

We would like to thank the referee for their review, which will serve to improve the manuscript. We respond to the referee below, with the referees comments indented and in blue, and our response in black.

The paper is very well written and well presented. The content should be of large interest for the relevant scientific community. Their results may be seen as provoking if you work on IFA, however they clearly express strengths and limitations of the work they present, and stress the need for evaluating the conditions (SAR, BD, foraminiferal abundance) at the given sites investigated. Overall, I find it to be a very good paper, more or less ready for publication. I only have a few minor comments.

Thank you for your kind words, we are glad that you note that we do our best to underline both the strengths and limitations of our experimental setup.

Consider to reduce the number of abbreviations used to ease the reading.

We will try to do so, thank you for pointing it out.

Add some information on the choice of site, and the real-life conditions you could expect at this site. The selected site is from a site where it would be great to have reconstructions, but where there is little foraminiferal material available for investigation.

Yes, we have assumed a “best case scenario” where it would be possible to retrieve a foram-rich sediment core from a location that is climatologically most interesting for ENSO, i.e. where the palaeo-ENSO signal could be expected to be very strong. Essentially, we want to test IFA under a hypothetical best case conditions. Any difficulties that exist in the “best-case” location would obviously be even more challenging in less optimal locations. We will make this clearer in the final version of the manuscript.

SST is defined twice in the abstract (L13 and L16).

Oops, thanks!

L63: not intuitively clear sentence. Suspect you refer to absolute abundance? and/or relative? Both will change through time.

Yes, here in the introduction we refer to abundance in general... which indeed changes through time no matter how it is defined.

L217: if 5 cm/ka is more realistic for the area, why put the main focus on the 10cm/ka scenario? I read this as a theoretical paper with an idealized approach, forcing the foraminiferal model with modelled SSTs that again are used to verify the modelled IFA response. I see the argument for choosing this location, being a sensitive area in the modelled SST fields, does it really matter for your result what the realistic sed rate is in the area?

We use ensemble runs to model 5, 10 and 40 cm/ka. 10 cm/ka is included in the main text, with 5 and 40 cm/ka in the supplement. Indeed, any of the three could be argued to be included in the main text, and in various drafts we had others in the main text. So we settled on the intermediate scenario.

L230: calculated as a by - delete as a

L280: delete is

L327: delete also?

Thank you for noting these typos.

Could you consider different species and how responses may vary between species, or is the result species independent and more a general representation of the effects of SAR/BD on the IFA?

In Figures 7 and 8 it is shown that the modelled species with a preference for warmer temperatures shows a bias towards warmer temperatures in the IFA temperature reconstruction. In the case of a species with a preference for colder temperatures, the bias in the IFA temperature reconstruction would therefore be towards colder temperatures. We can mention this in the text for clarity, thank you for your comment.

I see that it would be out of the scope for this manuscript, but I have one suggestion for a future study that I would love to see and that I think would strengthen the message in the end. It would be very nice to see how this tool and analysis would compare to a “real” IFA study, given that the conclusion put strong constraints to the IFA approach. E.g., a study where the modelled data was from a location and a time interval where IFA have been/could be done, and from where the temperature is well known (for instance instrumental constraints on temperature, lead or marker horizons constrained ages and hence sedimentation/accumulation rates, stained foraminifera for information on living dept, if not BD). I think such a study would provide a more approachable message for many working on these issues since this paper presents a quite technical and theoretical approach to IFA analysis and results. And given that the message would be the same, further emphasis the potential issues that exists with respect to IFA approaches.

Yes, these would be interesting future studies. We note, however, that we cannot model the effect of bioturbation using the instrumental record because the instrumental record is not long enough to represent the interval of time incorporated by bioturbation.

For a study using the instrumental record to study the response of single foraminifera in the water domain and how they might record climate events such as ENSO and at which locations, we refer you to Metcalfe et al. (2020) [<https://doi.org/10.5194/cp-16-885-2020>].

Thanks again for taking the time to review our work!