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

Anonymous Referee #2

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Braconnot and the coauthors study the role of dust in the mid-Holocene climate using an IPSL earth system model. They use sensitivity experiments to discuss how dust affects the climate. The issues discussed are important for understanding the mechanism of climate change and fruitful for the paleoclimate modelling community. Although the experiments are well designed to clarify the issues discussed, I feel that the manuscript is not well organized and there are careless inconsistencies here and there. I would also like to know more about the analysis of the biogeochemical aspects of dust effects, since the earth system model is used. Although they discussed the relationship of dust with AMOC, I would also like to know if there could be a correlation of dust with the suppression of ENSO during mid-Holocene. Providing insights on the role of dust on future climate change would enhance the value of the paper. Also, many

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of the figures are not of sufficient quality for publication at CP. Hence, I suggest major revisions before publication. Each comment is listed below.

L.13 mid-Holocene: the expression of mid-Holocene is not consistent in the manuscript (mid Holocene, midHolocene), standardize it.

L. 29: Introduction discusses only the issue of dust in mid-Holocene but a broader context would attract wider readers. Discuss the role of dust on climate of the past and future and why mid-Holocene is important among the different times.

L.71 mid mid-Holocene –> mid-Holocene

L. 73 Can you explain briefly what INCA-IPSL model is?

L. 99 Two expressions are mixed in each experiment in the manuscript, making it difficult to understand: MHREF, NODUST, Albani0k, Albani6k and f1, f2 . . .. Use one type. I prefer MHREF . . ..

L. 115 a slight reduction — I have an impression nearly 30 % of reduction is more than "a slight reduction"

L. 253 DJF: It is not clear that the calendar adjustment (Otto-Bliesner et al. 2017 GMD) is applied for the seasonal analyses throughout the study.

L. 259 Several important differences appear – Explain what the important differences how does they mean.

L 261: The summer monsoon precip. . . – Judged from Fig 5, the precipitation over Sahara seems greatly improved than previous modelling studies. Can you explain how much improved from the previous models and why? I could not distinguish pronounced improvement of the IPSL model at Fig. 8 of Brierley et al. CP 2020. Please discuss on it.

L 261: data reconstruction – give references

L 342: JF – why do you choose January-February instead of DJF? The same for JA.

L 597: Bartlein et al. 2011: Kaufman et al. 2020 Scientific Data, https://doi.org/10.1038/s41597-020-0445-3 provides narrower constraints than Bartlein.

L 598 paleoclimate reconstruction from pollen and macro fossil data (Fig.13). – Figure 13 does not explain paleoclimate reconstruction.

Fig. 14 is only discussed in the Discussion section. But I think the Discussion and Conclusion should be a summary of the entire paper. I suggest that Discussion and conclusion to start from Line 608. And add one section beforehand for from Line 585 to Line 607.

Line 615: mid-Holocene dust reduction –> mid-Holoicene

Table 1: If you call experiments by dust file, reform the table. For clarity, it is recommended to put MHREF, NODUST, etc. in the first column (simulation name), and the ripf code and f1 . . . can be in the last column. The same for Table 2.

Table 2: -0.-06 –> -0.06 ?

Figure 1: labels and legends are too small to read. Figure 1 (b): There exist clear negative trend of global mean temperature. This means that the experiments are not equilibrium. In such cases, I think it is important to align the time periods of the original experiment and the analysis of the branched group of experiments. In addition to the lack of equilibrium, there is another reason why you should take the same period. From (h), the 100-year variability of the AMOC is so large that if you take different periods, you may see differences in the AMOC state due to different phases.

In Figure 1 some experiments are only shown for 200 years while in table 1 all experiments are shown for more than 290 years.

Fig. 2: Add proper reference at REF.

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Figure 3: Make the figures bigger and fill in the gaps to make them easier to read.

Figure 6: How about a narrower range of temperatures? The colours in the diagram could be clearer and easier to read.

Figure 7: c, d, g, h – the highest and the lowest colors are difficult to distinguish.

Figure 9: c panels are almost the same with a. There are quite a lot of figures in this study. The comparison of a and c could be at supporting figures?

Figure 10: provide unit.

Figure 11: This is very busy figure. In order to get the point across, you need to make it easier to read. At least, I cannot read numbers at blue lines. Some of the numbers on color bars are half hidden. Give a, b, c . . . for each panel.

Figure 12: As in Figure 10 – > As in Figure 11

Figure 13: Should yellow color start from 0.25 Sv? Mask non-oceanic grids to black or gray. Southern boundary could be 35S? Uniformly dotting the stippling entire panel improves visibility.

L. 690: According to the data policy of climate of the past, the authors are requested to upload the data and codes for the analyses to a reliable data repository (or as supplement materials) so that anyone can reproduce the data in figures and tables. The authors are also requested to provide DOIs for the data on the ESGF.

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