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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Sensitivity studies on the impacts of Tibetan Plateau snowpack pollution on the Asian hydrological cycle and monsoon climate" *by* Y. Qian et al.

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The authors attempted to estimate how black carbon and dust impact on TP (Tibetan Plateau) glacier melting, water cycle, atmospheric circulation, and radiative forcing by a modeling study. This approach is right way and the outcomes are very important for the next step in the TP climate study. However, as Dr. Lau mentioned, I also have the same question on the outcomes because the authors did not show any statistical significance levels. I do not know how robust this study is. Currently, the topic on Himalayan glacier retreats is very sensitive to general public because of the misleading of the glacier disappearance mentioned in IPCC (2007). Hence, we should be more careful for this

kind of topic and do not exceed proper interpretation. Please do not forget that this study started from the overestimate of snow cover over TP like TP ice sheet. It means that the author only can discuss in terms of sensitivity and currently can not connect to the real TP condition and climate. Before the acceptance of this paper, the following things should be sure to satisfy. After these revisions, this paper is worth publishing in ACP.

1. As Dr. Lau mentioned, if the authors carried out ensemble simulations, the statistical significance levels should be shown. If the authors carried out single simulation for each case, they should carry out ensemble simulations with confidence limits. Only single simulation for each case loses the robustness of this paper.

2. Please re-check the whole draft carefully and remove misleading and overinterpretation parts so that general public will not believe that this study is consistent with real world over TP. Especially for snow-related statement such as P. 22863 Lines 8-9, etc. The authors should not use "well captured or well simulated" for the snow-related statements including BC concentrations in snow because the snow cover over TP was largely overestimated and not real world.

3. The comparison of BC concentrations in snow between the sporadic observations and simulations (annual mean) in Fig. 3 is not good because annual and seasonal BC concentrations are quite different (e.g., Fig. 3 in Xu et al., PNAS, 2009). I recommend the authors to show spring or summer mean of BC concentrations over TP. What the authors can do currently is to only compare order of magnitude in BC concentrations and emphasize this point again.

Other parts

P.22856 Line 12: The information on vertical resolution should be added such as 0-2 cm snow.

P.22858 Line 28: The EHP effect was first mentioned by Lau et al. (2006, Climate

Dynamics) and the authors should cite the first paper here.

P. 22860 Line 19: Mt. Everest ice => Mt. Everest ice core

P. 22863 Line 27: References lacked. Maybe, Xu et al. (2006), Ming et al. (2008, 2009).

P. 22869 Lines 2-3: The authors did not show how much snowfall decreases and rainfall increases. Please show the data and discuss this statement.

P. 22870 Line 1: Sect. 3.4 => Sect. 3.3?

P. 22877 Line 7: A reference lacked. Maybe Ming et al. (2009).

P. 22877 Line 14: 100 ug/kg in 0-2 cm snow?

Fig. 7: So much red color is difficult to compare. Please change the colors in the color bar.

Figs. 6 and 8: For pd1-pi1 case, the forcing has the peak in March but the temperature difference has the peak in April. Please explain this one month lag.

Fig. 10: Why does the difference in runoff have the peak in March (1 month earlier than snow fraction and SWE)? Please explain this.

Fig. 16: pd1-pi1 in surface forcing has maxima in March-April, but the SH flux has the maxima in April-May. Please explain these relationships and why 1 month lag exist here.

In addition, please explain in detail in the main text how soil moisture retain and time-lag of runoff after precipitation is taken into account in the calculation of land surface model.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 22855, 2010.