12B.3

OBSERVATIONS OF A GAP FLOW AT 80N -AND AN OVERVIEW OF IPY/THORPEX-NORWAY OBSERVATIONS

Idar Barstad,
(JE Kristjansson, Ø Hov, Ø Sætra, M Shapiro, A Sorteberg, E Kolstad, A Dörnbrack, E Irvine, V Grubisic, H Olafsson)

1. INTRODUCTION

As a part of the IPY initiative, the IPY/THORPEX-Norway was established to study extreme weather in the Arctic. The main goal was to improve weather forecast for the Atlantic part of Arctic. To reach this goal, as one of the main activities, the project undertook an observational campaign (Barstad et al. 2008) during Feb-Mar 2008 where the DLR Falcon using its lidar systems, dropsonde capability and in-situ measurements to observe polar lows, arctic fronts and terrain induced disturbances. In this extended abstract, we will focus on the terrain induced disturbances, and present a preliminary overview of the acquired measurements.

2. RESULTS

The Hinlopen jet

The first case after the transfer flight of the DLR-Falcon was the 27th Feb 2008, where the aircraft measured the Hinlopen jet. Standard forecast models showed weak wind (5-8 m/s) upstream the archipelago Svalbard, but during measurements it was revealed that the jet in the Hinlopen Strait reached up to 20m/s. Fig.1 shows the wind enhancement as simulated by a 3km model (two-ways nested with a 1km grid).

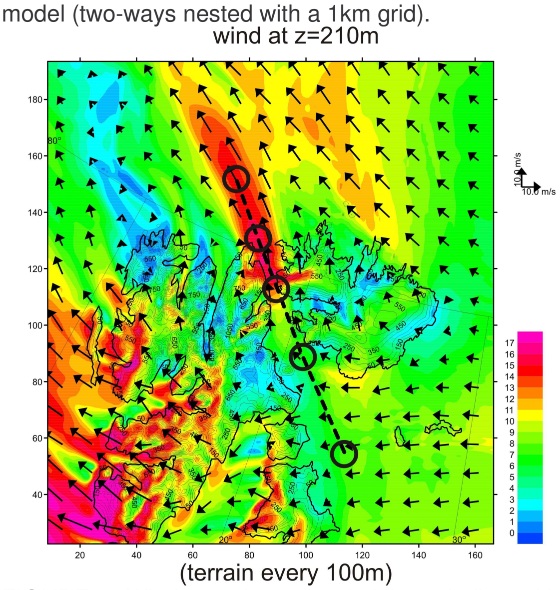

FIGURE 1: *Wind speed at 210m height as indicated by the colorbar to the right. Circles indicate dropsondes positions. Terrain contours every 100m starting at 50m elevation are shown.*

In the lee of the tallest mountains, a tendency of a wake is seen. From the lidar data, both the jet (Fig.2) and the wake (not shown) were detected. The dropsondes indicated in Fig.1 is overlaid by the simulation results in a vertical cross section depicted in Fig.3.

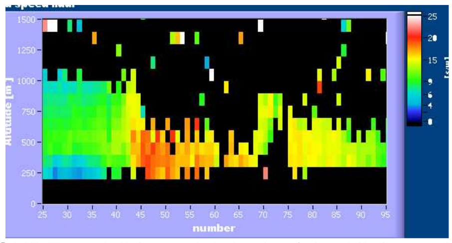

FIGURE 2: *A lidar quick-look of the Hinlopen jet. The wind blows from left to right, and the maximum wind is at the mouth of the strait.*

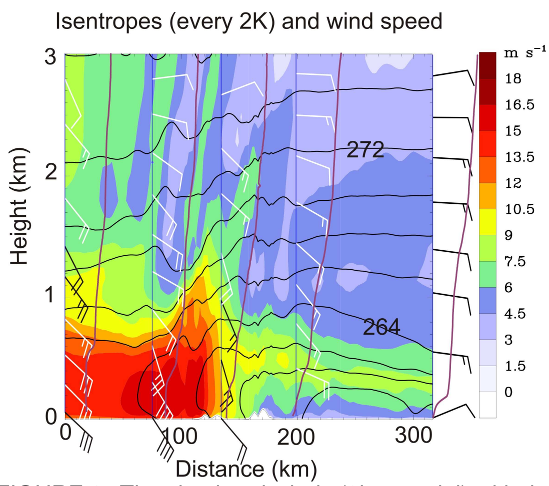

FIGURE 3: *The simulated winds (3km model) with the dropsondes on top. Positions of dropsondes are found in Fig.1. The wind blows from right to left, opposite to the direction in Fig.2.*

The second terrain-flow flight took place 6 Mar 2008, where a weak offshore flow in Troms County looked like it could lead to strong winds in the fjords. The measurements show rather weak wind in this case. An exception was lidar measurement detecting relatively strong winds at the inner part of the Malangen fjord which may be attributed to gravity wave activity.

The next observations of terrain induced disturbances took place the 9 Mar 2008 at Cape Tobin on eastern Greenland. The Falcon was on its way to Reykjavik, Iceland, to make measurements of winds closer to Greenland. A low over northern Iceland caused northeasterly wind and a weak warm front impinged the coast north of Cape Tobin. From cluster analysis of mslp-maps, we find that a weather situation with a low over Iceland is very frequent (not shown) for when strong winds appear at Cape Tobin. Fig.4 showing a 99%tile map of daily wind speed indicates that Cape Tobin is –wind wise-among the most hash places in the Arctic. In Fig.5 and 6, we see simulated results from a 3km model nested within a 9km wider model domain for the time and location for the dropsondes.

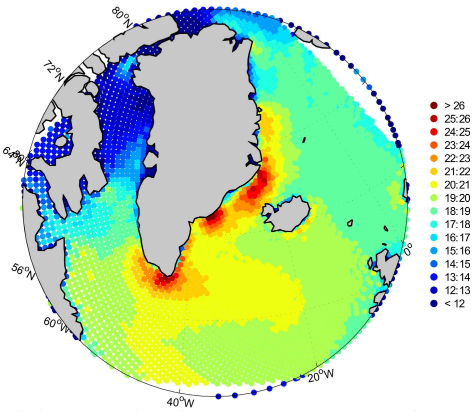

FIGURE 4: *99%tile of daily 10m wind (m/s) for (1961-1990).*

The dropsonde data for this case has not yet been fully interpreted, and any discussion is left for later presentations.

The results from preliminary investigations have indicated that the ice edge placement in the model is crucial to produce the correct low-level front near the ice edge, and that this front is strongly connected to the low-level strong winds.

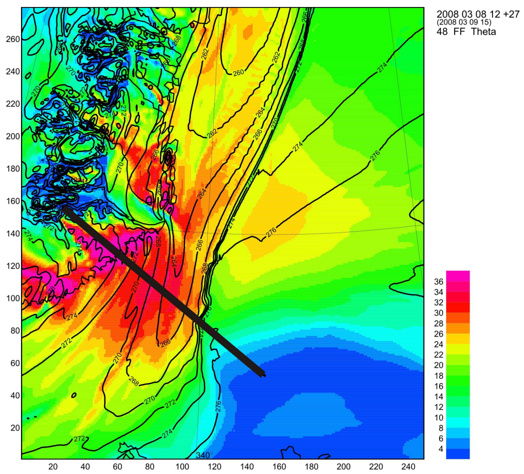

FIGURE 5: *Simulated wind speed and isentropes 170m above surface using a 3km model. Black line indicates vertical cross section shown in Fig.6.*

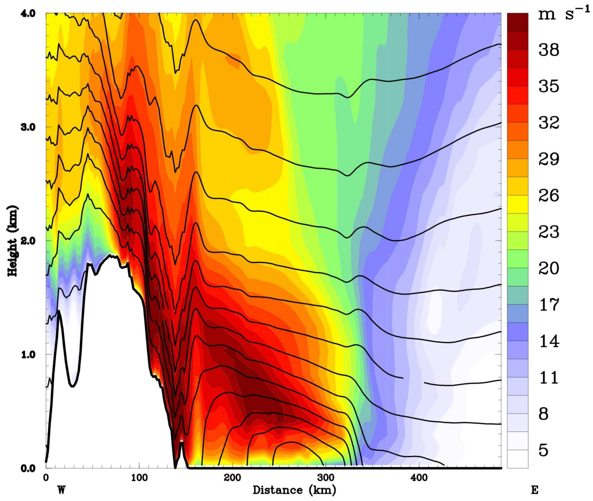

FIGURE 6: *Simulated wind speed and isentropes (every 2K) in the cross section indicated in Fig.5.*

The final terrain-flow case observed during the campaign was intended as a survey flight for a set of buoys near the Greenland coast. 5 dropsondes were released on the Denmark Strait. This area is the same as the one indicated as red in Fig. 4, and jet reaching up to wind speeds of about 35m/s was observed at 850hPa level. The observations are planed used along with surface-induced winds from satellite to arrest model simulations of the along-barrier winds.

3. PRELIMINARY CONCLUSIONS

During a 3 weeks observational campaign in the Barents Sea and in the Denmark Strait near Greenland, the DLR Falcon observed several cases of strong winds induced by terrain. The database includes gap winds, corner effects and barrier winds along with some wake observations. The future investigations will hopefully address improvements necessary to gain reliable weather forecasts of these phenomena in the region.

4. REFERENCES

Barstad, I. et al. (2008): The main observational campaign of the IPY-THORPEX-Norway project. Technical report R29, Bjerknes Centre for Climate Research, pp35. (http://www.uib.no/People/ngfib/R29.pdf)