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Conference abstract

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The 1986 Adriatic Sea swarm : b - value*

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On January 6, 1986, the first in a series of over 350 recorded earthquakes occurred in the central Adriatic Sea. Increased seismic activity lasted for 47 days. Such a great number of earthquakes enabled us to study this sequence in more detail, hoping that results may contribute to better understanding of the seismicity of the central Adriatic.

In this paper we have studied the b - value in the Gutenberg-Richter magnitude-frequency relation

$$\log N = a - bM \tag{1}$$

In our analyses we have used the seismograms recorded on the station Hvar (HVA), which is closest to the epicentral region. As there is no expression for calculating of magnitudes on the basis of Hvar records, we have used the value of $\log(A/T)_{max}$ instead of M in (1) (A and T being the amplitude and period read from the seismogram). This is a permissible substitution, as long as the epicentral distances are constant. Relation (1) now becomes

$$\log N = a - b \log(A/T)_{max} \tag{2}$$

which is the form we used in our calculations.

In accordance with the classification of earthquake sequences based on their temporal characteristics proposed by Utsu (1970), this sequence may be recognized as the earthquake swarm of the II kind (group 1-C).

The earthquakes may be grouped in four pronounced subsequences of foreshock-mainshock-aftershock events. Magnitudes of mainshocks ranged between M_L

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= 4.3 and M_L = 4.8, according to reports of KBA (Austria). We have analyzed the total of 321 shocks. The *b* - value for the whole sequence as well as for the four subsequences, was estimated using the maximum - likelihood method (Utsu, 1964; Aki, 1965). The results are summarized in the following table :

Sequence	Number of data	$b \pm 2\sigma$
Complete sequence	321 (275)	0.769±0.091
1	37 (29)	1.033±0.377
2	120 (93)	0.806±0.164
3	123 (113)	0.777±0.144
4	41 (36)	0.754±0.243

The cumulative frequency plots show that data may be considered homogeneous for log $(A/T)_{max} \geq$ 0.3. Consequently, all shocks which do not satisfy this condi tion, were removed from the data set. The number in parentheses in the second column of the table shows the remaining number of events. It should be mentioned that mainshocks were taken into account only when estimating the *b* - value for the whole sequence. The results show that *b* has a value significantly lower than the "normal", *b* = 1, in all cases, except for the subsequence number 1. The interpretation of these facts seems not to be trivial, and asks for a more thorough analyses.

Large number of shocks provided for a study of the relationship between the *b* - value and the amount of released energy, *E*. We have assumed that energy released by a single shock is proportional to $(A/T)^{1.5}_{max}$. The whole time sequence was then divided into a number of overlapping subsequences, each of which contained 50 events and was shifted by 3 events with respect to the previous one. The quantity $E = \sum_{i=1}^{50} (A/T)^{1.5}_{max}$ was calculated for each of windowed sequences together with the corresponding *b* - value. Results show a very pronounced relationship between the two quantities, in the sense of increasing the *b* - value with decreasing the total energy released within a window, and vice versa.

Aki, K. (1965):Maximum Likelihood Estimate of *b* in the Formula log *N* = *a* - *bM* and its Confidence Limits, Bull. Earth. Res. Inst., 43, pp. 237-239.

Utsu, T. (1964):Read at the Meeting of the Seismological Society of Japan, October 1964.

Utsu, T. (1970):Aftershocks and Earthquake Statistics - II, J. Fac. Sci., Hokkaido Univ. Ser. VII, Vol. VIII, No. 4, pp. 197-441.