

## ***Interactive comment on “The Horizontal Ice Nucleation Chamber HINC: INP measurements at Conditions Relevant for Mixed-Phase Clouds at the High Altitude Research Station Jungfraujoch” by Larissa Lacher et al.***

**Anonymous Referee #3**

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Authors present a new instrument to measure INP concentration particularly relevant to mixed-phase clouds. They validate the instrument performance using standard chemical compounds for which the thermodynamic properties are well known. They deploy the instrument at the field site to further validate the performance. Results look promising, and I recommend publication after addressing following minor comments. The main concern is how ice crystals are distinguished from droplets, and the discussion over this topic is not convincing.

Can aerosol movable injector perturb the flow conditions within the main chamber?

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The injector object is obstructing the sheath flow.

The length of the injector is defined but did not find the diameter of the injector. Do the injector has slots to inject aerosols? What are the dimensions of these slots? Do all these slots deliver aerosol particles evenly and how this is calculated?

The distance between the warm and cold plates is 20 mm. Typically within CFDC, it is around 10 mm. Is the gap is maintained at 20 mm because to increase the particle residence time? Would this affect the supersaturation profile?

Figures 2 and 3: It is not clear why different size acid droplets were used. In figure 2 ice can be detected in the OPC size bin 2 – 8  $\mu\text{m}$ . In figure 3, where we don't expect ice particles, the droplets can be seen in three bin channels that range from 0.5 – 5  $\mu\text{m}$ . The size channels overlap between figure 2 and 3. This is confusing to understand. Is this means one cannot use size channels only to distinguish between ice and supercooled droplets?

This leads to other question regarding figure 4. How one can determine the INP concentration using this data? On page 13 it says one can use size channel  $> 5 \mu\text{m}$ , but on page 12 (line 11) it says larger particles ( $> 5 \mu\text{m}$ ) may settle and one cannot see any particles in this channel. Both statements are confusing.

Page 13, lines 4-6: The experiment was conducted at these conditions and results are shown in Figure 4. Here it was shown that there are no particles observed in channel  $> 5 \mu\text{m}$ . What if all these ambient particles were Organics or pure inorganic salts; one can see the data shown in figure 4. But if there are small dust particles, they might induce ice nucleation and grow to size  $< 5 \mu\text{m}$ . In this case, droplets and ice particles co-exist. Discussion along these lines is necessary. Limitations imposed on INP concentrations by these conditions (page 13, lines 4-6) must be discussed.

Page 17: Authors use field measurements to validate the performance. However, there is an assumption made (although not mentioned in the manuscript) that aerosol

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properties (size, composition, morphology) have remained constant over all the years throughout winter. This may not be true and cannot use such data to validate the performance of the chamber. I suggest rephrasing the discussion to say that INP measurements results were comparable (Fig 9) with previous measurements but using different instruments.

To improve the readability I also suggest moving some of the text from section 2, 3 and 4 to supplementary. For example, section 2.3 can be shortened. Also, section 3.3 and 4.2.

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