ICG2022-112, updated on 28 May 2023
https://doi.org/10.5194/icg2022-112
10th International Conference on Geomorphology

Multidecadal evolution of high arctic glacial lake systems and their role in landscape paraglaciation - a case study of crammerbraene, svalbard

Iwo Wieczorek[1], Piotr Zagórski[2], Mateusz Strzelecki[1], Jacob Yde[3], and Łukasz Stachnik[1]
[1]Institute of Geography and Regional Development, University of Wroclaw, Wroclaw, Poland
[2]Institute of Earth and Environmental Sciences, Maria Curie-Sklodowska University, Lublin, Poland
[3]Department of Environmental Sciences, Western Norway University of Applied Sciences, Sogndal, Norway

The retreat of glaciers in response to climate warming leads to substantial changes not only in their mass balance, size and runoff but it also impacts their proglacial zones. A common characteristic of these proglacial changes is the development of glacial lake systems, which serve as meltwater and sediment reservoirs and become new elements in Arctic paraglacial landscapes. This paper investigates the evolution of a unique glacial lake system that has developed in the proglacial zone of the glacier system Cramerbraene in Svalbard since the termination of the Little Ice Age.

Our results indicate that the first glacial lakes appeared in the foreland of Crammerbreane in the late 1950s and early 1960s. Since then, the lake system has steadily increased in area concurrently with progressive retreat of Crammerbreane. In 2014, the first documented dam breaching of the terminal moraine occurred, leading to a glacial lake outburst flood (GLOF) event, which resulted in a loss of the lake area by 0.08 km^2. After this event, the lake area began to steadily increase again reaching its largest surface area in its development history in 2019: 0.44 km^2. In September 2019, a second and larger GLOF event occurred, reducing the lake area by 0.23 km^2 (~50%) within nine days. Recent satellite and aerial imagery indicates that the described lake system has been steadily draining since the 2019 GLOF event. More importantly, as a result of these two documented catastrophic glacial runoffs, the geomorphology in the foreland of Crammerbreane has been reworked, leading to changes in the course of the river channel that transports glacial water into Recherchefjorden.

These findings suggest that glacial lake systems in Svalbard play an increasingly important role in paraglacial Arctic landscape transformation, not only as glacial water and sediment storage reservoirs but also as active agents of downstream geomorphological changes through episodic catastrophic GLOF events.

This work was supported by Svalbard Integrated Arctic Earth Observing System [Airborne remote sensing campaign 2021] and the Research Council of Norway [333199].