Sediment Dynamics from the Summit to the Sea
(Proceedings of a symposium held in New Orleans, Louisiana, USA, 11–14 December 2014) (IAHS Publ 367, 413-420, 2014)

River, delta and coastal morphological response accounting for biological dynamics

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Abstract Management and construction can increase resilience in the face of climate change, and benefits can be enhanced through integration of biogenic materials including shells and vegetation. Rivers and coastal landforms are dynamic systems that respond to intentional and unintended manipulation of critical factors, often with unforeseen and/or undesirable resulting effects. River management strategies have impacts that include deltas and coastal areas which are increasingly vulnerable to climate change with reference to sea level rise and storm intensity. Whereas conventional assessment and analysis of rivers and coasts has relied on modelling of hydrology, hydraulics and sediment transport, incorporating additional biological factors can offer more comprehensive, beneficial and realistic alternatives. Suitable modelling tools can provide improved decision support. The question has been whether current models can effectively address biological responses with suitable reliability and efficiency. Since morphodynamic evolution exhibits its effects on a large timescale, the choice of mathematical model is not trivial and depends upon the availability of data, as well as the spatial extent, timelines and computation effort desired. The ultimate goal of the work is to set up a conveniently simplified river morphodynamic model, coupled with a biological dynamics plant population model able to predict the long-term evolution of large alluvial river systems managed through bioengineering. This paper presents the first step of the work related to the application of the model accounting for stationary vegetation condition. Sensitivity analysis has been performed on the main hydraulic, sedimentology, and biological parameters. The model has been applied to significant river training in Europe, Asia and North America, and comparative analysis has been used to validate analytical solutions. Data gaps and further areas for investigation are identified.

Key words sedimentation; morphodynamic model; bioengineering; biogenic material; climate resilience