

## Tsunami Simulation for Wave Run-Up in Phuket, Thailand

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### ABSTRACT

The nonlinear shallow water equation is used for simulate the wave run-up on Phuket beaches due to the 2004 Indian Ocean Tsunami. Compared with field survey reported and data published in the literatures, the results of the developed numerical model shows good agreement in wave run-up heights, wave velocity, and inundation distances.

**KEY WORDS:** Nonlinear shallow water equation; Tsunami; Wave run-up; Phuket

### INTRODUCTION

In December 26, 2004, an earthquake on the Richter scale of 9.3 occurred in the Indian Ocean off the west coast of Northern Sumatra near the Aceh province, Indonesia. Tsunami waves were generated and attacked the villages and resorts along shorelines of many countries including Thailand. Field data of wave characteristics and damage were collected by many governmental and private agencies.

Siripong et al. (2005) analyzed recorded water levels from 7 gauging stations along the Andaman coast of Thailand as shown in Fig. 1. They found that those waves propagated to the gauging stations with trough leading, which was called as "N wave" type. However, before attack shoreline, the crest or trough of wave varies depending on the bathymetry of the region, displacement of the ocean floor, etc. In their report, details of the flooding areas along 6 provinces in Thailand were presented. Maximum tsunami water levels are summarized in Table 1. Grilli, et al. (2005) also collected field data of tsunami run-up along the Andaman coast of Thailand and collected data are shown in Fig. 2.

To understand the tsunami wave characteristics such as wave generation, wave propagation, wave velocity and wave transformation, it is necessary to observe the wave profiles using buoys and water level station. In Thailand, there are 8 water level stations along the Andaman coastline, i.e. Ranong, Kuraburi, Phuket, Krabi, Trang, Tarutao, and Satun. The locations of these tidal gauging stations are shown in Fig. 1 as solid circles. The empty circle represents Banlaempo station which was not operated during the tsunami event. Even though other recorded tidal levels were available, unfortunately, those recorded water level

were unable to be used for tsunami wave analysis. The installed equipments were only designed for tidal measurements. Moreover, the 2004 tsunami waves were diffusive before reaching those stations. However, those recorded data were used by some researches to estimate the wave traveling using wave filter technique.

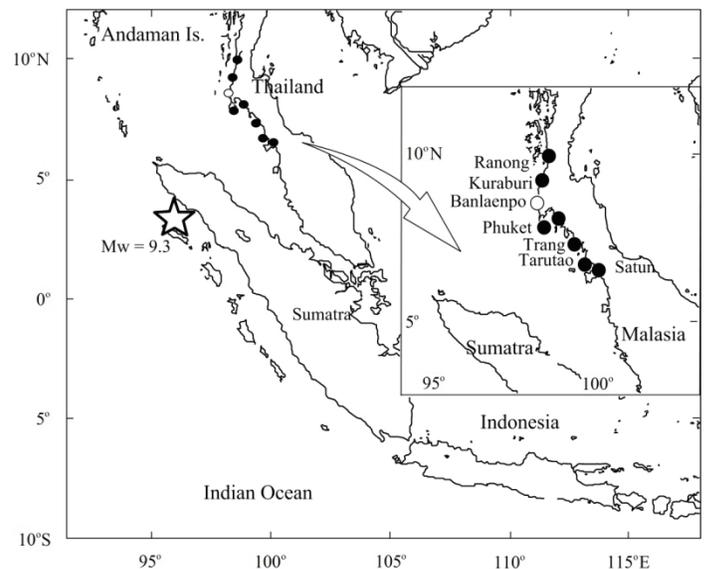


Fig. 1 Tide gauging stations along Andaman coastal of Thailand, Rabinovich et al. (2007)

Nowadays, mathematical model is a convenient tool applied to investigate the tsunami aspects such as the generations, propagations, and so on. Nonlinear shallow water equations (NLSW) including a bed friction were numerically solved in finite difference methods by some researches (Imamura et al., 2006; Kowalik, 2003). Their results showed that the equations can evaluate the tsunami characteristics as a propagating from the generated source, time arrival to the observation points. Meanwhile, when a tsunami approaches to a shoreline it usually may be broken, and therefore it is very difficult to reproduce its phenomena. Nevertheless, the equation has given their solutions like a