

## ***Interactive comment on “Arabian Sea upwelling over the last millennium and in the 21st century as simulated by Earth System Models” by Xing Yi and Eduardo Zorita***

**Anonymous Referee #1**

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General comments: The authors discuss Arabian Sea upwelling based on Earth System model simulations of the past and future projections using various forcing/GHG scenarios. Results are presented based on statistical analyses of model outputs from the MPI-ESM and CESM models. A key result of the study is that stratification in the upper Arabian Sea caused by stronger warming under GHG scenarios has the potential to override the effect from upwelling favourable winds. The manuscript should be published once my comments have been addressed.

Details: 1. Page 3, line 11: “. . . with an area per grid point which is four times coarser . . . You are referring here to an area  $i$  times  $j$  grid points, i.e. the area per model grid point in CESM-CAM5 is four times coarser than in CCSM4.

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2. Page 4, last paragraph: although the conclusion is correct I would like to suggest a more detailed explanation about the link between SST and vertical velocity, e.g.

Stronger winds in Arabian Sea => enhanced upwelling along coastline => enhanced cooling of SST => cooler SST advected to central Arabian Sea (via Ekman) where stronger winds cause enhanced downwelling.

Correlation: in central Arabian Sea a negative trend in SST correlates positively with a negative trend in upwelling (i.e. stronger downwelling).

3. Page 7, second and third paragraph: you state that (lines 6 & 7) “. . . the identified upwelling trends can presumably be attributed to orbital forcing”. Could you please elucidate the known impacts of changes in orbital forcing in Earth System models in the Arabian Sea and reference publication(s) (also see interactive comment by Sebastian Luening).

Last sentence in third paragraph: “. . . the reduction of the SW wind-stress which results from the long-term change of SLP contrast between mid and low latitudes due to the orbital forcing.” As above, please add reference(s) regarding the impact of orbital forcing.

Furthermore, did you perform model simulations without the orbital forcing to explore its impact on the trends in SST and wind stress in the Arabian Sea?

4. Page 7, last two lines: “. . . but they rise to similar values by the end of the simulations so the SST modelled by the MPI-ESM-LR has a larger trend than the CCSM.”

5. Page 9, lines 22: Arabian Sea

6. Page 9, line 27: “. . . upwelling responds to the change . . .”

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C2