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Climate of the Past Discussions

Interactive comment on "Impact of dust in PMIP-CMIP6 mid-Holocene simulations with the IPSL model" *by* Pascale Braconnot et al.

Anonymous Referee #1

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The manuscript presents the results from several simulations with IPSL model regarding the effects of dust on mid-Holocene climate. The authors have used a suppressed dust by completely removing the dust forcing, and a reduced dust by considering what happened during mid-Holocene humid period when there were less dust emissions. The authors have provided the detailed analyses of the dust radiative forcing on mid-Holocene climate, with particular focus on western African monsoon and Indian monsoon region. They conclude that taking into reduced dust in mid-Holocene account has minor improvements for the simulated climate when comparing with the reconstructions. However, they emphasise that the dust pattern matters, which determine the changes in atmospheric thermodynamics and dynamics. The comprehensive test on dust forcing in this work is important to clarify the issues on neglecting the reduced

dust in simulating mid-Holocene climate by using the same dust forcing as that in PI. The manuscript is well written and has provided clear message to the modelling community. For the final publication please consider the below minor comments.

1. For the dust forcing the authors only focus on the direct and semi-direct radiative forcing, but did not mention the indirect effects. The indirect effect is important for the monsoon region where the deep connection occurs. If the indirect effect can not be estimated in these experiments, some discussion would help the reader to understand why it has not been considered, and by neglecting the indirect effect, how much monsoon response could be underestimated.

2. In Fig2, Albani0k and Albani6k dust show increased dust in middle East, it would be helpful if the authors provide the information what cause this increase instead of refer to a reference. Reference for reconstruction in fig2 caption is missing.

3. On the model-data comparison presented in Fig14, the authors have mentioned that the dust forcing is not significant on regional climate change, given that the model results show large disagreement with the reconstructions (even opposite in sign), some explanation for the possible reasons would be helpful.

4. The figure quality needs to be improved, for example, it is difficult to observe the moist static energy transport vectors in Fig8. And in Fig11 and Fig12, it is difficult to see the numbers labeled in contours.

5. There are some typos throughout the manuscript, need to be carefully checked and corrected, some examples below (Line number is not shown complete, only show 2 numbers):

P6, L52, MMD and SD, provide what do they stand for.

P9, L21, "on ESG, should be ESGF

P10, L62, "It extends further north over Northern India and Pakistan", should be further west?

P11, L76, "and over the Tibetan Plateau", actually the region is north of the Tibetan Plateau, should be Gobi desert region, it does make sense with reduced dust in Fig2.

P11, L82, Tibetan Plateau should be Gobi desert.

P11, L83, Fig .6i should be Fig. 6j, in Fig6j should mention that large difference in precipitation also in Indian monsoon and East Asian monsoon region.

P12, L10, "...with interannual variability", should be centennial variability?

P13, Section 3.3, talked about the meridional heat transport in PW in different latitude, which figures are these numbers referring to?

P17, L53, Tibetan Plateau should be Gobi desert.

P20 L27, "associate with global warming", why global warming in this case?

P20 L27, "the reduces low level...", should be the weakening of low level...

P20 L28, "EAJ", should be AEJ

P22 L 66, "between in the ...", remove in

P23 L 03, "colder coldest", remove colder

Table 2, -0.-06, should be -0.06?

Fig7, how to read the peak month? It is better to mark 1, 2, 3...12 with different colour.

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