

11 TSUNAMI (HIGH WAVES)

It is well known that many tsunamis occurred during the large earthquakes in Turkey, which took place in Marmara Sea (Soysal 1979). During the site investigations, many people both on the northern and southern shores of İzmit gulf mentioned about high sea waves. The workers interviewed at TÜPRAŞ refinery said that they could see the screws of a ship which was unloading crude oil at the time of the earthquake. According to their statement the height of the sea wave should have been about 7m. In addition they said that the sea retreated for a distance of 100 m soon after the earthquake and the sea returned back with high waves. The people interviewed in Karamürsel, Halıdere, Değirmendere and Kavaklı said similar things. However, the sea wave height was said to be about 4m. Figure 11.1 shows a compilation of sea wave heights from different sources.

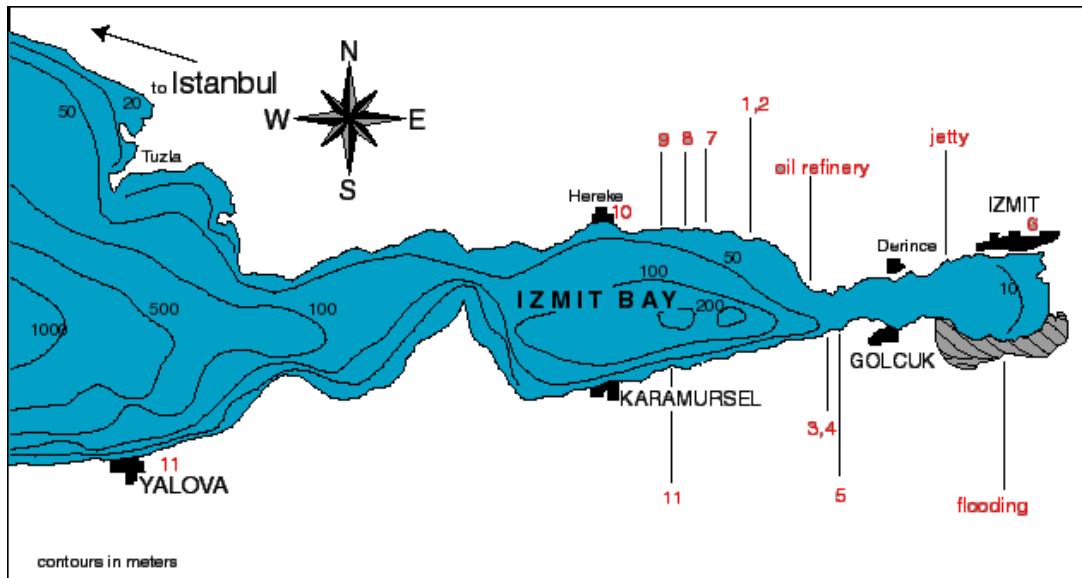


Figure 11.1 Sea-wave height distribution around the İzmit gulf according to local people

Some ships were thrown onto the land at some locations. Figure 11.2 shows a passenger ship at Değirmendere port. Another ship at UM shipyard at the eastern side of Gölçük was thrown onto

the land. Observations on the site indicated that the remains of sea shells and sea plants so that the sea must have been climbed onto the land up to a height of 4 m at this particular location.



Figure 11.2 A passenger ship at De ĭrmendere where a submarine landslide took place

Figure 11.3(a) shows a coffee-shop at De ĭrmendere, which should have been attacked by sea waves since the mud and traces of sea water were still seen two weeks after the earthquake. The windows of a bank next to this shop were broken and similar traces were also seen in the bank. The distance from shore at this particular location is about 12m. Figure 11.3(b) shows a refrigerator thrown by sea wave onto roadway from open-coffee-shop along the shore. The blocks used for the road pavement were all displaced and thrown away for a length of 100 m. Figure 11.4 shows the fountain along the shore of Hal ĭdere. The traces of crude oil could be observed on the back and both sides of this fountain with a height of 1.5m. From the traces, one may estimate the sea wave height to be more than 2.5m at this specific location to the east of De ĭrmendere.

From above statements and observations, it is quite clear that some high sea waves were observed during this earthquake. These tsunami-like high sea waves could be generated by a trans-tensional strike slip faulting in the gulf as well as by sub-marine sliding at De ĭrmendere and subsidence due to the secondary normal faulting at Kavaklı ĭ district. Furthermore, sloshing type of waves may also be observed due to the peculiar shape of the gulf. During the earthquake one of the

authors (Ö.A.) observed the sloshing of a pool in front of the hotel where he was staying at the time of earthquake.



(a) Coffee-shop



(b) Displaced and overturned refrigerator

Figure 11.3 damaged coffee shop and overturned refrigerator by high sea waves at De ir mendere



Figure 11.4 Traces of crude oil on the fountain smeared by high sea waves at Hal dere

Reference

Soysal, H. (1979): Tsunami (Deniz Ta mas) ve T rkiye k y lar n etkilemi tsunamiler. Deprem Ara t rma B lteni, 25, 45-46.