Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC1
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Comment on amt-2022-309

Anonymous Referee #1

Referee comment on "Using tunable infrared laser direct absorption spectroscopy for ambient hydrogen chloride detection: HCl-TILDAS" by John W. Halfacre et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2022-309-RC1, 2022

Comments to the Author:

The paper describes a commercial TILDAS instrument for measuring hydrogen chloride in ambient air and demonstrate the ability of sampling methodology to minimize inlet artefacts. Due to the "sticky" behavior of HCl gas, quantitative sampling remains a challenge for current approaches. To improve instrument response to changes in HCl gas concentration, a custom-fabricated quartz virtual impactor is used to replace particle filters to avoid excess surface-mediated interactions with filters, and the heating and PFBS coating methods are employed to improve transmission. Its performance validates that the sampling method is effective for reducing HCl "sticky" behavior. Overall, the paper is well written, with detailed characterization in the lab as well as reliable performance in the field sampling. I recommend this paper for publication in AMT after the following minor revisions.

General comments:

Section 2.2.1: The technique description of the TILDAS device is not clear, and more technical details need to be added, such as measurement principle, structural schematic diagram, etc.

Section 2.2.2: The custom-fabricated quartz virtual impactor can effectively remove the large particles (> 300 nm diameter) in the sampling line, which was approximately 13% of the total volumetric flow. Only gas molecules and small particles (< 300 nm diameter) can flow into the TILDAS instrument. Please explain how does the impactor work and how is the ratio of flow rate obtained?

Section 3.1: The performance of HCl TILDAS is evaluated in the lab with dry zero air as well as in the field with HCl-scrubbed sample air, and its precision and LOD are superior to the previously reported methods. More technical details need to be added to explain how does the instrument achieve better performance? Did the authors perform long-term measurements of a fixed concentration of HCl gas? This approach can better represent its real performance.

Section 3.3.2: There is an obvious offset about 0.07 ppbv (shown in Figure 8) before addition of nitric acid to the passivated sample inlet flow. Please explain the reason for the offset signal.

Section 3.4: The maximum concentration of HCl in field observation is about 0.1 ppbv shown in Figure 9(a). But the HNO_3 concentration of 4 ppbv may cause an increase of 0.08 ppbv of HCl. How to evaluate the error of atmospheric HCl concentration caused by HNO_3? And the influence of a potential leak on the measurement of HCl gas concentrations during observation needs to be clearly evaluated.

Specific comments:

Page 4, L137: The references could not be found in this manuscript.

Page 14, L382-387: The influence of humidity on the measurement bias of HCl concentrations is only reported at 60% RH. In fact, the relative humidity of atmosphere is often much higher than this value. Therefore, the authors need to give the relationship between the measurement bias and the relative humidity, so that the reader can clearly grasp it.

Page 18, L490: The data should be modified to 20 June 2021.