

Earthquake Observations at Central Weather Bureau: Current Status and Perspectives

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Taiwan, an island located on the border of the Eurasia plate and the Philippine Sea plate, is over the Circum-Pacific seismic belt. There are nearly 18,000 seismic events occurring in and around Taiwan every year, and earthquake hazard is one of the major natural disasters in Taiwan. In order to monitor and report seismic activities for earthquake hazard mitigation, the Central Weather Bureau (CWB) has been executing projects of Taiwan Strong Motion Instrumentation Program (TSMIP) since 1992. The TSMIP is a comprehensive, forward-looking, and continuous push-on project, and divides into three phases for every six years.

The first phase of the project is to build a modern network in urban areas with free-field strong-motion stations and building arrays. This includes gathering strong-motion data around Taiwan and providing them for institutions of engineering and disaster prevention, while revising building codes for earthquake resistant construction. There are more than 700 free-field stations and 60 building arrays at present, and collected many valuable seismic data for latest years.

The second phase is mainly constructing an Earthquake Rapid Reporting System (ERRS), which can reduce the response time for emergency notification with related units. In the development, a real-time strong-motion monitoring system was developed since 1995. After successive refinements during the past decade, there are totally 101 real-time stations implemented in Taiwan and offshore islands. While a potentially felt earthquake is occurring around Taiwan area, the location, magnitude, and shake map of seismic intensities can be automatically reported in about one minute. Within 3 to 5 minutes later, an official earthquake report is disseminated to various organizations and individuals.

The third phase focuses on the Earthquake Early Warning System (EEWS), and the ultimate goal of this phase is to provide an early warning of seconds to tens before the strong shaking arrival. In our development, a sub-network or virtual sub-network (VSN) approach based on the existing real-time strong-motion network is utilized for experimentation since 2001. Currently, for earthquakes occurring in or very near Taiwan, information can be automatically reported in about 20 seconds. Therefore, it can offer about 2 seconds before the P-wave arrival and about 13 seconds before the S-wave arrival for metropolitan areas located at 100 km from the epicenter.

Since 2003, the CWB has been replacing the existing 16-bit digital accelerographs used in its real-time strong-motion monitoring to 24-bit instruments at an annual replacement rate of 5 to 10% of the total. Besides, some high quality borehole seismic stations and a cable-based Ocean Bottom Seismographic (OBS) system are planned to implement on and off north-eastern Taiwan since 2007. In response to these new instruments, we will further develop multipurpose observational systems, as well as to any new research ideas.