

Submitted Abstract

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Abstract

The glaciers in the Himalayas are rapidly retreating. With the increasing loss of glacial mass, there is an increase in the number of glacial lakes and thereby, the potential threat of GLOF (Glacial Lake Outburst Flood) events. We aim to forecast the evolution and growth of proglacial lakes over Gangotri Glacier (Uttarakhand, India). Proglacial lakes are formed by damming action of a moraine, resulting due to retreat of melting glaciers. As the glacier melts and loses its mass, the glacier bed gets exposed, and any possible over-deepening, if available in “thereby exposed bed-topography”, shall act as a bedrock dam, to hold the meltwater, forming a moraine-dammed lake. As the glacier melts, more and more of such bedrock dams shall get exposed. The lakes shall not evolve to the full of its size at once, but slowly and gradually, as it loses the glacier mass above it. The present research aims to identify the potential sites for such glacial lake formation and forecast the growth of each of these lakes over time. This is done in two-fold steps. Firstly, identifying the potential sites of formation of glacial lakes, by preparing the glacier bed topography using the GlabTop2 |ITB model. This model has a self-calibration feature, that could calibrate even in the absence of field measurements. Secondly, a glacier evolution model is operated using a simple parameterisation approach, i.e., an empirical glacier specific function is used for updating the glacier surface using the climate model datasets. The updated glacier surface data helps us forecast the evolution and growth of glacial lakes. The spatial distribution of ice thickness for Gangotri was found to be within a range of 19m to 343m for the year 2014, having a glacier volume of 13.49 km³. Fifty potential sites for glacial lake formation were identified using the bedrock topography modelling, having a total storage capacity of 37.04m³. Our results shall help determine the possibility of further expansion of the glacial lakes present and their maximum storage capacities. Having an idea of the formation and growth of lakes in future can help us forecast the: hazard potential of a lake, its flood peak, and the downstream effect of its dam break events as it evolves over time.