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Abstract

Objectives/Scope: In conventional seismic processing, surface waves are treated as unwanted noise and steps are taken to remove them. In our study we utilize the surface waves for estimating the near-surface velocity model. Surface waves propagate in the shallow subsurface and can be used to derive shear wave velocities of the near surface. This is critical for datasets from desert areas as the near surface geology is complex and very challenging.

Methods, Procedures, Process: Surface wave analysis requires three steps: 1) acquisition of data that is un-aliased and with sufficient low frequency content, 2) processing to generate dispersion curves, and 3) inversion of the dispersion curves. In our study, we have used surface waves extracted from a 3D seismic dataset, acquired using single sensor geophones as well as buried geophones. The datasets were used to generate multimodal dispersion curves with sufficient coherence for picking. The dispersion curves were subsequently inverted to derive shear wave velocities characterizing the near surface.

Results, Observations, Conclusions: We have successfully used surface waves extracted from seismic datasets acquired using single sensor geophones as well as buried geophones to characterize the near-surface shear wave velocity model. The use of single sensor geophones, along with dense surface coverage, allowed us to acquire data which is un-aliased as well as having good low frequency content. The prestack gathers were used to generate dispersion curves with sufficient coherence for picking. The dispersion curves were subsequently inverted to derive shear wave velocities characterizing the complex near surface. In our analysis we have evaluated two inversion schemes, the Genetic Algorithm (GA) as well as the model-based algorithm which is Surface Wave Modal Inversion (SWAMI). The synthetic test runs showed the model-based algorithm (SWAMI) produced better results in the presence of velocity inversions. We have successfully applied the SWAMI surface wave inversion algorithm on the single sensor surface seismic field dataset as well as on datasets from the buried geophone (several meters below the surface) allowed us to generate high resolution near-surface velocity models which are critical for subsequent seismic data processing.

Novel/Additive Information: This paper presents successful application of surface inversion in a desert environment to characterize the near-surface velocity model. In conventional seismic processing surface waves are considered as noise and removed during early data processing. In our analysis we utilize the surface wave as a useful signal to characterize one of the critical processing challenges which is the complex near surface