INTERNATIONAL CONFERENCE ON MOUNTAINS AND CLIMATE CHANGE

Climate change and impacts in mountains

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Overview

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



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





Upstream-downstream links

Rhine Basin >50 million

> Danube Basin >80 million

Rhone Basin >15 million

Po Basin >15 million



The Rhone River catchment



95,000 km²; 16 million inhabitants

Swiss segment: 10,100 km² 1.2 million inhabitants



Rhone River discharge in the 1961-1990 reference climate



Beniston, 2010: Journal of Hydrology



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Evolution of global and alpine temperatures, 1901-2000



Changes in the Aletsch region 1850-2005



Heatwave days: Exceedance of 40°C threshold in Europe

1961-1990

2021-2050

2071-2100



High Summit

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



Geophysical Research Letters

Beniston, 2006:

Changes in summer precipitation (june-july-august) (Differences in % between 2071-2100 and 1961-1990) (HIRHAM RCM; A-2 Scenario)

Seasonal precipitation

Events greater than 50 mm/day



Changes in seasonal precipitation



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Glacier retreat: Tschierva Glacier, Engadine





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, 2006: Geophysical Research Letters

Changes in extreme precipitation in the Alps (IPCC A2 scenario)



Impacts on winter tourism





Shifts in vegetation





Rivalries between economic sectors impacted upon by changing water resources?



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Snow, ice and water in mountains:

expect major impacts in a warmer climate!

- Snow and ice in the Alps and similar mid-latitude mountain chains are dominant elements for runoff characteristics in numerous catchments
- Shifts in temperature and precipitation regimes could significantly modify the behavior of the mountain snow pack, thus changing:
 - the seasonal character of runoff
 - the timing of the peak flow
- Changing water amount will have numerous economic impacts:
 - Tourism
 - Energy
 - Agriculture
 - Mining
 - Natural hazards
 - Insurance sector





Assessing Climate impacts on the Quantity and quality of WAter





EUROPEAN CASE STUDIES

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





EUROPEAN CASE STUDIES

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NON EUROPEAN CASE STUDIES

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





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Many thanks for your attention

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