

TOURISM CLIMATE INDEX IN THE COASTAL AND MOUNTAIN LOCALITY OF ADJARA, GEORGIA

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ABSTRACT

Tourism climatology information was provided through climate indices such as those found in applied climatology and human biometeorology. There are more than 200 climate indices. In general, the tourism climate indices can be classified into three categories. Elementary indices are synthetic values that do not have any thermo-physiological relevance and are generally unproven. The bioclimatic and combined tourism climate indices involve more than one climatological parameter and consider the combined effects of them. An example of a combined index is the Tourism Climate Index (TCI) developed by Mieczkowski in 1985.

Values of TCI for mass tourism (or "Average Tourist") vary from -30 to 100 and they are subdivided into 10 categories. TCI values ≥ 80 are excellent, while values between 60 and 79 are regarded as good to very good. Lower values (40 – 59) are acceptable, but values < 40 indicate bad or difficult conditions for mass tourism, etc.

In this work the determination of the TCI to four coastal and mountain localities of the Adjarian Autonomous Republic (known tourist and health resort region of Georgia) is carried out (Batumi, capital of the Adjarian Autonomous Republic: 41.64° N, 41.64° E, 9 m a. s. l.; Kobuleti: 41.82° N, 41.78° E, 3 m a. s. l., distance from Batumi - 23 km along the coast of the Black sea; Khulo: 41.64° N, 42.30° E, 921 m a. s. l., distance from Batumi - 56 km; Goderdzi, 41.63° N, 42.52° E, 2025 m a. s. l., distance from Batumi - 73 km).

For the indicated localities the monthly average values of TCI in the period from 1961 through 2010 with the use of data of the Hydrometeorological department of Georgia are calculated. The contrast of TCI values in dependence on area relief is revealed. The special features of the variability of TCI values during this period of time in connection with climate changeability are studied. The most favorable from the point of view of the bioclimatic characteristics of a locality for the development of different forms of tourism periods of the year are determined (Sun & Beach Tourism, Eco Tourism, Birdwatching, Sport Tourism, Rural Tourism, Cruise Tourism, Wine Tourism, Ski & Mountain Resorts, MICE Tourism, Gambling Tourism etc.).

Keywords: *Tourism Climate Index, Bioclimate, Climate Change, Tourism.*

INTRODUCTION

Tourism as an important sector of the global economy is influenced by the geographical location, topography, landscape, vegetation, fauna, ecological situation, weather, climate, etc. The weather and the climate are two factors that in many respects influence decisions regarding areas to be visited (Matzarakis, 2006). Many climate indices for tourism have been applied in past research. Survey information about them can be found for example in the works (Abegg, 1996; Matzarakis, 2006).

A climate index approach is one way and researchers have attempted to represent the multifaceted nature of the climate potential for tourism. Several indices have been developed over the last 45 years to assess the suitability of climate for tourism activities (Mieczkowski, 1985; Scott and Boyle, 2001; Matzarakis and Freitas, 2004; Matzarakis et al., 2004).

The most widely known and applied index is the tourism climate index proposed by Mieczkowski (Mieczkowski, 1985). This index is a combination of seven factors and parameters. Mieczkowski's "Tourism Climate Index" (TCI) was designed to use climate data, being widely available for tourist destinations worldwide. Data about TCI are used for the information on the "Average Tourist" and can be useful for the planning developments of mass tourism.

TCI is used in many countries of the world (Abegg, 1996; Scott and Mc Boyle, 2001; Matzarakis and Freitas, 2004; Matzarakis et al., 2004; Cengiz et al., 2008; Kovács and Unger, 2014; Mendez-Lazaro et al., 2014), including such countries of the Black Sea-Caspian region as Turkey (Toy and Yilmaz, 2010) and Iran (Farajzadeh and Matzarakis, 2009; Gandomkar, 2010; Shakoor, 2011; Ramazanipour and Behzadmoghaddam, 2013; Ghanbari and Karimi, 2014). In the South Caucasus countries, a monthly value of TCI has been calculated in Georgia, first for Tbilisi (Amiranashvili et al., 2008), then for Batumi (Amiranashvili et al., 2010; Kartvelishvili et al., 2011), Anaklia (Amiranashvili et al., 2011), Baku and Yerevan (Amiranashvili et al., 2014).

For tourism climatology this bioclimatic parameter has also been used lately as Physiologically Equivalent Temperature (PET) – a combination of daily air temperature, relative humidity, wind velocity and mean cloud cover, etc. PET is one of the most popular physiological thermal indices derived from the human energy balance which is used in the analysis to describe the effect of the climate (Matzarakis et al., 2010; Shiue and Matzarakis, 2011; Matzarakis et al., 2014).

For evaluating the bioclimatic potential of the localities in Georgia from the human thermal comfort the complex, thermal indices as Air Equivalent-Effective Temperature (EET- combination of air temperature, relative humidity and wind velocity) and Air Radiation Equivalent-Effective Temperature (REET- combination of air temperature, relative humidity, wind velocity and solar radiation intensity) was used. A question about the use of data about the air thermal regime (as and TCI),

with certification of the health resort and tourist resources of Georgia is examined (Amiranashvili et al., 2011).

As it follows from the aforesaid, the studies of the complex bioclimatic characteristics of health resort and tourist zones (including TCI) are of great importance. Significant studies on these issues are carried out in Turkey and Iran. At the same time, an explicit deficiency in the studies of the tourism climate index in the countries of the South Caucasus (adjacent with Turkey and Iran) is observed.

The purpose of this paper is to compare the characteristics of tourism climate conditions (TCI) in four coastal and mountain localities of the Adjarian Autonomous Republic (known tourist and health resort region of Georgia) and to determine the most suitable months for various tourism and tourist activities in these cities. In addition to this, the special features of the variability of TCI values during period of time from 1961 to 2010 in connection with the climate changeability have been studied.

This work is the beginning of a more detailed study of the indicated index of tourism in the South Caucasus countries, which will make it possible to reveal the common picture of the distribution of this bioclimatic factor for the entire Black Sea-Caspian region.

STUDY AREA, METHODS AND DATA

The study area covers (Figure 1, Table 1) four coastal and mountain localities of the Adjarian Autonomous Republic (Batumi – the capital of the Adjarian Autonomous Republic, Kobuleti, Khulo and Goderdzi).

The Adjara Autonomous Republic is situated in southwestern Georgia along the Black Sea coast. It borders with Turkey and the Shavsheti Range on the south, the Meskhети Range on the north; the Arsiani Range on the east and the Black Sea on the west. The Meskhети, Arsiani and Shavsheti Ranges create the very interesting geographic relief of Ajara. Their average height is 2000-2500 m. The highest peak in Ajara is Mount Kanli (3007 m) in the Arsiani Range. The beautiful Goderdzi Pass (2025) m is on the same range as well. The deciduous as well as the coniferous forests on the mountain slopes of the Adjara highlands create unforgettable views.

The total area is nearly 3000 km² constituting approximately 4 percent of Georgia. The Adjarian coastline is 57 km long. The following seaside resorts and resort places are situated alongside the coast: Pichvnari, Kobuleti, Bobokvati, Chakvi, Tsikhisdziri, Mtsvane Kontskhi (the Green Cape), Makhinjauri, Batumi, Gonio, Kvariati and Sarpi.



Figure 1 Arrangement of four locations in Adjara for which the values of TCI are calculated

Table 1. Coordinates of four locations of Adjara

Location	Latitude, N, Degrees	Longitude, E, Degrees	Altitude, m, a. s. l.	Distance from Batumi, km
Batumi	41.64	41.64	9	0
Kobuleti	41.82	41.78	3	23
Khulo	41.64	42.30	921	56
Goderdzi	41.63	42.52	2025	73

Adjara is well known for its humid climate (especially along the coastal regions) and prolonged rainy weather, although there is plentiful sunshine during the spring and summer months. Adjara receives the highest amounts of precipitation both in Georgia and in the Caucasus. It is also one of the wettest temperate regions in the northern hemisphere. No region along Adjara’s coast receives less than 2200 mm of precipitation per year. The west-facing (windward) slopes of the Meskhети

Range receive more than 4500 mm of precipitation per year. The coastal lowlands receive most of the precipitation in the form of rain (due to the area's subtropical climate). September and October are usually the wettest months. Batumi's average monthly rainfall in the month of September is 320 mm. The interior parts of Adjara are considerably drier than the coastal mountains and lowlands. Winter usually brings significant snowfall on the higher regions of Adjara, where snowfall often reaches several meters. Average summer temperatures are between 22–24 °C in the lowland areas and 17–21 °C in the highlands. The highest areas of Adjara have lower temperatures. The average winter temperatures are between 4 – 6°C along the coast and around -3 -2°C in the interior areas and mountains. Some of the highest mountains of Adjara have average winter temperatures of -8–(-7) °C.

In the work the Tourism Climate Index (TCI) developed by Mieczkowski (Mieczkowski, 1985) is used. TCI is a combination of seven parameters, three of which are independent and two in a bioclimatic combination:

$$TCI = 8 \cdot C_{ld} + 2 \cdot C_{la} + 4 \cdot R + 4 \cdot S + 2 \cdot W$$

Where C_{ld} is a daytime comfort index, consisting of the mean maximum air temperature T_a , max (°C) and the mean minimum relative humidity RH (%), C_{la} is the daily comfort index, consisting of the mean air temperature (°C) and the mean relative humidity (%), R is the precipitation (mm), S is the daily sunshine duration (h), and W is the mean wind speed (m/s).

In contrast to other climate indices, every contributing parameter is assessed. Because of a weighting factor (a value for TCI of 100), every factor can reach 5 points. TCI values ≥ 80 are excellent, while values between 60 and 79 are regarded as good to very good. Lower values (40 – 59) are acceptable, but values < 40 indicate bad or difficult conditions for understandable to all tourism.

For the indicated localities the monthly average values of TCI in the period from 1961 through 2010 with the use of data of the Hydrometeorological department of Georgia are calculated. The difference between the mean values of TCI during the periods 1986-2010 and 1961-1985 with the use of Student's criterion was determined (level of significance not worse than 0.15).

RESEARCH FINDINGS

The results of the TCI calculations are presented in Figure 2-3 and Tables 2 and 3.

As it follows from Figure 2, the average annual values of TCI during 1961-2010 covered all four changes from the category "Extremely unfavourable" (Goderdzi) to the category "Very good" (all locations).

The intra-annual distribution of the TCI values for Batumi and Kobuleti (coastal cities) is of bimodal nature with an extremum in May-June and September. Let us note that a bimodal type of distribution of the TCI values is observed in many other places. For example the cities of Mahabad, Jolfa, Marageh, Sagez, and Parsabad (Iran) had a bimodal-shoulder peak distribution. Maximum TCI values were recorded in May, June and October. In these cities the spring and autumn weather are climatically comfortable for tourism (Farajzadeh and Matzarakis, 2009). New Orleans, Charleston, New York, St. Louis, Prague, Thessaloniki also relate to the cities with bimodal-shoulder peak TCI distribution (Scott and Mc Boyle, 2001; Matzarakis et al., 2004; Kovács and Unger, 2014), etc.

The intra-annual distribution of the TCI values for Khulo and Goderdzi (mountain localities) has a summer peak TCI distribution. An analogous type of TCI distribution, for example, is observed in Calgary, Seattle, Yellowknife and Toronto (Scott and Mc Boyle, 2001).

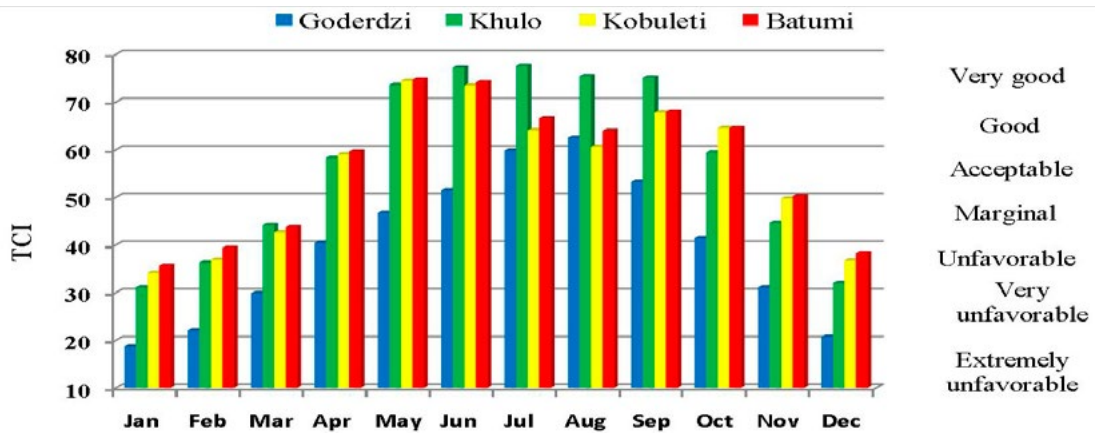


Figure 2. Mean values of TCI in four locations in Adjara in 1961-2010

The TCI values in the different cities of Iran change in the range from the category "Acceptable" to "Ideal" (Farajzadeh and Matzarakis, 2009; Gandomkar, 2010; Shakoor, 2011; Ramazanipour and Behzadmoghaddam, 2013; Ghanbari and Karimi, 2014), in Baku and Yerevan from "Marginal" to "Ideal", in Tbilisi, from "Marginal" to "Excellent" (Amiranashvili et al., 2014), in Debrecen, Prague, Thessaloniki and other cities of central Europe from "Very Unfavourable" to "Excellent" (Kovács and Unger, 2014), etc.

Table 2. Monthly variations of TCI in four locations of Adjara in 1961-2010
Mean - Mean 1961-2010; Mean I - Mean 1986-2010;
Mean II - Mean 1961-1985; Differ. I-II, $\alpha \leq 0.15$

Month	1	2	3	4	5	6	7	8	9	10	11	12
Location	Batumi											
Mean	36	39	44	60	75	74	67	64	68	65	50	38
Mean I	35	39	44	61	74	75	67	63	69	65	49	37
Mean II	36	40	44	59	75	73	67	65	67	64	52	39
Differ. I-II	No	No	No	No	No	2	No	No	No	No	No	No
Location	Kobuleti											
Mean	34	37	43	59	74	74	64	61	68	65	50	37
Mean I	34	37	44	62	74	73	62	56	67	66	50	37
Mean II	34	37	42	57	75	74	67	65	69	63	49	37
Differ. I-II	No	No	No	5	No	No	-5	-9	-2	No	No	No
Location	Khulo											
Mean	31	36	44	58	74	77	78	75	75	59	45	32
Mean I	30	36	44	59	73	77	76	74	75	60	45	32
Mean II	32	37	45	58	74	78	79	77	75	59	45	32
Differ. I-II	No	No	No	No	No	No	-3	-3	No	No	No	No
Location	Goderdzi											
Mean	19	22	30	40	47	52	60	63	53	42	31	21
Mean I	18	22	33	42	49	52	62	66	55	43	31	20
Mean II	19	22	28	39	45	51	57	59	51	40	31	21
Differ. I-II	No	No	5	3	4	No	5	7	4	No	No	No

The lower mean monthly values of the upper level of TCI (Very Good) in Batumi, Kobuleti and Khulo (in comparison with many of the above-indicated cities) are caused by the more rainy climate and a smaller sunshine duration, decreasing the contribution share of R and S to the general value of TCI.

In table 2 data on the monthly variations of TCI in four locations of Adjara in 1961-2010 and the changeability of TCI in 1986-2010 in comparison with 1961-2010 are presented.

In the indicated periods of time the following changes of TCI occurred.

Batumi. There is an increase of the TCI value in the last year of the 25-year period only in June. In this case this increase does not affect the TCI category – “Very good”.

Kobuleti. There is an increase of the TCI value in the last year of the 25-year period only in April. This increase has influenced the TCI category. A change in the category occurred – from “Acceptable” to “Good”, i.e., the climatic situation was improved. During July, August and September in the last year of the 25-year period a decrease a decrease of the TCI mean value occurred in comparison with the period 1961-1985. In this case in July and September the TCI category did not change and remained “Good”. In August the decrease of mean value of TCI led to a change in the TCI category from “Good” to “Acceptable”.

Khulo. No significant decrease of the TCI values in July and August. This decrease in the last year of the 25-year period does not affect the TCI category - “Very good”.

Goderdzi. A significant increase of the TCI values from March through May and from July through September is noted. In this case in May and September the TCI categories did not change (“Marginal” and “Acceptable” respectively). In March the “Very unfavourable” category became “Unfavourable” and in April the category “Unfavourable” changed to “Marginal”, while in July and August the category “Acceptable” turned into “Good”.

Thus, the process of global warming exerted most favourable influence on the alpine point Goderdzi. In March, April, July and August the TCI categories were increased by one gradation. As a whole, the indicated changes of TCI values noted are not very essential and within the limits of adjacent gradations.

In Figure 3 and Table 3 the data concerning the repetition of TCI monthly mean values and the number of months of various TCI categories in four locations of Adjara in 1961-2010 are presented.

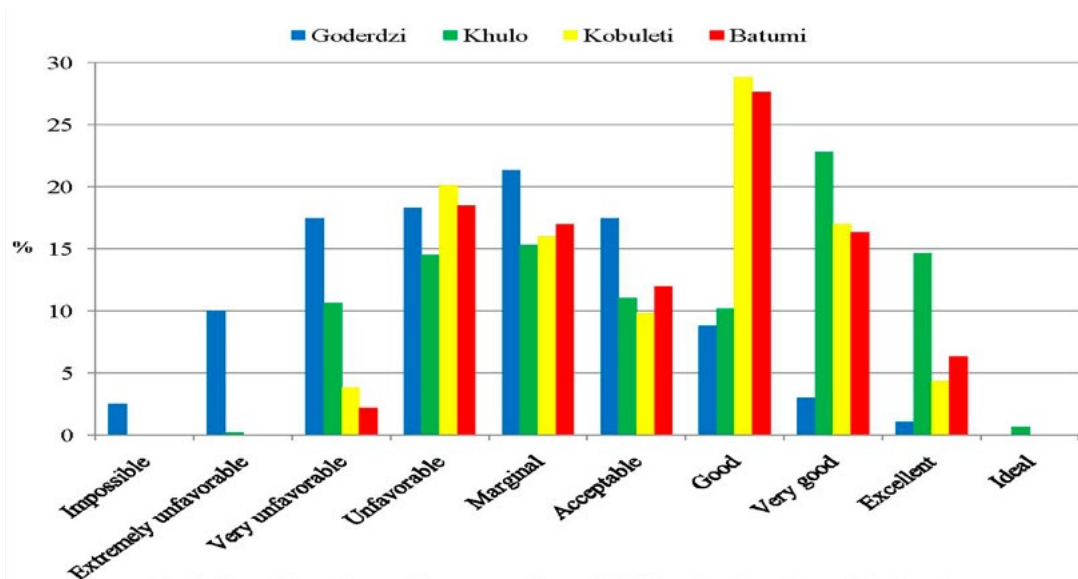


Figure 3. Repetition of the TCI monthly mean values in four locations of Adjara in 1961 - 2010

As seen in Figure 3 and Table 3, monthly repetition of TCI in Batumi and Kobuleti in the range from “Very unfavourable” to “Excellent” is found, with a max repetition of the TCI category “Good”, in Khulo - from “Extremely unfavourable” to “Ideal” (with a max repetition of the category “Very good”) and in Goderdzi - from “Impossible” to “Excellent” (with a max repetition of the category “Marginal”).

Table 3. Number of months of a various TCI category in four locations of Adjara in 1961-2010

TCI Category	Goderdzi	Khulo	Kobuleti	Batumi
Impossible	9	0	0	0
Extremely unfavourable	37	1	0	0
Very unfavourable	64	39	14	8
Unfavourable	67	53	74	68
Marginal	78	56	58	62
Acceptable	64	40	36	44
Good	32	37	105	101
Very good	11	83	62	60
Excellent	4	54	16	23
Ideal	0	2	0	0
Marginal-Ideal	189	273	277	290
% from year	51.7	74.7	76.0	79.3
Month in year (mean)	6.2	9.0	9.1	9.5

Thus, the bioclimatic characteristics (TCI) of Goderdzi permit implementation of mass tourism in this locality on the average in the course of 6.2 months per annum, in Khulo, Kobuleti and Batumi - from 9 to 9.5 months per annum.

DISCUSSION

In Adjara contrast of TCI values depending on the area relief is observed. Depending on the location of a tourism site the duration of the season for mass tourism on the average is varied from 6 to 9-10 months per annum. At the same time in Adjara it is possible to develop specialised forms of tourism that have no special requirements with regard to the weather (in essence, excess precipitations). As a whole here the following forms of tourism are already developed and over the long term can be introduced (<http://gobatumi.com/en>).

Sun & Beach Tourism: Sun and beach tourism is one of the most popular types of tourism in Adjara. The subtropical climate, the warm sea air, the infrastructure of the sea resorts, the sea and mountain combination create favourable conditions for holidays. The total length of the swimming zone is 21 km. The average sea temperature is + 21-29 °C.

Eco Tourism: Ecotourism is one of the leading types of tourism in Adjara. Foreign tourists are especially interested in ecotourism while visiting the region. The diverse flora and fauna as well as the abundance of historical and cultural monuments have created favourable conditions for ecotourism development. There are 4 protected areas on the territory of Adjara. Their diversity clearly indicates to the great potential of ecotourism in the region.

Bird & raptor watching Tourism: Just outside the city of Batumi - situated in the foothills of the Lesser Caucasus, on the eastern shoreline of the Black Sea - is one of the best places in the whole western Palearctic to watch migrating raptors. Here, it is possible to witness a migration spectacle that is rarely paralleled anywhere in the world: over 800000 raptors

belonging to 35 species are recorded here each autumn, as they make their annual journey south from Scandinavia, over the forests of Russia and the steppes of Central Asia to their wintering grounds in Africa. Strong movements of storks, cranes, bee-eaters, swifts, swallows, and a diverse assemblage of other “songbirds” are also seen here. The unique topography and climate in the region set the stage for bringing together so many birds at one time, at one place, guaranteeing a totally unique natural history experience.

Rural Tourism: There are many hunting and fishing places in Adjara with seasonal hunting of wild boar, hare and badger and trout fishing in the rivers. In the woods you can pick strawberries, bilberries and blackberries. Adjara is a diverse region. The constituent municipalities greatly differ from one another. For example, Kobuleti is rich in diverse parks: a Botanical Garden, the Mtirala National Park, the Kintrishi Protected Areas, the Ispani wetland and the Tikeri Managed Nature Reserve. Khelvachauri is famous for honey, Shuakhevi - for high quality tobacco, Khulo - for dry potatoes and plaited cheese, etc.

Wine Tourism: Adjara is one of the oldest centres of viticulture and enology. Adjara holds a worthy place within the world viticulture and enology in the formation of the ancient traditions of vine cultivation. The region played a significant role in the creation of vineyards. In this small area more than 40 cultural vine species have been created and approved.

Ski & Mountain Resorts: Adjara has great potential for the development of skiing resorts. Arrangement of skiing resorts has been widely conducted in Adjara recently with recreational-healthcare as well as entertainment purpose. They are designed for all four seasons of the year. The infrastructure of the resorts is actively reconstructed in the municipalities of Shuakhevi and Khulo, namely in the resorts of Gomarduli and Ghomas Mta in Shuakhevi and Kedlebi, Goderdzi and Beshumi in Khulo municipality.

MICE Tourism: Recent local and international events held in Adjara have recently made the Adjara region famous for MICE tourism activities. New projects directed at creating tourist infrastructure in the region promote conducting of international fairs and events and attract professionals working in the MICE-sector not only during the summer season but all the year round, too.

Cruise Tourism: Historically the Batumi Sea Port has always functioned as the logistic centre in the Caucasus. It was the first port providing the transit country status of Georgia. The announcement of the Batumi Port as “Porto Franco” in 1878 contributed to its further development. At the beginning of 20th century the Batumi Port held the leading position along the Black Sea littoral according to its significance and turnover. At present the Port of Batumi hosts several big cruise ships. A plan of reconstruction of the Port of Batumi is aimed at enabling it to accept sea vessels of all types and sizes.

Gambling Tourism: Gambling business is very popular in Batumi. A vast choice of casinos is offered to local as well as visiting gamblers. Gambling business is legally permitted in Georgia. At present, the majority of casinos in Batumi are located in the buildings of 5-star hotels. The recent construction of high-level hotels in Batumi points out that the development of the casino business in Adjara in many hotels is in the hands of some of the biggest casino operators.

In the future more active development is desirable of sports tourism (yacht tourism, pedestrian tourism, etc.); medical and sanitary tourism; cultural tourism (archaeology, history, agriculture, ethnography); adventure and extreme tourism (trekking, mountaineering, skiing, horseback riding, mountain-biking, etc.); conventions and conferences; religion tourism; VIP tourism etc.

CONCLUSIONS

Climate has a strong impact on the tourism and recreation sector and in some regions represents the natural resource on which the tourism industry is predicated. In this work the determination of the climatic potential of tourism in four locations of the Adjarian Autonomous Republic (Georgia) in correspondence with the “Tourism Climate Index” (TCI) made use of in other countries of is carried out.

In the future we plan a more detailed study of the climatic resources of this region for tourism (mapping the territory on TCI, long-term prognostication of TCI, determination of other climatic and bioclimatic indices for tourism - Physiologically Equivalent Temperature, Mean Radiant Temperature etc.).

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