

Atmos. Meas. Tech. Discuss., referee comment RC2
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Comment on amt-2021-6

Anonymous Referee #1

Referee comment on "In situ observations of stratospheric HCl using three-mirror integrated cavity output spectroscopy" by Jordan Wilkerson et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-6-RC2>, 2021

This paper reports the development of an off-axis integrated cavity output spectrometer (ICOS) with re-injection performance. A precision of 26 pptv was achieved with 30 s integration time in the lab. The developed instrument was evaluated in the HUSCE campaign, and the results were compared with MLS data. The manuscript was well-written and well structured. I recommend for publication after considering following comments.

1) Page 1, Line 13. The abbreviation of MLS is incorrectly marked here.

2) Page 3, Line 67. The response time is related to the volume of the cell and sample flow rate. This argument needs the support of the detailed information of these parameters.

3) Section 2.2, page 5. What is the bandwidth of the detector? The mirror reflectivity or effective cavity length was determined by the ring-down measurement. What is the ring-down time of the empty cavity? By using re-injection performance, more light will enter the cavity. It is no longer appropriate to use the base length divided by $1-R$ to express the effective optical path, which is usually used for laser beam one-time injection into the cavity.

4) Section 4. What kind of interference does "balloon interference" mean? What is the ascent and descent speed of the balloon? Will the release of the helium affect the measurement of HCl? Is the pressure of the sample cell kept constant or the same as the ambient pressure? Will the residence time of the sample in the cavity change?

5) During the flight, will the changes in the atmospheric temperature affect the performance of the cavity?