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Variability of hydraulic parameters in a braided river – a case study from the Białka River, Poland.

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ABSTRACT

During the Holocene, rivers flowing in the Carpathian foreland formed a natural system of braided channels. In the 20th century an increasing anthropopressure led to the degradation of many multi-channels and deepening of the Carpathian rivers. Nowadays, only some of them partially retained its original character.

In this study, we investigated river channel morphology and hydrodynamic conditions in the Białka River, which is an example of mountain partially braided river. Field measurements including bathymetry and velocity distributions in cross-sections located along the river course were carried out using an acoustic Doppler velocimeter (FlowTracker ADV) and acoustic Doppler current profiler (ADCP StreamPro). The measurements were conducted under low and medium flow. Based on these measurements various hydrodynamic parameters of the flow were calculated such as Froude and Reynolds numbers, shear stresses, and friction velocities. Moreover, the downstream hydraulic geometry (HG) relations were expressed in the form of power functions of discharge. The results revealed a great spatial variability in bathymetry and flow characteristics in individual cross-sections. Several regularities were observed in the distribution of hydrodynamic parameters along the analysed river reach. The variability in hydrodynamic conditions in the Białka River is associated with diminishing bed slope in the longitudinal direction, roughness distribution at the river bottom in particular cross-sections, and channel transformation. The results showed that both the summation of hydraulic exponents and the multiplication of coefficients equal unity. The findings from this study may improve the management and restoration of degraded braided rivers.