



## **Landslide and flash flood caused by the 2016-17 heavy rain events in Siorapaluk, north Greenland**

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Siorapaluk (77°47'N, 70°38'W), the northernmost settlement in Greenland, experienced landslide and flash flood events in the summers of 2016 and 2017. About 40 residents who mainly make their living for hunting were safe. However, hunting lodges were destroyed by landslides, and a part of the settlement was covered with debris by a flash flood.

We visited north Greenland including Siorapaluk in July 2018 and investigated the landslides from geological viewpoints. The timings of heavy rain events were estimated from interviews with locals and four years meteorological data observed by the expedition team of Hokkaido University in Qaanaaq settlement about 50 km southeast from Siorapaluk. Satellite images acquired from Planet Labs were used to check if landslides and flash floods occurred at the estimated heavy rain events.

Siorapaluk is located at the seacoast of Robertson fjord. Steep (more than 30 degrees) and high (more than 400-800 m) cliffs formed by glaciation dominate close to residence and hunting areas. Most of the landslides by the 2016-17 heavy rain events occurred on the upper- or middle part of their cliffs. According to our survey, more than two heavy rain events in August 2016 caused many landslides. Further landslides and flash floods occurred in August 2017. The total number of the landslides is more than 40. The largest landslide was about 300 m in width, about 720 m in horizontal length and about 250 m drop.

The cliffs including landslides are covered with sand and gravel. The base of the fragments consists of alternate layers of quartz sandstone and quartz conglomerate. Their bedding moderately or horizontally traverses the cliffs, making irregular shapes in vertical profiles of the cliffs. These irregular surfaces keep abundant fragments on steps formed by large strata. The rain water could penetrate the covered fragments and saturates the bottom of fragments just on the steps, resulting in rock fragments collapse. The collapsed sediment flowed down on the steep slopes as debris flow and reached the sea or deposited in valley bottoms. A remnant of landslide dam at the valley bottom behind the settlement is probably related to the flash flood event that hit the settlement. Many topographic remnants of old landslide scratches are observed on the slopes, suggesting that landsliding events have repeatedly occurred.

This case is important to consider the relationship between landslide hazards and climate change because rising temperatures have been occurring clearly and remarkably in the Arctic.