グリーンランド北西部カナック氷帽における質量収支・流動速度・氷温度観測

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Field observations of surface mass balance, ice velocity and ice temperature on Qaanaaq ice cap, northwestern Greenland

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Glaciers and ice caps (GICs) physically separated from the Greenland ice sheet are losing significant amount of ice mass, and this mass loss plays important contribution to sea level rise. Because the GICs are located at relatively lower elevations, they are susceptible to recent warming trend in Greenland. Despite the large mass loss of the GICs revealed by recent satellite data analysis, only a few field observations have been reported in this region. In this study, we measured surface mass balance, ice velocity and ice temperature on Qaanaaq Ice Cap (QIC) in northwestern Greenland in the summer 2012–2015. QIC (77°28´N, 69°13´W) is covering an area of 288 km^2. We carried out field campaign on Qaanaaq Glacier, an outlet glacier in the southern part of the QIC (Figure 1). We installed 7 poles along the survey route spanning the glacier terminus to the ice cap summit in order to measure surface mass balance. Ice velocity was measured by GPS survey of the poles. We installed 15 m-long cables equipped with three thermistor censers at Q1201, Q1204 and SIGMA-B on August 4, 2013 to measure ice temperature at the depth of 3, 8 and 13 m from ice surface.

Surface mass balance near the terminus in 2012–13, 2013–14 and 2014–15 was −1.2, −1.6 and −2.1 m w.e. a^{-1}, respectively. Mass balance at Q1206 (968 m a.s.l.) was 0.56 m w.e. a^{-1} in 2012–13, 0.30 m w.e. a^{-1} in 2013–14 and −0.16 m w.e. a^{-1} in 2014–15. Because mass balance has large variability from year to year during the study period, equilibrium line altitude ranged from 900 to 980 m a.s.l. Ice flows faster in the middle part of the survey route, and the greatest horizontal velocity was observed at Q1203. Ice temperature at the depth of 13 m was −10.7°C near the terminus, while it was −8.0°C at the upper most site. In summer 2014, we observed about 40 cm thickness of refrozen ice on the ice surface in summer 2012 at the upper most site, while no refreezing occurred near the terminus. This result suggests that ice temperature in the upper reaches was influenced by latent heat from refreezing.

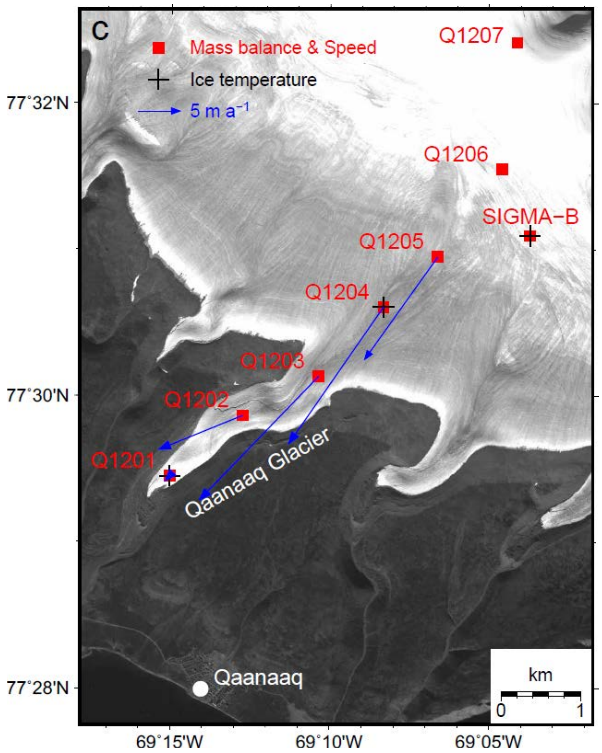

Figure 1. Satellite image (ALOS PRISM taken on August 25, 2009) of the study site, showing the locations of the measurement sites for surface mass balance, ice velocity and ice temperature. The arrows are horizontal surface flow vectors from August 4, 2013 to August 1, 2014.

References

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