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Atmospheric Measurement Techniques Discussions

AMTD

7, C4690–C4692, 2015

Interactive Comment

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 #3

Received and published: 21 January 2015

Summary:

The paper presents a design of an ice selective inlet for characterization of multi-phase clouds. The inlet uses a cyclone to eliminate particles larger than 20 ïĄ■m from the sample and smaller particles are passed through an evaporator section. Exploiting the difference in the saturation vapor pressures over ice particles and water droplets, the evaporator permits the near unchanged transport of ice particles while liquid droplets evaporate to smaller sizes. A counterflow impactor is then used to separate out the larger ice particles from the smaller droplets and the size distributions of the particles are measured using an optical particle counter. The inlet design uses well-established

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Interactive Discussion

Discussion Paper

aerosol sampling and separation principles and the preliminary results from the field deployment suggest that the sampler concept works reasonably. The paper is well written, addresses a critical atmospheric sampling requirement, and the methods employed are scientifically valid. After addressing the below comments I have for the authors, I believe that the paper should be published in AMT.

1) The entrance of the ISI uses an omni-directional inlet. How effective is this inlet for sampling large particles? In particular, I would expect that the sampling efficiency of large particles will be very dependent on the wind velocity. A paper on large particle sampling with an omni-directional inlet was published few years back (Lee et al, 2008; AST42:2, 140-151) that suggested that a small sample flowrate would result in strong wind-speed dependent sampling efficiencies for the inlet. For the current inlet dimensions, is the sampling performance curve known as a function of particle size and wind velocity? If not, can the measured particle concentrations be translated to ambient concentrations?

2) I would assume that large liquid droplets and ice particles will impact on the walls of the inlet and possibly shatter. What is expected critical size for impaction and shatter of liquid droplets and ice particles as a function of wind speed? Can this be eliminated as a source of artifact here? Similarly, could the impaction of large droplets/ice particles in the cyclone produce sampling artifacts?

3) Page 12492: Lines 10-15: What are the Reynolds numbers of flows in the different regions of the inlet? I would assume that the flow exiting the cyclone (and entering the evaporator) to be turbulent. Was turbulence considered in the flow modeling and more importantly in the particle trajectory calculations? Similar to the BMI PCVI transmission efficiency measurements, I recommend presentation of the transmission efficiency of the other elements of the instrument (droplet evaporation unit, omni-directional inlet, and cyclone).

4) Figure 9: Central to the success of the current design is the need for the cyclone

to eliminate droplets larger than 20 ïĄ■m from entering the evaporator section. If large droplets pass through the cyclone, then their long evaporation times will allow for their passage through the downstream counterflow impactor. From the data in Figure 9, it is seen that large droplets are indeed present in the flow. The availability of the two WELAS units should allow for the determination of the cyclone separator performance that is critical for the accurate characterization of ISI.

5) In Figures 2 and 3, the colors of the lines indicated on the legend are not consistent with that in the caption (the caption description is correct).

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