

A Method to Identify Multiple Concurrent Events and its Application

TAMARIBUCHI, Koji^{1*}

¹JMA

The extremely active seismicity after the 2011 off the Pacific Coast of Tohoku Earthquake caused serious issues for the automatic hypocenter determination such as the Earthquake Early Warning (EEW) system in Japan. Because multiple earthquakes shook distant seismometers within a short period of time, the system misidentified a large earthquake shook them.

To solve this problem, Liu and Yamada (2014) proposed a likelihood function suitable for classifying multiple concurrent earthquakes, which uses amplitude information. Tamaribuchi et al. (2014) developed the concept, named Integrated Particle Filter method (IPF), using maximum amplitudes together with P-wave arrival times, B-delta method, and principal component analysis. This method can avoid false alarms in the case of multiple concurrent events, including aftershocks of the 2011 off the Pacific coast of Tohoku Earthquake.

In this study, I applied this method to deep earthquakes such as occurred at Southern sea of Okhotsk (M7.3, 654km depth). The current system issued a warning because estimation of the earthquake was inland and shallow using only P-wave arrival times on the first alert. In this case, the IPF method can avoid the inaccurate warning taking into account the B-delta method as well as P-wave arrival times.

In addition, I developed the IPF method for smaller earthquakes such as JMA catalog. This method uses P- and S-wave arrival times and maximum amplitude integrally. I applied this method for some swarms and aftershocks activity, including the earthquake at Northern Nagano Prefecture on 22 October, 2014. In this case, this method can detect more than 1,700 events within 24 hours, although the current system could detect only 250 events.

I think it is useful to grasp seismic activities in real time. These methods, including for EEW and for JMA catalog, will deploy in the next our system.

References:

- Liu and Yamada, 2014, BSSA, 104-3, 1111-1121.
- Tamaribuchi et al., 2014, Zisin2, 67, 41-55.

Keywords: Automatic hypocenter determination, Earthquake Early Warning, JMA catalog