Tectonic loading of active faults in central Japan revealed by dense GPS observations

Takeshi Sagiya[1]; Mako Ohzono[2]; Kazuro Hirahara[3]; Manabu Hashimoto[4]; Yoshinobu Hoso[5]; Yasuo Wada[4]; Akira Takeuchi[6]; Ryosuke Doke[6]; Takuya Nishimura[7]; Hiroshi Yarai[7]

[1] Environmental Studies, Nagoya Univ.; [2] RCPEV, Graduate School of Sci., Tohoku Univ.; [3] Geophysics, Sciences, Kyoto Univ.; [4] DPRI, Kyoto Univ.; [5] RCEP, DPRI, Kyoto Univ.; [6] Grad. Sch. Sci. Eng., Univ.Toyama; [7] GSI

We have been conducting dense GPS observations around two active faults zones in central Japan, the Atotsugawa faults system and the Itoigawa-Shizuoka Tectonic Line fault system (ISTL). These faults constitute a part of the Niigata-Kobe Tectonic Zone (NKTZ), the inland strain concentration zone detected by the nationwide continuous GPS network. Our dense observations provide a key to understand detailed deformation pattern within the deformation zone and to solve the physical mechanism of the inland deformation as well as tectonic loading of active faults.

Around the Atotsugawa fault system, we resolved a detailed displacement rate pattern across the fault with accuracy less than 1mm/yr. The width of deforming zone around the fault is different for the fault-normal and fault-parallel components and the contraction across the fault distributes more widely, implying that the oblique contraction across the Atotsugawa fault may be partitioned into fault-normal and fault-parallel components and these two components are accommodated in a different manner. In addition, we find that shear strain is concentrated in a narrow region around the Atotsugawa fault. Strain distribution with in NKTZ seems to have a hierarchical structure, as is also supposed from seismic tomography studies.

Along the Itoigawa-Shizuoka Tectonic Line fault system (ISTL), our campaign observation revealed significant lateral heterogeneity along the fault. In the northern part, WNW-ESE contraction is dominant, consistent with reverse faulting of this portion. As the contraction is concentrated near the fault trace, the stress accumulation may not be significant due to steady sliding of the fault. On the other hand, the Gofukuji fault in the central part of ISTL is characterized by left-lateral shear, implying strike slip faulting. In addition, the left-lateral shear strain is not concentrated around the fault, but widely distributed over a long distance from the fault.

Gradual variation in deformation style is identified between the above two areas from GPS observations. We speculate this different deformation styles corresponds to different stages during the earthquake generation cycle at each fault. Considering viscoelastic relaxation in the lower crust, the distributed shear strain around the Gofukuji implies the fault is in the latest stage of its interseismic period.