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Imaging the crustal structure of the valley of Mexico and higher mode identification using H/V spectral ratio

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We reconstruct Rayleigh and Love waves from cross-correlations of ambient seismic noise recorded at 19 broad-band stations of the MesoAmerica Seismic Experiment (MASE) and Valley of Mexico Experiment (VMEX). The cross-correlations are computed over 2 years of noise records for the 8 MASE stations and over 1 year for the 11 VMEX stations. We use surface waves with sufficient signal-to-noise ratio to measure group velocity dispersion curves at period of 0.5 to 3 seconds. For paths within the soft quaternary sediments basin, the maximum energy is observed at velocity higher than expected for the fundamental mode. This observation suggests the importance of higher modes as the main vectors of energy in such complex structures. To perform a reliable inversion of the velocity structure beneath the valley, an identification of these dominants modes is required. To identify the modes of surface waves we use the spectral ratio of the horizontal components over the vertical component (H/V) measured on seismic coda. We compare the observed values with the theoretical H/V for the velocity model deduced from surface wave dispersion when assuming a particular mode. H/V ratio in the coda is computed under the hypothesis of equipartition of a diffuse field in a layered medium following Margerin et al. [2009] and Sánchez-Sesma et al. [2011]. We processed several events to ensure that the observed H/V is stable. The comparison of the modelled dispersion and H/V ratio allows for mode identification, and consequently to recover the velocity model of the structure. We conclude on the predominance of higher modes in our observations. The excitation of higher modes is key element of explanation for the long duration and amplification of the seismic signals observed in the Valley of Mexico.