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Waveform cross-correlation, cluster analysis and relocation applied to events in the Pamir-Hindukush seismic zone using IMS data

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Spatial event clusters make up a significant portion of global seismicity. Often such events also cluster in time (e.g. in aftershock series), thereby stressing routine bulletin production. Algorithms that exploit waveform similarity of co-located events bear a great promise to more efficiently and accurately process such event series. We are presenting a case study based on data of the International Monitoring System.

The Pamir-Hindukush seismic zone is a region of persistent high seismicity from shallow crustal depth down to 300 km in the mantle. Interpretation of the complex three-dimensional seismogenic structure is hampered by a lack of precision in earthquake locations. Source mechanisms of the events are highly variable, probably reflecting a complex stress and deformation regime of the slab like structure. We use waveform cross-correlation to define event clusters based on waveform similarity and to derive precise intra-cluster relative arrival times. A cluster represents a group of co-located events with similar source mechanisms. The clusters can then be relocated using the new arrival times and a multiple-event location algorithm.