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Heterogeneous seismic activity in focal area of the 2000 Western Tottori EQ (M7.3) detected by “0.1 manten” Hyper Dense Seismic Observation

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Earthquake faulting is a phenomenon of inelastic deformation taking place within seismogenic zone and its activity contributes dynamic behavior of the crust. Seismic moment tensor of small earthquakes is an important signal involving conditions of both stress and inelastic strain at the hypocenter. Thus seismic observation with high resolution and sensitivity is a key to solve a question how the crust deforms inelastically and accumulate stress in the seismogenic zone.

We have developed a new seismic observation system for long-term recording at one thousand sites and have completed one-year-observation in an aftershock area of the 2000 Western Tottori earthquake (M7.3). The seismic network with radius of about 18 km covered entire aftershock area of the M7.3 event. The observation enable us to determine focal mechanism with high accuracy and resolution. Automatic-detecting procedure was applied to the seismograms in order to detect small earthquakes. Over 5000 events of natural earthquakes were obtained during the observation. Sensitivity of the network is high and its detection limit for small earthquake was about magnitude of -1.0. Focal mechanism of the earthquake with magnitude range below zero could be determined. In this study, we showed spatial heterogeneous activity of the small earthquake around the fault of the main shock.

The detected aftershock activity is higher at north of the large slip area of the main shock than at other area. Taking into account the activity just after the main shock, we found decay rate of the aftershock at the high seismicity area is very low. The rate is smaller than inverse of the lapse time from the main shock, indicating that inelastic deformation due to the aftershock continue long duration compared with other part of the fault. This area corresponds to the hypocentral area of the preceding activity toward the main shock of the Western Tottori earthquake. These suggests a possibility that the high inelastic strain rate area at the north of the asperity of the main shock behaved as low strength area relaxing stress at the part and resulted stress loading to the asperity. In addition, we found some events having non-double couple component (NDC) by the “0.1 manten” hyper dense seismic observation. The magnitude of NDC is high around the asperity, suggesting fluid contribution for the earthquake faulting.