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Cellular automata modelling of future channel changes in a large gravel-beb river

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Reduced Complexity Models have been applied commonly to river channel in semiquantitative-explorative ways, without systematical efforts to test them at engineering and management time and spatial scales. Our attempt has been to test their ability to reproduce not only laboratory experiments and main aspects of river morphodynamics, , but also real channel behaviour at usefull time (decades) and spatial scales (tens of kilometer). This has to be done in a full knowledge of limitations of RCMs, using test methods which are able to verify their reliability in a contest of simplified modelling.
The aim of this study is the full application (sensitivity analysis, calibration and validation) of a cellular model in order to predict future channel evolution over a period of 40-50 years. The cellular model CAESAR (Cellular Automaton Evolutionary Slope And River model) was used. CAESAR is a reduced complexity model, that is a type of model developed partly to fill the gap between 2- and 3-D computational hydrodynamics morphological approaches, often too complex to be applied to long reaches over long timescales (e.g. years or decades). The substantial increase in speed of processing enables applications to multi-scenario approach.
The application was carried out on the Tagliamento River (Italy) in a 33 km braided reach. Our previous investigations allowed a detailed description of channel evolution over the last 100 years. In this period notable channel adjustments have occurred mainly caused by gravel mining and channelization works. A dominant and generalized narrowing/incision phase took place up to early 1990s, followed by a phase of channel recovery (i.e. widening and, at least in some reaches, aggradation).
At the current state of the research, a two steps sensitivity analysis was performed (Morris one-at-time screening method and Saltelli variance-based methods) to facilitate the calibration on a test-reach of 7 km. Validation has also been concluded on the entire 33 km reach. This long preliminary phase has made the following simulations (i.e. future channel evolution runs) much more feasible. Some “scenario-runs” have been performed to explore channel response to future different sediment management strategies, but also to assess the influence of other factors (flow regime, vegetation growth, lateral structures) on future channel evolution