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Atmospheric Measurement Techniques Discussions

Interactive comment on "Retrieval of δ^{18}O and δD in atmospheric water vapour from ground-based FTIR" *by* N. V. Rokotyan et al.

Anonymous Referee #1

Received and published: 6 March 2014

This paper discusses HDO and H218O retrievals from near infrared spectra. The results are compared with a model. The main conclusions of the paper indicate that while there is promise for these retrievals, spectroscopic errors prevent further improvement on the precision of the results.

General comment:

I have not been convinced that the selection of HDO and H2O windows is superior to those chosen by TCCON or NDACC. Unless I missed them, there are no figures and no in-depth discussion of the selection process, and no comparison of the dD calculated by TCCON or NDACC.

Specific comments:

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Interactive Discussion
Discussion Paper

P197L4 please explain what you mean by "an additional kinetic effect resulting from the differences in the diffusivity of water molecules in air."

P197L23&P198L1: Missing reference:

Nassar, R., P. F. Bernath, C. D. Boone, A. Gettelman, S. D. McLeod, and C. P. Rinsland (2007), Variability in HDO/H2O abundance ratios in the tropical tropopause layer, Journal of Geophysical Research, 112(D21), 1-11, doi:10.1029/2007JD008417.

P198L9L Missing reference:

Kuang, Z., G. C. Toon, P. O. Wennberg, and Y. L. Yung (2003), Measured HDO/H2O ratios across the tropical tropopause, Geophysical Research Letters, 30(7), 1372, doi:10.1029/2003GL017023.

P198L26: Define FTIR.

P200L20: Does FIRE-ARMS take the temperature sensitivity (i.e. E") into account when selecting windows?

P201L8-10. I'm confused as to why you do not use the standard parameters in GGG to assess the quality of your windows. For example, why do you use the peak value in the fitting residual instead of the reported RMS of the fit? Why do you calculate the correlation coefficients between windows instead of using the standard .cew output file which calculates the window-to-window bias and chiˆ2 statistics? How do the methods compare?

P202L10: Does adding additional windows increase or decrease the sensitivity to the a priori temperature profile?

P203L9: The TCCON H2O line list in GGG2012 is based on HITRAN 2008, Toth 2005, and Jenouvrier 2007, along with many additional lines added empirically, some of which were characterized and added to HITRAN 2012. If you claim that your new line list is better than the one in GGG, please show this.

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P204L26 - P205L2: While what you say is true, there are also drawbacks to a scaling retrieval. First, scaling retrievals depend on the shape of the a priori profile to be correct. Second, any vertical information in the spectra is not exploited.

P204-206: Please limit the description of GGG to what is directly relevant to this paper. The authors' contribution seems to have been to modify equation 3, which is embedded in GGG, to create an equivalent equation for H218O (equation 4), but it wasn't entirely clear to me. The authors should clearly differentiate between the work that they have done here and others' work on which they are building.

P209L4: Water variability can be significant in 6 hours. How does reducing the averaging time impact the results?

P209L23: How do the publicly-available TCCON dD results compare with your results?

P220 Table 1: Why not combine the H2O windows at 4635, 4645, and 4655?

P230 Figure 9: Please put error bars on the plots, and add the standard TCCON dD values on the middle plot for comparison.

Technical comments:

This paper must be thoroughly edited for English before publication. I will list some of the errors I found in the first 5 pages here, but this is not an exhaustive list.

P196L7 recorded by *a* ground-based

P196L9 Institute of Enivronmental Physics *at the University of Bremen*

P196L17 spectra are *presented* for

P196L18 Comparison*s* with the results

P196L19 *demonstrate good* agreement

P196L20 modeling result*s* show

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P196L21 connected with *an* incorrect

P196L24 Monitoring ** isotopic water vapour provides ** rich information

P196L26 evaporate** less actively

P197 first paragraph: change all d18O and dD to H218O and HDO, respectively.

P197L3 remove however

P197L11 Usually*,* concentration ratio*s* of different isotopologues *are* expressed

P197L14 is a measured ratio of *the* less abundant

P197L20 Thanks to the recent development of methods *that allow for the* retrieval

P197L22 replace for with in

P198L3 IASI ** retrieve*s* dD

P198L7 *The* ATMOS

P198L11 temporal distribution*s*

P198L14 applying *an* optical estimation

P198L23 composition at *the* surface

P198L28 *The* high spectral resolution of such instruments ** clearly resolve*s* absorption lines

P199L1 suitable *for* monitor*ing* atmospheric composition. *The* Total... (Hannigan et al., 2009) *use* FTIR observations for accurate and precise retrieval*s* of ... and other *trace gas* concentration... Retriev*ing* atmospheric methane, carbon dioxide and water vapour *abundances* from ...routine procedure that *can* be done with *a* precision of up to 0.25%... *The* TCCON community ... calculations can be affected by *the* different vertical sensitivity.

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P199L17 FTIR sites is *important* for *future* monitoring

P199L19 As *for* SCIAMACHY

P200L3 sufficient*ly*

P200L15 which are used by *the* TCCON community

L16 *To* our knowledge*, there are no standard windows that have been compiled for H218O retrievals.*

L17 To *select* spectral windows ** we have simulated atmospheric transmittance in *a* wide spectral range

L21 middle –> mid, add *the* before atmospheric state

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 195, 2014.