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Generic 2-D River Network Modeling of Flow and Sediment Transports

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A generic 2D river network model of flow and sediment transports is proposed for the flow and sediment simulation in the complex river network. The paper expands the three-step method adopted in the 1D river network to the 2D river network simulation. A 2D river network model is divided into several cells, including single river cell, “tree-like” river cell, “ring-like” river cell and “cross-like” river cell, which can reflect the interactive influence of flow field in the bifurcated channel and applies to generic 2D simulation. Based on equation of the 2D shallow water and unsteady non-uniform suspended sediment, the relationship between the variables (water level, discharge and sediment concentration) of each section and those of the boundaries are obtained through the full implicit matrix chase-after method. Through the conservation of water and sediment on the boundaries, the water level and sediment concentration on the nodes can be got by solving the irregular sparse matrix of conservation equation, so as to implement the coupled simulation of flow and sediment in the whole river network.

The paper take the Chengtong River Reach located in the low reaches of Yangtze River as the example of “cross-like” river to verify the algorithm. The model is calibrated using the measured data. A comparison of calculated water level, discharge and sediment concentration shows that the generic model can reflex the interactive influence of flow field, with reasonable accuracy, especially in the bifurcated channel.