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# Interpreting Coda Wave Decorrelation from ambient seismic noise interferometry, inputs from laboratory experiments

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Seismic and ultrasonic waves are sometimes used to track fluid injections, propagation, infiltrations in complex material, including geological and civil engineered ones. In most cases, one use the acoustic velocity changes as a proxy for water content evolution. Here we propose to test an alternative seismic or acoustic observable: the waveform decorrelation. We use a sample of compacted millimetric sand as a model medium of highly porous multiple scattering materials. We fill iteratively the sample with water, and track changes in ultrasonic waveforms acquired for each water level. We take advantage of the high sensitivity of diffuse coda waves (late arrivals) to track small water elevation in the material. We demonstrate that in the mesoscopic regime where the wavelength, the grain size and the porosity are in the same order of magnitude, Coda Wave Decorrelation (waveform change) is more sensitive to fluid injection than Coda Wave Interferometry (apparent velocity change). This observation is crucial to interpret fluid infiltration in concrete with ultrasonic record changes, as well as fluid injection in volcanoes or snow melt infiltration in rocky glaciers. In these applications, Coda Wave Decorrelation might be an extremely interesting tool for damage assessment and alert systems [1].

[1] R. Thery, A. Guillemot, O. Abraham, E. Larose, Tracking fluids in multiple scattering and highly porous materials: toward applications in non-destructive testing and seismic monitoring, Ultrasonics, **102**, 106019 (2019).