A01-O05

GLACIER DYNAMICS NEAR THE CALVING FRONT OF BOWDOIN GLACIER, NORTHWESTERN GREENLAND

Shin Sugiyama *(Institute of Low Temperature Science, Hokkaido University, Japan)*
Shun Tsutaki *(Arctic Environment Research Center, National Institute of Polar Research, Japan)*
Daiki Sakakibara *(Institute of Low Temperature Science, Hokkaido University, Japan)*
Jun Saito *(Institute of Low Temperature Science, Hokkaido University, Japan)*
Mihiro Maruyama *(Institute of Low Temperature Science, Hokkaido University, Japan)*
Naoki Katayama *(Institute of Low Temperature Science, Hokkaido University, Japan)*
Takanobu Sawagaki *(Graduate School of Environmental Science, Hokkaido University, Japan)*
Martin Funk *(Laboratory for Hydraulics, Hydrology and Glaciology, ETH, Switzerland)*
Andreas Bauder *(Laboratory for Hydraulics, Hydrology and Glaciology, ETH, Switzerland)*

sugishin@lowtem.hokudai.ac.jp

The Greenland Ice Sheet is rapidly losing mass, being influenced by retreat, thinning, and acceleration of marine-terminating outlet glaciers. Rapid changes observed near the glacier front cannot be explained by climate change alone. Glacier dynamics should play a key role, but lack of in-situ data near the calving front hampers our understanding of the mechanism of the glacier changes.

To better understand processes driving the recent changes in Greenland outlet glaciers, we carried out field measurements near the calving front of Bowdoin Glacier, a 3-km-wide outlet glacier near Qaanaaq in northwestern Greenland (Fig. 1a). The glacier flows into Bowdoin Fjord, which extends 20 km from the calving front to the main trunk of a fjord system. Satellite data have shown that the glacier has been retreating since 2008. Ice thickness was surveyed with ice radar (Fig. 1b) and short-term ice speed variations were measured by GPS. We drilled the glacier by hot water at approximately 2 km from the calving front (Fig. 2b) to measure basal water pressure and ice temperature. In the fjord, we measured water temperature, salinity, turbidity and dissolved oxygen by lowering a CTD profiler at several locations. Depth of the fjord was measured with a sonic depth sounder mounted on a boat.

Ice near the calving front was grounded but very close to flotation, suggesting ice flotation as the driver of the recent retreat. GPS data showed complex short-term ice speed variations, which were correlated with air temperature, precipitation and ocean tides. When the drilling reached the bed of ~260 m thick glacier, borehole water drained to the level ~30 m above the sea level. This observation confirmed the existence of a drainage system beneath the glacier and substantially high subglacial water pressure. The ocean measurements showed clear influence of glacial melt water. Water was cold, fresh and turbid near the surface, whereas deeper part was filled with relatively warm and salty water. These in-situ data collected near the glacier front form the bases to interpret the recent rapid retreat and project future evolution of Bowdoin Glacier.

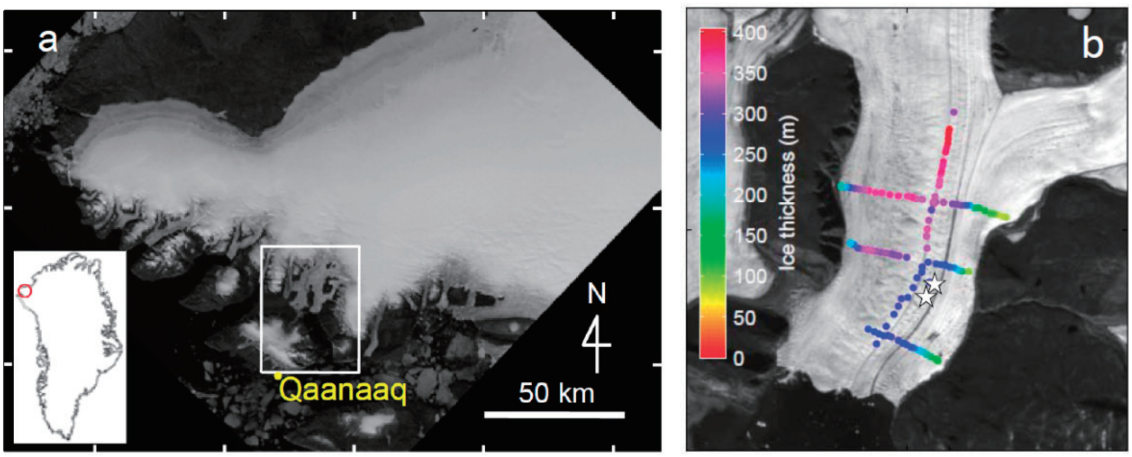

Figure 1. (a) Satellite image showing the study site in northwestern Greenland. (b) Ice thickness and hot water drilling sites (star) on Bowdoin Glacier.