

## ***Interactive comment on “Distinct responses of Asian summer monsoon to black carbon aerosols and greenhouse gases” by Xiaoning Xie et al.***

**Anonymous Referee #1**

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Review's comments for the paper: ACP-2020-483, entitled "Distinct responses of Asian summer monsoon to black carbon aerosols and greenhouse gases", submitted to ACP

General comments

By using PDRMIP simulations under double greenhouse gases (GHGs) forcing and 10 times of present-day Black carbon (BC) forcing this paper investigates the changes of Asian summer monsoon (ASM). Results show that both GHGs changes and BC changes lead to enhanced precipitation minus evaporation over the Asian monsoon regions, but physical processes involved show some distinct characteristics. GHG changes lead to enhanced monsoon precipitation mainly through the thermodynamic effect through increased water vapor in the atmosphere while changes by BC are through dynamical effect by enhanced large scale monsoon circulation due to en-

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hanced upper tropospheric warming over Asia. The topic is an interesting one. Results are interesting and they are well described. The paper is worth of publication. However, there are some specific comments listed below that need to be addressed to improve the quality of the paper. The paper, therefore, needs a minor revision before it can be acceptable for publication.

Specific comments

1. Section 2.1 on pages 3-4. It is better to summarize experiments in a Table and to give some extra information about model horizontal and vertical resolutions.
2. Section 2.2 on page 4. Highlight the three monsoon regions in figure 1.
3. Line 26 on page 4 Please confirm that the EASM region is over region (105-160E). It includes large part of ocean.
4. Line 6 on page 5. Change “the surface precipitation” to “precipitation”
5. Line 9 on page 5. Change “thermal gradients” to “pressure gradients” since this statement is on changes in SLP.
6. Lines 12-13. The statement of excessive precipitation over the southern slope of Tibetan Plateau in model simulations is due to model horizontal resolution lacks evidence to support this. Please add some refs to support it or whether you have analyzed individual model simulations to get this conclusion.
7. Line 15 on page 5. Change “the surface precipitation” to “precipitation”
8. Line 6 on page 6. The moisture budget decomposition is vertically integrated quantities. It is better to have word “vertically integrated” when authors describe each terms.
9. Line 20 on page 7. BC absorbs solar radiation and therefore leads to decreased solar radiation at the surface. Why it leads to warming of surface air temperature? Some clarifications on this would improve the paper and helpful for readers.
10. Line 33 on page 7. There are a rich of literatures on enhanced land warming over continents in response to GHG changes and these studies suggest that warming contrast is not due to different heat capacity of land and ocean. Suggest authors rephrase this and add a few of refs.
11. Line 14 on page 8. Rephrase this statement.
12. Line 3 on page 9. Remove word “enhancement”.

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