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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Significant wintertime $PM_{2.5}$ mitigation in the Yangtze River Delta, China from 2016 to 2019: observational constraints on anthropogenic emission controls" *by* Liqiang Wang et al.

Anonymous Referee #2

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This paper uses a data assimilation method to constrain the modeled PM2.5 concentrations over the Yangtze River Delta (YRD) region, and distinguish the impact on PM2.5 from meteorology and emission variations. The results show that the emission reduction measures in G20 summit and long-term emission control strategies in YRD successfully curb the PM2.5 levels both locally and regionally. This paper is good in general and within the scope of Atmospheric Chemistry and Physics. I recommend for publication once the specific comments expressed below are addressed. Specific comments: 1) The author should provide more details regarding how to conduct data

assimilation. First, the author needs to perform a sensitivity analysis in order to proof that choosing the fan-shaped quadrilateral (Figure1ïijL'minimizes the impact from outside on the YRD region. Second, how is the modeled PM2.5 constrained spatiotemporally by observations, applying DA generated scaling factors to the whole fan-shaped quadrilateral region, the YRD region, city by city, or grid by grid, and hour by hour or day by day? 2) The author used a statistical method to establish the correlation coefficients and chose separation distance of 180km as a threshold. The author needs to give more explanations on the value of chosen. If the purpose is to find a correlation length scale to minimize the effect on Xa, based on Fig 2, it seems that separation distance of 600km would be more appropriate. 3) How did the author isolate the impact from emission reductions on PM2.5 concentrations? Did the author use the constrained PM2.5 subtract the impact on simulated PM2.5 from meteorological variations? Even the modeled temperature, humidity, wind speed, and air pressure were also assimilated in this study, there are other parameters, for example, modeled PBL height, causing large uncertainties in the modeled meteorological field, and thus leading to bias and error in the calculated net impacts from emission variations. For example, figures c and f in Fig 5, show very small impact of anthropogenic emission control from 2016 to 2019 in most of Zhejiang province compared to the other provinces in the YRD region. Is it reasonable? 4) How did the author consider the regional transport of PM2.5 in this study? The regional emission control effect on PM2.5 may have influence on calculated net impact of emission reduction in each city and the localized mitigation potential.

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