Assessing the Influence of Epistemic Uncertainties on Earthquake Loss Estimates for California

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Abstract: To aid in setting scientific research priorities, we assess the potential value of removing each of the epistemic uncertainties currently represented in the US Geological Survey California seismic-hazard model, using average annual loss (AAL) as the risk metric of interest. Given all the uncertainties, represented with logic-tree branches, we find a mean AAL of $3.94 billion. The modal value is 17.5% lower than the mean, and there is a 78% chance that the true AAL value is more than 10% away from the mean, and a 5% chance that it is a factor 2.1 greater or lower than the mean. We quantify the extent to which resolving each uncertainty improves the AAL estimate. The most influential branch is one that adds additional epistemic uncertainty to ground motion models, but others are found to be influential as well, such as the rate of M ≥ 5 events throughout the region. We discuss the broader implications of our findings, and note that the time dependence caused by spatiotemporal clustering can be much more influential on AAL than the epistemic uncertainties explored here.

Biography: Edward (Ned) Field has been a research geophysicist with USGS since 2000. He specializes in the development of earthquake-forecast models, which are one of the two main modeling components used in modern seismic-hazard analysis (the other being ground-motion models). His focus area has mainly been California, which due to an abundance of scientific talent and data constraints, has enabled the forging of state-or-the-art methodologies. Ned has led the development of the Third Uniform California Earthquake Rupture Forecast (UCERF3), representing both multi-fault ruptures and spatiotemporal clustering (e.g., aftershocks); the relevance of both these effects was dramatically exemplified in a recent sequence of damaging earthquakes in New Zealand. These forecast models influence a variety of risk mitigation activities, including building codes and catastrophe models used by insurance industry. Important themes he is focused on nowadays include: a better quantification of uncertainties; the use of more physics-based approaches; and the need to add “valuation” to verification and validation protocols. Ned has also led the development of OpenSHA, which is an open-source, and platform-independent computational framework for conducting seismic hazard analysis, which supports loss modeling as well. He is also an active member of the planning committee of the Southern California Earthquake Center.