The prediction of the Migration rate of meandering rivers using Machine learning models

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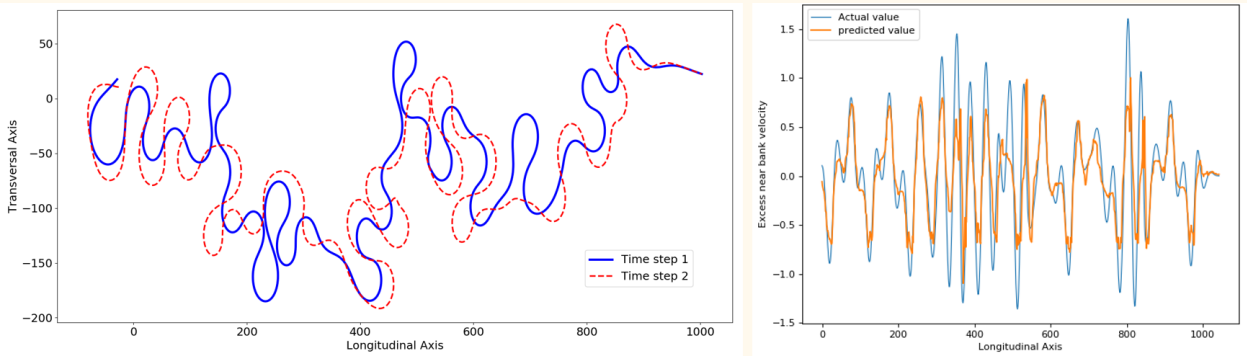

Figure1, right side) the migration of the meandering river in two different time steps, the solid blue line is planform in time step 1 and the red dashed line is the planform in the next time step. Also, the left side) is a result of the prediction of the migration rate of the river for the next time step using a model trained with time step 1. The orange line is the predicted value versus blue line that is the actual value of the migration rate.

Abstract

River meandering is the natural process that many lowland rivers undergo as a consequence of the alternation of bank erosion and accretion, which leads to the typical shape of the so-called meandering rivers. During the last decades, numerous modelling studies have been developed to reproduce their planform dynamics and to predict their future evolution. Most of these modelling approaches are physics-based, meaning that they solve the mathematical equations of shallow water open channel flow and fluvial sediment transport. Other types of modelling are very rare. Recent advances in artificial intelligence have led to promising results in many fields of science but their potential seems to have been so far rather unexplored in the prediction of meandering rivers morphodynamics. In this study, we have developed machine learning (hereinafter ML) models to compute the meander lateral migration rate based on

training dataset: once the model has been trained with known migration rates and curvature values at two consecutive time steps, it is used to predict migration rates at the following time step.

To this aim, the train and test dataset is coming from the outputs of a semi-analytical meander morphodynamic model which provides simulated evolving meandering planforms (described through the spatial curvature distribution) and migration rates computed through the excess near bank velocity. Such migration has been considered as the “Target” in the present study. The results for different models such as linear regression, feedforward neural network, SVM, and XGBoost were compared. It indicates that the “XGBoost” model with approximately 80 percent of accuracy in the prediction of the next time step, has the best result among them. This is just an opening chapter for the usage of ML in morphodynamics of meandering rivers and with advanced methods, there will be promising results ahead.