

Comment on cp-2021-17

Chris Brierley (Referee)

Referee comment on "Mid-Holocene monsoons in South and Southeast Asia: dynamically downscaled simulations and the influence of the Green Sahara" by Yiling Huo et al., Clim. Past Discuss., <https://doi.org/10.5194/cp-2021-17-RC2>, 2021

This manuscript deploys a coupled regional climate model to look mid-Holocene changes in climate over Southern Asia. I feel this research is generally well-described and worthy of publication in Climate of the Past. The manuscript is predominantly descriptive, though I have no issue with that.

I do, naturally, have some suggestions that I feel would improve the paper which should be considered before publication. I do not feel that they will change any of the conclusions, but will help convince the reader of the validity of those conclusions.

1. The region SA and SEA are only shown on Fig. 3 and never formally defined. I find it strange that SA is a square in the rotated grid of the RCM, meaning that it crosses various latitudes over northern India. Given that you are using regions and acronyms close to those used by the IPCC, at a minimum you should also show those. In fact, I suggest that you deploy the AR6 regions from Iturbide et al.

(<https://doi.org/10.5194/essd-12-2959-2020>) - codes are provided to calculate them by the authors. It is also important to state whether you are only looking over land, as in IPCC.

2. I suspect that if you replotted (some of) your figures as a raster rather than interpolated contours, the higher resolution of the RCM vs GCM will be much more obvious. (This could be done using `imshow` rather than `contourf` in python or `CellFill` in NCL).

3. Might I suggest a different approach to the palaeo calendar issue. At present you do discuss this in the methods, but it suddenly is mentioned in the figure caption. Firstly, I suspect there is little benefit to calendar adjusting for an average over JJAS - we found there was no need for MJJJAS in Brierley et al (2020). However, the calendar effect would alter the seasonal cycle time series that you present. If instead you plotted these seasonal cycles from daily data instead, then the issue of defining month is irrelevant. You must have

daily resolution data from the GCM (to drive the RCM). I think that plotting from daily data would be more useful to identify shifts in Fig 11.

4. Please can you be more explicit about the 15 years selected to drive the RCM simulations. Obviously ENSO would influence monsoon rainfall, can you reassure the reader that a different sampling on ENSO events is not responsible for the patterns described?

5. Some more information about improved representation of ocean upwelling the regional model would be useful to place the SST changes in context.

6. Can you please provide some context of the GCM and RCM resolutions with respect to the rest of the PMIP4 ensemble.

7. Table 1 is rather uninformative. Either scrap it or, preferably, include more synthesis of the different convection schemes.