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Atmospheric Measurement Techniques Discussions

Interactive comment on "Best practices for precipitation sample storage for offline studies of ice nucleation" *by* Charlotte M. Beall et al.

Anonymous Referee #4

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General comments:

This manuscript provides a systematic study of the effect of storage conditions on the number and activity of ice-nucleating particles (INP) in precipitation samples. The study has implications for numerous past and future studies of INPs, and it fits the scope of Atmospheric Measurement Techniques as it provides "techniques of data processing and information retrieval for [...] aerosols [...]".

The paper text, length, and most of the figures are appropriate. However, I have some specific reservations regarding some of the analysis and related figures. For example, figures S1-S4 should be revised and the related correlation analysis, too. Moreover, I do not agree with the recommendation of specific correction factors. The strength of the paper is not the provision of specific correction factors for various storage protocols

– in my mind the usefulness of such factors are questionable – but by showing which storage protocols are most suitable for offline measurements of INPs, and by making suggestions for sensitivity analyses that should go along with every such measurement in the future. For more details, see the specific comments below.

In summary, this is a useful paper, which may be publishable in Atmospheric Measurement Techniques after the comments below have been considered.

Scientific comments:

(1) Figure 1 and line 136: I am wondering, why the error bars shown are symmetrical. In a log-plot, I would assume unsymmetrical bars for symmetrical errors.

(2) L.138: Section 3.2: I am missing storage experiments with 'pure' water, since we know from our own experiments that even deionized/distilled water can become ice-nucleating after several days.

(3) L.192-193, L262-263 (conclusion), L.292-293: Apparently, there are significant deviations in the stored:fresh ratios, both above and below 1. How can then simple correction factors be applied? In addition, I am highly skeptical about these correction factors: given that the actual correction factors are usually small (mostly between 0.9 and 1.8), they are likely much smaller than most other errors in such type of ice nucleation studies, and so their usefulness is questionable in my view. In addition, it is highly questionable whether these correction factors can be applied to studies at other locations, using different sampling and investigation methods, and studying different (marine) samples. I would very much prefer to see instead the uncorrected raw data then in such studies. In summary, I do not concur with conclusion no. 2. The authors also seem to be skeptical as they state in lines 292-293: "However, it remains to be seen how INP sensitivity to storage varies by environment or INP composition."

(4) Figure S1-S4: I do not understand what is plotted in Figures S1 through S4 in

the supplement, and I am in doubt that it is correct. The captions say “INP losses or enhancements (%) . . .” What are losses in %? Shouldn’t they be given as negative numbers? How can losses and enhancements be fitted simultaneously as a basis for correlation analysis, as the figure captions imply?

Even if not losses in percent are meant but if loss factors are presented, then losses would imply values smaller than 1. However, in none of the figures S1-S4 is there any point below the 10ˆ0 line. How can that be, as figures 2-4 of the main paper clearly show that losses do occur?

Moreover, I am wondering whether plotting the losses or enhancements in percent does make sense at all. I think factors would be more suitable, because some of the changes are several orders of magnitudes. In particular for losses (not such much for enhancements), plotting them in percent may be misleading: for example losses by a factor of 10ˆ-2 or 10ˆ-4 (i.e., a difference of two orders of magnitude) would lead to a loss of nearly -100% in both cases (-99% or -99.99%). Note that losses cannot be lower than -100%!

Minor and technical comments:

(5) L.88: “At the MESOM Laboratory parking lot. . .” To which of the two collection points given (lines 81-83) does this location belong?

(6) L.262-263: “. . . it is worth noting that freezing is lethal for most cells” This statement is too general. Note that INTRACELLULAR freezing is lethal for most cells, while EXTRACELLULAR freezing is often not critical and, thus, survived by freeze-tolerating species.

(7) L.458 (caption to Fig.3): “measured in heated precipitation samples” When were the samples heated? Directly after collection, or just before measurement?

(8) L.468 (caption to Fig.4): “measured in filtered (0.45 μm) precipitation samples”

When were the samples filtered? Directly after collection, or just before measurement?

(9) Tables 5-7: Please provide a few sentences of explanation on the 95% confidence interval limits. What exactly do these values imply and, more importantly, how can they be applied? For example, considering line 2 in Table 5: the suggested correction factor is 1.72. The confidence limits of this correction factor are 0.25 and 11.27, implying that the correction factor could also be significantly below 1. I was wondering then, given this large confidence interval, whether it is useful at all to make such a correction (see also my comment 3 above).

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