

# Fluid-Induced Changes in Near-Surface Shear Velocity Derived From Surface Waves

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## Abstract

Seismic methods can monitor transient ground water by detecting changes in seismic velocity. Compressional and shear wave velocities respond to fluid-induced changes in the bulk modulus, shear modulus and density. We present three methods that allow these small perturbations in seismic velocities to be tracked through time in a field setting. Compressional velocities are tracked using differences in first arrival traveltimes. The shear velocities and subsequent perturbations are calculated from surface wave frequency components. A simple inversion scheme allows these velocities to be tracked as a function of depth below the surface. Using these strategies, several observations are made relating fluid saturation to seismic properties. We confirm prior observations of a large compressional velocity change associated with full saturation. Contrary to prior lab studies, we find shear velocities in an unconsolidated sandy environment to be quite sensitive to moisture content. Partial saturation can be detected from increased shear velocities resulting from greater cohesion between grains. We also observe the influence of pore pressure changes below the water table.