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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A study on the aerosol optical properties over East Asia using a combination of CMAQ-simulated aerosol optical properties and remote-sensing data via a data assimilation technique" *by* R. S. Park et al.

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First of all, we thank the reviewer for the careful reading of the manuscript and constructive comments. We have revised the manuscript, following the reviewer's suggestions.

We have also removed/added/changed the words and sentences in the manuscript. The changed and added parts are painted in a red color in the text. In this revision, we have recalculated Table 7, and re-plotted Figs. 5 and 7. Please, check them out.

General Comments: This is a well-written paper presenting an analysis of aerosol

distributions over East Asia using the CMAQ regional model and a variety of observations. The model results for aerosol optical depth and single scattering albedo are evaluated with MODIS AOD from the Terra satellite and ground-based measurements (AERONET and lidars). Details are given of how they improved their model over previously published results, through emissions and model conïňĄguration. I recommend publication after addressing the following comments.

Major comment: I am unclear on how the data assimilation of MODIS AODs is performed exactly. Are only the model calculated AODs adjusted to match the MODIS observations? Or are the simulated aerosol concentrations scaled and AODs recalculated after that adjustment. If only the AODs are adjusted, please include further discussion about what is learned by doing that, aside from producing an AOD distribution that is a bit closer to the observations. Reply: We are afraid that we did not 100% understand what reviewer exactly intended to point out here. But, based on our best understanding of this question, we try to answer. Because of the term of "aerosol concentrations scaled", reviewer might think that our assimilation was carried out, using observed particulate concentrations and we then "recalculated" AODs with the scaled aerosol concentrations. However, in this study we only adjusted AOD via the data assimilation. There were two main reasons for this: (1) there were no comprehensive particulate measurement networks in East Asia such as CASTNET and IMPROVE in USA. Therefore, we could not conduct the data assimilation with the observed aerosol concentrations and (2) if we had conducted the data assimilation with the observed aerosol data, there would have been another large uncertainty in the conversion from the scaled aerosol concentrations to the aerosol optical properties. In this case, we should conduct the data assimilation once more, using observed AODs, to produce more accurate AOD distributions. Again, our ultimate goals in this study are two-fold: (1) to more accurately estimate DRF by aerosols over East Asia (in order to do so, we need the accurate AOD and SSA fields) and (2) to better investigate particulate air pollution in East Asia. In case of SSAs, we have also tried to assimilate CMAQ-simulated SSA with OMI-retrieved SSA. But, there are large uncertainties in

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the OMI-retrieved SSAs, when they were compared with AERONET SSAs. Therefore, we assumed that the assimilation of CMAQ-simulated SSAs with OMI-retrieved SSAs would not increase the accuracy of SSAs (because of this reason, we did not show this work in this manuscript). Please, check out pp. 28:14-20 & pp. 29:22-30:2 in the revised manuscript.

Minor comments: 1. Section 2.2.1: A sentence on which aerosols are simulated would be helpful. For example, is SOA calculated, are aerosols bulk or for size bins? Is OA, which is mentioned later, only SOA or also primary OC? Reply: To give more accurate information to readers, we have added/changed the sentences. Please, check out the added/modified sentences at pp. 9:1-10.

2. Section 2.4: More details should be given on the MODIS AOD products used in the assimilation, including L2 or L3, which variables, and if any quality ïňĄltering was applied before use. Reply: We used the MODIS level 3 products. Some information that reviewer pointed out has been added into the revised manuscript. Please, see pp. 16:10-14.

Technical corrections: 1. Abstract: spelling "Honk Kong" p.23811, line 12: "distinctively" should be "distinctly". p.23815, line 15: "access" should be "assess". p.23816, line 1: the phrase is usually "ground truth". p.23820, l.12: CAMQ -> CMAQ; l.16: ADMA -> ADAM p.23821, l.27: agreements -> agreement p.23822, l.13: 'greatly capture' would be better as 'capture well'. p.23823: 'Gobbi' -> 'Gobi', in 2 places. line 24: should be 'generation and transport' (not plural). Reply: Thank you for these kind corrections. The above eight technical corrections were made in the revised manuscript. Please, check them out throughout the manuscript. These corrections in the revised manuscript are with a red color.

2. Table 5: in the last row the columns are shifted left. Reply: Yes, the columns in the last row were shifted. This mismatching appeared to occur during the format conversion of our original manuscript to the ACPD publication.

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3. Fig. 2: Explain what magnitude is in last column of table, and give units. Reply: The description of the magnitude is now added. Actually, we also put the magnitude in our original manuscript, but again it seemed to disappear during the format conversion of the original manuscript to the ACPD publication.

4. Fig. 7: Either put the x-axis 0 at the left of the plot, or draw a vertical dashed line at 0. Also, the yellow circles are not really visible – make circles and error bars both red. Reply: Thank you for these suggestions! We reflected the two points in Fig. 7. Please, check out newly plotted Fig. 7.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 23801, 2011.