

## ***Interactive comment on “Modeling study of PM<sub>2.5</sub> pollutant transport across cities in China’s Jing-Jin-Ji region during a severe haze episode in December 2013” by C. Jiang et al.***

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Anonymous Referee #2 Received and published: 9 March 2015 General comments: The paper give us new idea related to PM<sub>2.5</sub> transport across cities, especially from Beijing surroundings, the national capital region. The results will help understand and improve air quality problem in one of the most rapid developing area in China and even in the world. I recommend its publications after considering the following comments.

Technical comments:

1. Section 2.2: You wrote “The simulation period was 1–31 December 2013. The time

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step was set to 300 s, the forecasting time was 48 h, and the simulation began at 00:00 UTC every day”. As I understand, your model simulation was re-initialized everyday at 00:00 UTC time, based on NCEP reanalysis data, and then run for 48 hours. That means you have one day’s overlap for each run. Probably, your description is not clear or even misleading. Therefore, my questions is, Do you really run your model like this? Or you re-initialized it every day, or using spin-up technique to restart it every day or every other day?

Response: Yes, We run the model at 00:00 UTC time everyday, based on NCEP reanalysis data and the chemical tracer initial field, and the simulation time is 48 hour. The monthly mean values of all tracers from observation data are used for initialization at the very beginning of the model run. The initial values of all gases in RADM2 and aerosol concentrations are based on the 24 h forecast made by the previous day’s model run. The simulation results from 00 to 24 hours are used in this study. The model simulation begins from November 26 and the results of December 1–31 are used in order to avoid the uncertainties from the initial chemical fields at the model start. The brief explanation about this is added in the manuscript.

2. Section 3: You mentioned that SMOKE was used to transform your emission data into hourly gridded data require by GRAPES\_CUACE model. SMOKE must know what chemical mechanism will be used in the air quality model (AQM) for which the SMOKE output emissions are intended. Here comes my concerns: Do you use modified SMOKE version and did format transformation of emission data? If you use non-modified SMOKE, please give clear information, such as (a) What kind of chemical mechanism used by GRAPES\_CUACE? and (2) how many chemical species involved in GRAPES\_CUACE?

Response: Yes, we used modified SMOKE according to GRAPES\_CUACE, which is similar to RADM II chemical mechanism. The detailed introduction of chemical species and chemical mechanism were given in the several papers (Gong and Zhang, 2008; Wang et al., 2015a, acp). The brief explanation and the related papers are also added

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in the manuscript and references.

3. Section 4.3: the formulas of Tans for four directions show that you divide Z direction in seven layers from ground to 3000m, what's exactly of this definition? Can you give some explanation in your text, and why you define like that? Base on what? Aerosol and/or dust transport layers, wind speed or some other reasons? Also, how did you define your grid cell distance dX, and dY for Beijing area? Based on your simulation domain grid resolution ( $0.25^\circ \times 0.25^\circ$ ) or some other conditions?

Response: The observation studies of haze events in east China (Wang et al., 2014a) showed "there is an aerosol extinction layer from the height of 1-1.5 km to 2-3 km from the ground, indicating most of the PM10 pollutants are mainly concentrated in the near ground atmosphere layer below 1 km and a small part of pollutants can also spread to the height of more than 2-3 km from the ground". The explanation about this and the related paper are also added in the manuscript and references. The grid cell distance dx and dy is based on simulation domain grid resolution ( $0.25^\circ \times 0.25^\circ$ ).

Minor comments:

4. Would you mind to add Local Time (LT) to Table 1? Readers have to convert all UTC time when they read your paper. I even suggest you convert all UTC times in your report to Local Time (LT), because your study focused on PM2.5 transport across cities in a small region area, readers will easily catch the time when the haze episode(s) happened at local time.

Response: The LT has been added after all the UTC times in the manuscript.

5. As I understand, all measurements are local time (Beijing time), and all model outputs are UTC time, but you did not mention that in your text. Please confirm that you converted time to same standard time during comparison.

Response: It was confirmed that they are all UTC time.

6. I find word "ca." (no quotes) shows up in your paper many time, (e.g., Line 8 and 23  
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on page 3746, "at ca. 900 hPa" and "by ca. 10% per annum") . Please check them in detail to see if this caused by font that you selected in your word document. I guess the meaning of "ca." is about or "approximately".

Response: Yes, "ca." means circa (about), all "ca." are replaced with "about" in the manuscript.

7. Line 23 on page 3747: " as they are an important component ...", probably should be changed to "as they are important components ..."

Response: It is revised in the manuscript.

8. Please avoid starting sentences with abbreviation that people not familiar with. For example, Line 16 on page 3752: "PK is currently experiencing..." should be : "Beijing is currently experiencing...". Similar sentences at line 1-5 on page 3751 should also to be revised. I also noticed that you use "PK" instead of "BJ" as the abbreviation of "Beijing" in your whole paper, why not use "BJ", although I know the reason.

Response: These are all revised in the manuscript. All "PK" are replaced with "BJ"

9. Please improve quality of figures 4, 6, 8 and 9. It's very hard to read them clearly even I zoomed them in five times on my screen. I suggest that your use bigger font size for axis labels and graph legends.

Response: The figures have been redrawn.

10. It's not easy to find the "close correlation" (line 7 on page 3752) from Figure 4. would you mind to create a supplementary panel plot including scatter plot with regression line for each comparison. Readers will catch how close correlation between model results and measurements.

Response: Figure 4 has been redrawn.

11. Lines 24-26 on page 3750: please list station names in dictionary order, which can help readers track text and figures much more easier.

Response: It is revised in the manuscript.

12. Line 8-10 on page 3757: "As the calculation results in Table 1 show, .... by ca. 2727t from...". How did you get the value 2727t from Table 1, please explain it.

Response: The value 2727t was got from Fig.9. The total PM2.5 suspended over the PK area increased by about 2727 t from 12:00 UTC 6 December(980t) to 12:00 UTC 7 December (3707t). The explanation is also added in the manuscript.

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