Reply to Reviewer's Comments

We would like to first thank the editor and two anonymous reviewers for their comments to help improve our manuscript. Below we give a point-to-point response to address the reviewers' comments. The original comments are in black and our responses are in blue.

Comments from Anonymous Referee #2

This study addresses the impact of Asian desert dust on atmospheric aerosol load and photochemistry over Chinese megacities. Dust transport and radiative effects are computed for a dust event, which affected the Yangtze River Delta in May 2011, using the chemistry-transport model CMAQ. The article is designated as part of the special issue 'Atmospheric impacts of Eastern Asia megacities' in ACP. As such, I miss a more thorough analysis of the modeled dust impact and, in particular, an interpretation on how dust-related effects change the impacts of Asian megacities (cycle of air pollutants, etc.). In addition, there should be proper links to other contributions within the special issue.

Response: Thank you for your comments to improve my manuscript. We have added a more thorough analysis of the modeled dust impact in the discussion and conclusion section, including the impacts of dust on PM concentration, deposition, radiation, photochemistry, etc..

Papers of the special issue 'Atmospheric impacts of Eastern Asia megacities' focus on Eastern Asia megacity studies of chemical emission and deposition, atmospheric chemical composition and processing, impacts on weather and climate, regional transport and related topics, which include studies conducted within specific megacities as well as larger scale studies. The YRD is one of the most important regions in China and even East Asia. There are 10 papers in this special issue focusing on the YRD or Shanghai, one of its megacities. Huang et al. (2012), one paper published in this special issue, used comprehensive observation data and identified three typical types of haze in the YRD, i.e. secondary inorganic pollution, dust, and biomass burning. Another paper in this special issue, Fu et al. (2012), also indicated that dust storm significantly affected the particulate pollution in Shanghai in November 2010. Compared with other pollution sources, the dust storm can affect the air quality of a larger region. For example, Wang et al. (2013), another paper in this special issue, addressed the impact of Gobi desert dust on aerosol chemistry of Xi'an, an inland city of China during spring 2009.We can see that the topic of this paper is of high interests and this study is connected with a few other papers in this special issue. Different from the papers mentioned above, which are mainly based on monitoring data, this study applies atmospheric chemistry and transport model for the analysis and may give a more complete picture of dust impacts.

General Comments:

1. Section 3: The dust emission part would better fit in Section 4.3.In this regard, Figure 5 should be shown right after Figure 1, and Figure 7 before Figure4. In addition, appraising that modeled dust emissions are underestimated is difficult without presenting any comparison to observations at this point in the text.

Response: Thank you for your suggestion. We have adjusted the structure of the manuscript and the order of the figures. The revised manuscript is organized as follows:

Abstracts
1 Introduction
2 Model description
2.1 Simulation domain and episode
2.2 CMAQ model configurations and inputs
2.3 The in-line windblown dust model in CMAQ5.0
3 Model evaluation
3.1 Evaluation of meteorological simulations
3.2 Evaluation of chemical variables
3.2.1 Evaluation of pollutants concentration predictions
3.2.2 Evaluation of aerosol optical depth (AOD) predictions
4 Results and discussion
4.1 Dust emission
4.2 Analysis of metrological condition for this dust event
4.3 Dust transport and its impacts on PM_{10} concentration
4.4 Deposition of dust aerosols in the YRD region
4.5 Impacts of dust storm on optical/radiative variables and photochemistry
4.5.1 Impacts on AOD and radiation
4.5.2 Impacts on photochemistry
5 Conclusions

The order of the figures is as follows:

Fig.1 Modeling domains and location of the monitoring sites used for model evaluation
Fig.2 Comparison of simulated PM_{10} concentration (a, c, e) and $PM_{2.5}$ concentration (b, d, f) with observations at three sites in the YRD
Fig.3 Comparison of simulated daily average AOD with observations at two AERONET sites, 28 April to 6 May
Fig.4 Distribution of daily mean dust PM_{10} emissions by DUST_REVISED model
Fig.5 The temporal variation of dust emissions
Fig.6 Surface and 500 hPa weather chart in China
Fig.7 Surface meteorological variables from May 1 to 6 in Shanghai monitoring site
Fig.8 The spatio-temporal variation of dust impacts on PM_{10} concentration ($\mu g/m^3$) in the surface layer during this dust event (DUST_REVISED minus DUST_OFF)
Fig.9 The PM_{10} deposition in the YRD region from 1 to 6 May

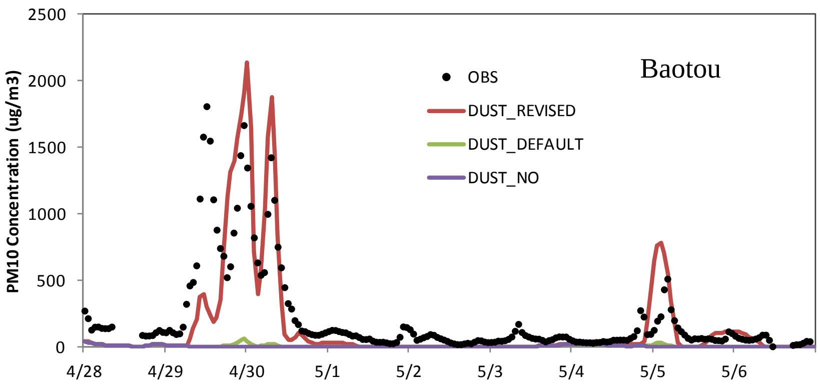
Fig.10 The average differences of the aerosol optical depth (AOD) at 550nm and downward irradiance simulated by DUST_REVISED and DUST_OFF, April 28 to May 6

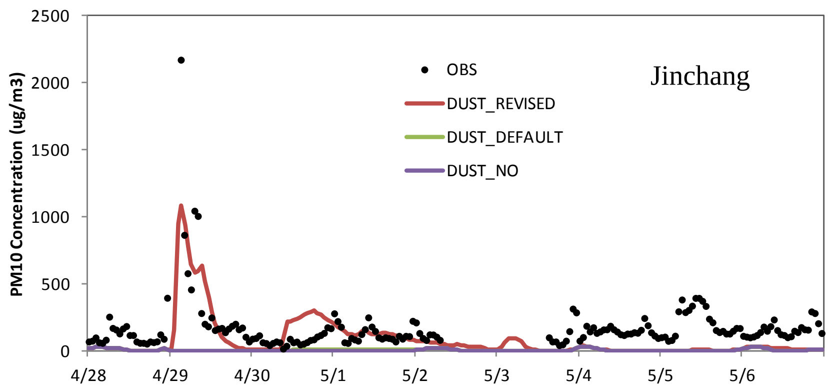
Fig.11 The average differences of the photolysis rates simulated by DUST_REVISED and DUST_OFF, April 28 to May 6

Fig.12 Diurnal cycle of the percentage change of the NO2 photolysis rate and the O3 photolysis rate at Shanghai, May 1 to May 3

Fig.13 The average differences between the simulations in the surface layer by DUST_REVISED and DUST_OFF, April 28 to May 6. (a) O3 concentrations;(b) OH concentrations

In addition, we have added the comparison between observations and predictions for PM_{10} at three sites near source region, which helps appraise the underestimates of default dust emission model. The 3 sites used for comparison include Baotou in Inner Mongolia (109.85E, 40.68N), Jinchang in Gansu Province (102.19E, 38.52N) and Yinchuan in Ningxia (106.17E, 38.48N). The comparison of observed and simulated hourly PM_{10} concentration is shown in **Fig.R1**. Compared with DUST_DEFAULT and DUST_OFF, the model performance for DUST_REVISED is improved significantly. The NMBs for Baotou, Jinchang and Yinchuan are -22.2%, -38.6% and -50.4% averagely during 28 April to 6 May. The R values for these three sites are 0.77, 0.66 and 0.59, respectively. We have added this discussion in section 3.2.1 and the supplementary materials.





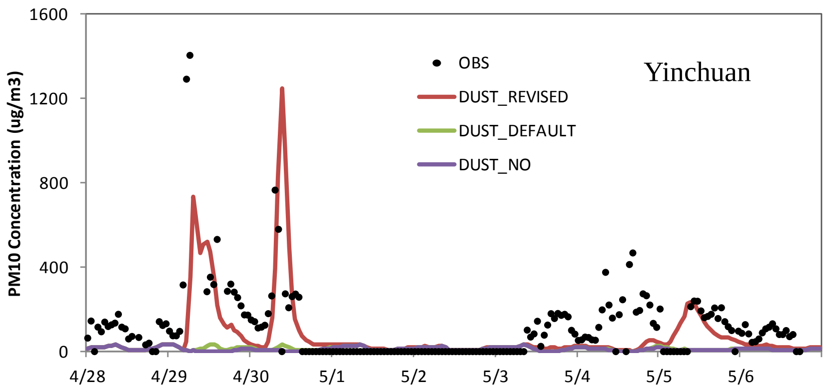
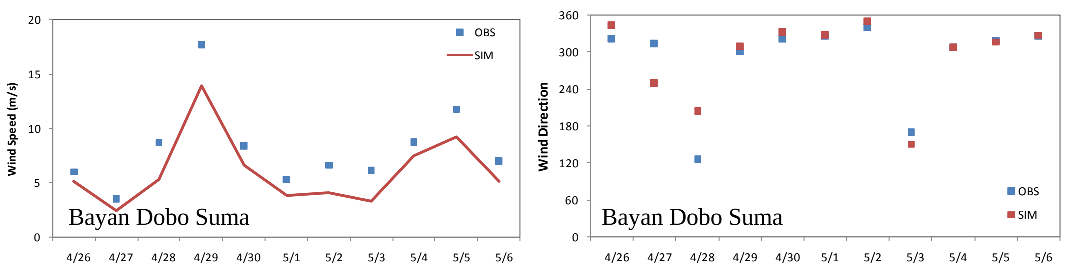


Fig. R1. The comparison of hourly PM_{10} concentration from observation and prediction with dust emission at three sites near dust source region

2. Section 4.1: The analysis of statistics averaged over the whole model domain seems arbitrary and less conducive to testing the model performance in terms of the ability to reproduce dust emission and transport. The evaluation should focus on the source regions and, in particular, on the representation of dust-generating peak winds.

Response: We added the comparison of wind speed and wind direction between observations and predictions at the 3monitoring sites. Bayan Dobo Suma in Mongolia (107.18E, 44.57N) is in the dust source region, Beijing (116.28E, 39.93N) is at the dust transport path and Shanghai (121.43E, 31.17N) is in the downwind region. As shown in Fig.R2, the model can generally reproduce the variation trend of the observations. The biases of wind speed for these three sites are -2.13, -0.51 and -0.48 m/s respectively. The wind speeds are a little more underestimated in the source region than in the downwind region, which is mainly resulted from the low resolution of the terrain at a coarse grid and less Data Assimilation(FDDA) data in the Mongolia region. We have added this discussion in section 3.1 and the supplementary materials.



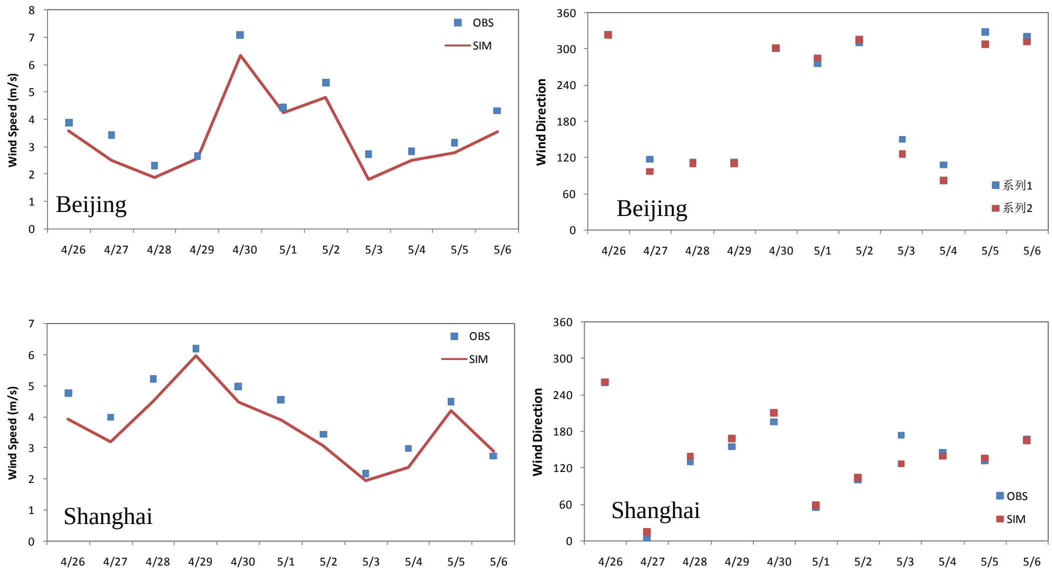


Fig. R2. The comparison of hourly wind speed and wind direction from observation and prediction at three sites

3. Section 4.2: In addition to local PM measurements, the model results should be compared to satellite observations (e.g., MODIS aerosol optical thickness, CALIPSO vertical profiles of aerosol) and sun photometer measurements from the Aerosol Robotic Network (AERONET). This is particularly important with respect to the accurate model representation of the dust radiative impact on photochemistry investigated in Section4.6.

Response: Thank you for your suggestion. We have added the discussion about comparison with sun photometer measurements from the Aerosol Robotic Network (AERONET) and MODIS aerosol optical thickness (AOD) to the section 3.2.2 and the supplementary materials.

Figure R3 compares the temporal variations of observed daily average AOD column from AERONET and predictions from DUST_REVISED at two sites. The Beijing site (116.38E, 39.98N) is located at the transport path of dust and the Taihu site (120.21E, 31.42N) is in the YRD region. The comparisons for the sites near the dust source region are not included, because the measurement data at these sites are missing during this episode. As shown in Fig.R3, the simulated AOD agrees well with the observations. The NMBs for Beijing and Taihu site are 5.4% and 17.8%, respectively. This demonstrated the ability of DUST_REVISED in capturing both the day-to-day variations of aerosols including dust particles.

Figure R4 presents the daily averaged AOD distributions derived from simulation and retrieved from MODIS during the dust event. The comparison shows that the simulated AOD can generally catch the spatial distribution of satellite observation over Eastern China.

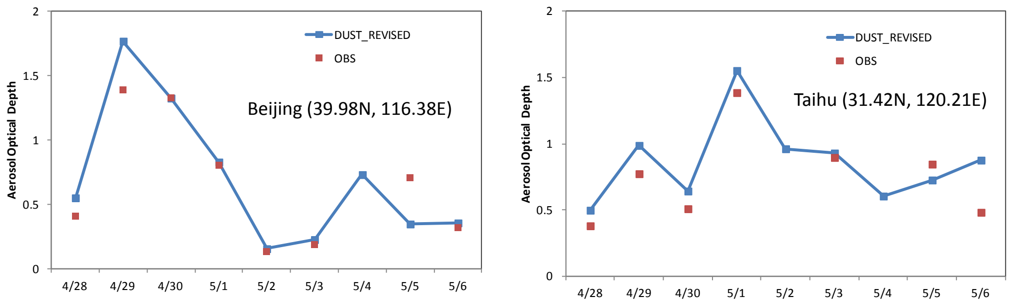
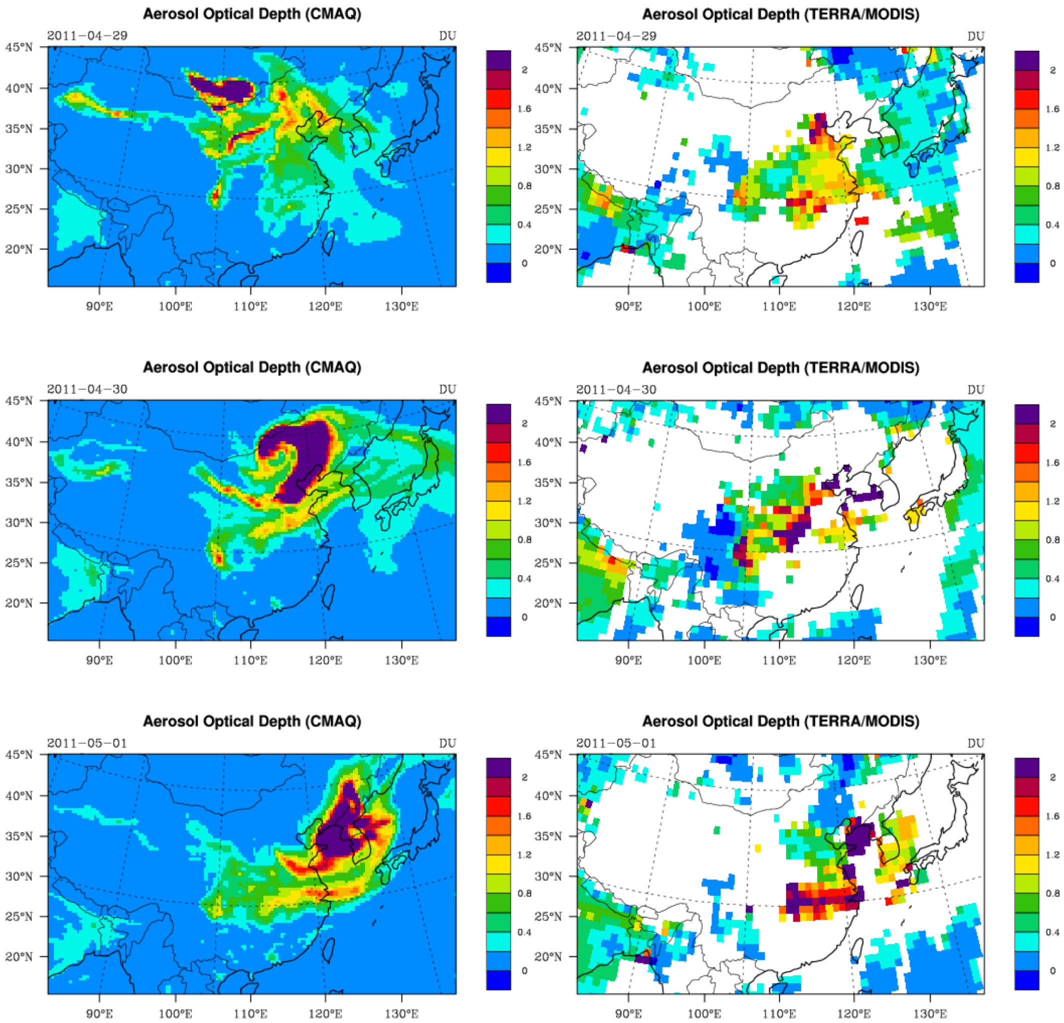


Fig.R3. Temporal variation of daily average AOD from DUST_REVISED and AERONET observations at two AERONET sites during 28 April to 6May



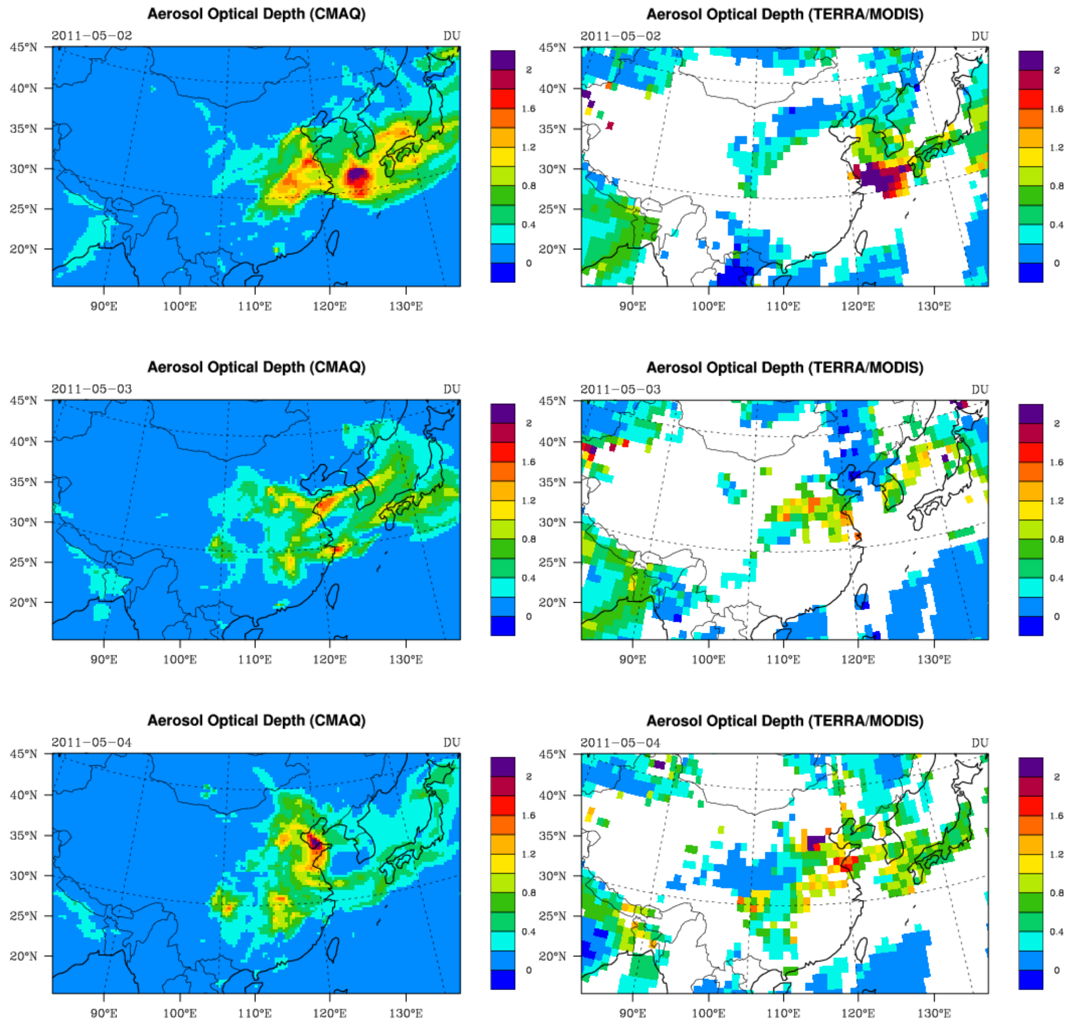


Fig.R4. Aerosol optical depth at 550 nm in 29 April to 4 May from model simulations (left) and from satellite measurements (right)

4. Section 4.6: The description of the dust impact on photochemistry is too short and needs more discussion, including links to previous studies in this field. As these effects are, of course, related to the radiative impact of mineral dust, the aerosol optical thickness(AOT)/extinction and direct radiative forcing have to be quantified first. How are dust radiative properties parameterized in the model? Could you explain in more detail, how the concentrations of OH, NO2, and O3 are related to each other, and which consequences the changes will have for atmospheric chemistry and air quality?

Response: Thank you for your suggestion. I have added detail discussion for this part and revised section 4.5 in the manuscript. The revisions are shown as follows:

"4.5Impacts of dust storm on optical/radiative variables and photochemistry

4.5.1 Impacts on AOD and radiation

Figure 10 presents the dust impact on aerosol optical depth (AOD) and irradiance averagely during 28 April to 6 May. The average contribution of dust on AOD in the whole China is 36.5%. The high values of contribution occurred near the source region, about 1.3DU (above 90%). The strong negative effects impacts on radiative forcing mainly concentrated over the source regions where heavy dust burden and large contribution to AOD from dust, about -30 to -20W/m^2 averagely. The relatively low values of irradiance change ranging from -20 to -10 W/m^2 could be found over North China Plain and China Sea. These values are similar with the previous study (Han et al., 2012). The hourly-average simulation results showed that in Shanghai, the largest perturbations of AOD and irradiance were about 0.8DU and -130 W/m^2, which could obviously influence the radiation balance in this region.

4.5.2 Impacts on photochemistry

(1) Photolysis rates

Dust particles have important effects on photolysis rates (Bian and Zender, 2003; Ying et al., 2011). Photolysis rates (min^{-1}), also called J-values, are computed for a chemical species *w* by (Philip, 2000)

$$J_w = \int_{\lambda_1}^{\lambda_2} F(\lambda)\sigma_i(\lambda)\Phi_i(\lambda)\,d\lambda$$

Where, $F(\lambda)$ is the actinic flux, $\sigma_i(\lambda)$ is the absorption cross section, $\Phi_i(\lambda)$ is the quantum yield, and λ is the wavelength. $\sigma_i(\lambda)$ and $\Phi_i(\lambda)$ are unique to reactions and species. But dust can affect the actinic flux through absorption and scattering.

An online photolysis module is incorporated in CMAQ 5.0, which allows the calculation of actinic fluxes and photolysis rates for every each grid at each time step based on the changes in particle concentrations (Binkowskiet al.2007). In this study, the impacts of dust on photolysis chemistry through their effects on the actinic flux are analyzed by comparing the results of DUST_REVISED with that of DUST_OFF.

There are two important photolysis rates affecting tropospheric ozone photochemistry, the NO_2 photolysis (J[NO2]) to form the ground state oxygen atom $O(^3P)$ and the O3 photolysis (J [$O_3(O^1D)$]) to form the electronically excited $O(^1D)$ atom (Li et al., 2011):

$$O_3 + hv \longrightarrow O_2 + O(^1D)$$

$$NO_2 + hv \longrightarrow NO + O(^3P)$$

As shown in **Fig.11**, the NO_2 photolysis (J[NO2]) and the O_3 photolysis (J [$O_3(O^1D)$]) as reduced by about 2.4% and 1.9% averagely in whole Domain 1 during 28 April to 6 May. The perturbations are mainly in dust source regions and along the dust transport path, which are similar with the distribution of irradiance changes.

Figure 12 shows the diurnal variation of the percentage change of J[NO2] and J[$O_3(O^1D)$] at Shanghai in the YRD region. The reduction of J[NO2] and J[$O_3(O^1D)$] due to dust is significant in the early morning of 2 May, nearly -40%. Besides the impacts of high dust concentration, it also indicated the effect of long aerosol optical path for incoming radiation when the solar zenith angle (SZA) is large in the morning

(Li et al., 2011).

(2) Concentrations of O_3 and OH

The photolysis frequencies of J [O_3 (O^1D)] and J [NO_2] play a key role in the formation of O_3 and OH in the troposphere through the following reactions:

$$NO_2 + hv \longrightarrow NO + O(^3P)$$

$$O(^3P) + O_2 + M \longrightarrow O_3 + M$$

$$O_3 + hv \longrightarrow O_2 + O(^1D)$$

$$O(^1D) + H_2O \longrightarrow 2OH$$

$$OH + VOCs + O_2 \longrightarrow RO_2$$

$$RO_2 + NO \longrightarrow RO + NO_2$$

The simulation results show that the surface O_3 concentrations reduced about 1.5% averagely for Domain 1 and the maximum reached 6 ppbv due to the dust storm. **Fig.13(a)** shows that the largest perturbations of O_3 occurred in a region including China Sea, eastern China and Korea. One major reason is that air mass with dust stayed in this region for two days (May 2-3, as shown in **Fig.8**) due to the high pressure control. The average decrease of OH was about 3.1% in whole Domain 1, resulting from the reductions in O (^{1}D) generated by ultraviolet photolysis of O_3 (Bian and Zender, 2003). As shown in **Fig.13(b)**, the reduction of OH concentrations is correlated with the spatial distribution of J[NO_2] reduction, due to the short chemical lifetime of OH. For the YRD region, because of the reduction of local generation and long transport, the O_3 and OH concentrations were decreased by 9.4% and 12.1% averagely. These values are comparable with that reported by Ying et al. (2011), in which the O_3 reduction in Mexico City could be 10ppbv and the reduction of OH was 5-20% during a dust event. The change of O_3 and OH level can further affect the formation of secondary aerosols in the atmosphere by changing the oxidation rate of their precursors. For example, nitrate particles and sulfate particles may decrease because of the less conversion of HNO_3 from NO_2 reaction with OH, and H_2SO_4 from SO_2 reaction with OH and O_3."

5. Section 5: This part rather summarizes the key points of the study than providing conclusions. The results should be more discussed in relation to previous findings in the literature and/or observations. Here, the work could be better put into the context of the special issue 'Atmospheric impacts of Eastern Asia megacities'. How do you judge the importance of this dust episode compared to others? What was the actual impact of the dust storm on the urban environment, air quality, and standard of living (human health, transportation) in these megacities? Which impact did the dust-related effects on photochemistry have on the life cycle of air pollutants?

Response: Thank you for your suggestions. As we explained in the responses to your general comments at the beginning, dust storm is one of the important sources of particulate matter pollution and haze in east China and the YRD. There are several papers in this special issue, including Huang et al. (2012) and Fu et al. (2012), addressing the impacts of dust on air pollution in the YRD. Our study is connected with those papers in this special issue. In some specific sections of the revised manuscript, we have added the discussions of our results in relation to previous findings in the literature. (see Page 12, Line 26-28; Page 13, Line 1-6; Page 14, Line 1-3; Page 16, Line 9-11)

Dust pollution occurred every year, but this dust event is one of the most serious ones in the YRD in recent years (Huang et al., 2012; Fu et al., 2009), during which the maximum PM_{10} concentration reached 1000μg/m^3. The dust particles in the downwind region are more harmful, because they can be carriers and reaction surfaces of many harmful species, such as fungal spores, microorganisms and anthropogenic pollutants including NO_X, VOC, and Pb during transport. The impacts are even more significant in such a high population-density region. So the analysis on this dust episode is important and this research is meaningful.

According to your suggestion, we made some revision and discussed more about the relative impacts of dust in the conclusion section. It was shown as follows:

"In this study, we analyzed a dust event in 2011 with the CMAQ5.0 coupled with an in-line windblown dust model. The threshold friction velocity for loose, fine-grained soil with low surface roughness in the dust model was revised according to Chinese monitoring data. The predictions of the model DUST-REVISED agreed well with the observations.

This dust storm broke out in Xinjiang and Mongolia during 28 to 30 April, 2011. Dust particles were transported a long distance and the impacts even spread to the YRD region. On 1 May, the PM_{10} concentration in the YRD region began to increase and the maximum reached 1000μg/m^3. The large amount of dust particles carrying fungal spores, microorganisms and anthropogenic pollutants during transport were a serious threat to public health. At such a high population-density region, the health loss can be large. The dust particles also had significant impacts on the optical/radiative characteristics by absorption and scattering. The visibility decreased to below 3km during the dust event, which is harmful to road transportation and flight. The hourly-average simulation results showed that in Shanghai, the largest perturbations of AOD and irradiance were about 0.8DU and -130 W/m^2, respectively. The decrease of actinic fluxes further impacts the photochemistry in this region. In Shanghai, the negative effects on the NO_2 and O_3 photolysis could be -35% when dust particles arrived. For the YRD region, because of the reduction of local generation and reduction of long range transport, the O_3 and OH concentrations are decreased by 9.4% and 12.1%. The change of O_3 and OH level can further affect the formation of secondary aerosols in the atmosphere by directly determines the oxidation rate of their precursors. For example, nitrate particles and sulfate particles may decrease because of the less conversion of HNO_3 from NO_2 reaction with OH, and H_2SO_4 from SO_2 reaction with OH and O_3.

The research about the dust pollution is an important work and modeling is a useful method. CMAQ is a wide-used air quality model and the revision of parameters for the dust emission model is meaningful for CMAQ application. Meanwhile, further studies, including more accurate particle size distributions of dust emissions, heterogeneous reactions on the surface of dust particles, the interaction between dust particle and meteorological parameters, shall be conducted to improve the understanding of dust impacts on air quality. The $PM_{2.5}/PM_{10}$ ratio for dust emission is a fixed value in the current model. But actually, it may be affected by soil texture, wind speed and so on. Secondly, the current CMAQ version does not consider about some important heterogeneous reactions on the surface of dust particles, such as SO_2, O_3, and H_2O_2, which might be an important contributor to the impacts of dust on pollutant concentration. More heterogeneous reactions shall be coupled into the model. Besides, we did not consider the effects though the feedbacks of dust on meteorology in this study. It is meaningful to consider this effect by running the two-way WRF-CMAQ system in the future."

6. References must be given for 'Chinese data' and 'American data'. The data sets should rather be named after the desert regions, to which they refer, using proper geographical terms.

Response: Chinese data is based on the measurement results of dust samples from the northern desert in China (Li et al., 2007). The American data is mainly based on the measurement results of dust samples from the Mojave Desert in America (Gillette et al., 1980). We have revised the relative description and references as follows (Page 7, line 10-14).

"The default value of $u'_{*ti,j}$ is based on the measurement results of dust samples from the Mojave Desert in America (Gillette et al., 1980) and the average value is 0.7, which is used in the simulation of DUST_DEFAULT. For the simulation DUST_REVISED, it was chosen as 0.3 based on the measurement results of dust samples from the northern desert in China (Li et al., 2007)."

7. Several times in the text, the phrase 'loose smooth surface' is used. Those land-surface conditions are better described as 'loose, fine-grained soil with low surface roughness'.

Response: Thank you for your suggestion. We have revised the description in the manuscript.

8. In the entire manuscript: Clearly state for which period and area deposition fluxes are given. Acronyms (e.g., page 5: ISORROPIA, SOA, POA; page 6: MEGAN; page9:NMB) have to be resolved.

Response: The deposition fluxes given in the manuscript are the average values for the YRD (Domain 3) during 1 to 6 May, which has been clarified in section 4.4 (Page 13, Line 11-14).We have resolved all the acronyms in the revised manuscript. SOA is the abbreviation of "secondary organic aerosol "; POA is the abbreviation of "primary organic aerosol"; MEGAN is the abbreviation of "Model of Emissions of Gases and Aerosols from Nature"; NMB is the abbreviation of "the Normalized Mean Bias". ISORROPIA is the name of an improved thermodynamic equilibrium aerosol model.

Specific Comments:

1. The information that the presence of dust causes a reduction invisibility to less than 3 km is only given in the abstract.

Response: We have added the description about visibility during the event in the section 2.1 of the revised manuscript (see Page 5, line 1-2). It was shown as follows:

"From 1 May of 2011, an obvious increase of the PM concentration in the YRD region was observed. The highest PM_{10} concentration reached over 1000μg/m^3 and the visibility decreased from above 10km to below 3km."

2. Page 5, Lines 16/17: I am not sure whether the details on all model levels are needed here, as the information is not used further in this article.

Response: Thank you for your comments. We have deleted the sentence.

3. Page 7, lines 14 – 16: The approach of separating dust into the size classes $PM_{2.5}$and PM_{10} by using a fixed ratio is very simplified, as of course the dust size distribution depends on soil texture and wind speed but also evolves during transport. Given the importance for this study, a more detailed discussion or better explanation is needed.

Response: Thank you for your comments. Here, the $PM_{2.5}$/PM_{10} ratio is only used for the dust emission in source regions. In the model, the particle size distribution actually evolves during the transport as well other processes, such as diffusion, deposition and so on. Of course, the emitted dust size distribution depends on soil texture and wind speed and a fixed ratio is indeed very simplified. We have to use this simplified parameter in this study because of limited literature data. Therefore, we have added the suggestion of further studies on the particle size distribution of dust emissions in the revised manuscript (see Page 17, line 15-17).

4. Page 10, lines 19/20: Here, observations should be used as reference for the location of dust storms, not the model.

Response: We have revised the sentence to "These possible locations of dust storms are in accordance with the satellite observations (http://www.temis.nl/airpollution/absaai/absaai-gome2a.php?year=2011&datatype=pics&freq=daily)". (Page 12, Line 1-4)

5. Page 10, lines 21 – 28: This part is not clear, please be more precise in describing how the dust distribution is related to the observed evolution of pressure, wind, and temperature.

Response: We have made some modification for this part, shown as follows:

"As shown in **Fig.6 (a)** and **Fig.6 (b)**, on 28 April, a cyclone was formed in the Mongolia, associating with a cold front in the rear part of the low-pressure system. Strong surface winds (8-14m/s) occurred in eastern Xinjiang and western Mongolia, generating a dust storm there. On 29 April, the low-pressure cyclone developed further and moved toward east to the middle-southern Mongolia (as shown in **Fig.6 (c)** and **(d)**). The strong horizontal wind flow and the vertical flow caused the uplifting of dusts in this region. These possible locations of dust storms are in accordance with the satellite observations (http://www.temis.nl/airpollution/absaai/absaai-gome2a.php?year=2011&datatype=pics&freq=daily). Due to the influence from the low pressure system, the high pressure associated with cold air arrived in the YRD region on 1 May (as shown in **Fig.6 (e)** and **(f)**). From 1 May, the pressure and wind speed began to increase, and the temperature began to decrease. As shown in **Fig.7**, the pressure in Shanghai increased from 1003.5mb on 1 May to 1016mb on 3 May, and the temperature decreased by 5-10 degree Celsius. When the upper-level trough was leading the approach of cold air from north to south, dust particles also arrived in the YRD and the PM_{10} concentration in Shanghai increased from 74μg/m^3 to 800μg/m^3 on 1 May (as shown in **Fig.2**). Controlled by high pressure, the wind became relatively light from the midday of 3 May, which is adverse to the dispersion of dust particles. The tail of the cold front passed over the YRD region at the end of 4 May. The temperature and wind speed began to increase, the pressure began to decrease. "

6. Page 14, lines 7 – 8: This sentence may give the wrong impression that implementing a new dust emission scheme is part of this study, which is not the case.

Response: Thank you for your suggestion and we have revised the sentence to "CMAQ is a wide-used air quality model and the revision of parameters for the dust emission model is meaningful for CMAQ application " (Page 17, Line 11-12)

7. Page 14, lines 8 – 13: The model performance, on the one hand, and the range of considered processes in a model on the other are two different things.

Response: Thank you for your suggestion and we have revised the sentence to "Meanwhile, further studies, including more accurate particle size distributions of dust emissions, heterogeneous reactions on the surface of dust particles, the interaction between dust particle and meteorological parameters, shall be conducted to improve the understanding of dust impacts on air quality." (Page 17, Line 12-15)

8. Figures 7 and 9: Please specify to which model level the concentration values and photolysis rates refer.

Response: They are both the values from in the surface layer. We have added this information to the captions for figures.

9. References: For Tong et al. (2012), please use the corresponding journal article in ACP. The order of references for Wang et al. needs to be checked.

Response: Thank you for your suggestion. We have revised the reference for Tong et al.(2012):

Tong, D. Q., Bowker, G. E., He, S., Byun, D. W., Mathur, R., Gillette, D. A.: Development of a Windblown Dust Module within the Community Multi-scale Air Quality (CMAQ) Model: Description and Preliminary Applications in the Continental United States, the Journal of Geophysical Research, 2011 (submitted)

Besides, we have check the order of references for Wang et al and it's shown as follows:

Wang, H., Zhang, X. Y., Gong, S. L., Chen, Y., Shi, G. Y., and Li, W.: Radiative feedback of dust aerosols on the East Asian dust storms, J. Geophys. Res.-Atmos., 115, D23214,10.1029/2009jd013430, 2010a.

Wang, K., Zhang, Y., Nenes, A., and Fountoukis, C.: Implementation of dust emission and chemistry into the Community Multiscale Air Quality modeling system and initial application to an Asian dust storm episode, Atmospheric Chemistry and Physics, 12, 10209-10237, 10.5194/acp-12-10209-2012, 2012a.

Wang, L. T., Jang, C., Zhang, Y., Wang, K., Zhang, Q., Streets, D., Fu, J., Lei, Y., Schreifels, J., He, K., Hao, J., Lam, Y.-F., Lin, J., Meskhidze, N., Voorhees, S., Evarts, D., and Phillips, S.: Assessment of air quality benefits from national air pollution control policies in China. Part I: Background, emission scenarios and evaluation of meteorological predictions, Atmospheric Environment, 44, 3442-3448, 10.1016/j.atmosenv.2010.05.051, 2010b.

Wang, L. T., Xu, J., Yang, J., Zhao, X., Wei, W., Cheng, D., Pan, X., and Su, J.: Understanding haze pollution over the southern Hebei area of China using the CMAQ model, Atmospheric Environment, 56, 69-79, 10.1016/j.atmosenv.2012.04.013, 2012b.

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