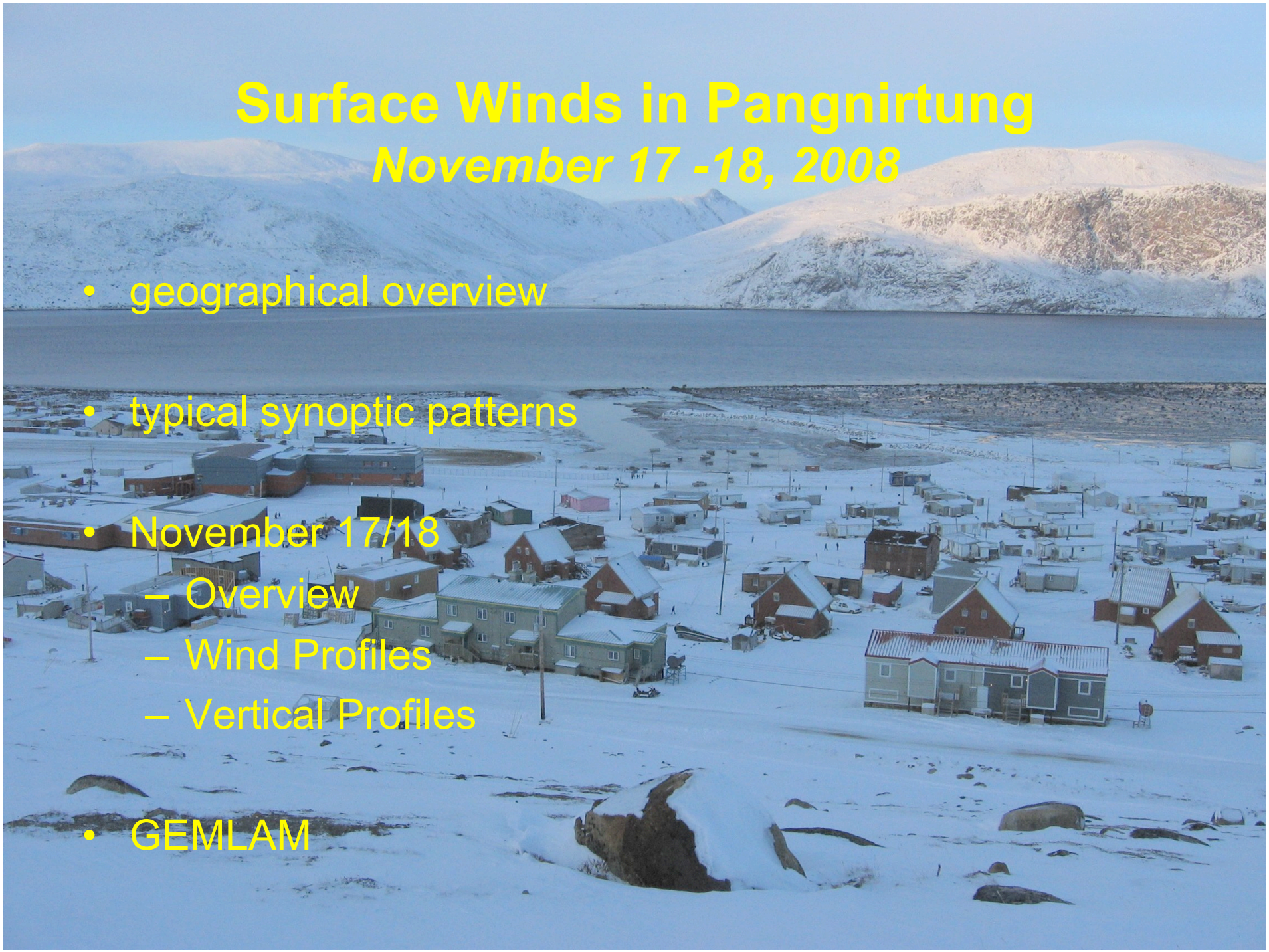

Which Way Blows The Winds
Pangnirtung
Nov 17 – 18, 2007

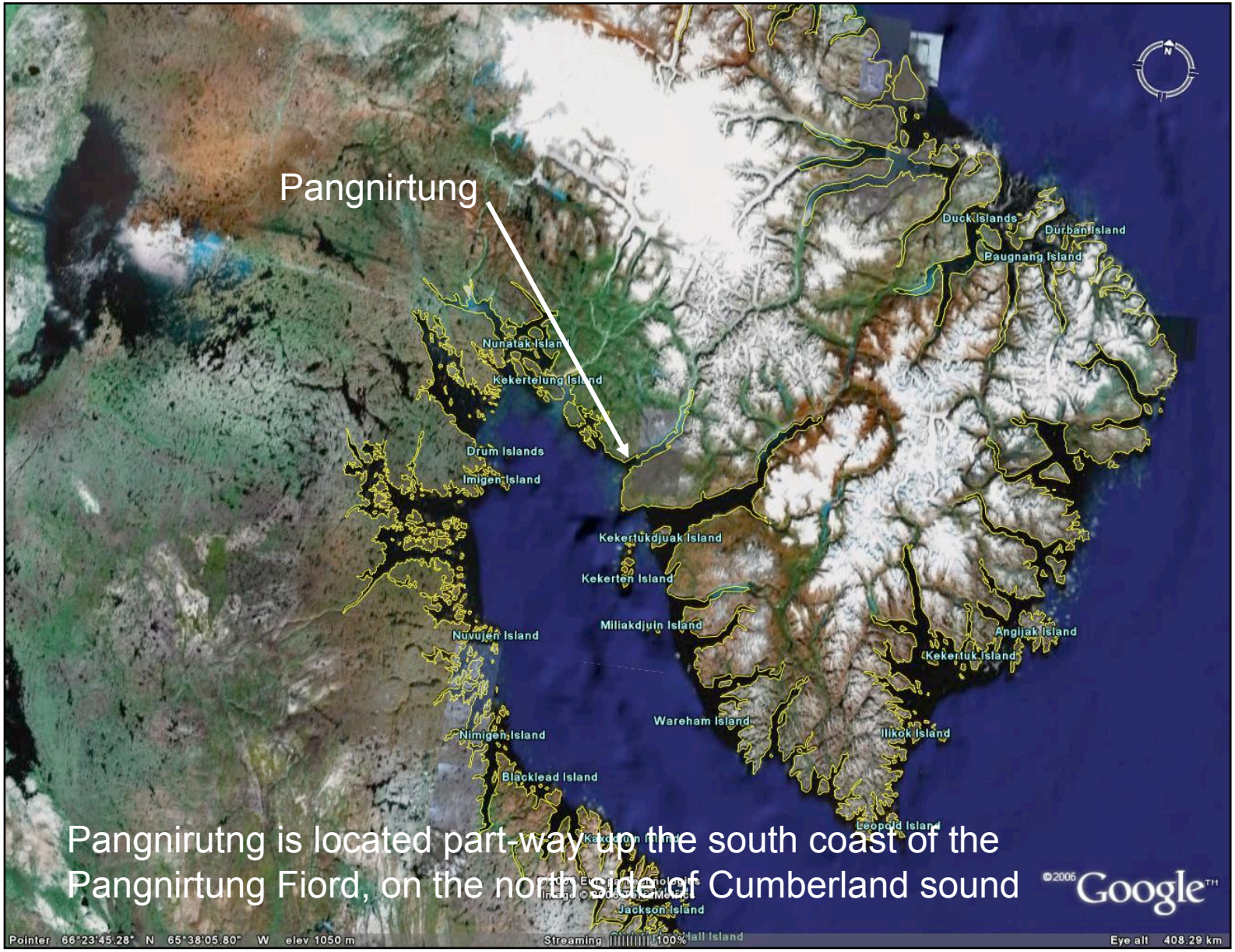


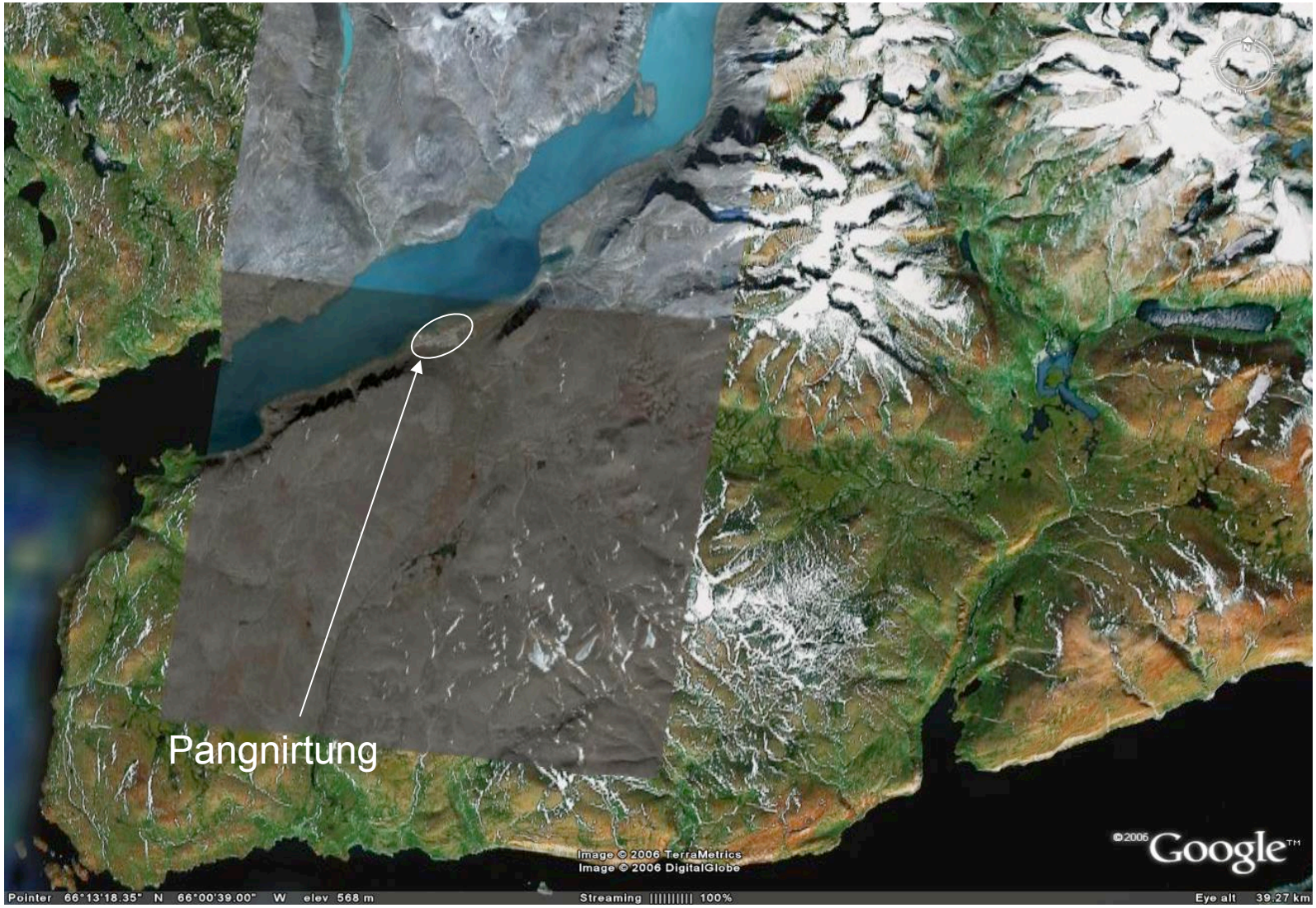
Surface Winds in Pangnirtung

November 17 -18, 2008

- geographical overview
- typical synoptic patterns
- November 17/18
  - Overview
  - Wind Profiles
  - Vertical Profiles
- GEMLAM

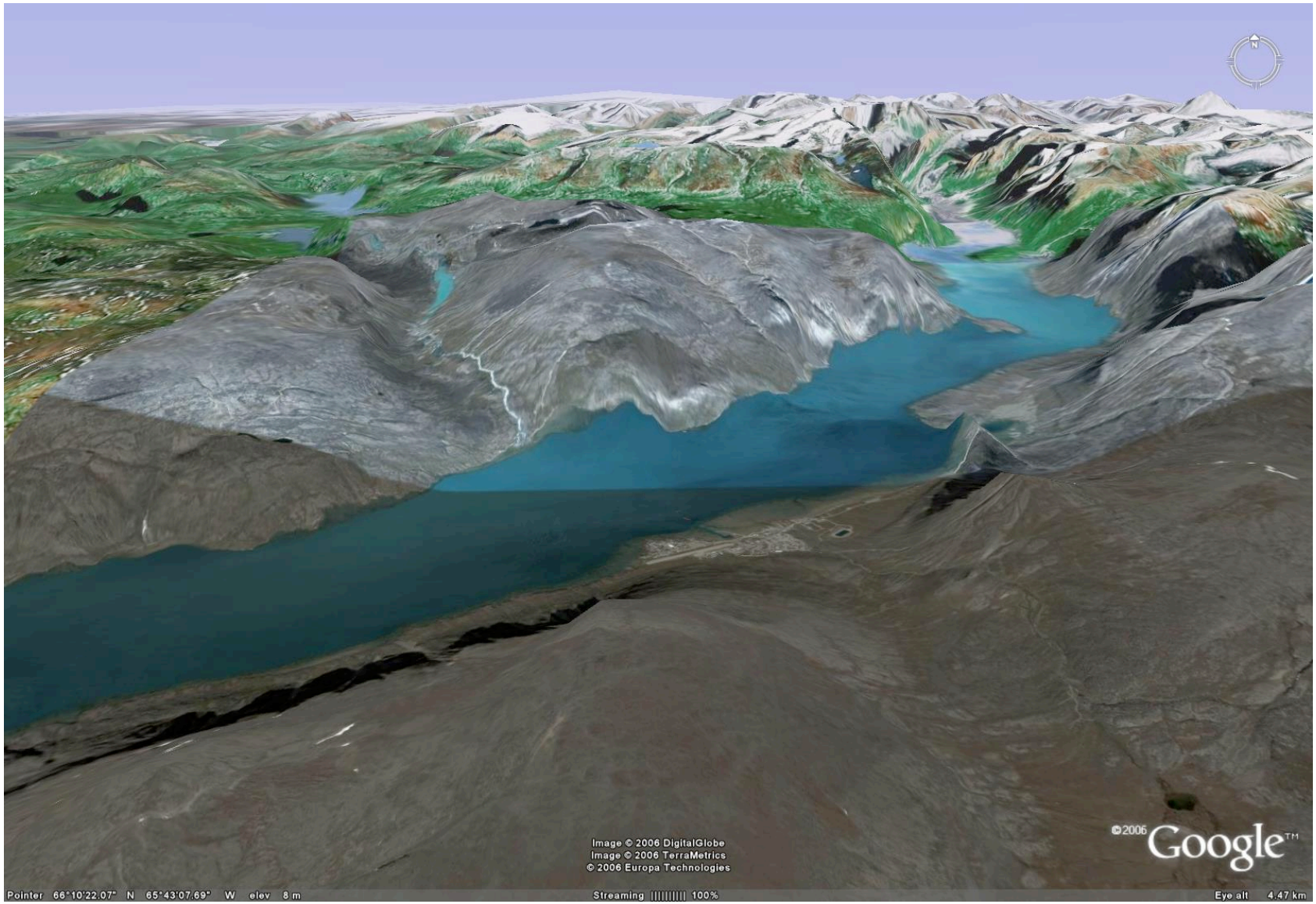
Geographical Overview



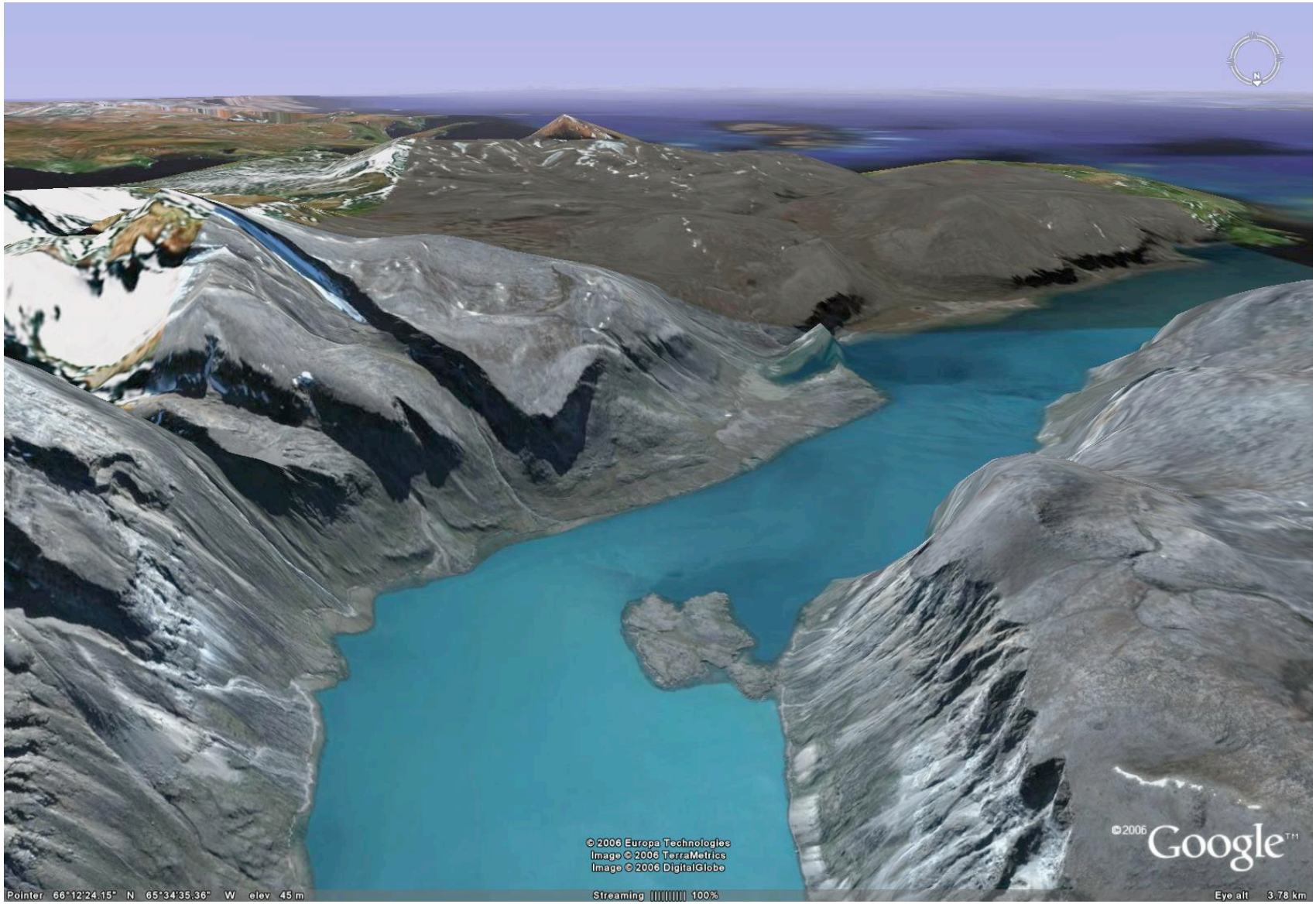


The terrain south of Pangnirutng rises quickly to 300 – 500 meters. Upstream the Pangnirung Fiord, it becomes more narrow, with adjacent mountains rising to over 1,000 meters

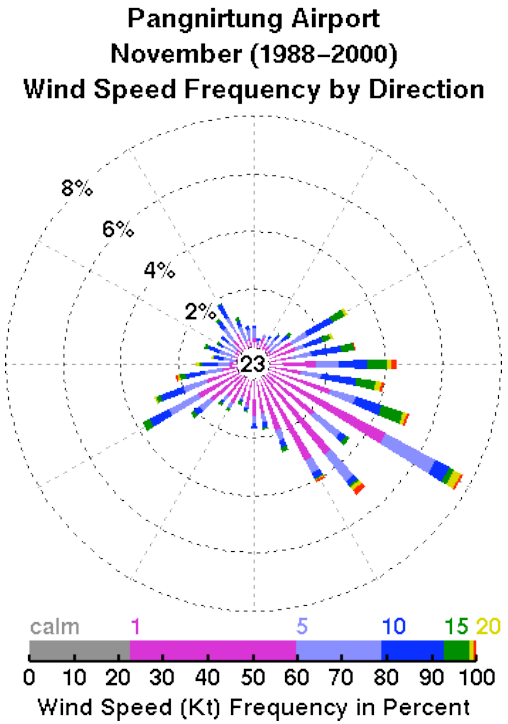
View Down From the Pass Behind The Town

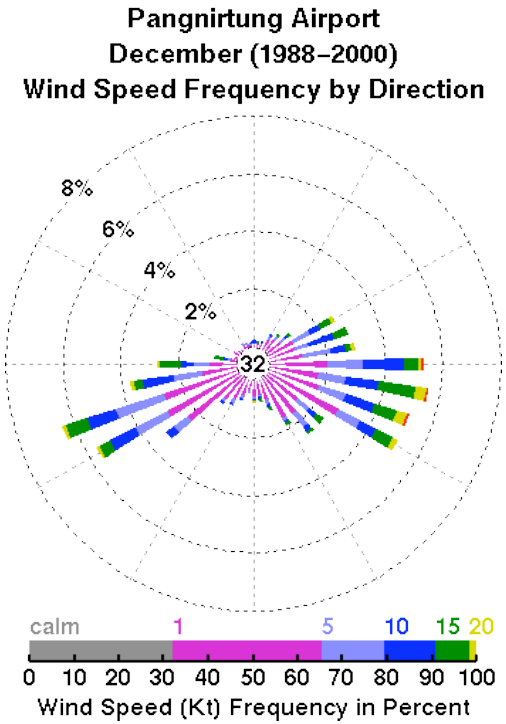


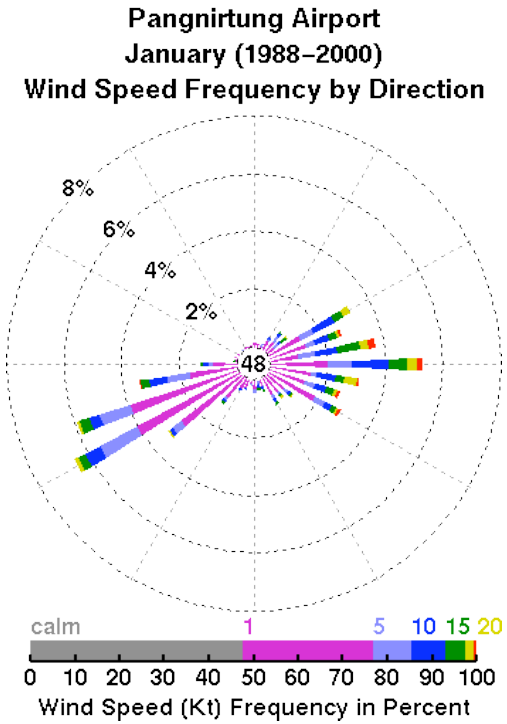
View Down the Fiord Towards Cumberland Sound



Wind Rose During Winter Months







Southeast winds are similarly common, and sometimes strong.

Strongest winds are from the east, which is neither down-fiord or downslope from the mountains

A preponderance of strong down-fiord winds are somewhat missing

Another Viewpoint

Other local knowledge would say that east winds are common, flowing down off Mount Duval

Perhaps, but this may be confined to north on Pangnirutng

It is hard to reconcile prominent east wind generally in Pangnirtung Fjord, as this direction is well-across the fiord

In my own brief talks with the community, some made sketch maps with the fiord aligned with east – a 45 deg rotation

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Human geographies of sea ice: freeze/thaw processes around Pangnirtung, Nunavut, Canada

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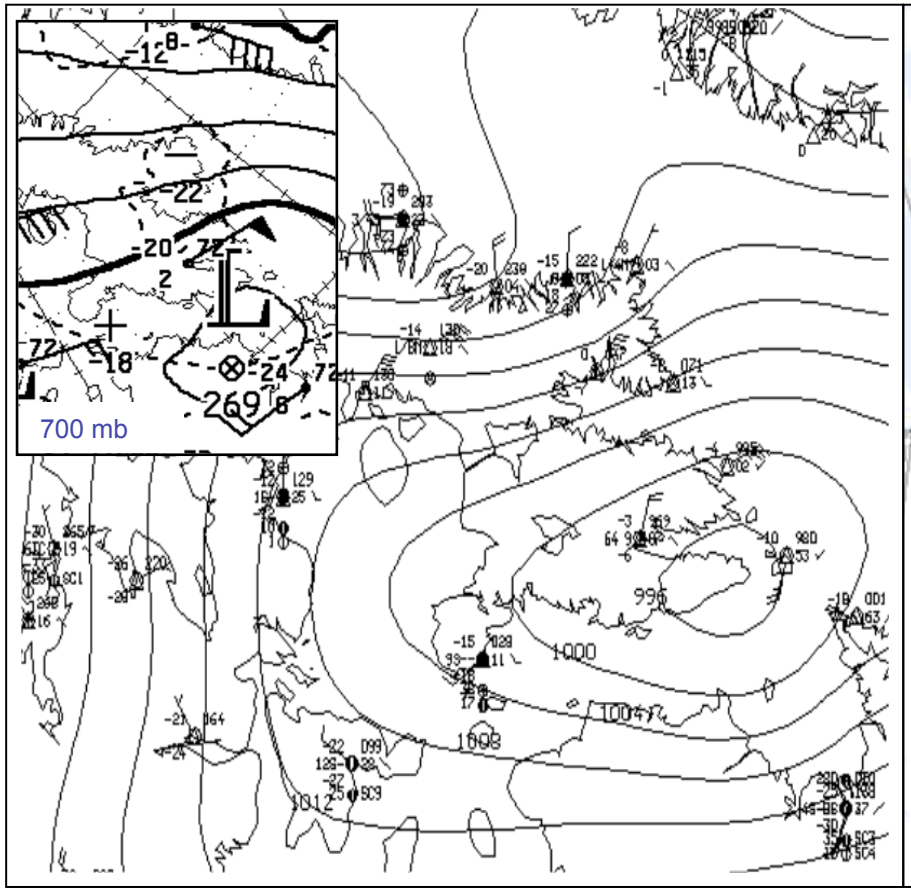
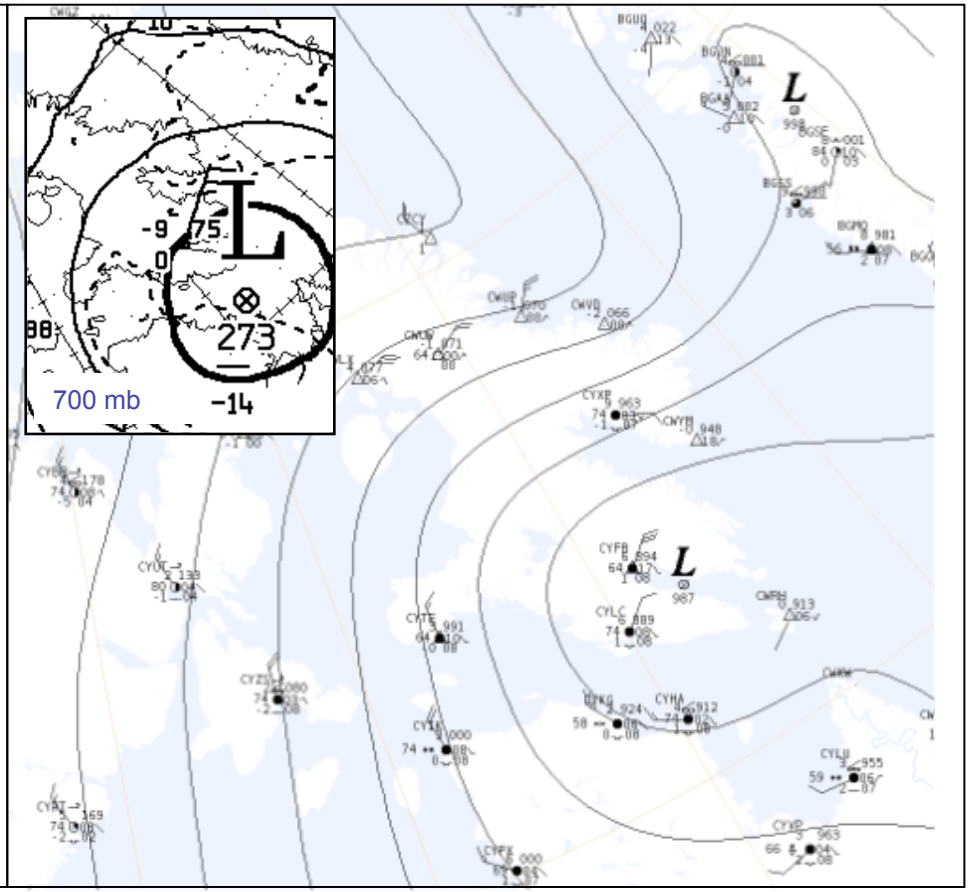
Table 4. Summary of predominant directional and seasonal winds around Pangnirtung, and their related influences on sea ice.

Direction	Season	Ice influence	Number of Sources
West	• prominent in Pangnirtung Fiord • afternoon breeze in spring/summer	• not good wind • blows ice into the fiord from Cumberland Sound • melts the ice and snow in the fiords	6
NW	• prevailing in fall and winter • colder winds	• can cause the ice to break off at tshe floe edge • pushes loose ice out • can also bring moving ice into Cumberland Sound from Davis Strait • brings good clear weather • freezes smoothly • freezes quickly	11
North	• prominent in Cumberland Sound • colder winds	• can cause the ice to break off at the floe edge • pushes loose ice out • can also bring moving ice into Cumberland Sound from Davis Strait • ice thickens faster	5
NE		• brings good weather	1
East	• prominent in Pangnirtung Fiord • strongest winds come off Mount Duval • stronger in the fall	• melts the snow on top of the ice • can break up the ice • floe edge comes closer to town • 'spits' the ice out of the fiord	7
SE	• prevailing in summer • warmer winds • more snow	• dangerous when strong • creates cracks in the ice • breaks up the sea ice • pushes moving or multi-year ice in • creates rough ice formations	9
South	• prominent in Cumberland Sound • warmer winds	• breaks up the sea ice • dangerous when strong • floe edge comes closer to town • pushes moving or multi-year ice in • more open water in Cumberland Sound	8

A Couple Of Historical Cases

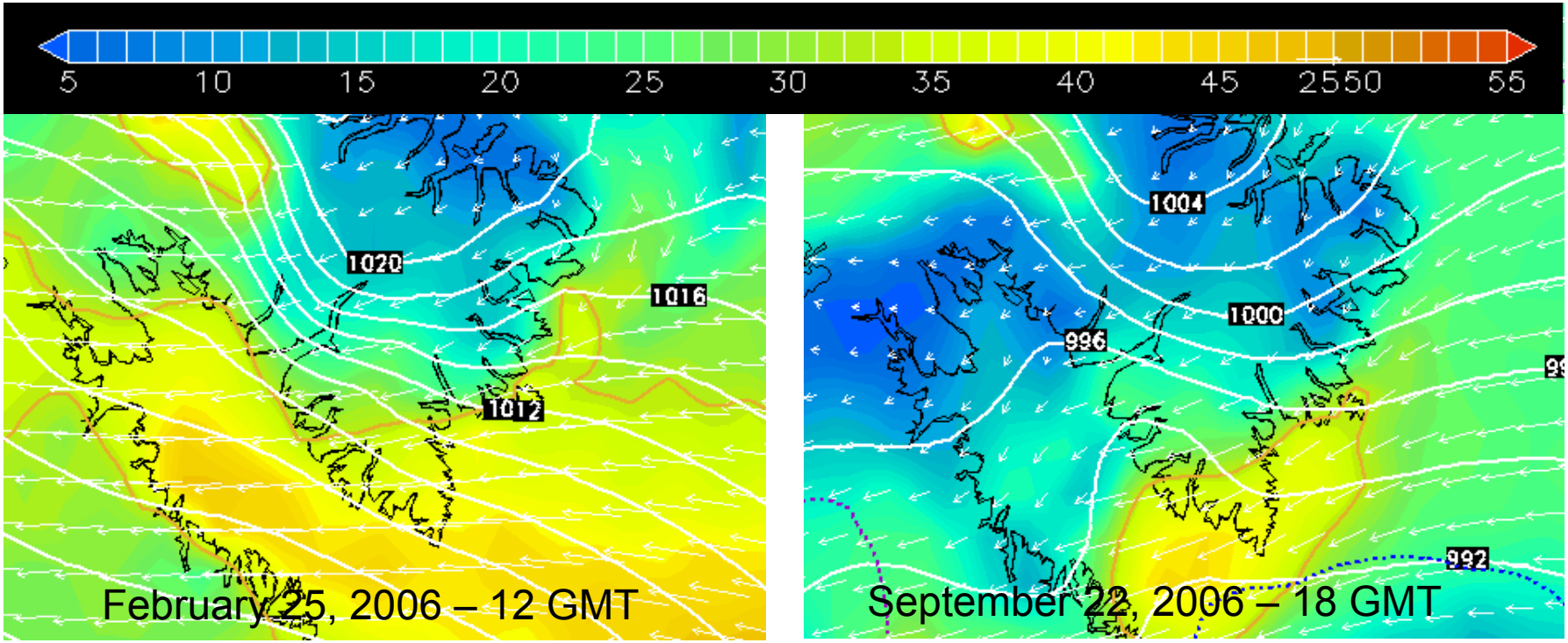


February 25, 2006 – 12 GMT



September 22, 2006 – 18 GMT

GEM Version and Observations



February 25, 2006 – 12 GMT

September 22, 2006 – 18 GMT

CWXP 250900Z AUTO 09033G47KT

CWXP 251000Z AUTO 09029G40KT

CWXP 251100Z AUTO 08032G51KT

CWXP 251200Z AUTO 08034G52KT

CWXP 251300Z AUTO 09034G51KT

CWXP 251400Z AUTO 09034G47KT

CWXP 251500Z AUTO 09033G50KT

CWXP 221500Z AUTO 25006KT

CWXP 221600Z AUTO 13006G17KT

CWXP 221700Z AUTO 26004KT

CWXP 221800Z AUTO 11012G19KT

CWXP 221900Z AUTO 11009KT

CWXP 222000Z AUTO 22009KT

CWXP 222100Z AUTO 29004KT

There's More To Life Than Surface Observations

CYXP 221300Z 24013KT 15SM 3.2/1.6 A2941 RMK SC6 NE WIND 070-20KTS/MNTN TOP DRSN

CYXP 221400Z 30008KT 15SM 4.5/1.1 A2942 RMK SC6 DRSN MNTN TOP E

CYXP 221500Z 25006KT 15SM 4.8/1.3 A2941 RMK SC6 NE WIND 070-20KTS-MNTN TOP DRSN

CYXP 221600Z AUTO 24010G15KT 5.6/1.0 A2942=

CYXP 221642Z AUTO 11012G17KT 7.2/-0.4 A2941=

CYXP 221700Z 24003KT 15SM 5.4/1.8 A2941 RMK SC7 WIND 060-20KTS NE

CYXP 221800Z 12012G18KT 15SM 8.6/-0.7 A2942 RMK SC7 SHWRS SW

CYXP 221842Z 13010KT 15SM

CYXP 221900Z CCA 12007KT 15SM 7.9/-0.3 A2942 RMK SC7

UACN10 CYXP 221319
EG
UA /OV CYXP /TM 1319 /FLDURD /TP A748 /TB
MDT 100O AGL TO GND ON ARRIVAL

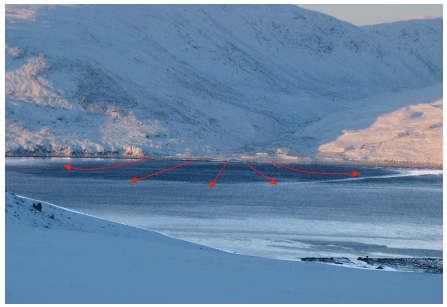
UACN10 CYXP 221632
EG
UA /OV CYXP /TM 1632 /FL008 /TP A748 /TB
SVR LOW LEVEL TURB RESULTING IN MISSED APPCH /RM VIA CZNB

September 22, 2006 – Pirep

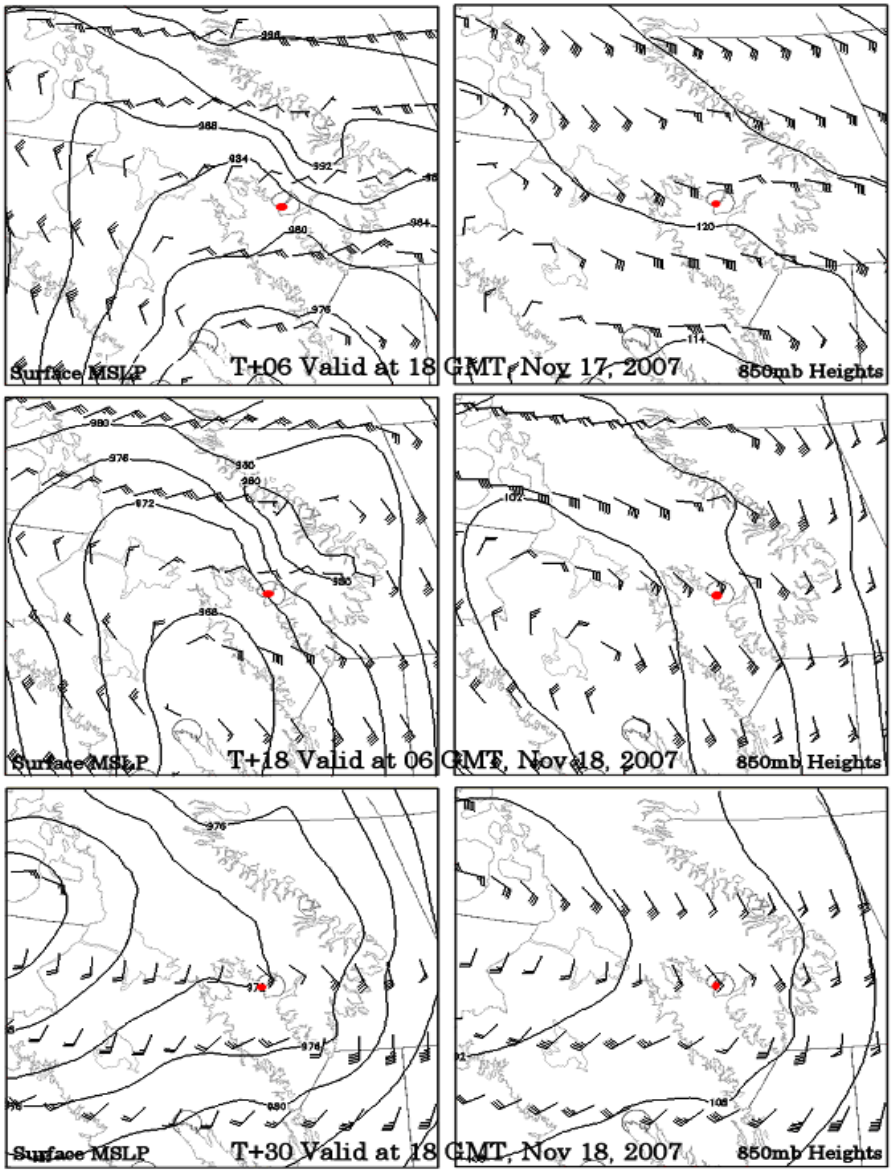
“Typical” Non-Synoptic Pangnirtung Winds

Measurements made in Pangnirtung show drainage winds flowing down the Duval River drainage and then spreading out.

It is similar on the other side of the fiord



Wind Event – November 17/18, 2007 – GEM and Observations



Following data from Saturday November 17 2007

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CYXP 171500Z 08012G19KT 12SM DRSN OVC020 M03/M07
CYXP 171600Z CCA 09020KT 7SM -SN DRSN OVC020 CYXP
171700Z 09018G28KT 8SM -SN DRSN OVC020
CYXP 171800Z 09019G24KT 1 1/2SM -SN DRSN OVC020
CYXP 171828Z 08020G31KT 1/4SM -SN +BLSN VV006 RMK
CYXP 171900Z 09021G28KT 1/8SM SN +BLSN VV003
CYXP 172000Z 09022G29KT 1/8SM SN +BLSN VV003
CYXP 172100Z AUTO 09026G33KT M05/M05 A2899=
CYXP 172200Z AUTO 09025G32KT M04/M04 A2890=
CYXP 172300Z AUTO 09024G35KT M03/M04 A2879=

Following data from Sunday November 18 2007

CYXP 180000Z AUTO 09019G31KT M02/M03 A2876=
CYXP 180100Z AUTO 08016G26KT M03/M03 A2874=
CYXP 180200Z AUTO 07024G34KT M02/M03 A2867=
CYXP 180300Z AUTO 10022G35KT M02/M04 A2864=
CYXP 180400Z AUTO 07022G32KT 03/M03 A2862=
CYXP 180500Z AUTO 08028G39KT 04/M02 A2860=
CYXP 180600Z AUTO 09025G32KT 03/M02 A2862=
CYXP 180700Z AUTO 10033G38KT 02/M01 A2864=
CYXP 180800Z AUTO **10038G44KT** 02/M01 A2867=
CYXP 180900Z AUTO 11029G34KT 00/M02 A2871=
CYXP 181000Z AUTO 11024G32KT M00/M01 A2872=
CYXP 181100Z AUTO 12020G26KT M00/M01 A2874=
CYXP 181200Z AUTO 11015KT M00/M01 A2876=
CYXP 181300Z AUTO 11015G21KT M00/M02 A2876=
CYXP 181400Z AUTO 10021G27KT M00/M02 A2876=
CYXP 181500Z AUTO 13016G24KT M01/M02 A2878=
CYXP 181600Z AUTO 26013G22KT M07/M07 A2883=
CYXP 181700Z 26016KT 1SM -SN DRSN OVC007 M07/M08
CYXP 181723Z 23013KT 1 1/2SM -SN DRSN OVC020 RMK

Balloon Trajectories Plotted Every Two Seconds

Time of trajectories (slightly rounded) from right to left are:

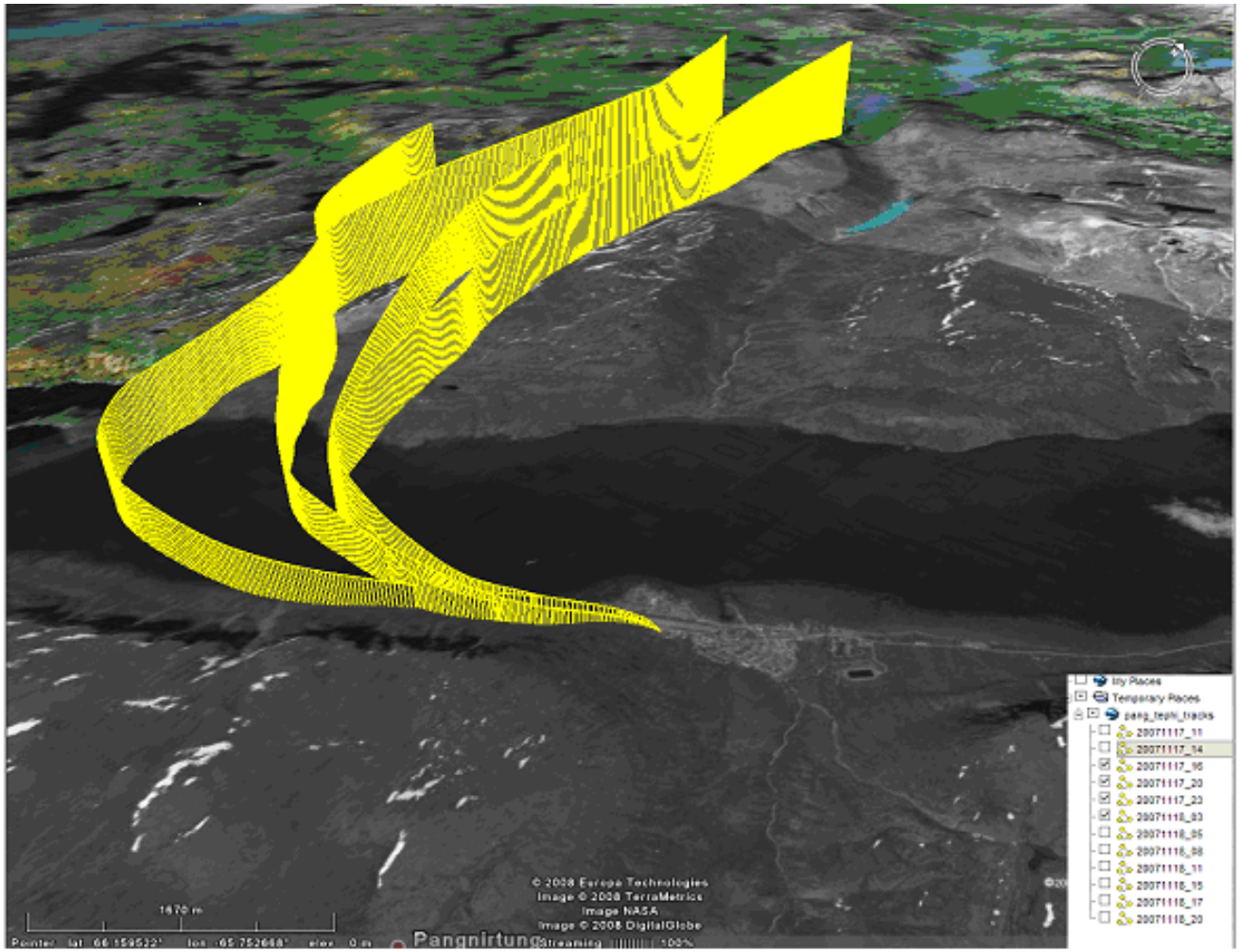
2007/11/17 - 18 GMT

2007/11/17 - 21 GMT

2007/11/18 - 00 GMT

2007/11/18 - 03 GMT

At 21 GMT, the change from surface easterly to northeasterly occurred about 30 seconds after launch at a height of 140 m



Question: Is it a case of north-easterlies not beginning until 140m or easterlies confined just near the terrain?

Balloon Trajectories Plotted Every Two Seconds

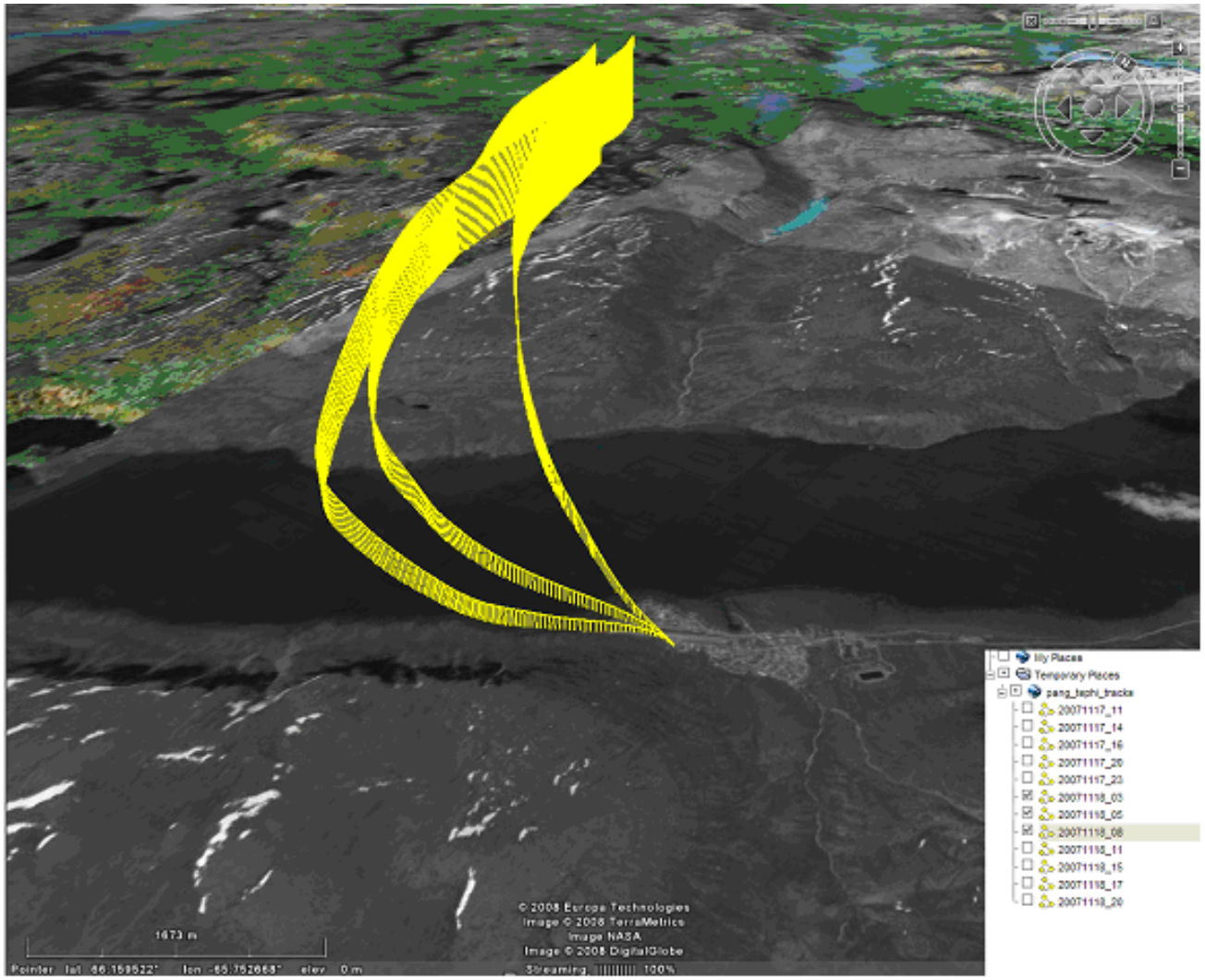
Time of trajectories from right to left are:

2007/11/17 - 03 GMT

2007/11/17 - 06 GMT

2007/11/17 - 09 GMT

This periods represents the transition from wind down the fiord to winds from the higher terrain



Balloon Trajectories Plotted Every Two Seconds

Time of trajectories from right to left are:

2007/11/17 - 09 GMT

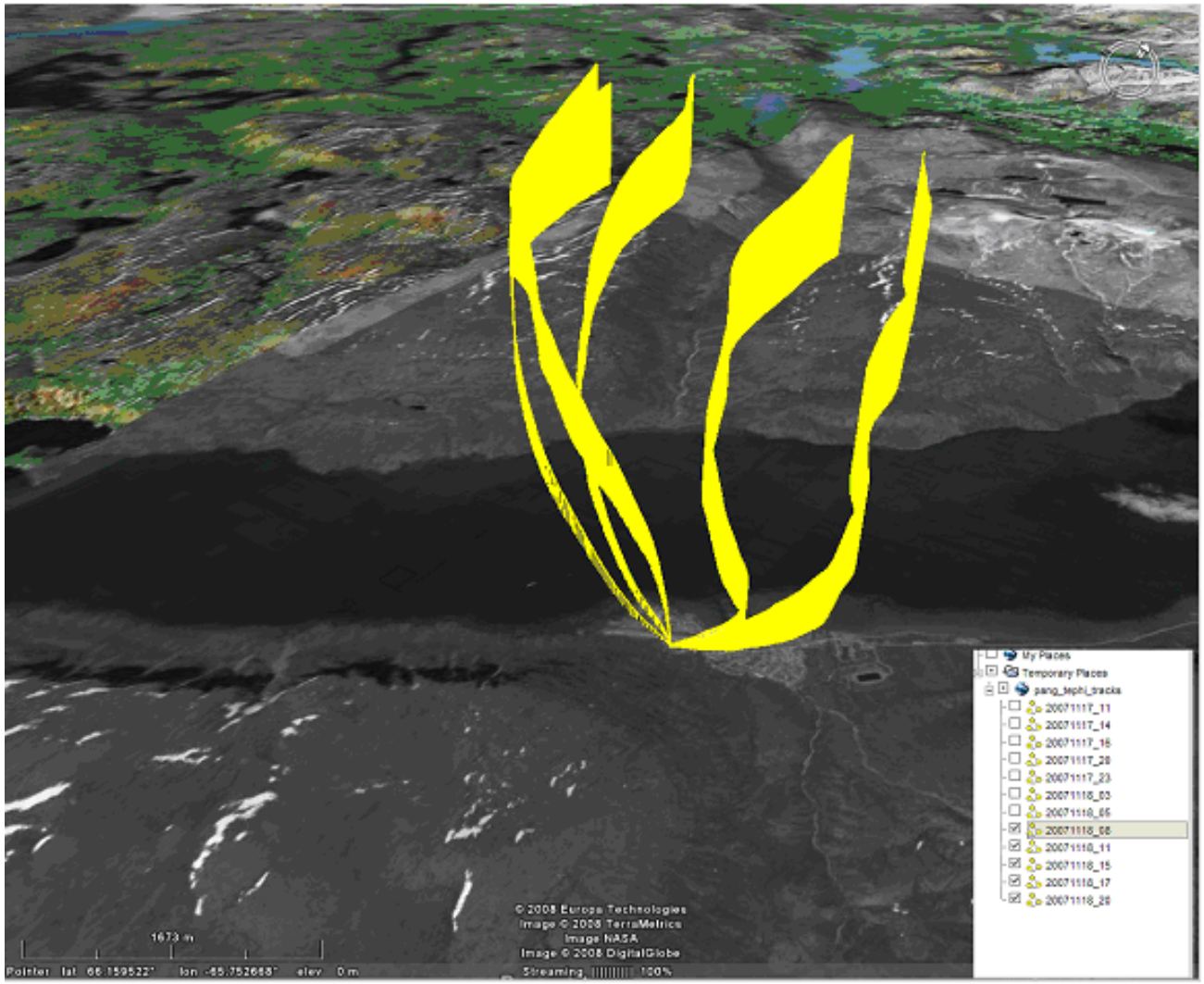
2007/11/17 - 12 GMT

2007/11/17 - 15 GMT

2007/11/17 - 18 GMT

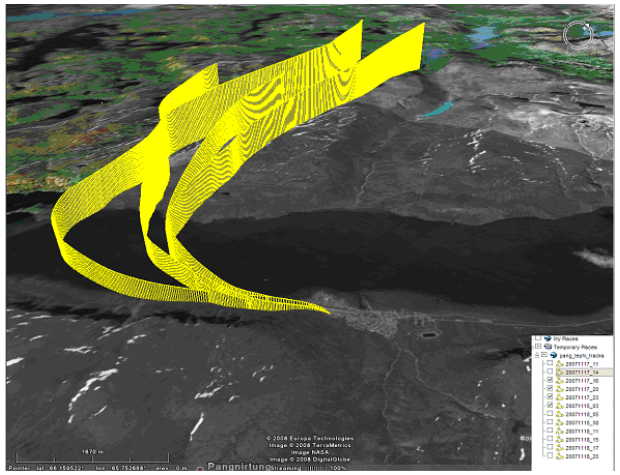
2007/11/17 - 21 GMT

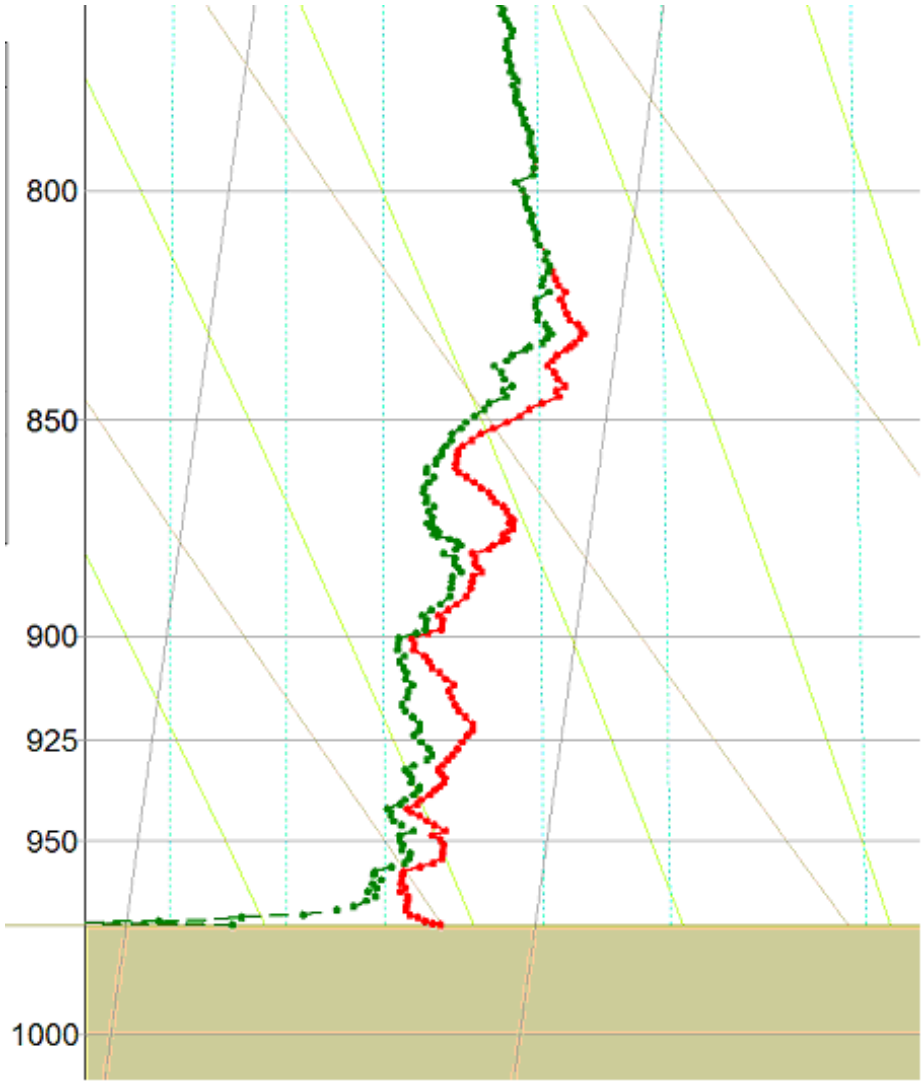
For the early time periods, winds are southeasterly at all levels,



Skew-T / Log-P Nov 17, 2007 – 23:30 GMT

At this time, the low level air is cool and moist, associated with the northeasterly flow down the fiord

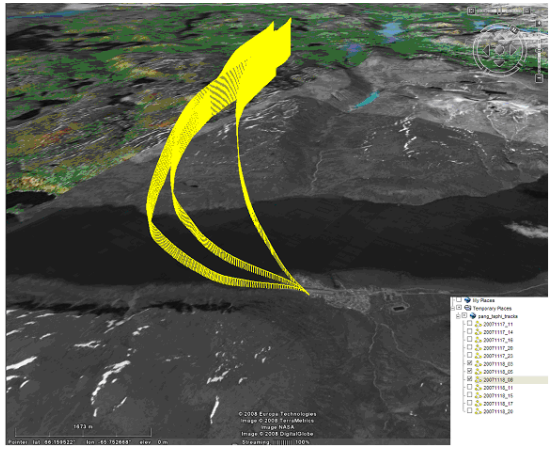


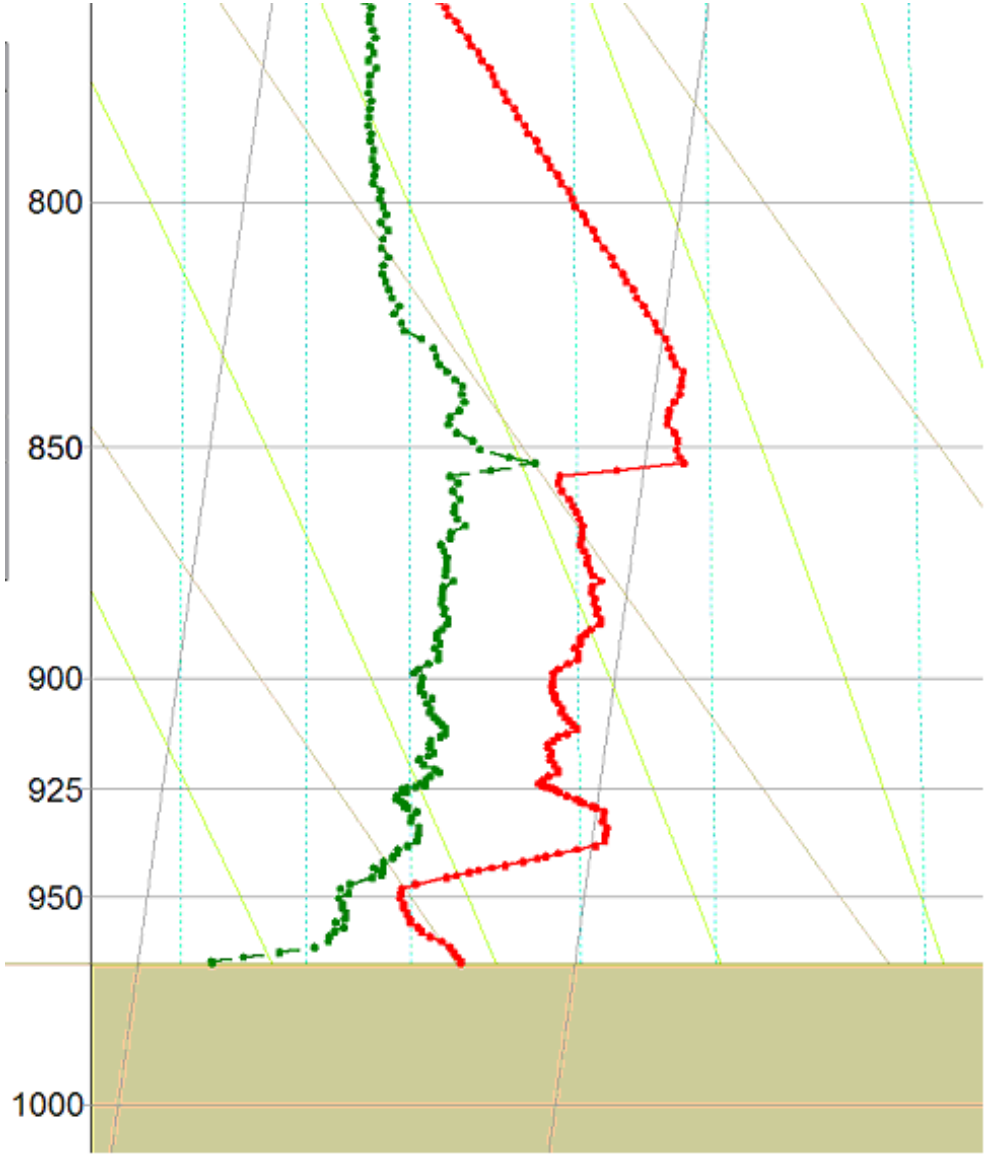


Skew-T / Log-P Nov 18, 2007 – 03:19 GMT

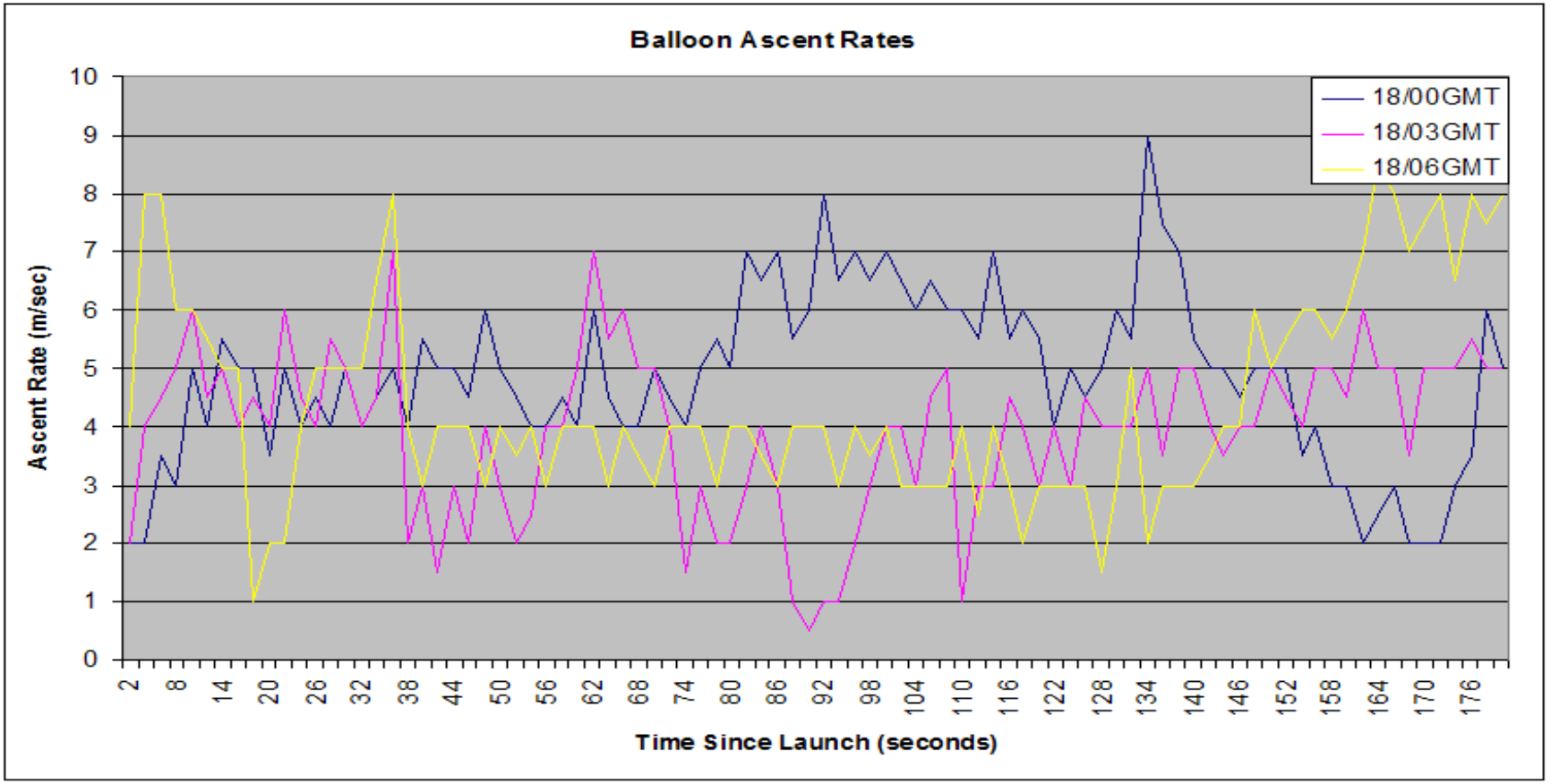
A nose of warm air appears at 935mb.

This is also the level of maximum wind speed (22 m /sec) and level at which northeasterly winds began to veer to southeasterlies





Balloon Ascent Rates



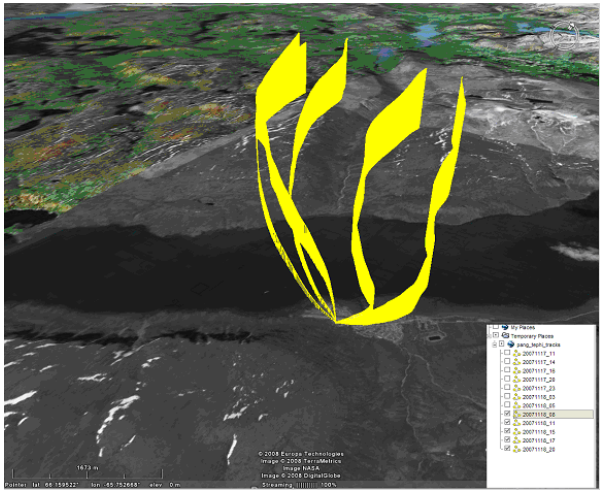
Possibly indicative of nothing, but the 03 GMT sounding shows a dip in the ascent rate at 38 seconds, corresponding to a height of 945 mb, which is at the base of the inversion

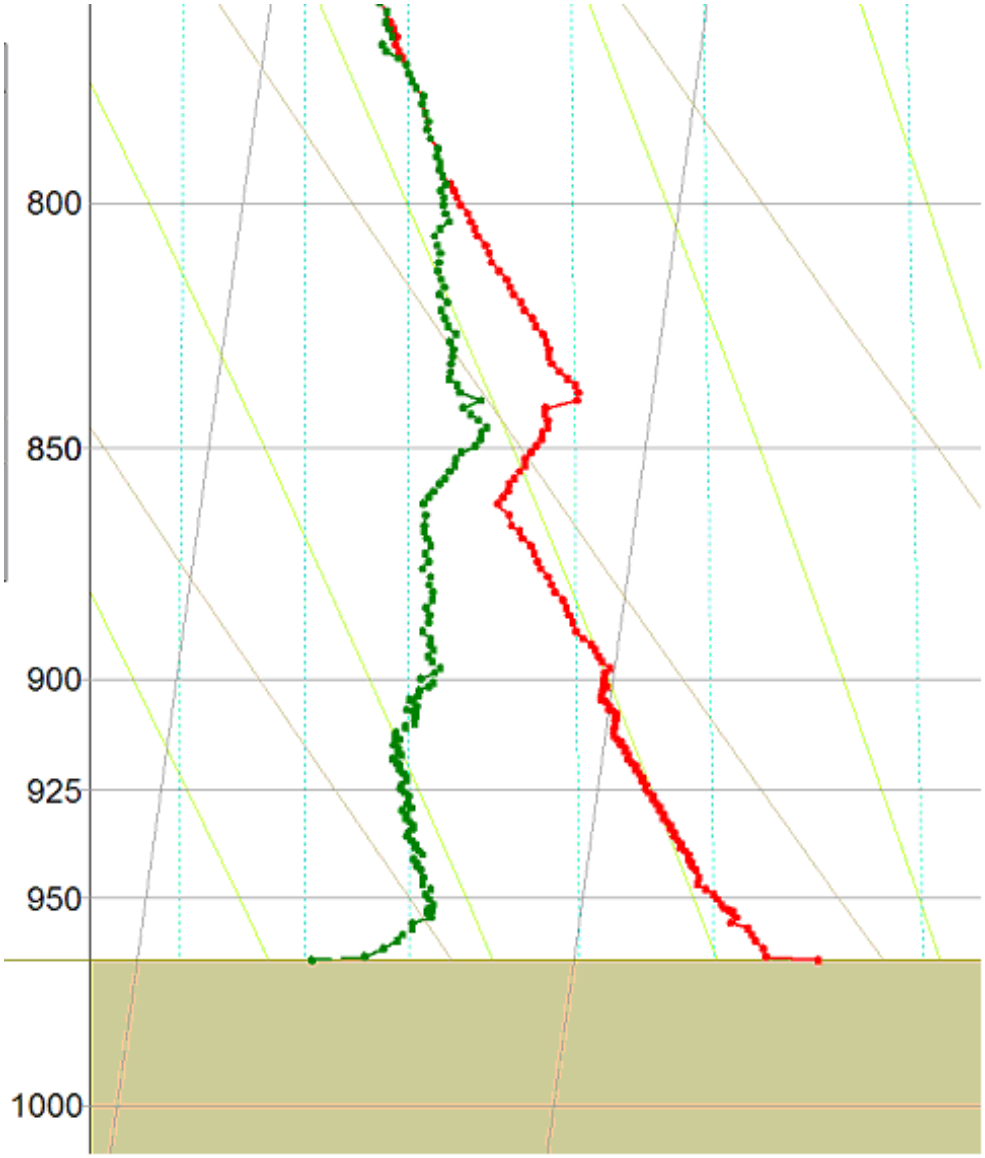
Evidence of wave at beginning of 06 GMT, but perhaps surprising that it begins with maximum ascent rates, so that phase / position of wave unexpected (but position of first crest is unknown)

Skew-T / Log-P Nov 18, 2007 – 05:19 GMT

The sounding is dry with a low-level adiabatic layer.

There are no more northeasterly winds anywhere in the sounding





What Has Been Learned

The observations describe a transition from flow down the fiord, to downslope flow from the mountains behind the town-site

This is not meteorologically astounding (as it potentially happens in many locations), but is the first time it has been measured at Pangnirtung

CYXP 180000Z AUTO 09019G31KT M02/M03 A2876=

CYXP 180100Z AUTO 08016G26KT M03/M03 A2874=

CYXP 180200Z AUTO 07024G34KT M02/M03 A2867=

CYXP 180300Z AUTO 10022G35KT M02/M04 A2864=

CYXP 180400Z AUTO 07022G32KT 03/M03 A2862=

CYXP 180500Z AUTO 08028G39KT 04/M02 A2860=
CYXP 180600Z AUTO 09025G32KT 03/M02 A2862=

CYXP 180700Z AUTO 10033G38KT 02/M01 A2864=

CYXP 180800Z AUTO 10038G44KT 02/M01 A2867=

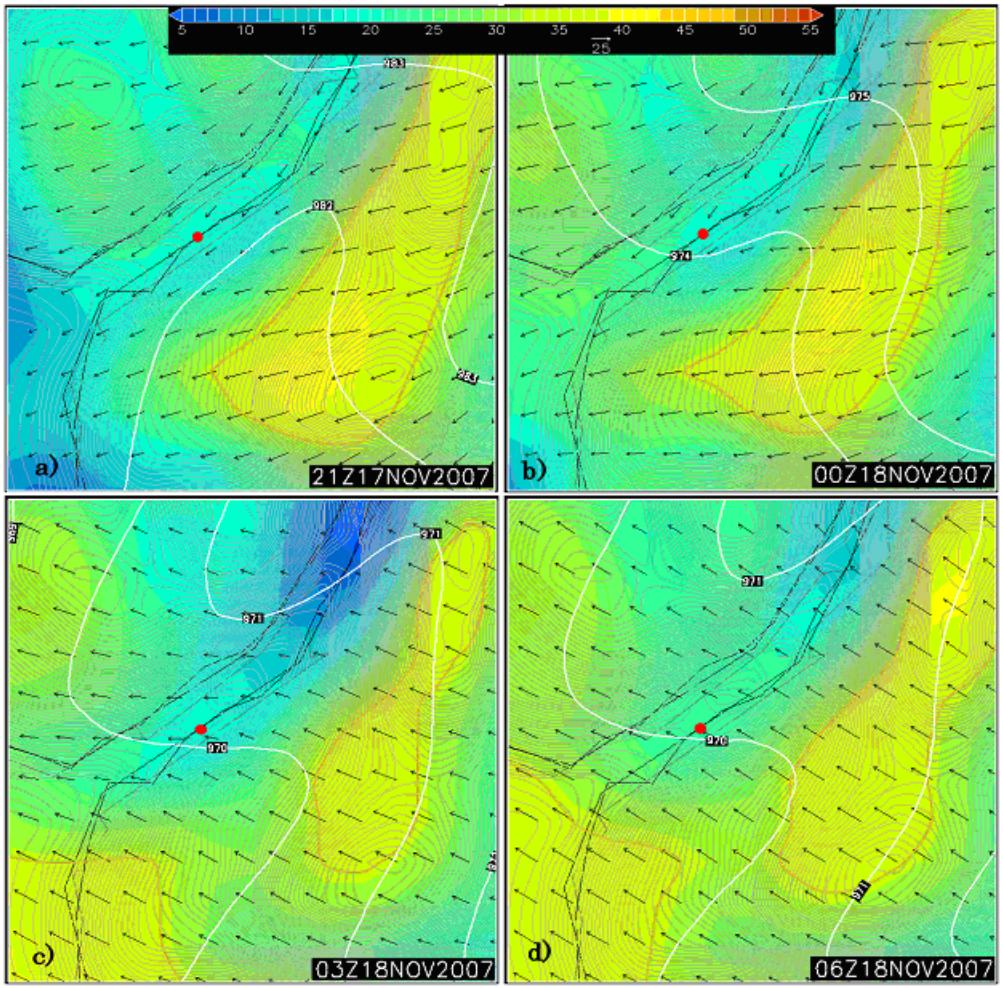
In the observations, the transition can be seen in the 5 deg C rise in temperature between 03 GMT and 04 GMT. However, to a busy meteorologist, this can easily be missed

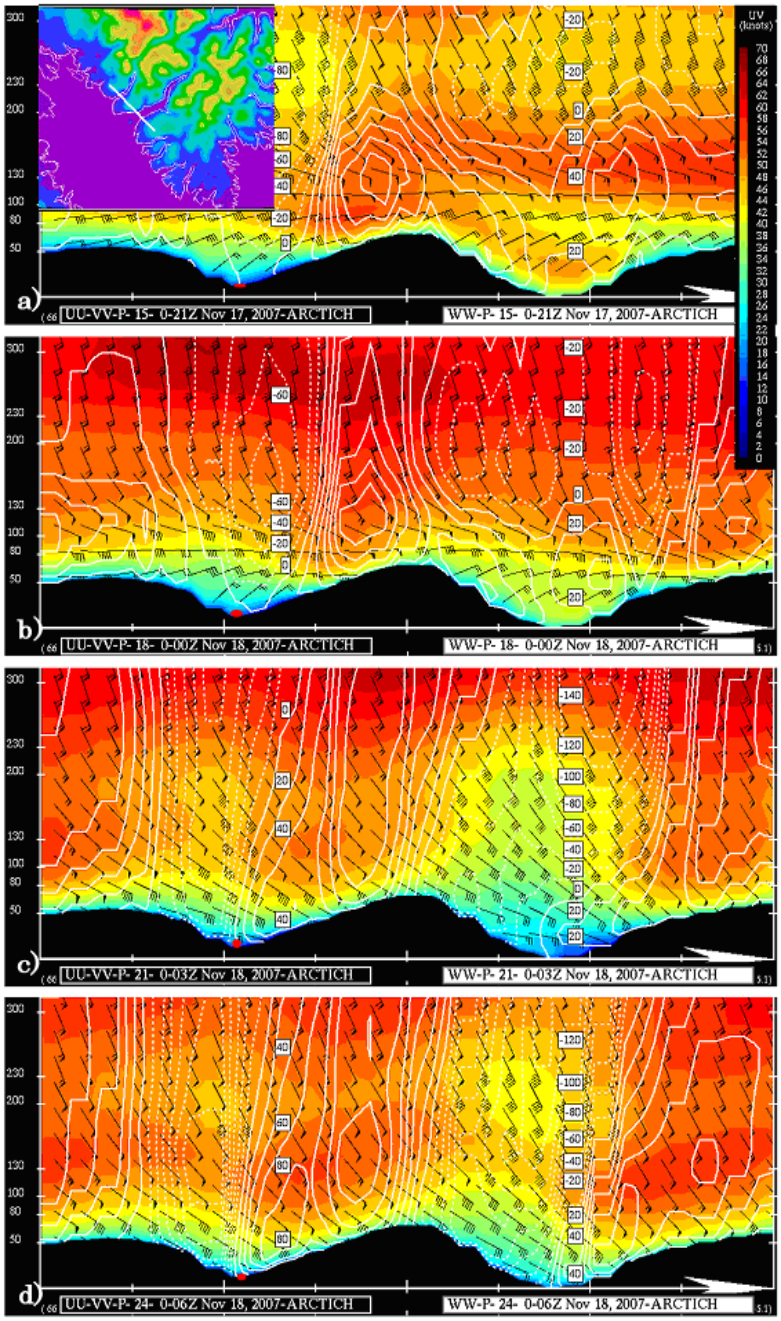
The transition is not well shown in the observations, and the consistent easterly winds do not well-reflect the likely low-level conditions over the fiord

Based on this storm it would appear that the weather station at the airport, nestled under the cliffs, is not representative of prevailing winds. This has significant impact for understanding and forecasting.

GEMLAM – performed quite well for this case, in describing the transition from northeast to southeast.

The profiles also indicated this storm as a “significant” event with strong vertical motion





The End

Thank you