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Atmospheric Measurement Techniques Discussions

Interactive comment on "The portable ice nucleation experiment PINE: a new online instrument for laboratory studies and automated long-term field observations of ice-nucleating particles" *by* Ottmar Möhler et al.

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Author comment in response to the comments provided by Referee #2

We thank referee #2 for her/his effort in reading and commenting our manuscript. In the following, we repeat the referee's comments (italics), give point-by-point answers, and suggest manuscript revisions based on the referee's comments and our answers. Respective reference will be given to the line numbers of manuscript version 1.

Referee comment: *A new laboratory instrument for INP measurement called "portable*

Ince Nucleation Experiment" (PINE) chamber is introduced in this manuscript. The design, working principles, and operational procedures of the PINE chamber are described in details, as well as preliminary results from the HyICE campaign, AIDA intercomparison and SGP-ExINP long-term measurements are provided as work cases in the paper. The development of the PINE chamber is a great contribution to the INP research field in specific and the Atmospheric science in general. It also provides long-term monitoring capability to operation-oriented organizations. The topic fits AMT scope perfectly. The paper is well organized and written. After the authors address my minor points, it should be in good shape for publication on AMT.

Minor comments: *The font on many figures is too small.*

Answer: This was also mentioned by Referee #1. We will re-plot the figures with larger fonts.

Referee comment: *Line 175: remove "and"*

Answer: done

Referee comment: *Line 265: What is the aerosol size range for these concentrations?*

Answer: The majority of particles was smaller than $500\,\mathrm{nm}$ in diameter. Only a minor fraction ($< 0.1\,\mathrm{cm}^{-3}$) had diameters between $0.5\,\mu\mathrm{m}$ and $5\,\mu\mathrm{m}$. We will add the following to line 264: "..., with the majority of particles smaller than $0.5\,\mu\mathrm{m}$ in diameter, ..."

Referee comment: *Lines 271 to 275: Is the assumption of ice saturated condition at the beginning of expansion reasonable? The response of the OPC does agree with this assumption. But is it universally valid?*

Answer: Yes, we think this assumption is reasonable because the frost point temperature of the air sampled into the chamber was higher than the average wall temperature. The excess water vapor quickly condenses to the cold chamber walls, so that ice saturated conditions of the air inside the cloud chamber are reached. We re-phrase line 273 for including this information.

Referee comment: *Line 287: "larger than the dense"*

Answer: changed

Referee comment: *Figure 6: Can a turbulence be introduced to the chamber to mix the air so that the temperature is more uniform across the chamber?*

Answer: This is a good idea and suggestion we have already discussed among the PINE team members. Of course, such fan driven mixing is an important part for operating the large AIDA cloud chamber at homogeneous gas temperature conditions. Until now, we did neither test this option for the small $10\,\mathrm{L}$ PINE chamber nor did we discuss the technical solution. But it is an option for further developing and improving the PINE chamber.

Referee comment: *Line 446: replace "largest" with "highest".*

Answer: done

Referee comment: *Line 468: Based on Fig. 12, the minimum INP concentration is about 0.02 L-1, not 0.2 L-1.*

Answer: The referee is right, it will be corrected. Thanks for noting this.

Referee comment: *There are multiple places stating that details on HyICE results and SGP-ExINP results will be discussed in details in future papers. Can reduce the redundancy.*

Answer: Yes, we agree. We removed respective statements for the HyICE campaign because not of relevance here (e.g. line 377, 474), but kept it for the DOE SGP campaign section. We suggest reformulating the sentence in line 320 to "Ongoing activities for improving the operation and data analysis tools for PINE also focus on developing an automated procedure for setting this threshold."

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