

Comparison of the historical meteorological data for the Arctic in the 19th century with the 20th Century Reanalysis dataset

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Introduction, data and methods

During the First International Polar Year 1882/83 period (IPY-1) nine meteorological stations were working in the real Arctic (i.e. defined after Treshnikov et al. 1985).

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.

Having the high quality controlled of original pressure, temperature and wind speed measurements from the Arctic it is possible to check the reliability of the existing gridding datasets. Meteorological data from the historical sites were compared with the data taken from the 2nd version of the 20th Century Reanalysis Project (Compo et al. 2011) for the nearest grids (tables on the right).

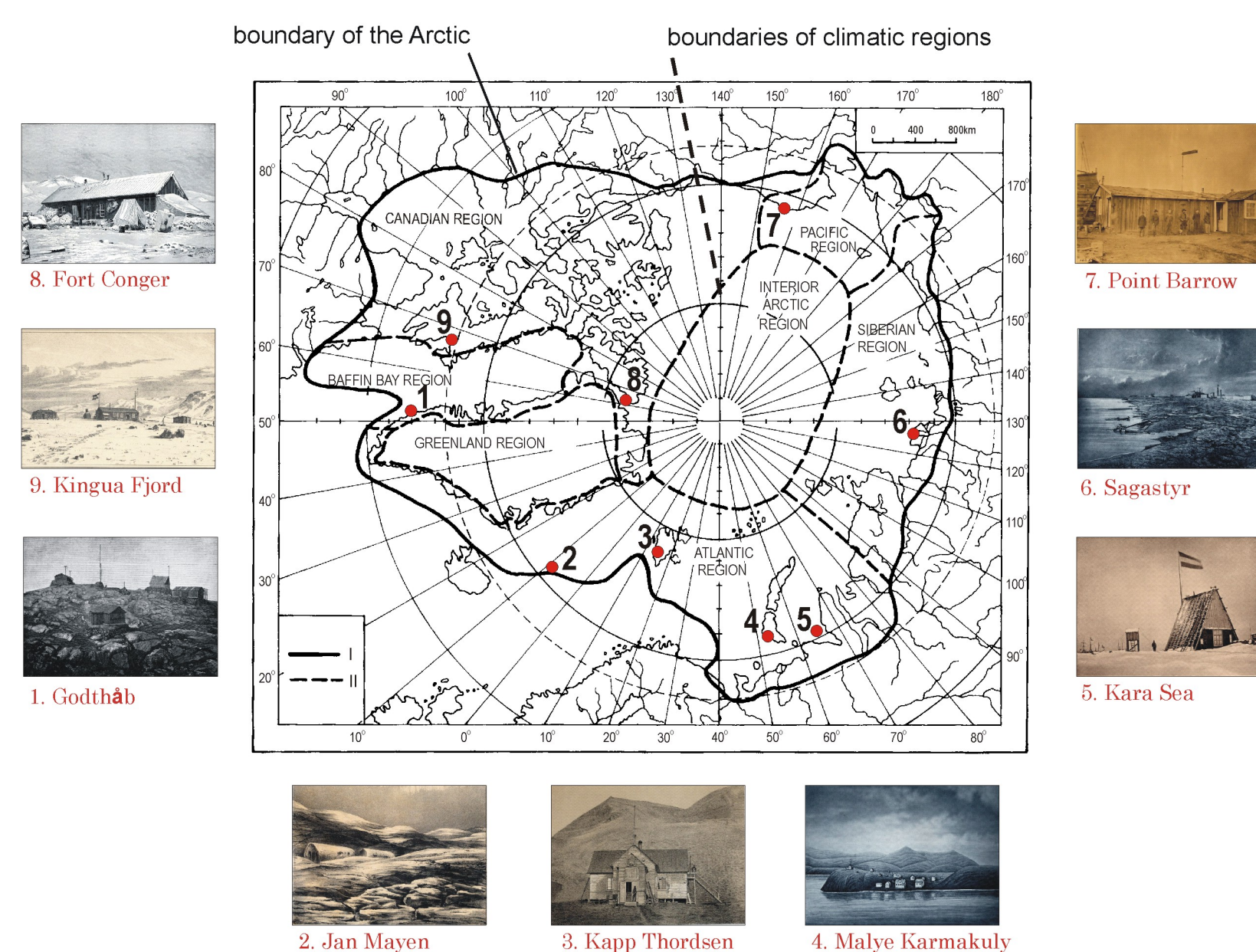
Geographical coordinates of the IPY-1 stations and 20CR grids.

Station	IPY-1 1882/83		20CR 1882/83	
	φ N	λ E	φ N	λ E
Godthåb	64.18	308.27	64.00	308.00
Jan Mayen	71.00	351.50	70.00-72.00	352.00
Kapp Thorsen	78.47	15.72	78.00	16.00
Malye Karmakuly	72.38	52.60	72.00	52.00
Sagastyr	73.37	124.08	74.00	124.00
Point Barrow	71.23	203.33	72.00	204.00
Lady Franklin Bay	81.73	295.25	82.00	296.00
Kingua Fjord	66.60	292.73	66.00	292.00

Geographical coordinates of the "Varna" drift in the Kara Sea and 20CR grids.

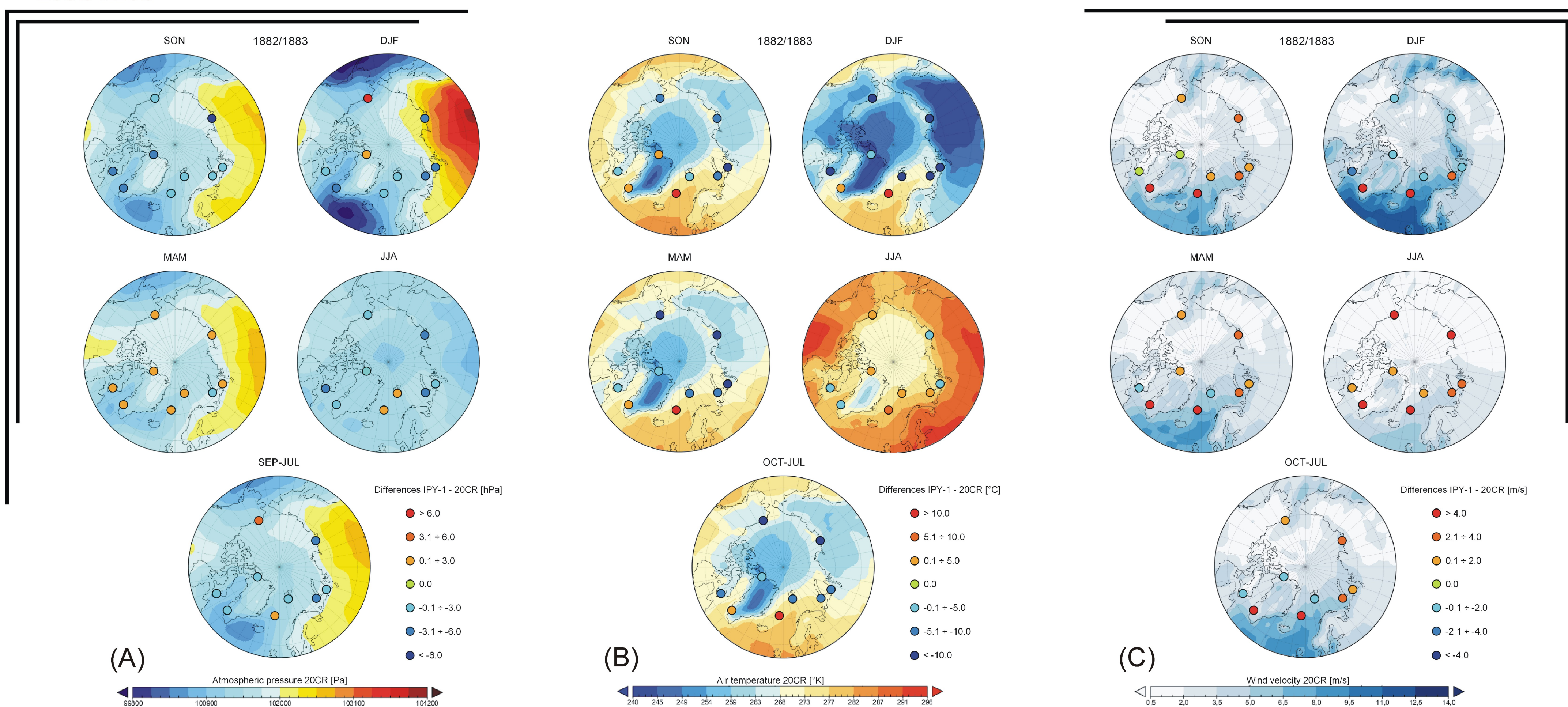
Year	Month	IPY-1 1882/83		20CR 1882/83	
		φ N	λ E	φ N	λ E
1882	Aug	71.38	55.21	72.00	56.00
	Sep	70.08	62.38	70.00	62.00
	Oct	70.20	64.20	70.00	64.00
	Nov	70.32	64.11	70.00	64.00
	Dec	70.63	64.82	70.00	64.00
	Jan	70.97	64.70	70.00-72.00	64.00
1883	Feb	71.18	64.42	72.00	64.00
	Mar	71.49	64.88	72.00	64.00
	Apr	71.62	65.02	72.00	64.00-66.00
	May	71.45	64.09	72.00	64.00
	Jun	71.26	63.83	72.00	64.00
	Jul	71.12	62.93	70.00-72.00	62.00-64.00
	Aug	70.62	60.49	70.00	60.00

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

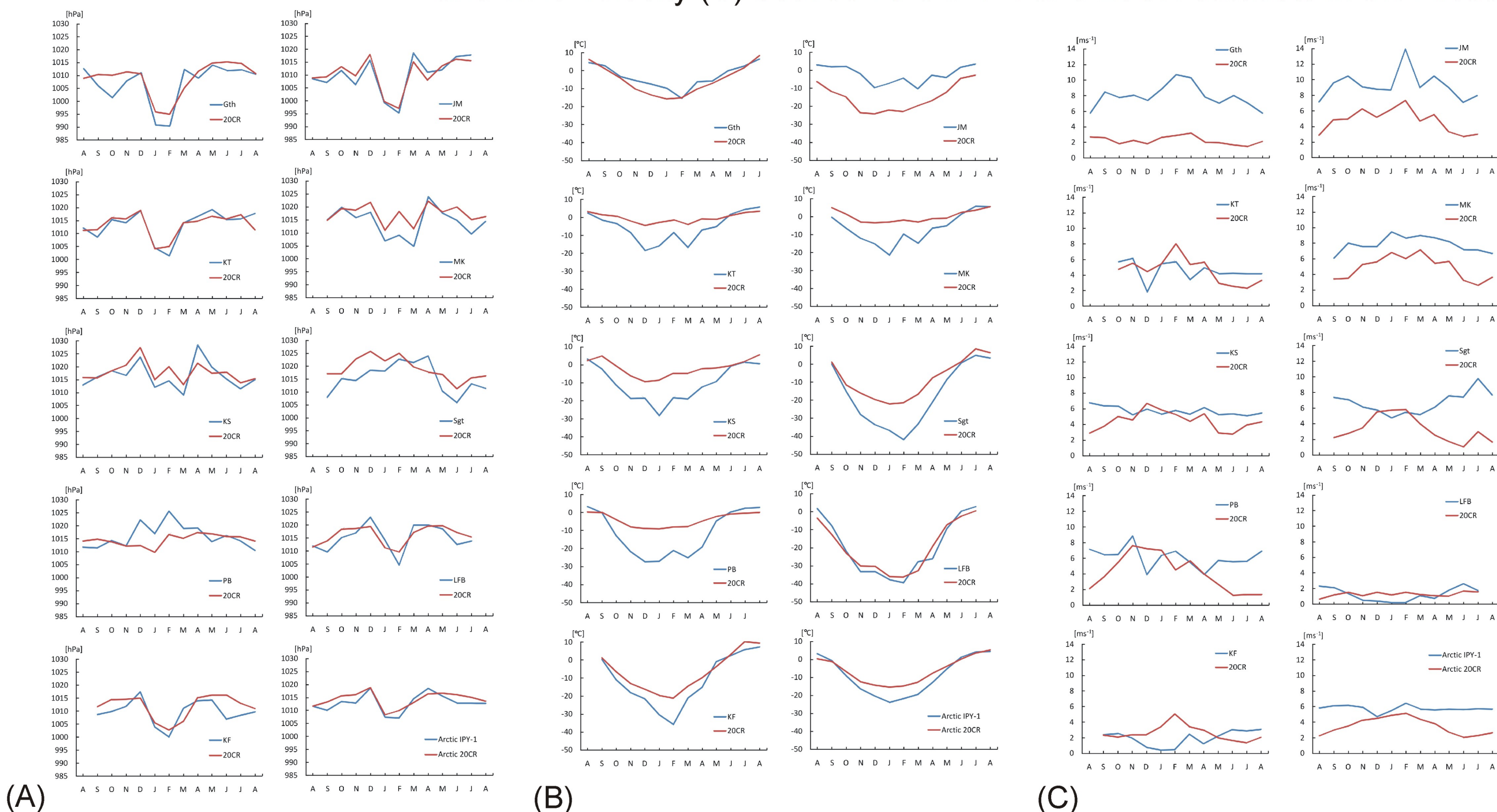


Boundaries of the Arctic and its regions after Treshnikov 1985.

Results



Mean seasonal (SON, DJF etc.) and for the common period (SEP-JUL or OCT-JUL) differences of atmospheric pressure (A), air temperature (B) and wind velocity (C) between the IPY-1 and 20CR datasets in the Arctic in the period of 1882/83.



Annul courses of atmospheric pressure (A), air temperature (B) and wind velocity (C) according to monthly values in the Arctic based on the IPY-1 and 20CR datasets in the period of 1882/83.

SYMBOLS:

IPY-1 - the First International Polar Year 1882/83
20CR - the 20th Century Reanalysis Project
Gth - Godthåb
JM - Jan Mayen
KT - Kapp Thorsen
MK - Malye Karmakuly
KS - Kara Sea
Sgt - Sagastyr
PB - Point Barrow
LFB - Lady Franklin Bay
KF - Kingua Fjord

Main conclusions

The 20CR dataset used data from observations based on the International Surface Pressure Databank (Yin et al. 2008) and therefore results of the atmospheric pressure are more close to those taken from the original IPY-1 dataset. On the other hand, 20CR reveal a quite large positive bias for the air temperature and a negative bias for the wind speed in comparison to the real data from the instrumental observations.

References:

Compo G.P. et al. 2011. The Twentieth Century Reanalysis Project. Quarterly Journal of the Royal Meteorological Society 137: 1-28. DOI: 10.1002/qj.776.
Treshnikov A.F. (Ed.) 1985. Atlas Arktiki. Glavnoye Upravlenye Geodeziy i Kartografiy, Moscow.
Yin X., Gleason B.E., Compo G.P., Matsui N., Vose R.S. 2008. The International Surface Pressure Databank (ISPD) land component version 2.2. National Climatic Data Center, Asheville, NC. doi:10.7927/H4TJ-6Q96
Woverland J.E. 2006. Climate lessons from the first International Polar Year. Bulletin of the American Meteorological Society, 1885-1697, DOI:10.1175/BAMS-87-12-1685.