Journal of the Georgian Geophysical Society, e-ISSN: 2667-9973, p-ISSN: 1512-1127
Physics of Solid Earth, Atmosphere, Ocean and Space Plasma, v. 27(1), 2024, pp. 77 – 90

Variability of the Holiday Climate Index in Tsalka (Georgia)

[1]Avtandil G. Amiranashvili, [2,3] Liana G. Kartvelishvili, [4,5]Andreas Matzarakis

[1]M. Nodia Institute of Geophysics of the I. Javakhishvili Tbilisi State University, Tbilisi, Georgia
[2]Institute of Hydrometeorology of the Georgian Technical University, Tbilisi, Georgia
[3]Georgian National Environmental Agency, Tbilisi, Georgia
[4]Faculty of Environment and Natural Resources, University of Freiburg, Freiburg im Breisgau, Germany
[5]Democritus University of Thrace, Komotini, Greece

ABSTRACT

Data about long-term monthly average values of Holiday Climate Index (HCI) for Tsalka (Georgia) are presented. Detailed analysis of the monthly, seasonal and annual HCIs values over the 60-year period (1956-2015) are carried out. The variability of the HCI in 1986-2015 compared to 1956-1985 was studied, and the trends of the HCI in 1956-2015 were also investigated.

Key Words: *Bioclimate, Tourism Climate Index, Holiday Climate Index*.

Introduction

The formation and successful functioning of the resort and tourism economy of an area largely depends on its geographical location, relief, historical-cultural and natural monuments, vegetation, the presence of natural disasters, weather, climate, etc. [1-5]. At the same time, weather and climate are the two main factors determining the bioclimatic resources of the territory. Accordingly, the study of these resources plays an important role for the organization and development of the resort and tourism industry in the area [6-12].

In recent decades in various studies, including Georgia, many climate indices for tourism have been used [6-17]. However, the most widely known index used both in the past and in the present is the Tourist Climate Index (TCI), proposed by Mieczkowski [18].

In southern Caucasus countries, the monthly TCI was first calculated for Tbilisi (Georgia) [19] and then for many other locations in the Caucasus (Armenia, Azerbaijan, North Caucasus, etc.) [3, 20-26]. The study [27] presents the first TCI calculations for Zimbabwe. In the work [28] evaluated the climate comfort of Argentina as an intangible resource for tourism. The applicability of the tourism climate index for Saudi Arabia in [29] is presented. In [30] assessing climate change impacts on tourism demand in Turkey through the Tourism Climate Index is carried out.

Despite the wide application of the TCI, it has been subject to substantial critiques [31]. The four key deficiencies of the TCI include the following: (1) the subjective rating and weighting system of climatic variables; (2) it neglects the possibility of the overriding influence of physical climatic parameters (e.g., rain, wind); (3) the low temporal resolution of climatic data (i.e., monthly data) has limited relevance for tourist decision-making; and (4) it neglects the varying climatic requirements of major tourism segments and destination types (i.e., beach, urban, winter sports tourism).

To overcome the above limitations of the TCI, the Holiday Climate Index (HCI) was developed to more precisely assess the climatic suitability of tourism destinations. The word "Holiday" was chosen to better reflect what the index was designed for (i.e., leisure tourism), as tourism is much broader by definition ("Tourism is a social, cultural and economic phenomenon which entails the movement of people to countries or places outside their usual environment for personal or business/professional purposes") [32-36]. In the same works, comparisons between the HCI and TCI were made.

A comparison of the Holiday Climate Index and Tourism Climate Index at several locations in Georgia and the North Caucasus in [37-39] are presented. The long-term average HCIs for 12 Kakheti locations (Akhmeta, Dedoplistskaro, Gombori, Gurjaani, Kvareli, Lagodekhi, Omalo, Sagarejo, Shiraki, Telavi, Tsnori and Udabno) in [40] are presented. For 6 stations in this region (Dedoplistskaro, Gurjaani, Kvareli, Lagodekhi, Sagarejo and Telavi), detailed analyses of the monthly, seasonal and annual HCIs over the 60-year period (1956-2015) were carried out.

It was found that there is a high degree of correlation between the HCI and TCI. However, considering that the TCI is calculated for the so-called "average tourist" (regardless of gender, age, physical condition), the value and category of this index are lower than the HCI values and categories. In general, based on our estimation, the HCI more adequately determines the bioclimatic state of the environment for the development of various types of tourism than does the TCI [37-40].

It should be noted that the scale of various bioclimatic indices (including TCI and HCI) is quite consistent with data on public health in various regions of Georgia [15, 41,42], as well as on the spread of the COVID-19 virus in Tbilisi [43].

Great importance is attached to studying the impact of climate change on TCI and HCI.

In study [9] noted that the TCI and HCI are good indicators of the environmental conditions for leisure activities in the Canary Islands. Using the Regional Climate Model, it is shown that by 2030-2059 and 2070-2099, tourism performance is expected to improve significantly in the winter and off-season but deteriorate in the summer months, including October, in the southeast, which is where hotels are currently located.

The aim of the study [44] is to assess the future HCI performances of urban and beach destinations in the greater Mediterranean region. For this purpose, HCI scores for the reference (1971-2000) and future (2021-2050, 2070-2099) periods were computed. HCI: The urban results showed that the Canary Islands have suitable conditions for tourism during almost all four seasons and all periods, which will have certain implications when other core Mediterranean competitors lose their relative climatic attractiveness. The HCI:Beach results for the summer season showed that Las Canteras, Alicate, Pampelonne, Myrtos, Golden Sands and Edremit all pose very good to excellent conditions without any Humidex risks for the extreme future scenario (2070-2099).

The study [45] provides the first application of a tourism climate index in the tropical southwest Indian Ocean, applying the recently developed Holiday Climate Index (HCI) for Réunion Island. The suitability of this index is evaluated for the case of this French department, with a particular focus on air conditioning availability in tourism accommodation establishments as this index excludes night-time thermal comfort. Both iterations of the HCI (HCI_{Beach} and HCI_{Urban}) are computed with meteorological data from Roland Garros Airport for the period 1991–2020, exploring monthly, annual, and seasonal climatic suitability. Mean monthly HCI scores reveal considerable seasonality in climatic suitability for tourism on the island with scores ranging from 89.3 (Excellent) to 36.9 (Marginal) for the HCI_{Beach} and 85.0 (Excellent) to 27.5 (Unacceptable) for the HCI_{Urban}, with more favourable scores calculated for July and August, displaying a clear austral winter peak seasonal classification. Over the 30-year period, there is no statically significant change in mean annual climatic suitability, and at a monthly scale, only one month of the year for each index displays statistically significant trends. These results are important in informing tourism strategies for the island to maximise visitor satisfaction through targeting advertising more deliberately for peak touristic climate suitability during the winter months.

The purpose of study [46] was to investigate the status of urban tourism climate in West Azerbaijan province using Holiday Climate Index (HCI). At first, daily meteorological data of 8 major cities in the province were collected for a ten years period (2008-2017) and after data processing and database preparation, the HCI values were calculated daily and monthly. The results showed that Mahabad with 197 days has the highest number of comfortable days in this province. Khoy with 192 days, Salmas with 182 days, Urmia and Piranshahr with 181 days, Sardasht with 171 days, Takab with 164 days and Maku with 155 days are next. in these days, there are ideal conditions for recreation and tourism. May and September are also the best months for tourism activities in West Azerbaijan province.

In [11] the tourism climate comfort of Longji Terraced Fields from 2002 to 2022 is discussed. The results show that the current Holiday Climate Index and Modified Climate Index for Tourism are not suitable for evaluating the Longji Terraces. Adjustments were made to these indices to account for the high annual precipitation and relative humidity of Longsheng. Combining extensive questionnaire surveys, it was found that the improved evaluation model better reflects tourists' perceptions of climate comfort. Analysis indicates that when the modified model value is above 70, tourist satisfaction exceeds 80%. The most comfortable tourism periods for the Longji Terraces are August, September, and October, while the least comfortable periods are January, February, and March. This study helps to understand the seasonal variations in tourism climate comfort at Longji Terraced Fields and provides a scientific basis for local tourism industry responses to climate change, thereby increasing tourism revenue.

The aim of study [47] is to assess the future HCI performance of urban and beach destinations in the greater Mediterranean region. For this purpose, HCI scores for the reference (1971–2000) and future (2021–

2050, 2070–2099) periods were computed with the use of two latest greenhouse gas concentration trajectories, RCP 4.5 and 8.5, based on the Middle East North Africa (MENA) Coordinated Regional Downscaling Experiment (CORDEX) domain and data. The outputs were adjusted to a 500 m resolution via the use of lapse rate corrections that extrapolate the climate model topography against a resampled digital elevation model. All periodic results were seasonally aggregated and visualized on a (web) geographical information system (GIS). The web version of the GIS also allowed for a basic climate service where any user can search her/his place of interest overlaid with index ratings. Exposure levels are revealed at the macro scale while sensitivity is discussed through a validation of the climatic outputs against visitation data for one of Mediterranean's leading destinations, Antaly.

The study [48] derived the Holiday Climate Index (HCI: Coast, HCI: Urban, and HCI: Combined) in the Mediterranean coastal provinces of Türkiye from 1976 to 2020. Utilizing the derived indices, the effects of climate-related holiday comfort on the number of tourist arrivals as well as on overnight stays between 1976 and 2020 were examined by panel data analysis. The study examined how comfort patterns could change during the period 2026–2050 under the pessimistic RCP8.5 scenario. It was detected that the comfort level significantly and positively affects the number of arrivals and overnight stays of tourists. Besides, comfort levels were found to deteriorate in the period 2026–2050 compared to the reference period, 1976–2020. As the comfort conditions get worse, the number of tourist arrivals and overnight stays is expected to decline in the future.

In [49] a study was conducted to analyze the holiday climate index (HCI) for Sri Lanka's urban and beach destinations. The analysis covered historical years (2010–2018) and forecasted climatic scenarios (2021–2050 and 2071–2100), and the results were presented as colored maps to highlight the importance of HCI scores. Visual analysis showed some correlation between HCI scores and tourist arrivals, but the result of the overall correlation analysis was not significant. However, a country-specific correlation analysis revealed interesting findings, indicating that the changing climate can be considered among other factors that impact tourist arrivals. The research proposes that authorities assess the outcomes of the study and conduct further research to develop adaptive plans for Sri Lanka's future tourism industry. The study also investigated potential scenarios for beach and urban destinations under two climate scenarios (RCP 4.5 and RCP 8.5) for the near and far future, presenting the findings to tourism industry stakeholders for any necessary policy changes.

In study [36] to investigate the TCI and HCI index to determine nature tourism in the Khamir-Qeshm mangrove forests from 1996 to 2021. The results of TCI revealed that the best tourism season is autumn late and winter in December, January, and February while the most unfavorable climatic conditions are June, July, August, September, and October. Based on the results of HCI, the most favorable tourism season is related to winter and especially March month, while the status of this index is acceptable from June to October. In general, the results of TCI and HCI indicate that autumn to the end of winter is the best time in terms of tourism climate, and spring to summer late, has the most unfavorable conditions for visitor's presence due to the extreme heat, high humidity, and sultry climate of the area. The statistical analysis of TCI and HCI also indicates that there is a significant and direct relationship between these two indicators with climatic variables and with the increase of the final coefficient, the climatic conditions of the area will be more favorable for tourists' presence. Considering the increasing tourism industry and nature tourism development in Khamir-Qeshm mangrove forests, proper planning in accordance with the favorable conditions of the tourism climate can protect this area, provide suitable infrastructure and facilities for tourists, and will also help create conditions to understand the comfortable feeling and tourist's satisfaction.

Study [50] presents an assessment of climate suitability for outdoor leisure activities in Romania using the Holliday Climate Index (HCI) for the near future (2021–2040), focusing on unfavorable and good climate conditions. The analysis employs data from an ensemble of model simulations in the context of RCP4.5 and RCP8.5 climate change scenarios. The results indicate that the number of days with low weather suitability is decreasing in almost the entire country, especially during the warm season, while during the winter and spring, extended regions may be characterized by a higher number of days favorable for outdoor activities than during the current climate. An estimation of the impact of climate change on tourism flux in Romania is further carried out, suggesting that the increasing attractivity of climate conditions may lead to an increased number of tourist overnights in the near future, and this will be more pronounced in rural destinations.

Assessing the impact of dust events on the Holiday Climate Index in the Taklimakan Desert region in [51] is presented.

Detailed information on the variability of the monthly values of the Holiday Climate Index in Tbilisi in 1956-2015 is presented in [52]. It also presents data on the interval forecasts of HCI variability in Tbilisi for the next few decades.

In the work [38] is performed a detailed analysis of monthly, seasonal and annual HCI values during a 60-year period (1956-2015) for 13 mountainous locations in Georgia (Bakhmaro, Bakuriani, Borjomi, Goderdzi, Gudauri, Khaishi, Khulo, Lentekhi, Mestia, Pasanauri, Shovi, Stepantsminda, and Tianeti) and compared HCIs and TCIs of monthly values for three points in Georgia (Goderdzi, Khulo and Mestia) based on data from 1961 to 2010. The variability data of the HCI in 1986-2015 compared to those in 1956-1985 and the trends of the HCI in 1956-2015 are also presented. Using Mestia as an example, the expected changes in the monthly, seasonal and annual HCIs of 2041-2070 and 2071-2100 were assessed. Some results of this work were used in [5, 53].

Finally, in the work [54] an analysis of data on the long-term average values of the Holiday Climate Index (HCI) for 8 settlements in the Kvemo Kartli region of Georgia (Bolnisi, Gardabani, Dmanisi, Tetri Tskaro, Marneuli, Tsalka, Manglisi, Rustavi) is presented. The intra-annual distribution of HCI values was studied; correlations between individual stations were determined based on average monthly and seasonal HCI values; it was found that the regression equations for the intra-annual variation of average monthly HCI values for all points of Kvemo Kartli have the form of a ninth-order polynomial; categories of average monthly and seasonal HCI values in the specified settlements of Kvemo Kartli were determined; a comparison was made of the statistical characteristics of average monthly HCI values in 8 points of Kvemo Kartli with the indicated characteristics in Bolnisi, Gardabani, Marneuli, Rustavi (height of stations above sea level $H < 1$ km) and in Dmanisi, Tetri Tskaro, Tsalka, Manglisi ($H > 1$ km), and a corresponding analysis of the repeatability of HCI categories was conducted. It is shown that the bioclimatic conditions in Kvemo Kartli are favourable for the development of the resort and tourism industry for all months of the year. A visual map of the distribution of mean monthly HCI categories on the territory of Kvemo Kartli has been constructed.

This work is a continuation of the study [54]. Analysis results of investigations of variability of the Holiday Climate Index (HCI) in Tsalka in 1956-2015 are presented below.

Study area

Tsalka (41.60 N°, 44.08 E°, 1458 m, a.s.l.) is a town and municipality center in southern Georgia's Kvemo Kartli region.

The district had a population of 2326. There are important historical monuments in Tsalka: Kldekari Fortress (ninth century) and the church of St. George in Dashbashi (tenth-eleventh centuries). Tsalka Canyon (formerly Dashbashi Canyon) and its new bridge are also interesting tourist attractions.

Tsalka Canyon in Georgia is a deep mountain gorge situated 100 kilometers west of Tbilisi in Tsalka Municipality. Long popular with visitors, the canyon has become even more alluring since a touristic center opened on the site in the summer of 2021, providing plenty of options for comfort and adventure in a picturesque setting.The canyon, measuring 7 kilometers long and 300 meters deep, was formed on a volcanic plateau through the process of erosion. This natural wonder is defined by steep slopes covered in lush vegetation, at the bottom of which flows the rapid waters of the Khrami River (Fig. 1). Yet the major attraction of Tsalka Canyon is its spectacular cluster of cascading waterfalls (Fig. 2).

In the summertime, their emerald waters glisten among the lavish green foliage, while in winter the waterfalls freeze, creating a frosty fairytale landscape.Visitors can easily travel from Tbilisi to Dashbashi Canyon (Tsalka Canyon) on a 2-hour drive one way. Once you reach the canyon’s entrance you must park your car and walk downhill along a well-marked mountain path that winds for 1.5 kilometers to the falls. The most challenging part of the trek is the steep climb back, but guests should also be prepared to walk across the stone-covered banks of the Khrami River. Most people need about 1-1.5 hours to complete the round-trip Dashbashi Canyon hike.In August 2021, a new complex opened at Tsalka Canyon with the aim of developing the nature reserve into an attractive touristic area.

The complex includes a 240-meter-long glass bridge right above the canyon, with a diamond-shaped cafe bar in the middle. There is also a visitor center, a high-quality hotel complex with cottages, an open garden restaurant, swimming pools, bridges, camping sites and a 500-meter paved road to the canyon river.A trip to Tsalka Canyon makes an ideal getaway from Tbilisi and can also be a stopping point on a more extensive journey. Near the canyon lies the picturesque Tsalka Lake, a favourite destination of Georgian fishermen. You can also hike to the ruins of the 9th-century Kldekari Fortress, and although little is left of this once-powerful citadel, the trek to it is rather charming. Another option is to combine a visit to Tsalka Canyon with a trip to Poka Nunnery of Saint Nino, situated on the shores of Paravani Lake [https://www.advantour.com/georgia/tsalka-canyon.htm]

Tsalka Canyon is a rewarding outdoor destination that will deepen your appreciation of Georgia's natural beauty [https://en.wikipedia.org/wiki/Tsalka].

Fig. 1. Tsalka Canyon [https://www.advantour.com/georgia/tsalka-canyon.htm; https://www.tripadvisor.com/AttractionProductReview-g294195-d17566244-Trip_to_The_Diamond_Bridge_and_Dashbashi_Canyon-Tbilisi.html]

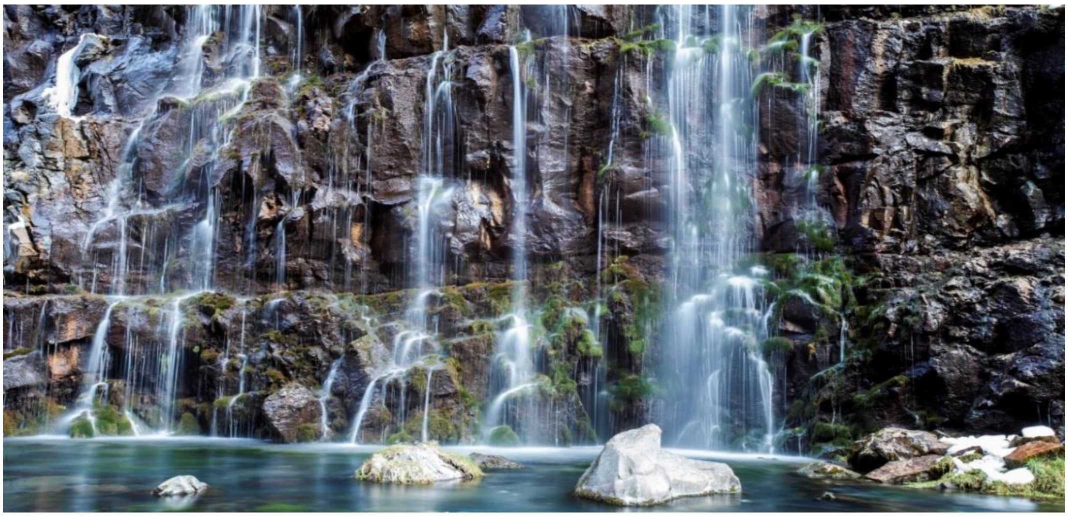

Fig. 2. Dashbashi waterfall, situated at the bottom of Tsalka Canyon. [https://en.wikipedia.org/wiki/Tsalka_Canyon#/media/File:Dashbashi_24.jpg]

Material and methods

For the monthly mean values of HCI calculation data of National Environmental Agency of Georgia from 1956 to 2015 were used: T_{max} - maximum air temperature, °C; RH – air relative humidity, %; P - precipitation, mm; CC – total cloud cover, degree; W wind speed, m/s (Table 1 and 2). HCI values and their categories were determined in accordance with the methodology described in the works [31, 37-39].

In the work analysis of data is carried out with the use of the standard statistical analysis methods. The following designations will be used below: Mean – average values; Min – minimal values; Max - maximal values; Range - variational scope; St Dev - standard deviation; σ_m – standard error; C_v, % – coefficient of variation (C_v = 100·St Dev/Average); 95%(+/-) - 95% confidence interval of mean; I)1956÷1985 – mean value of meteorological parameters and HCI in 1956-1985, first period; II)1986÷2015 - second period; t - Student criterion; α - the level of significance; Diff.(II-I) – difference between mean values of meteorological parameters and HCI in second and first periods were determined with use of Student criterion (α≤0.15); R - coefficient of linear correlation (α≤0.15); Δ_1 = 100· Diff.(II-I)/Mean(1956-2015) - relative variability of the difference between the mean values of the HCI in two periods of time relative to the mean value for the entire observation period, %; Δ_2 = 100·[HCI(2015) – HCI(1956)]/Mean(1956-2015) - relative variability of the difference between the HCI values in 2015 and 1956, determined by linear regression equations, in relation to the mean value for the entire observation period, %; a and b - coefficients of the linear equation of the trend of HCI values (HCI = a·year/month + b).

Table 1. Monthly values of meteorological parameters for HCI calculation in Tsalka during the cold season in three period of time.

Variable	Period	Jan	Feb	Mar	Oct	Nov	Dec	Cold	Year
T_{max}, °C	1956-2015	1.8	2.3	5.8	13.7	8.2	3.9	6.0	12.2
	II)1986-2015	2.1	2.7	6.4	14.1	8.3	3.9	6.3	12.6
	I)1956-1985	1.5	1.9	5.1	13.3	8.1	3.8	5.6	11.8
	Diff.(II-I)	0.6	0.9	1.3	0.8	0.2	0.1	0.6	0.8
	t	0.86	1.28	2.17	1.55	0.34	0.15	1.94	3.56
	α	No	No	0.03	0.13	No	No	0.06	<0.01
RH, %	1956-2015	73.9	74.6	75.2	79.6	77.0	74.6	75.8	76.8
	II)1986-2015	73.0	73.2	72.5	80.2	76.5	73.8	74.9	76.0
	I)1956-1985	74.9	76.0	77.9	78.9	77.6	75.5	76.8	77.6
	Diff.(II-I)	-1.9	-2.8	-5.4	1.3	-1.1	-1.7	-1.9	-1.6
	t	1.05	1.96	3.62	1.03	0.71	1.09	2.46	2.21
	α	No	0.05	<0.01	No	No	No	0.02	0.03
P, mm	1956-2015	21.5	28.1	38.9	49.8	33.5	22.7	32.4	57.0
	II)1986-2015	19.6	28.3	37.4	53.0	34.7	23.6	32.8	55.3
	I)1956-1985	23.4	27.9	40.3	46.6	32.3	21.7	32.0	58.7
	Diff.(II-I)	-3.7	0.4	-2.9	6.4	2.5	1.9	0.8	-3.4
	t	0.98	0.10	0.56	0.93	0.44	0.50	0.34	1.38
	α	No	No	No	No	No	No	No	No
CC	1956-2015	6.0	6.3	6.8	6.5	6.3	6.0	6.3	6.5
	II)1986-2015	6.2	6.5	6.8	7.0	6.3	6.3	6.5	6.7
	I)1956-1985	5.7	6.2	6.8	5.9	6.2	5.7	6.1	6.3
	Diff.(II-I)	0.5	0.4	0.0	1.0	0.1	0.6	0.4	0.4
	t	2.02	1.43	0.03	3.78	0.36	2.02	3.98	4.91
	α	0.05	0.15	No	<0.01	No	0.05	<0.01	<0.01
W, m/s	1956-2015	1.7	1.6	1.5	1.1	1.3	1.6	1.5	1.3
	II)1986-2015	1.4	1.2	1.3	0.8	1.0	1.2	1.2	1.1
	I)1956-1985	2.0	1.9	1.8	1.4	1.6	1.9	1.7	1.5
	Diff.(II-I)	-0.6	-0.6	-0.5	-0.5	-0.5	-0.6	-0.6	-0.5
	t	3.65	3.24	3.94	6.42	4.17	5.76	6.84	7.17
	α	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

In Tables 1,2 data on monthly values of meteorological parameters for HCI calculation in Tsalka during three period of time are presented. In particular, as follows from these tables, in 1956-2015 the average monthly values of these meteorological elements vary within the following limits: T_{max} - 1.8 °C (Jan) - 22.4 °C (Jul, Aug); RH - 73.9% (Jan) - 79.6% (Oct); P - 21.5 mm (Jan) - 116.8 mm (May); CC - 6.0 degree (Jan, Dec) - 7.2 degree (May); W - 1.0 m/s (Jul, Aug) - 1.7 m/s (Jan).

Table 2. Monthly values of meteorological parameters for HCI calculation in Tsalka during the warm season in three period of time.

Variable	Period	Apr	May	Jun	Jul	Aug	Sep	Warm	Year
T_{max}, °C	1956-2015	11.8	16.1	19.7	22.4	22.4	18.6	18.5	12.2
	II)1986-2015	12.1	16.2	20.2	22.9	23.2	19.2	19.0	12.6
	I)1956-1985	11.6	16.0	19.1	21.9	21.6	18.0	18.1	11.8
	Diff.(II-I)	0.5	0.2	1.1	1.0	1.6	1.2	0.9	0.8
	t	0.84	0.48	3.19	2.71	3.57	2.87	4.10	3.56
	α	No	No	<0.01	0.01	<0.01	<0.01	<0.01	<0.01
RH, %	1956-2015	76.1	78.7	78.5	77.5	77.4	79.0	77.9	76.8
	II)1986-2015	75.0	77.8	77.8	77.6	77.0	78.1	77.2	76.0
	I)1956-1985	77.2	79.5	79.2	77.3	77.8	79.9	78.5	77.6
	Diff.(II-I)	-2.2	-1.7	-1.3	0.3	-0.7	-1.8	-1.2	-1.6
	t	1.48	1.24	0.89	0.18	0.48	1.64	1.18	2.21
	α	0.14	No	No	No	No	0.11	No	0.03
P, mm	1956-2015	73.0	116.8	115.6	64.9	65.4	53.5	81.5	57.0
	II)1986-2015	75.8	108.5	122.7	56.2	59.5	43.7	77.7	55.3
	I)1956-1985	70.1	125.1	108.5	73.7	71.2	63.2	85.3	58.7
	Diff.(II-I)	5.7	-16.7	14.2	-17.5	-11.7	-19.5	-7.6	-3.4
	t	0.71	1.35	1.28	2.29	1.22	2.30	1.67	1.38
	α	No	No	No	0.03	No	0.03	0.10	No
CC	1956-2015	7.1	7.2	6.6	6.6	6.5	6.4	6.7	6.5
	II)1986-2015	7.2	7.3	6.8	6.8	6.7	6.5	6.9	6.7
	I)1956-1985	6.9	7.0	6.3	6.3	6.4	6.2	6.5	6.3
	Diff.(II-I)	0.3	0.2	0.4	0.6	0.3	0.3	0.4	0.4
	t	1.41	1.16	2.03	2.62	1.25	1.03	3.17	4.91
	α	0.15	No	0.05	0.01	No	No	<0.01	<0.01
W, m/s	1956-2015	1.3	1.2	1.2	1.0	1.0	1.1	1.1	1.3
	II)1986-2015	1.1	1.0	1.0	0.8	0.8	0.9	1.0	1.1
	I)1956-1985	1.6	1.3	1.4	1.2	1.2	1.3	1.3	1.5
	Diff.(II-I)	-0.5	-0.3	-0.4	-0.4	-0.4	-0.3	-0.4	-0.5
	t	4.29	2.41	3.80	3.88	5.31	4.12	5.56	7.17
	α	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

In 1986-2015, compared to 1956-1985, significant variability in the average monthly values of these meteorological parameters occurred as follows. T_{max} - growth in March and from June to October with a range of variability from 0.8 °C (Oct) to 1.6 °C (Aug); RH - decrease from February to April and in September with a variability range from -5.4% (Mar) to -1.8% (Sep); P - decrease only in September (-19.5 mm) and July (-17.5 mm); CC - growth in all months except March, May, August, September and November with a variability range from 0.3 degree (Apr) to 1.0 degree (Oct); W, m/s - decrease in all months of the year with a variability range from - 0.6 m/s (Jan, Feb, Dec) to -0.3 m/s (May, Sep). Thus, during the time period under study, the greatest variability among the studied meteorological parameters was observed for wind speed (all months of the year), the least - for precipitation (two months).

Results of analysis of studies of the variability of the Holiday Climate Index in Tsalka in 1956-2015 against the backdrop of climate change are presented below.

Results and discussion

The results in Fig. 3-6 and Tables 3,4 are presented. Fig. 3,4 and Tables 3,4 present data on the statistical characteristics and changeability of monthly and seasonal values of HCI in Tsalka in 1956-2015.

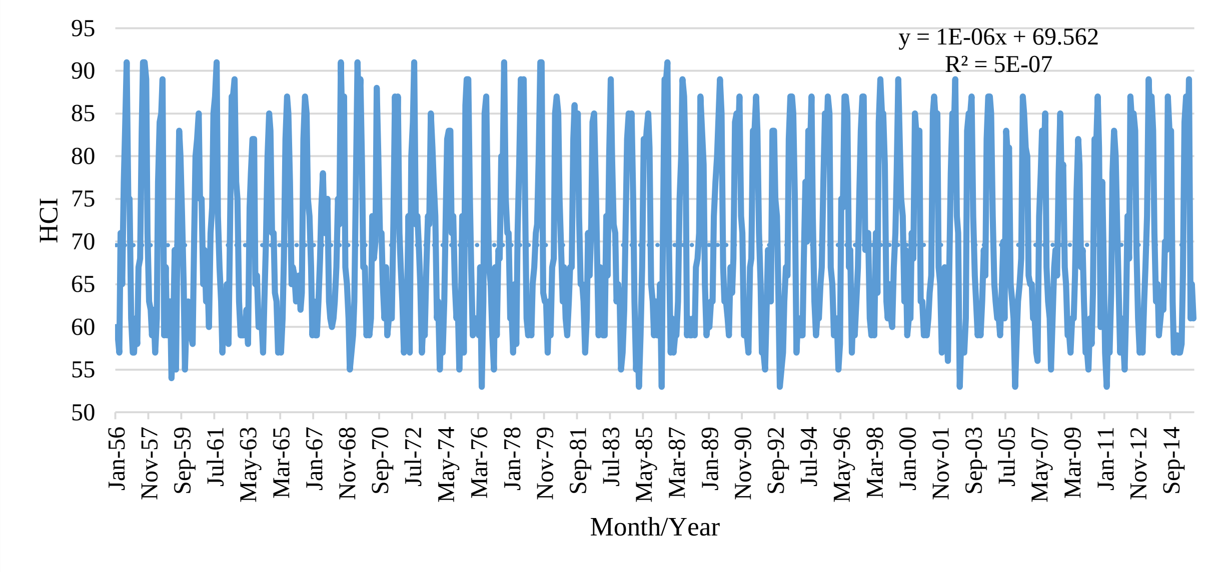

Fig. 3. Variability of monthly values of HCI in Tsalka in 1956-2015.

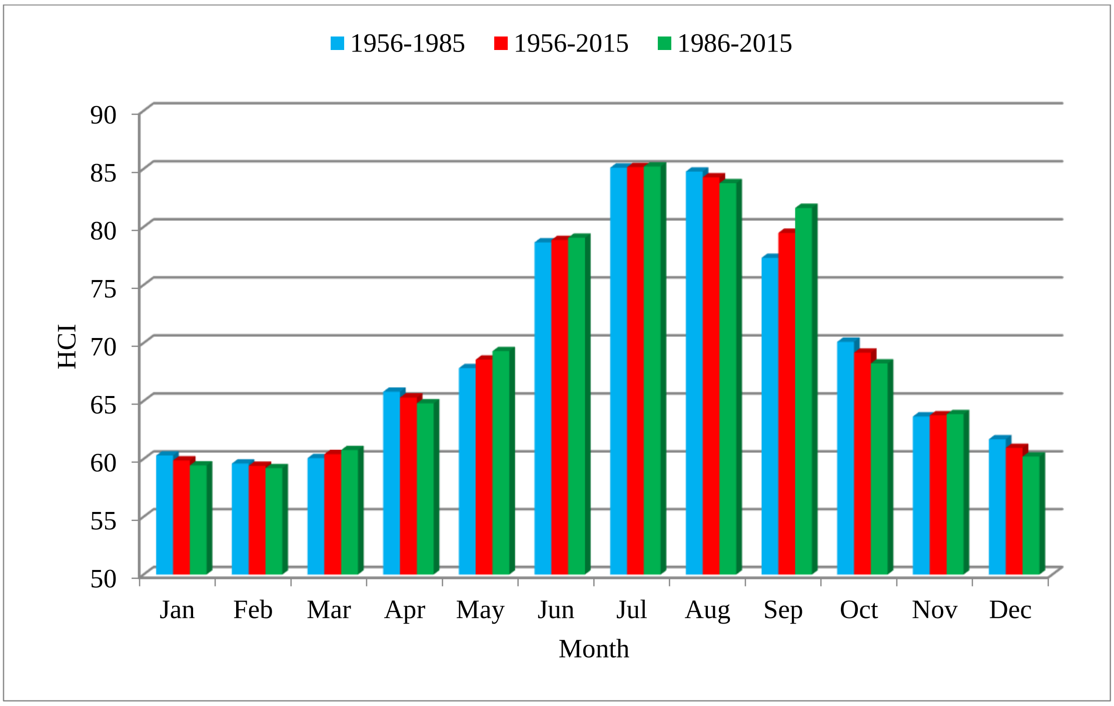

Fig. 4. Monthly values of HCI in Tsalka in three period of time.

In the period from 1956 to 2015 (Fig. 3,4 Tables 3, 4) monthly HCI values varied from 53.0 ("Acceptable", Jan, Feb, May, Dec) to 91.0 ("Ideal", Sep). The mean monthly HCI values for the entire observation period varied from 59.4 ("Acceptable", Feb) to 85.2 ("Excellent", Jul). Maximal value of Range for monthly values of HCI is 32.0 (Sep), Minimal - 12.0 (Mar).

Table 3. Statistical characteristics of HCI in Tsalka during the cold season (1956-2015).

Parameter	Jan	Feb	Mar	Oct	Nov	Dec	Cold	Year
Mean	59.9	59.4	60.4	69.2	63.8	61.0	62.3	69.6
Min	53.0	53.0	55.0	59.0	55.0	53.0	58.7	65.6
Max	67.0	67.0	67.0	79.0	77.0	69.0	65.5	72.3
Range	14.0	14.0	12.0	20.0	22.0	16.0	6.8	6.8
St Dev	2.8	3.0	2.8	4.2	3.9	3.5	1.6	1.6
σ_m	0.37	0.39	0.36	0.55	0.51	0.46	0.21	0.20
C_v (%)	4.7	5.0	4.6	6.1	6.1	5.8	2.6	2.2
95%(+/-)	0.7	0.8	0.7	1.1	1.0	0.9	0.4	0.4
II)1986÷2015	59.4	59.2	60.8	68.2	63.9	60.2	62.0	69.6
I)1956÷1985	60.3	59.6	60.1	70.1	63.7	61.7	62.6	69.6
Diff.(II-I)	-0.9	-0.4	0.7	-1.9	0.2	-1.5	-0.6	0.0
t	-1.19	-0.52	0.98	-1.73	0.20	-1.68	-1.50	0.11
α(t)	No	No	No	0.09	No	0.10	0.14	No
R	0.17	0.20	0.16	0.27	0.06	0.12	0.20	0.03
Δ_1, %	-1.4	-0.7	1.2	-2.7	0.3	-2.5	-1.0	0.1
α(R)	No	0.13	No	0.03	No	No	0.13	No
a	-0.0277	-0.0334	0.0257	-0.0663	0.0143	-0.0233	-0.0184	-0.0023
b	114.9	125.7	9.4	200.8	35.3	107.1	98.9	74.1
Δ_2, %	-2.7	-3.3	2.5	-5.7	1.3	-2.3	-1.7	-0.2

Table 4. Statistical characteristics of HCI in Tsalka during the warm season (1956-2015).

Parameter	Apr	May	Jun	Jul	Aug	Sep	Warm	Year
Mean	65.3	68.6	78.9	85.2	84.3	79.5	76.9	69.6
Min	56.0	53.0	61.0	78.0	71.0	59.0	70.8	65.6
Max	73.0	83.0	91.0	91.0	91.0	91.0	81.5	72.3
Range	17.0	30.0	30.0	13.0	20.0	32.0	10.7	6.8
St Dev	4.8	6.3	6.6	2.9	4.2	6.8	2.5	1.6
σ_m	0.63	0.82	0.85	0.38	0.55	0.88	0.33	0.20
C_v (%)	7.4	9.2	8.3	3.4	5.0	8.5	3.3	2.2
95%(+/-)	1.2	1.6	1.7	0.7	1.1	1.7	0.6	0.4
II)1986÷2015	64.8	69.3	79.1	85.2	83.8	81.6	77.3	69.6
I)1956÷1985	65.8	67.8	78.7	85.1	84.8	77.3	76.6	69.6
Diff.(II-I)	-1.0	1.5	0.4	0.1	-1.0	4.3	0.7	0.0
t	-0.80	0.90	0.23	0.13	-0.91	2.58	1.10	0.11
α(t)	No	No	No	No	No	0.01	No	No
R	0.12	0.10	0.06	0.04	0.24	0.32	0.10	0.03
Δ_1, %	-1.5	2.1	0.5	0.1	-1.2	5.4	0.9	0.1
α(R)	No	No	No	No	0.06	0.01	No	No
a	-0.0331	0.0375	0.0208	-0.0061	-0.059	0.1232	0.0139	-0.0023
b	131.1	-5.8	37.6	97.2	201.4	-165.1	49.4	74.1
Δ_2, %	-3.0	3.2	1.6	-0.4	-4.1	9.1	1.1	-0.2

The trend of monthly HCI values for all observational data is generally insignificant positive (Fig. 3). A significant linear positive trend in HCI values in certain months of the year was observed in September; negative – in February, August, October and in the cold half of the year. A significant increase in average monthly and seasonal HCI values in the second period of time compared to the first was observed in September, a decrease – in October, December and in the cold half of the year. The maximum absolute value of Δ_1 = 5.4% (Sep) and Δ_2 = 20.2% (Oct). The values of the coefficient of variation vary from 3.4% (Jul) to 9.2% (May). Thus, the variability of the HCI values in Tsalka during the study period is generally insignificant (Tables 3, 4).

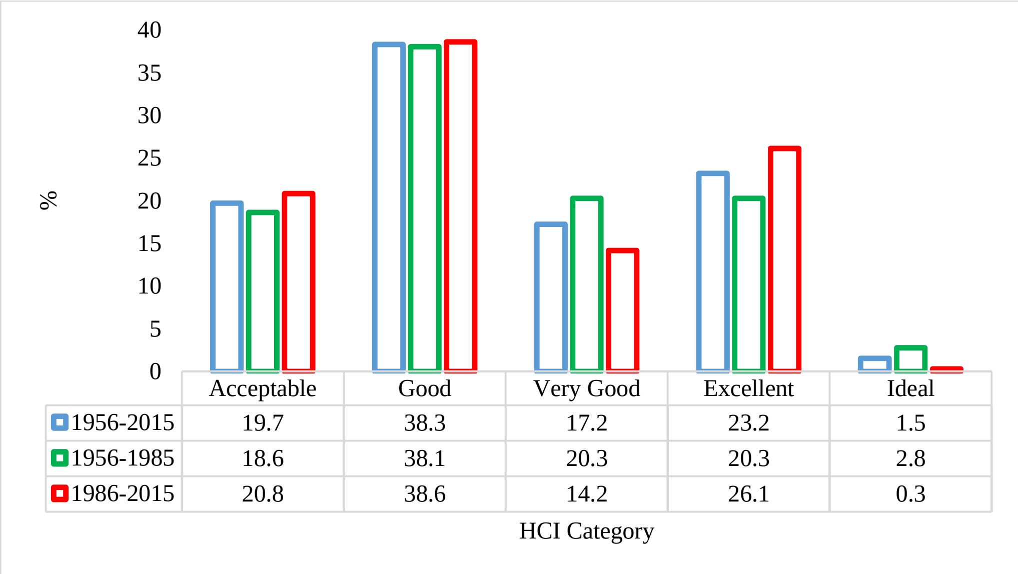

Fig. 5. Repetition of category of monthly values of HCI in Tsalka in three periods of time.

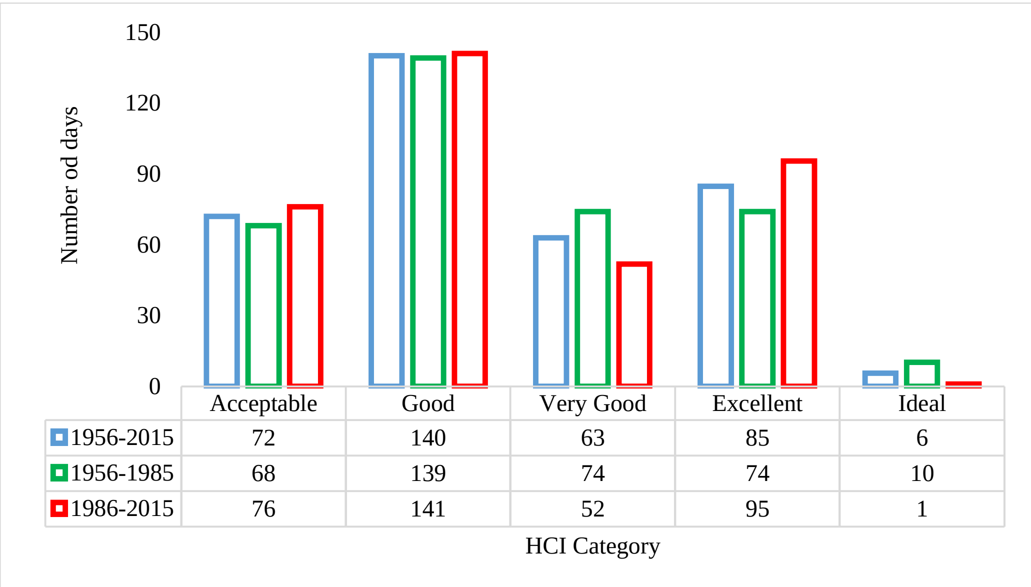

Fig. 6. Number of days in year with different category of HCI in Tsalka in three periods of time.

In the period from 1956 to 2015 the highest repeatability of HCI values (Fig. 5,6) was in the “Good” category (38.3% of cases, 140 days per year), the lowest - in the “Ideal” category (1.5% of cases, 6 days per year). In the second period (1986-2015) compared to the first (1956-1985) in Tsalka, climate change did not lead to a change in HCI categories. At the same time, the frequency of occurrence of the HCI “Acceptable” category increased from 18.6% to 20.8% (respectively, 68 and 76 days a year), the “Good” category increased very slightly - from 38.1% to 38.6% (respectively, 139 and 141 days a year), the “Very Good” category decreased from 20.3% to 14.1% (74 and 52 days a year, respectively), the “Excellent” category increased from

20.3% to 26.1% of cases (respectively 74 and 95 days a year), the "Ideal" category decreased from 2.8% to 0.3% (10 and 1 days a year, respectively). In general, in Tsalka practically all year round there are favorable bioclimatic conditions for recreation and tourism.

Conclusion

In the future, we plan to continue similar studies for other regions of Georgia (mapping the territory of Georgia by HCI values, studying their long-term trends, forecasting of HCI variability due to climate change). Research will also continue on the impact of various simple and complex bioclimatic indices, including HCI, on the peoples health.

References

[1] Vadachkoria M.K., Ushveridze G.A., Jaliashvili V.G. Health Resorts of the Georgian SSR.//Book: "Sabchota Sakartvelo" Publishers, Tbilisi, 1987, 383 p., (in Georgia, English and Russian).

[2] Kartvelishvili L., Matzarakis A., Amiranashvili A., Kutaladze N. Assessment of Touristical-Recreation Potential of Georgia on Background Regional Climate Change. //In the book: Proc. of IIst Int. Scientific-Practical Conference "Tourism: Economics and Business", June 4-5, Batumi, Georgia, 2011, pp. 250-252.

[3] Kartvelishvili L., Amiranashvili A., Megrelidze L., Kurdashvili L. Turistul Rekreaciuli Resursebis Shefaseba Klimatis Cvlilebebis Fonze. Book: Publish House "Mtsignobari", ISBN 978-9941-485-01-5, Tbilisi, 2019, 161 p., (in Georgian). http://217.147.235.82/bitstream/1234/293074/1/turistulRekreaciuli ResursebisShefasebaKlimatisCvlilebebisFonze.pdf.

[4] Lanchava O. A., Iliashi N., Radu S., Tsikarishvili K., Lezhava Z., Amiranashvili A., Chikhladze V., Asanidze L. Potential practical potential of Tskaltubo (Western Georgia) "White Cave". GEORGIAN SCIENTISTS, E-ISSN: 2667-9760, Vol. 3, N 1, 2021, 15 p., (in Georgian). Retrieved from https://journals.4 science.ge/index.php/GS/article/view/285

[5] Kartvelishvili L., Tatishvili M., Amiranashvili A., Megrelidze L., Kutaladze N. Weather, Climate and their Change Regularities for the Conditions of Georgia. Monograph: Publishing House "UNIVERSAL", Tbilisi, 2023, 406 p., https://doi.org/10.52340/mng.9789941334658

[6] Matzarakis A. Weather - and Climate-Related Information for Tourism. Tourism and Hospitality Planning & Development, August, vol. 3, No. 2, 2006, pp. 99–115.

[7] Amiranashvili A.G., Chikhladze V.A., Saakashvili N.M., Tabidze M.Sh., Tarkhan-Mouravi I.D. Bioclimatic Characteristics of Recreational Zones – Important Component of the Passport of the Health Resort – Tourist Potential of Georgia. Trans. of the Institute of Hydrometeorology at the Georgian Technical University, vol. 117, ISSN 1512-0902, 2011, pp. 89-92.

[8] Matzarakis A., Cheval S., Lin T.-P., Potchter, O. Challenges in Applied Human Biometeorology. Atmosphere, 12, 296, 2021. https://doi.org/10.3390/atmos12030296

[9] Carrillo J., González A., Pérez J. C., Expósito F. J., Díaz, J. P. Impact of Climate Change on the Future of Tourism Areas in the Canary Islands. //In the book: EGU General Assembly 2021, online, 19–30 Apr 2021, EGU21-11981, https://doi.org/10.5194/egusphere-egu21-11981, 2021.

[10] Rutty M., Steiger R., O. Demiroglu O.C., Perkins D.R. Tourism Climatology: Past, Present, and Future. Int. Journ. of. Biometeorology. Published online: 08 January 2021. https://doi.org/10.1007/s00484-020-02070-0

[11] Hu L., Guo X., Yan P., Li X. The Construction and Application of a Model for Evaluating Tourism Climate Suitability in Terraced Agricultural Cultural Heritage Sites: A Case Study of Longji Terraced Fields in China. Atmosphere, 15(7), 2024, 756. https://doi.org/10.3390/atmos15070756

[12] Pan S.-L., Wu L., Morrison A.M. A review of studies on tourism and climate change from 2007 to 2021. International Journal of Contemporary Hospitality Management, Vol. 36 No. 5, 2024, pp. 1512-1533. https://doi.org/10.1108/IJCHM-11-2022-1397

[13] Amiranashvili A.G., Kartvelishvili L. G. Long-Term Variations of Air Effective Temperature in Tbilisi. Trans. of the Institute of Hydrometeorology, vol. 115, ISSN 1512-0902, Tbilisi, 2008, pp. 214–219, (in Russian).

[14] Amiranashvili A.G, Bolashvili N.R., Chikhladze V.A., Japaridze N.D., Khazaradze K.R., Khazaradze R.R., Lezhava Z.L., Tsikarishvili K.D. Some New Data about the Bioclimatic Characteristics of the Village of Mukhuri (Western Georgia). Journal of the Georgian Geophysical Society, Issue B. Physics of Atmosphere, Ocean and Space Plasma, v.18B, Tbilisi, 2015, pp. 107-115.

[15] Amiranashvili A.G., Japaridze N.D., Khazaradze K.R. On the Connection of Monthly Mean of Some Simple Thermal Indices and Tourism Climate Index with the Mortality of the Population of Tbilisi City Apropos of Cardiovascular Diseases. Journal of the Georgian Geophysical Society, ISSN: 1512-1127, Physics of Solid Earth, Atmosphere, Ocean and Space Plasma, v. 21(1), Tbilisi, 2018, pp.48-62. http://www.jl.tsu.ge/index.php/GGS/article/view/2489

[16] Amiranashvili A., Japaridze N., Kartvelishvili L., Megrelidze L., Khazaradze K. Statistical Characteristics of the Monthly Mean Values of Air Effective Temperature on Missenard in the Autonomous Republic of Adjara and Kakheti (Georgia). Transactions of Mikheil Nodia Institute of Geophysics, ISSN 1512-1135, vol. LXIX, 2018, pp. 118-138, (in Russian).

[17] Amiranashvili A., Japaridze N., Kartvelishvili L., Khazaradze K., Revishvili A. Changeability the Monthly Mean Values of Air Effective Temperature on Missenard in Batumi in 1956-2015. Journal of the Georgian Geophysical Society, e-ISSN: 2667-9973, p-ISSN: 1512-1127, Physics of Solid Earth, Atmosphere, Ocean and Space Plasma, v. 25(2), 2022, pp. 49–58. DOI: https://doi.org/10.48614/ggs2520225960

[18] Mieczkowski Z. The Tourism Climate Index: A Method for Evaluating World Climates for Tourism. The Canadian Geographer, N 29, 1985, pp. 220-233.

[19] Amiranashvili A., Matzarakis A., Kartvelishvili L. Tourism Climate Index in Tbilisi. Trans. of the Institute of Hydrometeorology, ISSN 1512-0902, Tbilisi, vol. 115, 2008, pp. 27 - 30.

[20] Amiranashvili, A., Chargazia, Kh., Matzarakis, A. Comparative Characteristics of the Tourism Climate Index in the South Caucasus Countries Capitals (Baku, Tbilisi, Yerevan). Journal of the Georgian Geophysical Society, ISSN: 1512-1127, Issue (B). Physics of Atmosphere, Ocean, and Space Plasma, vol.17B, 2014, pp. 14-25.

[21] Amiranashvili A., Chargazia Kh., Matzarakis A., Kartvelishvili L. Tourism Climate Index in the Coastal and Mountain Locality of Adjara, Georgia.//In the book: Int. Sc. Conf. “Sustainable Mountain Regions: Make Them Work”. Proceedings, Borovets, Bulgaria, ISBN 978-954-411-220-2, 14-16 May,2015, pp. 238-244, http://geography.bg/MountainRegions_Sofia2015

[22] Rybak O. O., Rybak E. A. Application of Climatic Indices for Evaluation of Regional Differences in Tourist Attractiveness. Nauchnyy zhurnal KubGAU, №121(07), 2016, 24 p. http://ej.kubagro.ru/2016/07/pdf/16.pdf

[23] Amiranashvili A.G., Japaridze N.D., Kartvelishvili L.G., Khazaradze K.R., Matzarakis A., Povolotskaya N.P., Senik I.A. Tourism Climate Index of in the Some Regions of Georgia and North Caucasus. Journal of the Georgian Geophysical Society, ISSN: 1512-1127, Issue (B). Physics of Atmosphere, Ocean, and Space Plasma, vol.20B, 2017, pp. 43-64.

[24] Amiranashvili A.G., Japaridze N.D., Kartvelishvili L.G., Khazaradze K.R., Kurdashvili L.R. Tourism Climate Index in Kutaisi (Georgia).//In the book: Int. Sc. Conf. "Modern Problems of Ecology“, Proceedings, ISSN 1512-1976, v. 6, Kutaisi, Georgia, 21-22 September, 2018, pp. 227-230.

[25] Amiranashvili A.G., Kartvelishvili L.G., Matzarakis A., Megrelidze L.D. The Statistical Characteristics of Tourism Climate Index in Kakheti (Georgia). Journal of the Georgian Geophysical Society, ISSN: 1512-1127, Physics of Solid Earth, Atmosphere, Ocean and Space Plasma, v. 21(2), Tbilisi, 2018, pp. 95-112.

[26] Amiranashvili A., Kartvelishvili L. Statistical Characteristics of the Monthly Mean Values of Tourism Climate Index in Mestia (Georgia) in 1961-2010. Journal of the Georgian Geophysical Society, ISSN: 1512-1127, Physics of Solid Earth, Atmosphere, Ocean and Space Plasma, v. 22(2), 2019, pp. 68–79.

[27] Mushawemhuka W.J., Fitchett J.M., Hoogendoorn G. Towards Quantifying Climate Suitability for Zimbabwean Nature-Based Tourism. South African Geographical Journal, 2020. DOI: 10.1080/03736245.2020.1835703

[28] Tanana, A. B. et al. Confort climático en la Argentina: un recurso intangible para el turismo. Cuadernos Geográficos 60(3), 2021, pp. 52-72.

[29] Faraj T.K., Tarawneh Q.Y., Oroud I.M. The applicability of the tourism climate index in a hot arid environment: Saudi Arabia as a case study. Int. J. Environ. Sci. Technol. 20, 2023, pp. 3849–3860. https://doi.org/10.1007/s13762-022-04228-2

[30] Aygün Oğur A., Baycan T. Assessing climate change impacts on tourism demand in Turkey. Environ Dev Sustain 25, 2023, pp. 2905–2935. https://doi.org/10.1007/s10668-022-02135-7

[31] Scott D., Rutty M., Amelung B., Tang M. An Inter-Comparison of the Holiday Climate Index (HCI) and the Tourism Climate Index (TCI) in Europe. Atmosphere 7, 80, 2016, 17 p. doi:10.3390/atmos7060080www.

[32] Javan K. Comparison of Holiday Climate Index (HCI) and Tourism Climate Index (TCI) in Urmia. Physical Geography Research Quarteli. vol. 49, iss. 3, 2017, pp. 423-439.

[33] Hejazizadeh Z., Karbalaee A., Hosseini S.A., Tabatabaei S.A. Comparison of the Holiday Climate Index (HCI) and the Tourism Climate Index (TCI) in Desert Regions and Makran Coasts of Iran. Arab. J. Geosci. 12, 803, 2019, https://doi.org/10.1007/s12517-019-4997-5

[34] Rutty M., Scott D., Matthews L., Burrowes R., Trotman A., Mahon R., Charles A. An Inter-Comparison of the Holiday Climate Index (HCI: Beach) and the Tourism Climate Index (TCI) to Explain Canadian Tourism Arrivals to the Caribbean. Atmosphere, 11, 412, 2020.

[35] Yu D. D., Rutty M., Scott D., Li S. Comparison of the Holiday Climate Index: Beach and the Tourism Climate Index Across Coastal Destinations in China. International Journal of Biometeorology, 2020. https://doi.org/10.1007/s00484-020-01979-w, 8 p.

[36] Sobhani P., Danehkar A. Investigating tourism climate conditions in Iran's mangrove forests using Tourism Comfort Climate Index (TCI) and Holiday Climate Index (HCI). Journal of Natural Environment, 75(Special Issue Coastal and Marine Environment), 2023, pp.29-45. DOI: 10.22059/JNE.2022.351668.2494

[37] Amiranashvili A., Kartvelishvili L., Matzarakis A. Comparison of the Holiday Climate Index (HCI) and the Tourism Climate Index (TCI) in Tbilisi. In the book: Int. Sc. Conf. "Modern Problems of Ecology“, Proc., ISSN 1512-1976, v. 7, Tbilisi-Telavi, Georgia, 26-28 September, 2020, pp. 424-427.

[38] Amiranashvili A.G., Kartvelishvili L.G., Kutaladze N.B., Megrelidze L.D., Tatishvili M.R. Holiday Climate Index in Some Mountainous Regions of Georgia. Journal of the Georgian Geophysical Society, e-ISSN: 2667-9973, p-ISSN: 1512-1127, Physics of Solid Earth, Atmosphere, Ocean and Space Plasma, v. 24(2), 2021, pp. 92 – 117. DOI: https://doi.org/10.48614/ggs2420213327

[39] Amiranashvili A., Povolotskaya N., Senik I. Comparative Analysis of the Tourism Climate Index and the Holiday Climate Index in the North Caucasus. Transactions of Mikheil Nodia Institute of Geophysics, ISSN 1512-1135, vol. LXXIII, 2021, pp. 96-113, (in Russian).

[40] Amiranashvili A.G., Kartvelishvili L.G. Holiday Climate Index in Kakheti (Georgia). Journal of the Georgian Geophysical Society, e-ISSN: 2667-9973, p-ISSN: 1512-1127, Physics of Solid Earth, Atmosphere, Ocean and Space Plasma, v. 24(1), 2021, pp. 44-62.

[41] Amiranashvili A., Bliadze T., Chikhladze V. Photochemical smog in Tbilisi.//Monograph: Trans. of Mikheil Nodia institute of Geophysics, ISSN 1512-1135, vol. 63, 2012, 160 p., (in Georgian). http://www.dspace.gela.org.ge/bitstream/123456789/636/3/ფოტოქიმიური%20სმოგი%20თბილისში_წიგნი_2012_Ge.pdf

[42] Amiranashvili A.G., Japaridze N.D., Khazaradze K.R. On the Connection of Monthly Mean of Some Simple Thermal Indices and Tourism Climate Index with the Mortality of the Population of Tbilisi City Apropos of Cardiovascular Diseases. Journal of the Georgian Geophysical Society, ISSN: 1512-1127, Physics of Solid Earth, Atmosphere, Ocean and Space Plasma, v. 21(1), Tbilisi, 2018, pp.48-62. http://www.jl.tsu.ge/index.php/GGS/article/view/2489

[43] Amiranashvili A., Japaridze N., Kartvelishvili L., Khazaradze K., Revishvili A. Preliminary Results of a Study on the Impact of Some Simple Thermal Indices on the Spread of COVID-19 in Tbilisi. Journal of the Georgian Geophysical Society, e-ISSN: 2667-9973, p-ISSN: 1512-1127, Physics of Solid Earth, Atmosphere, Ocean and Space Plasma, v. 25(2), 2022, pp. 59–68. DOI: https://doi.org/10.48614/ggs2520225961

[44] Araci S.F. S., Demiroglu O. C., Pacal A., Hall C. M., Kurnaz, M. L. Future Holiday Climate Index (HCI) Performances of Urban and Beach Destinations in the Mediterranean. In the book: EGU General Assembly 2021, online, 19–30 Apr 2021, EGU21-13217, https://doi.org/10.5194/egusphere-egu21-13217, 2021.

[45] Prinsloo A.S., Fitchett J.M. Quantifying climatic suitability for tourism in Southwest Indian Ocean Tropical Islands: Applying the Holiday Climate Index to Réunion Island. Int J Biometeorol, 2024. https://doi.org/10.1007/s00484-024-02700-x

[46] Hemmati S., Taghiloo A. Determine the Suitable Time for Tourism in West Azerbaijan Province Using Holiday Climate Index (HCI). Geography and Human Relationships, 2024. DOI: 10.22034/GAHR.2024.433059.2017

[47] Demiroglu O.C., Saygili-Araci F.S., Pacal A., Hall C.M.,M. Levent Kurnaz M.L. Future Holiday Climate Index (HCI) Performance of Urban and Beach Destinations in the Mediterranean. Atmosphere, 11, 911, 2020. doi:10.3390/atmos11090911

[48] Bilgin B., Acar S., Demirala, Z., An N., Turp M. T., Kurnaz M. L. A synthetic approach to the Holiday Climate Index for the Mediterranean Coast of Türkiye. International Journal of Biometeorology, 2024, pp. 1-15. https://doi.org/10.1007/s00484-024-02704-7

[49] Samarasinghe J.T., Wickramarachchi C.P., Makumbura R.K., Meddage P., Gunathilake M.B., Muttil N., Rathnayake U. Performances of holiday climate index (HCI) for urban and beach destinations in Sri Lanka under changing climate. Climate, 11(3), 2023, p. 48. https://doi.org/10.3390/cli11030048
[50] Velea L., Bojariu R., Irimescu A., Craciunescu V., Puiu S., Gallo A. Climate Suitability for Tourism in Romania Based on HCI: Urban Climate Index in the Near-Future Climate. Atmosphere, 14(6), 2023, 1020. https://doi.org/10.3390/atmos14061020
[51] Xu X., Liu X., Yang X., Liu L., Guan J. Assessing the impact of dust events on the Holiday Climate Index in the Taklimakan Desert region. Int. J. Biometeorol., 68, 2024, pp. 1073–1079. https://doi.org/10.1007/s00484-024-02645-1
[52] Amiranashvili A., Kartvelishvili L., Matzarakis A. Changeability of the Holiday Climate Index (HCI) in Tbilisi. Transactions of Mikheil Nodia Institute of Geophysics, ISSN 1512-1135, vol. LXXII, 2020, pp. 131-139.
[53] Fourth National Communication of Georgia. Under the United Nations Framework Convention on Climate Change. (2021)//Book: Tbilisi. pp. 333-339. https://unfccc.int/sites/default/files/resource/4%20Final%20Report%20-%20English%202020%2030.03_0.pdf
[54] Amiranashvili A., Bolashvili N., Kartvelishvili L., Liparteliani G., Tsirgvava G. Holiday Climate Index in Kvemo Kartli (Georgia). Georgian Geographical Journal, E-ISSN: 2667-9701, 24(1), 2024, pp. 35-46. https://doi.org/10.52340/ggj.2024.04.01.05

წალკაში (საქართველო) დასვენების კლიმატის ინდექსის ცვალებადობა

ა. ამირანაშვილი, ლ. ქართველიშვილი, ა. მატზარაკისი

რეზიუმე

წარმოდგენილია წალკისთვის (საქართველო) დასვენების კლიმატის ინდექსის (HCI) მრავალწლიანი საშუალო თვიური მნიშვნელობების მონაცემები. ჩატარდა ყოველთვიური, სეზონური და წლიური HCI-ის მნიშვნელობების დეტალური ანალიზი 60 წლის განმავლობაში (1956-2015). შესწავლილია HCI-ის ცვალებადობა 1986-2015 წლებში 1956-1985 წლებთან შედარებით და შესწავლილი იქნა HCI-ის ტენდენციები 1956-2015 წლებში.

საკვანძო სიტყვები: ბიოკლიმატი, ტურიზმის კლიმატური ინდექსი, დასვენების კლიმატური ინდექსი.

Изменчивость климатического индекса отдыха в Цалке (Грузия)

А. Амиранашвили, Л. Картвелишвили, А. Матзаракис

Резюме

Представлены данные о многолетних среднемесячных значениях климатического индекса отдыха (HCI) для Цалки (Грузия). Проведен детальный анализ месячных, сезонных и годовых значений HCI за 60-летний период (1956-2015 гг.). Изучена изменчивость HCI в 1986-2015 гг. по сравнению с 1956-1985 гг., а также исследованы тенденции HCI в 1956-2015 гг.

Ключевые слова: Биоклимат, климатический индекс туризма, климатический индекс отдыха.