Title: The spatial sensitivity of teleseismic Sp converted waves

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Abstract: We characterize the spatial sensitivity of teleseismic Sp converted waves to improve constraints on lateral variations of uppermost-mantle velocity gradients, such as the lithosphere-asthenosphere boundary and the mid-lithospheric discontinuities. We use SPECFEM to generate 2-D scattering kernels that relate perturbations from an elastic halfspace to Sp waveforms. We show that these kernels can be well approximated using a computationally efficient ray-theoretical approach. Subroutines are then developed to calculate kernels for layered background models. As proof-of-concept, we show that lateral variations in uppermost-mantle discontinuity structure can be retrieved by implementing these scattering kernels within the first iteration of a conjugate-directions inversion algorithm. We evaluate the performance of this technique on synthetic seismograms computed for 2-D models with undulations on the lithosphere-asthenosphere boundary of varying amplitude, wavelength, and depth. The minimum station spacing required to produce unaliased images is 5 km, but the application of a Gaussian filter can improve results in cases where station spacing is greater without introducing sidelobe artifacts. Finally, we discuss prospects in applying this method to array datasets.