Climate
of the Past
Discussions

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Interactive comment on "Regional climate model simulations for Europe at 6 k and 0.2 k yr BP: sensitivity to changes in anthropogenic deforestation" *by* G. Strandberg et al.

Anonymous Referee #1

GENERAL COMMENTS This paper uses a regional climate model (RCA3) to explore the sensitivity of European climates at 6ka and 0.2ka to alternate estimates of land cover. The paper also diagnoses the effects of albedo and latent heat fluxes on the paleoclimatic simulations and compares the paleoclimatic simulations and land cover reconstructions to independent proxy data.

This is a thorough analysis that is well-written and presented. The methods are sound, and I agree with the general conclusions drawn.

The paper uses only a single GCM to set the lateral boundary conditions for the RCM, which is a limitation, but in my opinion not a fatal one. This experimental design also

does not permit landcover feedbacks to propagate to the ECHO-G GCM simulation, but again this is not a fatal flaw. The authors appropriately acknowledge both issues.

As thoughts for future work, it'd be very interesting to move beyond the LANDCLIM time periods of 6ka and 0.2ka and look at intervening time periods (e.g. 3 ka, 1ka) for the effects of spreading land use on regional climate trajectories.

SPECIFIC COMMENTS 1. One conclusion in abstract is that deforestation leads to higher temperatures because evapotranspiration is lower in unforested areas. But this ignores the effect of irrigation in agricultural areas, which would increase moisture supply and possibly increase evapotranspiration, thereby lowering summer temperatures. Presumably this irrigation effect isn't represented in RCA or LPJ-Guess. This irrigation effect might be particularly important in southern Europe.

2. How is 'present' defined? (see page 5789, line 22). Is it 1950AD radiocarbon? Clarify whether 0.2ka is 1750AD.

3. P5791,L14: What does it mean for the iterative modeling to be a 'viable modeling approach'? I'm generally prepared to accept that this is a valid approach, but would like to know more about these prior papers and how they assessed the viability of this approach.

4. ECHO-G Oetzi2 run. How was the model initialized and spun up?

5. Specify the 50-year time windows from the Oetzi2 run used to drive the RCA3 simulations. This is particularly important to know for the 0.2k BP run.

6. P5795, L19: How was this upscaling done? Simple averaging?

7. The exploration of data-model and data-data discrepancies in the paleoclimatic simulations is quite thorough and well done. However, it is a bit hard to follow and lacks accompanying figures showing the paleoclimatic proxy reconstructions. Only the pollen-based paleoclimatic reconstructions (which are at greatest risk of circularity) are shown.

8. When discussing the possible reasons for mismatches between the climate simulations and pollen-based reconstructions (P5803-5806), another possible issue is the challenge of accurately disentangling multiple climatic variables from the fossil pollen data.

9. P5807 L26: Why say that there are 'no systematic differences between the models'? Figure 9 strongly suggests systematic differences.

10. P5809: Agreed that the Kaplan (K) land-cover reconstruction at 0.2ka is in better overall agreement with the LANDCLIM reconstructions (versus the LPJ and Hyde vegetation reconstructions). However, Figure 12 clearly indicates that the K reconstructions are overestimating the extent of agricultural deforestation, especially in Central Europe. The authors acknowledge this point at the top of p5810 but downplay it. I suggest deleting 'slightly' from the top of page 5010 and adding a sentence noting that the true extent of agricultural deforestation at 0.2ka probably lies between the Hyde and Kaplan estimates, but probably closer to Kaplan.

11. Suggest deleting lines 5-13 on p5180. This treatment of land cover effects on future climate simulations is pretty cursory and not essential to the paper. Recommend keeping the commentary on past climate changes.

12. Suggest adding a sentence to the conclusions stating that the pollen-based vegetation reconstructions are most similar to those of Kaplan (vs. Hyde and LPJ) but suggest that LPJ may be inadequately representing heathlands in northern Europe and that Kaplan may be overestimating agricultural use in eastern Europe.

13. Suggest adding the proxy-based paleoclimatic estimates to Fig. 9.

14. It'd be helpful to see a map of the REVEALS land cover reconstructions (currently, only differences from simulated vegetation are shown).

TECHNICAL CORRECTIONS Suggest replacing run name '6kV+H' with '6kVH' (and same change for '6kV+K') to make it easier to read – e.g. '6k_V+H-6kV' in Fig. 3

legend is quite hard to parse

P5787

L15: "simulated deforestation is much more extensive than previously assumed, in particular according to the KK model" – this isn't quite right because prior published work by KK has already argued for extensive deforestation. Suggest instead to merge this sentence with next one "At ∼0.2k BP, extensive deforestation, particularly according to the KK model, leads to significant temperature differences. . ."

L20: since->because

L21-22: Clarify that this conclusion about deforestation causing drops in temperature is specific to Southern Europe.

P5788

L1: replace 'a thorough comparison with' with 'definitive discrimination among'

P5789

L7: insert 'on climate' after 'direct effect'

P5790

L10: LANDLIM -> LANDCLIM?

L11: insert 'of pollen dispersal' after 'mechanistic model'

P5791

L5: use->uses

L22: replace 'so called' with 'transient'

P5795

L10: replace 'significantly' with 'substantially' (significance usually implies a formal test

for statistical significance)

P5808

L13: replace 'covers' with 'cover'

Table 2: rows in 'MAT PFT' are misaligned with other columns. For example, no MAT PFT equivalent is listed for Abies nor Pinus.

Fig 5 legend: 'is different for' -> 'differs from'

Fig 8 legend: 'is different for' -> 'differs from'

Fig 9: Suggest reversing the color scheme for the albedo difference plots (left column) so that strong positive anomalies are colored blue instead of red. A higher albedo will tend to result in lower temperatures, so a blue color scaling would more intuitively match this effect.

Fig 11 legend correct typos 'a nd' and 'GCM:s'

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