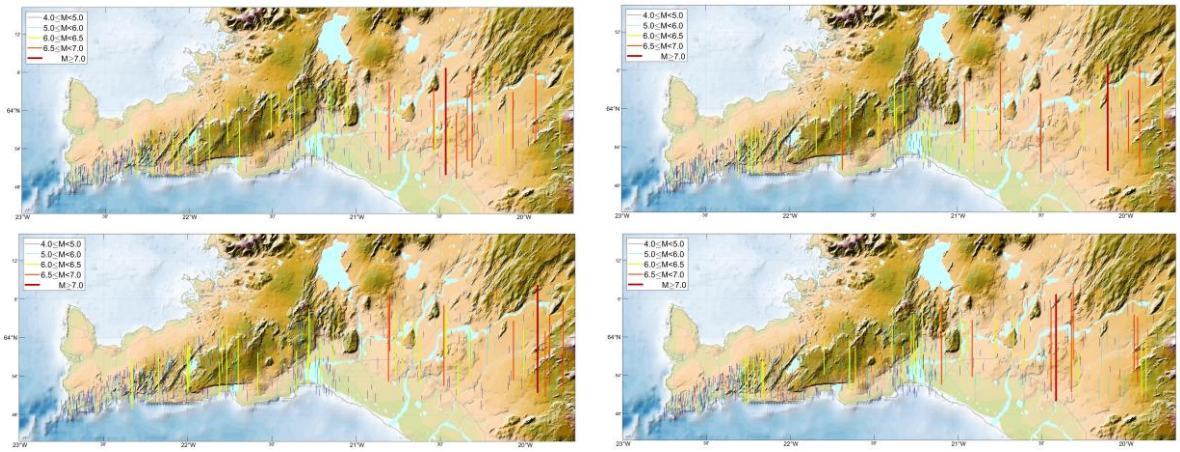
Sensitivity analysis of physics based site specific seismic hazard assessment for all the major towns in Southwest Iceland

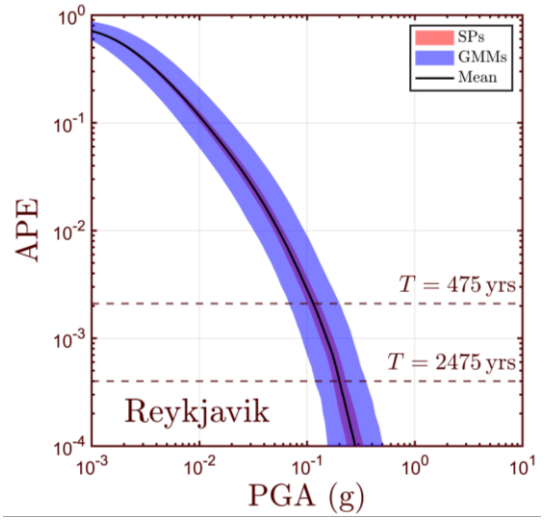
Grant number: 1800-1062

This study improves seismic hazard assessment in Southwest Iceland using a physics-based approach to probabilistic seismic hazard analysis (PSHA). The highest seismic hazard in Iceland occurs in the South Iceland Seismic Zone (SISZ) and the Reykjanes Peninsula Oblique Rift (RPOR), where transform faulting occurs close to densely populated areas, including the Capital Region where about 2/3 of Iceland's population resides. To better represent seismic sources, a physics-based finite-fault system model was developed for the SISZ–RPOR region, calibrated to plate motion and constrained by historical and instrumental seismicity as well as mapped fault geometries. The model represents suites of 3D strike-slip faults with corresponding slip rates, allowing spatially variable magnitude–frequency distributions consistent with observed seismicity. In this regard, synthetic finite-fault earthquake catalogues (FFCATs) were generated using Monte Carlo simulations to represent long-term seismic activity, providing a more realistic alternative to conventional PSHA approaches based on incomplete earthquake catalogues (different realizations of FFCAT shown below).



Different realizations of the FFCAT where the finite-faults are randomly located across the SISZ-RPOR.

These FFCATs were used to perform Monte Carlo PSHA for several cities in Southwest Iceland. Uncertainty and sensitivity analyses were conducted to evaluate the influence of seismic source characterization and ground motion models on hazard estimates. The results indicate that uncertainties associated with ground motion models dominate the overall hazard variability. These results demonstrate that physics-based FFCATs provide a robust framework for seismic hazard assessment in Iceland and highlight the importance of improving ground motion prediction models to reduce uncertainties in future hazard estimates.



The seismic hazard curve for Reykjavik for PGA.

Milad Kowsari
Faculty of Civil and Environmental Engineering, School of Engineering and Natural Sciences, University of Iceland, Reykjavik, Iceland, milad@hi.is