The effect of Volcanic Landscape on Seismic Hazard Assessment: The case of the Santorini caldera and the 2011-2012 volcanic unrest

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While various aspects of the volcanic landscape are widely studied by a variety of scientists, its role and effect on seismic hazard assessment are usually not considered. However, the effect of topography on seismic motions has been demonstrated both theoretically and experimentally, hence it is natural that the landscape morphology effect on seismic motions should be carefully examined, especially in volcanoes with strongly varying morphological features (e.g. caldera systems, etc.). In this work, we examine the example of the Santorini caldera system, stimulated by the recent 2011-2012 volcanic crisis and the related seismic activity of the Santorini volcano, which have raised the levels of public awareness and pointed out the need for a quantified assessment of the contribution of the landscape effect, as well as other factors, on seismic motions.

Strong evidence is presented from previous earthquakes which occurred in the broader Santorini area (e.g. the 9 July, 1956 Amorgos event, M7.5) that the local landscape topography, especially the intra-caldera steep slopes, has amplified ground motions up to a factor of two. For the simulations we employ a stochastic method for producing seismic synthetic waveforms for typical seismic scenarios in order to study the strong ground motion variability on the Santorini island. The simulations take into account the activated seismic fault along the Kameni line, considering different activation scenarios, using a dense grid of virtual receivers that cover the study area. Topographic aggravation effects are included using various approaches and the expected impact on the resulting damage assessment in Santorini is examined.