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Surface Velocities and Ice-Front Positions of Eight Major Glaciers in the Southern Patagonian Ice Field, South America,

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The Patagonian Ice Field is known to have undergone rapid retreat of frontal positions and significant thinning of its glaciers over the past decades. However, surface velocities have been measured at only a few of these glaciers. Thus, it remains uncertain if and to what extent the glacier dynamics have changed over time and contributed to ice loss in these ice field. In this study, we examine the temporal evolution of flow velocities and ice-front positions at eight major glaciers in the Southern Patagonian Ice Field.

In this study, we measured flow velocity fields of 8 large calving glaciers in Southern Patagonia Icefield (Jorge Montt, Occidental, Pio XI, O'Higgins, Viedma, Upsala, Perito Moreno, and Grey), applying pixel-offset (feature tracking) technique to the radar images derived from ALOS/PALSAR and Envisat/ASAR. We assumed that glacier flows parallel to surface slope based on SRTM4 digital elevation model. In addition, we measured positions of glacier front using SAR intensity images, and compared with the temporal changes of flow velocities.

Of the 8 glaciers we examined, Glacier Upsala, Jorge Montt and Occidental experienced significant speed-up and terminus retreat. These glaciers showed large accelerations near the glacier fronts, which indicates that they underwent longitudinal strain accelerations. It will increase the crevasse-depth, and drive the speed-up of calving. This result seems to support a calving model based on crevasse-depth criteria (Benn et al., 2007; Nick et al., 2010). Meanwhile, Glacier Pio XI revealed large spatial and temporal changes in the flow velocity without significant retreat.

Keywords: SAR, Patagonia, calving glaciers