Experimental study on the maximum possible scouring depth in Baotou reach of the Yellow River

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The governance strategy of suspended river in the wide valley channel segments has always been one of the core issues of river regulation in the upper reaches of the Yellow River. In order to accurately assess the efficiency and effectiveness of hydraulic driven scouring method for reducing the river bottom elevation, the flume experiments were adopted to simulate the maximum possible scouring depth under continuous scouring conditions. The hydrodynamic and sediment data in the Baotou reach of the Yellow River were taken as the prototype, and the design of movable bed scouring model was carried out. Considering the importance of bed surface adjustment of sandy riverbed under scouring conditions, especially the anti-scour characteristics of sand wave, the dynamic design of the model was completed by using the normal scale method for obtaining more similar bed form. In light of the significance of model sand selection for test results, a number of preliminary tests were carried out around the similarity of model sand. With the verification of moving bed resistance under the condition of dominant floods, 80 mesh wood powder treated with preservative is finally selected as the model sand for flume experiments. Taking the prototype flat discharge and suitable ecological discharge as the main hydrodynamic conditions, and the formation of steady-state sediment transport rate and vertical distribution of flow velocity as the test end conditions, the corresponding possible maximum scouring depths under different discharge conditions of Baotou reach were finally obtained. The test results show that the maximum reduction height of river bottom elevation is about 3.58m under the condition of continuous discharge of appropriate ecological flow. Meanwhile, the sand wave structure with boundary layer separation effect has been formed on the bed surface. The vertical distribution of fluctuating velocity show that the maximum value of turbulent transfer coefficient was at the same height as the crest of sand wave.