

Interactive comment on “Validation of water vapour profiles from the Atmospheric Chemistry Experiment (ACE)” by M. R. Carleer et al.

Anonymous Referee #2

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This paper presents an extensive and useful comparison of ACE FTS measurements of water vapor profiles to those of other instruments. However, I think it currently lacks key elements without which the utility of ACE measurements is limited. What specifically are needed are a complete window channel list and a random and systematic error budget.

Window selection is, of course, an important component to any spectroscopic retrieval, but because the paper lacks a table for this, the reader cannot be sure if their measurements can be properly reproduced by other interferometers. This is particularly important in the upper stratosphere and mesosphere. For example, to my knowledge, no FTS before ACE reported measurements of water above about 65 km. This is a significant advance for an absorption spectrometry mission, and the lines are there,

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but without a window selection table (and a graphic showing spectral fits), I really don't know for sure if what they're measuring is real or is mostly an a priori. Are the lines deep enough at 85 km to be any use? No linelist information is given either. I presume they're using HITRAN, but what version, and have any changes been made? Analysis of changes in stratospheric water using future solar-absorption FTIR instruments, without re-analyzing ACE spectra, becomes unnecessarily more complicated because linelist and line selection data are lacking for these current measurements.

While there is extensive discussion of an average bias between instruments, there is little in the way of answering if the measurements agree _within their respective errors_. The most important question a validation paper can answer is whether an instrument+retrieval is performing within its expected uncertainty, but that is not answered because no error budgets are given. What is the random error from temperature sensitivity? Pointing error? SNR? Interfering species? What is it as a function of altitude? What is the systematic error from linestrength parameters? Retrieval method? In short, there lacks information from which a reader can straightforwardly and quantitatively determine where in altitude and how much to believe a single ACE water profile.

Given this, the statement (pg 4520, line 10) that "ACE-FTS is probably the best available satellite instrument for validating future water vapour profilers" is unsupported. Validation of other instrument retrievals against ACE, and using ACE with other instruments to measure secular trends, require careful efforts to minimize differences in retrieval parameters if possible, and quantitatively understand systematic and random uncertainties in ACE water profiles. I just don't think there's enough in the paper to do that.

The comparison work in the paper is important and useful, and I'm not trying to dismiss that, but I think the paper should be re-written with (a) the window list and (b) full random and systematic error budgets. The context for the comparisons then becomes whether ACE is performing within its expected abilities, and the differences between ACE and other instrument's results can then be more usefully explored.

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Interactive comment on Atmos. Chem. Phys. Discuss., 8, 4499, 2008.

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