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Improvements of phase detection and identification using 3C array processing

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Seismic arrays traditionally are made of vertical sensors co-located with a single three-component (3C) seismometer. The deployment of fully 3C seismic array offers the possibility to use the coherency of the horizontal components in addition to the vertical ones. Indeed, the horizontal component traces give the opportunity to improve the detection and the characterization of the S-phases that have a greater amplitude on the horizontal component than on the vertical one. Yet, 3-C arrays are currently poorly exploited in automatic S-phase detection, classification and identification algorithm.

Our work focuses on the use of horizontal components in array processing technique, which is PMCC (Progressive Multi-Channel Correlation), to identify complex seismic wavefield features using data from the LSBB (Low Noise Underground Laboratory located in Rustrel, Southern France) 3C broadband seismic array. This array contains surface and near-surface stations together with deep stations. In this work, we use the five deepest stations that form a small-aperture array of 1.6km, distributed around a tunnel at approximately the same altitude, and where the deepest station is at more than 500m below the top of the mountain. The influence of horizontal trace rotation on the consistency of this sub-array is investigated using several recent local and regional events.

A campaign of measurements was performed to precisely establish the orientation of each station in the LSBB 3C seismic array using Fiber Optic Gyrocompass. These measurements have also permitted to investigate the influence of the stations orientation errors on the array consistency.