CONTROL OF MORPHOLOGY IN WATERSHED BY OPTIMIZING SEDIMENT SUPPLY OR RELEASE

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Abstract: This study aims to develop a simulation-based optimization model to control morphology by adjusting sediment transport (or fluxes) in watersheds with complex geometry during storm events in order to reduce extra erosion (or minimize morphological change) and sequentially preserve the equilibrium state of channels or rivers geomorphology. The methodology is based on the variational adjoint sensitivity theory to establish the relationship between sediment release (or supply) in open channel and morphological changes. The developed model combines an optimization module with a well-established one-dimensional model (CCHE1D) for simulating open channel flows and sediment transport in a watershed. Different optimization algorithms have been tested for their effectiveness and accuracy for constrained and unconstrained management situations of sediment control structures. The internal boundary conditions of the adjoint equations at a confluence (junction) derived by the variational approach which makes the developed control model applicable to solve optimal sediment control problems in channel networks over watersheds. The effectiveness of the developed model has been demonstrated by applying the model to different cases of excess erosion over watersheds and model has been proven to effectively minimize the morphological changes. This developed model of sediment control can be generally applied to make optimal decisions for watershed sediment management.

Keywords: Sediment control, Channel networks, Morphodynamic modeling, Non-linear optimization.

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