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Atmospheric Measurement Techniques Discussions

Interactive comment on "The Ice Selective Inlet: a novel technique for exclusive extraction of pristine ice crystals in mixed-phase clouds" *by* P. Kupiszewski et al.

Anonymous Referee #2

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Major Comments

This paper reports on a major experimental effort to solve a difficult problem–the capture of ice crystals in a mixed phase cloud. The paper is well written and the design is carefully and logically thought out. However, "before and after" checks with instruments built specifically for this purposes yielded differences that suggest the system is sublimating ice crystals, an unintended consequence. The field section (Section 3) should be expanded as suggested below. The design and theory is worth publishing, and I don't feel as strongly as the other reviewer that all aspects are required to be tested in the lab prior to deployment (although of course that would be useful). I suspect that

the paper represents several years of effort for design, fabrication and characterization of various aspects of the instrument already. But, since the instrument was involved in a major field program, additional characterization with field data, and comparisons to both the Ice-CVI and microphysical instruments would be useful.

p. 12499-12500: Sublimation of ice crystals during sampling is seen as a "major obstacle" in sampling mixed-phase clouds. Please elaborate on this issue here, rather than in the Conclusions. What fraction of ice crystals in the target size range are actually missing? Are only qualitative results on the nature of ice crystal composition possible? How do results overall compare with the earlier technology, the Ice-CVI, and with concentrations of droplets and ice measured by microphysical instruments? What steps can be taken to pinpoint the problem and improve the new instrument? etc.

Minor Comments

p. 12483, line 16: Insert "in mixed-phase clouds" after "enhance precipitation", as this is likely not the case in cirrus clouds. Line 21: Awkward wording. Suggest changing ", besides" to "in addition to".

p. 12484, line 4: Change "would" to "could", as this part of the chain is still speculative.

p. 12485-12486: What flow speed are the particles separated at? What prevents larger ice crystals from breaking up in the flow due to aerodynamic stresses (e.g., what are the Weber numbers)? What about impaction while making the turn into the "omnidirectional inlet"?

p. 12486, lines 4-12: All good and underappreciated points.

p. 12490-12491: The potential weakness is the 50 micron droplet, which may not have time to evaporate fully, depending on the accommodation coefficient. Granted the mean droplet size is usually much smaller than this, but larger droplets do exist at times in MPC. However, as is mentioned near the end, the cyclone is expected to remove most larger hydrometeors. What is the transmission efficiency of the cyclone?

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Will any 50 micron droplets make it through? Perhaps you should just limit discussion of evaporation to droplet sizes that are expected to be transmitted at efficiencies of a few percent or more. Larger sizes are likely to have negligible impact on results (particularly since they usually will be present at lower concentrations than smaller droplets).

Figure 1: I know this is primarily a schematic, but dimensions (at least lengths even if not to scale) should be included.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 12481, 2014.