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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosols indirectly warm the Arctic" *by* T. Mauritsen et al.

Anonymous Referee #1

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General comments

I like the hypothesis that cloud-aerosol interactions lead to the collapse of the cloud-aerosol system to a clean nearly clear state analogous to the Baker-Charlson hypothesis, but with the difference being the frozen surface that permits surface cooling and stabilization.

I am concerned about how underconstrained this study is, particularly with respect to the cloud liquid water path. Wasn't there a microwave radiometer on the ship? I know it is not able to measure low LWP, but the mean value used in the study is well above the limit of most microwave radiometers. If a microwave radiometer wasn't available, couldn't the cloud radar be used to constrain the cloud thickness?

I don't think these concerns will affect the conclusions of the study, but they need to be addressed.

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You might note that most global climate models that represent the aerosol effect on droplet number apply a minimum droplet number of typically 10 cm-3, and hence suppress the mechanism that you suggest is important in the arctic atmosphere.

Specific comments

1. page 16777, first paragraph. The description of mechanisms needs to be placed within the context of what is driving changes in the aerosol: anthropogenic emissions. 2.Page 16779, last paragraph. Do you have measurements of LWP? You refer to a "ASCOS median value". What is that based on? Also, how do the results depend on the assumed cloud thickness of 335 m? 3.Page 16779, last line. You are assuming the supersaturation that determines the number of droplets nucleated equals the supersaturation in your instrument, which is arbitrary. How does the assumed value affect the results? 4.Page 16780, line 2. Setting LWC is arbitrary. Given the hypothesis that nucleation influences LWC, this seems to be inconsistent. How do the results depend on this assumed value? 5.Page 16780, line 4. Diagnosing LWC using the threshold Re is also arbitrary. The basic problem is that the system seems to be underconstrained.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 16775, 2010.