Effect of Storm Surge Barrier at the North Branch on the Extreme High Water Level in Yangtze Estuary

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ABSTRACT

A storm surge barrier is planned to build at the entrance of the North Branch of the Yangtze Estuary for various purposes, e.g., preventing extreme high water level due to storm and salt intrusion in dry season. A process-based model of the Yangtze Estuary is elaborated to simulate water levels during typhoon period with the storm surge barrier included in the model as hydraulic structure. Scenarios for different storm surge barrier width are examined by the model. By applying real time control method, the storm surge barrier operation, such as gate opening and closing, is also implemented in the model. The simulated high water level during typhoon Winnie (9711) period with different opening width are compared with the reference case, i.e., without barrier, and the observation data. The width of 3km is recommended based on the largest reduction of extreme high water level. The optimal operation program during typhoon period is recommended.

KEY WORDS: Storm Surge Barrier; Coastal flood; Real time control; Typhoon; Yangtze Estuary

INTRODUCTION

The Yangtze Estuary is located halfway up China’s coastline (Fig. 1). It has ample water and sediment supply from upstream and obvious tidal influence, creating an estuary characterized by three major bifurcations and four outlets, with well-developed shoals, alternating channels, expanded sandbars, and a vast submerged delta. The part of the estuary considered in this study is the North Branch. The integrating management plan of the Yangtze Estuary is aimed at the sustainable development of the entire estuary with the basic strategy of maintaining the present layout of the estuary.

In the last half century, the North Branch has been degraded under the influence of both human interference (e.g., land reclamation) and nature morphology evolution, as become shallower and narrower. As a consequence, much less river discharge is flowing into the sea from this branch (<5% annually). This branch becomes flood dominant with more marine input, e.g., salinity, marine sediment. The saline water can sail upstream to the upper part of this branch and can even power into the South Branch under some circumstance, as is called salt intrusion from upstream in this estuary. In addition, with the branch being narrower and shallower, the coastal flooding, especially during typhoon period, become more severe than before. One of the alternatives for the management plan is to build a storm surge barrier at the entrance of the North Branch, so as to prevent the salt intrusion from the upstream of the estuary and the extreme high water level due to storms.