Atmos. Chem. Phys. Discuss., 15, C13318–C13321, 2016
www.atmos-chem-phys-discuss.net/15/C13318/2016/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Rapid growth in nitrogen dioxide pollution over Western China, 2005–2013" *by* Y.-Z. Cui et al.

Y.-Z. Cui et al.

linjt@pku.edu.cn

Received and published: 25 March 2016

This manuscript, titled "Rapid growth in nitrogen dioxide pollution over Western China, 2005-2013" by Cui et al. is an interesting work, analyzing the recent NOx emission trend over Western China using OMI observations. The paper is clearly written, except for a few noted word choices, and is well-suited for publication to ACP. However, there are several concerns that should be addressed carefully before being accepted for publication.

We thank the reviewer for comments, which have been incorporated into the revised manuscript.

Major comments:

1. The reliability of the wavelet decomposition analysis. This method is highlighted for being independent of prior assumptions. But the decomposition number is determined by the authors. How is the decomposition number selected? Is there any criteria? Will the estimated trend change if the decomposition number changes?

Please see our response to Reviewer 1 (major comment 2) for details. In particular, the decomposition is done through an iterative process, which stops when the period of the last approximation component (A5 in this study) is longer than the length of the dataset (116 months here). This criterion is typically used in investigating the long-term trend of a time series. Also, the A5-based trends are consistent with the linear trends calculated based on the original time series.

2. The reliability of subtracting "background". As far as I understand, the results will not change significantly without subtracting the background. If so, why bother?

We have re-structured Sect. 3 to better clarify why and how we treat the "background" values. Please see the new Sect. 3.2 for more detailed discussion of "background" values. In particular, the new Sect. 3.2 states that "To obtain the sole anthropogenic NO2, we further subtracted all NO2 VCDs by certain "background" values representing the natural influences. Removing the "background" influences is meaningful for Western China where the NO2 VCDs are currently not at an extremely high level (see Sect. 4.2.1)." As shown in our response to Reviewer 1 (major comment 1), Table R1 compares the trends with and without subtracting the "background" values. The two methods lead to similar results. In general, trends (%/yr relative to 2005) are enhanced when the "background" values are removed, especially for the northwestern provinces. This information is summarized in Sect. 4.2.1.

3. 34918, L6: OMI NO2 is used to scale base-year emissions and further drives model simulations. What's the uncertainty of this assumptions? Will it be the major contributor to the agreement between OMI observations and model simulations?

As already discussed in the original manuscript, uncertainties may rise from the non-

ACPD
15, C13318–C13321, 2016

linear relation between emissions and VCDs. We agree that scaling model anthropogenic emissions based on OMI NO2 trends will lead to model NO2 trends broadly consistent with OMI trends, if natural sources and meteorological conditions are not changed drastically. Therefore, in the new Sect. 4.2.1, we have added an additional model sensitivity simulation and associated discussion to confirm that anthropogenic emissions are the dominant factor of OMI NO2 trends: "To further confirm that anthropogenic emissions are the main driver of the observed NO2 trends, we conducted an additional model simulation for 2012 where anthropogenic emissions are fixed at the 2005 levels (while natural emissions and meteorology correspond to the 2012 levels). We contrasted the model NO2 change from 2005 to 2012 in this case to the standard case that has included year-specific anthropogenic emissions. Table 3 shows that inclusion of anthropogenic emission changes from 2005 to 2012 leads to large changes in model NO2, and keeping anthropogenic emissions unchanged leads to much reduced changes in NO2. The NO2 growth reduces from 85.8% to 6.9% averaged over the northwestern provinces and from 46.8% to -6.3% over Southwestern China."

Specific comments:

1. 34914, L12: Consider different word use than "provincial regions". Modified as "provincial-level regions".

2. 34916, L5: Please cite some literatures associated with emission inventories directly. We have added a citation.

3. 34917, L9: Please check "30%+0.7*10ËĘ15". Modified as "On a regional and monthly mean basis, the overall error of retrieved VCDs is about 30% (a relative error) plus 0.7$\times$1015 molecules cm-2 (an absolute error)".

4. 34920, L9: The conclusion is similar with that in van der A et al. (2006). Some discussion about his work is recommended. In addition, Fig 2a is not quite straightforward. Please consider a new form. The discussion and reference is added. We have further improved the explanations of Fig. 2a.

ACPD
15, C13318–C13321, 2016

5. 34929, L18: What does “Qianghai province” refer to? Modified as “Qinghai Province”.

6. Figure 4: Please add the meaning of the red and blue lines in the scatterplot. 7. Modified. In the scatterplot, the red line represents a linear fit, and the blue line is the 1:1 line.

Figure 6: The font size is too small to read. Modified.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 34913, 2015.