

Flächendifferenzierte Modellierung des Wasserhaushalts im Nationalpark Berchtesgaden

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Ziele

- Berechnung & Abschätzung der Wasserhaushaltskomponenten in der Region des NP (470 km²) mittels WaSiM
Wimbach, Klausbach, Königsseer-, Ramsauer- und Bischofswiesener Ache
- Prozessverständnis Interaktion Oberflächenwasser & Grundwasser & Schneedynamik im NP
- Verbesserung der Schneemodellierung in WaSiM:
Integration von AMUNDSEN und/oder ESCIMO
- Validierung des Schneemodells (Stationsdaten, MODIS)
- Erwartete Änderung des Wasserhaushalts unter Klimaänderung

Physically based algorithms for vertical water fluxes & groundwater:

- Evapotranspiration: soil and vegetation specific (Monteith)
- Flow through unsaturated zone (Richards)
- Suction head & hydraulic conductivity (van Genuchten)
- 2-dim groundwater model dynamically coupled to unsaturated zone

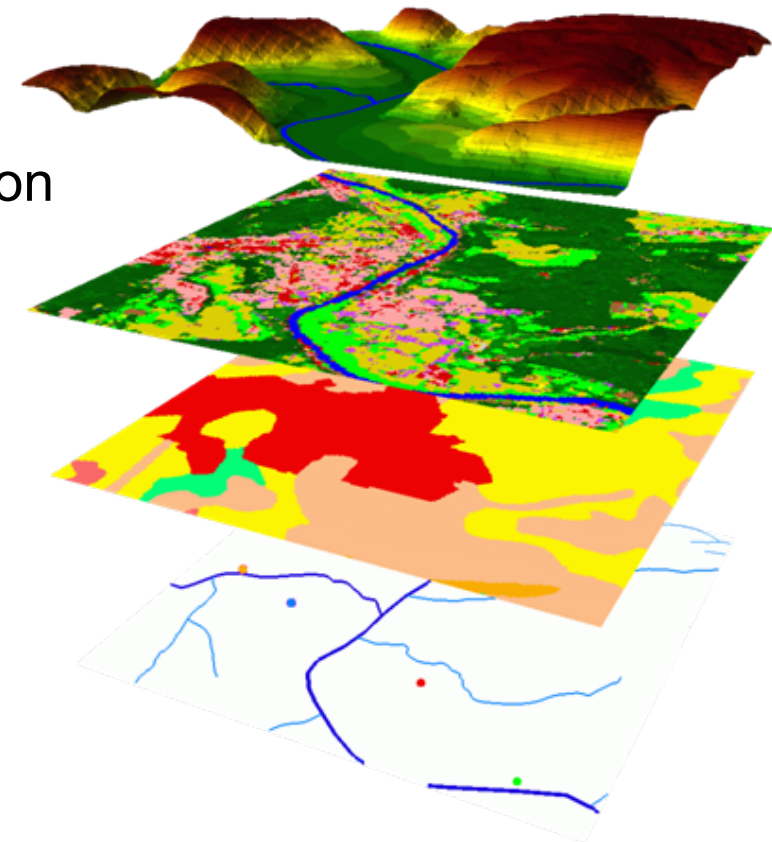
Conceptual approaches for lateral runoff aggregation

- Traveltime approach folded with linear storage
- Discharge routing: cinematic wave

Snow: day-degree approach

Setups so far at IMK-IFU

- spatial resolution: 90x90m² till 1x1 km²
- temporal resolution: hourly-daily
- subdivision into sub-catchments



Distributed Hydrological Model WaSiM

- Well-established tool for investigating the spatial and temporal variability of hydrological processes in complex river basins.
- Reasonable compromise between detailed physical basis and minimum data requirements.
- Previous applications demonstrated that WaSiM-ETH is able to address successfully very different hydrological problems on a wide range of scales.
- Is used by over 50 institutions (universities, research centres, regional authorities and engineering offices).

Distributed Hydrological Model WaSiM

Special features (incomplete):

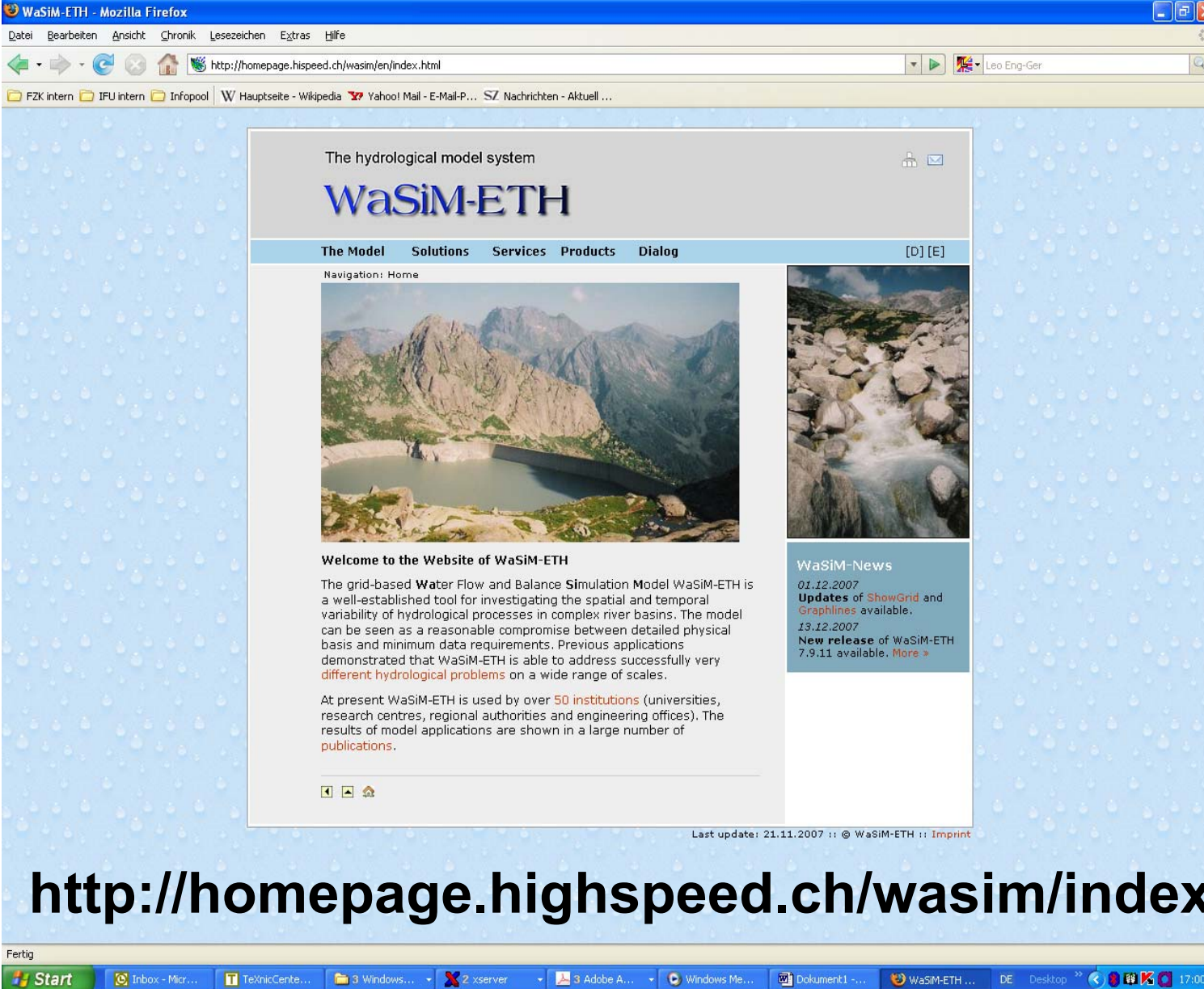
- Variable Cell Sizes
- Dynamic Simulation of Vegetation Development (LAI Dynamics)
- Advanced Landuse Table
- Advanced Soil Table
- Macropore Runoff
- Exfiltration and Re-Infiltration of Groundwater
- Irrigation Management
- Considering (artificial) Drainage
- Considering Ponds
- Modelling of Glacier Runoff
- Considering Reservoir Management
- Considering external Abstractions and Inflows
- Online Coupling with external Models
- Coupling of sequential Model Runs
- Coupling of Substance Transport (-> Tracer) with Water Flow

Data requirements

- **Geographical data:**
minimum: digital elevation model, land use and soil grid →
further spatial distributed data (slope, river network, subcatchments,...)
- **Meteorological data**
minimum: temperature and precipitation
standard: global radiation, wind speed, relative humidity
→ require spatial interpolation on regular WaSiM-grid
- **Hydrological Data**
river discharge time series
water management data (e.g. abstractions)
if available: groundwater heads, tracer, aquifer properties (hydr. conduct., porosities, colmation resistance, aquifer thickness)

- **Subcatchments**
Wimbach, Klausbach, Königseer, Ramsauer, Bischofswiesern Ache
- **Resolution**
 $\Delta x=100-500\text{m}$, $\Delta t=1\text{h}$
- **Approach**
Richards-eq., Penman-Monteith, 2-dom groundwater model, etc.
New snow module
- **Calibration/validation:** from 1990 on
- Validation of areal **snow cover dynamics** using MODIS satellite data
- **Finally:** climate change impact analysis (\rightarrow RCM driven WaSiM)

Water Balance Simulation Model ETH





The hydrological model system

WaSiM-ETH

The Model Solutions Services Products Dialog [D] [E]

Navigation: Home



Welcome to the Website of WaSiM-ETH

The grid-based Water Flow and Balance Simulation Model WaSiM-ETH is a well-established tool for investigating the spatial and temporal variability of hydrological processes in complex river basins. The model can be seen as a reasonable compromise between detailed physical basis and minimum data requirements. Previous applications demonstrated that WaSiM-ETH is able to address successfully very different hydrological problems on a wide range of scales.

At present WaSiM-ETH is used by over 50 institutions (universities, research centres, regional authorities and engineering offices). The results of model applications are shown in a large number of publications.

WaSiM-News

01.12.2007
Updates of ShowGrid and Graphlines available.

13.12.2007
New release of WaSiM-ETH 7.9.11 available. [More >](#)

Last update: 21.11.2007 :: © WaSiM-ETH :: [Imprint](#)

http://homepage.hispeed.ch/wasim/index.html

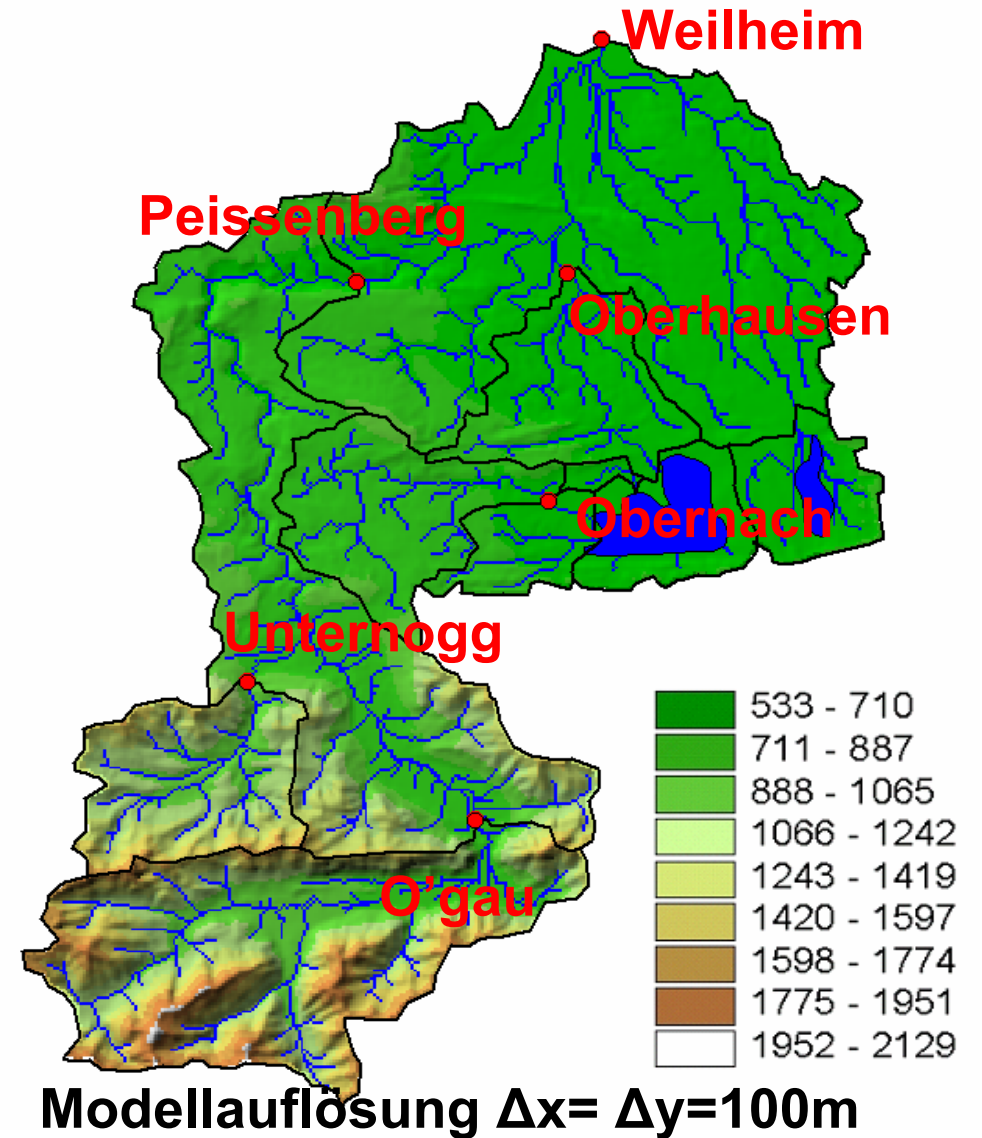
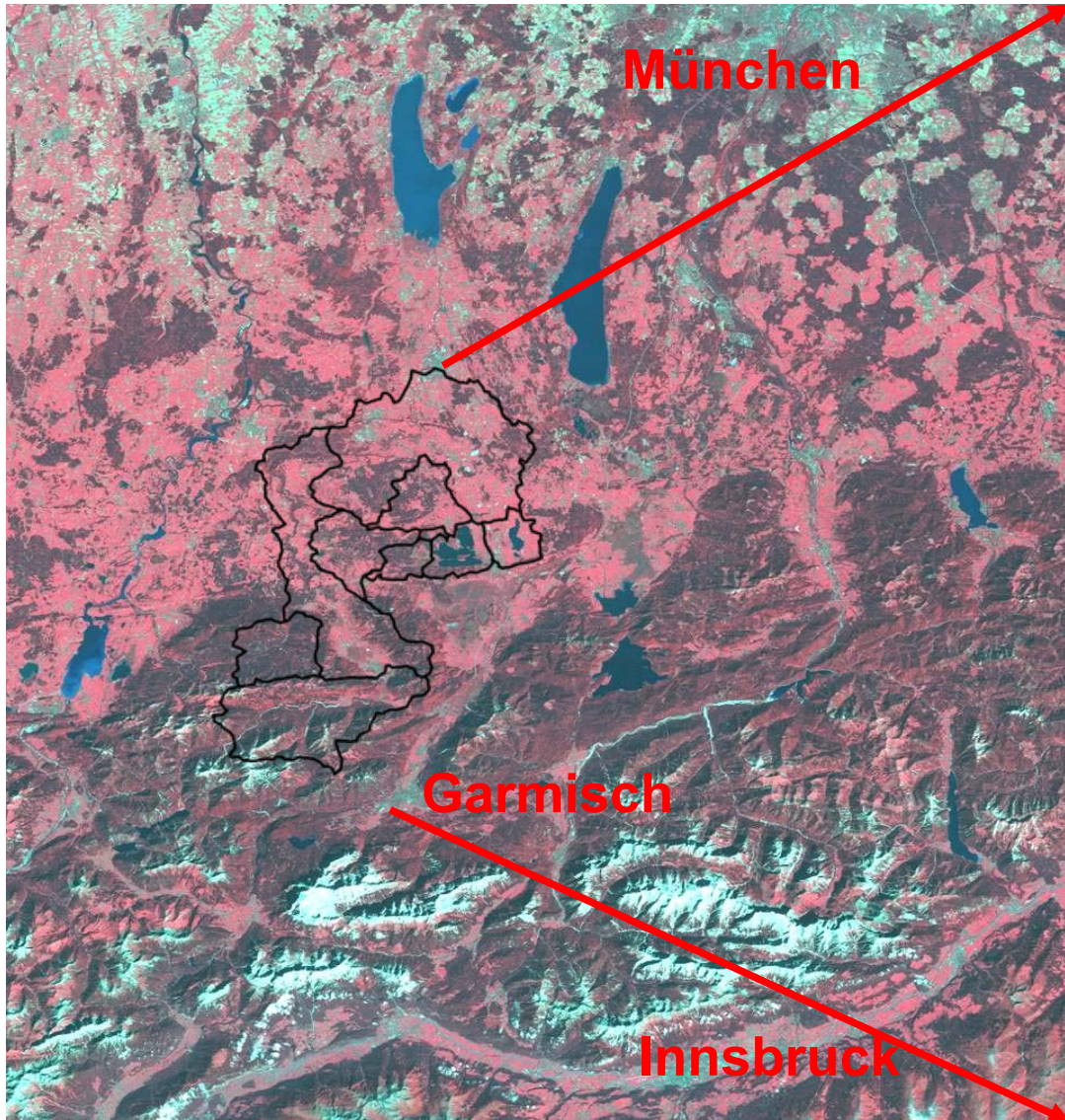
Beispiel 1

Ammer Einzugsgebiet

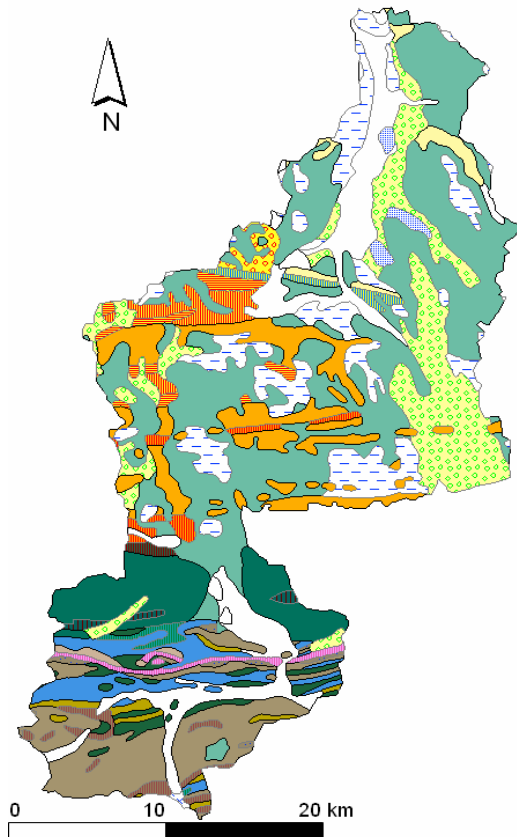
Ammer Einzugsgebiet



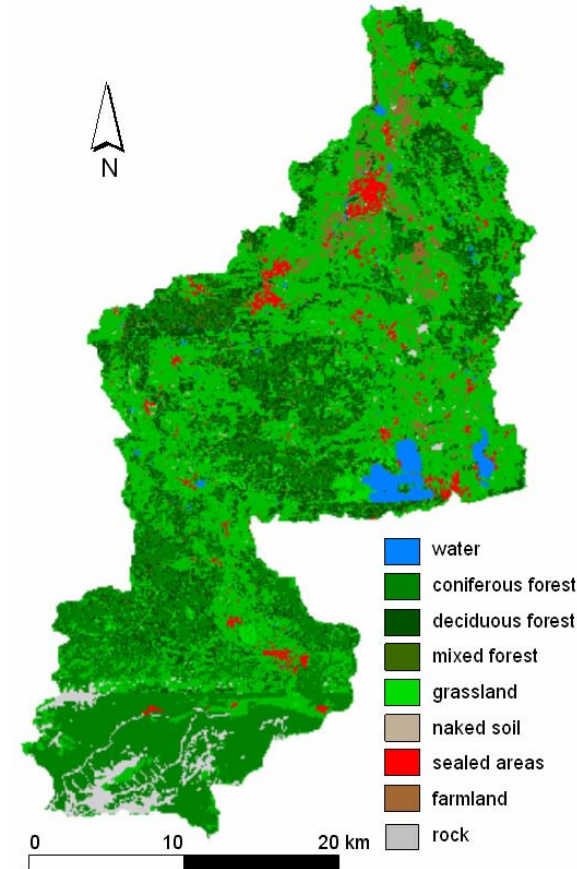
Ammer Einzugsgebiet



Ammer Einzugsgebiet

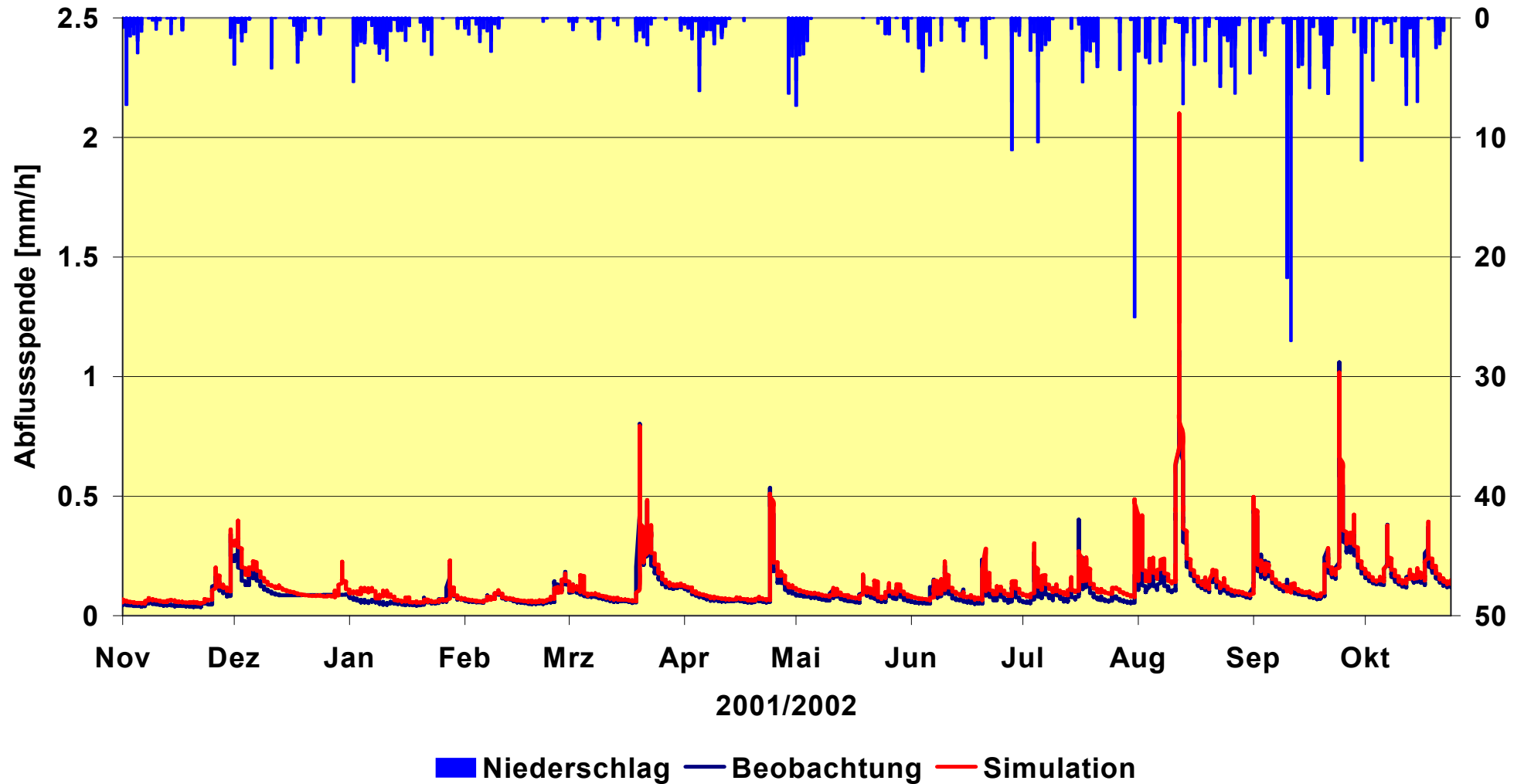


- "Branderfleck" strata
- floodplain deposits
- flysch – lias
- flysch – cretaceous
- peat
- dolomite
- detritus
- jurassic aged limestone
- triassic aged limestone
- sinter lime
- lacustrine limestone
- "Schrambach" strata
- upper oceanic molasses
- upper freshwater molasses, structureless
- upper freshwater molasses, conglomerate
- limestone
- "Raibler" strata
- alluvial fans
- "Unternogg" strata
- lower oceanic molasses, older part
- lower oceanic molasses, younger part
- lower freshwater molasses, older part
- lower freshwater molasses, younger part
- Würm-aged moraines
- Würm-aged gravel
- "Wetterstein" limestone

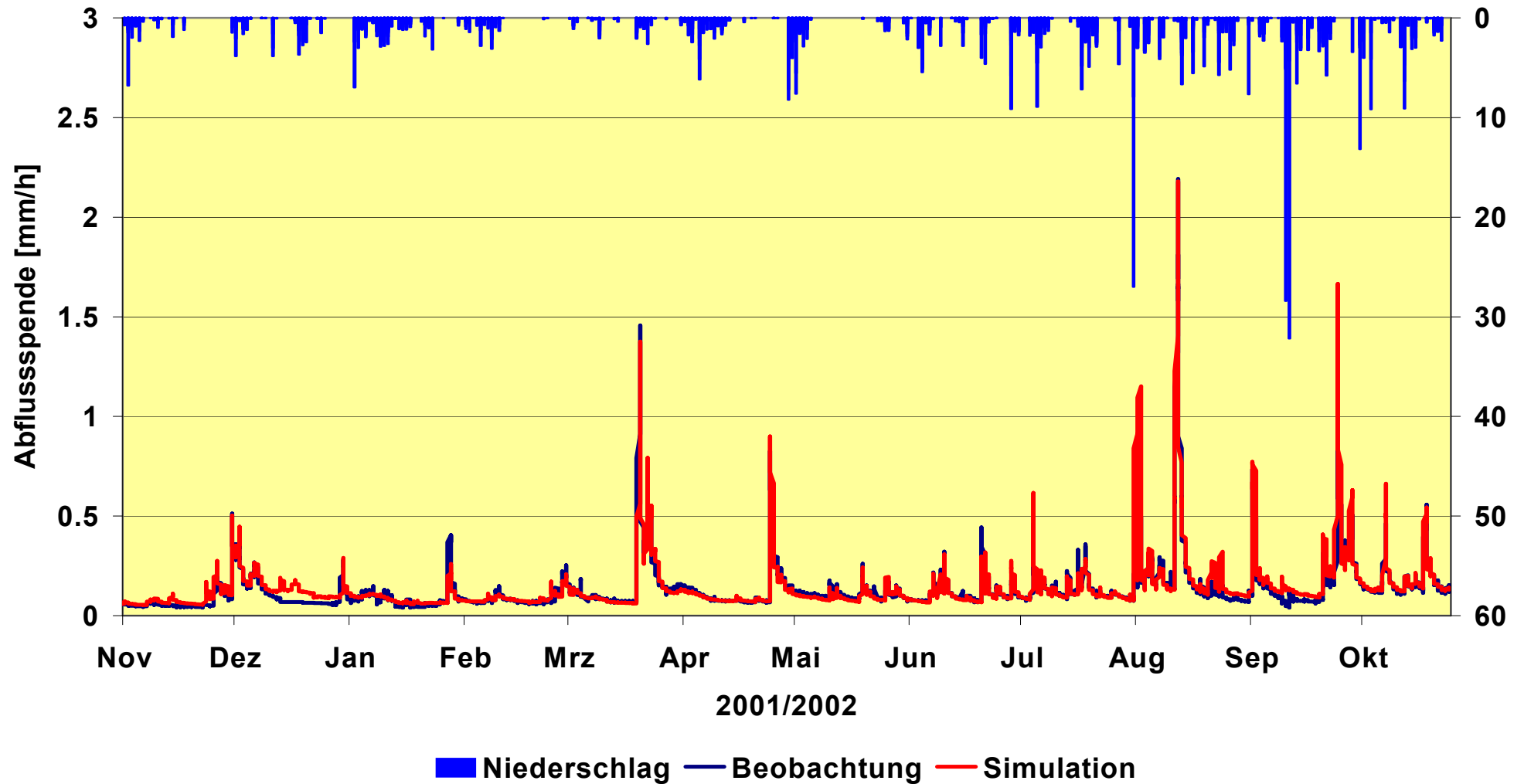


- water
- coniferous forest
- deciduous forest
- mixed forest
- grassland
- naked soil
- sealed areas
- farmland
- rock

Weilheim

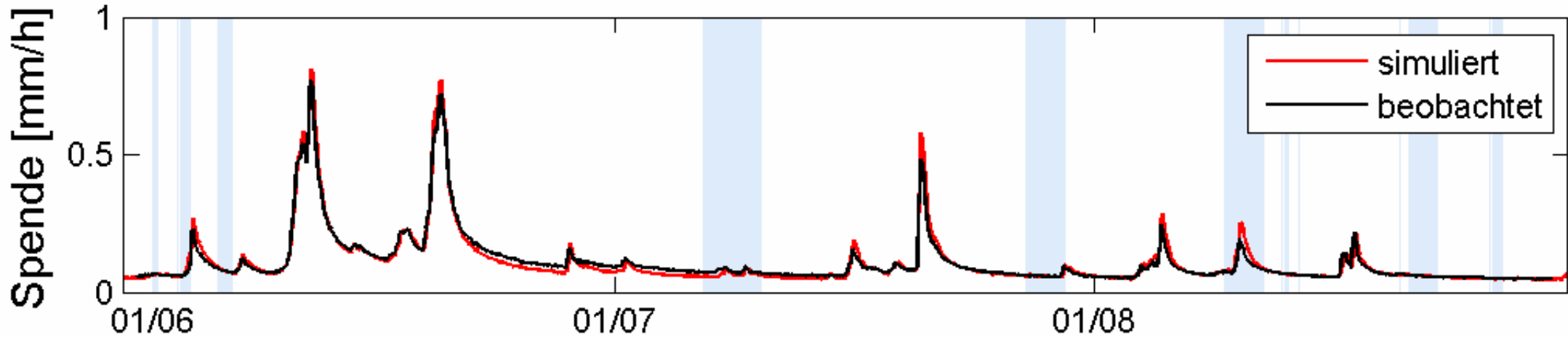


Peißenberg

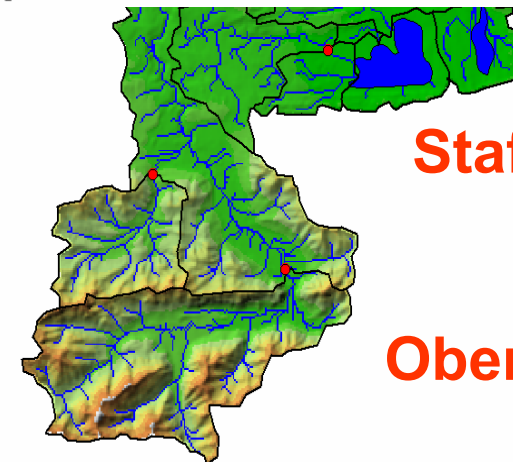
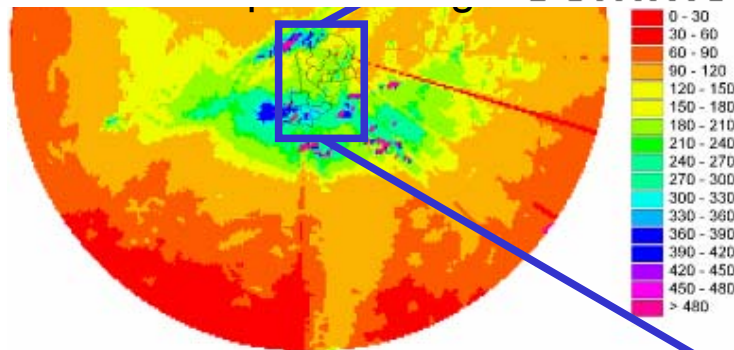


Erfassung der räumlichen Niederschlagsvariabilität im alpinen Terrain zur verbesserten Abfluss-Simulation

Weilheim



Sommer 2001



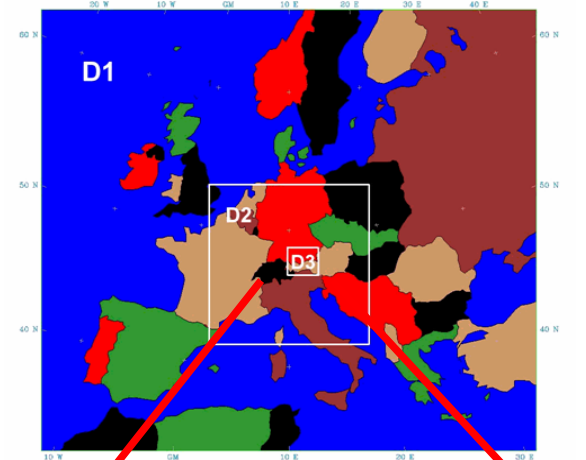
Staffelsee

Oberammergau

Regionale Klima-Hydrologie Modellierung

- Temperatur
- Niederschlag
- Wind
- Relative Feuchte
- Globalstrahlung

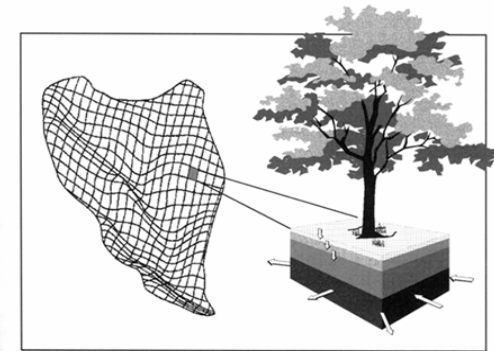
3-dim.
atmosphärisches
Modell



100x100km² → 4x4 km²

Hydrologisches
Modell

- Orographie
- Landnutzung
- Bodeneigenschaften
- Aquifereigenschaften
- Flussnetz



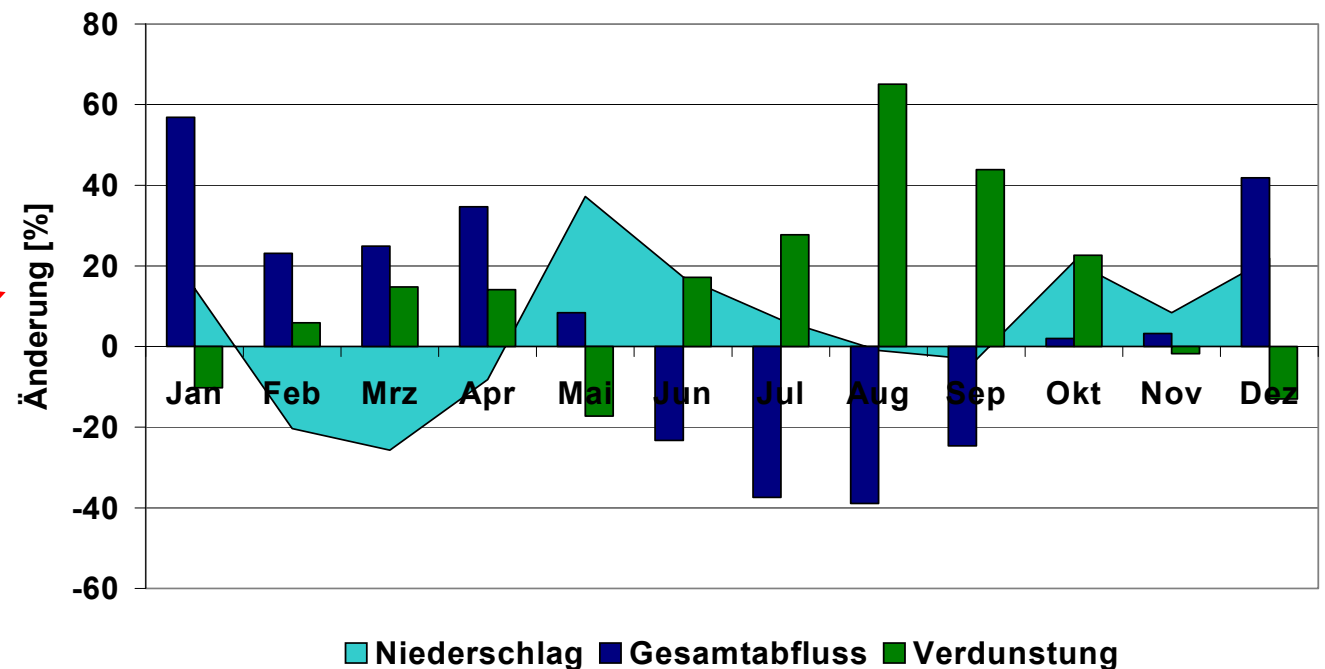
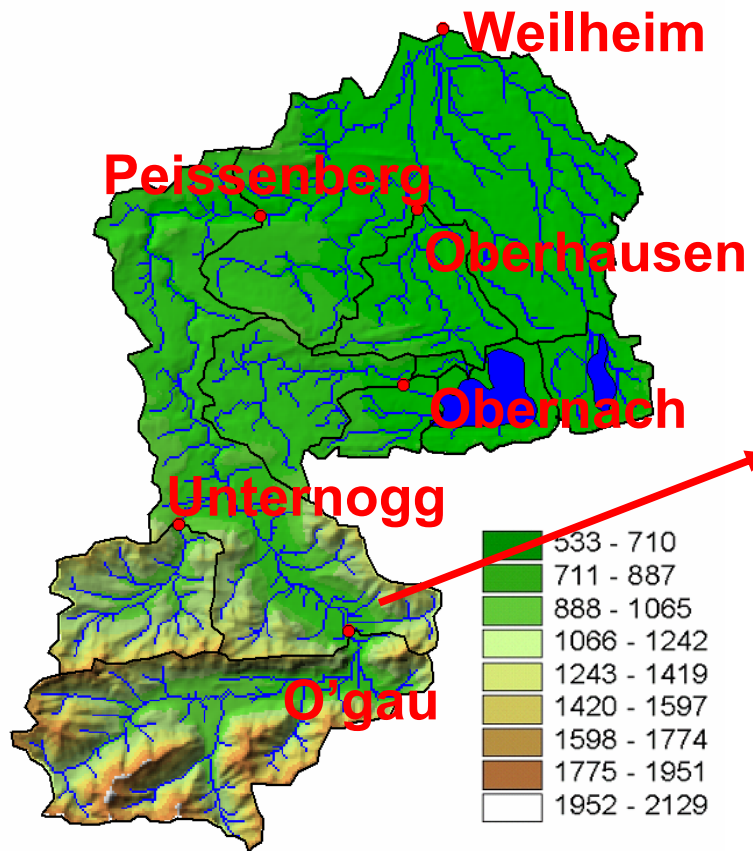
100x100 m² Auflösung

Evapotranspiration Infiltration **Abfluss** Grundwasser

Modellkaskade ECHAM4 – MM5 – WaSiM

Änderung 1990-99 vs. 2030-39

Oberammergau

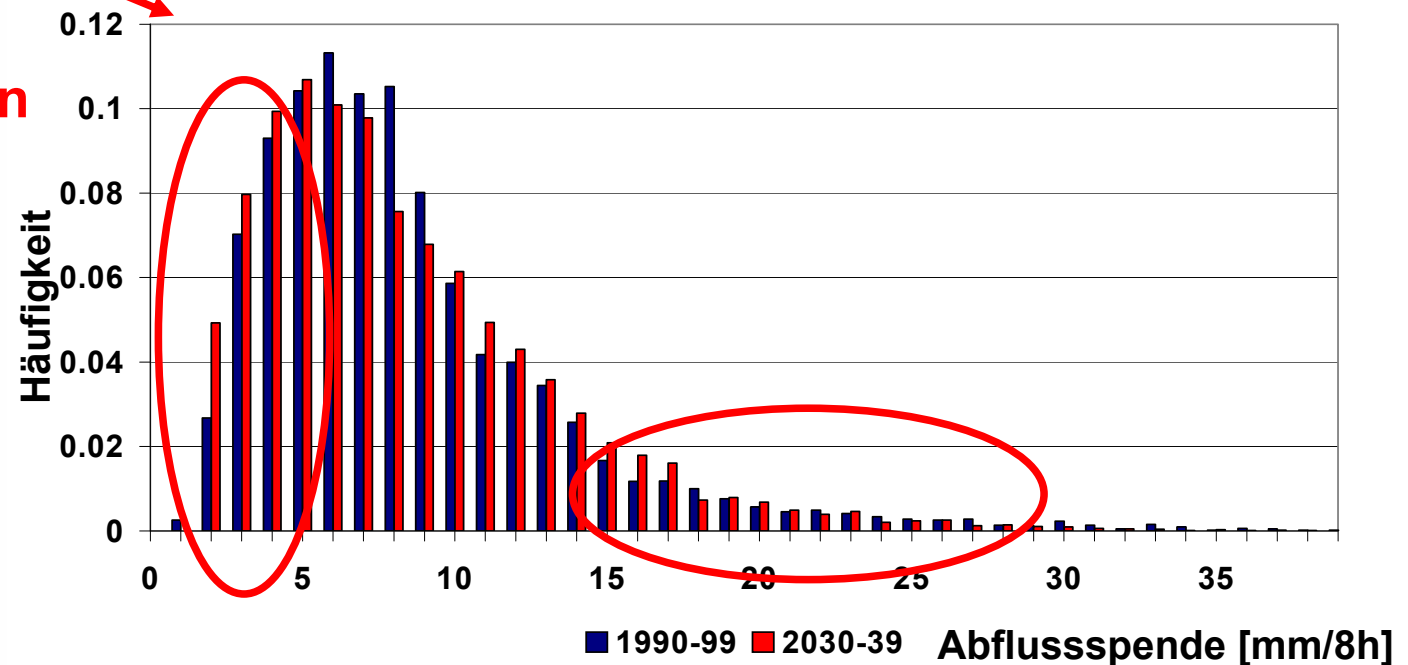
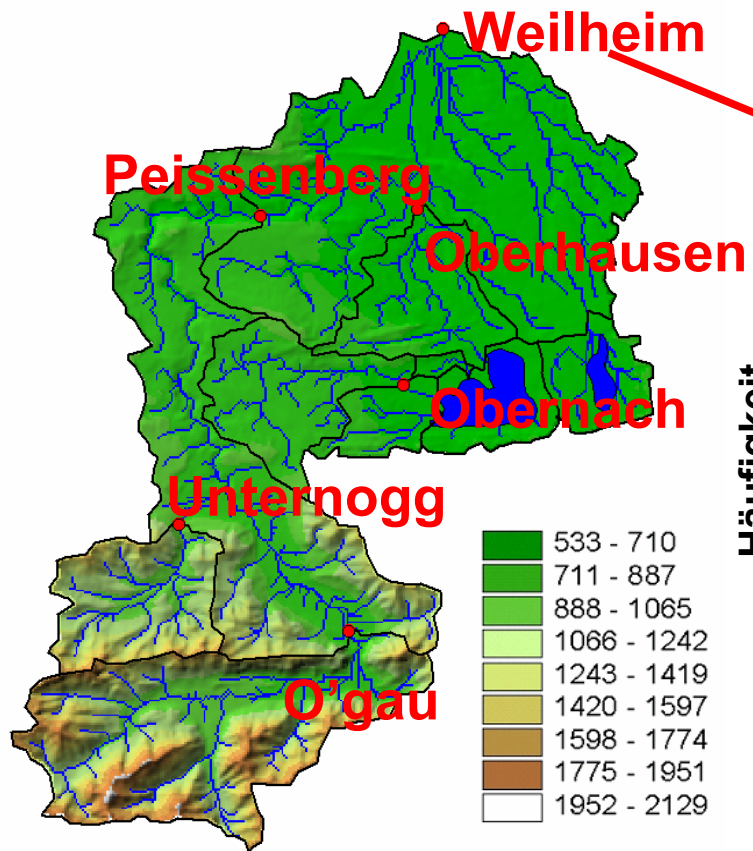


Zunahme Winter-, Verminderung der Sommerabflüsse

Modellkaskade ECHAM4 – MM5 – WaSiM

Änderung 1990-99 vs. 2030-39

Weilheim



Veränderung der Häufigkeiten: Zunahme von Hochwasser & Niedrigwasser!

Beispiel 2

Weißer Volta

West Africa



• 94000 km²



ke Volta

ay - October

November – April

ecol. zones:

n Savanna

encarta world atlas

Quantification of water balance variables: spatial distribution

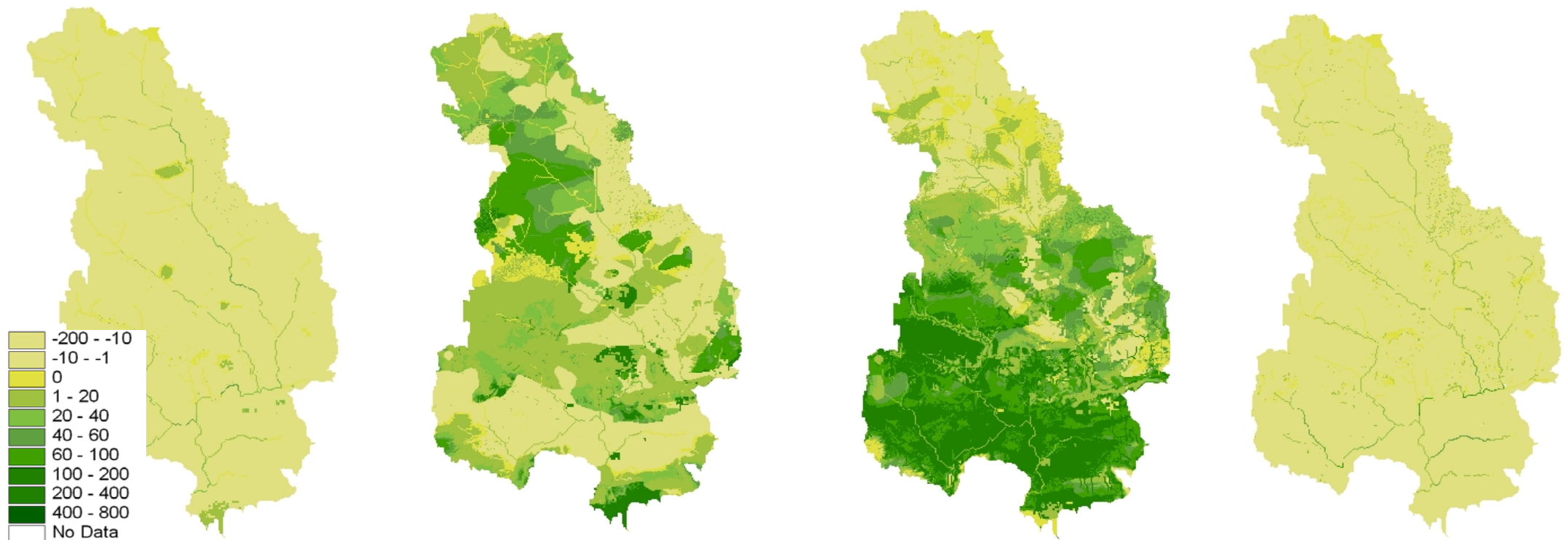
Groundwater recharge (monthly sums)

Apr 04

Jul 04

Sep 04

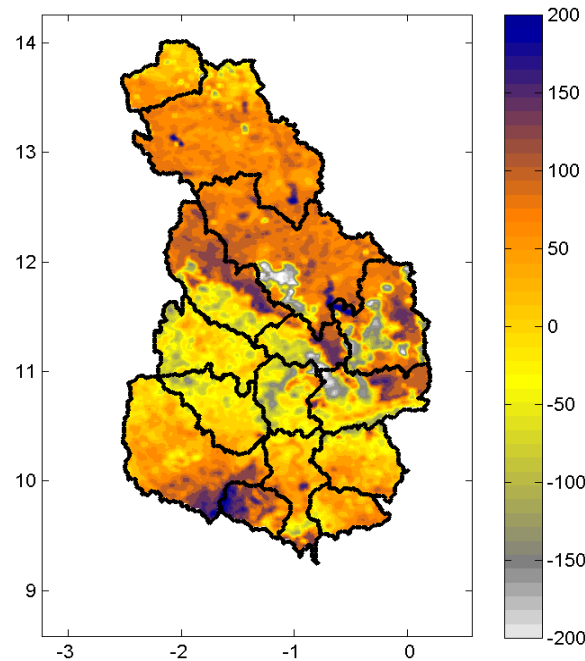
Nov 04



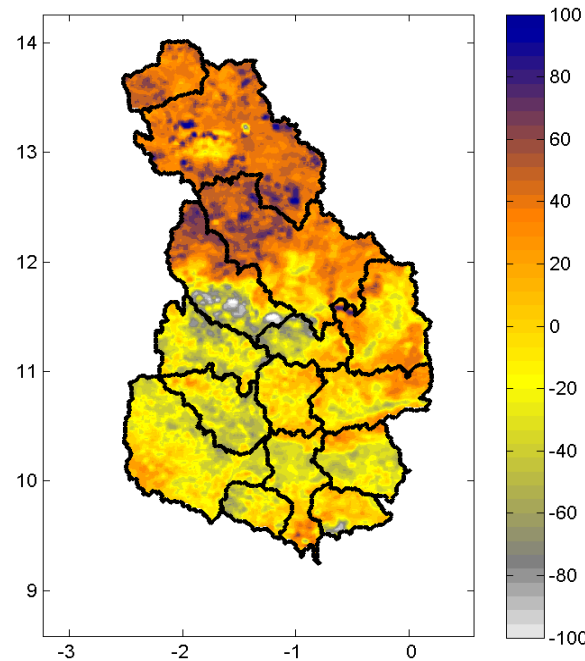
Assimilation of MODIS albedo and LAI in WaSiM

Spatial distribution using MODIS albedo & LAI of annual

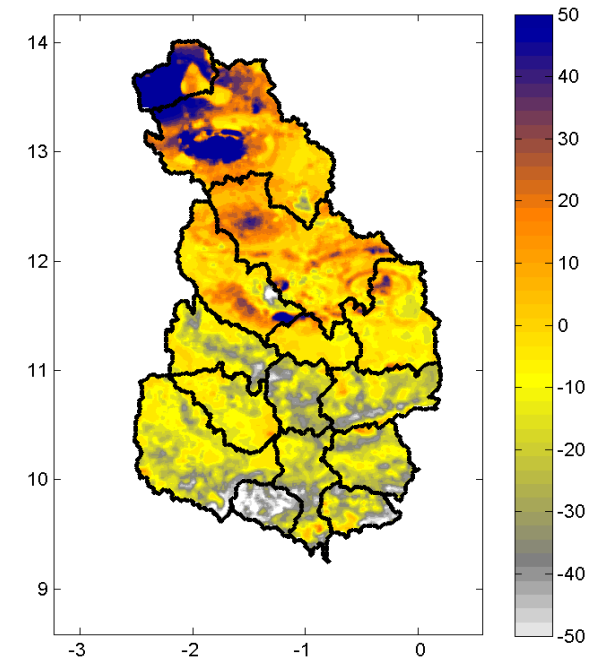
Potential ET



Actual ET



Total runoff



A scenic view of a mountain resort. In the foreground, a lush green field is partially enclosed by a wire fence. On the left, a small, rustic wooden cabin with a steep gabled roof sits on the grass. To the right, a larger wooden structure with a corrugated metal roof is visible. In the middle ground, a large, multi-story building with a prominent red-tiled roof and numerous windows stands behind a line of trees. The background is dominated by majestic, rugged mountains with significant snow cover under a clear, bright blue sky.

Vielen Dank für die Aufmerksamkeit