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Analysing the meandering rivers responses to the slope-changes, depending on their bankfull discharge – Case study in the Pannonian Basin

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The multi-variable connection between the channel slope, bankfull discharge and sinuosity values were analysed to get a mathematical formula, which describes the responses of the rivers, and gives the probable sinuosity values for every slope and discharge values.
Timár (2003) merged two planar diagrams into a quasi 3D graph. One of them displayed how the river pattern changes, according to the slope and bankfull discharge values (Leopold and Wolmann, 1957; Ackers and Charlton, 1971); the other based on flume experiments, and gives a connection between the slope and sinuosity (Schumm and Khan, 1972). The result graph suggests that the slope-sinuosity connection also works along the natural rivers, for every discharge values. The aim of this work was to prove this relation, and describe it numerically.
The sinuosity values were calculated along the natural, meandering river beds, using historical maps (2nd Military Survey of the Habsburg Empire, from the 19th century). The available slope and discharge values were imported from a database measured after the main river control works, at the beginning of the 20th century (Viczián, 1905). Analysing the reports of the river control works, the natural slope could be computed for every river sections. The mean discharges were also converted to bankfull discharges. Neither long time series, nor cross sectional areas were obtainable, so other method was used to generate the bankfull discharge.
After the above mentioned corrections a quadratic polynomial surface was fitted onto these points with least squares regression. The cross section of this surface follows the theoretical slope-sinuosity graph, verifying that the flume experiments and natural rivers behave similarly. The differences between the fitted surface and the original points were caused by other river parameters, which also affect the natural rivers (e.g. the sediment discharge). Furthermore, this graph confirms the connection between the slope and sinuosity, so the sinuosity is a useable parameter to detect the changing slope.
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