

A New Comprehensive Strong-Motion Database of Japan

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1. Introduction

The objective of this study is to provide a reliable strong-motion database recorded by new nationwide digital seismograph networks since August 1988 in Japan. Multi-proposed engineering usages of such a data set lead us to compile an extensive (free-filed) three-component acceleration records over a 14-year period. It should be noticed that records used in this study are open to public and provided by the Japan Meteorological Agency (JMA), Kyoshin (K-NET), and Kiban Kyoshin (KiK-net) nationwide strong-motion networks. In case of K-NET and KiK-net the accelerometer records accompany borehole information can obtain through the National Institute for Earth Science and Disaster Prevention's (NIED) web page or via CD-ROMs in ASCII or compress formats. However released JMA public-data, which consists of two seismometer types of JMA-87 and JMA-95, are available only in a specific binary format without any detailed information on soil condition of recording stations.

2. Characteristics of Compiled Strong-Motion Data

Considering regional perspectives on seismic activities and dense strong-motion networking systems in Japan it is desirable to select records of earthquakes equal to and greater than 5.0 in JMA scale¹⁾. Selected acceleration records are converted to a row-data format after applying a proper base-line correction²⁾. In order to remove a long-period effect on records a lower cut-off filter in frequency domain with a cosine-shaped transition from 0.01 to 0.05 Hz are applied. A preliminary summary of compiled database by this study is shown in Table I.

Table I. Preliminary summary of strong-motion database compiled in this study

No. of events	657
No. of records	over 23,000
No. of recording stations	over 2,000
Date recorded	August 1, 1988 to August 31, 2002 (14 year period)
Recording networks	JMA JMA-87-type (1988/08 – 1997/03) JMA-95-type (1996/10 – 1998/12 including the 2000 Tottori & the 2001 Geiyo) K-NET (1996/05 – 2002/08) KiK-net (1997/10 – 2002/08)
Magnitude range	5.0 to 8.1 (in JMA scale)
Depth range	0.1 to 600 km

The database represents regional earthquake source characteristics as follows:

- 1- Interplate and plate boundary earthquakes in a) Pacific subduction plate (e.g. the 1994 Sanriku Haruka-Oki earthquake, JMA magnitude, M of 7.5), b) subducting Philippine plate earthquakes (e.g. the 2001 Geiyo event, M=6.8), and c) Earthquakes within subduction plates (e.g. the 1994 Hokkaido Toho-Oki earthquake, M=8.1).
- 2- Shallow inland earthquakes such as the 1995 Hyogo-ken Nanbu (M=7.2) and the 2000 Tottori-ken Seibu earthquake (M 7.3) earthquakes.
- 3- Eastern margin of the Japan Sea earthquakes (e.g. the 1993 Hokkaido Nansei-Oki earthquake, M=7.8).
- 4- Earthquake swarms represent periphery of volcanoes for example those activities with small and medium size events in the open sea of the Izu Peninsula.

As for the distance definition we define the shortest distance from each recording station to the fault extent using the published fault-plane models for the above-mentioned events. However for other records the hypocentral distance is used. Records with Peak Ground Acceleration (PGA) less than 1 cm/s^2 in one horizontal component are omitted³⁾. Due to the large number of records for each recording station and based on the available provision schemes⁴⁾ and nationwide geomorphologic/geologic classifications⁵⁾, it is possible to make a preferred site

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classification for current recording stations. The final database can be surfed by the event date, magnitude, depth, site classification, and geographical coordinate or region name like Hokkaido, Tohoku, Kanto, Chubu, Kinki, Chugoku-Shikoku, or Kyushu-Okinawa (Fig. 1). Figure 2 shows the distribution of the JMA magnitude, depth, and PGA of the compiled data set used in this study. As it can be seen from Fig. 2b the database includes records from moderate to big damaging earthquakes like the 1993 Kushiro-Oki ($M=7.8$), the 1993 Hokkaido-Nansei-Oki ($M=7.8$), the 1994 Hokkaido-Toho-Oki ($M=8.1$), the 1994 Sanriku-Haruka-Oki ($M=7.5$), the 1995 Hyogoken-Nanbu ($M=7.2$), the October ($M=6.6$) and the December ($M=6.6$) 1996 Miyazaki, the March ($M=6.3$) and the May ($M=6.2$) 1997 Kagoshima, the 1997 Yamaguchi ($M=6.1$), the 1998 Iwate ($M=6.1$), the 2000 Tottori-ken Seibu ($M=7.3$), and the 2001 Geiyo ($M=6.8$) events.

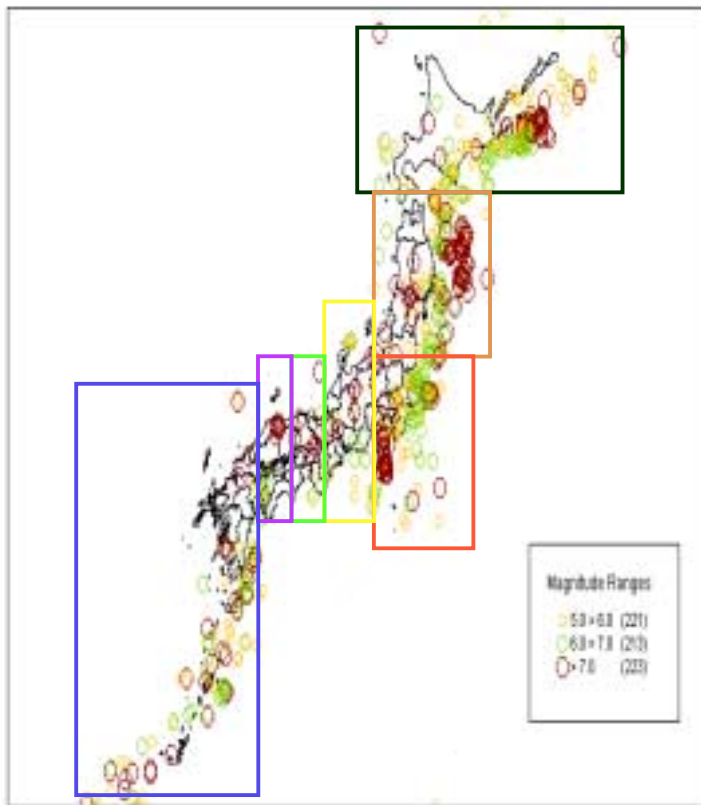


Fig. 1. Magnitude range, location of epicenters, and geographic distribution of earthquakes.

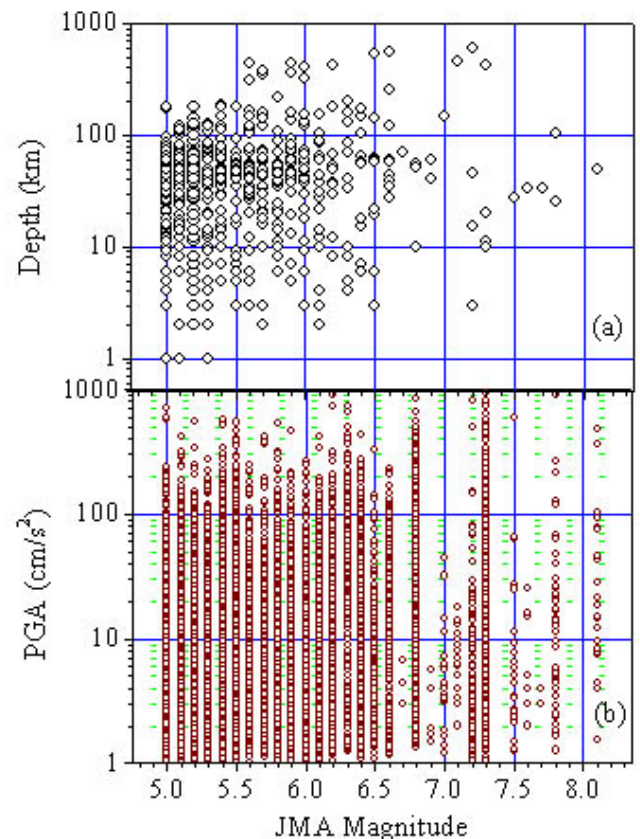


Fig. 2. Distribution of (a) magnitude with focal depth and (b) PGA larger of two horizontal components.

3. Concluding Remarks

In this study, extensive free-field three-component acceleration records, which have been registered during six hundred and fifty-seven earthquakes, were compiled using the three major nationwide strong-motion networks of Japan since 1988. In order to understand the site effect, which has an important role in the recorded waveform of earthquake ground motions, furthermore, we will conduct a proper site-classification scheme compatible to existing provisions and geomorphological/geological classifications. In the near future, the final compiled database will be open to researchers by the Earthquake Disaster Mitigation Research Center, EDM, upon a request.

References

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