EGUsphere, referee comment RC1
https://doi.org/10.5194/egusphere-2022-1354-RC1, 2023


# Comment on egusphere-2022-1354

Anonymous Referee #1

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Referee comment on "Physical processes and biological productivity in the upwelling regions of the tropical Atlantic" by Peter Brandt et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-1354-RC1, 2023

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General comments:

This is an interesting, extensive, and relevant compilation of knowledge about (upwelling in) the tropical Atlantic climate system. I find the introduction to be a bit disconnected which at times makes it hard to follow, the reader could be helped by working on the flow of the text and explaining why specific parts of the system are being introduced. Additionally, later on in the text statements are made that are not easily verifiable by the reader, e.g. wrt figure 3 and 4 and 5. More direction as to where the reader should focus and more explanation in the text would be helpful, especially to make this work accessible to a wider audience than the established tropical Atlantic community. Similarly the text at times mentions specific terms without either showing the equations or explaining what the terms represent. Either would be helpful here for completeness. Specific incidents are indicated below.

I recommend adding a connection to primary productivity / nutrient supply to the title, since it is discussed a lot in the text.

Specific comments

L50: add citation Yang, Yun, et al. "Suppressed Atlantic Niño/Niña variability under greenhouse warming." *Nature Climate Change* 12.9 (2022): 814-821.

Ll 80-85 The areas GGUS tAUS and EAUS should be indicated in the figure, the focus here is said to be on inner upwelling and not coastal upwelling. Indication of the region would help the reader understand which areas are being discussed and which are not.

Ll 88- 103 The discussion on where the water masses are coming from and going to : please add a sentence or two to the relevance of this discussion, potentially relating to primary productivity, OMZ, etc. Since this also is discussed in the individual sections (e.g. Ll243-245) this discussion here might be removed in favor of flow of the paper.

L 104: connection between upwelling and ITCZ unclear, I recommend mentioning the relevance of this section to the upwelling in the tropical Atlantic in the beginning of this section

Ll 133-135 please mark the upwelling favoring easterly winds in the figure, it is hard to see the variability in strength from Figure 1. When the winds are purely easterly they seem very weak (compared to September / October), should the reader focus solely on the region west of 40W? Please indicate in the figure and / or describe in the text.

Ll 138-140 Is the region between Cuanza and Kunene meant here with particularly weak winds? The winds further south seem strong. Please indicate maybe with a different colour the arrows of the area under discussion, and / or add more description to the text.

L 144 I am confused by the mention of inner tropical Atlantic upwelling, while the GGUS seems to follow the coast, similar to the tAUS. Again, indication of the areas in Fig 1 would help, and maybe a sentence on the differentiation between inner and coastal upwelling as it is used in this study.

Ll 174-176 Which part of Figure 5 is indicated here? Maybe an extra figure with Thermocline movement in conjunction with temperature change should be shown here. Or alternatively Fig 3 / 4 are meant, using the SSH as proxy for thermocline? Related: the Figure caption of Figure 5 should mention the source of the data as do the other figures

Ll 188-201 Since the focus of this paper is seasonal variability, a note on what we (do not) know about the variability of the STCs and TCs as they relate to equatorial upwelling would be helpful.

L 200-202 “The different forcing terms..” it seems odd that in a review of the forcing terms of the tropical Atlantic upwelling the physical processes forcing the upwelling are only mentioned in a short sentence with a reference. I recommend expanding on this sentence and ideally drawing a connection to the next paragraph, turbulent mixing.

Alternatively, a differentiation between the current work and Giordani and Caniaux 2011 would be helpful. Also since this review is on upwelling (and its impact on nutrient availability and primary production) the connection between upwelling and mixing could be explained.

L 223 Fig 3 or 4 can be referenced in addition to figure 5 since they show the surface and 5 the column, might be more intuitive for the reader

Ll223 Radenac reference, later on it is stated that the authors analysis PIRATA and models, please specify which dataset these results are based on as done later in e.g. L 241, 245

L 255 Fig 5 ; EUC and 20C are shown in all panels

L 277 December maximum is not clear in Fig 5d, looks similar throughout September - January. Fig 5c shows vertical advection maximum in November, how does this relate?

L 290 again confusion about inner vs coastal upwelling, explicit mention of coastal upwelling here (and throughout the text)

Ll 296-297 I suggest indicating the cells in Figure 1

Ll 313 "associated to the non-linear dynamics and its detachement.." Please add (half) a sentence on how this influences the upwelling

Ll 325 what do these non-linear terms represent? In this overview being more specific about the physical process would be helpful

Ll 331-332 this is a bit more explicit "when the nonlinear terms are removed and the Guinea Current is trapped" but more explanation would again be helpful. Since this paper summarizes the physical processes behind upwelling it should be explicit about these processes.

Ll 333-343 The discussion about the thermocline being closed to the surface in the simulation with least upwelling is difficult to follow. Earlier upwelling and upward movement of the thermocline have been positively correlated, how do they relate here?

Seemingly the thermocline is shallower in the western upwelling cell while that cell has less upwelling (than the east), isn't this counterintuitive?

L 358 "that is mostly wind driven" can this be seen in Fig 3? It would be good to refer back to the (relevant section of that) figure

L 397 again please indicate the tAUS in Fig 1

L 407 "are generally weak throughout the year" makes me think that it would also be good to indicate the tAUS region in Fig 4 or highlight the arrows in a different color (color coding arrows per upwelling zone might be a really good idea)

Ll 415-416 "..four remotely forced CTWs throughout the year (Fig 4b)" can these be indicated in the figure, as arrows or similar

Ll 448-449 Indicate tAUS in figure 2? Is the very very narrow coastal strip e.g. in 4b meant here, or solely Fig 4c where the colder coastal SSTs seem more obvious? Again how do the authors distinguish between coastal and interior upwelling?

Ll 451-455 description of coastal upwelling? It seems that the word inner in the beginning should be omitted or well defined.

Ll 489-490 "the spatially-averaged generation" of turbulence?

L 493 also evident in Figure 10?

L 496-497 related to increased mixing?

Ll 502-504 what is the causal relationship here? More mixing = more cooling and therefore less stratification, but here the argument seems to be more mixing => less stratification => more cooling, can you be more explicit about the suggested series of events?

L 514 suggest removing "it is"

L 522 additional forcing

Ll 522-524 this causality is not clear, please clarify

L538 what is the timescale of the AMOC weakening? Decadal?

L 540 add citation same as above Yun Yang

Ll 544 “or productivity” maybe better to phrase “also indicated by trends in productivity”

L 556 Please remind the reader how the influence of Ekman transport fits in with the seasonal modulation

L 586 what does inner mean here

Minor:

Some inconsistencies with the plural and singular in the text, e.g. Ll 241-242 ..waters… has ..