

REVIEW OF RESEARCH BEING PERFORMED IN THE RUSSIAN FEDERATION RELATED TO CTBT SEISMIC MONITORING

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ABSTRACT

During the last five years a number of research projects under the Russian Monitoring Technologies Program (RMTP) were performed. The major RMTP goal is to improve national and international capabilities to ensure compliance with the Non-Proliferation Treaty, Comprehensive Nuclear-Test-Ban Treaty (CTBT) as well as agreements on Nuclear Material Protection, Control and Accounting. We present some research results of two current projects of the SYNAPSE Science Center and Moscow State Technical University (MSTU).

The SYNAPSE Science Center project is intended to develop and investigate adaptive algorithms and software for data analysis from broad-band three-component seismic arrays, algorithms and software for seismic source identification, algorithms and software for automated data processing from local seismic networks as well as to develop a problem-oriented system for automated data analysis from seismic arrays and local seismic networks. Examples of applications will be presented for the following algorithms: statistically optimal seismic array data processing, extraction of seismic phase waveforms, and estimation of seismic wave arrival parameters based on data from three-component seismic arrays, automated location of small local events by the medium scanning (emission topography) method as well as newly developed methods and procedures of statistical discrimination. The project of the MSTU is intended to develop and investigate statistical procedures and software for nuclear explosion pattern recognition using data from seismic, radionuclide and other monitoring methods, taking into account source data errors. The results of the development of mathematical pattern recognition algorithms for a fixed sample size (parametric and non-parametric models) and mathematical algorithms for sequential pattern recognition methods will be presented.

We present the results of the first year performance on the seismo-acoustic research for the CTBT Monitoring project. This project has been performing by SAIC/SAIC GT and its subcontractors: the Geophysical Survey and the Joint Institute of Physics of the Earth of the Russian Academy of Sciences. These results are related to the calibration of the stations of the International Monitoring System (IMS) at the territory of the Russian Federation. Studies are designed to improve discrimination of seismic sources for the regions of the former Semipalatinsk Test Site, Lop Nor Test Site, North Caucasus, and Baikal Rift Zone as well as collection and analysis of an archive seismic records of earthquakes, rockbursts, chemical and underground nuclear explosions. The newly developed travel-time curves for major regional seismic phases (Pn/P, Pg, Sn/S and Lg) related to the East-European, West-Siberian platforms, Urals Folded Belt, North Kazakhstan and North Caucasus regions will be presented. The estimates of uncertainties for these travel-time curves are presented as well as their comparison with the IASPEI-91 tables.

We present results on the continuing development of the Peleduy small aperture seismic array in Southern Yakutiya, Russia. In March 1999, during a three week period, a team of American and Russian specialists installed seismic and communication equipment and thus put into operation the first small aperture seismic array in the territory of the Russian Federation; this is the first Russian array that satisfies the IMS station specifications. During the summer of 1999, all site upgrade efforts should be completed and the small aperture seismic array will be ready for final inspection and acceptance.

This part of the paper will be illustrated with photographs. Also, a short description of the geology of the seismic array site and array's boreholes as well as examples of seismic noise spectrums for the newly installed seismic array will be presented. These examples illustrate the low-level background noise at the Peleduy site.

Key Words: seismic arrays, seismic data processing and analysis, discrimination, location, calibration, seismic station upgrade