

Author responses to Anonymous Referees for “Millennial scale sea surface temperatures of the western Arabian Sea between 37 - 67 ka BP”

<https://doi.org/10.5194/egusphere-2024-865>

For ease we have copied the referee comments above the author responses.

RC2 - <https://doi.org/10.5194/egusphere-2024-865-RC2>

*The paper re-visits the classical sediment core NIOB 929 in the western Arabian Sea that has been previously used for studying surface ocean and paleoproductivity changes in response to variations in monsoon circulation. The paper extends previous data by adding high resolution Mg/Ca based sea surface temperature records (based on *G. bulloides* and *G. ruber*) for marine isotope stage 2 to 4, covering the time-interval of large-scale millennial-scale climate fluctuations as known for example from ice-cores.*

The paired Mg/Ca-based SST records allow to distinguish temperatures during both modern winter and summer monsoon seasons with high temporal resolution, clearly sufficient to display the pattern and timing of millennial-scale changes. Both SST records reveal high amplitude fluctuations, being much larger than millennial-scale SST changes during the last deglaciations or the previous interglacial. Importantly, these summer and winter SST changes do not show a systematic relationship with glacial northern hemisphere millennial climate change. This is important as the Arabian Sea and the northern hemisphere monsoon have been traditionally considered being primarily connected with the Greenland millennial-scale pattern. The authors discuss possible scenarios, also involving seasonal shifts of the ITCZ with potential more southern (Antarctic) influence during boreal summer when the convergence zone moves northward.

Overall, the paper is carefully written and the discussions are detailed and nicely involve previous findings from paleo-records in the Arabian Sea. It is hard to objectively assess the timing and pattern of the SST records in terms of northern versus southern millennial-scale timing. I partly agree with the comments of reviewer RC1 regarding a better presentation of the age model. However, radiocarbon dating will probably not provide sufficiently small errors to unequivocally connect to Greenland versus Antarctic pattern as 37-67 ka is at the limit of ¹⁴C dating. Therefore, the tuning approach with $\delta^{18}O$ records is probably the best age control possible for the older part of the record.

As quite some interpretation relies on the visual comparison to the ice-core records, I suggest to include them in all figures 4 to 6 to allow better illustrate the suggested non-straightforward relation of the summer and winter records to northern and southern hemisphere climate changes at millennial time-scales.

Response to RC2

We thank Referee 2 for their valuable comments and their time spent reviewing our manuscript. We are grateful for the positive feedback on our work and the insightful comments on how to

improve our manuscript. As also touched on by Referee 1 we agree with Referee 2 that improved design of Figures 4-6 will allow for easier comparison between records. We will integrate this change into our revised manuscript. Please also see response to RC1.