

Interactive comment on “A laser-induced fluorescence instrument for aircraft measurements of sulfur dioxide in the upper troposphere and lower stratosphere” by Andrew W. Rollins et al.

Anonymous Referee #2

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This manuscript describes the construction and flight testing of a laser-induced fluorescence based sensor for detection of upper atmospheric SO₂. The authors provide a description of the setup of the instrument, comparison of performance with other similar state-of-the-art measurements, and sample measurements from the flight campaign. The instrument represents a significant advance in the measurement technology of a species of strong importance to UT/LS chemistry. I recommend publication of this manuscript after the authors address the below minor comments.

- Pg 4 lines 4-11

C1

- This paragraph seems like an odd fit here, maybe better in background
- Fig 4
 - Figure is a bit difficult to interpret as the lines are difficult to see in the picture. Recommend replacing photo with a schematic for greater legibility.
- Page 7 line 6-9
 - Authors do not describe the method through which they use the reference cell.
- Page 7 line 9
 - I could not find from what trigger is the 20 ns gate measured?
- Page 7 line 18
 - Why use quenching by argon? Was air not available? How does that affect the calculated lifetime?
- Page 7 line 19
 - This is the first mention of laser pulse duration. This is controlled by the DFB pulse? Is there a difference in pulse duration between the DFB pulse and the pulse leaving the amplifier?
- Page 8 line 26
 - What form do the light baffles in the cell take? A pinhole? This would seem to result in significant dead volume, or at least slow volume, even with flow moving through from either end.
- Page 9 line 3

C2

- What error in SO₂ concentration does a 0.3 hPa error correspond to? Have the authors performed pressure sensitivity testing?
- Page 10 line 17-28
 - While the assumption that H₂O quenching is negligible is likely a valid one, this would be more convincingly asserted by a brief sensitivity analysis with this instrument. Have the authors performed such a test?
- Figure 13
 - SO₂ data also 10 s average?

Interactive comment on *Atmos. Meas. Tech. Discuss.*, doi:10.5194/amt-2016-155, 2016.

C3