Mapping of stress field around Itoigawa-Shizuoka Tectonic Line active fault system by microearthquake analysis

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The Itoigawa-Shizuoka Tectonic Line (ITSL) is considered to be one of the most active fault systems in the Japanese Islands. In order to reveal stress accumulation process of this fault system, we investigate the stress field based on focal mechanism solutions of microearthquakes.

We have made temporary observations in the southern and central part of the ITSL during the period from September 2005 to July 2006 (observation A) and from August 2007 to present (observation B), respectively. The events were recorded at sample rates of 200 Hz in continuous mode and by off-line recording with GPS clock.

In the case of microearthquakes, it is difficult to obtain a unique focal mechanism solution, because the number of stations detecting events decreases and their azimuthal coverage becomes poor. In this study, we determined the focal mechanism solutions using absolute P and SH amplitudes and P-wave polarity. The actual procedures of this analysis are as follows: We first determined the tentative focal mechanism solutions and seismic moments where the number of P-wave polarity data was ten or greater. We then calculated the logarithmic average of the ratios between the observed and theoretical amplitudes of these events, which was used as the amplitude station correction at each station. Using the amplitude station corrections, we redetermined the focal mechanism solutions and seismic moments. In total, we determined 278 and 131 earthquakes for the observations A and B. It should be noted that during the same period, the number of routinely determined first-motion focal mechanisms by JMA are 2 and 0, respectively. Most of earthquakes are reverse or strike-slip faulting. The P-axis directions are NW-SE to WNW-ESE, which conforms to the general tectonic trend in this area.

The ISTL active fault system consists of north (north-trending east-dipping reverse fault), middle (northwest-trending left-lateral strike-slip fault) and south segments (north-trending west-dipping reverse fault). Except for the southern part of the north segment, focal mechanisms of microearthquakes determined in this study agree well with the faulting style and slip sense that were estimated by the trenching survey and seismic reflection profiling.

Based on geomorphic features, Kondo et al. (2006) suggested that the principal slip component on the southern part of the East Matsumoto Basin faults (EMBF) is left-lateral slip and that the portion between the southern EMBF and Gofukuji fault is appropriately a single fault segment. It is interesting that the present result is consistent with their conclusion.

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