

Impact of Potential Climate Change on Plant Available Soil Water and Percolation in the Upper Danube Basin

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of the BMBF-project GLOWA-Danube



Objectives of GLOWA-Danube

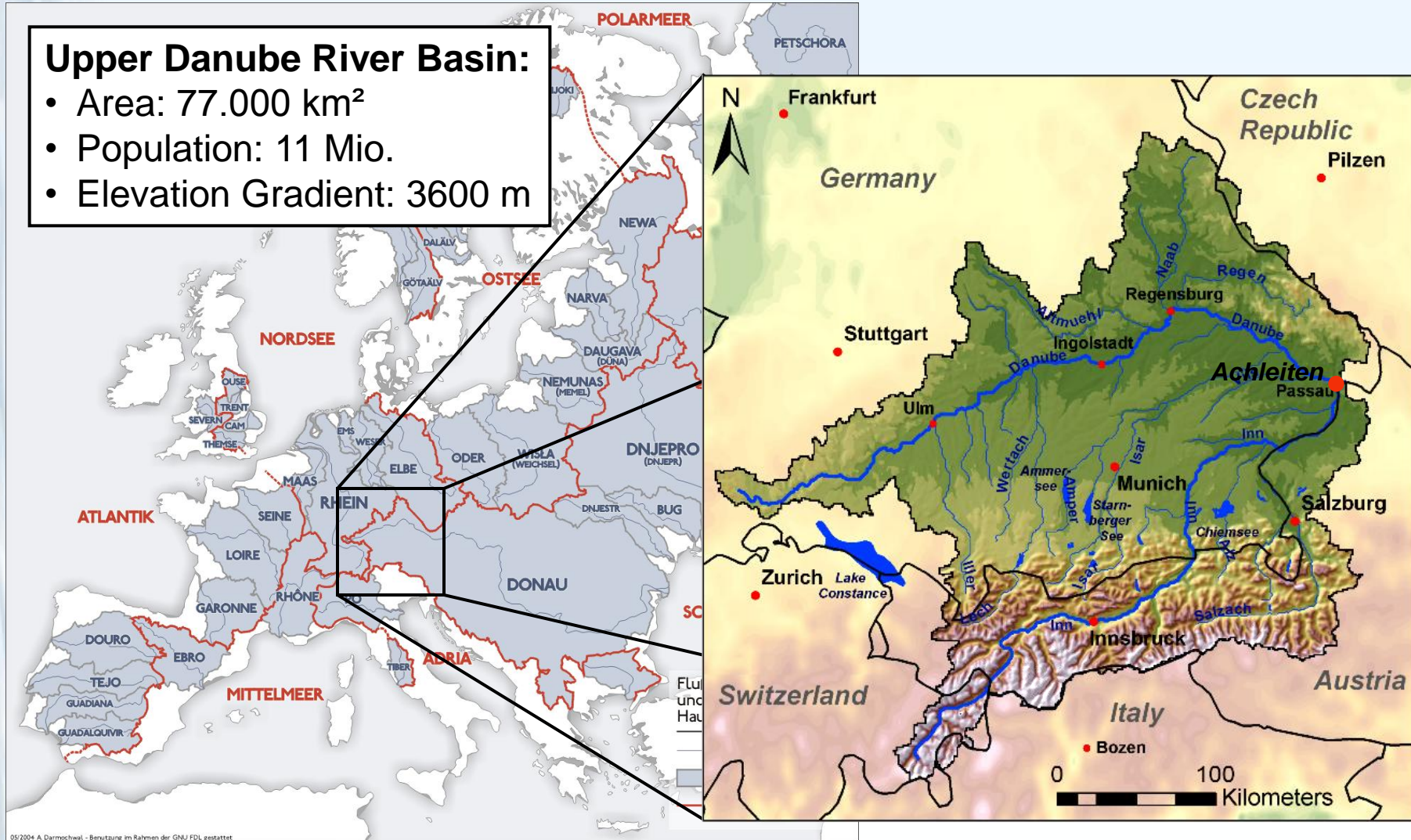
“Integrative Techniques, Scenarios & Strategies for the Future of Water in the Upper Danube Basin”

- Development and setup of the Global Change **Decision Support System DANUBIA**
- Development, analysis & evaluation of and socio-economic and Climate Change **Scenarios**
- Cooperation with **Stakeholders** to communicate results and develop adaption strategies
- Initiate a interdisciplinary Open-Source project called **OpenDanubia** (Start: October 2010)

A Regional Scale River Basin

Upper Danube River Basin:

- Area: 77.000 km²
- Population: 11 Mio.
- Elevation Gradient: 3600 m



05/2004 A. Darmochwal - Benützung im Rahmen der GNU FDL gestattet

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Upper Danube Soil Regions

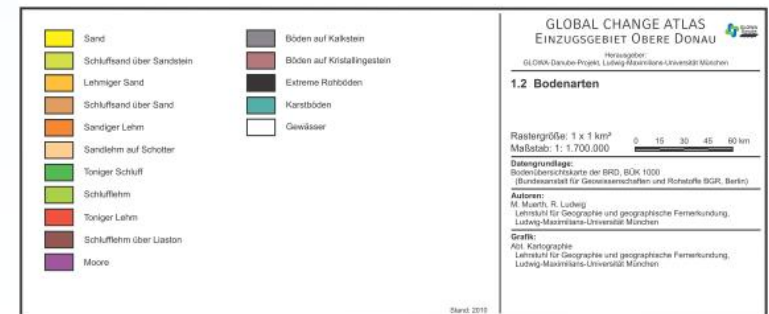
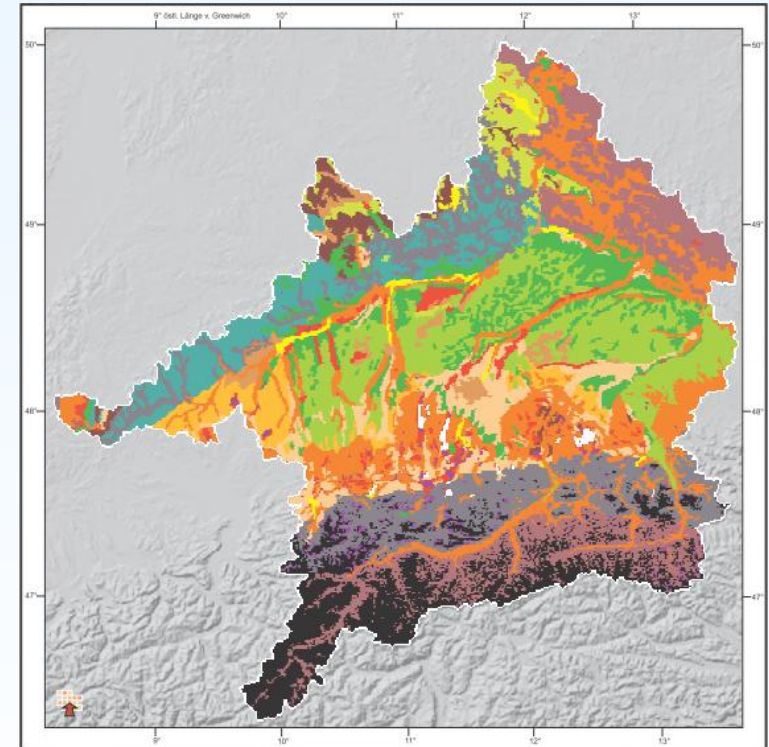
The Alps - mainly shallow Leptosols
(grey colours)

Alpine foothills – mainly Luvisols of
loam and sand loam texture
(orange colours)

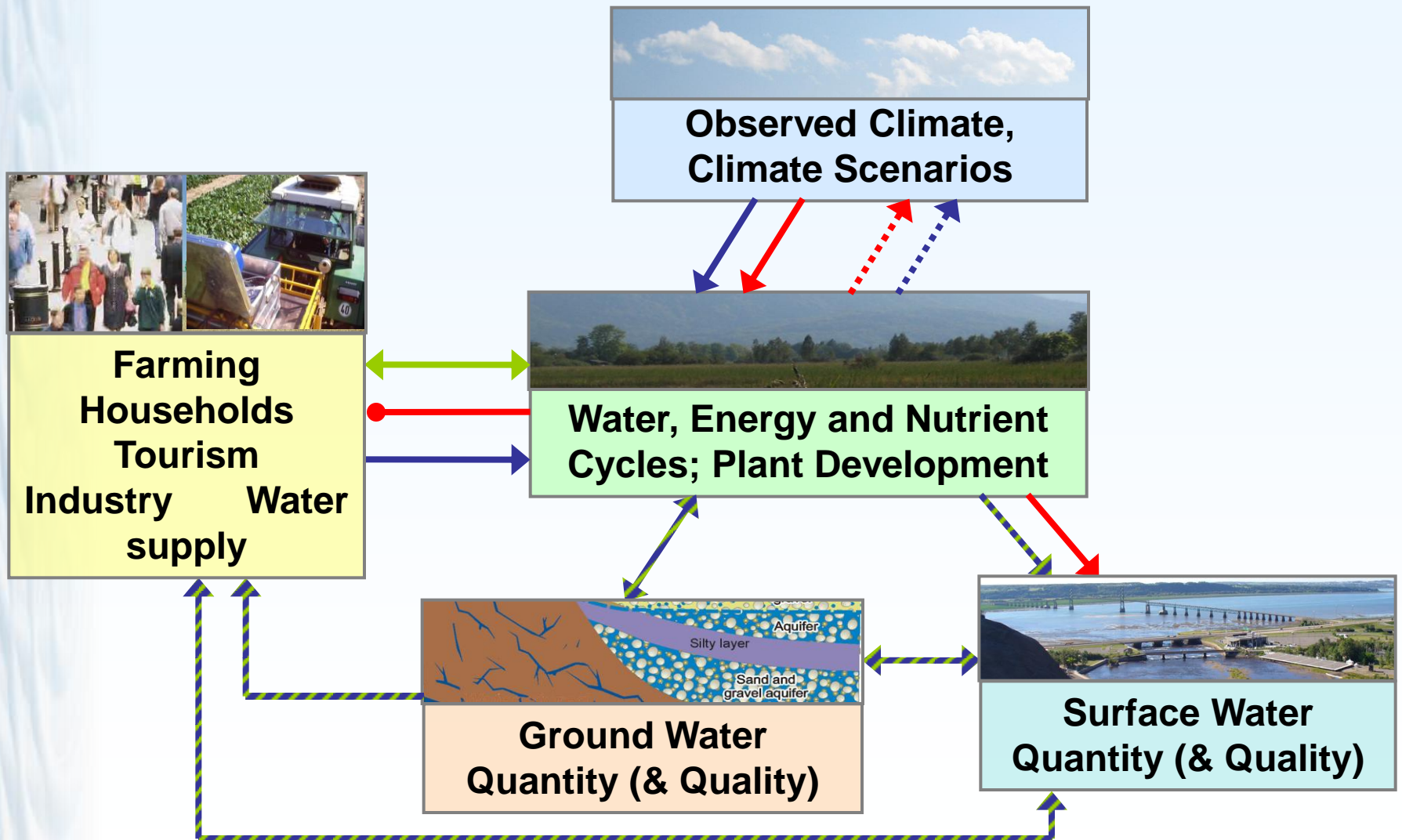
Tertiary lowland – mainly Cambisols
on silty Loess sediments
(green colours)

Limestone (Alb) – mainly loamy clay
Cambisols and Leptosols
(blue-grey colours)

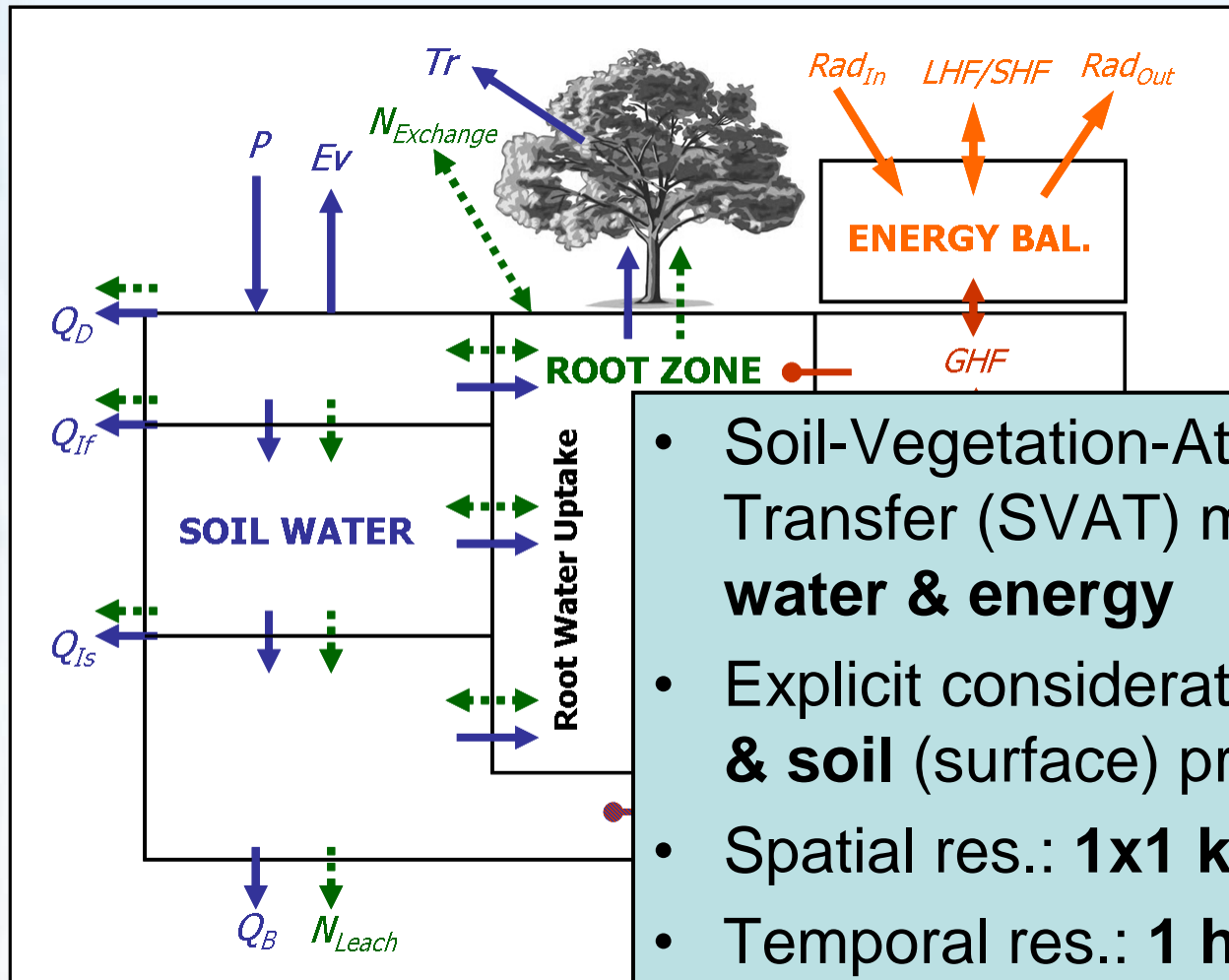
Bavarian Forest – loamy, sandy
Leptosols and Cambisols
(orange and violett)



The DANUBIA components



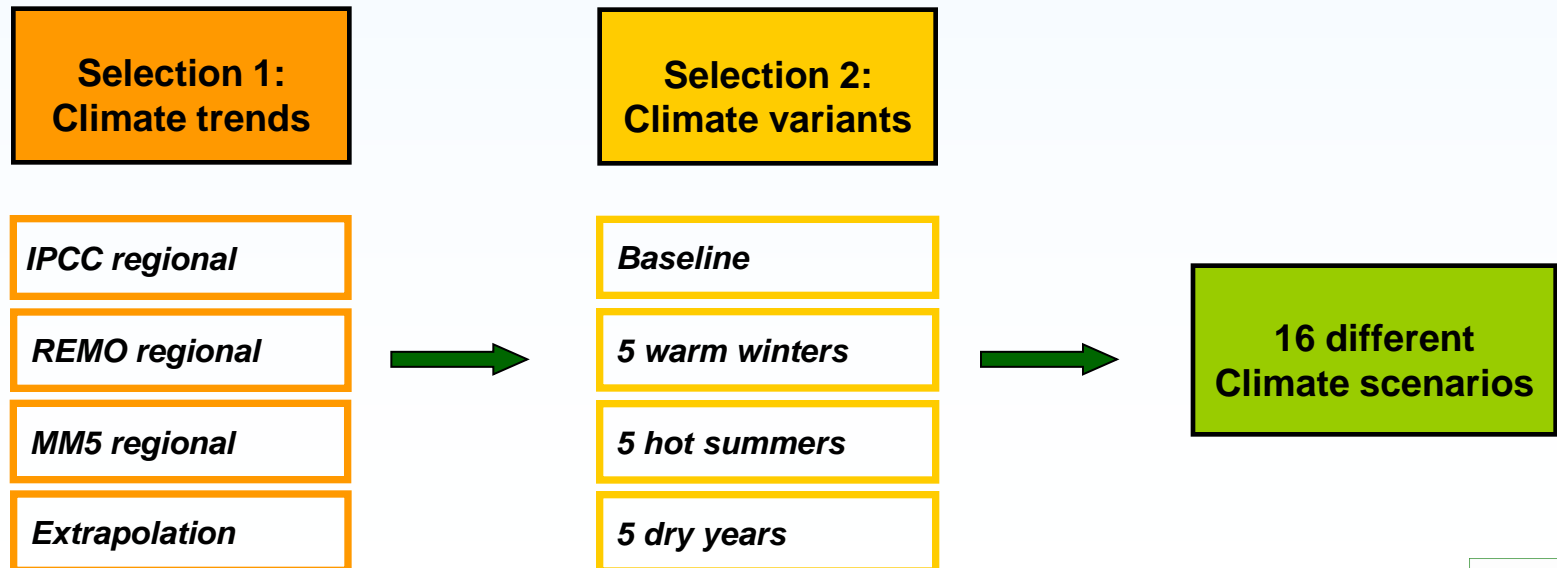
The Landsurface component



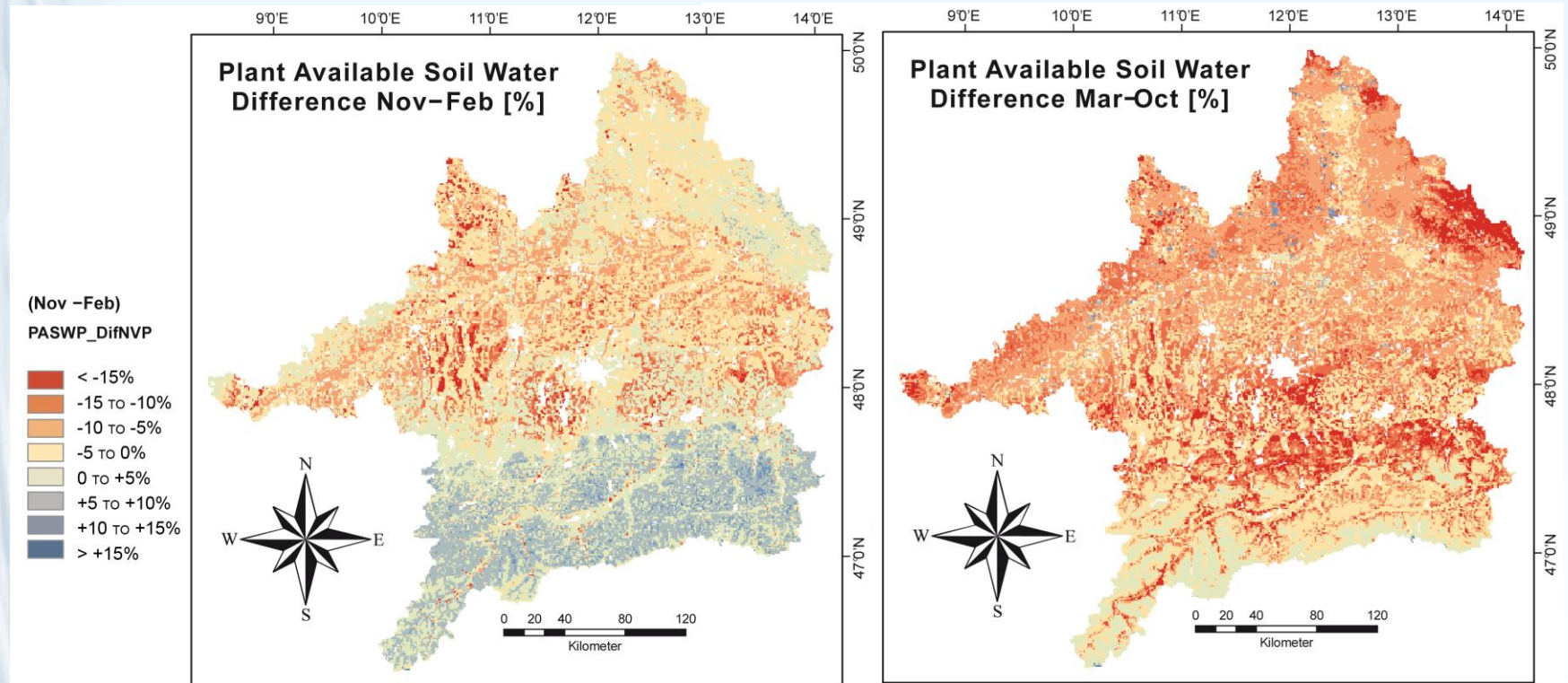
- Soil-Vegetation-Atmosphere-Transfer (SVAT) model of **water & energy**
- Explicit consideration of **canopy & soil** (surface) processes
- Spatial res.: **1x1 km²**
- Temporal res.: **1 hour**

IPCC-A1B based climatic trends

Climate trend (per 100 years)	dT (°C)	dP (%)		Trend based on...
		winter	summer	
<i>IPCC regional</i>	+3.3	+7	-14	IPCC (2007)
<i>REMO regional</i>	+5.1	-5	-31	Jacob et al. (2008)
<i>MM5 regional</i>	+4.7	+8	-29	Pfeiffer & Zängl (2009)
<i>Extrapolation</i>	+5.2	+47	-69	Extrapolation of station data

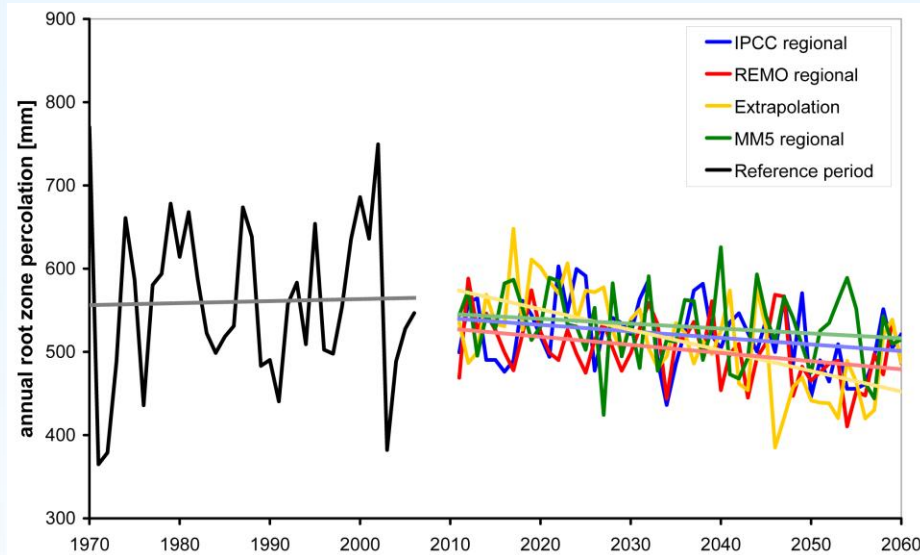


Impact on soil water dynamics



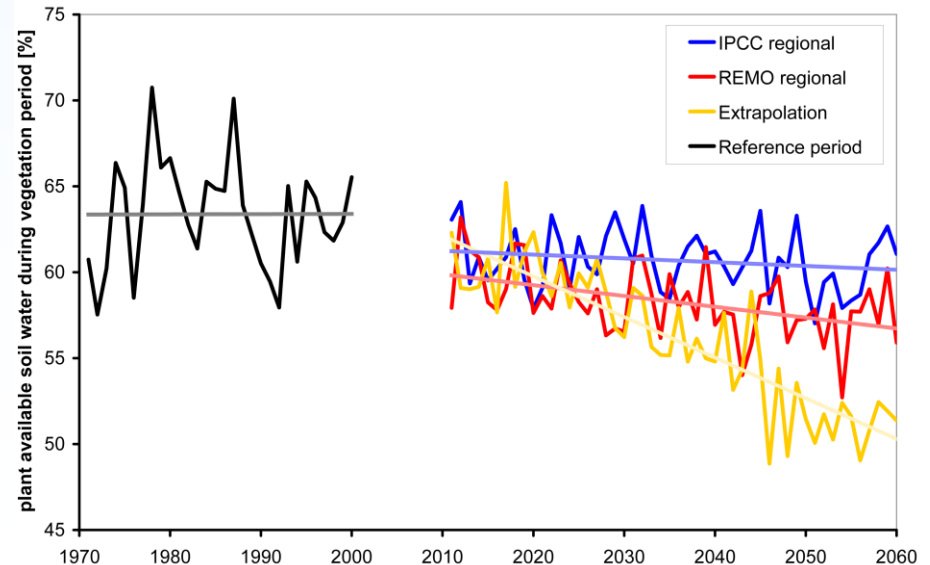
**Example from REMO regional – Baseline scenario:
Average change for 2036-2060 compared to 1971-2000**

Results II

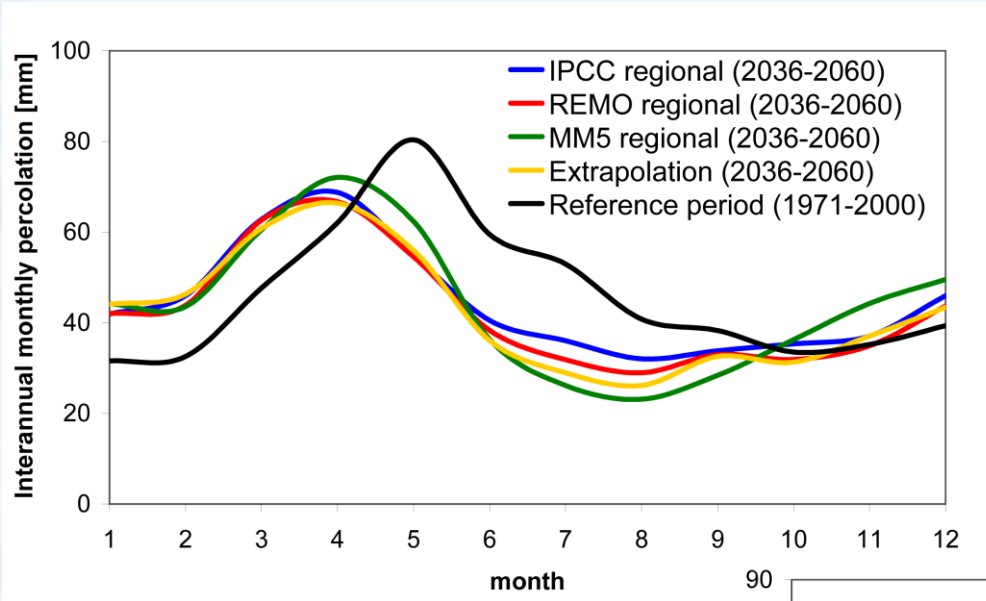


Decrease of root zone percolation by 7 to 14% between 1971-2000 and 2036-2060 depending on scenario

Decrease of PASW during vegetation period by 3 to 15% between 1971-2000 and 2036-2060 depending on scenario

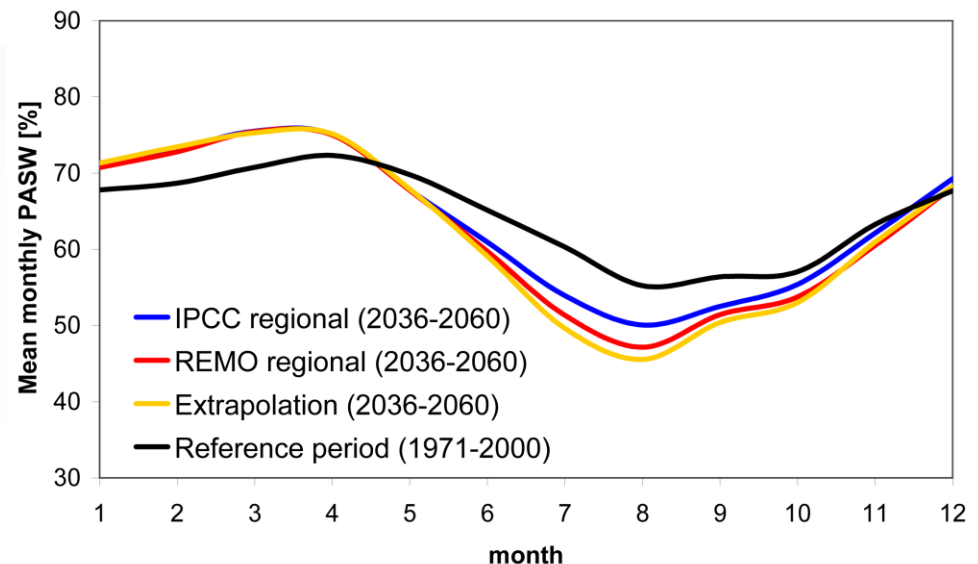


Dry soils during summer (2036 – 2060)



Decrease in summerly (JJA) root zone percolation by 24 to 59% between 1971-2000 and 2036-2060 depending on scenario

Annual decrease in soil water content is small, but temporal redistribution of percolation is drastic!



Conclusions

- Temporal redistribution of soil moisture has a strong impact on aquifer recharge, low flow occurrence and evapotranspiration (& vice versa!)
- During winter, changes in snow water storage due to an increase in air temperature affect water availability in spring and early summer
- Future adaptation of crop production by irrigation and change of cash crops is simulated together with the *Biological* and *Farming* working groups

An aerial photograph of a city, likely Głowa, situated on a wide bend of a river. The city is densely packed with buildings, many with red-tiled roofs. A prominent railway line runs through the center of the city, crossing the river via a bridge. The surrounding landscape is a mix of green fields and forested areas. The sky is clear and blue. Overlaid on the center of the image is the text "Thank you very much for your attention!" in a bold, black, sans-serif font.

**Thank you
very much
for your
attention!**