GC11-solidearth-42, updated on 19 May 2024
https://doi.org/10.5194/egusphere-gc11-solidearth-42
Galileo Conference: Solid Earth and Geohazards in the Exascale Era

A first look at the calibration of near-fault motion models to synthetic big data from CyberShake's application to the Southwest Iceland transform zone

Farnaz Bayat[1], Milad Kowsari[1], Otilio Rojas[3], Marisol Monterrubio-Velasco[3], Josep de la Puente[3], and Benedikt Halldorsson[1,2]
[1]Faculty of Civil and Environmental Engineering, School of Engineering and Natural Sciences, University of Iceland, Reykjavik, Iceland
[2]Volcanic activity, earthquakes and deformation dept., Service and research Division, Icelandic Meteorological Office, Reykjavik, Iceland
[3]Barcelona Supercomputing Center (BSC-CNS), Barcelona, Spain

The strongest earthquakes in Iceland take place in its two large transform zones, the largest being up to magnitude 7.1. As a result, the earthquake hazard in Iceland is the highest in the transform zone. The capital region along with multiple small towns are either in close proximity or on top of the Southwest Iceland transform zone. As a result, the seismic risk is the highest in this region. A new physical 3D finite-fault system model has been developed that model strike-slip faulting in the transform zone as occurring on an array of north-south, near-vertical, dextral strike-slip faults and distributed along the entire transform zone with inter-fault distances ranging from 0.5-5 km. It is well-established that for near-vertical strike-slip faults, large-amplitude and long-period velocity pulses are found in the direction parallel and normal to the fault strike, respectively. The former is due to permanent tectonic displacement as a result of fault slip, and the latter is due to directivity effects. While the former is concentrated in close proximity to the fault and in particular the location of largest subevent of slip on the fault, the directivity pulse is found close to the fault ends and further away along the strike direction, either away from one end or both depending on if the fault rupture is uni- or bilateral, respectively. The forward directivity effect is generally considered to be the most damaging feature of the ground motions, particularly for long-period structures in the near-fault region. The recorded near-fault data in Iceland, however, is relatively sparse, making it difficult to accurately capture the physical characteristics of near-fault ground motions. However, in the ChEESE project we have implemented the new 3D finite-fault system into the CyberShake simulation platform and applied in the kinematic rupture modelling and the corresponding ground motion time history simulation. As a result, we have produced a vast dataset of synthetic ground motion time histories for Southwest Iceland. The synthetic dataset now contains near all possible permutations of near-fault effects and will now be parametrized to reveal the scaling of key near-fault ground motion parameters (e.g., amplitude of pseudo-acceleration spectral, peak ground velocity, and the period of the near-fault pulses) associated with the source (fault slip distribution, and fault plane geometry). This parametrization will increase our understanding of near-fault ground motion and allow the development of simple, but physically realistic near-fault GMM that find practical application in physics-based PSHA.