Annals of the University of Oradea, Fascicle: Environmental Protection, doi.org/10.5281/zenodo.4362296, **Vol. XXXIV, 2020**
Analele Universităţii din Oradea, Fascicula: Protecţia Mediului, doi.org/10.5281/zenodo.4362296, **Vol. XXXIV, 2020**

THE ANNUAL RAINFALL REGIME IN THE AREA OF VAD-BOROD DEPRESSION

Pereş Ana Cornelia*, Borza Ioana*, Mintaş Olimpia*, Köteles Nandor*

*University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea, Romania, e-mail: peresana35@yahoo.com; borzaioanamaria@yahoo.com; buzasiu@yahoo.com; kotelesnandor@yahoo.com

Abstract

The multiannual average rainfall in the Vad-Borod Depression is 723.9 mm. The lowest rainfall total was recorded in 2011, a value of only 464.6 mm/year, as a result of atmospheric circulation occurring mainly in the southeastern sector, which carried to Romania's latitudes tropical dry air masses. The highest annual rainfall total was recorded in 1980, 1083.8 mm/year. Thus, the amplitude for the period inlcuded in the study is 619.2 mm.

Positive rainfall deviations against the multiannual average occurred in 44% of the years inlcluded in the study, while negative deviations in 56% of the cases.

In the 50 years included in the study only three years (1985, 2002 and 2019) were regarded as normal in respect of the rainfall amount. The exceedingly droughty years made up 48% of the total number of years, while the exceedingly rainy years represented 40%.

Key words: exceedingly droughty, exceedingly rainy, rainfall totals

INTRODUCTION

Over a year, the evolution of monthly rainfall totals changes from one month to another depending directly on the interactions between the large baric centres which determine the atmospheric circulation and control the air masses and the atmospheric fronts (with the baric formations that accompany them) (Godard, Tabeaud, 1993; Măhăra, 2001; Giuliacci M., 2003; Gaceu, 2005; Dumiter, 2007; Lucchetti, 2009).

The Vad-Borod depression is under the influence of air masses coming from the west and the northwest, that is, maritime air masses.

The rainfall regime depends to a great extent on the particularities of the general atmospheric circulation over Romania and, implicitly, over the Vad-Borod Depression (Moza, 2008, 2009; Köteles, Pereş, 2011; Pereş, 2012; Pereş, Köteles, 2013, 2015).

MATERIAL AND METHOD

In order to perform an as real and exact analysis as possible of the distribution in time of rainfall amounts, data recorded at the Borod weather station between 1970 and 2019 were used.

RESULTS AND DISCUSSION

The multiannual average rainfall in the Vad-Borod Depression is 723.9 mm.

From one year to another, the rainfall totals in the Vad-Borod Depression vary on an extremely wide range. An ascending or descending evolution of rainfall against the multiannual average, considered as normal, over larger areas, is determined by the dynamics of air masses (Gaceu O., 2005; Moza A. C., 2008, 2009).

The lowest rainfall total was recorded in 2011, only 464.6 mm/year, as a result of atmospheric circulation occurring mainly in the southeastern sector, which carried to Romania's latitudes tropical dry air masses. The highest amount of rainfall was recorded in 1980, reaching a value of 1083.8 mm/year, a year with intense frontal activity caused by the high frequency of air masses coming from the west and northwest of the continent, belonging to cyclones developed on the northern dorsal of the Azores High, but also to those belonging to the mobile cyclones developed in the area of the Mediterranean Sea.

Thus, in Borod, the amplitude for the period of the study is 619.2 mm (Fig. 1).

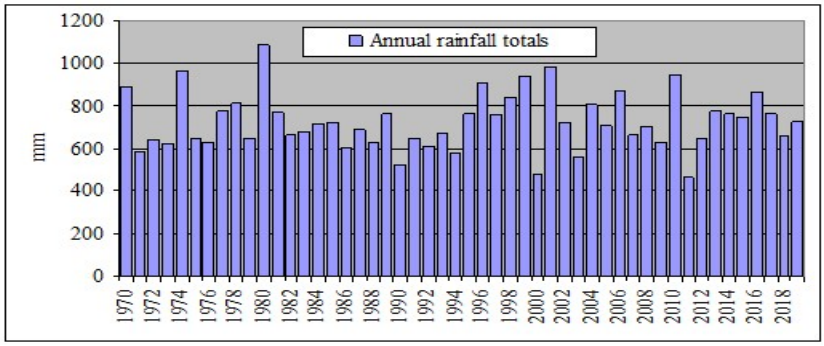

Fig. 1. Annual rainfall totals in Borod, 1970-2019

The reason of no atmospheric precipitations or of very low amounts is the prevalence of anticyclonic weather, with the high frequency of some stationary anticyclonic baric formations which develop over central, northeast or southeast Europe and which can join with the anticyclonic dorsal from the north of the Atlantic Ocean. The onset of anticyclonic weather results in clear sky, atmospherically calm, with high insolation and temperatures, especially in the warm season of the year, with no or wtih very little precipitations in these years (Stoica C., 1960; Ciulache S., 2002; Pereş A. C., Costea M., 2015).

Looking at the deviations of annual values from the multiannual average, it can be seen that in the period included in the study there were 22 years with positive deviations, which gives 44% of the years included in the study and 28 years with negative deviations, that is 56% of the cases (Fig. 2).

Looking at the negative and positive deviations from the multiannual average rainfall, it can be seen that the postive deviations show higher values. The highest postive deviations, in years with excess of rainfall, were recorded in 1980 (+359.9) and 2001 (+254.9). The highest negative deviations recorded the highest values in 2000 (-248.5) and 2011 (-259.3) (Fig. 2).

The lowest positive deviation occurred in 2019, 1.8 mm over the multiannual average.

The lowest negative deviation was recorded in 2002, -3.0 mm.

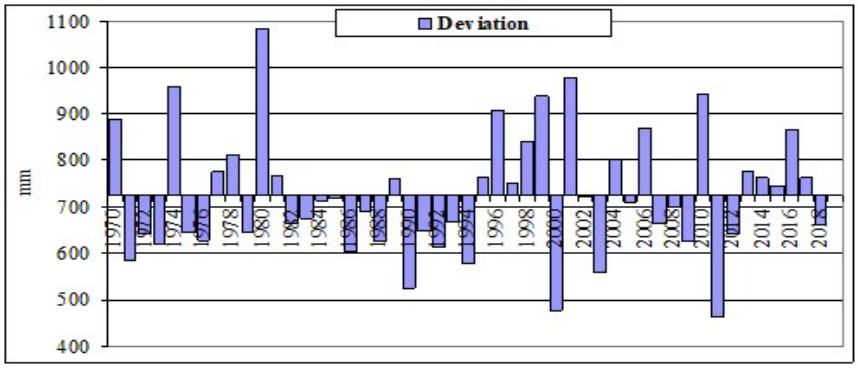

Fig. 2. Deviations of annual rainfall totals from the multiannual average in Borod, 1970-2019

By calculating the frequency of various annual rainfall totals, the probability of their occurrence could also be studied. Thus, the rainfall totals between 601-650 mm were the most frequent ones, being recorded eleven times, which makes up 22.0% of the total number of years included in the study.

The lowest frequency, and, accordingly, the lowest probability to occur, is represented by the totals between 501-550 and 1001-1500 mm/year, out of the 50 years included in the study there was only one annual year for each of these limits, which means a probability of 2.0%. There were no years with rainfall totals that fell between 401-450 mm (Table 1, Fig. 3).

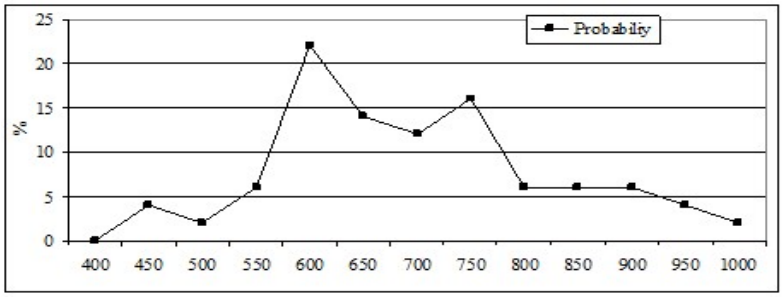

Fig. 3. The occurrence probability of various rainfall totals in Borod, 1970-2019

Table 1

The frequency of annual rainfall totals and their probabilities in Borod, 1970-2019

Rainfall totals (mm)	No. Of cases	Probability
401-450	0	0
451-500	2	4.0
501-550	1	2.0
551-600	3	6.0
601-650	11	22.0
651-700	7	14.0
701-750	6	12.0
751-800	8	16.0
801-850	3	6.0
851-900	3	6.0
901-950	3	6.0
951-1000	2	4.0
1001-1500	1	2.0
Total number of cases	50	

Source: data provided for processing by the A.N.M. Archives

In order to show the non-periodic variations of the annual rainfall totals, their deviations from the multiannual average were calculated and expressed as percentages, which made possible to establish the rainfall characteristics of the years according to the Hellman criterion (Table 2).

It can be seen from the table that in the 50 years included in the study only three years (1985, 2002 and 2019) can be regarded as normal from a rainfall point of view, as well as that there was a high number of exceedingly droughty years, 48% out of the total number of years. The frecquency of exceedingly rainy years was 40% (Table 2).

The high rainfall totals in the years when they occurred were the result of intense atmospheric circulation from the west, northwest and southwest of the continent.

Table 2

Rainfall characteristics of years according to the Hellman criterion in Borod, 1970-2019

Deviation against average %	Rating	No. of cases	Years
<-20	exceedingly droughty	24	1971, 1972, 1973, 1975, 1976, 1979, 1982, 1983, 1986, 1987, 1988, 1990, 1991, 1992, 1993, 1994, 2000, 2003, 2007, 2008, 2009, 2011, 2012, 2018
-20.0…-15.1	very droughty	1	2005
-15.0…-10.1	droughty	1	1984
-10.0…-5.1	moderately droughty	-	-
-5.0…+5.0	normal	3	1985, 2002, 2019
5.1…10.0	moderately rainy	0	-
10.1…15.0	rainy	0	-
15.1…20.0	very rainy	1	2015
>20.0	exceedingly rainy	20	1970, 1974, 1977, 1978, 1980, 1981, 1989, 1995, 1996, 1997, 1998, 1999, 2001, 2004, 2006, 2010, 2013, 2014, 2016, 2017

Source: data provided for processing by the A.N.M. Archives

Furthermore, the high amounts of rainfalls recorded in the area of the Vad-Borod depression can also be explained by the influence the relief, as a whole, has upon its own climate.

CONCLUSIONS

The multiannual average rainfall is 723.9 mm. In the period included in the study, the positive and negative deviations from the multiannual average made up 44% and 56% of the years respectively.

In the 50 years included in the study only three years (1985, 2002 and 2019) were regarded as normal in respect of the rainfall amount, while the exceedingly droughty years made up 48% of the total number of years, and the exceedingly rainy ones 40%.

REFERENCES

1. Ciulache S., 2002, Meteorologie şi climatologie, Editura Universitară Bucureşti.
2. Dumiter A. F., 2007, Clima şi topoclimatele oraşului Oradea, Editura Universităţii din Oradea.
3. Gaceu O., 2005, Clima şi riscurile climatice din Munţii Bihor şi Vlădeasa, Editura Universităţii din Oradea.

4. Giuliacci M., 2003, La previsione meteorologica, Ed. Meteo Mursia, Milano.
5. Godard A., Tabeaud M., 1993, Les climats Mecanismes et repartition, Armand Colin.
6. Köteles N., Pereş A. C., 2011, The conditions of atmospheric precipitations in Huedin Depression. Analele Universităţii din Oradea, Fascicula Protecţia Mediului Vol. XVI A, Anul 16, Editura Universităţii din Oradea, 2011, ISSN 1224-6255, pag. 404-410.
7. Lucchetti E., 2009, Meteorologia, Editore Technopress, Roma.
8. Măhăra Gh., 2001, Meteorologie, Editura Universităţii din Oradea.
9. Moza A. C., 2008, Aspects regarding the mean annual quantities of rainfall in the Crişul Repede hydrographic basin. Analele Univeristăţii din Oradea, Seria Geografie, Tom XVIII, Editura Universităţii din Oradea, ISSN 1221 – 1273, pag. 74-80.
10. Moza A. C., 2008, The maximum quantities of rain-fall in 24 hours in the Crişul Repede hydrographic area, Editura Universităţii din Oradea, Analele Universităţii din Oradea, Fascicula: Protecţia Mediului, Vol XIII, Anul 13, I.S.S.N. 1224-6255, pag. 443-447.
11. Moza A. C., 2009, Clima şi poluarea aerului în bazinul hidrografic Crişul Repede, Editura Universităţii din Oradea.
12. Pereş A. C., 2012, Meteorologie şi climatologie, Editura Universităţii din Oradea.
13. Pereş A. C., Köteles N., 2013, Frequency and quantity of atmosphere rainfall in Băile Boghiş spa area, Analele Universităţii din Oradea, Fascicula Protecţia Mediului Vol. XX, Anul 18, Editura Universităţii din Oradea 2013, ISSN 1224-6255, pag. 223-228.
14. Pereş A. C., Köteles N., 2015, The Annual Rainfall Regime in the Area of Oradea City, Analele Universităţii din Oradea, Fascicula Protecţia Mediului Vol. XXIV, Anul 20, Editura Universităţii din Oradea 2015, ISSN 1224-6255, pag. 215-220.
15. Pereş A. C., Costea M., 2015, The Monthly Rainfall Regime in the Area of Oradea City, Analele Universităţii din Oradea, Fascicula Protecţia Mediului Vol. XXIV, Anul 20, Editura Universităţii din Oradea 2015, ISSN 1224-6255, pag. 221-226.
16. Stoica C., 1960, Precipitaţii atmosferice în regim anticiclonic, Cul. Lucr. I.M./1960, C.S.A., I.M., Bucureşti.