

Response to the Interactive comment on “Air quality and emissions in the Yangtze River Delta, China” by L. Li et al.

Anonymous Referee #2

In this paper, the authors built up the latest emission inventories in the Yangtze River Delta (YRD) region in China and used MM5/CMAQ to simulate the air quality in that region in January and July 2004. It is a valuable study on the emission inventories and the application and evaluation of MM5/CMAQ in YRD region in China. However, there remain some errors and omissions for its final publication. The authors should provide appropriate and strong justifications before drawing any conclusions in the manuscript.

Here are some specific technical questions:

(1) The model performance is only evaluated with 10-day's observational data for each month (i.e., January 11-20 and 11-20 July, 2004), which is inconsistent with the simulation period in this study. If the observations are available, please use the whole month's data for model evaluation, which will make the conclusions more convincing.

Thanks to the reviewer for this good suggestion, this is very important in the work of model performance evaluation. However, the observational data in China is always quite difficult to obtain, especially the hourly concentrations. In this project, we only got 10-day's observational data for each monitoring site. Thus, this is the best we can do right now. We will try our best to get more hourly concentrations data to do model evaluation in the future study.

(2) Section 4 is closely tied up with Section 3.2.3, and the discussions of the CMAQ simulation results should not be separated with the model evaluation. Thus, please combine Section 3.2.3 and Section 4, and reorganize them.

We have revised the results in Section 4 with consideration of the model performance result in Section 3.2.3. Related discussions on model results in other parts have been revised accordingly.

(3) Please define the "monthly average". Is that monthly mean of hourly average or 24-hour average concentration of the air pollutant?

The “monthly average” in the manuscript is the monthly mean of hourly average of the air pollutants. This definition has been added to the manuscript.

(4) Please clarify the boundary conditions used in CMAQ simulations.

The boundary condition (BC) used for the largest domain of CMAQ is clean air, while the BCs for the nested domains are extracted from the CCTM concentration files of the larger domain. Text has been added to Section 2.2.

(5) Page 23659, line 21-24. Why are SO₂ reactions related to O₃ formation and destruction?

The SO₂ has been removed in the manuscript.

(6) Page 23660, line 2-4 and 11. Please clarify the version of CMAQ used in this study. CMAQ does have a version that couples the mercury chemistry, which apparently should not be the version used in this study.

The CMAQ version used in this study is version 4.4, which does not include mercury at that time. The “mercury” on page 4 has been removed, and the CMAQ version information has been added in the manuscript.

(7) Page 23661, line 1-2. What does “three-way” mean? As is known, CMAQ is one-way nested model.

Sorry for using the ambiguities word. Nesting can be accomplished by either a “one-way” or a “two-way” method. Since the CMAQ version used in the paper allows only static grid nesting, thus this paper adopts a one-way nesting method, with one coarse-resolution domain and two nest domains. The “three-way” has been changed to “one-way”.

(8) Page 23665, line 2 and 10. Is the NCEP data the real observational data? Is the NCEP data for MM5 evaluation the same set of data used in FDDA?

The NCEP data is not the real observational data. Since we don't have real observational meteorological data for the simulation period, we have to use NCEP data instead. We also used the NCEP data in FDDA. We realized that the observational data should be applied to do the MM5 model evaluation and FDDA, and we will try our best to improve this point in the future study.

(9) Page 23669, line 21-22. Is this the conclusion drew by the authors? If not, please cite the reference.

The reference has been added to the manuscript.

(10) Page 23671, line 19 and Page 23673, line 20. The authors claim that wind speed is low in winter in YRD region, which is not consistent with that showing in Fig. 7. Please make a justification.

Text regarding to the wind speed in winter has been revised in the manuscript.

(11) Page 23672, line 20-22. There is an omission in your discussions on O₃ chemistry. One important reason for higher O₃ concentration in the rural area

downwind should be the titration of O₃ by NO in the urban area with strong NO_x emissions.

Thanks very much! Text has been added in the discussion.

(12) Page 23674, line 20-22. There are lots of uncertainties in calculating real monthly average concentrations of air pollutants based on 10-day's model evaluation results. Please use the observed monthly average data from the regular monitoring sites if they are available.

Since we haven't got all the observational data, it is difficult for us to complete this point. We will try our best to do this in our future study.

(13) Please delete the two references that are not cited in the manuscript: Page 23677, line 30, and Page 23678, line 11.

The two references that are not cited have been deleted.

(14) In Table 2, are these results calculated for particular grid or an average of each grid at particular time? Please justify why only the data at specific time in 7 days are picked up and showed in Table 2.

In table 2, these results are calculated for an average of all the grids in the modeling area (28°N-35°N/118°E-123°E (NCEP data) and 28.12°N-34.94°N/118.08°E-122.95°E (modeled data)) at particular time. We selected specific time randomly, and will add more data soon.

(15) In Fig. 7, please modify the label of x-axis to the exact date if all the time is 8:00 am, and use the identical scales of x-axis for both two plots.

Revised.

(16) In Fig. 8-11, please modify the label of x-axis to the date and make the legend clear. Though "monitoring average" is represented by the dark solid line showing in the legend, it looks like there are three dark solid lines in each plot.

Revised.

Thanks again to the anonymous reviewer for his valuable suggestions, which greatly improved this paper.