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A model-based assessment of whether anammox or denitrification is the more important nitrogen-loss process in the Eastern Tropical Pacific

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The Oxygen Minimum zones (OMZs) are well known for being nitrogen (N) loss regions, brought about by the two processes: denitrification and anammox. The relative importance of these processes has, however, been subject to some debate. By means of a high-resolution coupled physical-biogeochemical model of the Eastern Tropical Pacific, encompassing the extended OMZ off Peru, we investigate whether we can infer from biogeochemical tracer distributions which of these two N-loss processes dominate. Sensitivity simulations are performed in which variations of biogeochemical model parameters select either anammox or denitrification as dominant N-loss process, and implications on the simulated nitrogen, carbon and oxygen fluxes and biogeochemical tracer distributions are investigated. Largest sensitivities are found in the simulated nitrate, nitrite and ammonium fields. Our model results provide an estimate of the biogeochemical and physical conditions that control the relative contributions of these two processes. In our model, both processes are active at the same depths, occurring in suboxic zones and near the upper edge of the OMZ. In the case study with anammox dominating N loss, the first step of denitrification is still required to provide the substrates for anammox.