

## ***Interactive comment on “Detecting critical PM<sub>2.5</sub> emission sources and their contributions to a heavy haze episode in Beijing, China by using an adjoint model” by Shixian Zhai et al.***

### **Anonymous Referee #2**

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#### General comments

The authors attempted to determine the contributions from local and surrounding emission to two PM<sub>2.5</sub> peaks during a heavy Beijing haze episode by using an aerosol adjoint model. Sensitivity analysis of the model simulations was performed to detect the PM concentration-source relationship by examining the temporal variation of a user-defined sensitivity coefficient and its time-integrated values. Given that there are still debates on the relative contributions of aerosols from local emission and regional transport to Beijing haze, the adjoint modeling studies and sensitivity analysis in this study would be interesting to the readerships of the ACP journal. However, some issues related to the clarity of discussions need to be addressed before its publication.

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## Specific comments

1) According to Fig. 4, what the reasons for the significant decrease of PM concentration during 11:00 to 17:00 on Nov. 21st? Could it be the development of PBL or the reduction of emissions during this period? 2) On p. 10 lines 2-5, the authors attributed the overall higher contribution from the surrounding emissions than local emissions to the obvious periodic fluctuation of hourly sensitivity coefficient of surrounding emissions. This explanation is not convincing for me since we only can infer that there was larger temporal variation for the contribution of surrounding emissions than that of local emissions based on the fluctuation of sensitivity coefficient. 3) I would suggest the authors to move the detailed discussions about computational efficiency of the adjoint model and the Models-3/CMAQ systems in the conclusion section (p. 12 lines 3-9) to section 4.3. Just a brief and concise summary is needed for the model computational efficiency in the conclusion section. 4) It was stated that the threshold to determine sensitive emission regions was based on the relative magnitude of sensitive coefficients and the sources contribution ratios of sensitive regions to the objective function (p. 10 lines 21-23). What are the exact values for the relative magnitude of sensitive coefficients and the sources contribution ratios of sensitive regions to the objective function? Otherwise, I feel that the selection of the threshold is arbitrary.

## Technical corrections

1) On p. 11 line 19: remove the first 'peak'. 2) The text in Fig. 1 was not legible. Please enlarge the font size. 3) For Fig. 6, the Y axis label of "PM2.5 concentration" overlays on the one for panel (c). Adjust its position to where is only for panels (a) and (b). 4) P. 6 line 8: 'might attribute' should be 'might be attributed'. 5) P. 6 line 10: I would like to use 'have proven' to replace 'had convinced'. 6) Please pay attention to the tense consistency through the manuscript. For example, on p. 6 line 28, it used both current and pass tenses (note the words 'take' and 'defined').

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