Biogeosciences Discussions

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Comment on bg-2021-114

Anonymous Referee #1

Referee comment on "Seasonal flux patterns and carbon transport from low-oxygen eddies at the Cape Verde Ocean Observatory: lessons learned from a time series sediment trap study (2009–2016)" by Gerhard Fischer et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2021-114-RC1, 2021

General comments

Fisher et al. use the time-series (2009-2016) sediment trap record of downward particle flux to 1 km and 3 km depth at oligotrophic site Cape Verde Ocean Observatory (CVOO) to investigate the transfer of particles from different types of eddies against the oligotrophic conditions. Specifically, they focus on the flux peaks observed during fall and winter period when low-oxygen Anticyclonic Midwater Eddies (ACME) passed over the sampling site and compare meso- and bathypelagic particles fluxes to oligotrophic conditions. The authors show that during the passage of low-oxygen eddies in late fall and winter the particle flux at CVOO significantly exceeded fluxes during oligotrophic conditions in spring and summer. A strong seasonal pattern of increased diatom fluxes was observed during the passage of ACMEs, which authors attributed to the pulsed nutrient injection by eddies stimulating the growth and subsequent export of diatoms. Fischer et al. also reported the reduction in carbon flux attenuation between 1 and 3 km depth during the passage of low-oxygen eddies. They suggest that higher POC fluxes compared to oligotrophic settings are eddie-induced and may result from a combination of higher surface production owing to upwelled nutrient supply, increased aggregation of small diatoms at the eddie boundaries, and low oxygen concentrations within eddies which hinder both the degradation of organic matter and zooplankton grazing.

An interesting observation is of BSi flux exhibiting higher seasonality compared to lithogenic fluxes and POC fluxes. The latter two also correlated well in years 2010 and 2012. Authors suggest that different particles have different source within ACMEs and also different transport pattern.

The study is methodologically and scientifically robust and builds on the earlier work by Fischer et al. 2016, which investigated the impact of hypoxic-anoxic eddie passage on the downward particle flux to the abyss at the same site in 2010. Now resolved at several years (2009-2016), these observations of particle fluxes during the time of passing

eddies, bring valuable insights into our understanding of impacts of low-oxygen eddies on the magnitude of carbon export and sequestration and controls over those. They also accentuate the complexity and variability of physical and biogeochemical conditions within mesoscale eddies (both cyclonic and anticyclonic), whose workings and impact on surface processes/production and downward particle flux still need to be understood.

I thus highly recommend the publication of this article in Biogeosciences. There are some comments below that I suggest the authors to address.

Specific comments

In line 147 the authors should specify which environmental data they used. It only becomes apparent in the results section that the authors refer to SST, wind speed and dust deposition data.

Figure 2 shows an increase in surface chlorophyll following/during enhanced dust deposition. The authors should discuss the role of dust as a source of nutrients in addition to it being a ballast material and/or an inducer for aggregation.

Lines 330-345: the discussion of the particle sources needs to consider local particle formation (within eddie interior and boundary) or remote whereby particles have already been formed away from CVOO and travelled to the site within the eddie. The source and hence age/state of particles might also influence the observed C:N ratios of the particles reaching the traps.

Technical corrections

Keep consistent with how subplots are labelled (capital letter in Fig 1 vs lower case letters in other figures).

Figure 1A: colour bar needs a title

Line 673: refer to link in text instead of providing it in figure caption.