



Developing a framework for the management of glacial risks in India

Holger Frey (1), Simon Allen (1), Alberto Muñoz Torrero Manchado (2), Adam Emmer (3), Christian Huggel (1), and Divya Kashyap (4)

(1) University of Zurich, Department of Geography, Zurich, Switzerland (holger.frey@geo.uzh.ch), (2) Institute for Environmental Sciences, University of Geneva, Switzerland, (3) Global Change Research Institute, The Czech Academy of Sciences, Brno, Czech Republic, (4) Swiss Cooperation Office India, Swiss Agency for Development and Cooperation, New Delhi, India

Natural catastrophes and disasters in high mountain areas often consist of chains of interacting processes rather than isolated ones. Different components of the environmental system react to changes in climatic conditions on differing temporal and spatial scales, leading to new and often historically unprecedented hazards. At the same time, rising population, expanding settlements and growing infrastructure in many mountain ranges worldwide increasingly expose human lives and assets to these hazards, exacerbating resulting risks. As such, the design and implementation of flexible and adaptive risk management strategies are essential prerequisites for sustainable development in the future.

Recently, the Standing Group on Glacier and Permafrost Hazards (GAPHAZ) of the International Association of Cryospheric Sciences and International Permafrost Association (IACS/IPA) published a guideline document for the assessment and mapping of glacier and permafrost related hazards. These guidelines propose future oriented and scenario based hazard assessment procedures by applying physically based numerical models for the simulation of related, cascading processes, which is a relatively new field of research. In parallel, mitigation of climate-related risks in recent years has undergone a shift in focus from engineering centered hazard prevention approaches towards more holistic, risk oriented management strategies. Besides structural mitigation measures, such approaches also consider different types of non-structural measures for lowering the risks by reducing exposure and vulnerability, or aiming at increased resilience.

In this contribution, we present the development of a framework for the management of glacier related hazards and risks in India - a work supported by the Global Programme Climate Change of the Swiss Agency for Development and Cooperation. In a first step, a review of existing data on glacial lakes and related hazards and risks is undertaken, aiming at the development of nationwide glacial lake hazard inventory. This will provide the basis for prioritising where on-ground mitigation efforts may eventually be focussed. In parallel, a group of scientific experts is expanding on existing guidelines and experiences with hazard and risk management in other countries with glaciated mountain ranges. Building on such international best practices and at the same time reflecting regional specifics of the Indian Himalayas (and particularly the priority areas identified), guidelines for glacier related hazard and risk assessments in India, with a special focus on risks of glacial lake outburst floods (GLOFs), will be drafted. These guidelines will be accompanied by a report on integrated risk management options, including suggested structural and non-structural measures. Semi-final versions of these guidelines will be discussed during participatory workshops in close cooperation with National Disaster Management Authority (NDMA) of India, the group of scientific experts and other stakeholders. By following this procedure, we want to guarantee that the guidelines will fully benefit from the international scientific state-of-the art knowledge and experience, and at the same time consider the specifics of the Indian Himalayas and eventually be tailored to the identified particular needs of this region.