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A Spectroscopic Monitor of Hydrogen Chloride (HCl)

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Chlorine is the most abundant halogen radical in the atmosphere. Chlorine containing gases with an atmospheric lifetime of less than ∼1 year is reactive chlorine. Reactive chlorine in the troposphere is dominated by HCl. Recent research has underscored the importance of conversion of sea-salt chlorine into a photo-labile form, $ClNO_2$ further inland than anticipated. This finding offers improved insight into the timing and transport of oxidative capacity of the atmosphere. A robust measurement of gaseous HCl is critically important to improve the understanding of the spatial and temporal oxidation capacity of the atmosphere and understand air quality in continental and coastal cities.

We have developed a highly sensitive spectrometer in combination with a fast-response active-passivation inlet system to produce sensitive HCl measurements at fast timescales and with high accuracy. The spectrometer has achieved excellent precision (15 pptv @ 1 Hz) and adequate accuracy (3%) without frequent calibration. The significant technical challenges posed when trying to detect gaseous HCl involves its affinity to stick to surfaces. Our active passivation inlet system greatly improves the time response for other sticky molecules. By applying these novel inlet methods to HCl, the time response of the instrument is better than 1 second.