

Impacts of local tsunamis on China coasts

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Abstract:

Even though the transoceanic Pacific Ocean tsunamis can be ignored for safety assessment of the coasts of China, the effects of local tsunamis on the coasts, potentially caused by the giant ruptures at the deep trenches near the continental shelf, have been received attention after the Indian Ocean tsunami in 2004 and the East Japan tsunami in 2011. It is believed that there are potential tsunami sources in the China Seas due to the fault ruptures along the Okinawa Trench in the East China Sea and the Manila Trench in the South China Sea.

Impacts of the 2011 East Japan tsunami on China coasts will be studied through numerical simulation and the measured data analysis at first. Distribution of the wave height along the China coasts are obtained and discussed. It turns out that the tsunami has almost no impact in the Bohai Sea, Yellow Sea and Liaodong Peninsula, while it generates wave height up to 0.4m in the East China Sea and the South China Sea.

Okinawa Trench in the East China Sea and Manila Trench in the South China Sea are considered to be the region with high risk of potential tsunami induced by submarine earthquakes. Tsunami waves will impact the Southeast Coast of China if tsunami occurs in these areas. The horizontal two-dimensional Boussinesq model is used to simulate tsunami from its generation, propagation, to runup on the shore in a domain with complex geometrical boundaries. The temporary varying bottom boundary condition is adopted to describe the tsunami wave generated by submarine movement. The Indian Ocean tsunami is simulated by this numerical model as a validation case. The time series of water elevation and runup on the beach are validated by the field measurement data. The agreements indicate that this model could be used to simulate tsunami and predict the waveform and runup well. Then, tsunamis in the Okinawa Trench and Manila Trench are simulated by the horizontal two-dimensional Boussinesq model. The arrival time and maximum wave elevation near the cities of Southeast coast were predicted by the model.

Through numerical simulation of the scenarios of the tsunamis potentially motivated in the East China Sea and the South China Sea, it turns out that different wave patterns will appear for tsunami waves moving on continental shelf of different morphology, including N-waves, an undular bore and solitary waves.

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