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Monitoring and Modeling of Sediment in Changjiang River

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Abstract:

To cope with sediment issues, the Bureau of Hydrology (BOH), Changjiang Water Resources Commission (CWRC), has set up large scale and continues prototype observation scheme for sediment monitoring in Changjiang River (Yangtze River). Researches have been carried out to study the sediment transport character and river morphology dynamics associate with silting and scouring process. The paper presents briefly the monitoring scheme and technology applied in the sediment monitoring. Attention has been given to the modeling technologies applied and developed in the modeling practices.

Using the large amount of flow and sediment observations, in BOH_CWRC, a 1-dimentional (1D) and a 2-dimentional (2D) flow and sediment models are developed for Changjiang River. The 1D model is developed to simulate the silting process in the reservoir region and scour process downstream of the three gorges dam. The 2D model is mainly used to simulate the process of sediment transport in Tunaozhi reach during the degrading period of the reservoir. Using these models, the scour and silting process is modeled in the curly river reach near Shashi city and the braided river reach near Wuhan city at the middle-downstream of Changjiang River. The simulation shows good agreement with the measurement.

In order to simulate surge generated by landslide in reservoirs, a horizontal 2D numerical model using the technology of moving coordinate system is developed. Comparing with the models developed using fixed coordinate system, the moving-coordinate system model is more flexible and therefore with better representation to the water reaction to landslide at reservoir.

Meanwhile, to cope with the serious scouring and collapsing at the flood diversion-weir which is normally caused by big floods or broken intentionally for flood diversion purpose, the model is required to be able to adjust the boundary (dynamic boundary) and move the calculation grids accordingly. Such problem cannot be solved by using the traditional constant calculation grid method. To deal with this problem, the paper introduces the so-called dynamic-grid method into the 2D dike break model using movable grid size. It has been found that the model can simulate the diversion-weir evaluation process well, which shows great potential for future application of the dynamic-grid method.

Keywords: River sediment, prototype observation, flow and sediment modeling, flood diversion, moving coordinate, dynamic-grid