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# Under which conditions do local marine sources influence Arctic mixed-phase clouds?

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Arctic low-level clouds are highly sensitive to microphysical processes, which can either sustain or break down the unstable mixed-phase state and thereby determine the longevity of the clouds and their radiative impact. They are influenced by the availability of aerosol particles, which can act as ice nuclei (IN) or cloud condensation nuclei (CCN). Potential sources of aerosols in the pristine Arctic include local marine aerosol emissions and long-range transport, e.g. of mineral dust, but it is not very well known what governs the Arctic background aerosol concentration and its variability. Therefore, it is important to quantify Arctic aerosol concentrations and the associated impact on cloud microphysics.

We derive characteristic vertical profiles of CCN and IN for two different situations in the Arctic and investigate the influence on the cloud microphysics and the evolution of a mixed-phase Arctic cloud. We compare a situation where the aerosol concentrations are predominantly governed by local sources (marine organics emitted at the surface) with one dominated by long-range transport (dust particles introduced above the boundary layer inversion). The influence of the different vertical aerosol profiles on the cloud microphysics is investigated using the large-eddy simulation solver MIMICA (Savre et al., 2014). We show that in a warm case study (cloud top temperatures above -9°C), based on the Arctic Summer Cloud Ocean Study (ASCOS) 2008, freezing in the clouds ist most probably initiated by entrained dust particles (or other highly efficient IN) from long-range transport. Based on our current knowledge, local sources of marine organics do not to have a large influence on the cloud structure and the cloud is rather insensitive to the vertical structure of the aerosol profile. The analysis is also done for a case with different (colder) meteorological conditions to investigate conditions when local marine sources potentially could be more important for the cloud evolution.