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Channel planform evolution: Spatial and temporal aspect

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The recent period is characterized by impacts of climate change. Increasing magnitude and frequency of flood events results in morphological and morphodynamical changes of river channels. It is a challenge for the fluvial geomorphology to highlight the morphological response to these events, because the knowledge of the morphological-sedimentological attributes of the river channel is the first step in pursue of a comprehensive knowledge of the riverine landscape and impact on its sustainable management. Research of the spatial variability of landforms and the regime of processes creates an appropriate knowledge base for other sciences interested in the riverine as well as terrestrial systems.
The contribution deals with the morphological changes of the channel pattern of the River Topľa (115 km in total length, 1506 km2 of catchment area, average annual discharge 8.08 m3.s-1 in mouth). The 72.5 km long segment has been studied (Strahler ord. 4-7). It represents a transient from the mountain cobble-bed to the basin fine gravel-bed river. The Topľa is a less regulated and laterally partly confined river in northeastern Slovakia, with flysch geology.
Three time horizons of the remote sensing imagery (1987, 2002 and 2009) have been analyzed using the GIS, with the reference time horizon of 1987. The analysis consists of identification and delimitation of an active channel bank line and the delimitation of the channel bars in the mentioned series of imageries. The active channel width, area of channel bars, lateral channel shift and area stricken by bank erosion were studied via overlaying layers. The last attribute showed a significant increase: during the 1987-2002 period the area of 32.6 ha was eroded, whereas during the following period (2002-2009) of frequent and intensive floods up to 70.0 ha was eroded. Likewise, the maximum channel shift was 260 m and 443 m in 1987-2002 and in 2002-2009 respectively.
The key results are not only the values of these parameters, but mostly their spatial distribution, which corresponds with the distribution of the geomorphological processes. The study reach has a piedmont character where these processes increase in the longitudinal direction, reach a morphodynamic apex and decrease afterwards. This river segment is represented by the presence of gravel bars and flow bifurcation, thus the river approaches a braided style, but does not reach it due to the insufficient slope. The contemporary flood events elongated this hyperactive segment delivering excessive sediment loads downstream. On the river reach level, the spatial distribution of increased processes is constricted by the tectonic and structural predispositions, which control them.

Keywords: channel planform, lateral shift, bank erosion, extreme flood events, the River Topľa