Oral | Symbol S (Solid Earth Sciences) | S-SS Seismology

[S-SS28_2AM2]Application and Future Development of Earthquake Early Warning

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Earthquake Early Warning (EEW) is provided to public users nationwide in Japan from October 2007. The attention to the system has been increasing by broadcasting from the television, radio, and mobile phone. The contribution of the automatic processing technology of observing waveform data is very important for the development of EEW. In this session, we will discuss on the technical improvement of EEW, the practical application of EEW, and the automatic processing technology.

12:30 PM - 12:45 PM

[SSS28-P04_PG]Early forecasting of aftershocks from seismic energy release rate immediately after the mainshock

3-min talk in an oral session

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Keywords:aftershocks, early forecasting, energy release rate, modified Omori law, Gutenberg-Richter law

The detection completeness of earthquakes just after a large earthquake becomes very poor because their signals are overlapped each other in seismogram records and are hidden by the large amplitude of coda waves. Currently, the JMA starts to serve the aftershock forecasting at least 24 hrs after the mainshock because long lapse times are necessary before the catalog data becomes available for the forecasting with a certain reliability. Recently, Sawazaki and Enescu (under review) succeeded in estimating temporal change in energy release rate for the mainshock and the early aftershock sequence by using the Hi-net continuous records. In their method, the energy release is not determined for each discrete event, but is estimated as a continuous process like a source time function which sums up energies from all the earthquakes occurring at the same time. Therefore, theoretically there are no missing energies in the energy release rate even just after the mainshock. The estimated energy release rate follows a power-law temporal decay like the modified Omori law from about 40 s after the mainshock, and the deviation of the energy release rate with respect to the temporal regression curve distributes according to a power-law like the Gutenberg-Richter law. Since the current aftershock forecasting is conducted based on these two statistical laws, the energy release rate would be available for the early forecasting of the aftershocks. We examine the statistical characteristics of energy release rate in the frequency range of 8-16 Hz for three crustal earthquakes took place in Japan. From the energy release rate obtained at the first 1 hr, 3 hrs, and 6 hrs after the mainshock, we estimate the number of energy release rate larger than 10^8 J/s (about M_W4/s) occurring within 24 hrs after the mainshock. For the 2008 Iwate-Miyagi Nairiku earthquake, the ratios of the estimated/observed numbers are 24/35, 12/20, and 20/10 for the forecasting at 1 hr, 3 hrs, and 6 hrs after the mainshock, respectively. Likewise, the ratios are 1524/223, 231/99, and 113/50 for the 2004 Niigata Chuetsu earthquake, and 17/59, 8/59, and 30/21 for the 2007 Niigata Chuetsu-oki earthquake. For the Niigata

Chuetsu earthquake, M_J5.9, M_J5.8, and M_J6.3 aftershocks occurred in the first 1 hr, while there are no aftershocks larger than M_J5.5 in the lapse times from 1 to 24 hrs. For the Niigata Chuetsu-oki earthquake, there are no aftershocks larger than M_J5 in the first 3 hrs, while M_J5.7 aftershock occurred 5.4 hrs after the mainshock. Such large aftershocks and their secondary aftershocks may change the pattern of aftershock activity, and causes the over- and under-estimations in the forecasting.