AGU FALL MEETING
San Francisco | 14 – 18 December 2015

S41B-2736: A Method to Retrieve the Multi-Receiver Moho Reflection Response from SH-Wave Scattering Coda in the Radiative Transfer Regime

Thursday, 17 December 2015
08:00 - 12:20
Moscone South - Poster Hall

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We discuss a method to retrieve the multi-receiver Moho reflection response by interferometry from SH-wave coda in the 0.5-3 Hz frequency range. An image derived from a reflection response with a well defined virtual source would provide deterministic impedance contrasts, which can complement transmission tomography. For an accurate retrieval, cross-correlation interferometry requires the coda wave field to sample the imaging target and isotropically illuminate the receiver array. When these illumination requirements are not or only partially met, the stationary phase cannot be fully captured and artifacts will contaminate the retrieved reflection response. Here we conduct numerical scalar 2D finite difference simulations to investigate the challenging situation in which only shallow crustal earthquake sources illuminate the Moho and the response is recorded by a 2D linear array. We quantify to what extent the prevalence of scatterers in the crust can improve the illumination conditions and thus the retrieval of the Moho reflection. The accuracy of the retrieved reflection is evaluated for two physically different scattering regimes: the Rayleigh and Mie regime. We only use the earlier part of the scattering coda, because we have found that the later diffusive part does not significantly improve the retrieval. The density of the spherical scatterers is varied in order to change the scattering mean free path. This characteristic length scale is calculated for each model with the 2D radiative transfer equation, which is the governing equation in the earlier part of the scattering coda. The experiment is repeated for models of different geological settings derived from existing S-wave tomographies, which vary in Moho depth and reflectivity. The scattering mean free path can be approximated for real data if intrinsic attenuation is known, because the wavenumber-dependent scattering attenuation of the coherent wave amplitude is dependent on the scattering mean free path. This link makes it possible to determine in which spatial and temporal bandwidth retrieval is most optimal for a specific geological setting.

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