OR/19/038 Conclusions

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Mosca, I. 2019. Comparing seismic hazard software packages: M3C vs. OpenQuake. *British Geological Survey Internal Report*, OR/19/038.

The present work aimed to compare one of the most recent software packages for PSHA (OpenQuake) with the approach used in the British Geological Survey and encoded in the FORTRAN program M3C. I analyzed the methodology and the IT functionalities of the two codes (Overview of the software packages) and, then run the codes to compare the hazard for the source zone model developed for the UK (Data).

I tested the software packages for 1) the most common GMPE models; 2) magnitude scaling relationships; 3) the treatment of the epistemic uncertainties in the recurrence parameters. In most of the tests, M3C and OpenQuake produce similar results from a visual inspection. When I made a quantitative assessment of their difference, I found that their relative difference Δ is between -0.15 and 0.15 for an annual probability of exceedance higher than 10^{-5} that represents the range of interest for the earthquake engineering (McGuire, 2004[1]). A range of Δ between -0.15 and 0.15 corresponds to a good tolerance level. Discrepancies between the hazard results computed by M3C and OpenQuake are explained by two factors: the different scaling relationship used in the two codes; and the use of GMPEs based on the rupture distance, rather than the Joyner-Boore distance. The fault rupture modelling is sensitive to these two factors.

Based on the results found in the present work, I conclude that the results produced by M3C and OpenQuake are in good agreement. The choice between them depends on: 1) the level of seismicity of the study area; and 2) the number of available processors for hazard calculations. In case of a region with high seismicity, the calculations performed by M3C may become computationally expensive because of a large number of simulated earthquakes for each source zone. OpenQuake becomes efficient and worth using as the number of processors increases.

Future updates of M3C should be in the following directions: implement the 3D modelling of fault rupture also for areal sources, and develop a version of M3C that runs on several processors in order to efficiently use this software also in high seismic regions.

References

1. ↑ MCGUIRE, R K. 2004. *Seismic hazard and risk analysis*. (Oakland CA: Earthquake Engineering Research Institute.)

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