An investigation on possibility of combination of Iran and California strong-motion datasets using analysis of variance

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It is believed that earthquakes from similar tectonic regions have a similar behavior and subsequently can be combined into one dataset. In this study the Analysis of Variance (ANOVA) method is applied to two large sets of strong motions, Iran and California datasets, in order to investigate the regional dependency of ground motions and consequently the possibility of combining these two datasets to form a single strong motion dataset. California dataset has been derived from NGA-West2 database. Iran strong motion records obtained in raw format from Iran Strong Motion Network (ISMN) and processed by modified wavelet de-noising approach by which large numbers of noisy acceleration records that are usually discarded from sets of records, can be corrected. Analysis of variance does not rely on deriving GMPEs which makes it a strong method for understanding of regional dependency.

In this research large datasets of both regions, Iran and California, with many intervals of overlapping data from the two regions are compared. Applying this technique to these large datasets is more likely to reach accurate and robust results since it cannot be performed for intervals with lack of overlapping data.

In this study, ANOVA is applied to PGA (Peak Ground Acceleration) and 5%-damped horizontal component of elastic response spectral acceleration at 6 different periods of 0.1, 0.2, 0.3, 0.5, 1 and 3 second. A single period-independent rotation measure (GMRotI) is used to combine two horizontal components. The closest distance to the fault rupture plane (Rrup) is calculated for all Iran acceleration records based on their causative fault plan's geometry. Also, moment magnitude scale has been chosen in this study. In order to avoid the site effect on ground motion and regional dependency's results, horizontal to vertical spectral ratio method for all recordings of different site categories performed to calculate site amplification at required period and implemented in analysis of variance.

In case of high evidence of regional dependency, earthquake ground motions in specified regions are dissimilar and should be kept separate to prevent biased prediction relationships. In case of low regional dependency of ground motions, the resultant combined database can be used in development of future ground motion prediction models to overcome incompleteness of data and existence gaps in distance-magnitude intervals of Iran or California dataset. Moreover, it can increase the applicable ranges of distance and magnitude in GMPEs and decrease the standard deviation of derived models.