at post storm events near the Kuroshio extension. Most of the data presented includes physical parameters from the Argo floats along with model reanalysis data to characterize the region, with little discussion or use of the Argo's biogeochemical parameters.

The authors suggest that the presence of lateral variability influences the stratification and therefore the biogeochemistry as observed by the floats. Unfortunately, the data as presented are not robust enough to draw meaningful or convincing conclusions. A main concern is that the observations have inherent time space aliasing that make the authors' results ambiguous. There is a wealth of literature that has done a more careful job looking at upper ocean dynamics with similar observational and reanalysis data products. As such, I cannot recommend this manuscript for publication at this time.

Major comments

L 120 - The authors use two scaling parameters, F_ME and F_EK which are meant to scale as effective buoyancy fluxes, not effective heat fluxes. They are meant to be compared with similar parameters in the energy equations. So, using it in equation 1 to define the temperature tendency is misleading and questions the authors understanding of the scaling parameters discussed.

218 – The presence of lateral heterogeneity doesn't prove that lateral processes dominate the upper ocean buoyancy budget, it just shows there is lateral variability. The floats are advecting through that, so understanding advection and time evolution is extremely difficult here.

L 258 – This is speculation, but not a result. There are many different processes that could be occurring and driving chl levels to rise. The story told here is not supported by Figures 10-11, so there needs to be more careful analysis before making this statement.

L 272 – This section is justified poorly. I suggest the authors remove it. The scaled "rate of change of stratification" peaks after the observed stratification increases. This could be a result of the floats moving into a more stratified feature with strong horizontal gradients. The cause and effect is not clear and not supported by the data. Additionally, I disagree with the use of these scalings in this way.

There have been several studies that look at lateral restratification after storm events, which are not included or discussed here. Many of those studies do a better and more thorough job linking the observations to lateral processes, questioning the utility of these results in the literature. Some are included here:

Cronin, Meghan F., et al. "Formation and erosion of the seasonal thermocline in the Kuroshio Extension Recirculation Gyre." Deep Sea Research Part II: Topical Studies in Oceanography 85 (2013): 62-74.

Lacour, L., et al. "The intraseasonal dynamics of the mixed layer pump in the subpolar North Atlantic Ocean: A Biogeochemicalâ□□Argo float approach." Global Biogeochemical Cycles 33.3 (2019): 266-281.

Johnson, Leah, Craig M. Lee, and Eric A. D'Asaro. "Global estimates of lateral springtime restratification." Journal of Physical Oceanography 46.5 (2016): 1555-1573.

Mahadevan, Amala, et al. "Eddy-driven stratification initiates North Atlantic spring phytoplankton blooms." Science 337.6090 (2012): 54-58.

Hausmann, Ute, Dennis J. McGillicuddy Jr, and John Marshall. "Observed mesoscale eddy signatures in Southern Ocean surface mixedâ□□layer depth." Journal of Geophysical Research: Oceans 122.1 (2017): 617-635.