

## ***Interactive comment on “Cleaning up the air: Effectiveness of air quality policy for SO<sub>2</sub> and NO<sub>x</sub> emissions in China” by Ronald J. van der A et al.***

**Anonymous Referee #2**

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The authors present a study of temporal trends of NO<sub>2</sub> and SO<sub>2</sub> derived from satellite observations over China, and relate them directly to changes in fossil fuel consumption in order to investigate the effectiveness of environmental regulations. While the former has been done in several studies before, the latter is to my knowledge new and provides an interesting approach. The study thus matches the scope of ACP and should generally be published.

However, the provided material is rather sparse (in particular as the introduction let the reader expect to see an analysis on provincial level, which is not given), and the results for NO<sub>x</sub> are not convincing; the authors try to interpret some local maxima by some reason, but I see no consistent explanation for the whole, rather complex, temporal

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pattern.

Thus, the study needs major revisions, in particular for NO<sub>x</sub>, providing additional information which either substantiates the discussion of trends or let the authors be more cautious with their statement about NO<sub>x</sub> concentrations being 30% higher without regulations.

Major concerns:

- Provincial levels The authors point out that it is great to have improved NO<sub>2</sub> and SO<sub>2</sub> datasets on high spatial resolution, which allow the analysis of time series on provincial level. Thus, the authors should indeed investigate the trends of SO<sub>2</sub>, NO<sub>x</sub>, fossil fuel, and ratios on provincial levels, which probably will provide valuable further information and help to understand/assess the NO<sub>x</sub>-per-fuel trend (see below).

- Annual vs. semi-annual means: For SO<sub>2</sub>, only April-September is considered "due to a lower accuracy at higher latitudes" (3.2) For NO<sub>2</sub>, information on the kind of averaging is missing in 3.3, but later it is stated that total annual emissions are used (3.4). Why? The lower accuracy and snow/ice argument holds as well for NO<sub>2</sub>. As the trends for both SO<sub>2</sub> and NO<sub>2</sub> are compared to fossil fuel and to each other, the period for calculating means has to be consistent. In any case, the authors should also provide the "winter"-trend for SO<sub>2</sub>, despite the lower accuracy. Is it similar (with higher noise) or significantly different from Fig. 3?

- NO<sub>x</sub> regulations Almost no information is provided about the concrete NO<sub>x</sub> regulations. Please discuss the different possibilities in general, and the taken measures in detail, for reducing NO<sub>x</sub> over China, and provide a table similar as for SO<sub>2</sub>. From what I learned from the media, there were different measures taken during the Olympic games, like shutting off power plants nearby and building new ones more remotely (which would change the local, but not the total trends, underlining the need for investigations on provincial levels), or reduction of traffic (which would affect the NO<sub>x</sub>, but not the NO<sub>x</sub> per fuel). These (and other) different measures and their effect on NO<sub>x</sub> vs.

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NOx per fuel trends have to be discussed.

- NOx per fossil fuel While the SO<sub>2</sub> per fuel significantly decreases over the years, in accordance to regulations, the situation is less clear for NOx. The authors state that already 2008 the regulations worked out (explaining the 2009 minimum). But why is NOx per fuel increasing again (by 20%!) in the following years? Have the measures been cancelled? The attempt to explain Fig. 6 by shipping is pure speculation, as it is not supported by any data. The conclusion that NO<sub>2</sub> would be 30% higher today without the measures taken is not convincing unless the decline in 2015 compared to the high plateau 2011-2014 is explained; or were all measures concerning NOx just taken in 2015? In any case, the 30% is overestimated as it compares the minimum to the maximum of the timeseries, completely ignoring statistical fluctuations.

Minor comments:

Page 1 Line 13: What does "spatially consistent" mean?

Page 1 Line 25: The factor of 3 for SO<sub>2</sub> is different from the statement in 3.4, and not supported by the presented data.

Page 1 Line 31: "concentrations" should be "column densities"

Page 2 Line 11: Please provide the full name of "He K."

Page 3 Line 2: Add a reference to Liu et al., 2016: <http://www.atmos-chem-phys.net/16/5283/2016/>

Page 3 Line 12: Please provide some information how and how far the new retrieval improves the quality of SO<sub>2</sub>.

Page 5 Line 15: NO<sub>2</sub> changes during the Olympic games (or during the Shanghai Expo) have been discussed before; please add references.

Page 6 Line 25: "by definition not sensitive": This is a too strong statement which only holds under the assumption that CHIMERE is doing everything right within the DESCO

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algorithm.

Page 7 Line 6: There is no "Fig. 5b".

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Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-445, 2016.

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