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Peak ground displacement attenuation on Mt Etna – Controlling factors and variability of predictions.

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Commonly seismic building codes and hazard assessment are based on peak ground acceleration as key parameter for severity of ground motion. However, its significance for evaluating the damage potential has been increasingly questioned. The conventionally used acceleration based response spectra describe only the elastic response of the structure, thus being only partially relevant for ductile elements (such as steel or concrete). These shortcomings have been tackled by integrating ground displacement as relevant parameters for the assessment of the damaging potential of an earthquake. Following this philosophy structures are designed to absorb energy in the plastic range which is entered during strong earthquakes. At the same time it has been noticed that eigen frequencies of structures decrease when their behaviour in the plastic range is considered.

Recent damaging events recorded on Mt Etna (i. e., the events on 27^{th} and 29^{th} October, 2002, Ml=4.8 and 4.5, respectively) were particularly rich in low frequencies though being of rather modest magnitude, which underscores the importance of displacement based parameters for the assessment of the damaging potential of Mt Etna earthquakes. On the other hand, the recent efforts of the INGV with respect to the installation of permanent broad band stations on Mt Etna and adjacent areas have disclosed the possibility of an analysis of the low frequency content of seismic signals. In this study we focus on the attenuation of peak ground displacement of Mt Etna earthquakes occurring in the years 2004 to 2006. The empirically obtained laws predict a definitely more rapid amplitude decrease for the region around Mt. Etna than generally reported for major earthquakes in Italy.

Synthetic studies have been carried out in order to investigate on the controlling factors

of peak ground displacement attenuation. A further scope of the simulations is an assessment of the variability caused by factors such as the depth, distribution of foci, azimuth source-receiver, and magnitudes (i. e., frequency content of the signal). The synthetic simulations for selected, well documented events show a reasonable match of predicted and observed decay laws. From the synthetic simulations we also obtain a considerable dispersion of calculated ground displacements at given distances. On the other hand our simulated amplitude decay laws tend towards the laws obtained for the major earthquakes in Italy when larger magnitudes for Mt Etna events are used. The observed attenuation for single events on Mt. Etna with dominating low frequencies (< 0.5 Hz) is a further evidence for the frequency dependence of the ground displacement decay laws.