Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SSS29-P06 Room:Poster Time:April 28 18:15-19:30

Earthquake source process of the 2013 Santa Cruz earthquake and the tsunami

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In order to understand the characteristics of large tsunamigenic earthquakes, we analyzed the earthquake source process of the 2013 Santa Cruz earthquake and simulated the tsunami. We first estimated the fault length of about 200 km using 3-day aftershock distribution and the source duration of about 110 sec using the duration of high-frequency energy radiation (Hara, 2007). From these results, we used the initial value of rupture velocity as 1.8 km/s for teleseismic waveform inversions. Teleseismic body wave inversion was carried out using the inversion package by Kikuchi and Kananmori (1991). Teleseismic P waveform data from 28 stations were used and band-pass filter of 0.005 ˜1 Hz was applied. Our best-fit solution indicated that the earthquake occurred on the northwesterly striking (strike = 290) and shallowly dipping (dip = 15) fault plane. Focal depth and rupture velocity were determined to be 23 km and 1.3 km/s, respectively. Moment magnitude of 7.8 was obtained showing somewhat smaller than the result of previous study (Lay et al., 2013). Slip distribution of the event showed roughly two patches of large slip, one around the hypocenter and the other to the southwest.

Using the slip distribution obtained by teleseismic waveform inversion, we calculated the surface deformations using formulas of Okada (1985) which would be assumed as the initial change of sea water by tsunami. Then tsunami simulation was carried out using Cornell Multi-grid Coupled Tsunami Model (COMCOT) code and 1 min-grid topographic data for water depth. Two DART buoy data were used to verify our simulation. In the presentation, we will discuss more details on the results of source process and tsunami simulation and compare them with the previous study.

Keywords: Santa Cruz, source process, tsunami