GCOM-W/AMSR-2 を用いたグリーンランド氷床表面融解検知手法の開発

島田　利元[1]、堀　雅裕[1]
[1] 宇宙航空研究開発機構地球観測研究センター

Development of the Greenland Ice Sheet surface melt detection algorithm for GCOM-W/AMSR-2

Rigen Shimada[1], Masahiro Hori[1]
[1]*Earth Observation Research Center, Japan Aerospace Exploration Agency*

Recent mass loss of the Greenland Ice Sheet had been affected by the expand of melt period for snow albedo reduction. Surface melt causes the enhancement of the snow metamorphism and the snow grain size gaining. And glacial microbe cultivation is also accelerated because they could live in the liquid water. Therefore, it is important to detect the snow melt onset. In previous studies, there were many methods for detecting the snow melt using space-borne passive microwave radiometer and these methods have been established in the satellite era (e.g. Abdatati and Steffen, 1997; Fettweis *et al.,* 2007). However, the most works had focused on summer season and there were few studies focused on early spring melting such as the timing of the melt onset. Therefore, it is difficult for detecting the early spring surface snow melt using passive microwave radiometer with previous methods. In this study, we develop the new method for detecting early spring snow surface melt from the comparison of meteorological observation and GCOM-W/AMSR-2. To detect the melt region on the Greenland Ice Sheet, we used several single band tests (Brightness Temperature (T_B) at 36.5 GHz horizontal polarization: $T_{B36.5H}$, T_B at 36.5 GHz vertical polarization: $T_{B36.5V}$, T_B at 6.9 GHz horizontal polarization: $T_{B6.9H}$ and T_B at 6.9 GHz vertical polarization: $T_{B6.9V}$) and normalized index test using T_B at 18.7 GHz horizontal polarization ($T_{B18.7H}$) and T_B at 10.65 GHz vertical polarization ($T_{B10.65V}$) (Fig. 1). This index using two brightness temperature of cross polarization in different frequencies was based on the XPGR method (Abdalati and Steffen, 1995). To validate the detection accuracy, the classification result was compared with surface temperature estimated from Longwave radiation observed by automatic weather station (AWS) installed by Programme for Monitoring of the Greenland Ice Sheet (PROMICE) from April to September in 2013 to 2016. The detection accuracy of this study (Table 1) was improved from XPGR method (Table 2). Producer's accuracy for surface melt detection had been improved from 14.76% to 81.38%. It is suggested that the algorithm of this study has the possibility for detection of slight snow melt.

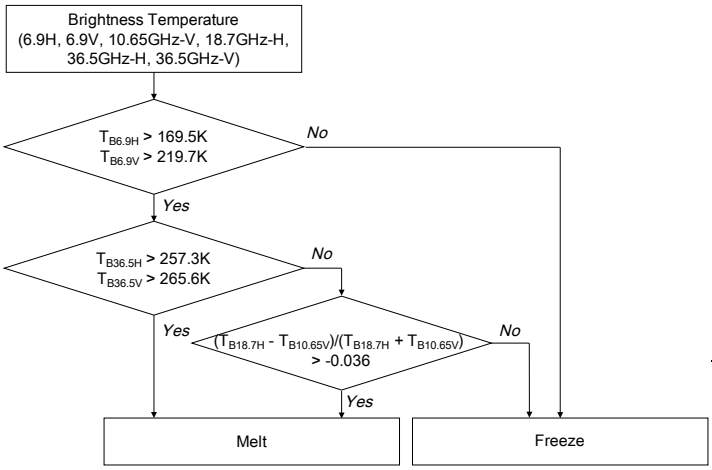

Figure 1. Surface melt detection algorithm flow

Table 1. Error matrix for melt detection using the algorithm in this study

		AMSR-2			
	Class	Melt	Frozen	Total	Producer's Accuracy
AWS	Melt	1097	251	1348	81.38%
	Frozen	315	2540	2855	88.97%
	Total	1412	2791	4203	
	Use's Accuracy	77.69%	91.01%		
	Overall Accuracy	86.53%			

Table 2. Error matrix for melt detection using XPGR method

		AMSR-2			
	Class	Melt	Frozen	Total	Producer's Accuracy
AWS	Melt	199	1149	1348	14.76%
	Frozen	334	2521	2855	88.30%
	Total	533	3670	4203	
	Use's Accuracy	37.36%	68.69%		
	Overall Accuracy	64.72%			

References

Abdalati, W. and K. Steffen, Passive microwave-derived snow melt regions on the Greenland Ice Sheet, *Geophys. Res. Lett.*, **22**, 787–790, 1995

Abdalati, W. and K. Steffen, Snowmelt on the Greenland ice sheet as derived from passive microwave satellite data, *J. Clim.*, **10**, 165-175, 1997

Fettweis, X., J. P. van Ypersele, H. Gallee, F. Lefebre and W. Lefebre, The 1979-2005 Greenland ice sheet melt extent from passive microwave data using an improvement version of the melt retrieval XPGR algorithm, *Geophys. Res. Lett.*, **34**, L05502, 2007