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Synthesis of atmospheric boundary layer measurements in Svalbard

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Due to the different climatological conditions in the Arctic, the atmospheric boundary layer (ABL) exchange processes differ considerably compared to mid-latitude regions. Especially the turbulent transport and vertical mixing is strongly modified by the predominant stable atmospheric stratification. This results in a high sensitivity of the local ABL characteristics on the synoptic forcing and the surface properties as well as its temporal variability. Hence, a comprehensive analysis of the entire ABL at a point in time is indispensable to improve the understanding of the prevailing short-term physical processes. This implies measurements of all relevant quantities of the surface energy balance as well as the measurement of the conditions in the atmospheric column above with sufficient temporal resolution. These measurements were operationally conducted with in-situ and remote-sensing instruments at the AWIPEV station in Ny-Ålesund (Svalbard).
In this presentation an analysis of the temporal variability of the ABL properties during a low pressure system passage over Ny-Ålesund based on the synthesis of different measurements is presented. The case study demonstrates the high sensitivity of the local ABL on the synoptic regime. Especially the high temporal variability of the turbulent exchange near the ground and the ABL height is emphasized. Furthermore, the analysis illustrates the coupling of the ABL with the synoptic-scale forcing.
Based on this case study, the combined measurement datasets were used to conduct a validation study with the weather research and forecasting (WRF) model. For that purpose, two model runs with different ABL schemes and study site optimized setup were conducted. The output and the performance of both ABL schemes for several measured and modelled variables are presented.