

Response to referee #1

*Page 1713, line 2: When discussing the temperature and precipitation anomalies (as shown in figures 1a and 2a), I think the authors should also point out where and how these differ to the model means from PlioMIP.*

We will add a paragraph in the manuscript where we compare in more detail our results with the PlioMIP results for temperature and precipitation.

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*Page 1713, line 29: Although discrepancy between modelled forest fraction and forest fraction derived from PRISM3D is evident in the high northern latitudes, it appears to be just as high, if not higher, in parts of the southern hemisphere, for example, central South America. This is most likely related to the discrepancies seen in the precipitation and/or temperature. It would be useful if the authors mention this and explain how the differences in the high northern latitudes come about.*

In high northern latitudes the forest extent is limited mainly by temperature and the length of the growing season, both of which are affected by the orbital configuration. This introduces significant variations in modeled high-latitude forest cover during the mid-Pliocene. In lower latitudes and in the tropics, changes in forest cover are related mainly to changes in precipitation. The modeled precipitation changes are generally less reliable (see also PlioMIP range from different models) which introduces larger uncertainties in the modeled vegetation. We will discuss the reasons for changes in forest cover in more detail in the revised manuscript.

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*Page 1716, line 6: 'Including orbital forcing improves agreement between model and data.' Is this simply on the basis that the blue line appears mostly within the shaded red area? By including variations in the orbital forcing, the temperature anomaly range increases, and so it is more likely that PRISM3D SST anomalies would fall in this range anyway. It would be interesting to see what the range of temperature anomalies would be if results from the warmest peaks only (as shown in fig. 3a) were used, especially in the tropics.*

The complete sentence at the page 1716 is “Including orbital forcing improves agreement between model and data assuming that PRISM3D SSTs represents the warmest annual conditions during the entire MPWP”. Indeed the Fig. 5 shows that Northern Hemisphere extra-tropical PRISM3D temperature anomalies are more close to the maximum anomalies simulated during entire MPWP rather than to average or PlioMIP values. As far as the tropics are concerned, orbital variability does not play an important role here and does not help to reconcile modeling results with paleoclimate reconstructions. The causes of such discrepancies, which have been seen also for other past climates (LGM, Eocene, etc.), remain debatable.

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*Figure 4: It may be worthwhile to re-plot the maximum summer insolation (black solid line from figure 3a) at the top of figure 4 as the authors mention that forest area varies closely with that particular insolation*

We will update Figure 4 accordingly.