Global Multi-Resolution Models of Surface Wave Propagation: the Effects of Scattering.

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How relevant are finite-frequency (i.e., scattering, banana-doughnut...) effects in seismic tomography? We derive tomographic maps of surface wave phase velocity at periods between 35-150 s, accounting for scattering via the Born approximation; maps are parameterized in terms of a grid of pixels of non-uniform density, higher within chosen regions of interest (including, alternatively, North America or the Mediterranean Basin). We compare our finite-frequency maps against ray-theoretical ones derived from the same data and with the same parameterization and regularization; this comparison should help determining to what extent the improvement in theory (from rays to finite-frequency kernels) leads to an improvement in model quality. A similar comparison had been attempted by other authors, using a degree-40 spherical harmonic parameterization; but a parameterization of higher nominal resolution, like ours, is more adequate to reproduce improvements in the effective resolution of the models. In addition to analyzing seismic data by tomography, we test the accuracy of linearized scattering theory, in the forward problem, by comparison with finite-differences calculations on an infinitely thin membrane. Finite-frequency effects should be particularly important at surface-wave periods (intermediate to long), where the Fresnel zone of waves becomes larger; moreover, the propagation of surface waves at a given frequency is a purely two-dimensional problem (as opposed to body waves), and its numerical solution is therefore relatively cheap; for both reasons, the study of surface wave propagation at a given frequency is a covenient scenario to learn more about the general nature of finite-frequency effects.