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Peak ground motion attenuation relationship at Mount Etna volcano (Italy)

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The attenuation relationship is an essential and crucial piece of information for the performance of a probabilistic seismic hazard analysis. Besides the classical peak ground acceleration, the estimation of peak ground displacement, representing the low frequency content of the seismic signal, has gained increasing importance for engineering seismology purposes. On the other hand, recent damaging events on Mt. Etna, such as the Santa-Venerina earthquake occurred on October 29, 2002, show indeed surprisingly high spectral amplitudes at frequencies as low as 0.3 Hz, despite their moderate magnitudes (ML$<$4.5). In this study we developed ground motion attenuation relationships suitable for Mt Etna volcano by using earthquakes recorded in the time span October 2003 - January 2006 at the broad-band stations of the seismic network managed by the Istituto Nazionale di Geofisica e Vulcanologia. About 80 events with ML$>$2.5, for a total of more than 600 three-component waveforms, were selected for the analysis. Particular attention was devoted to the data pre-processing, which was designed with respect to both needs of truly representing the low frequency content of small magnitude earthquakes and avoiding instabilities due to the presence of disturbances (such as sea microseism, volcanogenic signals and instrumental noise). Decay laws for the peak ground displacements were obtained first by using earthquakes for which enough data were available to cover a wide interval of distances. We also exploited the rich material for which the covered interval of distance was short, estimating "local" coefficient of decay referenced to the average distance. Synthetic studies are proposed for well documented events, which may help to understand the controlling factors of the attenuation of seismic signal parameters and its intrinsic variability deriving from the physical characteristics of the seismic source and wave propagation.