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A new 3D attenuation model for the southern Aegean subduction zone: Implications for the ground-motion prediction equations of intermediate earthquakes.

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We employ a new 3D anelastic attenuation model estimated for both P and S waves (Qp and Qs) by Ventouzi et al. (2015), as well as peak-value ground motion-prediction equations proposed by Skarlatoudis et al. (2013) in order to simulate intermediate events occurring in S. Aegean area using a stochastic model for the simulations. A typical application example of the proposed methodology is presented for the case of the Mw=5.0 intermediate depth event which occurred near the island of Nisyros, Dodecanese Islands, S. Aegean on July 25, 2015. The 3D attenuation model used for the S. Aegean area is determined by the tomographic inversion of attenuation times, t*, calculated for body waves using the slope of the acceleration spectra of waveforms, assuming an $\omega 2$ source model. The waveforms used have been recorded by a large amphibian temporary seismological network that was in operation in the broader Aegean area during 2005-2007, as well as recordings from the CYCNET network operated in the Cyclades region during 2002-2005.

Stochastic simulations of the strong ground motion were calculated by adopting the new 3D attenuation model obtained for both P and S waves (Qp and Qs) for the recent M=5.0, 2015 Nisyros earthquake, by applying the stochastic finite-fault modelling approach of Motazedian and Atkinson (2005), as revised by Boore (2009). The attenuation model for the S-wave simulations is determined of the basis of the results of Skarlatoudis et al. (2013), while the attenuation model for the P-wave simulations was estimated using the ratio of Qp/Qs defined by the 3D anelastic attenuation model of the tomographic inversion. For the S-wave durations the part of the seismograms starting from the S-arrivals and ending at the 95%-energy limit of the Husid plots (Husid, 1969) was used. In order to estimate appropriate values for the duration of P-waves, automatically picked P and S durations on the available seismograms were used. After appropriate calibration of all parameters involved in the simulations (fault position, fault strike and dip, etc.) separate stochastic waveforms for both P- and S-waves were performed. Final synthetics were produced using a time shifting according to the results from Ventouzi et al. (2013), who determined the estimated arrival times of both P and S waves as a function of epicentral distance for event groups of different focal depths. The results obtained in the present study (simulated Fourier spectra and time series) are in good agreement with the observed ground motions (PGA), for both back-arc and along-arc stations.