

STATISTICAL CHARACTERISTICS OF THE DAILY VALUES OF AIR EFFECTIVE TEMPERATURE ACCORDING TO MISSENARD IN BATUMI

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Abstract: *The paper presents the results of statistical analysis of the daily average and maximum values of air effective temperature according to Missenard in Batumi in 2018-2023.*

Key words: *Effective temperature, bioclimate, human health, ecology.*

Introduction

Data on the bioclimatic characteristics of the area are important for determining the level of their impact on the health of the population, promoting the development of the resort and tourism industry [1-10], etc. There are many bioclimatic indices (a combination of temperature and relative humidity, wind speed and other meteorological parameters), one of which is the frequently used effective air temperature according to Missenard [4,8,9,11,12].

For example, in [11] results of the statistical analysis of the mean monthly data about the values of air effective temperature on Missenard (ET) in two diametrically opposite located on the latitude geographical regions of Georgia: autonomous republic of Adjara (below – Adjara) and Kakheti region (below – Kakheti) are represented. The intra-annual distribution of values of ET is studied, their repetition on the categories of ET is obtained, detailed information about the categories of mean monthly values of ET, and also their upper and lower levels 99% of confidence interval is given, etc.

This work is part of these studies. The results of statistical analysis of the daily average and maximum values of air effective temperature according to Missenard in Batumi in 2018-2023 are presented below.

Study area, material and methods

Study area – Batumi (the capital of the autonomous republic of Adjara, Georgia).

The work uses data from the Georgian National Environment Agency on average daily and urgent (at 4 p.m. local time) values of temperature (T), relative humidity (RH) and wind speed (V) for the period from 2018 to 2023.

The air effective temperature according to Missenard was calculated using the formula [12]:

$$ET = 37 - (37 - T) / (0.68 - 0.0014 \cdot RH + 1 / (1.76 + 1.4 \cdot V^{0.75})) - 0.29 \cdot T \cdot (1 - 0.01 \cdot RH)$$

The categories of ET are presented in Table 1.

Table 1. The degree of human thermal sensation (category) depending on the values of air effective temperature.

ET	<1°C	1-9°	9-17°	17-21°	21-23°	23-27°	>27°
ET	Very cold	Cold	Cool	Comfortabl	Warm	Hot	Very hot

In the proposed work the analysis of data is carried out with the use of the standard statistical analysis methods. The following designations will be used below: Min – minimal values; Max – maximal values; ET_Mean – daily average air effective temperature; ET_Max – daily maximum air effective temperature; Low and Upp – lower and upper levels of confidence interval of average values with probability 99.999%.

Results and discussion

Results in Table 1,2 and Fig. 1,2 are presented.

Table 2. Statistical characteristics of ET_Mean and ET_Max in Batumi by month in 2018-2023.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	ET_Mean											
Max	13.0	10.6	13.4	17.6	18.4	23.7	25.2	24.0	23.8	17.9	14.9	13.2
Min	-12.8	-16.8	-11.6	-4.3	2.2	10.3	13.0	14.7	7.2	1.4	-4.6	-
Average	-0.1	-0.2	1.7	5.9	10.7	17.4	19.3	20.6	16.9	11.9	7.0	3.2
Upp	1.5	1.5	3.2	7.1	11.9	18.3	20.1	21.1	18.1	13.1	8.2	4.6
Low	-1.6	-1.9	0.1	4.7	9.5	16.5	18.5	20.0	15.8	10.7	5.8	1.8
	ET_Max											
Max	16.0	17.4	21.0	23.4	25.9	26.3	29.3	28.1	29.2	24.8	21.8	16.5
Min	-9.6	-13.4	-7.8	-1.2	3.6	11.8	14.2	18.8	10.3	5.4	0.4	-7.5
Average	4.4	4.3	6.0	10.3	14.5	20.5	22.3	23.7	20.5	16.0	11.4	7.6
Upp	6.0	6.3	7.9	11.9	15.9	21.4	23.2	24.2	21.5	17.3	12.7	9.0
Low	2.9	2.4	4.1	8.7	13.0	19.6	21.5	23.1	19.4	14.8	10.1	6.2

Table 3. Categories of monthly average values of ET_Mean and ET_Max and their upper and lower levels in Batumi in 2018-2023.

Mon		Upp	Average	Low		Upp	Average	Low	
Jan	ET_Mean	Cold	Very cold	Very cold	ET_Max	Cold	Cold	Cold	
Feb									
Mar									
Apr			Cold	Cold		Cool	Cool		Cool
May									
Jun									
Jul									
Aug		Warm	Comfortable	Comfortable		Hot			
Sep									
Oct							Cool	Cool	Cool
Nov									
Dec		Cold	Cool	Cold		Cold			

In particular, as follows from Table 2, values of ET_Mean change from -16.8° (February, “Very cold”) to 25.2° (July, “Hot”), and ET_Max – from -13.4° (February, “Very cold”) to 29.3° (July, “Very hot”).

In Table 3 data about categories of monthly average values ET_Mean and ET_Max and their upper and lower levels in Batumi in 2018-2023 are presented. As follows from this Table for different month category of ET_Mean change from “Very cold” to “Warm”, and category of ET_Max – from “Cold” to “Hot”. This

Table, in particular, can be used for practical purposes for a verbal description of the bioclimatic conditions in Batumi in different months of the year.

Fig. 1 and 2 presents data on the repetitions of ET_Mean and ET_Max values in Batumi by category throughout the year, as well as in the cold (October-March) and warm (April-September) seasons.

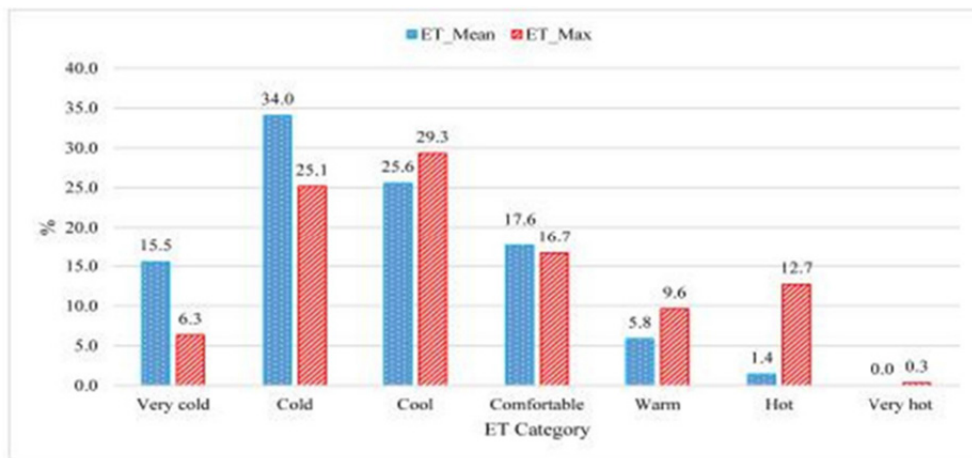


Fig. 1. Repetition categories of ET_Mean and ET_Max in Batumi during the year.

As follows from Fig. 1 the highest repeatability of ET_Mean values is in the "Cold" category (34.0%), and the lowest is in the "Hot" category (1.4%). The highest repeatability of ET_Max values is in the "Cool" category (29.3%), and the lowest is in the "Very hot" category (0.3%).

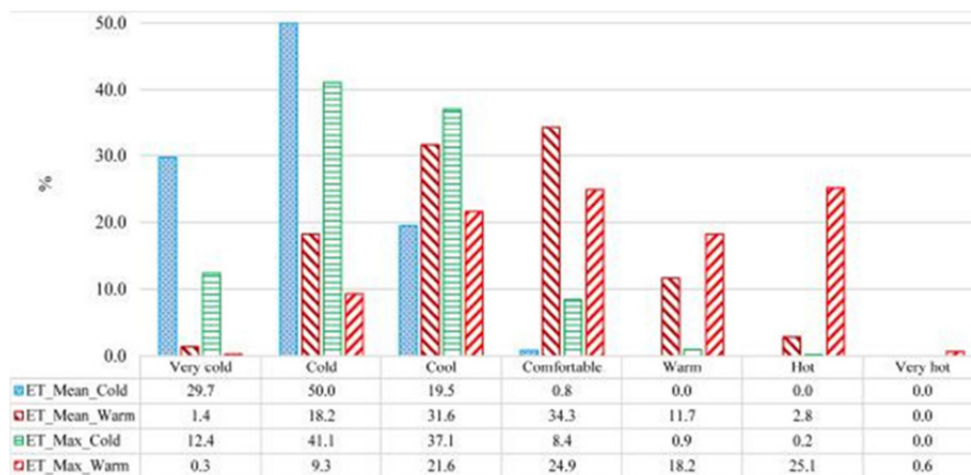


Fig. 2. Repetition categories of ET_Mean and ET_Max in Batumi during the cold and warm periods of year.

In cold period (Fig. 2) the highest repeatability of ET_Mean values is in the "Cold" category (50.0%), and the lowest is in the "Comfortable" category (0.8 %). The highest repeatability of ET_Max values is in the "Cold" category (41.1 %), and the lowest is in the "Hot" category (0.2%).

In warm season (Fig. 2) the highest repeatability of ET_Mean values is in the "Comfortable" category (34.3%), and the lowest is in the "Very cold" category (1.4 %). The highest repeatability of ET_Max values is in the "Hot" category (25.1 %), and the lowest is in the "Very cold" category (0.3%).

Conclusion

In the future, we plan to conduct a similar study for the different regions of Georgia.

Acknowledgement

The authors are grateful to the chief of the atmospheric physics department of M. Nodia Institute of Geophysics A. Amiranashvili for assistance in the fulfillment of this work.

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