Evaluation of the global attenuation relationships in the light of Pakistan specific earthquake strong motion catalog

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Ground-motion prediction equations (GMPEs), commonly known as the attenuation equations, are indispensable elements of seismic hazard analysis. These are the empirical relationships derived from available accelerogram data. These are used to estimate the values of strong-motion parameters (e.g. peak ground acceleration, peak ground velocity, and peak ground displacement) at the site of interest for input in seismic designs of structures. These equations describe the decay of strong motion parameters with distance from the source. GMPEs are applicable to regions for which they have been developed. These attenuation relations are area specific, i.e., they depend upon the tectonics and geology of the area where the strong-motion data comes from. This implies that attenuation relations developed for an area with a specific geological and tectonic setting may not be suitable for use for areas with different inherent geological and tectonic conditions. The accelerogram databank that is used to derive GMPEs continues to expand, but it is very unevenly distributed among different regions of the globe. This data is lacking in quantity and in quality for most regions of the world (including Pakistan) due to limited number of installed accelerographs. In such areas where GMPEs are yet to be established, one or more models derived for other regions preferably with similar or nearly similar regional tectonic settings are used. In the absence of GMPEs derived from locally collected strong-motion data, researchers working on seismic hazards in Pakistan have no option but to use GMPEs derived for other regions in the world.

Strong-motion data recorded by the Pakistan national strong-motion network has been compiled and processed systematically, along with detailed geophysical and geotechnical site measurements for all of its stations. The catalog information of 9 seismological agencies and other sources were examined to obtain reliable source, geometry and distance parameters for each event. The digital and analog strong-motion data were processed by a uniform methodology to remove the high- and low-frequency noise. The seismological and spectral information of 110

strong-motion records are available with us for use in this study. In this article, we present the fundamental features of this database and explain our methodology in GMPEs calculations. We present several comparisons of our database with other related studies to verify our approach during the computational stage of the seismological parameters. The database has enabled us to derive empirical magnitude conversion relationships to estimate moment magnitude in terms of different magnitude scales.