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Interactive comment on “Trends in OMI NO₂ observations over the US: effects of emission control technology and the economic recession”

by A. R. Russell et al.

Anonymous Referee #2

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The paper "Trends in OMI NO₂ observations over the US" by Russell et al. analyses a 7-year dataset of satellite observations of NO₂ with respect to trends and weekly patterns. The authors find different trends before, during, and after the economic recession, and deduce the reduction of mobile and non-mobile sources separately from the weekday vs. weekend trends. The study is appropriate for publication in ACP. The analysis is sound, and the paper is well written.

I recommend publication after dealing with the comments below.

- The conclusions drawn are sometimes too optimistic - e.g. concluding that "the economic recession had a significant impact on NO_x emissions" is a too strong statement

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given the actual annual changes of $-6 \pm 5\%$ yr $^{-1}$ before the recession and $-8 \pm 5\%$ yr $^{-1}$ during the recession. The change of both slopes is far lower than the respective uncertainties.

- Given the big advantage of satellite measurements, I don't see why the trends are only shown for selected locations. The authors should provide maps of the relative and absolute trends. These maps might replace Fig. 1, as "NO₂ in the Central US was anomalously high in 2011", i.e. the informative value of Fig. 1 is limited. Also the area affected by the NO₂ increase, and its absolute values, would be more informative than the current Fig. 7.

- The increase in remote regions is interesting, but could not be explained satisfactorily in the paper. Concerning this aspect:

- a) Is there any evidence for increasing NO_x from ground-based monitoring stations?
- b) The authors skipped the cross-track rows affected by the row anomaly (RA) completely from their analysis (i.e. also for the years before it appeared), to avoid artefacts in the derived trends. However, as far as I am aware, this was not done for the NASA stratospheric estimation algorithm; while for 2005, the complete swath was used to derive the stratospheric pattern, the last years of the considered period are either affected by the RA itself (if included), or by the exclusion of the affected pixels, which are distributed quite asymmetric along the swath. Thus, the RA could definitely result in a trend of the stratospheric correction - probably too small to affect the signal over urban hotspots, but perhaps the explanation for the observed positive trend in background levels. This hypothesis could be tested by e.g. comparing monthly mean total slant columns in 2005-2006 for the complete swath vs. the reduced swath used for the current analysis.
- c) The positive trend should be presented and discussed in absolute numbers rather than in relative changes, given the very low tropospheric column densities over the remote areas.

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- Some figures have to be revised. In Fig. 1, the unit is missing. Figures 2 and 4 are very small, labels are hardly readable.

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Interactive comment on *Atmos. Chem. Phys. Discuss.*, 12, 15419, 2012.

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