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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Consistent response of Indian summer monsoon to Middle East dust in observations and simulations" *by* Q. Jin et al.

Anonymous Referee #2

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This paper addresses the impact of Middle East dust on Indian summer monsoon precipitation. By combining results of ensemble simulations using WRF-Chem model with analyses based on observational data, the authors have presented certain correlations between variations of Middle East dust and Indian summer monsoon precipitation. They have derived a leading time of the former ahead of the latter by about 11 days, which is very close to the number from their previous analysis solely based on observations, and explained why this delay is dynamically reasonable. In addition, the authors also identified the sensitivities of modeled results to several selected parameters or model numerical schemes. I found the result intriguing because it reveals certain detailed features of dust emission, forcing, and the intraseasonal evolution of monsoonal precipitation, all derived from high-resolution modeling along with observa-

tions. It makes a good contribution to the current effort in examining the role of dust in influencing monsoonal precipitation variability.

Comments.

1. The physics background of the sensitivity simulation outcomes, i.e., why some parameters have substantial whereas others have little influence on precipitation response, could be further discussed. For instance, is the modeled precipitation supposed to be sensitive to aerosol mixing state, through optical or microphysical (i.e., nucleation) processes?

2. Section 7 provided some good discussions of the potential mechanisms behind the dust effects on precipitation. In 7.2, perhaps the authors should also look at lower level entropy to see if dust aerosols had caused any interesting change, if so, this might provide an additional explanation for dust induced circulation change. 7.3 appears to be too brief, the moist flux should be analyzed both in the lower atmosphere (e.g., below the cloud base) and upper troposphere (divergence layer). Moisture flux derived from integration through the entire atmospheric column might not be a good indicator for detecting the dust induced moisture flows.

3. Page 15573, Line 5: “cloud condensation nuclei”, note that this also applies to ice nuclei, especially for dust aerosols.

4. Page 15573, Line 10: “half of the world population”, perhaps this should be linked to the entire monsoonal climate zone rather than the Indian summer monsoon region?

5. Page 15573, Line 14: Use only “solar dimming” and “elevated heat pump” to summary the referred studies might not well reflect various hypotheses proposed in these papers.

6. Page 15578, Line 13: “divided” could be replaced by, e.g., “aggregated accordingly” or alike.

7. Page 15588, the authors should indicate corresponding layer of the discussed quan-

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15, C4297–C4299, 2015

tity in the discussions of various radiative forcings, e.g., “atmospheric forcing”, “TOA”, or “surface forcing”.

7. Page 15589, discussion of longwave fluxes, is any dust longwave effect associated with cloud change? Line 14: “hotter” to “warmer”.

8. Page 15590: “Dai et al. . . .Asian monsoon. . .”, the cited paper might be discussing the East Asian monsoon rather than the Indian summer monsoon?

6. Figure 6, caption, “AFFL” should be “ALLF”.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 15571, 2015.