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STUDIES OVER CLIMATE VARIABILITY IN CRISURI RIVER BASIN

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Abstract

The vast majority of rural economic activities are conducted under the direct effect of environmental conditions outdoors, where climate variability influences physiological processes of plants and growth animals conditions as those involved in development work such economic processes. Extreme weather events such as droughts, torrential rains, land degradation and soil assets fall into the category risk natural hazards expose human values. Trends in climate Cris basin is based on the main elements of weather observations recorded at the meteorological station Oradea, as well as data collected from various specialized archives. Elements established a specialized data base were processed by different methodologies.

Key words: *Climate change, climatic trend, climate variability, deficit of moisture*

INTRODUCTION

Climate of Bihor county is under the influence of the western circulation that carries oceanic air masses, moist but the geographical location and layout of relief prints special features to the climate (Dogaru N., 2012/2).

With the general characteristics of oceanic temperate and Mediterranean climate of the south and southwest, which make their presence felt within the study area, values of climatic elements are ordered according to the relief (Gergely Istvan, 2010).

This climatic variability due to natural factors, determined by its agricultural exploitation, has become more intense as a result of global climate changes and it is felt through increased frequency and intensity of periods of stress for field and horticultural crops.

It identifies climate sub-regions: 1-Plain Banato-Crişana, 5-Hills Banato Crişene and 9 Western Carpathians, Figure 1, (Popescu D.I, 2004).

The assessment of changing dynamics of climate elements on long periods of time can reveal trends that must be treated in culture technologies to give sustainable farming.

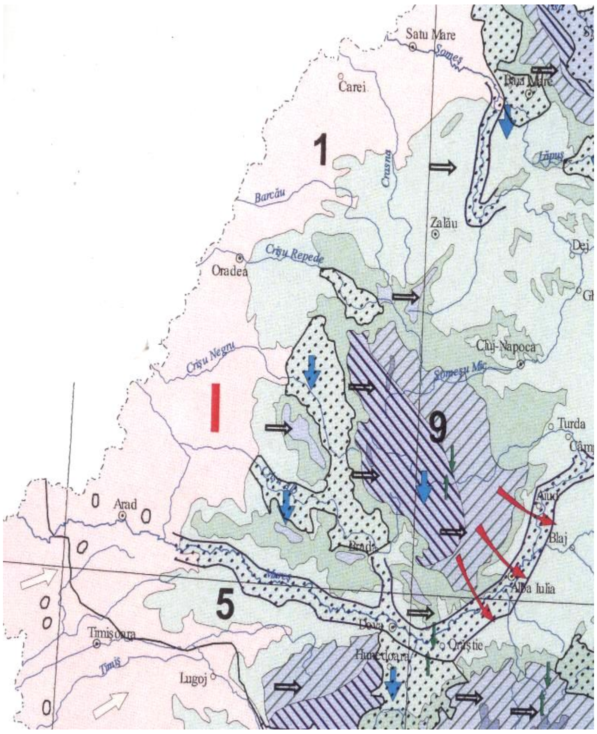

Figure 1. Climatic regionalization of the study area

MATERIALS AND METHODS

To meet the above objective regarding the evolutionary trend of climate in Crisuri hydro-graphic basin were organized researches based on key elements of meteorological observations recorded at the meteorological station from Oradea, as well as on data collected from various specialized archives (Dogaru N., 2012/2).

Elements formed in a specialized database were processed by methodology developed by various specialists:

Index Gorczynski, $KG = 1{,}7\frac{A}{\sin(L)} - 20{,}4$

where :

A–amplitude of annual average air temperature, ^{o}C;

L-latitude of location (absolute value)

Values obtained from the calculation shall be read after the following classification which determines the type of climate:

KG ≤ 12.4 - maritime climate,
12.5 - 18.4 weak maritime;
18.5 - 27.4 neutral;
27.5 - 33.4 weak continental;
> 33.4 continental

Index de Martonne: $i = \frac{P}{t+10}$,

where : P– annual average rainfall, mm;
t - annual average air temperature, ^{0}C .

The interpretation of the results is made by the below classification:

< 10, arid climate;
11 to 24 semiarid;
25-30 moderately dry;
30-35 under wet;
36-40 moderately wet;
41-50 wet;
51-60 very wet;
61-187 excessively wet.

Lang precipitation factor, i = P / T,

where :

P – annual precipitations, mm;

T - annual average air temperature, ^{0}C.

The values of this index are judged by the following scale:

i <20 - very arid area,
i = 21 to 55, arid area,
i = 56 - 180, semi-arid area.

Index de Martonne – Gottman:

$$b = \frac{1}{2}\left(\frac{Py}{Ty+10} + 12\frac{Pa}{Ta+10}\right),$$

where :

Py - annual precipitation, mm;

Ty - annual average air temperature, ^{0}C;

Pa - precipitation of the driest month, mm;

Ta - average air temperature in the driest month ^{0}C.

The values of this index are judged by the following scale:

b <5, extremely arid climate;
b = 6-14, arid climate;
b = 15-19, semiarid climate;
b = 20-29 under wet climate;
b = 30-59 wet climate;
b> 59 very wet climate.

Thornthwaite Humidity Global Index, I_m is calculated as follows:

$$Im = Iu - 0{,}6\,Ia$$

- index humidity, $Iu = 100\frac{s}{ETP}$
- s, monthly water surplus amount, mm
- index of aridity, $Ia = \frac{d}{ETP}$
- d, monthly water deficits amount , mm.

Assessment scale of this index is:

Im> 100, over wet climate;
100-80, wet climate;
20-0, under wet climate;
0 ÷ -20 under dry climate;
-20 ÷ -40, semiarid climate;
≤ -40.

The calculation of these indices was made for three specific periods: the period between the years 1895 – 1955, as reference period, where the climate was characterized by a greater stability compared to past decades, the decade 1990-1999 and the decade 2000 - 2009.

The results are in Table 1.

Table 1. Comparative climatic indices characteristic to Bihor County

Climate index		Calculation period			
		1896-1955	1990-1999	2000-2009	class limits
Gorczynski Index	value	84	79	84	> 34 continental
	Type climate	continental	continental	continental	
Martonne Index	value	31	31,6	28,6	25-30, moderately arid; 30-35, under wet
	type climate	under wet	under wet	moderately arid	
Lang Precipitation factor	value	60,0	50,9	54,2	56-180, semiarid area; 21 – 55, Arid area
	type climate	semiarid area	Arid area	Arid area	
Martonne-Gottman Index	value	32,9	30,8	32,5	30-59 Wet climate
	type climate	Wet climate	Wet climate	Wet climate	
Thornthwaite Humidity Global Index	value	-1,8	22,0	9,0	0 ÷-20 Under dry 0-20 Under wet
	type climate	Under dry	wet	under wet	
Clasifications ICPA	value	I_b=82mm,i_h=114%, i_a=32	I_b=88,8mm,i_h=116%, i_a=32	I_b=16mm,i_h=97%, i_a=28	
	type climate	surplus, moderately surplus	surplus, moderately surplus	surplus, low surplus	

RESULTS AND DISCUSSIONS

Methods of processing of raw climate data, highlight the Crisuri Plain climate variability and the climate trend to become more arid. Thus, according to the Martonne index, Lang precipitation factor and ICPA classification, in the last decades the climate has become more arid, a trend which reduces the volume of water that rains make them available to crops. More pronounced moisture deficit requires more extensive technological interventions, such as irrigation and use of varieties of plants hardier to drought and also by applying culture technologies in order to preserve in a greater way the soil water reserves.

Highlighting modification of annual rainfall frequency generation and average air temperature may indicate the development trend of climate. Therefore, the last four decades were taken in a comparative study, 1970-2010; the results are presented in table 2 and 3.

Table 2. Frequency of annual average precipitation in the study area

Annual precipitations, mm	Frequency (nr / %) per decades			
	1970-1979	1980-1989	1990-1999	2000-2010
1000 - 700	2 / 20	1 / 10	4 / 40	2 - 20
700 - 600	1 / 10	5 / 50	1 / 10	4 - 40
600 - 500	3 / 30	2 / 20	1 / 10	1 -10
500 - 400	4 / 40	2 / 20	2 / 20	2 / 20
400 - 300	-	-	2 / 20	1 - 10

Table 3. Frequency of annual average temperature air in the study area

Air temperature, ^oC	Frequency (nr / %) per decades			
	1970-1979	1980-1989	1990-1999	2000-2010
≥ 12	-	-		2 / 20
12 - 11	-	-	3 / 30	3 / 30
11 - 10	8 / 80	7 / 70	4 /40	4 / 40
10 - 9	2 / 20	3 / 30	3 / 30	1 / 10

CONCLUSIONS

It is noted that during the 40 years, it is developed the trend of producing a smaller volume of annual rainfall since the decade 1990 -1999. In the same time, the share of rainfall of 700 mm / year is maintained at the range of 10% - 40% of annual rainfall for each decade separately.

There is a clear trend of reduction in annual rainfall between 500 - 600 mm / year, from 40% in the decade 1970 -1979, to 10% starting with the decade 1990 -1999. Also, from the same decade weak precipitation occur, between 300 and 400 mm/year, (Dogaru N., 2012/1).

Dynamics of annual average air temperatures shows a consistent trend of increasing the annual average temperatures from 10^{o}C and 11^{o}C, to values greater than 12^{o}C, so starting to the decade 2000-2010 they accounted for 20%.

Weight loss annual average temperatures between 10^{o}C and 11^{o}C from 80% to 40% which modify the thermal regime of the area.

These conclusions support the interpretation of results from climatic indices on which it is considered the evolutionary trend of climate towards aridity.

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