SIMULATION OF UNSTEADY FLOWS DOWNSTRAM THE THREE GORGES PROJECT

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This paper presents numerical simulation results of water flows in a 61km long section of the Middle the Yangtze River channel downstream the Three Gorges Project. The purpose of this research is establish a numerical model that can accurately simulate unsteady flows in such long river channels, where during the dry season small discharges will occur (e.g., Q_{min}=3000m^3/s), and during flood the flood season larger discharges up to Q_{max}=76000m^3/s are frequent. A depth integrated velocities and solute transport model (DIVAST, Falconer 1991) is used to meet this purpose. The calculation is based on an orthogonal curvilinear coordinate system.

The roughness coefficient and eddy viscosity are important parameters in the DIVAST model. In this study, their values are determined based on measured stage-discharge relationships of the unsteady flows in the river channel under investigation. The time step in the calculation is 6 seconds.

This section of the Yangtze River runs through a transitional zone from the mountainous area to the great Wuhan plain, and the planforms of the river channel are mostly straight with a few bends (Fig.1). Within the next few decades, the operation of the Three Gorges Reservoir will pose great impacts on the seasonal variation of water stages in a 61 km long reach located between the City of Yichang and the downstream Zhicheng station, which is the focus of this study. It can be seen from the simulation results that flow patterns at the island braided zones and the river bend are quite different during the dry season and the flood season(Fig.2). Both in the submerged areas between the dykes and the direction of flows will change significantly when discharge varies.

The numerical model has been verified against field observations at the Yichang and Zhicheng stations during the year 1999 (Fig.3). Predictions of this model will be used helpful in analyzing the impact of the Three Gorges Dam on the navigation conditions and the fluvial processes of the river channel downstream of the project.

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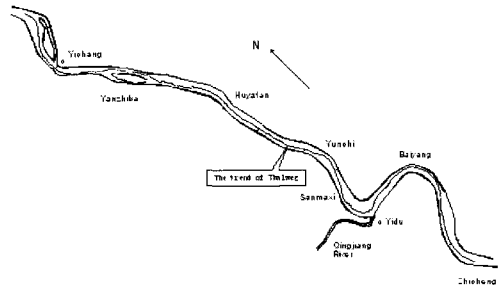
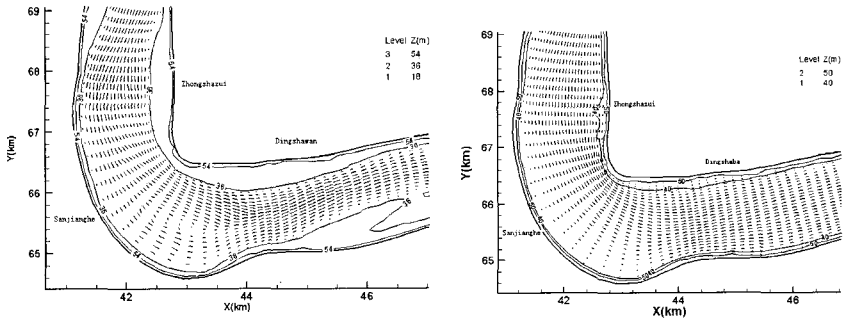


Fig. 1 The simulated 61km section of the Middle the Yangtze River channel



(*a*) Q=3140m^3/s (*b*) Q=50000m^3/s

Fig. 2 The flow field at the first bend (Q=3140m^3/s)

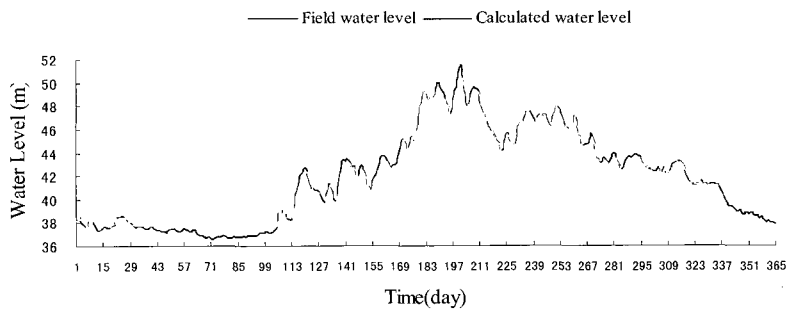


Fig. 3 Measured and calculated water stages at Yichang Station