Response to Faye McNeill

The authors thank Prof. McNeil for her insightful comments.

Figure 5 - The authors may gain deeper insight into the temperature and surface area dependence of their data by applying a thermodynamic model for predicting brine composition and volume as a function of temperature & total saline content in an ice brine system (e.g. using Cho et al. 2002 or our model Kuo et al. 2011).

Thermodynamic models such as those presented by Kuo et al. (2011) and Cho et al. (2002) can be used to predict brine composition and brine volume (fraction). These models indicate that the brine halide composition will be a function of temperature alone. The temperature independence for Cl_2 production that we observe for temperatures above the eutectic (Figure 5) may thus suggest that Cl_2 production is independent of brine $[Cl^-]$. This is consistent with reaction with Cl^- not being rate limiting. At the same time, we observe a strong dependence of Cl_2 production on the pH. Donaldson et al. ("Detailed Study of $HOCl + HCl \rightarrow Cl_2 + H_2O$ in Sulfuric Acid", *J. Phys. Chem. A*, **101**, 1997) suggest that the heterogeneous uptake of HOCl onto sulfuric acid solutions doped with HCl proceeds via:

$HOCl + H^+ \leftrightarrow H_2OCl^+$ R1
$H_2OCl^+ + Cl^- \rightarrow Cl_2 + H_2O$ R2
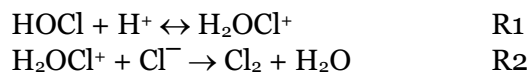
They found that R1 is rate limiting, which is consistent with this study which finds a) that Cl_2 production is independent of brine $[Cl^-]$ and b) a strong pH dependence for Cl_2 production.

Reasons for the observed temperature independence are now discussed in Section 3.8, with reference to the model predictions.

P14180 Line 19-26 regarding brine composition (dictated by temperature):

The text has been reworded.

The editing comments have been addressed.