

Rendiconto nivometrico 2021-2022 in Piemonte e Valle d'Aosta: neve, ghiaccio e acqua in un clima che cambia

Instabilità glaciale in Piemonte: eventi pregressi e scenari futuri

Marta Chiarle

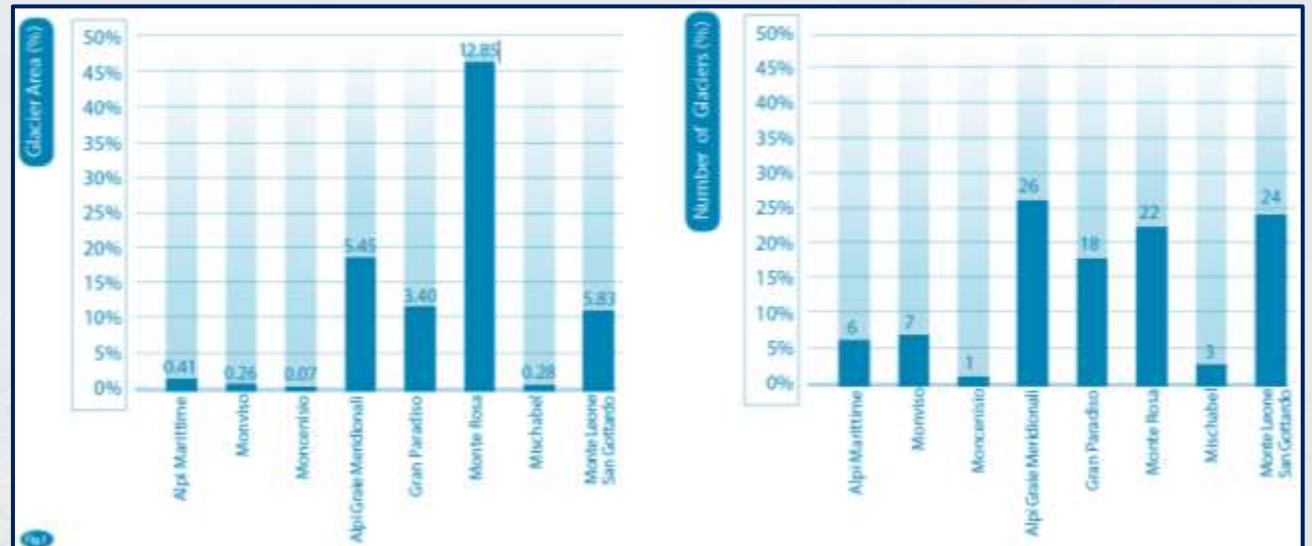
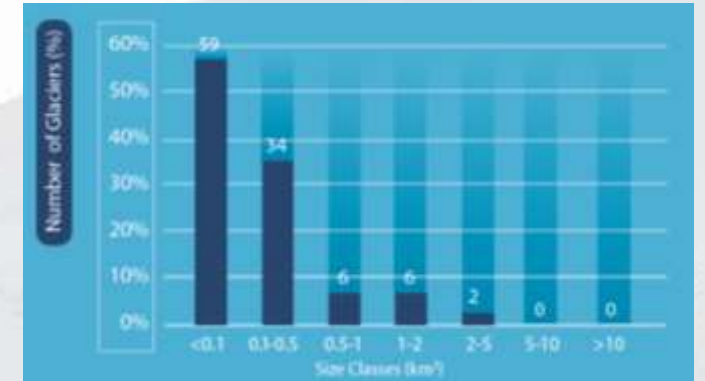
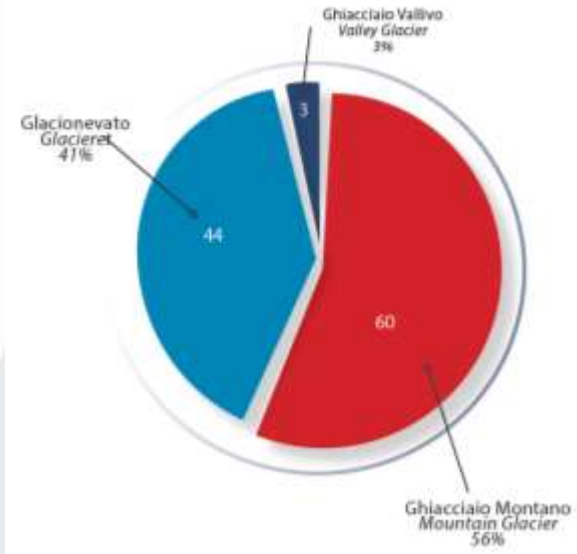


Torino, 23 novembre 2022



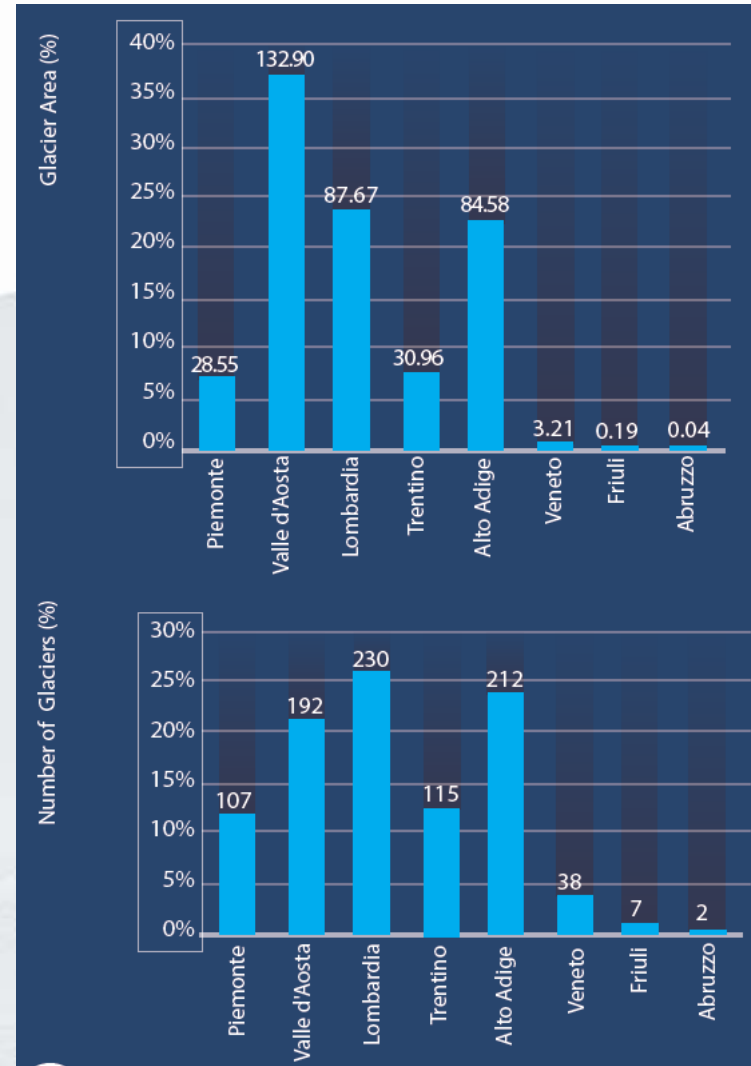
I ghiacciai del Piemonte oggi

(fonte: Smiraglia et al., 2015)



I ghiacciai del Piemonte oggi

(fonte: Smiraglia et al., 2015)



I ghiacciai del Piemonte negli ultimi 150 anni

(fonte: Smiraglia et al., 2015)



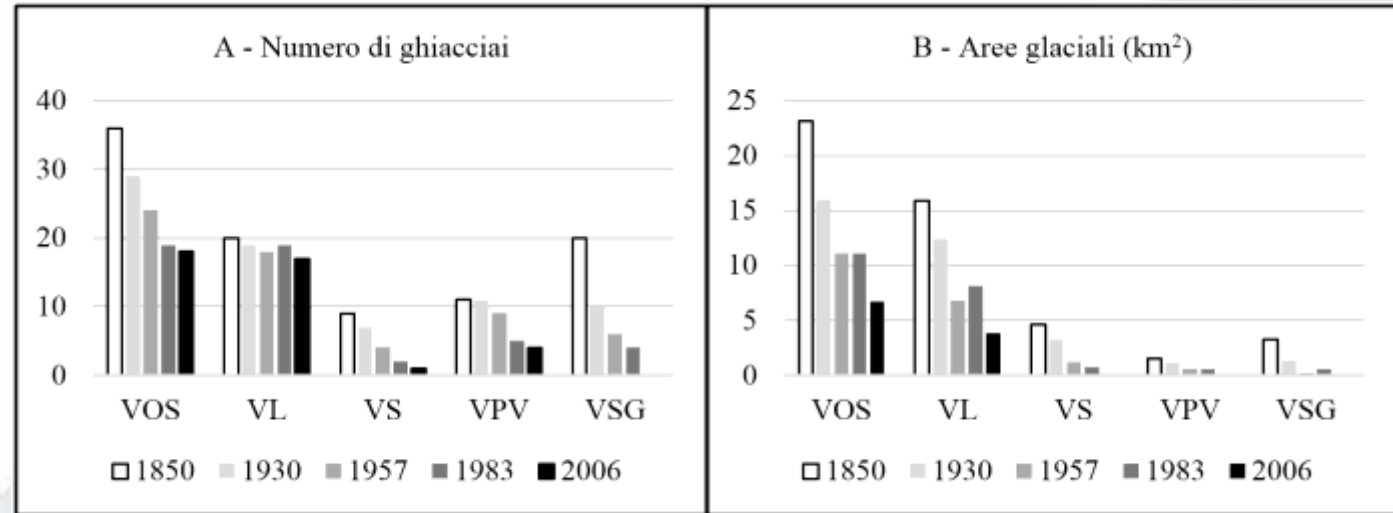
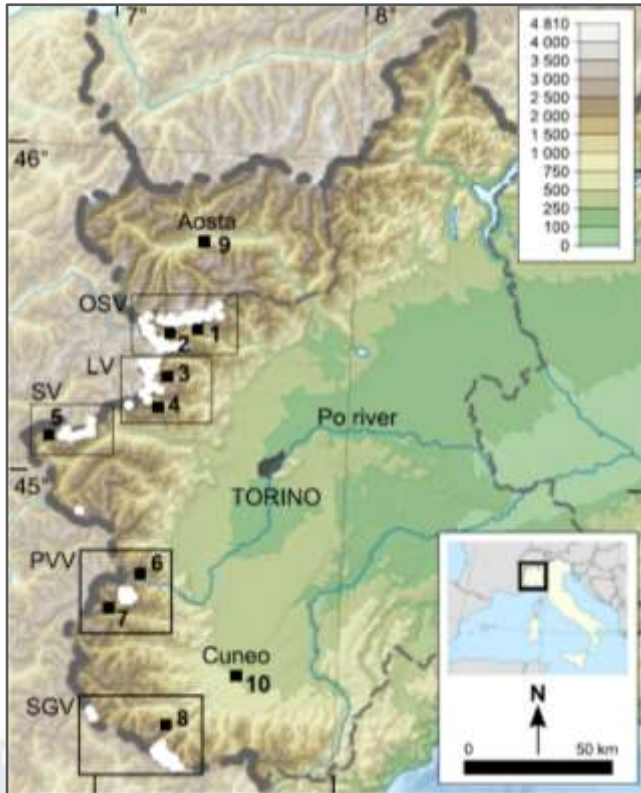
1957 - 2010

	Variazione area (%) Area change (%)
PIEMONTE	-49%
VALLE D'AOSTA	-27%
LOMBARDIA	-24% (-19%)
TRENTINO	-33% (-39%)
ALTO ADIGE	-31%
VENETO	-44%
FRIULI V.G.	-50%
ABRUZZO	-33%
TOTAL	-30% (-30%)

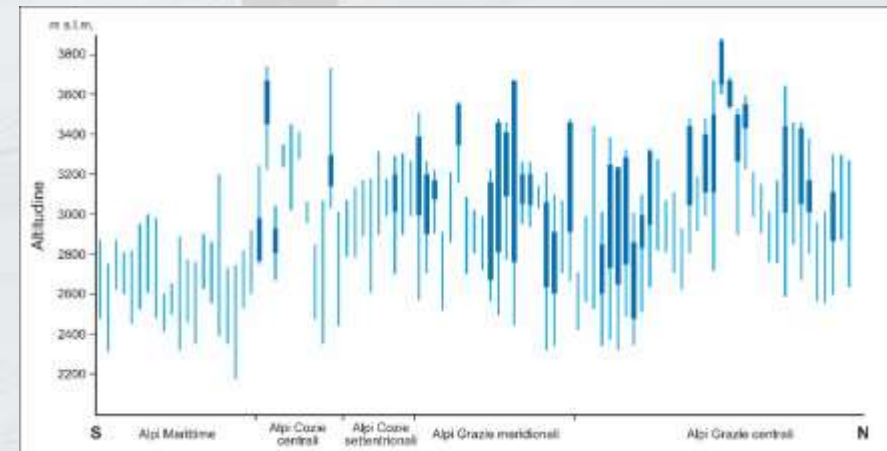
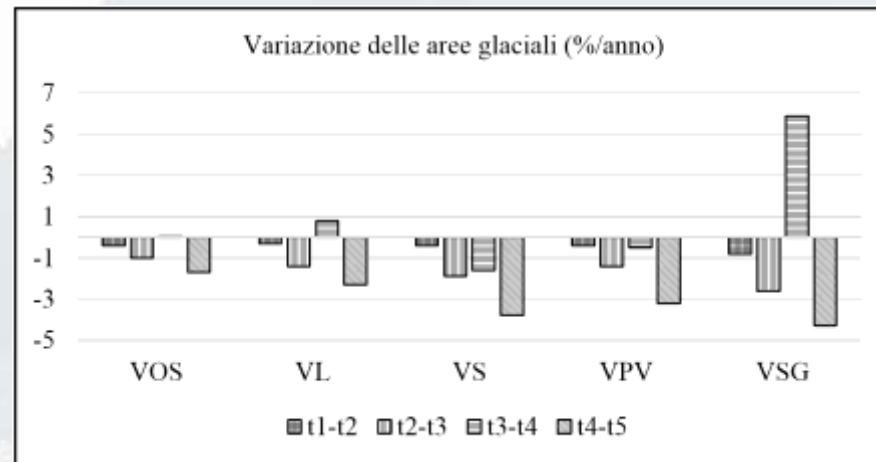
Gruppo montuoso Mountain group	Variazione area (%) Area change (%)
ALPI MARITTIME	-59%
MONVISO	-84%
MONCENISIO	-95%
ALPI GRAIE MERIDIONALI	-56%
GRAN PARADISO	-47%
MONTE ROSA	-36%
MISCHABEL	-65%
LEONE-GOTTARDO	-53%
TOTAL	-49%

I ghiacciai del Piemonte negli ultimi 150 anni

1850 - 2006



(VOS, Valli Orco e Soana; VL, Valle di Lanzo; VS, Valle di Susa; VPV, Valli Po e Varaita; VSG, Valli Stura e Gesso)



(Nigrelli et al., 2015, GEAM)

I ghiacciai del Piemonte oggi



Il caso esemplare del Ghiacciaio del Belvedere



Da oltre 20 anni, il Ghiacciaio del Belvedere (Valle Anzasca) è un **laboratorio a cielo aperto** per lo studio dell'instabilità indotta dai cambiamenti climatici in ambiente glaciale e periglaciale

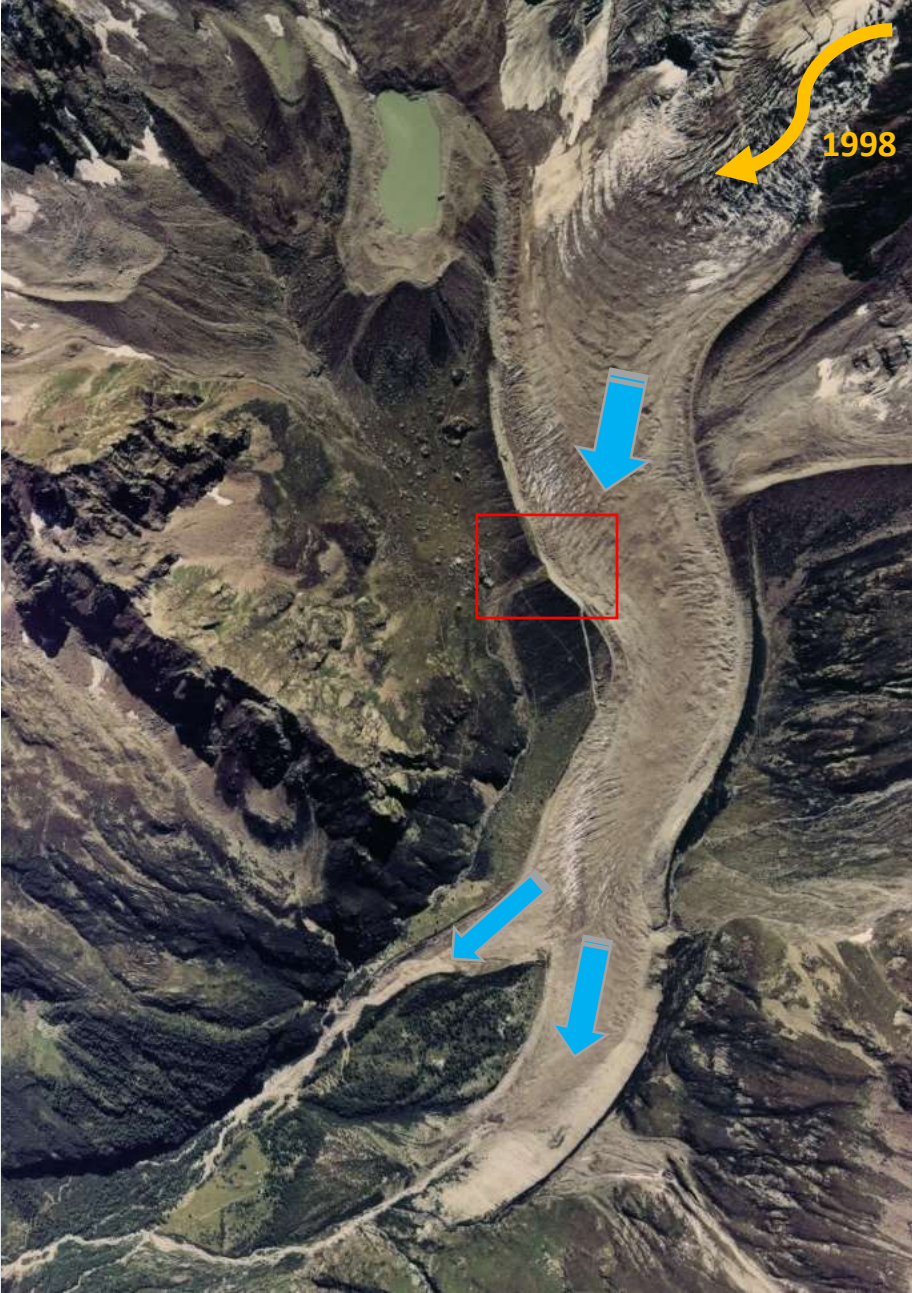




Colate di detrito dalla Parete Est del M.Rosa

1998-





Rapida avanzata glaciale («surge»)
2001-





Formazione di lago epiglaciale («Lago Effimero»)

2002-2003





**Ghiacciaio
del Belvedere**
Valle Anzasca

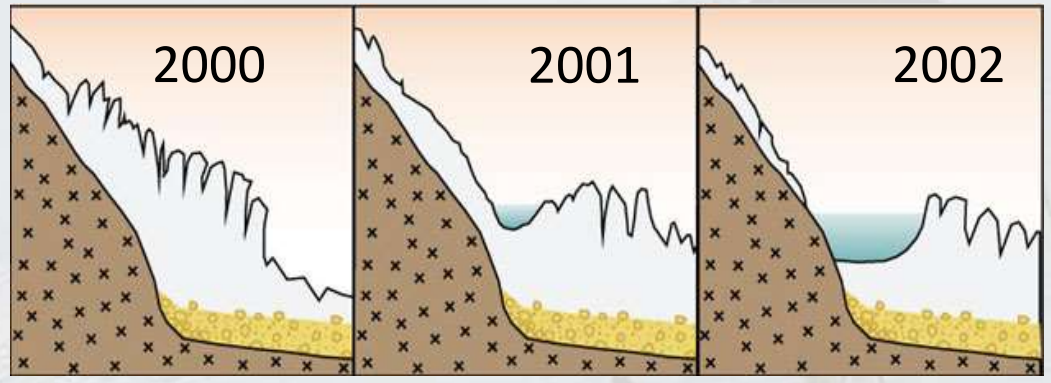
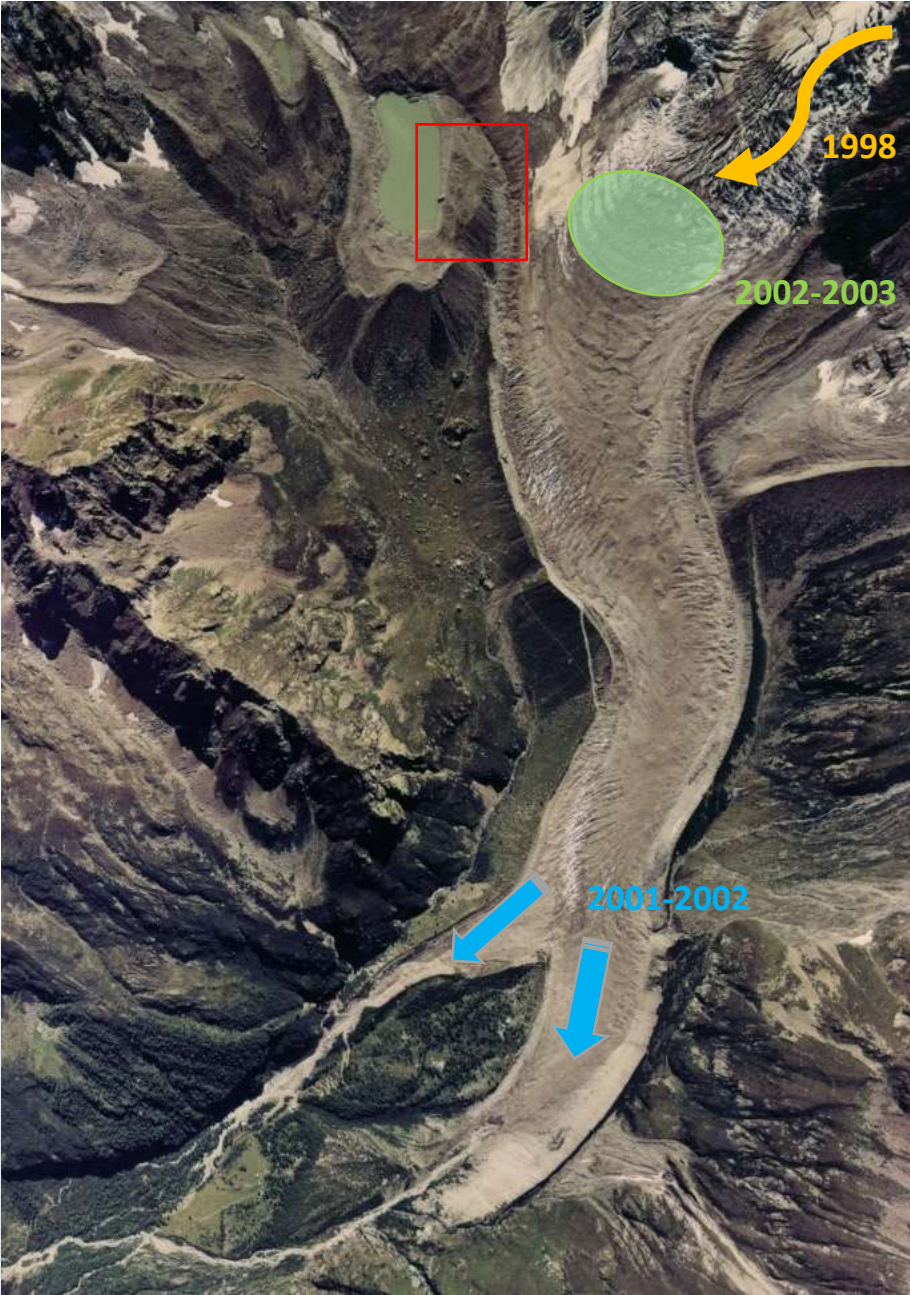




Foto: Protezione Civile Nazionale

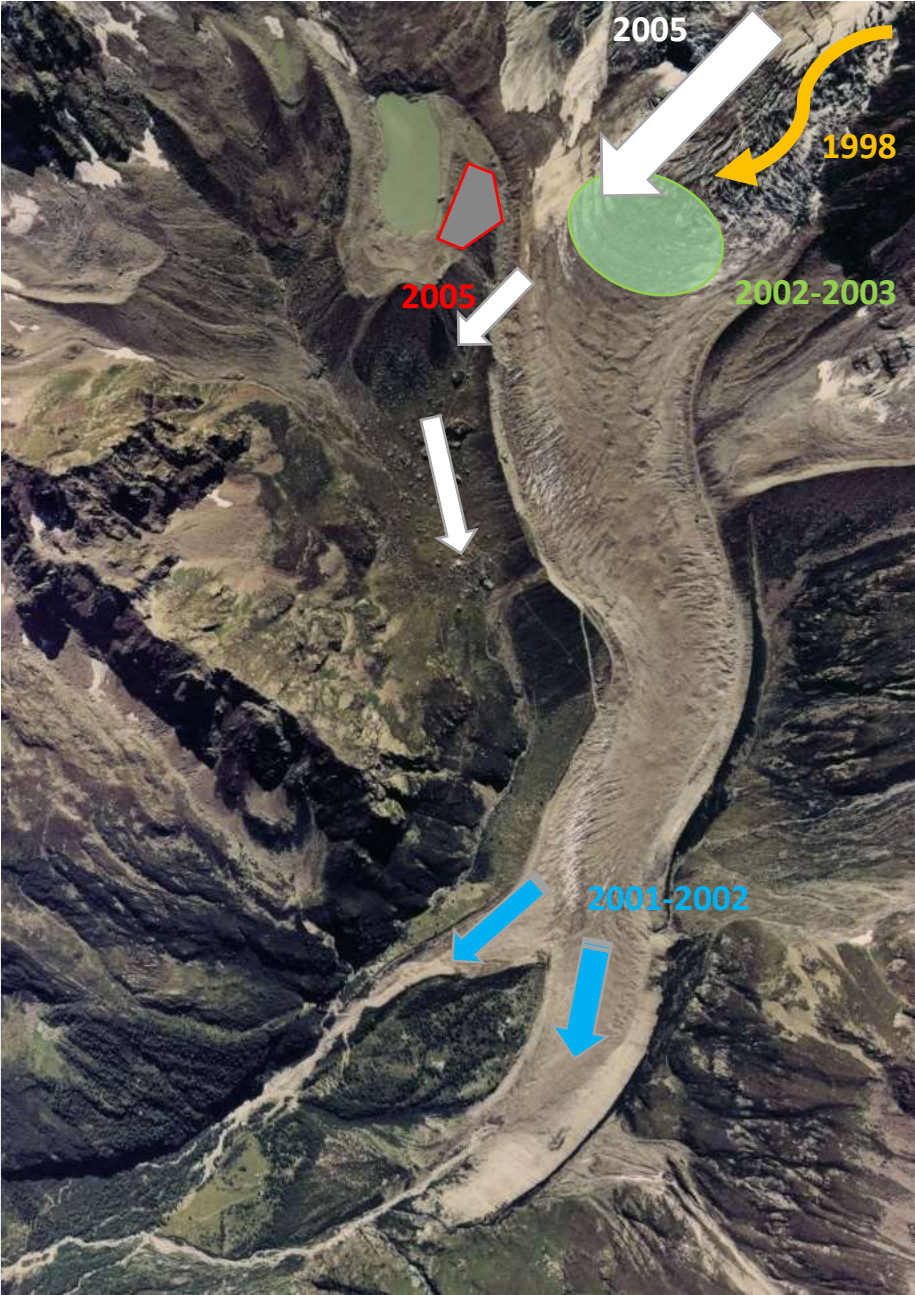


2001



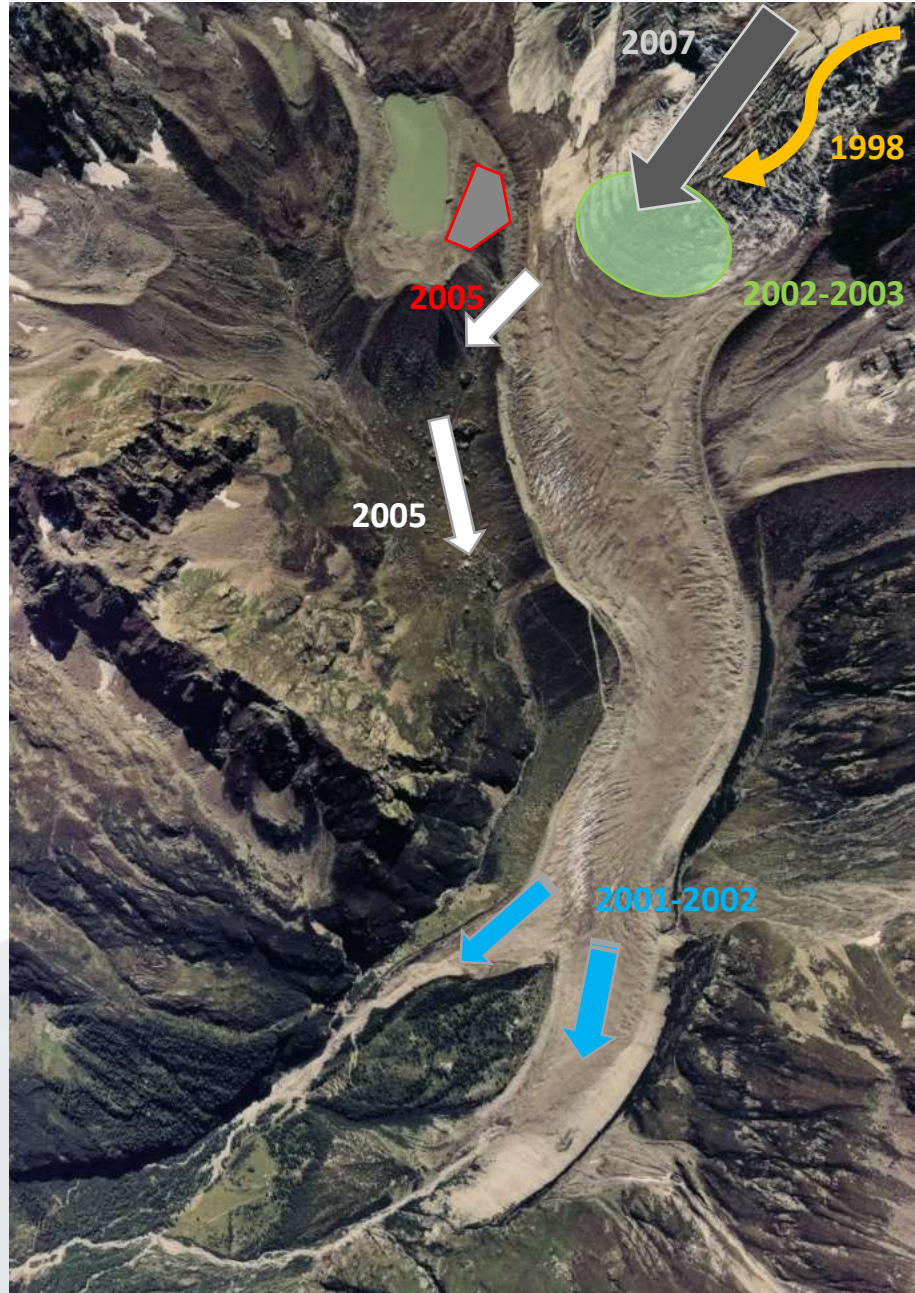
Scivolamento della morena delle Locce
2005-





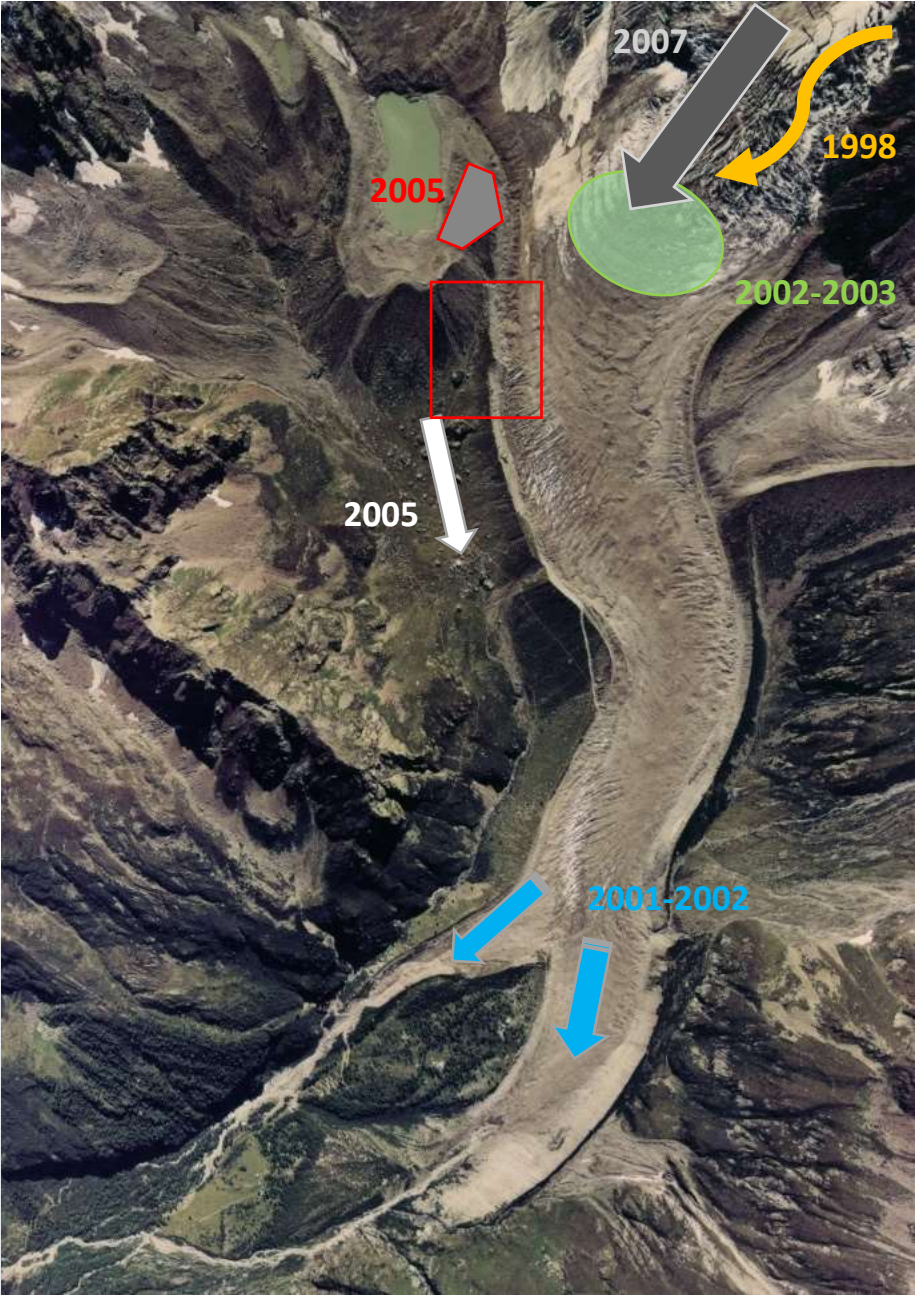
Valanga di ghiaccio
25 agosto 2005





Valanga di roccia
21 Aprile 2007

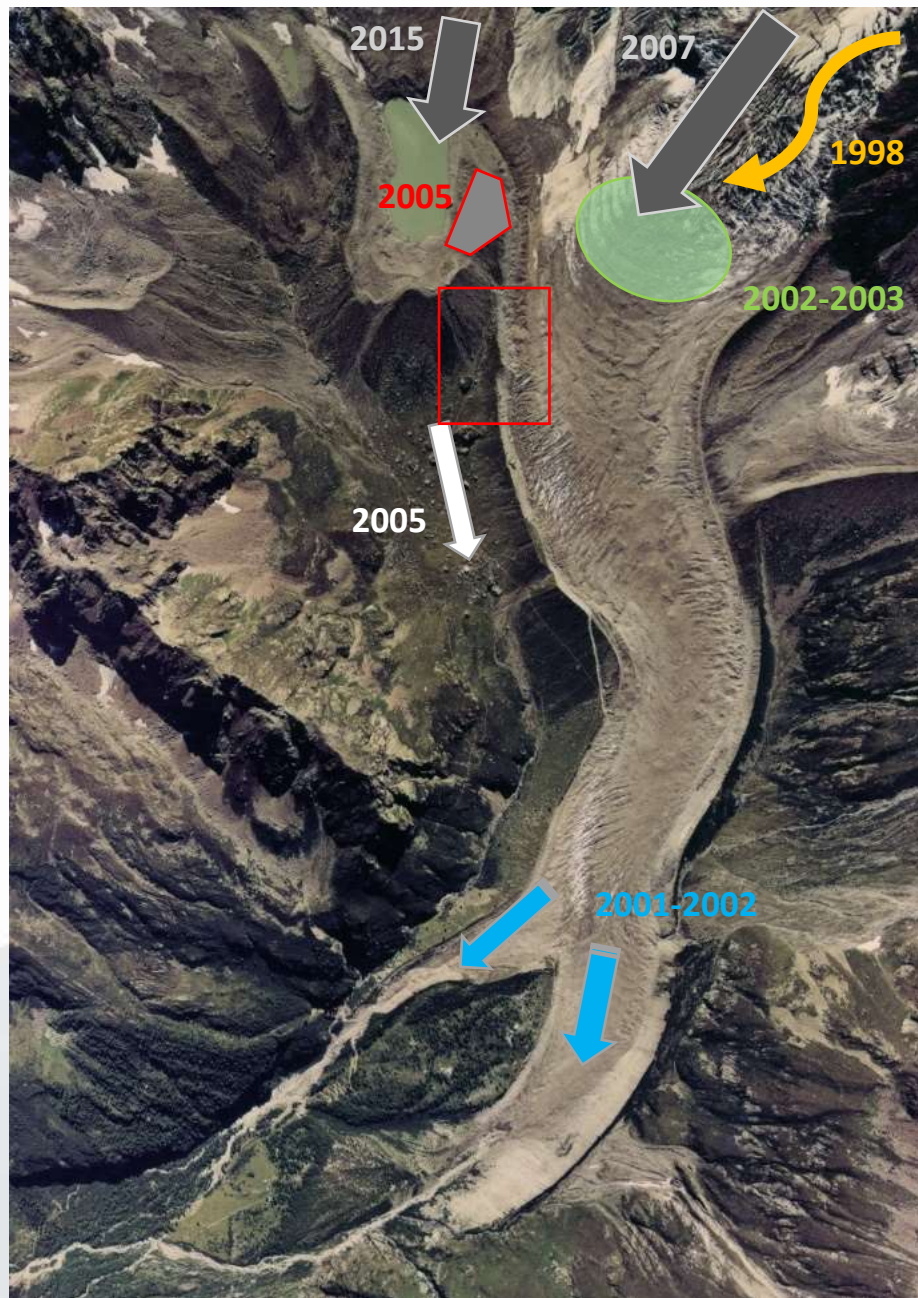




Cedimento della morena destra







Valanga di roccia
15 Dicembre 2015



Altri eventi significativi

Ghiacciaio Superiore di Coolidge

Monviso

Il crollo del

6 luglio 1989

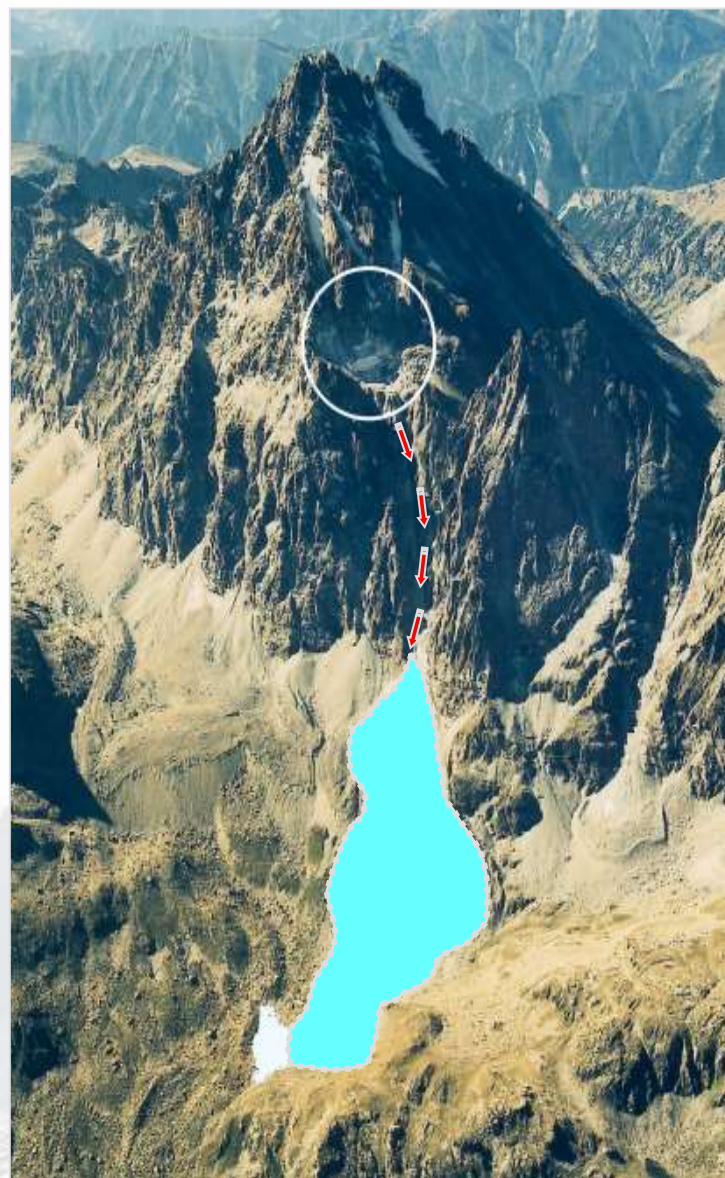


Foto: Archivio CGI

Altri eventi significativi



1894

Ghiacciaio del
Rocciamelone

Valli di Lanzo



2000



Rapida crescita di
lago marginale

2003-2004

Altri eventi significativi



1894

Ghiacciaio del
Rocciamelone

Valli di Lanzo



2000



2004

Rapida crescita di
lago marginale

2003-2004

Cambia il clima, cambiano i ghiacciai, cambiano i rischi

Ghiacciaio Superiore di Coolidge

Monviso



Foto: S. Perona, 2019



1987



1989

Foto: Archivio CGI

Cambia il clima, cambiano i ghiacciai, cambiano i rischi



1894

**Ghiacciaio del
Rocciamelone**

Valli di Lanzo

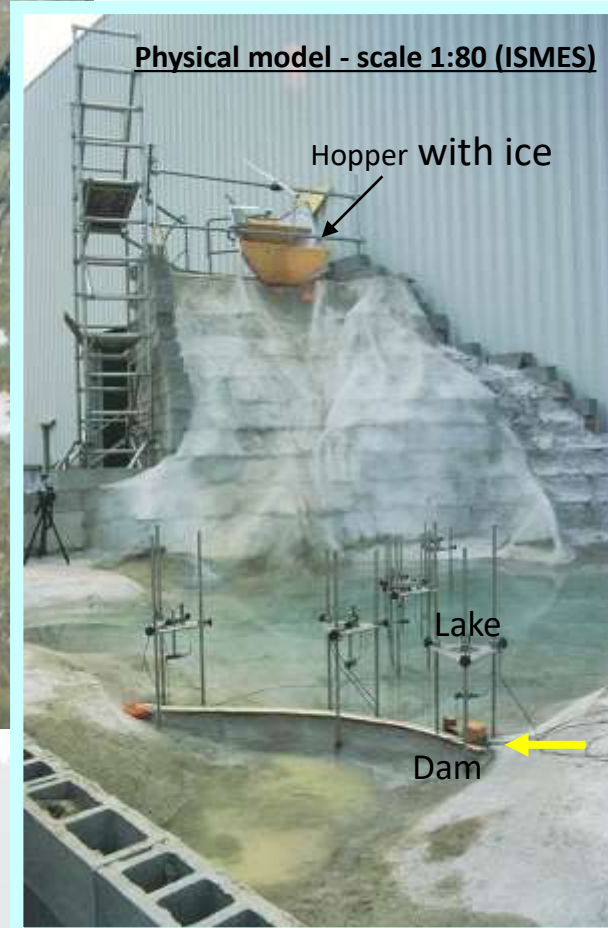


2000



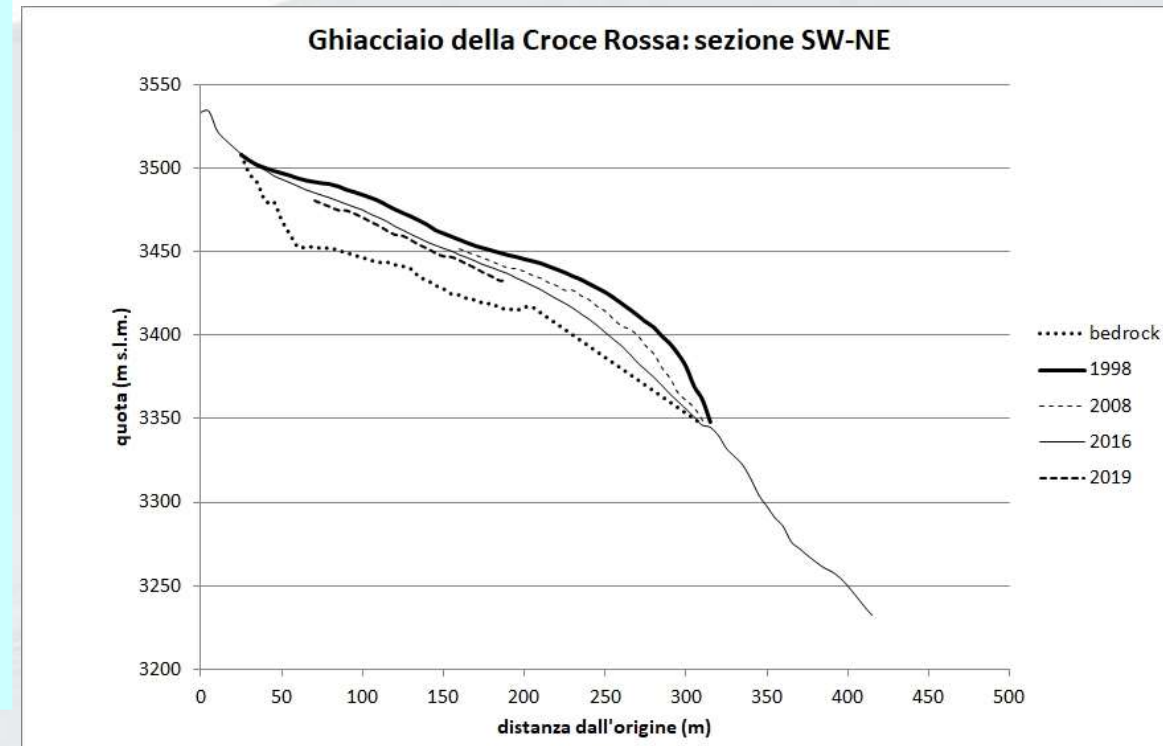
Foto: G. Savio, 2017

Cambia il clima, cambiano i ghiacciai, cambiano i rischi



Ghiacciaio della Croce Rossa

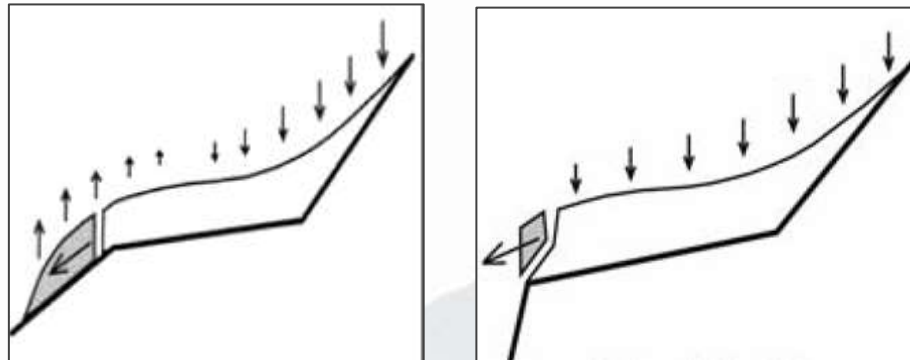
Valle di Viù



Elaborazione: A. Tamburini, GFDQ 43 (1)

Cambia il clima, cambiano i ghiacciai, cambiano i rischi

Geomorfologia

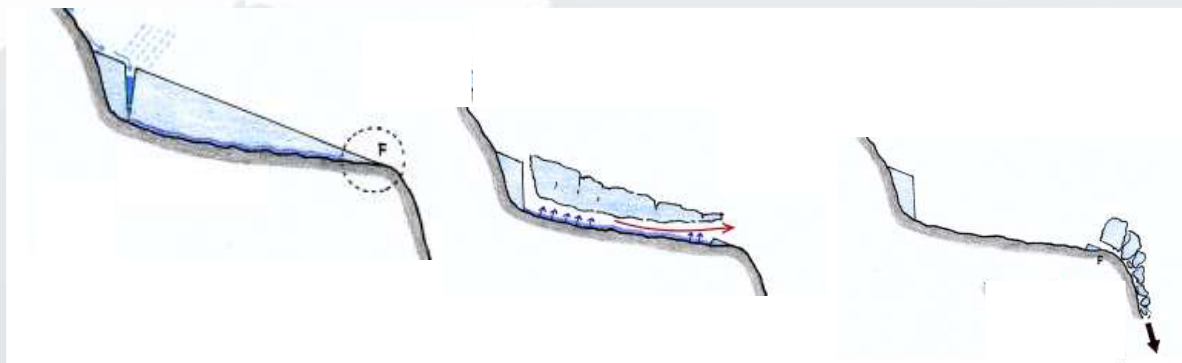


Pralong & Funk, 2006



Ghiacciaio delle Piode (Val Sesia)

foto: P.Piccini, 2017



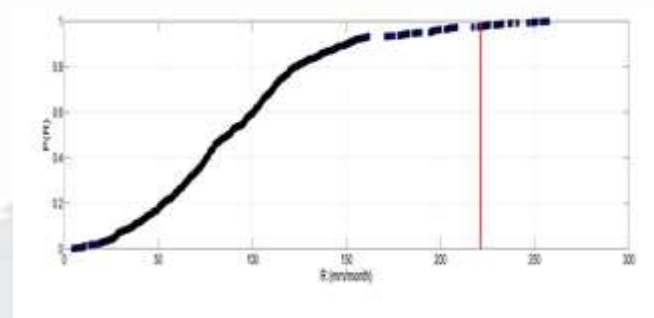
Elaborazione: G. Mortara



Gh. Sup. di Coolidge

Cambia il clima, cambiano i ghiacciai, cambiano i rischi

Acqua

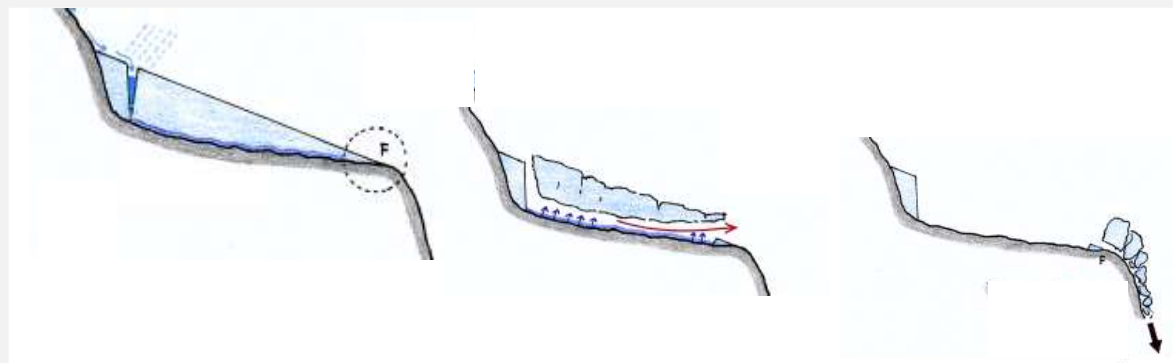
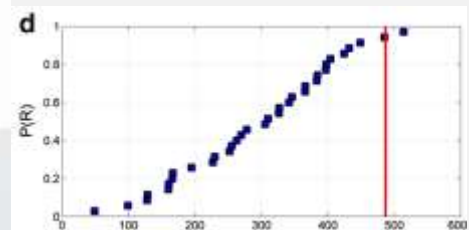


Gh. Del Belvedere (Valle Anzasca)

Nicchia tra 3.820 and 3.580 m s.l.m.

Paranunzio et al., 2015

Paranunzio et al., 2015



Elaborazione: G. Mortara



Gh. Sup. di Coolidge

Nicchia a 3.200 m s.l.m.

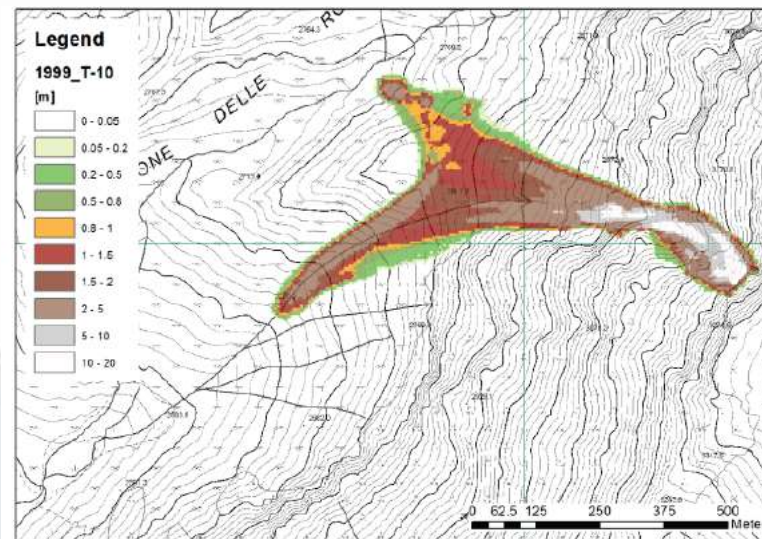
Cambia il clima, cambiano i ghiacciai, cambiano i rischi

Temperatura



Gh. Della Croce Rossa (Val di Viù)

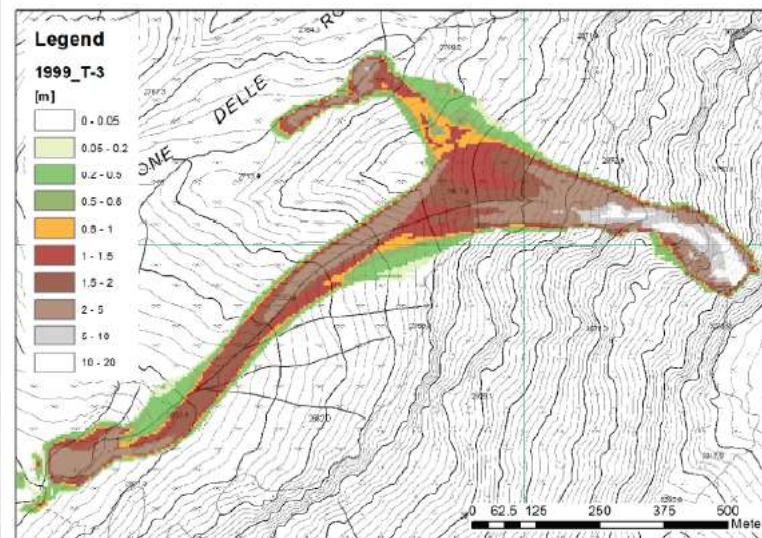
quota.: 3550-3344 m s.l.m.



-10 °C

Gh. Palon de la Mare, Effluenza Rosole (Valfurva)

Quota fronte: 3300 m s.l.m.



-3 °C

Maggioni et al., 2018

Torino, 23 novembre 2022

Cambia il clima, cambiano i ghiacciai, cambiano i rischi

Geomorfologia
Acqua
Temperatura



Gh. Meridionale di Hohnsand

Foto: P. Valisa, 2021

Cambia il clima, cambiano i ghiacciai, cambiano i rischi



Glacionevati

Glac. Settentrionale di Andolla

Foto: L. Sergio, 2021

Cambia il clima, cambiano i ghiacciai, cambiano i rischi



Val di Fosse (Val Senales)

29 Luglio 2005

Ghiaccio sepolto

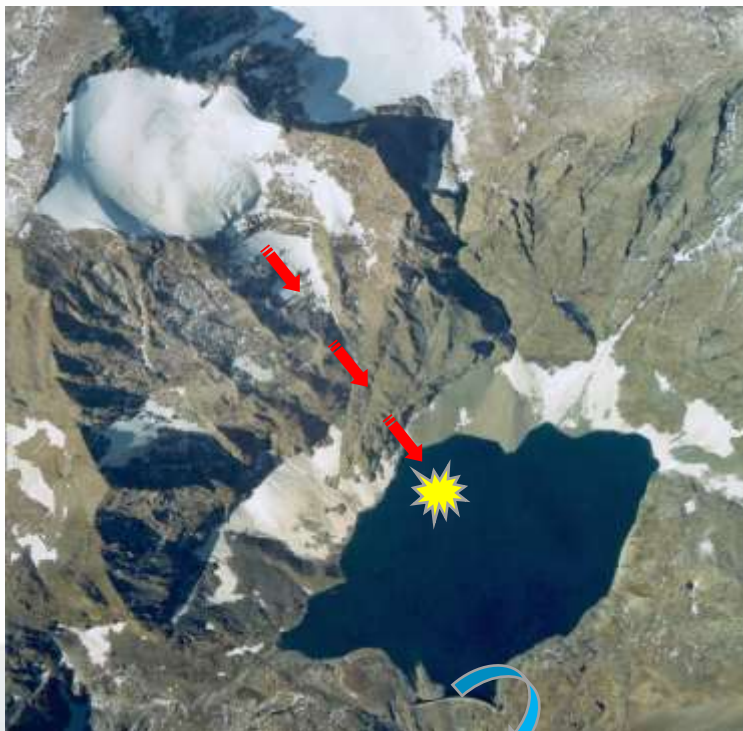


La fusione di una massa di ghiaccio sepolto a 3000 m s.l.m., ha dato il via a una colata detritica di 15.000 m³ che è defluita a valle per oltre 1 ora, interrompendo un noto sentiero in Val di Fosse

Foto: Provincia di Bolzano

Cambia il clima, cambiano i ghiacciai, cambiano i rischi

Catene di eventi



Gh. della Croce Rossa

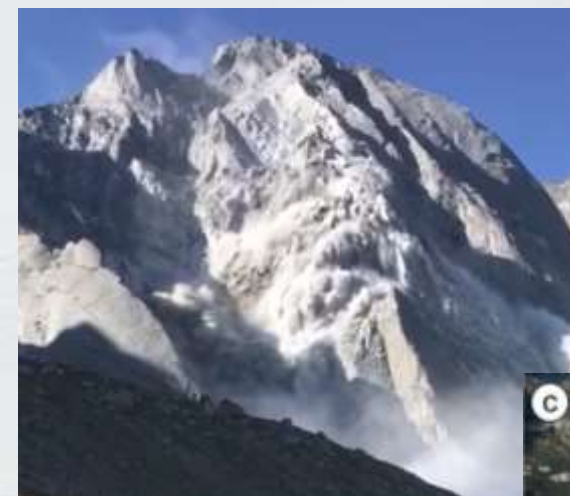


Gh. del Belvedere, 19 luglio 1979

Gh. del Palon de la Mare, aprile 2017



Foto: G. Cola



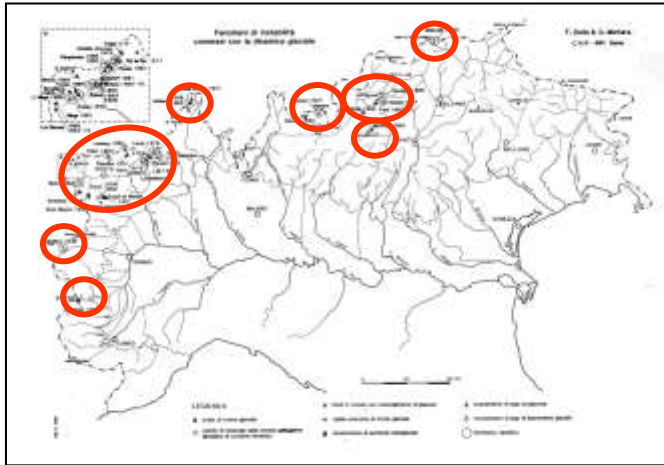
Pizzo Cengalo, 23 agosto 2017

Mergili et al., 2020



Strumenti disponibili

Dataset



Dutto e Mortara, 1991

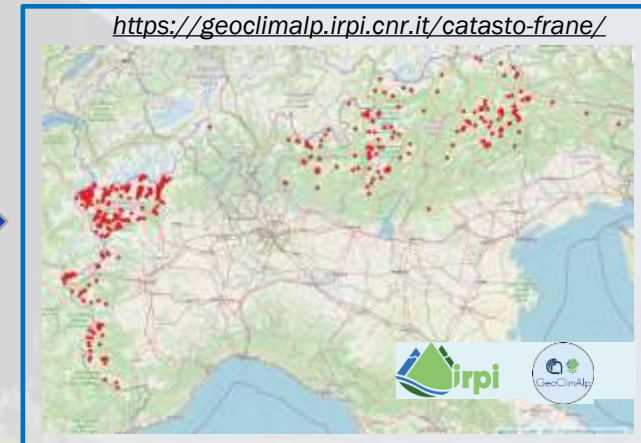
The screenshot shows the GLARISKALP website interface. The main header features the project name and the European Union flag. Below the header, there is a navigation menu with options like 'Introduzione', 'Risultati', 'La rete di cooperazione', 'Enti partecipanti', and 'Contatti'. The 'Risultati' section is active, displaying two main content blocks: 'INVENTARIO DELLE ESTENSIONI ATTUALI E PASSATE DEI GHIACCIAI' and 'CARTOGRAFIA GEOMORFOLOGICA DEI SETTORI DEGLACIALIZZATI'. On the right side, there is a map titled 'Esempio di cartografia dell'area di influenza della PEG nella Valle Orco' with a legend and a detailed view of a specific area.

http://www.glariskalp.eu/?it_risultati,3

The screenshot shows the 'GLACIORISK EUROPEAN PROJECT' website. The main menu is titled 'WELCOME TO GRIDBASE, GLACIER RISKS DATA BASE : MAIN MENU'. It lists participating countries: France (CERAMBER, ETNA, GNF-STH, LOZE-CHRS), Italy (COM-2001, EPS/Numbus), Norway (GOSLO, WRE), Iceland (GUESS), Austria (GOSLO), and Switzerland (ZUR-ETNA). The menu includes options to 'SELECT THE GLACIER LIST VIEW' and 'STATISTICS'.

<http://www.nimbus.it/glaciorisk/gridbasemainmenu.asp>

in via di implementazione per l'Italia: oltre 600 eventi di instabilità glaciale in 90 anni, 70 crolli di ghiaccio con volume >10.000 m³



<https://geoclimalp.irpi.cnr.it/catasto-frane/>

Strumenti disponibili

Linee guida

Fifth Framework Programme

GLACIORISK

EVGI 2000 00512

Deliverables

Report Period : 01.01.2001 – 31.12.2003



D3: Guidelines for scientific studies about glacial hazards

**SURVEY AND PREVENTION OF EXTREME GLACIOLOGICAL HAZARDS
IN EUROPEAN MOUNTAINOUS REGIONS**

<http://glaciorisk.grenoble.cemagref.fr>

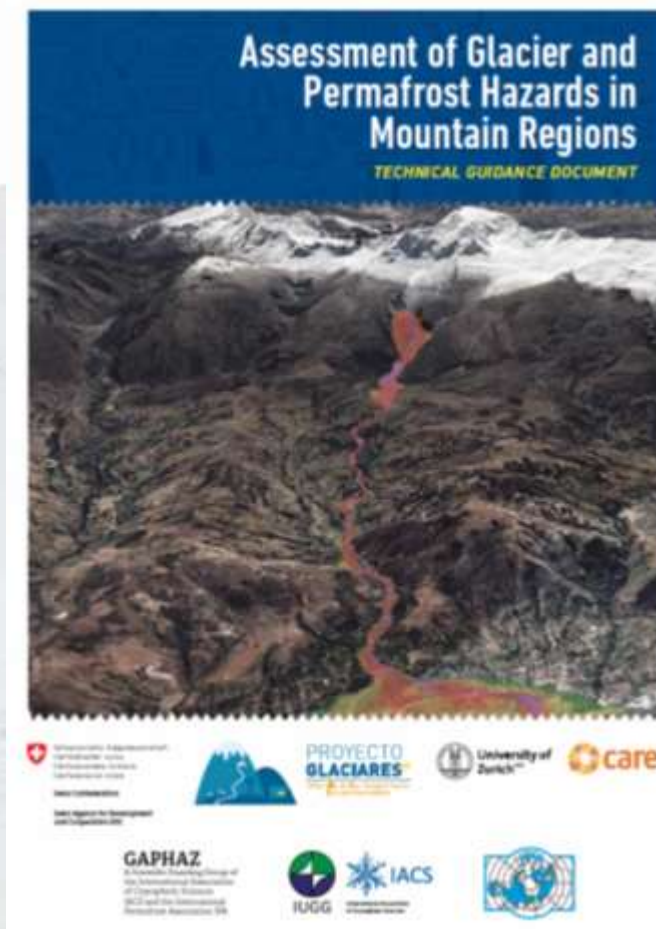
Compiled by Didier Richard and Michel Gay



terreno.

VALUTAZIONE DELLA PREDISPOSIZIONE ALLA PERICOLOSITÀ DI SETTORI GLACIALIZZATI E RECENTEMENTE DEGLACIALIZZATI

I dati che compongono l'inventario dell'estensione attuale e passata dei ghiacciai delle Alpi occidentali e la cartografia geomorfologica dei settori deglacializzati sono serviti come base per riconoscere quelle aree che possono essere oggetto di fenomeni di instabilità. Sono state esplorate piste diverse, utilizzando le funzionalità del GIS che permettono di incrociare i dati acquisiti, fra loro e con i diversi parametri dei modelli digitali di



Allen, S., Frey, H., Haeblerli, W., Huggel, C., Chiarle, M., & Geertsema, M. (2022). Assessment principles for glacier and permafrost hazards in mountain regions. In *Oxford Research Encyclopedia of Natural Hazard Science*

Strumenti disponibili

Casi di studio

FP6D: Programme of Deliverables

GLACIORISK

EVG1 2000 00512

Deliverables

Report Period : 01.01.2001 – 31.12.2002



D3: Guidelines for scientific studies about glacial hazards

SURVEY AND PREVENTION OF EXTREME GLACIOLOGICAL HAZARDS IN EUROPEAN MOUNTAINOUS REGIONS

<http://glaciorisk.gesslab.com/g3/>

Compiled by Didier Richard and Michal Gay



GLARISKALP

RISCHI GLACIOLOGICI E PROCCIDENSI
RISQUES GLACIQUES DANS LES ALPES OCCIDENTALES

2010-2011

EDYTEM

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Non-IPRA
Detailed description of the methodology, including specific details, under the terms of the license agreement on individual use. The article is a single article for personal use. For details on license terms and usage, visit: <http://www.elsevier.com/locate/ymssp>.
doi: 10.1016/j.ymssp.2013.05.001

Assessment Principles for Glacier and Permafrost Hazards in Mountain Regions

Allen, S. H., Pasten, F., Ariza, H., Hoggal, C. & Stoffel, H. (2010) Lake outburst and debris flow events at Endersby, June 2010. *Hydro-meteorological triggering and topographic predisposition*. *Landslides*, 13, 1479-1491.

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Assessment Principles for Glacier and Permafrost Hazards in Mountain Regions

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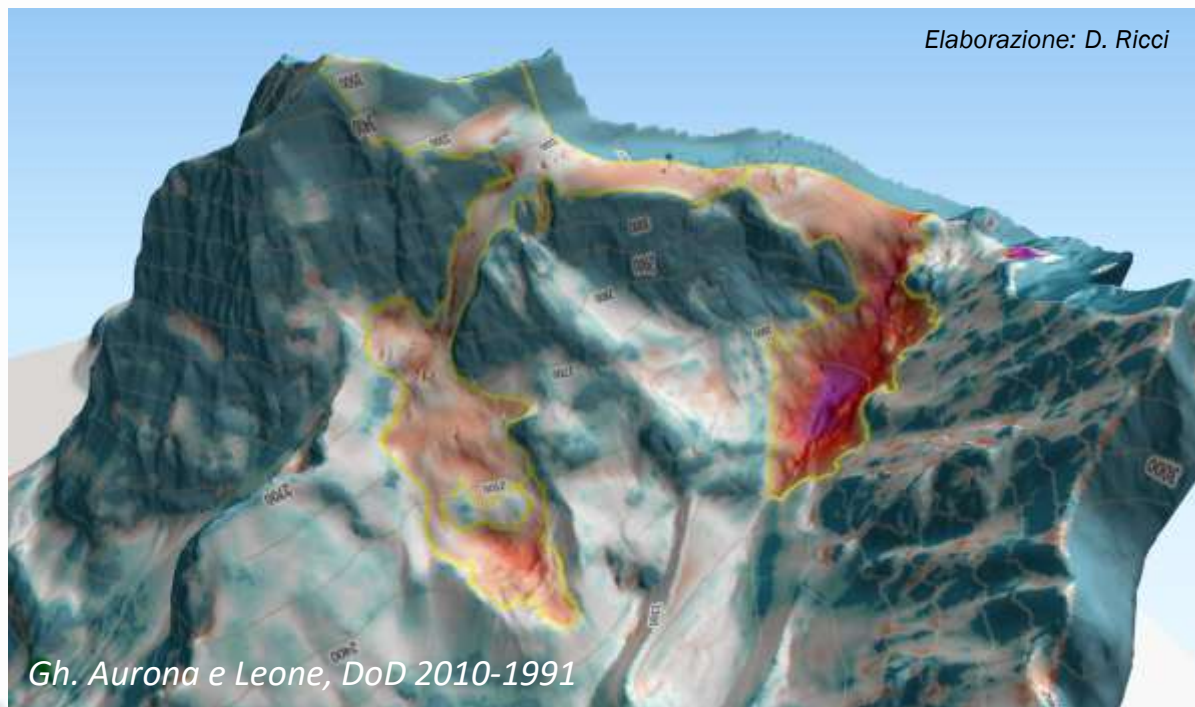
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Verso una valutazione dinamica della pericolosità glaciale



DTM

Dati di portata

Condivisione
esperienze e
conoscenze

Valutazione della
predisposizione
all'instabilità

Monitoraggio
situazioni critiche

Censimento
sistematico
eventi

Osservazione
delle
trasformazioni



Grazie per l'attenzione!

marta.chiarle@irpi.cnr.it

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