

Ground motion forecasting using a reference station and complex site response functions accounting for the shallow geology

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The distribution of damages due to recent earthquakes has shown that the effects of shallow geological structures on the level of ground shaking represent an important factor in engineering seismology. Whereas many previous studies have estimated local site amplification factors in the frequency domain, their application to the real-time modelling and forecasting of ground motion is not yet fully established. Here we present a method for the real-time correction of frequency-dependent site response factors. The method does not only account for the modulus, but also for the changes in the signal phase related to local site conditions. The transformation of the complex standard spectral ratios to a causal recursive filter in the time domain allows for the forecasting of the waveforms for soft soil sites almost in real time when the signal is recorded at a reference site. When considering travel time differences of the various seismic phases between the hypocentre and the studied sites, the level of ground motion at soft soil sites with respect to arrival time, energy, duration and frequency content can be well constrained, even in cases of a high spatial variability of the amplification patterns.