<u>3-D seismic imaging of the D" region beneath the Cocos Plate</u>

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The ***3-D velocity structure of the deep mantle*** has been recently inferred from imaging procedures such as migration, tomography, stacking, and waveform modeling, all which utilize localized 1-D reference structures. As these methods often have limiting assumptions it is essential to assess to what extent 3-D solution models are self-consistent with the imaging procedures from which they were produced; this is possible through synthesizing waveforms in laterally varying media. We use a ***3-D axi-symmetric finite difference algorithm*** to model ***SH-wave propagation*** through cross-sections of recent 2- and 3-D lower mantle models along a north-south corridor roughly 700 km in length beneath the Cocos Plate. Synthetic seismograms with ***dominant periods up to 3 sec*** are computed to assess fit of 3-D model predictions to data. Models considered include: (1) a ***D" reflector*** 264 km above the CMB with varying S-wave velocity increases of 0.9% to 2.6% by Lay et al., [2004] obtained using a double-array stacking method; (2) an ***undulating D" reflector*** with large topography obtained using a migration method by Thomas et al., [2004]; (3) cross-sections through the mantle shear ***velocity tomography model*** TXBW of Grand [2002]; and (4) cross-sections through a regional lower mantle shear wave tomography model based on finite frequency kernels from Hung et al., [2004]. Model predictions show strong waveform variability. We apply ***double-array stacking*** to synthetics to assess recovery of starting model D" discontinuity depths and also demonstrate the ***tradeoff between D" topography and velocity heterogeneity***. We compare synthetics of these models to each other as well as to high quality broadband observations. The dependencies of waveform features on the various scale lengths of structures in the different models tested are also explored.