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Biogeosciences Discussions

Interactive comment on "An eddy-stimulated hotspot for fixed nitrogen-loss from the Peru oxygen minimum zone" *by* M. A. Altabet et al.

Anonymous Referee #1

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Altabet et al report on the detection of an "N-loss" hotspot in the oxygen minimum zone of the Eastern Tropical South Pacific (ETSP). The hot spot is characterized by low oxygen concentrations, anomalously high nitrite concentrations, anomalously high d15N of nitrate, and a large fixed N deficit. As the authors explain, these are all signals of recent intense organic matter decomposition at the expense of nitrate as the respiratory electron acceptor.

The proposed mechanism for creation of the hot spot depends on the proposed scenario: organic matter was produced inshore in the upwelling region of high surface water nutrients, then entrained in an eddy and transported offshore, where it sank and was decomposed anaerobically in the upper regions of the OMZ. The eddy mechanism can explain the episodic nature of such hotspots, as well as their discrete occurrence

in space and the fact that they have not been detected previously in standard oceanographic survey mode investigations. However, the episodic nature of the organic matter input could be due to variability in its production elsewhere. On p 8022, it is stated that the eddy is actually fairly stationary and has been in the same place for three months. So either the degree of entrainment varies (i.e., sometimes a high OM wisp is entrained and brought round to Station 7) or the OM content of the steadily entrained filament varies, both of which are likely and would be effective.

The discussion on P 8021 addresses the difference in depth of the features shown in Figures 3 and 4. In Figure 3, the N' anomaly is most intense at about 100 m and extends from ∼50 to 300 m. In Figure 4, the very sharp peaks in excess N2 and 15N2 anomaly are at the very top of that zone, well out of the oxygen minimum interval. The authors conclude that these shallow features resulted from some process distinct from the process that produced most of the biogenic N2 in the system. These peaks are clearly distinct from the features in Figure 3, but the authors don't really offer an explanation of them, as I understand this section of the text. The discussion on P 8024 also leaves an unclear conclusion about the source of the excess biogenic N2. It could have originated from the inner shelf, either by advection of NH4 from sediments or advection of water that underwent denitrification at the sediment interface, and thus reflects the isotopic signature of sedimentary denitrification. So we appear to have two phenomena here. One is the eddy entrained organic matter decomposition that results in the stoichiometrically consistent distributions in Figure 3. The other is an apparently allochthonous biogenic N2 signal, also transported in from somewhere else, but presumably by a different path and perhaps from a different process. Both sets of signals indicate a hotspot, but for multiple reasons.

Minor editorial suggestions

P8015 L 2. Take the phrase "primarily as NO3" out of parentheses if you are going to refer to NO3 in the subsequent phrase as "which".

P8015 L 21. This is an important point. It might be worth emphasizing it by adding the phrase . . .”consistent with traditional stoichiometries (Chang et al. 1020), i.e., there is no evidence for allochtonous ammonium supporting the N loss processes in the open ocean OMZs. “ You could also cite Koeve and Kahler (2010) who explored the effect of varying the C:N ratio of organic matter on the resulting proportions of ANM and HDN.

P8018 L8. L Figure 4. Are you taking 5 μM O2 as the definition of the OMZ? Is that the concentration used to define the gray areas in Figure 4?

P8019 L 23. Too many “available”s

Interactive comment on Biogeosciences Discuss., 9, 8013, 2012.