



## Seismological observations of two tsunami generating landslides in Greenland

Trine Dahl-Jensen, Tine B. Larsen, and Peter H. Voss

Geological Survey of Denmark and Greenland, Copenhagen K, Denmark (tdj@geus.dk)

On June 17, 2017, a large landslide occurred in NW Greenland, 32 km from the small village of Nuugaatsiaq, population 100 in Karrat Fjord. The slide slipped into the fjord, inducing a large tsunami. The runup height of around 10 m swept through much of the village, producing widespread destruction – 11 houses were swept out to sea, and four people lost their lives.

This event spurred a re-visit to data from another large landslide at Paatuut in W Greenland which occurred on November 21, 2000 (Dahl-Jensen et al. 2004). Also here a large proportion of the landslide entered the sea and created a tsunami in Vaigat Fjord, which destroyed about 30% the abandoned minig village Qullissat across the 20 km wide Vaigat Fjord with run-up height of 28 m. At the closest populated village Saqqaq (40 km distance) boats were damaged by the tsunami.

Both landslides generated complex but differing seismological signals, seen over large distances. In both cases the signals suggest multistage events.

The Karrat Fjord landslide in 2017 generated seismic energy equivalent to a magnitude 4.1 earthquake, visible across the globe. Careful examination of the seismic waveforms indicates no triggering tectonic event. One seismic station, NUUG, is located in the village of Nuugaatsiaq and recorded the seismic energy generated by the slide and responded to the ground tilt induced by the fluctuating water levels from the resulting tsunami.

The Paatuut landslide in 2000 generated seismic energy equivalent to a magnitude 2.3 earthquake, and is thought to be released by a thaw/freeze sequence. The toe of the slide reached the coast and advanced into the sea over a nearly 2 km wide front. Over a width of 800 m in the centre of this front a steep (37 [U+F0B0]) escarpment terminates the subaerial part of the slide. The coastal escarpment indicates the collapse of a protruding tongue which originally formed the front of the toe. The collapse is believed to have generated a submarine slide and subsequently the tsunami. Volume calculations suggest that about 30 million m<sup>3</sup> of material slid below sea level (Dahl-Jensen et al. 2004).

Dahl-Jensen, T. et al. 2004: Landslide and Tsunami 21 November 2000 in Paatuut, West Greenland. *Natural Hazards* 31(1), 277-287.