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Surface-Wave Propagation Modes in the Valley of Mexico: Insights from Realistic 3D Earthquake Simulations

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(Invited Talk)

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By means of a parallel hp-adaptive scheme based on the discontinuous Galerkin (DG) finite-element method (Etienne et al., 2010; Tago et al., 2012) we simulate wave propagation in a 3D viscoelastic basin model of the Valley of Mexico. The model is 90 x 80 x 45 km^3 and includes both the surface topography (with elevation differences of ~3,000 m) and the intricate 3D geometry of the sedimentary layers. The medium is discretized with an adaptive tetrahedral mesh where the elements size and interpolation orders are locally adapted to the elastic properties (i.e. to the minimum wavelength) (hp-adaptivity). A large set of earthquake simulations for local events show that: (1) sustained surface-wave trains are generated in the basin edges; (2) first-overtone modes dominates their propagation in shallow regions of the basin (i.e. less than ~200 m thick, where most damages concentrated for past earthquakes); and (3) the large intrinsic attenuation of the uppermost layers (compressible clays with ~50 m thick) is responsible for this propagation regime. Our results are in accordance with borehole seismological observations and provide physical insights to better understand the long duration of ground motions in the Valley of Mexico.

References:

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