Geophysical Research Abstracts
Vol. 13, EGU2011-5646, 2011
EGU General Assembly 2011

Impact waves from rock/ice avalanches into new glacial lakes: lessons learned from the Nevado Hualcán/Laguna 513 event of 11 April 2010

Wilfried Haeberli (1), Huggel Christian (1), and Portocarrero Cesar (2)

(1) University of Zurich, Department of Geography, Zurich, Switzerland (wilfried.haeberli@geo.uzh.ch), (2) Unidad de Glaciologia y Recursos Hídricos (UGRH), Huaraz, Peru

Around 8 AM on 11 April 2010, a combined rock/ice avalanche of 105 to 106 m3 occurred in the steep SW-slope of Nevado Hualcán (6104 m), Cordillera Blanca, Peru, starting at an altitude of about 5400 m. The avalanche travelled over the steep surface of Glacier 513 into Laguna 513 (4400 m), which had started to form in the 1980s. In 1993, the freeboard of the lake had been artificially increased to 20 m by lake-level lowering through a set of artificial tunnels in the bedrock dam The impact of the 2010 event caused a "push-wave" (entire lake volume in strong simultaneous displacement), spilling at least once but perhaps twice over the bedrock dam. The wave height at the threshold was a few meters, giving a total wave height slightly below 25 m. The flood wave(s) from the water spilling over the bedrock dam rapidly transformed into a debris flow, which was deposited in the flat, uninhabited Pampa de Shonquil at about 3700 m. Erosion in the steep reaches of Río Chucchún below the Pampa then triggered another debris flow, which caused panic among people in the town of Carhuaz. Nobody was killed but damage was considerable.

Since 1941, after the big flood of Huaraz (December 13, 1941), the Peruvian Government through the Unidad de Glaciología y Recursos Hídricos has constructed 35 security tunnels and dams in order to reduce the risks represented by glacier lakes in the Cordillera Blanca. The lake-level lowering of 1993 at Laguna 513 inhibited much more serious consequences and constitutes an extraordinary example of successful hazard prevention and risk reduction. The hazard source at Nevado Hualcán, however, now relates to the warm permafrost and possibly polythermal hanging glaciers in the steep face of the summit area rather than to the steep glacier tongue at the lake originally envisaged. From the starting zone of the summit area, even larger ice, rock and mixed ice/rock avalanches can reach the lake. Moreover, further warming and glacier retreat could lead to the formation of another lake in the same catchment. Ongoing changes in ice conditions and rock-fall activity in the summit area must therefore be carefully observed. Possibilities for establishing a flood retention structure at the lower end of the Pampa de Shonquil should be investigated.

The 2010 event at Nevado Hualcán and Laguna 513 illustrates the necessities and possibilities of hazard prevention concerning impact waves in new lakes as a consequence of destabilising high-mountain ice and rock walls. The probability of such events may still be low but is steadily increasing with continued warming/deglaciation and an increasing number of already existing and newly forming lakes.