Letter of Responses

Response to Referee #2 (Acpd-10-C2098)

The paper by Wang et al. describes the variation of NMHCs in Beijing and discusses the effects of the control measures enacted for the 2008 Olympics. In general, this manuscript is clear and well written, and I recommend publication of this paper on ACP after revisions related to the following suggestions.

Reply: The authors would like to thank the Referee #2 for the careful review and helpful comments to our manuscript. We have prepared responses to each of the concerns and questions, which are listed below. The referee's comments are in *italics*, followed by the authors' responses.

1) More detailed information for the air sampling (e.g. sampling time of day, total sample number) at each site should be described.

Reply: Accepted. As stated in the revised manuscript, the samples were generally collected at 7:00, 9:00, 14:00, and 17:00 during the day, and the information has been added into section 2.2 (line 117-118). The total sample number has been stated in this section (line 120) and summarized in Table 1.

2) "Two criteria" for the data selection are unclear. The first criterion seems to be "wind speed below 2m/s and wind direction of 225–360 degree"? What does the second criterion, "the range of meteorological data in the Olympics", mean specifically?

Reply: Sorry for this confusion. Actually, there is a typo for wind directions, thanks for noting it. It is correct that the first criterion for data selection is wind speed below 2m/s and wind direction of 315–360 degree", and the reason for doing so was in the text of section 2.4. The second criterion was "using the range between 10% to 90% percentiles of temperature, relative humidity and pressure measured in August as a window (listed in Table 3 of the manuscript), the NMHC measurements in June, July and September with the three meteorological parameters falling within window, were used for further analysis, in order to minimize the meteorological influence". Accordingly, section 2.4 has also been updated in the revised manuscript.

3) Please state if the data in previous years in Beijing were chosen with the same criteria or not.

Reply: Yes, the data were chosen with the same criteria, and the statement has been added into the revised manuscript (section 3.1, page 10, line 248-249).

4) As pointed out by Referee 1, the comparison to NMHCs in other cities should not be useful, if they were not measured under similar conditions.

Reply: Yes, the authors agree with the reviewers, and we decided to remove this part from the manuscript together with the corresponding figure.

5) All the NMHCs data are shown only as their monthly averages, and it is difficult to have an idea about their day-to-day or diurnal variation. I recommend the authors should add a figure which shows the temporal variation of the whole data of a few selected hydrocarbons.

Reply: We agree that high time resolution information is important for the performance of NMHCs in the air. In fact the aim of this work was designed to reveal the variation of NMHCs during the 4 stages of the air quality control for 2008 Olympics. We consider that only 4 samples per day were not powerful enough to show the diurnal patterns. Actually, higher time resolution variations of NMHCs were also measured simultaneously by online methods at PKU site, e.g. by PTR-MS and online GC-MSD, and the day-to-day and/or diurnal variation of NMHCs will be presented in another paper. Therefore, we tend to present the day-to-day variation sampled by canisters at PKU site from this work as a reference in the supplement.

6) What time of day is assumed for the calculation of the contributions from major sources (Figure 5)? The biogenic contribution should be greatly changed by time of day.

Reply: It's very interesting to discuss this issue. In fact, we calculated the contributions by using data measured at 7:00, 9:00, 14:00, and 17:00 during the day. The authors agree with the reviewer that emissions from both anthropogenic and natural sources have diurnal patterns. As shown in the table below, our source apportionment results at PKU site show that biogenic contributions changed apparently by time of day. As the biogenic emitted species, e.g. isoprene, are highly reactive, the numbers in the table are the combined effect from emission and chemical losses.

We are sure that the CMB model calculation for biogenic emission contribution is far underestimated, due to fast chemical losses of isoprene from the source to receptor site. As in the reply to the comment (2) of the reviewer #1, we are trying to re-calculate the chemical losses, and perform better source apportionment for reactive species after a correction for their chemical processes. And the authors believe that we will have a better idea for the diurnal behavior of the biogenic emissions.

Table 1. Averaged biogenic contributions at 7:00, 9:00, 14:00, and 17:00 from June to September at PKU site (Unit: ppbv).

	June	July	August	September
7:00	0.21±0.05	0.42±0.07	0.29±0.07	0.17±0.06
9:00	0.19±0.06	0.78±0.12	0.65±0.11	0.58±0.10
14:00	0.27±0.06	0.40±0.07	0.30±0.11	0.32±0.05
17:00	0.21±0.06	0.55±0.09	0.27±0.06	0.25±0.08

Actually, this work aims at investigate the effectiveness of the air quality control measures based on the results of field measurement and source apportionment. Since the control measures spanned 4 durations from June to September, we used monthly averages as the basis for discussion. Therefore, Fig.5 of the manuscript presented the monthly averages of the CMB calculation.

7) I recommend the authors should compare the calculated total OFPs with the observed ozone data, if they are available.

Reply: It's a good suggestion. Since ozone was only measured at PKU site in this work, the authors present the comparison between calculated OFPs and the observed O_3 and Ox (O_3+NO_2) for this site, as an example. The table below shows the averaged mixing ratios of O_3, Ox and calculated OFPs from June to September. The linear correlation coefficients between the levels of OFPs and O_3 are generally lower than 0.32, showing a poor correlation between calculated OFPs and the observed ozone. These findings are quite similar with the results presented by a previous

study (Chang et al., 2005).
It was in fact quite reasonable for this correlation: The calculated OFPs present the maximum O_3 production under optimized conditions (Carter, 1994). It would be very nice to do the comparison between OFP and measure ozone at regional scale, to investigate the similarity and differences of spatial distribution of OFP and measured ozone, helping to reveal the regional ozone formation regimes (as we did in Pearl River Delta, see Zheng et al, 2009). However, it was hard to do the similar comparison with information from only several sites for such a purpose.

Table 2. The averaged mixing ratios of O_3, Ox and calculated OFPs in June, July, August, and September at PKU site (Unit: ppbv), and the linear correlation coefficients between daily maximums of OFPs and O_3 (R_1), and between daily maximums of OFPs and Ox (R_2).

	O_3	Ox	OFPs	R_1	R_2
June	68±30	81±28	218±73	0.24	0.39
July	68±27	79±27	176±71	0.32	0.39
August	58±31	66±31	104±59	0.25	0.44
September	52±32	64±32	148±66	0.17	0.36

8) typo error: In the caption of Figure 2(b), "propane" should be "propene".
Reply: Accepted, and the typo has been fixed.

References:
1: Carter, W.P.L.: Development of ozone reactivity scales for volatile organic compounds, J. Air Waste Manage. Assoc., 44, 881-899, 1994.
2: Chang, C.C., Chen, T.Y., Lin, C.Y., Yuan, C.S., and Liu, S.C.: Effects of reactive hydrocarbons on ozone formation in southern Taiwan. Atmos. Environ., 39 (16), 2867-2878, 2005.
3: Zheng, J.Y., Shao, M., Che, W.W., Zhang, L.J., Zhong, L.J., Zhang, Y.H., Streets, D.: Speciated VOC Emission Inventory and Spatial Patterns of Ozone Formation Potential in the Pearl River Delta, China, Environ. Sci. and Techno., 43, 8580–8586, 2009.