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Atmospheric Chemistry and Physics
Discussions

Interactive comment on "NO_x emission estimates during the 2014 Youth Olympic Games in Nanjing" *by* J. Ding et al.

Anonymous Referee #3

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The paper by Ding et al. presents independent evaluation of emission changes and regulation effects during the Nanjing Youth Olympic Games. It suggests the effectiveness of emission regulations in improving NOx air quality. The paper is within the scope of ACP. I have a few suggestions below.

One concern is the 1-month lag between derived emission reduction (in September) and the actual emission regulation (in August and prior). The lag has been attributed to the issue of Kalmar-based inversion and the lack of OMI data. While this may be the case, a more detailed analysis is needed. This is because the lifetime of NOx is short (several hours in summer), and thus there should not be any obvious lag (i.e., more than 1 day) between regulation and reduction. How many days are missing in August compared to other months (e.g., February, when there is no lag)? In addition,

all NOx-relevant emission regulations have been implemented by Aug 15, therefore it is not clear why emission reduction is not shown in August and previous months. In particular, Fig. 10 shows that June-August 2014 have higher emissions than June-August 2013, in contrast to the emission regulation starting from May 2014.

The authors make efforts to filter out aerosol-affected data. The criterion is based on NO2 comparison (OmF) rather than on the aerosol amount directly. There is a concern with this practical choice – whether a scene is filtered out or included depends on how "bad" the comparison is rather than depending on the underlined physical reasons (i.e., aerosols). As lots of "outliers" are filtered out, the criteria certainly affect the subsequent emission inversion. Is it possible to compare the chosen filter to an alternative filter where days with aerosols higher than some threshold are excluded? Are there high-aerosol days in the chosen days?

How many data are available for each month?

The OmF filter is based on absolute value rather than percentage value. Considering the seasonality in NO2, applying the filter means stronger filtering in summer and weaker filtering in winter. This will affect the derived emission seasonality. Please discuss.

The choice of asymmetric filtering could be better discussed. Line 24-27 of P6349 is not clear.

A looser cloud screening is used to include more OMI pixels. CRF > 50% means less than half of TOA radiance comes from 'clear-sky' portion of the pixel. The looser criterion may increase the data noise, which is especially relevant to the daily-based emission inversion. Some relevant figures and quantitative analysis would be welcome.

On the same issue – the 'back-of-the-envelop' calculation should be cautiously interpreted, as the lifetime of NOx could vary dramatically from one day to another, leading to large changes in NO2 VCD even with the same emissions.

The effect of Chinese Spring Festival has been studied by previous research on satellite NO2, so as the effects of lifetime versus emission on the seasonality of NO2. Please give more discussions on or comparisons with these relevant studies.

The model seems to exclude lightning emissions. Lightning emissions are very important in summer, especially considering the much increased sensitivity of OMI to aloft NO2. In addition, lightning emissions vary significantly from one year to another, and a climatological adjustment does not affect the interannual variability. Please discuss the implications of the lightning treatment on the emission inversion here.

Is 'biogenic' emission of NO the same as soil NOx? If not, does the model consider soil emissions that also peak in summer?

How is the model error treated?

The choice of Eobs in Eq. 1 needs more justification. Also, what is the unit of Csat, Eobs and Esat?

The paper cites H. Zhang et al. (2009) for explanation of the large emission seasonality. What is the quantitative result from Zhang et al. and is their result comparable to here?

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 6337, 2015.