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Interactive comment on "A two-decades (1988–2009) record of diatom fluxes in the Mauritanian coastal upwelling: Impact of low-frequency forcing and a two-step shift in the species composition" *by* Oscar E. Romero et al.

Anonymous Referee #2

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This paper by Romero, Ramondenc and Fischer provides a quasi 20yr diatom record collected by a sediment trap deployed in a mesotrophic region under the direct influence of the Cape Blanc filament. This new and important mesotrophic diatom dataset (CB meso) is compared with the equivalent record found in the trap with a more coastal location and consequently stronger influence by coastal upwelling (CB eu). Furthermore, the authors compare the record to large scale and low-frequency modes of climate and/or ocean circulation, and consider the variability encountered on the diatoms assemblage as a reflex of changes in the Canary Upwelling system at the Latitude

of Cape Blanc, which in turn is attributed to changes in the variability of global scale circulation mode reflected by the AMO index.

The paper is well structured and written and the results important, however I believe it could benefit from considering a few aspects mentioned below.

(Frankcombe et al., 2010) with the presented dataset the authors can only check on how major shifts between positive and negative states of AMO, occurred within the period of this record, affect the Canary Upwelling system, but not its fully and long-term effect on the system. However, the NAO index of atmospheric circulation over Europe has a periodicity in the order of 7-8 years (Knut Lehre Seip et al., 2019) and the work of (Yamamoto and Palter, 2016) shows a clear relation between the NAO and the AMO, with northerly winds associated to a positive state of AMO and zonal winds to a negative state of AMO. As such, it would be interesting to verify the relation of your data with NAO variability, since upwelling is indeed a response to an atmospheric process. It would also have been nice to have a comparison with the upwelling index or northerly wind strength. Maybe through another statistical approach, something like cross-correlation?

On which respects the effect of warming climate on the upwelling system and its primary production, you depart from the different conclusions reached by different studies, as presented in your introduction, to the proposal that your data is a different way of approaching the question. However, you conclude that your diatom data might be instrumental in distinguishing between climate-forced and intrinsic variability of the population of primary producers.

I have trouble with this statement, intrinsic variability is related to the basic needs of the organisms, so they will most probably change in function of the changes imposed on the system both by global and regional processes that in the end will also react to climate forcing!

Furthermore, although it is very important to understand the process behind your stunning increase in benthic diatoms, your record does not allow you to verify what happens in terms of the plankton production and assemblage evolution during this 20yr. Or does it? Can you deduce the effect of the benthic flux that obscures the total record, and explore the 20yr variability of the planktonic diatom flux and assemblages 'composition that reach the trap?

There is a general problem with the way references are listed in the text they do not follow an alphabetical order nor the year of publication.

What is the reason to use the term pelagial rather than pelagic? Although used for lakes I have not seen any paper that defends/justifies its use for the ocean environment.

The use of satellite images (composites for the n° of years considered for each specific time interval / diatom phase) for comparison would also be important to verify the variability on the surface water and upwelling conditions.

Different depths of trap deployment at some time intervals (Table 1) may influence the diatom assemblage encountered as a result of a different catching area and the different contribution of particles transported by intermediate nepheloid layers. This needs to be acknowledged and discussed especially because one of the periods coincides with the ENSO period.

Are you assuming that the intensification of the shelf and slope poleward current favors an increase in production of the benthic community and maintenance of the means of downslope transport, or the existence of a stronger poleward current gives rise to a stronger suspension of the benthic forms and their downslope transport in higher quantities? This needs clarification and discussion.

Specific notes: Pg. 3, Ln. 78 – The authors suggest that a different approach for the characterization of multiyear to interdecadal upwelling intensity in EBUEs is by assessing fluxes of particulates and microorganisms as captured by continuous sediment trap experiments."

Although you can assume that the flux of planktonic organism blooming in surface waters as a result of upwelling intensity, we are also aware that the nutrient content of the upwelling water is determinant for the size of the blooms as well as for the type of phytoplankton community. As such, bloom size and consequently microorganism fluxes could also reflect shifts in the upwelling source water associated with latitudinal shifts for example, rather than variations in upwelling intensity.

In fact, in this study besides the physical setting it is important to also consider the chemical (nutrient) and biological setting.

Pg. 6, Ln. 103 – The SACW occurs in layers between 100 and 400 m depth at the Banc d'Arguin and off Mauritania.

Pg. 8, Ln 250-252 – ENSO appears to be modulated by AMO, check Levin et al, (2017) or Chen et al., 2019 or Zhang et al., (2019).

Pg. 9. Ln. 301 – 302 – The list of species presented do correspond to marine plankton forms that although not thriving in the highly productive and colder coastal upwelling systems, and more likely to be found in warmer waters, they are also not characteristic or real oligotrophic waters.

Pg. 10, Ln. 323- 324 - The impact of the environmental variables on diatom communities was investigated by simple comparison using the samples clustering and the forcing values associated (Fig 4).

You are not using the forcing values, but rather the value of an index that is considered to define the coherent mode of natural variability occurring in the north Atlantic. Changes in this mode will have an impact on the circulation at your study site and be considered a forcing factor for your specific process.

Pg. 10, Ln. 329 – Please specify tendency of the gradient.

Pg. 10, Ln. 335 – Mentioned figure should be included as a supplementary figure.

Pg. 10, Ln 337 - the benthic diatom D. surirella decreased the diversity, although it also seems to be promoted determined by AMO strengthening. In the same way, the second CA axis samples scores are positively correlated with TDF, which confirms that coastal upwelling diatoms seems to promote define the TDF.

Pg.11, Ln 352 - Based on outstanding shifts in the species-specific composition of the diatom assemblage occurred throughout the study interval (Fig. 2b).

Please reformulate.

Pg. , Ln. 360 - Based on the long-term trends of our data and their statistical analysis (Figs. 2-5), we suggest that the proposed intervals were the response of the diatom populations to the impact of low frequency forcing on the Canary upwelling system.

To be correct, the upwelling system is the one that responds to the low frequency forcing. Diatom assemblages reflect hydrographic and nutrient availability brought up by the upwelled source waters.

Figure 4: Comparison of (a) clusters extracted from multivariate analysis with the environmental forcing variables (a1: Total diatom flux; a2: AMO; a3: Shannon diversity).

Besides being too small and difficult to see, total diatom Flux and Diversity are not forcing variables. They all reflect the community adaptation to the regional conditions resulting from the forcing factor(s).

References

Chen, S., Song, L. & Chen, W.: Interdecadal Modulation of AMO on the Winter North Pacific Oscillation-Following Winter ENSO Relationship. Adv. Atmos. Sci. 36, 1393–1403, 2019. https://doi.org/10.1007/s00376-019-9090-1

Frankcombe, L. M., Heydt, A. v. d., and Dijkstra, H. A.: North Atlantic Multidecadal Climate Variability: An Investigation of Dominant Time Scales and Processes, Journal of Climate, 23, 3616-3638, 2010.

Levine, A. F. Z., M. J. McPhaden, and D. M. W.Frierson: The impact of the AMO on multidecadal ENSO variability, Geophys. Res. Lett., 44, 3877–3886, 2017. doi:10.1002/2017GL072524.

Knut Lehre Seip, Øyvind Grøn and Hui Wang: The North Atlantic Oscillations: Cycle Times for the NAO, the AMO and the AMOC. Climate, 2019, 7, 43; doi:10.3390/cli7030043

Yamamoto, A. and Palter, J. B.: The absence of an Atlantic imprint on the multidecadal variability of wintertime European temperature, Nature Communications, 7, 10930, 2016.

Zhang, W., X. Mei, X. Geng, A. G. Turner, and F. Jin: A Nonstationary ENSO–NAO Relationship Due to AMO Modulation. J. Climate, 32, 33–43, 2019. https://doi.org/10.1175/JCLI-D-18-0365.1.

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