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Science Editor

Msc **Blerina Shkreta**
Academy of Sciences, Tirana, Albania
Tel.: +355 4 2266548
E-mail: shkretablerina@yahoo.com, akadshkreta@gmail.com

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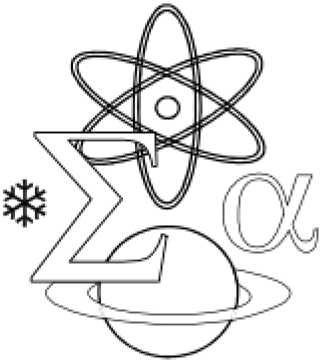

2017 (2)
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A STATISTICAL ASSESSMENT OF THE EARTHQUAKE ACTIVITYIN THE VLORA-LUSHNJA-ELBASANI-DIBRA TRANSVERSAL FAULT ZONE, ALBANIA

Ormeni RRAPO
Institute of Geosciences, Energy, Water and Environment Polytechnic University, Tirana, Albania
Öztürk SERKAN
Gümüşhane University, Department of Geophysics, Gümüşhane, Turkey
Gjuzi OLGERT
Institute of Geosciences, Energy, Water and Environment Polytechnic University, Tirana, Albania

ABSTRACT

In thepresent paper, a few seismotectonic parameters have been used for the statistical analysis of the seismic activity and assessment of the earthquake hazard potential along the Vlora- Lushnja-Elbasani-Dibra (V-L-E-D) transversal fault zone. There are a total of 2814 events in the time interval between 1964 and 2015 with $M_d \geq 1.7$. The correlation of seismotectonic*b*-value, fractal dimension *D*c-value, precursory quiescence *Z*-value, and theirinterrelationships with each other is here investigated. Anomalously low *b*-value areas coincide more or less with the spatial distribution of $M \geq 5.0$ earthquakes andtheir known rupture extents. The lowest *b*-values are centered at 40.83°N-20.03°E (in and around Kuçova),at 41.35°N-20.25°E (between Durrësi, Tirana and Bulqiza).Temporalchanges in *b*-value may be related to the stress variations in these times before and after the main events. Correlation dimension values are relatively large and the seismic activity is more clustered at larger scales in this transversal fault zone. The lowest *Z*-values show that the variations in seismic activity rate areinsignificant, and the highest *Z*-values demonstrate a decrease in seismicity rate. In the *Z*-value maps for all parts of the V-L-E-D, three areas exhibit significant seismic quiescence: centered at 41.00°N-19.78°E (region A, around Lushnja), 40.99°N-20.03°E (region B, in the Cerriku), 40.81°N-19.86°E (region C, including Kuçova). In addition to these three significant areas, there are some small quiescence areas in different parts of the V-L-E-D. Such kind of analyses of these can give important clues in order to reveal the earthquake hazard potential in the V-L-E-D and thus, special interest must be paid to these anomaly regions.

Keywords: Vlora-Lushnja-Elbasani-Dibrafault zone, earthquake activity, b-value,Dc-value, Z-value

1. INTRODUCTION

Albania is a seismically active area with tens of destructive large earthquakes over the past twenty centuries as revealed from the historical sources(Mogi, 1962;Polat, *et al*., 2008). The collision of Adria with the Albanian orogen is the source of the Albanian seismicity. This continental collision directly influences on the inner part of the country, on the longitudinal and transverse faults cutting across the eastern and north-eastern part of Albania (Aliaj, *et al*., 2001; Ormeni 2010). The Vlora-Lushnja-Elbasani-Dibra (V-L-E-D) Transversal Fault Zonein Albania is a major tectonicfeature with a well-defined fault trace and an established history of seismicity. Activity of the V-L-E-Dduring the 20th century began with the destructive Peshkopiaearthquake in 1920 in northeast Albania and migrated westwards by a series of destructive earthquakes in 1921, 1930, 1935, 1942, 1959, 1962, 1967, 1982, 2009, and 2014(Aliaj, *et al*., 2001; Ormeni 2010; 2012). The present investigation aims to analyze the spatial and temporal properties of seismicity pattern in the V-L-E-D Transversal Fault Zone in order to better understand the seismic hazards in this significant area. Consequently, theinvestigation addressed the mapping of size-scaling distributions (*e.g.*, spatial, temporal and magnitude distribution of seismic activity, completeness of magnitude, *Mc*, and *b*-values with time, fractal dimension, *Dc*-value, seismic quiescence *Z*-value) in the regional scale, and the correlation of results with the structural elements which carry high risk for the V-L-E-D region.

1. GEOLOGIC, TECTONIC / NEOTECTONIC SETTINGS OF ALBANIA

The main geological structures found within the Albanian territory are called the Albanides, which are part of the Dinaric-Albanid-Hellenic arc of the Alpine orogen. They are located between Helenides in the south and Dinarides in the north, which together form the Dinaric branch of the Mediterranean Alpine Belt. The V-L-E-Dtransversal fault zone (Ormeni 2012;Ormeni*et al*., 2013) (Fig. 1) with north-east strike dislocates the structure of the Albanides along their entire width. It is expressed by Vlora andLushnja flexure, Dumreadiapire dome, Elbasani Quaternary depression, Labinoti transversal structure, marked by important quaternary infill (Melo, 1986), Golloborda transversal horst continues toward the Tetova Quaternary graben in FYROM (Ormeni*et al*., 2013) (Fig. 1).

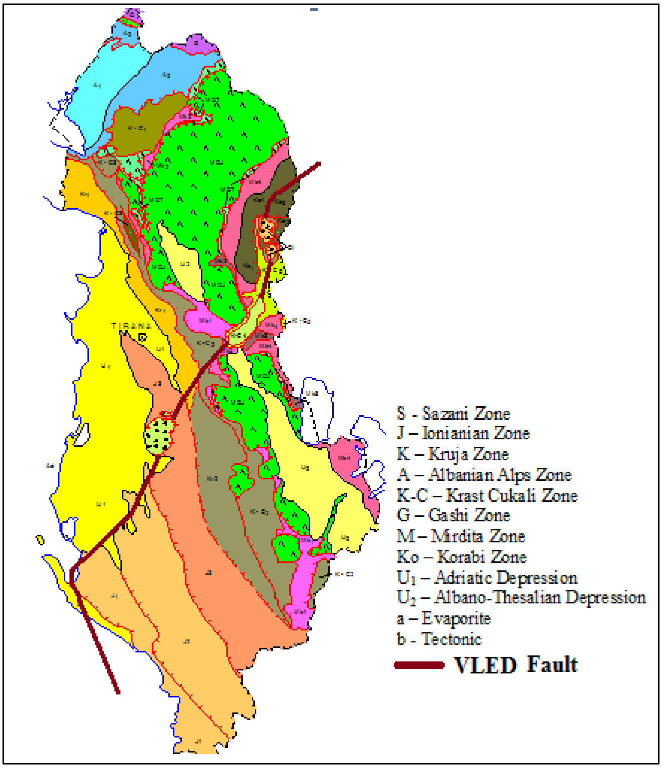


Fig. 1. Schematic tectonic map of Albania and seismic source zones in the VLED Transversal Fault Zone.

The region is both geologically and tectonically part of the Krasta tectonic subzone, which includes an area of Alpine folding. The Krastasubtectonic zone has been deformed by folds, normal faults, and strike-slip faults from movement of the main Alpine phases, which folded the aforementioned tectonic zone. Generally, the structures of the Krastasubtectonic zone extend N-S (Fig. 1). It must be emphasised that the investigated area of seismicity is located north of the Okshtuni tectonic window and south of the Dibra tectonic window. These tectonic windows are part of the V-L-E-D fault zone. This fault zone, NE trending for approximately 100 km in Albanian territory, consists of fragmentary normal faults cutting across the Krasta zone and dividing the Mirdita ophiolites zone in two main segments (Ormeni*et. al*., 2013)(Fig. 1). Based on the analysis of the focal mechanisms of moderate and strong earthquakes, the V-L-E-Dtransverse fault zone plays an important role in the seismotectonics of Albania, as well as of the FYROM(Aliaj, *et al*., 2001; Ormeni 2010).

The analysis of the focal mechanisms indicates the predominance of normal faulting with a strike-slip component, and the NNW-SSE extension in eastern Albania in response to the convergence between the Adriatic microplate and the Albanian orogen. The Vlora-Lushnja-Elbasani-Dibra fault zone has produced earthquakes in the past, and they are expected to continue to be active in the future. The studies in the past of moderate and strong earthquakes and their aftershocks have emphasised many geologic and seismotectonic characteristics of this area that constitute a threat for nearby urban areas of Vlora, Fieri, Berati, Lushnja, Elbasani, Librazhdi, Bulqizë and Dibra towns in Albania, and FYROM.

2. DATA AND DESCRIPTIONS OF THE METHODS

Figure 2 depicts the epicenter distributions of all earthquakes ($Md \geq 1.7$) and the principal main shocks ($Md \geq 4.5$). The focal depth analysis reveals that this seismicity was mainly generated in the shallow upper crust under tectonic conditions that were described earlier (Ormeni, 2012).TheV-L-E-Dhas experienced many damaging earthquakes during the past 95 years (Ormeni, 2010;2015). The Elbasani section has ruptured during earthquake occurred on 18 December 1920, (I=VIII degree), 31 March 1930 (M 5.7) and 19 May 2014 (M5.2). The Dibra earthquake of 30 November 1967 (M 6.7) is one of the greatest earthquakes that occurred in Albania.Here, other earthquakes 30 March 1921 Peshkopia (I=VIII-IX degree), 27 August 1942 Peshkopia (M 6.0), 6 September 2009 Gjorica (M 5.4)have occurred. The earthquakes have occurred 1 September 1959 Lushnja (M 6.2), 18 March 1962 Fieri (M 6.0), 16 November 1982 Fieri (M 5.4)in the Lushnja-Fieri section. The earthquakes that occurred in the Vlora segment are: 21 November 1930 Qaf-Llogaras (M 6.0).The behavior of seismic activity analyzed in this study is restricted to shallow events (<50 km). There are a total of 2814 events in the time interval 1964 and 2015 with $Md \geq 1.7$. In order to characterize the seismic behavior, a number of statistical parameters were used; namely size-scaling parameters (such as slope of recurrence curve b-value, fractal dimension Dc-value), temporal and spatial distribution of earthquakes with characteristics of seismic quiescence Z-value as well as the histograms of temporal, spatial and magnitude distribution along the V-L-E-D fault zone.

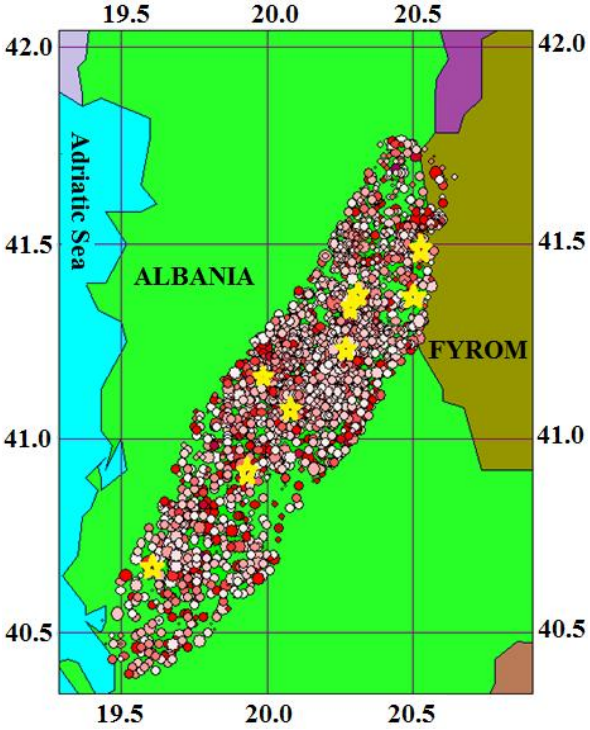


Fig. 2. Epicenter distributions of all earthquakes with Md≥1.7 and depth<70 km in the VLED Transversal Fault Zonebetween 1964 and 2015. Stars represent the principal main shocks with Md≥4.5.

3.1. Magnitude-frequency relation(*b*-value) and magnitude completeness, *Mc*

The relationship between the size of an earthquake and its frequency of occurrence named as Frequency magnitude distribution (Ormeni 2012) and defined as:

$$\log_{10}N(M) = a - bM \quad (1)$$

where $N(M)$ is the cumulative number of events with magnitudes equal to or larger than$M$. The parameters a and b are constants. The a-value shows the activity level of seismicity. The b-value is the slope of the frequency-magnitude distribution. The b-value has been shown to be inversely related to the shear stress in the crust (Wiemer and Wyss 2000). b-value is positively correlated with the increasing heterogeneity in the crustand shows (Özturk and Bayrak (2012)strong heterogeneity in finer scales. The b-value can be estimated from the maximum likelihood method (Aki, 1965):

$$b = 2.303 / (M_{mean} - M_{min} + 0.05) \quad (2)$$

where M_{mean} is the average value of magnitude and M_{min} is the minimum completeness magnitude in the seismicity catalogue to be analyzed. 0.05 value in this equation is a correction constant. The 95% confidence limits on the estimates of *b*-value are ±1.96 *b*/ *n*, where *n* is the number of events used to make estimation. The completeness magnitude, *Mc*, is an important parameter for many seismicity studies (Wiemer and Wyss 2000). In these studies, the usage of the maximum number of events available is necessary for high-quality results. Tendency of decreasing of *b*-values in temporal distributions before the large main shocks can be used as an indicator of the next earthquake (Özturk, 2011).Estimating of *Mc* can be made by the assumption of Gutenberg–Richter’s power-law distribution against magnitude (Wiemer and Wyss 2000).

3.2. Fractal dimension, *Dc*

Earthquake distributions are considered fractal, but indirectly. Fractal distributions imply that the number of objects larger than a specified size has a power law dependence on the size. The fractal distributions are the only distributions that do not include a characteristic length scale, and therefore, are applicable to scale invariant phenomena. Spatial patterns of earthquake distribution and temporal patterns of occurrence are demonstrated to be fractal using the two-point correlation dimension, *Dc*. The correlation dimension measures the spacing or clustering properties of a set of points. The correlation integral method was developed byGrassberger and Procaccia(1983) and correlation dimension, *Dc*, is obtained from the following equations(Grassberger and Procaccia, 1983):

$$Dc = \lim [\log C(r) / \log r] \quad (3)$$

$$C(r) = 2N_{R<r} / N(N-1) \quad (4)$$

where $C(r)$ is the correlation function, r is the distance between two epicenters or hypocenters, and N is the number of events pairs separated by a distance $R < r$. Fractal dimension is defined by fitting a straight line to a plot of log $C(r)$ against log r. Here r refers to the distance between each two hypocenters as stated in (Awad*et al.*, 2005; Polat, 2008). The nature of temporal-spatial fractal properties of the earthquake epicenters is characterized by fractal, in particular by the correlation dimension (Wiemer 2001). Fractal dimension, *Dc*, can be calculated to avoid the possible unbroken sites, and these unbroken sites have been suggested as potential ***seismic gaps*** to be broken in the future and *Dc* is related to hypocentral distance and to the physical models based on fluctuations in the elastic interactions between individual earthquake events (Toksöz*et al.*, 1979). For the hypocenter distribution (3D space), the uniform distribution is in accordance with Eq. (4) and it decreases with an increase in the clustering of events (Awad*et al.*, 2005). It is reasonable to assume that the higher *Dc* and lower *b*-values are the dominant structural feature in the study area and may arise due to clusters. It is also an indication of changes in stress (Polat, 2008).

3.3. Decomposing of catalogue and precursory quiescence *Z*-value

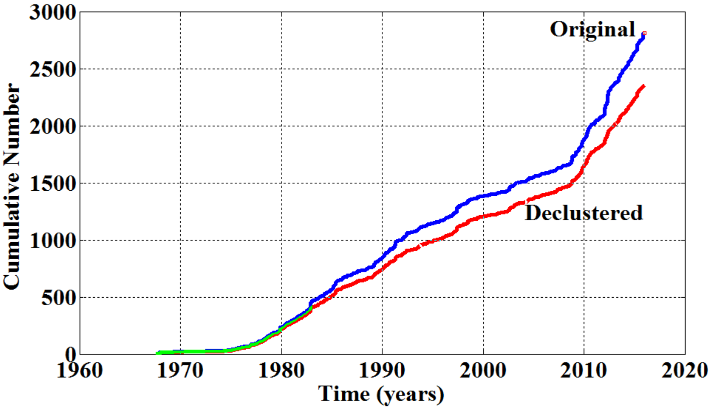
Some activities such as foreshocks, aftershocks, earthquake swarms, generally mask temporal variations of thenumber of events and the related analysis.The elimination of the dependent events from the catalogue is necessary for the reliable analysis of seismicity rate changes.In order to decompose(or decluster) the data based on the algorithm developed by Reasenberg(1985),*ZMAP* software in Wiemer(Wiemer 2001) is preferred.In study region, there are 2814 events with magnitudes greater than or equalto 1.7. *Mc* value for region is 2.5 and the number of earthquakes exceeding this completeness value is 1992. The decomposingprocess took away 460 events and 16% of the earthquakes were removed from the whole catalogue of region. Thus, the number ofevents for *Z*-value analysis was taken as 2354 for the VLED Fault Zone. In order to rank the significance of quiescence, the standard deviate *Z*-test is used(Wiemer and Wyss, 1994), generating the Log Term Average (LTA) function for the statistical evaluation of the confidence level in units of standard deviations:

$$\boldsymbol{Z = (R1 - R2)\,(S1 / N1 + S2 / N2)^{1/2}} \qquad \textbf{(5)}$$

where *R*2 is the mean seismicity rate in the foreground window, *R*1 is the average number of events in all background period, *S* and *N* are the standard deviations and the number of samples, within and outside the window. The *Z*-value calculated as a function of time, letting the foreground window slide along the time period of catalogue, is called LTA.

3. RESULTS OF SEISMICITY ANALYSIS AND DISCUSSION

A detailed investigation of the seismicity behavior in the V-L-E-D Transversal Fault Zone in Albania was carried out using the Gutenberg–Richter *b*-value, seismic activity rate changes, *Z*-value, fractal correlation dimension *Dc*-value and also by evaluating the histograms of the temporal, spatial and magnitude distribution in time intervals between 1964and 2015. As a result, this study is focused on the correlation of seismicity *b*-value, seismic quiescence *Z*-value, fractal dimension, *Dc*-value and interrelationships between some other seismicity parameters. The cumulative number of earthquakes *versus* time in the region for original catalogue and for decomposed events is shown in Figure3. Asshown in Graph.1, there is no significant change of reporting as a function of time between 1964 and 1974 for region. But further on, great seismic changes are seen in this area, especially after 1980. Also, time-number histogram for between 1964 and 2015 indicate an increase in the number of recorded events in the year of 2012 (Chart. 1).Many stations have been constructed in recent years, especially after 2003 providing the real-time data with the modern on-line and dialup seismic stations and V-SAT stations in Albania.



Graph. 1. Cumulative number of earthquakesversus time for the original and decomposed events.

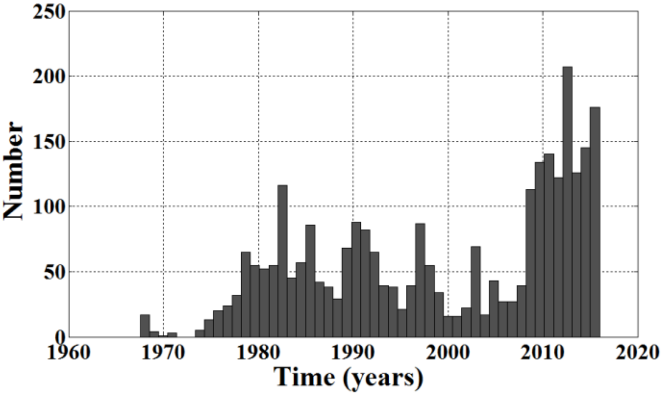


Chart.1. Time-number histogram for the seismic activity in study region.

Magnitude of earthquakes in this catalogue ranges from 1.7 to 6.7 with an exponential decay in their numbers from the lower to higher magnitudes. Graphic2 defines the magnitude-number histogram for the seismic activity of region. Most of the earthquakes are between 2.0 and 3.5, and a maximum *Md*2.5 is observed (Chart2). In order to investigate the seismic quiescence and the frequency-magnitude relationship, the change of *Mc* as a function of time is determined using a moving window approach. *Mc* is estimated for samples of 50 events per window for region by using the earthquake catalogue containing all 2814 events of *Md*≥1.7. Figure 6 depicts the variations of *Mc* with time for all parts of the V-L-E-D. For this region, *Mc* value is rather large and varies from 3.0 to 4.0 between 1964 and 1979 while *Mc* decreases to about 2.5 between 1989 and 1993 (Fig. 6). Then, it decreases to about 2.4 in the beginning of 1998. However, there is a great value about 3.3. This large value is observed after the 2007 Kuturman compound earthquake sequence.Therefore, it can be said that *Mc* generally shows a non-stable value in the different parts of the V-L-E-D. However, it can be easily said that *Mc* value varies between 2.5 and 3.7 in the V-L-E-D. Using *ZMAP* software, the *b*-value in Gutenberg–Richter (Wiemer and Wyss, 2000)relation calculated by the maximum likelihood method, because it yields a more robust estimate than the least-square regression method (Aki 1965). Gutenberg–Richter (G-R) low describes the statistical behavior of seismic zones in energy domain using the frequency magnitude of earthquakes (Awad*et al.*, 2005).

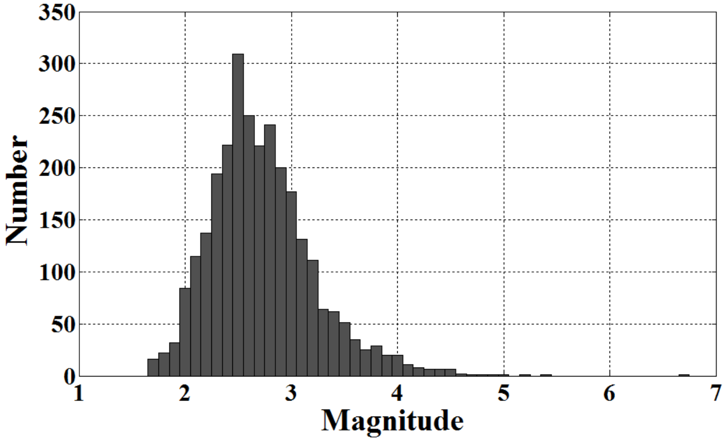
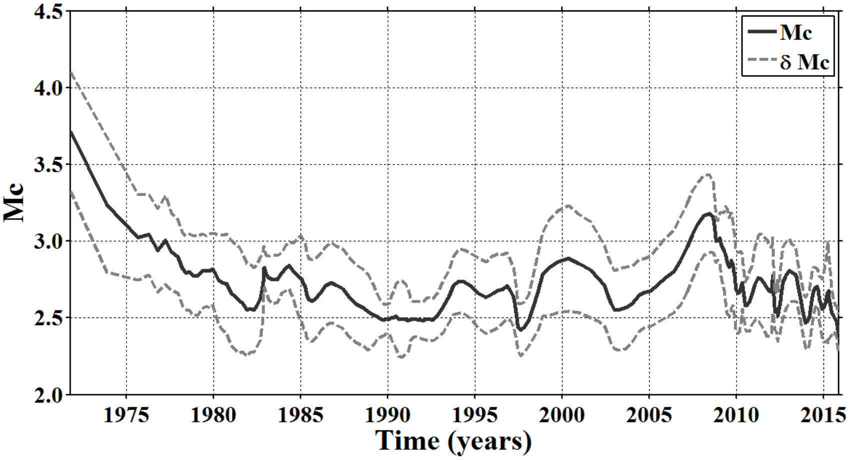
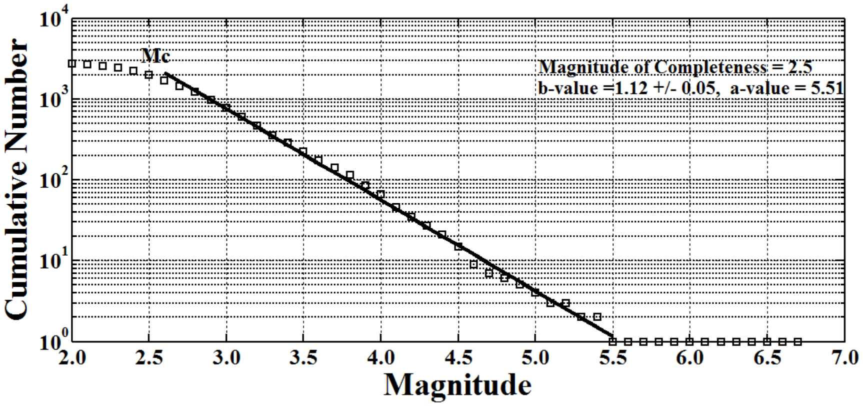


Chart. 2. Magnitude-number histogram for the seismic activity in study region.

Figure 7 shows the plots of cumulative number of the earthquakes against the magnitude for all parts of the V-L-E-D. The whole catalogue includes 2814 earthquakes (*Md*1.7) for epicentral depths less than 50 km. The *Mc*-value is calculated as 2.5 and using this value the *b*-value is calculated as 1.12 ± 0.05 and *a*-value 5.51 (Graphic3). The *b*-value and its standard deviation are determined with the maximum likelihood method, as well as the *a*-value of Gutenberg–Richter relation. The tectonic earthquakes are characterized by the *b*-value from 0.6 to 1.5 and are more frequently around 0.9. It is clearly seen that the earthquake catalogue matches the general property of events such that magnitude-frequency distribution of the earthquakes is well represented by the Gutenberg–Richter law with a *b*-value typically close to 1.

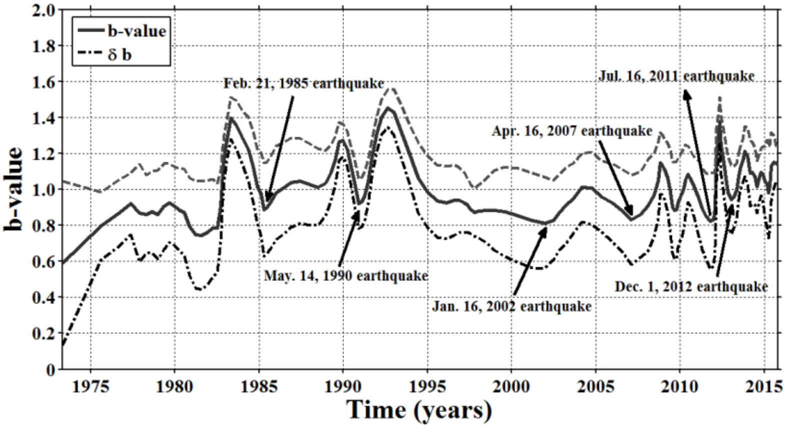


Graph. 2. Magnitude completeness, Mc, as a function of time. Standard deviation, δMc, of the completeness (dashed lines) is also shown. Mc value is calculated for overlapping samples, containing 50 events.



Graphic. 3. Magnitude-frequency-relation for all earthquakes between 1964 and 2015. The b-value and its standard deviation, as well as the a-value in the Gutenberg– Richter relation are calculated.

As depicted in Graphic4, the variation of the *b*-value as a function of time for the V-L-E-D Transversal Fault Zone is analyzed. A systematic increase in *b*-value can be observed until 1983 with *b*>1.2. The *b*-value shows a great decrease with *b*≈0.7 before the occurrence of 1985 February 21 earthquake and 1990 May 14 and a clear increase after the second main shock.Such a kind of behavior is also observed for some strong earthquakes in region(Ormeni 2012). There is a clear tendency of decrease with *b*≈0.8 before the 2007April16Kuturman compound earthquake and an increase with *b*>1.0 after the main shock (Fig. 8). Many factorscan cause perturbations of the normal *b*-value. The *b*-value for a region does not reflect only the relative proportion of the number of large and small events in study area, but is also related to the stress condition over the region (Utsu, 1971). Therefore, it is considered that the anomalies of decreases in *b*-value before the main shocks may be due to an increase in effective stress and can be used as an indicator of the next earthquake by observing the changes in *b*-value with time in the study region. Also, temporal increase in *b*-value may be related to the stress changes in these times before and after the main shocks (Öztürk 2011; 2012). In the areas of increased complexity in the active fault system associated with lower *b*-value, the stress release occurs on fault planes of smaller surface area (Öncel and Wilson, 2000).



Graph. 4.b-value variations versus time. b-value wasestimated for overlapping samples of 75events. Standard deviation, δb, of the b-values (dashed lines) is also shown. Arrows show the great decrease in b-values before the strongevents in study region.

In addition to temporal changes of *b*-value, regional distribution of *b*-value for the V-L-E-d fault zone is mapped by using decomposed data with *Md*≥2.5. We used a regional grid of points with a cell of 0.02° in longitude and latitude (Fig. 3). The spatial variations of *b*-value vary roughly between 0.8 and 1.4. The largest *b*-values (>1.2) are located in and around Cërrik. The smallest *b*-values (<0.9) are observed at 40.83°N-20.03°E (in and around Kucova), at 41.35°N-20.25°E (between Bulqizë, Shëngjergj, Stebleve and Dibër).The moderate values changing between 0.9 and 1.2 are found in the other parts of the study region. Many authors stated that the site of the lowest b-value mightbe the most likely place for a major earthquake (Awad*et al*., 2005; Polat*et. al*., 2008; Ormeni 2015). This could be explained with most promising environment where decrease in *b*-value is detected with an increase in mean stress. Similar results are also suggested by different authors for different parts of the world (Award *et al*., 2005; Öztürk 2011).

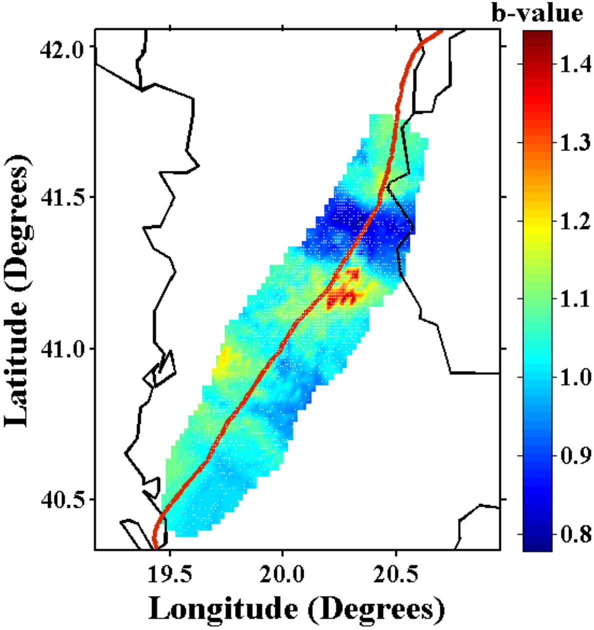
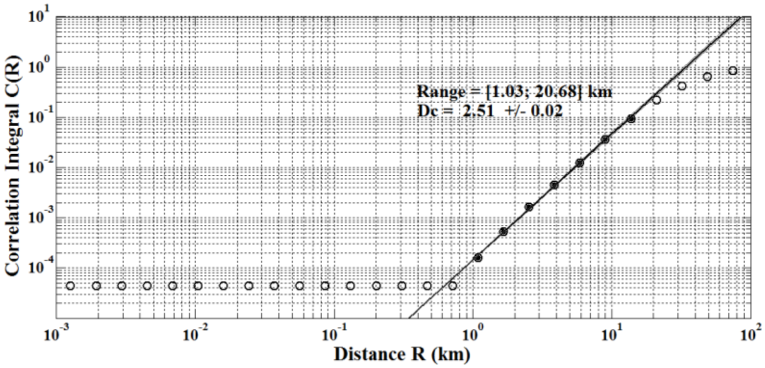


Fig.3. The map of b-value in VLED transversal fault zone estimated from the maximum likelihood method.

Correlation dimension, *Dc*, is estimated by fitting a straight (solid) line to the curve of mean correlation integral against the event distance, *R* (in km). The *Dc* values for the study area are obtained with 95% confidence limits by linear regression (Graph. 5). The earthquake distribution of 1841 earthquakes in the VLED Fault Zone is shown in Graph. 10. The correlation dimension, *Dc*, is calculated as 2.51 ± 0.02 for region. Correlation dimension, *Dc*, is estimated by fitting a straight (solid) line to the curve of mean correlation integral against the event distance, *R* (in km). The *Dc* values for the study area are obtained with 95% confidence limits by linear regression (Graph. 10).



Graph. 5. Correlation integral curves *versus* distance. Black dots represent the points in the scaling range.

The slope of the black line corresponds to the *Dc* value and the gray lines illustrate the standard errors.

Spatial distribution of the standard deviate *Z*-value for the V-L-E-D Transversal Fault Zone is presented for the beginning of 2010 (Fig. 4). Each *Z*-value is represented with different colors: the lowest *Z*-values are displayedwith blue and show that the change in seismicity rate is not significant, and the highest *Z*-values are represented with red and demonstrate a decrease in seismicity rate. Each *Z*-value in this representation is estimatedin correspondence of a different grid point. The computed *Z*-values are then contoured and mapped. To obtain a regional variation of the seismic quiescence mentioned earlier, the Reasenberg(1985) algorithm is applied to decompose the data. The areas under analysis were divided into rectangular cells spaced 0.02° in longitude and latitude. The nearest earthquakes, *N*, at each node are taken as 50 events after some preliminary tests for all regions and the seismicity rate changes are searched within the maximum radius changes by a moving time window, T_W(or i*wl*), stepping forward through the time series by a sampling interval asdescribed by Wiemerand Wyss (1994).

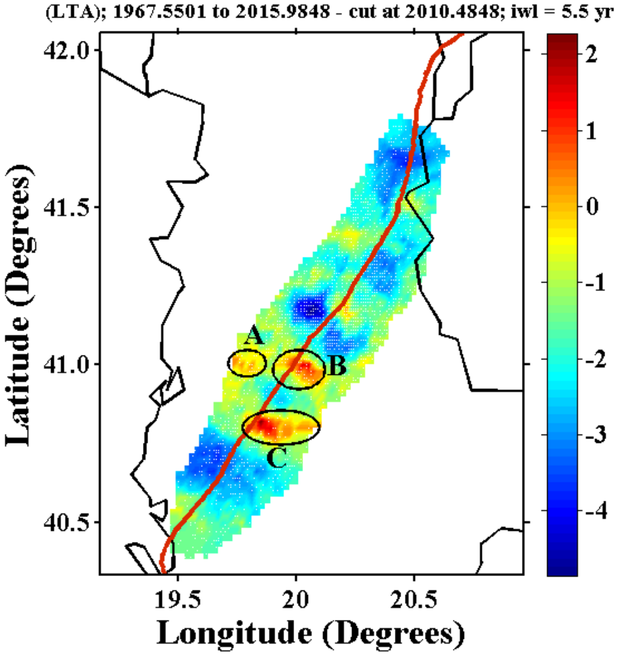


Fig. 4. Spatial distribution of Z-value in the beginning of 2010 with T_W(iwl) equal to 5.5 years. White dots show the decomposedevents.

The shape of the LTA function strongly depends on the choice of the length of the foreground window (*iwl*). While the statistical robustness of the LTA function increases with the size of *iwl,* its shape becomes more and more smooth, if the *iwl* length exceeds the duration of the anomaly. The time window, T_W, equal to 5.5 years is used. Since the quiescence anomalies obtained in Figure 3 are the best represented at the epicentral areas for T_W equal to 5.5 years, this time window length is used to image the spatial variation of the seismicity rate changes. For each grid point we binned the earthquake population into many binning spans of 28 days for all regions in order to have a continuous and dense coverage in time. The N and T_W values are generally selected accordingly to enhance the quiescence anomaly and this choice does not influence the results in any way. Figure 9 depicts the spatial variation of Z-values for region. The Figure 11 depicts the three areas (A, B, and C) exhibiting significant seismic quiescence. In addition to these three significant areas, there are some small quiescence areas. However, since these small quiescence areas are not very clear it is considered that they are not as significant as the other three quiescence areas. As a result, *Z*-value variation is represented in the beginning of 2010. Clear quiescence anomalies were identified at several seismogenic sources. In the *Z*-value maps for all parts of the V-L-E-D, three areas exhibit significant seismic quiescence. Covering the

V-L-E-D, the first significant quiescence is estimated centered at 41.00°N-19.78°E (region A, aroundLushnja) and the second one is estimated centered at 40.99°N-20.03°E (region B, in the Cërriku). The third significant anomaly is found centered at 40.81°N-19.86°E (region C, including Kuçova).

4. CONCLUSIONS

Temporal and regional assessments of the recent seismic activity are performed in order to put forth the seismic behavior in the V-L-E-DTransversal Fault Zone in Albania. So, a fewseismic parametersare used such as size-scaling parameters (such as slope of recurrencecurve *b*value), precursory quiescence *Z*-value, temporal and regional variationsof earthquakes with characteristic of fractal correlation dimension, *Dc*, aswell as the histograms of temporal, spatial and magnitude distributions. Forthis purpose, statistical analysis techniques based on the seismic tool *ZMAP*are used. The instrumental earthquake catalogues of ASN between 1964 and 2015 are compiled and finally2814 crustal earthquakes of magnitude equal and greater than 1.7, withdepths less than 70 km are obtained.Seismicity characteristics in the V-L-E-DTransversal Fault Zone show an important increase,especially after 2003. Analysis of completeness magnitude shows a valuebetween 2.7 and 2.9 for the V-L-E-D Transversal Fault Zone. *b*-value for studyis close to 1.0 and typical for earthquake catalogues. Temporal distributionsof *b*-values show a strong tendency of decreasing before the large mainshocks and this behavior can be used as an indicator of the future earthquake.The lowest b-values are centered at 40.83°N-20.03°E (in and around Kuçova), at 41.35°N-20.25°E (between Bulqizë, Shëngjergj, Stebleve and Dibër).Mapping of the *b*-values provides detailed images of the zones presenting low and high seismic activity and it may be used as a measure of seismic potential sources and relative hazard levels.Correlation dimension values are greater than 2.20 for all parts of the VLED. This suggests that seismic activity is more clustered at larger scales (or insmaller areas) in the VLED. Therefore, these higher values mean the dominant structural feature in the study area and may arise due to clusters. In order to separate the dependent events, Reasenberg algorithm is usedto separate the dependent events and the earthquake catalogue isdecomposed for the standarddeviate *Z*-value estimation. Importance of seismicity changes ismeasured at the nodes of a 0.02° grid space in longitude and latitude for the V-L-E-D Transversal Fault Zone. There are threeregions exhibiting significant quiescenceanomaly on the V-L-E-DTransversal Fault Zone in the beginning of 2010. These three anomalies are observed centered at 41.00°N-19.78°E (region A, around Lushnja), 40.99°N-20.03°E (region B, in the Cërriku), 40.81°N-19.86°E (region C, including Kuçova). These areas of seismic quiescence recently observed, whichstarted at the beginning of 2010 in three aforementioned regions, can be consideredas the most significant. The V-L-E-DTransversal Fault Zone was struck with strong earthquakes in recent years.Therefore, spatial and regional prediction of the nextstrong earthquake in the V-L-E-D Transversal Fault Zone would beuseful.

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