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The Arctic Boundary Layer over Sea Ice and Land Surfaces – Characterization from Observations and RCM Simulations

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The phenomenon if Arctic Ampli[U+FB01]cation is known to the public from melting glaciers and reports of retreating sea ice. For most people sea ice edge and glaciers are somewhere far away. But Arctic processes play an important role in global climate, such as implications on mid-latitude weather or regulating the meridional overturning circulation. Therefore improving the understanding of the processes a[U+FB00]ecting the Arctic climate system is important, in order to project future changes in a warming world.

Long-term weather observations at AWIPEV station, Ny-Ålesund (78.9°N, 11.9°E), show a significant increase in temperature and moisture. This increase is possibly associated with interactions between the surface and the atmospheric boundary layer. But the atmospheric boundary layer is not well characterized over large parts of the Arctic Circle, mainly due to sparse coverage of research stations in this area. However a good characterization of the boundary layer is necessary to improve weather and climate models and to gain further inside in the phenomenon of Arctic Amplification.

The Norwegian Young sea ICE cruise (N-ICE2015) with the RV Lance has the objective to understand the effects of the new thin, first year, sea ice regime in the Arctic on energy flux, ice dynamics and the ice associated ecosystem, and local and global climate. Drifting in the ice North of Svalbard between January and June 2015, the expedition offers a unique possibility to combine the observations in the sea ice with the long-term observation operated in Ny-Ålesund.

Looking at Arctic Amplification from a regional perspective is necessary to understand processes and feedbacks which are not resolved in larger climate models. The combination of similar measurements from this year's N-ICE 2015 research cruise and at the same time at Ny-Ålesund offers the opportunity of comparing model output with field observations under different aspects.

The combined dataset for this study consists of atmospheric observations taken at both sites with similar instruments: balloon-borne radiosondes, broadband longwave and shortwave radiation sensors, surface meteorology observations from a weather mast, such a temperature, humidity and wind at 2 m, 4 m and 10 m, an eddy-covariance system and a ceilometer.

The analysis of the measurements allows the retrieval of various atmospheric parameters, e.g. surface fluxes, boundary layer height etc., which can be compared with the output of the HIRHAM5 model and other regional climate models. On the one hand, the data will help to improve model parameterizations and to design research campaigns in the future, e.g. by suggesting new instruments which are needed to study the polar atmosphere. On the other hand, the combination of the Ny-Ålesund and N-ICE observations will set the observations of both sites into a larger regional context of the European Arctic, referring to measurements over land and over sea ice.