Stara Rzeka, Poland

**Basin characteristics**

**River Basin / River basin (acording EU-WFD)**
- River Basin: Stara Rzeka / Wisła
- Operation (from... to...):
- Gauge coordinates / Gauge datum: 49.964845 N; 20.501259 E / 216.5 m asl
- Catchment area: 22.22 km²
- Elevation range: 216.5-361.5 m asl
- Basin type: Mountain foothills, low elevation hills, flat main valley floor
- Basin size: 0.76 km²

**Climatic parameters**
- Mean precipitation, temperature and others
- Land use:
  - Forests 41.8%
  - Arable land 36.3%
  - Meadows 14.9%
  - Orchards 2.5%
- Soils:
  - Haplic Luvisols
  - Stagnic Luvisols
  - Cambic Luvisols
- Geology:
  - Tertiary and Cretaceous flysch (sandstones, claystones, shales)
  - Miocene clay covered with loess-like formations
- Hydrogeology:
  - Porous aquifer, poor hydraulic conductivity

**Catchment Area**
- Stara Rzeka: Q_{min} 0.02; Q_{max} 20.3; Q_{mean} 0.158 [m³/s]

**Main scientific results**

1. Seasonal changes of the chemistry are related to monthly changes in river discharge which affects characteristics connected with geology (SC, main ions), the lower 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 ions while in an agricultural catchment, the opposite is true.

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 (e.g. NO₃, PO₄ in agricultural catchment). Simultaneously, concentrations of compounds derived from diffuse sources (e.g. NO₃ and K in woodland and mixed catchments) increase. The pattern is reversed during the low flows of summer and autumn.

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. In the agricultural and mixed-use catchments SC and concentrations of main ions (except for HCO₃) 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, teaching processes and deliveries of chemical compounds occurring from surfaces to river channels. In the woodland catchment, this type of relationship does not exist.

5. Lower concentrations of HCO₃ 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 dilution processes during the summer season. The opposite is true of PO₄ which is related to higher concentrations of suspended matter – an important source of the phosphate ion – during summer floods versus winter floods.