

## Statistical investigation on tsunami occurred in Japan

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The Great East Japan Earthquake has branded lessons that it is important to predict the risks of tsunami in advance, and it is also important to take necessary safety measures against tsunami disasters. A large body of literature has been devoted to study tsunami. However, the analysis of tsunami, as well as the assessment and prediction of its effects, are difficult and complicated since the heights and scales of tsunami are greatly affected by the local geographical features.

Takahashi [1] tried to analyze tsunami data with eliminating the influence from the geographical features of coastline geometry, such as a bay or a harbor, etc. Takahashi [1] calculated the propagation of the energy of tsunami, from the historical data of tsunami, and provide the detailed map of Japan with the amount of energy reached at the 200-m depth contour of the Pacific Ocean. The amount of energy for every rural areas, prefecture, or narrower area, can be a useful index for planning refuge and also for planning breakwaters construction. This approach enables us to assess the dangers of tsunami to compare areas with a common criterion.

By the way, more than half a century has been passed since the age of Takahashi [1]. The amount of data on geographical feature and tsunami is much more than that used in Takahashi [1]. The computing resources have also become more powerful and faster. Therefore, this research aims to assess the risks of tsunami based on the concept of Takahashi [1], with the updated statistical data on tsunami until now, the updated geographical data, and more precise calculation with every 1km mesh. The result is a more precise quantitative evaluation of the danger of tsunami and can be used to assess the danger of tsunami for every point.

Our calculations show that the danger of tsunami is high in the Nankai Trough with its surrounding area and the northern part of the Tohoku district, compared with other areas. This result is considered to be an effective assessment which shows the danger for planning refuge and planning institutions.

This research implemented the concept of Takahashi [1] with computers and calculated the energy propagation more precisely than before with the current statistical data of tsunami. Moreover, the danger of tsunami could be computed more exactly using more exact geographical feature than that of those days used by Takahashi [1]. The data of the tsunami for 60 years since Takahashi [1] are also added. Since the measure of danger was computed for every 1 km mesh, it may have come to grasp the danger of the tsunami in each area in detail than before. Our approach can follow spreads of tsunami with less computing resources than detailed simulations and can be effective for preliminary estimations before performing more detailed simulations.

[1] Takahashi, R. (1951). "An estimate of future tsunami damage along the Pacific coast of Japan", Bull. Earthquake Res. Inst., Tokyo Univ. 29, 71-95.