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Interactive comment on “Ground-based remote sensing of tropospheric water vapour isotopologues within the project MUSICA” by M. Schneider et al.

Anonymous Referee #1

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Comments on: Ground-based remote sensing of tropospheric water vapour isotopologues within the project MUSICA by M. Schneider et al.

This is a well written paper on an interesting and topical subject. The authors have very clearly defined their objectives and demonstrated the quality of their observations and analysis. Their careful attention to error analysis enhances their arguments. While I believe that most readers will not follow all the matrix algebra, the comprehensive treatment of the data and attention to detail present a convincing argument. Their techniques should find wider use in the remote sensing of atmospheric isotopologues.

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Their results should prove to be a valuable test for atmospheric models that include isotopologues and for satellite validation. Also their detailed and careful analysis of the ground-based FTIR data adds considerable value to those NDACC observations (already shown to be of high quality by their presentation of the CO₂ retrievals).

I offer a few minor observations that may make the presentation clearer.

Page 3, Line 9 I do not believe that other work or the evidence here (Figure 3 A") really support a vertical resolution as good as 2 km. P3,L15 "interference from humidity" is a bit odd here since after all humidity is what is being measured. The retrieval may have a dependence on humidity but that is not interference.

P4,L2 cycle is comprised of the

P9,L13 Line 7 is not an equation. An equation contains an equal sign.

P10,L15 Are tropospheric water vapour concentrations logarithmic in the horizontal dimension or do they just vary so dramatically in the vertical?

P12,L9 What is the justification for the first step in equation 8, likewise for equation 9?

Figure 2 The radiance scale has a unit. Were the radiances really calibrated in these FTS observations?

P15,L14 and Figure 3 Figure 3 does not make the discussion clearer. I believe that few readers will know what "row kernels of the water vapour state" means. The plots in Figure 3 show four colored lines labeled with altitudes and a number of unlabeled grey lines; more description is required for this figure to be useful.

P16,L19 In Figure 4 the H₂O smoothing error seems to range from 6 to 90% through the troposphere. How can the smoothing error for the column, the sum of tropospheric layers, be only 0.1%?

P16,L17 Is the natural variability of δD less than that of H₂O because of the strong correlation between [H₂O] and [HDO] ?

P17,L13 I tend to regard the word "assume" to mean that there was no real justification. I think that your case for adopting some of the error estimates is much stronger than that. For some assume may be the correct word.

P18,L26 If the random error is about 5% throughout the troposphere, how is the total precision better than 1%?

P29,L5 Have other effects, that might be specific to only the high altitude sites, been eliminated?

P29,L20 What do the arrows and dashed lines in Figure 14 represent? P29,L22 isotopologues

P31,L24 I believe that the method presented here is complex, clear but complex, and not straightforward.

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 5357, 2012.

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