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Effects of Poisson Ratio and Density Values on V_S Profiles and V_{S30} Derived from Noninvasive Geophysical Techniques

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We present analyses of data collected from 31 seismographic station sites measured by non-invasive, passive- and active-source, and body- and surface-wave techniques, including: Microtremor Array Methods (MAM), Multi-channel Analysis of Surface Waves (MASW; Rayleigh and Love waves), Spectral Analysis of Surface Waves (SASW), Refraction Microtremor (ReMi), and P- and S-wave refraction tomography. Depending on the apparent geologic or seismic complexity of the site, field crews applied one or a combination of these methods to estimate the shear-wave velocity (V_S) profile and calculate V_{S30}. We study the inter- and intra-method variability of V_S and V_{S30} at each seismographic station where more than one technique was applied. For each site, we find both inter- and intra-method variability in V_{S30} remain insignificant (5–10% difference) despite substantial variability observed in the V_S profiles. We also find that reliable V_S profiles are best developed using a combination of techniques, e.g., surface-wave V_S profiles correlated against P-wave tomography to constrain Poisson's ratio and density, which are typical depth-dependent parameters used in modeling V_S profiles. Initial tests on synthetic data indicate V_{S30} can vary by as much as 20% when the assigned Poisson's ratio varies between 0.1 and 0.495 (dry soil to saturated cohesive soil). When using the same tests on observed data, we find that V_{S30} values vary as much as 30%, demonstrating that it is important to constrain the depth of high Poisson's ratio for saturated soils. We vary density within the realistic range of 1.7–2.0 g/cm^3 (dry soil) in our tests and find V_{S30} values vary only by a few percent.