

## ANGSTROM FIRE INDEX AS A BIOCLIMATIC INDICATOR (USING THE EXAMPLE OF THE IMPACT ON THE SPREAD OF COVID-19 IN TBILISI)

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*Abstract: The results of a study of the influence of diurnal values of Angstrom Fire Index (AFI, temperature and air relative humidity combination) on the infection positivity rate with coronavirus COVID-19 (IR) of the population of Tbilisi from September 1, 2020 to May 31, 2021 are presented. It was found that an increase in AFI values (reduction of fire danger) leads to an increase in IR. Thus, with the "Low" fire danger category, the IR value averaged 11.5%, and with the "Extreme" category - 3.5%. The relationship between the AFI and IR values has the form of a second power polynomial. Thus, AFI also manifests itself as a bioclimatic indicator. In the future, it is planned to compare AFI values with various indicators of human health.*

*Key words: Bioclimatic index, Angstrom Fire Index, COVID-19, infection positive rate.*

### Introduction

The Covid-19 pandemic in the world, including in Georgia, has left severe consequences. According data to the National Center for Disease Control and Public Health of Georgia [<http://data.ncdc.gov/?LangID=en>] from February 27, 2020 to September 30, 2022 in Georgia 1785137 new cases of COVID-19 infection were registered; died - 16912 people. Due to the sharp decline in coronavirus infection in Georgia after September 30, 2022, official statistics on COVID-19 are not published.

Scientists and specialists from various disciplines from all over the world, together with epidemiologists and doctors, have joined in intensive research on this unprecedented phenomenon (including in Georgia [2-10]), providing all possible assistance to them. A significant number of papers are devoted to studies of the influence of various meteorological factors on the COVID-19 pandemic [11-13]. Similar studies were also conducted in Georgia.

For example, in [14] the results of a study of the influence of diurnal values of separate components of simple thermal indices (temperature and air relative humidity, wind speed) on the infection positivity rate with coronavirus COVID-19 (IR) of the population of Tbilisi from September 1, 2020 to May 31, 2021 are presented. It was found that IR values are inversely correlated with air temperature and wind speed, and positively correlated with air relative humidity. The effect of four different thermal indices (air effective temperature and Wet-Bulb-Globe-Temperature) on the IR values averaged over the scale ranges of their categories was studied. It has been found that an increase of the air effective temperature leads to a decrease of the IR values. In the latter case, the level of significance of the relationship between thermal indices and IR values is much higher than in the case of the relationship between IR and separate components of these indices.

In this work results of the study of influence of Angstrom Fire Index on the positive rate of infection of the population of Tbilisi city with the COVID-19 virus over the same period of time are presented.

### Study area, material and methods

Study area – Tbilisi (the capital of Georgia).

Data of agency on the environment of Georgia about the daily max values of air temperature - T (°C), air min relative humidity – RH (%) for Tbilisi during September 1, 2020 to May 31, 2021 were used in the work. For the same days, data of National Center for Disease Control and Public Health of Georgia about infection positivity rate with coronavirus COVID-19 (IR) of the population of Tbilisi were used (IR = Confirmed Coronavirus Cases/Test Number, %).

The Swedish Angstrom Fire Index  $AFI = (R/20) + (27-T)/10$ . The gradations of the values of AFI are as follows: I.  $AFI \geq 4.1$  – Low, II.  $AFI = 4.0 \div 3.0$  - Moderate, III.  $AFI = 2.9 \div 2.5$  - High, IV.  $AFI = 2.4 \div 2.0$  - Very High, V.  $AFI < 2.0$  – Extreme [15,16].

## Results and discussion

Results in Fig. 1 and 2 are presented.

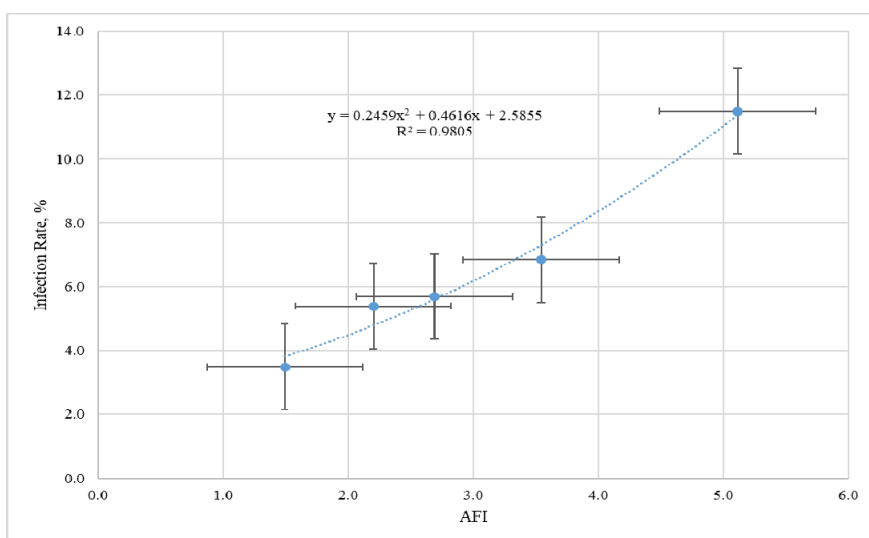


Fig. 1. Connection of COVID-19 Infection Rate with values of Angstrom Fire Index (AFI).

Connection of COVID-19 Infection Rate with Angstrom Fire Index (AFI) has the form of a two power polynomial (Fig. 1).

Fig. 2 shows that values of IR under different categories AFI decrease from 11.5 % (“Low”) to 3.5 % (“Extreme”).

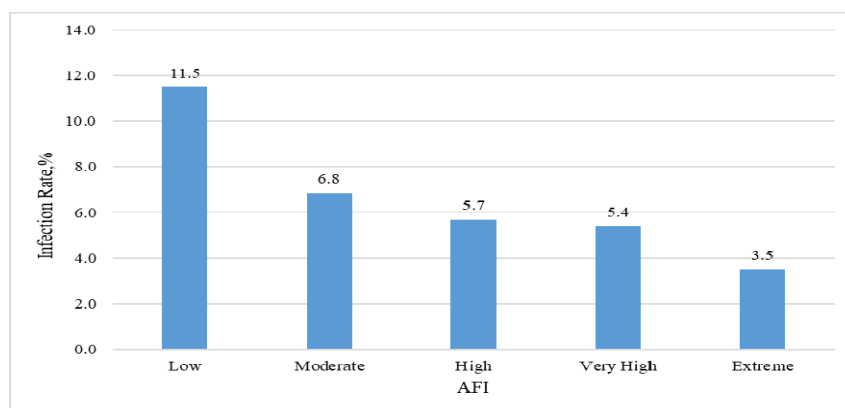


Fig. 2. Values of COVID-19 Infection Rate under different categories of Angstrom Fire Index (AFI).

Thus, it has been established that an increase in AFI values (a decrease in the degree of fire hazard) leads to an increase in IR values. At the same time, the relationship between these parameters is described mathematically with a high level of significance. This means that AFI in this case also manifests itself as a bioclimatic indicator. In principle, this was to be expected, since AFI, like a number of other simple bioclimatic indices, is a combination of temperature and relative air humidity. The main result of this study is to identify the suitability of the standard AAA scale as an indicator of the bioclimatic situation (similar to simple thermal indices [14,16]).

### Conclusion

In the future, it is planned to compare AFI values with various indicators of human health. If the standard AAA scale, like other thermal indices, turns out to be suitable for determining the degree of comfort-discomfort of a person's health state, then AAA, along with its main function, can be included in the well-known list of bioclimatic indices.

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