Submitted Abstract

ID IMC22-FSAbstr- 881

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Country	Japan
Region	Asia
Title	Snow And Ice Avalanche Studies In The Hkh Region.
Keywords	Avalanches, Hkh, Fatalities, Susceptibility, Gis
Type	List Of Focus Session
Focus Session ID	12

Abstract

The cryosphere of the HKH region not only sustains the livelihoods of billions of people residing downstream through its capacity to store water but also holds potential for hazards. One of these hazards, avalanches, so far remain poorly studied as the complex relationship between climate and potential triggers is poorly understood due to lack of long-term observations, inaccessibility, severe weather conditions, and financial and logistic constraints. In this study, available literature and data are reviewed to identify gaps and propose future directions of research and mitigation that should be undertaken to further strengthen the resilience of mountain communities against this hazard.

23 major avalanches with more than 10 fatalities in a single event are identified in four countries of the HKH region since 1972-2022. Afghanistan has the highest recorded avalanche fatalities (708) followed by Nepal (565), India (560) and Pakistan (278). Additionally, 349 people lost their lives while climbing on one of the 8000 m peaks located in the HKH range. Although fatalities are significant, and local long-term impacts of avalanches may be considerable, so far, no adaptation or mitigation measures exist in the region. Development of hazard zonation maps based on archive and modeling, development of regional data server and information hub, and the involvement of local authorities and communities in disaster risk reduction and management in collaboration with researchers, academics, local governments, scientists, and other relevant stakeholders should be considered to minimize the gaps. There is a necessity for extensive and long-term avalanche studies to better understand avalanche mechanisms, processes, and societal impacts in order to plan for sustainable development and resiliency in the mountainous areas of the HKH region.

To show the potential of relatively straightforward mapping approaches, potentially accessible to local stakeholders, and to understand the existing hazard situation in an exemplary area, an avalanche susceptibility map of the Langtang Valley using the Multi-Criteria Decision Analysis (MCDA)-Analytical Hierarchy Process (AHP) model in a GIS environment has been applied. Seven different terrain parameters including slope, curvature, terrain roughness, elevation, aspect, ground cover, and snow depth have been considered to derive avalanche a susceptibility map. This in turn is compared with tracked avalanches from remote sensing approaches and accounts of the local population.