Instantaneous glacier loss through catastrophic collapse: Disentangling the role of climate, geology and glacier dynamics at Flat Creek glacier, Alaska

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Abstract

In 2016, the quasi-simultaneous collapse of two neighboring glaciers in the Aru range in northern Tibet (Kääb et al., 2018) opened our eyes to a seemingly unique and practically instantaneous mode of glacier loss that is both catastrophic and possibly unprecedented in human history. Mostly unreported, to date, is a failure in Alaska's Wrangell - St.Elias National Park and Preserve, that, at first glance, shares some surprising similarities with the events in Tibet. First detected in seismic signals on July 31, 2015, a comparison of 2014 and 2016 ArcticDEM digital surface models (DSM), as well as corresponding Planet Labs optical images, reveals that a significant portion of the glacier has been lost in what appears to be one large mass failure. The July 2015 failure produced a very long runout of approximately 12 km, traveling over flat terrain on a forested fan and depositing debris over an area of roughly 7 sq. km. The failure tore into the ridgeline at the head of the drainage, removing about 100 m of the glaciated ridge. Preceded by a much smaller ice avalanche in 2013 (1.3 million m3), the 2015 event removed approximately 20 million m3 of ice and possibly rock, an amount similar in magnitude to the events in Tibet (60 – 80 million m3). Interestingly, and analogous to the Aru range, the area is home to numerous surging glaciers. Whether there is any connection between this and the failure mode is not clear. No earthquake activity was registered prior to the main avalanches, but all known failures occurred during peak melt season, and the 2015 avalanche may have followed a large precipitation event. We will present results from both remote sensing and fore-balance analyses as well as a 2018 field campaign, to help us understand what circumstances led to this catastrophic failure, and how it may relate to other events around the globe, in particular the 2016 twin glacier collapse in the Tibet.

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