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STATISTICAL CHARACTERISTICS OF ANGSTROM FIRE INDEX FOR TBILISI

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Summary: *The results of a statistical analysis of the daily values of the Angstrom Fire Index (I) for Tbilisi in the period from 2014 to 2018 are presented. AFI = (R/20) + (27-T)/10, where R is the minimum relative humidity, T is the maximum air temperature. The gradations of the values of I are as follows: I. AFI> 4.0 – Fire occurrence unlikely, II.AFI = 4.0 ÷ 2.5 – Fire conditions unfavorable, III. AFI = 2.5 ÷ 2.0 – Fire conditions favorable, IY. AFI = <2.0 – Fire occurrence very likely. In particular, it was found that a high fire hazard in Tbilisi is observed on average within 75 days a year, and increased – within 39 days a year. The largest number of days with high fire hazard was observed in 2018 (92 days), the smallest – in 2016 (57 days). Further, it is planned to expand work on this issue (using other more complex fire hazard indices, studying their trends in connection with climate change, determining these indices for other points in Georgia, etc.).*

Key Words: *Angstrom Fire Index*

Introduction. The problem of fires, including forest fires, is actual for many countries of world [http://www.sasquatchstation.com/Fire_Weather.php; http://www.forestservice.gr/meteo/fwi1.html], including Georgia [1]. In recent years this problem is aggravated by the global and local climate warming [2-9] which facilitates an increase in the fire hazard [10,11]. For evaluating the fire hazard in locality the set of indices is developed. One of simple of these indices is the Swedish Angstrom Index [10,11]. In this work the results of a statistical analysis of the daily values of Angstrom Fire Index (AFI) for Tbilisi in the period from 2014 to 2018 are presented.

Study area, material and methods. Study area is Tbilisi city. Data of the Hydrometeorological department of Georgia about daily maximum of air temperature T and minimum relative humidity R in the period from 2014 to 2018 are used. The Swedish Angstrom Index calculated from the formula: AFI = (R/20)+ + (27-T)/10 [10, 11]. The gradations of the values of I are as follows: I. AFI> 4.0 – Fire occurrence unlikely, II. AFI = 4.0 ÷ 2.5 – Fire conditions unfavorable, III. AFI = 2.5 ÷ 2.0 – Fire conditions favorable, IY. AFI = <2.0 – Fire occurrence very likely.

The standard statistical methods are used. The following designations will be used below: Min – minimal values; Max – maximal values; St Dev – standard deviation; C_v – coefficient of variation (%).

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

In Table 1 statistical characteristics of monthly values of Angstrom Fire Index in Tbilisi in 2014-2018 is presented. In particular, as follows from this Table values of AFI changes from -0.1 (July, fire occurrence very likely) to 7.3 (December, fire occurrence unlikely). The greatest variations in the values of AFI are observed during August (Cv = 52.0%), smallest – in December (Cv = 14.8%). The mean values of Angstrom Fire Index (Table 1, Fig. 1) changes from 1.6 (August, fire occurrence very likely) to 5.0 (December and January, fire occurrence unlikely).

Table 1

Statistical Characteristics of Monthly Values of Angstrom Fire Index in Tbilisi in 2014-2018

Param.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min	2.9	2.4	2.2	1.2	0.9	0.2	-0.1	-0.2	0.3	1.7	2.1	3.0
Max	6.9	7.1	6.5	5.9	5.6	4.5	4.4	4.4	5.3	6.9	6.8	7.3
Mean	5.0	4.7	4.0	3.3	2.9	2.2	1.8	1.6	2.4	3.8	4.5	5.0
St Dev	0.9	1.0	0.9	0.9	0.9	0.8	0.8	0.8	1.0	1.1	1.0	0.7
Cv,%	17.4	22.0	21.5	28.2	32.5	37.5	47.4	52.0	41.1	30.2	23.3	14.8

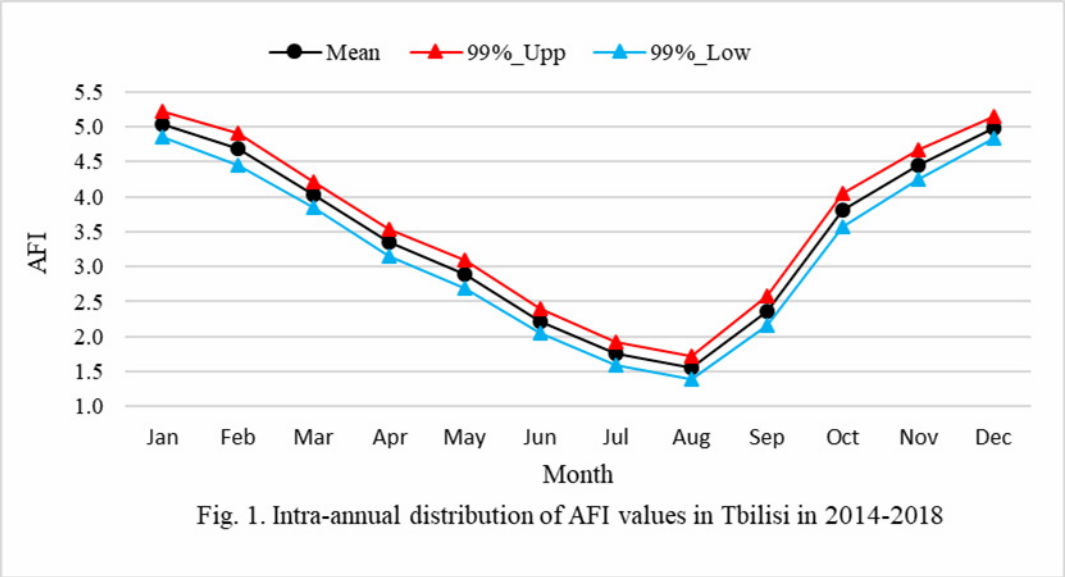


Fig. 1. Intra-annual distribution of AFI values in Tbilisi in 2014-2018

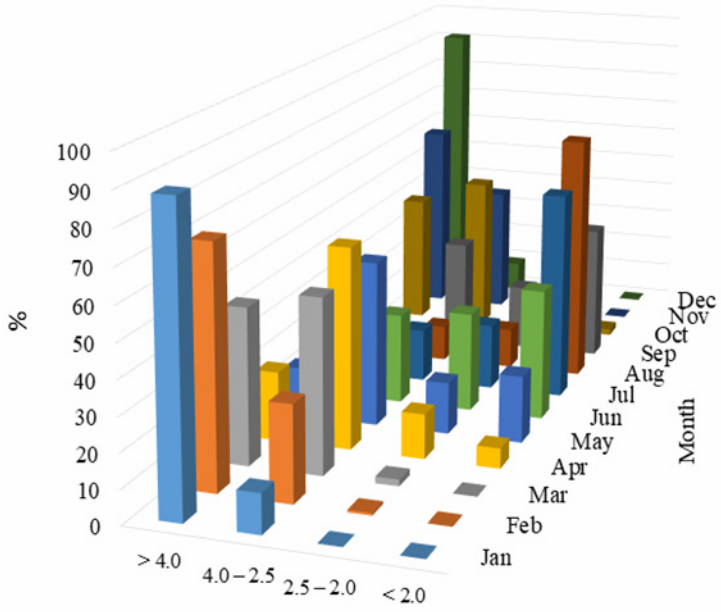
Table 2

Repetition of Angstrom Fire Index in Tbilisi for Four Gradations in 2014-2018 (%)

Year	> 4.0	4.0 – 2.5	2.5 – 2.0	< 2.0
2014	38.6	30.1	11.8	19.5
2015	38.6	30.1	12.1	19.2
2016	41.0	32.8	10.7	15.6
2017	34.2	35.9	7.1	22.7
2018	31.5	31.8	11.5	25.2
Mean	36.8	32.1	10.6	20.4

In Table 2 data about repetition of Angstrom Fire Index in Tbilisi for four gradations in 2014-2018 is presented. In particular, as follows from this Table a high fire hazard in Tbilisi is observed on average within 75 days a year (repetition – 20.4%), and increased – within 39 days a year (repetition – 10.6%). The largest number of days with high fire hazard was observed in 2018 (92 days, repetition – 25.2%), the smallest – in 2016 (57 days, repetition – 15.6%).

In Fig. 2 data about repetition of AFI in Tbilisi in different months for four gradations is presented. As follows from Fig. 2 on average in Tbilisi a high fire hazard in July and August is observed (repetition 63.2 and 75.5% respectively). Sufficiently fire dangerous months are also June and September (repetition of AFI<2.0 – 39.3 and 41.3% respectively). From November through March the values of AFI<2.0 is not observed.



	> 4.0	4.0 – 2.5	2.5 – 2.0	< 2.0
Jan	88.4	11.6	0.0	0.0
Feb	70.9	28.4	0.7	0.0
Mar	46.5	51.6	1.9	0.0
Apr	20.7	60.0	13.3	6.0
May	14.8	49.7	15.5	20.0
Jun	3.3	27.3	30.0	39.3
Jul	0.6	16.1	20.0	63.2
Aug	1.3	11.0	12.3	75.5
Sep	6.0	32.7	20.0	41.3
Oct	40.6	48.4	9.0	1.9
Nov	60.0	40.0	0.0	0.0
Dec	91.0	9.0	0.0	0.0

Fig. 2. Repetition of AFI in Tbilisi in different months for four gradations

From November through February in the majority of the cases fire hazard is absent (repetition of AFI> 4.0 changes from 60.0 to 88.4%).

Conclusion. Further, it is planned to expand work on this issue (using other more complex fire hazard indices, studying their trends in connection with climate change, determining these indices for other points in Georgia, etc.).

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