Modelling the influence of vegetation on the morphodynamics of a flood event in the Allier, France

M.J. Baptist

Delft University of Technology, Faculty of Civil Engineering and Geosciences, Water Resources Section, Delft, The Netherlands (m.j.baptist@tudelft.nl)

Understanding the interactions between vegetation and the morphology of rivers is becoming increasingly important in view of modern river management and climate change. There is a need for predictive models for the natural response of rivers to river rehabilitation. One way to study the effects of river rehabilitation is to study natural reference rivers. The Allier in France is considered as a landscape reference for the to-be-restored Border Meuse in the Netherlands. The Allier is highly dynamic, large amounts of sand and gravel are transported during floods and its morphology changes considerably from year to year. The riparian vegetation is characterised by pioneer species on the low-lying dynamic point-bars, herbaceous vegetation and grass on the higher parts and extensive softwood floodplain forests, mainly consisting of poplars, on the older and higher floodplains. Due to the river dynamics, this river shows natural rejuvenation of vegetation such that older forests are removed by erosion and young pioneer vegetation can start growing on the point-bars. This model study investigates the role of vegetation on the morphological changes of a single flood event that took place in December 2003. A state-of-the-art 2-DH morphodynamic model was applied in a 6 Mm^2 study area. This model accounts for the effects of vegetation on the hydraulic resistance and on the reduction of bed shear stress and subsequent bed load sediment transport. The model results show that vegetation has a pronounced effect on the hydrodynamics and morphodynamics. The results also reveal that this model has only limited success in simulating the observed morphological changes. Recommendations for further model development will be made. It can be concluded that vegetation is an important factor for the morphodynamics of gravel bed rivers, but our knowledge is at present insufficiently advanced to accurately predict the morphological changes in this section of the Allier.