Atmospheric
Chemistry
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Discussions

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Interactive comment

Interactive comment on "Enhanced atmospheric oxidizing capacity in simulating air quality with updated emission inventories for power plants especially for haze periods over East China" *by* Lei Zhang et al.

Anonymous Referee #1

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This study attempts to examine the influence of a more accurate emission inventory of coal-fired power plant, which was derived from online monitoring data and implemented in the Multi-resolution Emission Inventory for China, on the simulation of air quality during haze events. The authors find that the updated emission inventory improves the simulation of the ambient concentrations of the primary air pollutants and strengthens the formation of aerosols by increasing oxidizing agents like O3 and OH. This study sheds some light on how important of the use of more accurate emission inventory in reducing the uncertainty of air pollution prediction. Below are some issues which need sufficient revision.

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[Discussion paper]

1. In section 3, could the authors provide additional statistical significance tests for model validation? For example, when making comparison of observation and simulations, one of the statistical parameters the authors looking at is the correlation coefficients (see Tables 2 and 3). But, are these correlations between observation and simulation statistically significant? A quick check for this concern could be made by examining the p-values when doing linear regression. Also, the difference in most statistics (e.g. R, MFB, MFE, and so on) between MOD1 and MOD2 are relatively small (Tables 3 and 4), and it is difficult to evaluate how significant of the changes in concentrations of aerosol compositions presented in Table 5. Therefore, the authors may also need to perform some statistic tests to see the significance of the improvements in prediction of atmospheric chemical species when introducing with UEIPP into MEIC emission inventory. Following are other two minor issues about the statistics and their evaluation criteria. In lines 238-239, what's the detailed criteria for a "good" model performance proposed by Emery et al. (2001)? The MFB and MFE values for O3 in Table 3 appear much greater than the "satisfactory" criteria values (60% and 75%, respectively) proposed by Morris et al. (2005). Does this contradict with the statement in lines 253-254, i.e. O3 hourly variations were well captured?

2. In section 4.1, how great, a little more quantitively, of the BC radiative effects on the surface PM2.5 concentration? It seems the both 2 m temperature and boundary layer height (BLH) change a little in MOD2 relatively to MOD1. The signals in atmospheric warming and BLH reduction are too weak. Maybe focusing on haze episodes only could give stronger signals induced by BC absorbing. Also, try to check the vertical profiles of PM2.5 under different emission conditions, which might provide some insights of the relationship between surface PM concentration and the BLH, given that aerosols are well mixed in well-developed boundary layer. If necessary, additional simulation could be performed, in which UEIPP is used but BC radiative effects turned off. This sort of control experiments might help the authors to more quantitively evaluate the perturbation of surface PM concentration due to BC radiative effects.

3. In section 4.2, what's the reason for the enhancement in concentration of SIAs (surfate+nitrate+ammonium) greater than that of the PM2.5 (see Table 5 and lines 392-392)? I would expect that both the increases in SIAs and BC/EC should contribute to the increase of PM2.5, meaning the enhancement of PM2.5 should be larger than SIAs'. In addition, which process, the physical process like BC radiative effect stabilizing boundary layer or the chemical reaction like intensified SIA formation, is more dominant in the PM2.5 enhancement observed in this study when using UEIPP as coal-fired power plant emission inventory?

Minor comments:

Line 24: please expand the term of NMVOCs.

Line 61-63: What the refs for this statement that power plant emission is the most important source of pollutant?

Lines 266-267: Two related studies recently published (Wang et al., PNAS, 2016; Cheng, Y., et al., Science Advances, 2016) should be cited here.

Line 273: Pls change "reasonable" to "reasonably".

Line 279: The overestimates or underestimates are still present in MOD2. Use another word instead of "diminished".

Line 290: 16.38% should be -16.38%.

Line 389: Fig. 6 should be Fig. 5?