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Confronting boundary-layer representation in regional climate models with observations

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A series of regional climate models (RCMs) participated in the Polar-CORDEX model intercomparison by providing nudged/forced atmospheric simulations of observations from the Arctic Clouds during Summer Experiment (ACSE) in summer 2014. This 3-month July-to-October icebreaker-based field campaign operated within open water, 100% sea ice cover, and a mixture of both open water, sea ice and melt ponds from Tromsö, Norway, to Barrow, Alaska, and back.

We use a suite of in-situ and remotely sensed observations of the near-surface layer, boundary layer and free troposphere to evaluate the performance of physical processes as resolved by the RCMs. We focus on the surface energy budget (SEB), the thermodynamic and stability structure and of the lower atmosphere, and how clouds are impacted by, and force, the SEB components. We also draw on results from the Arctic Regional Climate Model Intercomparison Project (ARCMIP) from over 10 years ago as a basis of context for model development over the past decade.

The timing and location of the ACSE platform during early August coincided with direct observations of a significant, large-scale atmospheric advection event. Lower atmospheric temperatures and moisture spiked to anomalously large values, impacting the atmospheric stability, cloud formation and ultimately enhanced sea ice melt. The models are evaluated on their capacity in representing this important synoptic event.