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グリーンランド北西部 Bowdoin, Tugto 氷河の表面高度変化
Surface elevation change of Bowdoin and Tugto Glacier in northwestern Greenland

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Ice discharge from marine-terminating outlet glaciers has increased in the Greenland ice sheet (GrIS), and this increase plays important roles in the volume change of GrIS and its contribution to sea level rise. Thinning of GrIS marine-terminating outlet glaciers has been studied by differencing digital elevation models (DEMs) derived by satellite remote-sensing (RS). Such studies rely on the accuracy of DEMs, but calibration of RS data with ground based data is difficult because field data on GrIS marine-terminating outlet glaciers are few. Bowdoin Glacier is a marine-terminating outlet glacier in northwestern Greenland (77^{o}41'18"N, 68^{o}29'47"W). The fast flowing part of the glacier is approximately 3 km wide and 10 km long. Tugto Glacier is a 10 km long land-terminating glacier. These two glaciers are located adjacently, and those altitudinal range is almost same (0 – 350 m a.s.l.). Because those glaciers of different shape of the terminus are located under the same climate condition, comparing surface elevation change of those glaciers is crucial to better understand the influence of ice dynamics on the glacier thinning. In this study, we compare surface elevation change and ice flow regime near the terminus of Bowdoin and Tugto Glacier.

We measured the surface elevation over the glacier on August 20, 2007 and September 4, 2010, by analyzing Advanced Land Observing Satellite (ALOS), Panchromatic remote-sensing Instrument for Stereo Mapping (PRISM) images. We also measured surface elevation on bedrock in the eastern flank of Bowdoin Glacier by using the global positioning system on July 18, 2014. We calibrated the satellite derived elevation data with our field measurements, and generated a DEM for each year with a 25 m grid mesh. The DEMs were compared to calculate recent glacier elevation change. Mean surface elevation change for on Bowdoin Glacier increases downglacier from -13 to -20 m, whereas that in Tugto Glacier is spatially uniform (-11 to -12 m). The mean elevation change in Bowdoin Glacier is significantly greater than those observed on ice caps in the region, and similar to those reported for other marine-terminating outlet glaciers in northwestern Greenland. Ice flow velocity increases downglacier in Bowdoin Glacier, whereas no significant gradient of ice velocity was measured in Tugto Glacier. We suggest that a certain portion of the thinning in Bowdoin Glacier was due to stretching flow enhanced by acceleration of ice flow. Our study demonstrate that calving Bowdoin Glacier is losing more ice than land-terminating Tugto Glacier, which suggests the importance of ice dynamics and/or ice-ocean interaction in the ice mass loss in Greenland.

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