

Interactive comment on “A two-channel, tunable diode laser-based hygrometer for measurement of water vapor and cirrus cloud ice water content in the upper troposphere and lower stratosphere” by T. D. Thornberry et al.

Anonymous Referee #1

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General:

A newly developed hygrometer for airborne measurements of gas and condensed phase water is presented in the paper. The hygrometer is a two channel closed path TDLAS, enabling measurements in the wide range of 1 ppmv up to several thousand ppmv by using two different wavelengths near 2694 nm. The instrument is deployed on-board of the NASA Global Hawk during the second phase of the ATTREX field campaign in spring 2013.

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Altogether, the construction of all components of the NOAA water instrument is timely and thorough. The measurement principle, the in-flight calibration system and the inlets of both channels are well conceived, fabricated, thoroughly tested and its performance is described in detail. This makes the hygrometer in my opinion to a very valuable instrument for future airborne research in the field of UT/LS water vapor and clouds.

The paper is well organized and written, a pleasure to read. I have only few minor comments that the authors may consider, but they also could leave the paper as is.

Minor comments:

- 1) Figure/Table captions: I recommend to always explain abbreviations in figure captions so that each figure can be understood without reading the text in parallel.
- 2) Figure 1: could you show the sub-enclosure here? And it would be good to have annotations of the main components in the figure.
- 3) Figure 3: also here some annotations -in one panel- would make it easier for the reader to understand the construction, e.g. on which side the inlet/laser/detector and outlet/mirror port is (especially since it is conversed in comparison to figure 2)? where is the lens to collimate the beam? and would be good to sketch in the laser in the same way as in figure 3 (in the upper panel ?).
- 4) Figure 8: Would be good to state that the figure refers to the strong line.
- 5) 2.5 Inlets: I miss to see/know where on the aircraft fuselage the inlet is mounted, since this is important for its sampling performance (a photo ?). A description is given later in section 3.2 'Ice Water Content Measurement Uncertainty', I think it would be better already introduced here.
- 6) 2.5.2 Total water inlet, last lines of the section: later in section 3.2 it is described how the ice crystal size distribution influences the calculation of the IWC. This could be discussed already here, or cross references should be given between these two paragraphs.

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