

## Correlation imaging with seismo-electromagnetic waves

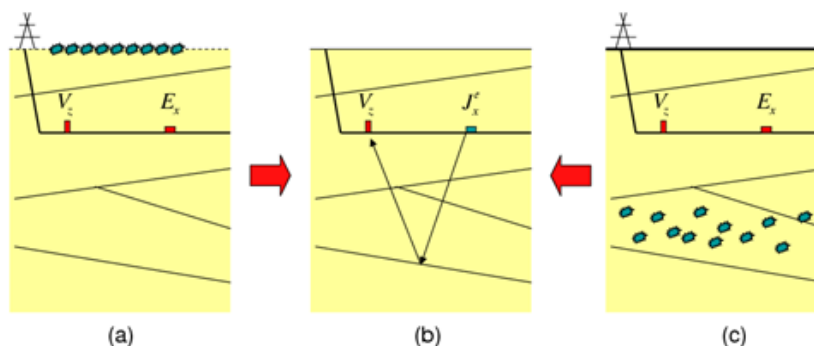
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Seismic interferometry is the passive seismological imaging technique which makes use of the cross-correlation of responses at different receivers in order to obtain the Green's function between these receivers. Using correlation to retrieve the Green's function response between two stations is in principle not limited to seismic systems but holds for a wide class of phenomena, including seismo-electromagnetic effects (*Wapenaar et al., 2006*). One of the beneficial effects of using seismo-electromagnetic phenomena, is that these can provide knowledge about the permeability of the medium via the coupling coefficient. Furthermore, from the measured data, supplemental information about the pore fluid content can be obtained.

The aim of this project is to identify and characterize the potential of correlation imaging with seismo-electromagnetic waves in well-controlled laboratory experiments and with theoretical modeling. It is a Shell-FOM project and a joint project between the University of Amsterdam and Delft University of Technology (the Netherlands). The experimental part is executed in Amsterdam, whereas in Delft the theoretical part and numerical modeling is performed.

For this combined set-up to work, the correlation imaging with seismo-electromagnetic waves needs to be investigated in 3D. The numerical examples of the 1D Green's function retrieval (*de Ridder et al., 2009*) have already shown how well the interferometric representation retrieves the exact results.

The results of this study will identify the feasibility of this novel method in e.g. prospecting of aquifers/reservoirs, the diagnostics of conditions near boreholes (well logging) and monitoring of hydrocarbon production.



*Cross-correlation of electric ( $E_x$ ) and acoustic ( $V_z$ ) signals from sources located at the surface (a) or located in the bulk (c) yields the direct acoustic response of a current source ( $J_x^e$ ) generating an electroseismic wave (b).*

### References

**Wapenaar, K., E. Slob and R. Snieder (2006)**, 'Unified Green's Function Retrieval by Cross Correlation', *Physical Review Letters* 97, 234301.

**de Ridder, S., E. Slob and K. Wapenaar (2009)**, 'Interferometric seismoelectric Green's function representations', *Geophysical Journal International* 178, 1289-1304.