1. Abstract

We analyzed the P- and S-wave displacement spectra of 700 microearthquakes in the moment range $10^{14}$ – $10^{16}$ Nm recorded at the dense, wide-dynamic range, seismic networks (IPSNet, Ingegneria Seismica Nazionale, INGV, and Istituto Nazionale di Geofisica e Vulcanologia, INGV) operating in southern Apennines (Italy). Source parameters are estimated by a multiphase inversion algorithm which combines with a multi-stage, non-linear inversion strategy. Estimates of the attenuation parameter $t^{*} = $ T/Q are obtained from the spectral decay of small microearthquakes below the corner frequency, and from the inversion of displacement spectra of relatively larger magnitude events. A Qs/Qp greater than 1 is found in some of the Seismograms and a peak in source-to-site attenuation is observed. The seismic radiation in the moment range $10^{14}$ – $10^{16}$ Nm is higher than predicted value being inferred from the analysis of the larger earthquakes. A Q-model of the seismic source is proposed for modeling the path attenuation effect in the investigated area. We estimate a crustal Qs higher than Qp and a 1.5 > Qp/Qs > 1 in a saturated medium embedding the Irpinia fault zone, down to crustal depths of 15-20 km. The corner frequencies obtained by using the spectral model correspond to the model obtained by using the expected value for q=10.9. The comparison between corrected and uncorrected displacement spectra demonstrates the effectiveness of the static and site terms/factors. For events with ML > 4.5, the seismic moment and $t^{*}$ coefficient are obtained by a technique which estimates the stress drop and the ratio apparent to static stress drop ratio (Savage-Wood seismic efficiency) is relatively high (0.5), indicating that the radiated energy is a very large fraction of the sum of energies spent by friction and fracture development. Seismic efficiency appears to be higher in the same depth range where high P/Vp and Qp values are also observed. This suggests that dynamic weakening driven by crustal fluid pressure is the most plausible mechanism of source attenuation for microearthquakes ruptures along the studied fault zone.

2. Seismic network, data processing and acquisition

For the spectral analysis, we have chosen magnitude-dependent frequency bands, by using the median at higher frequencies and the intercept at lower frequencies. By taking into account the overall site response curves for INGV and IPSNet stations, we determined the whole frequency band and site response, indicating that the whole frequency band and site response were larger in the southern part of the study area. The corner frequencies estimated for each station define the seismic source type and data transfer transfer factors.

3. Iterative, multi-step inverse of P and S displacement spectra

4. Results

5. Conclusions