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Submarine landslide tsunamis in fjord environments: the case of Pangnirtung Fjord, eastern Baffin Island (Nunavut, Canada)

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Fjord environments are subject to submarine mass wasting events due to their steep slopes, high sedimentation rates, and tectonic activity driven by glacial-isostatic rebound. In specific cases, these events can generate tsunami waves whose coastal heights are strongly influenced by the physiography, both subaerial and submarine, of the fjord. Here we present modeling simulations of a potential tsunami initiated by a submarine landslide in Pangnirtung Fjord, eastern Baffin Island (Nunavut, Canada). Pangnirtung Fjord, a 43 km long, 1 to 3 km wide, and 165 m deep fjord, is fed by numerous rivers that transport sediment from the surrounding high-relief, partially glaciated landscape. Collapse of the Kolik River delta, situated directly across from the hamlet of Pangnirtung, is the likely cause of the largest submarine landslide (2.1 km^2) identified in the fjord using multibeam bathymetric data and 3.5 kHz sub-bottom profiles collected in 2019. The mapped landslide extends across the flat basin and features a blocky deposit directly downslope of the delta. The landslide dynamics, the consequent water waves generation and propagation were simulated by means of codes developed by the Tsunami Research Team of Bologna University. The landslide parameters characterizing the downslope motion have been retrieved by matching the landslide dynamics with the observed deposit. As the landslide impulses to the water column are considered, the propagation of the waves inside the fjord is determined through the shallow water approximation of the Navier-Stokes set of equations. The waves reach the hamlet (3.5 km from the landslide source) in 200 s, and the surrounding fjord coasts in approximately 800 s. Maximum wave height values of approximately 2 m were modeled and used to construct an inundation map for the area, over a 2 m regularly spaced grid for the hamlet of Pangnirtung.