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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modeling diurnal variation of surface $PM_{2.5}$ concentration over East China with WRF-Chem: Impacts from boundary layer mixing and anthropogenic emission" *by* Qiuyan Du et al.

Anonymous Referee #1

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Generate comments: This study investigates the simulation of diurnal variation of surface PM2.5 concentration over East China in WRF-Chem. The authors test sensitive of model simulations to PBL configuration, PBL mixing coefficient, emission diurnal variation and injection height, etc. It is found that diurnal variation of surface PM2.5 is mostly sensitive to PBL mixing coefficient, while diurnal cycle and injection height of anthropogenic emission has smaller impacts than PBL mixing coefficient. It is a nice model sensitivity study. However, the evaluation of the model performance is simply based on surface PM2.5 observations. As discussed in the manuscript, the diurnal

variation of surface PM2.5 is impacted by emission, PBL mixing and transport. It will make the results more convincing by including more model evaluation on the simulation of aerosol and meteorological variables, such as temperature, moisture, wind, stability, PBL height, aerosol speciation, vertical distribution of aerosols, etc.

Specific comments: L78: and precipitation.

L136: What about Liu M et al. (2018)? What are they findings?

L233: Which emission (anthropogenic emission, biomass burning, dust or others) is the primary contributor(s) to the surface PM2.5 over East China in different season?

L325-327: How does the model simulate the diurnal cycle of temperature, moisture, wind, stability and PBL height? Could the biases in model simulated meteorological variables contribute to the bias in diurnal cycle of surface PM2.5?

L356-357: Is there any aerosol speciation data available to evaluate the model performance?

L430: How is PBL mixing coefficient calculated?

L364: Is there any in-situ observation of the vertical distribution of aerosols in the boundary layer? The CALIPSO data may be useful to validate the simulated aerosol profiles.

Figure 4: What is the unit of each variable? And what is the black line?

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