



Relevance of database for the management of historical information on climatic and geomorphological processes interacting with high mountain landscapes

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> Abstract

GEOCLIMALP (GEOMorphological impacts of CLimate change in the ALPs) is a research group of the CNR-IRPI established with the intent to deepen and improve the knowledge on the role of climate change in the morphogenesis of the alpine environment in general and of high-altitude environments in particular. The geological-morphological and climatic-hydrologic research fields are the main ones to be integrated in the scientific activities of the research group.

In the framework of the activities of the GEOCLIMALP research group, a system of databases has been developed for the storage and management of glacial, periglacial and mountain digital resources, related to the Greater Alpine Region in general, and to the North-Western Italian Alps in particular.

These resources are historical documents, publications, photos, aerial photographs, antique and recent maps, instrumental and survey data, related to: i) alpine glaciers; ii) natural instability processes and landforms in glacial/periglacial areas; iii) hydro climatic conditions of the alpine areas. This wealth of knowledge is mainly referred to the last 150 years.

<http://geoclimalp.irpi.cnr.it/>

> Glacier evolution in NW Italian Alps: an example

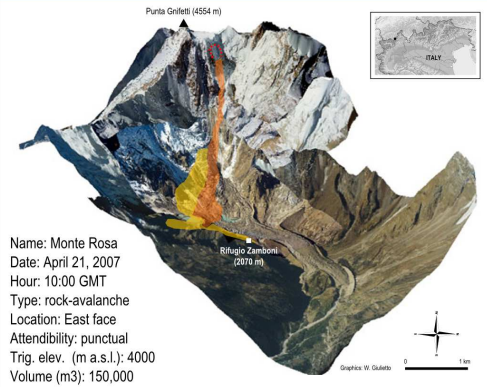


Breuil Meridionale Glacier

WGI code: I-4L01316027
CGI code: 202
Latitude N: 45.7059
Longitude E: 6.8347
Type: mountain glacier
Form: simple basin
Tongue activity: marked retreat

The two pictures show the strong retreat of the glacier snout in less than ten years.

> Natural instability processes: an example



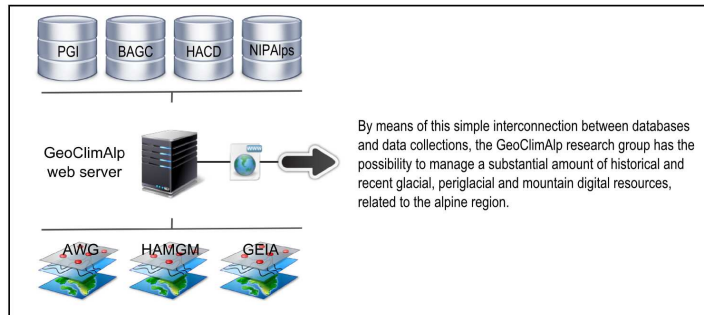
> Architecture and technology of the system of databases

The architecture of this system of databases is very simple.

The four DB and the other data set collections are stored in the GeoClimAlp web server.

The four server side databases are managed and used through a simple web interface. Data set collections are managed on local PC using a desktop GIS and is used on line by a WebGIS system, with the Google Maps and Google Earth services (both in the field and in the office) and with simple DB connections.

Database, web applications and desktop GIS have been developed using free open source software.



GeoClimAlp main studies:

- evolution on alpine glaciers
- geomorphological processes at high altitude
- climatic conditions of the glacial/periglacial areas
- climate change in the alpine environment

> Piedmont Glaciers Inventory (PGI)

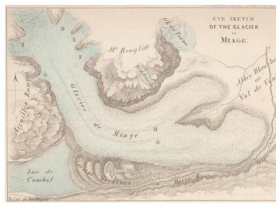
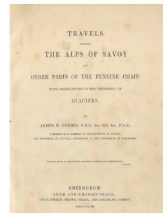
The database's architecture is server-side, and was designed by means of an open source software. Through this interface, any type of glaciological data can be managed, specific queries can be performed, and the results can be exported in a standard format.



Reference:
Nigrelli G., Chiarle, Nazzi A., Perelli L., Toris G., Giardino M. (2013) - A web-based, relational database for studying glaciers in the Italian Alps. Computers & Geosciences, 51, 101-107.

> Bibliographic db on Alps, glaciers and climate (BACG)

An example of digital resource stored in the DB: Forbes J. D. (1843) - Travels through the Alps of Savoy and other parts of the Pennine Chain with observations of the phenomena of glaciers.



Historical eye sketches of the Miage Glacier (Courmayeur, NW Italian Alps).

Reference:
Nigrelli G., Vergnano M. (2012) - A web-based, relational database for landslides, mud-debris flow and flood studies in northern Italy. Geoenvironment and Monitoring, 137, 67-70.

> Historical Alpine Climate Data (HACD)

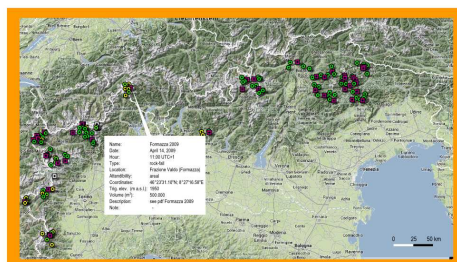
This DB was designed to manage several climatic parameters: temperature, precipitation, rainfall, snow depth, atmospheric pressure, relative humidity, wind; solar radiation, water level and water flow. The DB was developed following the World Meteorological Organization standards.



Reference:
Nigrelli G., Marino A.L.L. (2012) - Diodati: A web-based, open-source relational database for rainfall event studies. Computers & Geosciences, 48, 337-338.

> Natural Instability Processes in the Alps (NIPAlps)

Map service (loaded as a kml file in Google Maps) of the natural instability processes in high mountain environments of the Italian Alps (square, NIP; circles, meteorological stations used for the study of the relationships between processes and climate).

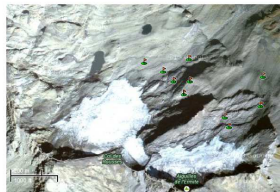


Reference:
Paranzotto R., Laio F., Nigrelli G., Chiarle M., Guzzetti F. (2014) - The impact of climatic factors on slope instability processes in permafrost areas: the case study of the Matterhorn (Northwestern Alps). EUCOP - 4th European Conference on Permafrost, 19-21 June 2014 - Evora, Portugal.

> High Alpine Mountain and Glacier Monitoring (HAMGM)

This dataset is a collection of field survey data collected with a gps receiver and by means of GIS tools.

- The main files collected are:
- traces of the approach routes to the glaciers
 - measures and photographs from fixed points
 - geodetic IGM benchmarks position
 - meteorological stations position
 - glacier terminus position
 - snout elevation
 - snow lines
 - lines of the moraine ridges
 - fixed points position



> Alpine WebGIS for environmental and cultural resources (AWG)

AWG is designed to store, analyze and present geological, environmental and cultural data. Through this web service, the viewer can display the different themes that make up the resources in terms of geotourism (e. g. glaciers, geosites, landslides, mountain landscape, scenic spots of observation and related photos).



Reference:
Giuliano M., Chiarle M., Giardino M., Morata G., Emira A. (2008) - Cambiamenti geomorfologici, evoluzione socio-culturale e geoturismo sostenibile in una comunità alpina: il caso del territorio di Ayas (Mora Rossa). Geobotica 24, 12-17. Website: <http://idpilsa.tor.univ.it/webalps/visuale.htm>