

Atmos. Meas. Tech. Discuss., referee comment RC3  
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## Comment on amt-2022-309

Anonymous Referee #3

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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-RC3>, 2022

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The manuscript describes a gas phase HCL sensor, based on tunable infrared laser direct absorption spectroscopy (TILDAS). The authors highlight the importance of HCL in the atmosphere, describing its influence. They describe the difficulties of monitoring HCL, it is "sticky" and results in such effects as long instrument response times. They describe current monitoring techniques, their strengths and weaknesses, and why their approach will be of benefit.

The authors first describe the TILDAS sensor design, followed by techniques to minimize sticky behavior of HCL on extraction, an "inertial inlet" and active passivation. They also describe procedures for validation, field testing and data analysis.

The authors present results for different configurations, such as with and without passivation and humidity effects, They present field data and compare sensitivity to other published set-ups. They discuss problems with HCL particulate and nitric acid.

They present 7-8 pptv at 1 Hz and 3σ limit of detection ranging from 21-24 pptv. For longer averaging times, the highest precision obtained was 0.5 pptv and 3σ limit of detection of 1.6 pptv at 2.4 minutes. These values are competitive compared to other optical techniques, which are considered more complicated to set-up. I think the manuscript should be published.

I believe the manuscript requires minor revisions and clarifications.

- The title needs to be considered. I find it misleading. TILDAS is not a novel

spectroscopic approach. It is the first application of TILDAS to HCL. Should be clarified to reader or manuscript changed.

- There is little detail on optical configuration of set-up. If it is new and custom made, more information can be given here.
- There is little detail to spectral fitting. They do talk about background subtraction. But, error can also come from the spectra fit. I think more detail should be given here.
- Re Methane measurement. Do you have a LOD or sensitivity for this measurement? it appears in plot, methane can fluctuate by approx 2-3 ppb in a few seconds. is this real? If yes, why not see these types of fluctuations with HCL
- ISORROPIA II.. a few sentences on theory are not in referred section
- The conclusion seems more like an outlook, except for first sentence.

Individual line comments/typos;

line 107... typo "it is has"

line 138... What is exact wavelength of laser and tuning range?

line 160... "gas phase via acid displacement" can you add a reference for this. There are references earlier, but they don't seem to fit this.

line 401 "It is well established that HCl and particulate chloride (pCl- 401 ) exist together in dynamic equilibrium" can you add reference here.

line 484 How is  $\text{NH}_3$  measured here?

Figure 10. Is the time on a) and b) the same. Not clear. y scale strange