Monitoring of polar snow for 20 years by satellite microwave observations

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Cryospheric change due to accelerated warming in the Arctic is a major concern（ACIA, 2005）. Such a change influences the environment, resulting in atmospheric, oceanic, and terrestrial changes. Arctic research projects are sending field research groups and establishing observation sites at various places in this region. Satellite observations are available to support research planning, and evaluation of observation period and place, as these observations cover both time and space.

Observation of the melting of snow cover and ice sheets use of satellite microwave radiometers to detect moisture content in snow from microwave radiation. A method called XPGR (Cross-Polarization Gradient Ratio) has been used as a main observation algorithm since the late 1990s, and has been used in climate change research as an index of ice sheet melting. In addition, a method called Diurnal Amplitude variation (DAV) is used to observe the melting of snow cover on land. The advantages of DAV, which detects changes in surface snow, are that it is sensitive to short-term meteorological changes and captures short-term fluctuations (Alimasi, 2016). It is possible to conduct a comparative study of snow cover on land and on ice sheet. In this presentation, we examined the characteristics and precautions for using XPGR and DAV respectively. In addition, using meteorological reanalysis data, intercomparison with satellite observation, effectiveness of each method, and points to note were investigated. The data used are AMSR (2002-2011), AMSR-2 (2012-2021) and NCEP data for the same period. These methods can be applied across the polar regions.

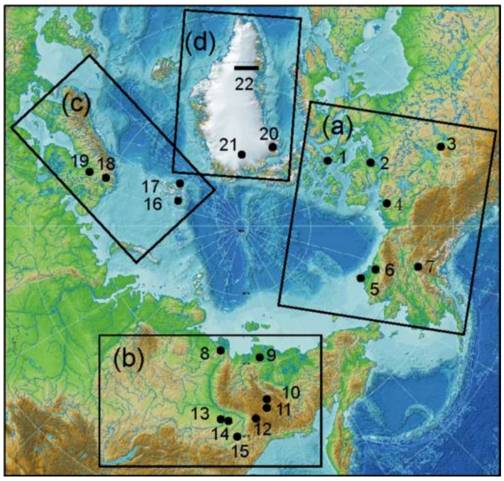

Figure 1.　Arctic observation sites .

Table 1.　Location of Arctic observation sites.

No.	Site	Lat.(degN)	Long.(degE)	No.	Site	Lat.(degN)	Long.(degE)
	North America				Greenland		
1	Resolute Bay	74.70	265.17		Qaanaaq–NEEM Transect		
2	Cambridge Bay	69.20	255.55	20	Qaanaaq（coast）	77.47	290.77
3	Fort Smith	60.01	248.11		ice sheet 400m	77.47	292.91
4	Inuvik	68.37	224.30		ice sheet 1300m	77.57	297.24
5	Barrow	71.30	203.41	～	ice sheet 1900m	77.48	299.56
6	Toolik Lake	68.63	210.40		ice sheet 2000m	77.59	301.61
7	Poker Flat	65.12	212.53		ice sheet 2100m	77.47	303.90
	Siberia			21	NEEM Camp 2400m	77.45	308.40
8	Tiksi	71.00	127.00				
9	Chokurdkha	70.00	148.00		Lat. 67.5N Transect		
10	Usti–Nera	64.57	143.24		glacier terminus 400m	67.50	310.00
11	Oymyakon	63.25	143.15		dark zone lower 1200m	67.50	311.00
12	Suntar–Khayata	62.58	140.83		dark zone higher	67.50	311.50
13	Spasskaya–Pad	62.23	129.62		melt pond zone 1500m	67.50	312.00
14	Yakutsk	62.03	129.73	22	ice/snow 1800m	67.50	313.00
15	Ust–Maya	60.42	134.53		snow 2000m	67.50	314.00
	Scandinavia/Svalbard				snow 2250m	67.55	315.29
16	Nortaustlandet	79.70	24.00		snow 2450m	67.54	316.45
17	Ny–Ålesund	78.92	11.93		ridge 2500m	67.53	317.62
18	Kevo	69.75	27.02				
19	Sodankylä	67.37	26.65				

References

Alimasi Nuerasimuguli，榎本浩之，2016，衛星マイクロ波観測による北極域雪氷モニタリング―積雪期間と融雪期間の推定―．雪氷，79（1），17-30.

ACIA, 2005: Arctic Climate Impact Assessment, Cam　bridge University press, NY, 1042 pp.