Prestack Imaging of Teleseismic Body Waves: A Comparison of Multimode Receiver Function Migration and Seismic Interferometry

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Over the past few years, the correlation-type reciprocity theorem for one-way wave fields has been extended to derive relations between the transmission and reflection responses of an arbitrary 3-D inhomogeneous medium. Based on this generalized relation, the interferometric seismic imaging(ISI) in the presence of passive seismic sources can be simulated by cross-correlating the transmission responses recorded at dense receiver array. The ISI inherently realizes symmetric pseudo-shot-receiver sampling, and prevents irregularities of offset distribution in CMP ensembles. We have investigated the possible application of ISI to teleseismic earthquake data, which ensures the basic assumption of the correlation-type reciprocity theorem that the seismic source is located beneath the all reflectors to be reconstructed.

Synthetic seismograms simulated by the elastic pseudospectral method for a simple 2-D/3-D crustal model are given to compare the seismic profile of multimode receiver function migration to seismic interferometric profiling. The numerical modeling results demonstrate the potential imaging capabilities of ISI for crustal structure with a high spatial resolution rather than the conventional Ps receiver function profile. We applied prestack Kirchhoff imaging to the teleseismic and regional earthquake data acquired along Odawara-Yamanashi seismic survey line, located in central Japan, and utilized multimode prestack migration for receiver function and ISI for back scattered phases to investigate the subducting Philippine sea plate and crustal structure of Izu collision zone. We further discuss practical difficulties and evaluate potential for joint imaging of multimode receiver function migration and seismic interferometry.