



Global grid of master events for waveform cross-correlation: from testing to real time processing

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Seismic monitoring of the Comprehensive Nuclear-Test-Ban Treaty (CTBT) requires a globally uniform detection threshold, which is provided by geographical distribution of the Primary Seismic Network of the International Monitoring System (IMS). This detection threshold has to be as low as allowed by the entire set of real time and historical data recorded by the IMS. The International Data Centre (IDC) analyzes all relevant data in automatic processing and interactive review to issue a Reviewed Event Bulletin (REB), which includes all qualified events as obtained for the purpose of nuclear test monitoring. Since 2000, raw data, individual detections, and created events are saved in the IDC archive currently reaching tens of terabyte. In order to effectively use this archive in global monitoring we introduced the waveform cross correlation (matched filter) technique. Cross correlation between real time records at IMS stations and template waveforms is calculated for a dense (spacing of ~ 140 km) and regular grid of master events uniformly covering the globe. There are approximately 25,000 master events with 3 to 10 templates at IMS stations. In seismically active zones, we populate masters with real waveforms. For aseismic zones, we develop an extended set of synthetic templates for virtual master events. For optimal performance of cross correlation, the Principal and Independent Component Analysis are applied to the historical (from earthquakes and underground nuclear tests) and synthetic waveforms. Real waveform templates and selected PCA/ICA components are used in automatic processing for the production of a tentative cross-correlation standard event list (XSEL).