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Interactive comment on "Version 2 of the IASI NH$_3$ neural network retrieval algorithm; near-real time and reanalysed datasets" *by* Martin Van Damme et al.

Anonymous Referee #1

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REFEREE COMMENTS on

'Version 2 of the IASI NH3 neural network retrieval algorithm; near-real time and re-analysed datasets' by van Damme et al.

SUMMMARY

The paper describes updates to an operational near-real time neural network algorithm to retrieve NH3 from IASI measurements, as well as an alternative product based on ECMWF reanalyses which produces a more stable long-term dataset. This follows on from an earlier publication in JGR (Whitburn et al, 2016) which gave a detailed description of the original algorithm, including some validation.

The paper itself seems more of an appendix to the the original paper, which is unfortunately in a different journal (JGR, although apparently open access) and might therefore have made more sense if this paper was also submitted to JGR rather than AMT. However, since this paper describes the algorithms used to generate a publicly available dataset, it should be published somewhere.

GENERAL COMMENTS

1) I understand the authors not wishing simply to repeat much of what was written in the original paper, however I feel just a few extra lines describing atmospheric NH3, the IASI instrument and the concepts of HRI and the neural network approach, as part of the introduction, would help make the paper stand alone as an independent publication (especially given the change of journal). On the other hand, the algorithm changes themselves are actually quite well explained and I didn't feel the need to read the original paper to understand those parts.

2) Despite reading the original paper, I'm still somewhat confused as to what the 'error' associated with the NH3 product is supposed to represent (which also arises from the point made on p7 L14). As I understand it there are two possible contributions. Firstly, there is the propagation of the instrument noise and various systematic error terms through the covariance matrix in the HRI component. Secondly there is the residual error from the neural network fit (for example, as shown in Fig 1), which may, or may not, be represented as an error in the scaling factor f.

3) As well as the maps in Fig 2 and Fig 3 it would be useful to have extra panels showing, for the common locations, a scatter plot of the differences between the retrievals in question. Also, relating to point 2, whether such differences can be explained in terms of the associated errors assigned to the product (bearing in mind that many such error components will cancel out when changing just the algorithm rather than the measurements). Section 3 contains a fairly lengthy qualitative discussion on how changes in the input data (surface and air temperature) lead to expected changes in sign in the

retrieved NH3, but it seems this could quite easily be quantified via linear error propagation of the mean difference profiles shown in Fig 4 through the HRI and application of the neural network for the associated scaling factor.

SPECIFIC COMMENTS

a) P5 L4: It would be useful to have a list of these 20 input parameters.

b) P5 L11: Of course, if the simulated spectra fail to take account of the proper treatment of surface reflections at high angles of incidence then there will always be an issue with real data at such angles. Could this be part of the problem? Certainly high angles seem to problematic for all retrievals, not just a neural-network problem.

c) P5 L14: by 'cosine of the viewing angle' I suspect you mean 'secant of the zenith angle' - the viewing angle, as measured from the satellite, generally relating less well to air mass than the zenith angle as measured on the ground once the earth's curvature is taken into consideration.

d) P7 L14: Even unweighted averages can be skewed by outliers. Have you considered simply recommending using a median value instead?

f) P7 L27: Is there some simple way to demonstrate these discontinuities in the time series (eg a plot of the median value over a large area) and, equally, the resulting 'improvement' from using reanalysis data?

TECHNICAL CORRECTIONS

P4 Eq 1: f not defined.

P6 L7: 'built' rather than 'build'.

P6 L22: 'third criterion' rather than 'third criteria'.

P7 L16: 'retrieval algorithms' rather than 'retrieval algorithm'.

P7 L19: (pedantically) 'data were' rather than 'data was'.

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