

## ***Interactive comment on “The response of the Peruvian Upwelling Ecosystem to centennial-scale global change during the last two millennia” by R. Salvattecì et al.***

**R. Salvattecì et al.**

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General comments (Anonymous Referee 2)

In general, I shall suggest the authors to develop more some parts of the article, and reduce very much other parts. The paper, in general, is not easy to read because it is very lengthy. There are many sentences that could be removed/cut as well as too many repetitions that distract the reader from the main message. I urge the authors to get a critical read over the paper and remove everything obvious or repetitive and try to write the paper in a much more straightforward style. On the other hand, all the methods are in a lengthy supplement and key informations must be described - even

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rapidly - in the article.

Reply: In the revised manuscript we now explain very briefly the methodological steps that were only in supplementary material in the original version. We also discuss the precipitation record in more detail. Additionally we have removed all repetitive parts rendering the manuscript more concise and easier to read.

#### Specific comments

1. You may avoid in some cases assigning oceanic features you describe to ENSO and/or ITCZ, or at least clarify the use of these terms rapidly and keep only one generic term, as it is impossible to disentangle whether changes in oceanic features are due to changes in the seasonal ITCZ or inter annual alteration of the Walker circulation.

Reply: In the revised manuscript we compare the ITCZ displacements and SPSH expansion/contraction with changes in precipitation in our record. El Niño/ La Niña-like conditions is used to define the persistent mean state of the PUE during the contrasting NH periods only in terms of productivity and subsurface oxygenation.

2. In the same vein, try to not use the terms "cold/warm periods" while you assign productivity changes associated with the LIA/MCA periods. The temperature pattern during those periods was not uniform, and your way of using those periods is sometimes awkward (e.g. page 5500 paragraph 5.2 "Our results show that during the cold periods (DACP and LIA), the PUE exhibits El Niño-like conditions with low export production". If it's El Niño-like I anticipate the LIA and DACP to be warm periods in the Peruvian upwelling!)

Reply: In the revised manuscript the terms "cold period" and "warm period" were replaced by Northern Hemisphere (NH) cold period and NH warm period. With this correction we hope to avoid misunderstandings.

3. Please clarify the use of the precipitation proxies. Unlike everything else, you get rid of it in paragraph 3.2.1. using an obscure publication and your description of the

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"rationale" is not understandable.

Reply: In the revised manuscript we use the precipitation proxies to assess if precipitation over the continent is more associated with changes in the ITCZ meridional displacement and SPSH expansion/contraction than changes driven by strong zonal (El Niño-like) shift of precipitation (Gutierrez et al., 2009). The rationale is now better explained in section 3.2.1.

4. Putting upside down the precipitation proxies in Figure 2 would help the eye to visualize synchronous changes in the proxies.

Reply: In the revised manuscript the precipitation proxies in Figure 2 are now plotted according to the reviewer's suggestion.

Literature cited

Gutierrez, D., A. Sifeddine, D. B. Field, L. Ortlieb, G. Vargas, F. Chavez, F. Velazco, V. Ferreira, P. Tapia, R. Salvattecchi, H. Boucher, M. C. Morales, J. Valdes, J. L. Reyss, A. Campusano, M. Boussafir, M. Mandeng-Yogo, M. Garcia, and T. Baumgartner. Rapid reorganization in ocean biogeochemistry off Peru towards the end of the Little Ice Age. *Biogeosciences* 6:835-848, 2009.

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