

**Review of : “Ice Crystal Concentrations in Wave Clouds: Dependencies on Temperature,  $D > 0.5 \mu\text{m}$  Aerosol Particle Concentration and Duration of Cloud Processing” by Peng et al**

The paper combines parcel modelling of streamlines through wave clouds with observations from aircraft to test the DeMott et al. 2010 ice nucleation parameterisation. The authors also attempt to investigate the importance of time dependent freezing.

The paper is well written and concise and potentially a good test of a commonly used ice nuclei representation. However, the determination of ice concentration from 50 micron size particles, that is used to directly compare to the DeMott et al. formula is my biggest concern. Measurements of these particle sizes is highly uncertain and this problem needs to be addressed more thoroughly before this paper can be published.

Major points:

26597:13-26598:20

The determination of ice concentration from 50 micron size particles is my biggest concern. This needs to be addressed before this paper can be published.

Shattering has been discounted, but it would be easy to quickly assess the fraction of particles with unusually short interarrival times to support the authors assumption.

The authors quote a comparison made between oil coated slides and the 2DC as proof of the reliability of using that measurement. At best that comparison is only valid for the 2dc probe with the configuration of electronics, optics and processing used at the time. I think that the later paper by Strapp et al. (2001, J. Atmos. Ocean. Technol., 18, 1150–1170) is more general and supersedes those previous findings.

Strapp et al. 2001 note that variation in time response and thresholds for the 2DC probes mean that sizing for particles smaller than 125 micrometers is highly uncertain. That uncertainty in sizing affects the assumed depth of field and translates into large uncertainties and biases in the concentration. Corrections have been proposed (references in Strapp et al.), but knowledge of the response characteristics, depth of field and detection threshold is required.

Possible solutions are to use a larger ice size threshold for which the concentrations are more reliable combined with an estimate of the number concentration of ice crystals larger than that threshold.

26605:10 Mixedphase time. I like what the authors have attempted to do, but the 5K temperature ranges are large. From DeMott et al 2010, the change in ice concentration would need to be greater than a factor of 2 in order to be observed for a 5K temperature window. I think that the authors need to add this to their discussion about what they are able to say about the importance of time dependent ice nucleation.

Minor points:

26593:5. By 'latter' do you mean heterogeneous freezing?

26601:10. At this point in the text I don't understand why the relative value was computed.

26602:24. Condition 1) indicates that  $N(D > 25 \text{ micrometers})$  has to be greater than  $2 \times N(D < 50 \text{ micrometers})$  for inclusion.