IWAS Ukraine

International Water Research Alliance Saxony

Impact of climate change on evapotranspiration and runoff

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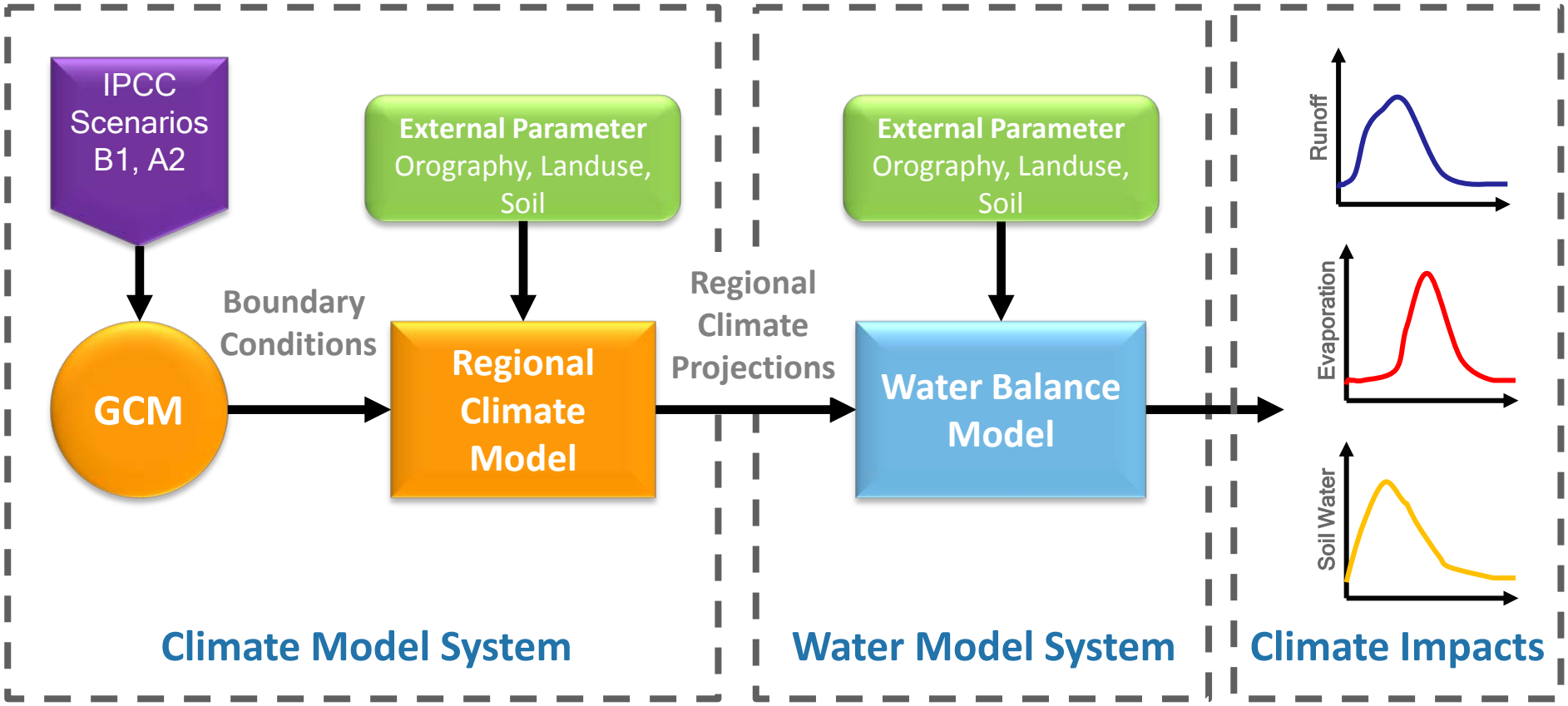
Introduction /Overview

- How influence the projected climatic changes evapotranspiration and runoff?
- Complex interactions among meteorological elements, soil and plants have to be analysed.
- This is possible only with a coupled modelling approach.

→ Assessment of the climate change impact onto water balance components (runoff components, actual evapotranspiration) and other socio-economic sectors (e.g. agriculture, ecology, energy)

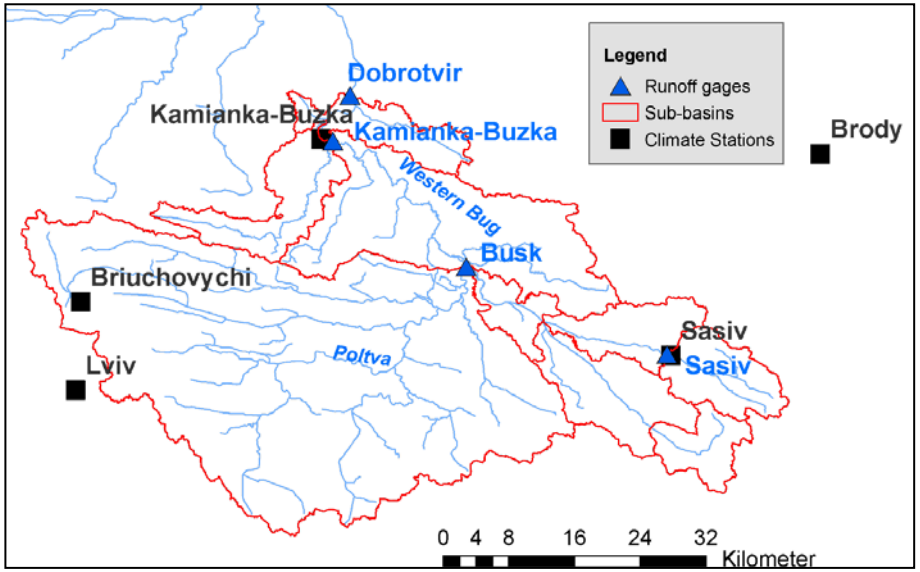
Climate Impact Modelling



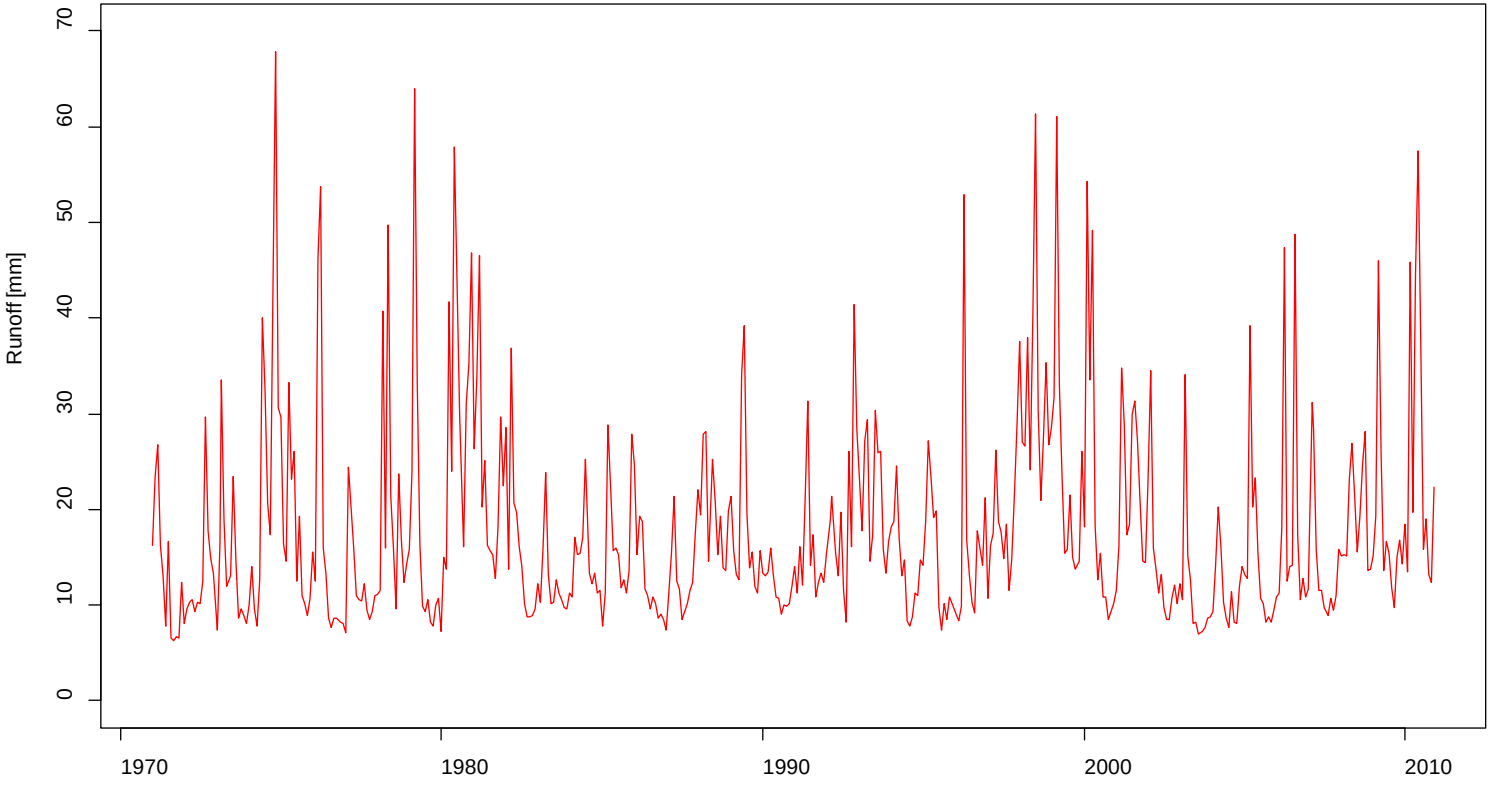
Water Balance Modelling

- Investigation Area: Basin Inflow reservoir Dobrotvir – 2616 km²
- Model: Soil and Water Assessment Tool (SWAT) - conceptual river basin scale model for quantification of water and matter fluxes and the impact of changing conditions
  - Parameterization based on input data, SWAT database
  - Adaptations based on Plant Parameter Database of the University Giessen, Germany
  - Calibration: 1981 - 1990

    Validation: 1971 - 1980



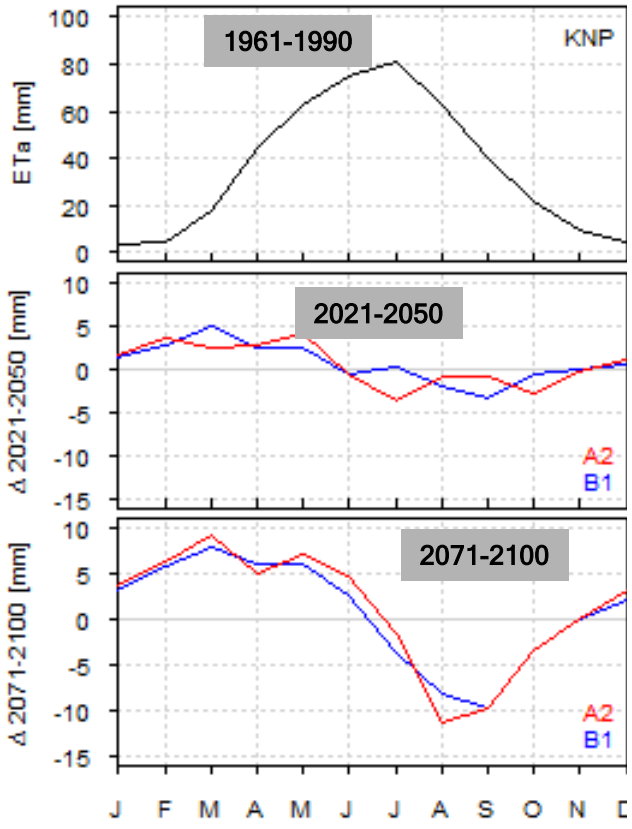
Calibration/ Validation



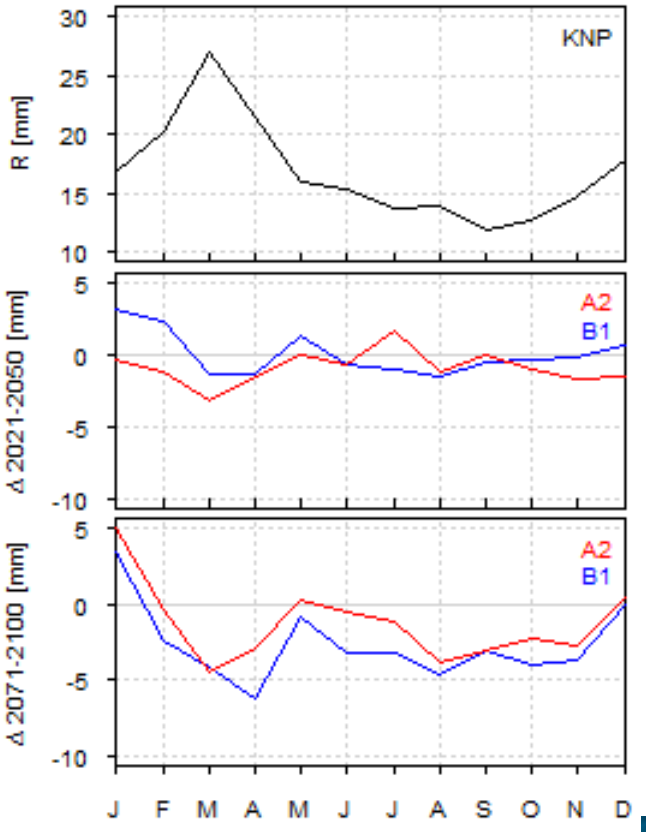
Results - impact of climate change

Regional climate projections : SRES scenarios A2, B1; analysis of periods 2021-50 and 2071-2100

Actual evapotranspiration ETa



Runoff



- nearly no impact until 2050
- at the end of century:

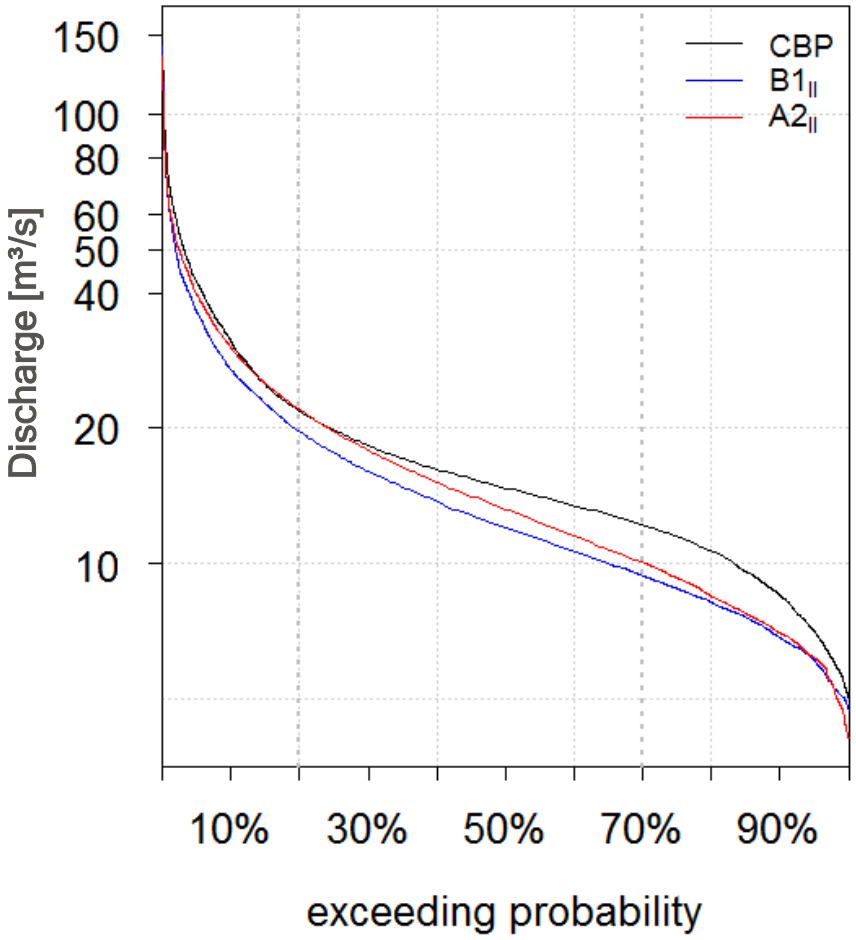
➢ ETa increasing in Dec-Jun (due to higher temp.) and decrasing in Jul-Oct (due to water deficit)

➢ Runoff decreasing the whole year, except Dec and Jan (due to water deficit)

Master Thesis: S. Fischer (2012)
Scenarios of future climate and water balance of a Ukrainan basine and its relevance for an IWRM

Flow duration curve

- FDC: probability that a certain discharge is exceeded
- Decreasing flow in 2071-2100 in comparison to present flow conditions (CBP) in all flow segments
- Strongest decrease during low flow and moderate flow conditions
- Reasons: reduced snow melt-induced floods, decrease in summer precipi-tation, increased evapotranspiration and annually reduced soil water storage



Impacts on water related sectors

- Water management: reduced water availability esp. during summer -> reduced groundwater recharge, concentration of pollutants -> water supply
- Agriculture, forestry: longer growing season, temperature and drought stress, higher risk of pest infestation and crop losses, growing need for irrigation
- Ecology: emigration/immigration of species -> reorganization of communities, problem: migration/adaptation speed of species, risk for aquatic species, invasive alien species
- Energy business: chances for solar industry, decreasing viability or potential of hydropower, changes in energy consumption (heating/ cooling)

Summary and Conclusion

- Climate change will impact all water related sectors.
- Increasing temperatures and solar radiation cause higher actual evapotranspiration rates in winter and spring.
- Decreasing summer and fall rainfall causes soil water depletion, decreasing actual evapotranspiration.
- Runoff is decrasing from spring till fall.
- Implications for water management, agriculture, forestry, ecology.
- Adaptation measures needed, especially for optimal water usage in the basin.

Thank you for your attention!