

Interactive comment on “A new airborne laser-induced fluorescence instrument for in situ detection of Formaldehyde throughout the troposphere and lower stratosphere” by M. Cazorla et al.

Anonymous Referee #2

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This paper presents a summary of a new laser-induced fluorescence instrument for airborne measurements of formaldehyde. As mentioned in the paper, accurate and precise measurements of formaldehyde are needed as they can provide an important constraint to test current models of atmospheric chemistry as well as provide retrieval validation for satellite measurements. The paper provides a detailed description of the instrument, including details on the calibration procedure and important figures of merit. The paper is well written and suitable for publication in AMT after the authors have addressed the following comments:

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1) The authors describe their procedure for calibrating the instrument in the laboratory, but do not appear to have a system to calibrate and zero the instrument in flight. As stated in the paper (page 8371) calibrations must be done over several days to ensure consistent results because “HCHO adheres to surfaces in tubing, fittings, regulators and flow meters. . .” How confident are the authors that ambient measurements of HCHO are not influenced by these effects in flight under variable HCHO mixing ratios? What is the intercept of the calibration plot shown in the inset in Figure 7? Does this intercept vary during calibrations, possibly reflecting absorption and degassing of HCHO in their system?

2) The authors demonstrate that the sensitivity of the instrument depends on pressure due to absorption line broadening and quenching (Figure 7). However, there is no mention of the possibility of quenching of the signal by water. Did the authors perform calibrations as a function of water vapor concentrations to test for this?

3) The authors state that the measured fluorescence signal is normalized to the reference cell signal to account for frequency drift of their laser with temperature. This correction assumes that the sensitivity of the reference cell varies linearly with the sensitivity in the detection cell. Did the authors test this during their calibrations?

4) Did the authors test for potential interferences from laser-generated HCHO in their system, perhaps from laser-generated OH (from the photolysis of ozone and subsequent reaction with water vapor) reacting to form HCHO, or perhaps from the photolysis of VOCs leading to HCHO formation in the detection cell? Although the laser power used is relatively low, potential laser-generated interferences should be taken into account given the high repetition rate and slow flow through their detection cell.

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