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Biogeosciences Discussions

Interactive comment on "Physical drivers of the nitrate seasonal variability in the Atlantic cold tongue" *by* Marie-Hélène Radenac et al.

Anonymous Referee #2

Received and published: 18 November 2019

The paper presents an analysis of the nutrient supply mechanisms in the Atlantic cold tongue (upwelling system) based on a combination of a regional biogeochemical model and observations from cruised conducted over about a decade, a mooring and satellite remote sensing (chlorophyll). After showing that observations and model results agree to a good extend the authors make use of the model (output) to disentangle the role of horizontal and vertical advection and diffusion, respectively to support the observed seasonality of chlorophyll with a strong maximum in August and September and a more moderate maximum in November-December. Vertical advection and vertical diffusion are found to be is the major source terms of nitrate to the euphotic zone in the cold tongue in summer, while meridional advection redistributes nitrate (in the ml) away from the upwelling center. The difference between the stronger summer nitrate supply

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(and bloom) and the smaller November-December upwelling (and bloom) are found to be associated with differences of the vertical locations of EUC core.

The paper is very well written and the descriptions are usually very clear. The study is carefully conducted and presents a important piece of science.

I have only a few minor, technical, comments:

a) The terminus 'cold tongue' is never defined, characterized or regionally narrowed down. After using this term in title and abstract, I would have expected something like a definition in the introduction. Instead you use the 'synonym' equatorial upwelling system there and only in line 79 use that terminus again. The first implicit definition that I see is in l 125ff. Perhaps it could help a wider audience if you better introduce/integrate the two terms 'cold tongue' and 'upwelling' in the introduction already.

b) l 134, Fig. 2a,b,c: please give (in the caption) explicitly which time periods you selected for no-upwelling vs. upwelling

c) l 163ff&174: boundary conditions: can you briefly explain why you mix model output and observations concerning the boundary conditions; (I am not familiar are GLORY S2V2; is this only physics?)

d) line 182, equ. 1 gives the explicit terms. Do the explicit terms at any time sum o fht dNO3/dt? What about implicit terms, i.e. transports associated with, e.g., the choosen advection scheme

e) line 201ff: a few more sentences describing the method could help here (otherwise we may need to read Vialard & Delecluse first in order to understand your quantification of entrainment; at least I did not get from that paragraph what you did)

f) caption Fig. 3; for (a) it is not clear whether surface data are shown; also the language and typographic of the phrase 'averaged in 1.5dg S-0.5deg N' can be improved

g) l 234: English: 'vertical structures are too shallow'

h) l 243: should it read: processes driving the seasonal variations of nitrate in the mixed layer are presented' ?

i) Fig. 5, caption. Please add which convention you used: 'positive eastward (c), northward (d) and upward (e,f)', I guess?

j) l 304: 'thermocline core' is not defined (from Fig. 7a I assume that you take the 20degC isothermal for the thermocline core, please say so explicitly

k) discussion: discussing the literature you discuss the role of TIW and Kelvin waves; can you make this more explicit from/for your model output ? (but I am clearly not an expert here!) from the last sentence of the conclusions though, I take that you may do so in a follow up study

Very nice, thanks!

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