SECOND EUROPEAN CONFERENCE ON EARTHQUAKE ENGINEERING
AND SEISMOLOGY, ISTANBUL AUG. 25-29, 2014

EMME STRONG-MOTION DATABASE SERVING FOR PREDICTIVE MODEL SELECTION TO EMME GROUND-MOTION LOGIC-TREE APPLICATIONS

Sinan AKKAR[1], Özkan Kale[2], Anooshirvan ANSARI[3], Raffi DURGARYAN[4], Ayşegül ASKAN GÜNDOĞAN[5], Hossein HAMZEHLOO[6], Ebru HARMANDAR[7], Nino TSERETELI[8], Muhammad WASEEM[9], Tawfique YAZJEEN[10], M. Tolga YILMAZ[11]

The ground-motion prediction equations for Earthquake Model of the Middle East (EMME) region of abundant data are going to be identified by testing a set of candidate GMPEs using a ground-motion dataset (EMME strong- motion databank) compiled from the earthquake recordings of the EMME region. The compilation of EMME strong-motion databank has come to its final stage by collecting the accelerograms from Caucasus (Armenia and Georgia), Iran, Jordan, Pakistan and Turkey. The sources of the strong-motion accelerograms in the database are national seismological agencies and projects as well as recently compiled global strong-motion databanks. Decomposition of the EMME database is illustrated in Figure 1 in terms of countries and sources of strong-motion data, and descriptions of these sources are listed in Table 1.

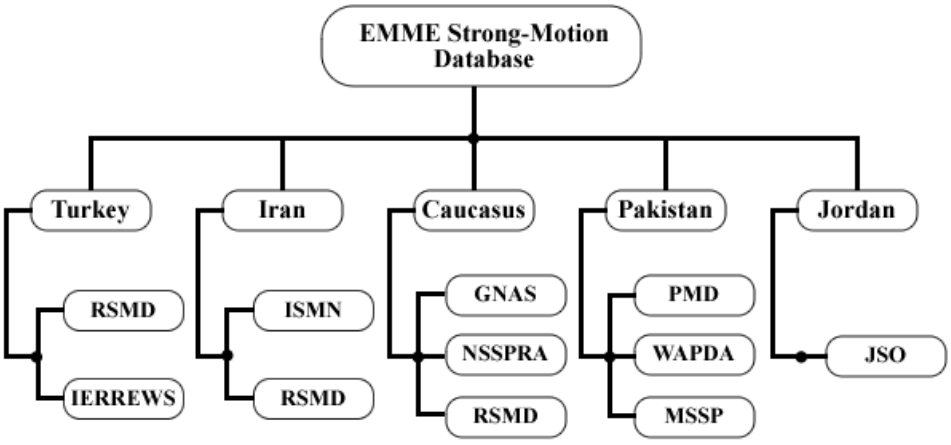

Figure 1. Node structure of the strong-motion accelerograms in EMME database.

[1] Professor, Boğaziçi University, Turkey, sinan.akkar@boun.edu.tr
[2] Ph. D. Candidate, Middle East Technical University, Turkey, ozkankale@gmail.com
[3] Dr., International Institute of Earthquake Engineering and Seismology, Iran, anooshiravan.ansari@gmail.com
[4] Dr., National Academy of Sciences of Armenia, Armenia, raffie_d@yahoo.com
[5] Professor, Middle East Technical University, Turkey, aaskan@metu.edu.tr
[6] Dr., International Institute of Earthquake Engineering and Seismology, Iran, hhamzehloo@iiees.ac.ir
[7] Dr., Boğaziçi University, Turkey, ebru.harmandar@gmail.com
[8] Professor, Institute of Geophysics of Tbilisi State University, Georgia, nino66_ts@yahoo.com
[9] Professor, University of Peshawar, Pakistan, eec_pesh@yahoo.com
[10] Dr., Jordan Seismological Observatory, Jordan, tyazjeen@nra.gov.jo
[11] Professor, Middle East Technical University, Turkey, mtyilmaz@metu.edu.tr

The metadata information (i.e., magnitude, source-to-site distance, hypocentral depth, epicentre and strong-motion station coordinates, strong-motion site classification, data processing etc.) of these accelerograms is studied in order to obtain a fully reliable database for testing of candidate GMPEs. Final form of the database contains more than 5000 multi-component strong motion recordings with a magnitude range between $3 \leq Mw \leq 7.6$ and for source-to-site distances up to 400 km. Iran and Turkey provides a significant amount of data (3152 and 1746, respectively) to the database. Such an extensive strong-motion archive will be of its first kind in the region.

Table 1. Descriptions of the strong-motion data sources given in Figure 1.

Acronyms of the Sources	Full Names of the Sources	Websites of the Sources	References of the Sources
GNAS	Georgian National Academy of Sciences	http://www.science.org.ge/english.html	-
IERREWS	Istanbul Earthquake Rapid Response and Early Warning System	http://www.koeri.boun.edu.tr/sismo/default.htm	Erdik et al. (2003) Harmandar (2009)
ISMN	Iran Strong Motion Network	http://www.bhrc.ac.ir/portal/Default.aspx?tabid=635	-
JSO	Jordan Seismological Observatory	http://www.nra.gov.jo/index.php?option=com_content&task=view&id=83&Itemid=122	-
MSSP	Micro Seismic Study Project under Pakistan Atomic Energy Commission	http://www.paec.gov.pk	-
NSSPRA	National Survey for Seismic Protection under the Government of the Republic of Armenia	http://www.adrc.asia/highlights/041/nsspra.htm	-
PMD	Pakistan Meteorological Department	http://www.pmd.gov.pk/	-
RSMD	RESORCE Strong-Motion Databank	http://www.projet-sigma.com/index.html	Akkar et al. (2014)
WAPDA	Pakistan Water and Power Development Authority	http://www.wapda.gov.pk/htmls/auth-index.html	-

The accelerograms which are going to serve for predictive model selection process are extracted from EMME databank after catalog- and record-based evaluation stages and revised version of the EMME databank is obtained. In the catalog-based evaluation stage, the accelerograms are investigated in terms of a) availability of event, record and station information (i.e., epicentral coordinates, moment magnitude, hypocentral depth, style-of-faulting, fault rupture dimensions or fault-plane solutions, station coordinates and site class), b) pre-defined magnitude and distance limits ($M_w \geq 4.0$ and $0km \leq R_{JB}$ (Joyner-Boore distance) $\leq 200km$), c) seismotectonic settings of the region (only shallow active crustal events from EMME region). The strong-motion accelerograms that do not satisfy the above catalog criteria and prerequisites are not incorporated into the revised EMME strong-motion database. In the record-based evaluation stage, poor quality recordings, duplicated records between different accelerometric data sources and existence of the both horizontal components are investigated. This form of the database includes only horizontal components of the recordings by considering the requirements of predictive model selection process. The poor quality recordings in the database are detected by considering the proposals of Douglas (2003). The recordings which classified as in poor quality or duplicated and do not have both horizontal components are not included in the revised database.

After the consideration of above cases, the revised version of EMME databank includes 1869 strong-motion accelerograms recorded from 418 events and 611 strong-motion stations. Figure 2 shows M_w vs. R_{JB} scatter plots of strong-motion recordings in terms of countries. The numeric information for the number of data corresponding to countries is denoted next to each legend in this figure. The moment magnitude (M_w) and source-to-site distance ranges of the recordings are $4.0 \leq M_w \leq 7.6$ and $R_{JB} \leq 200km$, respectively. The site classification of accelerograms is based on measured and inferred V_{S30} values. The database mainly consists of recordings from soft and stiff sites that correspond to a V_{S30} range of $180m/s < V_{S30} \leq 800m/s$. Half of the accelerograms in the database that are from strike-slip events dominate the database. The other half is almost equally distributed between normal (23%) and

reverse (27%) events. The acausal band-pass filtering procedure is applied in data processing. The filter cut-offs are determined from the frequency content of raw data.

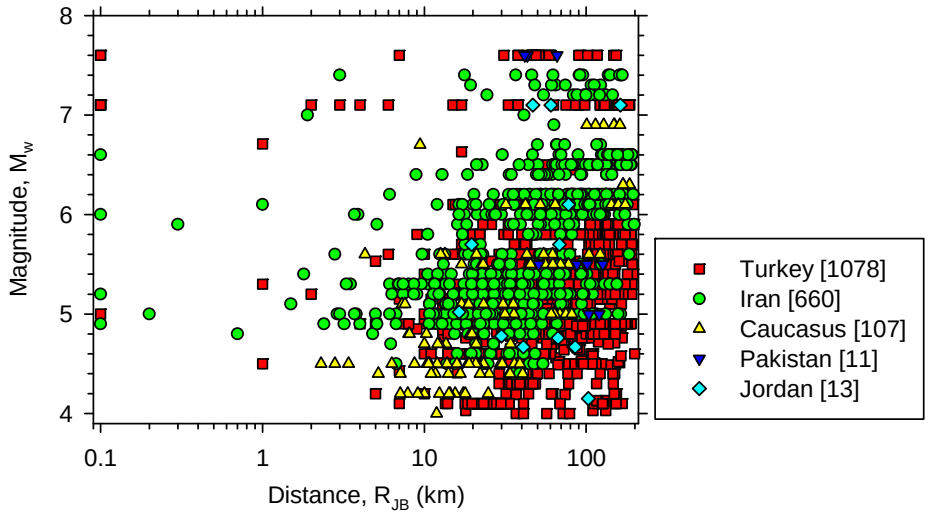

Figure 2. M_w vs. R_{JB} scatters of the database.

REFERENCES

Douglas J (2003) "What is a poor quality strong-motion record?", *Bulletin of Earthquake Engineering*, 1, 141-156.

Erdik M, Fahjan Y, Ozel O, Alcik H, Mert A and Gul M. (2003) "Istanbul Earthquake Rapid Response and Early Warning System", *Bulletin of Earthquake Engineering*, 1, 157-163.

Harmandar E (2009) Spatial variation of strong ground motion, Ph. D. Thesis, Bogaziçi University, İstanbul.

Akkar S, Sandıkkaya MA, Senyurt M, Azari Sisi A, Ay BÖ, Traversa P, Douglas J, Cotton F, Luzi L, Hernandez B and Godey S (2014) "Reference database for seismic ground-motion in Europe (RESORCE)" *Bulletin of Earthquake Engineering*, 12, 311-339.