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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The rate of water vapor evaporation from ice substrates in the presence of HCl and HBr: Implications for the lifetime of atmospheric ice particles" *by* C. Delval et al.

C. Delval et al.

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Answer to Referee Comment by J. P. Devlin in regards to "The rate of water vapor evaporation from ice substrates in the presence of HCl and HBr: Implications for the lifetime of atmospheric ice particles" by C. Delval et al.

In response to the referees lingering doubts on the accuracy of our HCl dosing procedure we would like to submit the Table displayed below. It shows the mass balance for six selected dosing experiments, namely that between HCl dispensed to the ice substrate (column 4 of enclosed Table) and the HCl recovered after the H_2O evaporation experiment (column 5 of enclosed Table) when the sample support is warmed up to completely desorb both the remaining H_2O and HCl. The quantitative aspect of the HCl dosing follows Figure 2 where the dose corresponds to the number of molecules defined by the hatched area (column 4 of enclosed Table). We have explicitly pointed out in the text that no loss of HCl into the gas phase is observed up to point E of Figure 3. Subsequently we count the number of HCl molecules desorbing into the cryostat chamber upon warming the cryostat by using the residual gas MS after suitable calibration according to equation (2). This is the origin of the values displayed in column 5. We believe that the quality and consistency of the displayed mass balance speaks for itself.

Experiment Number	Temperature (K)	HCl/Ice Structure	Number of HCl molecules deposited on ice (according to Fig.2)	Number of HCl molecules desorbing from ice during evaporation of the ice film (based on MS changes)
1	180	$HCl{:}6H_2O$	$8.7\ 10^{14}$	$8.4\ 10^{14}$
2	180	Amorphous	$2.1\ 10^{15}$	$2.0\ 10^{15}$
3	180	Amorphous	$4.3\ 10^{16}$	$3.6\ 10^{16}$
4	190	$HCl{:}6H_2O$	$1.1\ 10^{15}$	$1.1\ 10^{15}$
5	190	$HCl{:}6H_2O$	$1.0\ 10^{15}$	$9.8\ 10^{14}$
6	190	Amorphous	$2.0\ 10^{15}$	$1.7\ 10^{15}$

We will also present an additional explanatory drawing of the dosing arrangement in the revised paper (sorry, we can't submit the additional Figure in this response) that will display a horizontal cut whose plane contains the dosing tubes as well as the IR window including the beam. The cryostat stands out perpendicularly to the paper

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plane. The results of the dosing experiments displayed in the enclosed Table have all been obtained using this arrangement. We have calculated a negligible contribution of the background gas to condensation onto the IR window (0.77 cm^2) at a conservative upper limit of 10^{-6} Torr and a typical duration of the experiment of 1000s.

In the end we hope to have convinced the referee of the reliability of the dosing approach in the face of an untenable assumption on the IR absorption cross section of HCl hydrates that are nowhere to be found including in the referees own work. We take exception to the throw-away sentence at the end of the first paragraph that the point on the dosing "raises questions about much of the study".

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