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On the uncertainty of kappa (κ) estimates in boreholes

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The amplitude of the Fourier acceleration spectrum decays rapidly at high frequencies. This has been modeled by the parameter κr (Anderson and Hough, 1984). The site-specific component of κr, named κ0, describes the contribution of the first few km of the geological profile beneath a certain site. κ0 is an important parameter in characterizing high-frequency ground motion, crucial for certain structures such as nuclear facilities and small concrete dams. Large scatter has been observed in the values of κ0 published in literature, which may be due to different analysts (Douglas et al., 2010), or to differences in the approaches and frequency bands used for its estimation, and the different regions data may come from (Ktenidou et al., 2014, 2015).
We focus of two major European vertical arrays, EUROSEISTEST (Northern Greece) and CORSSA (Corinth Gulf), both installed in basins. We compute individual κr values for the surface and downhole stations. For each event recorded by each array, the difference between the surface and downhole κr values represents an estimate of the site-specific κ0 value of the soil column between the sensor ($\Delta\kappa$0). This approach eliminates the effect of the attenuation along the path without making assumptions as to the regional Q. The record-specific error of each κr value is usually not considered when deriving site-specific κ0 values. We compute record-specific errors and then average $\Delta\kappa$0 values for each site considering these individual errors. We find that the error in the $\Delta\kappa$0 values is large and may indeed exceed the value of $\Delta\kappa$0. This indicates the need for several recordings when computing site-specific κ0.