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# Discussion of the paper 'An empirical attenuation relationship for Northwestern Turkey ground motion using a random effects approach'

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Ozbey et al. [1] have worked out a new attenuation relationship applicable to northwestern Turkey based on recent ground motion data recorded during the 1999 Turkey earthquakes and a few of their following events. Because of our own work along similar lines [2,3] we believe the evolution of ground motion predictions for the same or similar regions is of interest even though our own models are intended to be applicable to the whole of Turkey.

Ground motion predictions based on records made in Turkey are affected by two influences. One is the relative uncertainty that shrouds the local site character. A good many sites do not have borehole or other data to establish their local site descriptor. The other is the interference from the buildings where the sensor may have been placed. In spite of these shortcomings, we have utilized available data from 47 stations that recorded 93 horizontal components during 19 distinct events to report prediction expressions in [2]. We have now updated this study by considering 57 earthquakes during 1976–2003 containing 112 records with 223 horizontal acceleration time series, to be reported in [3]. In 1999, Kocaeli earthquake data comprises 46 and 35% of our database assembled in [2,3], respectively. Ozbey et al. is based on 17 earthquakes that occurred within a one-year time window from August 17, 1999, with eight of them (Events No: 6,7,8,12,13,15,16 and 17 in Table 1 of Ref. [1]) are aftershocks from M7.4 Kocaeli EQ. and M7.2 Duzce EQ. mainshocks. Given the time of occurrence whether the remaining seven events can be considered as distinct is debatable. Most of the aftershock recordings associated with the two major 1999 events in Turkey were affected by highly nonlinear soil behavior in the close vicinity of the recording stations due to the mainshocks [4,5]. That may produce additional uncertainties to the records when classified under same geological descriptor. Owing to the fact that probabilistic seismic hazard analysis (PSHA) is intended to evaluate the hazard from discrete independent releases of seismic energy [7], and the purpose of an attenuation relationship is to serve the PSHA in the accomplishment of its mission, aftershock records were intentionally excluded in [2,3] in contrast to Ozbey et al.

The 27 vs. 1-year long time windows in the datasets are reflected in the magnitude distributions of the events that have been considered. Our data set contains events with magnitudes distributed more evenly in the range M4–7.4 (Fig. 2 of Kalkan/Gülkan [3] is inserted as Fig. 1(a)) whereas Ozbey et al. consider events that are deficient in the important range M5.8–7.2. This might constitute a more debilitating effect on the predictive power of the expressions than is provided by considerations of fixed vs. inter- or intra-event variability. Whatever the cause, the error terms are comparable (Fig. 2), but there exist systematic and major differences in the PGA or spectral acceleration predictions that the two sets of calculations provide, especially for magnitudes in the M5–6 range. We show these in Fig. 3 for PGA for M7.5 and M5.5 events for matching site

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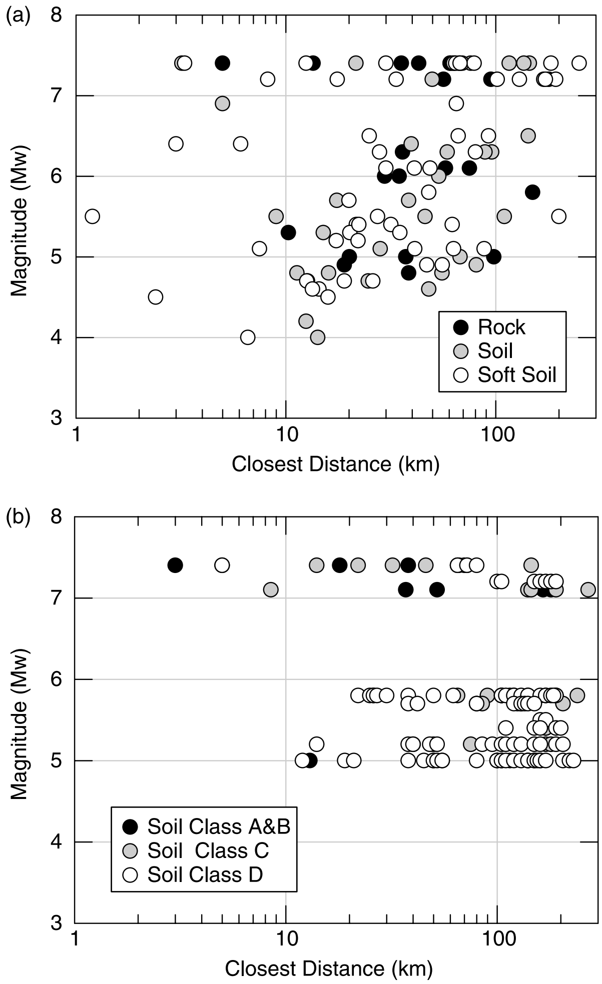


Fig. 1. Distribution of records in terms of moment magnitude and closest distance (a) Kalkan/Gulkan (3), (b) Ozbey et al. [1].

descriptions. Fig. 4 shows the differences in the predicted response spectra for M7.4, M6.5 and M5.5. Also shown in this figure are the predictions by Boore et al. [6]. These curves are reminders that data sets used for prediction equations have the greatest effect on the outcome, and

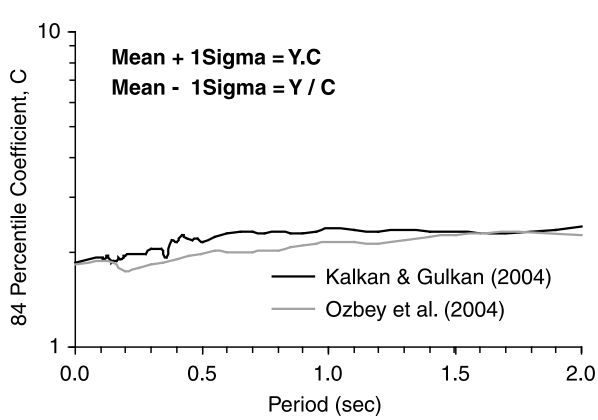


Fig. 2. Comparison of 16 and 84-percentile error terms at each spectral period (*Y stands for horizontal spectral acceleration*).

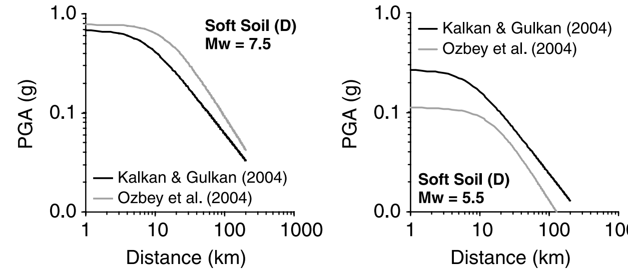


Fig. 3. Attenuation of PGA based on two models for M7.5 and M5.5 earthquakes (*Soft-soil = Soil Class D*).

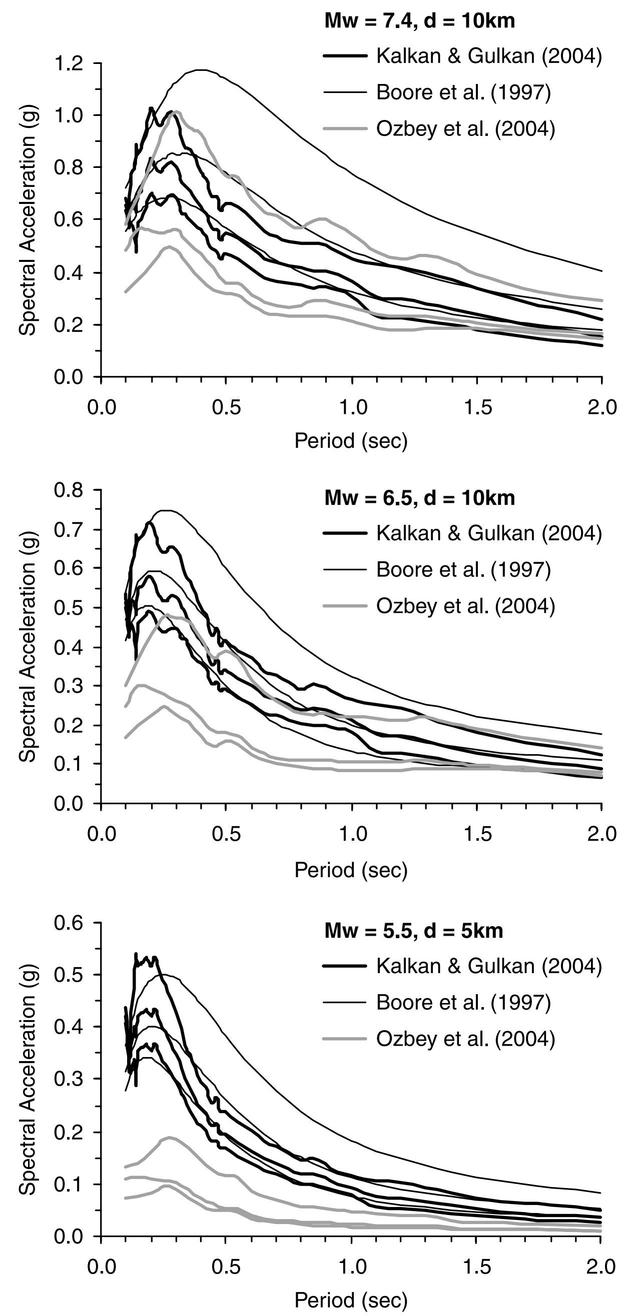


Fig. 4. Comparisons of prediction of response spectra for various distances and magnitudes (*Note that curves are in descending order for soft-soil, soil and rock*).

overwhelm the marginal statistical subtleties they may be found to contain.

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