

Slip distribution of the 1963 Kurile earthquake using tsunami waveforms

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On 13 October 1963, the great earthquake ($M_w=8.5$) occurred off the Etorofu Island. This event was an underthrust earthquake due to the subduction of the Pacific plate beneath the Kurile Islands. The Pacific plate subducts about 8cm per year under the Kurile Islands, and many great underthrust earthquakes occurred in the Kurile-Kamchatka subduction zone. The most recent great underthrust earthquake was the 2006 Kurile Islands earthquake ($M_w=8.3$) occurred about 350km northeast from the epicenter of the 1963 Kurile Islands earthquake. The location of the epicenter of the 1963 earthquake is 44.8N, 149.5E. Large tsunami was generated by the earthquake and propagated through the Pacific ocean and Okhotsk sea. We estimated slip distribution by tsunami waveform inversion using observed and synthetic waveforms at 9 tide gauges along the Pacific ocean and Okhotsk sea coast in Japan. Parameters of the fault model of the earthquake obtained from previous seismological studies were length=250km, width=150km, the shallowest depth=4km, strike=223, dip=22, rake=90. First, we divided the fault into 15 subfaults with the size of 50*50km. Then slip amount of the 1963 event on each subfault were estimated by the inversion of tsunami waveforms. Estimated slip distribution shows that the largest slip of 4.4m was found in the southeast part of the fault and another large slip of 2.2m was found in the northwest part of the fault. The seismic moment was calculated to be $4.2*10^{21}$ Nm ($M_w=8.3$) by assuming that the rigidity is $7*10^{10}$ N/m². This result is smaller than the seismic moment of $7.5*10^{21}$ Nm ($M_w=8.5$) estimated from surface waves by Kanamori [1970] and larger than the seismic moment of $2.7*10^{21}$ Nm ($M_w=8.2$) estimated from teleseismic body waves by Beck and Ruff [1987].