Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

SCG061-02 Room:302 Time:May 25 16:45-17:00

Comparison between the seismologically determined stress and the geologically determined slip direction along an active

Satoshi Tonai[1*], Norio Shigematsu[1], Kazutoshi Imanishi[1], Takashi Azuma[1], Kazuo Mizoguchi[2], Tomoyuki Ohtani[3], Ryosuke Kutsuna[3]

[1]Geological Survey of Japan, AIST, [2]CRIEPI, [3]Gifu University

We compared the seismologically determined stress solution and the fault-slip data observed at the outcrops along the Atera fault, Central Japan, to understand relationship between the crustal stress and the slip directions of active faults. The seismologically determined stress solution can account for all of the fault-slip data obtained from the main fault plane, whereas that cannot account for all of the fault-slip data apart from the main fault plane. The Atera fault is a NW-SE trending active sinistral strike-slip fault at the eastern part of Gifu Prefecture with high deformation rate and is one of the best studied active faults in Japan.

The seismologically determined stress solution was calculated by a stress tensor inversion technique (Michael, 1984) using the focal mechanism solutions of 22 microearthquakes that occurred around the study area between October 2003 and October 2010. The focal mechanism solutions consists mainly of reveres-faulting type and we obtained the stress solution with the maximum principal stress S1 oriented horizontally NW-SE or WNW-ESE. Misfit angles between the slip direction and the shear stress direction predicted by the stress solution are less than 30^o for all focal mechanism solutions, so we regard the stress solution as the crustal stress in the study area.

The fault-slip data were obtained at five outcrops of the Atera fault which was already reported by previous studies. Four of the outcrops are within 5 m and the other is about 100 m away from the main fault plane of the Atera fault. We observed more than 100 slickenlines on fault planes and acquired 58 fault-slip data composed of fault orientation, slip orientation, and sense of slip. Quite a few fault planes strike NW-SE and dip to the northeast and show dextral and sinistral strike-slip. Few fault planes show reverse fault. Crosscutting relationship among fault planes was not found.

We calculated a misfit angle of each fault-slip data for the stress solution and found that only about 20% of fault-slip data have misfit angle less than 30^o for the seismologically determined stress solution. It should be noted that all fault-slip data obtained from the main fault plane (5 data) show a small misfit angle less than 30^o, whereas those obtained apart from the main fault plane (0.3-100 m from the main fault plane) have a wide range of misfit angles. This variability of misfit angles indicates that slickenlines in the fracture zone have been formed by several different stresses. Small-scale spatial variation of stress regime in the fracture zone of an active fault may account for the variability of misfit angles. The other possibility is that the slickenlines have not been formed by the present stress regime but the geological paleostress regimes due to the long active history of the Atera fault.

A part of this research project has been conducted as the regulatory supporting research funded by the Nuclear and Industrial Safety Agency (NISA), Ministry of Economy, Trade and Industry (METI), Japan. The seismograph stations used in the microearthquake analysis include permanent stations operated by NIED (Hi-net), JMA, ERI, Nagoya University, and DPRI.

Keywords: Atera fault, active fault, microearthquake, focal mechanism solution, stress tensor inversion, minor fault