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Geoscientific Model Development Discussions

Interactive comment on "Development of $PM_{2.5}$ source impact spatial fields using a hybrid source apportionment air quality model" *by* C. E. Ivey et al.

Anonymous Referee #2

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This manuscript seems to be prepared with care. However, it is not clear the substantial contribution to modelling science compared with the previous paper of Hu et al. (2014). Hu et al. (2014) developed a hybrid CTM-RM method to calculate adjustment factors to refine the CTM-estimated source impacts at monitoring sites. This paper simply spatially interpolates the impact adjustment factors using the commercial MATLAB software. If this is the "new method" developed in this paper, it has no enough novelty for publication in GMD, a premier international journal. If the authors can revise the manuscript to highlight what new scientific findings they made by spatially interpolating the adjustment factors (rather than emphasizing on the method itself), it is still possible for this manuscript to be published. In addition, there are also some other

major comments that should be addressed before publication, as described below.

Specific comments: (1) Section 1. Introduction: The authors only used 2-3 sentences to describe the previous studies and their shortcomings. I think this part should be significantly expanded. (2) Section 2. Data and method: The configurations of the CMAQ-DDM modeling system should be described, e.g., the modeling domain, geographical projection, physical and chemical mechanisms, initial and boundary conditions, and emission inventory, etc. (3) Section 2.4 Model evaluation: The authors should explain the objectives of each evaluation method. (4) Section 3. Results; Section. 4 Discussion: These two sections should be reorganized. Firstly, the spatial extension method should be evaluated before any discussion of the modeling results, so Section 3.5 and 3.6 should be moved ahead of Section 3.1-3.4. Secondly, the discussion section is long and complex, with model performance, modeling results, advantage/shortcomings mixed up; the majority of this section is actually "results" rather than "discussions". I would suggest the author to merge the "results" and "discussion" sections and move most of the "discussions" to the corresponding sub-sections of "results". (5) Section 3.1, P653 L10-14: The authors should explain why the adjustment factors for specific sources are less than one, near one, or more than one. (6) Section 3.1, P653 L14-17: How much is the difference between these two methods? (7) Section 3.2: This section has the same problem with Section 3.1. Lots of modeling results are shown, but their reasons/implications are seldom illustrated. (8) Section 3.3: This manuscript focus on the development of source impact spatial fields. However, only the source impacts at the withheld CSN monitors are illustrated in this section. (9) A conclusion section should be added. The limitations of this method, except for that described in the last paragraph of the manuscript, should also be summarized. For example, the accuracy of this method still needs to be further improved by optimizing source profiles etc., and this method cannot capture the nonlinearity in the source-receptor relationships. (10) The figures and tables are not consistent with the citations in the main text. For example, in P653 L8, "Fig. 3" should be "Fig. 2". In addition, some figures and tables included in this manuscript are never cited or described in the main text, and some are

cited but not described.

Technical corrections: P649, L3-4: “Chemical Speciation Network (CSN)” should be “CSN” P655, L22: How do you determine outlying data pairs? P657, L1 and L4: What is the meaning of N? I deduce that it represents the number of observation sites but it should be explained. Table S4 and S5: I guess “HYB” should be “SH” because only the latter is described in the main text.

Reference: Hu, Y., Balachandran, S., Pachon, J. E., Baek, J., Ivey, C., Holmes, H., Odman, M. T., Mulholland, J. A., and Russell, A. G.: Fine particulate matter source apportionment using a hybrid chemical transport and receptor model approach, Atmos. Chem. Phys., 14, 5415–5431, doi:10.5194/acp-14-5415-2014, 2014.

Interactive comment on Geosci. Model Dev. Discuss., 8, 645, 2015.