

Weather Clim. Dynam. Discuss., author comment AC1
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Reply on RC1

Astrid Fremme et al.

Author comment on "Model-simulated hydroclimate in the East Asian summer monsoon region during past and future climate: a pilot study with a moisture source perspective" by Astrid Fremme et al., Weather Clim. Dynam. Discuss.,
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We thank the reviewer for these insightful comments and valuable questions (written in *italics*). Below are our replies at this current public discussion stage.

Specific Comments

1. How about the simulation of LGM with CAM5.1? A comparison between this simulation and the LGM experiments, in CMIP5/6, in simulating precipitation and the EASM circulation is necessary.

Reply: We agree that a comparison between the CAM5.1 LGM simulation and CMIP5/6 simulations can provide important context regarding main climatic features, such as precipitation and circulation. In the revised manuscript, we will compare these characteristics to published results from the PMIP4 experiments (Kageyama et al., 2021).

2. The statements in the abstract ["differences in moisture source conditions are larger between the different climate models than between different climatic boundary conditions using the same model"] made the topic less important. Of course, the evaluation of results driven by climate model output is important. However, when I saw the title, I expected more enlightenment when comparing between past and future climate conditions. I would suggest the authors consider the linkage between the intensity of EASM and the moisture contributions from different areas.

Reply: We see the potential discrepancy between the title and the sentence in the abstract highlighted by the reviewer. In the revision, we will include some specific details about the relation between moisture sources and EASM intensity in the abstract. However, we note that it is a key finding from our study that the hydroclimate appears to be simulated differently between models. Our finding that moisture source and transport differences between models are large, and consistently so across different climates, is very important in that it points out the potential limitations, and the large uncertainties in model-simulated hydroclimate. Correctly simulating a coupled cycle, such as the water cycle, is as important as it is difficult, and more work is needed to find out which representations are most realistic. In the revised manuscript, we will strive to improve the coherence between title and abstract, such that we do not disappoint reader expectations.

3. Moisture recycling during the transport pathway may influence the contributions of

moisture sources. In Fig. 4, moisture contributions from the Bay of Bengal increase in both CTL and PIN simulations, compared with ERAI. I guess such increases are connected to the lack of precipitation (moisture loss) over the Bay of Bengal. In other words, anomaly moisture gains (lack of moisture losses) over this region in both CTL and PIN simulations increase the corresponding moisture contributions. Moreover, the weaker precipitation in CTL makes the moisture contribution from the Bay of Bengal larger than that in the PIN. The moisture contributions from the Pacific are likewise.

Reply: We agree that the Bay of Bengal region shows consistent differences between the climate models and ERAI. In general, stronger recycling over Indochina, for example, would decrease more remote contributions, thus indicating stronger recycling in the CTL simulation than ERAI and PIN. In the revision, we will carefully revise the discussion of the model differences in this section, considering the potential role of moisture recycling for moisture sources.

4. L141: The PIN simulations are substantially colder than ERA-Interim?

Reply: In fact, the YRV temperature in PIN is close to ERAI, whereas the global mean has a slight cold bias. The low temperature bias applies only to the CTL-RCP simulations. We will phrase this correctly in the revision.

5. The CTL time slice used in this study is a 10-year period (L168) or a 5-year period (Table. 1). If the 1996-2005 period is selected, 1997/1998 strong El Niño is selected.

Reply: Thank you for this important comment, in fact we did run 10-year periods for all simulations. We will correct Table 1 accordingly. Indeed, the CTL time slice currently includes the 1997/1998 ENSO event. For the revisions, we will carefully check if the results look substantially different when removing these years from the analysis. If the impact is noticeable, we will shift the run period to exclude the ENSO event.

6. PIN is pre-industrial simulation and CTL is present simulation. Therefore, the comparison between ERAI and CTL is different from that between ERAI and PIN. Therefore, I would suggest the authors reorganize this manuscript solely with results from LGM and PIN simulations. The comparison between CTL and RCP could be formed into another manuscript.

Reply: Yes, the pre-industrial (PIN) and control (CTL) simulations are not identical. However, we also note from the comparison in Fig. 1 that the global and regional (YRV) temperatures are fully comparable, with the PIN simulation being in fact in between the CTL and ERAI global mean temperatures. We also emphasize that it is a central aspect of our study to include results from more than one climate model, thereby underpinning the robustness of our results in a climate system perspective. In our revisions, we will carefully consider where we can further clarify and strengthen our main objective and results, namely the usefulness of our moisture source and transport perspective to understand hydroclimate across models and climate states.

Technical Comments

I would suggest the authors thoroughly check these technical details in this manuscript before submitting the revised manuscript.

Reply: Thank you for these detailed technical suggestions, which we will correct during the revision.

References

Kageyama et al., The PMIP4 Last Glacial Maximum experiments: preliminary results and comparison with the PMIP3 simulations, *Clim. Past*, 17, 1065–1089, 2021, <https://doi.org/10.5194/cp-17-1065-2021>.