FREESIA broadband seismic waveform database - What has been done and what will be expected -

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FREESIA broadband seismic network now consists of 64 stations ranging from Hokkaido to Okinawa. All the data obtained are open through the Internet (http://argent.geo.bosai.go.jp). We are estimating moment tensor solutions (M>3.5) using the hypocenters reported by JMA. We confirmed that these solutions are consistent with the Harvard CMTs. Using these solutions, we investigated the stress field and fault structure of the recent topical seismic activities. This waveform database will be utilized for the realtime based analysis as well as the research-oriented work and both requests will be fulfilled by the database.

We have started to operate the FREESIA broadband seismic network on March 1995. At that time, only three stations (JIZ, SGN, and TYM) were in operation, but now 64 stations (located from Okinawa to Hokkaido) are working. In the early stage, waveform data was provided with to the user through e-mail, however, the Web interface has been prepared for waveform data retrieval since May 2000. All waveform data is stored as miniSEED format, and the user select the format (miniSEED, SEED, SAC, and TEXT are available now).

Concerning the broadband seismometer, we used the STS-1 at the beginning, however, its production discontinued. Then we started to use CMG-1T, but the quality of this sensor was not satisfactory. Thus we now decided to use STS-2. Although the response functions are different between STS-1 and STS-2, by correcting their responses, we are able to get very similar ground motions even in very long period signal. As for the strong motion velocitymeter, we first used VSE311, however, now we used its succeeding model of VSE355. The main difference is its low noise and low gain.

We have routinely conducted the moment tensor analysis using the broadband waveform database since 1997. All the results are displayed on the Web (http://argent.geo.bosai.go.jp) as well as they were published as the Technical Research Note of the National Research Institute for Earth Science and Disaster Prevention. We have compared the obtained moment tensor solution with those by Harvard University and we examined the quality of the solutions. Although the predominant magnitude ranges in both catalogs are different, we confirmed that common earthquakes in both catalogs are consistent with each other.

This kind of moment tensor analysis helped understand the interpretations of several seismic activities occurring in Japan such as the March 2000 pre-eruption swarm activity of the Usu volcano, tremendous seismic swarms near the Miyakejima volcano since June 2000, the western Tottori earthquake and its aftershock sequence in October 2000, the northern Hyogo swarm in January 2001, and so on. In all above sequences the results of the moment tensor analysis provided us with the information on the stress field and fault orientations. Moreover, we are revealing the tectonic stress field that has not been yet investigated due to the insufficient dataset.

Now the broadband seismic network has been developed and everybody is able to access the high quality waveform database quite easily. New findings will be obtained through the competition among users. We, the producer of the waveforms, should join this competition as a user in order to develop the system as well as to create new research field.

There will be two directions for the usage of this database. One is time-critical analysis, which is sometimes triggered by the occurrence of large earthquakes. This is basically a technical development and constraint of time usage becomes important. In this case, stability of the data quality becomes critical. The other is quality-critical analysis, in which the purpose of the data usage is rigorously defined. This is a research-oriented development and quality control of the waveform data is important. The broadband waveform database is ready for both directions.