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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Constraining black carbon aerosol over Southeast Asia using OMI aerosol absorption optical depth and the adjoint of GEOS-Chem" *by* L. Zhang et al.

Anonymous Referee #1

Received and published: 19 December 2014

This paper provides a valuable study of the emissions of black carbon in Southeast Asia using and inverse model. The work is extensive and the results relevant, I therefore recommend publication in ACP.

The main issue with the paper is its length. According to the title, it is mainly about the emissions of BC in Southeast Asia. However, reading it, it also turns out to be about the use of different types of cost functions, and about the sensitivity of the penalty terms, and about Bousserez's new technique, and about the sensitivity to grid resolution, and about comparing different prior emissions, and about the difference in surface BC concentrations... There is value in describing in detail the modeling work,

but it seems to me that a lot of this could have gone into supplementary material (or separate papers) to make a more readable paper.

Pg 28397: Sec 2.5: The explanation of the methods was hard to follow. I think the text could be reworked to be clearer about what is going on and why. Actually, I would probably recommend putting a, b, d into supplementary in order to streamline the paper although that's just a suggestion.

Fig. 5: Given that the spatial patterns are similar, I would have found a single 2D map preferable, and then maybe a bar chart by region to show the differences. I would then just focus on the "best" inventory and relegate plots using the others to supplementary.

Sec. 4.1 did not use the penalty term, even though the penalty term is central to the inversion technique. Maybe the discussion of the different cost function methods can be placed into supplementary (it could probably have been a short paper on its own?)

Fig. 15 and text on Pg 28408: The sensitivity tests on the penalty function could have been described in more detailed or left out (preferably the latter).

One question I had concerned the use of urban BC measurements in a model with a 0.5 degree grid. Maybe the authors could add a brief mention of this.

Minor comments:

Please do some spell-checking, especially of the figures, eg:

"CALIPOSO", "Thus of cost function"

Pg 28393-13: "those of OMI-based" is a sentence fragment.

Fig. 18: "downcaling"

Fig. 18: should label blue/red as before/after.

Fig. 19: "Indan"

A note on terminology: you should either have "a priori" or "prior", and likewise "a

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posteriori" or "posterior". eg. Fig 13. Should be "a priori". Fig. 11 should be "prior" (or "a priori")

Don't equations 2 and 6 need an equal sign?

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 28385, 2014.

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