

# **HANS ISLAND / TARTUPALUK**

## **A year of meteorological measurements**

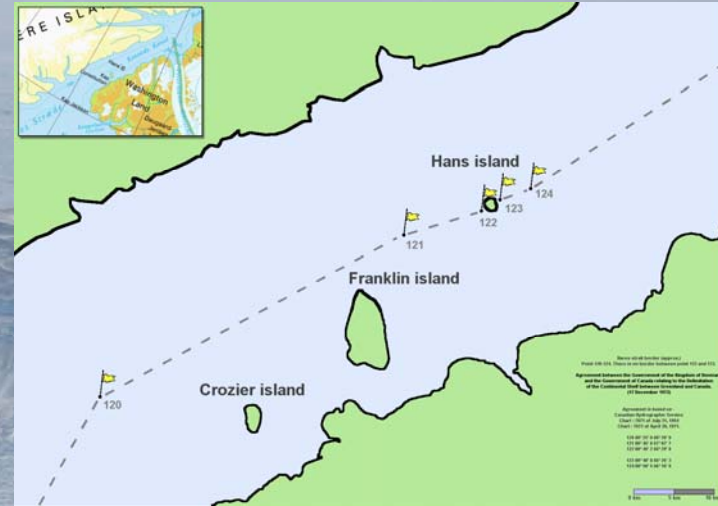
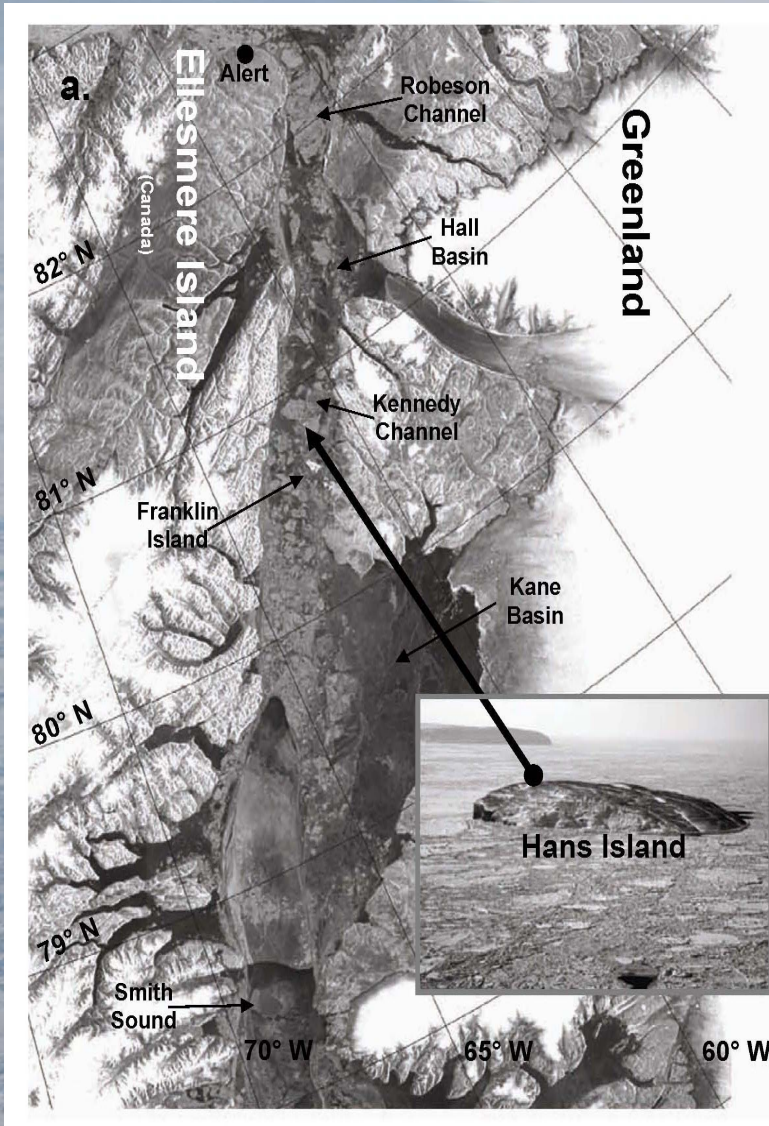
**J.P. Wilkinson, P. Gudmandsen, S. Hanson, R. Saldo,**

**R.M. Samelson, D. Barber, H. Melling, D. Mercer**

**+ many more**

**Changes of the Greenland Cryosphere  
Katuaq, Nuuk, Greenland, August 25-27, 2009**

# Where is it?



[http://upload.wikimedia.org/wikipedia/commons/f/f8/Nares\\_strait\\_border\\_\(Kennedy\\_channel\).png](http://upload.wikimedia.org/wikipedia/commons/f/f8/Nares_strait_border_(Kennedy_channel).png)

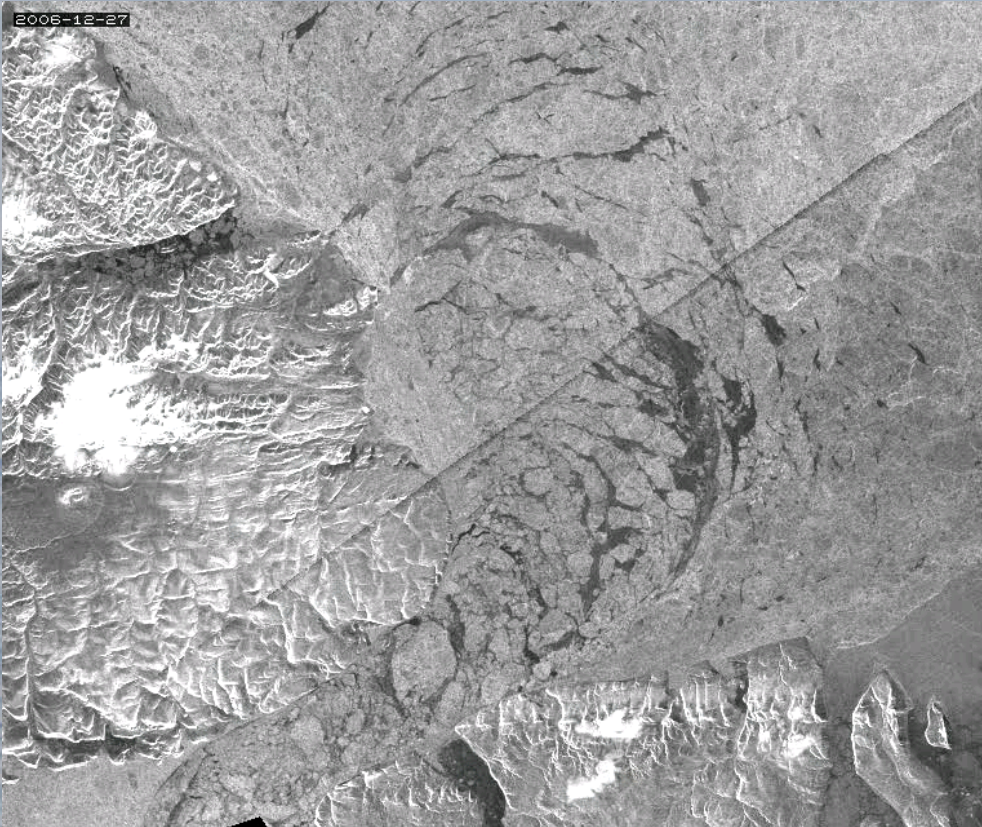
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# Its history

- First documented sighting: 28<sup>th</sup> August 1871 the vessel *U.S.S. Polaris* of the North Polar Expedition sailed past a small uncharted island in the middle of Kennedy Channel (Davis, 1876).
- The island was given the name Hans Island in honour of Hans Hendrik (1834-89; see Henrik, 1878) ), a Greenlander who assisted this expedition as well as four others to the region (E.K. Kane, 1853-55, I.I. Hayes, 1860-61, G.S. Nares, 1875-76 and N.A.E. Nordenskjöld. 1883).

# Why is it important?

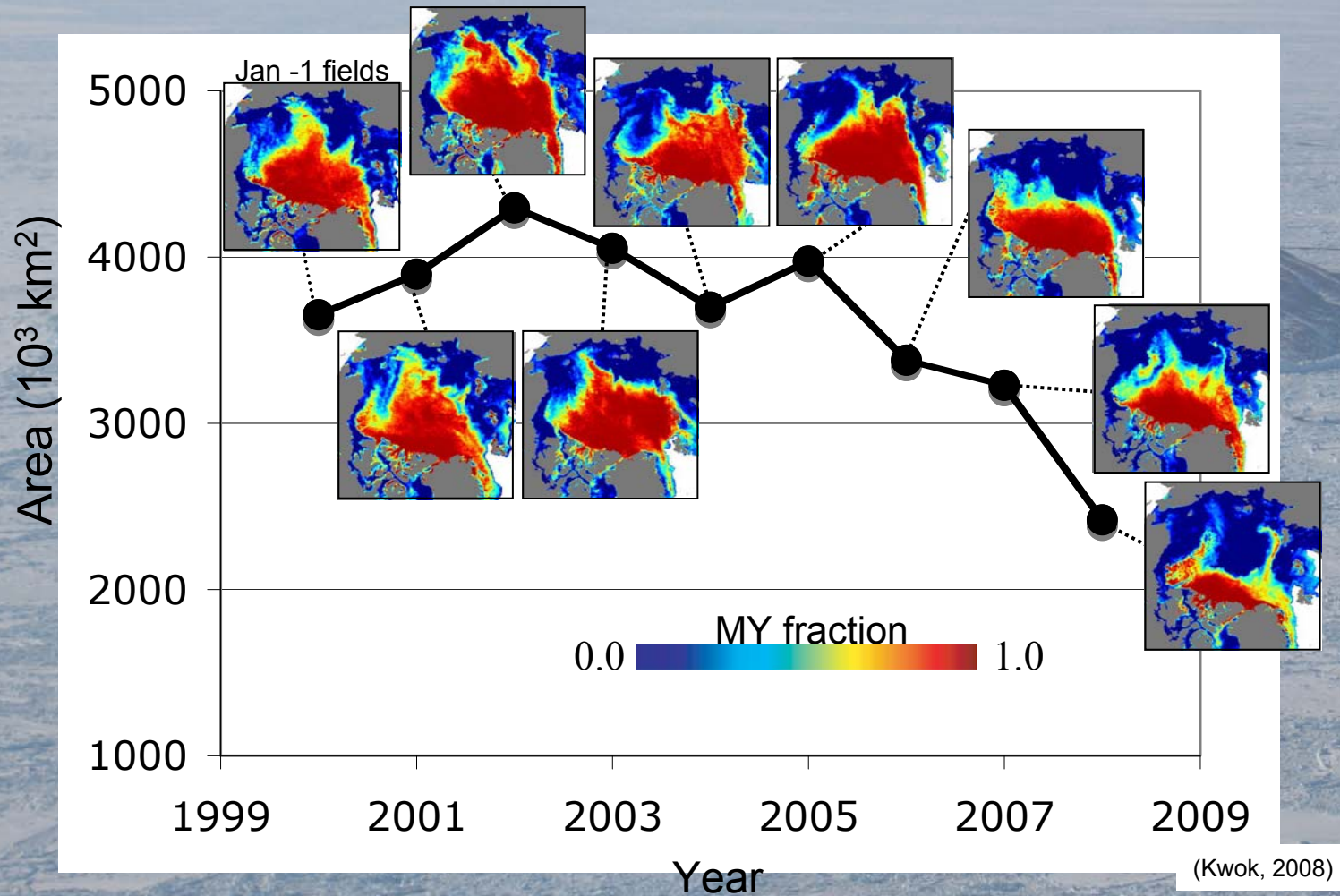
- Key role in the global hydrologic cycle by connecting the Arctic Ocean with the North Atlantic Ocean (Melling et al 2008).
- Any changes in the ice and fresh water flux through Nares Strait may alter the volume and extent of ocean deepwater formation. This in turn could influence the Atlantic meridional overturning circulation and hence global climate (Broecker, 1987; Lab Sea Group, 1998).



Courtesy: L Toudal

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# Why is it important?



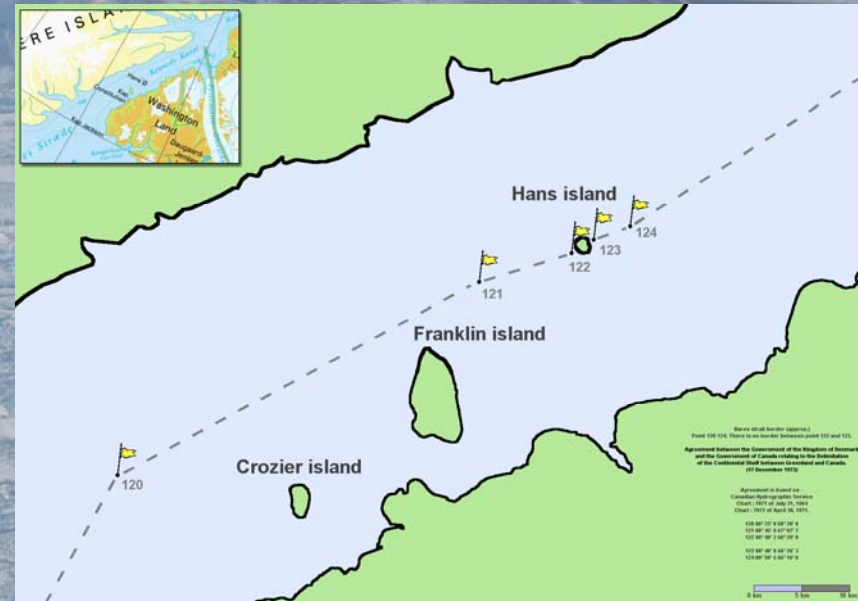
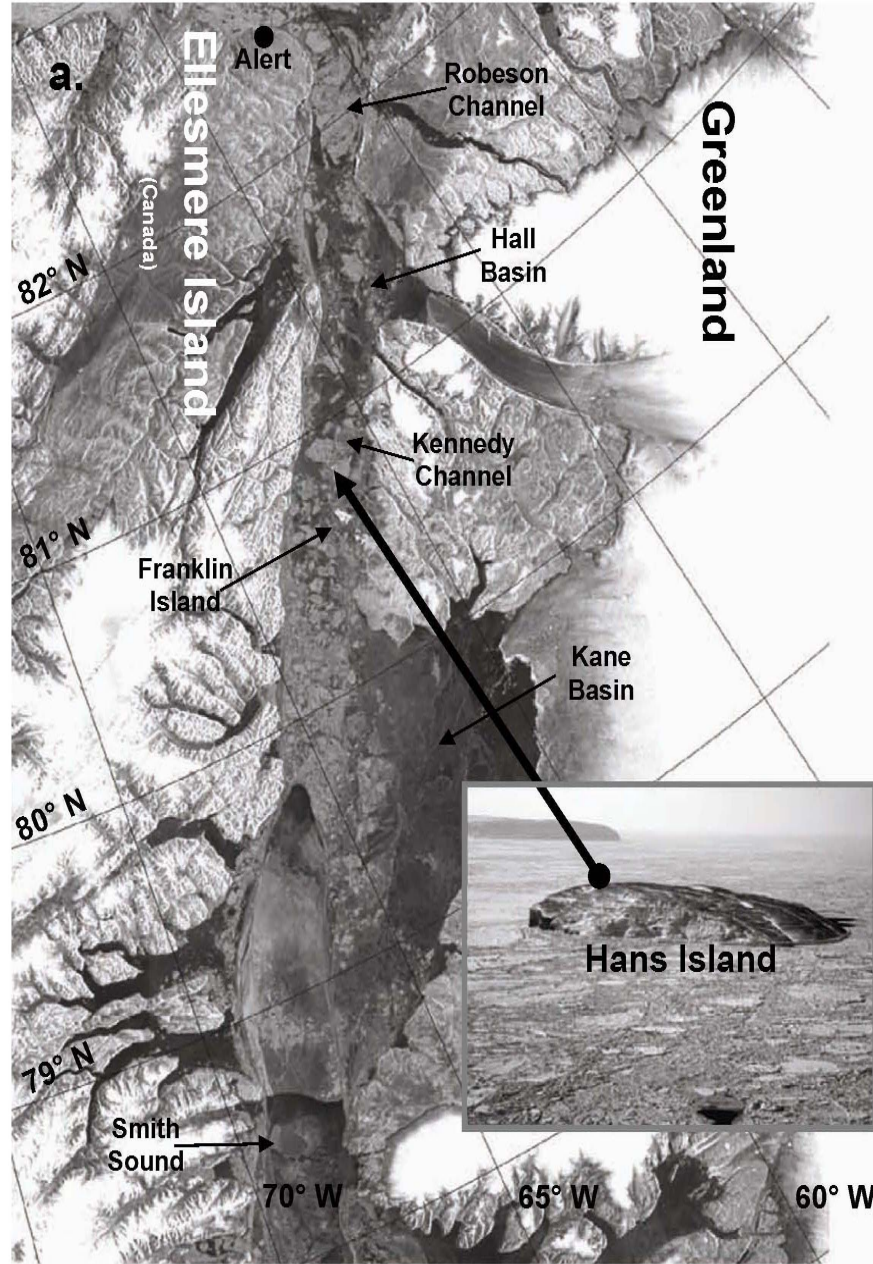
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# What has been monitored in Nares Strait?

- **Oceanographic mooring** at various locations in Nares Strait
- **Ice dynamics** monitored by satellite observations and buoy deployments
- **Atmospheric models**

VERY FEW CONTINUOUS  
METEOROLOGICAL MEASUREMENTS

# Hans Island, the ideal location?



[http://upload.wikimedia.org/wikipedia/commons/f/f8/Nares\\_strait\\_border\\_\(Kennedy\\_channel\).png](http://upload.wikimedia.org/wikipedia/commons/f/f8/Nares_strait_border_(Kennedy_channel).png)

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# Memorandum of Understanding

- Activities on the island are subject to diplomatic difficulties because Canada and Denmark/ Greenland have not been able to agree on the sovereignty of the island,
- The two governments have since agreed that the politically sensitive island may be exploited for joint scientific research activities. Thus, a collaboration between scientists at the University of Manitoba and the Technical University of Denmark led to the formulation of a memorandum of understanding (MOU) worked out with the support of the ministries of foreign affairs in Canada and Denmark.



# The deployment

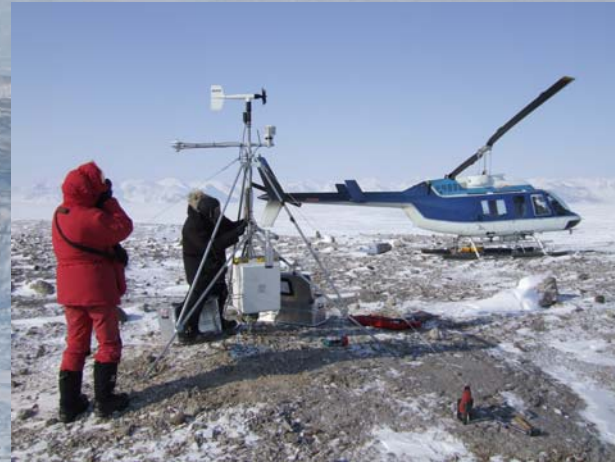
Preben Gudmandsen and Leif Toudal provided Weather and satellite images



On 9.45 am (local time) on the 4th of May four persons boarded the helicopter at the Canadian Military Station Alert bound for Hans Island. These persons were: Susanne Hanson (DNSC: Denmark), Matt O'Brian (Universal Helicopters Newfoundland: Canada), Duncan Mercer (Uni of Sydney: Australia) and Jeremy Wilkinson (SAMS: UK).

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# Installing the station



**Air temperature: -17C**

**Wind speed: 10 m/s**

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# The data

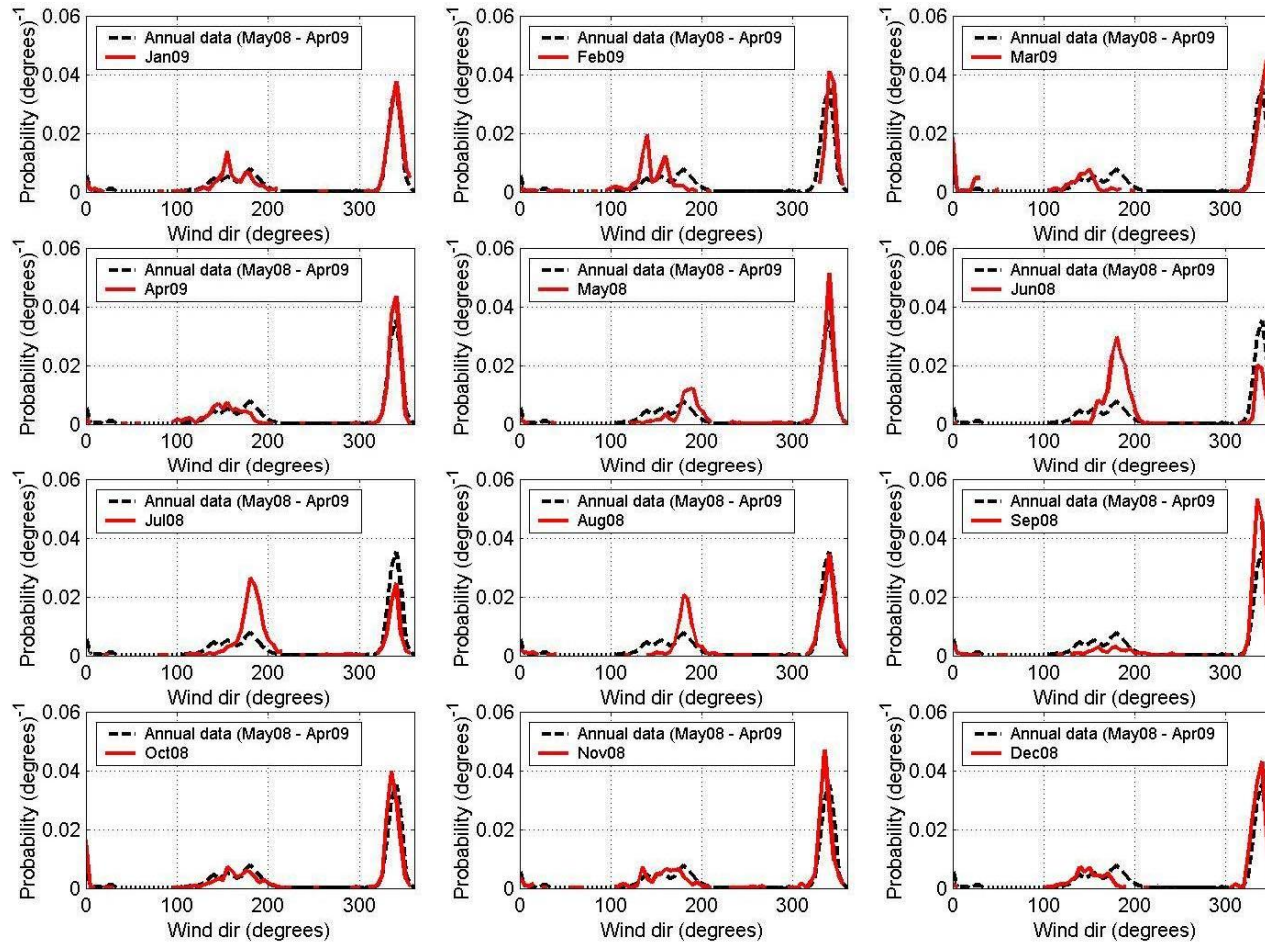
Every 30 minutes the station records wind speed and direction, air temperature, humidity, snow depth, solar radiation (up and down).

Example of data received (UTC):

4 5 2008 16 30 137 0 0 0 0 0 0 0 0 0 0 0 0

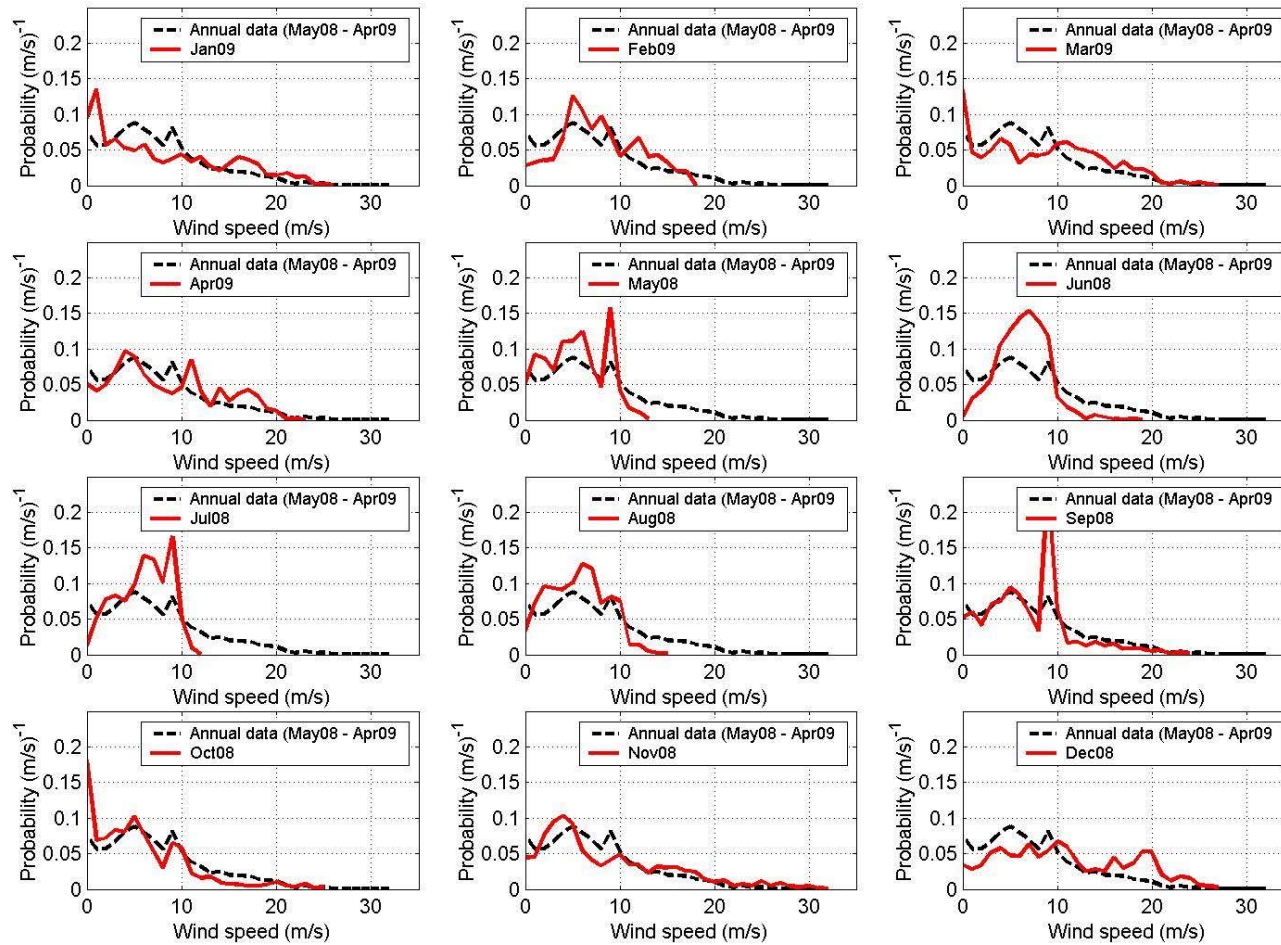
4 5 2008 17 0 137 13.7 -16.93 -17.03 -16.99 78.6 10.3 2.1 9.2 9.2 342 4.6 5.94  
2.85 1005.9 0.878

# Wind direction



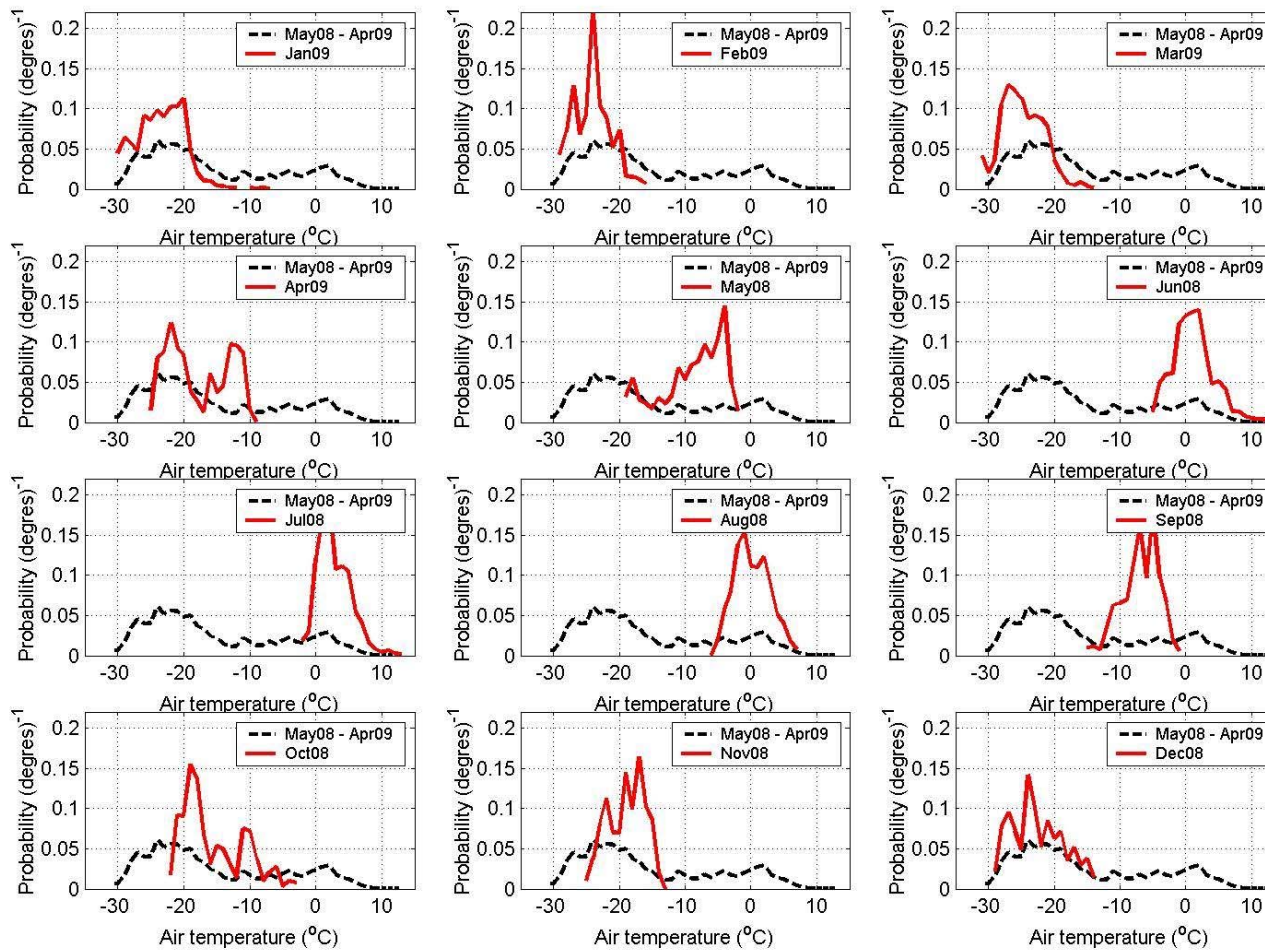
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# Wind speed



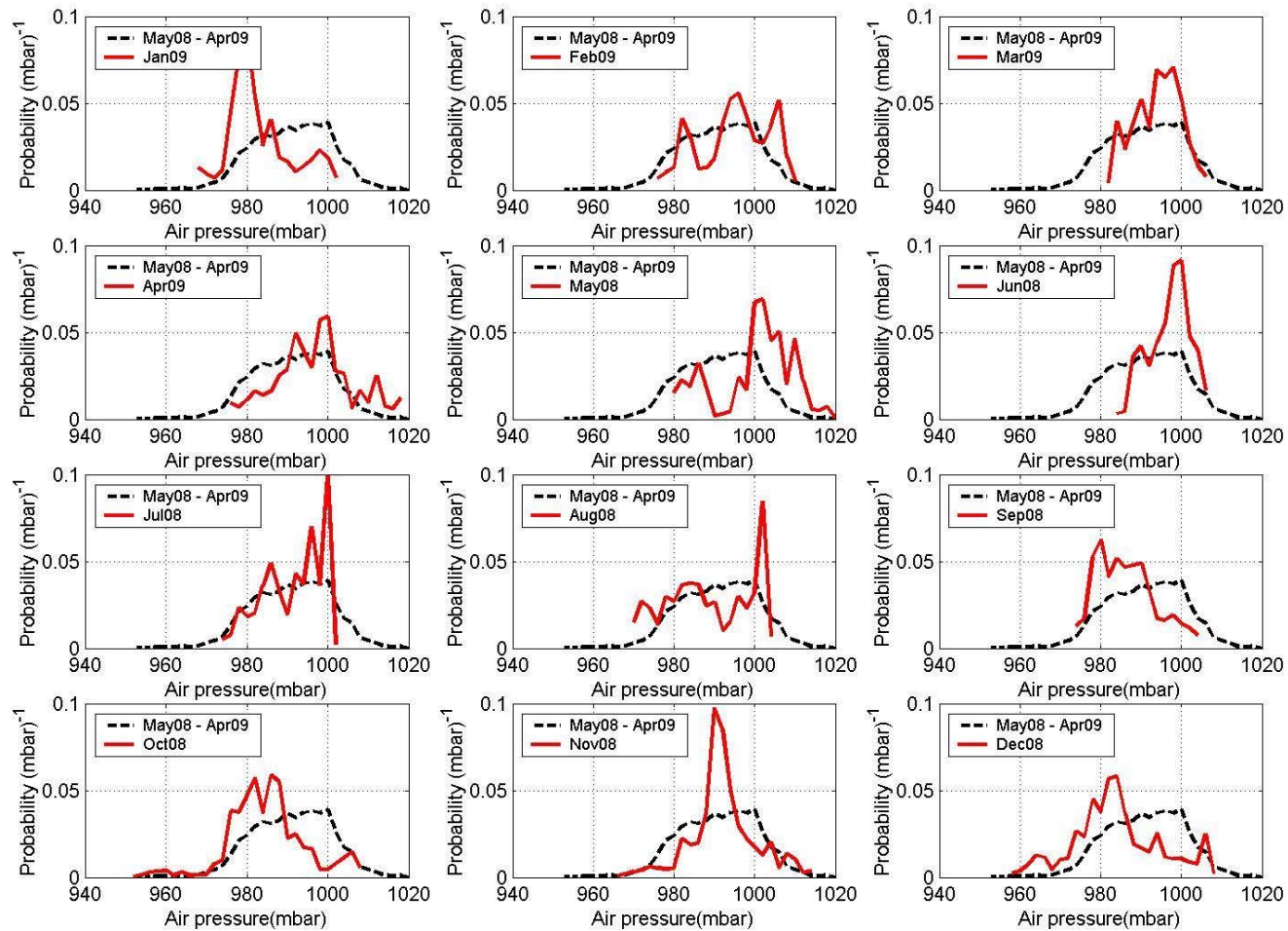
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# Air temperature



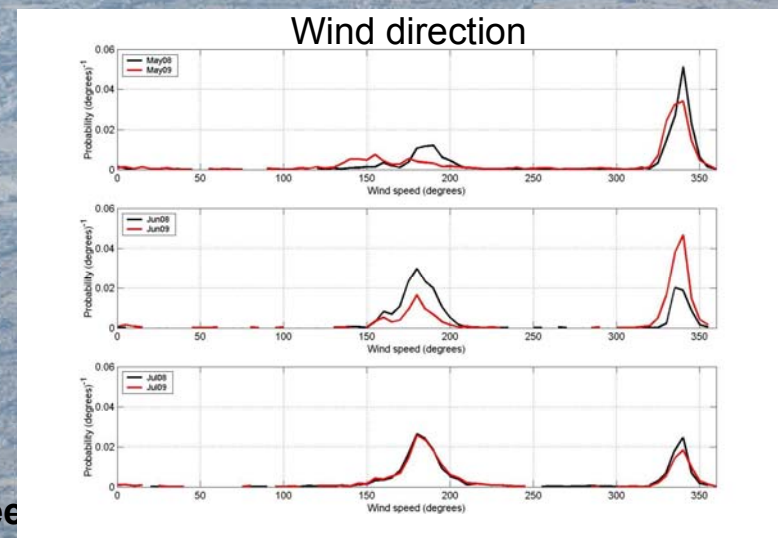
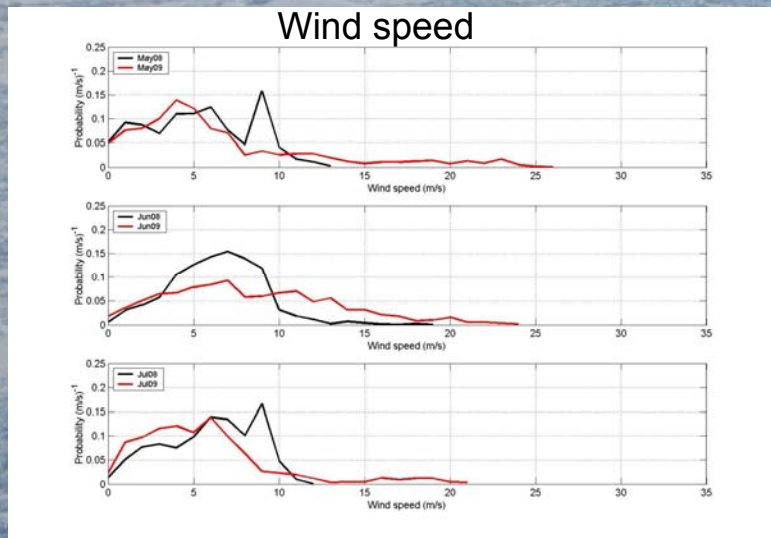
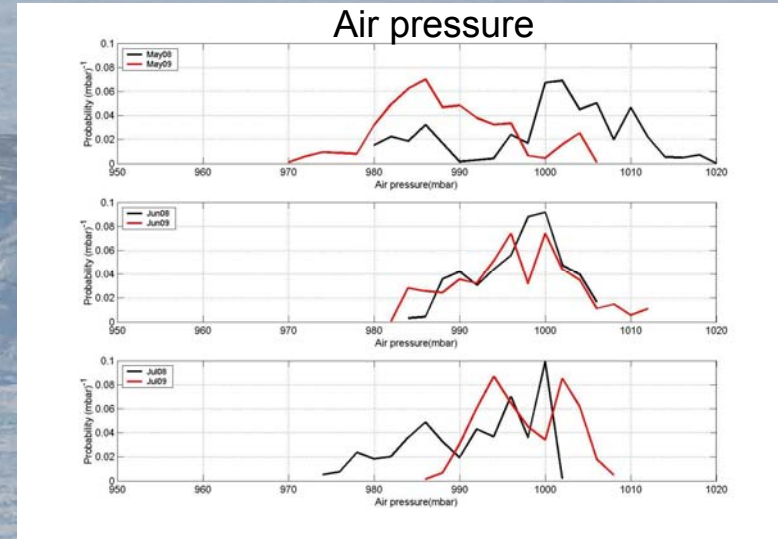
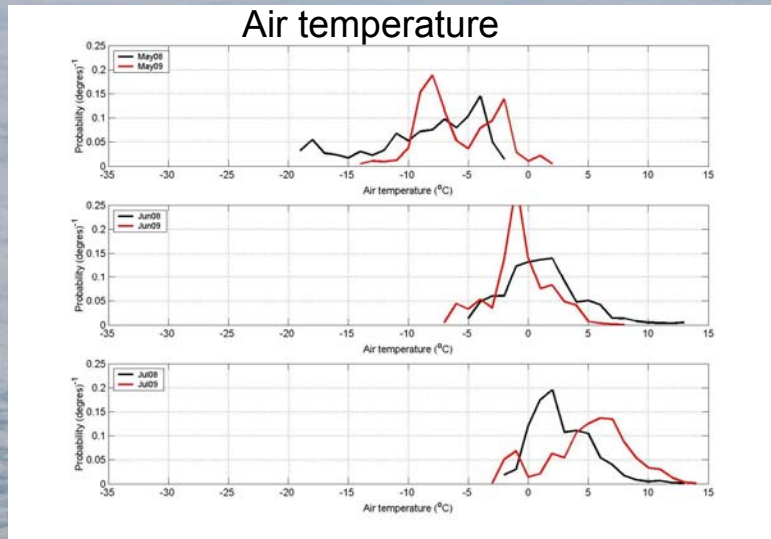
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# Air pressure



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# Seasonal variability



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# Seasonal variability

Hans Island: 28 April 2008



**100% ice cover**

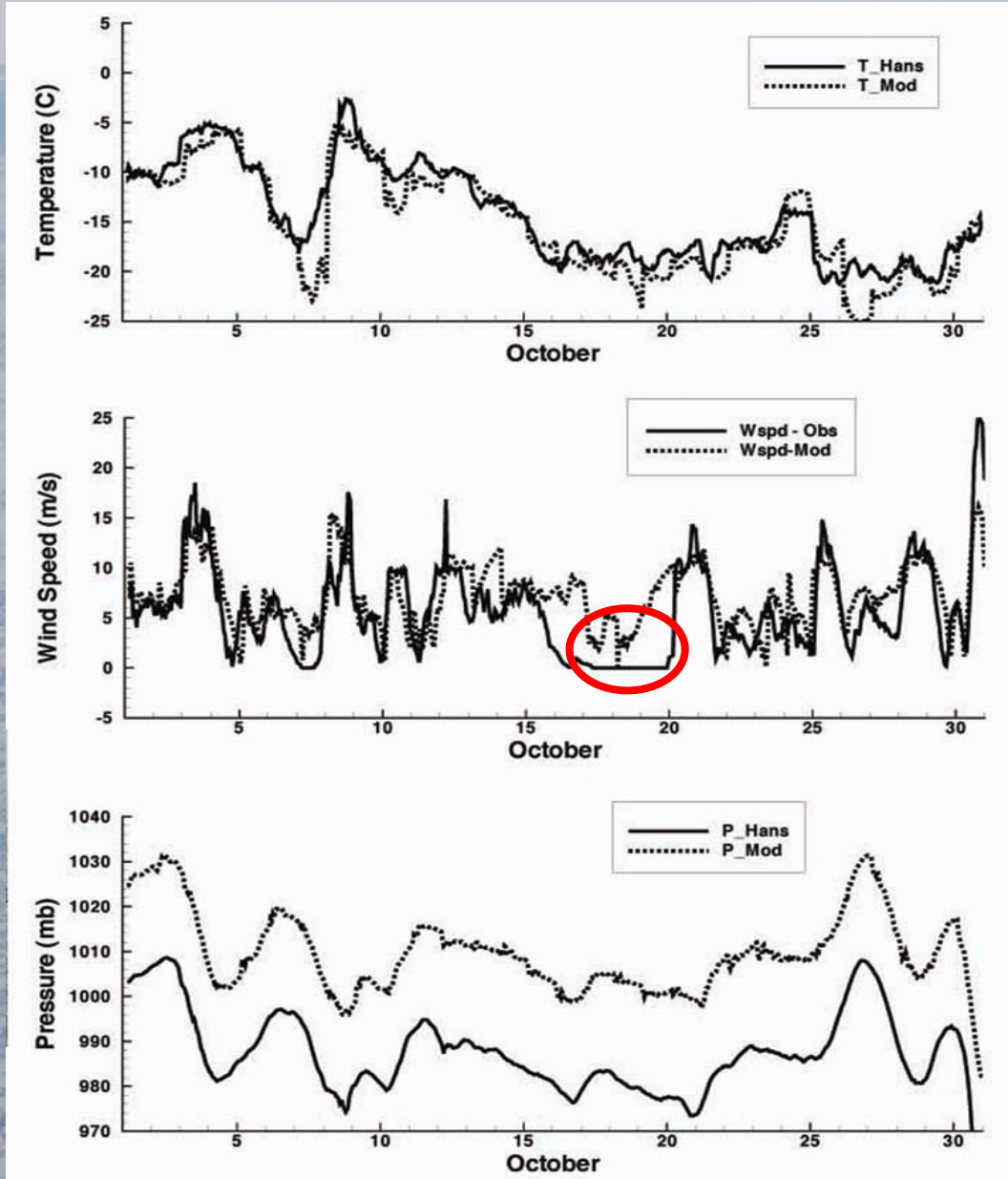
Hans Island: 8 May 2009



**Open water or Nilas**

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# AWS vs Model



*Examples of AWS output (solid curve) and mesoscale model output (dashed curve) for the month of October*

*Top: air temperature,  
Middle:; wind speed,  
Bottom; air pressure,*

*The red ellipse (around 18 October) indicates a short period when the anemometer data were apparently affected by icing.*

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# What now...

- Continue observation on Hans Island
- Expand meteorological observations to other areas in Nares Strait.
- Real time data: [http://dalriada.sams.ac.uk/awws\\_hans/](http://dalriada.sams.ac.uk/awws_hans/)
- Data downloaded from: <https://dalriada.nsm.ac.uk/phpmyadmin/>
- [jpw28@sams.ac.uk](mailto:jpw28@sams.ac.uk)

## Hans Island: Meteorological Data From an International Borderline

Just after midnight on 25 August 1871, the vessel *U.S.S. Point* of the North Polar Expedition, led by C. F. Hall, sailed past a small, uncharted island in the middle of Kennedy Channel (Doris, 1876). It is one of a number of narrow marine channels and sounds located between Canada's Ellesmere Island and Greenland that combined together form Nares Strait. Because of the dense fog at the time, the extent of the island could not be gauged. On the vessel's return voyage almost a year later, on 13 August 1872, the *Polaris* again passed this island. Expedition notes (e.g., Doris, 1876) reveal that the island was given the name Hans Island, or Hans O In Danit, in honor of Hans Hendrik (1834–1859) (see Hendrik, 1876), a Greenland-lander who assisted the expedition and four others to the region (led by E. K. Kane, 1853–1855; I. J. Hayes, 1860–1861; G. S. Nares, 1875–1876; and N. A. E. Nordenskjöld, 1883). Hans Island (80°49'35"N, 66°27'35"W) is a small sandstone landform that occupies an area of about 1.3 square kilometers and is 158 meters in height (Figure 1a). Also known as Tartupaluk (meaning "kidney-shaped place" in the Greenlandic language),

the island's topography could be described as wedge shaped in that its northern face slopes gradually upward and its southern regions are dominated by steep cliffs rising out of the ocean. The Nares Strait region plays a key role in the global hydrologic cycle by connecting the Arctic Ocean with the North Atlantic Ocean (Meiring et al., 2008). Any changes in the ice and fresh water flux through Nares Strait may alter the volume and extent of ocean deep-water formation. This in turn could influence the Atlantic meridional overturning circulation and hence global climate (Broecker, 1987; Lab Sea Group, 1998). Gudmundson [2004] and Samelson et al. [2006] have independently suggested that winds provide an important, perhaps dominant, forcing mechanism

for ice transport through the strait. The recent establishment of an automatic weather station (AWS) on Hans Island—which is claimed by both Canada and Denmark/Greenland—is, for the first time, allowing direct and continuous measurement of atmospheric conditions in the strait.

### Ice, Water, and Winds

For a number of years, a series of oceanic moorings has measured the ice and oceanic properties in the strait (Meiring et al., 2008). These measurements, and others that are ship based, provide a baseline understanding of the forces that influence the flow of ice and water through the strait (Marschall et al., 2006). However, atmospheric measurements have been a missing piece needed to complete this particular scientific jigsaw puzzle. Large-scale coupled models do not have the resolution to resolve the narrow,

channel-like flow or the complex orographic features. Recently, efforts to resolve the atmospheric conditions in the region have progressed to using a high-resolution, multiply nested, regional atmospheric mesoscale model that is embedded in a global operational forecast model (Samelson et al., 2006; Samelson and Barbour, 2008). Because surface winds are believed to drive the ocean surface currents and the sea ice and iceberg motion, it is important to obtain regular in situ meteorological measurements to verify and calibrate current and future regional atmospheric models.

Prior to the establishment of the Hans Island AWS, there have been no such regular in situ measurements available with which model results can be compared. The two closest meteorological stations—the Canadian military base CFS Alert on the Arctic

Hans Island cont. on next page

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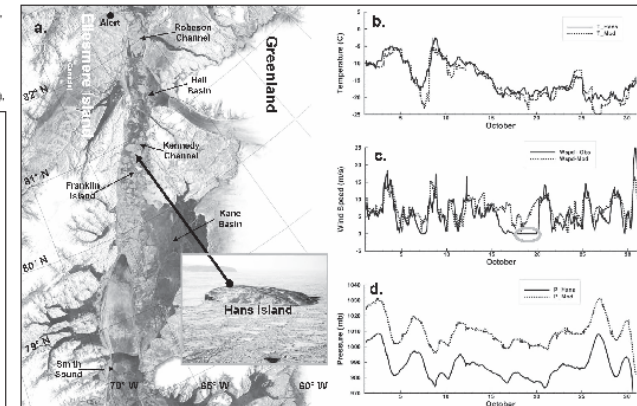


Fig. 1. (a) ENVI-SAR advanced synthetic aperture radar image from 23 April 2008 with an inset picture of Hans Island on the day of the automatic weather station (AWS) deployment (the black dot on the island indicates the AWS location; Ronnlin Island is visible on the horizon). (b–d) Examples of AWS output (solid curve) and mesoscale model output (dashed curve) for the month of October (air temperature, Figure 1b; wind speed, Figure 1c; air pressure, Figure 1d). White not perfect model results show good correlations with the observations. Note that the model output shown is from the lowest model grid point, located 8 meters above a flat bottom boundary, while the anemometer is 2.5 meters above local ground level at the 168-meter elevation of the top of the island; the constant offset in pressure between the two records arises from this difference in elevation of the model output and the AWS. The shaded ellipse (around 18 October) in Figure 1c indicates a short period when the anemometer data were apparently affected by icing.

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