[EJ] Evening Poster | S (Solid Earth Sciences) | S-CG Complex & General

[S-CG57]Dynamics in mobile belts

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The dynamic behaviours of mobile belts are expressed across a wide range of time scales, from the seismic and volcanic events that impact society during our lifetimes, to orogeny and the formation of large-scale fault systems which can take place over millions of years. Deformation occurs on length scales from microscopic fracture and flow to macroscopic deformation to plate-scale tectonics. To gain a physical understanding of the dynamics of mobile belts, we must determine the relationships between deformation and the driving stresses due to plate motion and other causes, which are connected through the rheological properties of the materials. To understand the full physical system, an integration of geophysics, geomorphology, and geology is necessary, as is the integration of observational, theoretical and experimental approaches. In addition, because rheological properties are greatly affected by fluids in the crust and fluid chemical reactions, petrological and geochemical approaches are also important. After the 2011 great Tohoku-oki earthquake, large-scale changes in seismic activity and regional scale crustal deformation were observed, making present-day Japan a unique natural laboratory for the study of the dynamics of mobile belts. This session welcomes presentations from different disciplines, such as seismology, geodesy, tectonic geomorphology, structural geology, petrology, and geofluids, as well as interdisciplinary studies, that relate to the dynamic behaviour of mobile belts.

[SCG57-P23]Construction of a dynamic fault model of the 2016 Tottoriken-chubu earthquake based on kinematic source inversion

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We constructed a dynamic fault model based on the past kinematic inversion results for the Tottoriken Chubu earthquake (Mw 6.2), which occurred in central Tottori prefecture on 21 October 2016. In this study, we obtained the temporal change of shear stress, using slip distribution and its temporal change obtained by Kobayashi et al. (2016), which is kinematic inversion of the observed seismic waveform. We used the boundary integral equation (Fukuyama and Madariaga, 1995; 1998) for calculation of dynamic faulting. We obtained the slip velocity by time differentiation from the temporal change of slip obtained by Kobayashi et al. (2016). In order to perform forward dynamic fault rupture calculation later, time and space increments were calculated, by interpolating from 1.0 s to 0.022 s and from 1.5 km to 0.25 km, respectively. Also, with reference to the one-dimensional underground structure model (Earthquake Research Research Promotion Headquarters, 2012), the P-wave velocity was set to 5.75 km/s and the rigidity to 31.2 GPa. As a result of the calculation, the temporal changes of the slip and the shear stress were obtained for each subfault. Then, we obtained the relationship between the slip amount and the shear stress for each subfault. From this relationship, the critical slip weakening distance and the stress drop amount were also obtained. As a result of this calculation, the maximum value of critical slip weakening distance was 1.3 m, and the stress drop amount ranged from -10 to 26 MPa. The obtained value of the critical slip weakening distance was large for use in forward dynamic fault rupture

calculation, indicating that the resolution of the slip time function used for the kinematic inversion is not satisfactory enough.
Using thus obtained spatial distribution of the stress drop amount, numerical simulations of dynamic fault rupture and seismic wave field are carried out to obtain values of peak stress and critical slip weakening distance which satisfy the observed seismic waveforms. We employed the boundary integral equation method (Aochi et al., 2000) for dynamic fault rupture calculation, and finite difference method (Aochi and Madariaga, 2003) for seismic wave field calculation, respectively. The initial crack was assumed ot be a circle with a radius of 1.0 km, and the values of fault size, physical property and spatiotemporal increment were the same as those for obtaining temporal change of shear stress from temporal change of slip amount. The distribution of stress drop amount obtained above was taken as the initial stress distribution, and the values of peak stress and residual stress were set to be constant on the fault plane. The value of the critical slip weakening distance was set so that the hypocenter was the smallest and the other part increased in proportion to the distance from the hypocenter. We assume the value of residual stress as 0 MPa. We changed the value of peak stress between 10 and 20 MPa, and the value (minimum value) of critical slip weakening distance between 0.10 and 0.20 m, respectively, to obtain the values which satisfy the observed seismic waveforms by a trial-and-error method. As a result, the value of peak stress and the critical slip weakening distance became 14 MPa and 0.12 m, respectively. Comparing the seismic waveforms obtained from the numerical simulations with the observed ones, the amplitudes were almost the same at the observation points located in the south of the fault. However, the amplitudes of the simulated seismic waveforms were smaller than those of the observed ones at the observation points located in the north of the fault. This suggests that slip also occurred in the north part of the fault in addition to the slip area in the central part of the fault, as can be seen in the kinematic inversion result.