

Interactive comment on “Monsoonal response to mid-holocene orbital forcing in a high resolution GCM” by J. H. C. Bosmans et al.

Anonymous Referee #1

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This study investigates the monsoonal response to mid-Holocene orbital forcing using a high-resolution atmosphere-ocean coupled model. The results are from the comprehensive 3-dimensional atmosphere and ocean general circulation model with relatively high resolution approach. The reproduced modern precipitation in monsoon regions is very impressive. The paper is overall well written and analyses are well performed. The manuscript is publishable as it is and could be a nice new addendum to previous many similar studies. Nevertheless, I propose several points to be considered before publication to raise the quality of the manuscript.

1. In the PMIP2 effort, atmosphere-ocean and sometimes with vegetation models were used to reproduce the mid-Holocene climate (e.g., Braconnot et al., 2007), which investigated basically the effect of orbital conditions for the mid-Holocene as in the cur-

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rent study. Even though there are merits in using the higher resolution GCM than in the PMIP2 coupled models, the monsoonal responses appear to be overall similar to those of the suite of previous studies including the PMIP2 results. Therefore, to justify the advantage of using the higher-resolution model over lower-resolution, authors might want to practice the same simulation but with lower-resolution version and compare the results between the two versions. 2. Since the coupled model used in this study has a relatively high horizontal resolution, it might take too long for climate system to reach equilibrium. In current study, the model was integrated for 50 years after perturbation and results of the last 40 years were used for analyses. Some proxies suggest that the ocean change was small during the mid-Holocene and thus ocean could be quickly adjusted in response to the orbital forcing change. Nevertheless, the 50 year integration time seems to be bit too short for ocean surface to reach a quasi-steady state. Please examine the evolution of ocean surface properties (e.g., sea surface temperature) to make sure the model is in moderate adjustment. 3. Authors need to check the tendency term of surface temperature (dT/dt). If globally averaged tendency term is not near zero, in the heat budget analyses authors need to consider this term to close the energy balance. 4. One of the most interesting subjects in the mid-Holocene climate is the substantial increase of precipitation over Sahel area. Although there is a slight improvement in precipitation in northern Africa over those of lower-resolution coupled models, the amount of precipitation is still not sufficient and rain band does not reach far enough to the north even using a high resolution model coupled with ocean dynamics. Does this mean that the resolution is not high enough yet or vegetation feedback is more important? A more comprehensive comparison of your results with previous results would be desirable.

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