

Some Pluviometric Characteristics of the Yugoslav Part of Banat

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Abstract *Pluviometric regime of the Yugoslav part of Banat, as well as the remaining part of Vojvodina partly has the characteristics of middle European, Danubian type, which has the feature of uneven dispersion of precipitation by months. In the study of pluviometric features of the surveyed area, the data from eight meteorological stations, out of which seven are situated on the territory of Banat and one on the territory of Backa. This paper renders more detailed analysis of precipitation regime, mean monthly and annual precipitation heights, frequency of precipitation, probability of precipitation and finally rain factor and draught index for the surveyed area as well as for the separate climatic regions of North, Middle and South Banat. All the parameters were discussed for the period between 1951 and 1990. On the basis of analyses, certain deviations in the occurrence of primary and secondary maxima and minima of precipitation in comparison to the results of previous researches have been established.*

Key words *Banat, pluviometric regime, precipitation heights, frequency of precipitation, rain factor, draught index*

Yugoslav part of Banat stretches along the eastern part of Vojvodina. In the north-south direction its position is between the Moris and the Danube rivers, and in the west-east direction between the Tisa river and the state border of Romania. The examined area occupies the area in the central part of mild climatic zone, significantly distant (about 2,000 km) from the main source of humidity, the Atlantic Ocean. At the same time, Banat is isolated from direct penetration of the cold, continental air, by the Carpathian Mountains and it penetrates only under special weather conditions. Closer to Banat is a smaller aquatic territory, the Mediterranean. However, the existence of a strong mountain barrier as the Dinaric Alps extending vertically to the direction of southern winds modifies the influence of the aquatic territory.

Method

In the research of pluviometric characteristics of Banat, data from eight meteorological stations were used. It is

necessary to point out that one of them (Senta) is situated outside Banat, but the reasons for including it was the lack of meteorological stations in the farthest north of Banat.

List of meteorological stations and their positional characteristics, starting from the northernmost:

- Senta: 45°56' North Latitude and 20°05' East Longitude, altitude 80m
- Kikinda: 45°51' North Latitude and 20°27' East Longitude, altitude 81m
- Jasa Tomic: 45°27' North Latitude and 20°51' East Longitude, altitude 81m
- Zrenjanin: 45°24' North Latitude and 20°25' East Longitude, altitude 80m
- Vrsac: 45°09' North Latitude and 21°19' East Longitude, altitude 84m
- Susara: 44°56' North Latitude and 21°08' East Longitude, altitude 180m
- Bela Crkva: 44°54' North Latitude and 21°25' East Longitude, altitude 90m
- Pancevo: 44°53' North Latitude and 20°40' East Longitude, altitude 80m

In the previous research and analysis of climatic elements at meteorological stations, the authors observed certain value differences, related to longitude and latitude of the position of stations. Applying those observations, Banat has been divided into three climatic regions: North Banat (meteorological stations Senta, Kikinda and Zrenjanin), Middle Banat (meteorological stations Jasa Tomic and Zrenjanin), and South Banat (meteorological stations Vrsac, Susara, Bela Crkva and Pancevo).

It is necessary to point out that Katic and his associates, in their work "Climate of SAP Vojvodina" (1979), divided Banat into four agro-climatic



■ Plate 1 Lowland dominating relief of the Banat; photo by: L.Lazic

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regions: North Banat, Middle Banat, South Banat, and East Banat. According to this division, meteorological stations in Vrsac and Bela Crkva belong to East Banat. As values of climatic elements in South and East Banat, i.e. meteorological stations situated there, indicate miniscule difference, it has been decided to merge these two regions into one – South Banat. In addition, this should be the right division from the geographical aspect, because if the region East Banat exists, then there should be West Banat to complement the division according to the compass points. Further more, latitude is one of the most important geographic factors for climate but its influence on South and East Banat cannot be observed due to their almost identical position according to this factor.

Time interval of following climatic elements used in this paper includes the period between 1951 and 1990, i.e. 40 years, with the exception of meteorological station in Jasa Tomic, which began its work in 1954, and the period of observation is three years shorter from the rest. The authors obtained values for the first three years of the observed period in this station by the method of interpolation between neighboring stations.

Precipitation Regime

Distribution of annual height of precipitation by months is called pluviometric regime or precipitation regime (Katic, Djukanovic, Djakovic, 1979).

Vojvodina is well known in literature by the Danubian type of rain regime, characterized by the highest rate in June (primary maximum), abundance in October (secondary maximum), and the lowest rate in winter, more precisely in January and February (Pavle Vujevic, 1924). About the same characteristics of annual precipitation are shown by other authors in different periods (Anderko, 1901, Milosavljevic, 1948). (Katic, Djukanovic, Djakovic, 1979).

As a contrast to this, Vojvodina, i.e., values for Banat, indicate striking deviations, with the exception of primary maximum. Secondary maximum has been moved from October to December, primary minimum does not occur in January or February but in March, and secondary minimum occurs in October, the month of former secondary maximum.

During the year, two maxima and two minima of precipitation are explicitly shown. The first, higher maximum occurs in June (86.8mm), May (69.8mm),

■ **Table 1** Mean monthly and annual quantity of precipitation (mm) in Banat between 1951 and 1990

	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Senta	39.0	39.7	37.0	45.0	66.5	79.2	47.9	52.6	37.3	32.6	48.1	48.7	573.6
Kikinda	34.3	35.0	34.3	44.7	53.5	76.4	53.4	51.7	37.5	33.2	46.5	46.7	547.2
Jasa Tomic	41.1	39.4	36.5	49.9	65.7	80.8	56.8	47.8	42.1	39.2	44.3	52.8	596.4
Zrenjanin	36.1	37.3	36.6	46.6	60.7	80.5	58.3	46.4	36.0	34.4	45.4	47.8	566.1
Vrsac	44.5	43.5	36.7	54.2	73.9	91.3	75.0	65.6	46.2	42.9	52.7	55.8	682.3
Susara	45.8	42.8	40.1	51.3	74.2	92.9	67.3	61.1	48.1	43.5	54.7	53.8	675.6
Bela Crkva	46.2	43.5	39.5	53.3	83.6	98.8	77.7	59.7	43.0	44.2	53.9	57.6	701.0
Pancevo	42.3	44.9	43.3	55.5	80.3	94.2	65.2	59.5	50.3	41.8	55.1	53.8	686.2
North Banat	36.7	37.4	35.7	44.9	60.0	77.8	50.6	52.2	37.4	32.9	47.3	47.7	560.6
Middle Banat	38.6	38.4	36.6	48.3	63.2	80.7	57.4	47.1	39.1	36.8	44.9	50.3	581.4
South Banat	44.7	43.7	39.9	53.6	78.0	94.3	71.3	61.5	46.9	43.1	54.1	55.3	686.3
Banat	41.2	40.8	38.0	50.1	69.8	86.8	62.7	55.6	42.6	39.0	50.1	52.1	628.6

Source: Meteorological yearbooks 1951-1990

the second in November (50.1mm) and December (52.1mm). Primary minimum occurs in March (38.0mm) and secondary in September (42.6mm) and October (39.0mm). (Table 1)

In observing maximum and minimum of precipitation in meteorological stations, smaller deviations are recorded. Thus, e.g. in meteorological stations in Senta, Kikinda, Zrenjanin and Pancevo minimum occurs in October. (Table 1)

When these values are observed in climate regions: North, Middle and South Banat, there are no deviations in values for the whole of Banat.

Mean Monthly and Mean Annual Heights of Precipitation

On the basis of observations between 1951 and 1990, the annual precipitation value on the territory of Banat is 628.6mm on average. The highest mean annual precipitation quantity has been recorded at meteorological station in Bela Crkva (701.0mm) and the lowest at the station in Kikinda (547.2mm), what indicates the great difference between the two. (Table 1)

The same relation has been noticed in observing Banat by its regions.

■ **Table 2** Mean quantity of precipitation (mm) according to seasons and vegetation period in Banat between 1951-1990

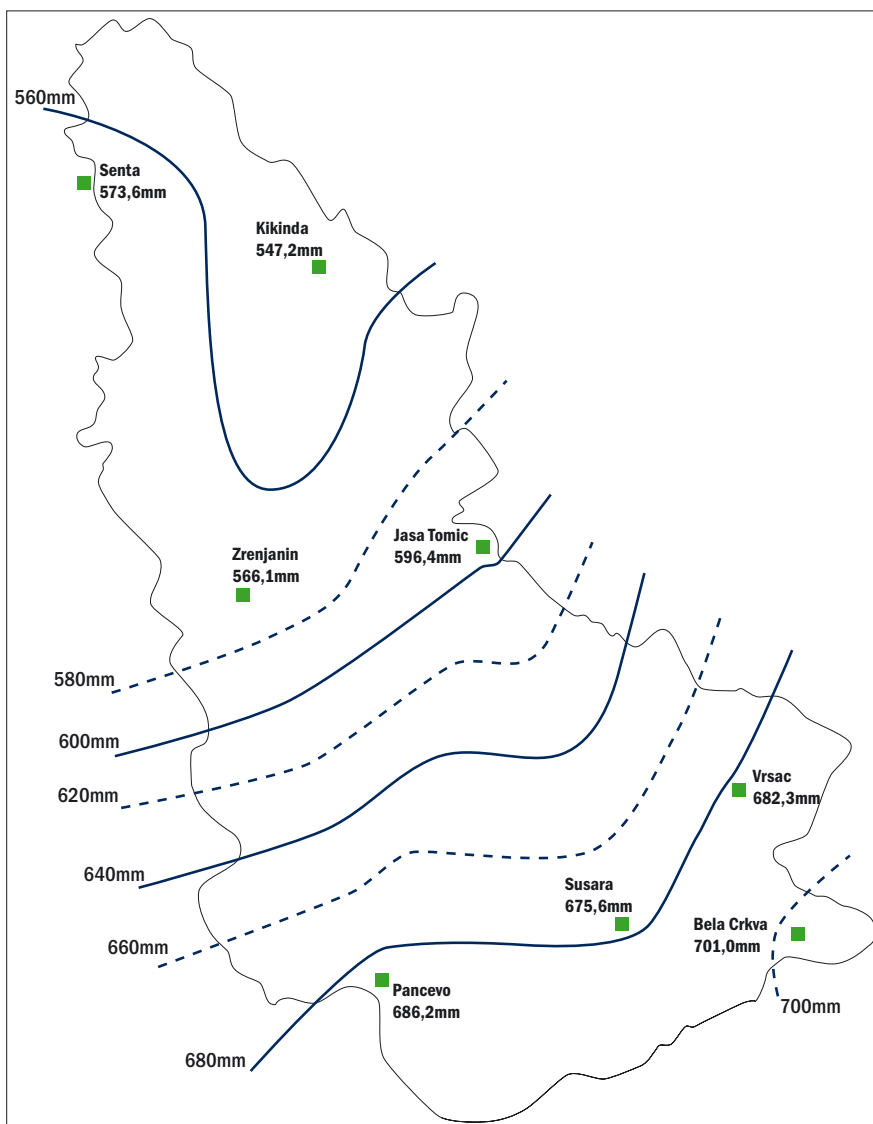
	Winter	Spring	Summer	Autumn	VP
Senta	127.4	148.5	179.7	118.0	328.5
Kikinda	116.0	132.5	181.5	117.2	317.2
Jasa Tomic	133.3	152.1	185.4	125.6	343.1
Zrenjanin	121.2	143.9	185.2	115.8	328.5
Vršac	143.8	164.8	231.9	141.8	406.2
Susara	142.4	165.6	221.3	146.3	394.9
Bela Crkva	147.3	176.4	236.2	141.1	416.1
Pancevo	141.0	179.1	218.9	147.2	405.0
North Banat	121.7	140.5	180.6	117.6	322.9
Middle Banat	127.3	148.0	185.3	120.7	335.8
South Banat	143.6	171.5	227.1	144.1	405.6
Banat	134.1	157.9	205.0	131.6	367.4

Source: Meteorological yearbooks 1951-1990

Namely, mean annual quantity of precipitation in North Banat is 560.6mm, whereas South Banat has 125.7mm higher value in this category. Middle Banat has slightly higher mean annual quantity of precipitation than North Banat, which is 581.4mm. (Table 1)

It has already been cited that the wettest month is June, but it is interesting to compare mean monthly values for this month in different meteorological stations. In June, the highest rate of precipitation occurs in Bela Crkva (98.8mm), the least in Kikinda (76.4mm). All meteorological stations in South Banat record more than 90mm, those in Middle Banat more than 80mm, whereas those in North Banat less than 80mm. The highest difference in quantity of precipitation is not recorded in this month but in May, when meteorological station in Bela Crkva gets about 30mm more rain than the one in Kikinda. (Table 1)

Annual variation of precipitation, which represent the difference between the sum of precipitation of the wettest and the driest month, is 48.8mm (June – 86.8mm, March – 38.0mm), whereas the relative variation is 7.7%. The



■ **Figure 1** Isolines of mean annual precipitation in Banat between 1951 and 1990

smallest annual variation is recorded at meteorological station in Jasa Tomic (7.4%), and the highest at the station in Bela Crkva (8.5%). The data indicate the even annual dispersion of precipitation on the territory of Banat.

In Banat dispersion of precipitation by seasons is the following: in summer 205.0mm, in spring 157.9mm, in winter 134.1mm, and the least in autumn 131.6mm. (Table 2). Observed according to meteorological stations, there is less precipitation in winter than in autumn in the following meteorological stations: Kikinda, Susara, and Pancevo. Lower values are recorded for winter in comparison to autumn in South Banat, too. (Table 2)

As Banat is mainly agricultural area, it is of great importance to survey the height of precipitation in vegetative period (from the beginning of April to the end of September). Mean height of precipitation in the period in Banat is 367.4mm; the least value in Kikinda 317.2mm, the highest value in Bela

Crkva, 416.1mm, and the difference is about 100mm. (Table 2)

The importance of quantity of precipitation in this period is the most clearly seen in the fact that any lack of water influences productivity of plants, i.e. demands irrigation. According to Longwin, precipitation of over 8mm during 12 hours is important for culti-

■ **Table 3** Mean monthly and annual number of days with precipitation height ≥ 0.1 mm in Banat between 1951 and 1990

	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Senta	7,2	8,3	8,9	12,1	12,9	12,0	9,5	7,9	8,3	7,9	11,9	11,1	118,0
Kikinda	7,7	7,9	9,9	12,3	12,6	13,1	10,0	8,9	7,9	8,0	11,9	10,6	120,8
Jasa Tomic	7,3	6,2	9,1	10,8	11,1	11,2	8,7	7,8	7,2	6,8	9,8	8,9	104,9
Zrenjanin	7,2	7,1	8,9	12,2	12,3	12,4	9,1	8,9	7,9	7,8	10,1	10,2	114,1
Vrsac	7,1	7,6	8,8	12,4	12,9	13,2	10,3	9,4	8,0	8,2	11,3	10,4	119,6
Susara	5,6	5,4	7,8	11,0	11,9	12,1	9,9	8,4	7,2	7,9	9,5	8,6	105,3
Bela Crkva	6,7	6,7	8,7	11,9	13,3	13,9	11,0	9,2	7,6	8,1	11,2	9,4	117,7
Pancevo	6,6	6,1	8,1	10,9	11,7	11,8	8,7	8,5	7,5	7,5	11,2	9,5	108,1
North Banat	7,5	8,1	9,4	12,2	12,8	12,6	9,8	8,4	8,1	8,0	11,9	10,9	119,4
Middle Banat	7,3	6,7	9,0	11,5	11,7	11,8	8,9	8,4	7,6	7,3	10,0	9,6	109,5
South Banat	6,5	6,5	8,4	11,6	12,5	12,8	10,0	8,9	7,6	7,9	10,8	9,5	112,8
Banat	6,9	6,9	8,8	11,7	12,3	12,5	9,7	8,6	7,7	7,8	10,9	9,8	113,6

Source: Meteorological yearbooks 1951-1990

vated plants, whereas precipitation of over 30mm during 24 hours is unfavorable or even harmful.

Frequency of Precipitation

Supposing that the days of precipitation differ by quantity of atmospheric water, the following border values for different precipitation intensity a day were suggested by Hope: for the days with weak precipitation 0.1mm - 1.9mm, for the days with mild precipitation 1.1mm - 5.0mm, for the days with strong precipitation 5.1mm - 10.0mm, and for the days with very strong precipitation 10.0mm and more. In this paper the data on average number of days, i.e. frequency of precipitation days with heights of precipitation ≥ 0.1 mm, ≥ 1.0 mm, and ≥ 10.0 mm.

The approach to the interpretation of the precipitation data enables the estimation of the arrangement of the number of days with mild and strong rain compared with the total number of precipitation days.

Frequency of precipitation days is an important element for numerous economy branches, especially for agriculture, because it is not equivalent whether the rain is falling for one day or several days, or whether its manifestation is weak, mild or heavy.

Mean Number of Days With Precipitation Height ≥ 0.1 mm

In Banat there are 113.6 days with precipitation height of ≥ 0.1 mm, on average a year. The largest frequency of precipitation days is at the end of spring and at the beginning of summer, precisely in May (12.3) and in June (12.5). It may be acknowledged that those are the same months with the largest mean precipitation quantity. The large frequency occurs also in April (11.7) and in November (10.9). The smallest frequency of precipi-

tation is recorded in winter, in January (6.9) and February (6.9). (Table 3)

The analysis of values at meteorological stations has acknowledged that Kikinda records the largest number of days with precipitation (120.8) and Jaska Tomic the smallest (104.9). Furthermore, a certain disorder is recorded, that Kikinda, the place with the smallest mean annual precipitation quantity, on the contrary, has the largest number of days with precipitation. It may be explained with the small intensity of precipitation, which is to be described later in this paper.

The situation is clearly understood also in observing values by climatic regions where it is acknowledged that North Banat, despite the fact that it has the smallest annual precipitation quantity, it has the largest number of days with precipitation (119.4), whereas Middle Banat has 109.5 aforementioned days and South Banat 112.8. (Table 3)

Mean Number of Days With Precipitation Height ≥ 1.0 mm

On the territory of Banat there are 90.6 days with precipitation height ≥ 1.0 mm on average. The largest mean number of days with precipitation ≥ 1.0 mm is recorded at meteorological station Bela Crkva (94.5), and the smallest at meteorological station Kikinda (84.9). The largest frequency of the aforementioned days occurs in December (10.2), then in June (9.4), in May (9.3), whereas the smallest frequency of precipitation ≥ 1.0 mm occurs in October (4.9) and in September (5.1). (Table 4)

The data on frequency of days with precipitation ≥ 1.0 mm, by climatic regions, are proportional to mean annual quantity of precipitation. That is to say, North Banat has the smallest mean number of days with precipitation ≥ 1.0 mm (86.9), and South Banat has the largest (96.4). (Table 4)

Mean Number of Days With Precipitation Height ≥ 10.0 mm

According to the agro meteorologists' attitude, if there is 10.0mm or more precipitation in one day, i.e. 10.0mm or more on 1m², it is considered sufficient quantity of precipitation for plants during vegetative period.

Mean number of aforementioned days during a year is 18.1 for Banat. The largest number occurs at the end of spring and at the beginning of summer (May – 2.3; June 2.5; July – 2.0), whereas the smallest number is recorded in March (0.8) and October (0.9). The largest mean value of days

■ **Table 4** Mean monthly and annual number of days with precipitation height ≥ 1.0 mm in Banat between 1951 and 1990

	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Senta	7,6	7,5	7,1	7,5	9,3	8,5	6,5	5,5	5,3	4,4	8,9	10,8	88,9
Kikinda	6,8	7,5	6,3	7,7	8,2	8,9	6,5	6,0	4,9	4,3	8,6	9,2	84,9
Jaska Tomic	7,8	7,9	7,3	8,4	9,8	9,1	7,3	5,5	5,3	4,4	8,4	10,6	91,8
Zrenjanin	7,3	7,7	6,4	7,6	8,6	9,1	6,3	5,8	4,8	4,6	8,8	9,2	86,2
Vrsac	7,9	7,9	6,7	8,2	9,8	10,1	6,9	6,5	5,0	4,7	8,5	9,5	91,7
Susara	7,8	7,6	7,5	8,5	8,8	9,5	7,0	6,2	5,5	4,2	9,2	11,2	93,0
Bela Crkva	8,3	7,9	7,0	8,1	10,1	10,2	7,4	6,4	5,1	5,1	8,6	10,3	94,5
Pancevo	7,8	8,4	7,4	8,1	9,4	9,5	7,2	5,8	4,7	5,2	9,6	10,4	93,5
North Banat	7,2	7,5	6,7	7,6	8,8	8,7	6,5	5,8	5,1	4,4	8,8	10,0	86,9
Middle Banat	7,6	7,8	6,9	8,0	9,2	9,1	6,8	5,7	5,1	4,5	8,6	9,9	89,0
South Banat	8,0	8,0	7,2	8,2	9,5	9,8	7,1	6,2	5,1	8,0	9,0	10,4	96,4
Banat	7,7	7,8	7,0	8,0	9,3	9,4	6,9	6,0	5,1	4,6	8,8	10,2	90,6

Source: Meteorological yearbooks 1951-1990

■ **Table 5** Mean monthly and annual number of days with precipitation height ≥ 10.0 mm in Banat between 1951 and 1990

	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Senta	1,1	1,1	0,7	1,2	1,8	2,5	2,0	1,5	1,3	0,8	2,0	1,6	17,6
Kikinda	0,8	0,9	0,5	1,2	1,4	2,4	1,7	1,6	1,0	0,9	1,2	1,6	15,2
Jaša Tomić	1,2	1,2	0,7	1,6	2,9	2,8	2,1	1,6	0,8	0,8	1,7	1,9	19,3
Zrenjanin	1,2	1,0	0,8	1,4	1,9	2,3	1,7	1,5	0,9	0,7	1,5	1,5	16,4
Vršac	1,2	0,9	0,7	1,5	2,6	2,7	2,2	2,0	1,0	1,1	2,1	1,8	19,8
Šušara	1,6	0,8	0,8	1,8	2,5	2,1	2,0	1,6	1,3	0,8	1,5	2,1	18,9
Bela Crkva	1,3	1,1	0,9	1,4	2,8	3,0	2,3	1,8	1,2	1,0	1,7	1,4	19,9
Pančevo	1,3	1,0	1,0	1,2	2,4	2,5	1,6	1,3	1,3	1,0	1,7	1,7	18,0
North Banat	1,0	1,0	0,6	1,2	1,6	2,5	1,9	1,6	1,2	0,9	1,6	1,6	16,4
Middle Banat	1,2	1,1	0,8	1,5	2,4	2,6	1,9	1,6	0,9	0,8	1,6	1,7	17,9
South Banat	1,4	1,0	0,9	1,5	2,6	2,6	2,0	1,7	1,2	1,0	1,8	1,8	26,2
Banat	1,2	1,0	0,8	1,4	2,3	2,5	2,0	1,6	1,1	0,9	1,7	1,7	18,1

Source: Meteorological yearbooks 1951-1990

with precipitation ≥ 10.0 mm is recorded at the meteorological station in Bela Crkva (19.9), and the smallest at the meteorological station in Kikinda (15.2). (Table 5)

Is climatic regions are observed, the largest mean value of days with precipitation ≥ 10.0 mm is recorded in South Banat (26.9), whereas the sum is approximately 10 days less for North Banat (16.4). (Table 5)

Probability of Precipitation

Probability of precipitation is the result obtained by dividing the mean number of days with precipitation in a month or

any other period with the total number of days of the month or period. Owing to its immediate indication to changes in annual humidity regime, probability of precipitation is important in practice, especially in agriculture.

The table demonstrates the fact that the largest number of days with precipitation in Banat is to be expected in June (41.5%); in May (39.8%), and in April (39.0%) when in every 10 days there are 4 days with precipitation on average. It also supports expectations of smallest number of days with precipitation in January (22.3), in February (24.5%) and

■ **Table 6** Probability of monthly and annual precipitation in Banat between 1951 and 1990

	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Senta	23,2	29,4	28,7	40,3	41,6	40,0	30,6	25,5	27,7	25,5	39,7	35,8	32,3
Kikinda	24,8	28,0	31,9	41,0	40,6	43,7	32,3	28,7	26,3	25,8	39,7	34,2	33,1
Jaša Tomić	23,5	21,9	29,4	36,0	35,8	37,3	28,1	25,2	24,0	21,9	32,7	28,7	28,7
Zrenjanin	23,2	25,1	28,7	40,7	39,7	41,3	29,4	28,7	26,3	25,2	33,7	32,9	31,2
Vršac	22,9	26,9	28,4	41,3	41,6	44,0	33,2	30,3	26,7	26,5	37,7	33,5	32,7
Šušara	18,1	19,1	25,2	36,7	38,4	40,3	31,9	28,0	24,0	25,5	31,7	27,7	28,8
Bela Crkva	21,6	23,7	28,1	39,7	42,9	46,3	35,5	29,7	25,3	26,1	37,3	30,3	32,2
Pančevo	21,3	21,6	26,1	36,3	37,7	39,3	28,1	27,4	25,0	24,2	37,3	30,6	29,6
North Banat	24,0	28,7	30,3	40,7	41,1	41,8	31,5	27,1	27,0	25,6	39,7	35,0	32,7
Middle Banat	23,4	23,5	29,0	38,3	37,7	39,3	28,7	26,9	25,2	23,5	33,2	30,8	30,0
South Banat	21,0	22,8	26,9	38,5	40,2	42,5	32,2	28,9	25,3	25,6	36,0	30,6	30,9
Banat	22,3	24,5	28,3	39,0	39,8	41,5	31,1	27,9	25,7	25,1	36,2	31,7	31,1

Source: Meteorological yearbooks 1951-1990

■ **Table 7** Probability of precipitation observed in seasons and vegetative period in Banat between 1951 and 1990

	Winter	Spring	Summer	Autumn	VP
Senta	29,5	36,9	32,0	30,9	34,3
Kikinda	29,0	37,9	30,2	30,6	35,4
Jaša Tomić	24,7	33,7	30,2	26,2	31,1
Zrenjanin	27,1	36,4	33,1	28,4	34,3
Vršac	27,8	37,1	35,8	30,3	36,2
Šušara	21,6	33,4	33,4	27,1	33,2
Bela Crkva	25,2	36,9	37,2	29,6	36,6
Pančevo	24,5	33,4	31,6	28,8	32,3
North Banat	29,2	37,4	31,1	30,8	34,9
Middle Banat	25,9	35,0	31,7	27,3	32,7
South Banat	24,8	35,2	34,5	28,9	34,6
Banat	26,2	35,7	32,9	29,0	34,2

in October (25.1%). With the regard to the whole year, it is to be expected that every third day would be with measurable precipitation. (Table 6)

With regard to meteorological stations, the largest probability of days with precipitation during a year occurs in Kikinda (33,1%). and the smallest in Jasa Tomic (28.7%). As far as climatic regions are concerned, the largest number of precipitation days is to be expected in North Banat (32.7%), and the smallest in Middle Banat (30.0%). (Table 6)

In observing probability of precipitation by seasons, it is clearly seen that the largest amount of precipitation in Banat is to be expected in spring (35.7%), and the smallest in winter (26.2%), what stands in discrepancy with the mean quantity of precipitation, assuming that summer has the largest values of mean quantity of precipitation, and autumn the smallest. It may be explained by higher intensity of precipitation in those seasons. Furthermore, in winter the largest amount of precipitation may be expected in North Banat (29.2%), and the smallest in South Banat (24.8). Probability of precipitation in spring is the largest in South Banat (34.5%), the smallest in

■ **Table 8** Rain factor and draught index (R. Lang) in Banat between 1951 and 1990

	Mean annual quantity of precip. (mm)	Mean annual temperature (°C)	Rain factor
Senta	573,6	10,9	52,6
Kikinda	547,2	10,7	51,1
Jasa Tomic	596,4	11,0	54,2
Zrenjanin	566,1	11,2	50,5
Vrsac	682,3	11,4	59,9
Susara	675,6	11,2	60,3
Bela Crkva	701,0	11,3	62,0
Pancevo	686,2	11,3	60,7
North Banat	560,6	10,8	51,9
Middle Banat	581,4	11,1	52,4
South Banat	686,3	11,3	60,7
Banat	628,6	11,1	56,6

North Banat (31.1%), whereas in winter the highest values of precipitation occur in North Banat (30.8%), and the smallest in Middle Banat (27.3%). (Table 7)

Rain Factor and Draught Index

On the basis of these two values, climatic types of the place or area may be defined by using annual sums of precipitation and mean annual air temperature.

Rain factor was introduced in climatology by R. Lang. The value (F) represents the ratio between annual sum of precipitation (H) and mean annual air temperature (t), i.e. $F=H:t$.

■ **Table 9** Draught index (Emmanuel de Martonne) in Banat between 1951 and 1990

	Mean annual quantity of precip. (mm)	Mean annual temperature (°C) + 10	Draught index
Senta	573,6	20,9	27,4
Kikinda	547,2	20,7	26,4
Jasa Tomic	596,4	21,0	28,4
Zrenjanin	566,1	21,2	26,7
Vrsac	682,3	21,4	31,9
Susara	675,6	21,2	31,9
Bela Crkva	701,0	21,3	32,9
Pancevo	686,2	21,3	32,2
North Banat	560,6	20,8	27,0
Middle Banat	581,4	21,1	27,6
South Banat	686,3	21,3	32,2
Banat	628,6	21,1	29,8

Assuming that two values are $H = 628.6\text{mm}$ and $t = 11.1^\circ\text{C}$, rain factor for Banat reads $F = 56.6$. According to Lang's division, this value corresponds to humid climate of steppes and savannas ($F = 40$ to 60). If the meteorological stations are observed individually, the one in Zrenjanin reads the lowest value of rain factor – 50.5 , and the one in Bela Crkva the highest – 62.0 . This points out that the station in Zrenjanin is among all in this area, the most typical representative of humid climate of steppes and savannas. At the same time, the station in Bela Crkva does not belong to

the same category, but to humid climate of thin forests. (Table 8)

Draught index was first introduced in climatology by French geographer Emmanuel de Martonne.

Draught, humid and mild areas are determined by using this value. Development and character of vegetation depend mostly on the quantity of precipitation (H) and air temperature (t), thus the two values are taken into account at calculating draught index:

$$I = H : (t + 10)$$

The result of this function is draught index for Banat: $I = 628.6 / (11.1 + 10) = 29.8$. (Table 9)

Conclusion

Observing the distribution of atmospheric sediment by months, as well as its mean annual values, it is obvious that southern parts of the examined area are more humid than northern. Especially, it is seen in the analysis of mean monthly and mean annual sums of precipitation by separate climatic regions of North, Middle, and South Banat. Specifically, during all twelve months in a year, South Banat gets the most of the sediment. During the period of ten months (except August and November) the quantity of precipitation regularly decreases from the south to north of the area. IN the aforementioned months North Banat is slightly more humid than Middle. As a result of the ratio of mean monthly quantity of precipitation by climatic regions, mean annual values are largest in South, then in Middle and finally in North Banat, being the driest region. The same ratio remains during all four seasons and during vegetative period. The values of the other analyzed parameters indicate the necessity of dividing the researched area into climatic regions of North, Middle and South Banat.

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