



Regional Analysis of the Hazard Level of Glacial Lakes in the Cordillera Blanca, Peru

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The Cordillera Blanca mountain range is the highest in Peru and contains many of the world's tropical glaciers. This region is severely impacted by climate change causing accelerated glacier retreat. Secondary impacts of climate change on glacier retreat include stress on water resources and the risk of glacial lake outburst floods (GLOFs) from the many lakes that are forming and growing at the base of glaciers. A number of GLOFs originating from lakes in the Cordillera Blanca have occurred over the last century, several of which have had catastrophic impacts on cities and communities downstream.

Glaciologists and engineers in Peru have been studying the lakes of the Cordillera Blanca for many years and have identified several lakes that are considered dangerous. However, a systematic analysis of all the lakes in the Cordillera Blanca has never before been attempted. Some methodologies for this type of systematic analysis have been proposed (eg. Emmer and Vilimek 2014; Wang, et al. 2011), but as yet they have only been applied to a few select lakes in the Cordillera Blanca. This study uses remotely sensed data to study all of the lakes of the Glacial Lake Inventory published by the Glaciology and Water Resources Unit of Peru's National Water Authority (UGRH 2011). The objective of this study is to assign a level of potential hazard to each glacial lake in the Cordillera Blanca and to ascertain if any of the lakes beyond those that have already been studied might pose a danger to nearby populations.

A number of parameters of analysis, both quantitative and qualitative, have been selected to assess the hazard level of each glacial lake in the Cordillera Blanca using digital elevation models, satellite imagery, and glacier outlines. These parameters are then combined to come up with a preliminary assessment of the hazard level of each lake; the equation weighting each parameter draws on previously published methodologies but is tailored to the regional characteristics of glacial lakes and their hazard potential. This phase of glacial lake hazard assessment aims to be geographically comprehensive in order to identify potentially dangerous lakes that may have previously been ignored. A second phase of analysis that includes site visits will be necessary for a thorough analysis at each lake to determine the potential hazard for downstream communities. The objective of the work presented here is to identify potentially dangerous lakes that warrant further study rather than provide a final hazard assessment for each lake of the glacial lake inventory in the Cordillera Blanca.

References:

- Emmer, A. and Vilimek, V.: New method for assessing the potential hazardousness of glacial lakes in the Cordillera Blanca, Peru, *Hydrol. Earth Syst. Sci. Discuss.*, 11, 2391–2439, 2014.
- UGRH – Unidad de Glaciología y Recursos Hídricos. *Inventario de Lagunas Glaciares del Peru*. Ministerio de Agricultura y Riego, Autoridad Nacional del Agua, Dirección de Conservación y Planeamiento de Recursos Hídricos, Huaraz, Peru, 2014.
- Wang, W., Yao, T., Gao, Y., Yang, X., and Kattel, D. B.: A first-order method to identify potentially dangerous glacial lakes in a region of the southeastern Tibetan Plateau, *Mountain Res. Develop.*, 31, 122–130, 2011.