Seismec survey at the Atotsugawa fault system in Central Japan

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As a result of dense seismic observations (Ito et al., 2001), a detailed map of hypocenters along the Atotsugawa fault system has been obtained. To solve the relationship between the distribution of earthquakes and the heterogeneous structure, we conducted seismic explosion surveys along the fault and surrounding areas.

In 2000, four explosions were shot in the northeast part of the Atotsugawa fault to study its structure by observing the trapped waves in the underground observation vault across the Mozumi-Sukenobu fault, one of the faults of the Atotsugawa fault system (Ito et al., 2001). We carried out observations of the explosion seismic waves towards southwestern direction along the Mozumi-Sukenobu fault, setting 47 temporary stations in a measure line of about 40 km long. In 2001, a big seismic explosion survey was conducted by the IFREE, Earthquake Research Institute, the University of Tokyo and some other universities. The line lies from the Tokai district to Noto Peninsula crossing the entire Chubu district northwesterly. One of the explosions was shot on the Atotsugawa fault in the experiment. The shot point is located about 27 km southwest of the shots in 2000 along the Atotsugawa fault system. We used these data together with the data obtained along the perpendicular line to the Atotsugawa fault for the analyses of the velocity structure.

By analyzing the data, we have obtained the thickness of the surface layer and the distribution of reflectors. The thickness of the surface layer is estimated to be between 0 and 3 km, by using the time-term method for refracted waves, on the assumption of the velocity of the surface layer and the basement to be 4.5 km/s and 5.9 km/s, respectively. The velocity of the surface layer is obtained from an average of the travel times of the direct waves. The basement velocity is also obtained from an average of the reversed travel times. The convex shape of the O-C residuals against shot distance shows the increasing velocity with depth in the basement layer. The result shows that the influence of the surface layer to the hypocenter location is not so large to change the characteristic distribution described above. Static corrections for the surface layer and observation height was applied before normal move-out correction (NMO) for the analysis of reflected waves. We used the velocity of NMO correction to be 5.9 km/s. In the reflection section, series of reflected waves at about 4 and 6 s of two- way travel time (TWT) are clearly seen beneath the profile line along the Mozumi-Sukenobu fault. The reflected waves of 4 s of TWT is also obtained along the perpendicular line to the Mozumi-Sukenobu fault. However, because of large S-waves amplitude, the reflected waves about 6 s of TWT are not clear. These results suggest that there are reflectors at the depth of about 12 km in the Atotsugawa fault area. Thus, the reflector is likely to be situated right under the cutoff of the seismogenic layer.

By using routine observation records, we will investigate the spatial extension of the reflector. We will apply a ray-tracing method to obtain the detailed P-wave velocity structure in the Atotsugawa region, and the relationship among the seismic velocity structure, the cutoff of the seismogenic layer and the seismic reflector will be revealed.