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Evidence of soil non-linearity at strong motion station sites in Turkey

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We look for evidence of soil non-linearity in the strong-motion data from the 1999 Kocaeli, Turkey earthquake. Soil amplification is considered for the soil sites by simulating time histories with linear soil amplification assumption and by comparing real and simulated records. Simulations are based on the computer code FINSIM (Beresnev and Atkinson, 1998) for synthesizing stochastic acceleration time histories from finite faults. First, a calibration for the prediction technique is made for the rock site stations (NEHRP B and C site classes) to come up with a source model with a minimum bias. Then, ground motion at soil site stations (NEHRP D and E site classes) are simulated with the calibrated source model, assuming linear soil response. Linear soil amplification is incorporated using two different approaches: in the form of frequency and site dependent soil amplification functions found using the quarterwavelength approximation (Boore and Joyner-1997); and by conducting site specific 1-D linear response analysis using EERA (Bardet, Ichii and Lin - 2000), that conducts equivalent-linear earthquake site response analysis of layered soil deposits. We choose only stations with existing S-wave velocity profiles determined from previously performed array microtremor and/or SASW studies. The model bias between recorded and simulated accelerations is taken as a measure of soil nonlinearity. Non-linear 1-D soil response is calculated using NERA (Bardet and Tobita - 2001) and the results are compared with recorded data.