Adam Emmer: Dynamic of evolution and hazardousness of lakes in the Cordillera Blanca (Peru)

Abstract:

High mountain environment of the Cordillera Blanca (Peru) is undergoing prespicious (goe)environmantal changes such as glacier retreat and associated formation and evolution of lakes. Glacial lakes may represent a threat for the society in case of sudden release of (part of) retained water ("glacial lake outburst flood"; GLOF). Reliable identification of hazardous lakes is a key persumption of effective GLOF risk management. The fundamental part of this thesis lies in creation of new method for assessing susceptibility of lakes to outburst floods, reflecting regional specifics of these events in the study area (preconditions, causes and mechanisms) and unsuitability of existing approaches revealed in previous research. Newly created method take into account five scenarios of GLOFs, which are assessed separately, using the combination of decision trees allowing integration of qualitative and quantitative characteristics (an overall number of 17 characteristics of the dam, lake and lake surrounding enter the assessment procedure). Thus, identification of specific causes and mechanisms is enabled. The method was verified by assessing susceptibility of 20 lakes, of which 10 produced GLOFs in past (pre-flood condition of these lakes was assessed). Those lakes which produced GLOFs in past were sucessfully identified and also the specific causes and mechanisms were revealed successfully in most of the cases. Lake inventory and classification were further made in a frame of this thesis. 882 lakes were identified and described by number of qualitative and quantitative characteristics. Susceptibility of all the lakes with area > 100,000 m^2 (n = 64) to produce outburst flood was then assessed. Implications and potential of new method are outlined, with special regard to planning of mitigation measures. It was shown, that diverse types of mitigation measures are effective for different scenarios of GLOFs. Substantial part of this work are four case studies: (i) Lake Palcacocha case study; (ii) Lakes Artizon and Santa Cruz valley case study; (iii) Jatunraju glacier and Lake Parón case study; and (iv) landslide-dammed lakes case study.

Keywords: natural hazards; GLOFs; high mountain environment; Cordillera Blanca