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Monitoring earthquakes by seismic arrays methods in SeisComP3

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We present how seismic arrays can be used interactively or automatically in SeisComP3 for monitoring micro-seismicity and teleseismic earthquakes worldwide.

Sparse seismic networks or high noise levels may prevent the detection and analysis of seismic events at all scales. Low-threshold nuclear explosions may remain unidentified as well as small earthquakes in remote areas or in hydrocarbon or geothermal fields. Such unfavourable conditions are eluded and low-amplitude signals are detected by applying array methods. In standard array procedures the waveforms are stacked and processed. Well-developed methods exist. Besides pure signal detection array analysis yields the time, the backazimuth and the incidence angle which are used to constrain the location of the source.

However, automatic array processing for unique signal detection and event location is still challenging. With the LAMBDA module we provide a new and powerful gempa module for automatic and interactive array analysis of seismic and infrasound data. The graphical user interfaces of SeisComP3 have been extended to support picks with slowness and backazimuth in addition to the detection time. LAMBDA is developed for the OpenSource framework SeisComP3. It provides different methods in real time. They include static and dynamic F-K analysis, beam packing and backprojection along traveltime curves. The detections may be solely used to identify the events or they can be jointly analysed with other network observations in the SeisComP3 backbone system. The joint array and network analysis allows to combine multi-purpose monitoring setups where arrays are integrated within networks. LAMBDA also assists in configuring arrays interactively and to form new arrays for specific purposes based on existing networks.

The LAMBDA module has been specifically applied to monitor induced seismicity as well as teleseismic events. The result are presented proving the performance and reliability of this module.