グリーンランド北西部カナック村で発生した氷河流出河川の洪水の発生メカニズム

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Mechanisms controlling floods of a proglacial stream in Qaanaaq, northwestern Greenland

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Increase in runoff from the Greenland ice sheet and peripheral glaciers and ice caps have great influence on coastal environment. However, few studies have focused on its impact on the human activity in Greenland. On 21 July 2015 and 2 August 2016, a proglacial stream flooded in Qaanaaq, a village in northwestern Greenland. These floods were caused by increased runoff from the nearby Qaanaaq Glacier and resulted in the destruction of a road between the village and Qaanaaq Airport. Possibly, these floods are the results of recently changing climate conditions in the Arctic region. In this study, we investigated these floods in 2015 and 2016 by using meteorological data observed at the village, Qaanaaq airport and 944 m a.s.l. of the glacier (Tsutaki et al., 2017), and the output of regional climate model NHM-SMAP (Niwano et al., in review). Model output at 5 km mesh grid points was downscaled to a 300-m grid, using a previously proposed method (Noël et al., 2015). This result is used to estimate daily runoff from Qaanaaq Glacier.

The flood on 21 July 2015 resulted from a combination of the significant amount of meltwater from Qaanaaq Glacier and the lack of snowpack in the upper part of the glacier. The highest daily temperature in 2015 was observed at Qaanaaq airport and there was no rainfall on that day. At the upper part of the glacier, the second greatest amount of melting in 2012–2016 was calculated on that day by the model. In 2015, snow at 944 m a.s.l. of the glacier disappeared earlier than in 2013–2016. The lack of snowpack in the upper part was a likely reason of the greater amount of runoff because less amount of meltwater was absorbed by snowpack. Snow accumulation in a period of 2014/2015 was less than the other periods in 2012–2016 (Tsutaki et al., 2017), and it is a possible reason of the early disappearance of the snow. Runoff computed for 21 July 2015 was the second greatest in 2015. The flood on 2 August 2016 resulted from substantial amount of rainfall. Daily precipitation of 89.6 mm with hourly maximum of 23.4 mm was recorded at the village on that day. This hourly rainfall was the greatest since the observation started from June 2014. The rainfall probably covered a large part of the glacier because the model calculated the largest daily rainfall in 2016 at the upper part. As well as the flood in 2015, there was no snowpack at 944 m a.s.l. of the glacier on the day of the flood in 2016. Because of the lack of snowpack in the upper part, the rainfall could flow out of the glacier surface immediately. Estimated daily runoff on the flood day was the third largest in 2016. In addition to the substantial amounts of melting and rainfall, the results of this study suggest that the glacier surface conditions also play an important role in the flood events.

References

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