

Interactive comment on “Cloud condensation nuclei as a modulator of ice processes in Arctic mixed-phase clouds” by S. Lance et al.

S. Lance et al.

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We thank the reviewers for their time.

After consideration of the comments by referee #2, we have decided to keep the offending sentence: “Our observations suggest that, while IN clearly must be present for ice to form in these clouds, IN concentrations are not the primary limiting factor for ice formation.”

As stated, ice nuclei are one limiting factor (“IN clearly must be present for ice to form”). Since droplet size is correlated to ice crystal concentrations, as has been shown previously, large droplets appear to be another limiting factor. We suggest that the presence

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of large droplets is actually the primary limiting factor, since our expectations about particles acting as IN (larger particles, black carbon, biomass burning and dust particles) cannot explain why the cleaner clouds would have greater IN concentrations. This is the basis of our conclusion and the main premise of the paper.

Diehl et al (2002) and others have shown that biological particles such as pollen can freeze at warmer temperatures (between -15oC and -10oC), especially when acting as contact IN. However, we see no reason to expect that primary biological particles are present in higher concentrations in the boundary layer over the mostly ice covered Arctic ocean.

Since the reviewer is correct in stating that we do not, in fact, know what particles are acting as IN in these clouds, we cannot say for sure that the cleaner conditions actually contain fewer IN. We also cannot be sure that the droplet size correlation is caused by a droplet-size dependent freezing mechanism. This is why our conclusion is tempered with a list of important considerations, which should be looked into further.

Diehl, K., et al., Atmospheric Research, 61, 125-133 (2002).

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 6737, 2011.