Interactive comment on "Global distributions and trends of atmospheric ammonia (NH_3) from IASI satellite observations" by M. Van Damme et al.

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Received and published: 9 December 2013

Dear Karen Cady-Pereira,

Thank you very much for your comments and questions. Below we provide a point-by-point answer (in blue).

This is an very clear and interesting paper, with some very nice results. I do have some questions on the retrieval scheme and results I hope the authors will be willing to address.
1. Is the Jacobian in equation 2 obtained from perturbing one representative profile? Doesn't the choice of this profile affect the results? How about the thermal contrast chosen to calculate K?

Yes this is correct. For the calculation of the Jacobian in eq 2, a standard atmosphere was used with a medium thermal contrast. In this way the contribution function G depends on both the ammonia profile and the thermal contrast. However these two dependencies are taken into account when the HRI are converted to columns using the look-up-tables. These were built using the same G function but for variable thermal contrast and two different profiles (land or sea).

2. The HRI approach is simple and powerful, but I would think it requires large quantities of data to average in order to produce the quality of the results shown here. Our experience with the Walker et al. (2011) approach is that it is sensitive to the back-ground profile chosen to obtain K and to some extent to the surface emissivity. Can you comment?

The HRI value is indeed dependent on the background profile (especially the thermal contrast, which depends on the surface emissivity). As we have explained above, this main dependency is taken into account using the LUT conversion. Other dependencies (such as possible dependence on the water vapour column) are also taken into account as the LUTs were built using a large set of different atmospheric conditions.

3. I may have missed the definition, but it is not clear what "sigma" is at the bottom of page 24311.

Sigma corresponds to the error on the value of HRI, which is defined here as the standard deviation calculated above an area without NH_3 (where HRI should be equal to 0).

4. Do you have any ideas of the source of the high NH3 values Greenland and Antarctica in Figure 6? Similar high values occasionally show up in the TES data also; we have eliminated these by requiring the surface temperature to be above 278K for a valid retrieval.

To remove those observations with very large uncertainties we exclude measurement with a surface temperature below 263.15K (which is explained p. 24312 but with a mistake on the

threshold, we have changed it in the text). But, the remaining data above Greenland and Antarctica still have a large estimated uncertainty (>100%).

Having said that, bird colonies are known to be responsible for NH_3 emission in those areas. Bird colonies account for some of the most concentrated natural sources of NH3 (For more details, see Riddick et al., Atm. Env. 2013 and Theobald et al., Atm. Env. 2013). Note also that in these areas large negative thermal contrast is not uncommon. In those conditions, pollutants are trapped in the atmosphere and this can lead to build up of surface concentrations of ammonia

References

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- Theobald, M. R.; Crittenden, P. D.; Tang, Y. S. & Sutton, M. A.
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Interactive comment on Atmos. Chem. Phys. Discuss., 13, 24301, 2013.