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Evaporation lifetimes of ice films dosed with small quantities of HCl and HNO_3 in the range 180 to 210 K

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The evaporation flux $J_{ev}(H_2O)$ of H_2O from HCl-doped typically 1 μm thick vapor-deposited ice films has been measured in a combined quartz crystal microbalance (QCMB)-residual gas mass spectrometric (MS) study. $J_{ev}(H_2O)$ has been found to be a function of the average mole fraction χ_{HCl} of HCl in the ice film and lies in the range 6x10^{14} - 3x10^{17} molecule cm^{-2} s^{-1} at 174-210 K for χ_{HCl} ranging from 1.5x10^{-4} to 5.0x10^{-3} at the start of the evaporation. The temporal dependence of an evaporating HCl-doped ice film reveals two limiting trends that are associated with the suggested presence of crystalline HCl hexahydrate HCl6H_2O and an amorphous HCl/H_2O mixture depending on the HCl deposition parameters, primarily on the rate R_{HCl} of HCl deposition. The crystalline hexahydrate in the presence of H_2O ice gives rise to a H_2O evaporation rate reduction factor $r^{b/e}$ between 20 and 27 as well as by a remaining ice thickness of d_D = 5490 $\pm$ 1200 ?. In contrast, $r^{b/e}$ is scattered widely for an amorphous HCl/H_2O mixture which makes this parameter a discriminating feature for the presence of the crystalline hexahydrate. Similar experiments have been performed on HNO_3-doped H_2O ice in the range 179-208 K under experimental conditions where α and β-NAT have been observed using FTIR absorption of the ice/HNO_3 film in transmission. Similar temporal trends of $J_{ev}(H_2O)$ with changing χ_{HNO3} have been recorded. In the HNO_3-contaminated ice d_D, the pure ice thickness of a 1 μm thick ice film not affected by the presence of HNO_3 measured using a $J_{ev}(H_2O)$ criterion, seems to follow an inverse temperature dependence with d_D varying between 130 and 700 nm at 208 and 191 K, respectively. This highlights the important role that diffusional processes of acidic contaminants play in determining the evaporative lifetimes of atmospheric condensates. The presentation will conclude with a critical com-

parison between HCl/H_2O and HNO_3/H_2O. The measured values of $J_{ev}(H_2O)$ may lead to significant evaporative life-time extensions for HCl-and HNO_3-contaminated Cirrus cloud particles under atmospheric conditions. In a new development we will briefly present the integrated QCMB-FTIR absorption experiment where the QCMB element is probed using FTIR in grazing incidence. First results will display polarized HCl/H_2O and its dynamic behavior under stirred flow and molecular flow conditions.