Atmos. Chem. Phys. Discuss., 11, C3005–C3008, 2011
www.atmos-chem-phys-discuss.net/11/C3005/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "The effects of a solar eclipse on photo-oxidants in different areas of China" *by* J.-B. Wu et al.

J.-B. Wu et al.

zifawang@mail.iap.ac.cn

Received and published: 9 May 2011

The authors thank the Referee #3 for reviewing this paper. The responses to each comment are as follow:

Comment 1: This work used wrf-chem to evaluate the effect of the 22 July 2009 on the surface photo-oxidants. The authors need to show how good are the wrf-chem results in simulating O3, NO, NO2, CO, etc. These comparisons are non-trivial, and they are very important to demonstrate how reliable is the model used in this study. Reply to comment 1: We agree with the Referee that the comparison between WRF-Chem and observation is very important. We compared the model simulations with the observation in downward solar radiation, temperature, ozone and nitrogen dioxide in some sites. The results showed that the Eclipse experiment can capture the main

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characteristics of the solar eclipse and its effects on atmospheric composition. In addition, we try to collect more observation in other cities in China to validate the model simulations. The scatter plot of O3 and NO2 in Beijing, Taiwan, Shanghai is showed in Fig. 1. Although the observation data is 1 hour resolution, the comparison between simulated and measured also reveals that the Eclipse experiment is reliable.

Fig. 1 Scatter plots of O3 (a) and NO2 (b) derived from measurement and simulation in Beijing, Taiwan and Shanghai. Comment 2: Given there are plenty of ambient monitoring stations in China, it should be straightforward in comparing and validating the model chemical and meteorological results with the ambient air measurements. Reply to comment 2: The solar eclipse in 22 July 2009 gives a rare opportunity to investigate how meteorological and photochemical processes respond to abrupt change of solar radiation. Therefore we conducted site measurement in Tongcheng and Hefei (located in the path of total solar eclipse) and archived high time resolution data. In addition as mentioned in response to comment 1, we try to collect some other observation data in China, such as data in Beijing, Taiwan, Shanghai. However, the resolution of these data (1 hour resolution) is too coarse to evaluate the Eclipse experiment in such abrupt period. Thus these comparisons are not suitable for this paper. But the comparison showed in these sites show that the model can reproduce the real atmospheric chemistry.

Comment 3: The photolysis rate calculations are not only used to calculate photolysis during the solar eclipse (see page 2478, lines 4-5 from the top), they are heavily used in the day-time chemistry calculations. Actually, due to this day-time fast photolysis rates, the photochemical reactions become very stiff than the night-time chemical calculations. Reply to comment 3: We agree with the Referee that the photolysis rates are also heavily used in the day-time chemistry calculations. Since the expression is not appropriate in Page 2478, line 4-5. We revised this sentence to “the Fast-J photolysis scheme (Wild et al., 2000; Barnard et al., 2004; Fast et al., 2006) was used to calculate photolysis rates”

ACPD

11, C3005–C3008, 2011

Comment 4: The selections of stations for comparisons made in Figures 2, 3, and 4 seem quite random. Solar radiations were compared in Hedo and Fukue; 2-m temperatures were compared in Beijing, Shenyang, Chongqing, Wuhan, Guangzhou, and Shenzhen; and O3 and NO2 were compared in Hefei and TOngcheng. Any reasons why these were selected? Reply to comment 4: The solar eclipse's umbral shadow first touched down in China at 00:56 UTC and left the mainland at 03:04 UTC, 2-hour occurring in China. High time resolution data is requested to investigate the responses of meteorology and atmospheric composition to the solar eclipse. Thus we conducted chemical measurement in Tongcheng and Hefei which locate in the path of total solar eclipse and archived high time resolution chemical data. In addition, since the solar eclipse cover a large range of area, the authors believe that it is better to validate the meteorological performance of the model in different percentage of sun's obscuration. Therefore, we collect 2-m temperatures data in 6 sites, in which two sites (Chongqing and Wuhan) lie in the path of the total solar eclipse, two sites (Beijing and Shenyang) lie 10 degrees north to the totality and two sites (Guangzhou and Shenzhen) lie 7 degrees north to the totality. We also collect high time resolution downward solar radiation data in Hedo and Fukue. With the validation in these sites which locate in and around China, we can have a better understanding that how good are the WRF-Chem results in meteorological and chemical simulations.

Comment 5: The differences shown in Figure 5 are hard to evaluate given no detailed information on the method used in producing these results. Reply to comment 5: We changed the caption of Figure 5 to: "The averaged differences of (a) temperature, (b) windspeed, (c) NO2, (d) CO, (e) O3, (f) NO between Eclipse and NoEclipse conditions in the WRF-Chem simulations, which are averaged over the time window of the eclipse 09:00-10:00 BJT (Beijing Time)."

Comment 6: I failed to find Figure 4 referred to in the text. Reply to comment 6: We have corrected it in the last paragraph in Page 2480.

ACPD

11, C3005–C3008, 2011

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/11/C3005/2011/acpd-11-C3005-2011-supplement.pdf

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Interactive comment on Atmos. Chem. Phys. Discuss., 11, 2473, 2011.