



## **An Study of S-wave Attenuation using records from the 20 May, 2012 Emilia Earthquake, Italy and the Main Aftershocks**

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We analyze the  $S$ -wave spectral amplitude decay with distance using strong-motion records from the 20 May 2012 Emilia-Romagna earthquake ( $M_w$  6.1) and five aftershocks with magnitudes ranging between 4.9 and 5.9. The data set consist of 6 earthquakes, 44 stations and 248 records with hypocentral distances in the range  $10 < r < 100$  km. We rotated the accelerograms to calculate transversal and radial components of the acceleration spectrum. We found nonparametric attenuation functions that describe the spectral amplitude decay of  $SH$  and  $SV$  waves with distance at 60 different frequencies between 0.1 and 40 Hz. These attenuation functions provide an estimate of the quality factor  $Q$  at each frequency analyzed. Assuming that geometrical spreading is  $1/r$  for  $r \leq r_x$  and  $1/(r_x r)^{0.5}$  for  $r > r_x$  with  $r_x = 60$  km and normalizing at 15 km (the recording distance where the attenuation functions start to decay), we find that the average  $Q$  for  $SH$  waves can be approximated by  $Q_{SH} = 82f^{1.2}$  and by  $Q_{SV} = 79f^{1.2}$  for  $SV$  waves in the frequency range  $0.10 \leq f \leq 10.7$  Hz. At higher frequencies,  $11.8 \leq f \leq 40$  Hz, the frequency dependence of  $Q$  weakens and is approximated by  $Q_{SH} = 301f^{0.36}$  and  $Q_{SV} = 384f^{0.28}$ . These results indicate that the  $S$ -wave attenuation is isotropic at local distances in the epicenter area. The estimates of total  $Q$  obtained (intrinsic and scattering attenuation) coincide with the estimates of total  $Q$  determined by Del Pezzo *et al.* (2011) in north central Italy using coda waves and Multiple Lapse Time Window Analysis (MLTWA).