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3D PHYSICS-BASED GROUND MOTION SIMULATION OF THE 2016 KUMAMOTO EQRTHQUAKES

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In this work, a physics-based, source to site, numerical approach is used to simulate important near-fault features in ground motions during 2016 Kumamoto Earthquake sequence occurred in the Kyushu region, Japan. The near-fault area consists of Kumamoto alluvial plain, igneous and volcanic rocks with rupture extended to the South of Mt Aso. Shear wave velocities range from shallow layers having Vs30 of 300m/s to 4500 m/s near the bedrock. The 3D numerical simulation is performed taking advantage of an open-source, high-performance code, SPEED (http://speed.mox.polimi.it/), based on the Discontinuous Galerkin (DG) Spectral Element Method (Mazzieri et al. 2013). DG allows both *h* and *p* adaptivity, which is advantageous when discretizing multi-scale features in the 3D model. SPEED also has advanced capabilities like Dynamic Rupture propagation for source process, non-linear material rheology, frequency-proportional Q factors and Rayleigh damping.

Several studies revealed that amplification factors at several locations could not be justified with linear site response, so local-site effects are accounted for in the simulations by introducing near-surface soft layer. First, we calibrated our model using the data given by blind prediction exercise organizers, i.e., 1D crustal velocity model, finite fault source solution, ground motion records at locations where a linear response is observed. Then we generate ground motions using a non-linear viscoelastic constitutive model for soil. We compare the validity of our simulation by comparing simulated data with the ground motion records at target locations, which will be disclosed by ESG6 committee at the end of the exercise. Also, for the different magnitude of earthquakes, we explore the extent of non-linear effects on the ground motion at different locations. Finally, several rupture scenarios are generated with stochastic slip distributions to study the variability of site-amplifications due to source characteristics, nonlinearity and path effects.

Keywords: 3D physics-based simulations, spectral element method, near-fault ground motion, non-linear site effects

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