Clim. Past Discuss., 3, S429–S431, 2007
www.clim-past-discuss.net/3/S429/2007/

Climate of the Past Discussions

Interactive comment on "Tropical cooling and the onset of North American glaciation" *by* P. Huybers and P. Molnar

Anonymous Referee #3

Received and published: 29 June 2007

Review of "Tropical cooling and the onset of North American glaciation", by P. Huybers and P. Molnar.

This is an interesting and original manuscript, discussing the idea that tropical Pacific SSTs control temperatures over North American continent, and thereby ablation (and ice sheet growth). This relation is elegantly analyzed for the recent past, using a relatively simple method. The authors conclude that cooling of the tropical Pacific could have been sufficient to initiate glaciation in North America around 3 Ma. In my view, this paper is a very useful contribution to the literature on the onset of glaciation. I find the paper well written and convincing, and propose to accept this manuscript with minor revisions.

My main suggestion for improvement is to extend the discussion in Section 5 about the possible role of tropical cooling in initiating glaciation. In the first two paragraphs of Section 5 (Page 781), the authors discuss their analysis of the relation between tropical Pacific SSTs, calculated PPD over North America and ice volume over the last 5 million years. Their PPD calculations are based on the assumption that the relation found between modern tropical SSTs and ablation is also valid in the Pliocene. This assumption is of course debatable and the manuscript would benefit from a more thorough discussion in which the results are compared with recent studies. For instance, are the PPD calculations presented in Figure 5 consistent with the results of Barreiro et al. (2006) and Haywood et al. (2007)? I would propose placing this discussion in a separate new Section 5 and to reserve the "Conclusions" for a summary of the main results.

Second, the focus of this study is entirely on the relation between temperature and glaciation, thereby neglecting the requirement of a significant moisture source. I suggest including a brief discussion on this issue (see for instance Haug et al., 2005), for instance on the impact of warm tropical Pacific SST on precipitation and snow fall on the North American continent.

Minor comments

1. Section 1, Introduction: Please explain briefly the methodology that is used in this study.

2. Page 774, line 22-24. Please provide a bit more information on the GHCN dataset. For instance, what time period is spanned by GHCN? Is it continuous? Does it really have a global coverage?

3. Page 774, line 27. Could you please be more specific concerning the magnitude of the changes in precipitation and snow accumulation that are associated with El Nino events?

CPD

3, S429–S431, 2007

4. Page 775, line 8. Please explain why a 2-year extension is chosen.

5. Page 775, lines 20-22. “Winter temperature can breach the freezing point at mid-latitudes, and warming is expected to increase ablation”. I am not convinced that a slight winter warming would have a large effect on ablation. As mentioned by the authors on Page 774 (line 7), a significant increase in ablation requires a summer warming. So I would suggest modifying this statement.

6. Page 777, line 9. “The NINO3.4 and northern North American temperature anomalies both average ˜1°C, giving a ratio of ˜1 (Fig. 3)Ě”. This information is not in Figure 3.

7. Page 778, lines 28-29. “Furthermore, observation of past temperatures are spaced at centennial or lower resolution”. This statement is confusing, as it is clearly not valid for the GHCN data. Please revise.

8. References: The reference to Lawrence et al. is incomplete (name of T.D. Herbert is missing)

9. Figure 1. Label (d) is missing.

10. Figures 3 and 4. I suggest to include the units in the Figures (next to the color bars), where appropriate.

11. Caption Figure 4. “the the tilt” should be “the tilt”.

Additional reference Haug, G.H., A. Ganopolski, D.M. Sigman, A. Rosell-Mele, G.E.A. Swann, R. Tiedemann, S.L. Jaccard, J. Bollmann, M.A. Maslin, M.J. Leng, G. Eglinton (2005) North Pacific seasonality and the glaciation of North America 2.7 million years ago. Nature 433, 821-825.

Interactive comment on Clim. Past Discuss., 3, 771, 2007.