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

Anonymous Referee #1

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Beall et al., describes a methodology used by a collaborative group of researchers collecting and then investigating precipitation samples. While the predominant focus is post-collection, laboratory ice nucleation studies it is also a methodology of use for other analytical techniques. The topic of the manuscript is not ground-breaking; storage and subsequent use of precipitation samples has been in place for many decades. However, the description of the methodology is useful for the field and worthy of a publication in AMT.

Beall et al. is a generally well written paper but there are some issues that the authors should consider in revision. Overall, the paper needs to expand the description of the experiments and their context to the larger literature. There are also several statements of cause – effect and/or attribution which, based on the experiments, seem to actually

be theory or assumption by the authors. These should be cleaned up so as to not misinform the reader.

Comments:

1. The 15 samples used as the basis of this paper seems a reasonable number; however, they are all from the same location and therefore likely have a similar mix of INP types. Do the researchers have access to more diverse samples? Would these results hold if the sample was e.g. collected from a boreal forest? A desert? (see also comment on the 'correction factor' in point 3). Given the expertise in the author list, it would seem that access to a variety of samples would be possible. To emphasize this point : the title of this paper is ""Best practices for precipitation sample storage for offline studies of ice nucleation" – of universal importance. But in the Discussion "The aim of this study was to identify a storage protocol . . . in a coastal environment." – much more limited. The 'coastal' modifier is then repeatedly used but this isn't even universally coastal – it is a single coastal location. Either the authors should place the much more geographically restrictive information up front – title and abstract – or provide a larger diversity of samples. The latter, clearly, would be much more beneficial to the field as a whole. 2. Follow on. : At what time of year / conditions were the samples collected? Are these from the same or similar events? What is the diversity of conditions (season, meteorological, etc.)? 3. Starting in the Abstract and continuing through the paper : ". . . non-heat-labile INPs being generally less sensitive to storage regime. . ." "Non-heat-labile INPs were generally less sensitive" This seems to be an assumption; the experiment determines abundances of heat or non-head labile INPs before and after but can not directly say something was changed or not. The authors should indicate that, based on abundances, they assume that the storage process is responsible for the change but not absolutely attribute it. As an example, a constant abundance could mean that no change was caused by storage or that there were roughly equal rates of enhancement and deactivation; the measurements made would not be able to differential this, correct? 4. If the assumption that heat labile INPs

are more sensitive to storage, I don't believe the authors can offer (again, point made in Abstract and continuing through paper):"correction factors are provided so that INP measurements obtained from stored samples may be used to estimate concentrations in fresh samples"– wouldn't said correction factor necessarily be a function of the ratio of non- to heat labile INPs? Therefore the correction factor would not be universal but a function of the INP mix? 5. Introduction "Measurements of INPs suspended in precipitation are commonly made offline using a droplet freezing assay technique, and many studies report results from samples stored prior to processing. Storage protocols vary widely, including total storage time, time between collection and storage, and temperature fluctuations between collection, shipment and storage (if these details are provided at all), yet generally samples are stored between + 4 °C and -20 °C (see Table S1)." – These two sentences follow on a paragraph on INP in clouds. They are disparate concepts and should represent two new paragraphs: (1) how are off-line INP measurements made (they are not only by drop freezing assay – that is only the technique used here)? and (2) there should be a more complete description of storage used by previous researchers, not just a statement that it varies widely / table reference. 6. Discussion, last paragraph starts "Significant enhancements in INP concentrations occurred less frequently than losses. Again, changes in the total particle size distribution could explain some of the observed INP concentration enhancements." – an important conclusion. However, the paragraph then changes topics to the impact of freezing on IN-active (biological) molecules. This is neither consistent with the topic of the paragraph nor is it part of the research outlined in the paper. Lines 259-269, as currently constituted, should be removed.

Grammatical / Spelling

Abstract "…likely and an additional uncertainty in INP concentrations…" remove and?

"Significant insights have been obtained…" 'highly uncertain' : please eliminate non-objective terms like 'significant' (throughout paper) – these are reader dependent, not quantitative.