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Atmospheric Chemistry and Physics Discussions

Interactive comment on "An evaluation of IASI-NH_3 with ground-based FTIR measurements" *by* E. Dammers et al.

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We would like to thank Referee #1 for his/her time, constructive and helpful comments, edits and suggestions.

L42: 'give a MRD of -32.4 ± (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%. The sentence did not entirely reflect the meaning. Former estimates were made on an expert guess basis/ comparison with ground observations. The new estimate is the first which is fully based on column measurements and a better estimate of the performance of the product.

Line 42 changed to: These results give an improved estimate of the IASI-NH3 product performance compared to the previous upper bound estimates (-50% - +100%).

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.)

We agree on this with the reviewer. However because of time restriction we chose to focus on this set of stations. Also we excluded high altitude stations located in regions with large variations of altitude, i.e. Jungfraujoch/Maido. The remaining possible stations/sites are mostly located in the arctic or Antarctic regions and not of direct interest to this study. All observations shown in Figure 1 were used as input in the comparison.

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?

This is already the case, changed line 246 to: To account for the topography we only used observations which have at maximum an altitude difference of 300 m (in) between the location of the FTIR and the IASI pixel position.

L253: Please give the information whether the temporal criterion restricts the comparison dataset to the cases of daytime IASI measurements.

Only daytime measurements were used in this study, nighttime observations can be compared but the number of coinciding observations is very low due to the small number of nighttime observations (only during summers is the sun still high enough during the late evening ∼local time 21.30). See line nr 128, where it was mentioned that we use the morning overpasses only.

L275: Please specify the source of the skin temperature together with its uncertainty.

Source is the IASI L2 temperature profiles,

Added Line 276: The Tskin temperatures are obtained from the IASI L2 temperature profiles which have an uncertainty of $\sim$2 K at the surface (August et al., 2012).

Added reference: August, T., Klaes, D., Schlüssel, P., Hultberg, T., Crapeau, M., Arriaga, A., O'Carroll, A., Coppens, D., Munro, R. and Calbet, X.: IASI on Metop-A: Operational Level 2 retrievals after five years in orbit, J. Quant. Spectrosc. Radiat. Transf., 113(11), 1340–1371, doi:10.1016/j.jqsrt.2012.02.028, 2012.

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. The effects are minor for most sites except for the stations with a large number of the IASI "sea" profile retrieved observations, i.e. for Wollongong and St. Denis. Typical averaging kernel; a typical averaging could be calculated, but the discussion remains to be about what is to be "typical". Something more applicable would be multiple "typical" AVK cases depending on terrain/climate classes. Either way this would introduce more uncertainty instead of dealing/solving the current ones.

L407: 'successful comparison' It is not clear what 'successful' should mean here. Try to be more specific. Removed the word "successful"

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.

This is true, however the exact effect cannot be estimated due to the variability of the

sensitivity from observation to observation. A short section has been added to the discussion; from Line 491 onward:

Fourth, the negative bias of the satellite observations can be expected by the lack of sensitivity to concentrations near the surface. This is of course where the ammonia concentrations usually peak. The FTIR observations however do fully observe the lower layers in the troposphere thus causing a discrepancy. Normally one can correct for this using the averaging kernel of the satellite observations. However, the IASI-NH3 retrieval does not produce an averaging kernel meaning it is not possible to calculate the exact effect. The use of a typical averaging kernel will cause more uncertainty as there is a large day to day variability in the averaging kernels as earlier retrievals showed (Clarisse et al., 2009).

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? The IASI-NH3 retrieval does not retrieve negative total columns following the current retrieval procedure. In case of the FTIR retrieval it is possible to get negative values but due to the retrieval restrictions/settings/procedure it is uncommon. For the "per" station comparison a selection was made, as described in the manuscript, to only use the positive values, in principle this indeed effects the comparison for low column amounts and something like an outlier trim function would be more valid.

Figure 5. Shifted the x- and y- limits to better show the negative values Figure 6. Added greyed values to show the selected and not selected values.

Technical: L30-32: the term 'observations' appears 4 times, try to reformulate Changed Line 30-32; Line 30: daily observations to (bi-) daily overpasses. Line 31: surface observations to surface measurements.

L180 and throughout the manuscript: '60km' -> '60 km' blank between unit and number Added a blank space to " km " in lines: L151, L182,L185, L359, L498, table 2, caption

figure 3, figure 4, figure 5, figure 6 and figure A1. Table 1 caption: 'The topography described the typography of the region' Please correct. Changed part of Table 1 caption to: The topography describes the geography of the region surrounding the site.

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