Waveform Inversion for Passive Surface Wave based on Beamforming

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ABSTRACT

Waveform inversion is a high-resolution subsurface model-building technique by fitting seismic waveforms in the temporal/spectral domain, and has been increasingly implemented from near-surface engineering and environmental problems to hydro-carbon exploration, and to crustal-scale investigations. Not like active source seismic methods, however, passive source seismic methods, as seismic interferometry method, could not proceed forward modelling without knowing the distribution of noise sources. In this work we investigate fundamentals and applications of a method - referred to as waveform inversion for passive surface wave - by simultaneous inversion of the extracted waveform information from inter-station correlation functions and noise sources based on a phase-shift scanning method as beamforming. We do not establish any complicated formulation of the forward problem of computing correlation functions, but simplify the forward modelling with the classic seismic interferometry methods. We design and implement a simultaneous inversion scheme, where the distribution of noise sources are just byproducts, and the damping parameter which is common in most joint inversion problems will not be included. Compared with the conventional 1D inversion scheme, the proposed waveform inversion scheme for passive surface wave will significantly improve the resolution of tomographic images, as well as the accuracy of the inverted velocity structure which could be terribly biased due to the unknown noise sources.

AAPG Search and Discovery Article #90321 2018 Grants-in-Aid Projects