

SOME ASPECTS OF CLIMATE VARIABILITY DEDUCTED FROM ANALYSIS OF DAYS WITH DIFFERENT THERMAL CHARACTERISTICS

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Abstract. In this article we examined several thermal parameters, namely: the average number of summer days and tropical days in July and annually, and the average number of days with frost and average number of winter days in January and annually, for seven weather stations located in different geographical conditions. A comparison was made between computed values to 1955 and the calculated values for the period 1961-2000. The data were edited by Meteorological Institute, 1966, and the National Agency of Meteorology, 2008.

Introduction

The publication of the volumes "Clima RSR" (Climate of the Socialist Republic of Romania), 1966, and "Clima României" (The climate of Romania), 2008, edited by the Meteorological Institute, National Agency of Meteorology respectively, allowed a comparison of the number of summer days and tropical days and also days of frost and winter, between the first and the second part of this century², to highlight some aspects of climate change trends in Romania during this period.

In these conditions, we made a preliminary comparison of mean values between the two periods, for the 7 stations scattered in different geographical conditions, included in both volumes. The station Miercurea Ciuc, elevation 661 m, does not appear in the 1966 volume, and thus we used data from the St. Gheorghe, altitude 561 m, in the same geographical conditions (mountain depression in the Eastern Carpathians) and calculated the vertical gradient reported to Predeal station, altitude 1093 m, for each parameter and then extrapolated the

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² It may be objected that the two periods are not equal, the first having a variable number of years of observations, (starting from 1896, to 1955 between 29 and 60 years with shortages during the two world wars), the second, with a fixed number of 40 observations years. However it is considered that an average of about 30 years of observations is sufficient to make some assessments on the climate parameters considered.

data at St. Gheorghe's, thus establishing probable values for Mc. Ciuc for the period 1961-2000.

1. Number of summer days ($t_{\max} \geq 25^{\circ}\text{C}$)

Surprisingly, we found that the first period was warmer than the second, the number of days of summer, until 1955, being higher in July by 1.5 ... 2.7 days, depending on the geographical location. There is an exception, in Timișoara, in the plains of south-western Romania, where in the second period the average number of days of summer was 0.9 days longer.

Annually, the same phenomenon takes place, i.e. in the period after 1961, a number of summer days less than 2.9 ... 10.6, from the first period without exception. We can see that the largest differences are in the depression areas, especially in depressions in the Eastern Carpathians. The mean difference for meteorological stations considered is -1.7 days in July and -7.1 days per year. (Tab.1)

Table 1 Average number of days of summer in July and annually

Meteo station	Altitude m	July			Annual		
		1896-1955	1961-2000	Δ	1896-1955	1961-2000	Δ
Constanța,	32	24.2	22.0	-2.2	68.9	63.4	-5.5
Timișoara	91	23.6	24.5	+0.9	100.0	96.3	-3.7
Tg. Mureș	309	21.3	19.5	-1.8	81.7	71.1	-10.6
Iași	100	24.9	22.5	-2.4	92.4	83.9	-9.5
Mc. Ciuc	661	14.9	12.2	-2.7	50.4	40.0	-10.4
Predeal	1093	5.1	3.6	-1.5	12.8	9.9	-2.9
Vf. Omu	2509	-	-	-	-	-	-

2. Number of tropical days ($\geq t_{\max} 30^{\circ}\text{C}$)

The analysis of this parameter confirms the previous observation, so the first period was warmer than the second, the number of tropical days until 1955 is higher in July by 0.7 ... 2.9 days, also depending on the geographical location. The exception is the mountains, where the Predeal station has averaged more than 0.3 tropical days in July. In the period after 1961 was recorded the same phenomenon, namely a small number of tropical days, by 1.2 ... 9.6 day. At 1000 m altitude no differences were found between the first and the second period. The mean difference for the stations considered is -1.9 days in July and -5.2 days annually. (Tab.2)

Table 2 Number of tropical days

Meteo Station	Altitude m	July			Annual		
		1896-1955	1961-2000	Δ	1896-1955	1961-2000	Δ
Constanța,	32	3.0	2.3	-0.7	7.0	5.8	-1.2
Timișoara	91	13.3	11.1	-2.2	40.0	30.4	-9.6
Tg. Mureș	309	7.5	5.4	-2.1	18.7	15.1	-3.6
Iași	100	10.6	7.2	-2.8	30.1	21.3	-8.8
Mc. Ciuc	661	4.3	1.4	-2.9	10.3	3.9	-7.7
Predeal	1093	0.0	0.3	+0.3	0.3	0.3	0.0
Vf. Omu	2509	-	-	-	-	-	-

3. Number of days with frost ($t_{\min.} \leq 0^{\circ}\text{C}$).

The analysis of this parameter shows a more uneven temperature. In January there are regions where the number of days with frost is lower in the second half of the twentieth century, for example on the seaside, but there are colder regions, in this respect (Timisoara, Iasi, mountain valleys). On the average, January seems a little colder in the last decades of the century. The annual regime is uneven, depending on local geography. There are regions with fewer days with frost (seaside, Transylvanian Depression, mountain), and regions with a greater number of days with frost (the south-west plain and especially depressions). Average values are -3 -4 days/year, that would mean something warmer and short winters, especially in the second half of the century (Table 3)

Table 3. Number of days with frost

Meteo Station	Altitude m	January			Annual		
		1896-1955	1961-2000	Δ	1896-1955	1961-2000	Δ
Constanța	32	22.0	20.0	-2.0	73.2	62.8	-10.4
Timișoara	91	25.0	25.9	+0.9	91.0	92.0	+1.0
Tg. Mureș	309	28.9	28.3	-0.6	127.2	117.9	-9.3
Iași	100	27.1	27.6	+0.5	113.6	108.7	-4.9
Mc. Ciuc	661	28.8	30.4	+1.6	168.9	173.2	+4.3
Predeal	1093	30.8	30.7	-0.1	177.1	170.3	-6.8
Vf. Omu	2509	31.0	31.0	0.0	262.7	259.7	-3.0

4. Number of winter days ($t_{\max.} \leq 0^{\circ}\text{C}$)

This parameter also confirms the previous observation, after 1960 being registered fewer winter days, so winters are warmer and shorter. The differences were in January of -0.1 ... -3.3 days per month, and -2.8 ... -8.3 days/year. The only

exceptions for the annual values are Omu Peak and Ciuc depression. The mean difference for stations considered is -1.4 days in July and -4.8 days annually. (Table 4)

Table 4. Number of winter days

Meteo Station	Altitude m	January			Annual		
		1896-1955	1961-2000	Δ	1896-1955	1961-2000	Δ
Constanța	32	9.2	7.0	-2.2	21.8	14.9	-6.9
Timișoara	91	10.5	9.1	-1.4	22.4	19.6	-2.8
Tg. Mureș	309	17.6	14.3	-3.3	40.7	33.2	-7.5
Iași	100	13.8	13.7	-0.1	40.4	35.8	-4.6
Mc. Ciuc	661	19.6	19.4	-0.2	60.0	55.2	-4.8
Predeal	1093	17.2	15.4	-1.8	62.2	53.9	-8.3
Vf. Omu	2509	30.2	29.3	-0.9	161.3	162.4	+1.1

Conclusions

The analysis of the average number of summer and tropical days shows that in the first half of the twentieth century, summers were warmer (by the values of July) and longer warm periods occur (annual values), than in the second half of the century, when the summers were cooler and shorter and winters are shorter and warmer compared to the first period.

So, after considering the parameters presented above, the analysis reveals not a climate warming trend in the second half of last century. From these initial observations a preliminary conclusion can be mentioned, namely that in the first half of the twentieth century the general character of the climate in Romania was more continental than in the second. The annual amplitudes were reduced, regardless of region and altitude.

References

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