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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Global precipitation response to changing external forcings since 1870" *by* A. Bichet et al.

Anonymous Referee #2

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This paper describes impacts of time-varying external forcings (especially focused on sea surface temperatures (SSTs), aerosol emissions (AEs), and greenhouse gases (GHGs)) on global land precipitation by analyzing ensemble simulation outputs performed by the ECHAM5 atmospheric general circulation model coupled with the Hamburg Aerosol Model (HAM). The authors concluded that (1) the decadal variability is mainly driven by the prescribed SSTs, (2) increasing AEs cause a decrease in global land temperature and precipitation, (3) increasing GHGs cause an increase in global land temperature and precipitation, and (4) increasing AEs have a larger impact on the hydrological cycle than increasing GHGs. Overall, the paper is well-written and contains potentially interesting results which merit publication. However, as shown below, there are some issues that should be addressed. For that reason, the paper requires major revision for publication in the journal.

1. (Fourth paragraph of section 2.1): Description of sensitivity experiments. In the CTRL runs, all the forcings (solar irradiance, GHGs, AEs, and SSTs) are time varying. However, in the sensitivity experiments, there is no description about how to treat the solar irradiance. The authors should exactly describe the details of the sensitivity experiment settings.

2. (Section 2.3): When comparing observed against simulated precipitation, how the authors handled the simulated data? The authors should explain this.

3. (page 9383, lines 22-23): It' not clear whether the "surface temperature" in the model is the surface air temperature at the lowest model level or the surface skin temperature at the model land surface. Please clarify. In the former case, the authors should mention rough height of the level.

4. (page 9386, line 9): We cannot see that "up to 0.4 degree warmer in 2000" from the current version of Fig.6. The authors should re-draw the figure with the ordinate ranging from -0.5 to 1.0, for example.

5. (page 9386, lines 24-27): Could you explain why the authors think so? Are there any reference papers about this?

6. (Page 9388, lines 9-12): I don't agree with this explanation: the global land net surface radiation is affected by the air advected from the oceans, because the advected moisture influences the atmospheric radiation.

7. (page 9389, lines 19-25): Could you explain the reason why "warmer transient SSTs no longer enhance the net advection of moisture from the oceans" despite of the fact that the SSTs are still warming?

8. (page 9390, lines 14-19): The authors should mention this more carefully. If the absorbing aerosols exist in the lower altitude, then it can cause convection. I suspect that increases in convective precipitation in the tropical Africa are the case of this situation.

9. (page 9393, line 15): ICCP -> IPCC

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Interactive comment on Atmos. Chem. Phys. Discuss., 11, 9375, 2011.

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