This study carries out extensive climate model simulations to understand the global and regional precipitation changes due to aerosol variations. Three models with different sophistications of aerosol effects are employed to provide an ensemble assessment. The model analysis is done in a quite comprehensive manner and the paper is well written overall. Therefore, I recommend accepting this manuscript by ACP after some necessary revisions as suggested below.

1) The limitations of current GCM in assessing aerosol effect on precipitation have to be clearly stated. For example, three GCM in this study do not account for the aerosol microphysical effects on convective clouds and precipitation which are still parameterized as the sub-grid scale processes (Wang et al., 2014, Fan et al., 2016).

2) Table 1, the sign of ERF from the removal of BC can be either positive or negative for different regions among three different models. Why is that? BC direct radiative forcing has been widely reported to be positive by previous modeling and observational studies (Ghan et al., 2012; Peng et al., 2016). Does your results imply the large spread of BC microphysical effects on cloud and precipitation among the models?

3) P3L18, are those model coupled with full chemistry? Like for CESM1, is the MOZART on?

4) P4L15-25 and Fig. S2, I'm not fully convinced that precipitation changes should be well correlated with ERF in physics. As you hinted in the paper, precipitation is related with atmospheric heating, while ERF is about the radiative flux variations at the top of atmosphere. The response of surface energy fluxes is an unknown factor. Moreover, I'm not sure if the global mean precipitation change is a good indicator here, as you have showed that the major spatial pattern of the simulated precipitation change is the "ENSO like" seesaw. The regional changes may be largely offset in the global mean.

5) P5L13-19, to better unravel the role of BC on convection, it would be useful to separately analyze the convective and stratiform precipitation in each model. I assume those two quantities are available for those models.

6) As the fully coupled models are used in this study, the simulated large-scale circulation changes should be closely linked with the polar climate change and the "Arctic amplification" is evident in Fig. 3. Therefore, the influence of emission changes on the Arctic sea ice and temperature should be relevant here, as discussed by Wang et al. (2018).

Suggested references:

- Wang, Y., M. H. Wang, R. Y. Zhang, S. J. Ghan, Y. Lin, J. X. Hu, B. W. Pan, M. Levy, J. H. Jiang, and M. J. Molina (2014), Assessing the effects of anthropogenic aerosols on Pacific storm track using a multiscale global climate model, P Natl Acad Sci USA, 111(19), 6894-6899.

- Fan, J. W., Y. Wang, D. Rosenfeld, and X. H. Liu (2016), Review of aerosol-cloud interactions: Mechanisms, significance, and challenges. J. Atmos. Sci., 73(11), 4221--4252.
- Ghan, S. J., X. Liu, R. C. Easter, R. Zaveri, P. J. Rasch, J. H. Yoon, and B. Eaton (2012), Toward a Minimal Representation of Aerosols in Climate Models: Comparative Decomposition of Aerosol Direct, Semidirect, and Indirect Radiative Forcing, Journal of Climate, 25(19), 6461-6476.
- Peng, J., et al. (2016), Markedly enhanced absorption and direct radiative forcing of black carbon under polluted urban environments, Proc Natl Acad Sci U S A, 113(16), 4266-4271.
- Wang, Y, J. Jiang J., H. Su, Y.-S. Choi, L. Huang, J. Guo, Y.-L. Yung (2018), Elucidating the role of anthropogenic aerosols in arctic sea ice variations. J. Clim., 31, 99–114.