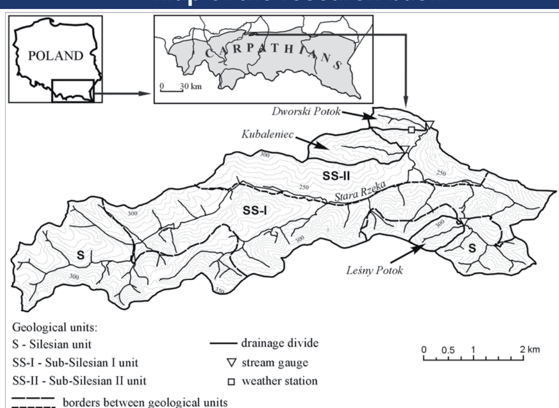
Łazy

Stara Rzeka, Poland

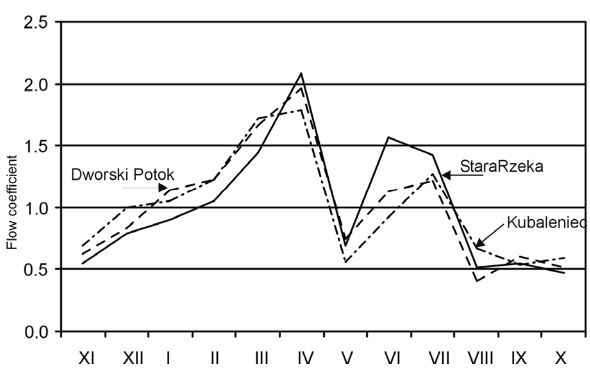
Basin characteristics

River Basin / River Basin (according EU-WFD)	Stara Rzeka / Wisła
Operation (from… to…)	Since 1987
Gauge coordinates / Gauge datum:	49.964845 N; 20.501259 E / 216.5 m asl
Catchment area:	22.22 km^2
Elevation range:	216.5-361.5 m asl
Basin type: (alpine, mountainous, lowland)	Mountain foothills, low elevation hills, flat main valley floor
Climatic parameters: (mean precipitation, temperature and others)	P = 580 mm
Land use:	Forests 41.8%; arable land 36.3%; meadows 14.9%, orchards 2.5%; built up areas 4,5%
Soils:	*Haplic Luvisols, Stagnic Luvisols, Cambic Luvisols*
Geology:	Tertiary and Cretaceous flysch (sandstones, claystones, shales), Miocene clay covered with loess-like formations
Hydrogeology: (Type of aquifers, hydraulic conductivity)	Porous aquifer, poor hydraulic conductivity
Characteristic water discharges: (Q_{min}, Q_{max}, Q_{mean})	Stara Rzeka: Q_{min} 0.02; Q_{max} 20.3; Q_{mean} 0.158 [m^3/s]

Map of the research basin



Mean hydrograph / Pardé flow regime



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

The Stara Rzeka basin represents the northern edge zone of the Carpathian Foothills with rolling hills dominating. Within the basin, there are three distinct sub-catchments under research: Leśny Potok (woodland, 0.48 km^2), Kubaleniec (agricultural, 1.03 km^2), and Dworski Potok (farmland, 0.29 km^2). The area straddles two levels of elevation: the higher being built of resistant flysch of the "Silesian tectonic unit" (36.9% of the area) and the lower being built of less resistant flysch of the "Sub-Silesian tectonic unit" consisting of two subunits: "Sub-Silesian I" (41.3%) and "Sub-Silesian II" (21.8%). The "Silesian tectonic unit" - sandstones and shales. The "Sub-Silesian I tectonic unit" - sandstones, claystones, shales, clays and conglomerates. "Sub-Silesian II tectonic unit" - claystones, marly clays, gypsum, sandstones and a salt series. Clayey Miocene formations atop flysch "Sub-Silesian tectonic unit" formations. The entire area lined with a thick layer of dusty loess-like formations, up to more than ten metres thick. Generally, the area is poor in groundwater. Poor permeability of superficial formations cause quick reaction to precipitation and snowmelt. Dense network of field roads favours surface runoff. Number of villages exert significant influence on the quality of streamwater and groundwater.

Instrumentation and data

Measured hydrological parameters	Measuring period	Temporal resolution	Number of stations
Discharge, water levels, precipitation	Since 1987	Daily (periodically hourly)	4

Field instruments: recording gauges, slope wash plots, weather station (air temperature, air humidity, wind speed, ground and ground surface temperature, rain acidity, wind speed and direction, snow cover).
Basic hydrochemical and soil laboratory at the Field Station of the University's Institute of Geography and Spatial Management in Łazy

Applied models

No models applied

Main scientific results

M Most of the research is focused on factors influencing the dynamics of streamwater chemistry

1. **1.** Seasonal changes of the chemistry are related to monthly changes in river discharge which affects characteristics connected with geology (SC, main ions). The higher the discharge, the lower the concentrations. Changes are controlled by dilution process. For some nutrients, the discharge causes different changes in catchments of different land use. In a woodland catchment, a growing discharge increases the concentration of these ions while in an agricultural catchment, the opposite is true.
2. **2**. The relationship between stream discharge and chemical concentration is different and depends on the source from which ions are derived. Increases in discharge caused by mid-winter and spring melt-water induce a reduction in chemical concentrations related to deeper bedrock sources (SC and most main ions) or to point sources, such as household wastewater discharge (eg. NO_2, NO_3, PO_4 in agricultural catchment). Simultaneously, concentrations of compounds derived from diffuse sources (e.g. NO_3 and K in woodland and mixed catchments) increase. The pattern is reversed during the low flows of summer and autumn.
3. **3**. Chemical composition is influenced by the degree to which soils is flushed and the subsequent availability of chemicals for transport. The effect of seasonal hysteresis is observed. The majority of ions records lower concentrations in spring and early summer, when chemicals are flushed from the soil during the preceding thawing periods. Resources of available compounds are replenished by intense chemical weathering of the soil covers during the warm season which increases concentrations during autumn and winter.
4. **4**. In the agricultural and mixed-use catchments SC and concentrations of main ions (except for HCO_3^-) are higher during floods caused by prolonged rainfall than during storm-induced floods. In the woodland catchment SC values and main ion concentrations are higher during storm-induced floods as opposed to floods caused by prolonged rainfall. This is the result of different water circulation patterns during floods in the woodland catchment where the dominant role was played by subsurface runoff. In catchments largely transformed by human agricultural activity, the dominant role was played by surface runoff. Higher SC values and ion concentrations are observed in the agricultural and mixed-use catchments during snowmelt-induced floods when the soil is unfrozen versus when the soil is frozen. This is the result of a number of infiltration opportunities being available, leaching processes and deliveries of chemical compounds occurring from surfaces to river channels. In the woodland catchment, this type of relationship does not exist.
5. **5.**Lower concentrations of NH_4^- are detected during rain-induced summer floods (both storm-induced and prolonged rainfall-induced) than during snowmelt floods both with the soil frozen and not frozen. This is related to stronger nitrification processes during the summer season. The opposite is true of PO_4^{3-} which is related to higher concentrations of suspended matter – an important source of the phosphate ion – during summer floods versus winter floods.

Key references for the basin

Chełmicki W. (ed.), 1998, The Carpathian Foothills Marginal Zone. Man and Environment, Prace Geogr., 103, Inst. Geogr. UJ, Cracow, 188 pp.
Raczak J., Żelazny M., 2005,. Diurnal fluctuations in stream-water chemical composition in small Carpathian foothill catchments (Southern Poland), [in:] Maraga F., Arattano M., 2005, Progress in surface and subsurface water studies at plot and small basin scale, Proceedings of the 10th Biennial International Conference of the Euromediterranean Network of Experimental and Representative Basins (ERB),Turin, Italy, 13-17 October 2004, Techn. Documents in Hydrology, no. 77, UNESCO, Paris: 101-108.
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