

Title

Virtual seismology: a new methodology for induced earthquake monitoring

Authors:

Kees Wapenaar, Joeri Brackenhoff, Jan Thorbecke and Evert Slob

Abstract:

Recent developments "beyond seismic interferometry" have enabled the creation of virtual sources and/or virtual receivers in the subsurface from reflection measurements at the earth's surface. Unlike in classical seismic interferometry, no physical instrument (receiver or source) is needed at the position of the virtual source or receiver. Moreover, no detailed knowledge of the subsurface parameters and structures is required: a smooth velocity model suffices. Yet, the responses to the virtual sources, observed by the virtual receivers, fully account for multiple scattering. The ability to retrieve the entire wave field between (virtual or real) sources and receivers anywhere in the subsurface, without needing a detailed subsurface model, has large potential for monitoring induced seismicity, characterizing the source properties (such as the moment tensor of extended sources along a fault plane), and forecasting the response to potential future induced earthquakes. This will be demonstrated with numerical models and preliminary real-data results.