Clim. Past Discuss., 7, C69–C72, 2011
www.clim-past-discuss.net/7/C69/2011/

Climate of the Past Discussions

Interactive comment on "Implications of the permanent El Niño teleconnection "blueprint" for past global and North American hydroclimatology" *by* A. Goldner et al.

D.S. Abbot (Referee)

abbot@uchicago.edu

Received and published: 5 March 2011

Paper: Implications of the permanent El Niño teleconnection "blueprint" for past global and North American hydroclimatology

Authors: Goldner et al.

Journal: Climate of the Past Discussions

Reviewer: Dorian S. Abbot

Overview: This work represents an interesting attempt to understand increased pre-

cipitation over continental regions, North America in particular, during past warm climates. The author's hypothesis is that this increase in precipitation is largely due to atmospheric teleconnections caused by a permanent El Niño state. This is a reasonable idea, but I feel that the way the idea is demonstrated could be improved. I outline my thoughts on issues that I think the authors should consider as they revise their paper below. The authors should feel free to contact me directly if any of my comments need clarification.

Comments:

1. **Precipitation and Heat Balance:** The main focus of this paper is the simulation of precipitation over North America during a permanent El Niño. It is therefore essential that the modeling framework can be trusted to give reasonable precipitation results. I think that because the modeling framework does not ensure surface heat balance, however, the simulations overestimate increases in precipitation from the modern to the permanent El Niño state.

The authors note on page 207 that precipitation changes 9.9% per °C between their MODERN and NINO simulations. As noted by the authors, this is roughly three times the value found in the same model elsewhere (I am pretty sure the model is run coupled to an ocean in the reference the authors give). I am troubled by this extremely high value, particularly since it exceeds the roughly 7.5% per °C Clausius-Clapeyron scaling (this is possible in radiative-convective models, but hard to do). I suspect that the ultimate cause of this high scaling is that the model is run with fixed SSTs and therefore the surface heat balance is likely nonzero. I suspect that if the global mean surface heat balance were calculated for the MODERN and NINO cases, you would find that the net heat flux from the surface to the atmosphere increases in the NINO case relative to the MODERN case. It is likely that increased latent heat flux accounts for some of this increased total heat flux, which could lead to the high scaling of changes in precipitation with temperature changes. If I am correct, then this is unphysical and problematic for the paper.

This problem would not occur if the model were run with a mixed layer and an appropriately-defined qflux. This point fits nicely with the work of *Vizcaino et al.* (2010), who show that using a mixed layer ocean that conserves energy is important for other permanent El Niño issues. I suspect that the scaling of precipitation changes with temperature changes in the *Vizcaino et al.* (2010) simulations is much lower than 9.9% per °C, although I was not able to find this statistic in that paper. By the way, notice that *Vizcaino et al.* (2010) is now published.

There are various ways the authors could deal with this comment. The most satisfying way would be to repeat the simulations, but run CAM in mixed layer mode and adjust the qflux like *Vizcaino et al.* (2010) to produce the El Niño state. The RegCM3 simulations could then be repeated within the mixed layer CAM. I understand that this would be time-consuming, but I think it would greatly improve the paper and make it more likely to have a lasting impact. Alternatively, the authors could perform mixed-layer CAM simulations to assess the impact of correctly balancing surface heat, but not do the RegCM3 simulations. This would be fine with me, particularly since I'm not convinced the RegCM3 simulations add much to the paper as it currently stands (comment 2). The final and least satisfying option would be for the authors to add a discussion of these points that would represent a significant caveat of their results, but not perform any additional simulations. This would at least make the issue clear to the reader and get it out in the open.

A related but less important issue is that there seems to be something wrong with the values given for observed changes in temperature (0.2°C) and precipitation (0.2%) during an El Niño. This would work out to 1% change in precipitation per °C, but the authors give a value of 3.2% per °C. Was there a typo in the change in precipitation given?

2. **Specific Comparison With Data:** Miocene and Pliocene conditions are vaguely described as "wetter" in the paper. Presumably it was not uniformly wetter (some regions must have been drier) so it would be useful to the reader if a bit more specific discussion of where it was wetter and where it was drier with citations were added. This brings up a more general point concerning the use of RegCM3: I do not think a regional-scale model is useful unless its output is being compared to regional-scale observations.

If the authors wish to make the point that atmospheric teleconnections can increase precipitation over North America in a permanent El Niño in a general sense, then I would stick to CAM, although I would repeat the runs in mixed layer mode (comment 1). If the authors think regional-scale effects are important and want to use RegCM3, then I would make more detailed and specific comparison to regional-scale data (like this site was wetter and by this much, this site was drier and by this much, etc.).

References

Vizcaino, M., S. Rupper, and J. C. H. Chiang (2010), Permanent El Nino and the onset of Northern Hemisphere glaciations: Mechanism and comparison with other hypotheses, *Paleoceanography*, *25*, PA2205, PA2205, DOI:10.1029/2009PA001733.

Interactive comment on Clim. Past Discuss., 7, 199, 2011.