

Interactive comment on “Rapid, optical measurement of the atmospheric pressure on a fast research aircraft using open-path TDLAS” by B. Buchholz et al.

Anonymous Referee #1

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The paper by Buchholz, Afchine and Ebert describes the determination of atmospheric pressure based on air-borne open-path laser absorption spectroscopy. Water vapor measurements in the UT/LS region are challenging due to low concentrations and difficult sampling issues. Thus open-path measurements outside the aircraft's fuselage are quite attractive, but they require accurate determination of pressure and temperature in the measurement volume. Buchholz et al. describe a method to determine the actual pressure based on an evaluation of the shape of a H₂O absorption line and compare it to pressure deduced from the aircraft's pressure measurement in a nose-boom and a pressure sensor integrated in the optical cavity of the instrument. In general the paper

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is very well written, highly interesting and deserves publication in AMT. Nevertheless, I have a few questions, which are not addressed in the manuscript. The authors should address these, before the paper is published.

Although the majority of physical processes affecting the line shape of a H₂O absorption line are discussed, there are other processes that are not mentioned: 1. What is the role of the laser line width itself? Can it be neglected? Frequency noise, in particular associated with back reflections into the laser, can cause significant line broadening that might affect the shape of the absorption line. 2. As the author state, the purpose of the HAL instrument is to measure water vapor in its various phases (gas, liquid, solid). How do cloud particles affect the determination of pressure from the line shape? 3. Up-wind antenna, other inlet systems and the outside White cell itself modify the air-flow and cause turbulence. How does this affect the measurements?

During SPURT HALO was deployed in the UT/LS region on both sides of the tropopause. Unfortunately the analysis presented here is restricted to rather high water vapor concentrations (larger than approx. 150 ppmv) yielding large signal to noise ratios. It would be interesting to show also results based on low H₂O concentrations (less than 50 ppmv), that are more typical for the tropopause region. I also assume that the stated total uncertainty 5.1 % is only valid for a rather large SNR. What is the uncertainty closer to the detection limit?

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