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Atmospheric Measurement Techniques Discussions

Interactive comment on "A new non-resonant laser-induced fluorescence instrument for the airborne in situ measurement of formaldehyde" *by* Jason M. St. Clair et al.

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This is an excellent paper, which describes a new extremely small and light weight instrument for airborne measurements of formaldehyde. The paper is well written and the procedures and methods employed are very sound and well documented. All aspects of the measurement technique, from detection principles, optics, sample handling, and especially data acquisition and processing, are described in very nice detail. The authors are to be commended for a very thorough instrument characterization. This reviewer recommends publication without any major changes. The authors may wish to consider the 3 very minor points discussed below:

1. It's clear from paper that the new COFFEE instrument is more susceptible to scattered light from aerosols than ISAF, and this is dramatically illustrated in Fig. 9. Although ISAF is not the focus of the present study, as the measurements from COFFEE are an outgrowth of ISAF measurements and analysis, the authors may wish to comment on what the ISAF signals look like with particle filtering, if available. Also, it would be worth commenting if Drierite-filtered air was added to the inlet in flight, or is this not necessary from your lab testing?

2. The authors on page 7 lines 28-29, indicate that "the final HCHO mixing ratio data product is produced by averaging the data from the two detection axes", it would be useful if the authors indicate what type of averaging was employed. Was a linear or weighted average employed? This could be important since as indicated on page 3 that detection axis 2 maximizes detection selectivity at the expense of deceased sensitivity, while axis 1 collects more fluorescence signal, potentially at the expense of selectivity. How are both attributes reflected in the final measurement?

3. My final minor comment regards the terminology of Fig. 7 and its discussion in the manuscript involving the Allan deviation plot. Although David Allen first introduced this concept in 1966 for characterization of frequency standards, it was Peter Werle's seminal paper (P. Werle, R. Mücke, and F. Slemr, "The Limits of Signal Averaging in Atmospheric Trace-Gas Monitoring by Tunable Diode-Laser Absorption Spectroscopy (TDLAS)", Applied Physics B57, 131-139, 1993), that first brought this valuable tool to the attention of the atmospheric measurement community. Several of us are trying to acknowledge Peter's legacy in the literature by now referring such analysis and plots as "Allan-Werle" plots and analysis.

Please also note the supplement to this comment:
https://www.atmos-meas-tech-discuss.net/amt-2017-282/amt-2017-282-RC2-supplement.pdf