



The October 2015 tsunamigenic landslide in Taan Fiord, Alaska

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On 17 October 2015, an estimated 75 x 106 m³ rock mass detached from a 850 m tall slope above the terminus of Tyndall Glacier in Taan Fiord, southeastern Alaska. It caused a tsunami that inundated over 20 km² of the fjord, whereas the landslide debris itself covered 2 km², most of which was deposited below the fjord waters. The catastrophic slope failure was the result of the rapid retreat and thinning of Tyndall Glacier, exposing an oversteepened slope mantled by loose ice-marginal deposits. Digital elevation models and optical satellite images from before the landslide show that failure was preceded by deformation and sliding for at least the past two decades since the glacier retreated to its current terminus position.

This landslide deposited into three very different environments: onto the glacier surface, onto land, and into the marine waters of the fjord. Part of the landslide debris traversed the submerged sections of the fjord and re-emerged onto land; a phenomenon not previously described in the literature. Despite traveling through fjord waters and climbing some 100 m onto adjacent moraines and alluvial fans, coherent hummocks with preserved source stratigraphy are found. Motion directions of the landslide mass were reconstructed from hummock and ridge morphometry and from structural analyses of the stratigraphic layers within the hummocks. Radial spreading commenced right at the base of the failure scarp.

Field work was carried out in the summer of 2016. A year later, almost all of the supraglacial debris had been advected into the fjord and half the subaerial hummocks were now buried by glacial advance; this rapid change illustrates how active sedimentary processes in high-altitude glacial settings can quickly obscure landslide-frequency analyses, and emphasizes the need for timely investigations of these natural hazards.