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Comment on egusphere-2022-702

Anonymous Referee #1

Referee comment on "The signature of NAO and EA climate patterns on the vertical structure of the Canary Current upwelling system" by Tina Georg et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-702-RC1, 2022

The manuscript describes analyses of ocean and other model output in the vicinity of the Canary Current Upwelling System. Specifically, it examines three different metrics of upwelling system indices, the vertical temperature structure of nearshore and offshore water columns, and the patterns of temperature that are correlated with wintertime indices of the North Atlantic Oscillation and East Atlantic atmospheric patterns. Oceanic temperature is obtained from the Global Ocean Ensemble Physics Reanalysis dataset obtained from CMEMS.

The authors find that (1) different upwelling indices have different values and seasonal cycles, (2) the isothermal depth of nearshore profiles during upwelling is less than that for offshore profiles, and (3) upwelling is most intense during the positive phase of the NAO and (4) especially that in combination with the negative phase of the EA.

In my opinion, the main advance of this paper is item (4) and this result is interesting and useful. Analysis of the upwelling indices appear and vertical structure are to me less novel, though it might be argued that they raise interesting questions (e.g., about what is the best upwelling index to use) and provide useful context (e.g., typical and anomalous isothermal layer depths) for the remainder of the paper.

Main Recommendation:

I think the manuscript would benefit from the authors choosing the best upwelling index to characterize the upwelling, presenting only that, and then expand on the NAO/EA parts of the paper. Is the comparison of UI important? Is the 5 month time-lag between UI_ERA and UI_SST important beyond showing that indices based on different data and approaches are different?

It would be helpful if the authors would include a local map of winds associated with the NAO and EA patterns (to understand their impact on local upwelling), along with their time-series, showing highlighted periods of upwelling that were used for averaging the model. At the moment, the method by which averaging is done is not clear. How many days contributed to the NOA+, NAO-, NAO+EA-, and NAO-EA+ fields shown in Figure 6 and 7. How much uncertainty is there in the averages calculated? Perhaps time-series or pdfs of upwelling events associated with different climate conditions could further support the argument that statistics change in different climate conditions.

Other comments

Lines 115-124: The calculation of UI_ERA5 I think should rotate the winds to the alongshore direction and then calculate the wind stress, rather than the reverse as is done presently.

The results section (around lines 210), the authors claim that a change in the ILD of 1-2 m during upwelling events. There is no error analysis to show significance of this, but even if there was, is a 10% deepening important? And (as they point out), this is not a new result (Line 213). This section might be dropped.

Similarly, What's to be interpreted as important in Figures 4 and 5. They do show differences in coastal and offshore profiles, but the figures seems routine. Why characterize the vertical profiles or representative sections? As the authors point out, the description that they give are in agreement with other works (Line 243).

Line 178: The result that the trends in UI are small over 25 years is interesting and useful.

Line 271: Minor comment: I think the authors mean "observed down to ~50 m depth"? Also Fig 6 has an error in listing 97.04 m twice. I think the authors mean ~200 m in the bottom row?

Figure 7 is very interesting and compelling.