

# ***Interactive comment on “The relative impact of cloud condensation nuclei and ice nucleating particle concentrations on phase-partitioning in Arctic Mixed-Phase Stratocumulus Clouds” by Amy Solomon et al.***

## **Anonymous Referee #2**

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Review for “The relative impact of cloud condensation nuclei and ice nucleating particle concentrations on phase-partitioning in Arctic mixed-phase stratocumulus clouds”

I found this paper to be of good quality with significant findings surrounding the relative impact of CCN and INP loadings on the stratocumulus cloud properties. I recommend publication in ACP with minor revisions. Please find some of my thoughts and comments below.

Minor Comments:

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Page 3 line 14: Is this due to less big drops ?

Page 3 line 24: ok I think I understand this. The increase in number is due to them not freezing and being removed from the cloud?

Page 3 paragraph 3: I think this could benefit from some discussion of secondary ice particle production mechanisms here even though they aren't particularly relevant to the temperature range in this study.

Page 10 line 19: Evaporated within 200 m of cloud base. 'below cloud base' should be stated.

Page 11 paragraph 1: I found this interesting. A fine balance indeed!

Page 12 line 13: A reduction in sublimation causes more ice to fall out. Why is sublimation varied in this simulation? Reduced sublimation due to the moistening of the layer below the cloud?

Page 14 line 3. This is interesting that you see larger CCN concentrations above the liquid layer in the inversion. Some observations have found an ultra-clean layer above the cloud top. Could you comment on why you might see something different in this case?

Page 14 line 6. Another interesting finding regarding the location of elevated layer of INP lower in the cloud. I wonder what the implications of this could be.

Page 15 line 23 the model physics vs the Morrison study could be of key importance. The clouds are clearly very sensitive to the ice phase and how the various processes are treated is crucial. E.g. sublimation, re-circulation, shielding of the ice from the liquid etc. One paper that may be relevant is Abel et al. (2017). They did some modelling that showed how sensitive stratocumulus clouds in Cold Air Outbreaks were to ice phase processes and part of that was the partitioning between the liquid and the ice.

Page 16: If the cloud becomes coupled to the surface we would lose the reservoir of

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INP. Why?

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