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The evaluation of seismic site effects in the Yalova province of western Turkey by seismic, microtremor array, and remote sensing methods

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The Yalova Province of western Turkey suffered a high level structural damage during the 1999 İzmit earthquake. We carry out integrated geophysical, geological and remote sensing survey methods to investigate local site effects and evaluate associated seismic hazard for the Yalova Province. For this purpose, the existing seismological, geological, and space imagery data have been compiled under a GIS system in digital form to provide on-line information on the seismotectonics and related active faulting for the study are. Five sites, which showed varying levels of structural damage, were selected on the basis of geological and remote sensing imagery data to study in detail by geophysical surveys carried out in October 2004. We use seismic refraction surveys to obtain shallow sub-surface (down to 30-50 meters) velocity structure information on both P and S-wave velocities at these sites. A six-cartridge, 12 gauge buffalo gun was used to provide seismic energy for seismic refraction measurements. This energy source has been sufficient to generate clear first arrival signals out to 200m offsets. First arrival travel time modeling method is used to evaluate the seismic refraction data. The Microtremor Array Measurement (MAM) data are collected to derive S-wave velocity information on the deeper part of the structure (1-2 km depth range). The MAM data were collected by using a 26-station array with 1Hz vertical velocity sensors forming four separate circles with radius of 50, 100, 200, and 400 meters. This data are analyzed by the SPAC method to derive detailed S-wave velocity information. We present results obtained from the combined analysis of seismic

refraction and MAM data and discuss the applicability of such joint methods for site effect investigations.