Dear Editor,
Dear Authors,

This is a well written paper and I strongly support its publication in AMT without further delay after addressing a few minor issues as described in the following.
I also attach a version the manuscript where I inserted some of my comments in more detail.

The authors would like to thank Matthias Schneider for his complete review and his comments. We modified the content as recommended.
A detailed point by point reply (in blue) is provided hereafter.

Page 11058 (Review on different space-based isotopologue observations):
This is nice to have, but I would prefer to be a bit more careful and not put your delD data in the same category as the delD data obtained, for instance, by Herbin et al. (2009) or from SCIAMCHY and GOSAT (Frankenberg et al. 2013; Bösch et al., 2013). Your IASI retrieval, the MUSICA IASI retrieval, and the TES retrievals are very close to actual retrievals of delD (in the optimal estimation sense) and they use a fixed apriori (at least your retrieval and the MUSICA retrieval, for TES I also think so, but please check).

This is in contrast to the other approaches. There H2O and HDO are retrieved and then aposteriori the delD value is calculate from the retrieved H2O and HDO data. A so-obtained delD value depends on the differences between the H2O and HDO averaging kernels. This differences are changing (depend on the actual measurement situation, e.g., varying humidity). This is important for nadir looking satellites (for limb scanning instruments it is probably less importanté). Furthermore some of those retrievals work with strongly varying aprioris and it is not sure what information of the delD product comes from the measurement and what is already there in the apriori assumption.

Maybe a good solution is to talk about your delD data (as well as the MUSICA IASI and TES data) as ñretrieved delDò data and for the other data products avoid the term retrieved and just say ñdelD data are presentedò, ñgive delD dataò, or something similar.

These comments are very interesting and we agree. We changed the paragraph (in bold, see as below). Note that we kept the TANSO-FTS name as you wrote in the pdf since it is the name of the instrument onboard the GOSAT platform even if we agree with your comment):

ñIn recent years the improvement in instrumental performances allowed to measure the water vapor isotopic signal from the measurements acquired by spaceborne instruments with the Infrared Atmospheric Sounding Interferometer (IASI) among them. Herbin et al. (2009) showed first the possibility to detect ŭD with IASI and they analyzed the distribution during a typhoon event over South-East Asia. **In their work, they retrieved separately HDO and $H_2^{16}O$, and then calculated the ŭD values according to the Eq. (1) as done in numerous studies.** Schneider and Hase (2011) performed a validation work over Tenerife and Lacour et al. (2012) presented results for the 3-6 km distribution, **both presenting a ŭD retrieval.**
Prior to IASI, the Interferometric Monitor for Greenhouse gases (IMG) (Zakharov et al., 2004; Herbin et al., 2007) and the Tropospheric Emission Spectrometer (TES) provided quasi-global distributions of ŭD representative of the mid-troposphere (e.g. Worden et al., 2006; 2007) whereas the SCanning Imaging Absorption spectrometer for Atmospheric CartograpHY (SCIAMACHY) instrument provided total column distributions, with

sensitivity down to the boundary layer (Frankenberg et al., 2009). Both TES and SCIAMACHY distributions required significant time averaging to reach the global scale, which puts a limit on what can be expected for monitoring short-term variability of water. The Thermal And Near infrared Sensor for carbon Observation - Fourier Transform Spectrometer (TANSO-FTS) (e.g. Boesch et al., 2013; Frankenberg et al., 2013) can also be used to derive the ŭD total column distribution, and the Atmospheric Chemistry Experiment - Fourier Transform Spectrometer (ACE-FTS) gave information on the ŭD variability in the Tropical Tropopause Layer (Nassar et al., 2007) **but as for TES and SCIAMACHY, their global coverage is still limited compared to IASI. The TES retrieval is relatively similar to the IASI ŭD retrieval, using a fixed a priori as well, while the other mission provided ŭD data based on separated HDO and $H_2^{16}O$ retrievals.ò**

Top of page 11061, bottom of page 11063

I would be happy to see here a very brief description/discussion of differences between your retrieval and the MUSICA IASI retrieval (Schneider and Hase, 2011; Wiegele et al., 2014).

We added this information at the end of the section ñ3.2 Particularity of the ŭD retrieval: the HDO/H_2O correlated approachò:

ñCompared to the IASI/MUSICA retrieval approach (Schneider and Hase, 2011; Wiegele et al., 2014), a smaller spectral range is used to lower contamination with interfering species and the temperature profiles are not adjusted. Instead, we use the EUMETSAT L2 retrieved temperature profile for each IASI field of view (Lacour et al., 2012).ò

Fig. 6, Aôôhd kernel:

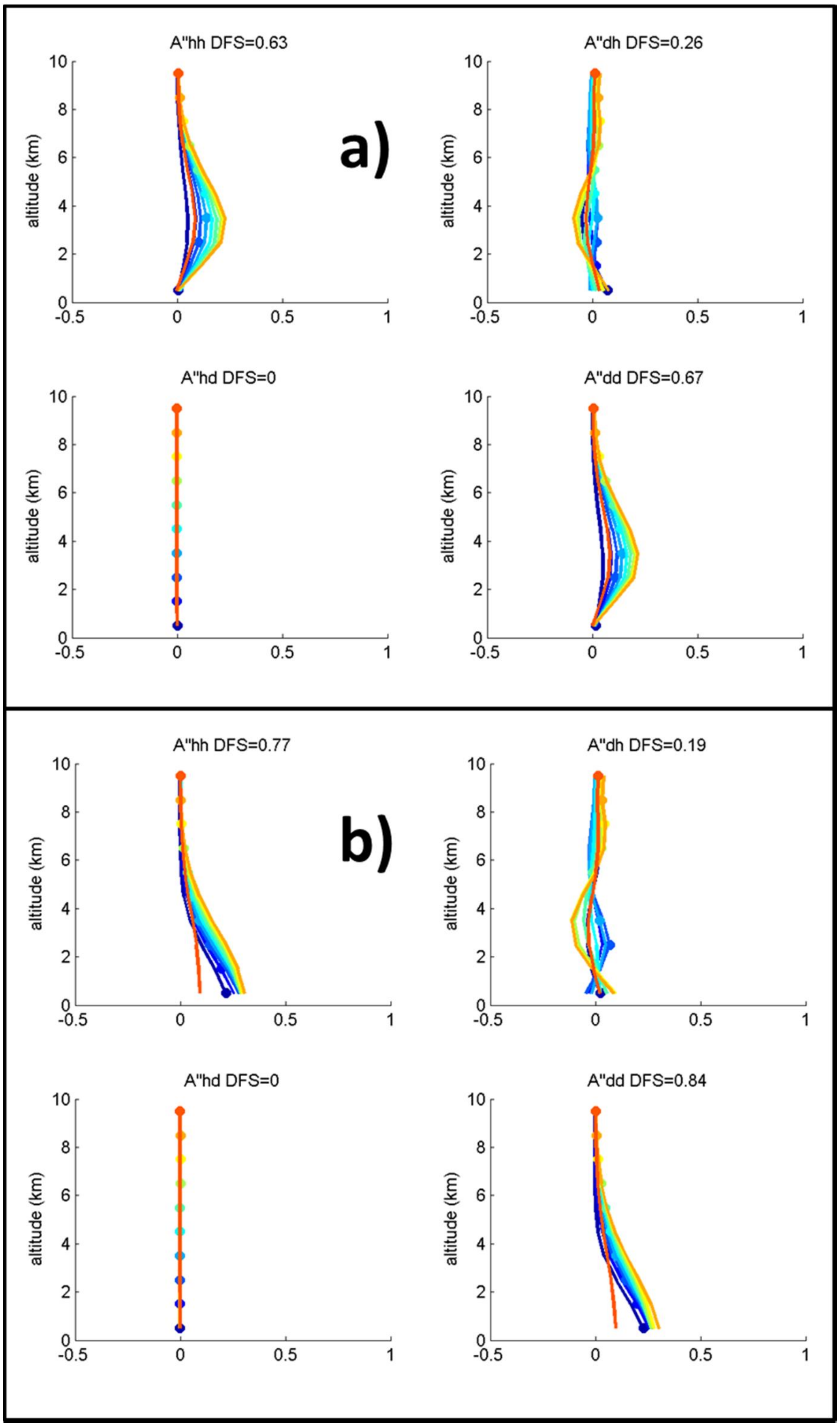
Did you consider that (ln[H2O]+ln[HDO])/2 or (H2O) variability is more than one order of magnitude larger than the ln[HDO]-ln[H2O] (or delD) variability? Or did you just plot the Aôô values? This needs to be explained/discussed. In Schneider et al. (2012) and Wiegel et al. (2014) we multiply these Aôôhd values by 12.5 in order to make the Aôôhd kernel adequately comparable to the Aôôdd kernel.

I ask this because your Aôôhd values are extremely low if compared to the MUSICA products (Schneider et al., 2012; Wiegele et al., 2014).

It is a good point. Previously, for this Figure, we have just plotted the Aôô.

Please be aware that our Ahd correspond to your Aih.

If we use your scaling factors (0.08 for Aôô$_{hd}$ and 12.5 for Aôô$_{dh}$), we get these graphs (for |φT|<4K on the top and |φT|>8K on the bottom):



Now, we present this Fig. as the Fig.6. We also add (in bold) this comment in the text:

ñThe final result of this procedure named Aôô(Schneider al. 2012) is shown on Fig. 6 for each compound (Aôô$_{hh}$, Aôô$_{dd}$, Aôô$_{hd}$, Aôô$_{dh}$) and for both thermal conditions, low (Fig. 6a) and high (Fig 6b) |φT|. **As explained in Schneider et al. (2012), the kernels Aôô$_{hd}$, Aôô$_{dh}$ are scaled by a factor of 0.08 and 12.5 respectively.**ò

Comparison between Fig. 6a and b:
This comparison is really nice and interesting and again clearly documents the great importance to have these Aôô kernels in order to understand the product. Thermal contrast is only one parameter that influences the kernels. Another is the vertical distribution of water vapour (or the temperature profile).
In extreme cases, like very humid air at surface and much drier air above you very likely have also a maximum sensitivity shifted towards lower altitudes.

Page 11068, line 12:
You should give the formulae you actually use for calculating your errors (you do NOT work with your Equations 13-15!). I suggest citing here the Equation Numbers of Schneider et al. (2012) you are referring to.

We added this information in the text as below:
ñFollowing the technique described by Schneider et al. (2012), we can determine directly the ŭD errors **(see their Eq (16) to (19) and we also apply the operators P of their Eq (6) and C of their Eq (14) on $S_{measurement}$ as: C P $S_{measurement}$ P^T C^T).**ò

LMDZiso ï IASI comparison according to your Eqs. (16) and (17):
Here you do not consider the cross dependencies Aôôhd and Aôôdh.
Actually I think this is a good idea, because of ñaddingò the cross dependency to the smoothed you should consider them as a kind of error. They will then become visible in the comparison between LMDZiso and IASI.

We added an explanation as below:
ñThe terms $Aôô_{hd}$ and $Aôô_{dh}$ are not used since they can be seen as errors. Their use would introduce additional errors on the comparison with the model.ò

Additional reference:
Wiegele et al. (2014):
A. Wiegele, M. Schneider, F. Hase, S. Barthlott, O. E. García, E. Sepúlveda, Y. González, T. Blumenstock, S. Dohe, M. Gisi, and R. Kohlhepp: ñThe MUSICA MetOp/IASI H2O and delD products: characterization and long-term comparison to NDACC/FTIR dataò, accepted for AMTD.

Added

Other comments on your pdf enclosed

Abstract:
As recommended, the sentence ñThe satellite measurements reproduce well the seasonal and day-to-day variations for ***ŭ***D, showing for the latter a good correlation with the model (*r* up to 0.8 with the smoothed data in summer).ò was changed by:
ñThe satellite measurements and the model agree well and they reproduce well the seasonal and day-to-day variations for ŭD, presenting a good correlation (r up to 0.8 with the smoothed data in summer).ò

p11057

ñé still challenging to retrieve from spaceò changed by ñé still challenging to retrieve from **remote sensing observations**ò

p11067

I prefer to keep the name DFS instead of DOFS.

This notation is also often used, e.g. see:

Decadal record of satellite carbon monoxide observations

H. M. Worden, M. N. Deeter, C. Frankenberg, M. George, F. Nichitiu, J. Worden, I. Aben, K. W. Bowman, C. Clerbaux, P. F. Coheur, A. T. J. de Laat, R. Detweiler, J. R. Drummond, D. P. Edwards, J. C. Gille, D. Hurtmans, M. Luo, S. Martínez-Alonso, S. Massie, G. Pfister, and J. X. Warner, Atmos. Chem. Phys., 13, 837-850, 2013