

Interactive comment on “Multi-satellite sensor study on precipitation-induced emission pulses of NO_x from soils in semi-arid ecosystems” by J. Zörner et al.

Anonymous Referee #2

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General comments

The authors have conducted an in depth analysis of soil NO_x emission responses to rain events preceded by a dry period. This is a significant analysis in that it was done at the global scale with high resolution, both spatially and temporally. The authors also conducted an in depth and satisfying evaluation of the factors that can lead to errors in using a top-down approach for estimating soil NO_x fluxes, including lightning, fire, meteorology, transport, cloud cover and AMF corrections etc.

While I have few criticisms of the analysis itself I do have trouble understanding how this analysis significantly enhances our understanding of global soil NO_x emissions. Synthesis and interpretation of the results were unsatisfying. For example, there is

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a confusing amount of time spent on correcting for background emissions following a pulse event. What is the purpose of this? Is it to advance modeling efforts? If so, there needs to be some direct connection of the results to modeling or at least a proposed way in which to use these results to inform modeling.

One of the unique and valuable aspects of the analysis is spatial resolution at the global scale however the authors focus much of the paper on a single event in the Sahel, a phenomenon many other papers have already focused on. The conclusion section does not even mention the global analysis except to say that it was done and confirm that semi-arid regions of the world are likely to have soil NO_x pulses. The significance of these pulse emissions at the global scale should be quantified and more clearly presented in order to show their significance within the global NO_x budget and how it has advanced our understanding of the global NO_x budget.

Also, within the Sahel analysis, it is again not clear how the results enhance our understanding of soil NO_x pulses in the Sahel beyond which we already know.

Overall, I have few criticisms of the analysis itself, just of the interpretation and presentation of the data.

Specific comments

On page 3 line 19, it is stated that soil NO_x pulses are only enhanced for 1-3 days post precipitation, however other studies have shown pulses to last much longer, up to 25 days. (See Oikawa et al. Unusually high soil nitrogen oxide emissions influence air quality in a high temperature agricultural region, Nature Communications 2015)

Pg 6 line 17, Authors state only minor effects resulting from uncertainty in precipitation events across 3 data products. However it would be preferable to quantify that uncertainty or at least state the maximum and average amount of deviation there is across the data products for different regions. Appendix A shows only 1 example.

Pg.7 line 20. Please provide at least a discussion of the error associated with land

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cover data sets.

Line 19 Pg 11–The authors refer to error caused by AMF several times however never indicate any quantification of that error, or suggest references that have investigated error in data products such as in OMI. After filtering for cloud cover, for example, what amount of error is expected to remain?

On pgs 14-15 there is a large discussion of whether enhanced VCD's are the result of precipitation on Day 0 vs precipitation generally being enhanced following that first rain event, aka seasonal changes. For example, the authors state "However, it still needs to be clarified whether the enhanced NO₂ VCDs after Day0 are induced by the initial precipitation on Day0 or by continuous precipitation during the following days." But it is not clear to the reader why this distinction is important.

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