Nowadays Seismicity of Bulgaria

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Върху сегашната сеизмичност на България

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Абстракт: В настоящата работа се предлага обобщена информация за резултатите от събирането, обработката и анализа на първичните данни за сеизмичните събития, регистрирани от Националния сеизмологичен център на Департамента по сеизмология в НИГГГ на БАН за 2010 г. Анализират се последните сеизмични атаки върху територията на България и непосредтвено прилежащите земи.

Information on the results of collection, processing and analysis of the data about the seismic events recorded by the National Seismological Centre (NSC) in Department of Seismology of NIGGG - BAS during 2010 is presented below. Besides for pure seismological interest, the analysis and evaluation of the space, time and energy distribution of the nowadays seismicity, open up possibilities for searching some time correlations with the parameters of different geophysical fields aiming to find out eventual precursor anomalies for the events in the near future.

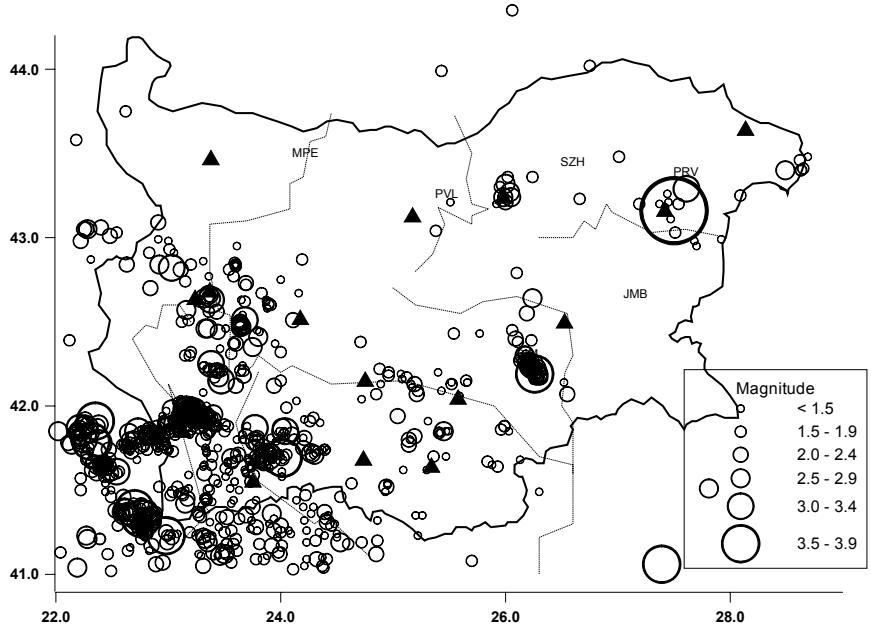

Fig.1. Map of epicentres in Bulgaria and adjacent lands during 2010

The recording and space localization of the seismic events in NSC during 2010 (Fig.1) is realized by means of the new digital network (Solakov et al., 2005). The routine processing and acquisition of the initial data is organized in a real time duty regime. The operations are fulfilled by the authors of this communication. The computing procedure for determining the parameters of the seismic events is an adaptation of the widespread product HYPO'71 (Solakov , 1993). As a result of the achieved experience in the authors interpretation work, different magnitude's lower threshold for successful determination of local, regional and long distance earthquakes is established: M=1.5 for the territory of Bulgaria (Botev et al., 2010). The precision of the epicenter's determination is different; except on the distance it depends also on the specific position of the epicenter in relation to the recording network. For the period of observations presented in this communication, the primary data about 2000 local, regional, distant earthquakes and industrial explosions on the territory of Bulgaria are recorded, classified and processed (as a work bulletin) in the Department of Seismology. After comprehensive analysis of the records and application of the above mentioned calculation procedures it is established that 998 of all registered earthquakes are in the Bulgaria area outlined by geographic latitude 41^0 – 44.5^0 N and longitude 22^0 - 29^0 E (Fig.1). In the same time one of the strongest seismic attacks on the territory of Bulgaria was caused by outside events. The strongest shakable events with epicenter outside Bulgaria during

the study period occurred in Kralevo region (Serbia) on 07th October (magnitude M=4.4 and intensity I=III-IV in Vidin) as well as in Marmara Sea (Turkey) on 03 November (M=5.5 and intensity I=III-IV in Kurdzhali region).

Fig.1 illustrates the seismicity just in the territory of Bulgaria and nearby lands. The earthquakes are differentiated by magnitude intervals. The seismic stations are also noted in the same figure by triangles. On the territory of Bulgaria a relatively high degree of activity of weak earthquakes is observed during 2010 - 998 events against about 600-800 for most of the previous years. The earthquakes of a magnitude higher than 3.0 are in a standart amount - 28 events compared with the averaged number of about 20-30 for most of the all previous years (and 31 for 2006).

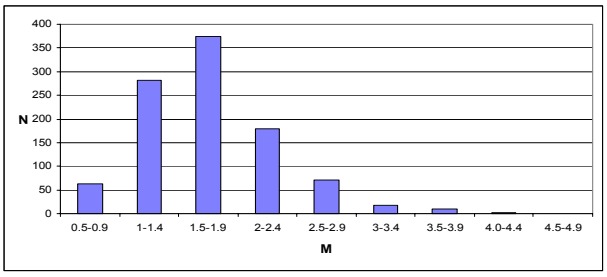

Fig.2. Magnitude – frequency distribution of the earthquakes

The maximum realized magnitude M=4.4 is higher too than the maximum magnitude in the course of previous years; its usual value used to be about 4.0 and less. As usually, the largest concentration of epicenters is marked in the southwestern part of the territory presented in Fig.1. The Kroupnik seismic source, known with the strongest crustal earthquakes in Europe (M=7.8, 7.1) for the last 160 years. In 2010 about 70 events of M<3.0 and 6 of M≥3.0 occurred in this region. The 16 May event with M=3.3 is felt on Blagoevgrad region by intensity of IV EMS. The strongest earthquake for the south-western part of Bulgarian territory is with magnitude M=3.5, it is felt in Gotce Delchev region (western slopes of Rhodope mountain) by intensity of IV-V EMS.

The Bulgarian seismic sources in 2010 are relatively more active than during the previous year. They produced more than 20 earthquakes affecting different localities in this country by intensity of up to IV degrees EMS. Eight cases of magnitudes between 2.2 and 2.8 aroused shocks of intensity three or a bit more: 6 of them originated in Monastery Hyghland territories and two only in Maritsa seismic zone. In the rest part of the 2010 felt events caused excitation of lesser intensity. The prevailing number of them was caused by small dislocations in Rila-Rhodopean Region; two of them showed a certain seismic activity in the Central and Eastern part of the Balkan Mountain. The strongest event with magnitude Ms=4.4 occur in north-eastern Bulgaria on 07 November and caused macroseismic impact with intensity of VI degree EMS scale. Most significant seismic activity is associated with the Vitosha fault structure in the Sofia region where three shocks during the time of two weeks shook the city center with maximum intensity of VI EMS since 27 August to 10 September.

A detailed analysis of seismicity in the individual seismic zones is hard to be fulfilled because of the insufficient quantity of events and the narrow magnitude range of the earthquakes. The joint statistics of all the events in Fig.2 characterize predominantly the seismicity parameters of the southwestern part of the territory under investigation.

The magnitude-frequency distribution for the entire data set is presented in Fig.2. The number of localized events increases with the magnitude decreasing: for M=4-4.5 is 1 event, for M=3.5-3.9 is 9 events for M=3.0-3.4 is 18 events, for M=2.5-2.9 - 70, for M=2.0-2.4 - 180 and so on. The abrupt diminishing of the number of earthquakes in the first two intervals (M<1.5) in Fig.4 determines also the registration power of the seismic stations network.

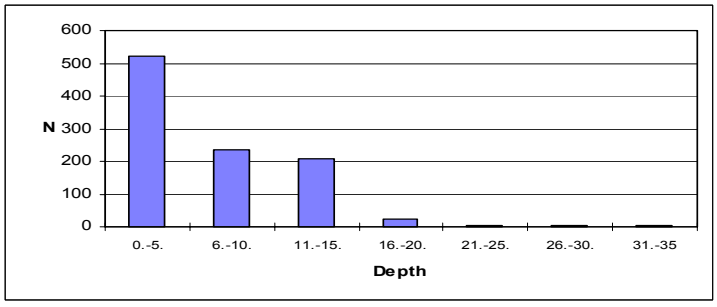

Fig.3. Depth - frequency distribution of the earthquakes

The picture of the depth distribution in Fig.3 shows that the majority of events occur down to 20 km depth. It is possible the established predominating depth (from 0 to 5 km) to be also due to the presence of unidentified industrial explosions. In the same time the number of events in the interval 15-20 km is very

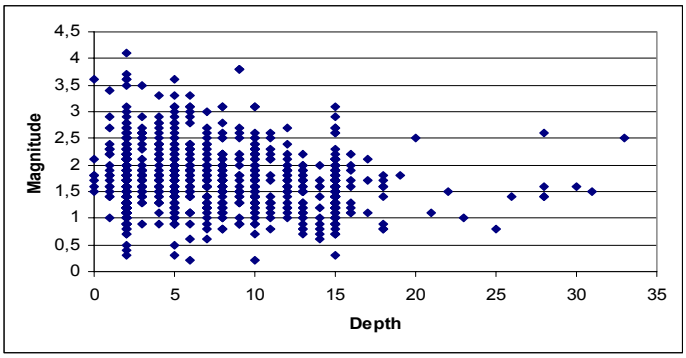

Fig.4. Magnitude - depth dependence

lower. The magnitude distribution of the events in depth (Fig.4) don't permits to note some differentiation of depth "floors" with the increase of magnitude - the maximums can be traced out for all of the depth interval from 0 to 15 km.

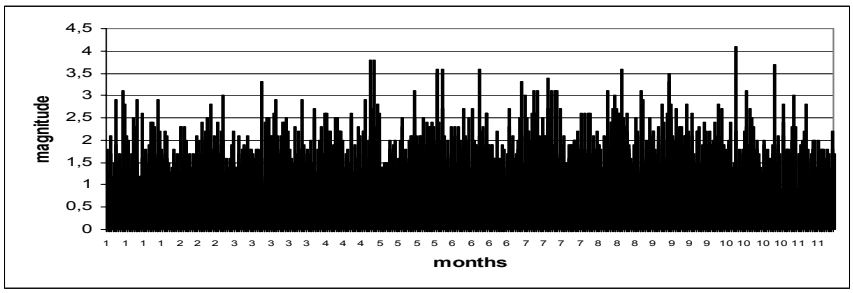

Fig.5. Magnitude-time distribution of the earthquakes.

Figure 5 shows the energy release in time through the earthquake magnitude-time distribution. It suggests that October and June, the months when the most number of events occurred, are also with maximum of energy release. Some other strongest events occurred in November.

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