



Reversible adsorption of hydrogen chloride to ice surfaces

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Hydrogen chloride is the most important reservoir of gaseous, reactive chlorine in the atmosphere. Although several laboratory investigations of the interaction of HCl with ice surfaces have been conducted, there is still great uncertainty associated with the adsorption isotherms of HCl on ice, which is largely a consequence of most previous studies being unable to work at concentrations relevant for the atmosphere and to explore the non-saturated part of the isotherm at sub-monolayer coverage.

We have conducted experiments on HCl uptake on ice surfaces at temperatures between 190 and 220 K, using a coated wall flow tube. HCl at concentrations as low as 2×10^9 molecule cm^3 ($\sim 10^{-8}$ Torr) was detected using a chemical-ionization, quadrupole mass spectrometer.

The equilibrium surface coverage of HCl on ice could be interpreted using the Langmuir-model to derive partition coefficients (K_{Lang}). We find that the dissociative Langmuir isotherm describes our data significantly better than the non-dissociative type. Surprisingly, and in contrast to the behavior of the majority of traces-gases which adsorb reversibly on ice surfaces, the partition-coefficients we derive for HCl do not show a systematic dependence on temperature, precluding the simple derivation of an adsorption enthalpy and indicating the presence of more complex adsorption and desorption mechanisms for strong acids ionizing on the surface compared to H-bonded trace gases.