

Interactive comment on “Aircraft validation of Aura Tropospheric Emission Spectrometer retrievals of HDO and H₂O” by R. L. Herman et al.

Anonymous Referee #2

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GENERAL COMMENTS

The paper uses the comparatively precise and accurate measurements of H₂O and HDO taken through several aircraft campaigns over Alaska to validate profiles of the same entities produced from EOS AURA TES nadir measurements.

The paper is well written and its scope fits well into AMT. It will be useful to users of TES HDO data as this comparison validates and enhances on the error budget of the retrieved data. However, in its current state, it seems a bit too much like a delta improvement to referenced papers; it should thus be improved by making it more self-contained, especially with respect to the in situ comparison and the bias correction, to reduce the need to reference preceding papers to understand this one.

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SPECIFIC COMMENTS

page 3809, line 15: The paper states that the in situ data are interpolated onto a very fine grid. This seems strange, as, first, the in situ data should be given on a fine grid to start with and, second, Fig. 3 seems to indicate that only data on a very coarse grid is employed.

The references given, give quite a lot of detail with respect to mapping matrices between grids of different resolutions, but the Fig. 3 looks a lot as if “just” the value of the in situ profile at the appropriate level was chosen/sampled. The paper should be improved to make the employed method clear, ideally without having to cross-reference a chain of previous papers.

In case the in situ data was actually only sampled on a coarse grid, the effect of that drastic downsampling should be estimated, e.g. by the formula $x_{\text{insitu}/AK} = (I-A)x_a + G * F'_{\text{insitu_grid}} x_{\text{insitu}}$ where F' is a Jacobian of the forward model with respect to the original in situ grid.

page 3812, Sect. 4.3 / Fig. 4: This section describes how a new bias correction is derived. It is confusing that Fig. 4 shows already the bias corrected values (this is not obviously given in the caption, but can be derived from the text), as it shows the bias of the bias corrected values. It might be helpful to visualise this correction by also plotting the bias-uncorrected values together with the linear fit used for correction as a second plot to the left.

Further, why was a linear relation chosen?

page 3812, Section 4.3: It should be explicitly discussed, why the bias correction derived over a rather specific local region and time of year can be used for the globally derived HDO/H₂O ratios.

MINOR/TECHNICAL CORRECTIONS

page 3806, line 4: The employed spectral range is given to be the entire range from

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1170 to 1330 cm^{-1} , but the referenced paper states it to be the range depicted in its Fig. 1, which goes only to 1320 cm^{-1} . Also, the referenced paper mentions that some regions are excluded, making it at most “almost the entire range”.

page 3806, line 24: Is the data (log-)linearly interpolated?

page 3811, line 14: It might be beneficial to either constantly use geometric altitudes or pressure levels, but to not switch in between them.

page 3812, line 16: Actually, Worden11 gives Worden07 as source for this equation; even though the equation cannot be easily identified in the older paper.

page 3811, lines 20f.: In this section, it is specified how the insitu profile is extended towards the ground, but not how it is extended above the aircraft ceiling. At least a reference to Sect. 4.4 should be given here.

page 3814, line 15: How is the prior profile for extending the measured profile defined? Is this the same tropical one used as a priori for the retrieval or a more fitting one for the time and place of the in situ measurements?

page 3815, line 11: It is not clear how many profiles are contained in that match of 28 July. Further, it might be simpler to also plot and describe values of these errors in per mill.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 3801, 2014.