Feature Analysis of Super Storm Surge due to Typhoon “Saomai”

Xiang Lin¹,², Bo Yang³ and Jun Chen¹
¹ College of Harbor, Coastal and Offshore Engineering, Hohai University
  Nanjing, Jiangsu, China
² the State Key Laboratory of Satellite Ocean Environment Dynamics (Second Institute of Oceanography, SOA)
  Hangzhou, Zhejiang, China
³ Power China Hubei Electric Engineering Co. Ltd.
  Wuhan, Hubei, China

ABSTRACT

A tide-surge coupling model based on the Princeton ocean model (POM) was established to study the features of a storm surge caused by Typhoon Saomai. The calculation area of the model contains Fujian, Zhejiang, and Jiangsu provinces. Processes of the storm surge at nine stations along the coast from southern Zhejiang Province to northern Fujian Province were calculated by the model. The results showed that the storm surge variation curves at the nine stations can be classified as three types: the standard type, fluctuation type, and stochastic type. Standard curves generally occurred at stations that had the shortest distance from the typhoon landing site; fluctuation curves occurred at stations at a distance from the landing site; and stochastic curves occurred near the edge of the area affected by the typhoon. The Aojiang Station had the storm surge peak value (4.01 m), which was caused by various factors, such as the location of the typhoon landing point, special topography and the interaction between the storm surge and tide.

KEY WORDS: POM; typhoon; storm; set-up; saomai; feature analysis.

INTRODUCTION

Fujian coastal areas are often subjected to typhoon storm surges in summer and autumn every year for its special geographic position and climate conditions. With the increase of global temperature, occurrence frequency of super typhoon has dramatically increased in the ten years. In 2006, “SaoMai” typhoon hit Fujian and Zhejiang province, which was the worst typhoon to impact China in 60 years. It brought catastrophic disaster to Chinese eastern coastal areas, causing a direct economic loss of 19.65 billion Yuan (Guo, 2011).

Typhoon 0608 (“SaoMai”) was formed east of Guam on August 5, 2006. It became severe tropical storm on 7th and violent typhoon on 9th, which landed in Cangnan city in Zhejiang province at 5:25 pm, August 10. The typhoon had a maximum wind speed (about 60 m/s) and a minimum pressure (about 920 hpa) in the center (Lu, et al., 2007).

In recent years, variety of numerical model of storm surge is flourishing over the world (Zhang, et al., 1990; Guo, et al., 2009; Huang, et al., 2012). A high resolution tide-surge coupling model based on POM was established to calculate processes of storm surge due to typhoon0608 at nine different stations along the southeast coast. Then, the characteristics and causes of storm surge were analyzed with results from the model.

NUMERICAL MODEL

The tide-surge coupling numerical model built in this paper was based on POM (Xie, et al., 2008; Batten, et al., 2007) and Takahashi wind field model(Xu, et al., 2008).

The calculation area of this model was from east longitude 119 degree to 125 degree, and north latitude 25 degree to 33 degree (see Fig 1). A latitude-longitude grid of 1°×1′ spacing was used and the total grid cells number was 173641.

Boundary Conditions

The boundary condition of wind-stress is used on sea surface. A number of scientists have studied the relationship between wind speed and wind-stress (Luo, et al., 2011; Zijlema, et al., 2012; Zweers, et al.,