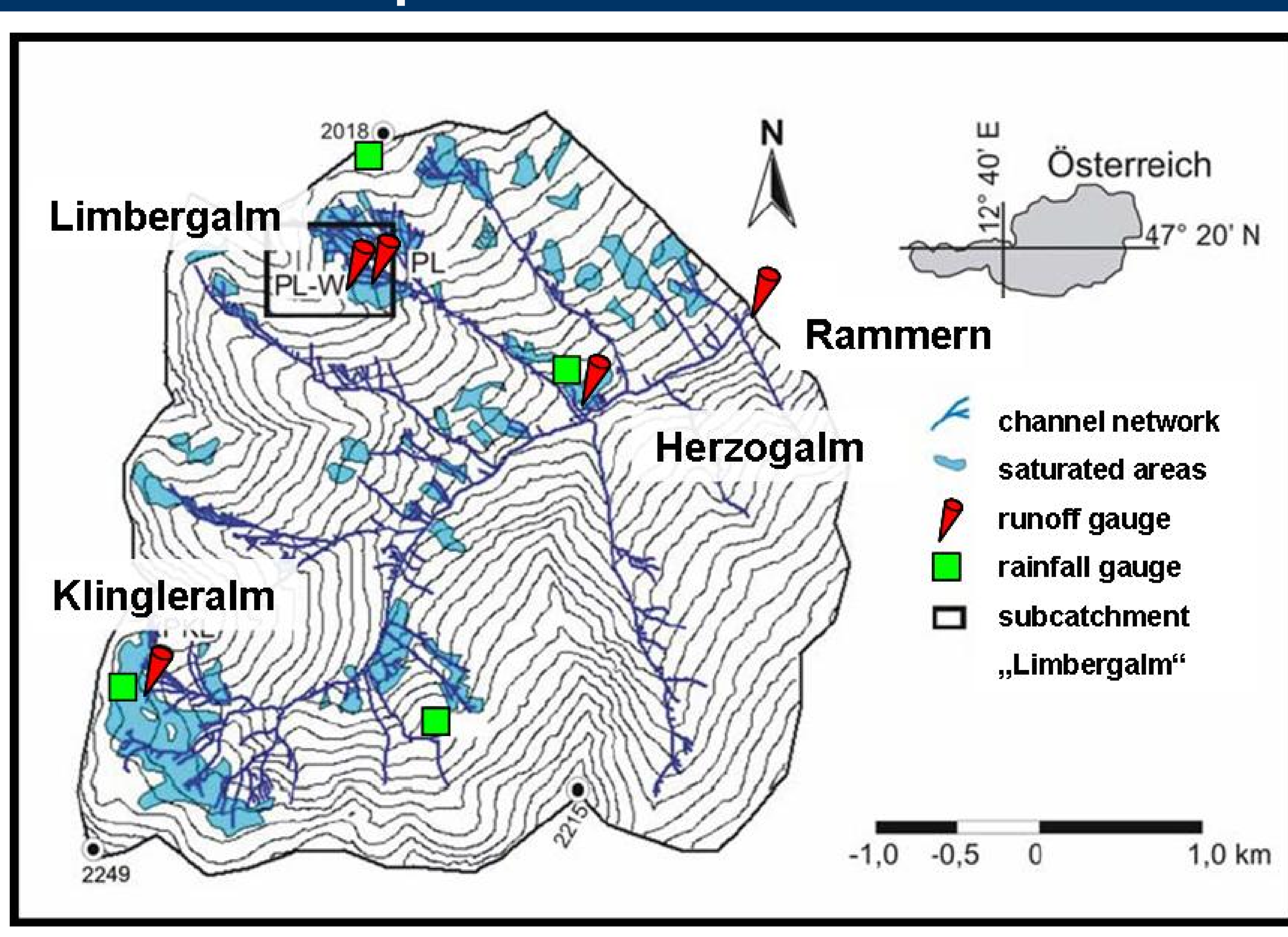
Rammern

Löhnersbach, Austria

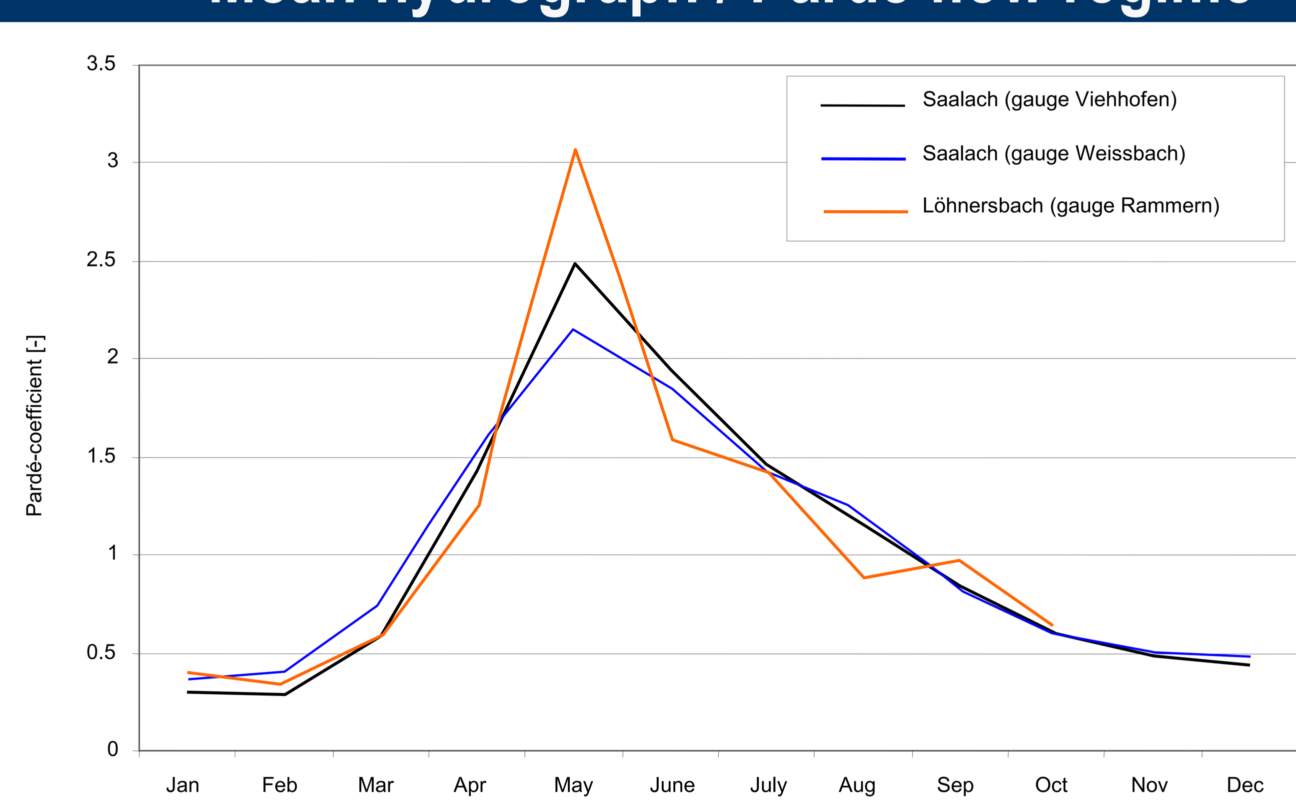
Basin characteristics

River Basin / River Basin (according EU-WFD)	Danube
Operation (from... to...)	since 1990
Gauge coordinates / Gauge datum:	47° 21.513, 12° 40.045
Catchment area:	16 km²
Elevation range:	1100 to 2200 m a.s.l.
Basin type: (alpine, mountainous, lowland)	alpine
Climatic parameters: (mean precipitation, temperature and others)	P: 1500 mm/a; T: ø 5°C
Land use:	spruce forest, alpine pasture
Soils:	Cambisol, Podzol, Gleysol
Geology:	northern greywacke zone (shale and sandstone)
Hydrogeology: (Type of aquifers, hydraulic conductivity)	unconfined aquifer; hydraulic conductivity 10^{-4} m/s
Characteristic water discharges: (Q_{min}, Q_{max}, Q_{mean})	Qmin: 0,03 m³/s; Qmax: 6,3 m³/s; Qmean: 0,56 m³/s

Map of the research basin



Mean hydrograph / Pardé flow regime



Pardé flow regime for gauge Rammern, Viehhofen and Weissbach.
Gauge Rammern is part of catchment Viehhofen.

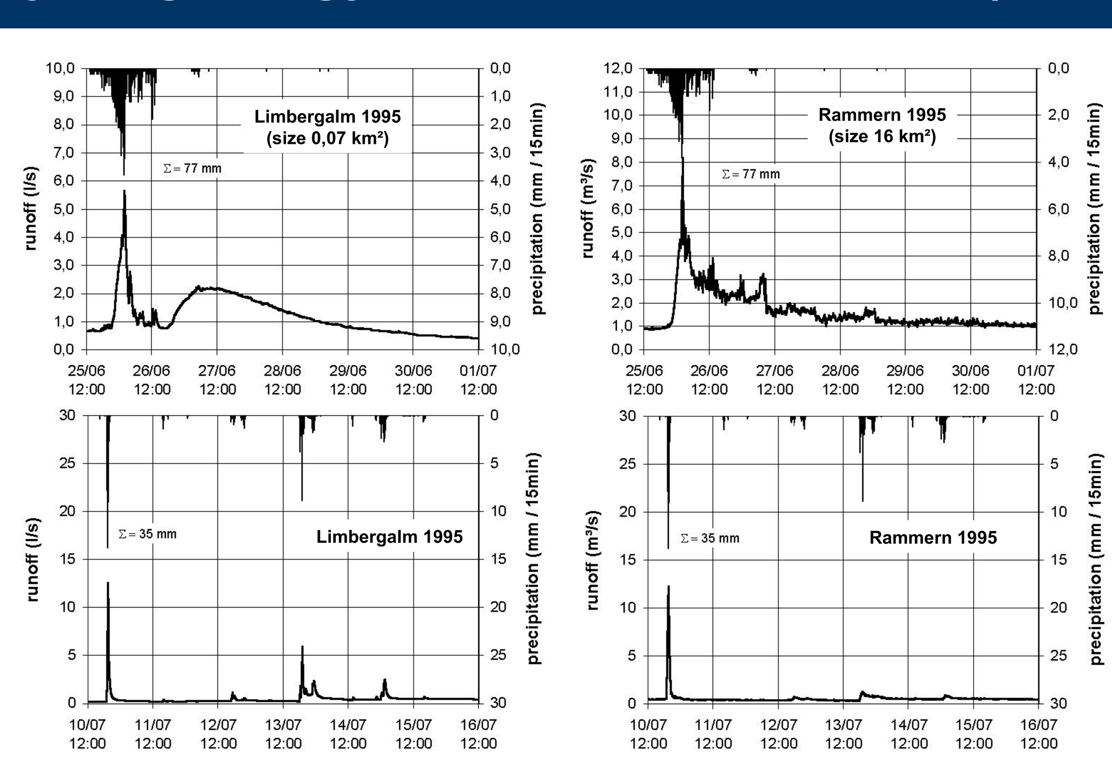
Special basin characteristics (hydrogeology, lakes, reservoirs etc.)

two typical event types at different scales

bimodal

and

unimodal



Instrumentation and data

Measured hydrological parameters	Measuring period	Temporal resolution	Number of stations
precipitation	1992 - 2005	5 min (April to Oct.)	4
temperature	1992 – 2005	5 min (April to Oct.)	1
temp. precip., snow, wind, air hum.	since 1931	5 min	2
discharge (Rammern)	since 1990	5 min	1
discharge	1992 - 2005	5 min	4
spring (discharge, elect. cond., temp., turbidity)	since 1999	1 h	1

Applied models

1. HQSim: developed by Kleindienst (1996) and applied by Kirnbauer et al. (2009)
2. TAC^D: Uhlenbrook (1999) and Johst et al. (2008)
3. Potsdam Model: developed of and applied by Zillgens et al. (2005)
4. BROOK: Federer & Lash (1978) and Kirnbauer et al. (1994)

Main scientific results

Experimental process studies:

Hydrological investigations in the upper Saalach region covered catchment sizes from 0,07 km² (Limbergalm, and other saturation areas of similar size), 16 km² (Rammern/Löhnersbach) and 150 km² (Viehhofen/Saalach). The studies that concentrated on processes to be observed on saturation areas in the Löhnersbach catchment gives evidence that the runoff coefficient on such areas is high but not unity and that it shows considerable dynamics: It increases with event precipitation and with increasing antecedent soil moisture as indexed by baseflow prior to the events. The quick runoff response to precipitation events is mainly generated on such areas by saturation overland flow but also by quick subsurface flow generated upstream in the duff layers below alpine roses and other shrub vegetation. Tracer and hydrochemical investigations substantiated these findings. At the microcatchment Limbergalm (0,07 km²) two characteristic event types could be distinguished: A unimodal flashy type resulting from short and high intensity rainfall events. Lower rainfall intensities but greater cumulative precipitation and/or high initial baseflow trigger a bimodal type of hydrograph consisting of a quick, flashy first runoff reaction and a second, smooth hydrograph due to subsurface stormflow. These two event types can be observed across all scales of the study area and can be seen as indicator of the catchment behaviour. If the bimodal type can be observed on the microscale on all greater scales runoff is dominated by subsurface stormflow, high runoff coefficients and slow recession of the falling limb of the hydrograph.

Runoff modelling:

Based on these field investigations the model structure was derived for the micro catchment: Surface and quick subsurface processes are modelled raster based with the diffusion analogy approach. Slow subsurface processes are modelled with the linear reservoir approach applied to hydrotopes delineated on GIS-base by combining geological and vegetation information. This model structure was the basis for modelling at the small catchment scale (16 km²). Model parameters were calibrated with data from two years. The model validation followed two ways: a) an on-site validation with runoff data from the catchment outlet and b) a multi-site validation for the tributaries (alpine torrents of about 1,2 to 2,5 km²) to the main brook of the small catchment. The simulated hydrographs of these tributaries were compared to daily discharge measurements with the salt dilution method and showed satisfactory agreement. This seems to indicate that the model describes the main features of the process.

Key references for the basin

1. Kirnbauer, R., Tilch, N., Zillgens, B., Merz, B. & Uhlenbrook, S. (2005): Tracing runoff generation processes through different spatial scales - Field studies and experiments. – Int. Conf. on Headwater Control VI, Bergen, Paper-Nr. 136.
2. Tilch, N., Uhlenbrook, S., Didszun, J., Wenninger, J., Kirnbauer, R., Zillgens, B. & Leibundgut, C. (2006): Hydrologische Prozessforschung zur Hochwasserentstehung im Löhnersbach-Einzugsgebiet (Kitzbüheler Alpen, Österreich). – Hydrologie und Wasserbewirtschaftung 50(2):67-78.
3. Zillgens, B., Merz, B. & Kirnbauer, R. (2005): Tracing runoff generation processes through different spatial scales - data analyses and modelling approach. – Int. Conf. on Headwater Control VI, Bergen, Paper-Nr. 135.

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