Capturing geographically-varying uncertainty in earthquake ground motion models

or

What we think we know may change

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Abstract

Our knowledge of earthquake ground motions of engineering significance varies geographically. The prediction of earthquake shaking in parts of the globe with high seismicity and a long history of observations from dense strong-motion networks, such as coastal California, much of Japan and central Italy, should be associated with lower uncertainty than ground-motion models for use in much of the rest of the world, where moderate and large earthquakes occur infrequently and monitoring networks are sparse or only recently installed. This variation in uncertainty, however, is not often captured in the models currently used for seismic hazard assessments, particularly for national or continental-scale studies.

In this theme lecture, firstly I review recent proposals for developing ground-motion logic trees and then I develop and test a new approach for application in Europe. The proposed procedure is based on the backbone approach with scale factors that are derived to account for potential differences between regions. Weights are proposed for each of the logic-tree branches to model large epistemic uncertainty in the absence of local data. When local data is available these weights are updated so that the epistemic uncertainty captured by the logic tree reduces. I argue that this approach is more defensible than a logic tree populated by previously published ground-motion models. It should lead to more stable and robust seismic hazard assessments that capture our doubt over future earthquake shaking.