Modeling of Storm Surge for Typhoon Muifa and Typhoon Damrey

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ABSTRACT

The storm surge during the events of Typhoon Muifa and Typhoon Damrey are numerically modeled and the accuracy is examined by the field observed water level data. The results show that: (1) with the consideration of tidal effect, the accuracy of storm surge modeling results can be notably improved, particularly in the shallow water area; (2) a large-scale anti-clockwise circulation flow is formed at the left side of typhoon-affected area, and the maximum typhoon-induced current has a magnitude of 1m/s.

KEY WORDS: Jiangsu coast; storm surge; rope; astronomical tides; Typhoon Muifa; Typhoon Damrey.

INTRODUCTION

Storm surge is a phenomenon that the sea level abnormally elevated by the strong wind forcing and the low air pressure. It will induce large-scale water level variations in the coastal area, particularly when meeting with high astronomical tides, which may cause a high risk for sailing ships and coastal defense structures (Zhang et al., 1999).

Previous studies have shown that the non-linear interaction between tides and storm surge is important but very complicated due to the effect of shallow water and local topography (Zhang and Sheng, 1987). To avoid massive computational costs, many storm surge forecast centers still adopt the linear super-imposition of storm surge and astronomical tidal level to predict the water level during the storms. In order to understand how much error it may cause if not considering the non-linear effect, a comparative study is carried out by modeling of two representative typhoons, i.e., Typhoon Muifa and Typhoon Damrey, with and without the effect of astronomical tides.

Brief Introduction to Typhoon Muifa

Typhoon Muifa (1109) was formed at 14:00 (GMT+8h) on July 28th, 2011 in the area of Northwest Pacific Ocean. It moved to north first, and then turned to west at the evening of August 2nd. After getting close to the eastern coast of China, Typhoon Muifa kept on moving towards north, and landed at the northwestern coast of North Korea at 18:30 on August 8th, with the central maximum wind speed 23m/s and the lowest pressure 985hPa. The typhoon finally disappeared on August 9th in the northeastern area of China. The route of Typhoon Muifa is shown in Fig. 1.

Brief Introduction to Typhoon Damrey

Typhoon Damrey (1210) was formed on July 28th in 2012 and slowly developed at the early stage. By late on July 30th, the development of Damrey began to accelerate. It was intensified into a strong typhoon on August 2nd, and landed at Xiangshui in Jiangsu Province of China at 21:30 of the same day. The typhoon was weakened into a tropical storm near Lianyungang and disappeared near the coast of Qinhuangdao in Hebei Province of China on August 4th. The route of Typhoon Damrey is shown in Fig. 2.