

Ocean Sci. Discuss., referee comment RC1
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Comment on os-2021-36

Anonymous Referee #1

Referee comment on "Causes of uncertainties in the representation of the Arabian Sea oxygen minimum zone in CMIP5 models" by Henrike Schmidt et al., Ocean Sci. Discuss., <https://doi.org/10.5194/os-2021-36-RC1>, 2021

This manuscript provides valuable insights into the misrepresentation of the Arabian Oxygen minimum zone (ASOMZ) in 10 historical CMIP5 model simulations, and relates these model deficiencies to the analysis of the different water masses that ventilate this OMZ. Overall, I have found the paper very useful in providing metrics to quantify the representation of the OMZ in these models. The approach of relating deficiencies at different depth of the water column to water masses of different origins provides a new and original understanding of the ventilation pathways of this OMZ, that complements nicely a previous study by the same first author in 2020. The main finding is that CMIP5 models tend to underestimate the lower part of the OMZ due to ventilation of highly oxygenated waters from the Southern Ocean.

I am confident that this work should eventually provide a very valuable contribution but I have a major concern, which is that I found that the writing was often clumsy, sometimes to a point where I was not sure I understood the meaning correctly. Although I did find the ideas and general approach of the paper very promising, reading it was not as pleasant as it could have been and I had to struggle my way through. My major problem was that I could not really understand how water masses were determined based on my reading of 3.3. For example, I did not understand how the formation regions have been localized (lines 5-6-7). I also did not understand how the water mass properties (T-S) were derived from observations. Therefore, it was difficult to follow 4.3 (water representation in models).

Major understanding issues also involved how Figure 1 was generated, how IODW, ICW, RSW/PGW were identified from Figure 2 (where do the ovals come from?).

I really liked Figure 4, which is a very nice and synthetic way of representing the OMZ, but I add difficulties because of too many lines on the same plot. I would suggest to have more panels, for instance to group them by set of clusters instead of showing all models

together, with WOA in all of them (which would make 4 clusters x 3 panels= 12 panels). I have the same comment for Figure 5. Also I think it would be easier if the information contained in Table 2 was somehow shown in a set of figures, that would ease the presentation of results and the discussion. Information about the age tracer should also be shown in a synthetic figure.

In the end, because of my misunderstanding, my review is rather limited in terms of how I am able to evaluate the methodology and conclusions, and I believe that the presentation issues that I've raised must be fixed before a full assessment of the content can be provided.