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Reconstruction of temporal changes of a lowland river from historical maps and recent measurements – a case study from the Morava River, Czech Republic

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Presented contribution summarizes preliminary results of the study of dynamics of temporal changes in planform geometry of the Morava River from the second half of the 19th century until the present. The analyzed river reach is approximately 10-kilometre long segment of the Morava River corridor between the towns of Rohatec and Bzenec (south-east Moravia, Czech Republic) which represents one of the last remaining quasi-natural reaches of the large meandering lowland rivers in the Czech Republic. The Morava River has evolved its course here without any significant anthropogenic intervention since the 1930s when the stream was artificially straightened in two partial segments. Although the fluvial erosion and accumulation processes have a natural character here, their rate is accelerated due to river straightening downstream as well as upstream from the study reach. The research is conceived as the study of two time horizons and two spatial scales. The focus of the paper is on the relation between the continual changes of planform of the river reach and changes of floodplain land use in the period of 1841 – 2010. Ten sets of old maps were consulted in order to trace the evolution of the planform, starting with the digitalized maps from the 2nd and 3rd Austrian Military Survey of Moravia from years 1841 and 1876 (both in scale 1:28 800). For the period of 1876-1991, sets of Czechoslovak military topographic maps were used for evaluation of the changes from the years 1953 – 55, 1961 – 1969, 1987 (in scale 1:25 000). Subsequent development of the planform is based on the topographic map of Czech Republic from 1991 (1:10 000). The analysis of stream morphometry in 2003, 2005 a 2007 was conducted by means of relevant georeferenced aerial photographs. The channel geometry was vectorised in each of the time layers and the land use of riparian zone was categorised and recorded. For each of the time layers the fundamental stream morphometric parameters were defined or calculated. Each individual time layer is thus characterised by the number and localisation of the inflexion points of bands, sinusoity, wavelength, width of meander belt. The analysis proves that the originally straightened reaches have strong repercussions on upstream river segments. The sinuosity of channel has been increased and width of meander belt has been enlarged in the areas under the influence of straightened reaches. Detailed morphometric analysis was carried out on two dynamic areas of referential stream reaches which were selected on the basis of different land use of riparian zone (cultivated field vs. forest). The evolution of these representative stream reaches and the transformation of bends/meanders were qualitatively described and rate of lateral migratin was calculated in the course of the above-mentioned time period. The second part of the research is the analysis of selected discrete parts of channel based on geodetic measurements of three representative segments of concave banks of meanders/bends characterized by varying geometry, bank materials, structures and various land use of floodplain. The measurements take place in regular intervals and in addition to measurements after larger floods. The extent of eroded area of floodplain was calculated for each of the individual land use categories. Further calculations based on the portion of eroded area and perimeter of eroded area polygon show the intensity of annual migration of bank. Obtained data show variability in the intensity of annual migration of bank. The average rate of annual migration was 3.6 m in the field area (with maximum of about 6 m) and the average rate in forested area differed only in decimetres (with maximum of 1.3 m) in 2010.
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