Soil Dynamics and Earthquake Engineering 31 (2011) 598–610

Contents lists available at ScienceDirect

Soil Dynamics and Earthquake Engineering

journal homepage: www.elsevier.com/locate/soildyn

Tsunami hazard in the Eastern Mediterranean and its connected seas: Toward a Tsunami warning center in Turkey

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ARTICLE INFO

Article history:
Received 16 July 2010
Received in revised form
10 November 2010
Accepted 17 November 2010
Available online 24 December 2010

ABSTRACT

Tsunami mitigation, preparedness and early warning initiatives have begun at the global scale only after the tragic event of Sumatra in 2004. Turkey, as a country with a history of devastating earthquakes, has been also affected by tsunamis in its past. In this paper we present the Tsunami Hazard in the Eastern Mediterranean and its connected seas (Aegean, Marmara and Black Sea) by providing detailed information on historically and instrumentally recorded significant tsunamigenic events surrounding Turkey, aiming to a better understanding of the Tsunami threat to the Turkish coasts. In addition to the review of the Tsunami hazard, we have studied a possible Tsunami source area between Rhodes and SW of Turkey using Tsunami numerical model NAMI DANCE-two nested domains. We have computed a maximum positive amplitude of 1.13 m and maximum negative amplitude of −0.5 m at the Tsunami source by this study. The distribution of maximum positive amplitudes of the water surface elevations in the selected Tsunami forecast area and time histories of water level fluctuations near selected locations (Marmaris, Dalaman, Fethiye and Kas towns) indicate that the maximum positive amplitude near the coast in the selected forecast area exceeds 3.5 m. The arrival time of maximum wave to Marmaris, Dalaman, is 10 min, while that of Fethiye and Kas towns is 15–20 min. The maximum positive amplitudes near the shallow region of around 10 m depth are 3 m (Marmaris), 1 m (Dalaman), 2 m (Fethiye) and 1 m (Kas). Maximum positive amplitudes of water elevations in the duration of 4 h simulation of the Santorini-Minoan Tsunami in around 1600 BC in the Aegean Sea are also calculated based on a simulation performed using 900 m grid resolution of Aegean sea bathymetry with a 300 m collapse of 10 km diameter of Thera (Santorini) caldera. We have also presented the results of the Tsunami modeling and simulation for Marmara Sea obtained from a previous study. Last part of this paper provides information on the establishment of a Tsunami Warning Center by KOERI, which is expected to act also as a regional center under the UNESCO Intergovernmental Oceanographic Commission – Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS) initiative, emphasizing on the challenges together with the future work needed to be accomplished.

1. Introduction

Despite the fact that tsunamis were well-known among the Earth-scientist communities, it was mostly considered as secondary phenomena, and it was only after the tragic event of Sumatra in 2004 most of the people realized the real threat of a Tsunami. Indonesian Tsunami led to the death of approximately 250,000 people, caused damage of property and business in more than $4.4 bn, and left around 700,000 people homeless, leaving an unprecedented damage in the economy and infrastructures of the region. Ironically, it was these numbers that sent a strong signal to the decision makers that they have to do something about it, and as a consequence, Tsunami mitigation, preparedness and early warning initiatives have begun at the global scale. Turkey, as a country with a history of devastating earthquakes, has been also affected by tsunamis in its past, and a possible Tsunami affecting the coastal areas of Turkey may cause considerable damage, especially considering the densely populated coastal areas, infrastructure and harbors. More than 30 sunken ships found in Theodosius Harbor during the construction of the Marmaray Rail-Tube Tunnel at Yenikapi location of Istanbul. Furthermore, the sedimentary sequence discovered at archeological excavations contains significant records of sea-level change due to various reasons, among which the content of one layer suggests an abrupt event [1]. This abrupt event was interpreted as a Tsunami event caused by the AD 553 Istanbul earthquake [2]. In the Aegean and

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doi:10.1016/j.soildyn.2010.11.005