Clim. Past Discuss., 7, C631–C633, 2011
www.clim-past-discuss.net/7/C631/2011/

Climate of the Past Discussions

Interactive comment on "Cold tongue/Warm pool and ENSO dynamics in the Pliocene" *by* A. S. von der Heydt et al.

Anonymous Referee #1

Received and published: 26 May 2011

This is an interesting study which examines the sensitivity of ENSO during the Pliocene using a coupled model of intermediate complexity (a modified version of the Zebiak-Cane model). The authors first set the context for the study by describing the ambiguity which surrounds the so called perennial El Nino state of the Pliocene. They then go on to describe the sensitivity tests carried out with the model to determine if such a state is feasible during the Pliocene. There results indicate that such a dramatically different condition for the Pliocene tropical Pacific is unrealistic.

Overall I found this to be a generally well put together piece of work which addresses an important topic in palaeoclimatology. It is suitable for publication in Climate of the Past following minor revision.

Comments: The authors attempt to describe the permanent El Nino concept for the

Pliocene but in doing so they also fall into its ambiguity trap to a degree. The term permanent El Nino-like should not be confused with a permanent El Nino state. El Nino–like should convey nothing more than a warming in the EEP and a lower SST gradient between the EEP and WEP as is displayed by the US Geological Survey PRISM3 SST data set and the coupled climate modelling studies of Haywood et al. (2007) and Bonham et al. (2009). In that sense all the studies above show an El Nino-like condition, but what the data and models are now showing with greater and greater clarity is that this does not, by any means, imply a that permanent or perennial El Nino state existed during the Pliocene. The author's investigation is still perfectly valid since Federov and co-authors have extrapolated a perennial El Nino from an El Nino-like condition (e.g. Fedorov et al. 2010 and 2006).

From the description of the model it would appear that a number of attributes of the model of central importance to the models prediction of ENSO are explicitly given rather than being emergent properties of the model itself. The degree to which the authors feel that the behaviour of such a simplified model is constrained by the explicit values given to the model warrants some further discussion. Of course there are plenty of prescribed values in an ocean GCM but then again there are more emergent properties too. Could this have affected the ability of their model to predict something out of the box for the Pliocene? Would a perturbed physics ensemble have been useful and justifiable here?

The authors should include discussion around two knew studies that have very recently been published in Nature and Paleoceanography.

The first by Watanabe in Nature using geochemical signatures in Pliocene corals to identify variations in temperature and precipitation over ENSO timescales. The second by Scroxton et al. in Paleoceanography analyses oxygen isotopes in hundreds of individual foram shells to determine that ocean temperature variations consistent with ENSO variation occurred during the Pliocene.

References to include:

Persistent El Niño–Southern Oscillation variation during the Pliocene Epoch, Scroxton, N., S. G. Bonham, R. E. M. Rickaby, S. H. F. Lawrence, M. Hermoso, and A. M. Haywood (2011), Paleoceanography, 26, PA2215, doi:10.1029/2010PA002097.

Permanent El Niño during the Pliocene warm period not supported by coral evidence Tsuyoshi Watanabe et al. Nature 471, 209–211. doi:10.1038/nature09777

Interactive comment on Clim. Past Discuss., 7, 997, 2011.