

We would like to start this response to Reviewer document with a thank you to all three Reviewers for their work to help us improve the manuscript. We also thank your patience; the length of time between review and revision was that we took your comments very seriously. First, we have conducted a new and comprehensive set of experiments to validate all inlet components as well as the composite system. This was the source of many review points from all three Reviewers. Second, we have removed the Storm Peak experiments, the source of several comments. We believe this streamlines and focuses the paper on the inlet calibration work. Specific changes are outlined below in a point by point format, including reference improvement, with our response in *italics*. With regard to the extensive new experiments we will often refer to 'please see new content for details' for simplicity.

Responses to Reviewer 3

In introduction or later in results part I would like to see comprehensive discussion on possible sampling artefacts. Statement on L112-113 that there is no possible break up just because modelling says so is not sufficient. For example, can the effect of scavenging of interstitial particles by ice crystals and droplets be estimated?

This topic was the subject of Pekour and Cziczo (2011); we now include “A treatment of inadvertent transmission of particles smaller than the D50 as well as droplet and ice crystal breakup was considered by Pekour and Cziczo (2011); specifics for SPIDER are discussed in the following sections.” in the introduction and an increased discussion in Section 2.

How relevant are latex PSL spheres used for calibration with respect to different aerodynamic behaviour of ice crystals?

Please see extensively expanded calibration tests with both droplets and ice.

There are earlier studies showing (e.g. Fig 4 in Kupiszewski, 2016) that in various environments there are smaller ice crystals and INP particles than is the lower cut size of sizing OPC and cut off selection size of PCVI. Using instrument with lower cut off on both, residual and interstitial (PF) flow line is necessary to provide relevant quantitative characterization of the instrument.

We have enhanced the measurements as much as possible with new instrumentation, including an APS. Regarding small particle transmission, please see previous comments that all PCVIs are subject to some level of inadvertent transmission, normally proportional to the number density of aerosol particles. Therefore, small particle transmission is expected, the goal is to reduce it as much as possible. Since the focus of these studies are larger particles the reduction of small particle artifacts was not a focus of this work.

Also lower size cut off of the initial separation around 10 μm does not cover full size of spectra of hydrometeors (e.g. Patade, 2015) and this should be discussed in the manuscript how SPIDER can be possibly modified or combined with additional instrumentation to provide relevant information on how big fraction of population it actually sample.

The field work from 2021-22 is now removed.

References

Kupiszewski et al, JGR 2016, <https://doi.org/10.1002/2016JD024894>
Patade et al, JGR 2015, <https://doi.org/10.1002/2015JD023375>