2006 年屏東外海地震引發海嘯的數值模擬探討

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摘要

2006 年 12 月 26 日屏東外海發生兩場芮氏規模約 7.0 的地震，此兩場地震雖未對台灣造成海嘯災害,但震央附近潮位站確實記錄到類似海嘯波的長波水位。過去台灣西南海域發生大規模海底地震的記錄較少，故國人普遍對此區域可能引發的海嘯災害缺乏警覺性。本研究應用數值模擬方法，計算屏東外海兩場海底地震造成之海嘯長波的傳遞,以評估台灣西南海域若發生海底地震引發的海嘯對台灣可能造成的衝擊。本研究採用 Harvard CMT 的地震參數，以斷層模式計算海底垂直位移量，假設此位移量為海嘯波之初始波形，再以海嘯模式 COMCOT 計算海嘯波的傳遞，並利用潮位站的實測水位資料驗證海嘯模擬結果。另外考慮在不同震源深度、平均滑移量、破裂面寬度下進行海嘯數值模擬，以探討地震參數對海嘯波波形以及傳播的影響。模擬結果顯示，當震源深度由 40 公里減少為 10 公里時，海嘯初始振幅變化由 0.09 公尺增大為 0.4 公尺，在後壁湖潮位站的最大水位則由 0.2 公尺增加為 0.4 公尺。當平均滑移量由 1 公尺增加為 3 公尺時，海嘯初始波高變化由 0.02 公尺增大為 0.6 公尺，在後壁湖潮位站最大水位則由 0.35 公尺增加為 1 公尺。台灣西南海域水深約為 2000~3000 公尺，在此海水深度下，地震可引發高速傳播的海嘯波。本研究模擬顯示，屏東地震產生的海嘯前導波在地震發生後 17 分鐘即抵達恆春海岸。這意謂若在同樣地點發生規模較大的海底地震，則此海嘯即可能在短時間內對台灣西南沿海構成威脅。

A Numerical Study on the Tsunami Generated by the Ping-Tung Submarine Earthquakes

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Abstract

On December 26, 2006, two M_L=7.0 submarine earthquakes occurred offshore Ping-Tung, Taiwan. Though these two earthquakes have not caused any tsunami hazard, the tidal gauges near the epicenters did record the incidences of long water waves, similar to tsunami waves. There have not been many seismic records of large submarine earthquakes offshore southwestern Taiwan. As such, people living in the coastal area around Taiwan generally lack alertness for potential tsunami hazards caused by submarine earthquakes. In order to assess the potential tsunami hazards in this region, numerical simulations of the tsunami-wave propagation generated by the two Pingtung submarine earthquakes are conducted in this study. The initial tsunami wave height is assumed to be equal to the seafloor vertical displacement caused by the earthquake, and Harvard CMT source parameters are used to calculate the seafloor vertical displacement using elastic fault model. The water-level records of the available tidal gages are used to validate the simulation results. The effects of the source parameters (source depth, average dislocation, and fault-plane width) on the initial tsunami wave height and the subsequent propagation are also studied. The results indicates that the initial tsunami wave height increases from 0.09 m to 0.4 m and the maximum water level at Hou-Bi-Hu tidal-gauge station increases from 0.2 m 0.4 m, as the source depth decreases from 40 km to

10 km; the initial tsunami wave height increases from 0.02 m to 0.6 m and the maximum water level at Hou-Bi-Hu tidal-gauge station increases from 0.35 m to 1 m, as the average dislocation increases from 1 m to 3 m. The water depths in the southwest region offshore Taiwan are between 2,000 m and 3,000 m, which can result in a large propagation speed of the tsunami wave. Our simulation result indicates that the leading tsunami wave arrives at Heng-Chun coast within 17 min after the quake. This implies that if the same submarine earthquake with a larger magnitude occurs, it would certainly cause devastation to the southwestern coasts of Taiwan.