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Study on the 1960 Chile Tsunami by Tsunami Arrival Time Analysis

Meng-Ju Chung (1), Tso-Ren Wu (1), Han Wu (2), and Mei-Hui Chuang (1)

(1) National Central University, Graduate Institute of Hydrological and Oceanic Sciences, Taiwan (q20161819@gmail.com), (2) Seismological Center, Central Weather Bureau, Taiwan

The 1960 Valdivia earthquake with magnitude Mw 9.5 was the strongest earthquake recorded in Chile. The generated tsunami was the most devastating one in the world. The tsunamis were recorded in many cities around the Pacific Ocean. In Taiwan, the tsunami heights were 66 cm and 30 cm recorded at Keelung and Hualien. Because of the extremely long distance between Chile and Taiwan, no severe damage was reordered. However, a large earthquake with magnitude Mw 8.8 occurred again in 2010 at the similar location, with wave heights 66 cm and 52 cm at Houbihu and Wushi, the Chile tsunami was considered as a tsunami source area with high potential hazard with careful consideration.

In this study, the tsunami numerical model COMCOT (Cornell Multi-grid Coupled Tsunami Model) was used for simulation and analysis. The analysis method was Impact Intensity Analysis (IIA) and was further combined with the Tsunami Arrival-Time Analysis (TATA). The IIA method was based on the Green's function. The tsunami was discretization as a point source, and the tsunami impact coefficient of each point source was analyzed to show the intensity of tsunami impact on the study site in each region. However, the tsunami directionality was ignored in IIA method. The tsunami directionality is especially important to the trench-type tsunami. In order to overcome this problem, we newly developed the TATA method to inspect the effect of similar arrival time from a series of unit-sources.

The results of IIA showed that the signal of Keelung Harbor in Chile was stronger than that of Hualien Port. After analyzing the isochronism by the TATA method, the epicenter was moved northwards for about 500 km to conduct the scenario simulation. The maximum wave height of Keelung Harbor was found to be more than 1 meter which is 70% higher than the one in the 1960 Chile tsunami event. From this result, it can be seen that the earthquake and tsunami of 1960 and 2010 were not the most serious impact on Taiwan.A worst-case scenario is presented in the full article.