

High-resolution discharge and groundwater recharge simulations by conceptional hydrological models in the Neckar Basin, Germany

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Outline

- Intended objectives
- Developed models
- Discharge simulations
- Groundwater recharge
- Conclusions and implications
- Outlook



RIVERTWIN - Goals

•Scenarios of integrated water resources management to support the establishment of River Basin Management Plans (RBMP)

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Integrated regional model

for scenario analysis and evaluation under contrasting ecological and socioeconomic conditions in three river basins

http://www.rivertwin.org/







Intended objectives

- Coupled and adapted surface water models (HBV/LARSIM)
- High resolution discharge and groundwater recharge simulations
- Impact of climate/socio-economic change on water balance

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Hydrological Modelling







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Hydrological Modelling









HBV-IWS: Model structure

- Spatially distributed process description
- Transfer functions linking model parameters with catchment characteristics







HBV-IWS: Calibration strategy

• Parameters of transfer functions calibrated directly for a set of subcatchments using discharge at outlet



- Regionalization in the other subcatchments using soil, land use and topography
- distributed predictions
 natural variability
 few free parameters







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Structure of LARSIM

• resolution: 1 km²

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• Knauf

(LHG)

- Penman-Monteith
- Xinanjiang-Model
- linear reservoirs







Gauge Rockenau

Neckar Basin



- 14.000 km²
- 91 1030 masl
- temperate humid





Climate scenarios

	Temperature	Precipitation
1988 – 1999	9.3 °C	1074 mm
Enke dry	10.9 °C	1162 mm
Enke wet	10.9 °C	1220 mm
Yang A2	12 °C	1208 mm
Yang B2	11.9 °C	1311 mm

Land use scenarios

A10: 6% more dense settlement (50% sealed, 35% grasland, 15% forest) B20: 5% more loose settlement (30% sealed, 50% grasland, 20% forest)













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Mean annual groundwater recharge Enke

1987-2003	2021-2030 dry	2021-2030 wet	
137 mm	122 mm	130 mm	





Mean annual groundwater recharge Yang

1987-2003	2021-2030 A2	2021-2030 B2	
137 mm	160 mm	156 mm	





Mean annual gw recharge land use scenarios

2021-30 dry	2021-30 A10	2021-30 B20
122 mm	120 mm	122 mm







Conclusions and implications

- Conceptual models can provide information about internal state variables –
 only if the calibration considers catchment characteristics
- Increase in temperature and precipitation will not perturb water balance in the Neckar basin significantly
- Differences in scenario results are relatively small
- Projected urban growth shows no negative impact on water resources





Outlook

- Training workshops and sample model transfer to SIC (Uzbekistan) and DH (Benin) accomplished
- Model set-up for the Ouémé has started
- Multi-response data will be used to check consistency
- Other regionalization method based on the similarity of raster cells
- We have to expect different results from different climate/downscaling/hydrological...models





Hydrological Modelling in the Neckar Basin



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