Shallow Velocity Structure Exploration with Multimode Surface Waves from Ambient Noise

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It's a hot topic in seismologic studies to obtain shallow velocity structure through ambient noise. Most previous research use the fundamental mode surface wave to inverse the velocity structure while many studies demonstrate that higher modes contain useful information. The information of accurate higher-mode surface waves can provide more constrains to reduce the uncertainty of structure inversion.

In this study, the Vector Wavenumber Transform Method (VWTM) based on spatial autocorrelation method are developed to extract multimode surface waves, especially higher mode dispersion curves. We investigate the validity of VWTM using the synthetic ambient noise simulated by the discrete wavenumber method. The effects of distribution styles of seismic stations, such as arbitrarily shaped array and linear array, on higher mode surface wave are explored. Then this method is applied to observed data recorded by an array with short period seismometers. The clear higher mode dispersion curves are extracted. With the higher mode and the fundamental dispersion curves, we get the shallow structure with the Simulation Algorithm Method (SAM). At last, we discuss the limitation of VWTM and compare the inverted velocity structure with logging data.