CREATING A COMMON SEISMOLOGICAL DATABASE FOR THE EUROPEAN ARCTIC

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Long-term observations have shown that seismic activity in the European Arctic manifests itself not only in a form of strong earthquakes but also as a huge number of seismic events of small magnitudes. This requires careful study.

Such research will be carried out within the international Russian-Norwegian project RFBR №14-05-93080. In addition, seismic monitoring is needed to ensure the safe development of hydrocarbon fields in the Arctic seas. Note that currently the information on Arctic regions seismicity collected in the world seismological centers is quite incomplete for many reasons.

The project participants plan to perform a joint analysis of the data collected during previous years. NORSAR (Norway), Kola Branch of the Geophysical Survey of the RAS and the Institute of Ecological Problem of the Ural Branch of the RAS (Russia) have collected data needed for the analysis of a seismic activity in the European Arctic. We will also use data of closed and temporary seismic stations of our organizations (for example, mini-array «Amderma»).

The analysis of spatial distribution of seismic events shows that each seismic network has its own areas of assured events detection as well as shadow zones.

The research project will allow scientist to unite the experience and knowledge of the two countries and gain the overall picture of seismicity in the European Arctic.

It is important to make a common data base containing both raw wave form data and results of their processing with open access for the project participants.

The data base must contain information on weak seismic events of different origins occurred in our region. Possible number of such events in the base can amount to several dozens or even hundreds of thousands. As a whole the seismic network in the European Arctic is sparse and seismic stations can be separated from each other by hundreds of kilometers. Thus, for instance ZFI station situated in Franz-Joseph Land is at a distance more than 600 km from the nearest station in Spitsbergen. It means that many seismic events can be recorded only at a single station.

Huge number of events makes their manual processing impossible. We need algorithms and software for automated data processing including event detection, location and classification routines which would give a small number of false alarms. These algorithms should work with single station data, both for 3-component stations and seismic arrays.

The project participants have long time experience of work with intelligent algorithms of seismic detection and location. Seismologists from NORSAR (Norway) have developed a fully automatic GBF bulletin based on generalized beamforming approach. This bulletin is issued for about 15 years and it is a great source of information on regional seismicity. Several single station processing and classification algorithms have been developed in Kola Branch of Geophysical Survey of RAS.

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We plan to unite the algorithms into an intelligent data processing system making fully automated detection and location of seismic events and in some cases their classification. In addition to the algorithms some system of logical inference should be created for separation of true events and false alarms. Possible base for the system would be Bayesian belief networks.

When the system (or its working prototype) will be created we will use it for retrospective processing of all data available. The establishment of a joint seismic bulletin and catalog for the Euro-Arctic region will be the final result of this project.