



New glaciological research projects in the Cordillera Vilcanota - Cusco - Peru

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Tropical glaciers are highly sensitive to alterations in climate and therefore good indicators for global climate change. Glaciers located in Peru represent 71% of all tropical glaciers in the world, and have shown a significant area reduction of about 43% within the last 40 years mainly due to the increase in surface temperature. Tropical glaciers play a particular role as freshwater reservoirs and buffers to river discharge variability and water scarcity within a pronounced wet and dry season. Their monitoring is extraordinarily important but few studies exist on mass balance.

The Cordillera Vilcanota, at the origin of the Rio Vilcanota-Urubamba, contains about 25% of all glaciers in Peru. In recent decades, glacier shrinkage has accelerated in this mountain range. Between 1988 and 2010, glacier area was reduced at an annual rate of about 4 km² (1.1 %) from some 360 km² to about 270 km² (25%). A total volume loss of 40-45% (from 17-20 km³ to 9.2-12.4 km³) can be estimated for the period 1962-2006, with an accelerated rate since the 1980s. In 2010/11, first point net mass balance measurements were carried out on Suyuparina glacier and the adjacent Quisoquipina glacier. In 2013, mass balance measurements were reinitiated in the frame of a long-term monitoring campaign. The first year of direct mass balance measurements (stakes and pits) show that ablation is highly influenced by the complex microtopography of the glacier, mainly characterized by the existence of ice cliffs, causing a spatially heterogeneous ablation pattern. There is a large scatter in point mass balance in function of elevation, which makes it difficult to estimate accurately the equilibrium line altitude (ELA) and the annual total glacier mass balance from these point measurements. For the hydrological year 2013/14, stake measurements for sites on the lower part of the glacier varied between +0.2 and -4 m w.e. (water equivalent), while accumulation in the uppermost part of the glacier showed values between +1.2 and +1.4 m w.e. Further studies will be carried out to i) understand the role of the irregular surface, especially the ice cliffs, in the total annual mass balance of Suyuparina glacier and of similar glaciers in the Cordillera Vilcanota; ii) develop an appropriate method to interpolate direct mass balance measurements to estimate the total mass balance of this type of glaciers; and iii) to calibrate the direct glaciological method with the geodetic method of high-resolution DEM differentiation to estimate the total mass balance on Suyuparina glacier.