

We are very grateful to the reviewer for the positive assessment of the manuscript, valuable comments and helpful suggestions. All comments have, where possible, been addressed or answered. Replies are inline in blue.

RC1: 'Comment on amt-2023-48', Anonymous Referee #1, 26 Jun 2023

The authors have presented version 4 of the IASI NH₃ product. In this version, they introduced total columns averaging kernels. With the averaging kernels, the IASI NH₃ can be easier to be compared with model simulations and can be better implemented for the NH₃ assimilations in the models. The improvement of HRI calculations makes the product more robust across the different IASI instruments. The manuscript is clearly written and well-structured and will be of interest to scientists using the IASI NH₃ observations. I therefore recommend publishing this manuscript in AMT after addressing some minor comments below.

Minor comments:

L55: eq (1) and (2) are used to calculate the HRI and estimate true NH₃ total column. According to the context, I guess that mean spectrum includes the NH₃ background column B. Are they related? Maybe a short sentence to describe the relation between mean L and background B?

This is correct. A short sentence has now been added to clarify that the background B corresponds to the mean NH₃ in mean L.

L75-77: eq (4). Can you explain a little bit more on why you introduce the filter? After applying the filter, all low values will be removed and when averaging the product over a period, this will introduce a positive bias, which will affect a trend analysis of the NH₃.

In fact, the filter does not preferentially remove low values: it removes observations for which the scaling factor is smaller than a certain threshold, irrespective of the amount of NH₃ (as the scaling factor is the ratio between HRI and column). Small scaling factors correspond to situations where there is little or no measurement sensitivity.

L164: revise 'take care off' to 'take care of'

This has been corrected.

L281 you have mentioned 'N' here. This is the first time you introduced 'N'. I guess this is the normalization factor. Please specify it. Figure 3 shows the AVK normalization factors. Please mention that this is the 'N' variable in the caption.

This has been added and clarified (also in the caption).

L395 what do you mean by a larger here? Can you give a clearer explanation here?

We meant "more general" instead of larger. It is more general, as the network is trained for a larger set of vertical profiles. We removed the word "larger" now.

Figure 8. Can you also add a sub-figure to show the difference of the two versions? It will be easier to see the distribution of the difference.

A subfigure has now been added with the difference.

Section 6.2 presented the intercomparison between ANNI v4 and results of an optimal estimation approach. Authors shows the consistency of both retrieval approaches. After reading the section, I am wondering why use the NN method instead of the optimal estimation approach? Maybe add some discussion about it.

The NN method approach has numerous advantages over the optimal estimation approach (the most straightforward one is computational efficiency, but there are several others). These are discussed and summarized in section 7 in Whitburn et al. (2016). As section 6.2 in the current paper is mainly meant to exclude the existence of biases, we did not want to discuss (dis)advantages of either approach here. However, in view of your comment, we have now added a sentence referring to Whitburn et al. (2016).