Synthesis of Tsunami Waveforms Including Dynamic and Static Pressure Change: Practical tests of tFISH

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Most tsunami studies neglected the effects of seismic waves in synthesizing tsunami waveforms. This is not a serious problem when using coastal tide-gauges and sensors deployed far from the tsunami source. However, when the records obtained inside or near the source are used, this becomes a significant problem because seismic waves contaminate tsunami signals. Therefore, in order to correctly evaluate the performance of tsunami forecasting methods, it is necessary to take into account the effects of seismic waves in addition to tsunami. In this study, we propose a synthesis method for ocean-bottom pressure records including both seismic waves and tsunami (Saito and Tsushima 2016 JGR). The method conducts seismic-wave and tsunami simulations in synthesizing the pressure records. First, a linear seismic-wave simulation is conducted with a kinematic earthquake fault model. Then, a nonlinear tsunami simulation is conducted using the sea-bottom motion calculated in the seismic-wave simulation. By using these simulation results, we synthesize realistic ocean-bottom pressure records including both seismic wave and tsunami. We synthesized the ocean-bottom pressure records of S-net for a simplified Tohoku-Oki earthquake fault model. Then, the performance of a tsunami source estimation method of tFISH was examined. Even though the synthesized records contain large dynamic pressure change, which is not considered in the algorithm, tFISH successfully worked with expected performance: tFISH correctly estimated the tsunami source when 5 min elapsed after the earthquake occurred. The pressure records synthesized in this study, including both seismic wave and tsunami, are more practical for evaluating the performance of our tsunami monitoring ability, whereas past tsunami studies usually neglected the seismic wave contribution.

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