Radiative transfer equation for surface and body waves

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Abstract: The motivation of this talk is to study the propagation of seismic waves in Earth's crust and to derive a radiative transfer equation that accounts for body and surface waves and multiple scattering by heterogeneities. The model considered in this talk is an acoustic wave equation in a randomly heterogeneous two-dimensional half-space with reflecting boundary conditions and with a thin layer near the surface. There are two types of modes that can propagate: those that are almost trapped in the thin layer, and thus model surface waves, and those that penetrate deep into the medium, and thus model body waves. We show how the wave becomes incoherent (its mean goes to zero) while the incoherent wave fluctuations can be described by a radiative transfer equation satisfied by the mean Wigner transform of the wave field. We describe some properties of the radiative transfer equation including a nontrivial coupling mechanism between body modes mediated by surface modes and the existence of a slowly evolving metastable surface mode distribution which ultimately leads to energy equipartition between all modes.

This is based on joint work with L. Borcea (University of Michigan), M. V. de Hoop (Rice University), and K. Solna (University of California at Irvine).