Geophysical Research Abstracts, Vol. 9, 04047, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-04047

Complete vector-wave envelopes in 3D random media based on radiative transfer theory and with Born scattering coefficients

J. Przybilla, **M. Korn**

Institut für Geophysik und Geologie, Universität Leipzig, Germany

(mikorn@uni-leipzig.de)

Radiative transfer theory (RTT) describes energy transport through random heterogeneous Earth medium. It is frequently used to simulate observed mean square (MS) envelopes of high-frequency seismic waves. Unlike other theories, like Markov approximation, RTT is capable of simulating complete envelopes from the first P-wave onset until the late S coda. So far, mostly acoustic and/or isotropic scattering approximations have been used. Here, we present Monte Carlo solutions of the full elastic energy transport equations including direction dependent and conversion scattering. Individual scattering interactions are described by the coefficients obtained from the Born single-scattering approximation. Simulated envelope shapes for a pure P-wave source in unlimited random medium are compared to (1) vector-wave Markov envelopes in Gaussian media for small lapse times, and (2) average envelopes obtained from full 3D wave field modelling with a FD method. In general, envelope shapes agree well for a range of random medium parameters. Pulse broadening and peak amplitude delay are consistent between all methods, if one includes the wandering effect known from the parabolic wave equation into RTT. From the FD modeling we note that even by a pure compressional source some amount of shear wave energy is generated by the random heterogeneities near the source. This effect is not present in RTT or Markov approximation.

We conclude that RTT correctly models complete vector-wave envelopes for a wide range of scattering parameters, although Monte Carlo solutions become cumbersome in the regime of strong forward scattering.