# Velocity structure beneath the active fault zone

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Japan Islands are covered with active faults. In the upper crust, microearthquakes occur actively and giant earthquake occur with a long time interval at the active faults like the Hyogo-ken Nanbu earthquake. These earthquakes are considered to occur because of the release of accumulated strain at the weak zone such as fault plane. Matsumoto (2007) investigated the crustal heat flow with NIED Hi-net borehole distributed in whole Japan Islands and also estimated the upper and lower limited depth of seismogenic zone. D10 is the upper limit and D90 is the lower limit of the zone. He revealed that each distribution of D10 and D90 has steep peak and that heat flow becomes low beneath the active faults. In this study, we calculate the velocity (perturbation) beneath the surface trace of the active faults with the three dimensional velocity structure beneath the Japan Islands (Matsubara et al., 2007) and compare the distribution of them to that of those beneath all Japan.

We pick the location of the active faults with the interval of 500 m and calculate the velocity perturbation at depths of 5, 10, 15, 20 km beneath them. The value represents the velocity beneath the fault zone since the resolution of the structure (Matsubara et al., 2007) is about 20 km (0.2 degree) in horizontal direction.

The average velocity at each depth is the standard velocity. The averages of P-wave velocity perturbation at depths of 5, 10, 15, 20 km are +0.85%, +0.23%, -0.15%, -0.55%, respectively. Those of S-wave velocity perturbation are +0.51%, 0.47%, -0.13%, -0.75%, respectively. This implies that shallow region is high-velocity and deeper part is low-velocity beneath the fault zone for both P- and S-wave.

The region with low heat flow is considered to have high velocity. The heat flow is low beneath the fault zone and the peak of the distribution of D90 is 12 km and it is concentrated to that depth (Matsumoto, 2007). This is consistent with the high-velocity zone in the upper crust and it implies it is difficult for earthquakes to occur in the deeper part. It is consistent with the low-velocity ductile lower crust at a depth of 20 km.

It is easy to consider that the high-velocity zone is brittle and the low-velocity zone is ductile. The low-velocity zone beneath the fault zone in the lower crust means that the lower crust is ductile. We can consider that the strain produced by the deformation of lower crust is accumulated at the shallower part and that the weak zone becomes fault with failure. It is consistent with the consideration of Iio and Kobayashi (2002) that aseismic slip at the deeper extension of the fault accumulates the strain at the seismic fault.