

Developments in seismic interferometry; time-lapse monitoring and autofocusing of internal multiples

Roel Snieder, Nori Nakata, Filippo Broggin, Kees Wapenaar, Jyoti Behura

Seismic interferometry is a technique to construct wave fields propagating between receivers by cross-correlation of measured wave fields. When applied to noise this technique has proven effective to extract surface waves. When applied to downhole sensors with either noise or active shots, seismic interferometry has provided body waves with an unprecedented illumination. Because noise, or earthquakes, illuminate the subsurface quasi-continuously, seismic interferometry has a potential for time-lapse monitoring that has not been fully exploited. We show data examples of changes in the near-surface that are associated with the shaking caused by earthquakes and with precipitation. The basic equations of seismic interferometry can also be used to extract internal multiples from recorded reflected waves. This can be exploited in a data-driven method to focus internal multiples onto a target point in the subsurface. This method only needs the reflected waves recorded at the surface, and an accurate estimate of the direct wave that propagates between the target point and the surface.