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

Summary and general comments

This study presents a quantitative evaluation of the ice nucleation (IN) abilities of seven types of aerosol particles measured by four IN counters co-located at TROPOS, Leipzig. Based on the results obtained, the authors address the importance of the inter-comparison workshop with co-deployed instruments, uniform aerosol dispersion procedure and size segregation method. From my point of view, the difference in the ice crystal threshold sizes of PINC and SPIN is well justified (Sect. 3.2). Not employing upstream impactors to minimize biases of particle losses throughout this inter-comparison work was wise (P5L2-4).

Besides the suggestions for future studies made by the authors (P22L28-33), a comparative validation workshop of atmospherically representative ambient samples or in-situ field comparison of IN techniques (*DeMott et al*., 2017, ACPD) is also an important assignment for the IN research community. Finding a universal calibrant that can be used for validating any IN instruments at home bases should be kept as an alternative approach especially for those who may join this research field in the future.

I support publication of this manuscript after some minor comments below are properly addressed. Given the technical nature of the manuscript, it may be better published as a technical note in ACP or AMT than a regular research article according to the journal guidance:

www.atmospheric-chemistry-and-physics.net/about/manuscript_types.html.

I will leave this discussion to the authors and the editor.

Minor/technical comments

Section 3.3: It is not conclusive that the observed difference between *FF* and *AF* is due to different ice nucleation modes (that is, immersion vs. condensation) or technical artifacts/limitations (e.g., different methods in ice detection and IN efficiency estimation). Is it really fair to say what the authors present in this particular section is immersion vs. condensation? One can presume that the technical artifacts, such as ice detection, IN efficiency estimation (e.g., *FF* vs. *AF*), misalignment of particle stream in the chamber and inhomogeneous distribution of particles in individual droplets, play substantial role on potentially explaining the observed difference amongst the compared techniques. For this matter, the sub-title of this section should be named differently?

P1L10: Better read with “the whole range of atmospherically relevant thermodynamic conditions”

P2L19: The dominance of immersion freezing (P18 L2-3) may be better discussed in here. The extended discussion may be helpful to the reader.

P4L5-6: “…droplet containing a single aerosol particle…” - how good is this assumption? In reality, multiple particles might be in a droplet when aerosols were made using a suspension (*Emersic et al*., 2015, ACP; *Baydoun et al*., 2016, ACP; also your own statement in P9L4-5). This may be RH & droplet size dependent. Would this factor be important to interpret the difference between *FF* and *AF*?

P14 L12: *Sullivan et al*., 2010, GRL – authors perhaps meant to cite the following paper?

> Sullivan, R. C. et al. (2010, ACP), Irreversible loss of ice nucleation active sites in mineral dust particles caused by sulphuric acid condensation, Atmos. Chem. Phys., 10 ,11,471–1 1,487, doi :10.5194/acp-10-11471-2010.

Sullivan et al. (2010, GRL) demonstrated that condensation/diffusion of hygroscopic materials could make particles ice active in immersion/condensation mode (which may be discussed anyway in the paper separately…).

P14L24-25: “The brichN particles are the most hygroscopic…” - based on what? CCNC? Either data or reference is missing.

P21L4-5: “…particles of uniform composition such as microcline” - I disagree with this statement. The authors state that their microcline sample contains bi-components (P4L10-12).

P22L7-10: I suggest separating into two sentences to improve the clarity of the statement - e.g., “Treatment of the microcline sample with either sulfuric or nitric acid…permanently in immersion freezing. In addition, the nitric acid treatment lead to…between 233 K and 243 K.”.