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Strong motions and source process during the 2009 Suruga Bay earthquake through observed records on rock outcrops

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On 11 August 2009, a moderate earthquake of M6.5 occurred in the Suruga Bay region, south off Shizuoka prefecture. During this event, JMA Seismic Intensity reached 6 lower in several cities around the hypocenter, and at Hamaoka nuclear power plant of Chubu Electric Power reactors were automatically shutdown due to large ground motions. Though the epicenter is located at the eastern edge of source area for the assumed great Tokai earthquake of M8, this event is classified into the intra-plate (intra-slab) earthquake, due to its focal depth lower than that of the plate boundary and fault geometry supposed from the moment tensor solution. Dense strong-motion observation network has been deployed mainly on the rock outcrops by our institute around the source area, and the waveform data of the main shock and several aftershocks were obtained at 1 3 stations within 100 km from the hypocenter. The observed peak ground motions and velocity response spectral amplitudes are both obviously larger than the empirical attenuation relations derived from the inland and plate-boundary earthquake data, which displays the characteristics of the intra-slab earthquake faulting. Estimated acceleration source spectra of the main shock also exhibit the short period level about 1.7 times larger than the average of those for past events, and it corresponds with the additional term in the attenuation curve of the peak ground acceleration for the intra-plate earthquake. Detailed source process of the main shock is inferred using the inversion technique. The initial source model is assumed to be composed of two distinct fault planes according to the minute aftershock distribution. Estimated source model shows that large slip occurred near the hypocenter and at the boundary region between two fault planes where the rupture transfers from primary to secondary fault. Furthermore the broadband source inversion using velocity motions in the frequency up to 5 Hz demonstrates the high effective stress area on the east of hypocenter generates a high-frequency velocity pulse observed at the stations on the Izu Peninsula region.

Keywords: the 2009 Suruga Bay earthquake, rock outcrop station, strong ground motion, source process, inversion analysis, effective stress