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A coupled large-eddy simulation sea ice model for simulating Arctic air mass transformation

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As warm, moist, maritime air masses are advected north over the high Arctic pack ice, the air mass is transformed with fog and low-level mixed-phase clouds typically forming below the surface temperature inversion. The moist air, and the clouds forming, influence strongly the surface energy fluxes and consequently the formation and melting of sea ice. Further cooling and drying of the air eventually result in cloud dissipation, and the boundary layer transforms into a clear state with strong surface radiative cooling. The processes of air mass transformation, cloud formation and cloud dissipation are challenging to represent in large-scale models, affecting our understanding of their sensitivity and contribution to climate warming. In order to obtain a more detailed understanding of these processes, and their influence on the surface energy balance, we employ atmospheric large-eddy simulation (LES) coupled to a simple sea ice model. In this presentation, we will show results from idealized simulations of winter Arctic air mass transformation for a range of different initial temperature and moisture profiles and discuss the potential impact on sea ice formation.