PermaNET • Permafrost long-term monitoring network

A new rock glaciers inventory in the North-Western Alps

Michèle Curtaz (1), Marco Vagliasindi (1), Stéphanie Letey (2), Umberto Morra di Cella (2), and Paolo Pogliotti (2)

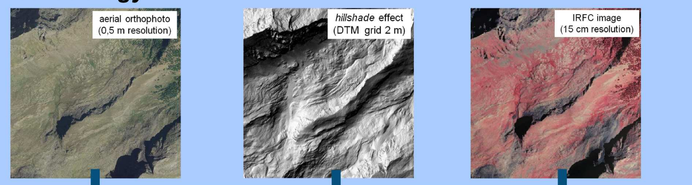
(1) Fondazione Montagna sicura, Courmayeur, Italy (corresponding author: mcurtaz@fondms.org)

(2) Agenzia Regionale per la Protezione dell'Ambiente della Valle d'Aosta, Saint-Christophe, Italy

Introduction

A new rock glaciers inventory for Aosta Valley region (Italy) is presented. Some data already exist in the Rock Glacier Inventory of the Italian Alps (data collection of the Italian Glaciological Committee, edited by Smiraglia and Guglielmin, 1997), but a census based on the new cartographic products available has been performed for the entire region. The work was done in the framework of the PermaNET project. The inventory is part of Aosta Valley Glaciers Inventory and it will be soon published online at http://catastoghiacciai.regione.vda.it/Ghiacciai/MainGhiacciai.html.

1. Methodology

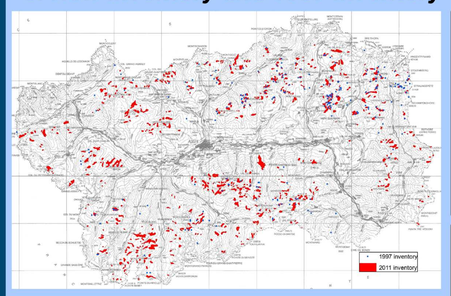


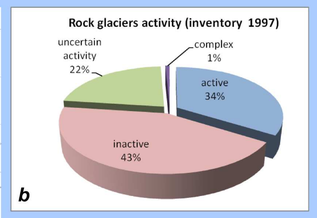
shape files:
- perimeter
- lenght ("flow line")
- width (3 segments)
- front scarp line

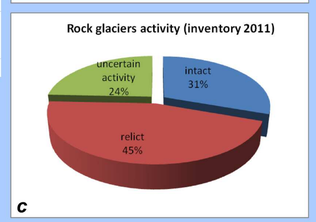
table with data and descriptive information

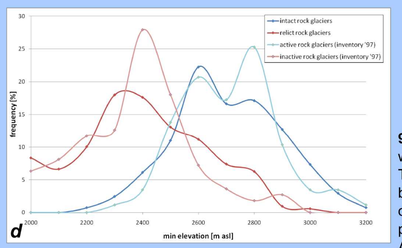
Each deposit was manually bounded inside a GIS environment crossing the visual information coming from the stereoscopic vision of IRFC images, hillshade effect derived from DTM and ortophotos. Main geomorphic parameters were automatically calculated using the DTM. Other data were collected in a detailed table filled for each rock glacier; the fields were chosen on the example of existing rock glaciers inventories (Seppi et al., 2005) and on ***PermaNET Evidences Database*** guidelines.

3. New inventory and 1997 inventory









937 rock glaciers were localised and **bounded in 2011**, while in **1997 inventory there were 237 data** (figure a). The frequency of different states of activity is similar; both of them show a relevant number of uncertain data, due to the difficulties to define the activity from photointerpretation method (figure b and c).
Also the distributions of the lower elevation of the rock glaciers show similar trends.

References

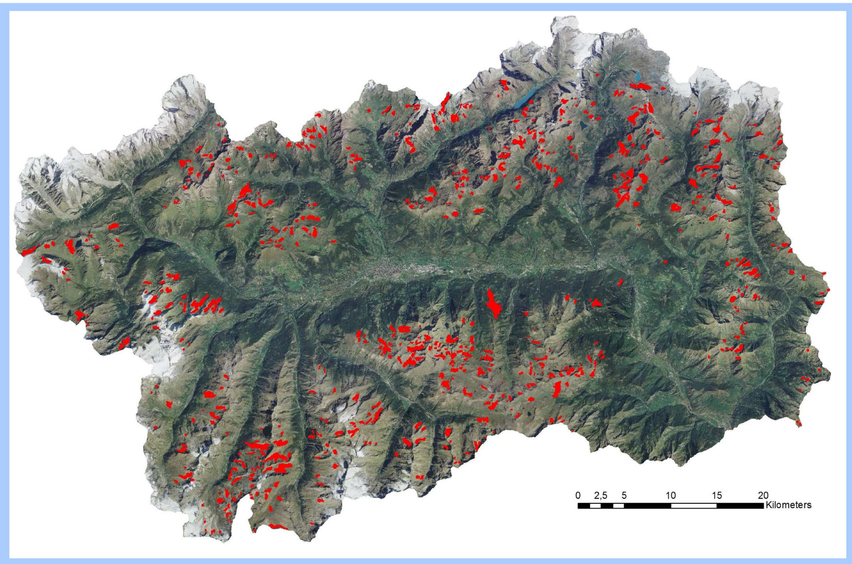
Seppi, R., Carton, A., Baroni, C. 2005, Proposta di una nuova scheda per il censimento dei rock glaciers da fotografie aeree: applicazione sull'Alta Val d'Ultimo (Gruppo Ortles-Cevedale), Geogr. Fis. Dinam. Quat. Suppl.VII

Guglielmin, M., Smiraglia, C. (eds.) 1997, Rock glacier inventory of the italian alps, Arch. Comit. Glaciol., GNGFG., 3, Torino

This ongoing study is carried out within the project **PermaNET** funded by the Alpine Space program. For more information please visit **www.permanet-alpinespace.eu.**

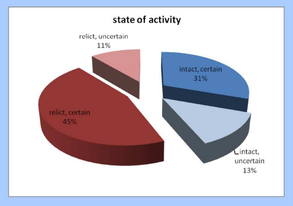
2. Data analysis and results

The Aosta Valley is a small alpine region in the Alps, in the North West of Italy, at the corner with France and Switzerland. Its surface (about 3300 km^2) is prevalently mountainous with more than 50% of the territory above 2000 m asl and about 5% of glaciated areas.
A permafrost probable distribution map is under realisation in the frame of the project ***PermaNET - Permafrost long-term monitoring network*** (Alpine Space programme).

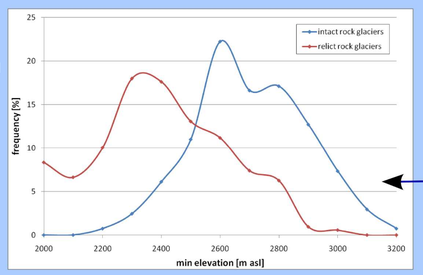


A total amount of **937** rock glaciers was detected, covering an area of about 62 km^2 corresponding to 1,9% of Aosta Valley.

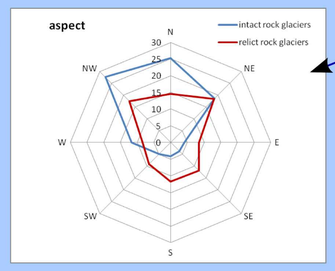
528 relict (=56%) and **409 intact (=44%)**
- including active and inactive rock glaciers, which possibly still contain ice.
More reliable data are associated to relict rock glaciers, while for intact ones the state of activity is often uncertain.



Mean value of lower elevation:
- intact rg: 2654 m asl
- relict rg: 2340 m asl

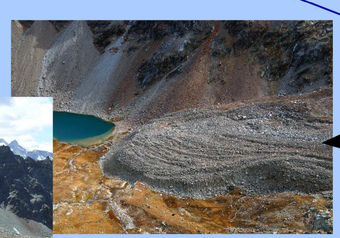


About **60 %** of the rock glaciers have **North facing** aspect (more than 70% of intact rock glaciers and about 50% of relict ones).

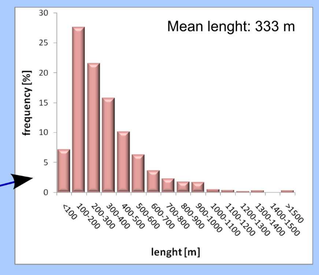


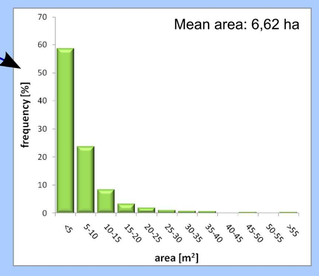
17% of rock glaciers are located above **vegetation limits** (n° 145 intact, out of 160 total), 69% in continuos meadows and 14% (n° 122 intact, out of 129 total) below tree limits.

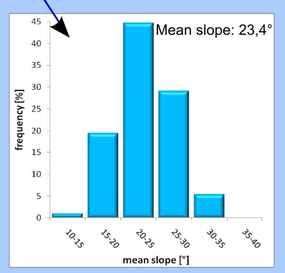
For 64 rock glaciers an **interference with constructions** was detected, but most of them (n° 45, corresponding to 70%) are relicted and no danger can therefore be assessed.



	FIELD NAME	POSSIBLE CHOICES	FIELD DESCRIPTION
GENERAL	RG_ID		Progressive number
	NAME		Name, most significant place close to the RG
	X		Centroid coordinates (UTM ED50)
	Y		
	MAP		Regional map number
	LAT		Centroid coordinates (WGS84)
	LON		
MORPHOMETRY	Max elevation	Derived from ArcGIS calculation functions based on DTM	Maximum elevation of the polygon perimeter
	Min elevation		Minimum elevation of the polygon perimeter
	Max elevation of the scarp		Maximum elevation of the upper part of the front scarp (if evident)
	Max elevation of the relief		Maximum elevation of the peak/ridge above the RG
	Lenght		Calculated from the polyline shape
	Width		Mean of 3 different segments
	Area		Derived from the polygon shape
	Aspect		Mean aspect of the polygon
	Slope		Mean slope of the polygon
ROCK GLACIER CHARACTERISTICS	Degree of activity		Actual (Active/inactive)
			Relict
	Geometry		Tongue shaped
			Lobate
			Equidimensional
	Form		Simple
	Complexity (*)		Complex
			Multipart
			Multilobe
			Multiunit
			Multiroot
	Alimentation		Morainic-derived
			Talus-derived
	Location		Circle
			On slope
			Foot of slope
			Valley bottom
	Relation with glacial form		Glacier
			Glacieret
			Snowbank
	Relation with vegetation limits		Above vegetation limits
			Below the continuous meadow limit
			Below the tree limit
	Morphological features		Longitudinal ridges
			Transverse ridges
			Swollen body
			Hollow body
			Presence of conical pits
OTHER INFORMATION	Possibles interferences		Actual and future possible interferences with constructions
	Notes		
	Notes 2		Annotations related to field surveys
	Aerial photographs		Aerial photographs characteristics
	Other cartographic data		
	Other available material		Historical iconography, other pictures
	Monitoring or study activities		
DEGREE OF QUALITY	Degree of Quality		Perimeter delimitation certain
			Uncertain perimeter delimitation in the frontal part
			Uncertain perimeter delimitation in the upper part
			Degree of activity certain
			Degree of activity uncertain
			Morphological features certain
			Morphological features uncertain
			Shade in the ortophotos







Most rock glaciers are **tongue shaped** (n° 608, 65%), 181 (19%) are lobate and 148 (16%) are equidimensional (lenght and width comparable).

The operators charged of the work marked the degree of certainty in bounding rock glacier perimeter, in assessing state of activity and in recognizing morphological features.
In 535 cases the **perimeter delimitation** was indicated "uncertain", most of time (90%) because of the difficulties to delimit the upper part.