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The Alps: mountains glaciers

ITALY (Aosta Valley): The Prè de Bar glacier.

1929



2007



ITALY (MONTE ROSA): Indren Glacier

1920



2000



Contrasting Little Ice Age climate conditions with the present



An 1870 postcard view of the Rhone glacier in Gletsch, Switzerland, contrasted with the shrinking 21st-century version of it. (Dominic Buettner for The New York Times)

Glacier fluctuations: clear indicators of a warming climate

Muir Glacier



1941



2004

McCall Glacier



1958



2003

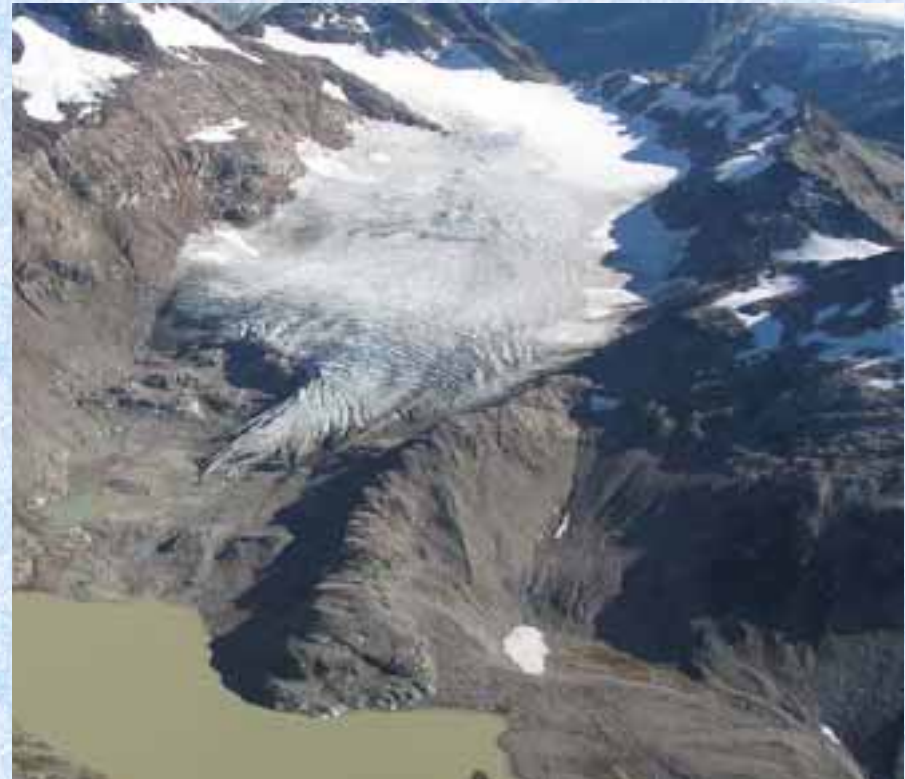


**Fraction of Glacier Area Lost
Western United States
Average ~40% since 1900**



1960

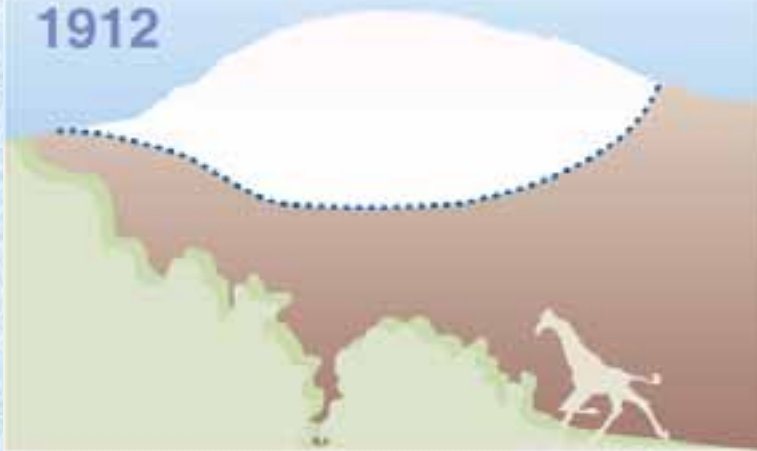
South Cascade Glacier, Washington



2004

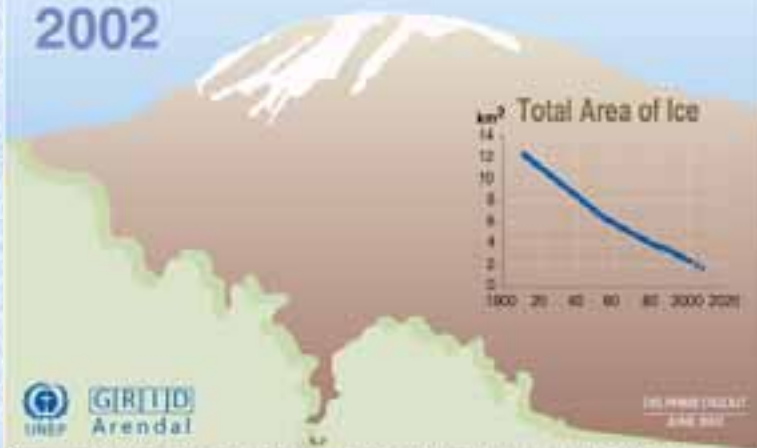
The Melting Snows of Kilimanjaro

1912



Glaciers
ice --- Estimated line

2002



UNEP GRIFFIN Arendal

DELPHI CONSULT
ZINE 2002

Sources: Meeting of the American Association for the Advancement of Science (AAAS), February 2001 ; Earthobservatory.nasa.gov.

Area
(km²)

15

10

5

0

<1880

1912

1953

1976

1989

2000

2003



Global Warming is unequivocal

Since 1970, rise in:

- ❖ Global surface temperatures
- ❖ Tropospheric temperatures
- ❖ Global SSTs, ocean Ts
- ❖ Global sea level
- ❖ Water vapor
- ❖ Rainfall intensity
- ❖ Precipitation extratropics
- ❖ Hurricane intensity
- ❖ Drought
- ❖ Extreme high temperatures
- ❖ Heat waves

Decrease in:

- NH Snow extent
- Arctic sea ice
- Glaciers
- Cold temperatures

**Impacts on winter recreation
can be severe --**





Avalanche hazard (highway, ski resort, back-country, structures) may increase or decrease depending on local snow climate:

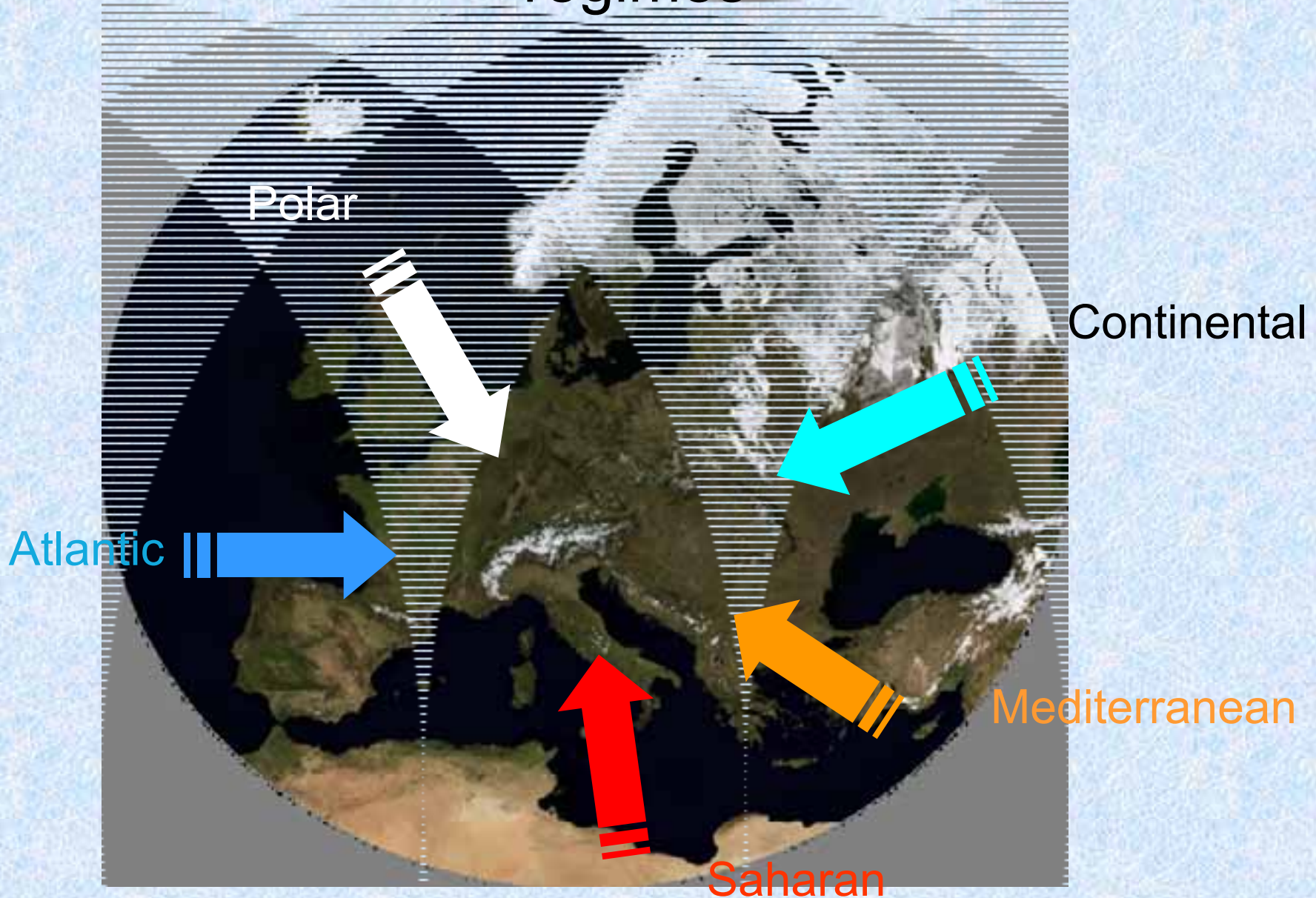


Maritime climate - more rain on snow increases hazard.

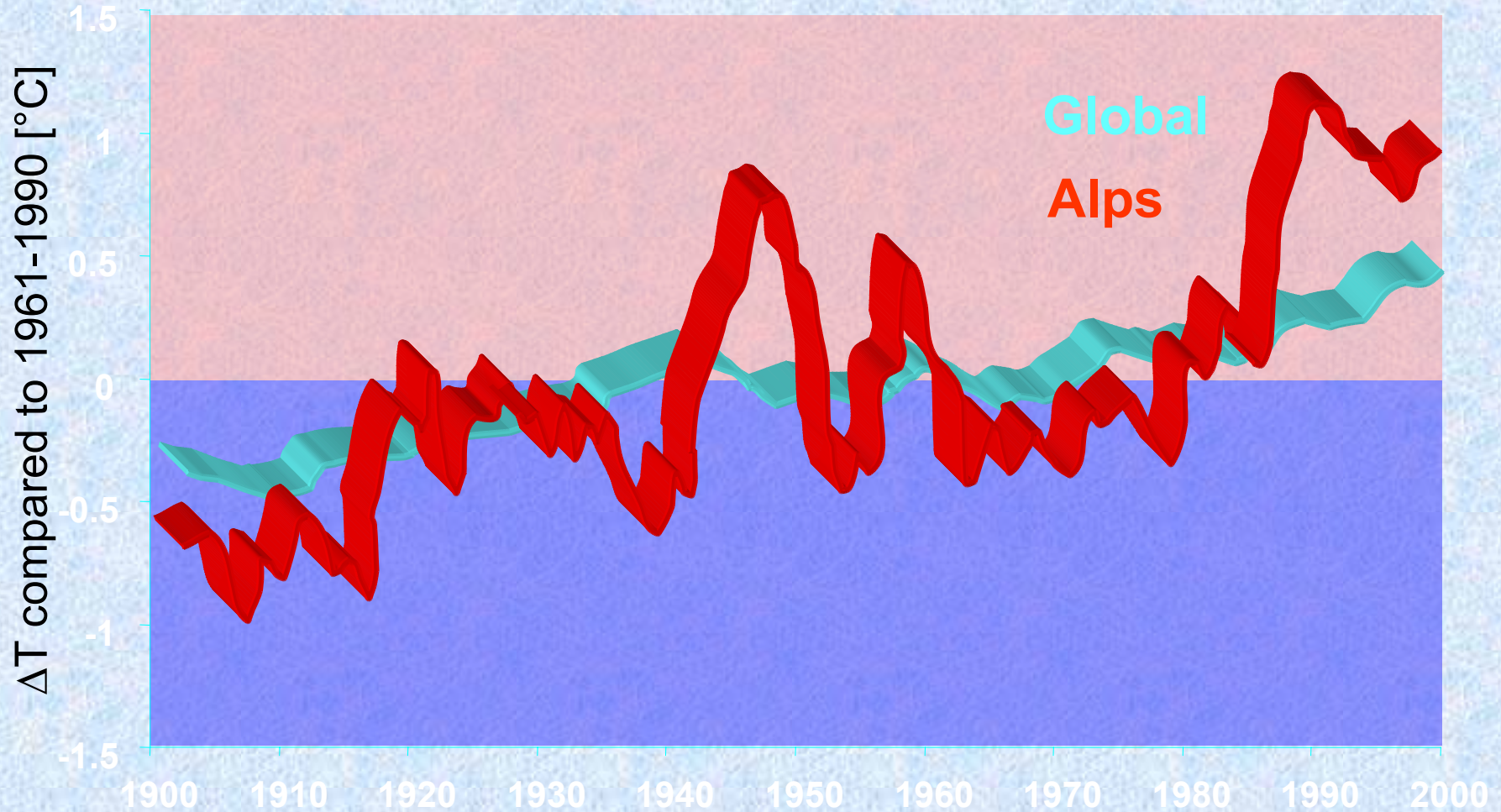
Continental climate – warmer air temperature results in more stable snow structure, hazard decreases.



The Alps: crossroads of numerous climatic regimes

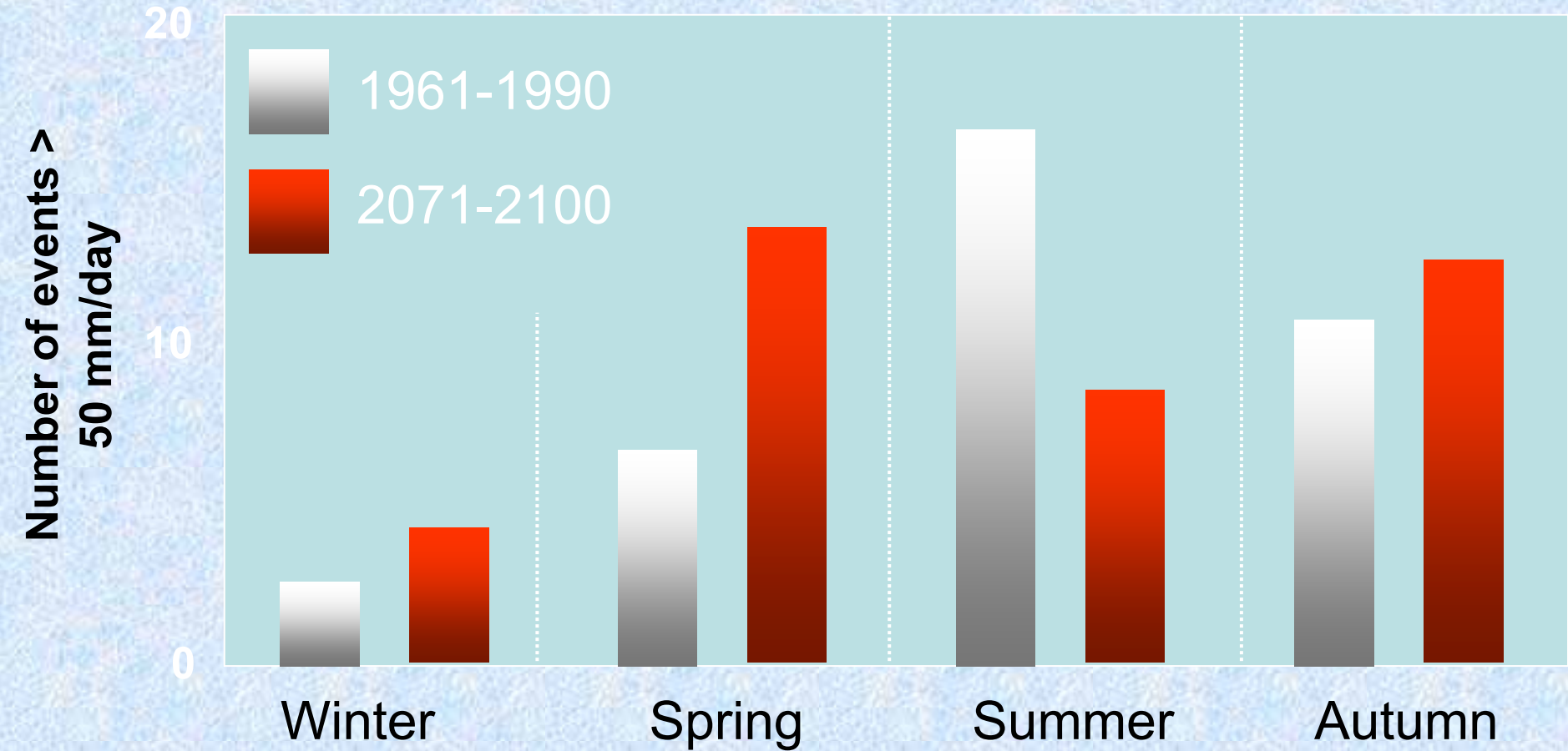


Evolution of global and alpine temperatures, 1901-2000



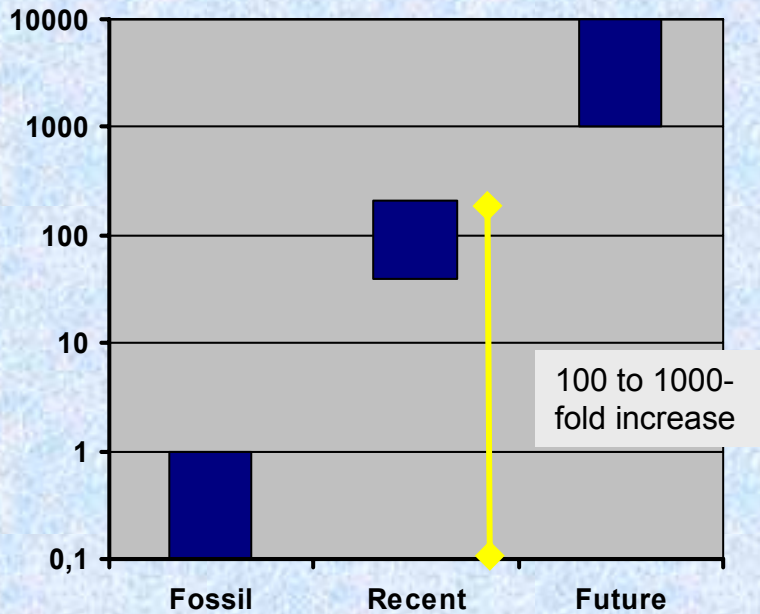
Changes in extreme precipitation in the Alps

(HIRHAM Regional Climate Model)



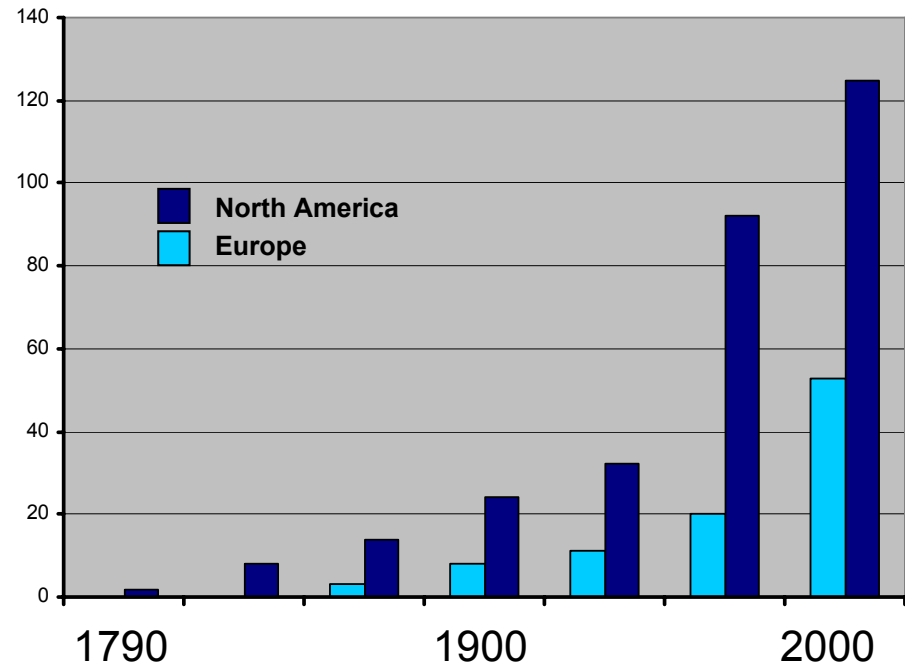
Change in Species Diversity

Number per Thousand Species



Extinctions
(per thousand years)

Number of Species



Homogenization
(e.g. growth in marine species introductions)

Mexico



New Zealand



Andes



Alps



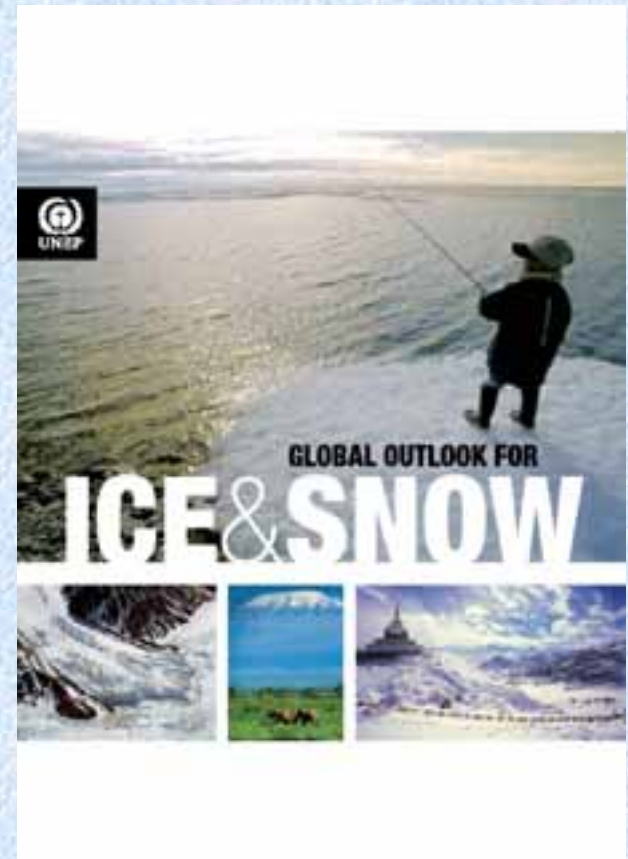
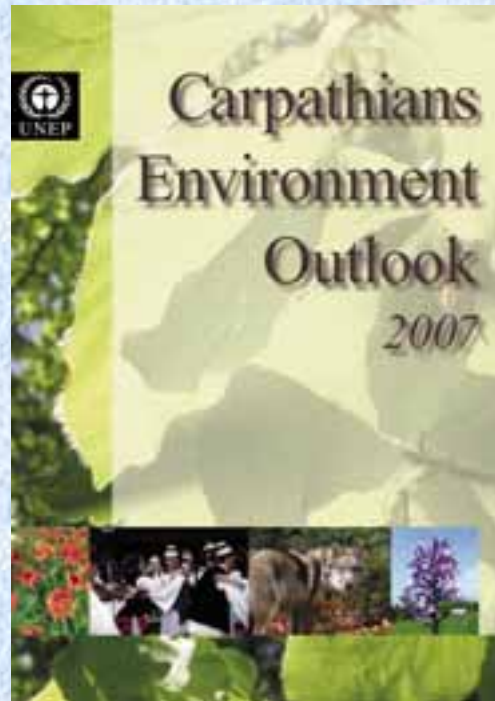
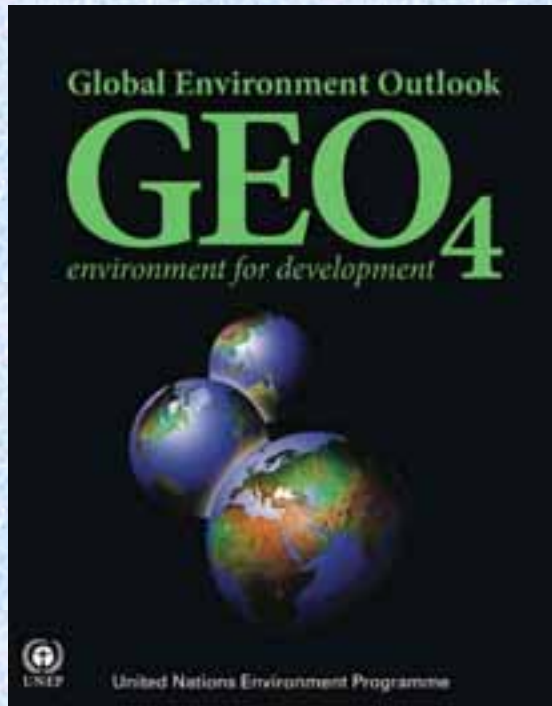


Most of the current increase in forest cover in the Alps has to do with landuse change (infilling). 4 % of the current encroachment (100%) seems to be due to upward migration.

How can remote sensing contribute to global change research in mountain regions?

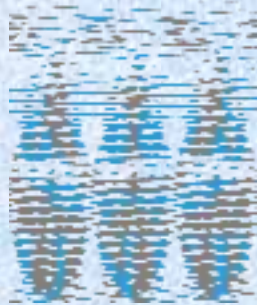


Assessments



Assessment of consequences of climate change on spacial development and economy and adaptation measures.





Thank you !

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<http://mountains.unep.ch>