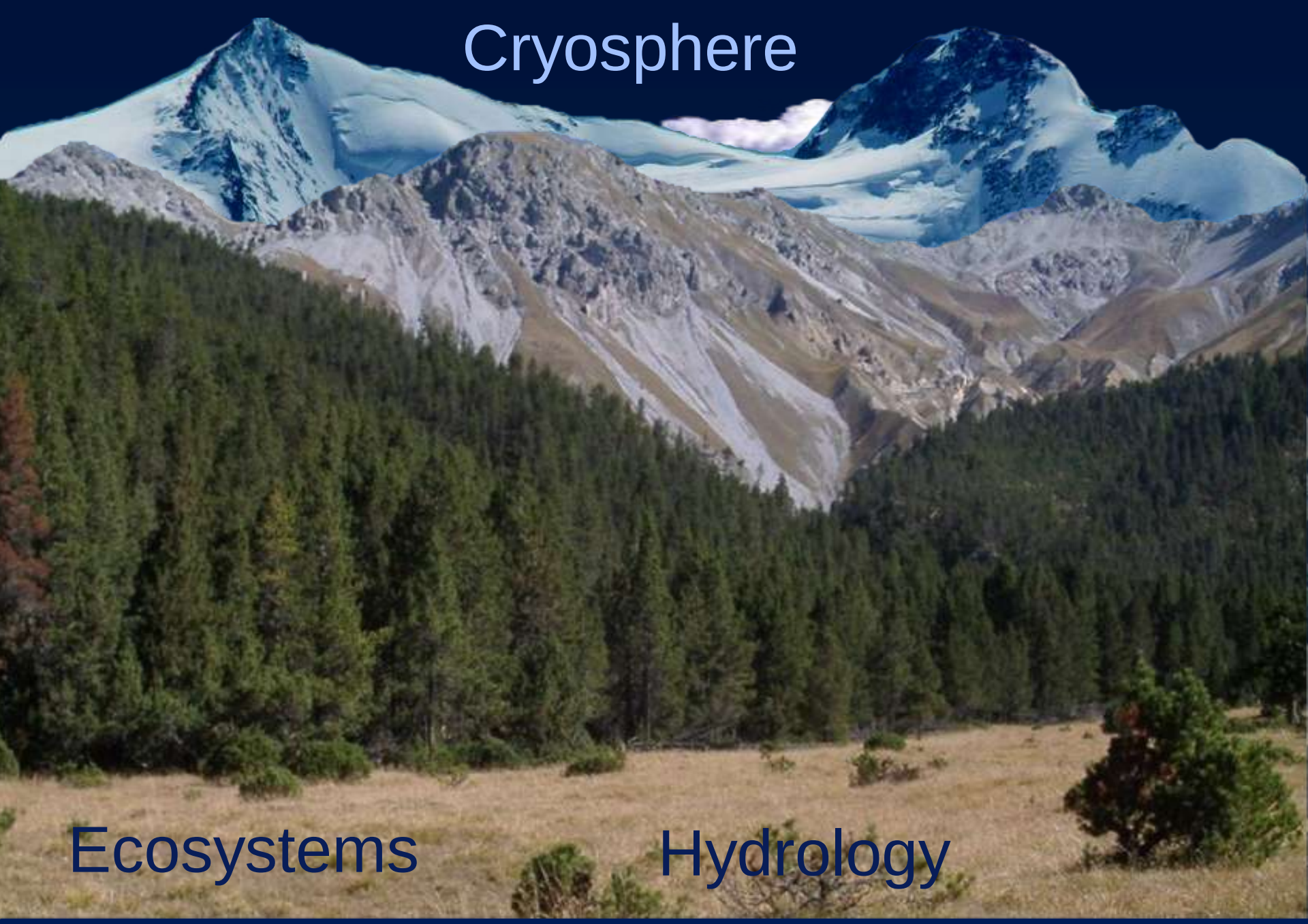
Modeling strategies within the *ACQWA* Project

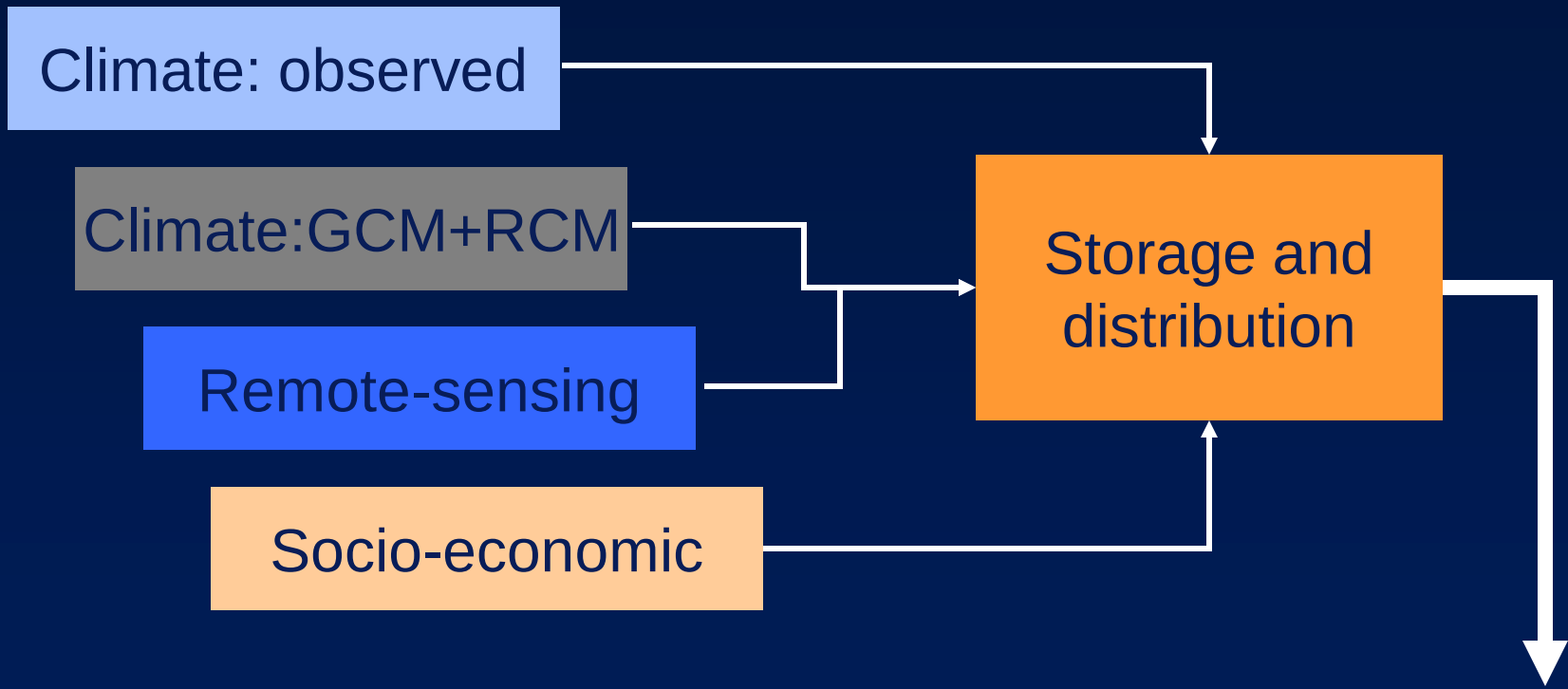
Martin Beniston

Head of the Geneva Environment Insitute

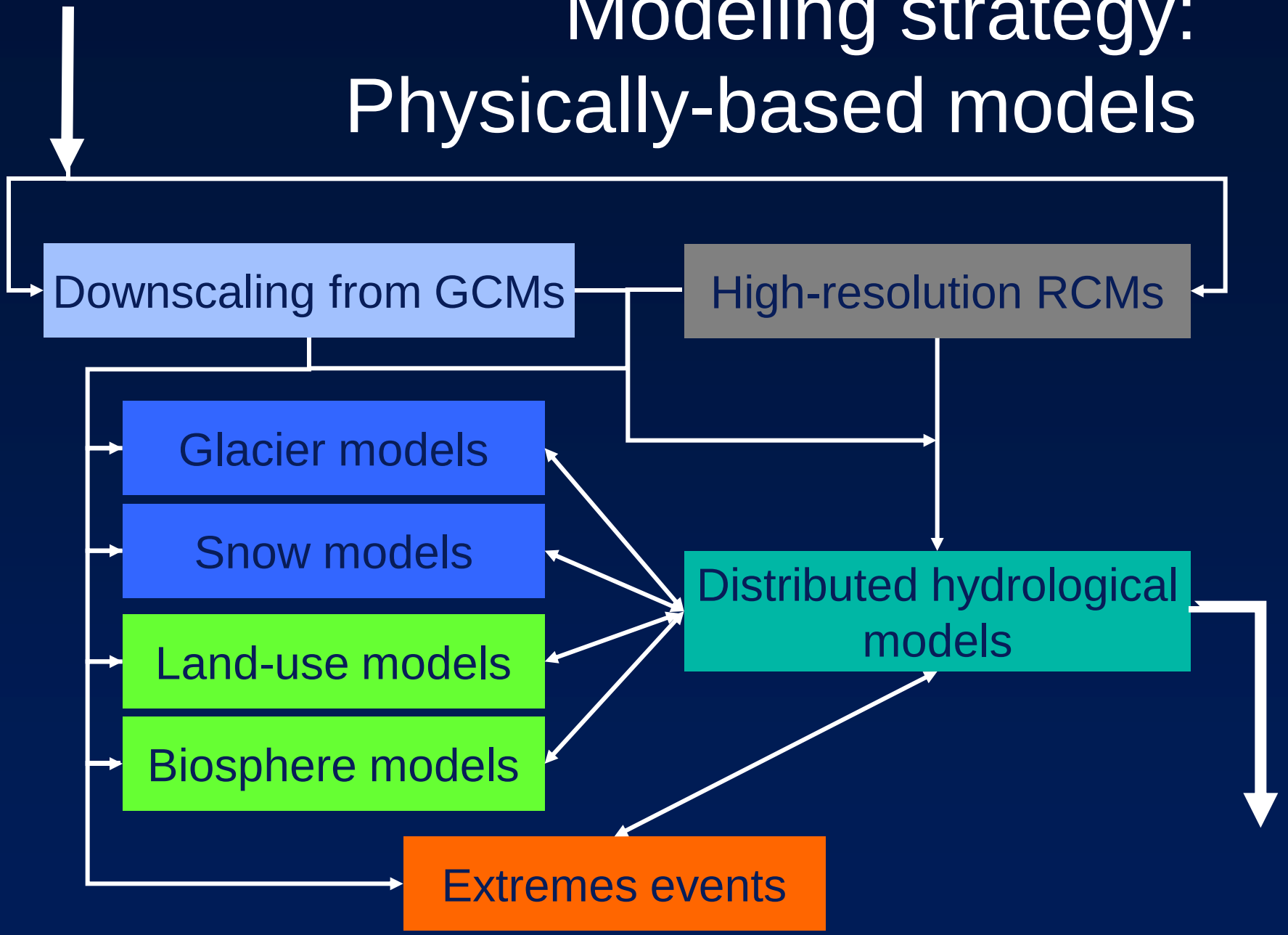
The University of Geneva, Switzerland



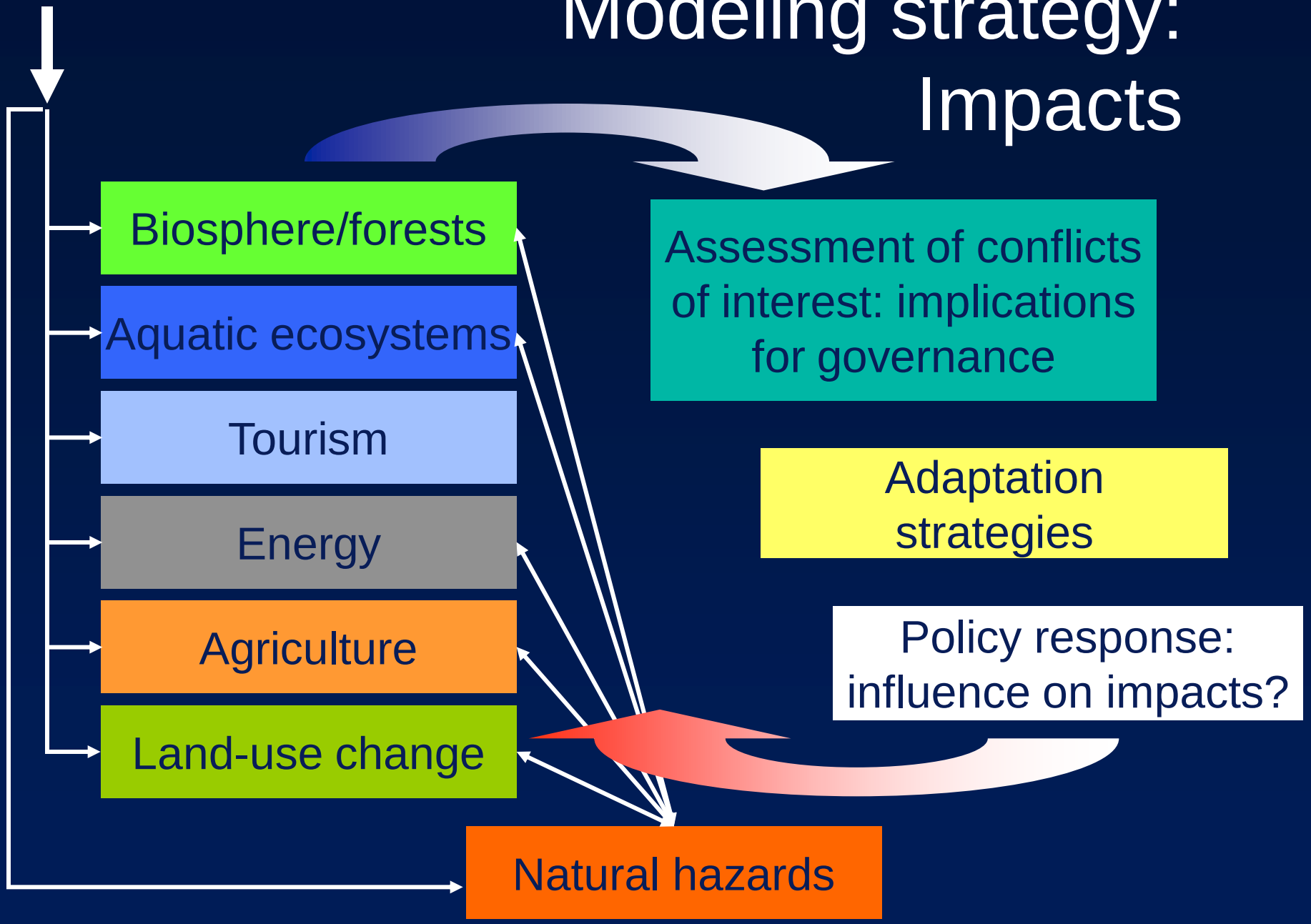
Modeling strategy: Inputs



Modeling strategy: Physically-based models

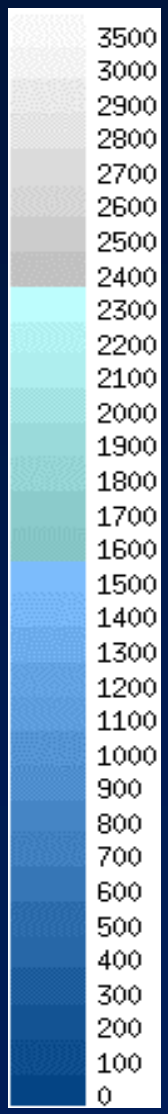


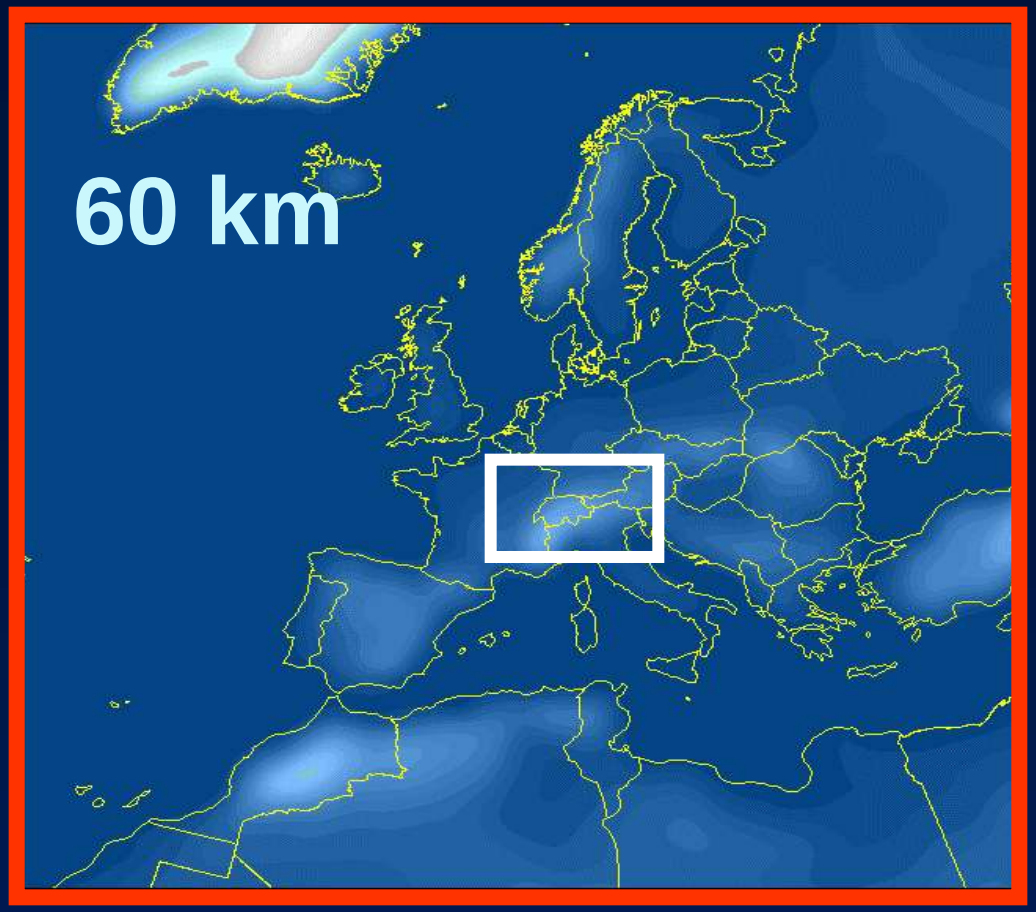
Modeling strategy: Impacts



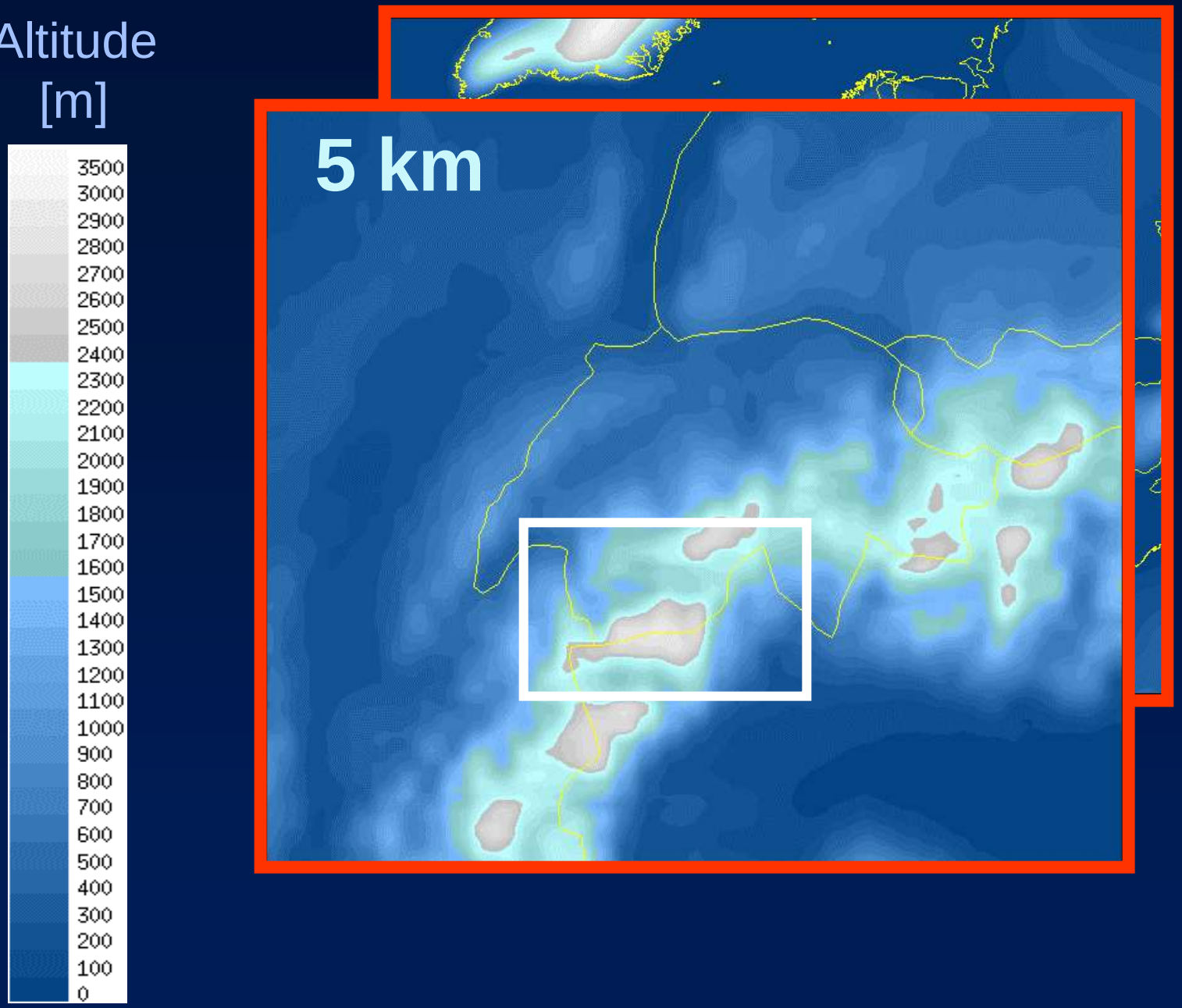
RCMs

Cascade nesting

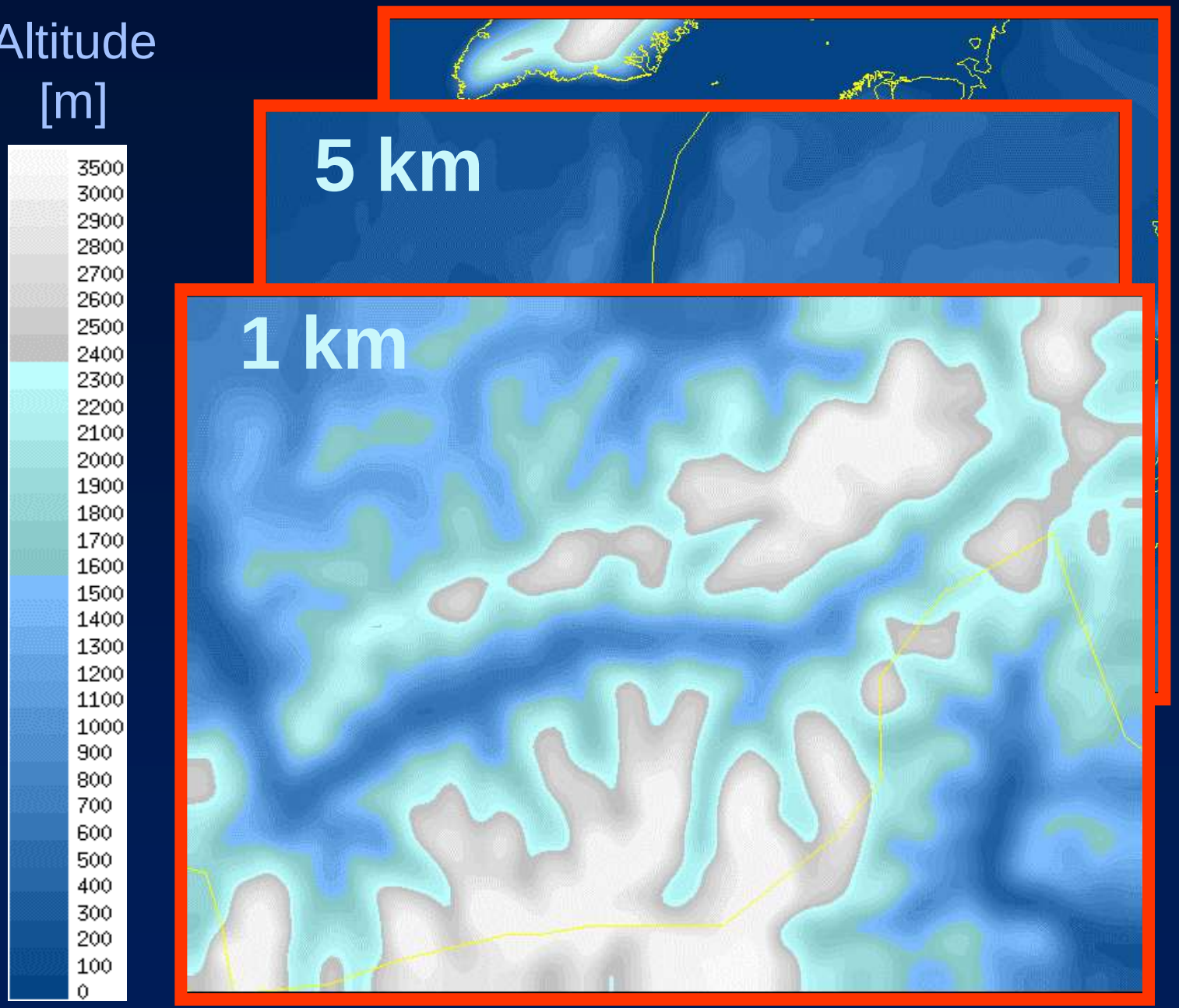




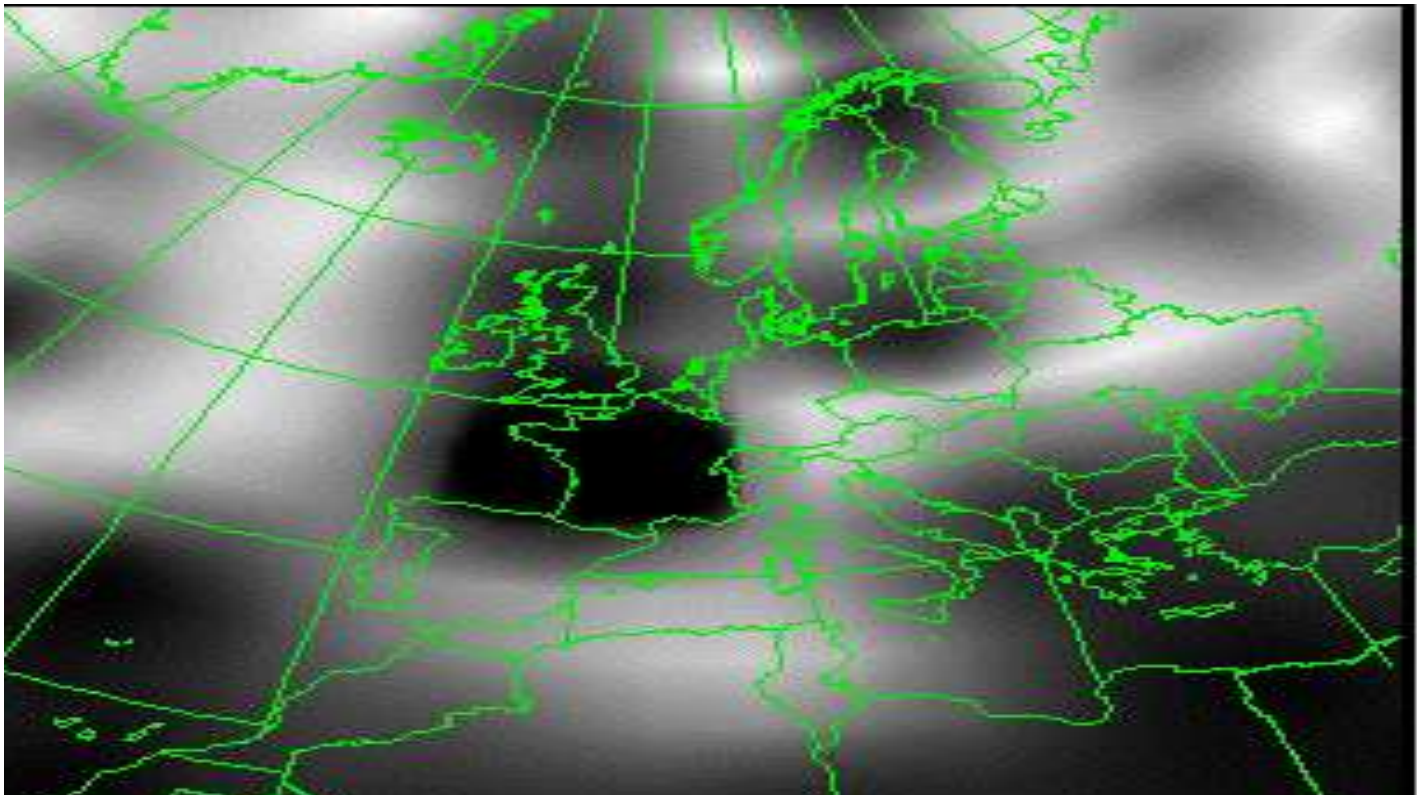
Cascade nesting



Cascade nesting



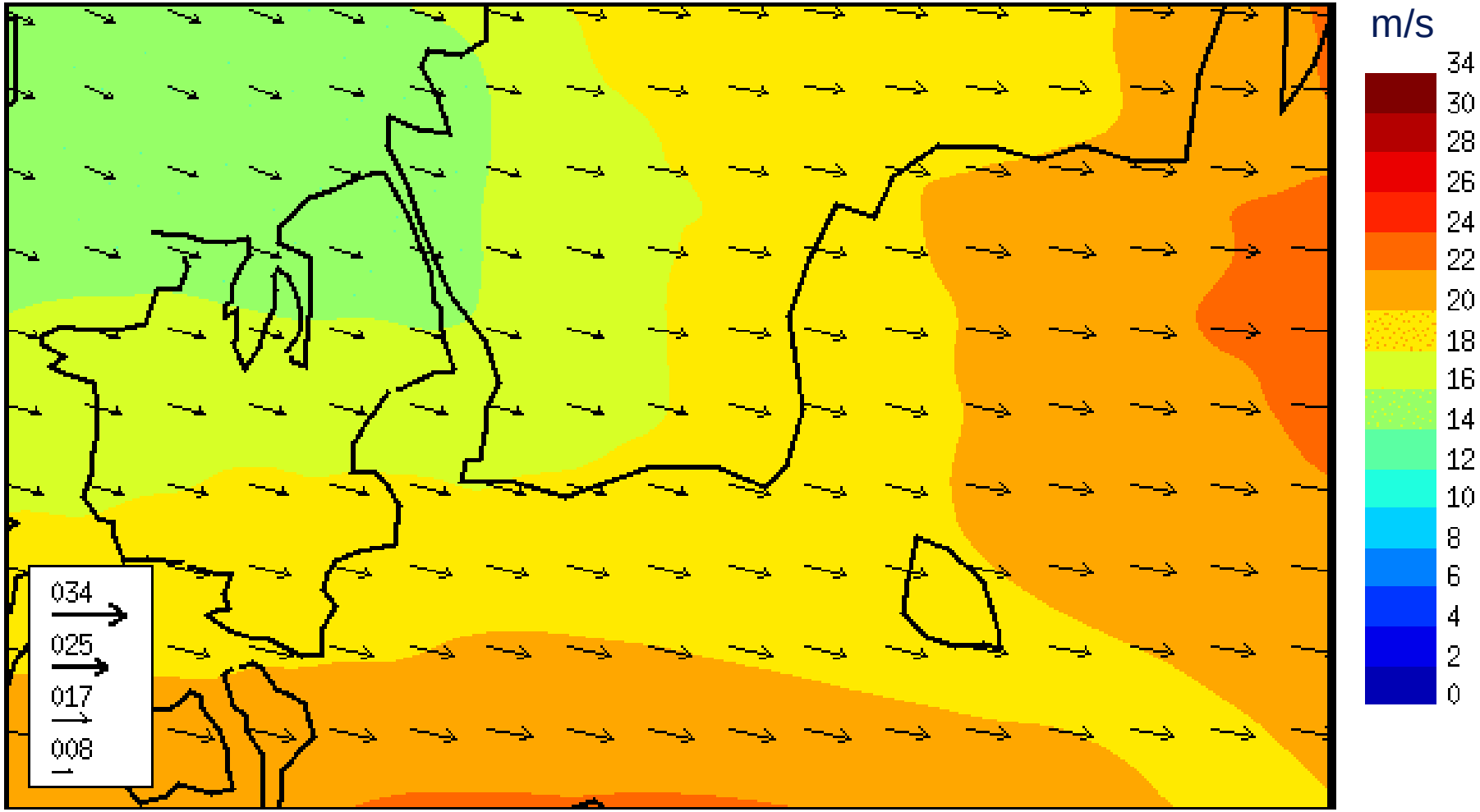
Simulation of a winter windstorm (*December 1999; CRCM2 model*)



S. Goyette, University of Geneva

Goyette et al., 2003: J. Geophys. Res.

Detail of windstorm over southern Sweden



S. Goyette, University of Geneva

Nilsson et al., 2007: Global and Planetary Change

Extremes

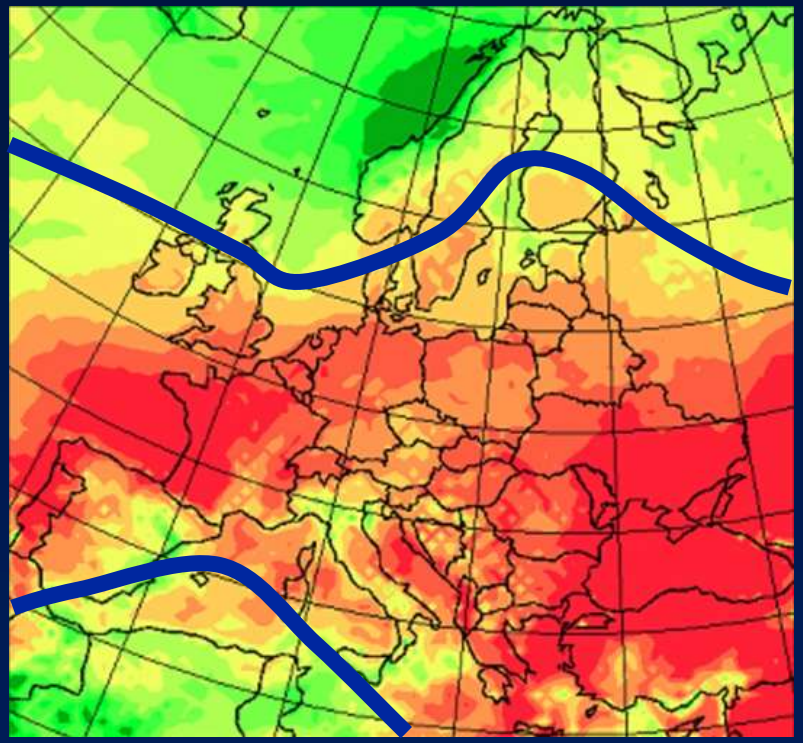
Changes in *summer* precipitation (june-july-august)

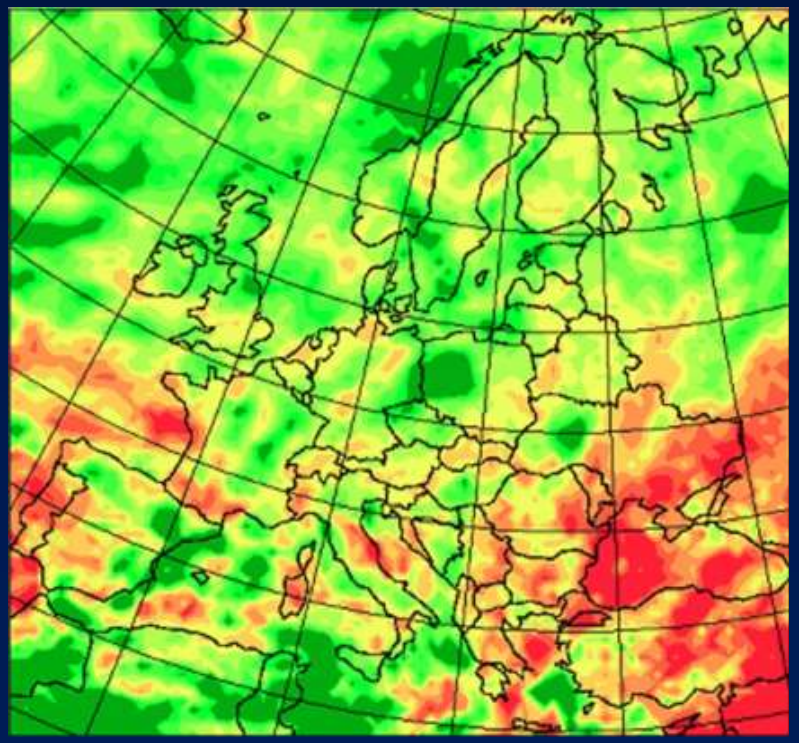
(*Differences in % between 2071-2100 and 1961-1990*)

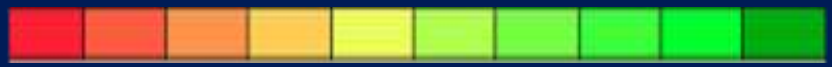
(HIRHAM RCM; A-2 Scenario)

Seasonal precipitation

Precipitation > 50 mm / day



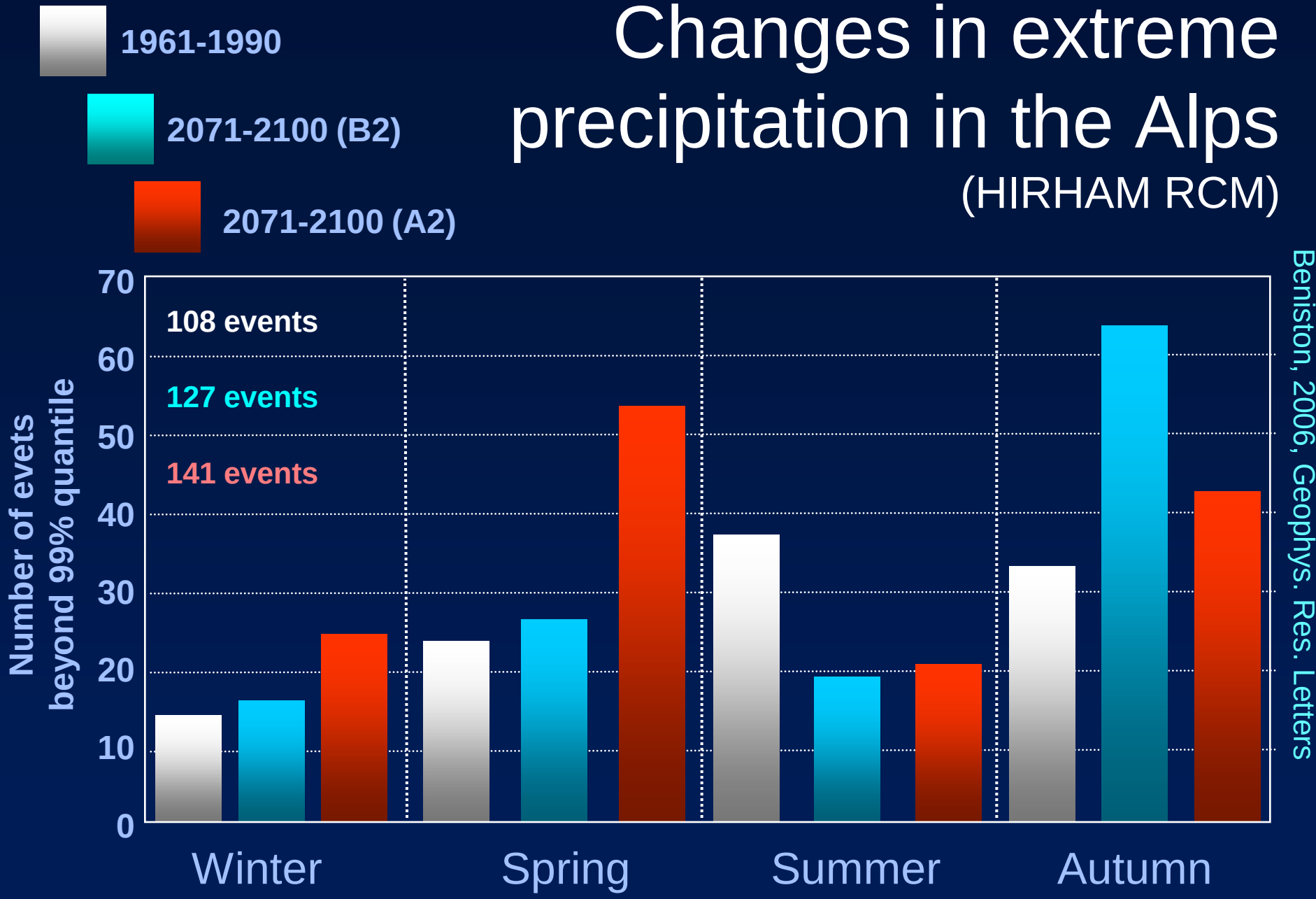




Christensen and Christensen, Nature, 2003

Changes in extreme precipitation in the Alps

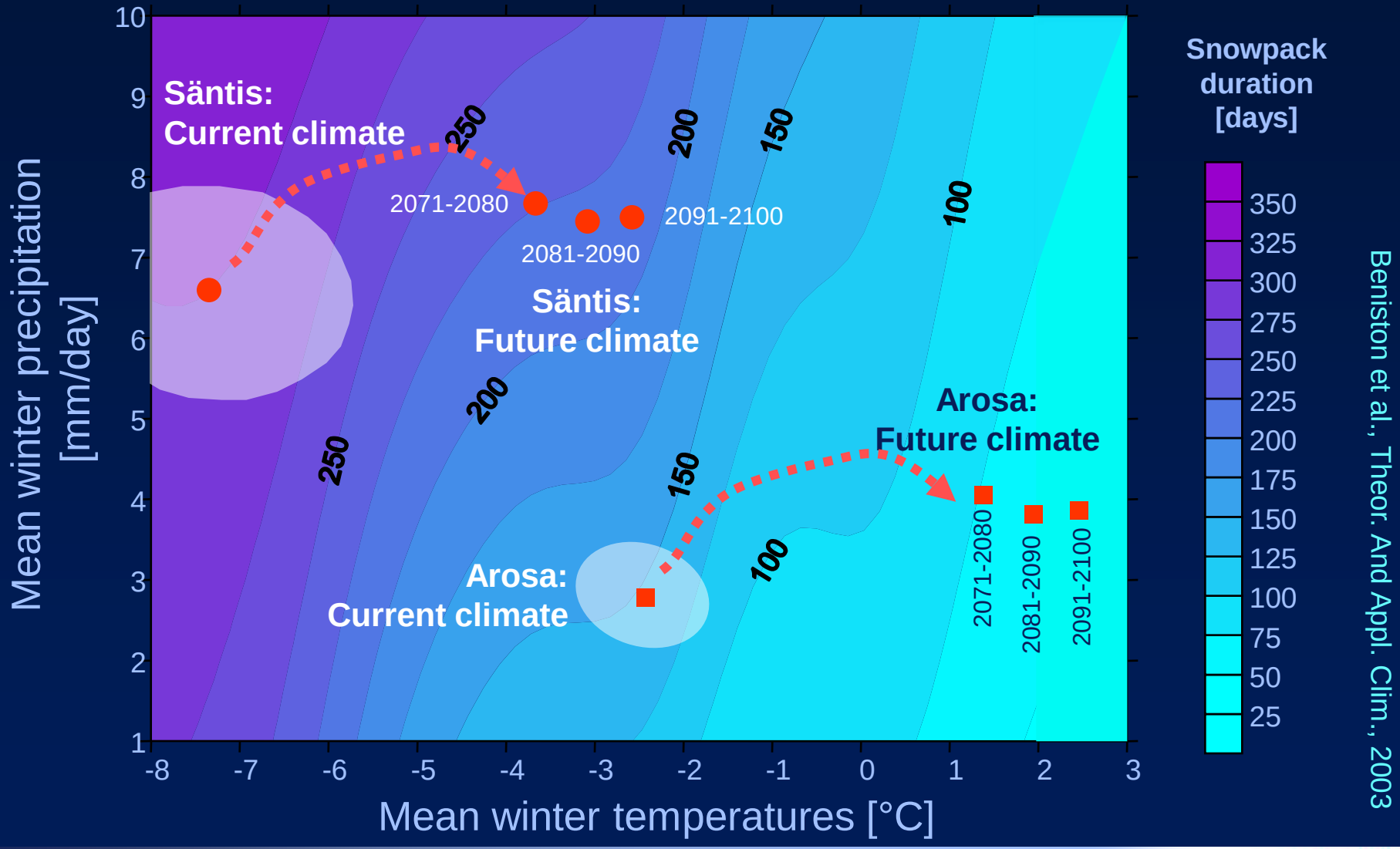
(HIRHAM RCM)



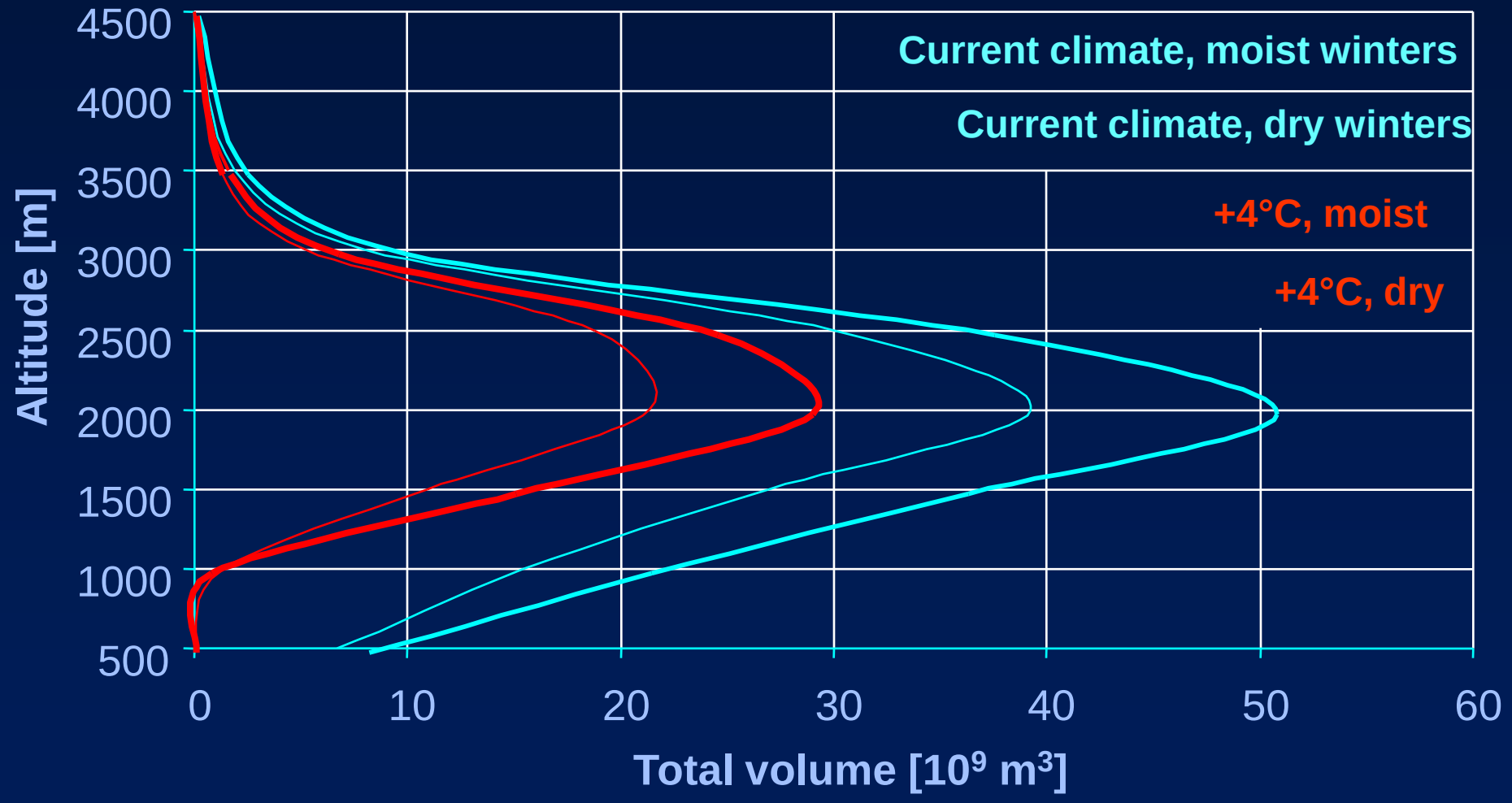
Consequences for floods

Snow

Possible shifts in snow duration for a projected climatic change in the Alps

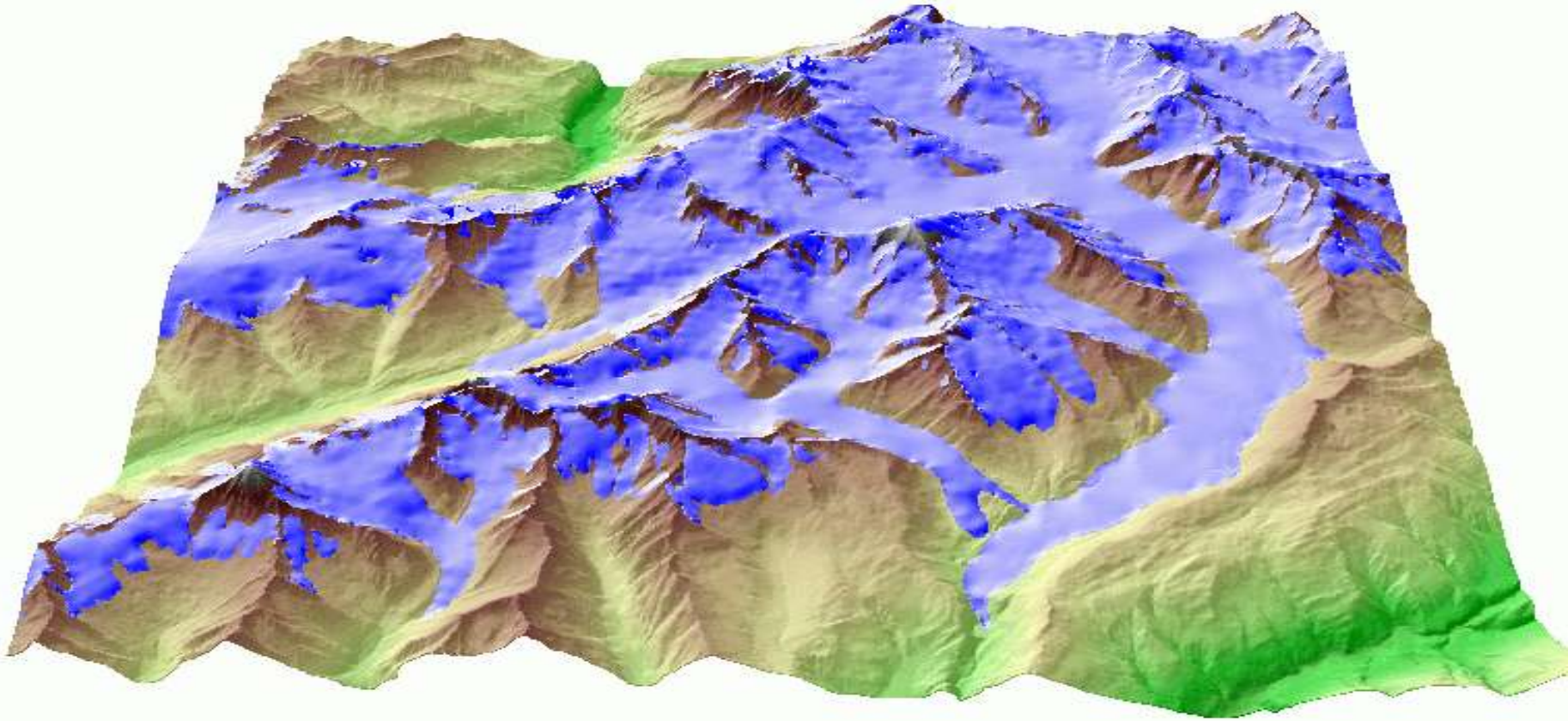


Shifts in snow volume according to altitude

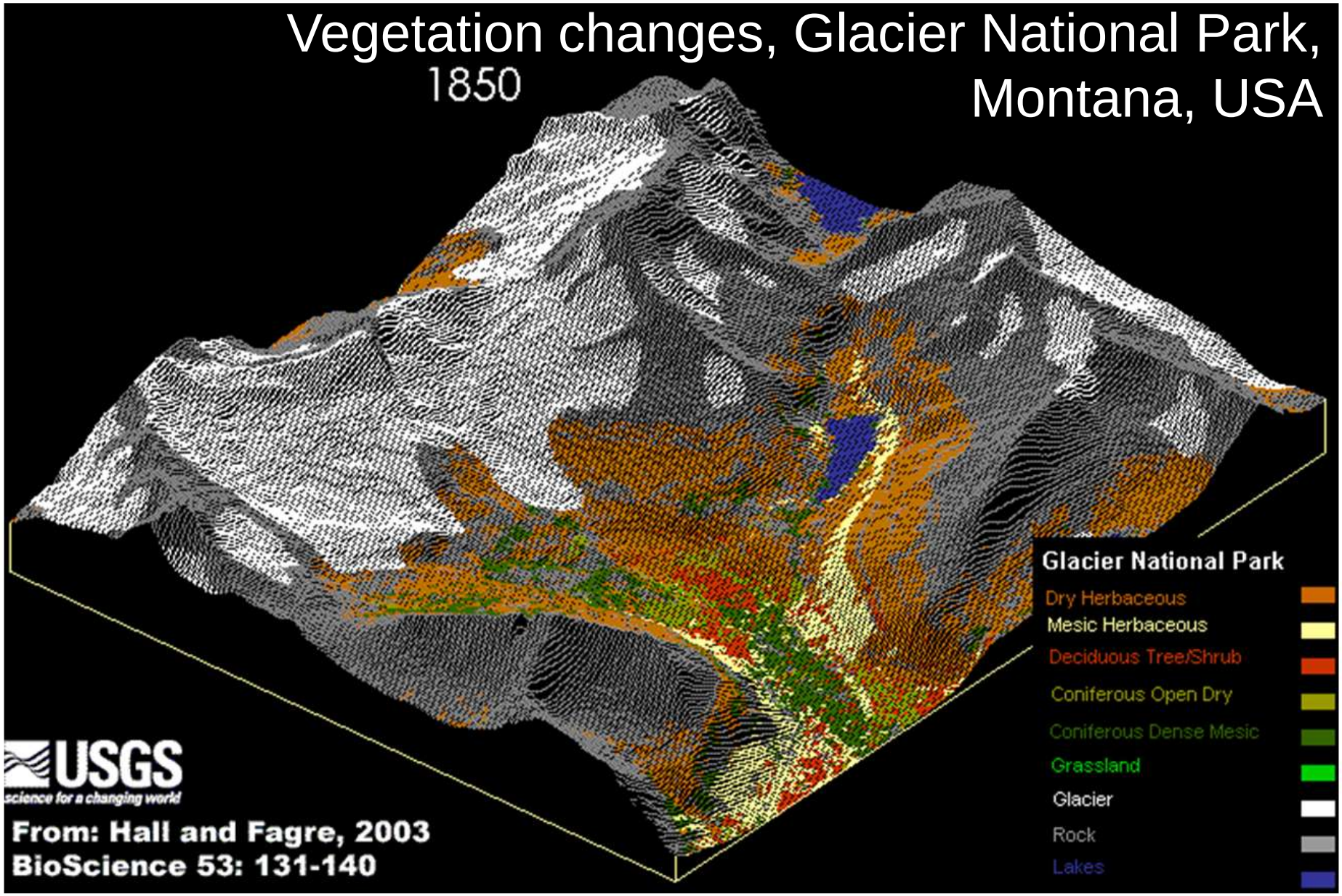


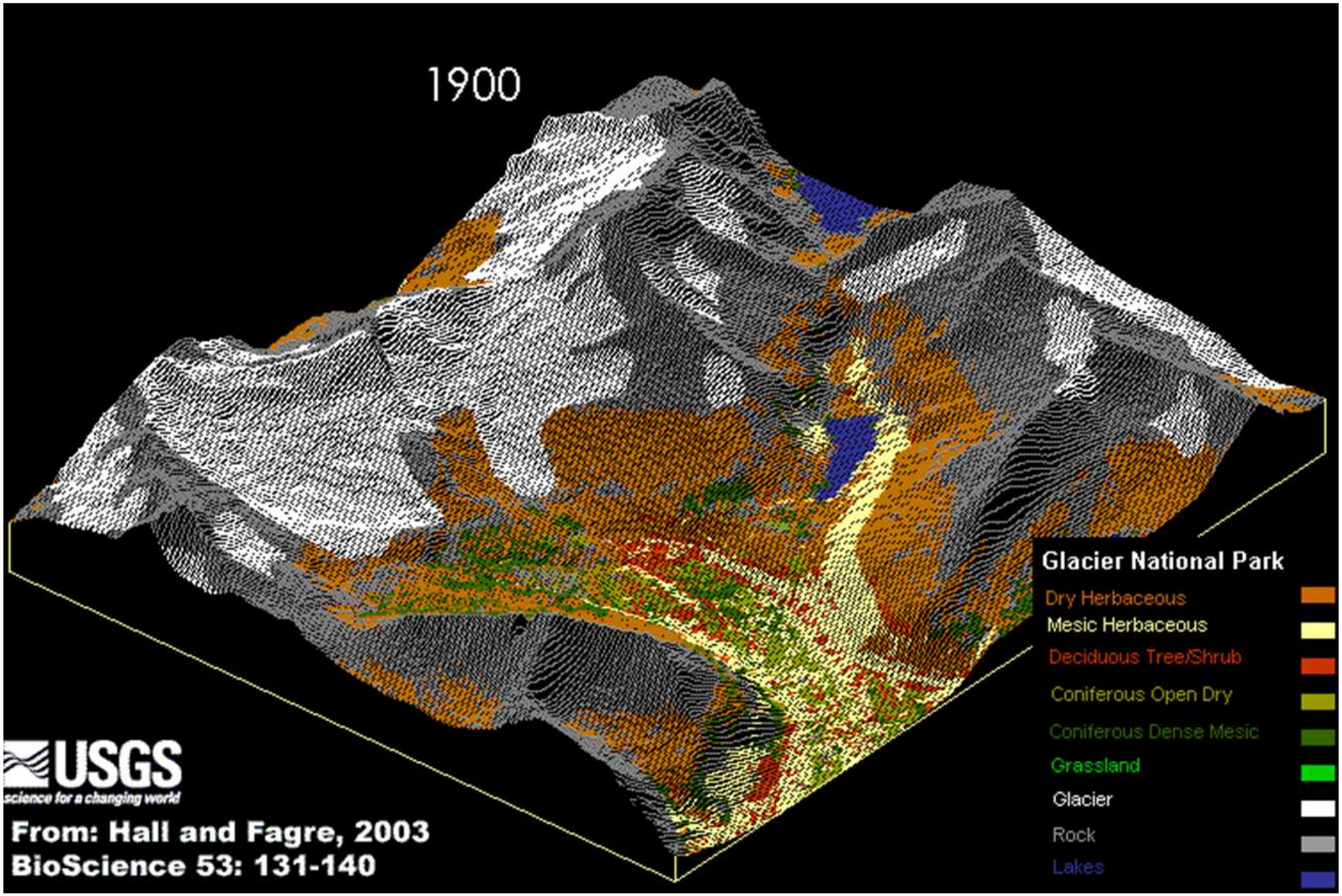
Ice

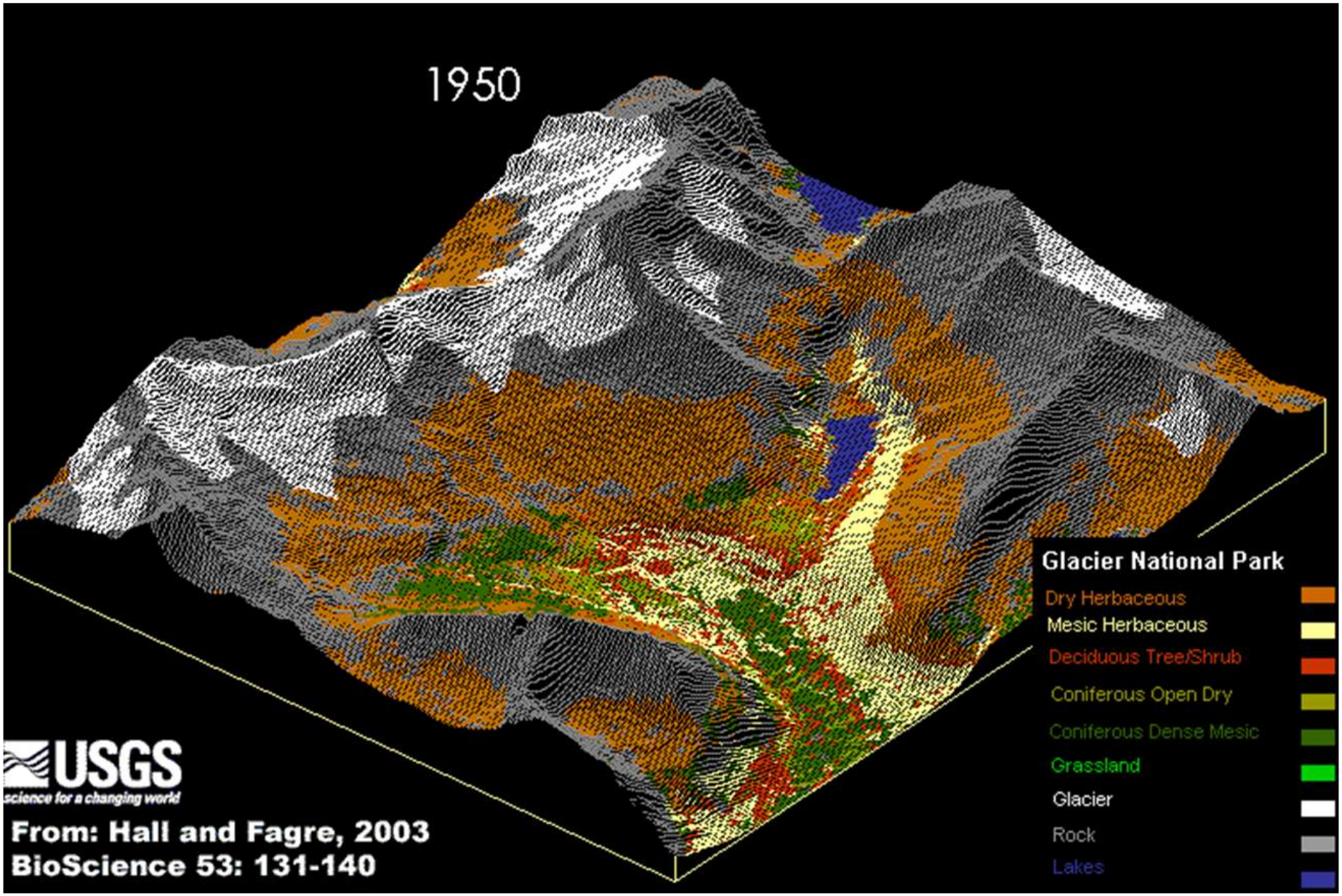
Simulation of the retreat of the Aletsch Glacier, 1950-2005

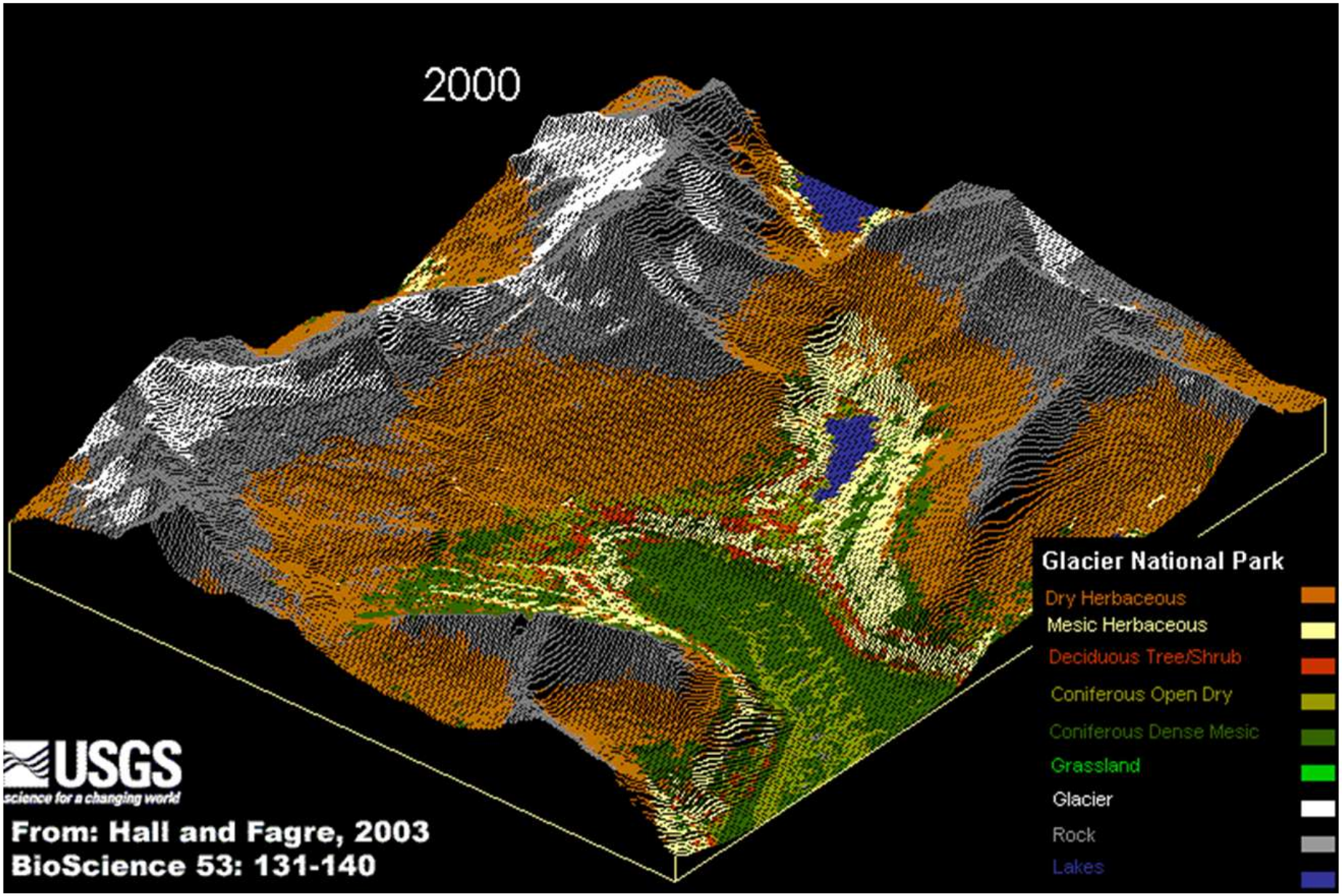


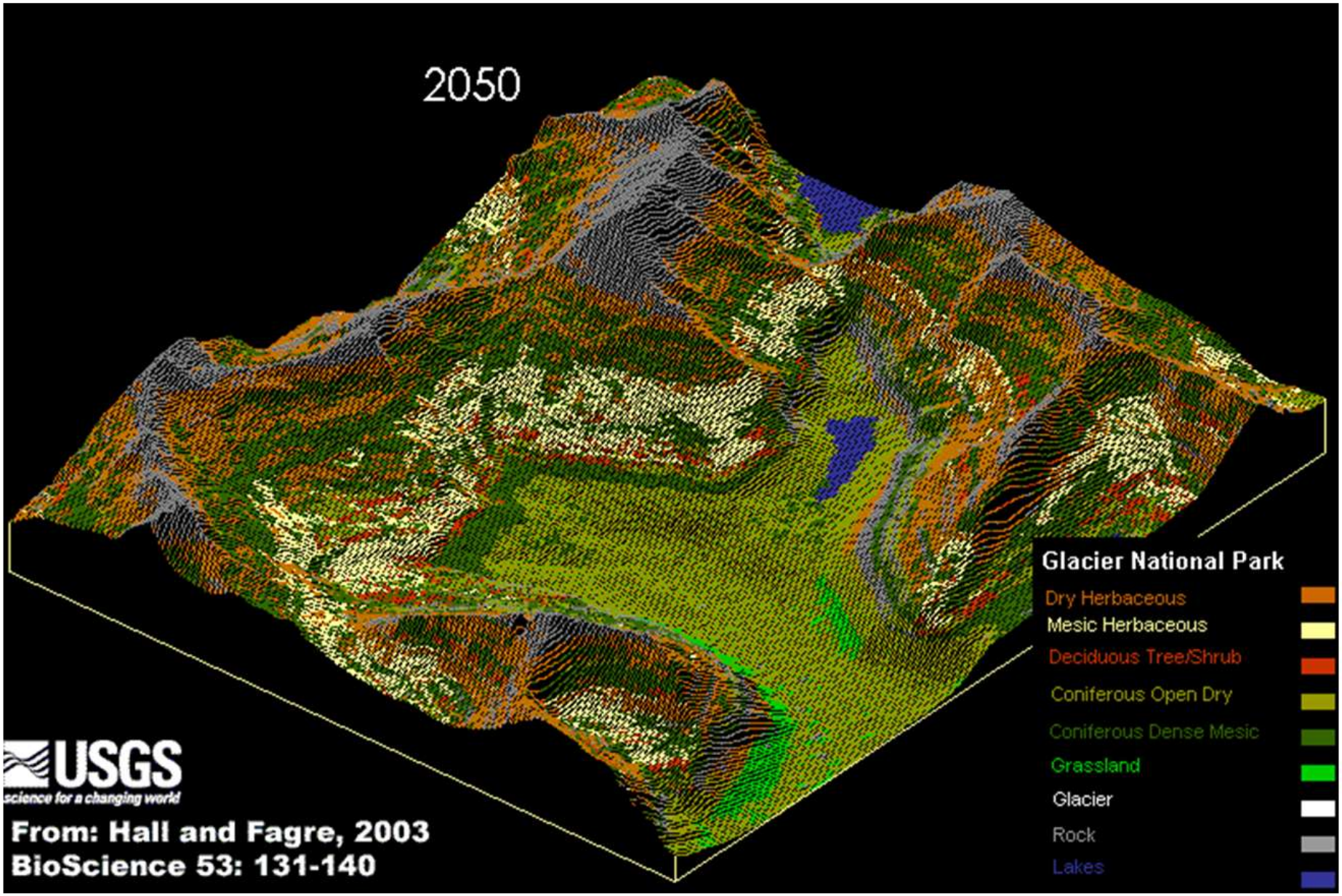
Vegetation

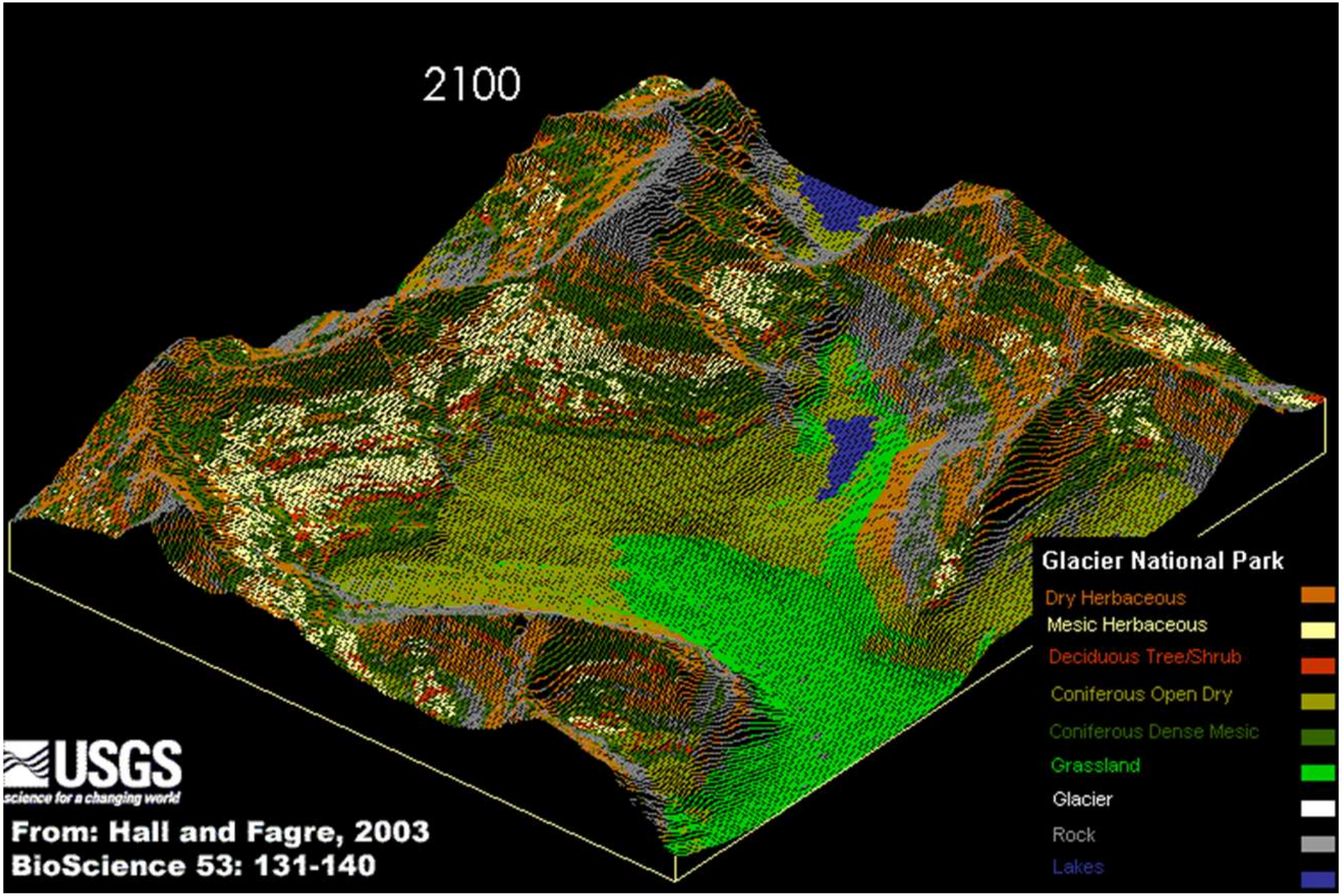

Vegetation changes, Glacier National Park, Montana, USA
1850
Glacier National Park
Dry Herbaceous
Mesic Herbaceous
Deciduous Tree/Shrub
Coniferous Open Dry
Coniferous Dense Mesic
Grassland
Glacier
Rock
Lakes
USGS
science for a changing world
From: Hall and Fagre, 2003
BioScience 53: 131-140


1900
Glacier National Park
Dry Herbaceous
Mesic Herbaceous
Deciduous Tree/Shrub
Coniferous Open Dry
Coniferous Dense Mesic
Grassland
Glacier
Rock
Lakes
USGS
science for a changing world
From: Hall and Fagre, 2003
BioScience 53: 131-140


1950
Glacier National Park
Dry Herbaceous
Mesic Herbaceous
Deciduous Tree/Shrub
Coniferous Open Dry
Coniferous Dense Mesic
Grassland
Glacier
Rock
Lakes
USGS
science for a changing world
From: Hall and Fagre, 2003
BioScience 53: 131-140


2000
Glacier National Park
Dry Herbaceous
Mesic Herbaceous
Deciduous Tree/Shrub
Coniferous Open Dry
Coniferous Dense Mesic
Grassland
Glacier
Rock
Lakes
USGS
science for a changing world
From: Hall and Fagre, 2003
BioScience 53: 131-140


2050
Glacier National Park
Dry Herbaceous
Mesic Herbaceous
Deciduous Tree/Shrub
Coniferous Open Dry
Coniferous Dense Mesic
Grassland
Glacier
Rock
Lakes
USGS
science for a changing world
From: Hall and Fagre, 2003
BioScience 53: 131-140


2100
Glacier National Park
Dry Herbaceous
Mesic Herbaceous
Deciduous Tree/Shrub
Coniferous Open Dry
Coniferous Dense Mesic
Grassland
Glacier
Rock
Lakes
USGS
science for a changing world
From: Hall and Fagre, 2003
BioScience 53: 131-140

Hydrology

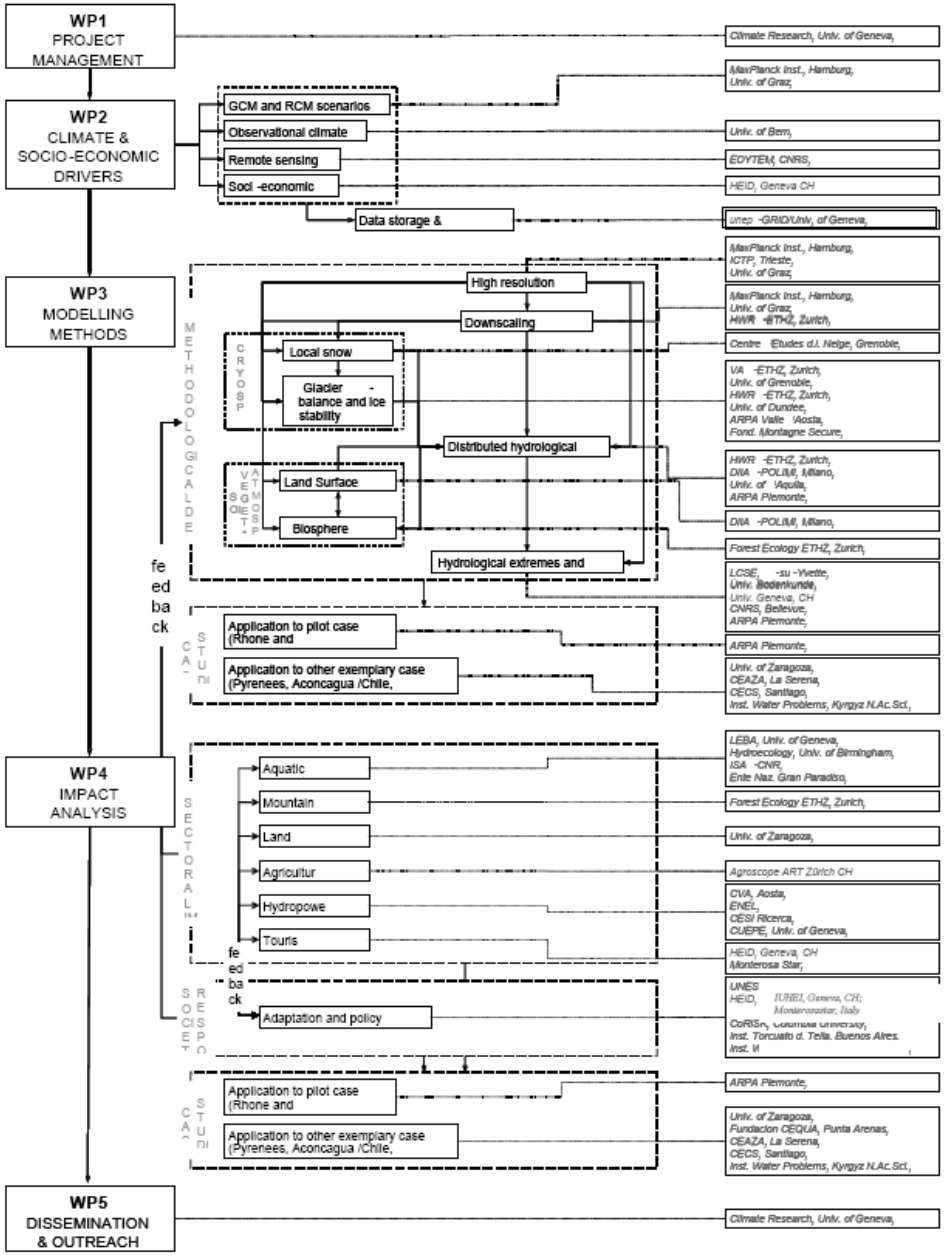
Modeling strategies for water

- Distributed catchment response to climate scenarios
- Subgrid variability of the response of rivers
  - the local/point scales: very detailed modelling of processes that are characterized by significant small scale dynamics and nonetheless have a considerable impact
    - on processes at a larger scales
    - on socio-economic aspects

Hydrological models

- TOPKAPI model (ETH-Zurich)
- FEST model (Politecnico di Milano)
- CHyM model (ICTP, Trieste, and l'Aquila, Italy)
- Model characteristics:
  - raster based (function of DEM availability and catchment scale, approx. range 50 to 500 m grid size)
  - physically based/oriented
  - continuous in time with hourly resolution
  - explicit in the soil/and component
  - internally consistent
- They produce distributed output scenarios for:
  - snow and ice accumulation/melting
  - interception
  - evaporation/evapotranspiration
  - infiltration/soil moisture/groundwater storage
  - streamflow

Links between partners and Work Packages



www.acqwa.ch

Martin.Beniston@unige.ch