Projecting climate change impacts on water resources in Switzerland

B.Schaefli

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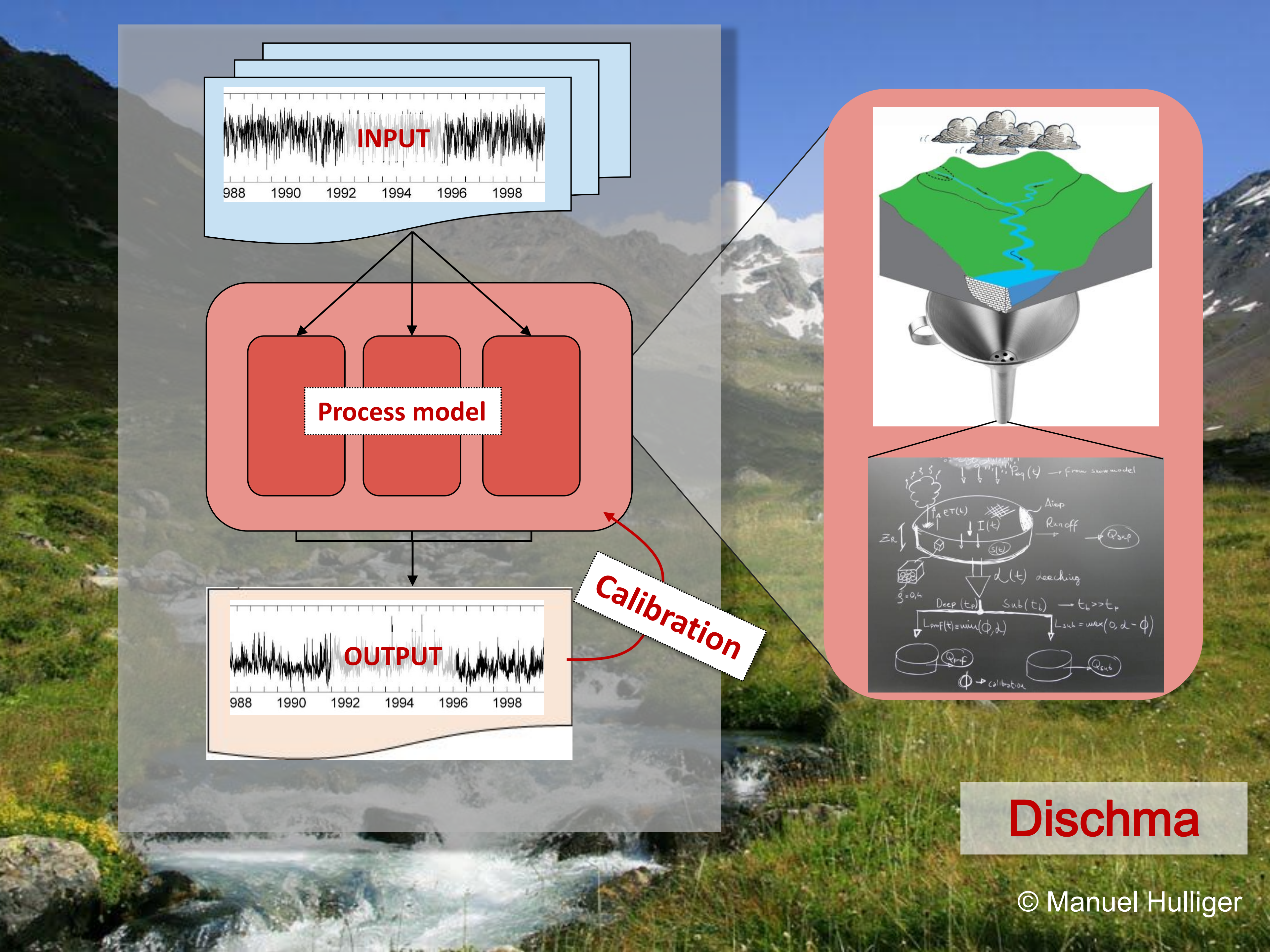
INPUT
988 1990 1992 1994 1996 1998
Process model
OUTPUT
988 1990 1992 1994 1996 1998
Calibration
Dischma
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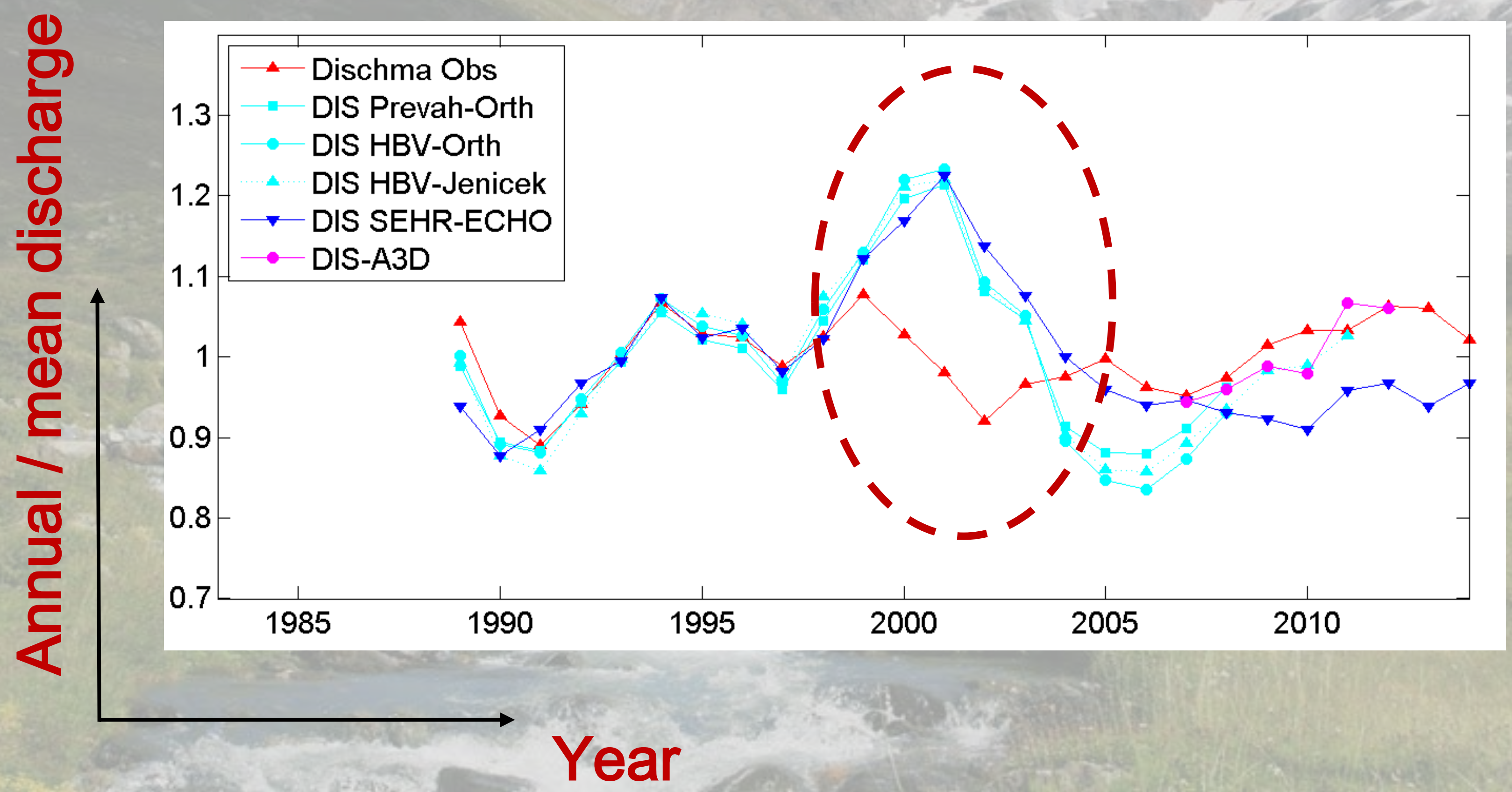
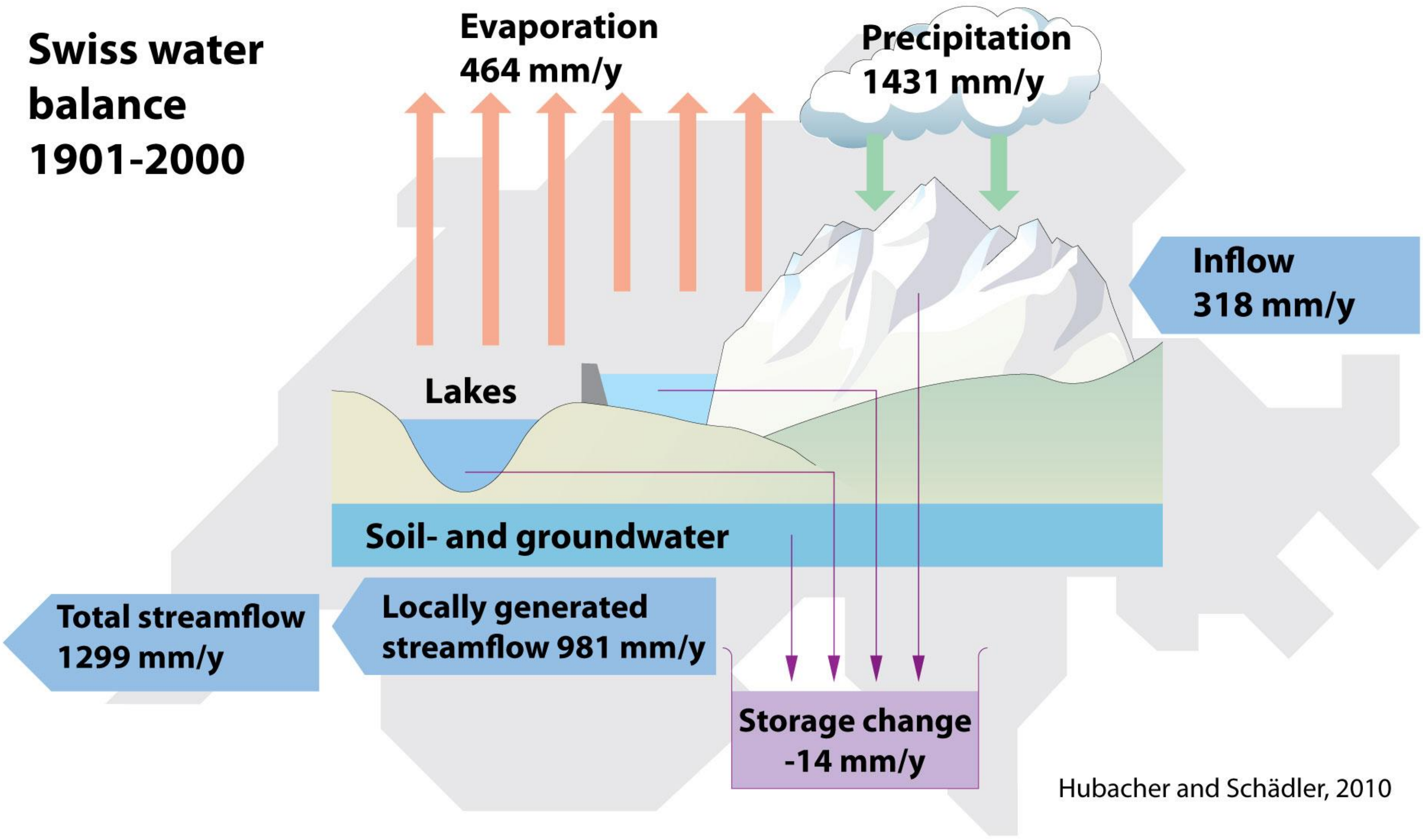
Simulations from 4 different models / 3 different groups … all wrong?



Swiss water balance 1901-2000



Hubacher and Schädler, 2010

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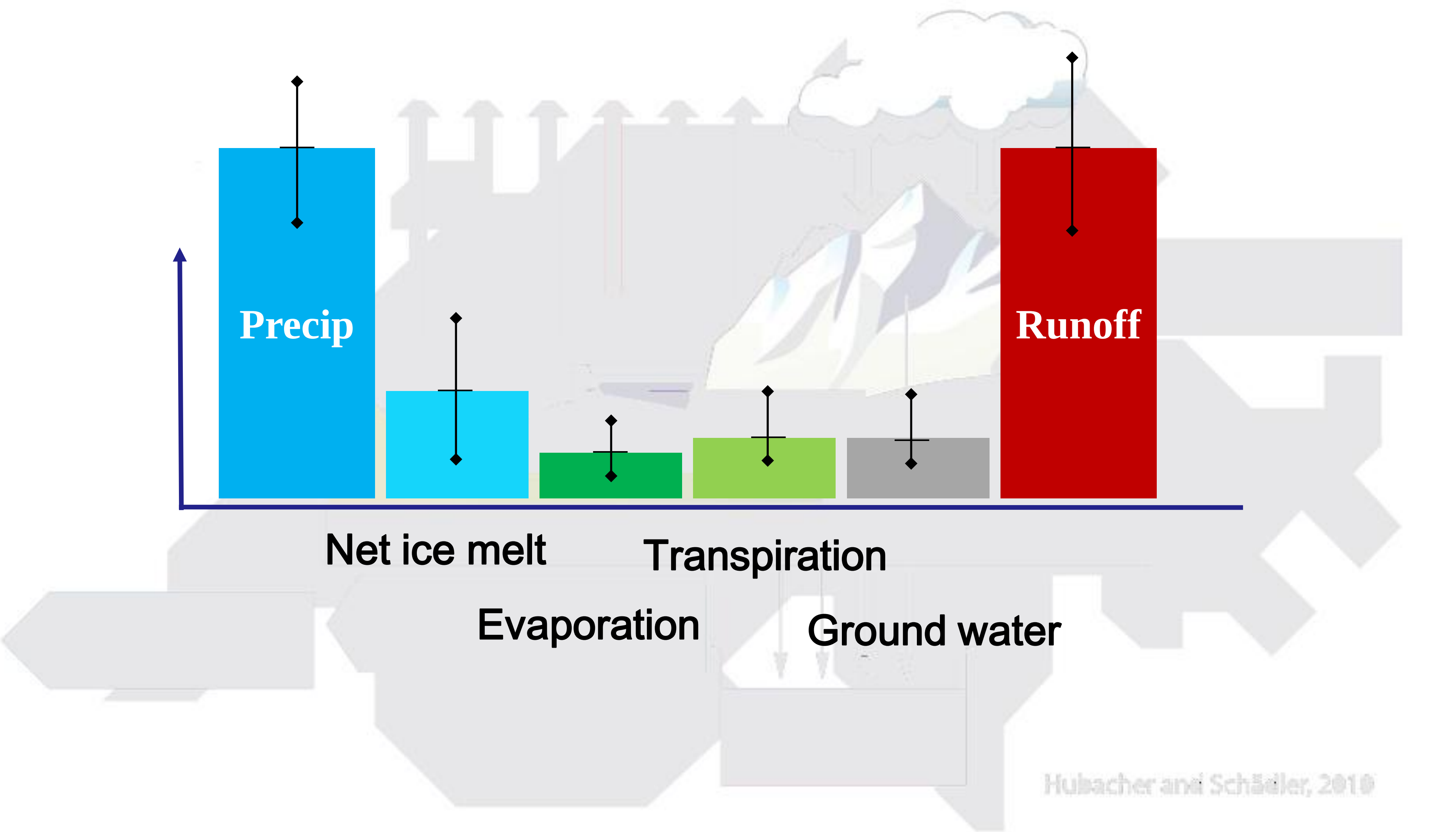
Current water resources ?



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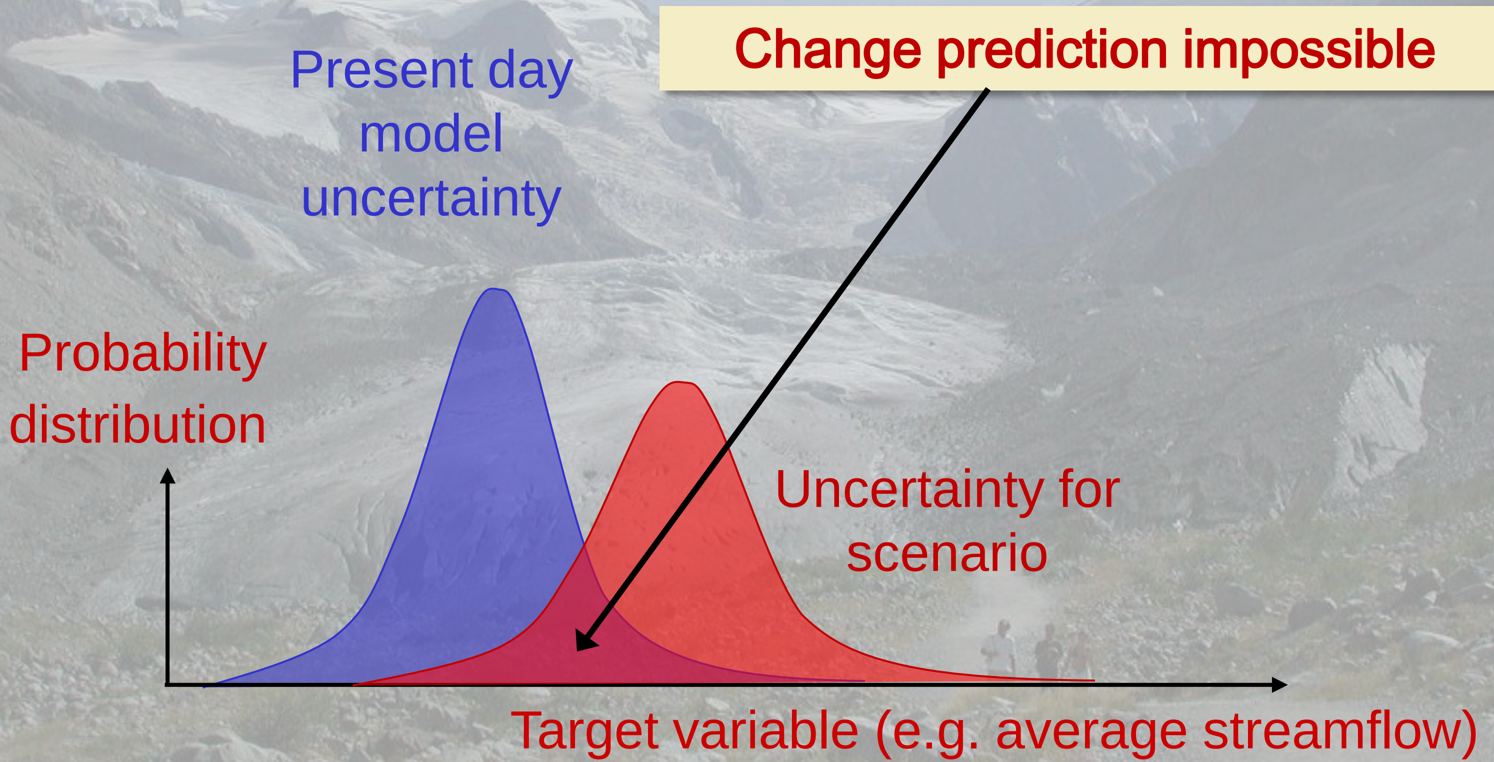
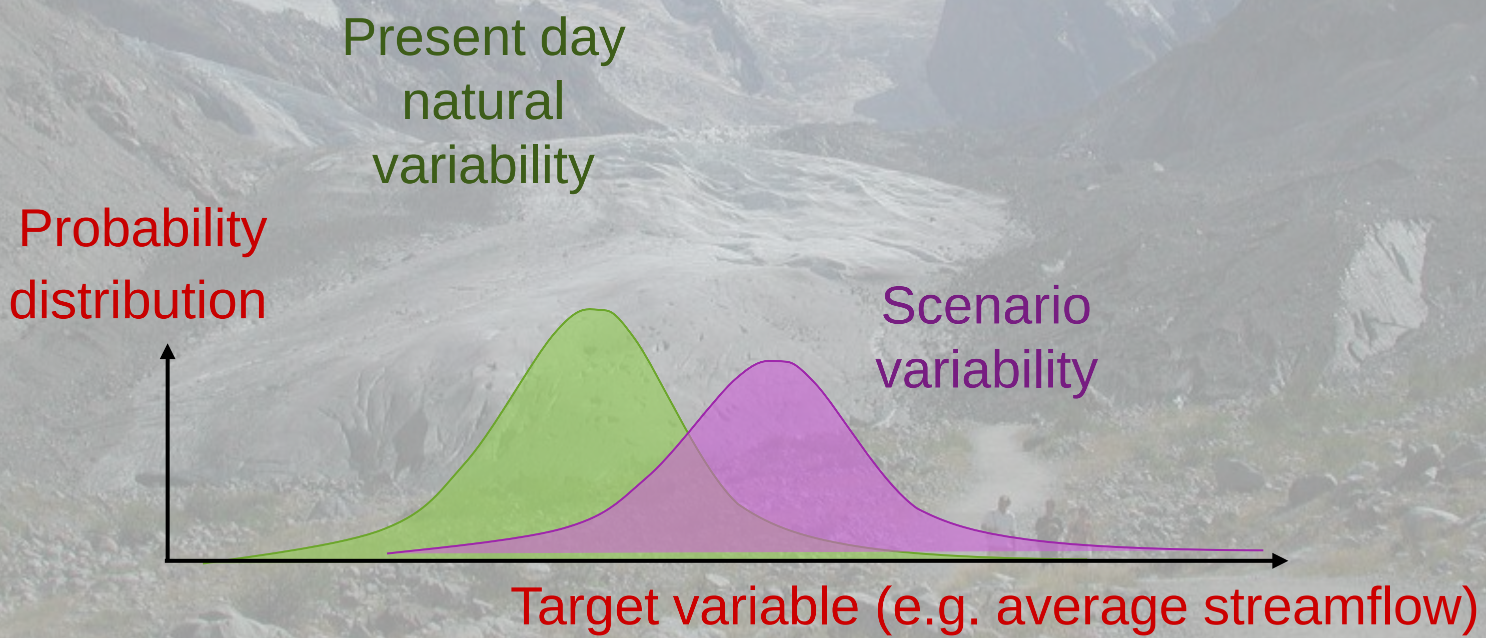
Role of (un-)certainty ranges



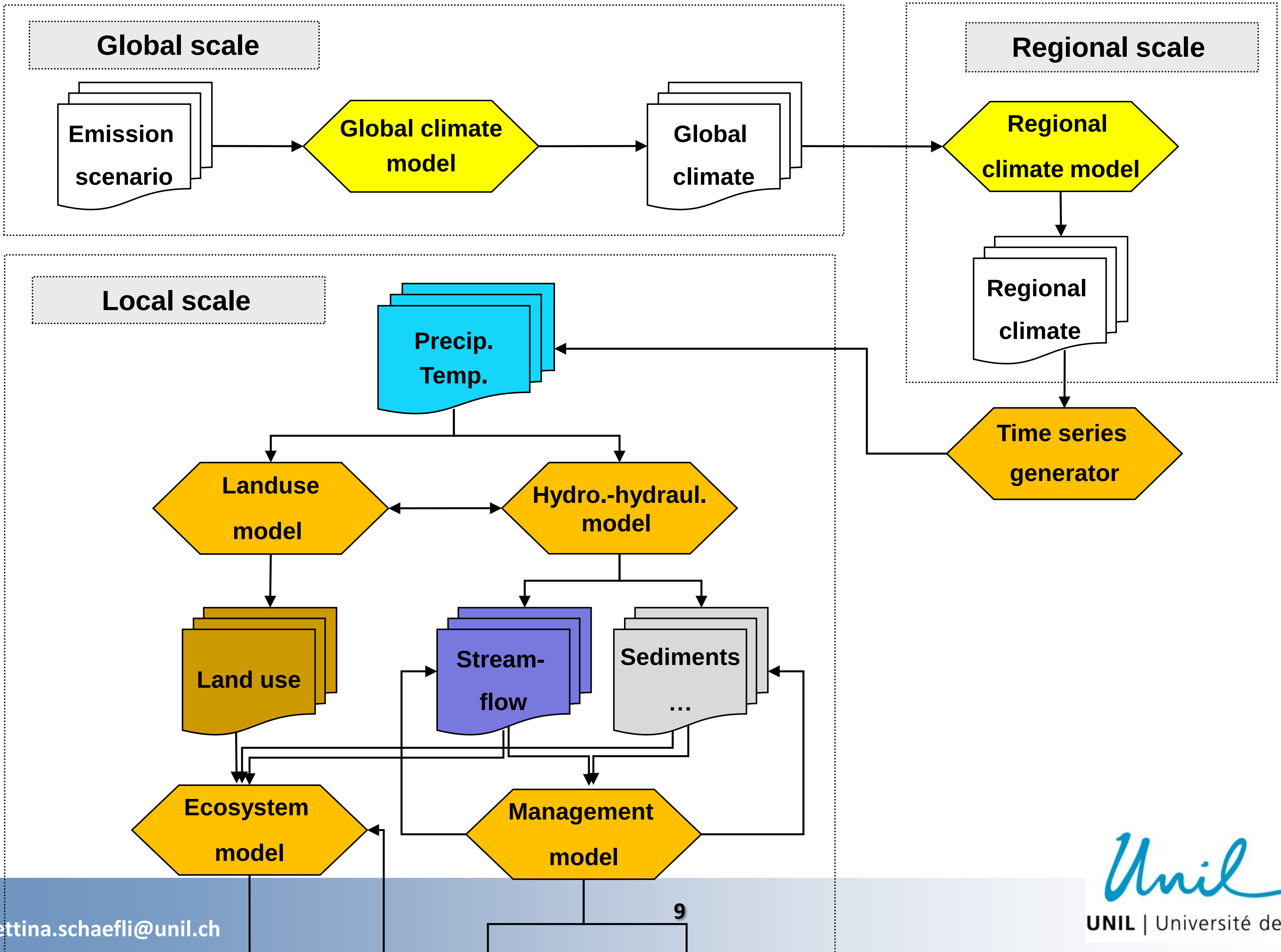
Role of natural variability

Significance of changes ?




change
prediction
impact
climate
© Philograf

Climate change model chain



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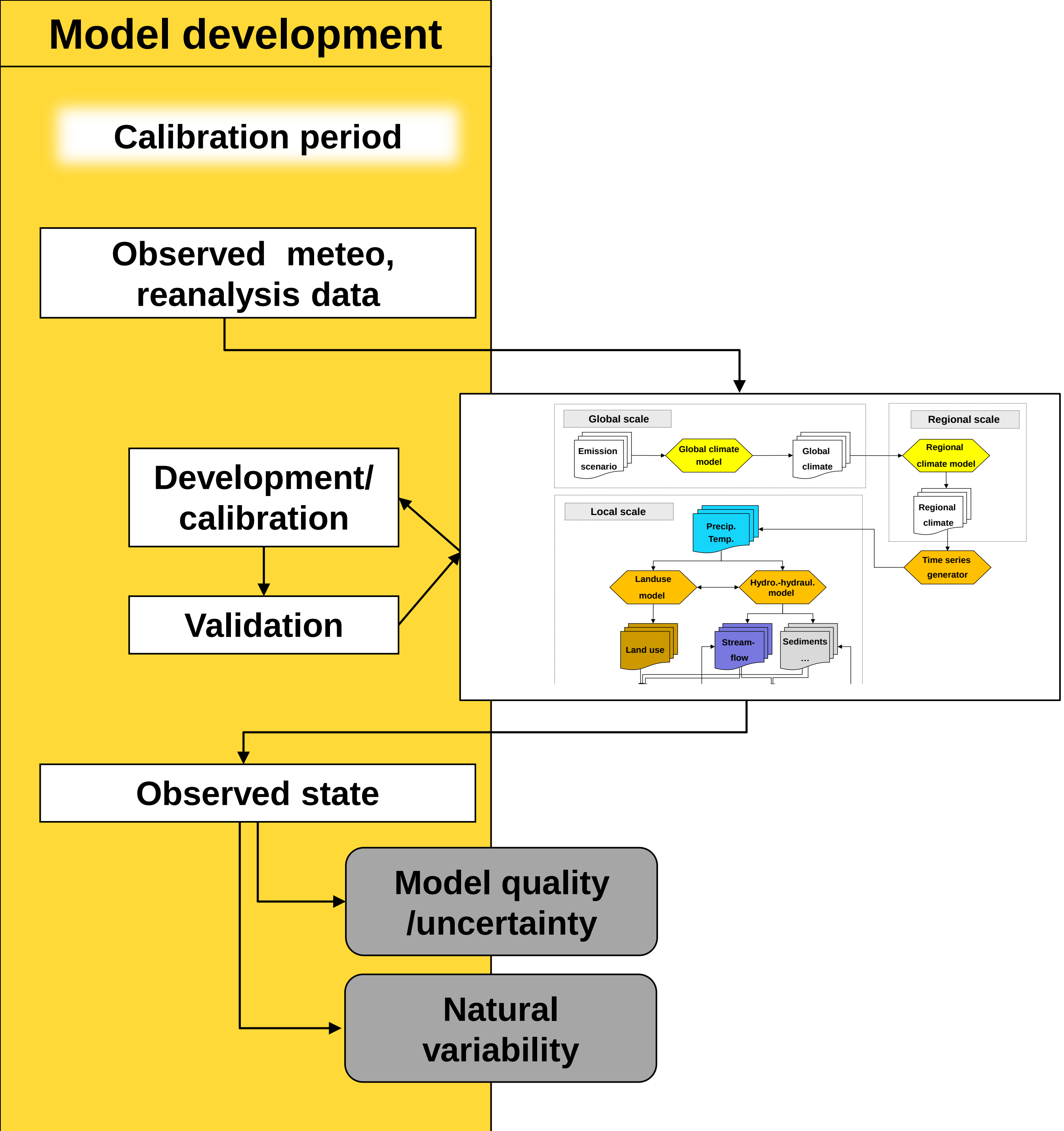
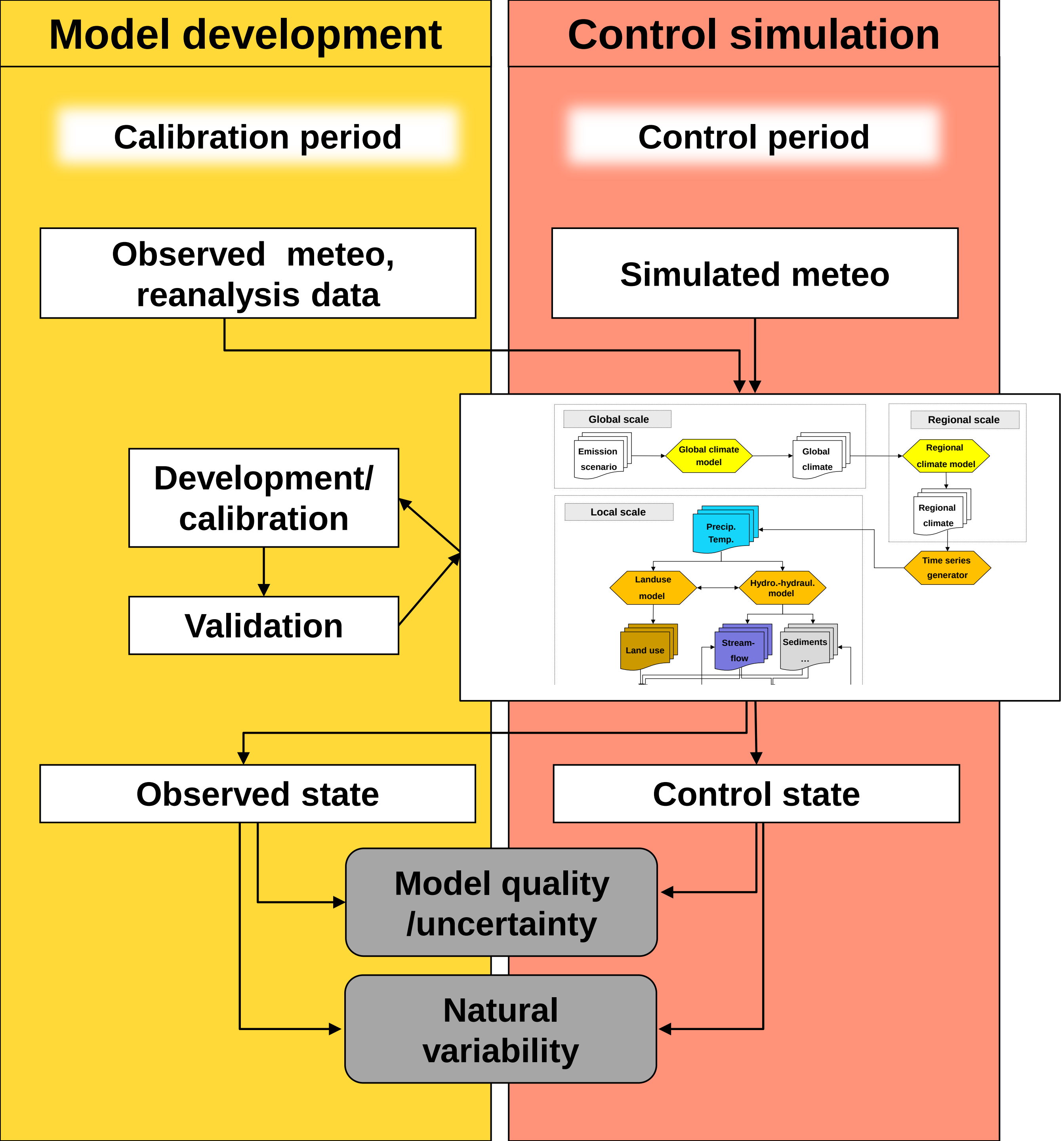

Model development
Calibration period
Observed meteo, reanalysis data
Development/ calibration
Validation
Global scale
Emission scenario
Global climate model
Global climate
Regional scale
Regional climate model
Regional climate
Time series generator
Local scale
Precip. Temp.
Landuse model
Hydro.-hydraul. model
Land use
Stream- flow
Sediments …
Observed state
Model quality /uncertainty
Natural variability



Model development
Control simulation
Calibration period
Control period
Observed meteo, reanalysis data
Simulated meteo
Global scale
Emission scenario
Global climate model
Global climate
Regional scale
Regional climate model
Regional climate
Time series generator
Local scale
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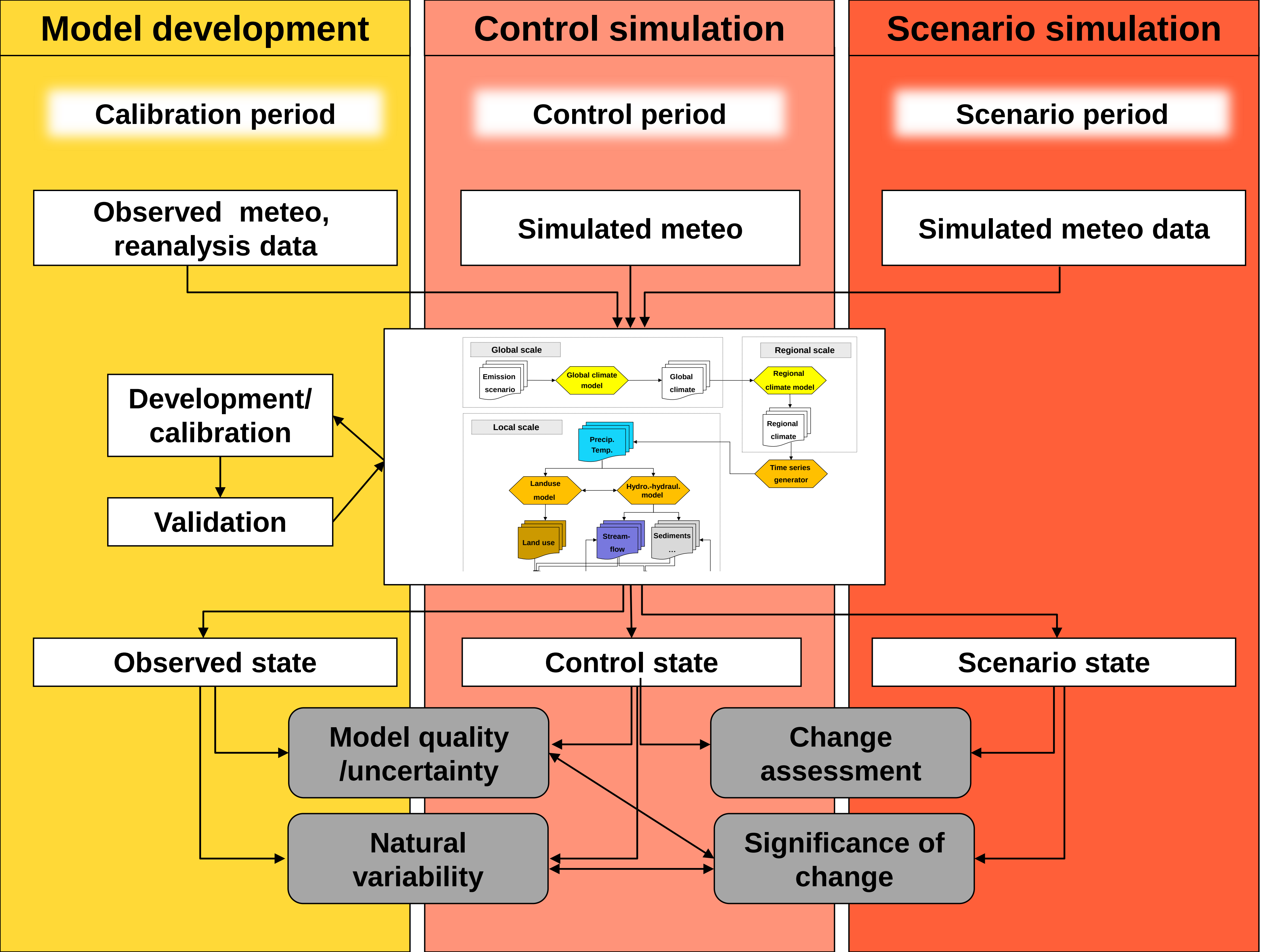
Control state
Model quality /uncertainty
Natural variability



Model development
Control simulation
Scenario simulation
Calibration period
Control period
Scenario period
Observed meteo, reanalysis data
Simulated meteo
Simulated meteo data
Global scale
Emission scenario
Global climate model
Global climate
Regional scale
Regional climate model
Regional climate
Time series generator
Local scale
Precip. Temp.
Landuse model
Hydro.-hydraul. model
Land use
Stream-flow
Sediments …
Development/ calibration
Validation
Observed state
Control state
Scenario state
Model quality /uncertainty
Change assessment
Natural variability
Significance of change

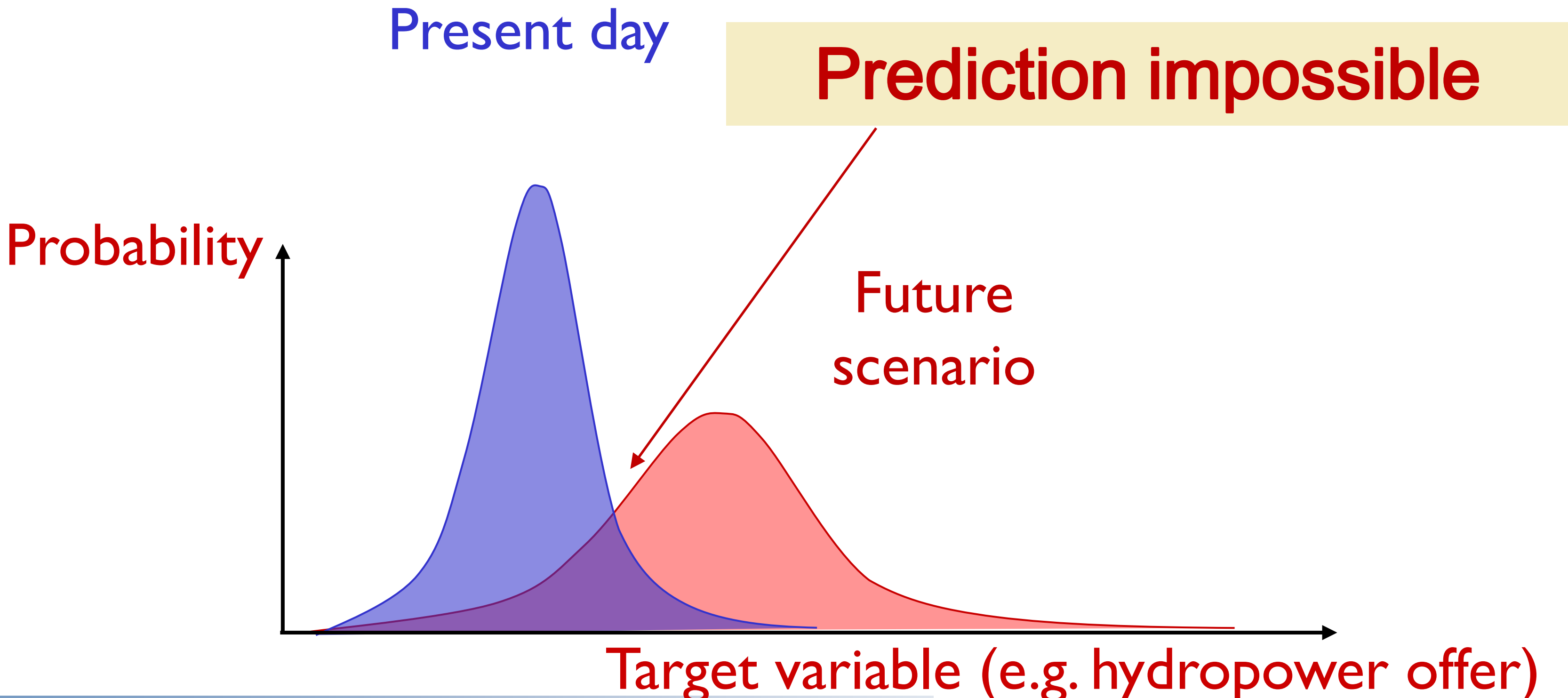
Can we make useful climate change predictions ?

Answer 1: No because …

- **Scenario production with calibrated models & simulated meteorology**

Can we make useful climate change predictions ?

Answer 2: No because …



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Can we make useful climate change predictions ?

Answer 3: No because …

- **Baseline prediction uncertainty**

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Certain changes !

Can we make useful climate change predictions ?

Answer 4: Yes but only for certain aspects …

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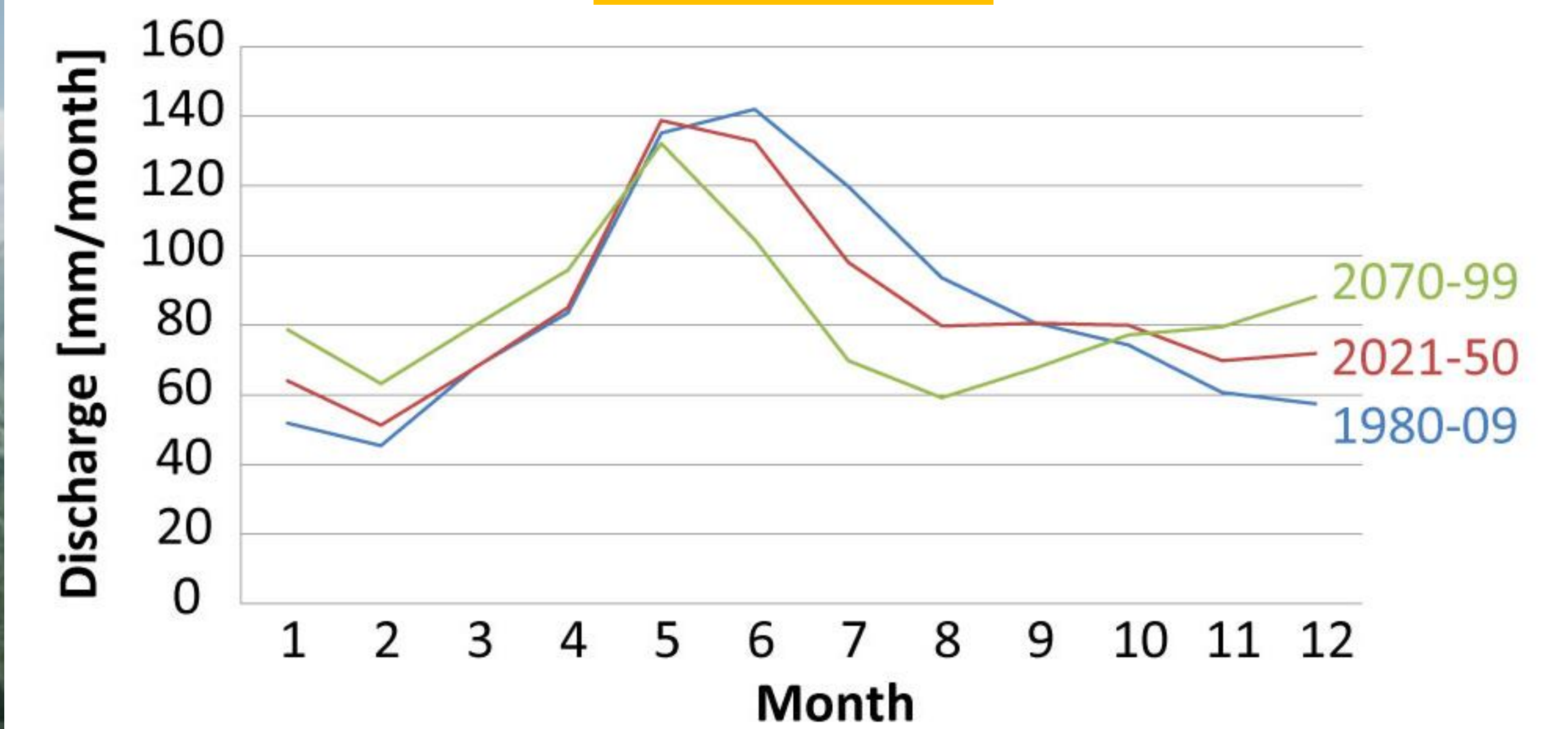
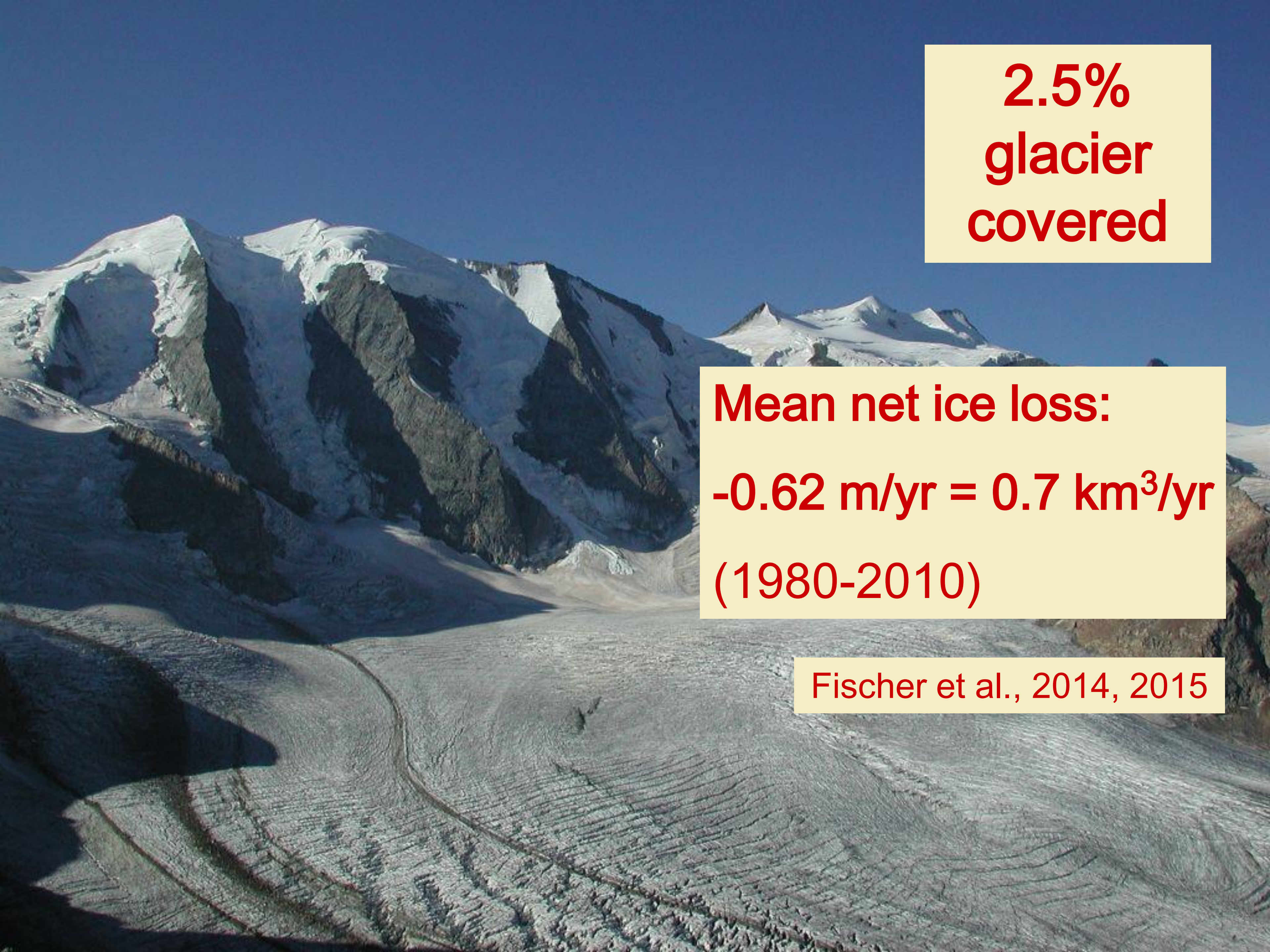
Climate change impact on water resources

CCHYDRO



(source: «report «CCHydro Veredelung»)


2.5% glacier covered
Mean net ice loss:
-0.62 m/yr = 0.7 km³/yr
(1980-2010)
Fischer et al., 2014, 2015

Moment of peak water ?

- Ongoing estimation of all glacier volumes with ice penetrating radar

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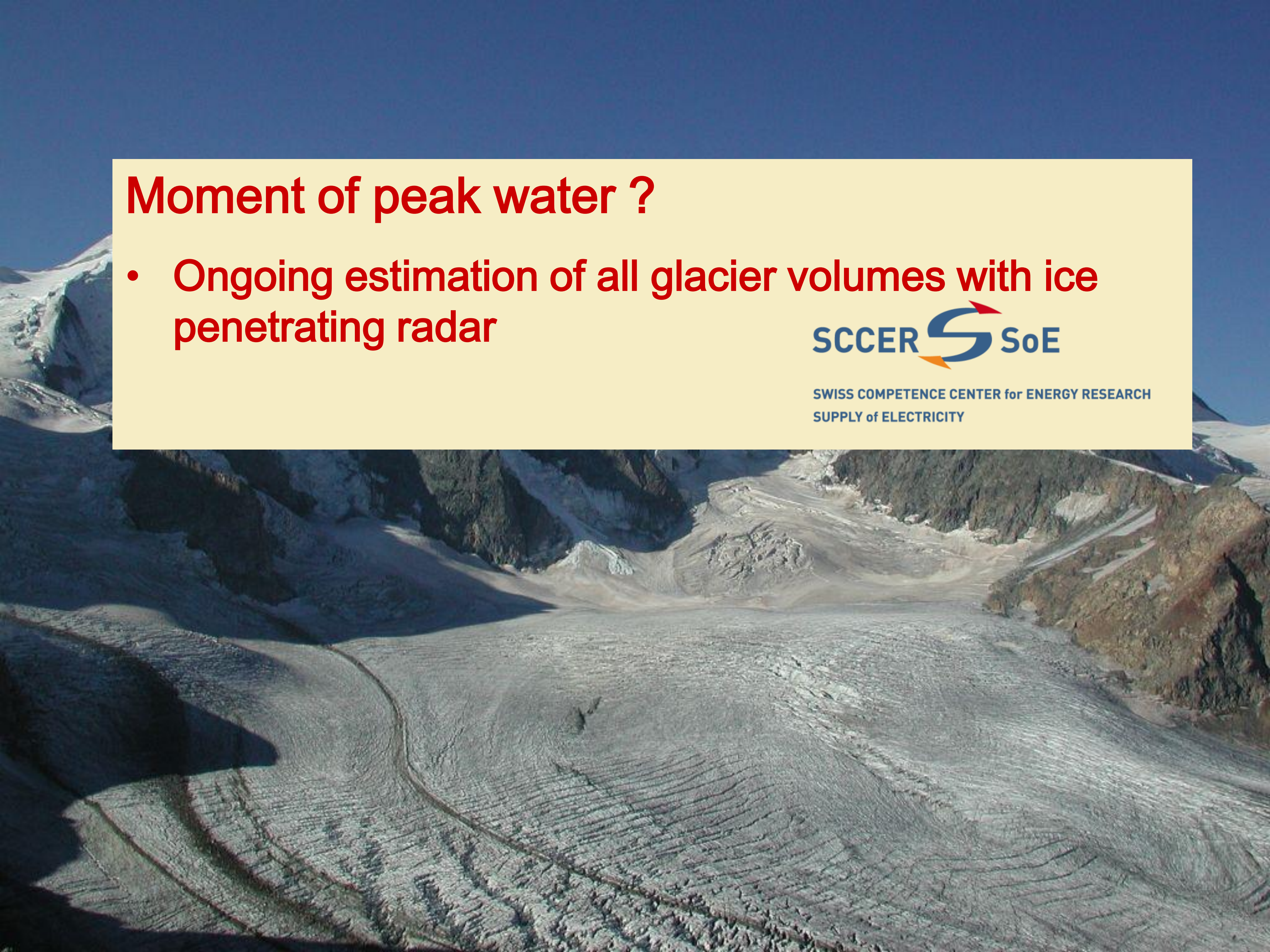
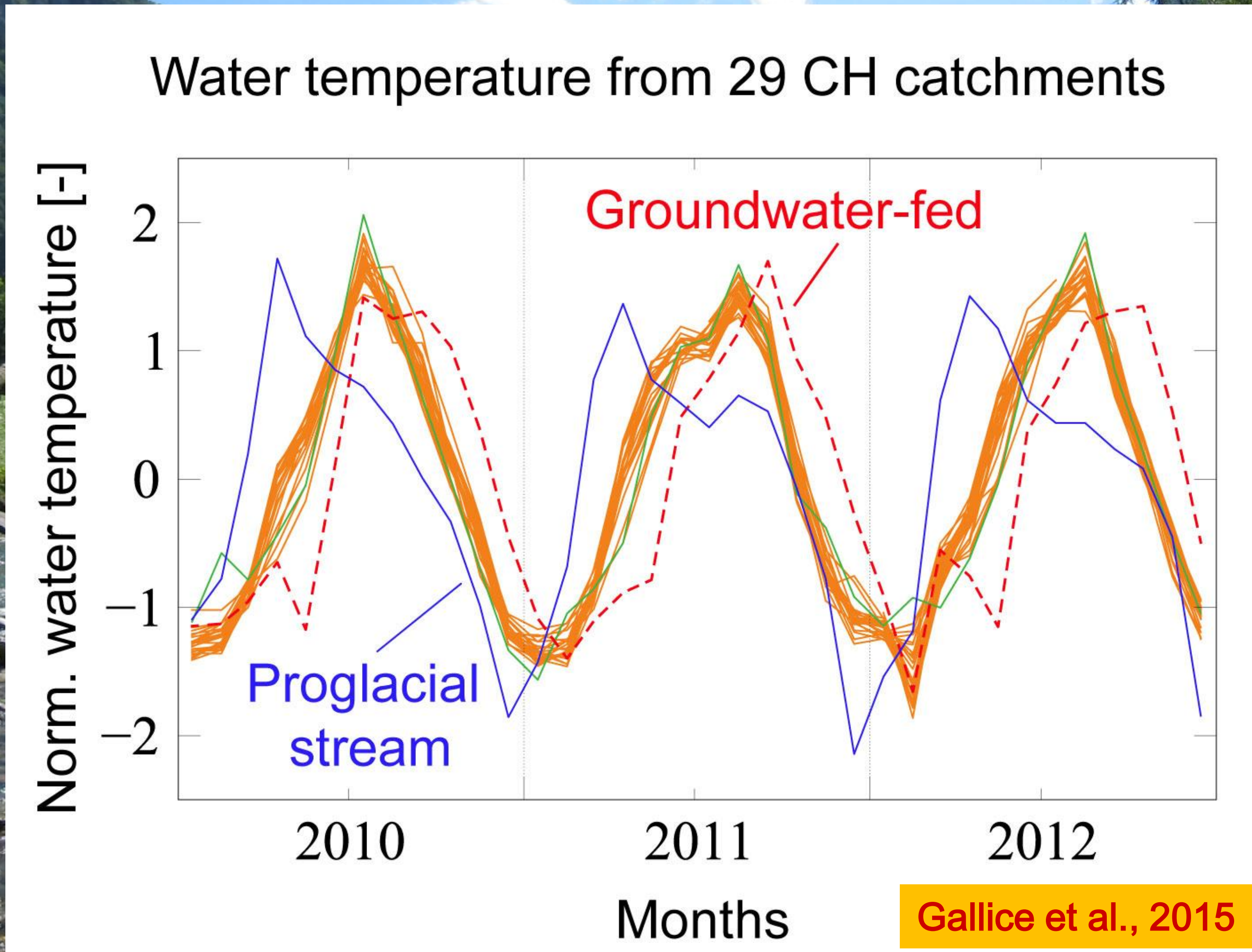
SUPPLY of ELECTRICITY



Future water temperatures ?



(c) Adrian Michael

Future sediment loads ?

- Several ongoing projects
  - SCCER-SoE
  - NRP70
  - SedFate (SNF Sinergia)

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(c) M. Funk

Quantification of extremes

Stochastic tools for local-scale meteo scenarios

New tools to assess model chain reliability

Understand vulnerability & risk reduction tools

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Focus on vulnerability ?

- Quantify water resources vulnerability
  - Catalogue of climate-related critical events
  - Vulnerability assessment via scenarios from observed data
  - Assessment of spatial co-variations of water resources

- Real-time forecasting to decrease risks

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Conclusion - challenges

- **Water resources quantification**
  - **Better quantification of baseline scenarios (uncertainty)**
  - **Experimental catchments !**

- **Prediction of extremes**
  - **Focus on meteo & scenario generators**
  - **Limits of predictability for selected case studies**
  - **Shift to vulnerability assessment ?**

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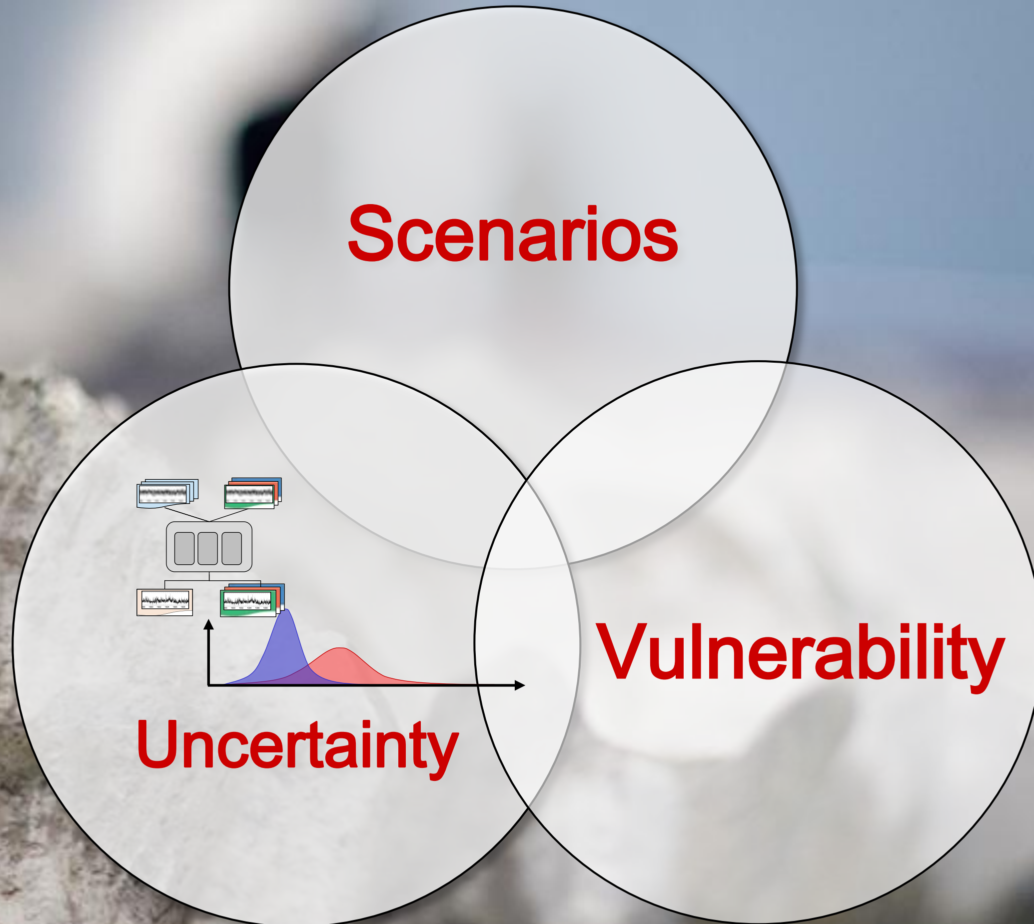

Schaefli, B.: Projecting hydropower production under future climates: a guide for decision-makers and modelers (..), WIREs Water, 2015.