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VARIABILITY OF PRECIPITATION IN OLTENIA

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ABSTRACT. ***Variability of Precipitation in Oltenia.*** Excess atmospheric precipitation is part of the category of climatic risk phenomena and is located at the opposite pole to the phenomena of dryness and drought (Octavia Bogdan, Ion Marinică, 2007). They are possible in any season of the year and can be determined by both rains and heavy snowfalls, produced mainly by cyclonic activity on the continent. Precipitation is one of the important factors that can compete with triggering the phenomena of dryness and drought, but also of excess humidity. The causes of excess precipitation are related to the dynamics of the atmosphere, but it can also be maintained by other factors that depend on the characteristics of the active surface. The precipitation deficit is characterized by precipitation that is below the values of daily averages and monthly averages (below normal values). A multitude of factors participate in the triggering of drought and dryness phenomena with the climatic parameters that define the state of dry and arid weather (Ion Marinică, 2006).

Keywords: Oltenia, precipitation, moisture, dryness, drought.

1. INTRODUCTION

The work proposes an analysis of the dynamics of the pluviometric regime in Oltenia, from the period: 1981 – 2017. The rainfall regime depends directly on the regime of the general circulation of the atmosphere. The structure of Romania's active surface has a particularly large role in the geographical distribution of precipitation, the Carpathians having a role of orographic dam and dividing the country into regions where the weather and climate have different aspects. ***Excess amounts*** cause intense processes of soil erosion, landslides, floods and floods (Dragota, 2006). At least as dangerous are ***the deficient amounts of precipitation*** or their lack over longer intervals. They cause the occurrence of droughts as well as aridization phenomena, being associated with the increased anthropogenic pressure on the environment, which favours the expansion of desertification. ***The role of an orographic dam of the Carpathians*** is manifested by the blocking of cyclonic and anticyclonic formations on either side of them. Contrasting situations often appear in the evolution of precipitation, from one year to another, which allowed us to observe an apparently paradoxical situation: the regions that usually suffer from dryness and drought are also the regions where the greatest excess of moisture. Among the multiple causes that determine these processes, the most important are:

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- ***the position of these regions on the periphery of areas of cyclonic and anticyclonic influence*** that oscillate in one direction or another, bringing waves of rain or drought.

- the greater influence they have on the respective regions, Mediterranean cyclones with normal and retrograde evolution.

- the characteristics of the plain relief with numerous roofs, which retain water, as well as the decreasing altitude from west to east, in the southeast of the Romanian Plain, being the lowest in the country, towards which the entire water table that has accumulated water from all over the territory of the country. - ***The main cause*** that determines the excess moisture is the cyclonic activity on the continent and the interaction of cyclones with anticyclones, which brings air masses with different characteristics into contact. (Marinică et al., 2016).

1.1 Physical-geographic characterization of the Oltenia region

The Oltenia area includes the strategic geographical axis of Jiu and Olt, the Danube Meadow in the southern area of Dolj and Olt counties, the Carpathian and Subcarpathian area in the north of Gorj and Vâlcea counties, as well as the Danube river, which crosses Oltenia starting from the northwest of Mehedinți county and continuing with the south of Dolj and Olt counties (Fig. no.1).

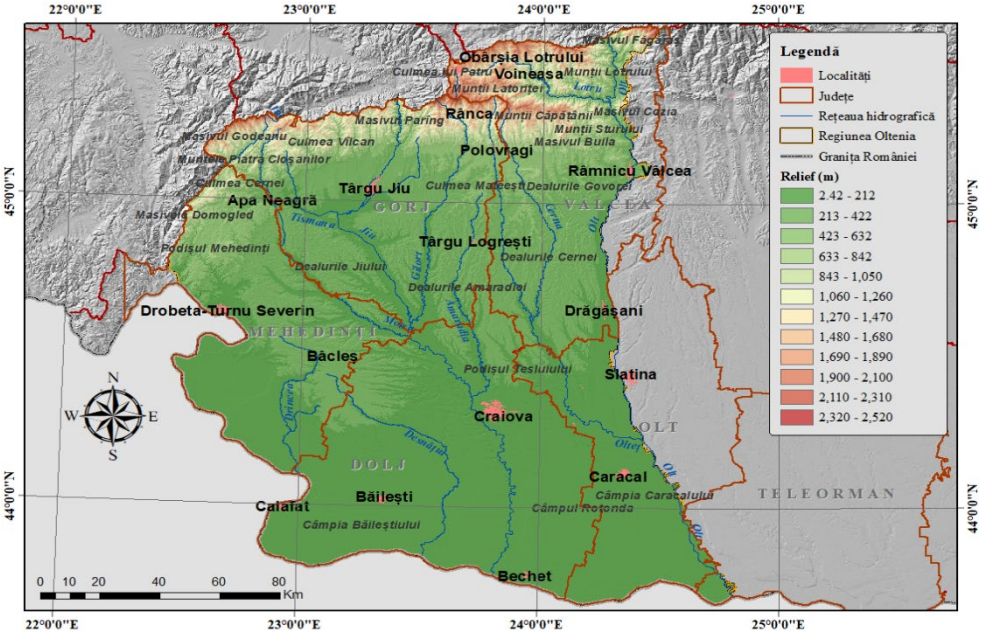

Fig. 1. Oltenia historical province (Processing in GIS)

The elevation of the relief decreases from north to south, and the highest point is Mount Parângul Mare (2519 m), located right on the northern border of Gorj county describing a wide amphitheater. The orientation of the hills is generally in the north-south direction, and this is of great importance regarding human

settlements and the construction of the infrastructure of communication routes, but also on the interaction of the relief with the general circulation of the atmosphere above Oltenia, a factor that is important in the nuance local climate. The underlying active surface is very varied, from the sand dune areas in the southern extremity to the mountain peaks in the northern extremity. The topoclimates of Oltenia are influenced by relief, vegetation, and soil composition. The territory between the Danube River, the Olt River and the Southern Carpathians, Oltenia, is divided into three relief zones, which follow each other from north to south: to the north, the southern slope of the Vâlcan and Parâng Mountains and the southeastern slope of the Godeanu and Mehedinţi Mountains , in the center, the Oltenia Subcarpathians, the Getic Plateau and the Târgu Jiu Intercollinear Depression, and to the south, the Oltenia Plain. The territory monitored from a meteorological point of view by the Oltenia Regional Meteorological Center is mainly the historical province of Oltenia. It is located in the southwestern part of the country and includes the counties: Mehedinţi, Gorj, Vâlcea, Dolj, Olt, a small part of Caraş-Severin county up to the Cerna river valley, and in the north, a small part of Hunedoara county, respectively the Jiului Valley (with Petroşani municipality) to the peaks of the Carpathians (respectively Vârful Parângul Mare – Parâng meteorological station).

Table 1. Meteorological stations in Oltenia - geographical coordinates

Nr. crt.	Weather station (County)	Station code	Coordinates		Altitude(m)
			Latitude	Longitude	
1	Craiova (DJ)	15450	44°18'37"	23°52'01"	192
2	Bechet (DJ)	15494	43°47'23"	23°56'39"	36
3	Băileşti (DJ)	15465	44°01'45"	23°19'52"	57
4	Calafat (DJ)	15482	43°59'06"	22°56'46"	61
5	Slatina (OT)	15434	44°26'32"	24°21'16"	172
6	Caracal (OT)	15469	44°06'00"	24°21'26"	106
7	Bâcleș (MH)	15412	44°28'34"	23°06'47"	313
8	Drobeta Turnu Severin(MH)	15410	44°37'35"	22°37'34"	77
9	Târgu Logrești (GJ)	15369	44°52'41"	23°42'31"	265
10	Târgu Jiu (GJ)	15340	45°02'26"	23°15'34"	203
11	Padeș (Apa Neagră) (GJ)	15341	44°59'49"	22°51'34"	251
12	Polovragi (GJ)	15344	45°09'56"	23°48'31"	531
13	Râmnicu Vâlcea (VL)	15346	45°05'20"	24°21'46"	237
14	Drăgășani (VL)	15395	44°39'56"	24°14'14"	280
15	Voineasa (VL)	15319	45°24'40"	23°58'01"	573
16	Obârșia Lotrului (VL)	15297	45°26'08"	23°37'51"	1348
17	Petroșani (HD)	15296	45°24'23"	23°22'36"	607
18	Vf. Parâng (HD)	15320	45°23'15"	23°27'47"	1548

The surface of the 5 counties is 29,015 km². To the south it has a natural border with the territory of Bulgaria, the Danube river; to the east, the eastern limit of Olt county, which north of the town of Scărișoara (located to the right of Olt) deviates far to the east approaching Roșiori de Vede, including part of the Boianului Plain and the Cotmenei Piedmont. The southernmost point of Oltenia is located in the middle part of the minor bed of the Danube downstream of Ostrovul Păpădia, a little more southeast of the ridge of Tânjelii (the latter with an altitude of only 28 m). Oltenia is crossed by numerous rivers, the most important being Oltul and Jiul, which flow from north to south, and the Danube river, from west to east. (Geografia României, 1983). Due to the position of the region, it is influenced by the Mediterranean climatic standards, more than by the temperate-continental systems, which affect the neighboring regions. In general, it is warmer in the Oltenia Region than in the rest of the country.

1.2 Weather stations in the Oltenia area

The meteorological stations in the Oltenia area, which are part of the administrative structure of the Oltenia Regional Meteorological Center, based in Craiova (Fig. no. 2, Table no. 1)

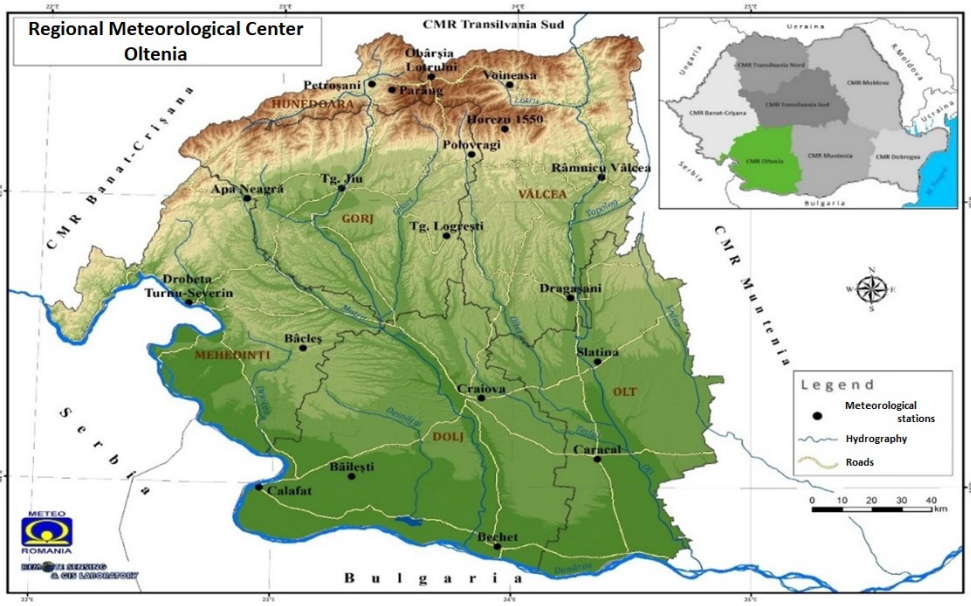

Fig. 2. Meteorological stations within the C.M. R. Oltenia (Processing in GIS))

2. DATA AND METHODS

These come from the weather stations from the administrative structure of ANM Bucharest - Oltenia Regional Meteorological Center: Craiova, Drobeta Turnu-Severin, Târgu Jiu, Râmnicu Vâlcea, Slatina, Vf.Parâng, Bechet, Obârșia Lotruului, Calafat, Bâcleș, Polovragi, Voineasa, Drăgășani, Caracal, Târgu Logrești, Băilești, Petroșani, Apa Neagră. Weather stations managed by C.M.R. Oltenia are included

in the counties: Dolj, Olt, Vâlcea, Gorj, Mehedinţi, Hunedoara and are located on all the relief steps of Oltenia. For a complex analysis of the climatic risk phenomena in Oltenia related to precipitation, such as: drought, dryness, excess humidity, torrential rains, hail, classic data processing methods will be used, but also modern ones, used especially in recent years, both internationally and nationally in climatological research. Thus, the following methods were used: deductive, inductive, analytical, comparative, as well as statistical-mathematical and graphic methods. Among the methods of processing and interpreting rainfall data, we mention methods for calculating averages, frequencies and insurances, the standardized anomaly of precipitation to illustrate the excess and deficit of precipitation, the trends (linear and polynomial regression) for temperatures and precipitation, the coefficient of variation.

3. RESULTS

Table 2. Multiannual monthly averages for Oltenia in the interval 1981 – 2017 (mm)

Weather Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Craiova	41,0	35,1	44,2	53,1	66,3	69,6	65,8	49,3	46,6	45,9	49,2	49,2
Calafat	37,0	34,0	38,6	48,8	55,0	**49,3**	**52,1**	37,9	46,7	**41,6**	46,3	46,4
Băilesti	38,2	35,2	40,0	48,5	55,3	53,1	52,7	44,3	46,6	44,4	44,9	48,4
Bechet	33,6	**28,1**	40,3	46,5	60,0	58,6	53,4	**33,6**	**38,7**	43,3	38,8	**37,1**
Slatina	36,2	31,9	40,4	48,7	60,4	67,4	69,6	60,6	44,9	45,5	41,1	39,0
Caracal	35,8	29,6	40,0	**44,4**	**52,6**	62,6	60,1	44,9	42,1	42,3	41,2	39,7
Dr Tr Severin	44,7	45,3	44,1	59,1	66,5	64,7	57,2	41,0	53,0	52,8	52,9	65,6
Bâcles	**30,3**	31,5	37,2	54,3	64,6	57,3	61,7	46,3	48,6	42,8	**36,7**	42,7
Tg Jiu	47,0	47,5	45,6	62,1	76,8	85,4	86,9	65,7	58,9	61,4	55,5	63,5
Tg Logreşti	37,6	38,5	38,5	53,7	71,8	74,9	72,5	62,1	48,3	48,5	45,8	48,2
Apa Neagră	**58,5**	**61,9**	**61,3**	76,3	88,6	95,5	89,5	61,4	**71,8**	**76,6**	**80,0**	**81,2**
Polovragi	44,6	45,7	51,3	**68,4**	**98,1**	100,1	**99,0**	**84,3**	65,2	69,4	62,3	63,8
Rm Vâlcea	36,1	33,8	36,8	59,6	79,7	85,1	80,1	76,1	55,2	52,4	47,9	50,1
Drăgăsani	35,1	31,6	**35,9**	52,1	72,0	68,2	70,9	55,6	50,0	49,4	42,0	42,2
Petroşani	39,2	37,2	42,3	56,7	75,8	**101,2**	86,7	67,0	59,9	45,6	43,3	47,0
Vf Parâng	49,0	44,5	55,9	80,5	111,3	131,0	117,1	92,7	83,6	62,6	53,1	52,5
OLTENIA	***40,2***	***38,2***	***43,3***	***57,1***	***72,2***	***76,5***	***73,5***	***57,7***	***53,8***	***51,5***	***48,8***	***51,0***

3.1 EXCESSIVE PRECIPITATION (large amounts of precipitation from the period 1981 - 2017)

The highest amounts of precipitation recorded at the weather stations in Oltenia during the analyzed period were in the years: 2005, 2010 and 2014 (Table no. 3). The rainiest year during this period was 2014 (Figure no. 4). The highest maximum rainfall recorded in 24 hours was 131.8 mm at Tg Jiu on 16.07.1998. The highest annual amount of precipitation was 1591.4 mm at Apa Neagră in 2014. Precipitation

is one of the important factors that can compete with the triggering of the phenomena of dryness and drought, but also of excess humidity. The regime of precipitation directly depends on the regime of the general circulation of the atmosphere. The role of an orographic dam of the Carpathians is manifested by the blocking of cyclonic and anticyclonic formations on either side of them. During the year, there are 2 annual rainfall maxima (ANM Clima României, 2008): The main rainfall maximum from May-June is generated by oceanic cyclones, and in Oltenia it has the following values: In the Romanian Plain, values of 65-75 mm in Calafat and 66.5 in Băilești, Craiova 70.7 mm. In the Getic Plateau values between:75 – 100 mm, at Tg Logrești 76.2 mm, Drăgășani 70.7 mm. In the Subcarpathians between: 90–100 mm, Tg Jiu 93.0 mm, Polovragi 112.3 mm.(Table no. 2, Figure no. 3).

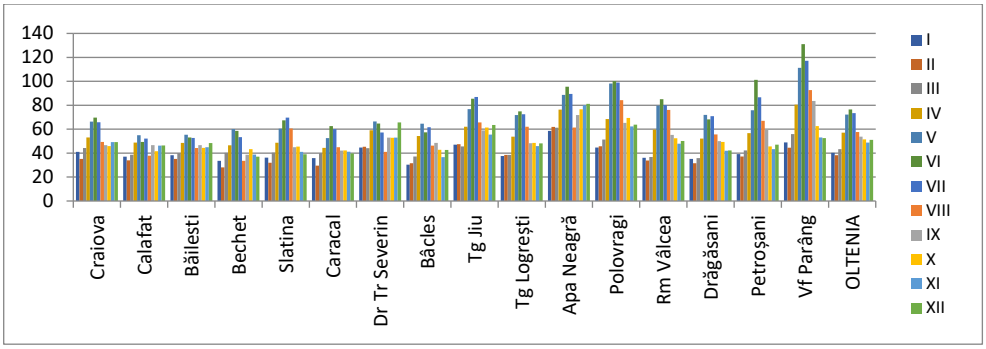

Fig. no. 3 Multiannual monthly averages - Oltenia from 1981 – 2017

The secondary pluviometric maximum in the November - December interval has lower values than the main one by 20 - 30 mm in the Oltenia Plain. ***The minimum annual rainfall*** is recorded in the months of February - March at the end of winter and the beginning of spring. The values recorded in this minimum are: 25 – 40 mm in the Oltenia Plain, and higher values are recorded in the west and north of it and lower in the southeast, between 45-60 mm in the Oltenia Subcarpathians.

3.2 The monthly rainfall regime

3.2.1 Rainfall regime in January

The multiannual rainfall averages in January are between: **30.3** mm at Bâcleș in the southwest of the region and **58.5** mm at Apa Neagră in the northwest of the region. High values (≥ 40.0 mm) are recorded in Craiova 41.0 mm, Dr.Tr.Severin 44.7 mm, Polovragi 44.6 mm, and in the mountain area 49.0 mm at Vf.Parâng. More modest values of monthly precipitation are recorded on the Olt corridor at Caracal 35.8 mm, Slatina 36.2 mm, Rm. Vâlcea 36.1 mm, Drăgășani 35.1 mm. (Table no. 2)

The distribution of average monthly precipitation values is closely related to the thermobaric formations that affect Oltenia in January, the types of frequent atmospheric circulations and the interaction of air masses and atmospheric fronts with the stepped relief of the region.

The overall average for the entire region in January is **40.2** mm.

Table 3 Excess precipitation from the period 1981 – 2017/ Annual precipitation from 2014 / the maximum amount of precipitation in 24h.

EXCESSIVE PRECIPITATION - Oltenia period 1981 - 2017 (mm)					
Anul	2005	2010	2014	*Highest 24 h maxima*	*Date*
Craiova	1082,3	826,9	1147,2	**77,6**	13.04.2003
Calafat	809,5	590,1	979,1	**84,8**	01.10.1981
Băilești	850,0	776,1	1032,8	**63,7**	03.09.2014
Bechet	807,8	686,5	840,5	**87,2**	03.08.2017
Slatina	999,1	738,3	1024,2	**104,8**	08.08.2002
Caracal	901,8	714,0	937,6	**102,2**	05.09.2014
Dr.Tr.Severin	846,4	876,5	1167,5	**118,8**	15.09.2014
Bâcleș	909,0	683,4	728,3	**78,1**	25.09.2015
Tg. Jiu	1121,9	981,4	1079,1	**131,8**	16.07.1998
Tg.Logrești	978,6	807,7	1140,2	**85,9**	08.08.2004
Apa Neagră	1284,8	1443,6	1591,4	**91,8**	23.10.2014
Polovragi	1233,3	1178,0	1188,7	**85,6**	03.07.2017
Rm. Vâlcea	1085,3	948,4	1135,0	**97,8**	26.06.1992
Drăgășani	1034,5	764,4	1156,9	**85,4**	03.07.2017
Petroșani	853,8	980,8	794,0	**67,2**	15.08.2016
Vf. Parâng	1220,3	1318,8	1262,8	**77,8**	12.08.2005
Average	1001,2	894,7	1075,3		

The months of January with the most precipitation were recorded in Oltenia during the reference period as follows: 1998, 2003, 2004, 2009, when monthly precipitation values ≥ 100 mm were recorded in the Subcarpathian area, and the highest it was 134.4 mm in 2009 at Apa Neagră. The poorest January months in precipitation were recorded in the years: 1982,1983,1989,1990,1991,1992 when in the south of the region there were values below 10 mm, and the recorded record was 0.0 mm in 1989 in Craiova and Calafat. The trend of monthly precipitation amounts was increasing one by one.

3.2.2 Rainfall regime in February

The multiannual rainfall averages are between **28.1** mm at Bechet in the south of the region and **61.9** mm at Apa Neagră (Padeș) in the subcarpathian area. The lowest multiannual values are recorded in the south and southeast of the region: Bechet 28.1 mm, Caracal 29.6 mm, Drăgășani 31.6 mm, Slatina 31.9 mm. In the south-west the values increase slightly, Calafat 34.0 mm, Craiova 35.1 mm, Băilești 35.2 mm. The highest values ≥ 40 mm are recorded in the west and north-west of the region : Dr. Tr. Severin 45.3 mm, Tg Jiu 47.5 mm, Apa Neagră 61.9 mm. (Table no. 2)

It is the poorest month of the year in terms of precipitation, although the monthly average is 38.2 mm, slightly below the January average. The richest February months in the last 50 years are: 1969, 1972, 1978, 1979, 1984, 1986, 2005, 2006, months in which, especially in the subcarpathian area, the amounts of precipitation were ≥ 100 mm, and the record is held by the weather station Apa Neagra with 194.2 mm in 1986.

The overall average for the entire region in February is **38.2** mm.

3.2.3 Rainfall regime in March

The multiannual rainfall averages are between 35.9 mm at Drăgășani and 61.3 mm at Apa Neagră in the west of the Carpathian area. The values are slightly higher than those of February. Low precipitation values are recorded in Rm. Vâlcea 36.8 mm, Bâcles 37.2 mm, Calafat 38.6 mm. High precipitation values are recorded at Polovragi 51.3 mm, Tg Jiu 45.6 mm, and in the mountain area Vârful Parâng 55.9 mm (Table no. 2).

The overall average for the entire region in March is **43.3** mm.

The trend of monthly precipitation amounts in March was an increasing one.

3.2.4 Rainfall regime in April

The multiannual rainfall averages are between 44.4 mm at Caracal and 80.5 mm at Vf. Parâng in the mountain area. Lower precipitation values are recorded in Calafat, Băilești, Bechet. Higher precipitation values are recorded at Tg Jiu 62.1 mm, Apa Neagra 76.3 mm, Polovragi 68.4 mm in Gorj county (Table no. 2).

The overall average for the entire region in April is **57.1** mm.

The trend of the monthly amounts of precipitation in April was an increasing one. The driest April in the last 50 years was in 2007. The frequency of April months with monthly precipitation values below 10 mm in the south of Oltenia in the last 50 years is 6.0%.

3.2.5 Rainfall regime in May

It is the warmest, most unstable and most rainy of the spring months. The multiannual rainfall averages in May are between 52.6 mm at Caracal and 98.1 mm at Polovragi and 111.3 mm at Vârful Parâng in the mountain area. Lower precipitation values are recorded in Calafat 55.0 mm, Băilești 55.3 mm, Caracal 52.6 mm. Higher precipitation values are recorded at Apa Neagră 88.6 mm, Rm. Valcea 79.7 mm, Petroșani 75.8 mm (Table no. 2).

The overall average for the entire region in May is **72.2** mm.

The trend of monthly precipitation amounts in May was decreasing for weather stations in the southern half of the region and slightly increasing in the northern one.

3.2.6 Rainfall regime in June

The month of June is the richest in precipitation and the most unstable of all months of the year. The multiannual rainfall averages in June are between 49.3 mm in Calafat and 101.2 mm in Petroșani, and in the mountain area 131.0 mm in Vf. Parâng. Low precipitation values in the south of the region at Băilești 53.1 mm and at Bechet 58.6 mm. High values are recorded in the subcarpathian and submontane area at Apa Neagra 95.5 mm, Tg Jiu 85.4 mm, Polovragi 100.1 mm, Rm. Vâlcea 85.1 mm, and in the mountain area at Vf. Parâng 131.0 mm (Table no. 2).

The general average for the entire region in June is **76.5** mm.

In the east of the region and the Olt corridor, the values are slightly higher than in the central part. The main pluviometric maximum in Oltenia is recorded between May and July and confirms the fact that Oltenia rains a lot in spring and in the first part of summer.
The trend of the monthly amounts of precipitation in June was an increasing one.

3.2.7 Rainfall regime in July

In the month of July, the days are warmer than in June, and the degree of instability of the weather is less than in June, because the valley of the vast depression zone in southwest Asia (Arabian Depression), the ridge of the Azoric Anticyclone and sometimes the ridge of the North- African, increasing frequency of days with afternoon instability.

The multiannual rainfall averages in July are between 52.1 mm at Calafat and 99.0 mm at Polovragi, and in the mountain area 117.1 mm at Vf. Parâng. Low precipitation values in the southwest of the region at Băilești 52.7 mm and at Bechet 53.4 mm, Dr.Tr.Severin 57.2 mm. High values are recorded in the north of the region at Apa Neagra 89.5 mm, Tg Jiu 86.9 mm, Rm. Vâlcea 80.1 mm, and in the mountain area at Vf. Parâng 117.1 mm. The June record is 314.7 mm in 1991 in Polovragi (Table no. 2).

The general average for the entire region in July is **73.5** mm. The trend of monthly rainfall amounts in July was an increasing one.

3.2.8 Rainfall regime in August

It is the last month of summer, the most stable and sunny, and in some years the hottest month of summer. The backbone of the Azorean Anticyclone extends to the east, above Eastern Europe, maintaining stable, warm and dry air masses in the area of our country.

The multiannual rainfall averages in August are between 33.6 mm at Bechet and 84.3 mm at Polovragi, and in the mountain area 92.7 mm at Vf. Parâng. Low precipitation values in the southwest of the region at Calafat 37.9 mm, Băilești 44.3 mm and Dr.Tr.Severin 41.0 mm. High values are recorded in the north of the region at Polovragi 84.3 mm, Tg Jiu 65.7 mm, Rm. Vâlcea 76.1 mm, and in the mountain area at Vf. Parâng 92.7 mm. The August record is 225.5 mm in 1975 at Apa Neagră (Table no. 2).

The overall average for the entire region in July is **57.7** mm.

The trend of the monthly amounts of precipitation in August was an increasing one.

3.2.9 Rainfall regime in September

It is the first month of autumn, the last month of the warm season, and the instability of the weather is reduced compared to August due to the persistence above Europe of a belt of high atmospheric pressure that joins the Azorean Anticyclone with the Eastern European one. The monthly multi-year precipitation averages in September are between 38.7 mm at Bechet and 71.8 mm at Apa Neagră, and in the

mountain area 83.6 mm at Vf. Parâng. Low precipitation values in the southeast of the region at Calafat 46.7 mm, Băilești 46.6 mm, Caracal 42.1 mm and Slatina 44.9 mm. High values are recorded in the north of the region at Polovragi 65.2 mm, Dr.Tr.Severin 53.0 mm, Rm. Vâlcea 55.2 mm, and in the mountain area at Vf. Parâng 83.6 mm. The record for September is 230.6 mm in 2014 at Dr.Tr.Severin. For the warm season, September is the driest month (Table no. 2).

The general average for the entire region in September is **53.8** mm.

The trend of monthly precipitation amounts in September was an increasing one.

3.2.10 Rainfall regime in October

It is the most stable autumn month and the first month of the cold season, and Romania is under the influence of the Eastern European barometric maximum. The monthly rainfall averages are between: 41.6 mm at Calafat and 76.6 mm at Apa Neagră, and in the mountain area 62.6 mm at Vf. Parâng.

Lower values are recorded in the central, southern and eastern part of the region: Calafat 46.3 mm, Băilești 44.9 mm , Bechet 43.3 mm Caracal 42.3 mm, Slatina 45.5 mm. High values are recorded in the north and west of the region: Tg Jiu 61.4 mm, Polovragi 69.4 mm, Rm. Vâlcea 52.4 mm, Dr.Tr. Severin 52.8 mm (Table no. 2).

The general average for the entire region in October is **51.5** l/m². The trend of monthly precipitation amounts in October was an increasing one.

3.2.11 Rainfall regime in November

The monthly rainfall averages are between: 36.7 mm, at Bâcleș and 80.0 mm, at Apa Neaagră.

The overall average for the entire region in November is **48.8** mm. Values lower than 50 mm are recorded in: Bechet, Slatina, Caracal, Băilești, Petroșani, Rm. Vâlcea. Values higher than 50 mm are recorded at: Polovragi, Tg.Jiu, Dr,Tr,Severin (Table no. 2). Precipitation is mostly liquid during the month, and towards the end of the month sleet and snow appear more and more frequently. The trend of monthly precipitation amounts in November was an increasing one.

3.2.12 Rainfall regime in December

The monthly rainfall averages are between: 37.1 mm at Bechet and 81.2 mm at Apa Neagră, and in the mountain area 52.5 mm at Vf. Parâng (Table no. 2). The overall average for the entire region in December is **51.0** mm.

Values lower than 50 mm are recorded in: Bechet, Slatina, Caracal, Băilești, Calafat, Bâcleș, Drăgășani. Values higher than 50 mm are recorded at: Polovragi, Tg.Jiu, Dr.Tr.Severin.

The trend of monthly precipitation amounts in December was an increasing one.

4. Deficient precipitation (small amounts). Non-periodic variations in rainfall amounts and their negative deviations. Analysis of negative deviations of annual and monthly amounts of precipitation compared to the multi-year average considered normal**.**

The lowest annual amounts of precipitation in the south of Oltenia and their deviation.

The negative deviations of the average annual amounts of precipitation compared to normal (Table no. 4) highlight the driest years and the intensity of the drought in those years.

Table 4 Negative deviations of the average annual precipitation

Meteorological station	Lowest quantity	*Year*	Negative deviation	Multiannual average
Dr.Tr.Severin	285,6	2000	-375,4	661
Tg Jiu	458	1934	-296	754
Craiova	269,4	1907	-252,6	522
Rm. Vâlcea	245,5	1925	-459,5	705
Drăgășani	178,3	1907	-401,7	580
Slatina	277,4	2000	-244,6	522
Calafat	258,8	2000	-309,2	568
Băilești	262,7	1992	-287,8	550,5

Table 5 Lowest amount of precipitations

LOWEST PRECIPITATION VALUES - Oltenia period 1981 - 2017 (mm)							
Station	**1992**	**1993**	**2000**	***Station***	**1992**	**1993**	**2000**
Craiova	293,3	403,0	339,1	**Tg. Jiu**	454,3	549,5	333,4
Calafat	304,1	416,8	258,8	**Tg. Logreşti**	383,4	473,7	325,0
Băilești	262,7	401,9	271,5	**Apa Neagră**	617,7	709,4	338,1
Bechet	406,4	378,7	303,6	**Polovragi**	575,8	642,3	394,8
Slatina	272,0	447,0	277,4	**Rm. Vâlcea**	496,1	537,8	350,2
Caracal	333,5	305,6	281,0	**Drăgășani**	331,7	447,1	323,2
Dr.Tr.Severin	418,1	511,5	285,6	**Petroșani**	576,6	560,6	478,9
Bâcleș	332,5	466,9	359,2	**Vf. Parâng**	797,5	732,7	524,3
		Year	**1992**	**1993**	**2000**		
		Average	428,5	499,0	340,3		

The driest year from 1981 to 2017 was the year 2000. The lowest amount of annual precipitation recorded in 2000 was 258 mm in Calafat in Dolj county, the highest amount of precipitation recorded in the same period was 524 .3 mm at Vf. Parâng in the mountain area. (Table no.5).

5. Annual rainfall regime

The annual precipitation averages for the interval 1981 - 2017 are between: **511.9** mm at **Bechet** and **902.6** mm at **Apa Neagra**, in the mountain area **928.8** mm are recorded at **Vf. Parâng**. Figure no. 4).

Low values below 600 mm are recorded in: Calafat 533.7 mm, Băilești 551.4 mm, Slatina 585.8 mm, Caracal 535.3 mm and Bâcleș 553.9 mm .

High values over 600 mm are recorded in: Craiova 613.9 mm, Dr.Tr.Severin 646.8 mm, Tg Jiu 756.4 mm, Tg Logreşti 639.4 mm, Polovragi 852.1 mm, Rm Vâlcea 692.9 mm, Drăgăşani 605.1 mm and Petroşani 699.1 mm.

The overall annual average for the entire region is **663.1 mm**.

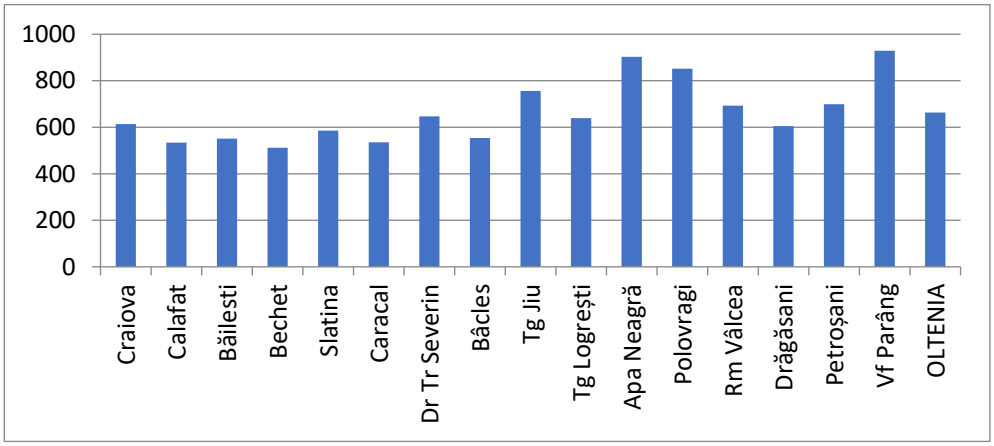

Fig. 4 Average annual amount of precipitation - Oltenia period 1981 - 2017 (l/m²)

The variation graphs of the annual amounts of precipitation at the meteorological stations in Dolj county (Fig. no. 5, Fig. no. 6, Fig. no. 7, Fig. no. 8) show significantly increasing linear trends with one exception – meteorological station Bechet, where the trend is insignificantly decreasing, whose coefficient of decrease is -0.0687 (Fig. no.5). In the case of Băileşti and Calafat stations, the linear trend of evolution is very slightly upward (Fig. no. 6, Fig. no. 7). The most intensively increasing trend is the linear variation from the weather station in Craiova, whose growth coefficient is 2.7428 (Fig. no. 8).

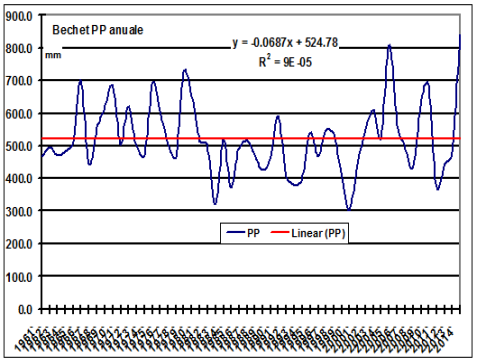

Fig.5 Variation of the annual amounts of precipitation in Bechet. Source: Data processed from the CMR archive

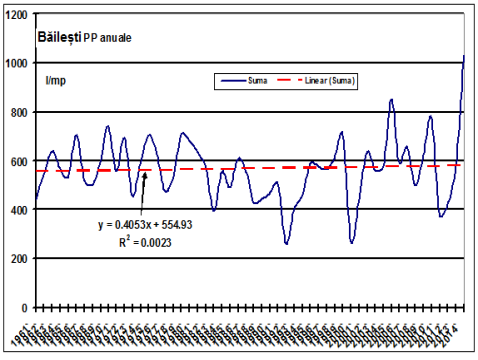

Fig.6 Variation of the annual amounts of precipitation in Băileşti. Source: Data processed from the CMR archive

This situation is explained by the very low quantities in the period 1981-2001, followed by quantities well above normal for the period 2002-2014, whose average is about 110 mm higher than normal for the entire period, while at the other stations meteorologically, the positive deviation of the average of this period falls between 50 and 70 mm compared to normal. We observe an important manifestation of climatic changes in the precipitation regime: the strongly increasing linear trend at almost all weather stations except for the one in the extreme south of the county where the interaction of atmospheric circulation with local relief conditions often causes a decrease in atmospheric precipitation. In Craiova, where the meteorological station is located at the southern limit of the hills, the interaction of the atmospheric circulation with the local relief conditions, frequently determines the intensification of atmospheric precipitation.

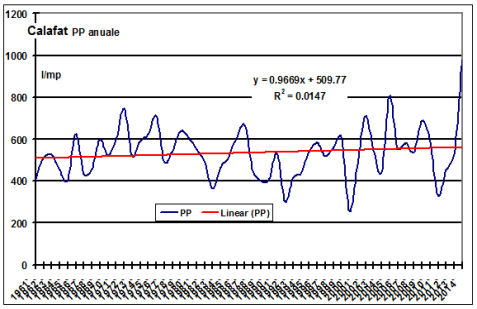

Fig.7 Variation of the annual amounts of precipitation in Calafat. Source: Data processed from the CMR archive

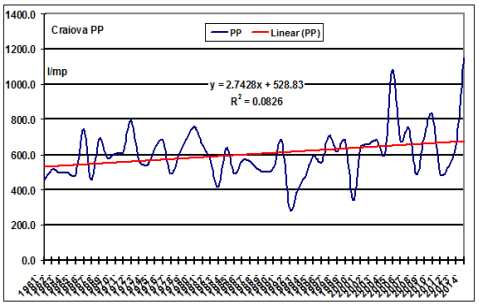

Fig.8 Variation of the annual amounts of precipitation in Craiova. Source: Data processed from the CMR archive

CONCLUSIONS

The Oltenia area is a region particularly exposed to certain categories of climatic risks, namely those that are possible all year round, such as the lack of precipitation and drought, as well as those characteristic of the hot semester - torrential rains, hail, heat waves, etc. Also, in addition to the typical risk phenomena, determining the evolution trends of temperatures and precipitation amounts is an extremely important aspect due to, on the one hand, the direct impact, and on the other hand, due to the role they have in aggravating climate phenomena. In Oltenia, an important manifestation of climatic changes is highlighted in the precipitation regime: their slightly increasing linear trend. The most intensively increasing trend is the linear variation of precipitation from the weather station in Craiova. Here the meteorological station is located at the southern limit of the hills, the interaction of the atmospheric circulation with the local relief conditions, frequently determines the intensification of atmospheric precipitation. However, drought periods returned after rainy periods and due to the association with high temperatures with heat and heat waves, their impact on agriculture was increasingly destructive. Although the situation seems paradoxical, although precipitation increases, the intensity and duration of droughts also increases, which causes the climate to become more arid.

Data source:
Database of the National Meteorological Administration - CMR Oltenia

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