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Interplay between large scale and local meteorological conditions in an Arctic fjord based on research aircraft measurements

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A majority of the population of High Arctic lives at onshore locations, typically characterized by fjords and other features of complex topography. Therefore it is essential to better understand interaction of the large-scale atmospheric flows and local conditions in such areas. In this study, we used data from a winter research aircraft campaign over a long (about 110 km) and wide (5-20 km) south to north oriented Arctic fjord which has an ideal straight axis but is bounded with complex topography varying in the scale of a hundred meters to kilometers. The research aircraft flights were part of the Spring Time Atmospheric Boundary Layer Experiment (STABLE). Analysis of the data shows a channeling of the easterly large-scale flow along the fjord towards its bottom located in the south. This channeled large scale flow interacts in a complex manner with a locally driven shallow katabatic flow region propagating northward from the glaciers and mountains at the fjord bottom. The interaction of these two flow regimes is further complicated by large changes in the surface conditions; the surface type is glacier and snow-covered land in the south, complete sea ice cover in the most of the fjord and open water in the fjord mouth area in the north. The related changes in the surface temperature are driving a shallow strong convective boundary layer in the north. The detailed analysis of the aircraft measurements provides an excellent testbed for atmospheric mesoscale model simulations aiming e.g. at effects of model resolution over an Arctic fjord.