NEW MAGNITUDE SCALING RELATION FOR EARLY WARNING IN TEHRAN

Mohammad SASANI
PhD Student, International Institute of Earthquake Engineering and Seismology, Tehran, Iran
m.sasani@iiees.ac.ir

Mohammad Reza GHAYAMGHAMIAN
Associate Professor, International Institute of Earthquake Engineering and Seismology, Tehran, Iran
mrgh@iiees.ac.ir

Anooshiravan ANSARI
Assistant Professor, International Institute of Earthquake Engineering and Seismology, Tehran, Iran
a.ansari@iiees.ac.ir

Keywords: Earthquake Early Warning, Magnitude Estimation, Alborz Region, Dominant Ground Motion Period

ABSTRACT

Tehran city, the capital of Iran, is located in the southern part of Alborz mountains in north of Iran, which is a very prone area to earthquake. The recent developments in early warning systems encourage its application for seismic hazard mitigation, especially in mega-cities like Tehran. Here, an effort was made to develop a new relation for magnitude estimation using the initial few seconds of the earthquake rupture. Among several methods applied for such purposes, the estimation of average ground motion period in a 3 sec time window from the beginning of an earthquake record (τ_c) is the most applicable and reliable one.

In this study, the earthquake data in Alborz region recorded by Road, Housing and Urban Development Research Center are collected from 1995 to 2013. The 218 data with magnitude larger than 4.7 are selected for τ_c estimation. Then, the P-wave arrival is picked visually for each record. The τ_c was computed for three different time windows of 2, 3 and 4 seconds after the P-wave arrival. Next, the new scaling relation between τ_c and magnitude (M_w) is developed. The results show that at least a 3 second time window after the P-wave arrival is needed for reliable estimation of magnitude by using τ_c. Furthermore, the developed relation is compared by those introduced by Wu and Kanamori (2005b), Kanamori (2005) and Heidari et al. (2013), which show a good agreement by the Wu and Kanamori's relations. Meanwhile, it shows a clear difference with Heidari et al. relation. This could be attributed to their used data, which were limited to the low magnitude data with Mw lower than 4.6.

INTRODUCTION

Concurrent with the development of urbanization, earthquake hazards pose serious threats to lives and property in urban areas. For seismic hazard mitigation, a practical earthquake forecast method appears to be far from realization, because of the extreme complexity involved in earthquake processes (e.g., Kanamori et al., 1997), but another approach to mitigate seismic hazards is the development of early warning systems (EWS) (Allen, 1978; Allen and Kanamori, 2003; Nakamura, 1988; Wu and Kanamori, 2005a). An EWS