Italian glaciers, sensitive sentinels of climate change

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ETH Zurigo (Susan Ivy Ochs, Stefano Casale, Giulia Guidobaldi & SED team)

Dendro Group (Riccardo Cerrato, Anna Coppola, Giovanni Leonelli, Manuela Pelfini, Paolo Cherubini, Hans Linderholm, Goteborg Univ, Björn Gunnarson, Stockholm Univ,, Michele Brunetti, CNR Bologna)

I ghiacciai come indicatori delle modificazioni ambientali e climatiche
Ovvero: I GHIACCIAI ITALIANI SENTINELLE DEL CLIMA CHE CAMBIA

Pian di Neve, Adamello 1990

I ghiacciai sono sensibili indicatori climatici perchè variano le loro dimension in risposta alle variazioni del clima (principalmnte temperature estive e precipitazioni invernali; IPCC, 2013)

Careser Glacier 2003 (left)
and 2019 (right)
photo Luca Carturan

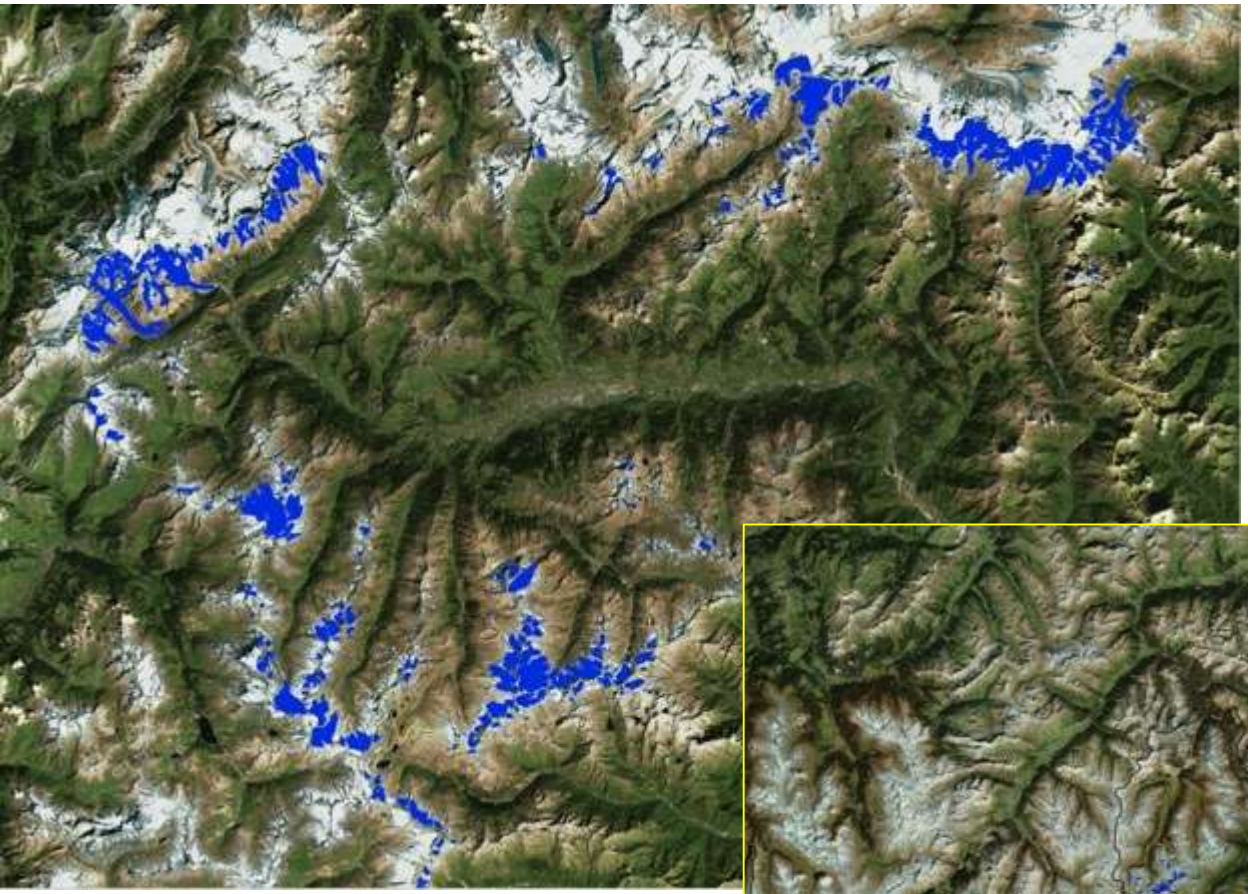
I Ghiacciai sentinelle del clima che cambia

Zemp, M.and 38 others(2019): **Glacier monitoring to track warming**. Nature, 576, p. 39.

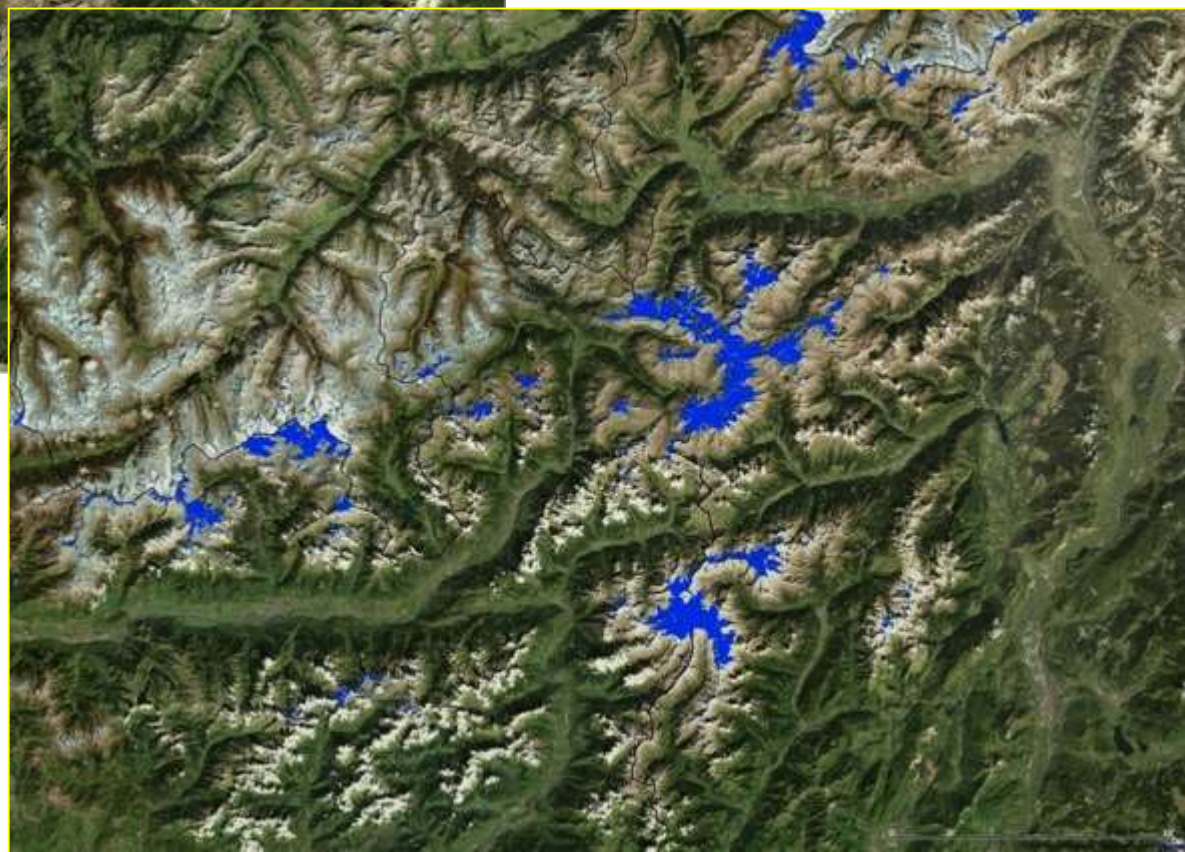
Madrid COP 25
United Nations Framework Convention on Climate Change

CIRSEC – Centro Interdipartimentale di Ricerca per lo Studio degli Effetti del Cambiamento Climatico
S5: Effects on geological processes – 6 Dic. 2019

I ghiacciai attuali…….dati quantitativi



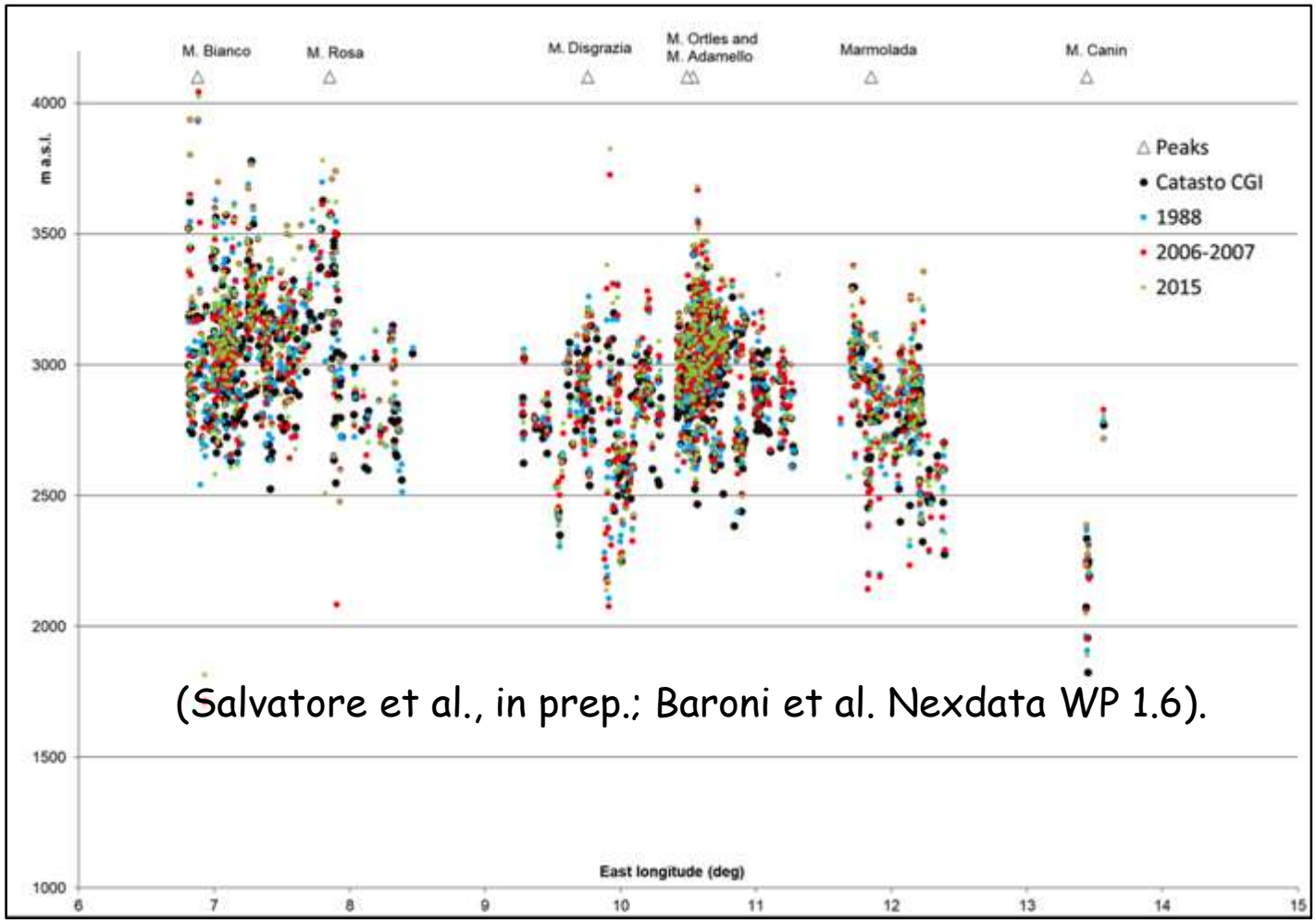
1988-89
2006-07
2014-15



Salvatore M.C., Zanoner T., Baroni C., Carton A., Banchieri F.A., Viani C., Giardino M. & Perotti l., 2015 - *The state of Italian glaciers: a snapshot of the 2006-2007 hydrological period*. Geografia Fisica e Dinamica Quaternaria, 38(2), 175-198
https://gfdq.glaciologia.it/038_2_07_2015
http://www.glaciologia.it/i-ghiacciai-italiani/
http://repo.igg.cnr.it/ghiacciaiCGI/ghiacciai_new.html

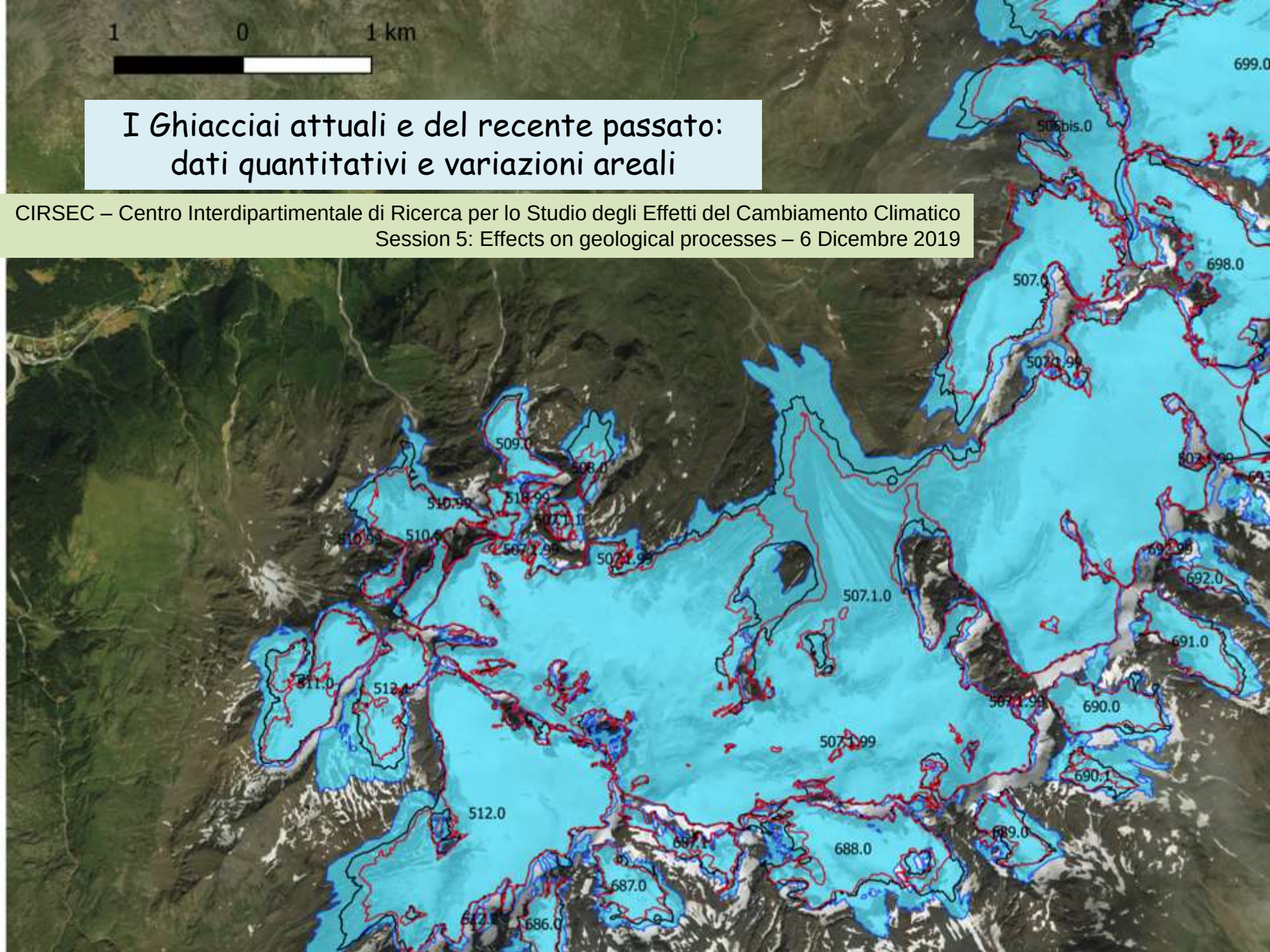
Ghiacciai delle Alpi Italiane: quota media

I Ghiacciai attuali e del recente passato: dati quantitativi



(Salvatore et al., in prep.; Baroni et al. Nexdata WP 1.6).

Altimetric distribution of mean elevation of Italian glaciers with respect to longitude in different time steps

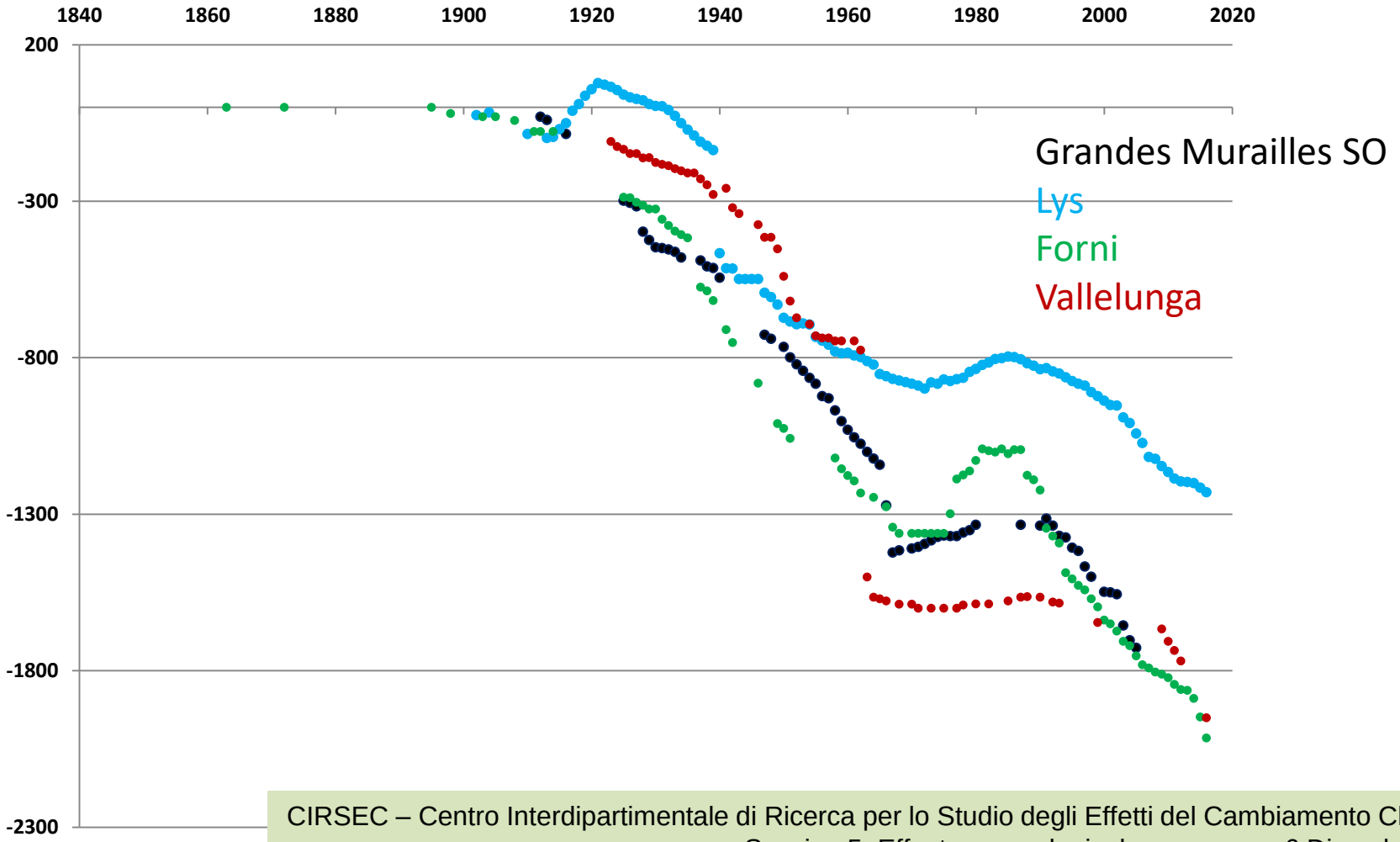


I Ghiacciai attuali e del recente passato: dati quantitativi e variazioni areali

CIRSEC – Centro Interdipartimentale di Ricerca per lo Studio degli Effetti del Cambiamento Climatico

Session 5: Effects on geological processes – 6 Dicembre 2019

	Max frontal retreat (in m)	Time interval	Glacier_name
Western Alps	-1726.5	(1912) 1925 – 2005	260.0 Ghiacciaio des Grandes Murailles SO
	-1229.4	1902 – 2016	304.0 Ghiacciaio del Lys
Central Alps	-2014.85	1895 – 2016	507.1 Ghiacciaio dei Forni
Eastern Alps	-1965.2	1899 - 2016	777.0 Vedretta di Vallelunga

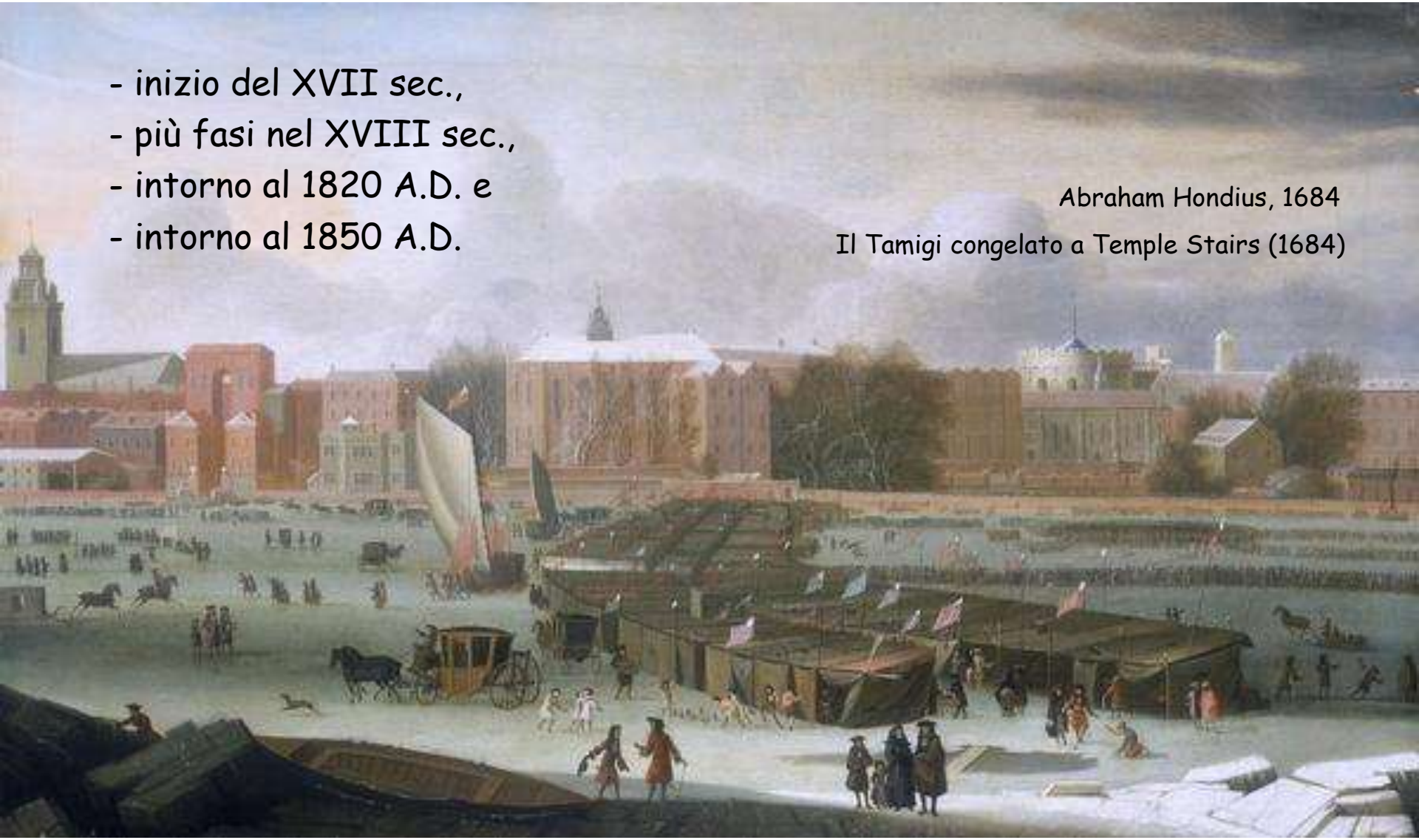


Il presente come chiave di interpretazione del passato
Strumenti e metodi:
geomorfologia e geologia glaciale per datazione fasi e ricostruzione ELA del passato

E' noto che i ghiacciai hanno modificato forma ed estensione abbandonando depositi ai margini delle lingue o presso le fronti e lasciando tracce del proprio stazionamento a varie quote, comprese le zone di accumulo.

Piccola Età Glaciale (XV -XIX Sec. Max ~1850)

- inizio del XVII sec.,
- più fasi nel XVIII sec.,
- intorno al 1820 A.D. e
- intorno al 1850 A.D.

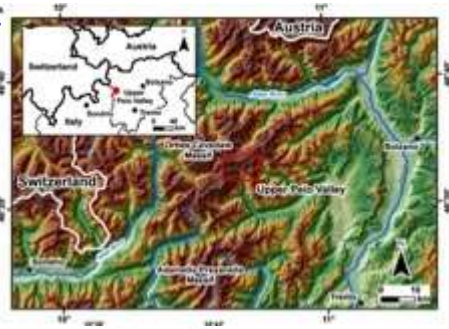


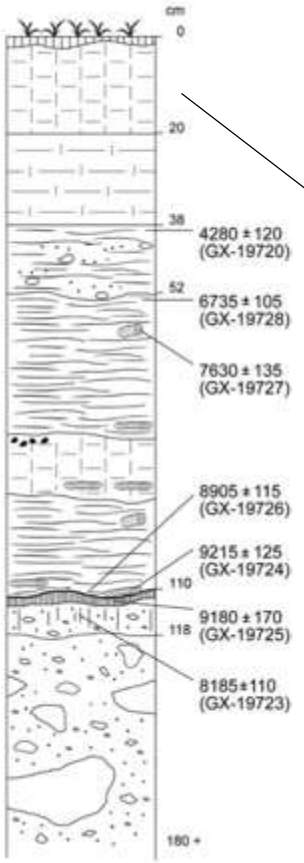
Abraham Hondius, 1684

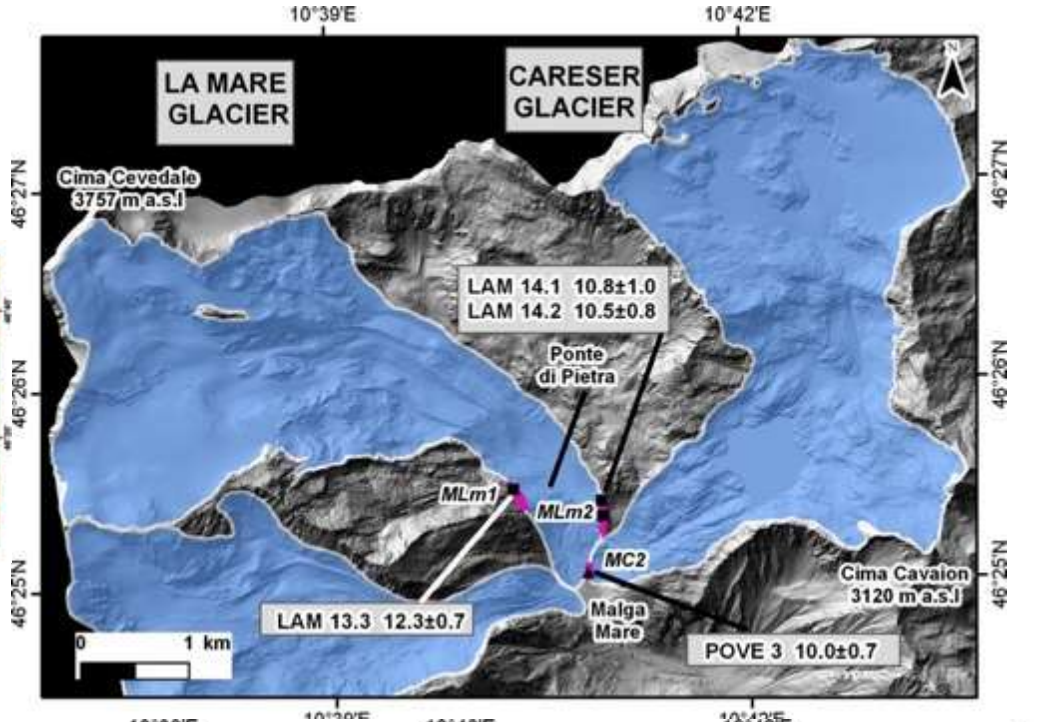
Il Tamigi congelato a Temple Stairs (1684)

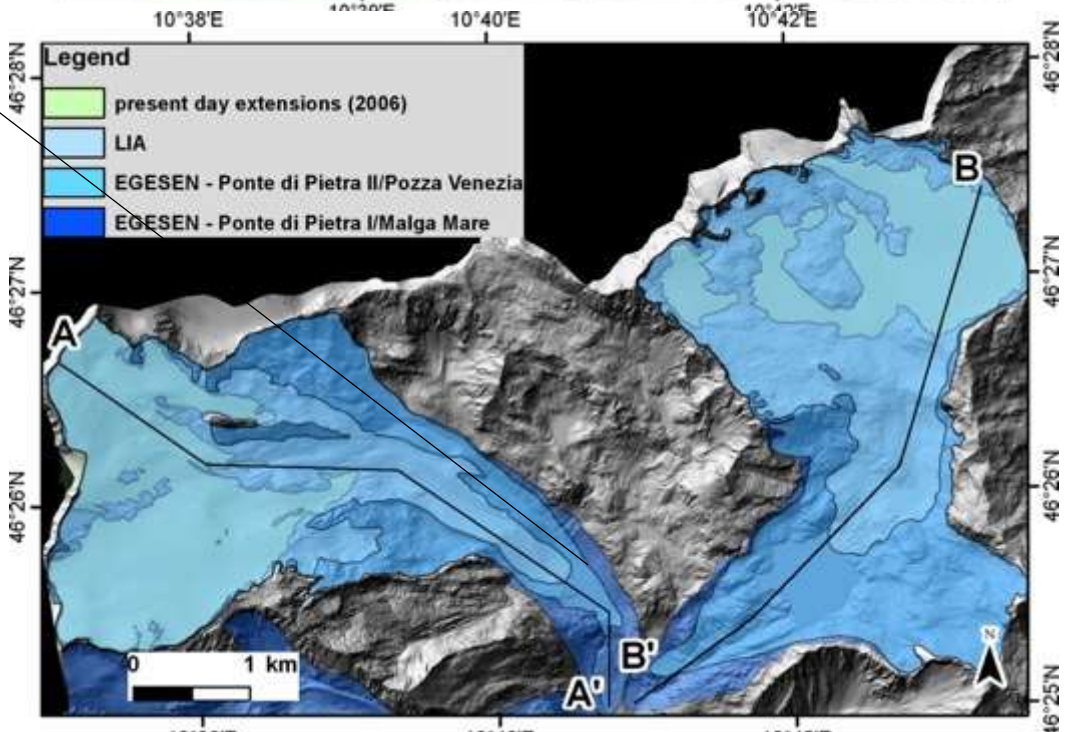
Lunghi e rigidi inverni - Avanzata vigorosa dei ghiacciai

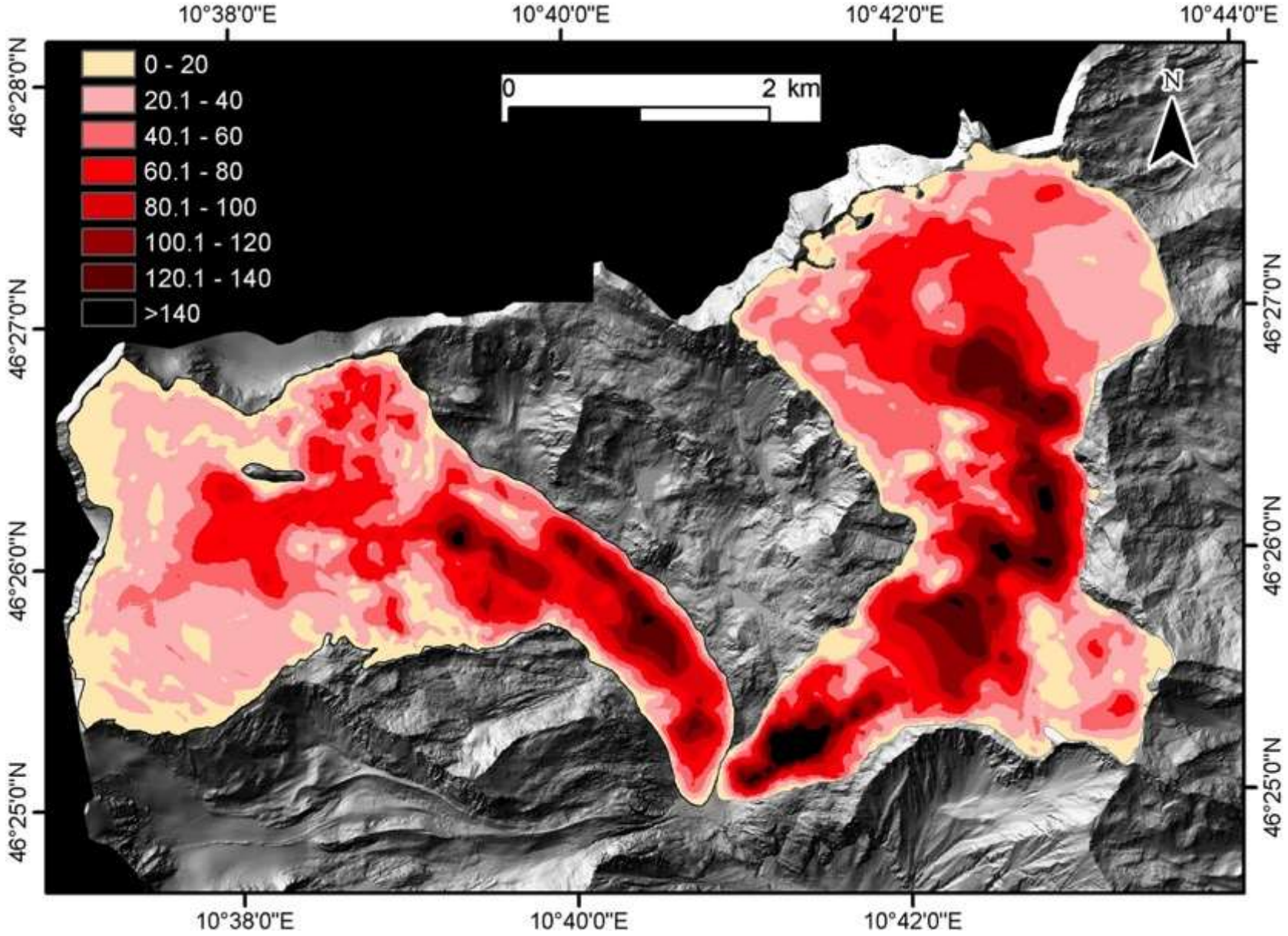
Baroni C., Casale S., Salvatore M.C., Ivy-Ochs S., Christl M., Carturan L., Seppi R. & Carton A. (2017) - Double response of glaciers in the Upper Peio Valley (Rhaetian Alps, Italy) to the Younger Dryas climatic deterioration. Boreas, 46(4), 783-798 doi.org/10.1111/bor.12284







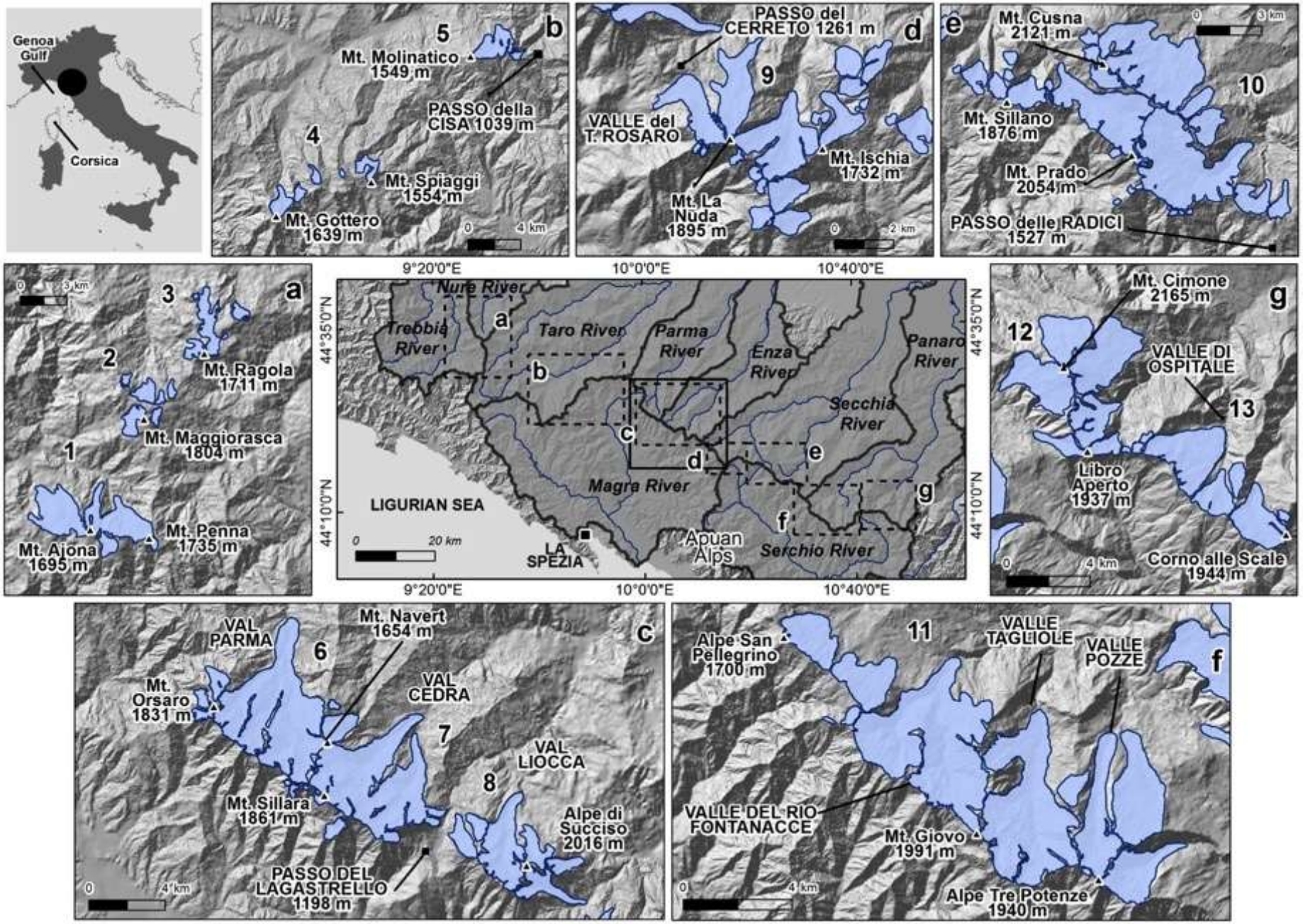




Egesen vs. 2006 -Riduzione di spessore (in m)

Baroni et al., 2017. Boreas, 46 (4).

Baroni C., Guidobaldi G., Salvatore M.C., Christl M. & Ivy-Och, S. (2018) - Last glacial maximum glaciers in the Northern Apennines reflect primarily the influence of southerly storm-tracks in the western Mediterranean. Quaternary Science Reviews, 197, 352-367. doi: 10.1016/j.quascirev.2018.07.003



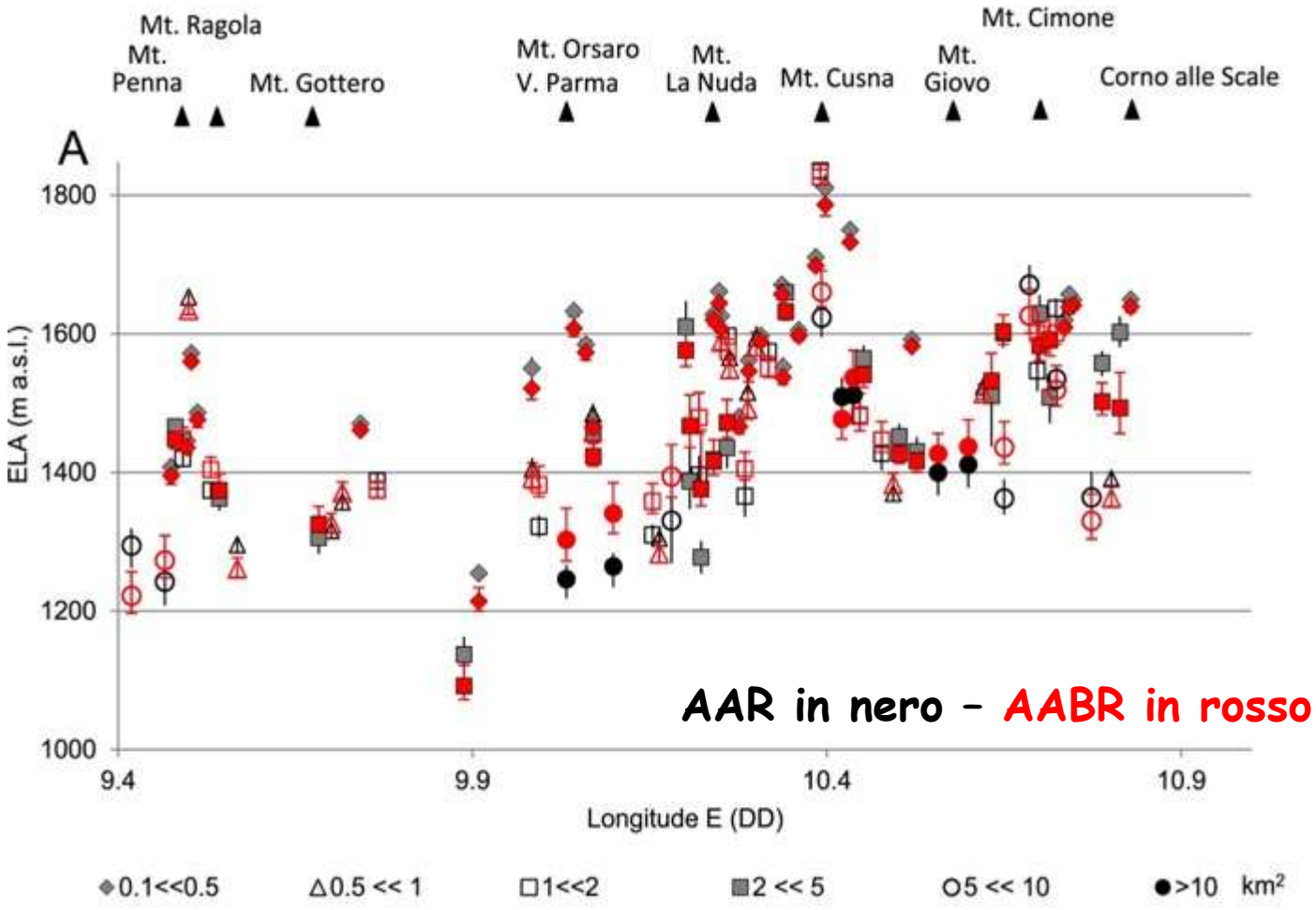
Equilibrium Line Altitude (ELA) LLGM

distinta per classi dimensionali rispetto alla longitudine

Minimum values: Ligurian Apennines, Val Parma, Val Cedra – elevations between 1170 m a.s.l. and 1250 m a.s.l.

Small glaciers (<0.1 to 2 km²): wide elevation range, between (1250 to 1900 m a.s.l., mean value 1540 m a.s.l.)

Big glaciers (>2 to >10 km²): elevation range between 1170 and 1670 m a.s.l. (mean of 1440 m a.s.l.).



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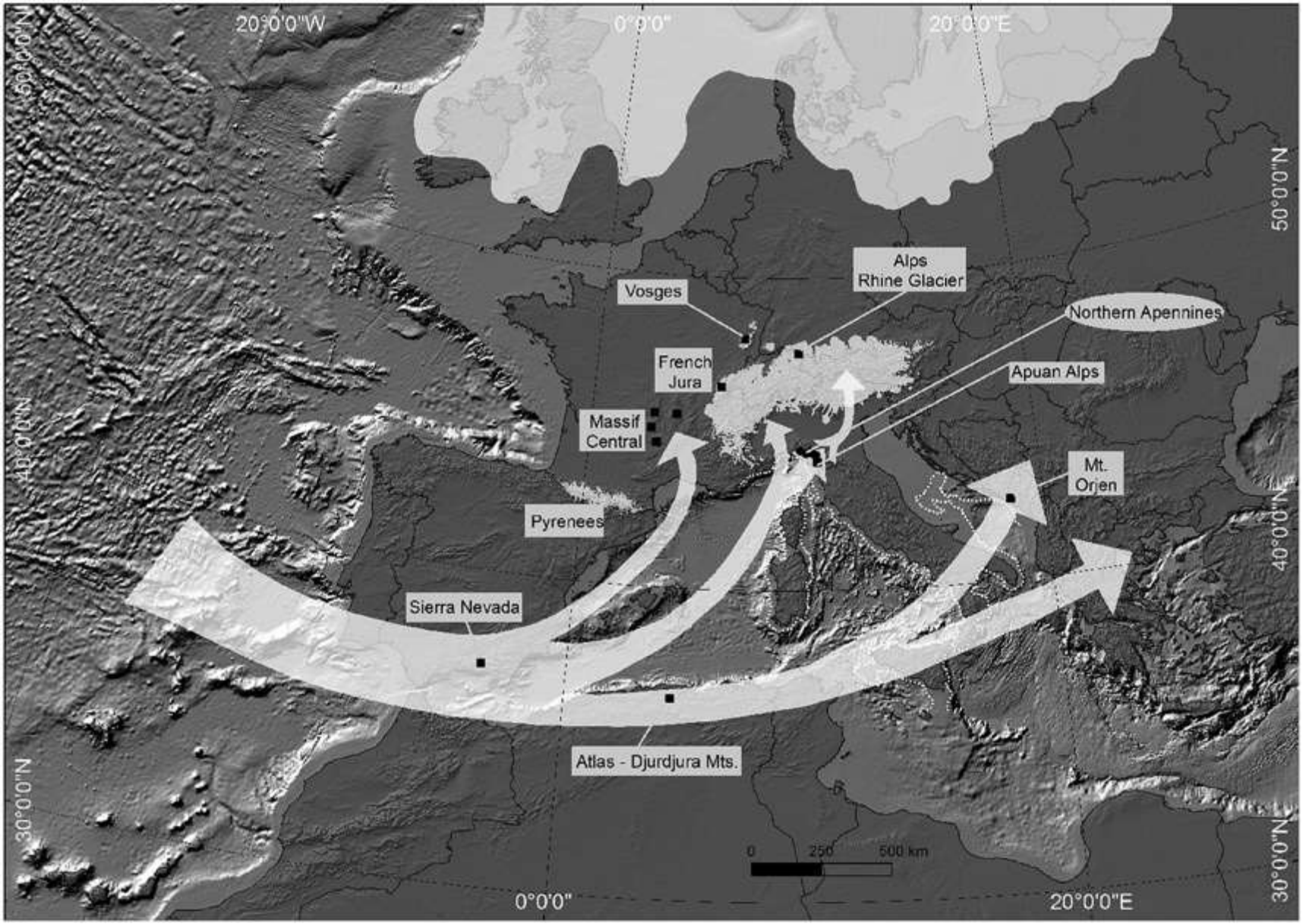
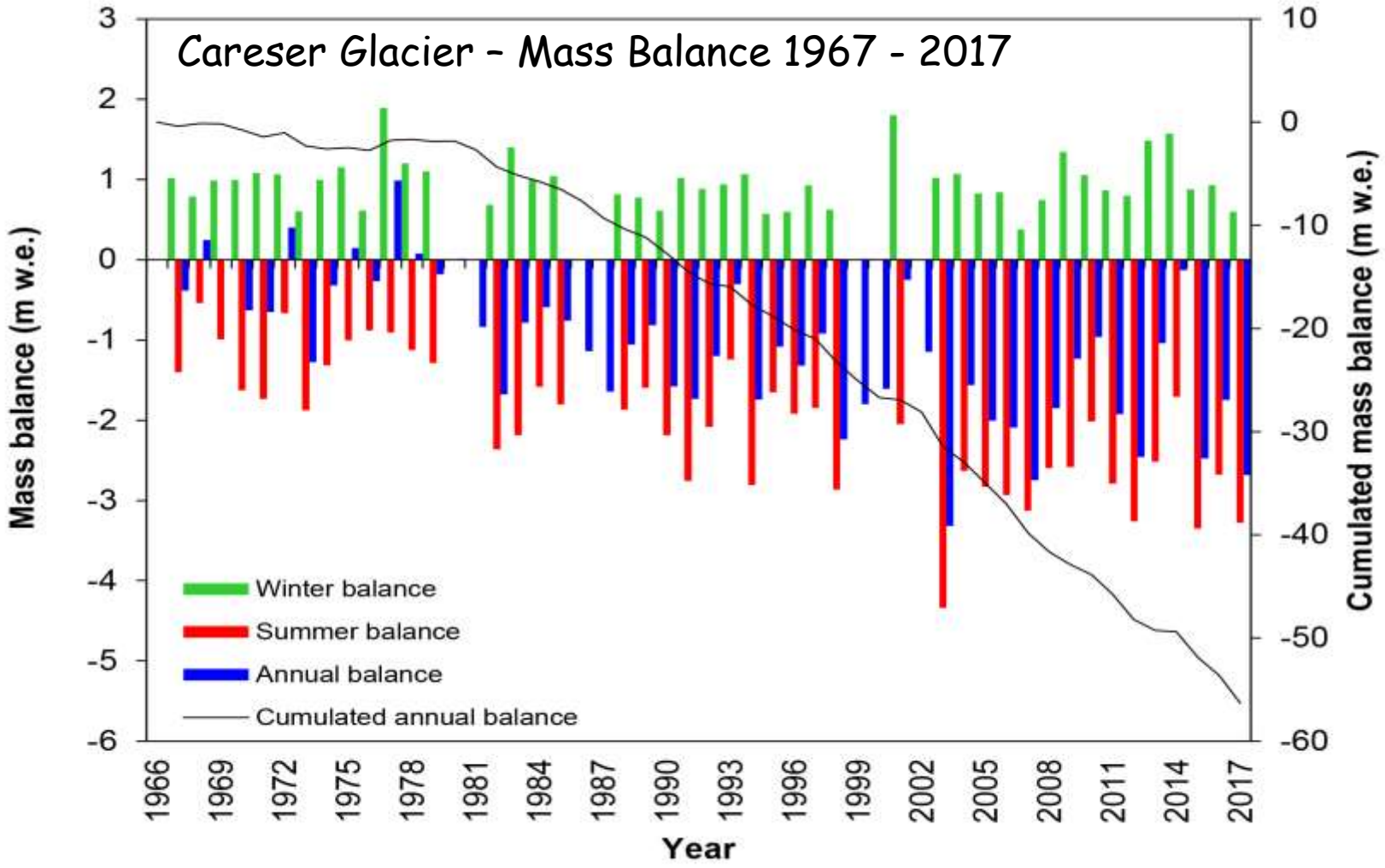
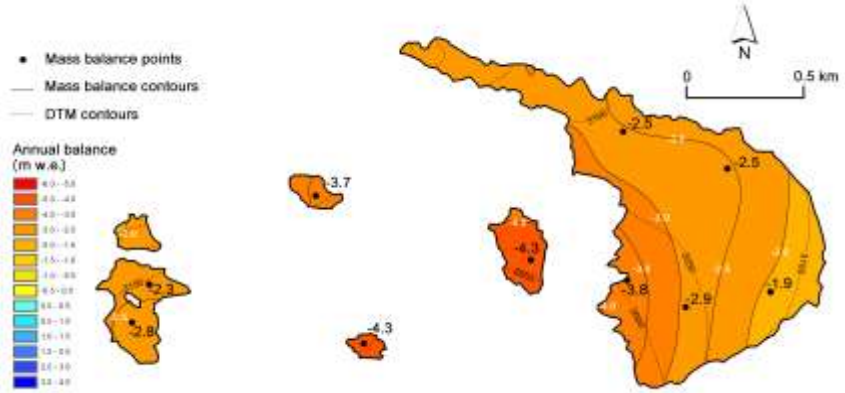


Photographic comparison of the Careser glacier in August 1933 (above, courtesy of Comitato Glaciologico Italiano) and on 28 August 2012 (below, photo L. Carturan).

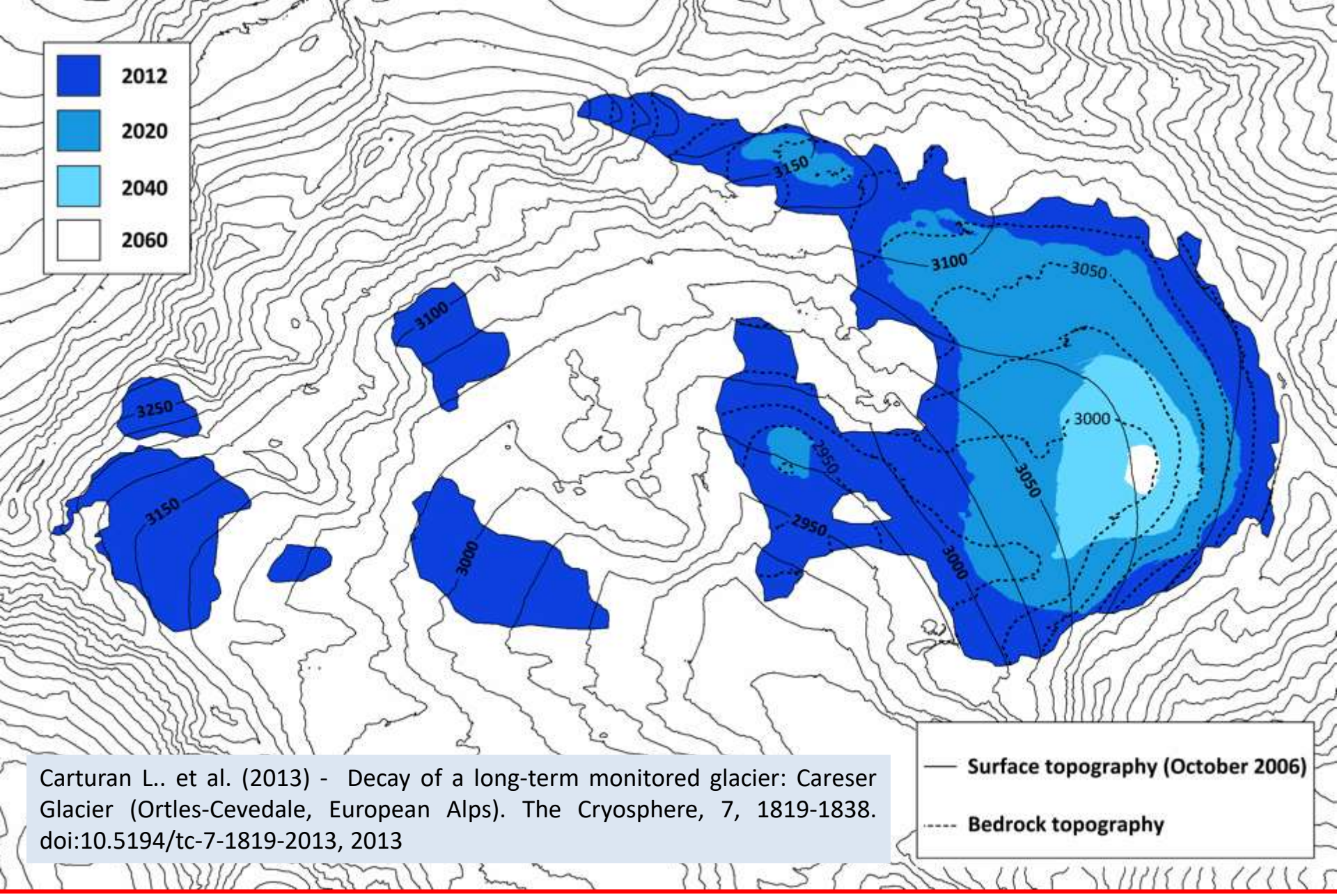
Scenari futuri:
Decay of glaciers in the Alps

Carturan et al., 2014





Baroni C., Bondesan, A., Carturan L. & Chiarle, M. (2018) - Report of the glaciological survey 2017. Relazioni della campagna glaciologica 2017. Geografia Fisica e Dinamica Quaternaria, 41 (2), 115-193. doi: 10.4461/GFDQ.2018.41.70



Carturan L.. et al. (2013) - Decay of a long-term monitored glacier: Careser Glacier (Ortles-Cevedale, European Alps). The Cryosphere, 7, 1819-1838. doi:10.5194/tc-7-1819-2013, 2013

Current (2012) and future extent of the Careser Gl., assuming unchanged spatial distribution of the mean annual mass balance compared to the decade from 2003-2012

Grazie per l'attenzione