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Seasonal changes of basal water pressure computed from numerical glacier hydrology model

FURUYA, Masato[1*] ; WERDER, Mauro[2] ; ABE, Takahiro[1] ; YASUDA, Takatoshi[1]

[1]Hokkaido University, Graduate School of Science, [2]University of Zurich

Seasonal velocity changes at mountain glaciers have been known since 1980s (e.g., Iken and Bindschadler, 1986), and those at Greenland Ice sheet were detected in early 2000 (Zwally et al., 2002). While such short-term glacier dynamics have not been taken into account in the standard ”long-term” glacier modeling, this is not only due to the limitations of computational resources but also due to the implicit assumption that the winter velocity is the slowest. Spring/early summer speed-up has been well-documented and studied from both observational and theoretical sides. Meanwhile, although the wintertime initiation of glacier surge in Alaska has been empirically known, no extensive wintertime velocity measurements have been performed because of logistics problems. However, Abe and Furuya (2014) detected those signals at the quiescent surge-type glaciers in Yukon/Canada. Moreover, at the two surging glaciers in the West Kunlun Shan, NW Tibet, Yasuda and Furuya (2015, submitted) detected seasonal modulation signals in their surface velocity data, indicating ˜200 % increase of surface velocities from fall to winter. These new glacier velocity observations indicate that the effects of meltwater on glacier dynamics are still poorly understood. We review the present status of numerical modeling of subglacial hydrology, and argue the future prospects.

Keywords: glacier surface velocity, seasonal change, glacier hydrology, basal water pressure