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# 2011 年東北地方太平洋沖地震津波の波源逆解析における断層破壊過程の影響
# Effects of rupture process in the source inversion of 2011 off the Pacific coast of Tohoku Earthquake Tsunami

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The 2011 off the Pacific coast of Tohoku Earthquake (Mw 9.0) and Tsunamis attacked and severely damaged the east coast of Japan. Inverse analysis on the tsunami source was conducted on the basis of sea-level observation of GPS buoys and water pressure gauges located near the source area. Observed data are inverted to determine the initial sea-surface height distribution and its time development that are generated by the rupture motion of inter-plate faults and the related sea-floor deformations. We use an inversion method of synthesizing tsunami Green's functions. To compute the Green's functions, tsunami wave propagation was calculated on the basis of the finite-difference approximation of linear long-wave equations in a spherical coordinate system. Such inversions are usually ill-posed problem mainly because of limited observation. To avoid the ill-posedness, smoothing and rupture constrains are imposed. The rupture constraint is based on a priori information about the tsunami source region. The region at a given time is estimated by the distance from epicenter and a rupture velocity. According to the seismic wave analysis by Japan Meteorology Agency, epicenter is located at N38$^o$6.2', E142$^o$51.6', 24 km deep and the rupture velocity and the rupture duration is assumed as 2.0 km/sec and 3 minutes respectively. The inversion result shows that the peak of surface elevation moved eastward from epicenter for first 1 minute to reach close to the Japan Trench and moved northward along the trench axis for next two minutes. The maximum elevation of tsunami source is +6.9 m in total and is located at northeast of epicenter in the west side of the trench axis. The crest of initial wave form is distributed in the west side of the trench. To investigate the effect of rupture process, we perform another inversion with the assumption of rupture velocity as infinity. A major difference between the two inversions is the location of the wave form crest. In the infinite rupture velocity case, the crest penetrates into east side of the trench. The tsunami source model of finite rupture velocity show a better accuracy for the prediction of waveforms which were temporally and/or spatially different from waveforms used in the source inversion. Therefore, it is concluded that the effect of rupture time lag is not negligible in the 2011 off the Pacific coast of Tohoku Tsunami case and the effect should be included in the validation of inundation or damage on the coastal area and the assessment for future risk.

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