



Water availability in the sub-basin Quillcay from 1970 to 2050 considering glacial retreat and climate change

Daniel Colonia (1), Judith Torres (1), Claudia Giráldez (2), Holger Frey (2), and Christian Huggel (2)

(1) Unidad de Glaciología y Recursos Hídricos, Autoridad Nacional del Agua, Huaraz, Perú (dcolonia@ana.gob.pe), (2) Department of Geography, University of Zurich, Zurich, Switzerland (claudia.giraldez@geo.uzh.ch)

Since climate influences the behavior of tropical glaciers, they are excellent indicators of climate change. The knowledge related to glacier dynamics is important in the use and exploitation of water resources in the Peruvian Andes for different activities. The aim of this study is to estimate glacier water availability in the sub-basin Quillcay - Cordillera Blanca, taking into account climate change and glacier retreat during the periods 1970-2013-2050.

The data used are Liss III and Landsat 5 TM images of 1987, 1996, 2006 and 2013. The methodology is based on the application of the Normalized Difference Snow Index (NDSI), visual interpretation and field data. The availability of water stored in glaciers was estimated by calculating glacier volume, using a high resolution (5m) Digital Elevation Model (DEM), and by applying the method of slope-dependent thickness together with physical parameters of each glacier. A future scenario of glaciers in 2050 was determined, considering the trend of change of glacier volume from the period 1970-2013.

The results show that the surface area of glaciers in the sub-basin Quillcay decreased by $\sim 29\%$ between 1970 and 2013, with an average rate of -0.85% yr⁻¹. Their total volume loss was $\sim 40\%$, with an estimated average rate of -0.93% yr⁻¹. Amongst the watershed, the sub-catchments Churup and Cojup had the lowest water availability in 2013 with 5% and 33% respectively. Furthermore, it was demonstrated that the water stored in glaciers will gradually decrease towards 2050 as the estimated volume loss between 1970 and 2050 is approximately $\sim 74\%$. This could cause serious concerns for the development and economy of the sub-basin Quillcay during the dry season as water is fundamental for economic activities and vital needs of the population downstream. The information obtained in the study will be useful for decision makers to raise public investment projects focusing on adaptation to climate change and to the progressive decrease of water resources in the tropical regions.