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Response of basic hydro-chemical indicators to rainfall-runoff events in forest disturbed catchments in upper Vydra, Central Sumava Mountains

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The quantity and quality of streamflow in forested basins in montane regions is complex due to spatial and temporal hydrological processes and land cover changes. Basic hydro-chemical parameters can be used as indicators to understand the contributions of sub-streams, hydrological behaviors, and changing runoff sources to the streamflow. The relationship between the indicators and discharge provide further information on runoff dynamics in terms of both quantity and quality.

We therefore used three basic hydro-chemical parameters: water temperature (WT), pH, and electronic conductivity (EC) in six experimental catchments within the upper Vydra basin, Central Sumava Mountains. In the 6 studied sub-catchments, water stages, WT, EC, and pH have been continuously monitored at the catchment outlets and corresponding meteorological parameters such as precipitation and air temperature have been collected in 10-minute interval at 3 stations since 2009. Each of these 6 sub-catchments has an area around 2-5 km2 and covers different types of physiographic conditions, land cover related to forest intensity and the type of disturbance. We aim to investigate inter-relationship between the indicators (WT, pH, and EC) and the streamflow (Q) response to different rainfall-runoff events.

The sub-catchments have generally a relatively low pH (5.5-6.6) and EC (24-45 uS/cm), while the upstream has lower pH and higher EC than downstream and the outlet of Vydra basin at Modrava. The upstream-downstream gradients could be resulting from the peat bog proportion, which is higher in the upstream spring area. Different rainfall-runoff events, dry periods, snow melting periods, wet-periods, long-term rainfall, storm events, and unimodal and bimodal flood waves, are causing different responses of Q and studied indicators. Moreover, the response is varying in the studied catchments with different forest cover. In general, the EC performed in a positive correlation with Q, while performing in a negative correlation with pH. These responses to the rainfall-runoff events, the EC-loop and the pH-loop give information about the streamflow pathways in different catchments with varying forest proportions.

The contribution of this study gives an alternative to high-cost techniques and an application of using simple natural tracers to indirectly quantify rainfall-runoff processes in stream and the role of sub-streams to the whole basin.

Key words: streamflow, electrical conductivity, pH, water temperature, rainfall-runoff events, Vydra basin