

Interactive comment on “An evaluation of IASI-NH₃ with ground-based FTIR measurements” by E. Dammers et al.

Anonymous Referee #1

Received and published: 12 April 2016

The manuscript by Dammers et al. describes the result of comparisons between ground-based solar absorption FTIR and space-borne mid-infrared nadir observations of NH₃ total column amounts. Due to its importance reaching from air-quality to climate change issues, high-quality measurements of ammonia with global coverage are significant contributions for our understanding of relevant processes and the improvement of models. The current manuscript provides one of the first steps in better understanding the quality of space-borne NH₃ datasets on a global scale. Due to its large variability such a comparison is complicated and puts high demands on selection of co-incidence criteria – a point which is well captured by the authors. Beyond the quantitative analysis, various reasons for the (mostly) underestimation of NH₃ total column amounts by the satellite sensor are discussed which might lead to optimization of the satellite retrieval algorithms. One slight drawback of the paper is that the IASI retrieval approach

C1

used here for the comparison is fast, and unfortunately, does not deliver all means, like averaging kernels, for more in-depth analysis. Thus, I would have liked to see also comparisons to IASI results from other NH₃ retrieval schemes. Still, after tackling some of the issues below, I support publication in ACP.

L42: ‘give a MRD of $-32.4 \pm (56.3) \%$, ... These results indicate that the IASI-NH₃ product performs better than previous upper bound estimates (-50% - +100%).’

Really better? But $-32.4\%-56.3\% < -50\%$.

L160: ‘We excluded stations which have only retrieved or are believed to have, NH₃ total columns smaller than...’

However, those cases are also interesting to check for any overestimation of NH₃ columns in the IASI dataset (many of the enhancements seen in Figure 1 in remote areas might be artefacts.)

L246: ‘To account for the topography we only used observations which have at maximum an altitude difference of 300 m between the location of the FTIR and the IASI pixel position.’

But this criterion does not allow to exclude all cases where there is a mountain between FTIR and IASI measurement but still FTIR and IASI are at the same altitude. It should be extended also to the ‘way’ between FTIR and IASI position. Can you exclude such a case?

L253:

Please give the information whether the temporal criterion restricts the comparison dataset to the cases of daytime IASI measurements.

L275:

Please specify the source of the skin temperature together with its uncertainty.

C2

L300:

To apply this method seems a bit strange since the satellite profile retrieval is not vertically resolved at all, but the FTIRs are. One should test how much the results change in case this method is not applied. Further, it should be possible to calculate a typical averaging kernel of the IASI retrievals by theoretical simulations.

L407: 'successful comparison'

It is not clear what 'successful' should mean here. Try to be more specific.

L462ff.: possible explanation for the negative bias of satellite data.

Don't one expect an underestimation of total columns from satellite mid-IR observations especially for gases with maxima very near to the surface due to the small thermal contrast there? The FTIR instruments, however, observe the entire columns. This difference would be included in case correct satellite averaging kernels could be used. This should be discussed more in detail.

Fig. 6 and general:

Both datasets, FTIR and satellite ones, seem to exclude negative values. Is this correct? If yes, how is it achieved (log-retrieval?) and should this not have an effect on the comparison for low column amounts?

Technical:

L30-32:

the term 'observations' appears 4 times, try to reformulate

L180 and throughout the manuscript:

'60km' -> '60 km' blank between unit and number

Table 1 caption: 'The topography described the typography of the region'

C3

Please correct.

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-141, 2016.

C4