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Statistics on the Performance of Instrument Types and the Significance of HVSR data for Shallow Vs HVSR/DC Joint Inversions - A Result from the Large-N Maupasacq Experiment (Southern France)

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Horizontal-to-Vertical Spectral Ratios (HVSR) and Rayleigh group velocity dispersion curves (DC) can be used to estimate the shallow S-wave velocity (Vs) structure. Knowing the shallow Vs structure is important for geophysical data interpretation either in order to better constrain data inversions for P-wave velocity (Vp) structures such as travel time tomography or full waveform inversions, or to directly study the Vs structure for geo-engineering purposes (e.g. ground motion prediction). The purpose of this study is to appraise in particular how much information HVSR can add in a large N experiment and how different instrumentation types affect this.

During the Maupasacq large-scale experiment, 197 three-component short-period stations, 190 geophone nodes and 54 broadband seismometers were continuously operated in Southern France for 6 months (April to October 2017) covering an area of approximately 1500 km2 with a site spacing of approximately 1 to 3 km. On the obtained HVSR and DC data, a statistical Joint inversion is performed for the shallow Vs structure. The results indicate that the addition of HVSR data to the DC inversion reduces the variance of the recovered shallow Vs model and improves the convergence to a smaller data misfit. While broadband and short period instruments delivered similar results, geophone nodes performed significantly worse due to their much higher cut off frequency.