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Upstream and downstream morphodynamic influence in simulated and real meandering rivers

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This study investigates the dependency of meander lateral migration rates on the spatial distribution of channel centerline curvature in both synthetic and real meandering rivers. It employs Machine Learning techniques (hereafter ML) to relate observed local lateral meander migration rates with the local and the upstream/downstream values of the centerline curvature. To achieve this goal, it was primarily essential to identify the feasibility of using ML in the meandering river's morphodynamics. We then determined the ability of ML to predict the excess near bank velocity based a set of input data using different regression techniques (linear and polynomial, Stochastic Gradient Descent, Multi-Layer Perceptron, and Support Vector Machine). We then moved forward to study the upstream-downstream influence on local migration rate. Synthetic meandering river planforms, as obtained through the planform evolution model of Bogoni et al. (2017), which is based on Zolezzi and Seminara (2001) meander flow model, were used as test cases for the calibration and check of the different adopted ML algorithms. The calibrated algorithms were then applied to multi-temporal information on meander planform dynamics obtained through the PyRiS software (Monegaglia et al., 2018), to quantify to which extent the upstream and downstream distribution of meander centerline curvature affects the local meander migration rate in real rivers.

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