Glaciers and climate change – situation scenarios impacts

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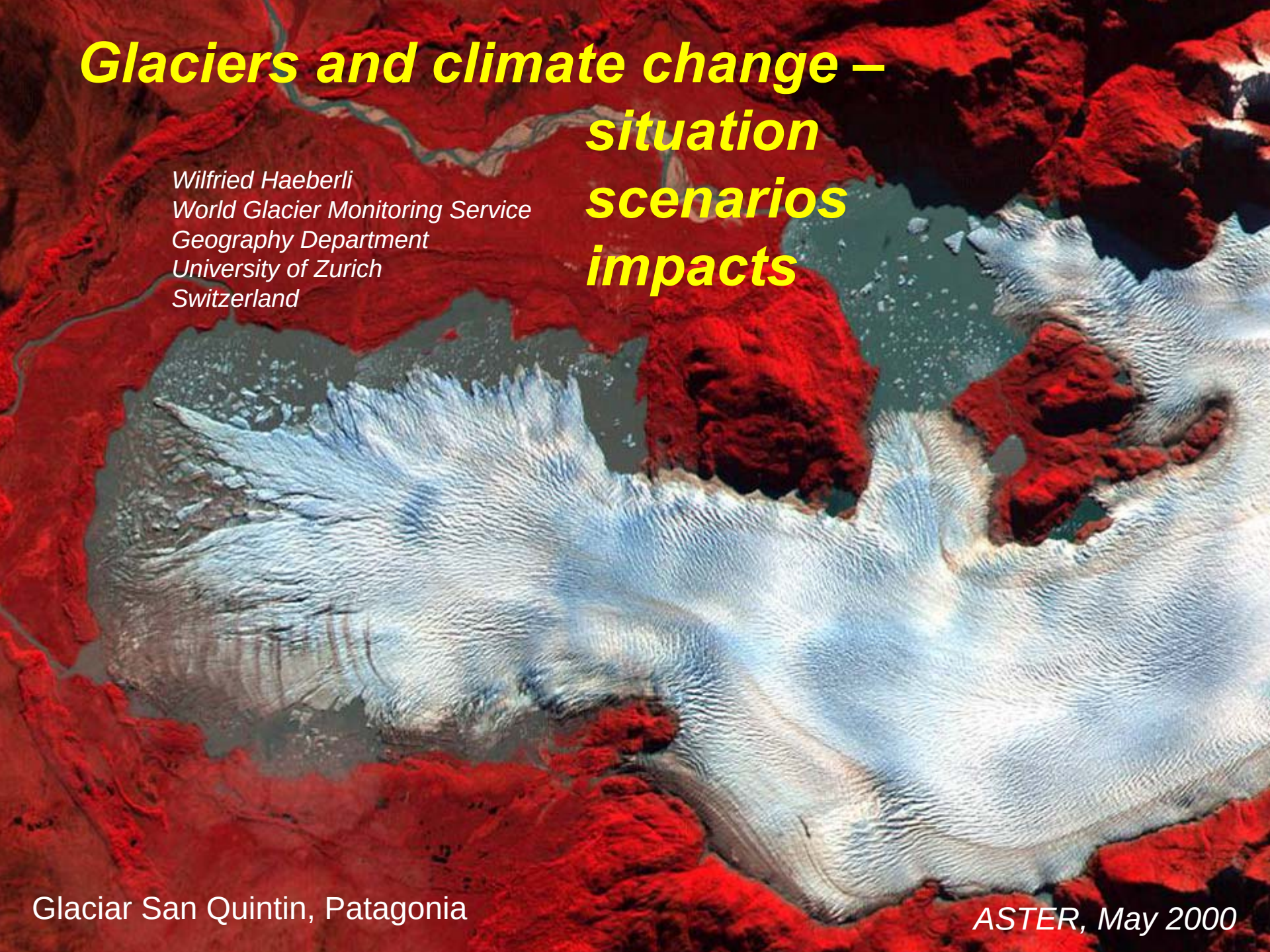

Glaciar San Quintin, Patagonia

ASTER, May 2000

Global Glacier Changes: facts and figures

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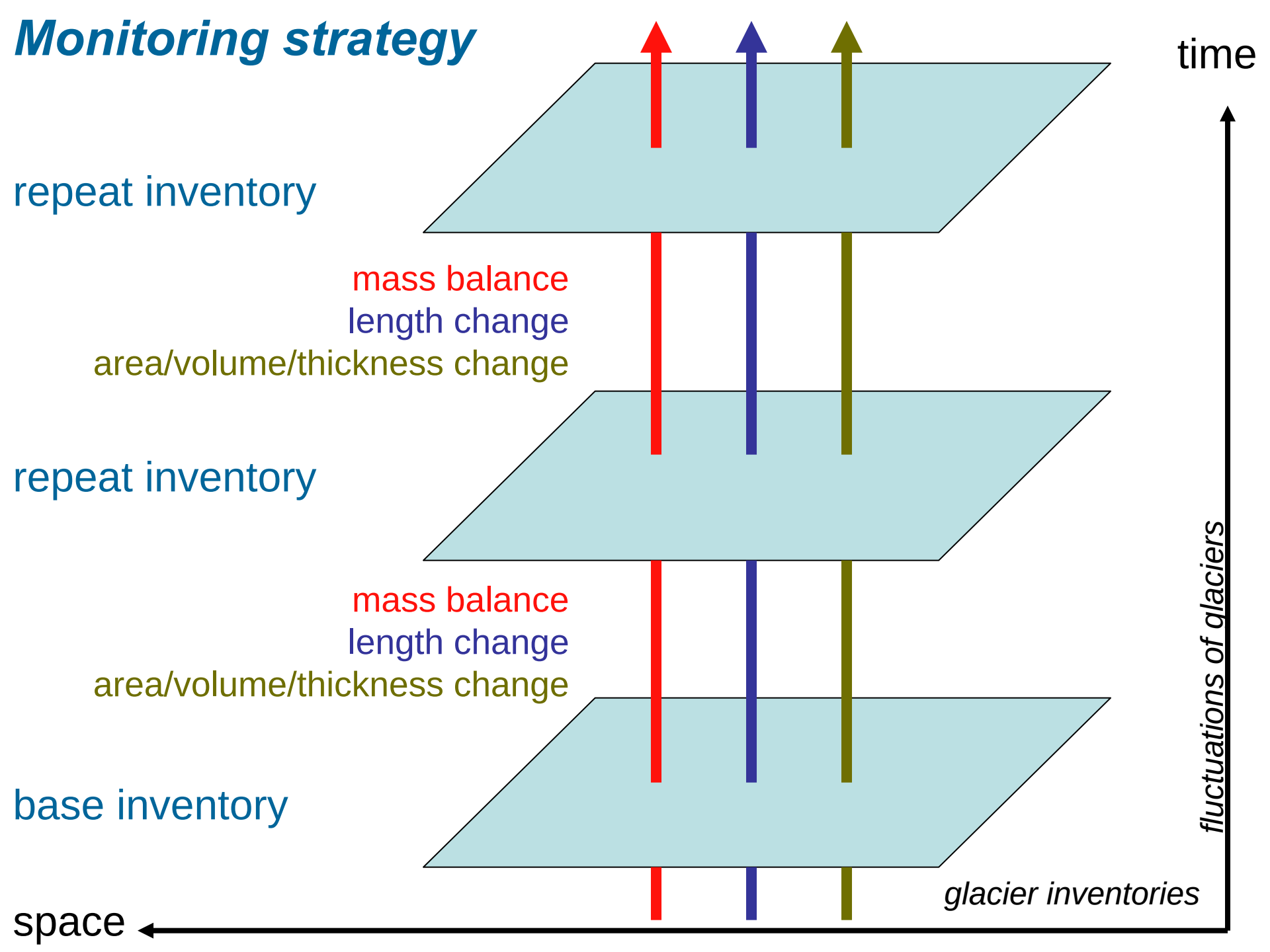
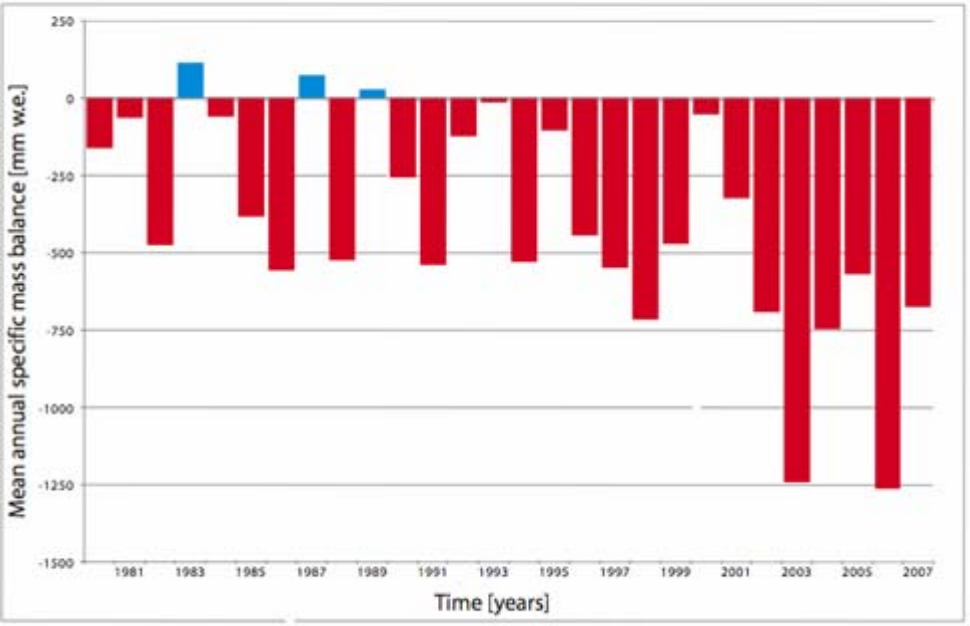
wgms

UNEP

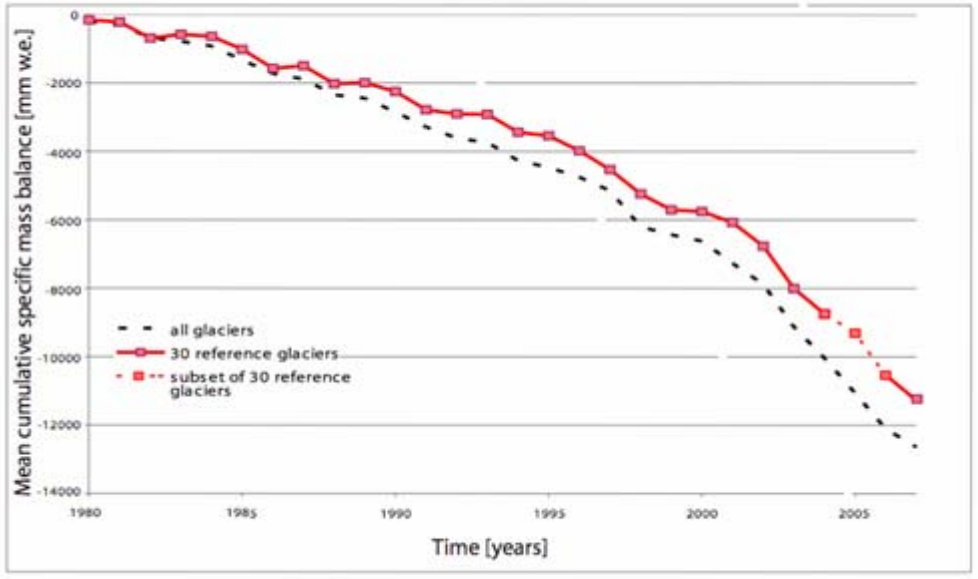
Monitoring strategy

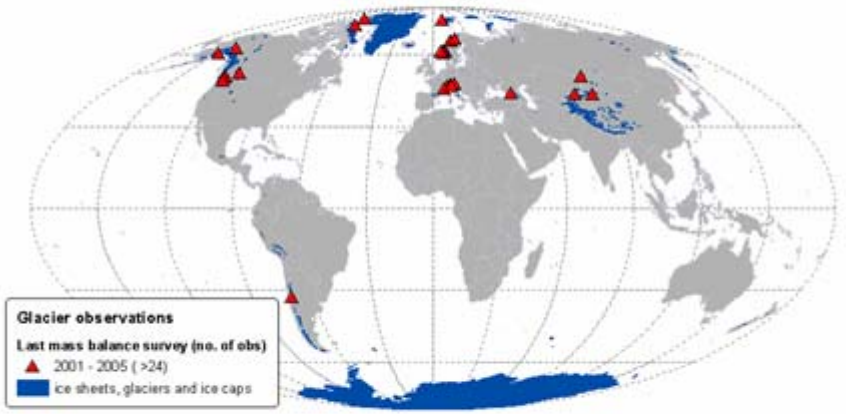


Mass balance



WGMS





UNEP press release 16.03.2008:

- new record loss: - 1.4 m w.e.
- only 1 positive balance (Echaurren)
- average loss rate 1980-1999 doubled since 2000
- previous record (1998) exceeded in 2003, 2004, 2006

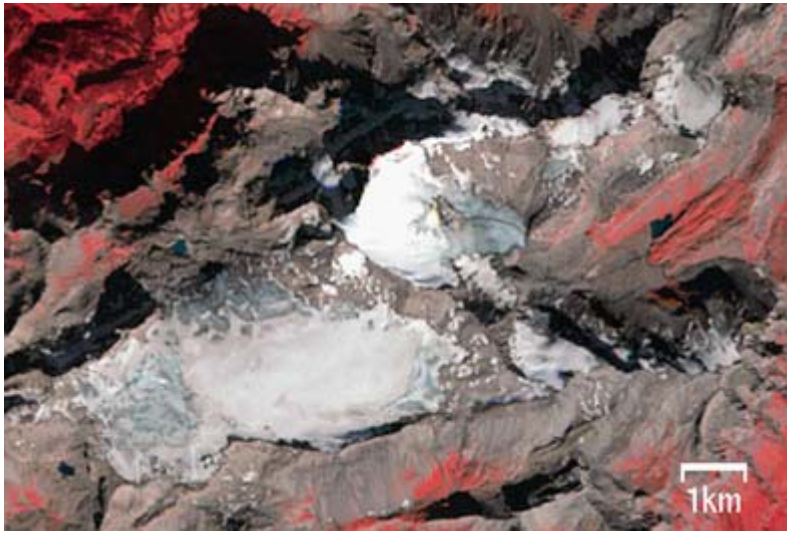
Albedo change

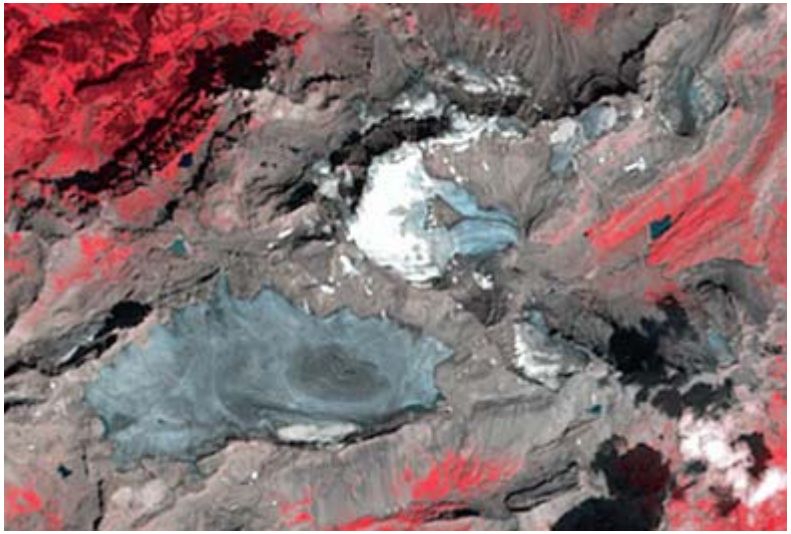
1985

Plaine Morte - Wildstrubel

2003

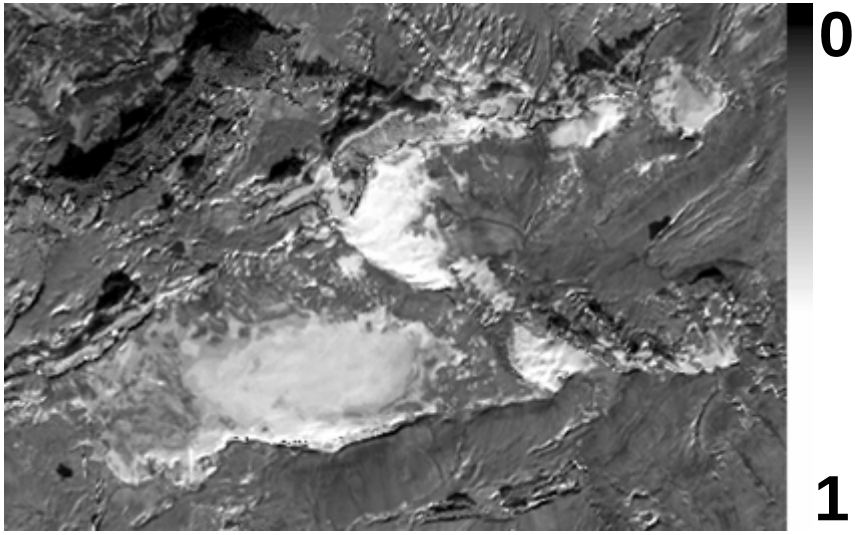
false colour

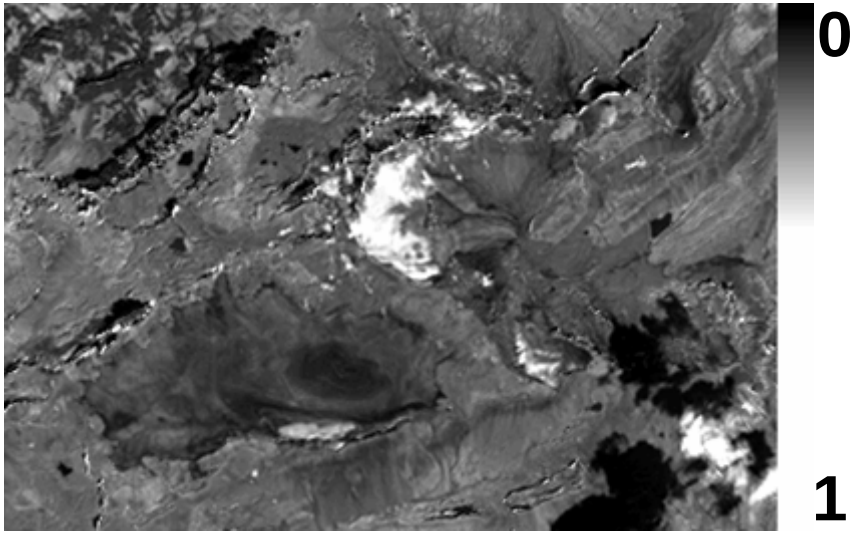




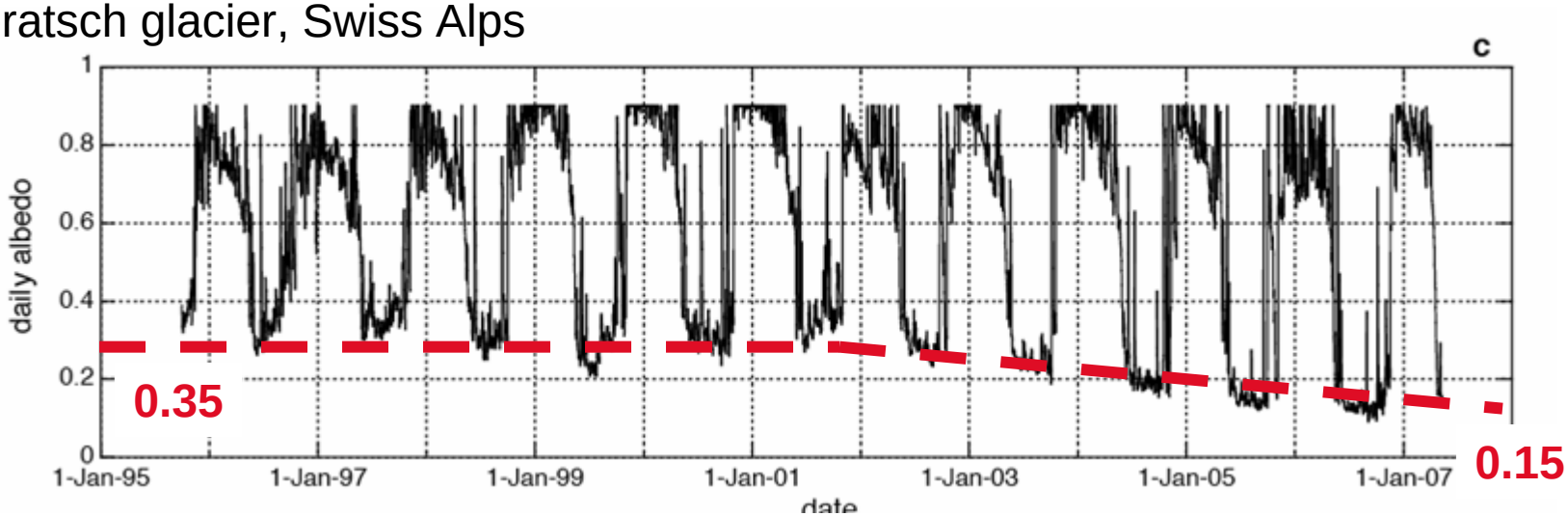
Paul

albedo



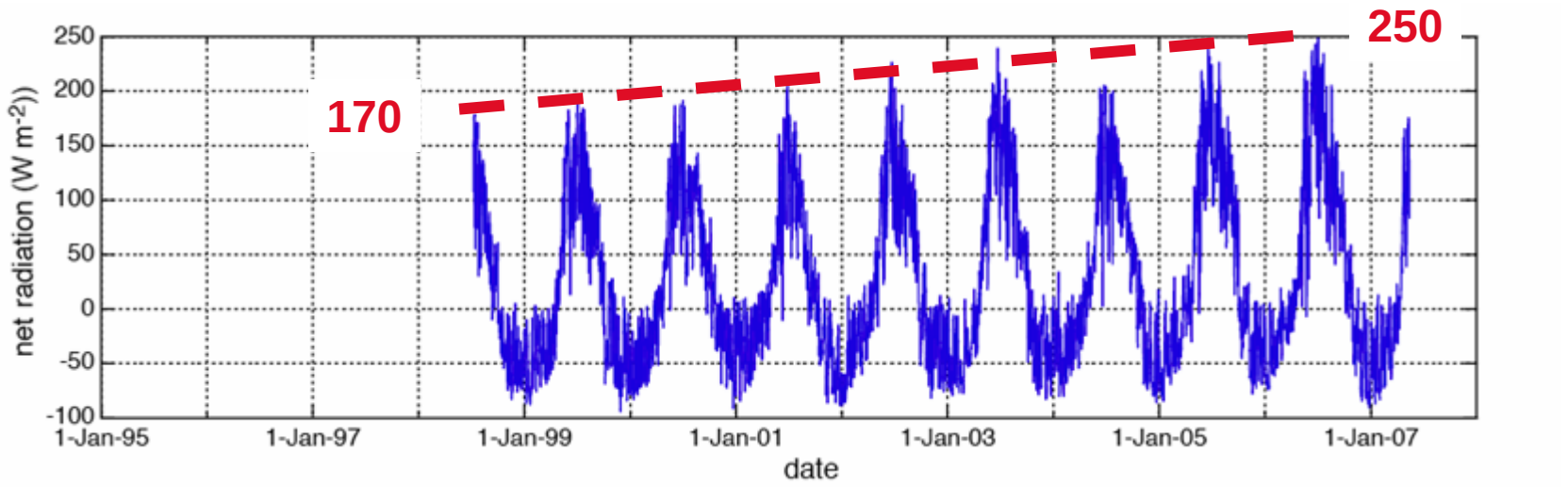


Morteratsch glacier, Swiss Alps

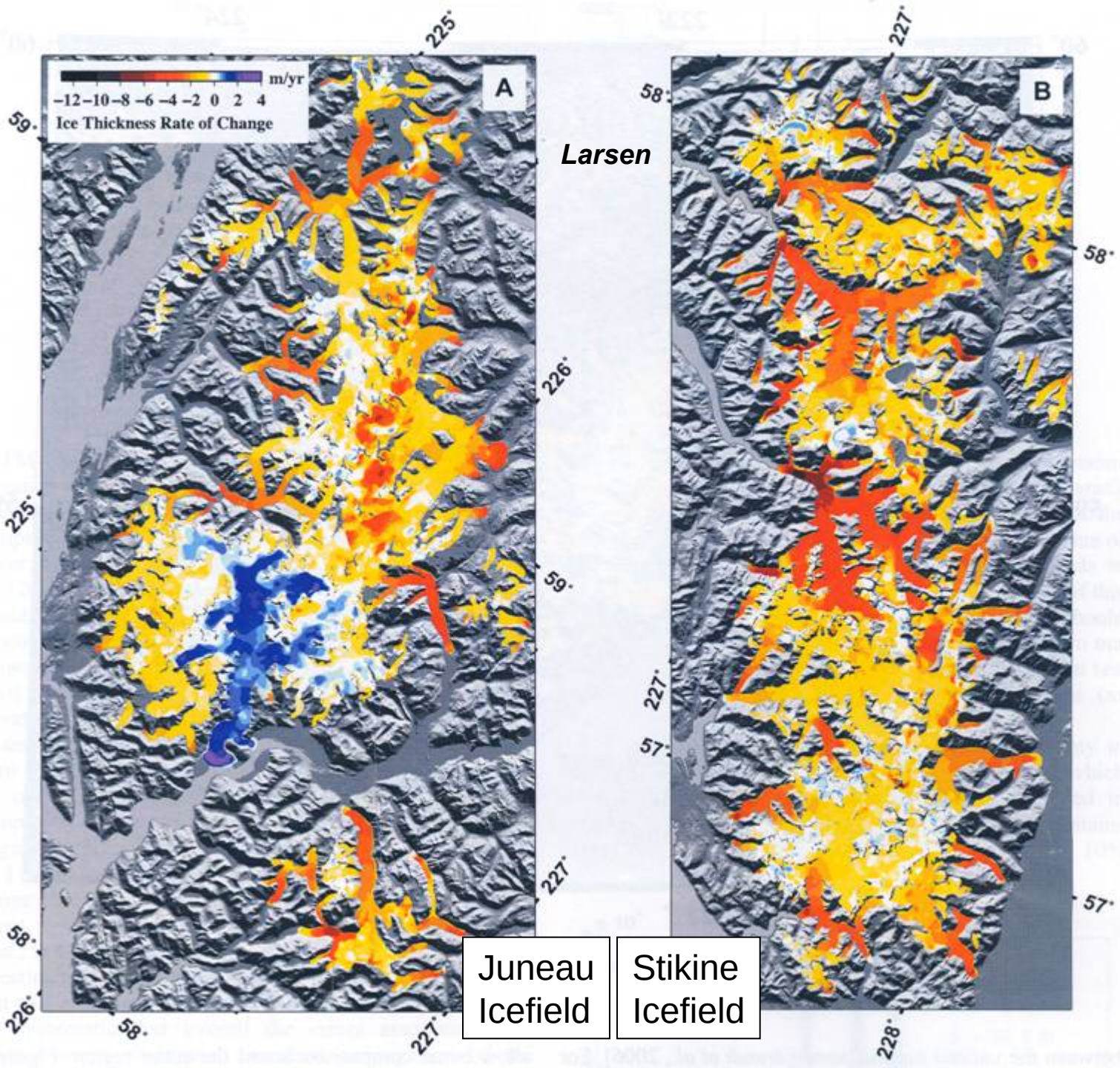


Albedo change

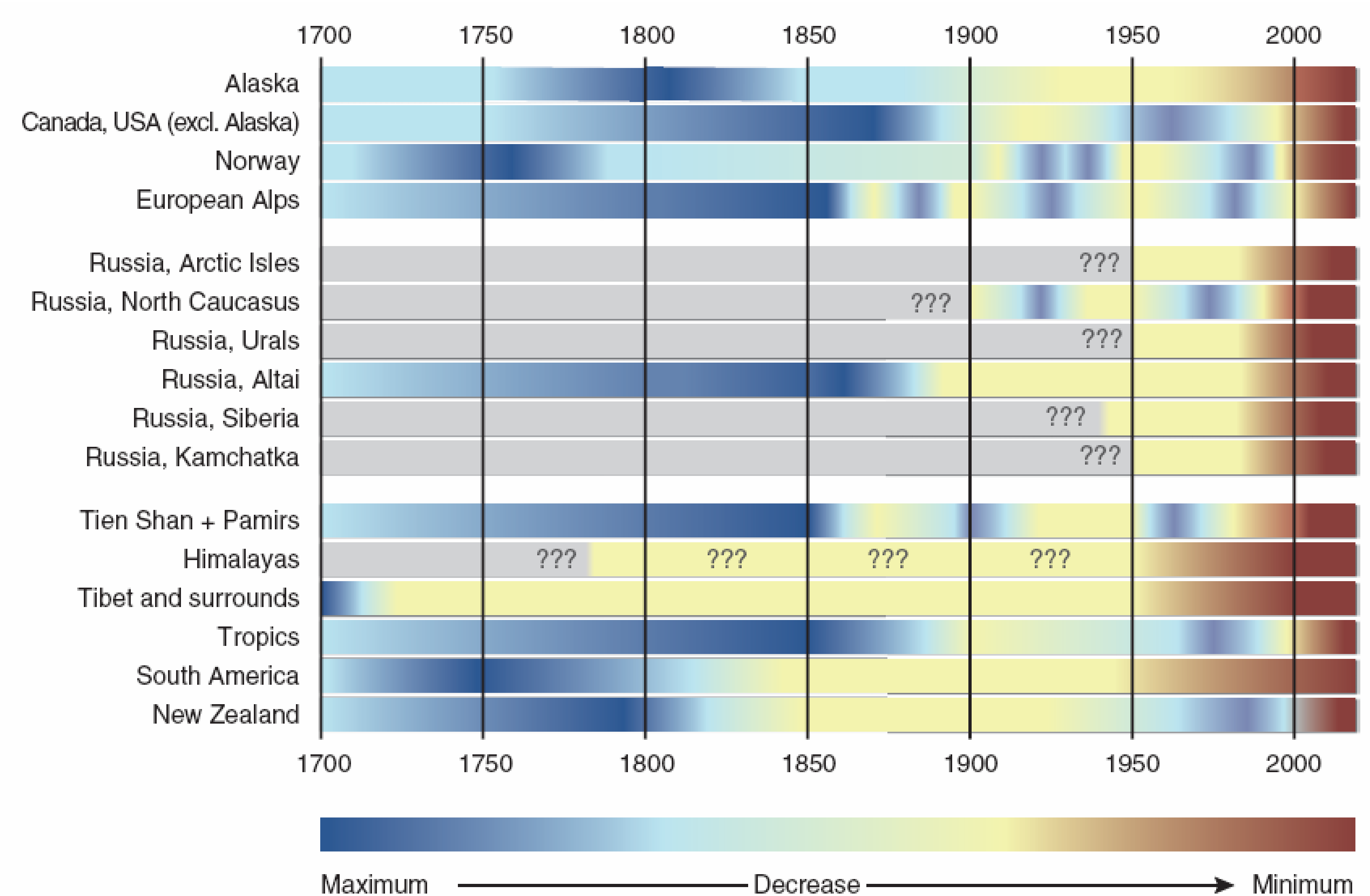
Oerlemans



Δ DEM


m/yr
−12 −10 −8 −6 −4 −2 0 2 4
Ice Thickness Rate of Change
A
B
Larsen
Juneau Icefield
Stikine Icefield

□□□□□□□□□□□□□□□□□□□□ *(advance/retreat)*



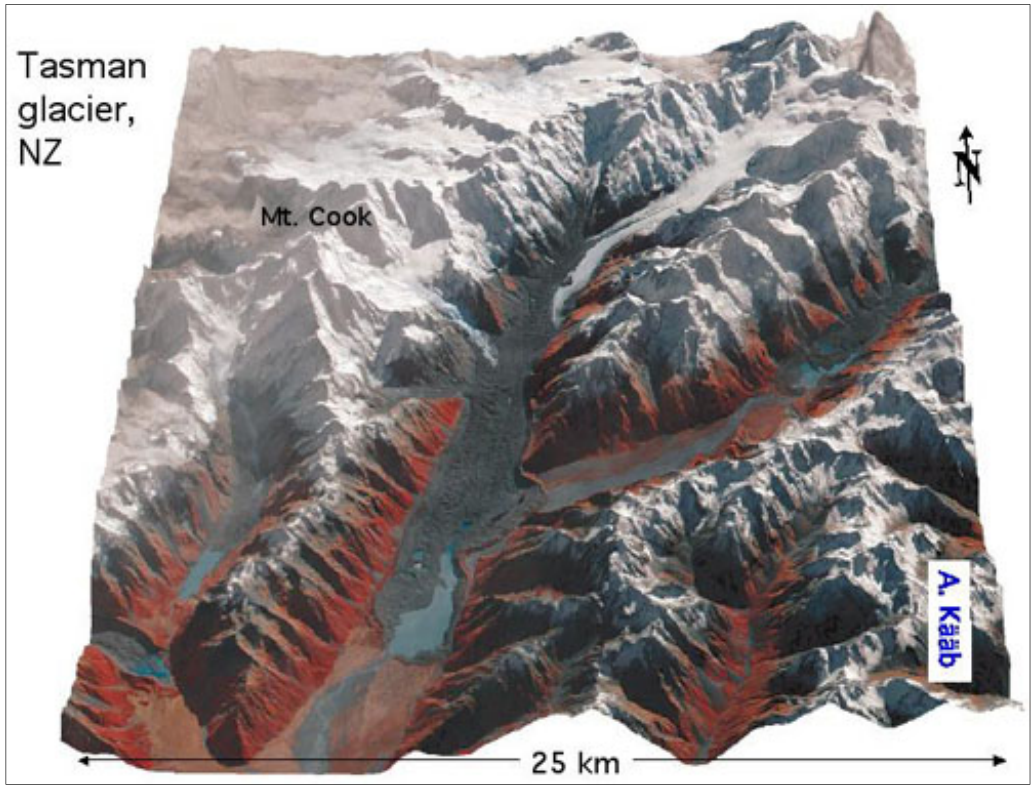
WGMS/UNEP

Alean

extraordinary

□□□□/□□□□□

caves



Glacier inventories satellite observations

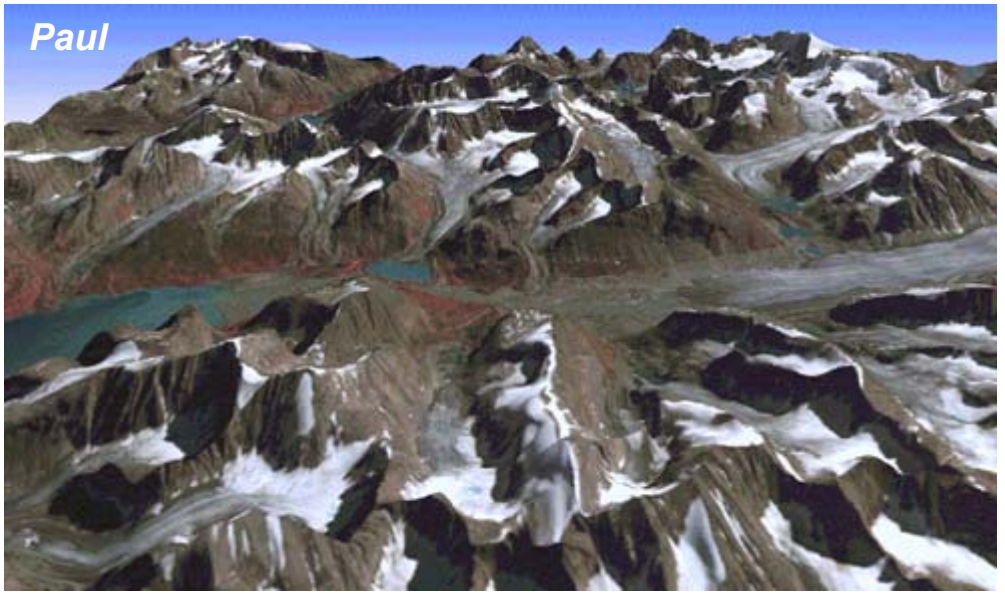
GlobGlacier

European Space Agency (ESA)

GLIMS

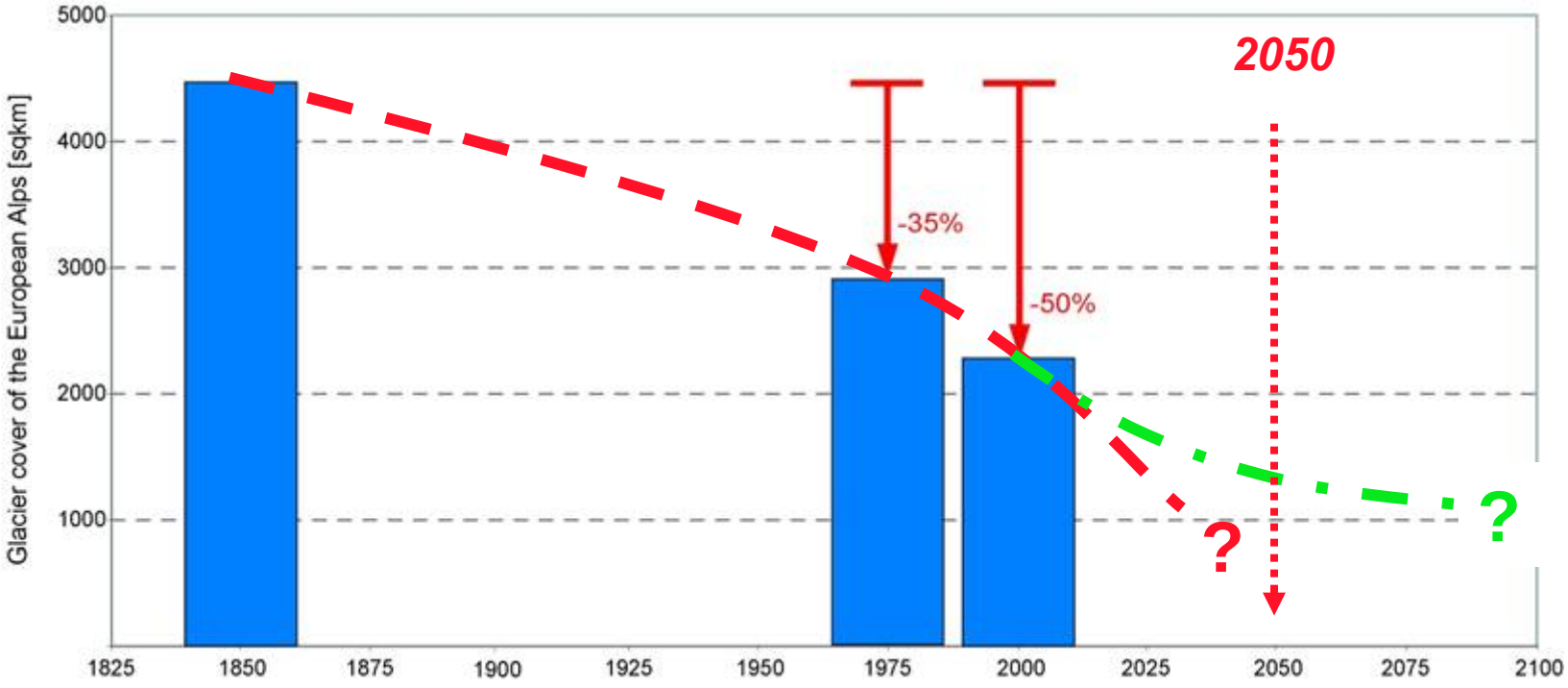
Global Land Ice

Measurement from Space



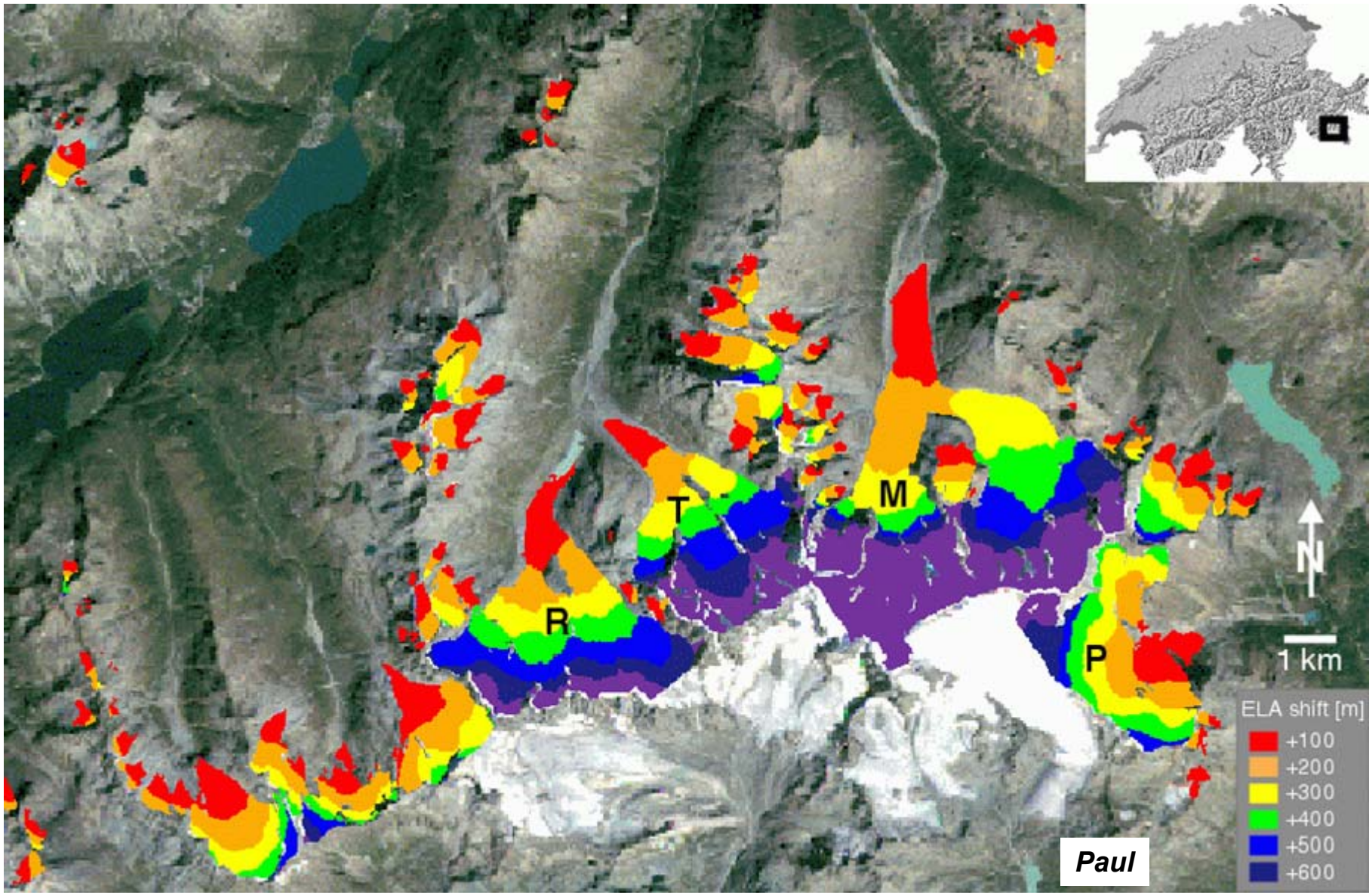
Baffin Island

European Alps: evolution of glacier area/volume

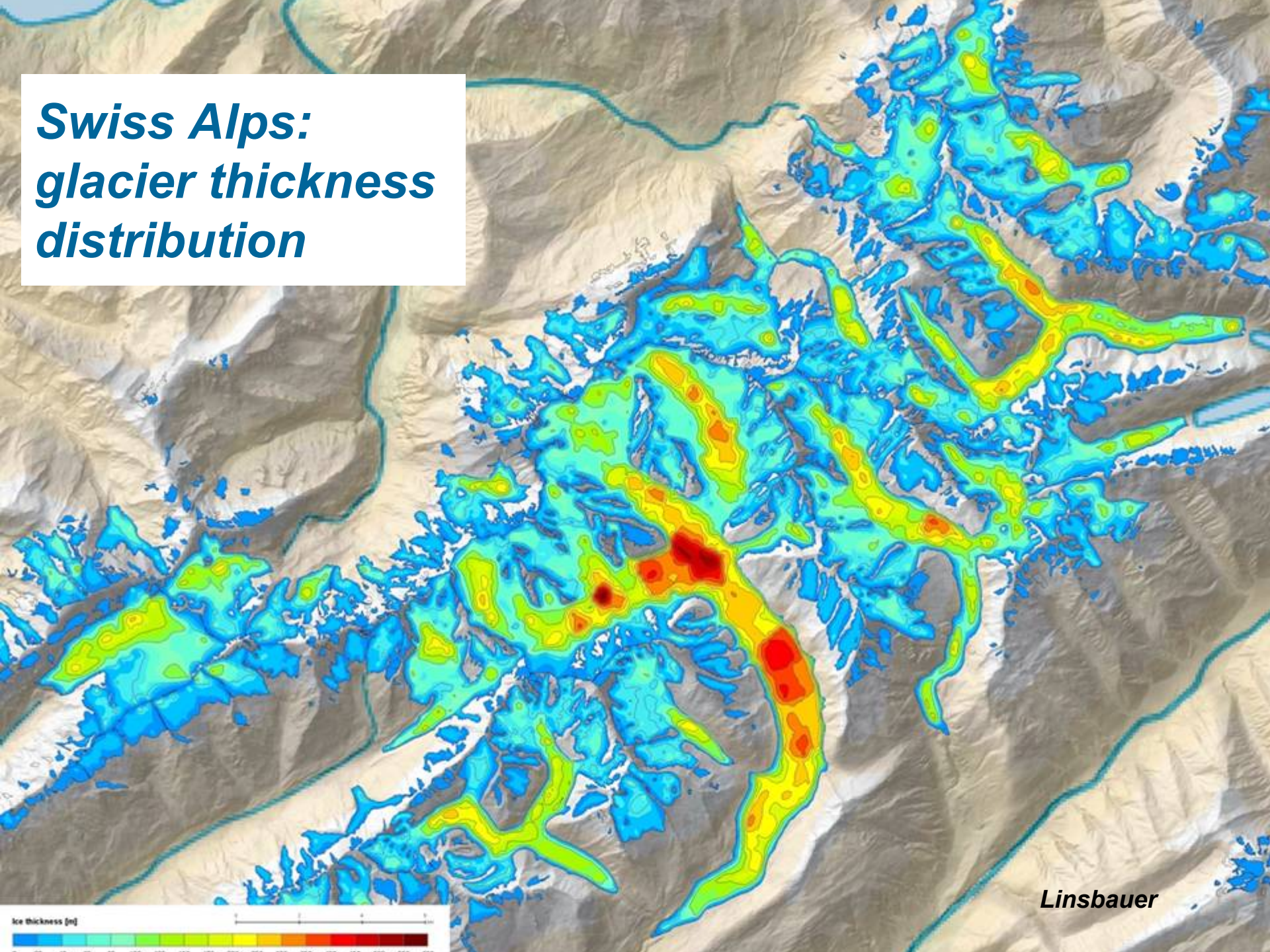


mean annual volume loss:	1850 - 1975:	0.5%	total ca. 50%
	1975 - 2000:	1%	total ca. 25%
	since 2000:	2 - 3%	total ca. 20%
	2003 alone:		ca. 8%

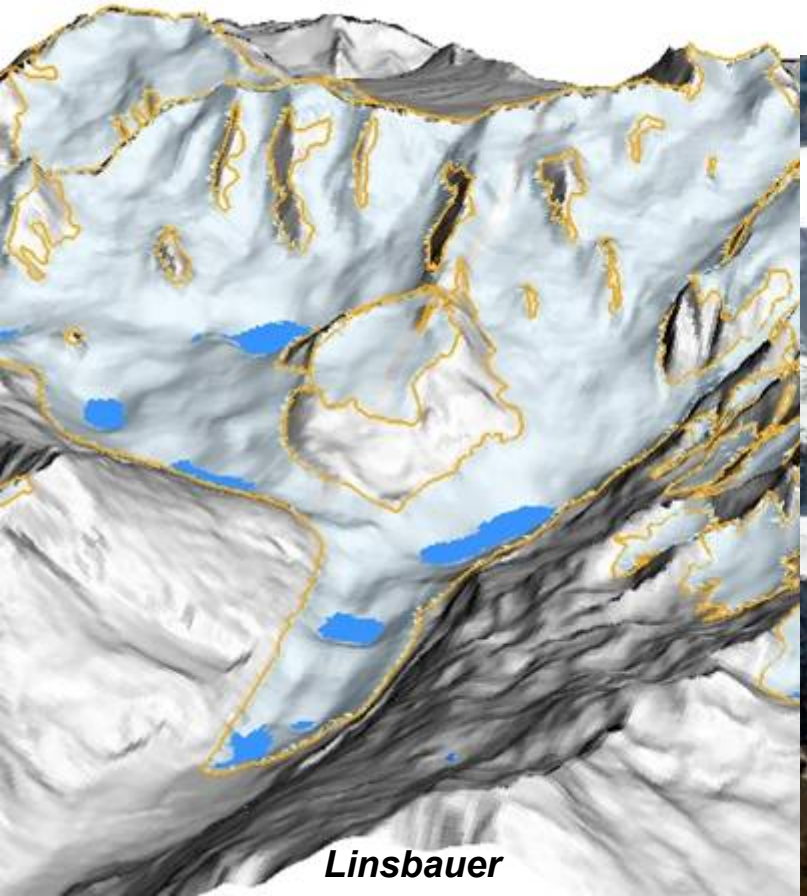
European Alps: glacier retreat scenarios



Swiss Alps: glacier thickness distribution



Swiss/European Alps:
DEM without glaciers, new lakes




vanishing glaciers -
new lakes:
tourist attraction
hydropower potential
hazard source
conflict area
???

Swiss/European Alps: questions about new lakes

- where and when will the new lakes form?
- what will there characteristics (area, depth, damming) be?
- what hazards can occur to and from the lakes?

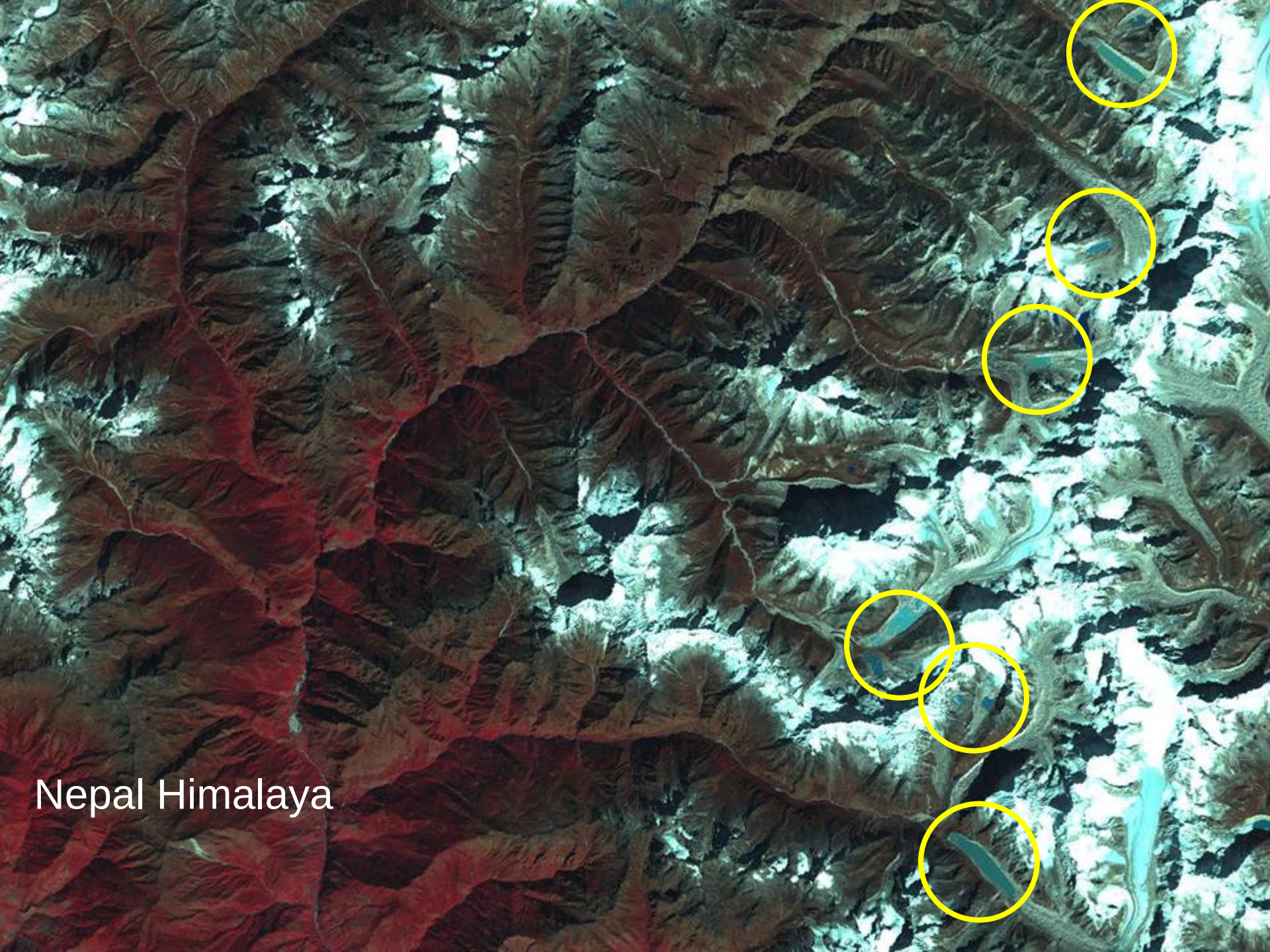
- can the new lakes enhance the hydropower potential?
- how will they influence reservoir sedimentation?
- what are their impacts on operation and safety of hydropower schemes?
- can innovative multipurpose projects take advantage of the new lakes?

- what is the influence of new lakes on landscape attractiveness?
- what are the costs for flood protection and ecological river regulation?
- is there profit for tourism and the regional economy from technical improvements?
- what is the impact of new lakes and hydropower schemes on tourist activity?

- *who owns the new lakes?*
- *who is responsible for them?*
- *what interests and conflicts could develop with respect to the new lakes?*

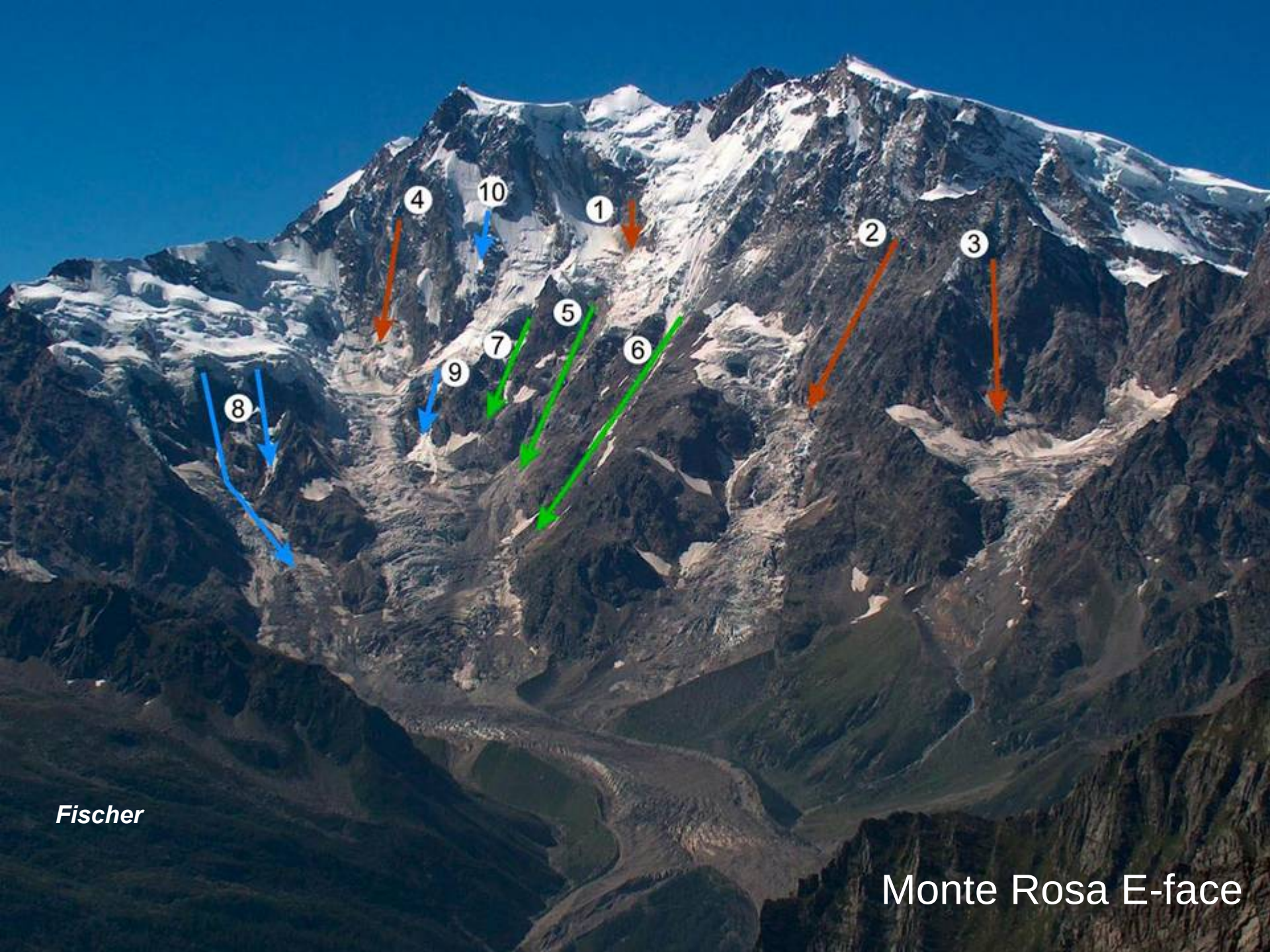
Milhuacocha

Hegglin

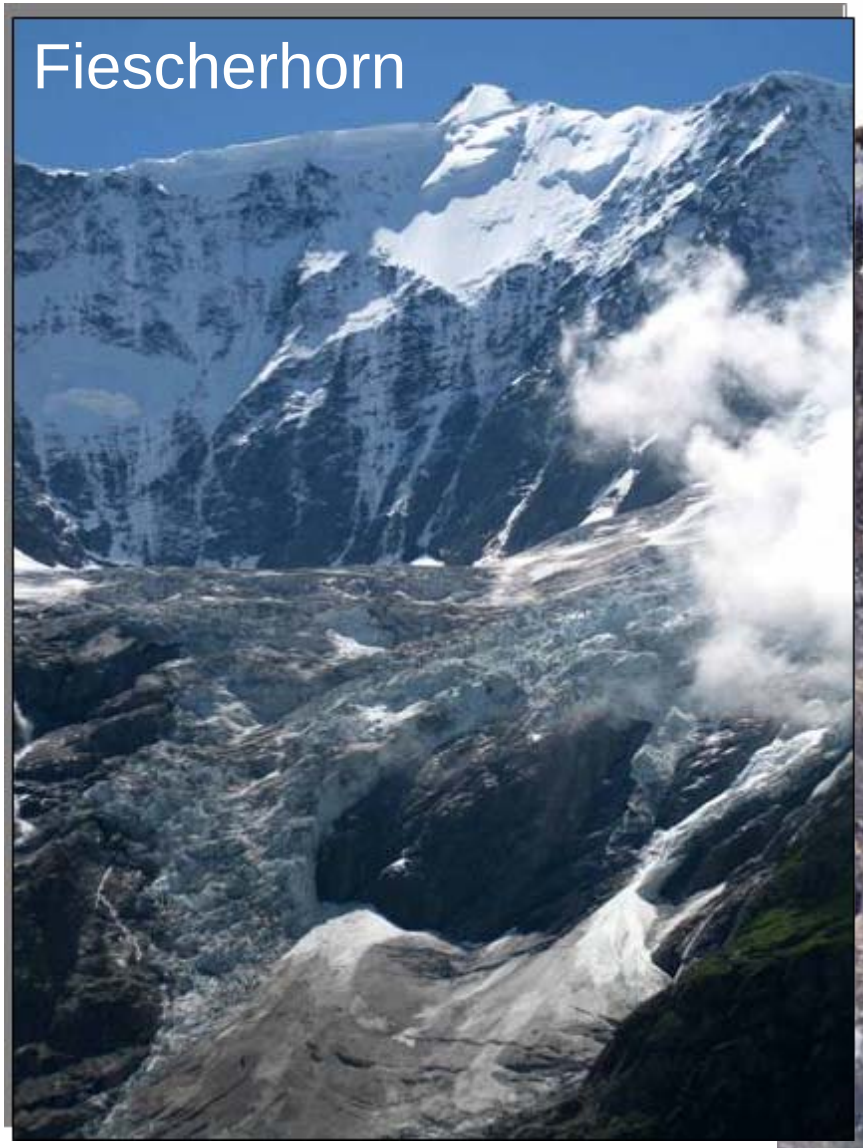

Nepal Himalaya

European Alps:

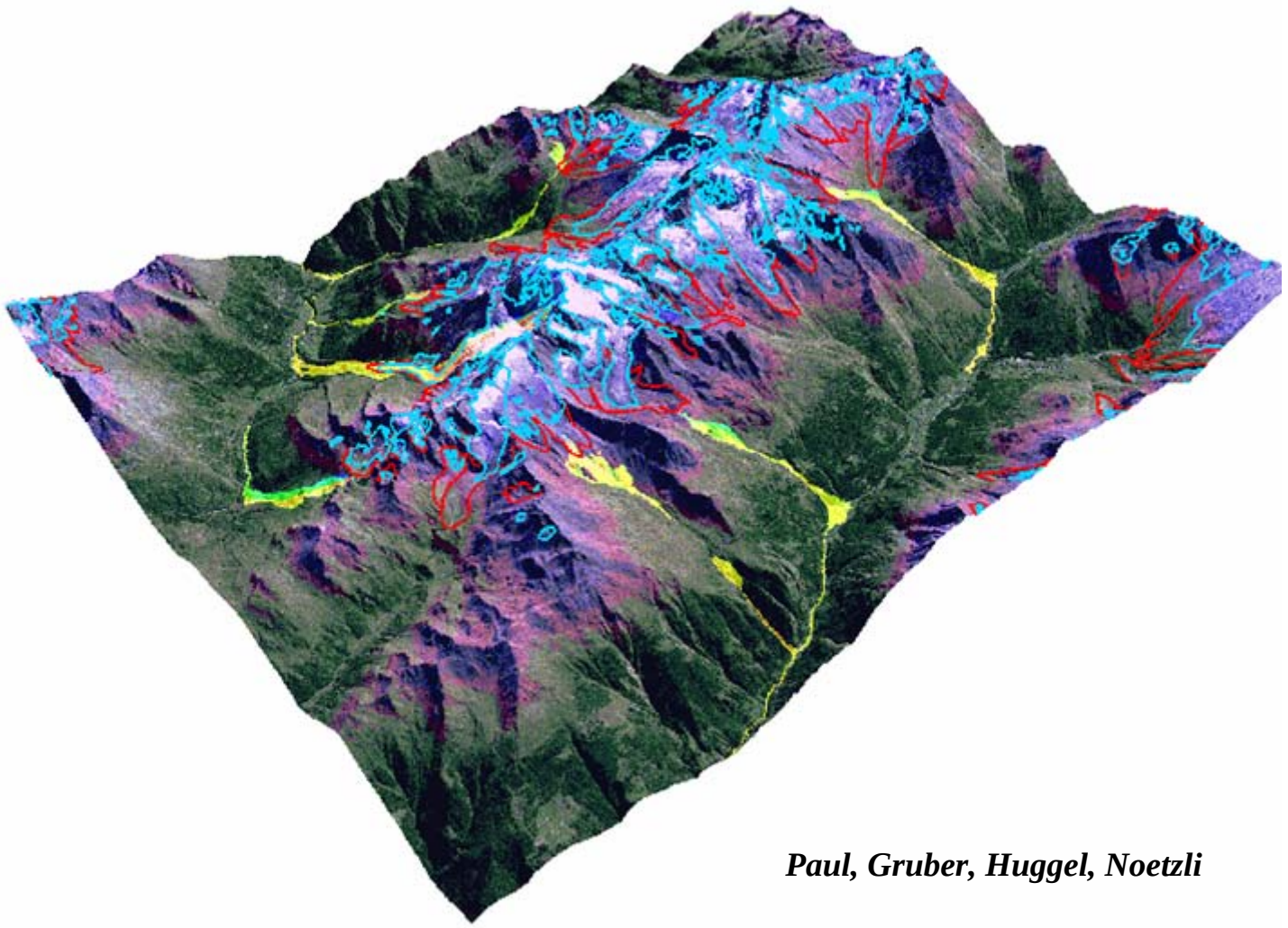
recent supraglacial lakes


4
10
1
2
3
5
7
6
9
8
Fischer
Monte Rosa E-face

Monte Rosa 2005



Integrated hazard analysis

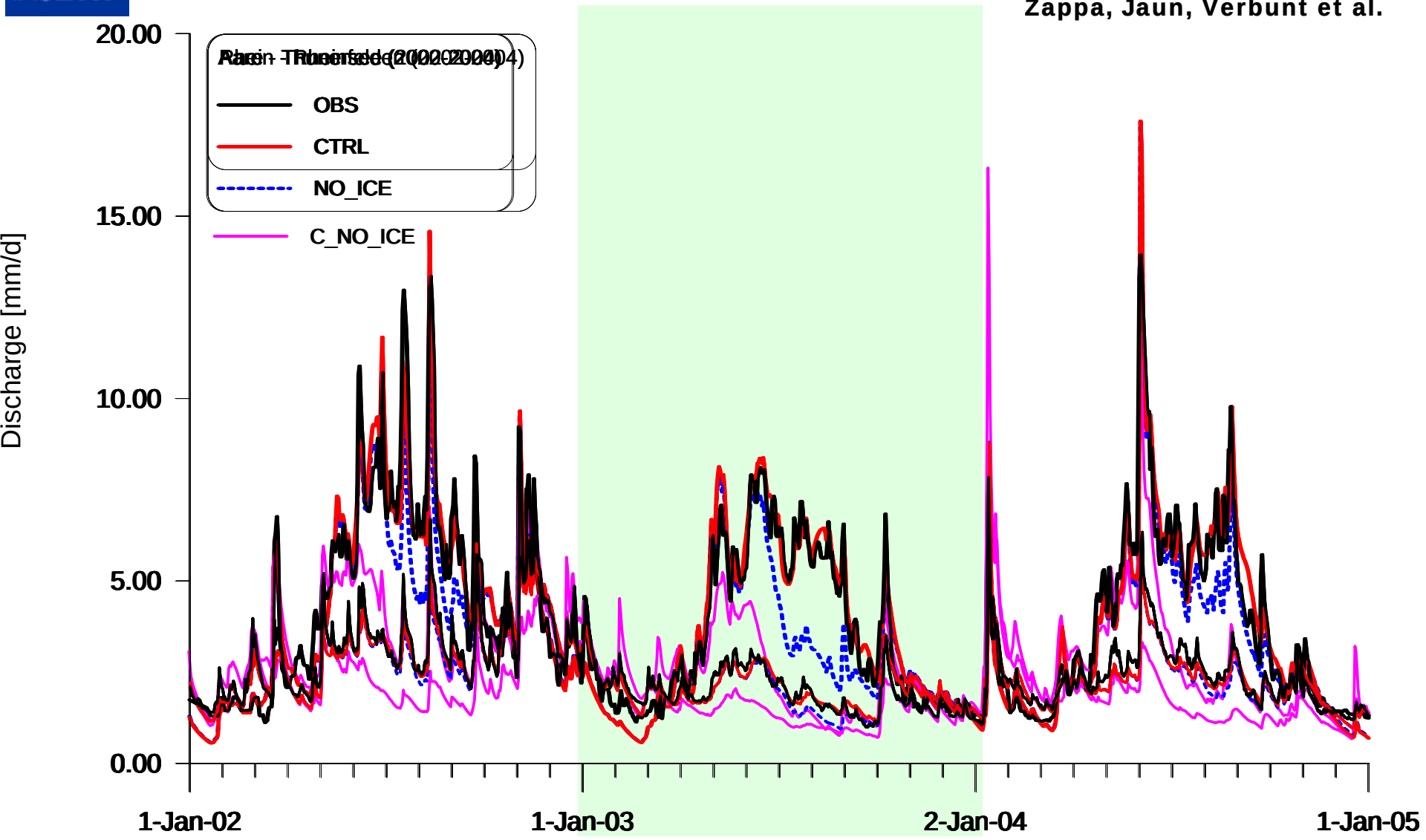


Paul, Gruber, Huggel, Noetzli

Hydrological Impacts of Heat Waves

IACETH

Zappa, Jaun, Verbunt et al.



Water stress Europe:

2003 conditions in 2070 - 2100

supply side:

- extreme discharge minima in summer
- months-long low-discharge periods
- reduced flow velocities
- less power production
- increased water temperatures
- deeper groundwater/lake levels
- perturbed aquatic ecosystems

+ feedback

target conflicts

demand side:

more water needed for:

- households/industry
- agriculture/irrigation
- power production
- forest fires