グリーンランド北西部における溢流氷河の質量減少

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Ice mass loss from outlet glaciers in northwestern Greenland

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Ice discharge from calving glaciers has increased in the Greenland ice sheet (GrIS). This increase plays important roles in the volume change of GrIS and its contribution to sea level rise (van den Broeke et al., 2009). To investigate the mass loss of GrIS calving glaciers, ice surface elevation change has been studied by differencing digital elevation models (DEMs) derived by satellite remote-sensing. Advanced Land Observing Satellite (ALOS), Panchromatic Remote-sensing Instrument for Stereo Mapping (PRISM) images have a spatial resolution of 2.5 m, which is fine enough to measure several meters of elevation change on glaciers (Sawagaki et al., 2012). The large spatial coverage of the images (1225 km^2) is suitable for studying glaciers distributed over a large area.

In this study, we measured surface elevation change of 17 outlet glaciers near Inglefield Bredning in northwestern Greenland (77°47′–78°10′N, 65°00′–72°47′W). These glaciers flow into the ocean except for two land-terminating glaciers. We processed stereo pair of ALOS PRISM images acquired in summer 2007 and 2010 with a digital map plotting instrument (Leica Photogrammetry Suite) to generate DEMs with a 25 m grid mesh. Elevation data from ALOS DEMs were calibrated on ice-free terrain, and compared to calculate ice surface elevation change between 2007 and 2010.

The surface elevation of all the studied glaciers decreased and the rate of the elevation change increases downglacier. The mean elevation change rate ranged from −0.4 to −4.9 m a^{-1}. Marine-terminating Tracy and Bowdoin Glaciers thinned at rates of −4.9 and −4.1 m a^{-1}, which were larger than those at other glaciers. The rate at Tugto Glacier, a land-terminating glacier located near Bowdoin Glacier, was −2.8 m a^{-1}. This result confirms that recent thinning of GrIS outlet glaciers is more significant at marine-terminating glaciers as compared to land-terminating glaciers. Rapid thinning of marine-terminating outlet glaciers observed in this study suggests the importance of ice dynamics and/or ice-ocean interaction in the mass loss of GrIS.

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