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GRiD MT (Grid-based RealtIme Determination of Moment Tensors)

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We have implemented a PC-based analysis system to monitor long-period (20-50 sec) seismic wavefield to simultaneously determine origin time, location and seismic moment tensor of seismic events in realtime (practical delay of about 3 minutes). The algorithm is based on the idea suggested by Kawakatsu (1998), in which a concept of gird-based such system is introduced.

With the current configuration, each PC (Pentium4, 3.06GHz; Chipset 850E; 1GB RDRAM PC1066 memory) monitors a 240kmx240kmx90km volume (6875 grids) with horizontal and vertical grid size of 10km and 9km, respectively. Receiving continuous flow of seismic data from three broadband stations, a PC determines the "best" moment tensor solution within the volume every one second. Goodness of solution is measured by the variance reduction (VR hereafter) of modeled waveforms, and by monitoring VR every second, it is possible to identify a seismic event. We employ 2-minute long waveforms for the VR estimation, and thus this requires a maximum of 2-minute delay in the event detection; further additional ˜30sec is used to confirm the identification of appropriate peaks of VR above some threshold (VRc). Therefore, it takes, on the average, about three minutes after the occurrence of a seismic event to issue an event detection.

This system has been operating at ERI since April, 2003, and the monitoring results can be found at the following URL: http://wwweic.eri.u-tokyo.ac.jp/GRiD_MT/ . Presently, it monitors the seismicity of five regions along the Pacific coast of Japan. We employ VRc of 0.65 for the event identification. With this threshold value, we identify about 80% of earthquakes (Mj>4.4, or equivalently Mw>˜4.0) identified by Japan Meteorological Agency. There also exist about 16% of false event identifications, which may be reduced by employing other information. Otherwise the system

works well; the comparison with the JMA catalogue indicates that standard deviations of location and origin time are about one grid size and few seconds, respectively. The estimated moment tensors are also very consistent with manually determined ones. This system is also useful to monitor active volcanoes where unusual long-period seismic events may occur.