

Interactive comment on “The fate of upwelled nitrate off Peru shaped by submesoscale filaments and fronts” by Jaard Hauschildt et al.

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This study investigates the effects of filaments and fronts on subduction of nitrate in the Peru-Chile Upwelling System, using a submesoscale permitting regional ocean model coupled with a biogeochemical model. The results of this study found that about 40% of the newly upwelled nitrate near the coast of Peru is subducted before being used by phytoplankton. The results show a more pronounced subduction occurs at submesoscale fronts near the cold filaments, which were underestimated by the previous mesoscale resolving models. The manuscript is well written and includes new insights on the subduction of the nitrate in EBUS. Therefore, I have only several minor comments below.

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P1L11 “highlighting the additional value of direct rate measurements for model validation.” Unclear

P2L13 “citepChavez2007, Gruber2015, Koehn2017, Brady2019.” Typo

P11L8 “80m (100m)” Spaces are needed before “m”.

P11L29 “30km” A space is needed before “km”.

P11L30 “. . .along-shore position matches with two SST minima (16 °C) at the coast. . .” I couldn’t find two SST minima 16 degree at the coast in Figure 2. From the color scale they look like 18-19 degree.

P14L2 “. . .is characterized in the following. . .” “is” should be “are”.

Figure 3 and 4 captions There is no explanation for the broken white lines, which are probably MLD by reading legend, but the information should be in the captions.

P17L28 “In brief, in situ PP observations based on carbon suggest that a significant portion of the observed offshore reduction in nitrate concentrations is due to uptake by PP. Simulations indicate that approximately 40.6% of upwelled nitrate is subducted 30 and not utilised by PP.” Is this because PP estimated in-situ without the effect of subduction of nitrate?

P19L32 “While the coincidence of increased subduction and a negative change in nitrate may seem counterintuitive, . . .” To me, increased subduction and reduction of nitrate are not counterintuitive.

P20L2 “-2 ” Is the minus sign here for a increase?

P20L3 “A plausible explanation for this pattern is that organic matter is able to sediment at shallower depth on the slope in the mesoscale simulation, which permits enhanced local remineralization and nitrate release with respect to the submesoscale simulation.” I’m confused. If this is the case, remineralized nitrate is higher in 1/9 degree simulation with negative value in Figure 7b in below 300 m near the coast?

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P23L7 “Along-shore variability of PP in the simulations is closely related to chlorophyll concentrations, while the observed relationship of PP and chlorophyll is clearly more complex (Table 1). Investigating the reasons for this discrepancy is beyond the scope of this study and left for future work ” Is this because PP estimated in-situ without the effect of subduction to dark layers?

P23L13 “Near-surface stratification in the model is by a factor of 2-3 lower than in the observations ” What mixing parameterization used in this study is missing in the manuscript. Is it KPP or two-equation type turbulence closures?

P23L18-31 “However, the fact that nitrate concentration...” I think that PISCES includes ammonium. Therefore, the authors can see the fraction of ammonium for the PP.

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