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Evaluating IMS capability: modeling, simulation, processing, and estimation within entire software environment

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In this work we will discuss the approach for IMS seismic stations capability evaluation. Certain experience in this area was gained while using our proprietary core bundle software SNDA during last decade. It was successfully used in seismic event real-time detection and location (local to global) with networks and small aperture arrays data with real-time simulation module as a tuning tool. The following questions related to evaluation problems were asked: what is the probability of detection of seismic signal generated by the event occurred at arbitrary point of the Globe at given seismic station obscured by microseismic background? what is the accuracy of determination of seismic phase parameters? The following stages of evaluation were considered: (1) synthesizing seismic signal activated at arbitrary point of the Globe and recorded at given seismic station, (2) immersion of synthetic signal into many-hours recording of actual station microseismic background thus providing naturally changing SNR, or pre-determined SNR at certain thresholds, (3) simulating real-time environment for data processing platform, (4) running real-time detection and phase parameters estimation software which must verify validity of synthetics and simulation processes with statistical verification of results. The goal was set as creation of the technique and software for synthesizing trusted set of seismograms “recorded” at IMS stations (single 3-component or arrays) generated by the seismic sources placed at arbitrary points of 3D Earth. The following sources were considered: (1) explosion or earthquake given in form of Harvard CMT-format, (2) real explosion or earthquake, given in form of 3-component waveform, recorded at local (or regional) distance from the event origin, (3) theoretical source function. The important stage of evaluation is seen as introducing real seismic recording into a process. Model seismogram calculation in this case consists of introducing propagation times for main regional or teleseismic phases and correction of amplitude and period of these phases. The empirical time-correction and calibration functions are applied based on statistics of historical earthquakes and explosions for source-station trace under modeling.