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Reply on RC1

Nikou Hamzehpour et al.

Author comment on "Measurement report: The Urmia playa as a source of airborne dust and ice-nucleating particles – Part 1: Correlation between soils and airborne samples" by Nikou Hamzehpour et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-356-AC1, 2022

We thank Reviewer 1 for his/her thoughtful comments. We reproduce the reviewer's comments in black and our responses in blue. Line numbers refer to the revised manuscript.

The authors collected soil and dust samples in the Urmia Playa area in northwest of Iran. Physicochemical properties of soil and dust samples are analyzed. Mineralogical composition, elemental composition, and enrichment factors of dust samples are analyzed to identify the dust source. Moreover, the ice nucleation ability of soil and dust samples is also analyzed. The authors found that the IN activity positively depends on organic matter and clay minerals, while negatively depends on salinity, pH, K-feldspar, quartz, etc., which is very interesting.

The manuscript is well organized, the subject is relevant, the results are well presented and discussed, and, perhaps most importantly, the manuscript deals with an area where relevant observations are relatively rare. I believe the manuscript is suitable for publication after a minor revision.

Minor points:

I would like to see some discussions on what we learn from this study for the modeling community regarding the INP parameterization, in particular, for regional modeling over this area.

Reply: This is a very good question. Indeed, this region of the globe has gained little attention so far and we are not aware of regional climate modelling of it that includes INP properties. Also in global model studies like the recent study by Froyd et al. (2022), this region gained little attention in the discussion of the different emission sources. The present study shows that it is a regionally or even globally important source region for soil dust, yet, measurements performed by DSC cannot be directly converted to ice nucleation active site densities as required for input in models. We intend to do in future ice nucleation experiments with instruments that provide INAS. In addition, this region needs to be adequately represented as an emerging dust source region in models to yield meaningful results.

- Why the dust sample locations are away from the soil sample locations? Please clarify.

Reply: the collected dust samples have not been sampled far from the soil samples. They are collected at the meteorological stations in the nearby cities. The mean distance between soil and dust sampling locations is typically around 3 km. Like this, the local relevance of the soil sampling locations can be better judged compared with sampling soil and dust samples at exactly the same location. We collected samples in a reasonable distance from the soil samples to see:

- If there are other dust sources participating in the composition of the airborne dust samples in the region.
- If the dust coming from the playa surfaces affect the dust composition of the nearby cities.

- The observed data and also post-processed data should be accessible even though during the review process.

Reply: We have uploaded the observed and post-processed data to the ETH data repository.

- P4, L130: during -> from.

Reply: corrected

- P4, L132: "potential evaporation value" -> "an annual potential evaporation value".

Reply: corrected

- P25, L563: In most 2 wt% suspension cases, the second heterogeneous freezing peaks are still there. Please clarify.

Reply: Interestingly, the two investigated suspension concentrations yield INP densities so that the freezing signal in the 2 wt % samples is hardly lower or in some cases even larger than the one of the 5 wt % samples. We discuss this aspect in more detail in Part 2 of this paper series. In general, a small difference between the freezing signal of two different sample concentrations points to the presence of competing INPs with similar characteristic temperatures. In the Lake Urmia Playa samples, we have the additional effect of agents present in the samples that reduce or even inhibit the IN activity of INPs. We discuss this in Part 2.

- The title: "source" -> "a source"

Reply: corrected