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STOCHASTIC FINITE FAULT GROUND MOTION SIMULATION FOR CAMPI FLEGREI VOLCANIC AREA

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Ground motion scenarios due to strong earthquakes which could occur in the volcanic area of Campi Flegrei have been evaluated. The main episodes of sustained and recorded seismicity which stroke Campi Flegrei area occurred during the most important bradiseismic crises, 1982-84, when the soil uplift was accompanied by thousands of local earthquakes characterized by maximum duration magnitude up to 4.0 (maximum MCS Intensity equal to VII). Many efforts have been done in the recent years to asses strong ground motion parameters in volcanic areas by using point source stochastic approach, probabilistic method or GMPEs extensions. The lack of observed seismic data for large historical earthquakes has not allowed a reliable and quantitative evaluation of ground motion and we have followed the idea to simulate large scenario earthquakes based on a well calibrated set of parameters. The simulating method used in this work is the stochastic approaches based on finite fault simulations (Motazedian & Atkinson, 2005) that has been widely applied in the last years in several tectonic settings. The strategy of work has been organized in two stages: (1) *calibration* of input parameters (source, path, site and instrumental parameters) by comparing observed waveforms and synthetic ones in terms of peak amplitude (velocity and/or acceleration) and response spectra; (2) *simulation* of scenarios for strong earthquakes that can occur in the areas of interest.

In relation to calibration (point 1), the simulations were evaluated for 10 local earthquakes ($0.7 \leq M_D \leq 2.2$) that occurred at Campi Flegrei in the period 2000-2012 and are then compared with the observed data in both the frequency and time domain. To follow the stochastic approach, it is necessary to know the models and parameters which includes seismic source (geometry of fault, slip distribution, stress drop, etc.), path and local site effect features. Source features (geometrical parameters, length and width, stress drop, seismic moment) were taken from focal mechanism solutions and source scaling dynamics results that indicate a stress drop range between 5 and 15 bar. The values of seismic moment M_0 were calculated by considering the flat part of seismic spectra in the range between 2-6 Hz. The average frequency-dependent shear waves attenuation relationship estimated for the region was set equal to $Q_S = 27f^{0.6}$. Empirical site effects functions (amplification vs frequency) was taken by published results and high frequency decay "k" parameter was set equal to 0.0015 as evidenced by other analyses. We have chosen to generate 30 simulations for each case, in order to evaluate the comparison between observations and simulations on the base of averaged peak ground motion PGV and response spectra. The calibration procedure confirms the Qs and k parameterization whilst for stress drop we have found average value equal to 7 bars.

Having defined the input parameters setting, we have performed a stochastic simulation for the largest scenario earthquake (point 2). For Campi Flegrei area, using the historical seismic catalogue of Italy (CPTI11, Rovida et al., 2011), we have performed a simulation in terms of PGV for the M_W=5.4 earthquake of 1537 as reported in the catalogue.

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The PGV scenario is characterized by a maximum value equal to 6 cm/s near the epicenter and the distribution of PGV results strongly influenced by source geometrical properties. Finally, in the case of Campi Flegrei area, the stochastic approach has revealed a good tool to calibrate source, path and site parameters/physical quantities but the investigated lowest magnitudes represent a lower limit on which apply the stochastic method as a calibration tool, due to the small size of the source and the strong influence of local site effect in the observed waveforms.

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