

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2022-449

Anonymous Referee #1

Referee comment on "The Urmia playa as a source of airborne dust and ice-nucleating particles – Part 2: Unraveling the relationship between soil dust composition and ice nucleation activity" by Nikou Hamzhepour et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-449-RC2>, 2022

Review of Hamzhepour et al.

This manuscript reports the outcomes of a range of experiments aimed at determining which components of a range of soil samples are responsible for their ice nucleation activity. The manuscript concludes, reasonably I think, that bio-organic matter is probably responsible for the ice nucleation activity of unaltered samples. It is found that removing carbonates and salts from the dust increases the ice nucleation activity of both the mineral and organic fractions of the samples. It is an interesting and thorough study and the paper is well written. I have a few comments which the authors may wish to consider, however I support publication.

Comments

The conclusions are based on quite small temperature shifts. I think it is important that there is some discussion of the temperature uncertainty of the two measurements reported from the DSC, as mentioned by Referee 2.

Page 19 line 438- Whale (2022) recently showed that MgCl_2 has a similar effect on ice nucleation by feldspar to monovalent cations.

It seems relevant that the ice nucleation activities of both alkali feldspars (Harrison et al., 2016) and quartzes (Harrison et al., 2019) are known to vary a great deal. Something of why this is is known for feldspars (Whale et al., 2017; Kiselev et al., 2021) however, as far as I am aware, there is no good explanation at all for the quite broad range of ice nucleation activities observed for quartz samples. It may turn out to be incorrect to treat

all 'quartz' and all 'feldspar' as having the same responses to solution environment and the treatments laid out here. The 'reference' experiments are certainly interesting and worthwhile but there seems to me no guarantee at this point that the quartz and feldspar in the natural samples will behave similarly with regard to salt and pH environment. For instance the work of Perkins et al. (2020) and Yun et al. (2020) showed unexplained enhancements of ice nucleation by feldspar in the presence of K^+ ions, which hasn't been observed in other studies, suggesting that there may be more than one mechanism responsible for ice nucleation by feldspars. In a similar vein, I would not be entirely shocked if it turned out hydrogen peroxide treatment damaged the ice nucleating ability of minerals. A recent study by Daily et al (2022) showed that heat treatment can slightly impair the ice nucleating ability of feldspar for instance, which probably wouldn't have been expected. I don't think these concerns undermine the study, but I do think it would be a good idea to make clear that the complexity of the problem is such that there are unknowns, and that the various chemical treatments employed could have unintended impacts on observed ice nucleation.

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