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Elastic energy transfer from non-isotropic sources below a free surface

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Records of local earthquakes are very different at different stations even at similar distances. Not only the ratio of direct P- and S-wave amplitudes varies, also the shape of P- and S-coda shows significant variations. We use elastic Radiative Transfer Theory (RTT) to model full seismogram envelopes of local earthquakes. The crust is described by a random medium with statistical fluctuations of wave velocities and density around constant background values. The energy field is excited by a non-isotropic source corresponding to the radiation of a point shear fracture. Energy transfer through the elastic medium is modeled with a Monte-Carlo technique that takes into account non-isotropic scattering and conversions between P- and S-modes. Approximating the earth's surface with a plane our simulation also models reflections and conversions that occur when a wave encounters the surface. We show simulations with varying source orientation to demonstrate its influence on the shape of the coda. Conversions at the surface are observed to alter the shape of the P-coda whereas the effect on the late S-coda is minor. The improvements that are achieved as compared to modeling with isotropic source and neglecting surface conversions are discussed by means of a data example.