The Italian Glaciological Committee
Over a Century of Italian glaciers monitoring

Carlo Baroni

Earth Sciences Department, University of Pisa and CNR, Institute of Geosciences and Georesources
ITALIAN GLACIOLOGICAL COMMITTEE - CGI
DATAbase for reconstructing the spatial-temporal evolution of the Glacial Resource in the Italian ALPs over the last 100 years in the framework of the NextData Project (DATAGRALP)

CNR IRPI - Torino resp. Marta Chiarle
CGI - resp. Carlo Baroni
Antonio Stoppani (1824-1891)

In Stoppani’s work we can find the first observations about Italian glaciers with peculiar informations about past and contemporary glacier dynamics.

Great observer and explorer, multi-disciplinary researcher, Stoppani is considered the ‘Father’ of Italian Geology which was superbly explained in his greater work on natural sciences “Il Bel Paese” (The Beautiful Country). (1876)
Stoppani made first observations about the spectacular outburst floods on two well-studied Italian glaciers:

- Ghiacciaio dei Forni (Ortles-Cevedale Group)
- Ghiacciaio del Belvedere (M. Rosa Group)
The **Italian Glaciological Committee (CGI)** has been working in Italy since 1895, with the task of promoting and coordinating research in the field of glaciology.

In origin, the CGI was a commission for the study of Italian glaciers within the Italian Alpine Club (CAI); Since 1914, it became independent organism with the support of the National Research Council (CNR) and of other organizations and agencies interested in glaciological research.

**Carlo Somigliana** (1860-1955)

First President of the **Italian Glaciological Committee** (1910-1953) after having been President of the Italian Glaciological Commission.
Great Physicist and Mathematician Carlo Somigliana was also an expert mountaineer.

His passion for the mountains and his understanding of the physics were greatly combined when he derived a simple relationship to obtain

ice-thickness estimates and bedrock morphologies from surface velocity data
Great leader of glaciological research in Italy, in 1914 Carlo Somigliana started the publication of the Bollettino del Comitato Glaciologico Italiano.

A simple and well defined program:

... “collect through scientific methodology the larger amount of observations about glacier physics, hydrology and morphology of our Alps.”
Quantitative analysis

Miage Glacier, Mount Blanc area, survey 1913

stereogrammetric survey (Stereoautografo von Orel)

(Francesco Porro, Boll. CGI n. 1, 1914)
Since its origin, the CGI recognized the importance of systematic monitoring of Italian glaciers and, in particular, of measurement of frontal variations. This activity is regularly conducted since the end of the 19th Century, supplying therefore one of the longest observations series of glaciers frontal variations in the world.
The annual glaciological surveys allowed acquiring a large amount of data and a precious photographic documentation.
Ghiacciaio del Pizzo Varuna (Bernina) record of its extinction (2012)
A section of the CGI Bulletin is dedicated, since 1927, to the results obtained in the framework of the annual glaciological survey (http://www.gfdq.glaciologia.it/).
At present, approximately 150 glaciers are monitored every year by voluntary surveyors, also linked to regional associations
http://www.glaciologia.it/i-ghiacciai-italiani/le-campagne-glaciologiche/?lang=en
Mass Balance - La Mare Glacier (Ortles Cevedale Group)

Mass balance of selected Italian glaciers is measured since 1967 (e.g. Careser Glacier). About a dozen of glaciers are presently monitored for measuring the glaciological mass balance.
All the collected data related to the monitoring of frontal variations and annual mass balances measured in the Italian Alps contribute to the World Glacier Monitoring Service (WGSM) database (www.geo.uzh.ch/microsite/wgms/).
Glacier length changes; advancing (blue) and retreating (red) glaciers.
Glacier Inventories

Glacier inventories represent important tools, which allow the quantification of glaciers extension and volume … and their evolution

Miage Glacier (Mt. Blanc)
Comitato Glaciologico Italiano

Generale CARLO PORRO e Ingegnere PIETRO LABUS

ATLANTE DEI GHIACCIAI ITALIANI

Parte Prima

Carta Corografica

Scala 1:500,000

“Porro” Inventory 1925-1927
1925 “Porro” Inventory 1925-1927
774 glaciers in 4 sheets at the scale of 1:500.000

773 Glaciers on the Alps
1 Glacier on the Apennines (Calderone)

Atlas of the Italian Glaciers; Porro and Labus, 1927
http://www.glaciologia.it/pubblicazioni/?lang=en
Ghiacciaio di Cresta Bianco

Gruppo
Alpi Dolomiti

Carte topografiche: Carta piatta Rossa Italiana
della zona

Lunghezza massima (secco il pendio):...m. 2900
Lunghezza massima (trasversalmente al pendio):...m. 2700

Inclinazione media della superficie:

Quota del punto più alto:...m. 3200
Quota basso:...m. 2300

Esposizione: Sud

Portata di detto torrente (in litri al 1')

Data dell'osservazione: 20 Settembre 1924

I.G.M.I. Y

Ghiacciaio Adamello

Gruppo Adamello
Alpi Retiche

Carte topografiche: I.G.M.I. F. 20 III N.O. M.Adamello

Lunghezza massima (secco il pendio):...m. 1500
Lunghezza massima (trasversalmente al pendio):...m. 750

Area (in proiezione topografica orizzontale): ettari 120

Inclinazione media della superficie: 24°

Quota del punto più alto:...m. 3200
Quota basso:...m. 2300

Esposizione: Sud

Portata di detto torrente (in litri al 1')

Data dell'osservazione: 7 Agosto 1919-18 Luglio 1920

Dott. Prof. G. Merciai
- 838 glaciers, which existed at the end of the 1950s;
- 190 glaciers that disappeared from the previous inventory are also reported.

In total 1028 glaciated units were documented (http://www.glaciologia.it/ghiacciai.html).


**838 Glacial bodies**
at the end of the '50s of the 19th Century

**745 Glaciers**
**93 Glacierets**

+ **190 extinct glaciers** (in the previous 50 yrs)
Glacial bodies at the end of the ‘50s of the 19° Century

- 745 Glaciers
- 93 Glacierets

+ 190 extinct glaciers (in the previous 50 yrs)

(for a total of 1028 entries)

covering a total extension of 494 km²

In the volumes, glaciers of the Italian Alps are grouped in three main sectors:
- 322 glaciers are hosted in the Western Alps (Piemonte)
- 185 glaciers in Central Alps (Lombardia)
- 330 glaciers in the Eastern Alps (Tre Venezie)
http://www.glaciologia.it/ghiacciai.html
The meltwater generating from Italian glaciers was also summarized:

- 534 glaciers contributed to the hydrological regime of Po River
- 255 glaciers to the Adige River and the remaining
- 48 glaciers belonged to other hydrological basins.

http://www.glaciologia.it/ghiacciai.html
The southernmost Italian glacier, the Ghiacciaio del Calderone was still the only glacier in the Apennines (Gran Sasso Massif), located at the southernmost glacierization limit of Europe.
Desio 1967

President of the Italian Glaciological Committee until 1975.
1397 glaciers of the Italian Alps, covering a total extension of 608 km²

- 531 in Western Alps (322 in 1959-62)
- 305 in Central Alps (185 in 1959-62)
- 560 in Eastern Alps (330 in 1959-62)
The more recent updating of the Italian glaciers inventory refers to 1988-’89. Based on an aerial photogrammetrical survey conducted across the entire Italian Alps, the inventory was supported by the Italian Minister of the Environment.

This inventory considers 787 glaciers with dimensions greater than 0.05 km², which covered a total area of 474 km² (about 20% of the total extension of the glaciers in the Alps).

The comparison between the two CGI inventories evidences a reduction of the glacierized areas in the Italian Alps from 1959 and 1988-89.

The Gran Sasso Massif hosts the remnant of the last Apennine glacier, the Calderone Glacier, now reduced to little more than a debris covered glacieret.
Download GLIMS outlines in current view
(work best in default projection (don't use "Zoom to..." tool))

Latitude:
Longitude:
The largest glacial complex of the Italian Alps is the Adamello Glacier, a composite summit glacier about 18 km² in 1991, 16 km² in 2007.
while the larger valley glacier is the Forni Glacier in the Ortles-Cevedale Group

13 km² in 1991
12 km² in 2003
Avio Glacier (Adamello Group) (August 1984)

Over 80% of the Italian glaciers, however, consists of glaciers very small in size.

Mt. Adamello (3539 m)
Little Ice Age (15th -19th Cent. Max ~1850)

Long and bitter winters
Vigorous glacier advances

Abraham Hondius, 1684
Thames at Temple Stairs (1684)
Mandrone and Lobbia Glaciers
Adamello Group (Central Alps)

Originalkarte der Adamello
Presanella Alpen (Payer J. 1865)
More than 140 glaciers were present on the Adamello-Presanella Group during the LIA
More than 140 glaciers were present on the Adamello-Presanella Group during the LIA in 1983 more than 90 extinguished and many other new glaciers were originated by wider retreating glaciers. In 1983 about 100 glaciers extended about 53 km².
The Italian glaciers, since the end of the maximum Holocene advance (LIA) have experienced a phase of generalized retreat, accentuated in the 50s of the 20th Century, which was followed by a slight advancing stage culminated in the late '70s and early '80s. Since the '90s there was a general withdrawal of almost all the Italian glaciers.
Since the second half of the 19th Century the Italian glaciers lost more than 40% of their areal extension. The mean annual snow line rose about 100 m, as a mean.

Many of the wider glaciers subdivided originating minor glacial bodies. Several small glaciers disappeared or are presently reduced to glacierets, while many others are almost completely debris-covered.

Data source: L. Carturan
Climatic variation at the Careser dam cumulated winter precipitation (October-May)

Data source: L. Carturan
Climatic variation at the Careser dam
Mean Temperature of the ablation season (JJAS)
Mass Balance and ELA rise - Sforzellina Glacier
(Ortles - Cevedale)

Cannone et al., 2008 (Mass Balance by C. Smiraglia et. Al)
2003: most negative mass balance of Alpine glaciers

Isotherm 0°C above 4000 m for several days, longest ablation season endured 93 days (mean of the last 20 yrs = 45 days)
In recent years, almost 100% of the Italian glaciers are retreating; numerous alpine glaciers have repeatedly found entirely below the snowline, recording significant frontal retreat, contractions of the accumulation basins, thinning of glacial bodies and tongues.
From 1850 AD to 2006 the Lobbia Glacier reduced by 42% while
- the Adamello Gl. reduced by 36% (2007)
- Glaciers of the northern side of Presanella group reduced by 60% (2003)
- Glaciers of the eastern side of Presanella group reduced by 66% (2003)
Only the inertia of the ice has allowed glaciers to overcome these critical steps: the strong imbalance that seems to characterize the glaciers compared to current climatic conditions suggests that if this situation will last, further dramatic areal and volume reductions must be expected.
White – War (First World War)
The site of Punta Linke (Ortles-Cevedale)

Credits:
Soprintendenza per i beni librari archivistici e archeologici della Provincia autonoma di Trento, Museo di Peio, Comune di Peio e Provincia Autonoma di Trento
Forni Glacier
Ortles-Cevedale Group
about
13 km$^2$ in 1991,
12 km$^2$ in 2003

IGM, 1917 – From P.zo Tresero

G. Cola, SGL - 2010
A) Taglio di un pilastrino; 
B e C) pilastrino A1; 
D e E) pilastrino A2; 
F) pilastrino A3. 
Le linee rosse identificano la dimensione del taglio effettuato.
Bartoli et al. (1992) - *La Città di Ghiaccio*
The Iceman
5300-5050 anni cal BP
Figure 7. Actual and reconstructed June-July mean temperature over their entire overlapping period (1760-2004) \( (r = 0.53) \).

Figure 8. Reconstructed June-July mean temperature. The thick line is the 11-year moving average.
Thank you for kind attention....