

The Cryosphere Discuss., referee comment RC1
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Comment on tc-2021-376

Gernot Nehrke (Referee)

Referee comment on "Sublimation of frozen CsCl solutions in ESEM: determining the number and size of salt particles relevant to sea-salt aerosols" by Ľubica Vetráková et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-376-RC1>, 2022

The manuscript represents a study on the growth of CsCl crystals within the chamber of an ESEM and, based on these observations, draws conclusions for the formation sea-salt aerosols. The relatively large effective cross section of Cs results in a good contrast in the BSD signal, allowing a good separation between the CsCl crystals and ice. The authors argue that CaCl can be used to study the formation of sea-salt crystals (mainly NaCl) due to the similarity in eutectic temperatures.

At this point I do not agree with the authors. The difference in solubility product of both minerals is huge (more than a factor of four). The formation of minerals and their size in from sea ice is a complex process that involves the presence of different mineral phases. For example, the mineral precipitation during the formation of frost-flowers follows a complex temperature profile. Often the increase in temperature is moderate in the beginning (the water is already close to the freezing temperature of sea-water) followed by a sharp drop in temperature. The cooling rates used in the ESEM study in which a droplet of distilled water containing various amounts of CsCl does not represent a situation that mimics the natural one. I don't see an explanation how the different scenarios used (cooling rates, concentrations, and seeded vs. un-seeded) relate to natural processes. In an isolated, relatively clean system like the water droplet in an ESEM processes like supercooling are very likely, which will have a strong impact on the precipitation kinetics. This is not comparable to the natural system.

To summarize, I do not criticize the experiments itself, but I have my doubts that they allow any conclusions for the formation of "salt particles relevant to sea-salt aerosols). In my opinion the study would be more suitable for a journal like the "Journal of Crystal Growth" or "Crystal Growth and Design".

Best regards

Gernot Nehrke