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Climate of the Past Discussions

Interactive comment on "Late Pliocene Cordilleran Ice Sheet development with warm Northeast Pacific sea surface temperatures" *by* Maria Luisa Sánchez-Montes et al.

Anonymous Referee #2

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Sánchez-Montes et al. present a new comprehensive set of Plio-Pleistocene records from IODP site U1417 in the Gulf of Alaska encompassing SST, IRD, input of terrigenous organic matter and pollen counts. The authors infer dynamics of the Cordilleran ice sheet over 4-1.7 Ma and discuss conceptual models for potential climatic controls. It is an exciting dataset and a valuable contribution to the debate on regional versus global climatic triggers for glaciation in the Northeast-Pacific realm during the Northern Hemisphere Glaciation. The study also adds new information to the plioVar database. The application of biomarkers, pollen and IRD is robust and state of the art. Nevertheless, the manuscript needs some revision regarding the clarity and logic of several parts in the discussion.

The interpretations of the TAR-index partly need a more detailed discussion to clarify the interactions of different factors controlling the TAR (i.e. vegetation cover, petrogenic contributions and aquatic production) and the link to glaciation. At the present stage, particularly section 4.3 on the iNHG and the early Pleistocene is inconclusive with respect to variations in the sources of organic matter and the inferences on glaciation dynamics in the region. Also, the chronology of processes described in section 4.3 is a bit convoluted. In order to clarify and strengthen the interpretations of the TAR-index, the CPI has to be better represented in the manuscript. At the moment it is mentioned a few times in the text but the record is not shown in any figure. I recommend to plot the CPI along with the TAR in figure 2.

In section 4.4 the discussion about the climatic controls on glaciation is very hard to follow and needs to be revisited for clarity. The reader gets lost in the detailed descriptions and comparisons of different gradients during the Plio-Pleistocene and today. I recommend to at least shorten these paragraphs or to delete them. Similarly, the extensive discussion of the PDO analogue in cold and warm periods is confusing and could be shortened. Since the Plio-Pleistocene SST gradients are highly dependent to uncertainties in the absolute SST-estimates associated with the application of UK'37, the gradients need to be discussed in context of those uncertainties. In light of uncertainties on absolute values, section 4.4 would be strengthened by setting the focus on the warming trend that is recorded across the entire North Pacific instead of setting it on the SST gradients.

Moreover, the manuscript should be revisited in terms of language and grammar. There are several spelling and grammar mistakes throughout the manuscript (see detailed comments below). This also applies to the supplementary material.

Detailed comments:

p. 1, line 24: MPWP should be called Mid-Piacenzian-Warm-Period.

p. 5, line 19: ". . .provides similar SST estimates in northern high latitudes than previous

calibrations." Replace "than" by "to".

p. 5, lines 17-20. I recommend to mention the standard errors of the calibrations.

p.5, line 23: It would be helpful for non-biomarker experts to indicate what the authors wish to reconstruct using the %C37:4.

p.5, line 29: Sentence uses present tense. Turn to simple past.

p. 7, line 1: What is the standard deviation of the statistical mean?

p. 7, line 5: "Gi1 period (3.6-3.4 Ma) warm period. . .": I suggest to write . . ."Gi1 warm period (3.6-3.4 Ma)" or something similar along this line.

p. 7 lines 22-24: It is not clear how the high TAR-values relate to limited mountain glaciation as the interpretation of the TAR is missing. The same applies to the %C37:4.

p. 11, lines 1-3: What about petrogenic contributions?

p. 11, line 7: Which interval is meant by: "at first"?

p. 11, line 9: How does the erosion pattern explain the TAR? I don't understand which TAR-variations the authors address.

p. 11, line 12: Do the authors mean an "alternative or additional explanation" to the interpretations in lines 1-3?

p. 11, lines 12-15: which changes in the TAR do the authors mean? Do they refer to the iNHG or the period afterwards? Does the CPI record a change in the source?

p.11, lines 16-17: when exactly is this change in the CPI recorded? How is the switch in the source "away from the more mature coal bedrock" connected to the Surveyor Channel? Does it mark a switch to the channel or a switch away from the channel?

p. 11, lines 20-21: I recommend to add a standard deviation to the average values.

p. 13, line 9: decree or degree?

p. 13, line 10: "aren't" should be "are not".

p.13, lines 11-13: the reference to the figures seems to be mixed up here. C is indicated as summer in the text while in figure 1 panel C is references as winter.

p.14, lines 21-22: how do the vegetation reconstructions from this study fit the results deduced from the El'Gygytgyn pollen record?

p.14, line 32, "the data is the first climatic data": replace "is" by "are".

Figure 1: The sites can be larger and I also suggest to add the study site U1417 to panel A.

Figure 2 and 3: I recommend to increase the size of these figures. They show a lot of data and the small size makes them look quite busy. It is sometimes hard to read the small annotations. I suggest to increase the font size and also the lengths of the x-axes. Some graphs overlap each other as the y-axes are very closely spaced. The distances between the y-axes should be increased a bit. The x-axes would be easier to read if minor ticks were shown. In Figure 3 the line thickness of the x-axis should be increased and I suggest to add data points to the single graphs, as done in Figure 2.

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