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Atmospheric Chemistry and Physics Discussions

Interactive comment on "NO_2 pollution over India observed from space – the impact of rapid economic growth, and a recent decline" *by* Andreas Hilboll et al.

Anonymous Referee #3

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Hilboll et al. presents an analysis of NO2 pollution changes over different regions of India and their socioeconomic drivers, by combining multiple satellite products and official socioeconomic data. I have a few suggestions as follows.

Multiple satellite products are used. Although some consistency is found in trend results (Fig. 1 and Fig. S1), there are clear quantitative differences among these products, especially after 2012. For example, the trend of OMI NO2 is clearly different from those in GOME2-a and GOME2-b (for all regions in Fig. 1 except North Indian Plain). For North Indian Plain, the OMI trend (Fig.1) is different from the DOMINO NO2 trend in Fig. S1. The large uncertainties in these satellite datasets make it difficult to conduct further linkage to socioeconomics. Is it possible to focus the analysis on regions

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that multiple satellite products show quantitatively consistent trends? What are the uncertainties in trends from individual products considering retrieval and representative errors?

The NO2 growth rates are quantitatively significantly different from those in socioeconomic data, often by a factor of 10 (Table 1). It appears that chemistry, meteorology and/or other factors play major roles here. Can these factors be better accounted for in linking NO2 trends to emission trends? How are the roles of chemistry/meteorology in NO2 trends over India compared to the roles over other countries?

A statistical model is used to calculate the NO2 trends. Please discuss the model here briefly. Also, the model does not account for shift in seasonality when the pollution grew, which is important for fast changing pollution regions. Please discuss the caveat of this model.

Many regions are discussed here. A map defining all these regions will be extremely helpful for a general reader to understand the analyses.

The explanations in the last three paragraphs of Sect. 3.1 could be further improved. North Indian Plain also have large emissions from non-traffic sources such as power generation and industry. Can other factors be ruled out? The explanation for Chhattisgarh, Jharkand and Odisha is focused on power generation, how about other factors? Also, it is not clear why and how the monsoon signal is clear for South India but not for other regions. Can the changes over these regions be also found in OMI NO2 data? Overall, a region-specific analysis of major socioeconomic factors before discussing the causes of NO2 trends in these regions will much help the causation analysis.

The OMI NO2 data should be analyzed more intensively (e.g., in Figs 3,5,6 and Table 1), given its long temporal coverage (2004-present), different time of day (to help discuss the role of chemistry), and a higher resolution (to help reveal the hotspots). Comparing OMI with morning-time instruments will also help reveal the satellite uncertainty.

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Fig.1 and S1 – starting the y-axis from a higher value (e.g., 15) than zero will help visualize the NO2 changes.

Fig. 3 – can you show results from OMI and quantitatively compare to GOME-2 results?

Fig. 6 – NO2 was flat (or even declined) from 2008 to 2011 while electricity and GSDP grew clearly. Why? How about the OMI NO2 data?

Table 1 – how about the NO2 trends from OMI?

Sect. 3.4 – where are the numbers (3e14 – 24e14 molec cm-2) from?

Conclusion – "This may imply that changes in meteorology or up to now not understood changes in tropospheric chemistry are also of significance." – given the uncertainty (especially after 2012), similar sentences addressing the roles of non-emission factors should be highlighted in the abstract.

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