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Research on water-sediment numerical simulation of middle and lower reaches of the Yangtze River and estuary

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Abstract

Base on 1D-2D water-sediment transportation numerical algorithm, the middle and lower reaches of Yangtze River simulation model is established form Yichang city of the Middle Yangtze To Liuxiao Town site on Yangtze river estuary. The numerical model simulate the river-lake water and sediment exchange, between the Yangtze River and Dongting lake or Poyang lake. After the completion of Three Gorges Reservoir, The Yangtze river runoff distribution was changed during the year. Through the model, we analyze the impact of the change of the Yangtze river water sand on the effect of runoff and tides.

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1. The introduction

The middle and lower reaches of the Yangtze river and the Yangtze river estuary region is a major development belt, the Chinese economy is also the Yangtze river basin flood control in key areas. The three gorges dam to the Yangtze river estuary distance is 1800 km. The three gorges project construction and application, has played a huge detention flood storage effect, makes the region in the middle reach of Yangtze river flood control standard by once every 20 years up to 100 a, reducing flood damage, promote the valley cross-strait economic development played a

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huge role. In addition, the use of the three gorges reservoir, the sediment deposition in the reservoir, the dam under river water flushing, which resulted in the reduction in the middle and lower reaches of the Yangtze river water level, especially, in low water level declines; the middle and lower reaches of the Yangtze river along the decreases of Cheng Sha change quantity of the Yangtze river estuary to the sand. The Yangtze river estuary to sediment in the Yangtze river estuary, silting evolution plays an important role^[1], and the change of the upstream runoff and sediment discharge, makes the Yangtze river estuary changes coming water and sediment conditions, thus influence the change of the Yangtze river regime, its for the Yangtze river estuary waterway, the ecological environment has significant impact.

Drainage of sediment of the three gorges project on the one hand, provides a main source of sediment downstream. On the other hand, from Yichang to Yangtze river estuary, along the Dongting lake and Poyang lake, the Han River, and many other sand into the water, and also for downstream along the river washed supplement provides a considerable amount of sediment.

Water and sediment mathematical model is an important means of the research problem of lake sediment. About the impact of the change of the three gorges reservoir with the Yangtze river estuary sediment has quite a few related research results^{[2][3]}, but the use of water and sediment mathematical model for the simulation analysis of the three gorges reservoir with the Yangtze river estuary sediment of the long-term impact of research is less. As the three gorges reservoir into 175 m uptime, runoff regulating in one year and retaining of Sediment by three gorges reservoir, will effecting reach under the dam long time. So, building the middle and lower reaches of the Yangtze river and the Yangtze river water sand overall mathematical model including the tributary of Dongting lake and Poyang lake and the Han river form Yichang to Liuxiao. And use the before and after the use of the three gorges reservoir water and sediment data for many years, after the three gorges reservoir with the Yangtze river sediment transport calculation, to analyze the three gorges after using the change of the Yangtze river runoff and sediment discharge. This article will use the measured data and mathematical model calculation results were analyzed, and explore the long-term storage of the three gorges reservoir, the use of Yangtze estuary to the influence of sediment.

2. The middle and lower reaches of the Yangtze river water and sediment numerical simulation requirements

Along with the development of the numerical method and computer science and technology, fluid mechanics research except by experiment and theory analysis method, scientific calculation numerical simulation has been applied more and more widely, and for complex scientific and engineering provides an effective way to resolve the problem. For simulation of the large complicated water and sediment numerical model, the key is to water and sediment migration for the whole system, should physical, multidimensional and high resolution "of the numerical simulation. Numerical simulation model for the middle and lower reaches of the Yangtze river and estuarine water sand, should meet the following requirements:

The whole system: In the middle and lower reaches of the Yangtze river and the composition of river water and sediment transport, not only need to consider the Yangtze river upstream of the coming water and sediment, also need to consider qingjiang, dongting lake water system, water system of the han, han north and sediment from upland and poyang lake water system and also take into account the key role of the Yangtze river upstream reservoir, and the Yangtze river erosion and deposition of the riverbed change. Therefore, we need to research the middle and lower reaches of the Yangtze river in the system of water and sediment transport.

Physical: Numerical simulation model to be able to reflect water and sediment transport in the middle and lower reaches of the Yangtze river lakes and rivers evolution rule, and deep breathing flooding dynamic process of lakes.

Diversification: Should be considered according to the middle and lower reaches of the Yangtze river paragraphs hydraulic characteristics, multi-dimensional numerical simulation of river channel by using the one-dimensional model, lake using two-dimensional model.

High resolution: Sensitive model need to be able to distinguish sediment discharge and the response of the main control station through traffic, on the main control station clearly show the bed scouring and sedimentation was the dynamic effect of water sand process.

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