Dear referee,

Please find below your comments (blue font) and our responses (black font).

General comments

The paper by Schneider and Hase elaborates a new retrieval method of HDO/H2O abundances using the IASI instrument and they perform a rigorous validation exercise using ground-based FTS data as wel as radiosonde measurements. Agreeing with the 1st reviewer, I don't see any real need for changes in the analysis and my comments are mostly technical and should be straightforward to implement.

Specific comments

Page 16108, line 23: Better to add specific references here (not just list them at the end of the introduction). There are a few papers by Risi et al as well as a recent JGR paper (in press) by Kei Yoshimura, all of which should be cited as they directly concern interpretation of satellite data.

RESPONSE:
Ok, we will better specify the individual references and also add the submitted but still not published JGR papers of Risi et al. and Yoshimura et al.

Page 16110, line 2: Add TES and IASI resolutions here, otherwise it is unclear by how much they are different. You can oppose the two instruments: TES: good spectral resolution but bad coverage when compared to IASI. Further, it sounds awkward here to say : "it is very likely..." . The whole paper is about showing that you can, so just state that.

RESPONSE:
(1) Ok, the spectral resolution is 0.1 cm-1 for TES and 0.5 cm-1 for IASI.
(2) We will state that we will show that IASI can measure delD.

Line 21: Explain acronyms the first time they appear. Is Schneider and Hase 2009a an RTM reference?

RESPONSE:
PROFFIT is "Profile Fit" and PRFFWD is the "PROFFIT Forward Model". We will explain this in the paper.

Page 16112, line 19: Is this a typical IASI spectrum in Figure 1 (or one with high SNR, low SNR?)? It would be good to add the SNR estimate , residual wrt to SNR (as stated by reviewer 1) and ideally to also plot the HDO and H2O Jacobians in the figure as sub-panels so that one can see the regions of sensitivity.

RESPONSE:
It is a typical IASI spectrum for a typical cloud-free observation over the subtropical ocean. As we have already stated in the response to referee # 1 we will create a multi-panel figure showing the measured and simulated radiances in one panel, the residual in a second panel, and very likely the Jacobians of H2O and HDO in a third panel.

Page 16117, Spectroscopic uncertainties: Do you account for self-broadening (as H2O-H2O broadening is almost 5 times higher than H2O-air broadening)? Errors (or neglect of) in self-broadening may be quite crucial as this bias would depend on the H2O VMR in the end and propagate into the interpretation of results (e.g. when looking at the Rayleigh-curve relationship).

RESPONSE:
Yes, in the applied spectral region the self-broadening parameters are about 4-5 times larger than the air broadening parameters. However, even for very humid conditions there are only 2% of water molecules (H2O VMR of 20 000 ppm = 2%) and an error in the self broadening parameters is of secondary importance compared to errors in the air-broadening parameters.

Line 25: Dot after importance

RESPONSE:
Ok.

Page 16121, line 24: Nice is a rather qualitative statement. Do you mean "best" or do you mean nice because this is a region of special interest (or a mix of the two)?

RESPONSE:
We will replace “nice” by “good”.

Page 16122, convolution of EUM data: Convolving EUM profiles with the PROFFIT AKs only yields same characteristics as PROFFIT if the EUM AKs are very narrow. Otherwise, it is a double convolution. In principle, you would need to find the convolution function with which you get PROFFIT AKs when convolving EUM AKs. Did you test for this? It may be only a very small effect.

RESPONSE:
EUM AVKs are not very narrow but they are clearly narrower than our AVKs. Thereby the mentioned double convolution should be a minor effect. However, we did not estimate the magnitude of this effect.
Nevertheless, we thought about your suggestion and we are not sure if it is feasible. Even if feasible, realizing your suggestion is more difficult than it looks at a first sight:

(1) We believe that your proposal for finding a convolution function that will exactly produce PROFFIT AVKs when applied on EUM AVKs is mathematically not feasible. The reason is that the EUMETSAT and the PROFFIT retrieval do not use the exactly same spectral region of the IASI spectra. So the two retrievals apply different measurements and the space spanned by the PROFFIT AVKs is generally not a subspace of the space spanned by the EUM AVKs. In other words: even though the EUM AVKs are narrower than the PROFFIT AVKs, there might be a subspace of the PROFFIT AVKs that is not accessible for the EUM AVK.
Comparing products from different retrieval algorithms (or data from different remote sensors) always has its limitations, which cannot be fully overcome. A possibility would be to document the limitations of a EUM-PROFFIT comparison the way we do for the ground-based FTIR-IASI comparison (Eq. (9) and Figure 12). However, we don’t think that such discussion is necessary here, since the EUM and the PROFFIT data agree very well, even though our approach introduces additional uncertainties into the comparison.

(2) Even though both retrievals used exactly the same measured spectral bins we are not sure if we can find such convolution function:
We would need to find a matrix A that solves the following equation:
$AVK_{prf} = A * AVK_{eum}$
That is:
$A = AVK_{prf} * AVK_{eum}^{-1}$
However, AVK_{eum} is a singular matrix!
For its inversion we could apply a singular value decomposition ($AVK_{eum} = U * D * V'$) and consider only the leading values of D. However; isn't this also an approximation? We are not sure if this approximation is better than our approximation by using a "double convolution". We think that further theoretical work would be required to clear this issue.

Summary: You suggestion is an interesting idea, but we are not sure if it is feasible. In any case it can not be done in straight forward manner and needs further thoughts and developments. We think that this is outside of the scope of our paper.

Many thanks to the referee for the interesting and fruitful discussion!

Best regards,
Frank and Matthias