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Climate of the Past Discussions

Interactive comment on "High resolution climate and vegetation simulations of the Mid-Pliocene, a model-data comparison over western Europe and the Mediterranean region" *by* A. Jost et al.

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Overall this is a good paper that examines mid-Pliocene climate through numerical climate modelling at higher resolution than has been done in the past. The work is extended via a regional data/model comparison and through sensitivity tests that examine the significance of mid-Pliocene vegetation on the climate of Europe and the Mediterranean.

I have been aware of this work for some time, through its presentation at meetings, and I am glad to see it submitted to Climate of the Past.

I congratulate the authors on their work, in particular for the very detailed nature of

analysis of model results and there potential limitations, along with their defence of their experimental design and modelling framework.

Comments/Queries:

1) PRISM2 boundary conditions were used. These boundary conditions are provided on a 2 degree by 2 degree grid yet the model is run at a 60 Km resolution. The PRISM2 orography over Europe and the Mediterranean is not different from the PRISM modern topography anyway, and in the absence of a geological reconstruction of topography showing substantial differences from modern at high resolution I don't think the justification of running (or presenting the model results for) the model at this resolution for only the European and Mediterranean for the mid-Pliocene is clearly demonstrated. Perhaps further justification could be added. It seems clear that to support higher resolution global modelling effort PRISM boundary conditions probably need to be provided at a higher than 2 x 2 resolution.

2) A brief description of the LMDZ.3.3 and ORCHIDEE models would be useful.

3) I was a little surprised to see that ORCHIDEE was run off-line of the GCM given the fact that the GCM was set up with PRISM2 boundary conditions less the vegetation which was specified as modern (modern as in anthropogenic vegetation rather than using an estimate of Potential Natural Vegetation (PNV) as a starting point, which would have at reintroduced forest rather than grassland to much of Europe). Therefore the climatology given to ORCHIDEE does not include any changes made by the vegetation itself so should we be surprised that there are then issues when it comes to the data/model comparison section (especially relating to hydrological parameters)? I appreciate that it is not always easy to modify the vegetation in GCMs but this could have been overcome by running ORCHIDEE in dynamic mode allowing climate and vegetation to come into equilibrium (as in Haywood and Valdes, 2006). To their great credit the authors spend some considerable time discussing and justifying this and as they point out the impact of the vegetation appears to be small but it does not seem like

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the cleanest or most appropriate modelling strategy which could have been employed.

As the authors point out there are very significant differences between mid-Pliocene vegetation and PNV and especially mid-Pliocene and anthropogenic vegetation! This is shown in Figure 1. Figure 1 shows a PNV estimate for Europe and the Mediterranean using outputs from the Hadley Centre model driving the BIOME 4 mechanistic model of vegetation. It also shows the same but for a mid-Pliocene scenario with reconstructed biomes added from the Salzmann et al. (2008) data set.

During the Middle Pliocene Europe was dominated by warm-temperate vegetation with many tropical taxa, in particular in the south. The warm temperate forests were largely replaced by temperate (Western Europe) and cool temperate forest (Eastern Europe) in response to a cooler and drier modern climate. Warm intemperate vegetation persisted in some southern Mediterranean regions and the British Isles. However, these forests are very different from the mid-Pliocene warm temperate vegetation! South eastern Spain and parts of northern Africa were covered with temperate xerophytic shrublands during the Pliocene. This biome has been replaced by temperate sclerophyll woodland and shrubland which indicate wetter and probably cooler climates today.

4) Similar to 3 the specification of CO2 at 315 when a DGVM is in use is also a weakness, one that is again defended well by the authors. I agree there will be competing effects on the overall impact that higher CO2 would have, but until the model is run to see the impact the discussion comes across as a little speculative.

Minor comments:

1) I don't think some of the citations used for PRISM data and data sets are the most appropriate. Perhaps the authors could talk to Harry Dowsett about this.

2) The Middle Pliocene does not exist in the most recent geological time scale. The PRISM data refers to the time slab 2.97 to 3.29 Ma which the PRISM group has informally defined as the mid-Pliocene.

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3) I think the abstract could be shortened.

4) On the bottom of page 1369 reference is made to reconstructions of global annual mean temperature from the PRISM data set (Dowsett 2007). Estimating global annual mean temp change from the PRISM data set alone is impossible. The data coverage varies across different regions and data in data spare regions (for SSTs for example) is partly a product of interpolation. The only way an estimate of global annual mean surface temp change can be gained is through the use of the PRISM boundary conditions in a GCM.

5) Abstract second sentence - “Here” instead of “There”.

6) What is meant by excess precipitation in the abstract.

Interactive comment on Clim. Past Discuss., 5, 1367, 2009.

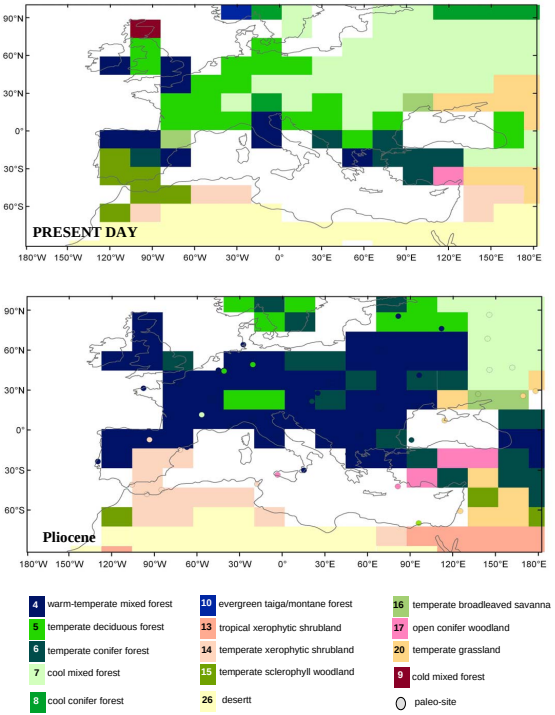

Fig. 1.

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