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Multicomponent seismic arrays: demonstrating their potential for improved event detection and characterisation

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IMS seismic arrays are predominantly formed using multiple vertical sensors with a single three-component (3-C) seismometer co-located at one site. The deployment of fully 3-C seismic arrays, such as ARCES (PS28) and SPITS (AS72), offers the possibility to take additional advantage of the coherency on the horizontal components. For the case of S-phases, this has the potential to significantly improve their detection and characterization. Despite this, 3-C arrays are currently poorly exploited in automatic phase detection and classification algorithms.

Using events from the 2020 NORSAR regional reviewed bulletin and based on data from the ARCES and SPITS arrays, our work focuses on demonstrating the benefits of using all three components for array processing. We use the PMCC (Progressive Multi-Channel Correlation) algorithm to initially process each individual component, merging the results to form a multi-component phase detection, from which a Kurtosis phase picker is applied. For a second, more computationally intensive technique, we use all three components to rotate our data into a ray-coordinate system for a predefined set of azimuth and slowness values. Each component of the rotated data are then processed, with the resulting detections compared to both the vertical-only results and the PMCC multi-component technique

Promotional text

We investigate solutions to efficiently use horizontal components for seismic array processing. Our study aims to demonstrate how the IMS 3C-arrays can be better exploited, while also highlighting the advantages of such 3-C deployments for event detection.

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