

## ***Interactive comment on “Regional Contributions to Particulate Matter Concentration in the Seoul Metropolitan Area, Korea: Seasonal Variation and Sensitivity to Meteorology and Emissions Inventory” by Eunhye Kim et al.***

**Anonymous Referee #1**

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This manuscript seeks to distinguish between Korean and foreign contributions to particulate matter in Korea. It applies two meteorological models and four emissions cases to a full year episode to characterize how the source attributions differ across the cases. The modeling shows that the relative share of PM from domestic and foreign sources differs substantially by day and season.

Overall, most methods are sound, the article is well explained, and the figures and tables are clear. My main concerns are that: 1. The findings are framed as being robust and representing uncertainty. However, this limited number of cases does not

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constitute a comprehensive ensemble or represent the range of uncertainty that may exist in the emissions inventory. The modeling relies on a somewhat arbitrary set of 4 emissions inventories, which differ for domestic and foreign sources and which do not directly represent the year (2014) that is simulated. Thus, it is not justified to call the findings robust (p. 1, line 25 and p. 12, line 19) and more caution is needed in interpreting the findings. 2. Source contributions are defined by doubling the impact of 50% emission reduction runs. However, if the reductions are applied only to anthropogenic emissions (this was unclear), then some of what is being termed "foreign" is actually resulting from biogenic emissions within Korea. Also, zero-out impacts are often larger than 2x the impact of 50% out cases, due to nonlinearities of the chemistry of pollutant formation. If that is the case here, it would systematically under-represent the domestic contribution, and hence over-represent the foreign share. One run should be conducted to test the linearity of response from 50% to 100% reduction, and language should be more cautious in defining source apportionment if it is based on 50% cases. 3. The model substantially under-estimates observed PM. This raises serious doubt about the conclusions, since it could indicate error in either the domestic or foreign emissions inventory.

Minor suggestions: p. 2, line 28: "region's" p. 2, line 33: excess precision in numbers p. 3, lines 3-6: Meteorological uncertainty has been studied elsewhere, with larger ensembles than considered here p. 6, line 26: "compromising" is the wrong word p. 9, lines 1-7: These explanations are not convincing, and the discussion of specific days is not helpful p. 12, line 25: How can results be "considerable but not significant"?

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