Atmos. Chem. Phys. Discuss.,
doi:10.5194/acp-2016-591-RC1, 2016

Atmospheric Chemistry and Physics Discussions
Open Access

Interactive comment on "Air Quality Improvement in a Megacity: Implications from 2015 Beijing Parade Blue Pollution-Control Actions" *by* Wen Xu et al.

Anonymous Referee #3

Received and published: 30 September 2016

Air pollution in China, especially the North China, has drawn the world's attention in recent years. The Chinese government is capable of applying stringent and intensive emission control over a short period, during which an important event was held in Beijing or other major cities. This usually resulted in remarkably clean sky during the event. These manmade "control experiments" provide good opportunities to disentangle the complicated impacts of anthropogenic emissions and meteorological conditions on air quality. There have been quite a few published studies on the emission control periods of the 2008 Olympics, the 2014 APEC, and the 2015 Beijing Parade. This study distinguishes itself by analyzing wide spread monitoring sites both in Beijing and nation-wide (measurement network of NO_2 and NH_3 in Beijing and three NCP background sites is certainly a plus) and using a GEOS-Chem model to quantify the relative contributions of emission reduction and favorable meteorological conditions to air quality improvement. Generally, this manuscript provides useful observation datasets and insightful analyses on the emission-control policy. I recommend this manuscript to be accepted by ACP if the following concerns can be addressed.

Major points:

1. At line 110, the authors stated that the previous studies did not systematically quantify the contribution of NH_3 from traffic sources to urban $PM_{2.5}$ and implied at they could address this question through their NH_3 observations. However, they only reported the concentration levels of NH_3 and stopped at the conclusion that on-road traffic is an important source of NH_3 in urban Beijing. It has long been demonstrated that on-road vehicles are major NH_3 sources for roadside sites. It is also obvious that reducing on-road vehicles during the emission control period will reduce NH_3 concentrations measured at these sites. It will require more analyses to extend from NH_3 concentrations measured at a few sites to $PM_{2.5}$ at the city scale. The authors brought up an important question about the linkage between NH_3 emission and $PM_{2.5}$ (which is one key reason why we care about NH_3), but did not really answer that. The authors should have the resources for further analyses, as the GEOS-Chem model can readily link the NH_3 emissions to $PM_{2.5}$.

2. Another innovative aspect of this study is characterizing the nonlinear response of pollutants to emission reduction (lines 111-112). The magnitude and spatial pattern of emission reductions are very important quantities, but they were assumed in a fairly arbitrary way (line 224). I think these assumptions need to be justified. In Fig. 13, one may argue that the response could be linear if the emission reductions are uncertain (say what assumed to be 5% reduction is really 10%). Are these emission reductions also used in GEOS-Chem simulation?

3. The third innovation is quantifying the relative roles of emission reduction and favorable meteorology in air quality improvement (lines 112-113). The conclusion about this topic was drawn from the GEOS-Chem simulation, but I found that there is very limited information about this vital part of the analysis. What were the simulation time period and spatial coverage? What anthropogenic emission inventories were used? How were the emissions reduced in the model when simulating the Parade blue period? How did the simulation results compare with the rich observation datasets presented in Section 3?

Minor points:

1. Lines 91-92 and line 97: Is “North China” equivalent to the geographical extension of these six provinces or parts of them? The air mass and meteorology in parts of Inner Mongolia could be very different from the North China Plain.
2. Lines 139-141: Are these two sites (27 and 28) inside or outside the tunnel? NO_2 concentration at site 27 seems extremely high for ambient measurements (Fig. 2 B). Is that because it is in the tunnel?
3. Lines 201-202: Why was post-parade blue period not included in this dataset?
4. Lines 258-260: It will be less confusing if the acronyms (SWR, SOI, SOB) are spelled out.
5. Line 289: Please define WSI.
6. Line 441-442: Beijing actually has large agricultural sources, and its dominant NH_3 sources are still agriculture, at least according to the inventories. To argue that traffic is indeed an important NH_3 in Beijing, the authors need to provide more evidence on the roles of traffic emissions on $PM_{2.5}$ and/or on human/ecosystem exposures. See the first major comment point.

7. Line 451: I want to bring it to the authors' attention that Chang et al. (2016) reported mileage-based NH_3 emission factor of 28 mg/km in Shanghai, one order of magnitude smaller than the emission factor used here. Note that one of the coauthors of this work is also on the author list of Change et al. (2016).

8. Lines 452-456: These numbers do not mean that much, just multiplying literature emission factor and activity data. If the traffic NH_3 emission was reduced by a half, can it explain the observed reduction in NH_3 concentrations? Did NH_3 emission reduction play any role in the $PM_{2.5}$ reduction?

9. Line 517: Why was Fig. 4 mentioned after Figs. 5–11?

10. Figure 2: Please define the meaning of "*" and "**" in the caption.

11. Figure 8: This figure is hard to read and seems redundant with Fig. 9 for the wind and pressure.

12. Table S1 caption: Information on the "thirty-one" monitoring sites?

Reference:

Chang, Y., Zou, Z., Deng, C., Huang, K., Collett, J. L., Lin, J. and Zhuang, G.: The importance of vehicle emissions as a source of atmospheric ammonia in the megacity of Shanghai, Atmos. Chem. Phys., 16(5), 3577–3594, doi:10.5194/acp-16-3577-2016, 2016.

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-591, 2016.