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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Intense atmospheric pollution modifies weather: a case of mixed biomass burning with fossil fuel combustion pollution in the eastern China" *by* A. J. Ding et al.

Anonymous Referee #2

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This study reported a haze episode occurred in western Yangtze River Delta (YRD) region of East China during the intensive biomass burning season in June 2012. The authors examined both air pollution measurements and meteorological data over SORPES site as well as WRF model results (temperature and precipitation, without the aerosol included in the model), and suggested that the extremely intense haze episode has modified the synoptic weather pattern in this region. This is probably for the first time shows observational evidences how a mixed (biomass burning and fossil fuel combustion) man-made atmospheric pollution changes the weather with a substantial modification in air temperature and precipitation. This study highlights a cross-disciplinary

need to study the environmental, weather and climate impact of the mixed biomass burning and fossil fuel combustion sources in the East China. Overall the results are interesting and measurement data are valuable. In general the paper is well written. However, there are some weaknesses in the manuscript, especially in the modeling part. After the below comments are carefully addressed, I would suggest to accept the manuscript for publication in the Atmospheric Chemistry and Physics.

Major Comments:

(1) The WRF modeling section. This is the weakest part of this study. Authors attribute the "failure in the prediction of air temperature and rainfall by the WRF model during a heavy pollution episode" to the weather modification by aerosols. People would argue many other factors could result in the failure of temperature and precipitation prediction in the model. Many current weather or climate models that have already included the aerosol direct and indirect effects still often fail in predicting precipitation. Without the advanced data assimilation, it is not surprising that the WRF or other weather forecast model is not able to correctly forecast the weather, especially the intensity and location of precipitation, no matter whether or not the model incorporates the aerosol/chemistry component. So further analysis/simulation may be needed to isolate the aerosol effect in the observation so as to convince readers it is the aerosol that has modified the precipitation pattern and temperature during this event. I am wondering why not perform two simulations using WRF-Chem, one with aerosol added and another one without aerosol, then you can easily quantify the aerosol effect on precipitation and temperature. WRF-Chem certainly would be more extensive, but it's just a few days event, so should be affordable.

(2) SORPES data. The paper (e.g. Figures 2, 3 & 4) presents different datasets focusing on chemical compositions, while they are useful, but not really relevant to the focus of this study. What more useful and relevant for this study are the data like aerosol optical depth, single scattering albedo, direct radiation, diffuse radiation, etc., I am wondering why those data are not presented or measured.

Technical comments:

P14380, L17, More relevant studies over China could be cited here, e.g. Li et al., 2011.

P14382, L5, KAIN-FRITSCH is called in all grid sizes from 45 to 5 km?

P14385, L9, lowermost?

P14385, L17-19, this is the weakest part. Temperature modification is possible, but precipitation modification is less convincing.

P14386, L5-10, the review of other studies should be appeared in the introduction section. More analysis based on the data collected at this site may be needed to support your hypothesis.

P14386, L16, “positive” feedback?

P14387, L3, on-line models have been developed for many years, e.g. Giorgi et al., 2003.

P14387, L6, this study should be a good opportunity to evaluate the model.

Table1 Do you have separate diffuse and direct radiation flux data?

Figure 8 This is a good conceptual figure but not appropriate appeared in a technical paper without the analysis to support the mechnisms illustrated.

References: Li Z, et al., 2011. "East Asian Studies of Tropospheric Aerosols and their Impact on Regional Climate (EAST-AIRC): An Overview." Journal of Geophysical Research. D. (Atmospheres) 116:Article No. D00K34. doi:10.1029/2010JD015257. Giorgi et al., 2003. "Indirect vs. Direct Effects of Anthropogenic Sulfate on the Climate of East Asia as Simulated with a Regional Coupled Climate-Chemistry/Aerosol Model." Climatic Change 58(3):345-376.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 14377, 2013.