Future and recent changes in flow patterns in the Czech headwater catchments

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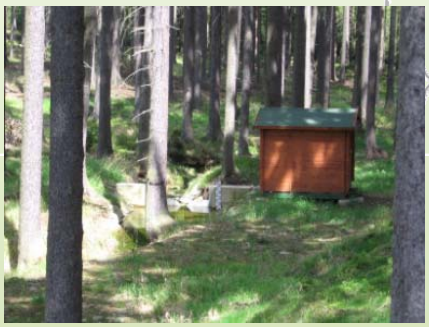
Introduction

- Headwater catchments = ecosystems sensitive to changes
- Anticipated climate change – increase of temperature and seasonal redistribution of precipitation
- What will be the impact of climate change on study sites?

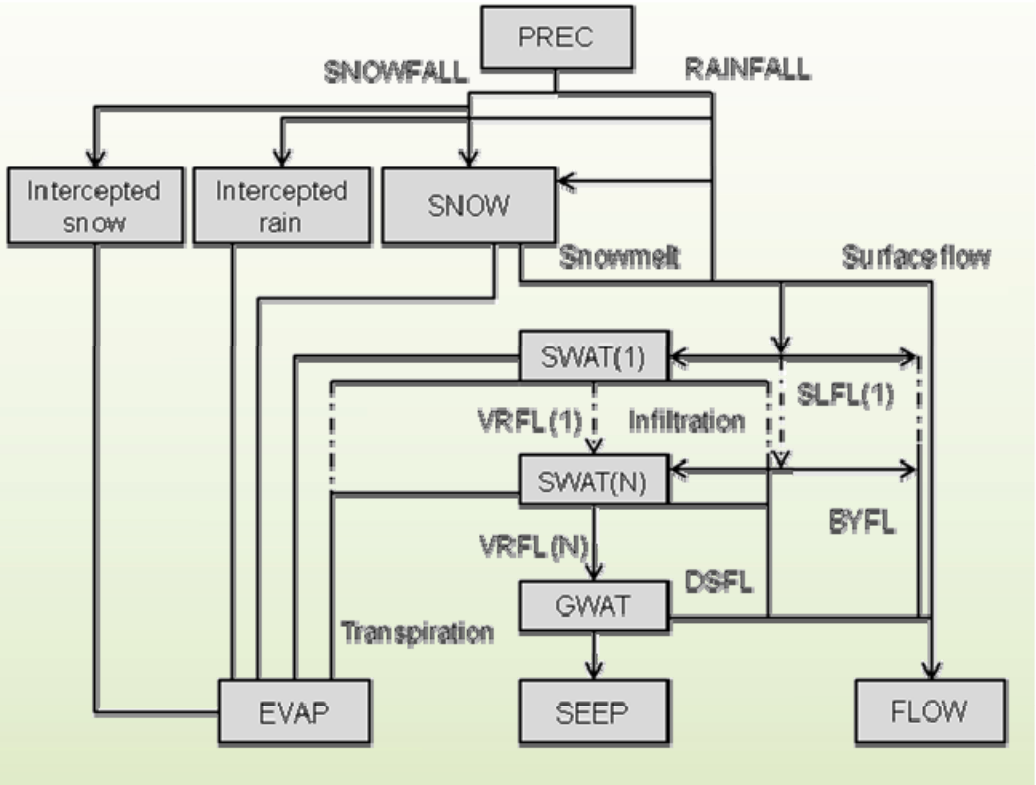
Study sites

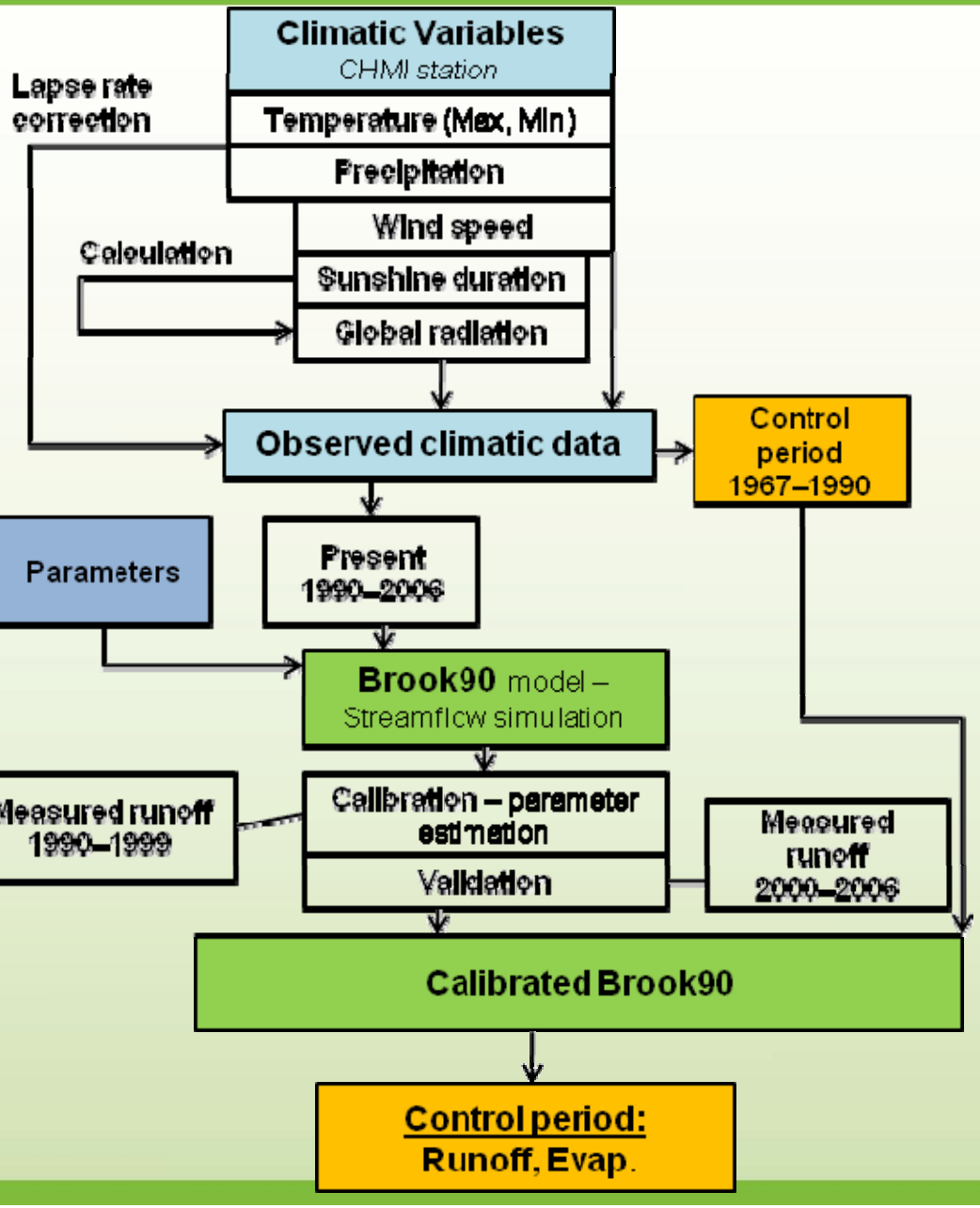
- GEOMON network
- Lysina:
  - Area - 0.27 km^2
  - 829-949 m a.s.l.
- Litavka:
  - Area – 1.84 km^2
  - 695-840 m a.s.l.
- Červík:
  - Area – 1.85 km^2
  - 640-961 m a.s.l.



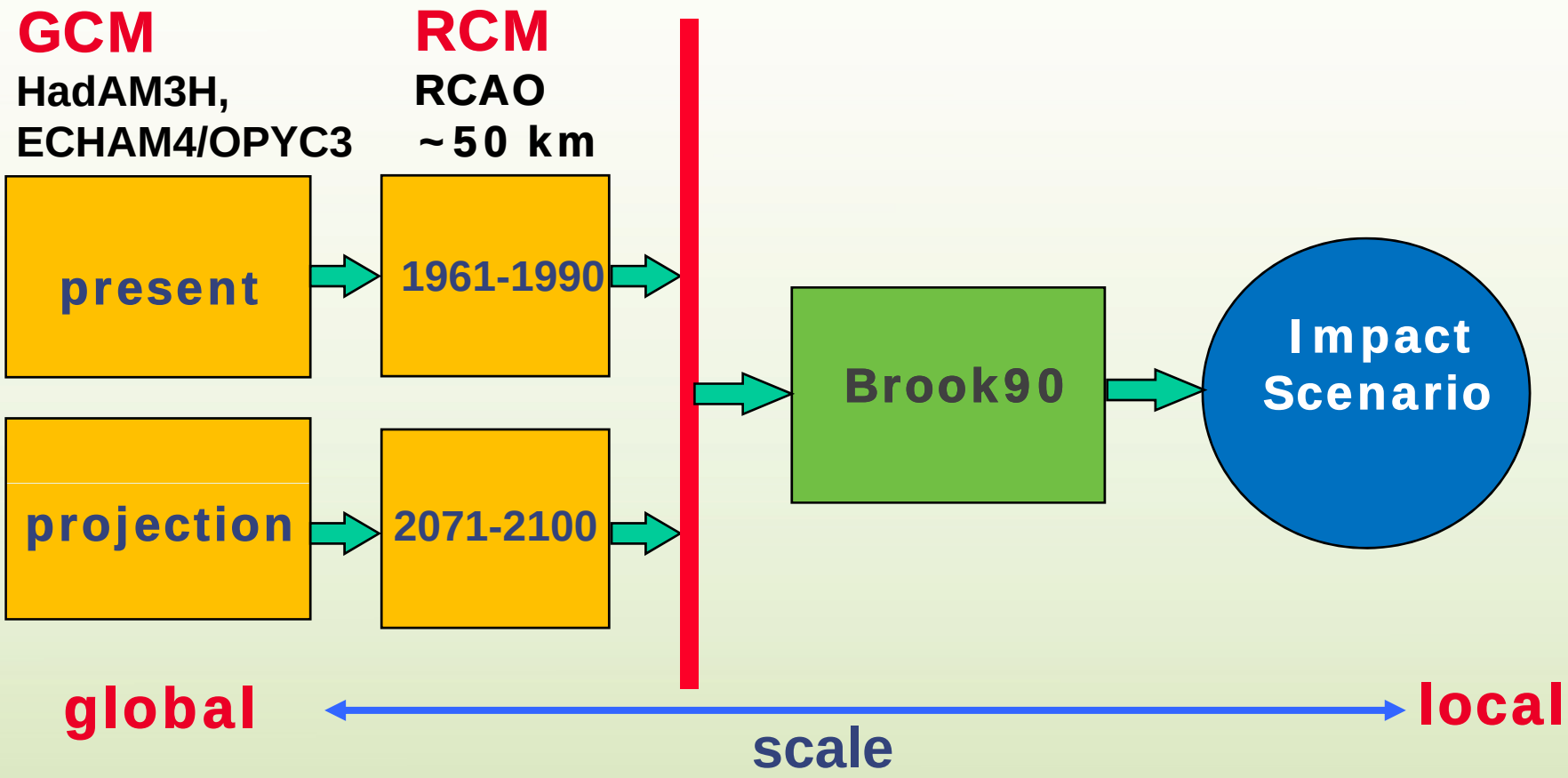
Hydrological model Brook90

- Lumped model – daily step
- Parameter – process oriented model

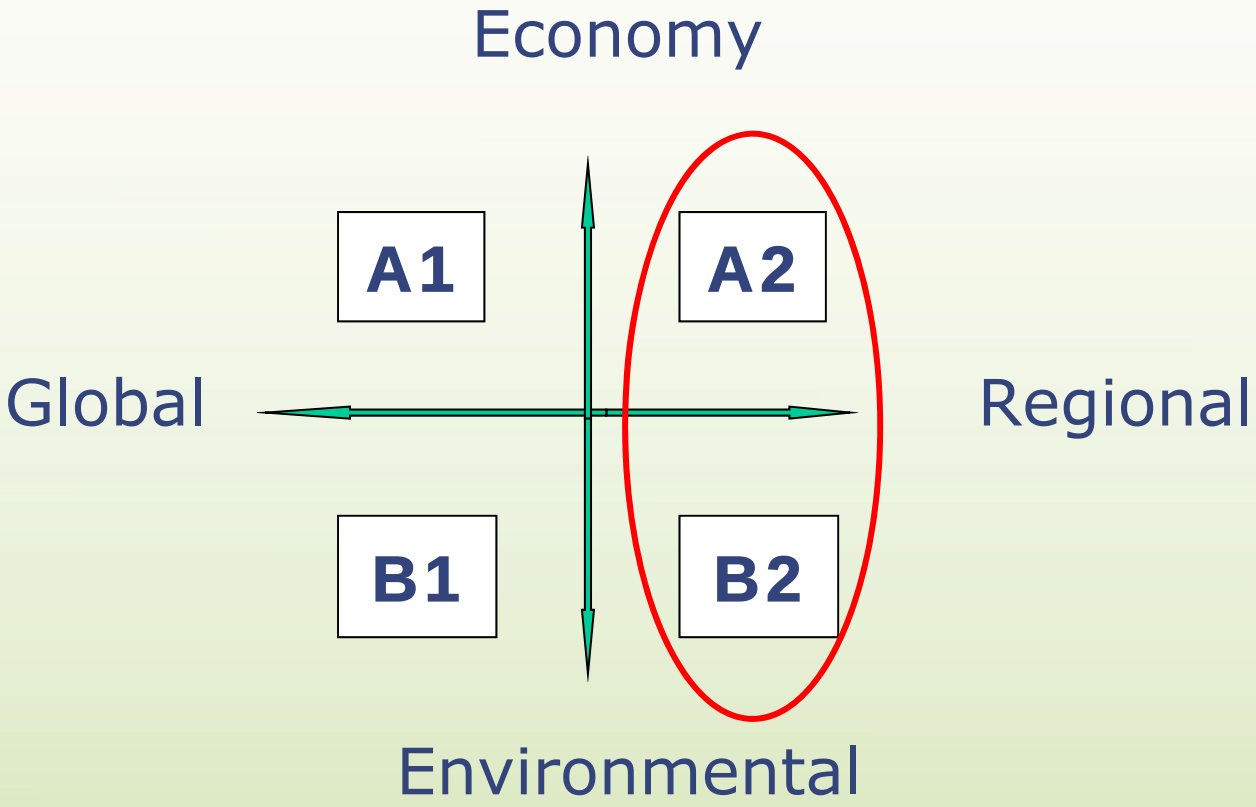



Climatic Variables
CHMI station
Lapse rate correction
Temperature (Max, Min)
Precipitation
Wind speed
Calculation
Sunshine duration
Global radiation
Observed climatic data
Control period 1967–1990
Parameters
Present 1990–2006
Brook90 model – Streamflow simulation
Measured runoff 1990–1999
Calibration – parameter estimation
Validation
Measured runoff 2000–2006
Calibrated Brook90
Control period:
Runoff, Evap.

Delta approach



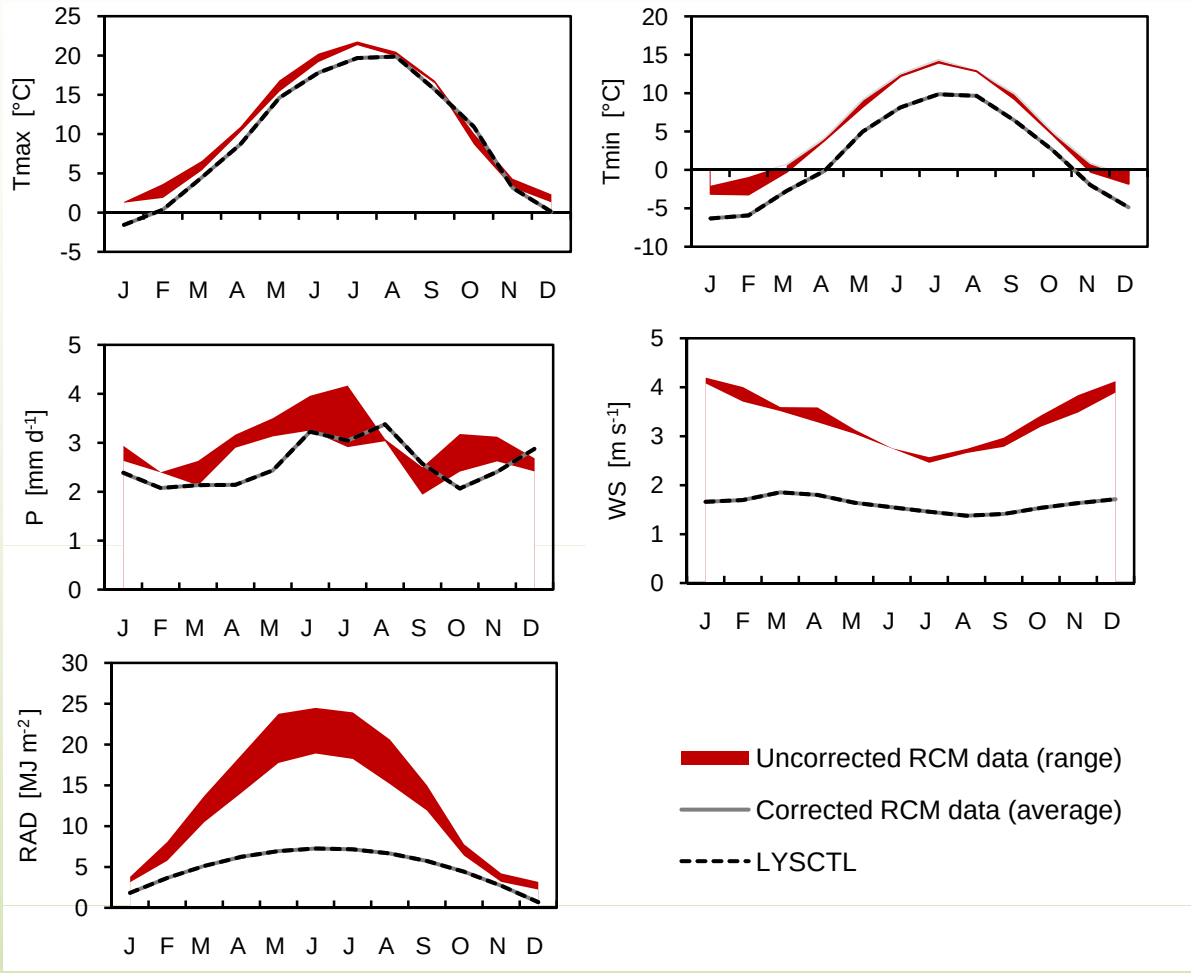
Emission Scenario



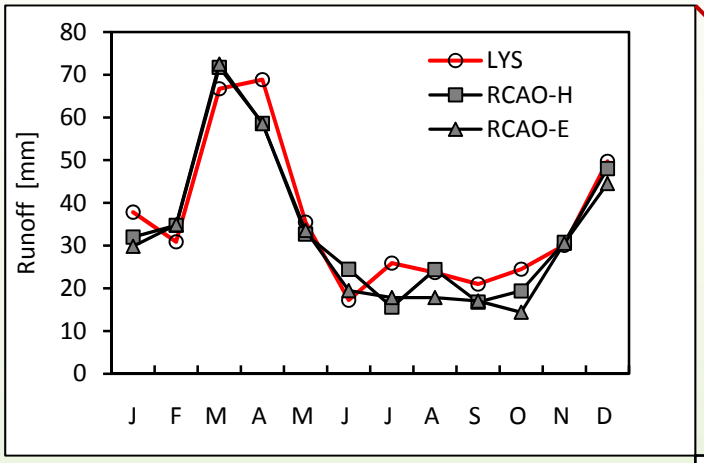
RCM input data (1961-90)

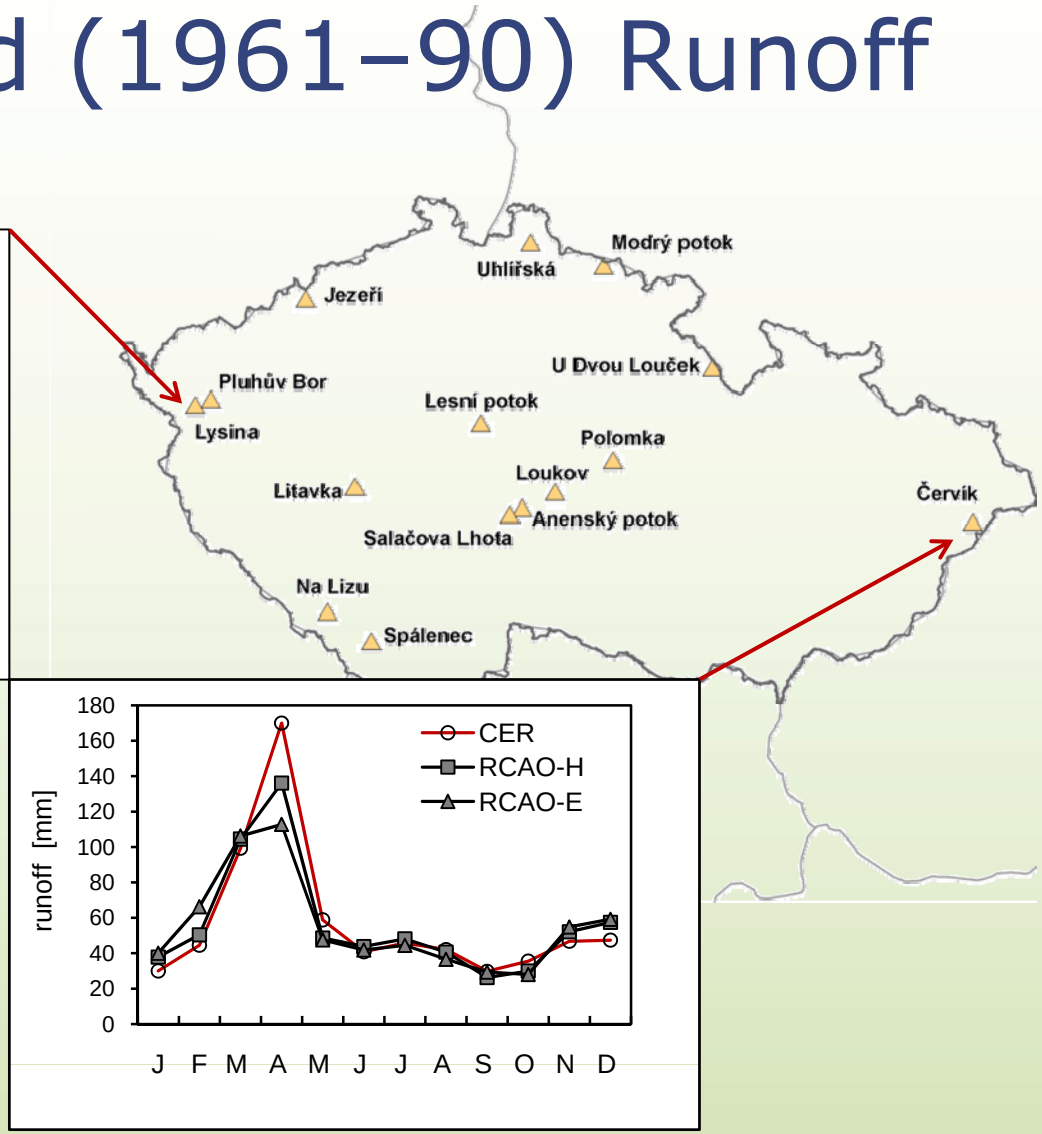
- Difference between observed and simulated data

- Local scale correction factors for individual months, based on difference between observed and simulated montly means



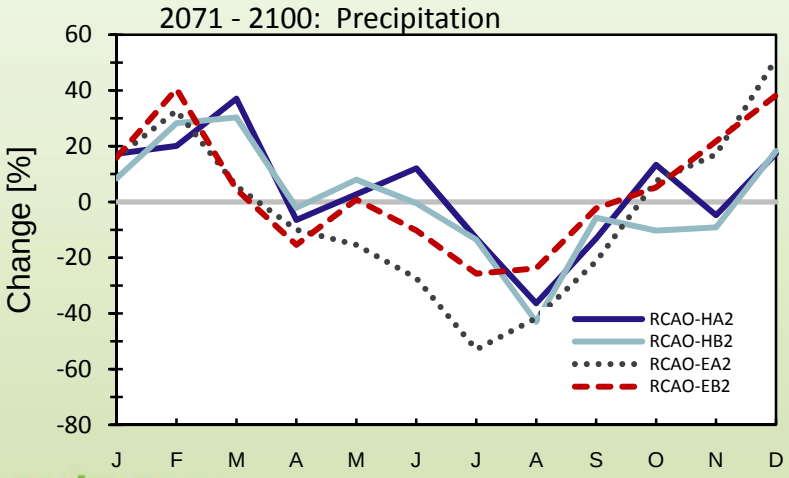
Control period (1961–90) Runoff

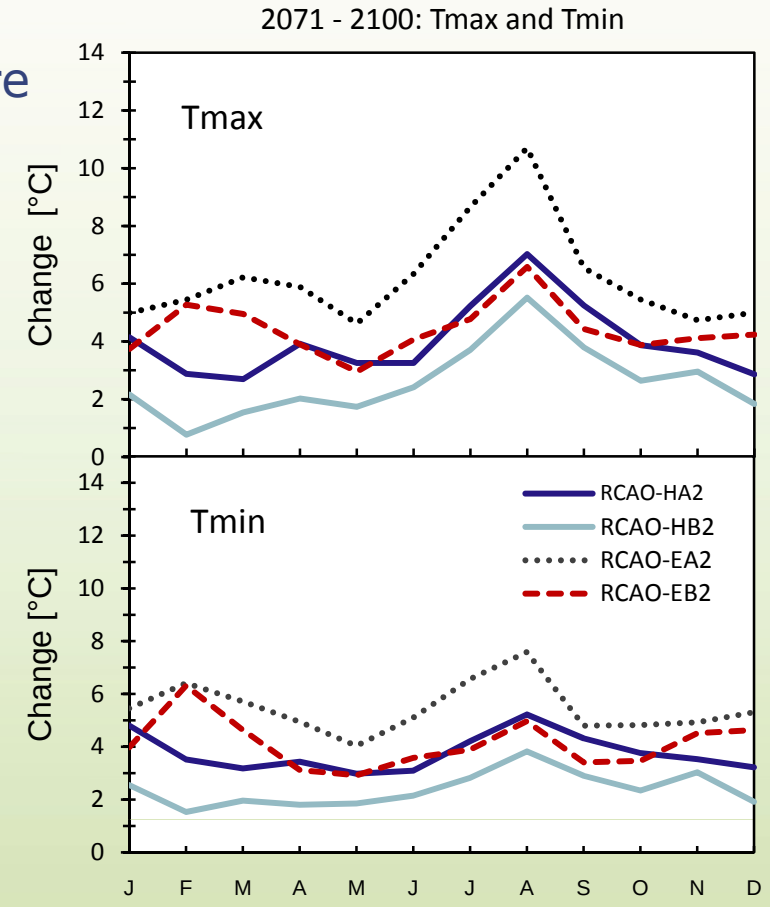




Future temperature and precipitation

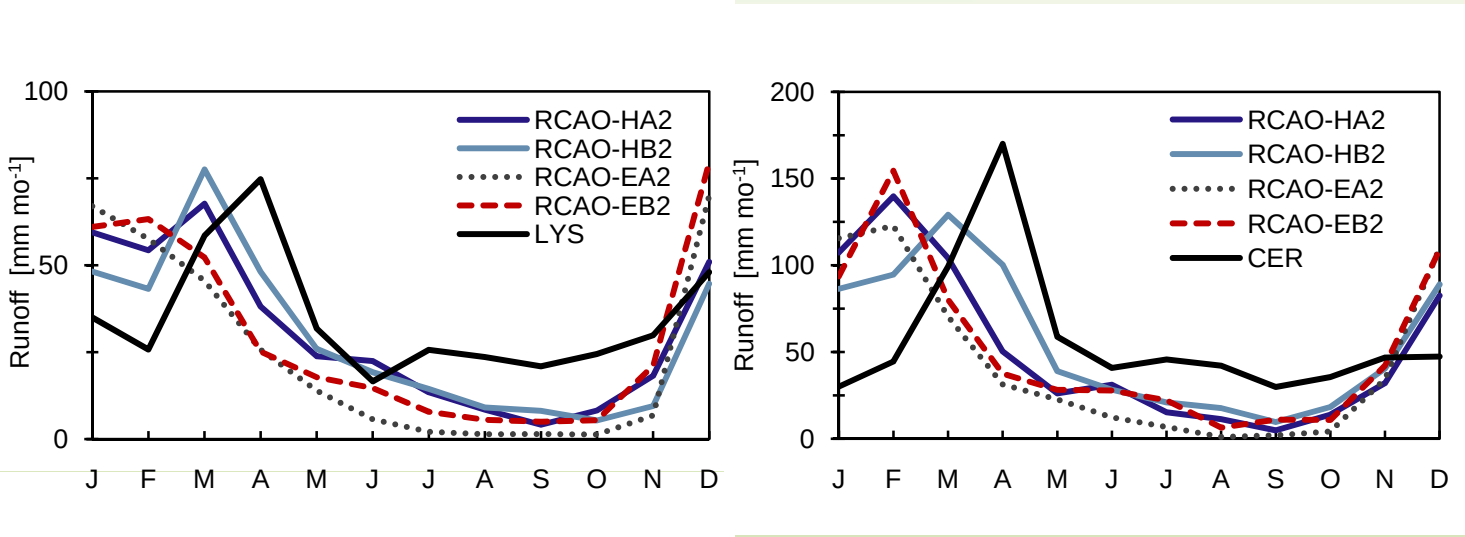
- Increase of mean annual temperature by 2.5-5.8 °C
- Minor change in annual precipitation amounts (2–9 %)





Changes in runoff 2071–2100

- Mean annual runoff decrease 2-30% (LYS), 2-20% (CER)
- Winter increase ~70% (LYS), 180% (CER), shift in runoff maxima
- Summer decline ~80% (Aug and Sep), with maximum in Aug up to 90%



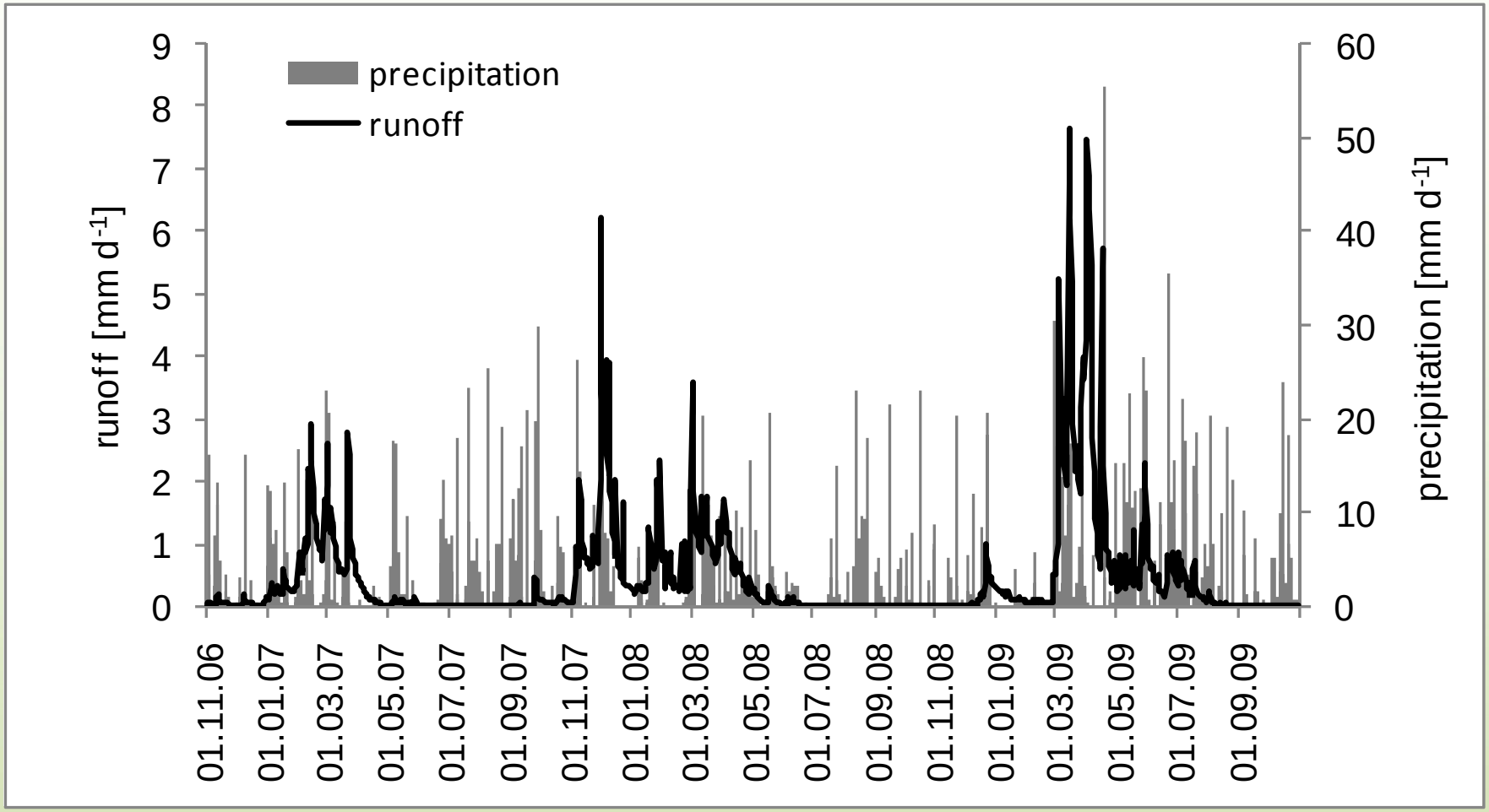
Recent runoff changes

- Significant increase of Feb. runoff, decrease in Jul. at the Lysina catchment
- Litavka catchment
  - In hydrological years 2007–2009 were annual precipitation amounts from 764–1057 mm (the average for 1961–1990 was 750 mm at this area)
  - the annual runoff was only 87–227 mm.
  - The stream dried up from: July-September 2007,

    the end of June to the beginning of December 2008 ,

    September-October 2009

Litavka


precipitation
runoff
runoff [mm d-1]
precipitation [mm d-1]
0
1
2
3
4
5
6
7
8
9
0
10
20
30
40
50
60
01.11.06
01.01.07
01.03.07
01.05.07
01.07.07
01.09.07
01.11.07
01.01.08
01.03.08
01.05.08
01.07.08
01.09.08
01.11.08
01.01.09
01.03.09
01.05.09
01.07.09
01.09.09

Conclusions

- The future runoff cycle will change notably
- Increase of runoff in winter – shift in spring runoff maximum
- Significant decrease in summer – could lead to dry-up of the stream for short periods
- At some catchments are these changes already seen recently

Thank you for your attention