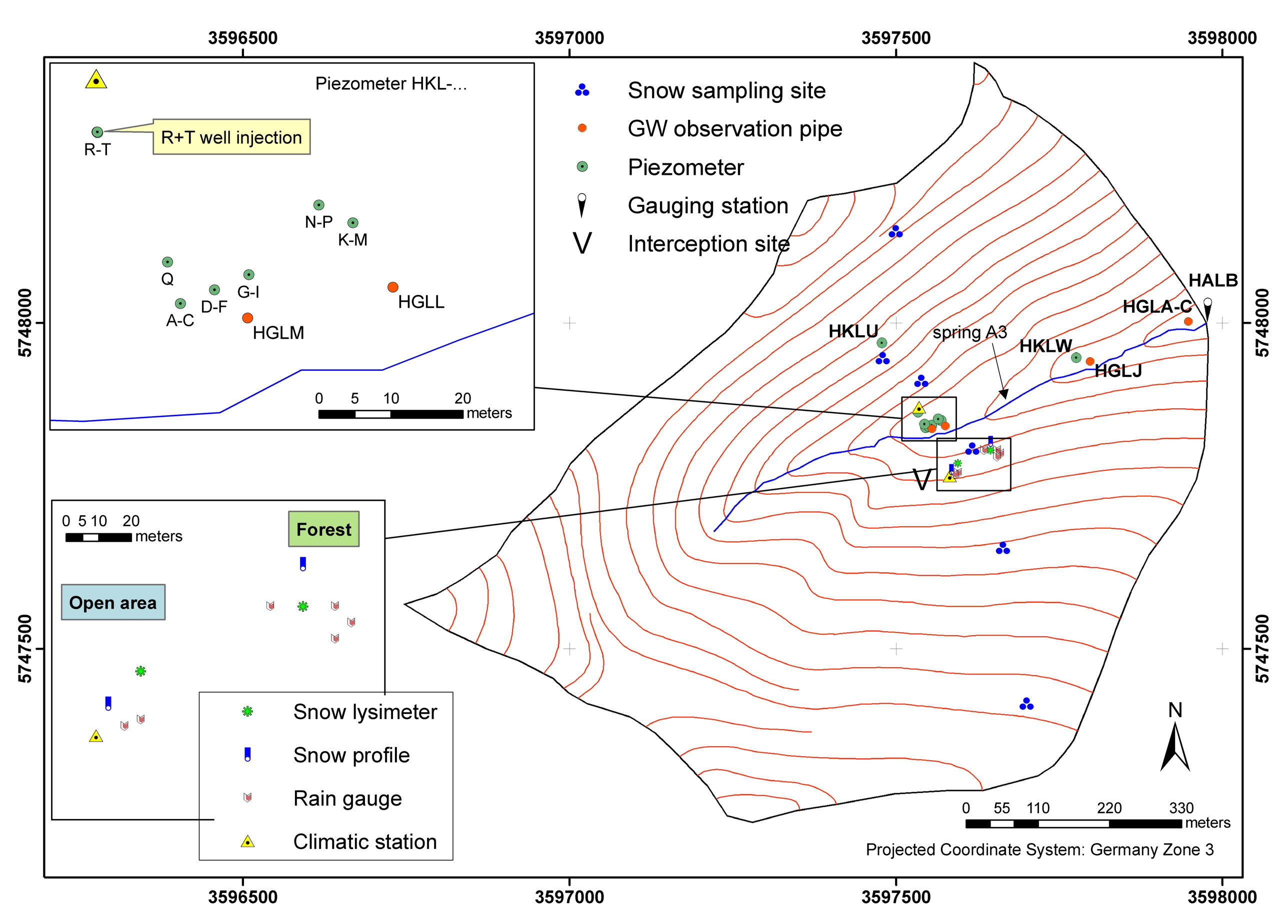
Lange Bramke

Bramke basin, Germany

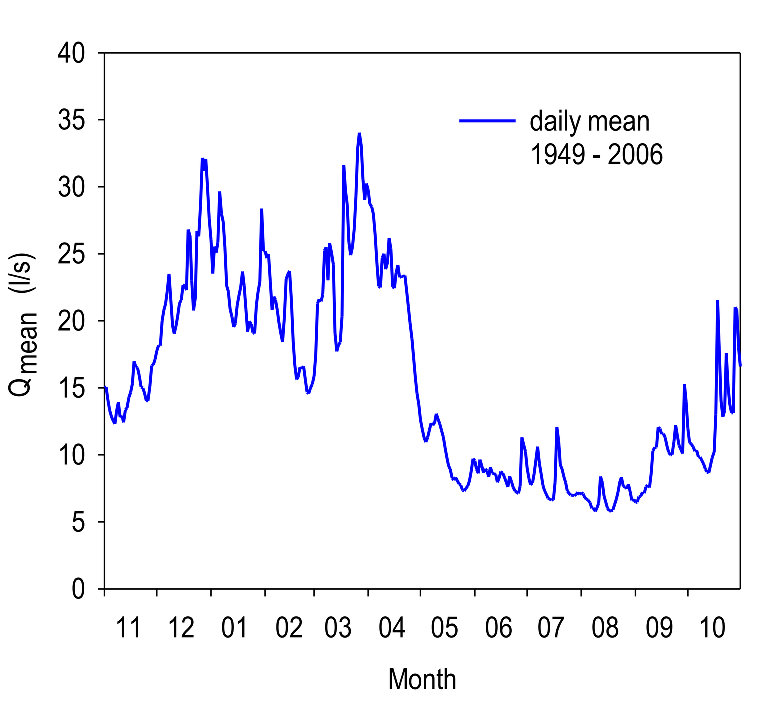
Basin characteristics

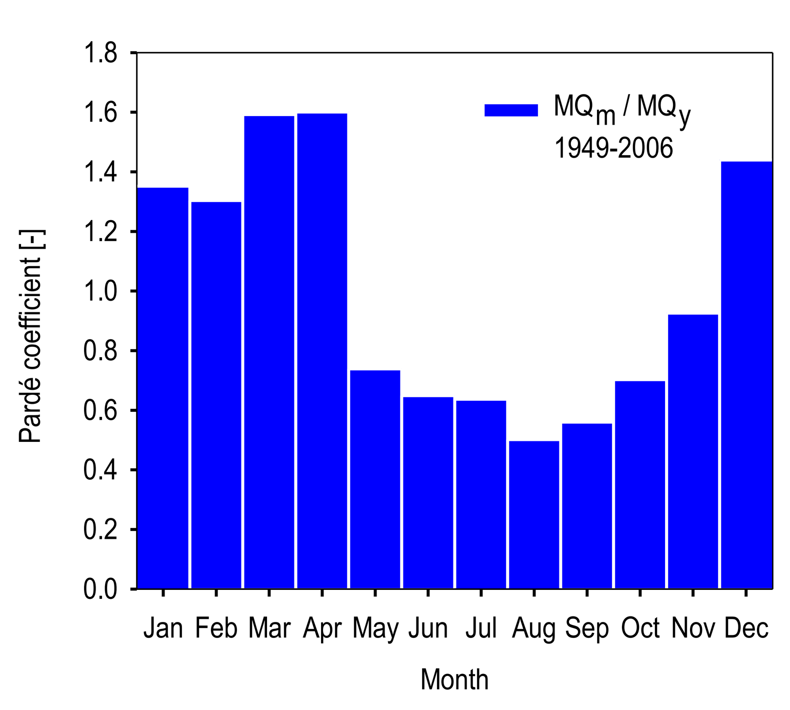
River Basin / River Basin (according EU-WFD)	Oker river basin / Weser river basin
Operation (from… to…)	Since 1948, still in operation
Gauge coordinates / Gauge datum:	10°26'E; 51°52'N / 537.76 m a.m.s.l.
Catchment area:	0.76 km²
Elevation range:	538 – 700 m a.m.s.l.
Basin type: (alpine, mountainous, lowland)	Mountainous
Climatic parameters: (mean precipitation, temperature and others)	1240 mm (1949-2007), 6.5°C (1962-2007)
Land use:	90% Norwegian spruce, 10% grassland
Soils:	Podsolic brown earth, brown earth Podsol, Pseudogley
Geology:	Sandstones, shaly quartzite
Hydrogeology: (Type of aquifers, hydraulic conductivity)	Fractured rock aquifer with a shallow porous aquifer overlay along the stream channel
Characteristic water discharges: (Q_{min}, Q_{max}, Q_{mean})	0.0 l/s, 15.79 l/s, 634 l/s (1949-2007)

Map of the research basin



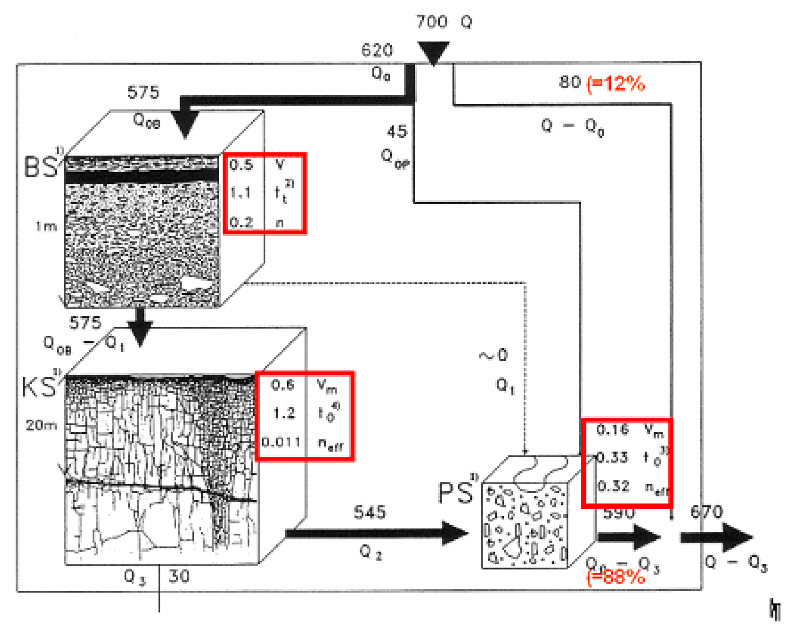
Mean hydrograph / Pardé flow regime





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

Mean annual water fluxes [mm WC] and hydraulic reservoir features



BS = Soil water reservoir
KS = Fractured rock groundwater reservoir
PS = Porous groundwater reservoir
Q = Water flux [mm/a]
V; Vm = Total volume; volume of mobile water [10⁶ m³];
t_t = Mean transit time of tracer [a];
t_o = mean transit time of water [a]
n = Total porosity
n_{eff} = Effective porosity

Instrumentation and data

Measured hydrological parameters	Measuring period	Temporal resolution	Number of stations
Stream flow	Nov 1948 – cont.	1h 10 min (since 1992)	1
Precipitation	1949 – cont. 1980 – cont. 1992 – cont.	Daily Hourly Impuls/ 0.1mm	2
Air temp., humidity	1987 – cont.	1h / 10 min.	2
Groundwater level	1988 – cont. 1992 – cont.	Weekly, Hourly	21 5
Environmental isotopes ^3H, ^2H, ^{18}O	Event based	Event dependent	Event dependent

Applied models

1. Concept model
2. Mike Basin
3. Feflow
4. IHACRES

Main scientific results

1. No overland flow exists. Direct runoff (=event water) equals to 12 %(= 80 mm/a) of total which is less than 5% of the input. Since interflow is negligible, indirect flow is 88 % (= 590 mm/a) and consists of groundwater.

2. The unsaturated zone and the fissured rock aquifer are short-cut by preferential flow paths which enable fast percolation. Groundwater recharge is extremely high (620 mm/a). The mean transit time of groundwater is 2.0 years.

3. Subsurface pressure heads and groundwater exfiltration react spontaneously on basin input. The latter controls the generation of flood hydrographs which consist dominantly of groundwater. Major cross-faults function as efficient drain channels.

4. The successive steps of the runoff formation process are probably the following:

   (i) Infiltration with saturation of top soils, quick drainage through macropores towards greater depths, and compression of the capillary fringe which may initiate pulse pressure transmission and connected aquifer reactions without mass transfer;

   (ii) Rise of piezometric table, i.e. increase of subsurface pressure head and subsequent mass displacement, which can be split into vertical seepage in the unsaturated (cf. (i)) and lateral (groundwater) flow in the saturated zone; and

   (iii) Groundwater exfiltration to stream channels as a combined effect of pressure transmission and mass transfer, with hydrograph generation as a result. To maintain the quantitative input/output balance, short-term groundwater losses are compensated without much delay, i.e. groundwater recharge is a permanent process throughout the year.

Key references for the basin

1. Herrmann, A. & Schumann, S. (2009) Untersuchung des Abflussbildungsprozesses als Kontrollmechanismus für den Gebietswasserumsatz des Oberharzer Einzugsgebiets Lange Bramke (Investigations of the runoff formation process as a mechanism for monitoring the basin turnover in the Lange Bramke catchment, Upper Harz Mountains). Hydrologie und Wasserbewirtschaftung 53(2), 64-79
2. Herrmann, A. (2008): 30 Jahre integraler Forschungsansatz zum Abflussbildungsprozess und 60 Jahre Abflussbeobachtungen im Oberharz.(30 years of integrated scientific investigation of the runoff formation process and 60 years of runoff observations in the Upper Harz Mountains). Hydrologie und Wasserbewirtschaftung, 52 (3), 132-136
3. Maloszewski, P., Herrmann A., Zuber, A. (1999) Interpretation of tracer tests performed in fractured rock of the Lange Bramke basin, Germany. Hydrogeological Journal, 7: 209-218.

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