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Site-Conditions Proxies, Ground-Motion Variability and Data-Driven GMPEs: Insights from NGA-West 2 and RESORCE Data Sets

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We compare the ability of various site-condition proxies (SCPs) to reduce the aleatory variability of ground-motion prediction equations (GMPEs). Three SCPs (measured Vs30, inferred Vs30, local topographic slope) and two accelerometric databases (RESORCE and NGA-West 2) are considered. An Artificial Neural Network (ANN) approach including a random-effect procedure is used to derive GMPEs setting the relationship between PGA, PGV and pseudo-spectral acceleration PSA(T) and explanatory variables (Mw, RJB, and Vs30 or Slope). The analysis is performed using both discrete site classes and continuous proxy values. All "non-measured" SCPs exhibit a rather poor performance in reducing aleatory variability, compared to the better performance of measured Vs30. A new, fully data-driven, GMPE based on the NGA-West 2 is then derived, with an aleatory variability value depending on the quality of site-condition proxy (SCP). It proves very consistent with previous GMPEs built on the same data set. Measuring Vs30 allows to benefit from an aleatory variability reduction up to 15%.