



An overview of barrier winds off southeastern Greenland during the Greenland flow distortion experiment

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During the Greenland flow distortion experiment barrier (GFDex) flow was observed by an instrumented aircraft on 1, 2, 5 and 6 March 2007 off southeastern Greenland. During this period the barrier flow increased from a narrow jet, $\sim 15 \text{ m s}^{-1}$, to a jet filling almost the whole of Denmark Strait with maximum wind speed exceeding 40 m s^{-1} . Dropsonde observations show the barrier flow was capped by a sharp temperature inversion below mountain-height. Below the inversion was a cold and dry jet, with a larger northerly wind component than that of the flow above, which was also warmer and more moist. Thus, the observations indicate two air-masses below mountain-height: A cold and dry barrier jet of northern origin and, above this, a warmer and moister air-mass which was of cyclonic origin.

Numerical simulations emphasise the non-stationarity of the Greenland barrier flow and its dependence on the synoptic situation in the Greenland-Iceland region. They show that the barrier jet originated north of Denmark Strait and was drawn southward by a synoptic-scale cyclone; with the strength and location of the maximum winds highly dependent on the location of the cyclone relative to the orography of Greenland. Experiments without Greenland's orography suggest a $\sim 20 \text{ m s}^{-1}$ enhancement of the low-level peak wind speeds due to the presence of the barrier. Thus, the Greenland barrier flows are not classic geostrophically-balanced barrier flows but have a significant ageostrophic component and are precisely controlled by synoptic-scale systems.