Applicability of NGA-West 2 GMPEs to Japan: how to evaluate models using correlated observations

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We compared the performance between the newly developed NGA-West 2 GMPEs and native Japanese GMPEs. The dataset set we used was the most comprehensive among similar studies, consisting of 16 earthquakes of Mw 5.5-6.9, each producing at least 8 records within 40 km to the epicenter. The observations were not used in creating the GMPEs under evaluation, so the test was truly prospective and assessed directly the predictive power of the models. The NGA-West 2 GMPEs was found to perform better than older models.
We emphasize two issues of GMPE evaluation that have been less explored in the literature. Firstly, observed ground motions are believed to be correlated, and are modelled to be correlated. Such a correlation should be duly respected in the evaluation. Secondly, the observation can be considered as a realization of some random process, and so the performance metric, whatever it is, is also a random variable. Such uncertainty should be considered when assessing whether one model is better than the other. We handled the data correlation by treating the observed ground motions as one multivariate random variable. We assessed the uncertainty of evaluation by a cluster bootstrap.

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