

RESEARCH ARTICLE

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Analysis precipitation regime. Period dryness and climate risk determination for agriculture on albanian territory

ALBERT KOPALI* ADRIAN DOKO

Department of Agro-Environment and Ecology, Agricultural University of Tirana, Albania

*Corresponding author e-mail: albertkopali@yahoo.it

Abstract

Agriculture is one of the most interested sectors in climate studies, because the agriculture activity is very sensitive to meteorological yearly progress as temperature and rain falls. Studying the dryness effects present of yearly periods is with a special interest in agriculture, because many plants are autumn and spring sowing and they feels the stress conditions that it is due to lack of rainfall. Repeating long drought periods combined with other reasons can cause potentially serious damage to water resources [1]. Adding to this conditions of climatic changing situation which according to numerous studies conducted on climate change and its effects, have shown an increasing trend in the values of average temperatures and a decrease in amount of rainfall which is evident on Mediterranean region and in Albania too [2]. Evaluation of ecological factors particularly determining the climatic dryness periods of the year, becomes more difficult when these assessments are made for local spaces. For the territorial planning of agricultural systems purposes and their management on local conditions, especially in dry and semi-dried areas, takes a significant determination of dryness year periods with which it is closely related the crop production. This study aims at determining the periods of dryness of the year in Albanian conditions, studying it closely linked with the expected climate change in the agricultural interest areas.

Key words: climate, agro-clime, temperature, precipitation, drought period

1. Introduction

In studying of the environmental impact on the plants the climate poses as an factor with the greatest impact and has a determinant role in the distribution of plants as well as on many agronomic aspects of their cultivation. Determination of climatic zones evolution represent a permanent field of study, because despite of divisions climatic zones, in recent decades have observed significant changes to climate and this makes it necessary to study the dynamics of these changes. Albanian territory included on subtropical sub zone of western coast and it is divided into two climatic zones: Atlantic Mediterranean and continental [3]. Despite the division of the territory of our country in four zones and 13 sub zones, by defined climatic features, in recent years are observed deviations from multi-year average values due to observed climate change. According to the studies [4,5,6,7] the Southern Europe in which is included also Albania is becoming drier and hotter and with less rainfall. Agriculture and rural areas will be more affected by climate change and particularly by the lack of precipitation [8]. Precipitation decreasing was evaluated by 9-23 % till 2025 [9]. World Bank Climate Portal (2009) predicts that the average annual rainfall in Albania is expected to be decreased with -2.4 - 3.8 % in 2025 and with -3.8 and - 6.1 % in 2050. The reduction in

rainfall will be higher in summer and lower during winter. In summer rainfall will reduce by - 5.6 - 8.0 % in 2025 and -9.1 - 20.0 % in 2050, while the rainfall in winter period will be relatively stable, with precipitation that will be reduced by 0 - 1.6 % in 2025 and 0 - 1.8 % in 2050. Climate changes and particularly the reduction of the amount of rainfall has important impacts on agricultural production. The phenomenon of drought, which comes due to lack of rainfalls must be evaluated on several aspects where the greatest importance for the agriculture production takes the drought duration. A correct choice of the evaluation and of indicators method will better identify the phenomenon of drought as well as lack of water in the soil. The drought is a phenomenon that has visible effects on the quantity and quality of agricultural production especially at vegetable plants [10], especially in areas with irrigation additional restrictions. On the other hand, except the drought, the rainfall intensity increase is another phenomenon which is associated with increased erosion [11]. This study highlights the trend of rainfall situation in Albania conditions, determining the periods of dryness, seeing those associated with expected climate changes.

2. Materials and methods

For observing the rainfall evolution of the situation in Albania is done an analysis on monthly rainfall

historical data series published by IHM [3,12,13] as well as other records of rainfall data at some Mediterranean stations for field areas. The published data refer to 228 stations distributed around the country, the historical series include different intervals in the period 1931-1975, 1977-1986 and also from the data of some stations for the period 1997-2007. On digital way are analyzed the climatic variables values for precipitation data for 222 stations [13]. From the records of rainfall data (pluviometric) it is noted that many stations represent gaps in the data series; few stations have a high number of years (approximately 40 years from 1931-1970). Monthly data that were missing are supplemented with the interpolation method [14]. Determination of dryness periods of the year was made by the method with Bagnlous & Gossen ombrothermic diagrams [15] for all regions of the country. There is also done and comparison for periods of dryness compared with the preceding decade of progress in the last 10 years, for those stations where data were available, with the aim of identifying and determining the tendency of climate change on this phenomenon.

3. Results and discussion

Albania is generally characterized by a relatively high rainfall regime with an annual average of about 1485 mm/year. Lower amount of precipitation falling in the southeastern area (up to 600 mm/year) going up to

about 1000 mm/ year in the Mediterranean field area. According rainfall areas fluctuated between 649 and 1060 mm/ year in the western lowland area (in the districts of Vlore, Fier, Berat and Durres Lushnja) which are the main areas of agricultural production and especially vegetable crops; lower mountain northern and southern areas (Cologne districts, Korca and Pogradec), as well as some areas in the northeast, in the district of Kukes and Dibra. Much higher rainfalls values, which vary between 2295 and 3117 mm/ year precipitate in mountain areas with higher altitudes above sea level as in the southernmost area (Gjirokastra, Tepelenë, Vlora and Saranda) and northern areas (Puka, Tropojë and Shkodra). Territories with less precipitation (annual precipitation with 75 % probability values included between 694 and 968 mm and with a probability of 25 % by value included between 944 and 1396 mm) are Kukes, Dibra, Pogradec, Korca and Cologne district in the east; Fier, Lushnja, Durres and Tirana areas along the Adriatic coast; on Tepelenë, Berat and Korce, in the south central area of Albania. Territories with more precipitation (in which the total annual precipitation with a probability of 75 % are equal to or greater than the value included between 1,397 and 2,099 mm and with a probability of 25 % equal to the value included between 2048 and 3214 mm), are the districts of Shkodra, Tropojë, Puke on the north and Vlora, Gjirokastra and Tepelenë on the south [16].

Table 1: The distribution of annual precipitation and mean annual temperature by homogeneous climatic zones

<i>Climatic Homogene Zones</i>	<i>Precipitation (mm/year)</i>	<i>Annual medium Temperatures (°C)</i>	<i>Climatic Homogene Zones</i>	<i>Precipitation (mm/year)</i>	<i>Annual medium Temperatures (°C)</i>
1	1858	8,7	14	1031	9,5
2	1172	5,3	15	967	4,4
3	2537	5,2	16	1514	6,2
4	1942	6,0	17	1445	11,2
5	2039	10,4	18	2719	6,9
6	1732	10,8	19	1116	9,3
7	1328	8,1	20	1151	10,0
8	1080	7,2	21	1656	7,8
9	1254	6,7	22	1314	9,7
10	805	10,2	23	1953	9,3
11	1101	6,3	24	1751	11,1
12	1207	6,2	25	806	4,7
13	1091	5,5	26	1648	8,1

By analyzing the dryness periods in the country by the Bagnlous F., Gaussen H., method (1957) , from the construction of ombrotermike Gaussen Bagnoulus diagrams are evidenced that the periods of drought throughout the country are very short and they happen mainly in July and August and not on the entire surface of the country. Summer drought are more evidenced are

in the Southern Highlands and the intermediate zone (Mediterranean lowland areas), along the coastal area. The largest amount of precipitation on Albanian territory falls mainly during the winter, so the total annual amount noticed that about 80 % of annual precipitation begins to fall from October until the end of March.

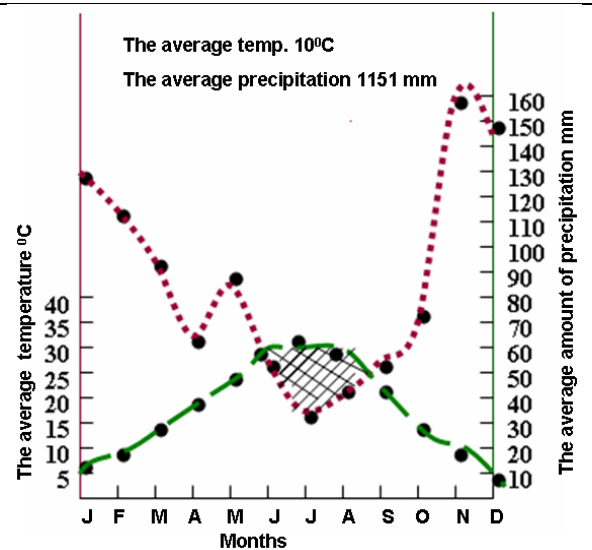
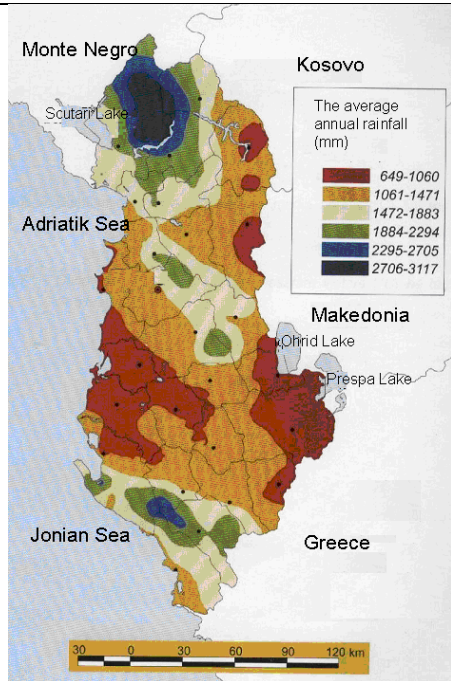


Figure 2. Determination of periods with dryness in the area of Tirana (1931-1975) with the method Bagnoulus & Gaussen (1957).

Figure 1. The distribution of precipitation in Albanian territory under similar climatic zones

Table 2 The average amount of rainfall for the period 1997-2007 (mm) in the area of Tirana

		Months											
	January	February	March	April	May	June	July	August	September	October	November	December	
1	*	*	*	*	6.8	6.4	*	*	0.4	*	23.0	2.0	
2	12.0	0.2	*	2.0	3.2	*	*	*	*	*	*	*	
3	30.4	*	*	18.0	1.0	2.3	*	*	*	*	*	*	
4	0.0	*	*	3.6	3.0	0.0	*	*	*	*	*	11.2	
5	*	*	*	*	*	3.5	*	*	43.6	*	3.0	*	
6	*	*	*	*	1.0	13.2	*	0.2	6.6	*	*	*	
7	*	3.4	*	*	*	3.4	*	*	4.0	49.4	*	*	
8	*	2.0	*	*	*	2.3	*	*	3.0	0.6	*	0.1	
9	0.4	2.0	*	*	*	0.5	*	1.0	*	2.0	2.0	2.8	
10	*	1.6	*	*	*	*	1.0	*	*	1.0	55.0	11.8	
11	*	*	*	*	*	*	*	*	10.2	4.6	*	15.8	
12	0.4	*	*	*	*	*	*	2.0	5.0	31.8	8.4	*	
13	*	29.4	*	*	*	5.0	*	*	*	5.2	4.4	*	
14	*	*	*	*	*	*	*	*	*	*	25.6	*	
15	*	*	*	*	*	*	*	*	*	*	6.8	*	
16	*	1.0	*	*	*	*	5.0	*	*	*	1.8	*	
17	0.2	*	*	*	3.0	*	*	1.0	*	*	27.0	0.1	
18	2.0	2.0	*	1.2	*	*	*	*	*	*	12.2	1.6	
19	*	6.0	*	*	2.0	*	*	*	*	10.2	*	*	
20	*	2.0	21.9	*	*	*	*	*	3.0	2.6	*	*	
21	*	*	10.0	*	1.2	*	*	*	*	*	13.0	*	
22	*	*	4.2	*	*	*	1.0	*	*	18.0	*	*	
23	*	*	12.8	*	*	*	*	*	*	*	*	*	
24	23.0	0.0	19.6	*	3.0	*	*	*	*	*	*	0.4	
25	23.0	12.6	12.4	5.0	0.0	*	*	*	*	*	*	0.4	
26	0.0	0.8	1.4	3.0	0.4	*	1.0	*	3.2	2.4	19.0	9.6	
27	4.0	25.2	*	3.0	*	*	*	*	*	3.0	*	13.0	
28	3.8	*	8.2	*	10.4	*	*	*	1.0	18.0	*	*	
29	*	*	*	*	14.0	*	*	*	1.0	8.0	5.0	*	
30	*	*	4.2	*	2.4	*	*	*	*	*	2.4	*	
31	*	*	22.6	*	*	*	*	*	*	*	*	*	
Total	99.2	88.2	90.5	35.8	51.4	36.6	8.0	4.2	80.0	148.8	201.2	68.0	

The survey analysis shows that the November is the month during which precipitates more rain than in other months. The analysis conducted especially for the dryness period of the year in Albanian territory results that the Mediterranean plains areas are affected more by drought, which although relatively short duration, make necessary fulfillment through irrigation, since in this area mainly are cultivated vegetable crops which are relatively with high demand for water availability.

On the other hand, based on the observation it is evidenced that during the last decade has a notable decrease in precipitation in the form of snow and increased rainfall intensity in short intervals of time (daily). From the analysis of the 10 year period from 1997 to 2007 for Tirana region, which is included in the field Mediterranean area, there is a significant reduction of rainfall and specifically during the months of July and August has been only four days with a total rainfall of 8.0 mm on July and 4.2 mm on August. So that has seen an extension of the period with dryness during these two summer months. Similarly, the average annual rainfall for this period is 911.9 mm / year for the area of Tirana, therefore significantly lower if comparing with the period 1931-1975, during which the annual average of this period have fallen 1,151 mm/year rainfall.

A similar situation can be seen also in other districts which are included in the Mediterranean field area. The reason of this observed difference is believed to be the climate changes. On the other hand it is seen that the reduction of the level of rainfall accompanied with an increase in temperature levels for the respective periods, which increases even more the risk for agriculture activity, especially in areas with lacking irrigation systems. The distribution and intensity survey in the last 10 year has shown an intensity increased of precipitation, especially in November (as has happened on the 10/03/2014 which have fallen within a day over 55 mm rainfall), a phenomenon which is linked with the increased erosion phenomenon to the respective areas.

4. Conclusions

From this study is shown that although Albania is generally characterized by a regime of relatively high rainfall, on the lowland Mediterranean area, which is one of the main areas of land for agricultural production, they result in values not high (about 1000 mm/year). They appear deficient in the northeastern and southeastern areas of the country. Year drought

periods result to be July and August, which although relatively short they tend to be extension that makes a real concern for agricultural production, which should be compensate through additional irrigation. During the last decade it is seen a decrease tendency trend in the average amount of precipitation compared with previous decades, which is more evidenced in the Mediterranean field area, a phenomenon which seems to be influenced by climate change and, according to the forecast scenarios which are expected to grow further [17]. The analysis indicated that despite the fall of the average annual precipitation level in their total, there will be increased occurrences of days with extreme precipitation, which would potentially increase the possibility of hydro soil erosion.

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