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## ***Interactive comment on “Different photolysis kinetics at the surface of frozen freshwater vs. frozen salt solutions” by T. F. Kahan et al.***

**T. F. Kahan et al.**

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We wish to thank Dr. Domine for his careful and insightful comments. He makes two substantive points concerning the manuscript: First, that there should be more clarity concerning the nature of the ice sample (and the meaning of “bulk” ice in the context of reactions); and second (related) that samples may well not be at equilibrium and so interpretations based on equilibrium phase diagrams may not be appropriate. As part of the second point, he questions our interpretation of Figure 3.

We agree with his general concerns and will address them in the revised manuscript. In particular, the Introduction will be reworded to clarify the different regimes present in frozen aqueous systems, and the reaction kinetics which have been observed within these. We will briefly discuss the fact that unless freezing is carried out very slowly, it is

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likely that non-equilibrium effects will be important in describing the phase partitioning of frozen solutions. We will base part of this discussion on the references suggested by Domine (Cho et al and Thibert and Domine) and cite them as appropriate.

In the Discussion we will note that a quantitative description of the phases present in our samples may not be given by the equilibrium phase diagrams. Further, we will stress the equilibrium nature of the quantitative statements concerning brine concentrations. We will remove the data point in Figure 3 which shows the loss result at 243 K since we do agree its interpretation is ambiguous. However, we do note that there are many (not two only) measured data points for the kinetics measured at various [NaCl] at 253 K and that the trend from these is clearly monotonically decreasing with increasing salt concentration. While acknowledging that an equilibrium phase diagram may not be entirely appropriate to interpret our measurements, we note that in a qualitative way, it is consistent with observations and that such a picture would predict the slower NaBr results, also shown in Figure 3.

All the minor points will be addressed as suggested, except the final one. The present results (especially given their unknown departure from equilibrium) do not allow us to make general statements concerning the interactions between sea-salt particles and snowflakes.

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