

Effectiveness of the breakwaters of Shimoda Bay for tsunamis judging by the analysis of the 1854 Ansei Tokai Earthquake-Tsunami

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Shimoda port town, near the tip of Izu Peninsula, Shizuoka Prefecture, was severely damaged by the tsunami of the 1854 Ansei Tokai Earthquake. In total 840 houses were swept away or entirely destroyed, 30 houses were partially destroyed, only 4 houses were kept safe, and 122 people were killed due to the tsunami. At that time, a Russian warship Diana was anchored in this bay, and a crew member recorded the view of the attacking of the tsunami. In addition that, several officers of the Tokugawa shogunate recorded reliable document mentioning the damage of Shimoda city in detail. The first wave came to the bay at 15 minutes after the main shock, and the most part of the residential area of Shimoda was severely damaged due to the second wave. Sea water inundated up to the level of 6.5 meters above the mean sea level at the southern edge of the residential area of Shimoda city. We conducted a numerical simulation of the tsunami and reproduce the tsunami attacking Shimoda. We successfully reproduced those facts that (1) the initial wave came into the Shimoda bay about 15 minutes after the main shock, (2) the second wave was the highest, and the height was about 8 meters, (3) the second wave invaded into the residential area of Shimoda at 22 minutes after the main shock. In order to clarify the effectiveness of the breakwater at the mouth of the Shimoda bay for the protection of future tsunamis, additional numerical calculation with this breakwater was made. It was clarified that tsunami inundation height will be 20% less than the case without the breakwater, and moreover the current speed of sea water will be smaller.