

Referee comment: Dust Transport and Local Anthropogenic Emissions Differently Shape Atmospheric Ice-Nucleating Particles: Insights from an Industrial Urban Atmosphere, Yang et al., 2026

The manuscript presents one-month measurements of the INP concentration, size distribution and chemical species in the Chinese city of Taiyuan. While for days influenced by dust transport an enhanced INP concentration and inas density was observed, pollution episodes did not influence the aerosols' freezing ability substantially. As none of the chemical components correlated with the INP concentration during non-dust days, they concluded that the INP population in these times is composed of an interplay of particles rather than one single source.

Overall, the manuscript is well written and suits the scope of the journal. However, there are some points, listed below, that need clarification and would further improve the quality of the paper. After addressing these comments, I would recommend the manuscript for publication.

General comments

In L.172 you state that the surface area A , used to calculate n_s , is obtained from the SMPS measurements. According to L.111 the SMPS data cover the diameter range from 3 nm– 453 nm. With that, you leave out the particles larger than 0.5 μm in size, which are thought to be the most active in ice formation and many parameterizations are based on that. Even though the number of particles larger than 0.5 μm in size might be low, the total surface area is strongly affected. I am aware that the conversion from the optical to the aerodynamic diameter may introduce some uncertainty, however, not including these particles in the surface area will increase the uncertainty of n_s . I would suggest calculating n_s with the combined size distribution of the SMPS and OPC and provide a detailed discussion on the uncertainty of the surface area and with that n_s . Furthermore, the discussion around Fig. 2 and the comparison to literature data and parameterizations should be revised.

Minor comments

- L.92: Please add the altitude of the measurement site
- L.102: What is a two-channel sampler? Did you sample 2 filters in parallel with that? And what is your sampling cut-off? Please provide more details on that.
- L.121: Why did you convert everything to the mobility diameter? In the manuscript you don't pick it up again, so I think you should discuss the conversion of the mobility diameter to the aerodynamic diameter and give an uncertainty for that.
- L.122: Here you should give the value of the uncertainty. I think this is an important addition also for the discussion of n_s , which should include the larger particles (see my comment in the general comments section)
- L.153: Were also the aerosol data converted to standard conditions?
- L.178: Please specify why you chose 850 m a.s.l.; is it the height of the station?

- L.206: You discuss here the INP concentration at a temperature of -15 °C. However, looking into Fig. 1a, it is not clear which of the temperature ranges you mean (-12.5 °C - -15 °C or -15 °C to 17.5 °C). Please clarify it in the text.
- L.207: Do you refer to the n_s values seen in Fig. 3? Either add the reference to the figure or add the n_s values in Fig. 1.
- Fig.1a: The color of the bars of the INP concentration seems to change when you mark the special periods such as the dust transport. For more clarity, please make sure that the shaded areas are in the back and do not change the color the other markers.
- Fig. 1a: The gray triangles of the DeMott et al., 2015 parameterization should be removed here. You can add them to Fig. 2, where you anyways discuss some INP parameterizations.
- L.236: Cu and Sr are not shown in Fig. 1c or 1d.
- Fig. 2: Your freezing spectra of the dust episode have a very interesting profile, which is very characteristic of biological aerosol particles and not in the first place of dust. Hu et al., 2023 observed a similar INP concentration in Beijing in spring during dust transport. They performed a heat treatment on the samples and concluded that there might be some mixing of the dust aerosol with more heat sensitive, potentially biological, particles. Did you also perform a heat treatment to your samples? I think the discussion you provide in L.310 ff should be provided already here, with reference to the above-mentioned paper.
- L.274: should be orange instead of light gray
- L.278 ff: DeMott et al., 2015 is a parameterization made for desert dust aerosol. While for the dust episode it is a valid choice, it is expected that for the remaining measurements it might not provide reasonable results. Please specify this in the text.
- L.340: Did you also check the same correlations for other temperatures?
- Conclusions: When you discuss your findings during the dust transport episode, you should mention that potential aging processes do not suppress the INP efficiency. Next to that, you should mention again the potential mixing with biogenic particles. Since they are very ice active, it could be that you see in your samples primarily the biogenic particles freezing rather than the dust particles.

References

Hu, Y., Tian, P., Huang, M., Bi, K., Schneider, J., Umo, N. S., Ullmerich, N., Höhler, K., Jing, X., Xue, H., Ding, D., Liu, Y., Leisner, T., and Möhler, O.: Characteristics of ice-nucleating particles in Beijing during spring: A comparison study of measurements between the suburban and a nearby mountain area, *Atmospheric Environment*, 293, 119451, <https://doi.org/10.1016/j.atmosenv.2022.119451>, 2023.

