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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The ground-based FTIR network's potential for investigating the atmospheric water cycle" *by* M. Schneider et al.

D. Griffith (Referee)

griffith@uow.edu.au

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The ground based FTIR network's potential for investigating the atmospheric water cycle M. Schneider, K. Yoshimura, F. Hase and T. Blumenstock Referee's comment by David Griffith, University of Wollongong

This paper compares several years of ground based solar FTIR remote sensing of water vapour and its HDO isotopologue in the atmosphere from two sites (Kiruna and Izana) with an isotopically-enabled general circulation model of the atmosphere. Both the measurements and the modelling are thoroughly executed with well-referenced methods. From the comparison, the authors assess the value of such datasets and data-model intercomparisons to improve our understanding of the global atmospheric water cycle. Atmospheric water vapour plays a major role in the radiative balance of the

earth-atmosphere system, and the paper makes a significant and useful contribution. It is well suited to publication in ACP and I recommend publication after addressing the minor and technical comments below.

Comments: Abstract page 26199 line 8 (and corresponding in text): remove "... which demonstrates the good quality of the FTIR data." See further comments below

2.1: I strongly recommend a summary of errors, both random and systematic, of the FTIR technique here. Throughout the paper, when experimental and model data are compared, the reader has no feel for whether the observed scatter within the FTIR data and disagreement with the model is due to measurement error, real atmospheric variability, or model error. Similarly, in at least one or two of the figures, some error-bar indication of the FTIR measurement error would be very informative (although I do not recommend plotting each point with an error bar).

This concern is closely related to the already published referee comments on this paper by Matthew Johnson. I agree that as stated the argument about agreement between measured and modeled data can be construed as circular – agreement between two un-validated datasets does not prove they are both correct!

Other related comments later in the text to this error discussion: - 26204 line 20, the term "more variability" may simply be measurement random error, based on what the reader has read so far. Requires justification. - 26208, lines 10-24,section 3.4: This section would benefit from an earlier assessment of FTIR (and model) errors, and it should be reworded accordingly. - 26211 line 20 et seq. Error comparison not justified without prior description of errors.

26210, line 1 and section 4.5: the f<sub>I(t) term. Here and in section 4.5 it is not clear just how these indices are applied and fitted. Are they scaled contributions of pre-defined indices (variable in time and space). The functional form of f<sub>I (t) should be given, either with Eq 1 or in 4.5.

Technical, typographical & grammatical comments and suggestions:

Page 26200 line7: reanalysis not reanalyses 13, 16: remove NAO and AO acronyms from the abstract.

26201 8: ambiguous (double negative) use of “depletion” and “decreases” . I suggest “The vapour then becomes gradually more depleted in heavy isotopologues. . .”

26202 2: . . . have been performed for up to two decades. . . 7: . . .FTIR systems for up to 13 years. . . 12: Remove sentence “Both sections. . .. Sect 4.” Why encourage the reader to skip? – they will figure it out themselves! 15: define acronym SST (and all acronyms) on first use. 18: replace “resumes” with “summarises” 22: “There are about 25 ground based FTIR stations within NDACC, including Kiruna and Izana.”

26203 6: “. . . during recent years. . .” 16: The meaning of “nudging” might not be clear. If I understand nudging correctly, I suggest “IsoGSM allows for adjusting or nudging large scale (climatological?) horizontal wind and temperature fields towards actual reanalysis values (from ECMWF, NCEP??)

26204 12: replace “removed” with “minimized”.

26205 6-7: replace “applying” with “using” 15-16: I suggest removing “Concerning”: “The PWV measurements and simulations agree very well.” 22: Do you mean “. . . whereas the mean delD value is -210‰ the mean simulated value is -260‰;”

26206 10: “Typical degrees of freedom. . .” 13: remove “well” 15: “For Izana, this sensitivity range. . .” 17: “. . .resolves much higher vertical detail.” 23: suggest replace “punctiform” with “point”

26207 13: Statistics of (not “on”) the IosGSM-FTIR differences 26: remove “good”

26209 2: SST is not defined 6: The annual cycles are superimposed on short time scale . . .. 25: “. . . yields very robu fitting results.”

26210 23: . . . and the measurement, as shown in Fig. 5. First reference to a Figure

should be part of main text, not in parentheses).

26211: 4: . . . we fit the 10 parameter function to the H2O time series and the 11 parameter function to the delD time series when fitting fc. 27: replace “advert” with “give notice” ?

26212 19: indicationg appears twice 21: the water evaporates from the Atlantic Ocean

26213 10: maximum not maxima

26214 25: weak not week.

26216 2: We find that H2O and delD are positively. . . (not “is”) 3: The correlation is particularly strong (remove “in”) 12: . . . the correlation is still strong (not are) 19: These correlations. . . 29: This connection only becomes significant. . .

26218 2: which might indicate that. . .

26219 1: . . .data is IsoGSM able to. . .

Fig 13 – the plotted data are off the axes

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