

Clim. Past Discuss., referee comment RC1
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Comment on cp-2021-51

Qiong Zhang (Referee)

Referee comment on "Holocene vegetation transitions and their climatic drivers in MPI-ESM1.2" by Anne Dallmeyer et al., Clim. Past Discuss.,
<https://doi.org/10.5194/cp-2021-51-RC1>, 2021

Dear Anne and co-authors,

I have read through your submitted manuscript, noticed it is the work you presented in EGU 2021, a really nice work. In this manuscript you have presented the results from a 8000-year long Holocene transient simulation with MPI-ESM1.2, focus on the long term trend in different vegetation type and changes in global and regional vegetation pattern. The simulated vegetation changes are compared with the pollen-based reconstructions and showed good agreement. The climatic drivers for these changes are identified using redundancy analysis, you conclude that the overall trend in global pattern is linearly following the orbital forcing, and some rapid non-linear changes are observed in a few regions - not only the well-known Sahara region but also in northern high latitudes and other monsoon margins. You also found that the precipitation is the main driver for regional difference in northern high latitudes, and the mechanism is associated to the changes in circulation that induced by the changes in global summer monsoon.

The manuscript is logically structured and very well written, has provided comprehensive information regarding the changes in vegetation both in MPI-ESM1.2 model simulation and in pollen reconstructions. Such detailed information on the trend and changes in global and regional vegetation pattern certainly contribute a good reference for both the climate modelling community and paleo-climate community. I have a few comments below for you to consider to improve the presentation.

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I understand that this long transient simulation is performed from 6000 BCE to 2000 CE for 8000 years. In section 2.3 (p7-line234) the authors explain that for an easier nomenclature they define mid-Holocene time slice to 8 ka b2k. However, it is not easy for most of us who always regard mid-Holocene as 6 ka, as showed in the literature in the introduction. When reading the manuscript I often have to remind myself this 8 ka b2k actually is the commonly mentioned 6ka, and have to do some convert when

looking at the figures. I suggest to use conventional 6 ka in the paper, some readers may misunderstand (if not read carefully but only take a look at figures) that 8 ka here refers to 2000 years before 6ka. This manuscript focuses on the natural vegetation variability, and the presented results do not include the last 2000 years (past2K), therefore present 6000 BCE (6ka) to 0 would nicely fall to the common understanding.

- For the difference between the mid and late Holocene, you compute the difference for first 100 years and last 100 years without land-use (250-150 BCE). Considering that the simulation shows the multi-centennial variability (as mentioned in P4-line132), I suggest to use few more hundreds years' data to compute the change between the mid and late Holocene, or check the dominant frequency, I notice that for butterworth-Filter you used 500 years. This can remove the possible impact of multi-centennial variability. Besides, when presenting the changes between two periods, should provide the statistical significance test to show the changes are robust.
- The changes in regional vegetation pattern are presented extensively in section 5, it would be nice to have a schematic diagram or table to summarise the major conclusion (vegetation type with changed percentage etc.) instead of long summary text that somewhat repeat section 5.
- It is interesting to see that there are more regions showing rapid vegetation shift besides the well-know collapse of green Sahara, the examples given in Figure 13 showing the rapid transition are impressive. However, the two grid box showed in Fig.13 seems they are selective examples, I would expect to see the transition features in Sahara first, also expect to see transitions in more PFTs as showed in Fig.12.
- P6-line 195, a "spin-down" is used, can you explain why use this instead of "spin-up"?
- P10-line 335, mentioned "These events may at least partly be associated with the volcanic forcing prescribed to the model", more clarification would be good, does it mean those events do not present in the non-volcanic forced simulation in this model? A reference on this could help the understanding.
- P11-line 396, "monsoon region is increased" better as "monsoon area is expanded".
- P18, line 661, " last millennia", should be "last 8000 years"?