Atmospheric
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Discussions

Interactive comment on "Empirical validation and proof of added value of MUSICA's tropospheric δD remote sensing products" *by* M. Schneider et al.

Anonymous Referee #2

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The manuscript of Schneider at al. presents a validation of ground-based FTIR observations and space-based IASI observations of the isotopic ratio of water vapour against well-calibrated aircraft profile observations near Tenerife and they present an assessment of the random and systematic uncertainties. They also present a demonstration of the potential value of such remote-sensing data by comparing anomalies of the H_2O-deltaD curves observed from remote sensing to those from aircraft and ground-based in–situ sensors.

The manuscript presents a first attempt of absolute validation of remote sensing products of deltaD and it is overall sound and the methods are described in detail. Also, the demonstration that remote-sensing observations of deltaD can add value is convincing. One issue might be that the paper promises more then it delivers in terms of valida-

tion. The validation exercise is based on a single location with a very small number of data points (6 for FTIR validation and 13 for IASI validation) and indeed later-on in the manuscript these critical limitations are mentioned (p. 6935). I would suggest that the title (include the location in the title), the introduction and the summary need to reflect these limitations.

Since the focus is on Tenerife, it would be good to know why this location has been chooses. How representative is this site, how does it relate to the global water cycle and to which extend will the results be meaningful for any other location (e.g. all IASI comparisons are over ocean and observations over land can behave differently). Also, I think that the small number of data points is a serious limitation and I do not believe that a standard deviation from an ensemble of 6 members will be a robust description of the random error.

The large discrepancies between the theoretical estimates of the random error and the observed scatter between the FTIR and the aircraft profiles raises the question about the useful or validity of the method to assess the random error.

For the estimated biases, I would suggest to give an uncertainty as well. Also, Fig 10 and Fig 11 suggest that there is a simple linear relation between the remote-sensing and the aircraft deltaD observations which could then be easily corrected. Furthermore, it is of fundamental importance if the bias will change for different geophysical scenarios of if you would expect the same behaviour everywhere.

Finally, I think that section 5 gives rather a demonstration than a proof of the added value. It is a proof that IASI and FTIR can observe deltaD that is different to the mean delta-D vs H_2O curve but this does not necessarily mean that they lead to new scientific insights.

I have also a number or minor comments below that should be addressed before publication in AMT:

p. 6918, l1.7: …indications for a positive deltaD bias… -> give the values as well

p. 6918, l1.9: … add information to the H2O observations -> I would suggest to re-phrase: … add information to the known H2O-delta correlations

p. 6920, l2.: … no really convincing empirical quality …. -> convincing is a subjective term. Maybe use 'no rigorous empirical quality assessment against calibrated in-situ observations …

p. 6920, l7.: again convincing is no scientific term.

p. 6920, l.2 9-22: disucss the limitations of the study.

p. 6922, l2: 3000-5000ppmv appears too small to represent the encountered atmo-spheric concentrations

p. 6922: uncertainty of deltaD from ISOWAT: are the quoted numbers the random errors or the systematic errors. Can you give a break-down.

p.6922, l. 22: ..well documented accuracy and precision: please give both

p.6922, section 2.2: did you do a cross-comparison of ISOWAT and the Picarro?

p. 6924, l10: vertically reasonably resolved -> what does 'reasonably' mean here

p. 6924, l12. : independent on H2O -> independent of H2O

p. 6925, section 3.1: I think that a brief description of the retrieval approach and the used terminology is needed so that is it clear what is meant by 'apriori' and 'averaging kernels'

p. 6925,l18: vertically reasonably … -> again, what does reasonably mean here

p. 6927, l.12: …have are… -> …are…

p. 6928, l15 ff.: the averaging needs more details. I assume that x is given in vmrs while M uses partial columns which seems to be a mis-match

C2855

p. 6931, l15: is it possible to estimate the effect of the different airmasses between the instruments

p.6932, l9: there is no significant bias … -> I think that you can only say that you can not observe 'significant bias' as 'significant' is driven by the precision of the involved instruments and the number of data points.

p. 6932: scatter of 45 permil and 15 permil -> can you say how much you would assign to the random error of the FTIR (as this is really the relevant quantity)

p. 6933, l11: farer -> further

p. 6933, l20: how do you know that these are 'outliers' ? 3 out of 13 is a large fraction of the total ensemble.

p. 6934, l. 1: I don't see why this mean that IASI data will increase our knowledge

p. 6935, l1-2: The biases in deltaD are usually give in permil. Now you give the biases as percent which is confusing (is it percent of permil?)

p. 6937: this section appears a bit out of context. Maybe say at the beginning of this section what the purpose is.

p. 6941, l10: I do not believe that this proves that this is scientifically useful information. This would be proven if somebody takes the data to improve our knowledge.

p. 6951, fig 1: it is almost impossible to see the different profiles. Can you make the figure larger and maybe use lines instead of symbols.

p. 695, fig 1: Again, the structure in data cannot be see as the figure is much too small. Maybe have 4 panels underneath each other and use the full width.

p. 6956, fig 6 (and Fig 8): Say what the numbers in the legend refer to (days?)

6960, figure 10 (and Fig 11): Can you give correlation coefficients and the values for the shown linear fit

C2856

6961, Fig 11: Are error bars for some points missing or are they simply much smaller (and cant be seen)?

6963, Fig 13 (and Fig14): The figure caption does not explain what the 4 panels show and what the different symbols show. Also, the 2 versions of green cant be distinguished.

6966, Fig 16, Figure is much small, maybe try to re-arrange the panels differently

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