

MODELING OF TSUNAMIS IN THE EASTERN MEDITERRANEAN AND COMPARISON WITH CARIBBEAN

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ABSTRACT

When the oceanographical, geographical, geological and geophysical data of Caribbean and Mediterranean Seas are compared, some similarities and differences between these seas can be found. According to the historical information, although there have been observed numerous tsunamis in history, there is a silent period in the last decades in both seas. For comparison the general characteristics of tsunamis in the Mediterranean basin is examined by the simulation techniques in this study.

Mediterranean Basin is consisted of the Mediterranean Sea, Aegean Sea, Black Sea and the Sea of Marmara. It is located in the Mediterranean part of Alpine-Himalayan orogenic belt. There are 3 main active fault zones nearby and in the Mediterranean Basin at east are the North Anatolian Fault Zone (NAF), East Anatolian Fault Zone (EAF) and the Hellenic Arc. The coastal areas at the Eastern Mediterranean Basin have experienced tsunamis many times in history. The generation mechanisms and their characteristics have not been well described. According to the historical information, or distribution of fault zones, volcanos, and other probable tsunamigenic sea bottom formations, there are numerous source areas which may be considered responsible for those tsunamis. One of the important source areas of tsunamis in the eastern Mediterranean is the fault zone named Hellenic Arc which is a subduction zone of about 1000 km in length starts from south west of Greek mainland and follows a curve at south of Crete and south east of Rhodes island and directs towards Anatolia along North East direction near Dalaman town. The deepest region of Mediterranean with a depth of 4000 m and more is in between Rhodes and Dalaman region near Hellenic Arc. This region can be called Rhodes - Dalaman trench and might be one of the most important tsunami prone areas in the whole Mediterranean Basin. Aegean sea is one of the most active seismic regions in Europe also containing a volcanic arc with active volcanoes. The sea of Marmara is another inland sea located at north west of Anatolia and near south of Istanbul. The North Anatolian Fault Zone is divided into two branches at east of the Marmara sea. One of the branches passes the sea along east west direction another follows the line parallel to south coasts of the sea. Both branches enter the northern part of Aegean sea. The Black sea is another sea in the Mediterranean basin and numerous tsunamis have also been observed in this sea.

The historical earthquakes and associated tsunamis in the whole basin of Eastern Mediterranean are identified from the catalogues and the reliability of historical data is tested. The occurrence probability of large magnitude earthquakes and tsunamis are also selected from the historical data. The results of some paleotsunami studies are interpreted to understand the location of probable source, and to determine approximate intensities of some historical tsunamis.

As for the model studies, numerous number of tsunami events are simulated. Some of tested events are based on the interpretation of the historical data and results of paleotsunami studies, and other events are selected as synthetic events based on scenarios related to hypothetical conditions. In the simulations two mathematical models 'TUNAMI-N2' and 'TWO-LAYER' are used. Both models have been created in Tohoku University, Japan by Prof. Fumihiko Imamura. TUNAMI N2 has been developed in collaboration with Prof. Imamura, Prof. Yalciner (METU, Turkey) and Prof. Synolakis (USC, USA) and registered by them. TWO LAYER has been developed in collaboration with Prof. Imamura, Prof. Yalciner and Prof. Pelinovsky (Nizhny Novgorod State Technical University, Russia) for the tsunami waves generated by submarine landslides. The maximum water level near the shore for each simulation at several different specified shore locations are computed and analyzed for each simulation in each sea in the Eastern Mediterranean Basin.

A similar simulation study is also performed for the Caribbean sea briefly in order to develop a comparable data for comparison with the Mediterranean sea. The similarities and differences determined in this study will be compared and discussed.

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