

Publication of the Japan University Network Earthquake Catalog of First-Motion Focal Mechanisms (JUNEC FM²)

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We determined focal mechanism solutions for 14,544 earthquakes that occurred in and around the Japanese Islands from July 1985 to December 1998 by using first-motion polarities reported by the Japan University Seismic Network, and compiled the Japan University Seismic Network Earthquake Catalog of First-Motion Focal Mechanisms (JUNEC FM²). JUNEC can be obtained from ftp site provided by ERI: <ftp://ftp.eri.u-tokyo.ac.jp/pub/data/junec/hypo/>. JUNEC FM² also can be obtained via ftp site: <ftp://ftp.eri.u-tokyo.ac.jp/pub/data/junec/mech/>. The Earthquake Research Institute, the University of Tokyo has compiled observed data with the cooperation of universities and determined hypocenters amounting to about 190,000.

This catalog covers small-magnitude earthquakes ($M \geq 2.0$) prior to the recent development of seismic observation networks and automated waveform data processing systems, and it will prove helpful in understanding the spatial and temporal heterogeneities of stress fields by combing recent focal mechanism solutions. Abundant focal mechanism solutions will be useful for statistical analyses. Their distribution is spatially and temporally heterogeneous, and it clearly reflects both the development of observation station network and spatial variations of first motion polarity report rate (i.e., first motion polarity report number / the number of picked onsets). Determined focal mechanisms are basically consistent with previously reported ones such as Full-range Seismograph Network of Japan (F-net; Okada et al., 2004) moment tensor solutions provided by National Research Institute for Earth Science and Disaster Prevention (NIED), or P-wave first motion focal mechanisms provided by the Japan Meteorological Agency (JMA) though some focal mechanisms are significantly different from them.

In Japan, an abundance of first-motion focal mechanism solutions for earthquakes have been determined after the 1995 Kobe earthquake (magnitude according to JMA-, M_{JMA} 7.3) through the development of the High Sensitivity Seismograph Network Japan (Hi-net). In addition, moment tensor solutions for moderate- to large-magnitude earthquakes have been routinely determined since 1997 using the F-net and improved data processing systems. These focal mechanism solutions have provided a good understanding of the fault structures and the local/regional stress fields in which earthquakes occur. However, focal mechanism solutions for earthquakes covering the Japanese Islands prior to the development of recent seismic observation networks have been very limited, barring a few studies (e.g., Ichikawa, 1961, 1971). Following the 2011 off the Pacific coast of Tohoku earthquake (moment magnitude according to the JMA, M_w 9.0), the distribution of focal mechanism solutions has drastically changed especially in and around the source region. This indicates that stress fields or focal mechanism solutions are temporally variable. In light of this, data on the focal mechanisms of earthquakes extending as far back as possible are desirable in order to investigate intermediate- to long-term spatial and temporal heterogeneities of focal mechanism solutions and local/regional stress fields.

Acknowledgements

We used a program modified from HASH (Hardebeck and Shearer, 2002) to estimate the focal mechanism solutions and the pick files observed by Hokkaido University, Hiroasaki University, Tohoku University, the Earthquake Research Institute of the University of Tokyo, Nagoya University, the Disaster Prevention Research Institute of the Kyoto University, Kochi University, Kyushu University, and Kagoshima University. We also used focal mechanism solutions for earthquakes provided by NIED and JMA. This study was supported by the Special project for reducing vulnerability for urban mega earthquake disasters from the Ministry of Education, Culture, Sports, Science and Technology of Japan.

Keywords: first-motion focal mechanism solution, Japan University Network Earthquake Catalog (JUNEC)