

Reviewer 2

The proposed work deals with the formation of intermediate waters in the northern Red Sea (RSOW) during winter (2019), analyzing physical and biogeochemical mechanisms through glider observations, satellite data, and models. The authors explore the role of cyclonic vortices and atmospheric forcing in ventilation and nutrient transport. The work highlights key processes such as cooling, convective mixing, and mesoscale interaction in ocean dynamics. The paper presents interesting new features and, in general, is well written with a high quality of figures that allows for a quick and thorough understanding of the work. Despite this, some doubts remain about the description and motivation for the use of some datasets, and some minor considerations about the writing.

We thank the reviewer for their comments. We have revised the manuscript to provide clarity and explain in detail the datasets that have been used.

1) Recheck the introduction of acronyms, they are often not introduced properly, even if you add the citation, the acronym must be described explicitly. E.g. RSOW, AE etc, possibly with the acronym next to the extended form.

We thank the reviewer for the suggestion, and we have reviewed the whole manuscript for consistency.

2) The introduction is detailed with respect to some physical aspects of the studied area, but the topic of the work could be described more accurately, the state of the art of this topic with a quick overview of the motivations.

We thank the reviewer for the suggestion. We have revised and updated the introduction accordingly, focusing on the description of the mechanism of RSOW formation, including the coupling of the physical and biogeochemical processes in the study area.

3) Please emphasise the motivations of the study also in the conclusions.

We have revised the conclusion section, emphasising our motivations (lines 628-654)

4) Suggest putting the results obtained into more context with previous studies on this area.

We agree with the reviewer comment to contextualize our results. We have revised both the discussion and conclusion sections, providing a synthetic overview of the previous studies in the area. **Table 2** summarizes the major conclusions from the previous studies in the study region in relation to our study regarding the formation of the RSOW in NRS.

5) Why did you choose to use the MERRA dataset, even though there are better performing datasets with a higher resolution (e.g. ERA5)? I suggest justifying your choices and showing that MERRA-2 is the best choice, particularly for the basin in question. It would be interesting to show a very brief comparison MERRA-2 vs ERA5 vs FNL-GDAS (and/or analysis data from global models, such as IFS or GFS).

We thank the reviewer for the comment. We revised the manuscript in the lines 202-208. Our decision to use MERRA/MERRA-2 dataset was based on two factors. The first is based on

having consistency with previous studies in the Red Sea, so our work can be comparable. The second factor is that a dedicated study regarding the heat fluxes over the study area demonstrated that both MERRA-2 and ERA5 provide comparable and accurate heat fluxes in the northern Red Sea. We have cited the relative study of Al Senafi et al. (2019) [Surface Heat Fluxes over the Northern Arabian Gulf and the Northern Red Sea: Evaluation of ECMWF-ERA5 and NASA-MERRA2 Reanalysis - <https://doi.org/10.3390/atmos10090504>] in this manuscript. Based on their study, both ERA5 and MERRA2 provide accurate heat flux data in the northern Red Sea with a correlation of 0.97–0.98. Furthermore, both represent the seasonal variability and wind effects on air-sea fluxes accurately. A detailed comparison of different atmospheric datasets is beyond the scope of the present study.

6) Regarding the figures, I suggest enlarging the fonts and optimising the spaces between the panels

We thank the reviewer for the suggestion. The figures have been updated to improve clarity and increase the font size.