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Automated Tracking of Glacial Lake Outburst Floods in Norway

Jogscha Abderhalden and Irina Rogozhina

Norwegian University of Science and Technology, Department of Geography, Norway

No continuously updated glacier and glacial lake inventories exist for Norway. Previous inventories have been developed for the time periods of 1947-1985, 1988-1997 and 1999-2006 for glaciers and 1988-1997, 1999-2006, 2014 and 2018 for glacial lakes, by manual digitization, and semi-automated mapping. However, these methods are both time consuming and do not allow for an analysis of glacial lake behaviour on shorter timescales or on a seasonal basis. Therefore, one aim of this study is to present consistent inventories for glaciers and glacial lakes in Norway using semi-automated mapping and machine learning techniques applied on satellite imagery of different spatial and temporal resolution (Landsat 30m, 16 days, and Sentinel 10m, 5 days). An automated method that allows frequent monitoring of glacier variables can provide essential knowledge for the understanding of glacial lake dynamics in a changing climate.

In addition to glacial lake inventories, smaller ice caps with active glacial lakes are investigated more closely, aiming at following the development of glacial lakes throughout seasons. Here we are also analyzing the suitability of PlanetScope imagery compared to the Sentinel and Landsat imagery to detect the known glacial lake outburst flood events and identify currently unrecognized hazard-prone glacial lakes. Since the field-based investigations of glacial lake changes (especially of the ice-dammed lakes) are sparse in Norway, developing methods for remote-sensed, automated monitoring of glacial lake changes and glacial lake outburst floods is essential in order to develop early warning systems, detect potentially hazardous lakes and prevent human losses and damages to infrastructure and local businesses.