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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Top-down estimate of black carbon emissions for city cluster using ground observations: A case study in southern Jiangsu, China" *by* Xuefen Zhao et al.

Anonymous Referee #1

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General Comments:

The authors provide a detailed analysis to constrain BC emissions from Jiangsu (China) using observations from two stations. They found BC emissions are significantly overestimated in the bottom-up inventories, which has important implications. However, I have some major concerns about the representation of their stations to the whole region, and the inversion methodology. I recommend the paper for publication after consideration of the points below.

Specific Comments:

1: Abstract Lines 28-29, please confirm the same BC concentrations (i.e. 3.4 ug/m3)

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Discussion paper

at both sites. In addition, Lines 39-40 say: “the simulated annual mean was elevated to 2.6”. I assume it is elevated from 3.4 to 2.6?

2: Line 257-258 Are 5 days long enough to minimize the influences of initial conditions? I checked the methodology of other studies and found much longer initialization periods. For example, 3 months in Wang et al. (2013) and Mao et al. (2015).

Wang, X., Wang, Y., Hao, J., Kondo, Y., Irwin, M., Munger, J. and Zhao, Y.: TopâĂŘdown estimate of China's black carbon emissions using surface observations: Sensitivity to observation representativeness and transport model error, J Geophys Res Atmospheres, 118(11), 5781–5795, doi:10.1002/jgrd.50397, 2013.

Mao, Y., Li, Q., Chen, D., Zhang, L., Hao, W. and Liou, K.: Top-down estimates of biomass burning emissions of black carbon in the Western United States, Atmos Chem Phys, 14(14), 7195–7211, doi:10.5194/acp-14-7195-2014, 2014.

3: Table 2 As shown with the annual mean result:

* NJU, the a priori is 0.4 lower than obs, and is reduced by 0.6 in the inversion. The a posteriori is 1.0 lower than obs.

* PAES, the a priori is 0.9 higher than obs, and is reduced by 0.8 in the inversion. The a posteriori is 0.1 higher than obs.

It seems that the inversion simply moves the bias from PAES to NJU by reducing the total emissions, suggesting the inversion system is dominated by PAES. Considering the inconsistency between NJU and PAES, it is hard to say whether the conclusion is reliable to provide a good representation for the whole region.

4: Section 4.1 As shown in Table 2, the model simulation (2.38) is already lower than obs (2.69) in April at NJU. When only NJU data is used, how could the inversion keep reducing the emissions with scaling factors, 0.42, 0.95 and 0.65? Theoretically, an inversion system should minimize the discrepancy between model and obs rather than magnifying it.

5: Table 4 More information is needed in the caption. It is really difficult to follow the discussion to distinguish the Cases (B, 1, 2, 3, 4, 5) and Cases (6, 7).

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