



## **Automatic Event Bulletin Built By Waveform Cross Correlation Using The Global Grid Of Master Events With Adjustable Templates**

Ivan Kitov, Dmitry Bobrov, and Mikhail Rozhkov  
CTBTO, Vienna, Austria

We built an automatic seismic event bulletin for the whole globe using waveform cross correlation at array stations of the International Monitoring System (IMS). To detect signals and associate them into robust event hypotheses in an automatic pipeline we created a global grid (GG) of master events with a diversity of waveform templates. For the Comprehensive Nuclear-Test-Ban Treaty (CTBT), the GG provide an almost uniform distribution of monitoring capabilities and adjustable templates. For seismic areas, we select high quality signals at IMS stations from earthquakes. For test sites, signals from UNEs are best templates. Global detection and association with cross correlation technique for research and monitoring purposes demands templates from master events outside the regions of natural seismicity and test sites. We populate aseismic areas with masters having synthetic templates calculated for predefined sets of IMS array stations. We applied various technologies to synthesize most representative signals for cross correlation and tested them using the Reviewed Event Bulletin (REB) issued by the International Data Centre (IDC). At first, we tested these global sets of master events and synthetic templates using IMS seismic data for February 13, 2013 and demonstrated excellent detection and location capability. Then, using the REB and cross correlation bulletins (XSELS) experienced analysts from the IDC compared the relative performance of various templates and built reliable sets of events and detections for machine learning. In this study, we carefully compile global training sets for machine learning in order to establish statistical decision lines between reliable and unreliable event hypotheses, then apply classification procedures to the intermediate automatic cross correlation bulletin based on the GG, and compile the final XSEL, which is more accurate and has lower detection threshold than the REB.