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Homogenization and implementation of a 3D regional velocity model in Mexico for its application in moment tensor inversion of intermediate-magnitude earthquakes

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Moment tensor inversions for intermediate and small earthquakes (M. < 4.5) are challenging as they principally excite relatively short period seismic waves that interact strongly with local heterogeneities. Incorporating detailed regional 3D velocity models permits obtaining realistic synthetic seismograms and recover the seismic source parameters these smaller events.

Two 3D regional velocity models have recently been developed for Mexico, using surface waves and seismic noise tomography (Spica et al., 2016; Gaite et al., 2015), which could be used to model the waveforms of intermediate magnitud earthquakes in this region. Such models are parameterized as layered velocity profiles and for some of the profiles, the velocity difference between two layers are considerable. The "jump" in velocities between two layers is inconvenient for some methods and algorithms that calculate synthetic waveforms, in particular for the method that we are using, the spectral element method (SPECFEM3D GLOBE, Komatitsch y Tromp, 2000), when the mesh does not follow the layer boundaries. In order to make the velocity models more easily implementec in SPECFEM3D GLOBE it is neccesary to apply a homogenization algorithm (Capdeville et al., 2015) such that the (now anisotropic) layer velocities are smoothly varying with depth.

In this work, we apply a homogenization algorithm to the regional velocity models in México for implementing them in SPECFEM3D GLOBE, calculate synthetic waveforms for intermediate-magnitude earthquakes in México and invert them for the seismic moment tensor.