



Airborne investigations of a fully turbulent stable boundary layer over a polynya near Greenland

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The aircraft-based experiment IKAPOS (Investigation of Katabatic winds and POLynyas during Summer) was performed in June 2010 around the Northwest of Greenland. The research aircraft POLAR 5 of Alfred-Wegner-Institute (AWI, Bremerhaven) was used to investigate at summertime katabatic wind systems as well as the boundary-layer structure over the North Water Polynya (NOW). In order to study the turbulence structure and 3D spatial structures of mean quantities, POLAR 5 was instrumented with a turbulence-sensing nose boom sampling at a rate of 100 Hz, additional basic meteorological equipment, radiation and surface temperature sensors, laser altimeter, and a multiple downward-looking cameras.

The atmospheric conditions found over the Nares Strait in June are usually characterized by a near-surface temperature in the range of -3 to 2 °C and winds below 5 m s^{-1} from various directions. GME (Global Model) model results from German Weather Service (DWD), however, reveal that the pressure in the northern Baffin Bay was about 5 hPa lower compared to average conditions for June in the period 2007 to 2011. This lead to higher average wind speeds (up to 10 m/s), high constancy of the north-easterly wind direction, and a clear channeling by the coastal mountains of Greenland and Ellesmere Island.

Due to the summertime conditions, the near-surface temperature is lower than that of the advected air and, hence, vertical profiles show a well-developed stable boundary layer (SBL). To our knowledge, this is the first aircraft campaign under such conditions in the Arctic. The measured 3D structure of the SBL at the sea ice-ocean interface represents a valuable verification data set. The turbulence data set can be used for verification of model simulations of regional climate models. As an example, the SBL local scaling hypothesis by Nieuwstadt (1984) could be successfully verified.