**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Development of a fast, urban chemistry metamodel for inclusion in global models" *by* J. B. Cohen and R. G. Prinn

Anonymous Referee #2

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This paper presents interesting work on simulating the impact of urban plume processing within global models. This is an important issue in the atmospheric sciences, and the paper represents a scientific advance. Overall, I would recommend publication after a careful revision of the manuscript. In particular, the paper requires improved organization, more careful writing and a general increase in attention to details.

General comments: It seems to me that the paper is missing a section where the results of the method would be used to demonstrate both the necessity and the significance of the method described.

pg 4656, line 6: What happens at the extremes? It seems that this could potentially be significant, especially if the metamodel is extrapolated from very few sites / episodes to general conditions.

pg 4658, ln 2-27: Comparison with air quality data. Maybe a table would make this data clearer. Also, what was the selection criteria? I appreciate that doing a comparison is a potentially endless task, but it seems that some extra justification / citations are needed here, including reference to meta-analyses. The comparisons in fig 6-12 are inadequate (and the figures are very hard to read, even as electronic versions). For example, why are China results compared with Guadalajara (not Guadalara, by the way)? Maybe the number of comparisons could be narrowed down, but be made more thorough. Fewer cases, but comparisons could include histograms of actual data? At any case, Fig 6-13 felt like a core dump that was hard to sift through.

Specific comments:

Introduction: There is only one citation. Surely there is a larger literature on the regional impact of urban plume processing that would be relevant here? This could include urban field campaigns as well as meta reviews of experimental work.

Section 2: This covers only 3 papers. Aren't there any others that would be relevant, has anybody else used the papers cited?

Section 3: Again, more care should be shown in citing relevant work.

Pg 4639, ln 8-10 is somewhat sloppy. Could you be a bit more specific? There should be a more detailed discussion of the strengths and weaknesses of CAMx.

Pg 4639, ln 22-30: There is a strange switch from general comments (which could be reduced to the actual point of importance for this study) and specific information about the method. This should be better organized. I would like to see some more information about the specific sites and about the selection criteria used.

Pg 4640, ln 16: The aerosol modeling is treated as if it were a totally standard component of the model. As I understand it, there are numerous options and versions available. The paper should be clearer about which models are used and outline some of the expected strengths and weaknesses.

Pg 4640, ln 27-28: This is an example of a careless statement that could be rephrased more scientifically.

Section 6: It would help to clarify that you are comparing with Calbo / Mayer. Maybe the first 3 paragraphs could be integrated more smoothly in the method section (sec. 4). The last 2 paragraphs (pg 4650) seem like they belong in the discussion.

Equation 8: Would it help to be clearer about "Flux", possibly by including "Flux In" and "Flux Out", or specifying "Net Flux". This is alluded to briefly in line 15. To what extent is transport of pollutant across urban areas significant? (eg. Biomass burning plumes, industrial plumes?)

pg 4653, ln 19 to pg 4654, line 13: the discussion is not as easy to follow as it could be. "Sulfur is not predicted as accurately... Sulfur is predicted reasonably well..."

Table 1: Presumably these are real cases for real cities. It would help to have this information, and to give each one a name based on the dominant feature. This would facilitate the discussion.

Technical comments:

pg 4633, ln 18-22 is a run-on sentence

pg 4645, ln 13: to improve this upon this

pg 4652 ln 18 "the the"

"EFs" should be defined in fig 7 etc.

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