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Anemological conditions in the Arctic during the First International Polar Year 1882/1883

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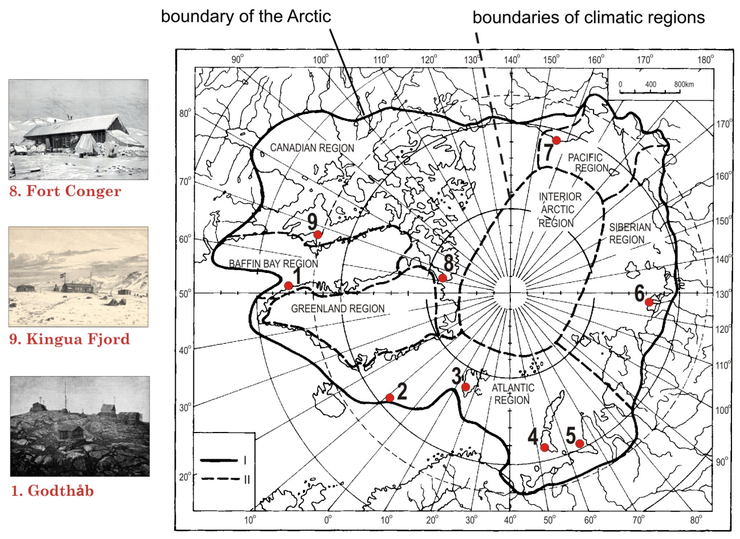
Introduction, data and methods

During the First IPY period nine meteorological stations were working in the real Arctic (i.e. defined after Treshnikov et al., 1985). What is very important meteorological observations in all these stations were carried out according to the same methodology and the all measurement instruments were subject of strict calibration and control (before, during and after expedition). As a result, all gathered meteorological data are of good quality and are fully comparable. Instead of these, as Wood and Overland (2006) rightly noted 'No synthesis of the data was undertaken', although recently a few papers dealing with this subject have been published (e.g. Luedecke 2004; Przybylak 2004; Przybylak and Panfil 2005; Przybylak and Wyszyński 2009; Przybylak, Vizi, Wyszyński 2010; Wood and Overland 2006) describing only small parts of the available data (mainly temperature and air pressure) for the First IPY.

The poster describes anemological conditions (wind speed and directions) in the Arctic during the First International Polar Year 1882/83 (IPY-1) based on hourly data gathered for nine stations representing almost all climatic regions of the study area. For the analysis the following parameters have been used: mean daily wind speed (V, calculated from 24 hourly data), daily maximum (V max) and minimum (V min) wind speed (selected from 24 hourly data) and extreme values (V max abs, V min abs). Frequency (%) of occurrence of wind directions and calms were also examined. The main focus of the paper is directed to the spatial distribution of wind parameters, and their annual and daily courses.

Meteorological stations in the Arctic during the First International Polar Year 1882/83



8. Fort Conger

9. Kingua Fjord

1. Godthåb


2. Jan Mayen


3. Kapp Thordsen

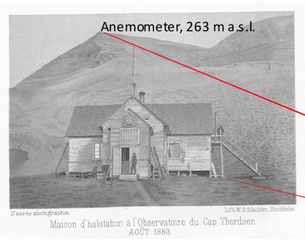

4. Malye Karmakuly

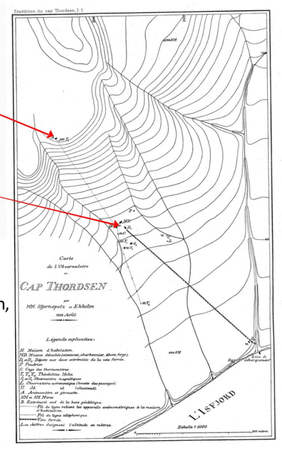

7. Point Barrow


6. Sagastyr

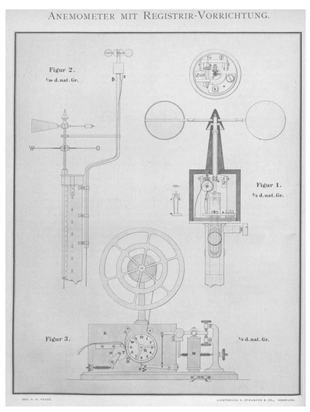

5. Kara Sea

Boundaries of the Arctic and its regions after *Treshnikov1985* .





Location of the anemometer at the Kapp Thordsen meteorological station, Isfjord, Spitsbergen.



Anemometer by dr. Recknagel used at the Kingua Fjord, Cumberland Gulf, Canadian Arctic

Methodology of measurements of wind directions and speed during the IPY-1 1882/83

- with hourly resolution (sometimes every 4 hours)
- anemometers of Wild, Recknagel, Robinson, Teorell, Hagemann, Casell
- wind speed in ms^{-1}, estimation according to Beaufort scale
- direction according to 16-degrees scale (except LFB – 8-degrees scale)
- varied hights of anemometers above the ground:

Godthab	5.3 m	Sagastyr	6.35 m
Jan Mayen	4.4 m	Point Barrow	8.5 m
Kapp Thordsen	6.0 m	Lady Franklin Bay	9.4 m
Malye Karmakuly	9.7 m	Kingua Fjord	8.6 m
Kara Sea	7.2 m		

- common period of measurements 1882.OCT – 1883.JUL

Methodology of processing collected data:

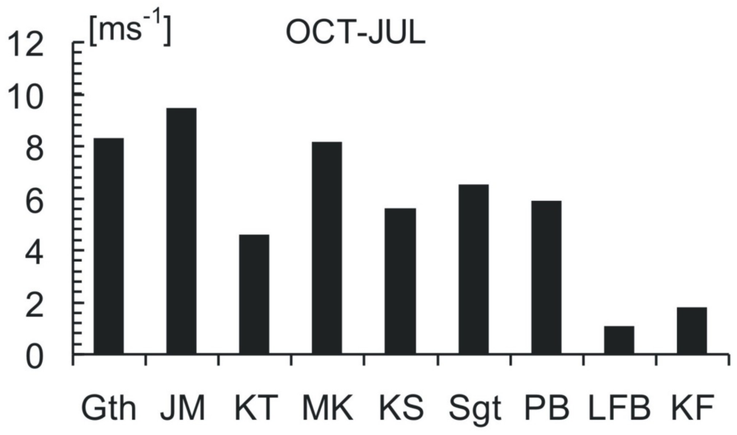
- manual digitalization of collected data (direction and speed)
- recalculation of the wind velocity to 10 m a.g.l. according to the Hellmann's algorithm (after *Bradtke 1919)*:

$$\frac{V}{V_0} = \sqrt[5]{\frac{h}{h_0}}$$

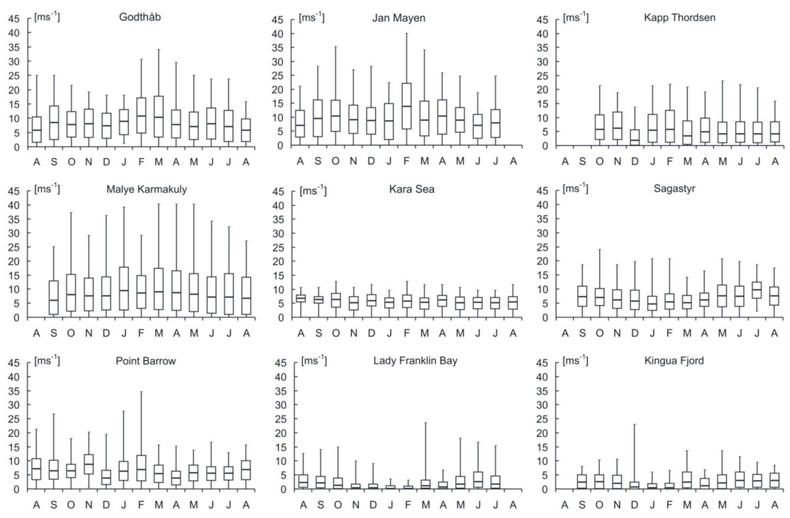
where:
V – wind velocity at the searching high (h)
V_0 – wind velocity at the high of measurement (h_0)

- basic climatological characteristics

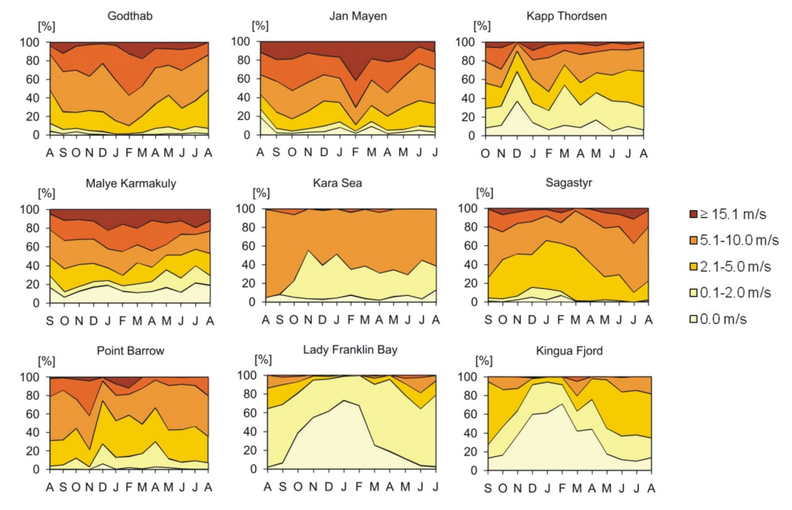
Results



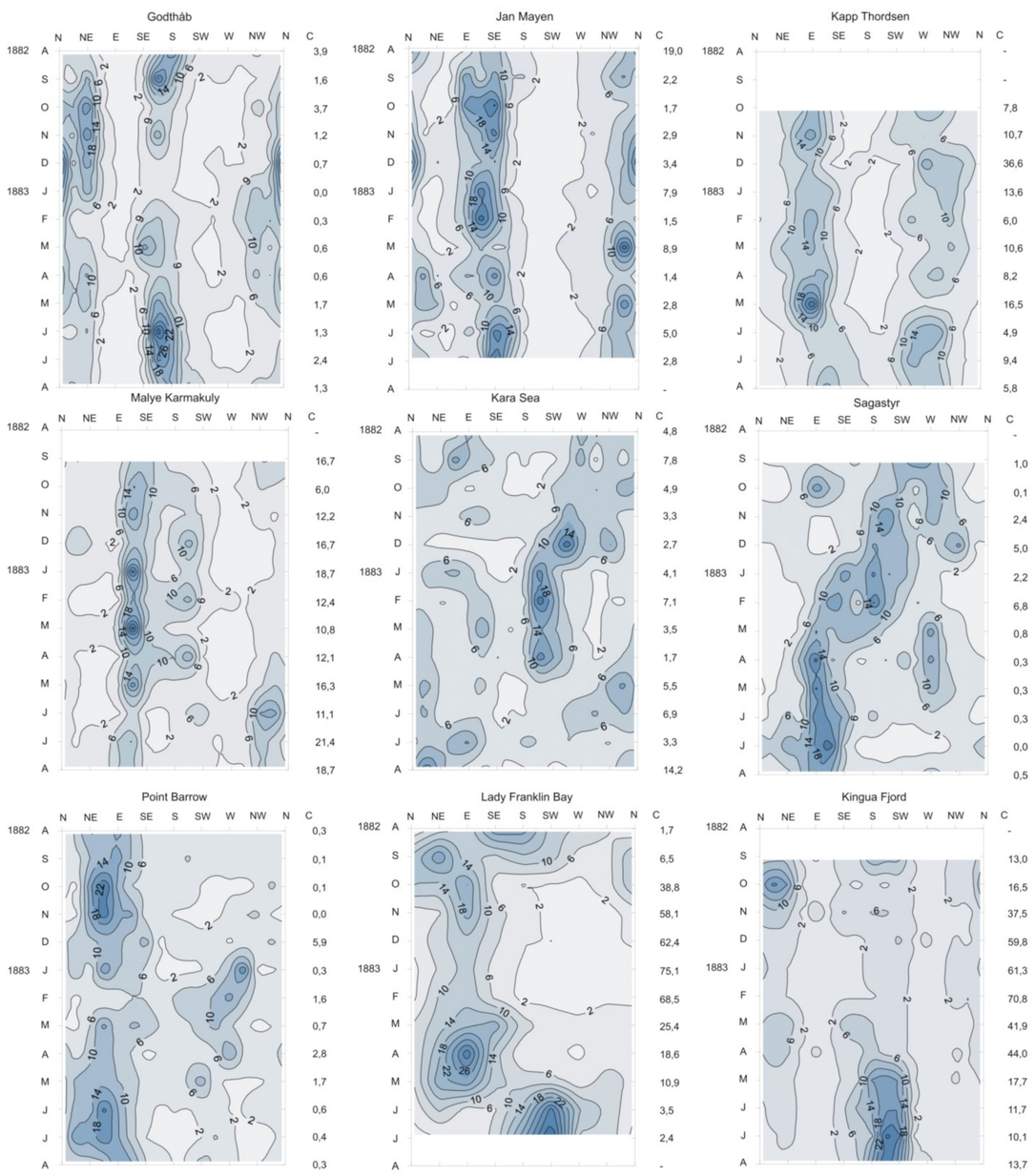
Mean wind velocities [ms^{-1}] for the common period (OCT-JUL) at 9 stations working in the Arctic during the IPY-1 1882/83.



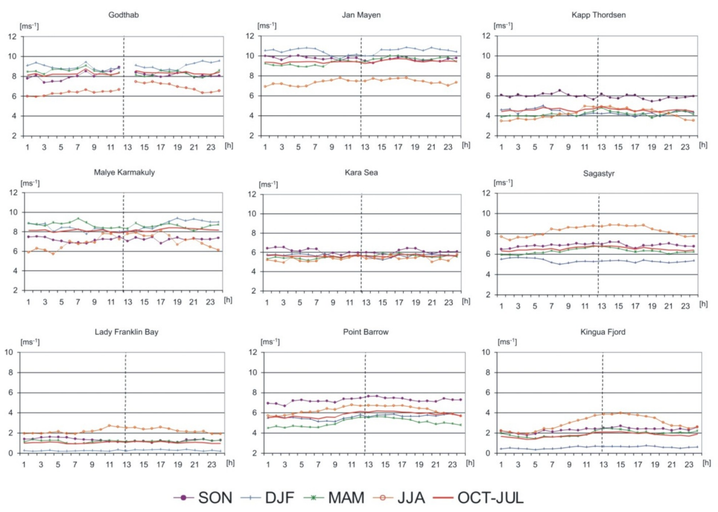
Annual courses of wind velocities [ms^{-1}] in the Arctic during the IPY-1 1882/83.



Frequency (%) of the occurrence of wind speed in ranges in the Arctic during the IPY-1 1882/83
Ranges after *Bartnicki 1930*, modified.

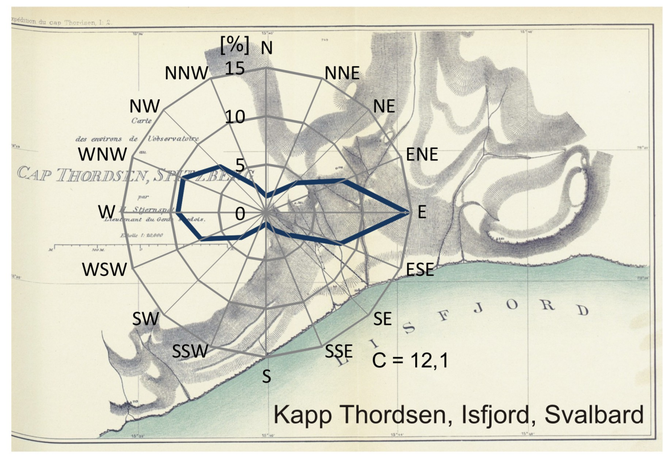


Frequency (%) of the occurence of wind directions and calms (C) in the Arctic during the IPY-1 1882/83



Average daily courses of the wind speed [ms^{-1}] according to seasons and for the common period (OCT-JUL) in the Arctic during the IPY-1 1882/83.

EFFECT OF THE LOCAL OROGRAPHY ON WIND DIRECTIONS



Main conclusions

1) The spatial distribution of wind velocities over the Arctic during the IPY-1 was similar to the modern one presented by Przybylak (2003). The Atlantic, Baffin Bay, and Pacific regions and also the central part of the Siberian region had (for the common period OCT-JUL) the highest wind speeds, oscillating between 5.6 and 9.4 ms^{-1}, while the Canadian Arctic and the station Kapp Thordsen on Spitsbergen showed the lowest wind speed averages (1.1 - 4.6 ms^{-1}).

2) In the annual course, the highest monthly wind speed means and their greatest variability occurred during the winter months in the Atlantic, Baffin Bay and Pacific regions. Low wind velocities during wintertime were noted in the central part of the Siberian region and in the Canadian Arctic.

3) In the daily course clear maximum wind velocities (with an increase of about 2 ms^{-1}) were observed in the noon and afternoon hours during the summertime.

4) Spatial distribution of wind directions in the Arctic during the IPY-1 reflected roughly the pattern which is observable today.

5) We also found that wind directions were modified by the local orography.

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