

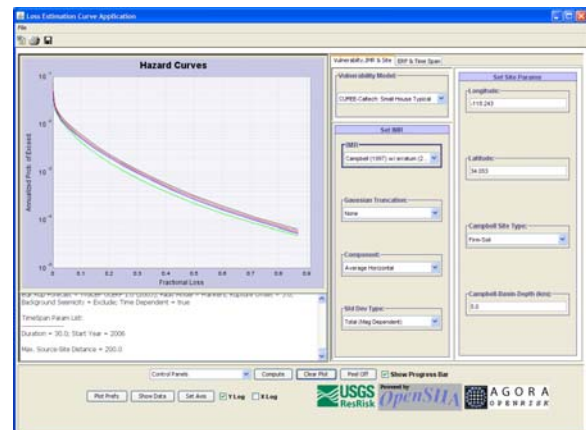
# OpenRisk: Free Open-Source Risk Software

By Keith Porter and Charles Scawthorn



What are the potential impacts of new knowledge in earth science, geotechnical engineering, structural engineering, or social science, in terms of societal risk? How, for example, do next-generation attenuation relationships affect probabilistic societal or insurance loss? Natural-disaster researchers cannot maintain adequate expertise in all of the many domains of natural hazard risk to answer these questions themselves, and partnering with the other disciplines can be time-consuming or prohibitively expensive. To employ commercial risk software by RMS, AIR, or EQECAT is likewise expensive. For many modeling aspects, an outsider cannot insert new knowledge into either the commercial models or public models such as HAZUS-MH. One possible solution to this problem is *OpenRisk*, a small but growing suite of object-oriented, web- and GUI-enabled, open-source, and freely available software code for conducting multihazard risk analysis. The resulting body of code and applications is also referred to as OpenRisk.

OpenRisk extends the capabilities of the open-source seismic hazard analysis software OpenSHA (see [www.opensha.org](http://www.opensha.org)) developed by the US Geological Survey and the Southern California Earthquake Center. OpenSHA's developers encode the state of the art in seismic hazard knowledge as it develops, and is generally 1-2 years ahead of commercial risk software. OpenRisk adds vulnerability and risk capabilities to OpenSHA that enable a researcher to estimate loss-exceedance curves for a single asset, perform benefit-cost analysis for retrofit or other change to a single asset, or calculate expected annualized loss for a portfolio of assets. The researcher can explore the sensitivity of the results to changes in the earthquake rupture forecast, ground-motion prediction equations, site soil conditions, or vulnerability model. In current development is the ability to estimate the loss-exceedance relationship for a portfolio of assets. Another OpenRisk application calculates fragility functions based on empirical damage evidence of various types, and an open-source vulnerability model cracks the "open safe" of the HAZUS-MH vulnerability relationships for repair costs and indoor casualties for 128 combinations of model building type and code era. All the data and software can be downloaded for free from [www.risk-agera.org](http://www.risk-agera.org).



**Single-site loss exceedance curve calculator showing the sensitivity of loss to different ground-motion prediction equations**

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