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**Title:** *An aircraft-based study of the boundary layer over the Greenland ice sheet and the NOW polynya*

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The aircraft-based experiment IKAPOS (Investigation of Katabatic winds and Polynyas during Summer) was performed in June 2010. The investigations comprised studies of the summertime katabatic wind system in the coastal area of northwest Greenland, and of atmosphere/sea-ice/ocean exchange processes over the NOW (North Water) polynya. The measurements were performed using the research aircraft POLAR 5 of Alfred Wegener Institute (AWI, Bremerhaven). Besides navigational and basic meteorological instrumentation, the aircraft was equipped with radiation and surface temperature sensors, two laser altimeters, and video and digital cameras. In order to determine turbulent heat and momentum fluxes, POLAR 5 was instrumented with a turbulence measurement system collecting data on a nose boom with a sampling rate of 100 Hz.

A total of six research flights have been performed, two of them were katabatic wind flights (over Humboldt and Steenstrup glacier, respectively). The katabatic wind flights capture conditions of weak and strong synoptically forced katabatic wind with up to 14 m s<sup>-1</sup> wind speed. Over the NOW, a stable, but fully turbulent boundary layer with strong winds of 15 m s<sup>-1</sup> to 20 m s<sup>-1</sup> was present during conditions of relatively warm synoptically induced northerly winds. Strong surface inversions were found in the lowest 100 m to 200 m. As a consequence of channeling effects at Smith Sound a well-pronounced low-level jet system was documented. These channeling effects lead to an increased wind-induced sea-ice export from the Nares Strait through Smith Sound. Cross-sections of mean quantities over the polynya and the ice sheet are presented. The multiresolution decomposition is used to identify the spectral gap for the computation of turbulent fluxes. For the NOW polynya flights gap scales are between 500 m – 1000 m and sensible heat fluxes are around -30W/m<sup>2</sup>. For the katabatic wind a gap scale of 250m is found and sensible heat fluxes are around -5 and -20W/m<sup>2</sup> for weak and strong synoptic forcing, respectively.

The results of IKAPOS are valuable for the validation of numerical models (including climate models) and will contribute to the understanding of the exchange processes over summertime Arctic polynyas and the Greenland ice sheet.