

Review of “Leipzig Ice Nucleation chamber Comparison (LINC): Inter-comparison of four online ice nucleation counters” by Burkert-Kohn et al.

**General Comment:**

This manuscript presents the results of the direct inter-comparison of four cloud chambers (i.e., The Leipzig aerosol cloud interaction simulator (LACIS), the Portable immersion mode cooling chamber coupled to the portable ice nucleation chamber (PIMCA-PINC), the Portable ice nucleation chamber (PINC), and the spectrometer for ice nuclei (SPIN)). Different size-selected (200, 300, and 500 nm) uncoated (microcline, kaolinite, birch pollen) and coated (microcline/H<sub>2</sub>SO<sub>4</sub>, microcline/HNO<sub>3</sub>) aerosol types were used to determine the performance of these INP counters. Given the versatility of the used cloud chamber, three out of the four heterogeneous ice nucleation modes were also studied (i.e., deposition nucleation, condensation and immersion freezing).

Although this manuscript does not present a completely novel idea given that this approach was introduced/presented in earlier studies, it is the first time that these four instruments are directly compared. This is of high value for the ice nucleation community, especially because the SPIN is a commercial instrument that will be used in several studies. There is an urgent need to understand what different cloud chamber measures, and this study provides very useful information that helps cloud chamber users to interpret their results. The manuscript is very well written and the figures are easy to follow. The experiments were carefully designed and the results are accurately interpreted. This manuscript can be accepted in ACP after the following minor corrections are taken into account.

**Minor comments:**

1. I am wondering if the authors can comment about the following question. Out of the four instruments investigated in this study, what is the most reliable? Is there a “standard” instrument that can be used to validate a newly designed INP counter?
2. I like Figure 2 but it took me sometime to follow it. It may be more useful to use filled and open symbols here.
3. I did not understand why the LACIS modeled results by the SMB reached a plateau but not the PIMCA-PINC? Is it the model instrument specific?

**Specific comments:**

Page 2, line 3: Do the authors mean: “its importance”?

Page 2, line 3: I don’t think this is the only paper showing this. Please add more references here.

Page 2, line 4: Spell-out INP.

Page 2, line 6: Add references after “climate”.

Page 2, line 19: Replace “which” with “what”.

Page 2, line 20: Add references after “understood”.

Page 2, lines 20-22: I don't understand what the authors want to communicate here. Please clarify it.

Page 2, line 25: hourly? daily?

Page 2, line 33: DeMott et al., 2016 could be add it to the list.

Page 3, line 10: Please state what type of CFDC the authors refer to. CSU?

Page 3, line 12: Please state what type of mineral dust was used.

Page 3, line 33: Add references after "activity".

Page 4, line 23: I found the pore size quite big. Is there any chance that small fragments of the pollen grains could go through the filter pores?

Page 4, line 31 and Figure 1: I think it should be "Nuclei" instead of "Nucleus".

Page 5, line 12: "parallel" is out of place.

Page 6, line 12: Please state what diameter the authors are referring to.

Page 7, line 29-30: Based on Garimella et al. (2016), the SPIN has a depolarization optical detector. I am wondering why the authors did not use this to discriminate between ice particles and droplets, instead to focus on their size only?

Page 8, line 6: Delete Hartmann et al., 2011.

Page 10, line 25: I am wondering why the authors did not perform an experiment with 500 nm microcline particles as done for kaolinite and Birch pollen.

Page 11, line 1: Add references after "INPs".

Page 11, line 16: "note" is out of place.

Page 12, line 18-19: This is a bit unclear. Please clarify it.

Page 14, line 28-32: Given that these experiments differ from the others (i.e., they are not directly comparable), I am wondering if this should be removed for consistency.

Page 17, line 11-12 and Figure 7: Add "W" to RH.

Page 18, line 3: I don't think this is the only paper showing this. Please add more references here.

Table 1. Why is microcline twice here?

## References

DeMott, P. J., Hill, T. C. J., McCluskey, C. S., Prather, K. A., Collins, D. B., Sullivan, R. C., Ruppel, M. J., Mason, R. H., Irish, V. E., Lee, T., Hwang, C. Y., Rhee, T. S., Snider, J. R., McMeeking, G. R., Dhaniyala, S., Lewis, E. R., Wentzell, J. J. B., Abbatt, J., Lee, C., Sultana, C. M., Ault, A. P., Axson, J. L., Martinez, M. D., Venero, I., Santos-Figueroa, G., Stokes, M. D., Deane, G. B., Mayol-Bracero, O. L., Grassian, V. H., Bertram, T. H., Bertram, A. K., Moffett, B. F., and Franc, G. D.: Sea spray aerosol as a unique source of ice nucleating particles, *P. Natl. Acad. Sci. USA*, 113, 5797–5803, doi:10.1073/pnas.1514034112, 2016

Garimella, S., Kristensen, T. B., Ignatius, K., Welti, A., Voigtländer, J., Kulkarni, G. R., Sagan, F., Kok, G. L., Dorsey, J., Nichman, L., Rothenberg, D. A., Rösch, M., Kirchgäßner, A. C. R., Ladkin, R., Wex, H., Wilson, T. W., Ladino, L. A., Abbatt, J. P. D., Stetzer, O., 15 Lohmann, U., Stratmann, F., and Cziczo, D. J.: The SPectrometer for Ice Nuclei (SPIN): an instrument to investigate ice nucleation, *Atmos. Meas. Tech.*, 9, 2781–2795, doi:10.5194/amt-9-2781-2016, 2016.