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New lakes in de-glaciating alpine areas: addressing current and future risks from impulse waves due to rock/ice avalanches

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The changes in high mountain environments are increasingly fast and complex. Future-oriented hazard assessments have therefore to be integrative in the sense that they must deal with all possible processes, interactions and process chains in relation to possible future (rather than present or even past) conditions.
Here we present a comprehensive approach on risk analysis with respect to impact waves from rock/ice avalanches into existing and newly forming lakes in de-glaciating alpine regions and the therewith triggered floods. The aim is to provide a practice-oriented, straightforward and easy–manageable framework for decision-makers in order to facilitate the assessment process of the risks evolving from high-mountain lakes. The framework is developed in close collaboration with stakeholders on the level of communities, cantons and federal agencies as well as from the private sector (mainly hydropower sector) and international institutions. Priority is thereby given to an integral, holistic point of view instead of profound investigation on detailed questions. The full integration of future conditions (e.g. glacier vanishing, landscape evolution and lake formation as a consequence of climate change) provides long-lasting results that can also be highly relevant in other fields of application.
The main focus of the study is thereby put (1) on risk analysis including definition of critical factor combinations triggering rock/ice avalanches into lakes; probabilities of different elements in the process chain leading to impact waves and floods; physical parameters of mass movements; exposition and vulnerability of objects, (2) risk evaluation/perception and (3) planning of prevention and flood risk reduction measures. The study is carried out with the help of case studies in the Swiss Alps, taking into account integral lake management.
Considering the current risk management strategy in Switzerland, the presented study approaches the urgent need for appropriate risk assessment methods regarding glacier floods and hazards associated with existing and new lakes. The emphasis on scenario considerations for the coming decades together with the increasing rates of change in nature are likely to provide growing importance to the results of the study. The integral approach chosen in the project has the potential to serve as an example for applications to other complex process chains in other geo-hazard fields and geographic regions. First results indicating possible location and appearance time of future alpine lakes in Switzerland and their vulnerability to rock/ice avalanches will be presented.