Brugga
Brugga basin, Germany

Basin characteristics

River Basin / River Basin (according EU-WFD): Brugga Rhein
Operation (from… to…): From 1933 to now
Gauge coordinates / Gauge datum: E: 3421750 m N: 5311600 m Datum: 308 m.a.s.l.
Catchment area: 40.1 km²
Elevation range: 1493 m.a.s.l. (Feldberg) – 434 m.a.s.l. (Oberried)
Basin type: Mountainous
Climatic parameters (mean precipitation, temperature and others): P=ca. 1730 mm T=ca. 7.7°C ETP=ca. 566mm
Land use: Forest: 75.7; grassland: 21.8; acres: 1.5; impervious: 0.9
Soils: Brown earth, gley soil, podzol
Geology: Gneiss, Migmatite; Quaternary overlaying strata
Hydrogeology: Basement: connected fissures, n=0.1-2.1%, k=10⁻¹⁰⁻¹⁵ m/s⁻¹; Quaternary strata: extremely variable parameters
Characteristic water discharges: [Qmin:0.2; Qmax: 33.6; MQ:1.55 [m³/s]]

Map of the research basin

Mean hydrograph / Pardé flow regime

Special basin characteristics (hydrogeology, lakes, reservoirs etc.)

Instrumentation and data

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<th>Measured hydrological parameters</th>
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<th>Temporal Resolution</th>
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<tr>
<td>Springs</td>
<td>1998 – now</td>
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<tr>
<td>Temperature, EC, pH</td>
<td>1995 – now</td>
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<td>Major ions</td>
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<td>Q: 1998-now; P:1995-now weekly</td>
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<td>Silicate</td>
<td>1998 – 2004</td>
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<td>Precipitation</td>
<td>1994 – now</td>
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<tr>
<td>Climate parameters (temperature, humidity, radiation, wind)</td>
<td>1994 – now</td>
<td>daily</td>
<td>3</td>
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Applied models

1. Precipitation-Runoff Modeling system (PRMS); Mehlhorn, 1998
2. Tac (tracer aided catchment model), TOPMODEL, HBV, PRMS; Uhlenbrook, 1999
3. Tac² (tracer aided catchment model, distributed); Mehlhorn, 2002
4. Mixing models (with two and three components); Didzun, 2004
5. Catchment water quality model (non point source model, NPSM); Eisele et al. 2001

Main scientific results

1. Tracer experiments: Groundwater residence time in the lower Quaternary strata and basement: 920 d; Groundwater dynamic in the lower Quaternary strata and basement: 340 d (double porous medium)
   Modeling with PRMS/tracer based conceptualization, validation and calibration: direct runoff: 16%; indirect runoff out of the upper Quaternary strata: 52% and out of lower Quaternary strata and basement: 32%
2. Development of a semi distributed rainfall runoff model (Tac). Tracer data can serve as multi-response data to assess and validate a model.
   Direct runoff is generated on saturated and impervious areas and on steep permeably boulder fields. It can amount 50 % of total runoff, long term portion is ca. 10%.
   Two underground flow system: 1-hillslope groundwater, ca. 70% of total runoff, mean residence time of 2-3 years; 2-cratine fissured aquifer system, ca. 20% of total runoff, mean residence time of 9 years. Further development of the semi distributed model Tac to the distributed model Tac².
3. The hydrochemical distinguishing between upland springs, hill slope water and stream water is possible. But flowpaths in hillslopes feature a great heterogeneity, neither depth nor position of hillslope water have systematic influence on the natural tracer concentrations.
   The spatial heterogeneities is clearly scale dependent. They are much more pronounced in small subcatchments but reduce with increasing catchment size.
4. The applied model proved to be applicable in a mesoscale catchment performing satisfactory results for the simulation of stream flow. The simulated nitrate concentrations were strongly controlled by the nitrogen input, the water movements and the nitrogen reactions in the different sub-areas. The simulation of nitrogen transport for the validation period showed only an agreement with the measured concentrations for the mean values, but the short time dynamics of the measured curve could not be fitted.

Key references for the basin


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