

Interactive comment on “Satellite evidence of substantial rain-induced soil emissions of ammonia across the Sahel” by Jonathan E. Hickman et al.

Anonymous Referee #1

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This manuscript examines pulses of NH₃ observed by the IASI-A instrument on MetOp-A over the Sahel. These pulses occur at the start of the rainy season and appear to correspond to increased biochemical activity in soils induced by rainfall. The paper is well written, the analysis is clear, and the results are very interesting. My main concern is that the timing of the enhancements in OMI NO₂ (May-June), IASI NH₃ (March-April), and surface NH₃ (May-June) appear to be different. I elaborate on this below.

The timing of the NH₃ peaks seems to be different than those of NO₂. Several studies (for example Jaeglé et al., 2004; Hudman et al., 2012) have examined satellite NO₂

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pulses over the Sahel, finding that the pulses take place sometime in May-June, corresponding to the arrival of the first rains after the dry season over various regions of the Sahel. Figure 2, shows the same pattern of the largest OMI NO₂ enhancement taking place in June. For NH₃, the authors focus mostly on March and April. Some discussion of why the timing would be different in terms of pulses of NO₂ and NH₃ would be useful to include in the manuscript (for example in section 3.2.3 discussing the co-emissions of NH₃ and NO₂). Does it have to do with different population dynamics of the various bacteria and their response to subsequent wetting events? Interestingly, Figure 3 shows that surface observations do indicate maximum NH₃ mixing ratios in May-June (at least for sites b, c, f), consistent with the OMI NO₂ pulses. Why would surface observations of NH₃ show a different seasonality than the satellite observations of NH₃? Is the increasing cloud cover affecting the number and quality of the retrievals in May-June? Is the later June NH₃ pulse masked by clouds?

Minor comments. - Throughout the manuscript (including the abstract). The authors refer to NO₂ as ‘nitric dioxide’. It should be nitrogen dioxide.

- Equation 1. It isn’t clear how this is used for low concentrations. Does the equation mean that even if the error is above 100%, if the concentrations are low enough then the retrievals are kept? Also, it would be useful to have units after 5×10^{15} (I assume it is molec/cm²)

- Equation 3. There is an extra space before the τ_x (effective lifetime), also, x should be subscripted.

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