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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Source, transport and impacts of a heavy dust event in the Yangtze River Delta, China in 2011" *by* X. Fu et al.

Anonymous Referee #2

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This study addresses the impact of Asian desert dust on atmospheric aerosol load and photochemistry over Chinese megacities. Dust transport and radiative effects are computed for a dust event, which affected the Yangtze River Delta in May 2011, using the chemistry-transport model CMAQ. The article is designated as part of the special issue 'Atmospheric impacts of Eastern Asia megacities' in ACP. As such, I miss a more thorough analysis of the modeled dust impact and, in particular, an interpretation on how dust-related effects change the impacts of Asian megacities (cycle of air pollutants, etc.). In addition, there should be proper links to other contributions within the special issue.

General comments: Section 3: The dust emission part would better fit in Section 4.3. In this regard, Figure 5 should be shown right after Figure 1, and Figure 7 before Figure

4. In addition, appraising that modeled dust emissions are underestimated is difficult without presenting any comparison to observations at this point in the text.

Section 4.1: The analysis of statistics averaged over the whole model domain seems arbitrary and less conducive to testing the model performance in terms of the ability to reproduce dust emission and transport. The evaluation should focus on the source regions and, in particular, on the representation of dust-generating peak winds.

Section 4.2: In addition to local PM measurements, the model results should be compared to satellite observations (e.g., MODIS aerosol optical thickness, CALIPSO vertical profiles of aerosol) and sun photometer measurements from the Aerosol Robotic Network (AERONET). This is particularly important with respect to the accurate model representation of the dust radiative impact on photochemistry investigated in Section 4.6.

Section 4.6: The description of the dust impact on photochemistry is too short and needs more discussion, including links to previous studies in this field. As these effects are, of course, related to the radiative impact of mineral dust, the aerosol optical thickness (AOT)/extinction and direct radiative forcing have to be quantified first. How are dust radiative properties parameterized in the model? Could you explain in more detail, how the concentrations of OH, NO2, and O3 are related to each other, and which consequences the changes will have for atmospheric chemistry and air quality?

Section 5: This part rather summarizes the key points of the study than providing conclusions. The results should be more discussed in relation to previous findings in the literature and/or observations. Here, the work could be better put into the context of the special issue 'Atmospheric impacts of Eastern Asia megacities'. How do you judge the importance of this dust episode compared to others? What was the actual impact of the dust storm on the urban environment, air quality, and standard of living (human health, transportation) in these megacities? Which impact did the dust-related effects on photochemistry have on the life cycle of air pollutants?

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References must be given for ‘Chinese data’ and ‘American data’. The data sets should rather be named after the desert regions, to which they refer, using proper geographical terms.

Several times in the text, the phrase ‘loose smooth surface’ is used. Those land-surface conditions are better described as ‘loose, fine-grained soil with low surface roughness’.

In the entire manuscript: Clearly state for which period and area deposition fluxes are given. Acronyms (e.g., page 5: ISORROPIA, SOA, POA; page 6: MEGAN; page9: NMB) have to be resolved.

Specific comments: The information that the presence of dust causes a reduction in visibility to less than 3 km is only given in the abstract.

Page 5, Lines 16/17: I am not sure whether the details on all model levels are needed here, as the information is not used further in this article.

Page 7, lines 14 – 16: The approach of separating dust into the size classes PM2.5 and PM10 by using a fixed ratio is very simplified, as of course the dust size distribution depends on soil texture and wind speed but also evolves during transport. Given the importance for this study, a more detailed discussion or better explanation is needed.

Page 10, lines 19/20: Here, observations should be used as reference for the location of dust storms, not the model.

Page 10, lines 21 – 28: This part is not clear, please be more precise in describing how the dust distribution is related to the observed evolution of pressure, wind, and temperature.

Page 14, lines 7 – 8: This sentence may give the wrong impression that implementing a new dust emission scheme is part of this study, which is not the case.

Page 14, lines 8 – 13: The model performance, on the one hand, and the range of considered processes in a model on the other are two different things.

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Figures 7 and 9: Please specify to which model level the concentration values and photolysis rates refer.

References: For Tong et al. (2012), please use the corresponding journal article in ACP. The order of references for Wang et al. needs to be checked.

A final intense proofreading of the manuscript by an English speaking person is recommended.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 21507, 2013.