Future heat-related impact assessment of tourism industry to climate change in Cyprus

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Abstract

Tourism is a very important sector of Cyprus economy, attracting millions of tourists every year and providing economic growth and employment for the country. Climate has a strong influence on the tourism and recreation sector and in some regions represents the natural resource on which the tourism industry is predicated. The aim of this study is to investigate the impacts of projected climate change on tourism industry in Cyprus. To do so, both "Tourism Climate Index" (TCI) and "Beach Climate Index" (BCI) have been examined. The projections of climate change impacts on tourism we present, performed using KNMI RCM based on the A1B scenario. Future period was chosen the 2071–2100 while the 1961-1990 period used as the control run to compare the respective results of distant future projections.

Introduction

Climate has a strong influence on the tourism and recreation sector and in some regions represents the natural resource on which the tourism industry is predicated. Conditions for tourism as described by the Tourism Comfort Index [2] are expected to improve in northern and western Europe [8]. Hamilton et al. [7] indicated that an arbitrary climate change scenario of 1°C would lead to a gradual shift of tourist destinations further north and up mountains affecting the preferences of sun and beach lovers from western and northern Europe. In the Mediterranean region mainly in southern and southeastern parts, higher summer temperatures may lead to a gradual decrease in summer tourism but an increase in spring and autumn tourism leading to the lengthening and the flattening of the tourism season in the near future [1].

Tourism is a very important sector of Cyprus economy, attracting millions of tourists every year and providing economic growth and employment for the country. On average, the overnight stays in Cyprus during the period 2000-2010 consisted of 93% foreign tourists and 7% of Cyprus residents (internal tourism) [17]. Regarding the source countries of foreign tourists, arrivals of tourists from the United Kingdom during the period 2000-2010 constituted the main source of foreign tourism with 54% of total tourist arrivals, followed by the Nordic countries, Germany, Russia and Greece [6].

It is estimated that approximately 90% of the tourists visit Cyprus for leisure purposes (e.g. sun and sea, sports, culture etc.) while the rest 10% for business purposes (e.g. conferences, meetings etc.) and for visiting relatives and friends.

During the last decades, Cyprus has developed its tourist accommodation infrastructure to a great extent in order to meet the needs of the increasing incoming tourism. According to the Cyprus Tourism Organization, 95% of beds are established in the coastal cities of Famagusta, Paphos, Larnaca and Limassol, 2.6% in the capital of Nicosia which is located inland and 2.5% in the villages of the mountain Troodos (Hill Resorts) [5].

Tourist arrivals during the year for the period 2001-2010 may be categorized in two seasons. The season from May to October where the monthly share of tourist arrivals is above 11%, with the highest shares of the year recorded in July and August (13-14%), and the season from November to April where the share is below 9%, with the months from December to February reaching the lowest shares throughout the year (2-3%) (Figure 1) [4].

The projected climate warming in Cyprus (Table 1), in other words, the increase in air temperature as well as the increase in the frequency and intensity of extreme weather events (heat waves) may have an effect on the tourism industry of Cyprus. To investigate the impacts, negative or positive, of projected climate warming on the tourism climate resource in Cyprus, the "Tourism Climate Index" (TCI) and the "Beach Climate Index" (BCI) have been examined.

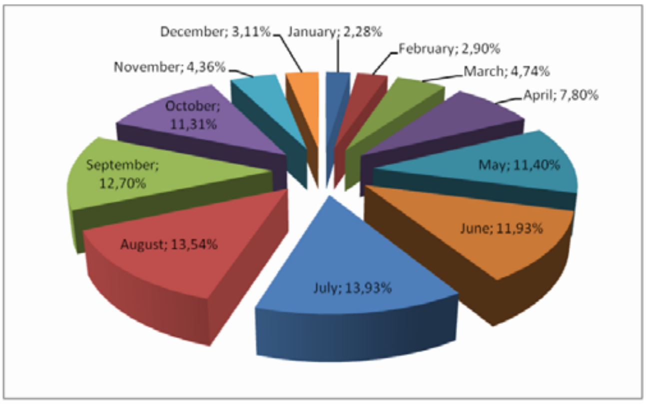

Figure 1: Average distribution of tourist arrivals during the year, 2001-2010 [3,4]

The projections of climate change impacts on tourism we present are for the future period 2071–2100 and based on the intermediate A1B scenario of the Special Report on Emissions Scenarios (SRES) of the Intergovernmental Panel on Climate Change [15]. For both TCI and BCI, they are based on the daily output of the RACMO2 regional climate model (RCM) developed at KNMI in the Netherlands [9, 10] within the framework of the ENSEMBLES project. The model has a horizontal resolution of 25 km × 25 km.

The control run represents the base period 1961–1990 and is used here as reference for comparison with distant future projections. The future period, 2071 – 2100 specifically chosen due to the significant warming which is projected and may negatively affect tourism industry (Table 1).

Table 1: Both near and distant future climate warming in Cyprus related to present-day climate (Future – control period).

	Western Regions		Mountain Regions		Inland Regions		Southern Regions		Southeastern Regions	
TXa	(+) 1.4	(+) 3.0	(+) 1.9	(+) 3.8	(+) 1.6	(+) 3.6	(+) 1.5	(+) 3.4	(+) 1.3	(+) 3.2
TXDJF	(+) 1.2	(+) 2.9	(+) 1.2	(+) 3.2	(+) 0.8	(+) 3.0	(+) 1.2	(+) 3.1	(+) 0.7	(+) 2.8
TXMAM	(+) 1.5	(+) 3.1	(+) 1.7	(+) 3.8	(+) 1.6	(+) 3.5	(+) 1.5	(+) 3.5	(+) 1.4	(+) 3.1
TXJJA	(+) 1.6	(+) 3.5	(+) 2.6	(+) 4.6	(+) 2.5	(+) 4.6	(+) 2.0	(+) 4.4	(+) 1.8	(+) 3.7
TXSON	(+) 1.4	(+) 3.2	(+) 1.9	(+) 3.7	(+) 1.5	(+) 3.5	(+) 1.7	(+) 3.7	(+) 1.3	(+) 3.2
TX>35°C	(+) 2	(+) 15	(+) 30	(+) 50	(+) 34	(+) 52	(+) 19	(+) 45	(+) 17	(+) 45
TN>20°C	(+) 32	(+) 56	(+) 38	(+) 58	(+) 29	(+) 55	(+) 30	(+) 56	(+) 25	(+) 52

where: TXa=Average annual maximum temperature (Tmax), TXDJF=Average winter Tmax, TXMAM=Average spring Tmax, TXJJA=Average summer Tmax, TXSON=Average autumn Tmax, TX>35°C=Number of heatwave days (maximum temperature>35°C), TN>20°C= Number of tropical nights (minimum temperature>20°C). Projections carried out by the Hadley Centre PRECIS RCM in the framework of European Union project CYPADAPT (CYPADAPT, 2012). Near future period (blue) is 2021-2050 while distant future period (red) is 2071-2100. Control period is 1961-1990.

Tourism Climate Index – TCI

The tourism climatic index as a concept has evolved from more general knowledge about the influence of climatic conditions on the physical wellbeing of humans. In the 1960s and 1970s systematic research in this field yielded many insights, ranging from preferred temperatures, and the role of relative humidity to the appreciation of wind effects. It should be noted that the appreciation of climatic conditions is also dependent on a host of non-climatic factors, such as the level of activity, clothing, and genetic setup.

Mieczkowski [13] was among the first to apply the general findings about human comfort to the specific activities related to recreation and tourism. He devised a tourism climatic index consisting of five sub-indices, describing daytime thermal comfort, daily thermal comfort, precipitation, hours of sunshine, and wind speed. The mapping of raw data to sub-index values depends on the kind and level of tourist activity. Beach holidays require climatic conditions different from ski holidays; in his article, light activities, such as touring, are used as a reference. The five sub-indices and their relative contribution to the TCI are outlined in Table 2.

The thermal comfort sub-indices are based on effective temperature, which is a measure of temperature that takes the effect of relative humidity into account. According to the latest bio-meteorological literature, both short and long wave radiation are essential for deriving modern thermal indices [11, 12, 16]. Information on these environmental parameters is, however, not generally available in observed climate datasets. The wind sub-index combines information about wind speed and temperature. The other sub-indices are based on single variables and reflect either the empirical findings of physiological research or qualitative assessments of tourist preferences, for example in relation to precipitation. A standardized rating system, ranging from 5 (optional) to 0 (extremely unfavorable), was devised to provide a common basis of measurement for each of the sub-indices. Mieczkowski proposed the following equation for calculating the TCI for outdoor recreational activities:

$$\mathrm{TCI} = 2\,(4\mathrm{CID} + \mathrm{CIA} + 2\mathrm{R} + 2\mathrm{S} + \mathrm{W})$$

Where:

CID = daytime comfort index

CIA = daily comfort index

R = precipitation index

S = sunshine index

W = wind speed index

The weights used in the equation are ultimately subjective, although they do have a basis in scientific knowledge. In the equation proposed by Mieczkowski, the highest weight is given to the daytime comfort index to reflect the fact that tourists are generally most active during the day. The amount of sunshine and the amount of precipitation are given the second-highest weights, followed by daily thermal comfort and wind speed. Tables 3 & 4 summarize the TCI weighting scheme. After summing the weighted individual components, the result is multiplied by two, so that the maximum TCI score is 100.

Table 2: Sub-indices within the tourism climate index.

Sub- Index	Daily Variables	Climate Influence on TCI	Weighting in TCI
Daytime Comfort Index (CID)	Maximum daily temperature & minimum daily relative humidity	Represents thermal comfort when maximum activity occurs	40%
Daily Comfort Index (CIA)	Mean daily temperature and relative humidity	Represents thermal comfort over the full 24h period (including sleeping hours)	10%
Precipitation (P)	Total precipitation	Reflects the negative impact that this element has on outdoor activities	20%
Sunshine (S)	Total hours of sunshine	Rated as positive for tourism-but can be negative because of the risk of sunburn and added discomfort on hot days	20%
Wind (W)	Average wind speed	Variable effect depending on temperature (evaporative cooling effect in hot climates	10%

		rated positively, while “wind chill” in cold climates rated negatively)

Table 3: TCI Weighting Scheme for Effective Temperature, Precipitation and Sunshine.

Rating	Effective Temperature (°C)	Precipitation (mm)	Sunshine (hrs)
5.0	20-27	0.0-14.9	10h or more
4.5	19-20 27-28	15.0-29.9	9h-9h59min
4.0	18-19 28-29	30.0-44.9	8h-8h59min
3.5	17-18 29-30	45.0-59.9	7h-7h59min
3.0	15-17 30-31	60.0-74.9	6h-6h59min
2.5	10-15 31-32	75.0-89.9	5h-5h59min
2.0	5-10 32-33	90.0-104.9	4h-4h59min
1.5	0-5 33-34	105.0-119.9	3h-3h59min
1.0	-5-0 34-35	120.0-134.9	2h-2h59min
0.5	35-36	135.0-149.9	1h-1h59min
0.0	-10- -5	150.0 or more	<1h

Mieczkowski proposed a classification of TCI scores, with values in excess of 60 corresponding to “good” conditions, scores exceeding 70 representing “very good” climatic conditions, levels of over 80 corresponding to “excellent” conditions, and scores of 90 or more standing for “ideal” circumstances. The detailed classification scheme of TCI is outlined in Table 5.

Table 4: TCI Weighting Scheme for Wind Speed.

km/h	Beaufort scale	Normal System	Trade Wind System	Hot Climate System
<2.88	1	5.0	2.0	2.0
2.88-5.75	2	4.5	2.5	1.5
5.76-9.03	2	4.0	3.0	1.0
9.04-12.23	2	3.5	4.0	0.5
12.24-19.79	3	3.0	5.0	0
19.80-24.29	4	2.5	4.0	0
24.30-28.79	4	2.0	3.0	0
28.80-38.52	5	1.0	2.0	0

>38.52	6	0	0	0

Table 5: Classification of TCI score.

Numeric value of index	Description of comfort level for tourism activity
90-100	Ideal
80-89	Excellent
70-79	Very Good
60-69	Good
50-59	Acceptable
40-49	Marginal
30-39	Unfavorable
20-29	Very Unfavorable
10-19	Extremely Unfavorable
<9	Impossible

Beach Climate Index – BCI

Based on the work by Mieczkowski [13], Morgan et al. [14] developed a user-based climate index to assess the climate suitability of coastal destinations specific for beach recreation. Similar to Mieczkowski's TCI, Morgan et al.'s beach climate index (BCI) is made up of smaller components (sub-indices) that, after weighting, add up to a maximum score of 100 (ideal conditions). The weights are based on the importance that the beach users attached to each of the four components.

As mentioned above almost 90% of visits in Cyprus are for recreational purposes. In addition, 89% of the tourists visiting Cyprus prefer the coastal cities for their stay. The assessment of both previous indicators shows that Cyprus tourism is strongly dependant on beach tourism. Consequently, through the analysis of BCI the investigation of the effects of warmer climate on tourism will focused exactly on beach tourism which is the most preferable and will be confined to the coastal zone of Cyprus from west (Paphos District) to south (Limassol District) and southeast (Larnaca and Famagusta District).

The resulting equation is as follows:

$$\mathrm{BCI} = 0.18\mathrm{TS} + 0.29\mathrm{P} + 0.26\mathrm{W} + 0.27\mathrm{S}$$

in which BCI is the beach climate index, TS, P, W, and S are the components of thermal sensation, precipitation, wind, and sunshine, respectively. Each of the four components is itself represented by an index, with values ranging from 0 to 100. These values are the beach users' evaluation of the underlying weather conditions. The four sub-indices and their relative contribution to the BCI are outlined in Table 6. In the equation proposed by Morgan, the highest weight is given to the precipitation index to reflect the negative impact that this element has on outdoor activities. Wind speed and the amount of sunshine are given the second-highest weights, followed by thermal sensation. Tables 7-9 summarize the BCI weighting scheme.

The final Beach Climate Index (BCI) can attain values ranging from 0 to 100. Morgan et al. [14] divides this range as suggested by Mieczkowski [13], with values below 40 seen as unfavorable, the range between 40 and 60 as acceptable, values from 60 to 70 as good, between 70 and 80 as very good, and scores above 80 as excellent for beach tourism (Table 10).

Table 6: Sub-indices within the beach climate index.

Sub- Index	Daily Variables	Climate Influence on BCI	Weighting in BCI
Thermal Sensation (Ts)	Maximum daily temperature, minimum daily relative humidity, proportion of daylight hours in which there is sunshine & wind speed	Represents beach users' preferred thermal sensation	18%
Precipitation (P)	Total precipitation	Reflects the negative impact that this element has on outdoor activities	29%
Sunshine (S)	Total hours of sunshine	Rated as positive for tourism-but can be negative because of the risk of sunburn and added discomfort on hot days	26%
Wind (W)	Average wind speed	Occurrence of high wind on beaches can cause annoyance in terms of disruption of personal belongings (so that they have to be secured or weighted down) and indirect effects of blowing sand	27%

Table 7: BCI Weighting Scheme for Thermal Sensation.

Rating	Effective Temperature (°C)
100	32.5-34.4
77	34.5–35.4
39	29.0–32.4
24	35.5–36.4
21	26.0–28.9
2	21.0–25.9

Table 8: BCI Weighting Scheme for Wind Speed.

Rating	Wind Speed (m/s)
100	< 4
50	4–6
0	> 6

Table 9: BCI Weighting Scheme for Precipitation and Sunshine.

Rating	Precipitation (mm)	Sunshine (hrs)
100	<15	10h or more
90	15-30	9h-9h59min
80	30-45	8h-8h59min
70	45-60	7h-7h59min
60	60-75	6h-6h59min
50	75-90	5h-5h59min
40	90-105	4h-4h59min
30	105-120	3h-3h59min

20	120-135	2h-2h59min
10	135-150	1h-1h59min
0.0	>150	<1h

Table 10: Classification of BCI score.

Numeric value of index	Description of comfort level for beach activity
> 80	Excellent
70-80	Very Good
60-70	Good
40-60	Acceptable
< 40	Unfavorable

Results

TCI

To testify climate change impacts on the tourism industry in Cyprus during summer months, average summer TCI was examined. Figure 2a shows that southeastern and inland regions present, in the present climate, the lower values of the TCI of about 60-65 in other words "good" conditions according to the classification (Table 5) except for Famagusta area where TCI is more elevated of about 72-76 namely "very good" conditions. Same to Famagusta conditions presented in western regions too where TCI is about 76. Finally, in mountain area of Troodos as well as in southern areas, the TCI reaches 68 namely "good" conditions for tourism activities. As far as future changes are concerned (Figure 2b), western, mountain, southern and Famagusta area present a significant decrease in TCI. More specifically, the decrease is about 15 in mountain and southern regions and 16-18 in western regions as well as in Famagusta. In addition southeastern area of Larnaca as well as regions of Nicosia presents the lower decrease of about 13 and 9 respectively. Regarding classification, all areas of Cyprus are classified at lower classes compared to present-day climate. Projections testify that all areas of Cyprus are classified between "marginal" and "acceptable" during summer months.

To investigate the possible shift in tourist's preferences before (spring) and after (autumn) summer due to the improved weather conditions during these seasons, the average spring TCI (Figure 3) and the average fall TCI (Figure 4) were examined. Figure 3a depicts that in present-day climate TCI during spring is very elevated almost in all areas of Cyprus. More precisely, southeastern and inland region present the highest TCI of about 78-80 namely "very good" and "excellent" conditions for tourist activities. Also in western, mountain and southern areas TCI varies from 74-76 in other words "very good" conditions. Concerning future changes, Figure 3b illustrates that southeastern (apart from Famagusta) and inland regions present a small decrease of about 2. Conversely, western regions as well as Famagusta show an increase of about 2-6. Finally, mountain and southern areas show no change. According to classification, all areas of Cyprus are classified as "very good" and "excellent" for the case of Famagusta for tourism activities.

Concerning autumn TCI, Figure 4a depicts that in the present-day climate Cyprus TCI varies from 75 in mountain, southern, southeastern and inland regions to 78 in western and Famagusta. As a result, in all regions of Cyprus TCI is classified as "very good". As far as distant future changes are concerned (Figure 4b), western and southern areas present an decline of about 8-9 while southeastern and inland areas present a higher decrease of about 9-12. Finally, Troodos Mountain shows the lower decrease of about 5-6. As a result, in all regions of Cyprus TCI is classified lower than present-day climate namely "good".

To study the potential for winter tourism in Cyprus and how this may change in the distant future, average winter TCI has also been examined. As shown in Figure 5a, inland and southeastern areas present the higher

TCI of about 60 namely “good” conditions for tourist activities. In addition in western and southern areas TCI is about 57 while in Troodos Mountain is about 55. In both cases TCI is classified as “acceptable”. Concerning distant future changes, Figure 5b depicts that TCI during winter increases. More specifically, in inland, southeastern and western areas the increase is about 10 while in southern and mountain areas the increase is about 9 and 8 respectively. As a result, in all areas of Cyprus distant future winter TCI is classified in higher class compared to present-day climate, to wit “very good” for inland and southeastern regions and “good” to the remaining areas.

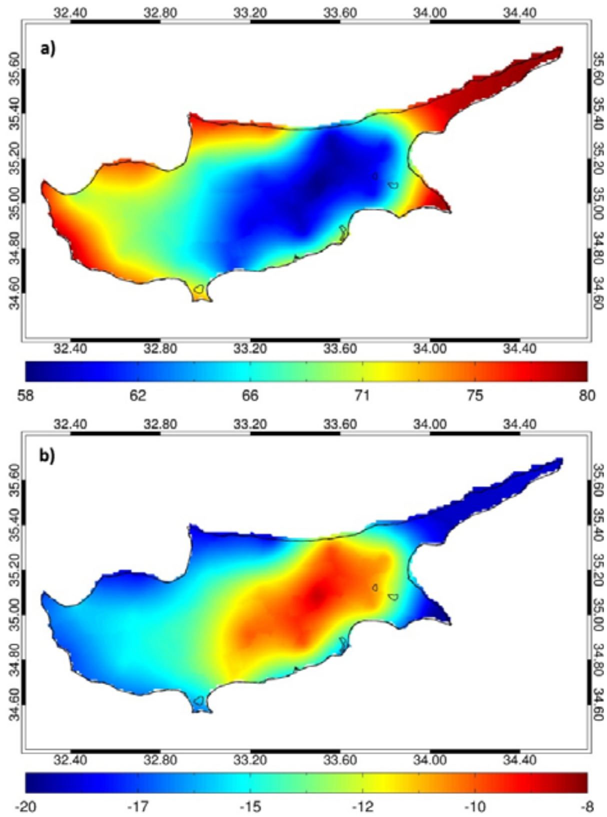

Figure 2: (a) Average Summer TCI for control period, (b) Changes in Average Summer TCI in the distant future (Future – Control period)

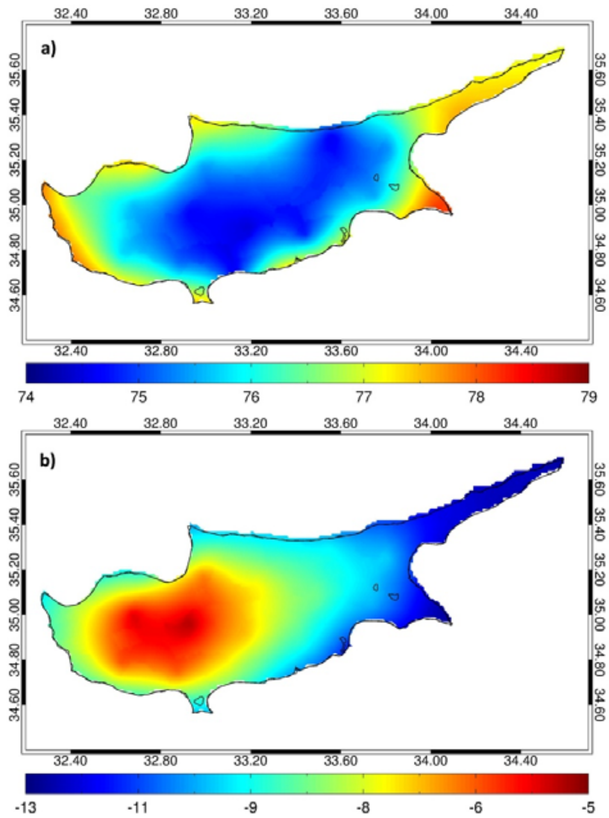

Figure 3: (a) Average Fall TCI for control period, (b) Changes in Average Fall TCI in the distant future (Future – Control period).

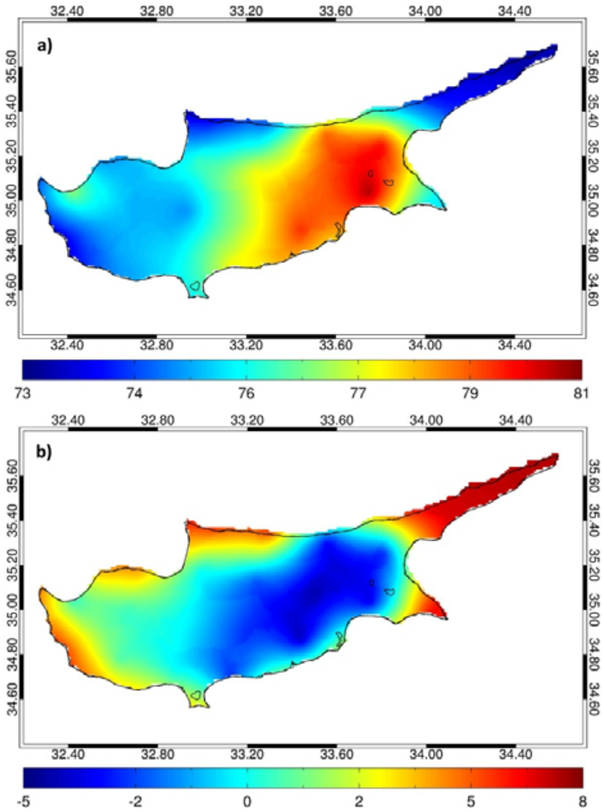

Figure 4: (a) Average Spring TCI for control period, (b) Changes in Average Spring TCI in the distant future (Future – Control period).

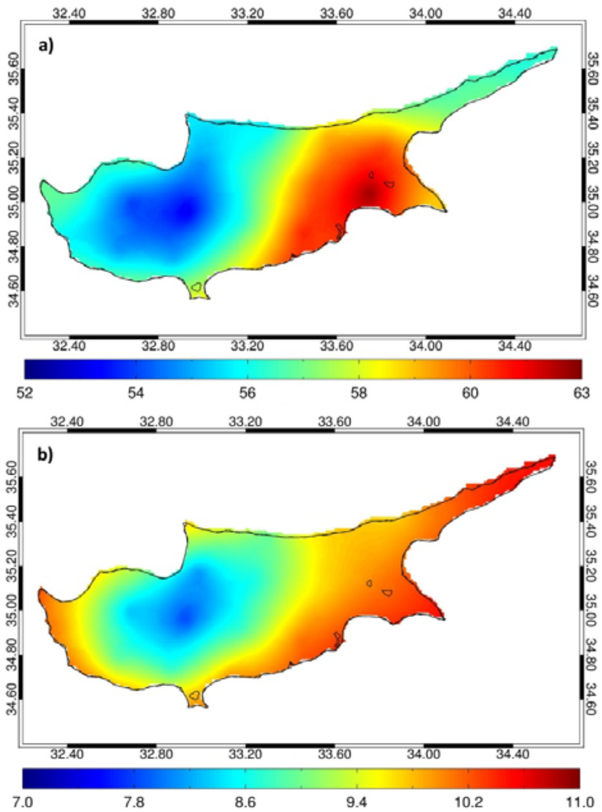

Figure 5: (a) Average Winter TCI for control period, (b) Changes in Average Winter TCI in the distant future (Future – Control period).

The overall findings of the analysis of TCI for both present-day climate and future changes due to climate change are summarized in Table 11.

Table 11: TCI values for control period as well as potential distant future changes.

	Western Regions		Mountain Regions		Inland Regions		Southern Regions		Southeastern Regions	
	Control	Change	Control	Change	Control	Change	Control	Change	Control	Change
ASuT	76	(–) 16-18	68	(–) 15	60-65	(–) 9	68	(–) 15	60-65	(–) 13
ASpT	74-76	(+) 2-6	74-76	0	78-80	(–) 2	74-76	0	78-80	(–) 2
AFT	78	(–) 8-9	75	(–) 5-6	75	(–) 9-12	75	(–) 8-9	75	(–) 9-12
AWT	57	(+) 10	55	(+) 8	60	(+) 10	57	(+) 9	60	(+) 10

Where: ASuT= Average Summer TCI, ASpT=Average Spring TCI, AFT=Average Fall TCI, AWT=Average Winter TCI

BCI

Figure 6a illustrates the average summer BCI for the present-day climate. It is shown that western coastal zone presents a BCI of about 77 and is classified as "very good" while in southern and southeastern coastal zone BCI is about 79 and 81 and is classified as "very good" and "excellent" respectively. As far as future changes are concerned, Figure 6b depicts that a slight increase of about 1 is projected for western coastal areas, while for southern and southeastern coastal regions no change is expected. As a result, the classification of the coastal zone during summer regarding distant future is "very good" for western and southern coastal area and "excellent" for southeastern area.

Concerning spring BCI, Figure 7a illustrates that in western coastal zone BCI is about 68 and is classified as "good" while in southern and southeastern areas BCI reaches 71 and 75 respectively and it is classified as "very good". Regarding distant future changes (Figure 7b), it is shown that no change is expected for southern and southeastern areas while a minor increase approximately 2 is expected in western coastal zone. Consequently, in the distant future all the coastal zone of Cyprus is anticipated to be classified as "very good" for beach tourism.

As regards autumn BCI, Figures 8a depicts that in the present-day climate, BCI of western areas is about 68 ("good") while in southern and southeastern coastal areas BCI is about 70 and 74 respectively ("very good"). As far as distant future changes are concerned (Figure 8b), it is anticipated a minor increase of about 1 in western coastal zone while no changes are expected for southern and southeastern zone. Therefore, autumn BCI for distant future is classified as "very good" for all coast zone.

Finally, as concerns winter BCI, Figure 9a illustrates that in western coastal areas BCI is low and about 52 in other words "acceptable" while in southern and southeastern areas BCI is higher and about 60 and 64 respectively in other words "good". As regards distant future changes, Figure 9b shows that for all coastal zone is anticipated and increase in BCI. More specifically, in western areas the increase is expected approximately 3-4 while in southern and southeastern coastal zone is expected in the order of 2-3. As a result, the classification remains in the same levels as in the present-day climate, namely "acceptable" for western areas and "good" for southern and southeastern coastal zone.

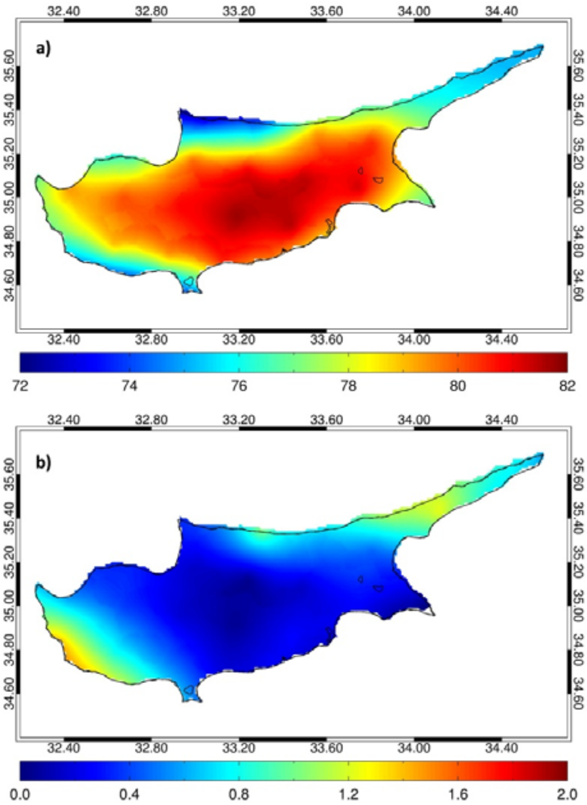

Figure 6: (a) Average Summer BCI for control period, (b) Changes in average Summer TCI in the distant future (Future – Control period).

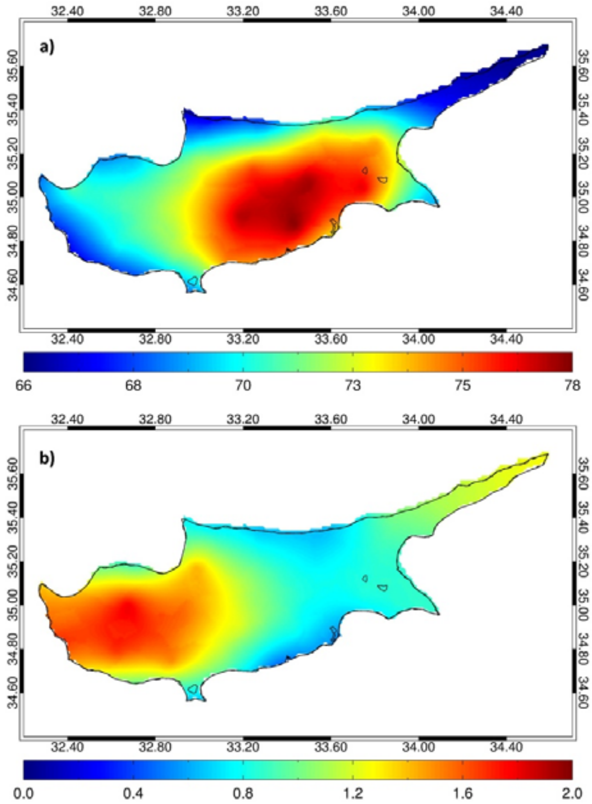

Figure 7: (a) Average Spring BCI for control period, (b) Changes in average Spring TCI in the distant future (Future – Control period).

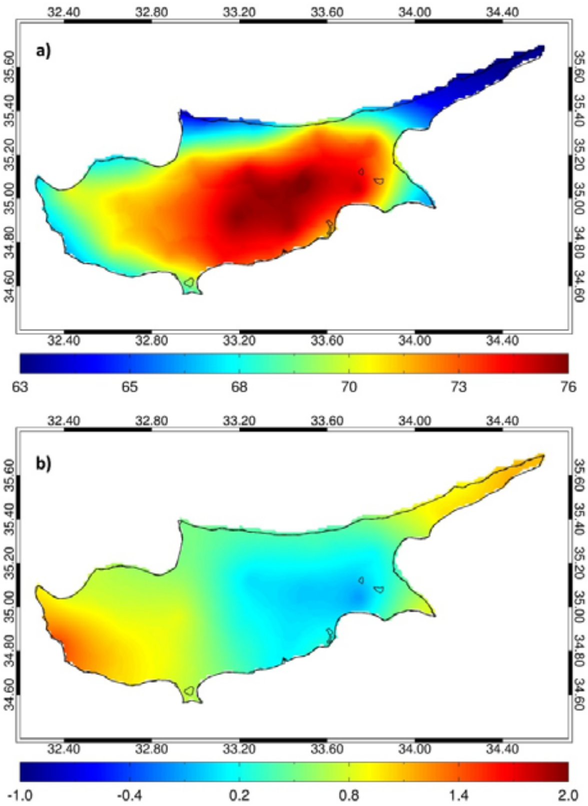

Figure 8: (a) Average Fall BCI for control period, (b) Changes in average Fall TCI in the distant future (Future – Control period).

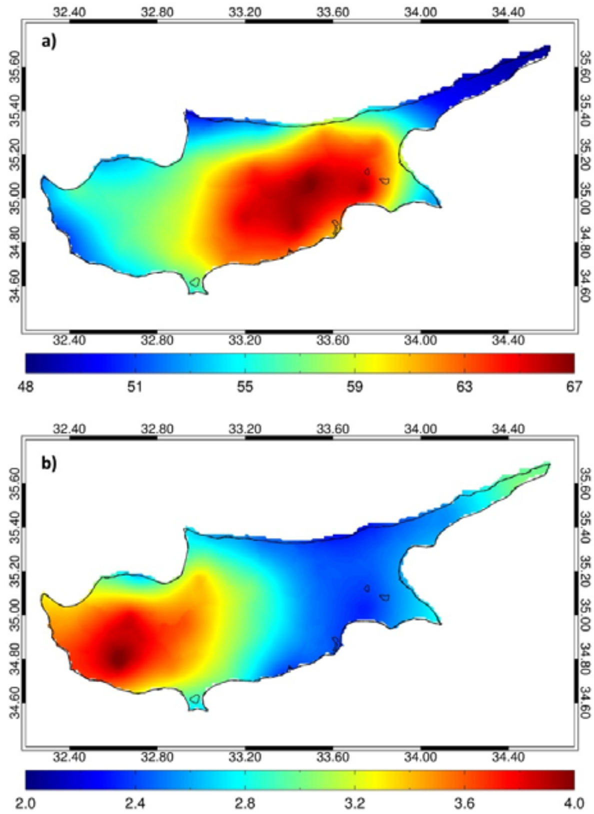

Figure 9: (a) Average Winter BCI for control period, (b) Changes in average Winter TCI in the distant future (Future – Control period) (b).

The overall findings of the analysis of the BCI for both present-day climate as well as future changes due to climate change are summarized in Table 4-2.

Table 12: BCI values for control period as well as potential future changes

	Western Coastal Regions		Southern Coastal Regions		Southeastern Coastal Regions	
	Control	Change	Control	Change	Control	Change
ASuB	77	(+) 1	79	0	81	0
ASpB	68	(+) 2	71	0	75	0
AFB	68	(+) 1	70	0	74	0
AWB	52	(+) 3-4	60	(+) 2-3	64	(+) 2-3

ASuB=Average Summer BCI, **ASpB**=Average Spring BCI, **AFB**=Average Fall BCI, **AWB**=Average Winter BCI

Conclusions

From the aforementioned TCI results, we conclude that in the distant future, the considerable warming which is projected during summer (when the majority of tourists visit Cyprus) for the period 2071-2100 will have an negative impact on the tourism industry of Cyprus. Western, mountain, inland and southern regions are classified slightly "acceptable" while southeastern regions, where the warming is expected more severe, are classified as "marginal". Also, autumn tourism will negatively affected by warming in Cyprus. All areas of Cyprus are classified as "good" from "very good" in the present-day climate. On the other hand, winter tourism (sightseeing, winter swimming etc.) is anticipated to be benefited by warmer climate. Actually during winter, almost all areas of Cyprus are expected to be classified as "good" in the distant future from "acceptable" in the present-day climate. In addition, warming will benefit spring tourism providing "very good" conditions for all tourist activities. Subsequently, the shift in tourist's preferences before and after summer due to the improved weather conditions seems to be promoted in Cyprus alleviating the tourist's displeasure due to the extensive warming during summer.

Considering BCI results, it can be concluded that contrary to TCI outcomes the anticipated extreme warming will not negatively affect the Cyprus beach tourism in the distant future. As a matter of fact, any changes will be positive. Although summer is anticipated extremely warm at coastal regions, it appears that in the distant future it will continue to offer "very good" and "excellent" conditions for tourists to carry out their activities. Also, "very good" conditions are expected for both spring and autumn for beach tourism in Cyprus. Finally, winter tourism seems to be benefited since it is anticipated the higher increase in the BCI proving "acceptable" for western and "good" for southern and southeastern coastal areas conditions for beach tourism.

For the analysis of both TCI and BCI it can be concluded that the extreme warming which is projected for distant future in Cyprus (mainly during summer) will have negative impacts on tourism activities such as sightseeing, medical tourism, alternative tourism etc. In addition such tourism activities seem to be benefited before and after summer in other words during spring and autumn where warming and extreme events will be not so intense. Conversely, regarding beach tourism, it doesn't appear to be negatively affected by the anticipated warming even during summer. In addition, apart from summer, both spring and autumn are expected to provide very good conditions for beach tourist activities.

References

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