Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2019-11-RC1, 2019

Atmospheric Measurement Techniques
Discussions

Interactive comment on "Evaluation of ambient ammonia measurements from a research aircraft using a closed-path QC-TILDAS spectrometer operated with active continuous passivation" *by* Ilana B. Pollack et al.

Anonymous Referee #2

Received and published: 7 April 2019

The manuscript 'Evaluation of ambient ammonia measurements from a research aircraft using a closed-path QC-TILDAS spectrometer operated with active continuous passivation' describes an instrument modified for airborne measurements of gas-phase ammonia (NH3) and its characterization and performance during flights on the NSF/NCAR C-130 aircraft. Three modifications/additions were made to the previous NH3 QC-TILDAS to improve its performance on an aircraft platform. These included mounting the instrument on a custom designed vibration isolation plate; addition of high frequency to an optical component; and the implementation of an active continu-

ous passivation system to improve time response. Implementation of the mechanical modifications minimized the motion sensitivity of the instrument reducing the 1 Hz precision to 60 ppt. While the active passivation, not absolutely necessary for a well maintained instrument, significantly improved the time response of a dirty instrument and will likely ease maintenance requirements for field campaigns in remote environments and/or over long periods of deployment time.

This paper is well written and appropriate for Atmospheric Measurement Techniques. It demonstrates an improvement in instrument performance from previous ground deployments and makes it a nice addition to the mix of available airborne NH3 instruments. I recommend publication after addressing a few minor comments listed below.

Specific Comments Page 1, Line 17 – Please give temperature range of the aircraft cabin instead of simply labeling it hot. This would give the reader context when considering using the instrument in other environments, such as, a trailer or tower.

Page 4, Line 26 – The inertial inlet description is sparse. The reader is not told what material it is constructed from until Page 7, Line 4 in the text or finds it buried in the caption of Figure 1. It is most logical for the reader to state that here in section 2.2.2 Inertial Inlet. In reference to figure 1, what is the size of the critical orifice? What temperature is it heated to? Also, it is a little misleading to say the 'The QC-TILDAS detector is typically operated with a heated inertial inlet . . .' since, from the literature and later in this manuscript, it seems other QC-TILDAS instruments measuring methane, carbon monoxide, ethane, for example, do not require or use an inertial inlet. Perhaps it should say 'The NH3 QC-TILDAS detector . . .'.

Page 6, Line 46 – While I applaud updating the cross-section used with optical absorption system described by Neuman et al., 2003, the number used here, 4.69e-18 cmˆ2, is slightly different than the 4.4e-18 cmˆ2 used in the 2003 manuscript not in contrast to. Furthermore, it appears that the +/- 0.03e-18 is the standard deviation of the average of the three cross sections listed here. What is the uncertainty of each and then the uncertainty for the average? Are these two cross sections used in interpreting the absorption cell results here and in the previous manuscript within each other's uncertainty?

Page 7, line 4-7 – Since the sample flow rate is critical in calculating the calibration mixing ratios, the orifice size should be given in the text either here or in section 2.2.2.

Page 8, Section 4.3 – Some of the fits shown in Figure 5, particularly in panel b, do not match the data when it begins to flatten out. Would a triple exponential fit work better? Also, it would be easier for the reader to judge the fit if the data is present as symbols and the fit as a solid line.

Page 15, line 19 – I am concerned on the use of 'highlights the slightly faster time resolution of NH3 compared to CO.' without the qualifier 'for the instruments as configured here' to prevent misconstruing or over generalizing the observations in the future. It seems unlikely it would hold true if the instruments were configured with equal flow rates and tubing lengths.

Figure 1 – Please indicate the i.d of the PFA tubing used, the size of the critical orifice in the inertial inlet, and the temperature the inertial inlet is held at. From Figure 1 the length of the strut appears to be 12 cm, not the 36 cm stated in the text. What is the function of the aux. draw, which is not mentioned in the text or caption?

Figure 2 – With the lower panel in units of ppbˆ2 on a logarithmic scale, it is very difficult to see where the 60 ppt precision estimate comes from. Perhaps consider a lower right axis in ppt? Also, I suggest using the same scale in the lower panel for both plots.

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2019-11, 2019.