



Analysis of the ambient seismic noise at Bulgarian seismic stations

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Modernization of Bulgarian National Seismological Network has been performed during a month in 2005. Broadband seismometers and 24-bits digital acquisition systems with dynamic range more than 132dB type DAS130-01 produced by RefTek Inc. were installed at the seismic stations from the existing analog network.

In the present study the ambient seismic noise at Bulgarian National Digital Seismological Network (BNDSN) stations is evaluated. In order to compare the performance of the network against international standards the detail analysis of the seismic noise was performed using software and models that are applied in the international practice. The method of McNamara and Bulland was applied and the software code PDFSA was used to determine power spectral density function (PSD) of the background noise and to evaluate the probability density function (PDF). The levels of the ambient seismic noise were determined and the full range of the factors influencing the quality of the data and the performance of a seismic station was analyzed. The estimated PSD functions were compared against two models for high (NHNM) and low (NLNM) noise that are widely used in seismological practice for seismic station monitoring qualities assessment.

The mode PDF are used to prepare annual, seasonal, diurnal and frequency analyses of the noise levels at BNDSN stations.

The annual analysis shows that the noise levels at the Northern Bulgarian stations are higher than the ones at Central and Southern stations for the microseisms' periods (1sec -7sec). It is well observable at SS PRV and PSN located near Black sea. This is due to the different geological conditions of the seismic stations as well. For the periods of "cultural" noise the power distribution depends on the type of noise sources and as a rule is related to human activities at or near the Earth surface. Seismic stations MPE, VTS and MMB have least mode noise levels and the noisiest stations are PGB, PVL JMB.

The seasonal variations are seen in the microseism band. The noise levels increase during the winter and autumn months and decrease in summer and spring seasons. There is an expansion of the double-frequency peak. These variations are due increased intensity of Black sea storms and heavy atmospheric conditions during the autumn and winter.

The diurnal variations are produced by increased human activities during the daylight working hours and lower ones during the night. The variations are visible for the periods shorted then 1s. They are influenced by the noise sources. There are no variations in noise levels at stations PVL and KDZ.

The frequency analysis prepared in the study estimates the noise variations as a function of geographic location of the Bulgarian seismic stations into three sub-intervals: from 0.02s to 0.14s, from 0.16s to 0.76s and from 1.8s to 8s. The analysis shows that in the period interval of the microseisms the noise levels are as higher as the station are close situated to Black sea. In the other two sub-intervals of periods the values of the noise levels are higher if the "cultural" noise sources are near the stations.

The results from the performed analyses shows that estimated PSD fall within NLNM and NHNM for all of the BNDSN stations.

It has been shown in the study that the seismic noise analysis is very useful tool for evaluation performance of the BNDSN seismic broadband stations as well as for the site selection for new stations.