

Clim. Past Discuss., author comment AC2  
<https://doi.org/10.5194/cp-2021-186-AC2>, 2022  
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## Reply on EC1

Julia C. Tindall et al.

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Author comment on "The warm winter paradox in the Pliocene northern high latitudes" by Julia C. Tindall et al., Clim. Past Discuss., <https://doi.org/10.5194/cp-2021-186-AC2>, 2022

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Thank you for providing comments. We will address the comments as follows when we revise the paper.

- *Although CMMT and WMMT were written out in full in the figure captions, it might be a good idea to also write them out in full when they first appear in the text, eg line 395.*

Sorry, this was an oversight. We will do this in the revised version.

- *Line 161: concerning mismatches between the reconstructed and simulated biomes in central Eurasia, are there any clues as to what the causes could be? eg the temperature, precipitation and the nature of the biomes in that region.*

I think this comment refers to line 261. We briefly discussed the cause in lines 262-264: "Here, the reconstructed biome is 'temperate conifer forest' and the model simulates 'evergreen taiga'. BIOME4 can only simulate 'temperate conifer forest' when the cold month temperature is above -2°C, a condition that is not provided by any of the PlioMIP2 models. The biome data-model mismatch in this region is not easily resolved and is due to the warm winter paradox (i.e. data suggesting warmer winters than can be modelled)."

We do not think this needs further clarification, however please let us know if you think otherwise.

- *Line 266: Are the correct biomes in North America and Western Europe all evergreen taiga/montane forest? In fact, it seems Eastern Europe, to the east of the Baltic Sea, also shows good agreement in the biomes.*

The editor is correct that over North America (and Greenland) both model and data show large areas of Evergreen taiga/montane forest, and the model-data agreement is on this biome. Where the biome is different the model and data disagree. The sites where model and data do not agree over North America are:

- 81N, 22W, modelled =shrub tundra, data=Evergreen Taiga/Montane forest – although these biomes are quite different, we note that at a nearby location the modelled biome is also evergreen Taiga
- 80N, 99W, modelled =temperate deciduous forest, data=Evergreen Taiga/Montane forest. Again, we see that a nearby location shows the modelled biome to be evergreen

#### Taiga

- 67N, 141W, modelled =Evergreen Taiga/montaine forest, data =deciduous taiga/montaine forest. These biomes are both cold forests and have very similar parameters, so there is only a small data-model mismatch. At a nearby location the data biome is also Evergreen Taiga.
- 65N, 161W, modelled biome=cool conifer forest, data biome=shrub tundra. This is a data-model mismatch. The reason for this data model mismatch is unknown.

Over Europe the biome is not Evergreen Taiga. Here the sites where the model and data agree are 'warm mixed forest'. In the text we discuss the model-data mismatch over Europe as:

"Over Western Europe, the warm mixed forest in the model extends too far to the east and the MMM does not reproduce the extent of the cool mixed forests seen in the data. However, it is quite easy to simulate cool mixed forest in this region with only minor parameter changes to the BIOME4 model (not shown), suggesting model and data are 'close' in this region".

We would like to thank the editor for pointing out that model and data also agree over Eastern Europe. In the revised version of the manuscript, we will write 'Europe' instead of 'Western Europe'.

- *Line 303: It might be worth also showing the annual mean results in figure 6.*

We agree that this could be useful. However, there is already a lot of information on figure 6, so we will provide the annual mean results in the supplement.

- *Line 484: I think "reason" needs to be changed to "reasons".*

Thanks for pointing this out. We will change this in the revised version.