北西グリーンランド SIGMA-A, -B サイトで 2012-2013 年に観測された気象要素の変化

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Variations of meteorological elements measured at the sites SIGMA-A and -B in northwestern Greenland in 2012 and 2013

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To clarify the contributions of light absorbing snow impurities and glacial microbes to recent abrupt melting of snow/ice in Greenland as part of “Snow impurity and Glacial Microbe effects on the abrupt warming in the Arctic (SIGMA)” Project, two automatic weather stations (AWS) were installed at the sites SIGMA-A (78°03’N, 67°38’W, 1,490 m a.s.l.) on Greenalnd Ice Sheet (GrIS) and SIGMA-B (77°31’N, 69°04’W, 944 m a.s.l.) on Qaanaaq Ice Cap in northwestern Greenland in July 2012. After that the meteorological elements have been measured successfully during one year. Figure 1 depicts the results of air temperatures and snow surface level which indicate that the 2013 summer at SIGMA-A was much colder than 2012 and annual mass balance was positive at the both sites. At SIGMA-A the monthly mean air temperatures in July 2012 and 2013 were -0.2°C and -4.1°C, respectively, and annual mass balance was +102 cm (snow pit result 110 cm). Although the snow surface level decreased by several centimeters in 2012 summer period at SIGMA-A, snow accumulated continueouly in 2013 summer. At SIGMA-B the surface conditions in the 2011 and 2012 summers were bare ice at which glacial microbes covered. However, the snow cover has survived over the 2013 summer at SIGMA-B together with the wide areas higher than 700 m on Qaanaaq Ice Cap. Annual mass balance at SIGMA-B was +68 cm. These contrasting result of meteorological elements between 2012 and 2013 is related with the large-scale circulation patterns around Greenland and the Arctic Ocean. In 2012 the surface melting of GrIS was considerably higher than normal along the western GrIS coast as a result of the enhanced warm southerly air advection associated with the abnormal persistence of anticyclonic circulation centered in South Greenland (Tedesco et al., 2013). However, anticyclonic circulation was centered in the Arctic Ocean, northwest of Greenland in 2013 summer. Furthermore, high albedo due to frequent snowfalls on Qaanaaq Ice Cap in 2013 summer would suppress the surface melting at SIGMA-B.

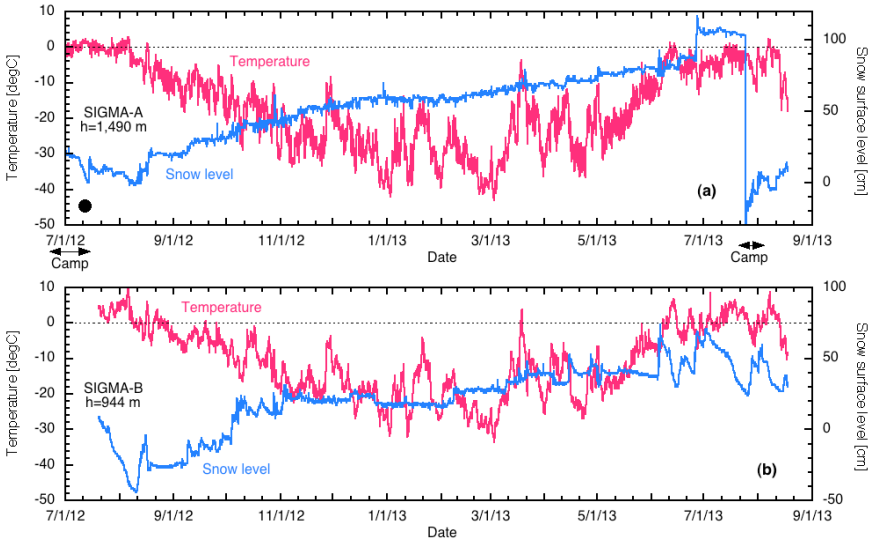

Fig. 1 Time series variations of air temperatures and snow surface level measured at the sites (a) SIGMA-A and (b) SIGMA-B on northwestern Greenland from July 2012 to August 2013. An abrupt decrease of snow surface level at SIGMA-A on 24 July 2013 was due to extension of the AWS mast.

References

Tedesco et al., The Cryosphere, 7, 615-630, doi:10.5194/tc-7-615-2013, 2013.