

# A Comparative study of tourism comforting climate in Iran (case study in the Markazi province and southern Kharasan province of Iran) with TCI model in GIS environment

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**ABSTRACT:** Tourism is considered one economical part susceptible to the climate and the effect of attractions and climate obstacles on tourism have more importance. Climate is one of the important factors in the tourism development: one suitable climate can be followed with the positive answers of tourists and tourists plan their trip according to the climate condition. In this research, by using tourism climate index (TCI) Mixofoski (1985) evaluated tourism climate Markazi province and southern khorasan province and the generalization of point by point data combination of maps, times and suitable locations have been identified to attend tourists using GIS facilities. the results showed that the rank percent of climate comfort times of southern khorasan is more than Markazi province , So that , in Markazi province ordibehesht (Iran month) to Mahr has the best conditions. for tourists and Azar , Dey, Bahman and Esfand months has in comfort situation of good, acceptable and tau due to severe cold and ices and in this province during year ideal rank is 16.66%, excellent rank is 28.03% , very good rank is 8.33%, good rank is 16.66% , acceptable rank is 27.72%. 10w rank is 7/57% , while in southern khorasan , Farvardin , Ordibehshet , Khordadm, Tir, Mordad, Shahrivar, Mehr, Aban, Esfand months are the suitable times for tourism and just Azar , Dey , Bahman months are acceptable for trip according to climate comfort in some cities like Birjand , ghayen , Ferdous. In southern Khorasan, 17/85% is for ideal rank, 37/71% for excellent, 14/28% for, very good, 17/85 for good and in southern Khorasan , the tires of climate comfort for tourist attraction is more than Markazi province and the climate calendar differs in two provinces.

**Keywords:** tourism comforting climate, TCI model, GIS, Iran.

## INTRODUCTION

Tourism is the main sector of global economics and is one of the biggest world industries and it is predicted that by 2020, international tourism reaches 1/6 billions and the financial flow is more than 2 trillion dollars throughout the world (world Tourism organization, 1998). One of the required information of tourists for travel is the climatic condition of the destination and most tourists take into consideration the climatic condition to select tourism destination (faraj zadeh , 2009). From perspective of tourism planning, climate has high importance and tourists usually seek. Desirable climate that tourism destination. Climate is the most important factor in the development of the tourism sector. To develop tourism in southern Khorasan and Markazi province – the suitable places and times must be identified to attend tourists. Because one of the most important needs of tourists is too aware of climate situation and the suitable times for tourism. The main aim of this research is to study and determine qualitative climate conditions of provinces from comfort dimension and identify climate calendar for tourism according to tourism climate index. To make the suitable planning by identifying appropriate months for attendance of tourists.

**Tourism for comfort**

The relation between atmosphere and tourism has various and complex forms. the combination on the one hand depends on poly-morphism of tourism and on the other hand depends on the effects of the climate, Because the effects of climate and the whole has more prominent than other indices of tourism ( Zolfaghari , 2008).

Climate and tourism effect on each other as the main components of one system and propose one new subject as tourism climatology. Tourism, Tourism organization, Travel agents and tourism planner need to attend the role and importance of the climate and effective climatic parameters in tourism considerably. Because , today the attention on tourism and its role in developing economical activities, creation of the new jobs and finally meeting the mental and physical needs of human , specially has importance in the industrial and advanced societies.

**The relationship between climate and tourism**

Climate and tourism are dependent on each other, so that having favorable climatic conditions – considered some of the advantage and potentials for tourism and often passengers pay their attention on selection of travel place and time. Comfortable climate conditions are expressed by indices and human, environmental and agrology elements are interfered. These indices present climatic data that shows the reaction of people to climate and in the numerical classification, has degrees from very appropriate to wary in appropriate.

**Hypothesis**

Tourism climate comfort times of southern Khorasan is more than Markazi province

**Research purposes**

1. Determine the comfortable climate for tourism development in the provinces
2. Identify the appropriate months of the year for the tourists
3. Comparative comparison of climatic comfort in the provinces Methodology.

In this study, the method is descriptive – analytical and processing data that has been prepared using climatic data and index of tourism comfort climate using computer software of tourism calendar for the studied province.

In this research, statistical data (mean temperature, maximum temperature, minimum relative humidity, amount of sunshine, wind speed) for a ten – year period (2002-2012) of 11 synoptic stations of southern Khorasan has been evaluated and Tourism comfort climate of two provinces has been compares and prepared for each province monthly.

**Tourism climate index**

T.C.I consists of three words : Tourism , climate , index , that has been presented by my kazovesky (1985) is combination of seven parameters which 3 have been used independently and 2 used in relation to bio climatology. This index is calculated by the following equation:

$$TCL= 8CID +2CID+4R+2W \quad (1)$$

CID is comfort index during day which includes the average maximum daily temperature (TMAX) and the mean relative humidity (RH). CID daily comfort index includes the average daily temperature and relative humidity. R is the rainfall in millimeter. W is duration of sunshine hours and w is the average wind speed in meters per second.

Table 1. Characteristics of the studied stations in Markazi Province

Number	Station name	latitude	Longitude	altitude
1	Arak	06-34	42-49	1803
2	Saveh	03-35	20-50	1108
3	Tafarosh	34-41	01-50	1980
4	Khomein	33-37	05-50	1835
5	Delijan	33-59	41-50	1524
6	Komeijan	34-43	19-49	1741
7	Mohalat	33-53	29-50	1620
8	Zarandieh	06-35	49-49	1590
9	Khandab	24-34	11-49	1739
10	Shazand	33-57	25-49	1913
11	Ashtian	32-34	00-50	2097

Table 2. Characteristics of the studied stations in Khorasan Province

Number	Station name	latitude	Longitude	Altitude
1	Birjand	53-59	32-53	1491
2	Ghayen	56-60	15-33	1389
3	Ferdous	57-58	32-42	
4	Tabas			
5	Bashroyeh			
6	Nehbandan	30-32	58-60	
7	Khousf			

**How to calculate the tourism climate Index**

**How to calculate the Tourism climate Index**

Tourism climate index is composed of 7 parameters. 3 parameters are independent and 2 parameters associate with bioclimatology. This index is calculated by the following equation.

$$TCI=2(4CID+CIA =2^*R+2^*S+W) (2)$$

In this equation, CID is the comfort index during the day which includes he average maximum daily temperature and an average relative humidity (RH). CIA is daily comfort index, which includes average daily temperature and relative humidity. R is rainfall (mm), S is unration of sunshine hours. W is the average wind speed in meters per second.

**Calculation of the daily comfort index (CID)**

The variables include maximum daily temperature and average minimum daily relative humidity. This sub-index shows the thermal comfort conditions at the moment of the maximum tourism activity and its share is to percent. To calculate, by putting their two variables in the figure 1, daily comfort amount is obtained.

**The calculation of 24-hour comfort index**

This sub- index shows thermal comfort conditions at 24-hour and its share in Tc1 id 10 percent. CID index is obtained by placing the variables of the maximum daily temperature and the minimum relative humidity. Because this index shows the mean thermal comfort condition at 24 hour. Has less importance than the previous index and its shave in formula TCI is 10 percent.

**Calculated rainfall:**

Since tourists have a great desire for calm weather, so whatever the weather conditions are more relaxed and less rain falls, it is more pleasant for them. In formula TCI, absolute value has been used to calculate rainfall.

Table 3. The classification manner of rainfall variable in tourism climate index

Rank	Average of monthly rainfall ( mm)
5	0-14.9
4.5	15-29.9
4	30-44.9
3.5	50-59.9
3	60-74.9
2.5	75-89.9
2	90-104.9
1.5	105-119.9
1	120-134.9
0.5	135.149.9
0	150 or more

**Calculated sunshine (sunshine hours)**

Sun is as a positive factor in climatic comfort. Formula TCI, the variable of overage sunshine hours per day is used. This variable is obtained by dividing average Mont lily sunshine hours by the number of days in each month

Table 4. Sunshine classification manner

Rating radiation	The number of hours of sunshine per day
5	10 hours or more
4.5	9-9.59
4	8-8.59
3.5	7-7.59
3	6-6.59
2.5	5-5.59
2	4-4.59
1.5	3-3.59
1	2-2.59
0.5	1-1.59
0	Less than one hour

**Calculated wind**

Wind is one complex variable in the evaluation of tourism climate in TCI. Considering that it has different effect in the climatic comfort at the different climates. we must considers separate ranking system. for this purpose ,4 types of ranking system of wind speed have bleed considered in Formula TCI.

Table 5. The classification of wind variable in the tourism climate index

Wind speed in km / h	Normal system	system Alyzeh	warm climate system
Less than 2.88	5	2	2
2.88-5.75	4.5	2.5	1.5
5.76-9.03	4	3	0.5
9.04-12.23	3.5	4	0
12.24-19.79	3	5	0
19.80-24.29	2.5	4	0
24.30-28.79	2	3	0
28.80-38.52	1	2	0
More of 38.52	0	0	0

Finally, after calculation of TCI, its numerical value is between 0 to 100 that each region has one special number according to climatic conditions. A table 24, one kind of division has been presented for this index.

Table 6. TCI classification for drawing on the map Discussions and results

TCI Score	Descriptive valueTCI
0-100	Ideal
80-89	Excellent
70-79	Very Good
60-69	Good
50-59	Acceptable
40-49	low
30-39	undesirable
20-29	Very poor
10-19	, extremely poor
0-9	unbearable

Table 7. The final results obtained from index TCI monthly in the Markazi province

Month City	Esfand	Bahman	Dey	Azar	Aban	Mehr	shahri var	Mordad	Tir	Khordad	Ordibehe sht	Farvardin
Arak	Good	Acceptable	low	low	Good	Ideal	Excellent	Excellent	Excellent	Ideal	Excellent	Good
Mohalat	Good	Acceptable	Acceptable	Good	Good	Ideal	Excellent	Very good	Very good	Excellent	Ideal	Excellent
Delijan	Good	Acceptable	Acceptable	Acceptable	Good	Excellent	Excellent	Very good	Very good	Excellent	Excellent	Very good
Tafarosh	Acceptable	Acceptable	low	Acceptable	Good	Ideal	Ideal	Excellent	Excellent	Ideal	Very good	Good
Saveh	Good	Good	Acceptable	Good	Very good	Ideal	Ideal	Very good	Very good	Excellent	Ideal	Excellent
Zarandiyeh	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Excellent	Ideal	Excellent	Excellent	Ideal	Excellent	Good
Khandab	Acceptable	low	Acceptable	Acceptable	Acceptable	Excellent	Excellent	Excellent	Excellent	Ideal	Excellent	Good
Ashtian	Acceptable	low	Acceptable	Acceptable	Acceptable	Excellent	Ideal	Excellent	Excellent	Ideal	Very good	Acceptable
Khomain	Good	Acceptable	low	Acceptable	Good	Ideal	Ideal	Excellent	Excellent	Ideal	Excellent	Good
Komeijan	Good	low	low	Good	Good	Excellent	Excellent	Excellent	Excellent	Ideal	Excellent	Good
Shazand	Acceptable	Acceptable	low	low	Acceptable	Ideal	Ideal	Excellent	Excellent	Ideal	Very good	Good

Source: research findings

Table 8. The final results obtained from index TCI monthly in the southern Khorasan province

Month City	Esfand	Bahman	Dey	Azar	Aban	Mehr	shahri var	Mordad	Tir	Khordad	Ordibehe sht	Farvardin
Birjand	Good	Acceptable	Acceptable	Excellent	Excellent	Ideal	Excellent	Excellent	Very good	Excellent	Ideal	Excellent
Ghayen	Good	Acceptable	Acceptable	Good	Excellent	Ideal	Ideal	Excellent	Excellent	Excellent	Ideal	Excellent
Fredous	Good	Acceptable	Acceptable	Acceptable	Excellent	Ideal	Ideal	Excellent	Very good	Excellent	Ideal	Excellent
Basharoyeh	Very good	Good	Acceptable	Good	Excellent	Excellent	Excellent	Very good	Good	Very good	Ideal	Excellent
Tabas	Excellent	Good	Good	Good	Ideal	Ideal	Excellent	Good	Acceptable	Acceptable	Ideal	Ideal
Nehbandan	Very good	Good	Good	Very good	Ideal	Excellent	Excellent	Very good	Very good	Excellent	Excellent	Excellent
Khosf	Very good	Good	Acceptable	Good	Excellent	Ideal	Excellent	Very good	Very good	Excellent	Excellent	Excellent

Source: research findings

Table 9. Dividing rank of climatic comfort index by the number of mouths in Markazi province

City Rank	Tafarosh	Shazand	Komeijan	Khomain	Saveh	Delijan	Ashtian	Zarandiyeh	Khandab	Mohalat	Arak
Ideal	3	3	1	3	3	0	2	2	1	2	2
Ideal	2	2	5	3	2	4	3	4	5	3	4
Very good	1	1	0	0	3	3	1	0	0	2	0
Good	2	1	3	3	3	2	0	1	1	3	3
Acceptable	3	3	1	2	1	3	5	5	4	2	1
Low	1	2	2	1	0	0	1	0	1	0	2

Table 10. Dividing classification of climatic comfort index by the number of months in the southern khorasan province

City Rank	Khosf	Nehbandan	Tabas	Basharoyrh	Fredous	Ghayen	Birjand
Ideal	1	1	4	1	3	3	2
Excellent	5	5	2	4	4	5	5
Very good	3	4	0	0	0	0	1
Good	2	2	4	3	1	2	1
Acceptable	1	0	2	1	3	2	3
Low	0	0	0	0	0	0	0

Table 11. The number and percent the rank of the tourism climatic comfort in Markazi province and southern Khorasan province in year

Low	Acceptable	Good	Very good	Excellent	Ideal	Rank
10	30	22	11	37	22	Markazi
7.57	22.72	16.66	8.33	28.03	16.66	Percent
0	12	15	12	30	15	Southern Khorasan
0	14.28	17.85	14/28	35.71	17.85	Percent

**Summarizing the results and findings**

In this research, tourism climate of provinces has been evaluated using tourism climate index (TCI). This index evaluated systematically the climatic conditions for tourism activity using parameters: average maximum temperature , average temperature , minimum relative humidity , average relative humidity, precipitation (mm), total sunshine and wind speed (km/h): the research performed using data from 11 synoptic in central province and 7 stations in south khorasan province over a period of 10 years after obtaining climatic data of the stations for analysis the Excel and calculation were performed using TCI climate index and then transferred into the geographic information system (Arc/GIS) and local analyses based on zoning tourism climatic conditions have been conducted at monthly time scale and maps in the monthly scale have been prepared for two provinces and the obtained results have been presented by time calendar of appropriate months for tourism in two provinces.

**REFERENCES**

Amelung B and Viner D. 2006. Mediterranean tourism: Exploring the Future with the Tourism Climate Index, *Journal of Sustainable Tourism* 14:349–366.

Becken S. 2005. Harmonizing climate change adaptation and mitigation the case of tourism resorts in Fiji. *Global Environmental change*, 15: 381-393.

Gartner Willam C. 1996. *Tourism Development*, Van Nostrand Reinhold.

Harrison SJ and winter bottom C. 1999. the potential effects of climate change on the Scottish tourist industry. *Tourism management*, 20: 203-211.

Holjevac Al. 2002. Avision of tourism and the hotel industry in the 21 s.t century, *Hospitality management*, vol.22,200.119.

Javarpoor I. 2007. *climatology basics* , publications of payam noor university.

Mieczkowski Z. 1985. The tourism climatic index: a method of evaluating world climates for tourism. *Canadian Geographer*, 29(3),220-233.