Fault Slip Distribution determined by Automated Source Process Analysis with Teleseismic Body-Wave based on Scaling Relationships Derived from Fault Slip Distributions

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1. Introduction
We have examined optimized preset parameters for automatic source process analysis with teleseismic body-wave. First, we set size of fault and subfault based on scaling relationships derived from fault slip distribution studies, and we investigated that fault plane included rupture area for many events. Then, we set sampling rate and rise time of basis function based on subfault size, and we investigated that we could avoid instability of the solution caused by setting too high-resolution temporal or spatial parameters for many events. Finally, we set other parameters by using experiential knowledge, and we investigated that we could set all parameters for automatic source process analysis based on hypocenter data and focal mechanism data.
This time, we set parameters more precisely based on event magnitude, we selected stations automatically by using signal-to-noise ratio of waveforms, and pick P-wave onset time automatically by using an auto-pick program for hypocenter determination. Thus we have become to do source process analysis automatically.
In this report, we investigated fault slip distributions of large earthquakes (M7.5) determined by automated source process analysis. And for verification, we compared fault slip distributions and aftershock distributions, and others.

2. Analysis Methods
We used the same program package as Iwakiri et al. [2014] for analyzing source process with teleseismic body-wave. This program package is modification of the program package by Kikuchi and Kanamori [2003]. We used broadband waveform data which were downloaded from IRIS DMC HP, and set sampling rate and band-pass filter band based on event magnitude. We used hypocenter data of JMA for events in and around Japan, and USGS for events in other areas. We used focal mechanism data of JMA for events in and around Japan, and W-phase moment tensor of USGS for events in other areas. Hypocenter was assumed as the center of fault plane, and subfault size was set based on event magnitude (number of subfault were fixed). Source-time function was set as triangle functions, and rise time was set based on event magnitude (number of basis function were fixed). Preset source time duration was assumed as the sum of rupture front arriving at the most distant subfault from hypocenter and the source duration of a single subfault (source duration of a single subfault was determined from average slip based on scaling relationships and experiential slip velocity). Velocity structure for Green’ s functions were set based on the IASP91 model and the CRUST2.0 model. We used the ABIC [Akaike, [1980]] for temporal and spatial smoothing constraints, and the hyperparameters were set so that ABIC value becomes minimum. Maximum rupture speed was set experientially at 0.70 times of S-wave velocity of near hypocenter. Event magnitude for preset parameters based on scaling relationships was selected from the magnitude +0.0, +0.1, +0.2, +0.3 of Mw (by JMA CMT solution) or Mww (by USGS W-phase moment tensor), and finally we selected event magnitude for preset parameters so that ABIC value become minimum.

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3. Verification Methods
(1) We compared aftershock distribution with slip distribution.
(2) We compared seismic moment estimated by aftershocks with slip distribution (seismic moment release).
(3) We compared tsunami source area with slip distribution.

4. Results
Rupture area analyzed by automatic source process analysis located in and around aftershock area for many events. Large aftershock tended to occur adjacent to rupture area. Seismic moment estimated by aftershocks and seismic moment release from main shock were complementary to each other for some events.

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We thank IRIS for providing the broadband waveform data and IASP91 model. We also thank USGS for providing event parameters. We also use the CRUST2.0 model.

Keywords: Automated Source Process Analysis, Scaling Relationships, Aftershock Distribution

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