



## **Rock glacier inventory in the Orobic Alps and the Livigno Valley, central Italian Alps**

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We present a new rock glacier inventory compiled for the Orobic Alps (2000 sqkm) and the Livigno Valley (270 sqkm), Lombardy Region, Italy. This effort is part of a larger ongoing project that aims at building a region-wide database of periglacial landforms. The two study areas represent the extremes, in terms of hydro-climatic and physiographic characteristics, within the spectrum of alpine terrain variability in Lombardy.

The inventory of the two study areas has been conducted by combining a number of remotely-sensed images with field traverses. Specifically, the interpretation of high-resolution (0,5 x 0,5 m) digital aerial photos flown in 2000, 2003 and 2007 in conjunction with a 2-m DSM (Digital Surface Model), allowed identifying and mapping 416 and 108 rock glaciers in the Orobic Alps and in the Livigno Valley respectively. Measurements and photographs taken during fieldwork provided critical ground control for the validation of data extracted from remotely-based analysis. Attributes for each rock glacier include type (talus-lobate, talus-tongue shaped, debris-lobate, debris-tongue shaped, and protalus rampart), activity (active/inactive, or relict), minimum and maximum elevation, aspect, slope, geographic location, area, and dominant lithology.

Preliminary results show that in both study areas rock glaciers are quite uniformly distributed, with lower spatial densities in the most heavily glacierized areas. This pattern seems to reflect the geomorphological classification between glacial and periglacial environments. In the Orobic Alps, 388 (93%) rock glaciers were classified as relict while only 23 (21%) in Livigno Valley with 75 (89%) active or inactive. The most common rock glacier type in both areas are protalus ramparts (59% in the Orobic Alps and 36% in the Livigno Valley) followed by talus lobate rock glaciers (35% in the former and 32% in the latter). The active/inactive rock glacier's minimum elevation, often considered discontinuous permafrost's lower limit, is set a 2747 m a.s.l. in the Livigno Valley and 2386 m a.s.l. in the Orobic Alps. In both study areas, rock glaciers sit at similar slopes (chiefly around 20-25°), face predominantly north sectors, and are composed by metamorphic debris, in agreement with local dominant lithologies.

The identification and classification of rock glaciers in Lombardy will form the basis to draft a preliminary region-wide mapping of discontinuous permafrost potential; hence, test and refine available physically-based models of permafrost spatial distribution.