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Interactive comment on "Simulating the mid-Holocene, Last Interglacial and mid-Pliocene climate with EC-Earth3-LR" *by* Qiong Zhang et al.

Anonymous Referee #2

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This paper presents the results of the EC-Earth3-LR for simulating the three past warm periods (mid-Holocene, Last Interglacial, and mid-Pliocene) which are documented in the Paleoclimate Model Intercomparison Project (PMIP) phase 4. In this paper, Zhang et al provide a comprehensive and diagnostical analysis on the modeling results. This work is very meaningful and valuable for the PMIP4 group. I would recommend its publication after addressing the comments as follows :

1. The introduction is a bit broadly. I suggest the authors can provide more information on the three past warm periods rather than giving a general introduction for all PMIP4 target periods. 2. In section 2.2.2, the authors organize a whole paragraph to describe the new albedo parameterization of snow on ice-sheet, but for the readers, we still have no idea about the core information of this new scheme. I suggest the authors

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can put forward directly the core information about this scheme rather than citing a reference. 3. I suggest to change the title of section 4.1, since the authors present both SAT and PRECIP anomalies. Or the authors can integrate section 4.1 and 4.2 as one section describing the response of global mean temperature and precipitation. 4. In line 333, “and induce weaker Hadley circulation (Fig. 5c)”, is it weaker or stronger ? 5. In Figure 5, could the authors provide the contour interval value. For the walker circulation, the authors interpret westward shifts of the ascending part in lig127k and midpliocene. For the readers, it is not straightforwardly understood in Fig 5. Could the author provide a supplement fig for the climatology result of these two simulations for the walker circulation ?

6. How do the authors define the sea ice edge in Fig 7 ? The Arctic minimum SIE in midpliocene in Fig 7 disappears, does it mean no sea ice in midpliocene in Aug ? However, in Fig 6, the Arctic SIE anomalies between midpliocene and piControl show that the SIE anomalies in Auguste is weaker than that in March, which seems not consistent with the sea ice edge presented in Fig 7.

7. Last but very important question, how do the model results comparing with the records ? Since the authors highlight “the ability of the model to capture the climate response under different climate forcings, providing potential implications for confidence in future projections with EC-Earth model”in their abstract. It is better to examine the model performance with the related reconstructions.

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