

Interactive comment on “Modelling an alkenone-like proxy record in the NW African upwelling” by X. Giraud

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General comments:

The paper is clearly within the scope of Biogeosciences and a welcome submission since it is novel in its combining of a proxy model, proxy data, and a climate model to address a problem with the proxy. This technique should become more common in the future. In this case, it is an ocean model (albeit regional) and the alkenone SST proxy and the problem is temperature discrepancies. The conclusions reached, while not as decisive as might be desired, are certainly substantive in that they indicate what factors might be most responsible for the problem, giving a direction for further, possibly-decisive research (in another field).

While overall the paper is well-structured, the specific language of the paper is awkward to grammatically incorrect throughout, often to the point of being confusing. Since I find

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the work of the paper important and think it should be published (after revision) and read, I took extra time and did a line-by-line edit. I include general editing notes below, which also include scientific issues (but in general the science is good). The author or other interested researchers can contact me at dthresher@giss.nasa.gov for the line-by-line edit, with or without the original lines. Space restrictions preclude including the line-by-line edit here.

General editing notes:

You are modelling "the alkenone temperature proxy record" not "an alkenone-like proxy record". The result (hopefully) will be "alkenone-like" but that is not what you are modelling. The former expression is more accurate and less awkward. I have edited accordingly.

"alkenone-derived" should indeed be hyphenated but you do so inconsistently. However, I suggest dropping "-derived" altogether. "alkenone temperatures" is just as clear ("derived" is assumed) but shorter and less awkward. I have edited accordingly.

"coretop" is seen in the literature as both one word and two, rarely hyphenated. I suggest using it as one word, by analogy with "treetop". I have edited accordingly.

The "K" in "UK'37" should be capitalized. See PrahI et al. (1988), which you cite for this index. I have edited accordingly.

Quite often you use "coccolithophores distribution" and similar phrases where the first word is a noun to be used as an adjective. Making the first word plural is incorrect. You might have meant "coccolithophore's distribution" (possessive first word), which would be technically correct but awkward; similarly, for "coccolithophorid distribution" (actual adjectival first word), which you also use. Probably because it sounds less awkward, it has become common with long and unusual words used as adjectives to just leave them as unmodified nouns; thus, "coccolithophore distribution". I have edited accordingly.

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Abstract, Introduction, Conclusion – One of the reasons I think this work is so important is that it could address (with climate models, proxy models and proxy data!) an important problem with alkenone SSTs: they seem to give overly warm tropical SSTs at the Last Glacial Maximum compared to climate models and other proxy data. This should definitely at least be mentioned, if not thoroughly discussed, in one or more of these sections (e.g., what are the implications of your conclusions to this problem?). It would give some high-impact context to your paper, which otherwise might seem to be, at first glance, just another obscure modelling experiment.

Section 2.1.2 – Why wasn't the more-recent Levitus 1998 used instead of Levitus et al. 1994? Could some temperature discrepancies be due to that?

Section 2.3 – Some mention and consideration of sediment bioturbation is in order (perhaps in Appendix A too).

Section 2.3.3 –

You state flatly that lack of biogeochemical feedback between the parent and child grids is not a problem but current loops are quite prominent in the study area. Comment?

The description of the protocol of the simulations is a little sparse. I had to edit it based too much on assumption.

It would be better to consider the "sensitivity tests" simulations in their own right, i.e., give them names, formally describe their setup, etc..

What class of computer were the simulations run on and how much real time did it take? I realize there is a tendency in the literature to not mention this anymore but it is important for readers to know this. For non-modellers in particular, which may be a large part of your audience, an idea of the practicality of the work is necessary, for future use of it and to gauge its uniqueness.

Some discussion of equilibrium is absolutely necessary. Even realistic results can be due to transients ("right for the wrong reasons"). While the study area is relatively

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shallow, these are ocean simulations and they are short. Plus, you have parent and child grids and piecewise simulations. All might cause transients. Perhaps all this is discussed in the original model references but at least that should be mentioned.

Section 3 – In each subsection/paragraph it should be made clear which simulation you are talking about. I have not edited to do this.

Section 3.1 –

I assume it but it might be worth mentioning (again, particularly for non-modellers) that the ocean results are the same for all simulations.

"South of Cape Blanc, the currents flow northward in summer and southward in winter." This does seem to be the case or at least is not clear from Figure 3. I removed the statement in my editing.

You try to show good agreement between model and observed using different resolution plots (Figure 4) and then explain away differences as due to the different resolutions. It would be better just to regrid the higher-resolution (model) plots. This is not reflected in my line-by-line editing though.

Section 3.2, fourth paragraph (and Fig. 6) – what simulations are the coccolithophore and phytodetritus concentration depth profiles from? I did my editing leaving this information blank.

Section 4.1 –

Again, it would be better to consider the "sensitivity tests" simulations in their own right, i.e., give them names, formally describe their setup, etc.

What does "with an increase scale of 200 m" mean? I left it out in my editing so you would note and rewrite it.

Section 4.4, 4.5 – In the first paragraph of 4.4, after dismissing other factors as small, you state flatly that the cause of the temperature difference "has to be found in the

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production depth". My reaction was "or some factor you've missed or the sum of all the minor factors". Then in the third paragraph of 4.5 you actually discuss "missing processes in the modelling". It might be better to do this in 4.4 (also). My editing there only softened your statement. And what about the possibility of the sum of all the minor factors being the cause?

Section 4.4 –

Define PI.

Does "According to this last sensitivity case" really mean simulation DELAY+GROWTH? Simulation GROWTH or both seems more likely. To cover the possibilities I've made it less-specific in my editing.

Appendix A –

The general layout of the argument is awkward (Assumptions #1/2 but then you mention others as well) but I've left that in my editing.

I don't understand (and thus could not edit) the sentence "This assumption could be discussed in regard to the variation of primary productivity or sedimentary flux over the past period, as well as modifications in the mixing rate in the sediments." Are you saying the exponential decrease could be due to one of these factors? But then you assume constant production and mixing rates.

Immediately following the preceding, I don't understand what "The present function" is. Equation (A1), (A2), the whole Appendix?

Figures and Tables –

Table 1 – What are the units of time? Indicate this in the sentence describing the variables. Also in that sentence, should be "radians", plural.

Fig. 1 – Are the SSTs simulated or climatological?

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Fig. 6 – What simulations are the coccolithophore and phytodetritus concentrations from? Fill this in in my editing (xxxx).

Fig. 10 – It may be my PDF viewer but I see no linear regression lines. Nor do I understand what they would be of. I've left mention of them in my editing though.

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