Numerical Simulation of Tsunami Run-up on Jask Port Caused by Largest Possible Earthquakes of Makran Subduction Zone

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Regarding to 2004 Sumatra tsunami caused more than 225,000 loss of lives, the investigation of Indian Ocean tsunami sources seems necessary. One of tsunamigenic zones of the Indian Ocean is Makran Subduction Zone (MSZ) located at the northwest of Indian Ocean across from southern coasts of Iran and Pakistan. MSZ has experienced some deadly earthquakes and tsunamis, most important of them is the 1945 tsunami occurred following a huge earthquake led to more than 4000 people be killed. The results of recent research, carried out based on thermal modeling of the MSZ, have shown that past assumptions may have significantly underestimated the earthquake and tsunami hazard in the MSZ and it is potentially capable of producing major earthquakes, up to magnitude 8.7-9.2.

In this paper, two large MSZ’s earthquake (Mw=9.1&8.7) and following tsunamis has been simulated using GEOWAVE model. GEOWAVE is an integrated tsunami simulation numerical model in which the tsunami generation and two later stages, i.e. propagation and inundation, are simulated by TOPICS and FUNWAVE models, respectively. Unlike previous studies, containing just one large-scale global model, in this study one high resolution local model has been also defined in order to capture tsunami run up. Local model domain is defined around Jask Port where can be considered as one of the main populated coastal area of Iran around Makran zone.

According to run-up calculations results, most areas of Jask port are inundated by tsunami waves generated by largest possible earthquake of MSZ (Mw=9.1). Model results show the tsunami waves arrives to coasts of Jask (and also other coastal areas of Iran) just about 25 minutes after the earthquake; but the results also show along the coastlines locating north of MSZ, i.e. Iran’s and Pakistan’s coasts, falling water of tsunami is first observed (Figure 1). This can be trusted as a useful natural warning sign to the local communities. It is also observed the tsunami waves propagate perpendicular to the faulted area (unlike landslide tsunamis propagate radial). Hence, when eastern part of MSZ is faulted by earthquake, the tsunami waves along the coastlines of the Jask are small even for large earthquakes (Mw=8.7). Therefore, it can be concluded the tsunami risk at Jask port is depends more on location of MSZ earthquakes than their magnitude.

Key Words: Tsunami Modeling, Makran Subduction Zone, Inundation Mapping, Jask port
Figure 1: Computed tsunami waves propagating at (a) 1, (b) 3.5, (c) 6, (d) 8.5, (e) 11 and (f) 13.5 minutes after the earthquake