

The EU ACQWA Project: From Science to Policy

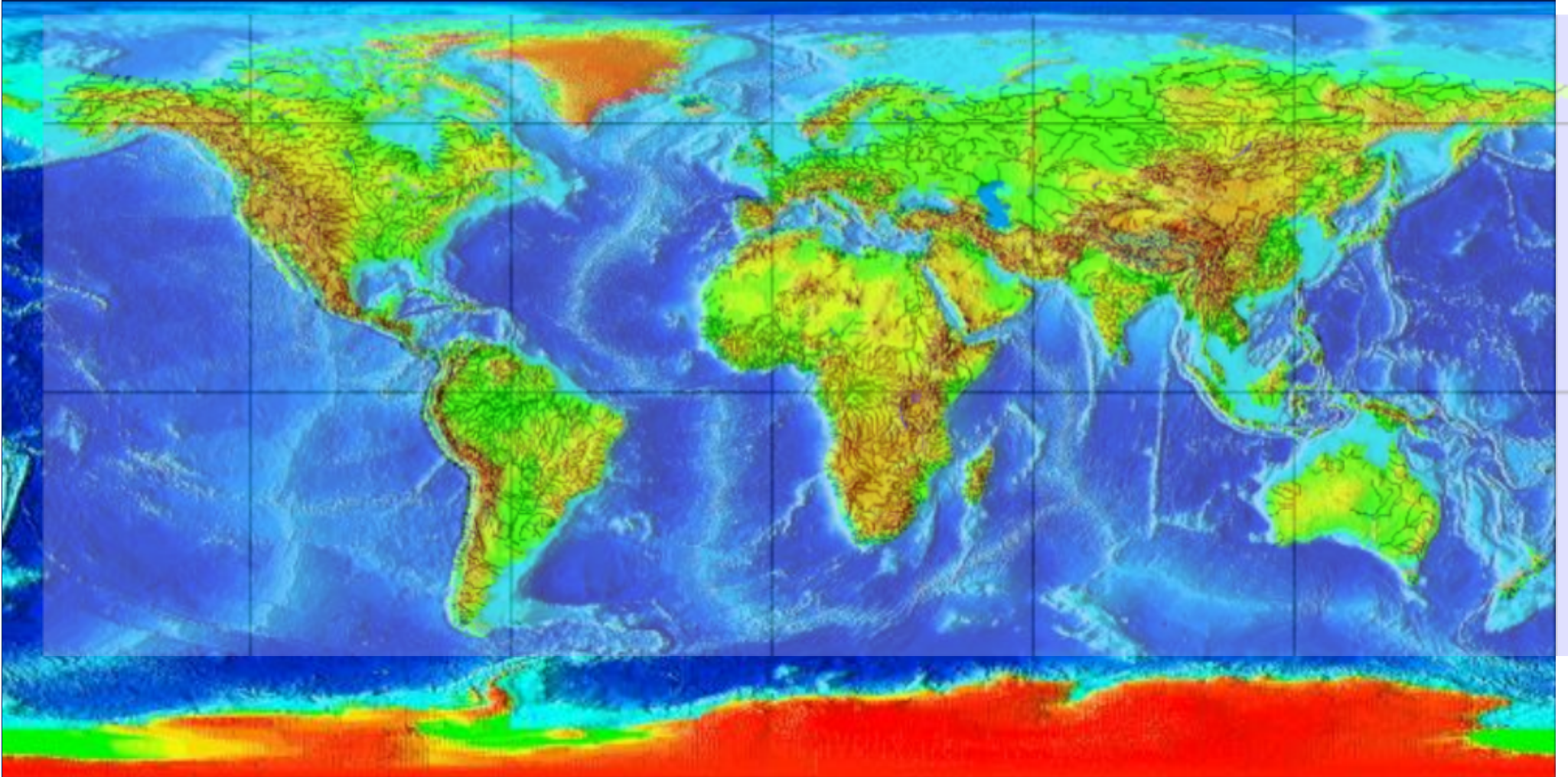
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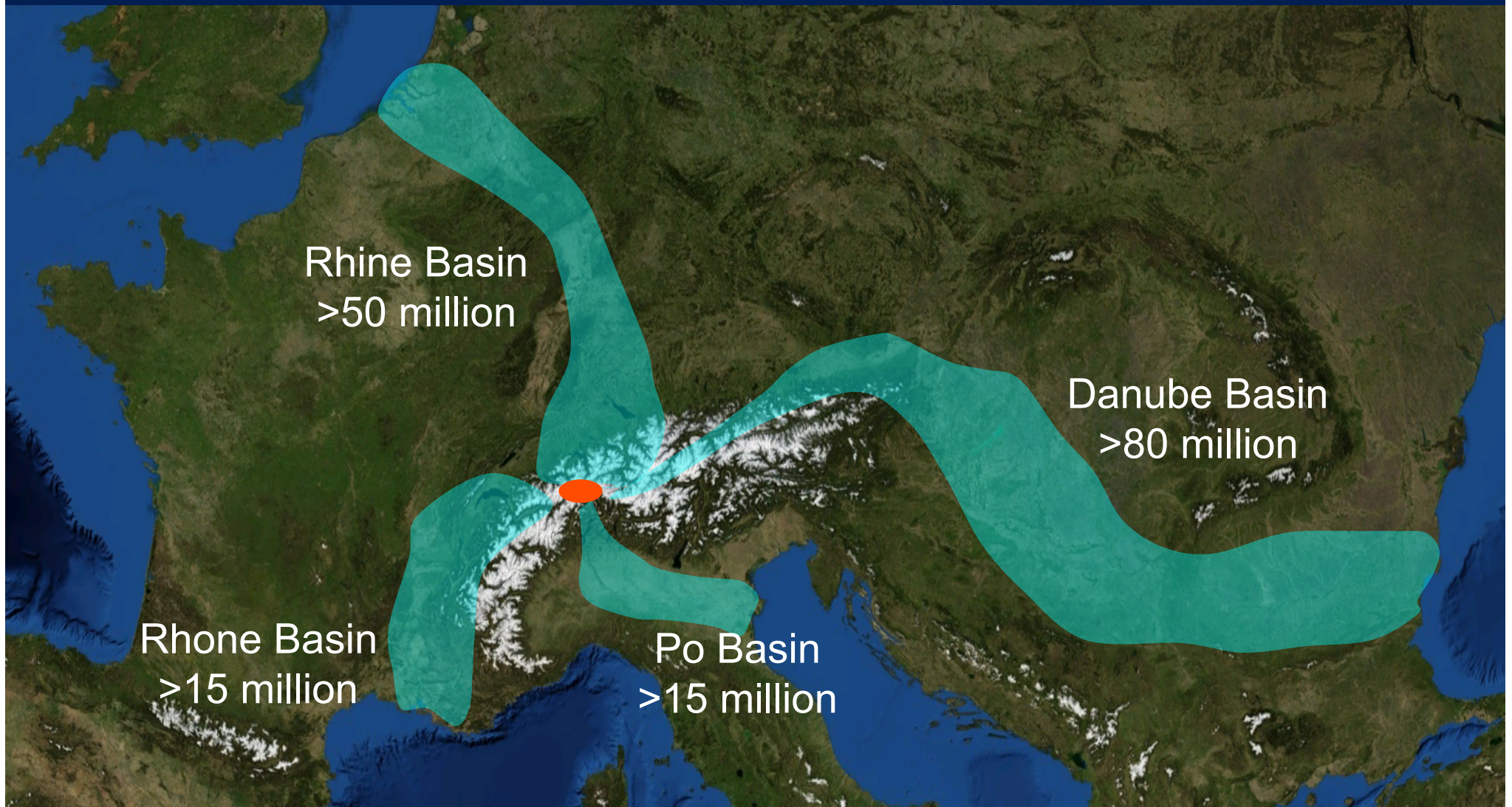
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- Mountains and water
- Current and future climate (Alps)
- Potential impacts
- Concluding remarks

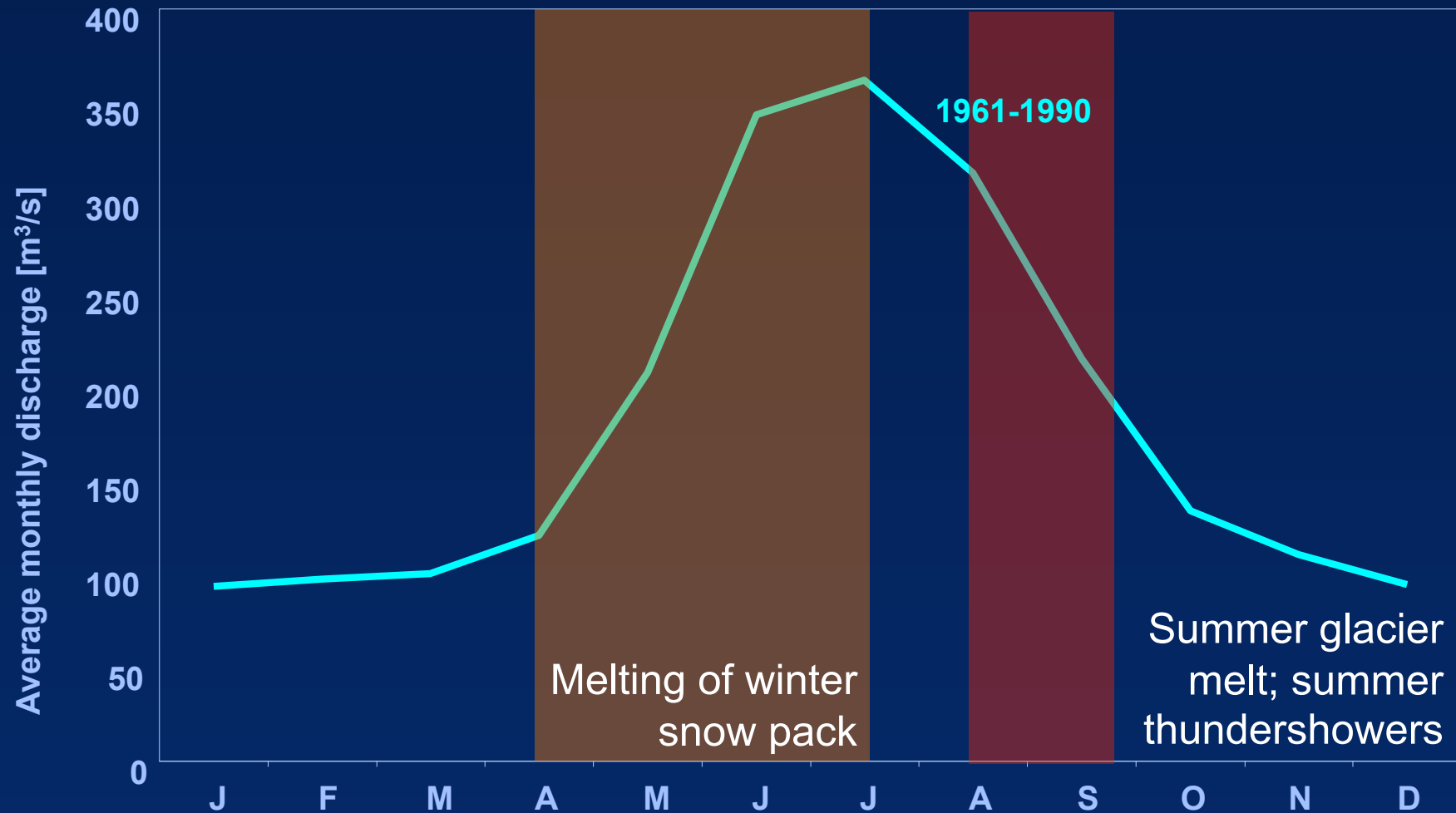
Mountains as a source of more than 60% of the world's rivers



Upstream-downstream links



Rhone River discharge in the 1961-1990 reference climate



Beniston, 2010: Journal of Hydrology

Assessing Climate impacts on the Quantity and quality of Water



MODELS

Climate

Glaciers

Snow

Biosphere

Hydrology

EUROPEAN CASE STUDIES

Rhone, Switzerland

Po, Italy

Aragón, Spain

Pyrenean catchments, France

MODELS

Climate

Glaciers

Snow

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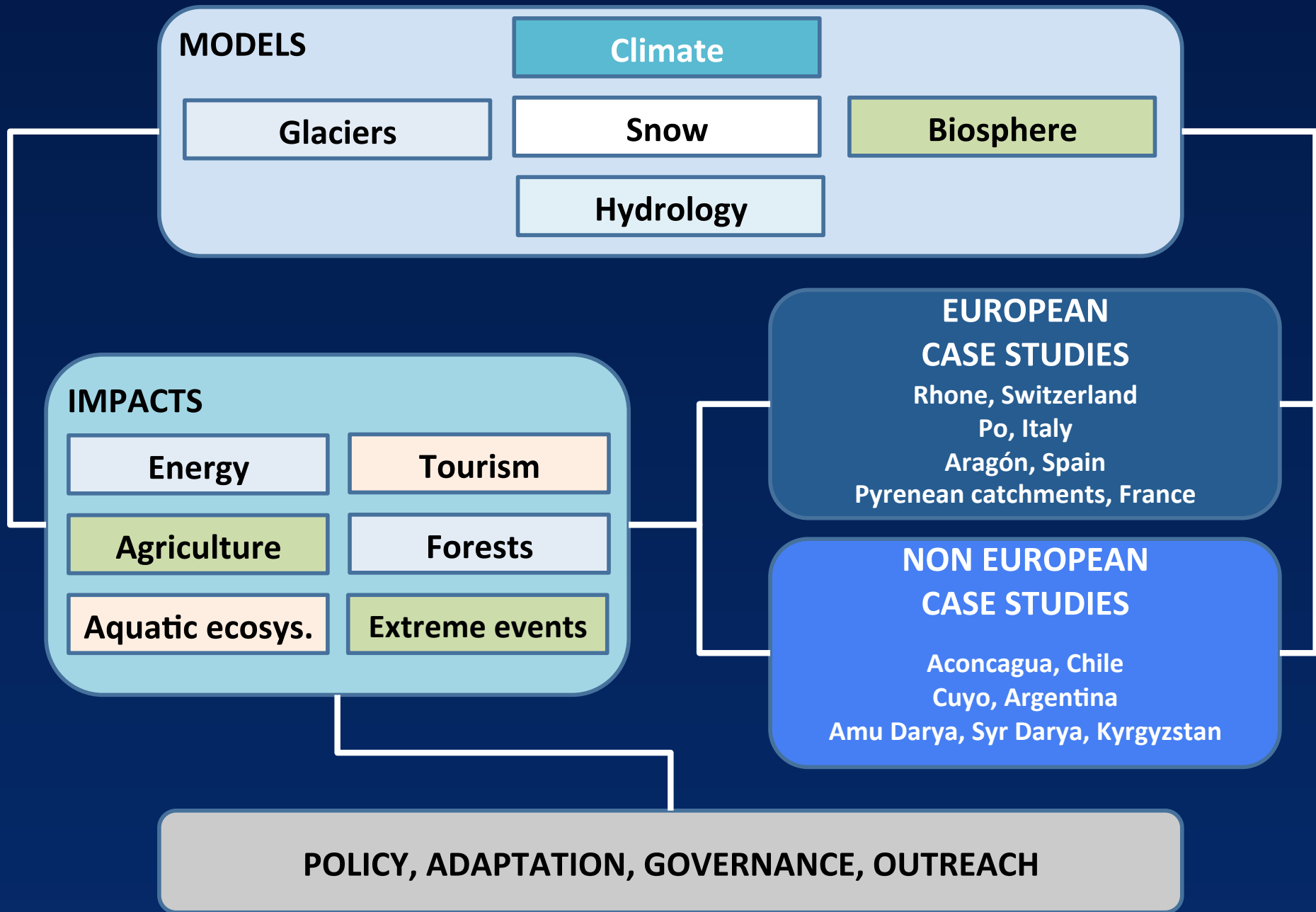
Hydrology

EUROPEAN CASE STUDIES

Rhone, Switzerland
Po, Italy
Aragón, Spain
Pyrenean catchments, France

NON EUROPEAN CASE STUDIES

Aconcagua, Chile
Cuyo, Argentina
Amu Darya, Syr Darya, Kyrgyzstan

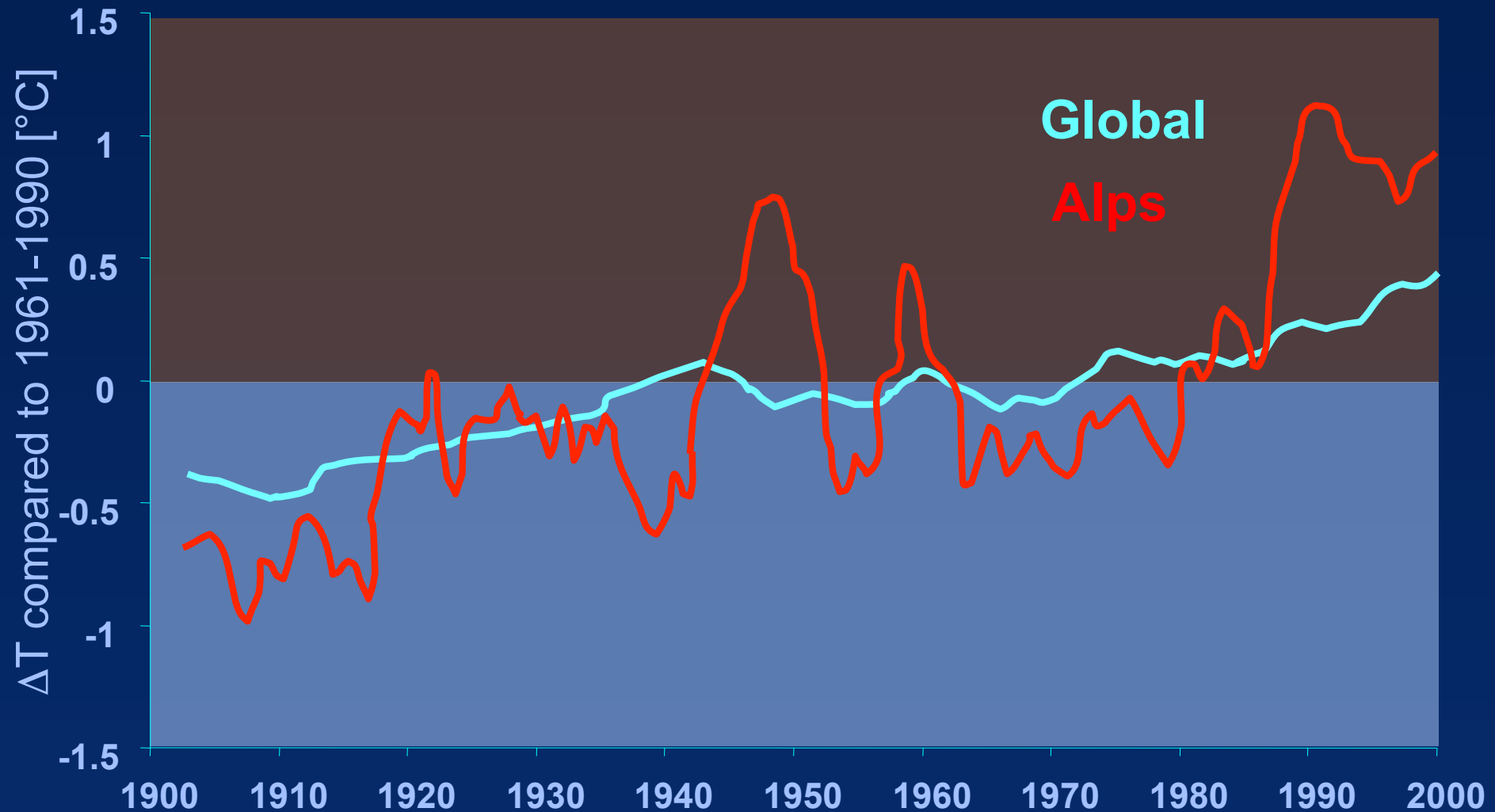


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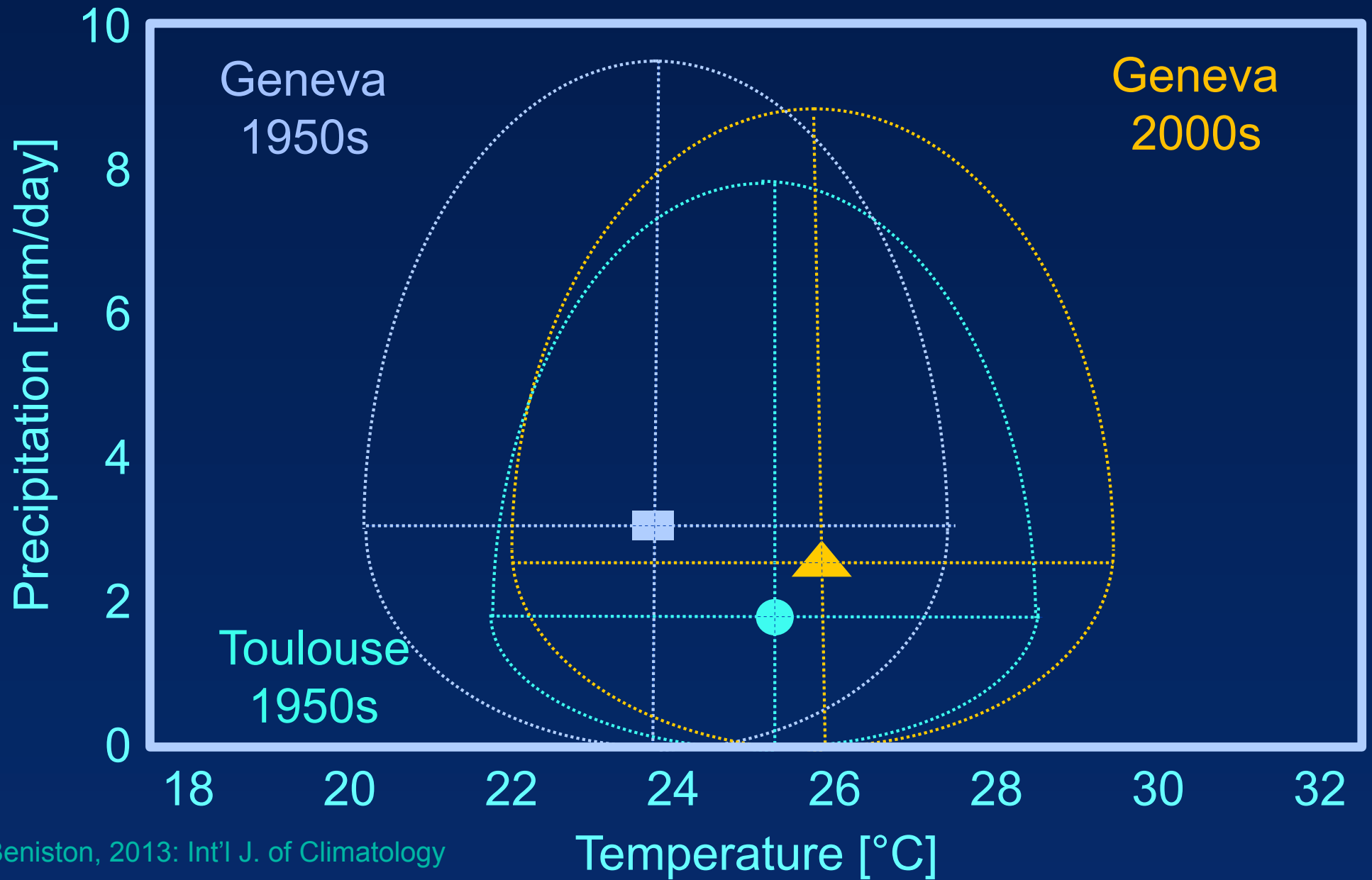
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Evolution of global and alpine temperatures, 1901-2000

Beniston, 2000: Environmental Change in Mountains, Arnold, London

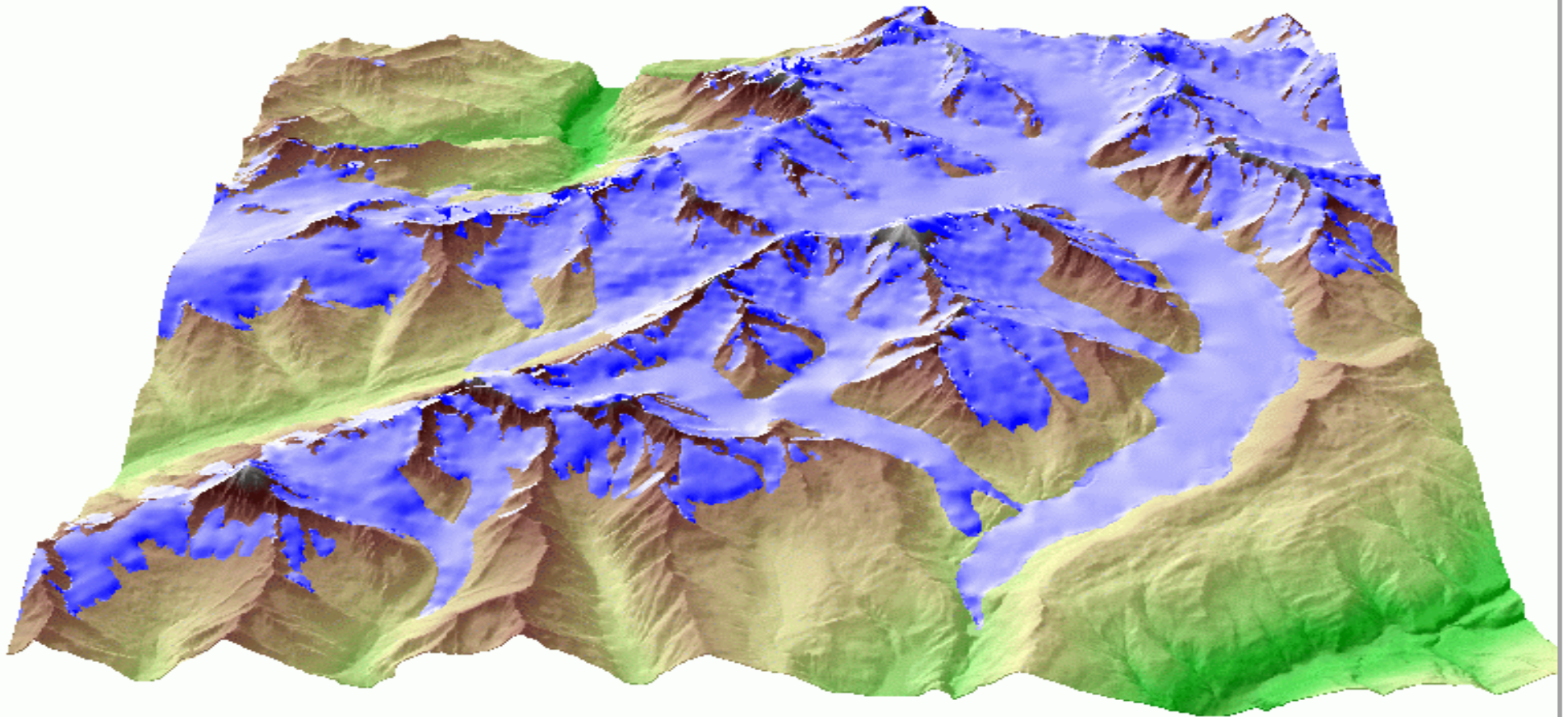


«Analog climates»



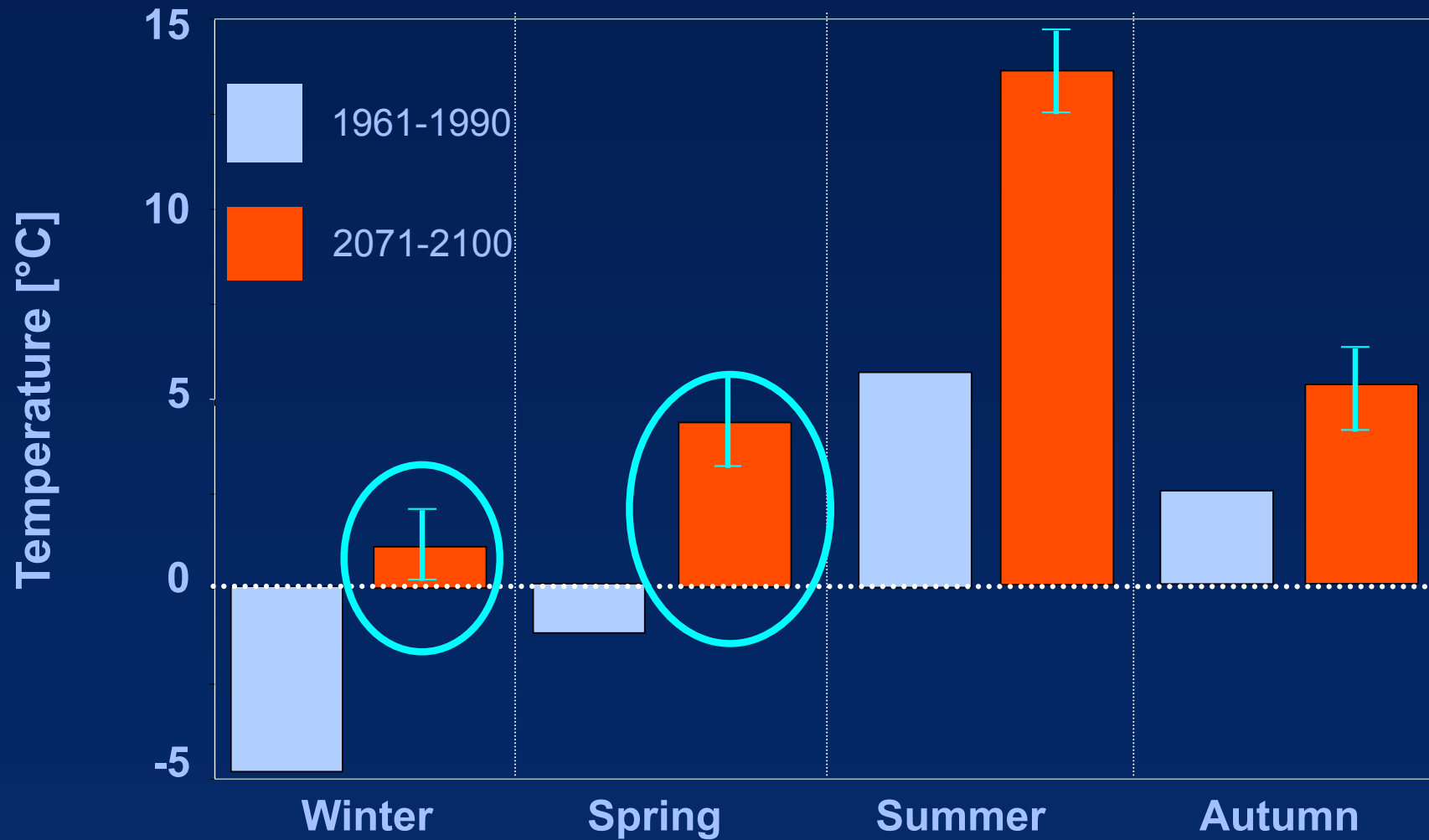
Beniston, 2013: Int'l J. of Climatology

Changes in the Aletsch region, 1950-2005



Temperature
change by
2100...

Changes in seasonal temperatures (at 2,500 m asl)

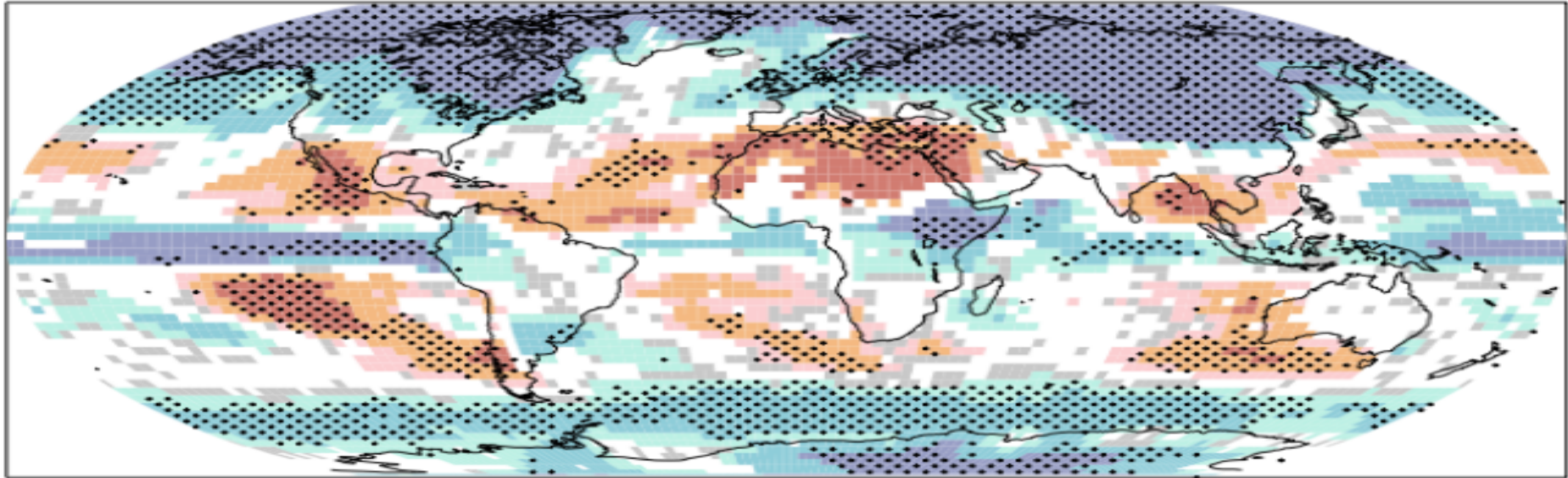


Beniston, 2004: *Climatic Change and Impacts*, Springer

multi-model

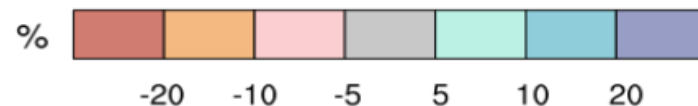
A1B

DJF

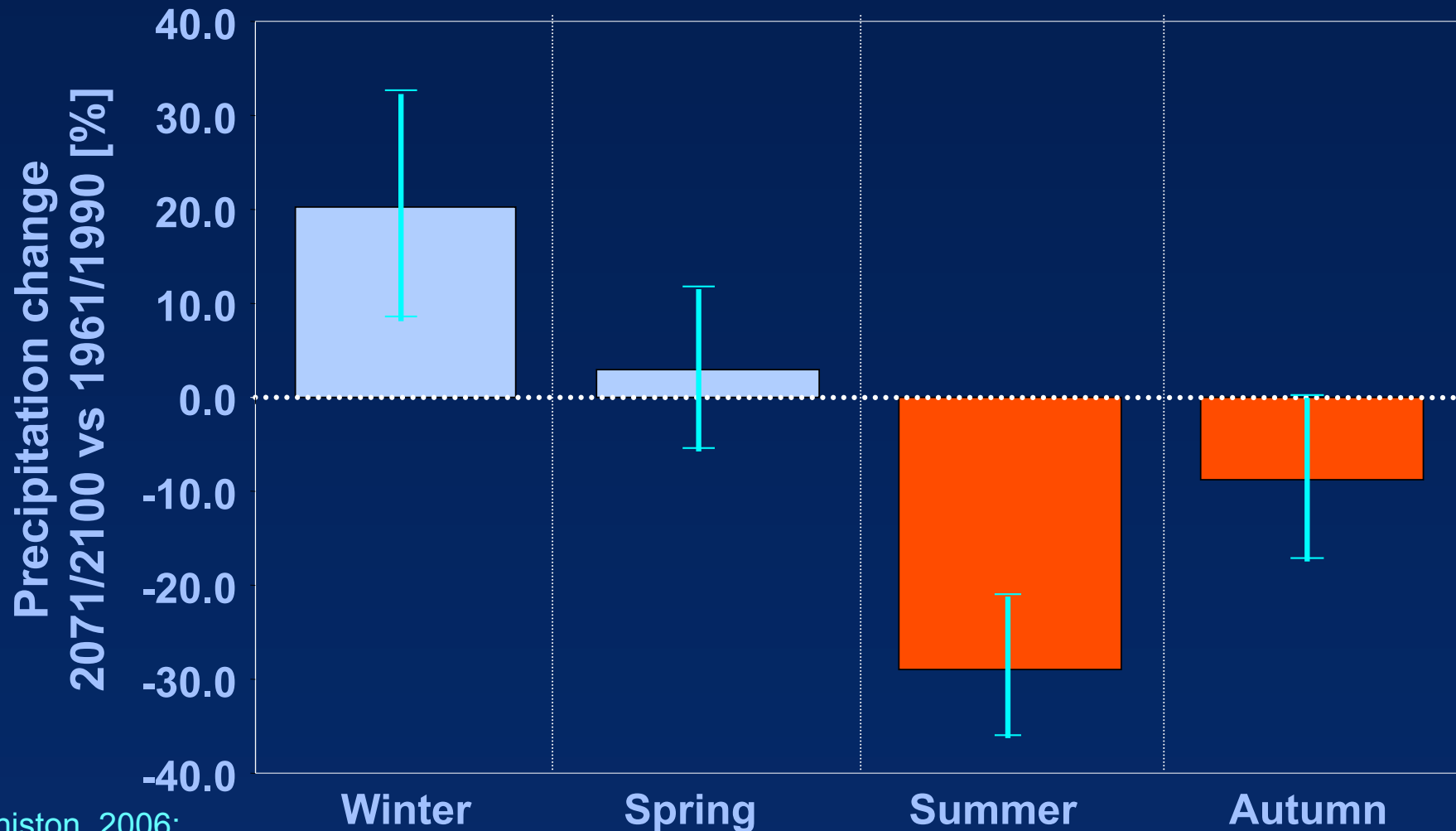


Precipitation change by 2100...

IPCC, 2007



Changes in seasonal precipitation in the alpine source region



Beniston, 2006:
Geophysical Research Letters

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Glacier retreat: Tschierva Glacier, Engadine

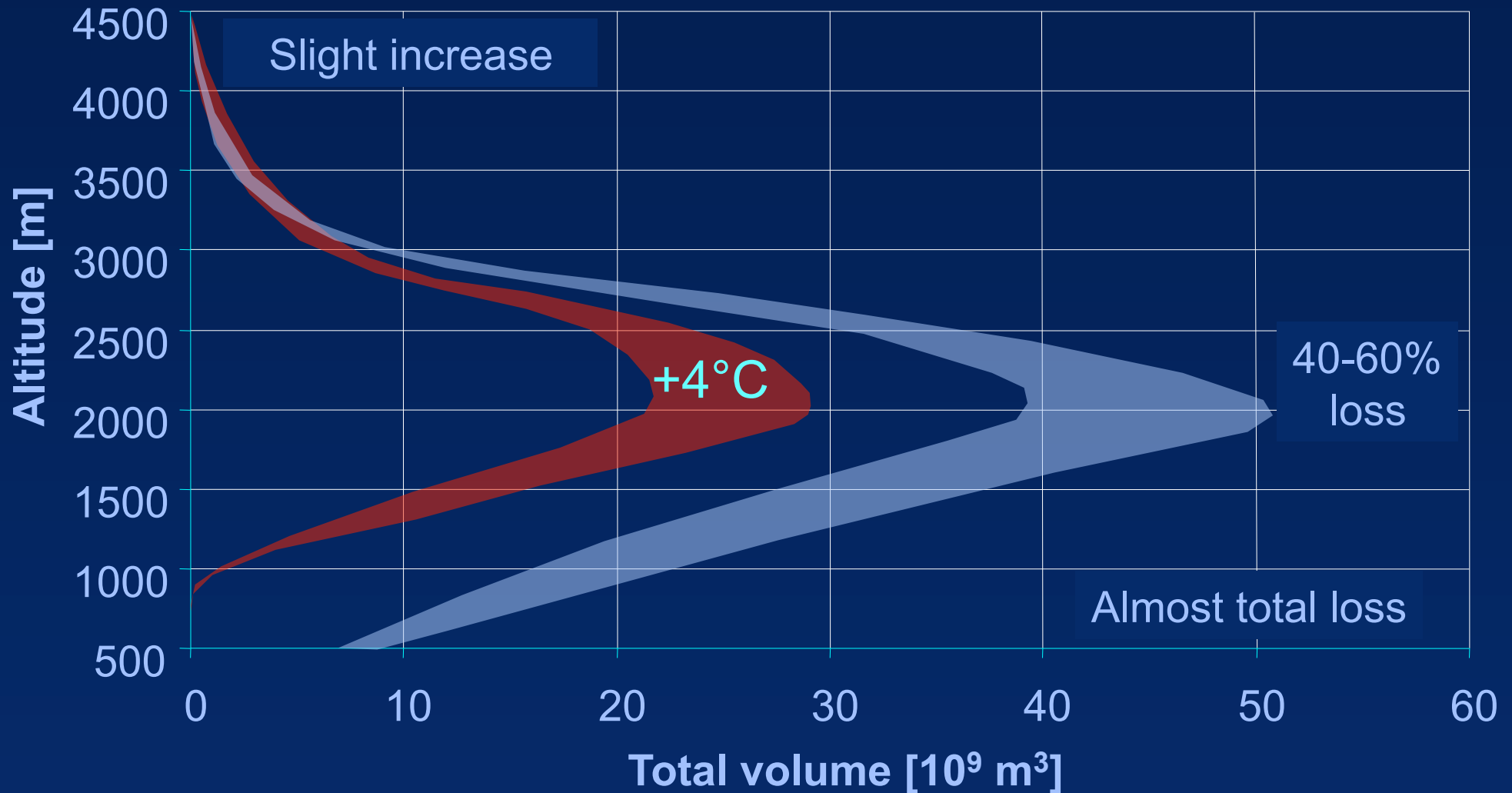
Courtesy: Max Maisch
University of Zurich, Switzerland



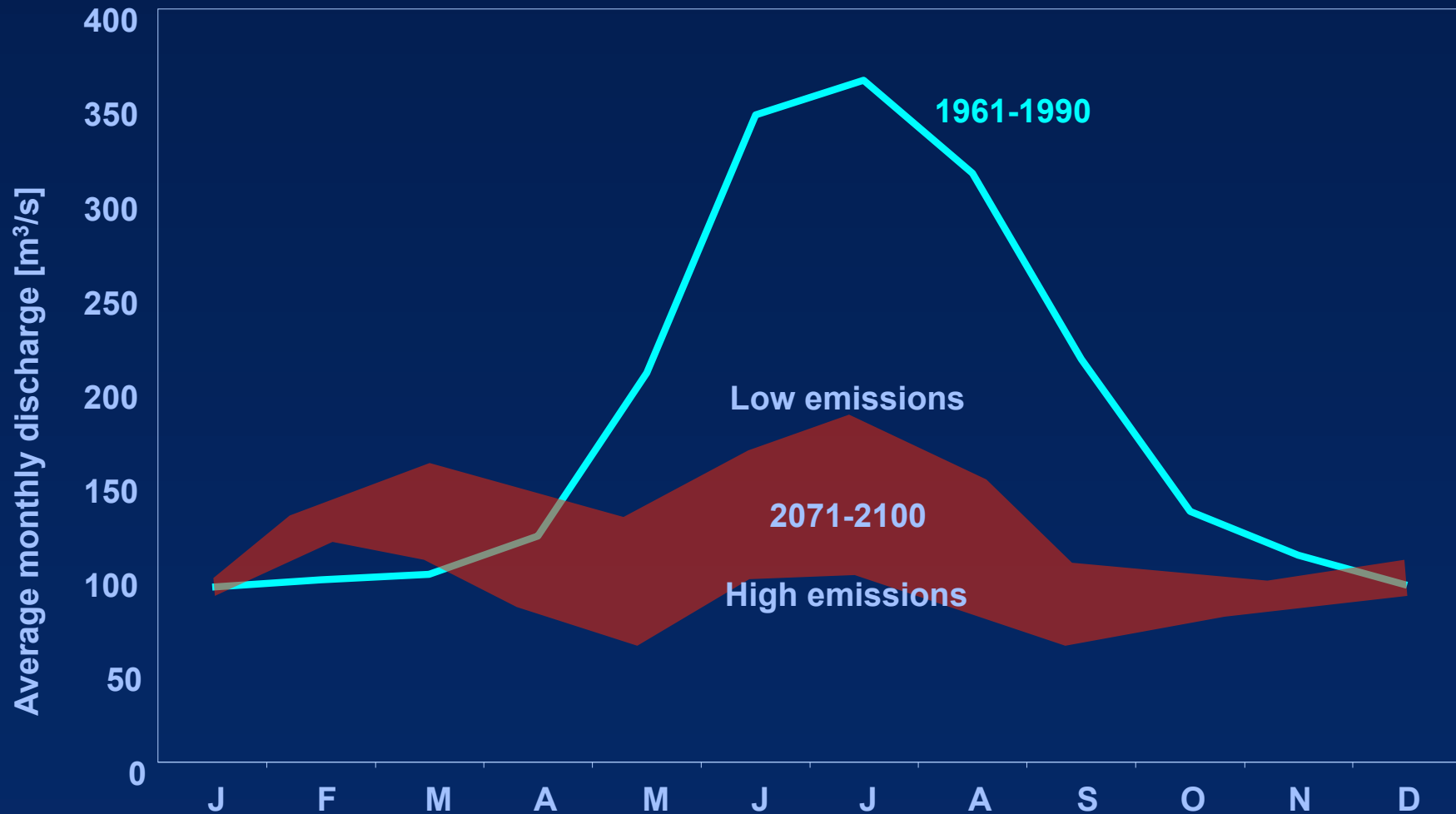
2050?
+3°C?

Shifts in snow volume according to altitude

Beniston et al., 2003:
Theor. and Appl. Clim.



Possible future discharge by 2100 (m³/s, River Rhone)

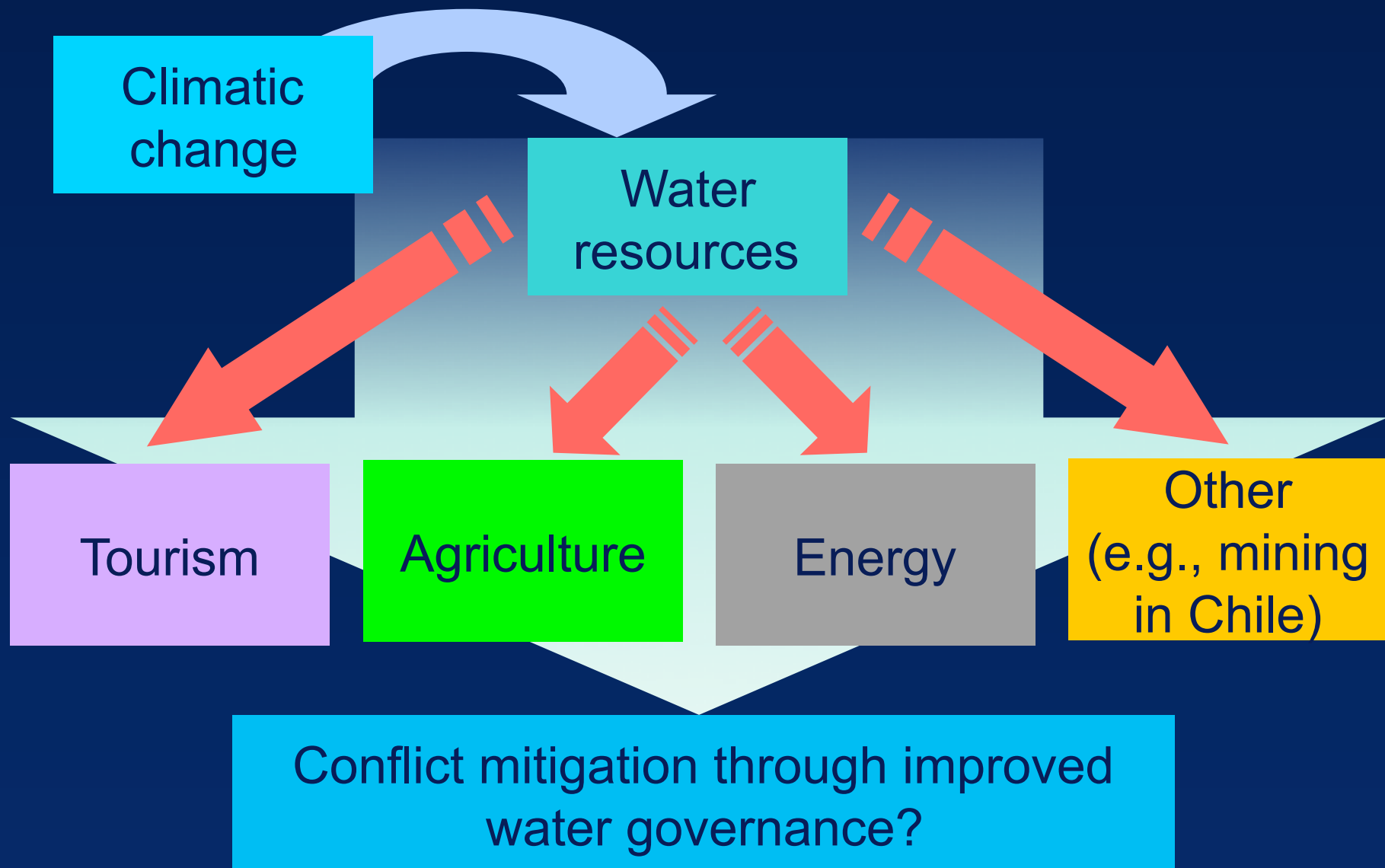


Beniston, 2010: Journal of Hydrology

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Rivalries between economic sectors impacted upon by changing water resources?



Translating science into policy...

- Water governance will need to be both adaptive and flexible in developing rules that regulate hydro-power, water rights allocations, urban growth and spatial planning
- Water managers need to be able to make decisions under uncertainty for the practical aspects of water allocation
- An adaptable water governance regime must not only manage current uncertainty levels of climate variability, but also the more unpredictable forms of uncertainty in a changing climate
- Technical adaptation should prioritize no-regret, reversible, flexible and iterative action integrating adaptation and mitigation
- Infrastructure design will need to account for both natural climate variability *and* change through stochastic approaches that examine multiple possible futures

Many thanks for your attention

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www.unige.ch/climate

www.acqwa.ch