



Analysis of Single-Path Sigma Using SMART-1 Array Data in Taiwan

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The standard deviation of the logarithmic residuals in ground-motion prediction may directly influence the result of probabilistic seismic hazard analysis, especially in lower probability. "What method can reduce the sigma more?" is a hot issue in recent years. Now, we focus on "How to clarify the minimum variance of ground motion residuals from median attenuation in nature". This study differs from most previous studies in that it examines the variability of ground motion for individual earthquakes using dense array recordings. The basic assumption is that the dense array recordings can be treated as repeated measurements for a given seismic source, ray path, and site condition. The variation in peak ground motion (PGA) over short distances is used to directly measure the statistical properties of PGA and in particular, to measure the variability in PGA. We used the SMART 1 array recordings from four earthquakes (1986/07/30, 1986/11/16, 1986/05/20 and 1983/09/21) to analyze the single source to single station variance. The SMART-1 array consists of a center station (C-00) and three concentric rings (named inner I, middle M, and outer O) of radii 200, 1000, and 2000 m, respectively, with 12 equally spaced stations on each ring. The similar topography and soil conditions for the stations in the SMART 1 array reduce the effect of variations in the local site conditions on the recorded PGA. For this reason, SMART 1 data are less affected by variations in site conditions than other strong motion data sets. Finally, we analyze the single path sigma by using variogram method. Measured semi-variances at different distance bins (lags) and plot a semi-variogram. Nugget effect is commonly found in each single earthquake. This means even the distance between two stations is equal to zero; there still is significant difference in ground-motion residual. This is potentially the most promising approach to find a natural sigma for use in probabilistic seismic hazard analysis and is worth pursuing in future studies.