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Finite-frequency global tomography of surface waves including mode coupling

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In recent years, seismic velocity models of the mantle have been created using combinations of long period surface-wave dispersion data, teleseismic body waveforms and travel times, and normal modes. Most models are based on ray-theoretical methods to minimize the computational burden. Although the large-scale features are robustly determined, finite-frequency theory is needed to resolve smaller structure at the Fresnel zone scale. It is our ultimate goal to incorporate finite-frequency theory into the tomographic solution for all data types. In this presentation we will focus on the influence of finite-frequency effects on the Rayleigh wave tomography. We use the updated van Heijst and Woodhouse (1999) Rayleigh wave phase-velocity dispersion data set which contains 20 million measurements of minor- and major-arc fundamental mode and higher-mode dispersion data. We compute isotropic shear wave velocity perturbations to the isotropic PREM reference model, using wavelets to compress the size of the tomographic problem. We analyze the differences in the tomographic solutions between models that do and do not account for phase conversion and mode coupling during scattering, which is known to occur at shorter periods. We show our wavelet approach and discuss the implications of our results on future finite-frequency tomographic problems based on combined data sets.