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Seasonal fluctuations of quiescent surge-type glaciers around Yukon: Winter speed-up and the mechanism

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Water at the base of glaciers and ice sheets plays a primary role in generating short-term ice surface velocity changes (e.g., Zwally *et al*., 2002; Sundal *et al*., 2011). High-rate velocity measurements over wide areas are thus useful to better understand the spatial-temporal distribution of water inside the ice body.

Recent satellite data have revealed the velocity field of ice-sheet and mountain glaciers (e.g., Rignot *et al*., 2011; Yasuda and Furuya, 2013). Around the border of Alaska and Yukon, however, the ice velocity distribution has only recently mapped (Burgess *et al*., 2013) and their spatial and temporal evolution remains unconstrained. There are also many surge-type glaciers and surge events often initiate in winter, but the mechanism remains uncertain. Moreover, significant contributions of the glaciers retreat to the possible sea level rise are predicted, and ongoing interactions between glacial erosion and landscape evolution are also suggested around this region.

Applying offset-tracking technique to Synthetic Aperture Radar (SAR) data acquired by ALOS/PALSAR from 2006 to 2011, we examined spatial and temporal changes in the ice velocity of surge-type glaciers near the border of Alaska and Yukon. We found significant upstream accelerations at many surge-type glaciers from fall to winter, regardless of surging episodes. Moreover, whereas the summer speed-up was observed downstream, the winter speed-up propagated from upstream to downglacier. Given the absence of upstream surface meltwater input in winter combined with an earlier observation of vertical surface motions (Lingle and Fatland, 2003), we support the hypothesis of englacial water storages that promote basal sliding through increased water pressure as winter approaches. Our findings have implications for more realistic modeling of glacial hydrology and its link to subglacial erosion.

Some of the results and implications were reported at JpGU2013 (Abe and Furuya, 2013). We extended the analysis area to see if the winter speed-up is universal. We are going to show some new results and our implications.

Keywords: SAR, Offset tracking, Surge-type glaciers, Alaska/Yukon, Winter speed-up