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Assessment of Tourism Climate Comfort for Tourism Development in Nghi Son Town, Thanh Hoa Province, Vietnam

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ABSTRACT: This study evaluates tourism climate comfort for tourism development in Nghi Son Town, Thanh Hoa Province, Vietnam, using the Tourism Climate Index (TCI). The methodology includes collecting and processing long-term climatic data, calculating TCI components (CID, CIA, R, S, W) based on the Mieczkowski method, and conducting monthly analysis. The results show that TCI values range from 45.4 to 64.6, indicating clear seasonal variation. The period from December to April presents the most favorable conditions, characterized by mild temperatures, low rainfall, and high sunshine duration. In contrast, the summer–autumn season (June–October) is less favorable due to high temperatures, heavy rainfall, and extreme weather events. However, a mismatch exists between TCI and coastal tourism seasonality, as summer remains the peak period due to the attractiveness of marine resources. The findings provide a scientific basis for climate resource assessment and support sustainable tourism development.

KEYWORDS: TCI index, coastal tourism, Nghi Son town, tourism climate comfort.

1. INTRODUCTION

In recent years, climate change and the growing trend of seasonal tourism shifts have created an urgent need for a scientific and systematic assessment of climate resources. In this context, the Tourism Climate Index (TCI) has been widely recognized as an effective tool for evaluating climatic suitability for tourism activities. The TCI, first proposed by Zbigniew Mieczkowski in 1985, is regarded as one of the earliest quantitative approaches integrating climatic factors affecting tourism [1]. The index evaluates climatic favorability based on the integration of seven meteorological parameters into five component indicators, including the Daytime Comfort Index (CID), the Daily Comfort Index (CIA), as well as precipitation, sunshine duration, and wind speed. These variables are calculated and standardized into a scoring system to provide an overall monthly assessment throughout the year. TCI-based studies have been applied across various climatic regions and tourism types worldwide, particularly in coastal tourism. The index enables a quantitative and intuitive assessment of climatic comfort for tourism purposes. Since its introduction, TCI has been extensively employed in global studies to identify optimal tourism seasons, classify tourism climate regions, and support sustainable tourism planning across temporal and spatial scales.

Over time, international scholars have continuously refined and expanded the application of TCI to overcome several initial limitations, particularly its insufficient consideration of tourists' perceptions across different tourism types and cultural contexts. Research applying TCI to assess the impacts of climate change on tourism emerged relatively early, notably in Canada, where studies revealed shifts in tourism seasonality under changing climatic conditions [2]. Building upon this foundation, more specialized approaches were developed to better suit specific tourism activities. Among these, the development of indices such as the Beach Climate Index (BCI) for evaluating climatic conditions in coastal tourism has attracted significant attention [3], [4]. Alongside these studies, the integration of future climate simulation data into TCI analysis has increasingly become a major research direction, enhancing forecasting capacity and supporting the formulation of effective adaptation strategies for the tourism sector in the context of global climate change.

In Vietnam, studies applying the TCI began to emerge after 2010 and gradually demonstrated their practical value in evaluating climatic conditions for tourism development. Pioneering research conducted in Hue clarified climatic comfort levels and identified favorable periods for cultural–historical tourism activities [5]. Subsequently, the scope of application expanded to distinctive tourism destinations such as Da Lat, contributing to a better understanding of the relationship between TCI values and seasonal fluctuations in tourist arrivals [6]. More recently, studies in island and coastal areas, particularly Phu Quoc, have gone beyond simple climatic evaluation to analyze the role of climatic factors in organizing and adjusting coastal tourism products [7]. Although these studies remain largely descriptive, they have established an important scientific foundation for analyzing the relationship between climate and tourism development at the local scale.

Despite these initial achievements, studies applying the TCI in Vietnam still reveal several limitations. First, the component indices have not yet been adequately adjusted to reflect the climatic perceptions of domestic tourists. In addition, most existing studies primarily rely on historical meteorological data, while the incorporation of future climate model projections remains limited. To address these shortcomings, several recent studies have introduced notable improvements, particularly the adjustment of TCI component weights according to the characteristics of the tropical monsoon climate and the integration of GIS technology for spatial mapping of the index to support tourism territorial management

more effectively [8]. These approaches demonstrate significant potential for localizing the TCI, thereby contributing to the development of a scientific tool with practical value for forecasting, planning, and adapting sustainable tourism development. This is especially meaningful in the increasingly complex context of climate change in Vietnam, particularly for coastal areas such as Nghi Son — the focal area of this study.

Nghi Son is one of the key coastal areas of Thanh Hoa Province. Established through the expansion of Tinh Gia District, the town occupies a strategic position in the southern part of the province, bordering Nghe An Province. With its long coastline, attractive beaches, diverse natural landscapes, and rich nearshore island systems such as Nghi Son Island, the area possesses considerable potential for the development of marine, resort, and ecotourism. Furthermore, the presence of the Nghi Son Economic Zone has created strong momentum for infrastructure and service development, thereby enhancing the area's capacity to attract tourists.

At present, tourism activities in Nghi Son remain highly seasonal and strongly dependent on weather and climatic conditions. Factors such as intense summer heat, storms and heavy rainfall toward the end of the year, and high humidity levels may significantly reduce tourists' travel experiences. Meanwhile, quantitative and systematic assessments of climatic suitability for tourism activities in this area remain limited.

Based on these practical considerations, the study entitled "Assessment of the Tourism Climate Index (TCI) for Tourism Development in Nghi Son Town, Thanh Hoa Province" was conducted to determine the spatial and temporal suitability of climatic conditions for tourism activities. The study aims to provide a scientific basis for appropriate tourism exploitation, minimize climate change-related risks, and enhance the effectiveness of sustainable tourism development in the locality.

2. DATA AND RESEARCH METHODOLOGY

2.1. Data

The study utilized long-term average meteorological data (30-year averages) collected from the Tinh Gia Meteorological Station under the Thanh Hoa Hydrometeorological Center. The dataset includes average temperature, average daily maximum temperature, average relative humidity, minimum relative humidity, precipitation, sunshine duration, and wind speed.

2.2. Research Methodology

The Tourism Climate Index (TCI) integrates seven climatic parameters, including two combined parameters: CID (Daytime Comfort Index) and CIA (Daily Comfort Index), together with three independent parameters: R (Rainfall), S (Sunny Day/Sunshine Duration), and W (Wind Speed) [9]. These components are standardized and calculated according to the TCI rating scale proposed by Zbigniew Mieczkowski [1].

The formula is as follows:

$$TCI = (8 \times CID) + (2 \times CIA) + (4 \times R) + (4 \times S) + (2 \times W)$$

Where:

CID is the Daytime Comfort Index, calculated based on the average maximum temperature and the average minimum relative humidity, according to Figure 1;

CIA is the Daily Comfort Index, calculated based on the average air temperature and average relative humidity, according to Figure 1;

R represents the average daily rainfall in a month (mm), calculated according to Table 1;

S represents the average daily sunshine duration in a month (hours), calculated according to Table 1;

W represents the average wind speed (m/s), calculated according to Table 2.

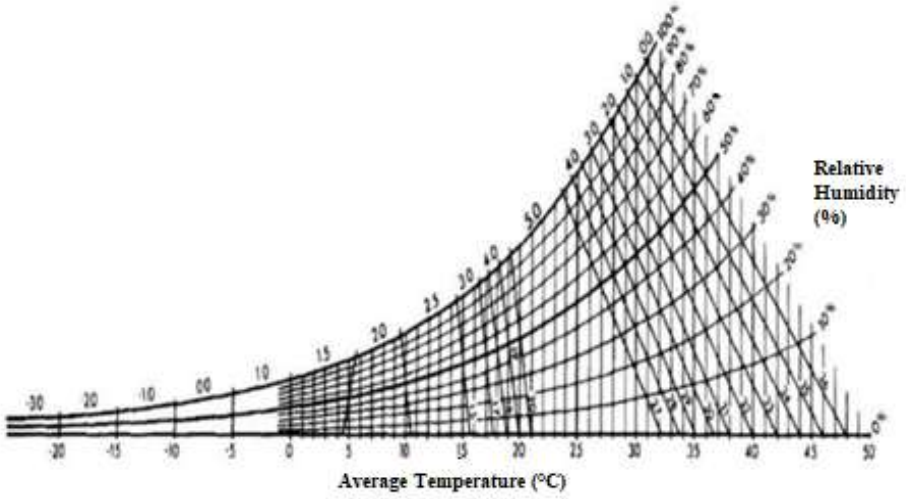

Figure 1. Graph illustrating the relationship between CID and CIA [1]

The two combined parameters, CID and CIA, are determined through the correlation graph between air temperature and humidity (Figure 1), in which the horizontal axis represents temperature and the vertical axis represents average relative humidity. The values of these indices are identified at the intersection of the two variables on the graph, thereby indicating the corresponding level of climatic comfort.

The CID is calculated based on the relationship between maximum temperature and minimum relative humidity, reflecting thermal–humidity comfort conditions during daytime periods when tourism activities mainly occur. Meanwhile, the CIA is determined from average daily temperature and average relative humidity, representing the overall thermal–humidity comfort level throughout a 24-hour period, including both daytime and nighttime conditions.

These two indices complement each other, allowing for a comprehensive assessment of the influence of the temperature–humidity combination on the physiological comfort of tourists under different temporal conditions.

Table 1. Determination of average rainfall and sunshine duration for TCI calculation [1]

Average Daily Rainfall per Month	Sunshine Duration per Day	Rating Value
0 – 14.9 mm	> 10 h	5.0
15 – 29.9 mm	9 – 9 h 59 min	4.5
30 – 44.9 mm	8 – 8 h 59 min	4.0
45 – 59.9 mm	7 – 7 h 59 min	3.5
60 – 74.9 mm	6 – 6 h 59 min	3.0
75 – 89.9 mm	5 – 5 h 59 min	2.5
90 – 104.9 mm	4 – 4 h 59 min	2.0
105 – 119.9 mm	3 – 3 h 59 min	1.5
120 – 134.9 mm	2 – 2 h 59 min	1.0
135 – 149.9 mm	1 – 1 h 59 min	0.5
> 150 mm	< 1 h	0

Table 2. Determination of Wind Speed for TCI Calculation [1]

Wind Speed (km/h)	Wind Speed (m/s)	Rating Value
< 2.88	< 0.80	5.0
2.88 – 5.75	0.80 – 1.60	4.5
5.76 – 9.03	1.60 – 2.51	4.0
9.04 – 12.23	2.51 – 3.40	3.5
12.24 – 19.79	3.40 – 5.50	3.0
19.80 – 24.29	5.50 – 6.75	2.5
24.30 – 28.79	6.75 – 7.80	2.0
28.80 – 38.52	7.80 – 10.70	1.0
> 38.52	> 10.70	0

From the TCI calculation results based on the characteristic climatic factors, the relative importance of each component index can be identified.

Table 3. Input Factors and the Influence Levels of TCI Component Indices

No.	Component	Input Factors	Input Scale	Influence on TCI
1	CID	Average monthly maximum temperature (°C); Average monthly minimum relative humidity (%)	0–100	Most important (×8)
2	CIA	Average monthly temperature (°C); Average monthly relative humidity (%)	0–100	Moderate importance (×2)
3	R	Average monthly rainfall (mm)	0–100	Very important (×4)
4	S	Average daily sunshine duration in the month (or total sunshine hours divided by number of days)	0–100	Important (×2)
5	W	Average monthly wind speed (km/h or m/s)	0–100	Lesser influence (×1)

Based on the monthly TCI results, the characteristics of tourism seasons and suitable tourism periods throughout the year were analyzed according to the TCI classification scale proposed by Zbigniew Mieczkowski (1985). The following table presents the classification of climatic suitability levels for tourism activities according to TCI values:

Table 4. Classification Scale of the Tourism Climate Index (TCI) [1]

TCI Value	Classification	Meaning
90 – 100	Ideal	Ideal climatic conditions for tourism
80 – 89	Excellent	Highly favorable for tourism activities
70 – 79	Very good	Suitable and comfortable conditions
60 – 69	Good	Relatively suitable, though some limiting factors may exist
50 – 59	Acceptable	Acceptable conditions, but with several limitations
40 – 49	Marginal	Unfavorable conditions with many constraining factors
30 – 39	Unfavorable	Poor conditions, causing difficulties for tourism activities

20 – 29	Very poor	Highly unfavorable conditions
10 – 19	Extremely poor	Conditions may pose health risks
0 – 9	Impossible	Tourism activities cannot be conducted

The analysis of TCI not only helps identify favorable tourism seasons but also supports destination management in regulating tourism seasonality, reducing pressure during peak seasons, and extending tourism operation periods. Furthermore, the research findings may serve as a scientific basis for developing climate tourism calendars, supporting tourism product planning and destination promotion strategies at the local level.

3. RESEARCH RESULTS AND DISCUSSION

3.1. Climatic Characteristics of Nghi Son Town

Nghi Sơn is located along the southern coastal area of Thanh Hoa Province, within the typical tropical monsoon climatic zone of the North Central Coast region of Vietnam. The climate is characterized by two distinct seasons: a hot and humid summer season (from May to October) and a cold and dry winter season (from November to April of the following year) [10]. However, due to its direct adjacency to the East Sea, the climate of Nghi Son exhibits certain characteristics distinct from inland areas, particularly a relatively small annual temperature range and persistently high humidity throughout the year.

The annual average temperature ranges from approximately 23.2°C to 24.1°C, with the highest temperatures occurring in July (around 29–33°C) and the lowest in January (approximately 15–18°C). During summer, Nghi Son is strongly influenced by the Southwest monsoon, which brings hot and humid air masses, creating sultry weather conditions that are nevertheless favorable for coastal tourism activities. In winter, the Northeast monsoon causes cooler and drier conditions; however, due to the moderating maritime effect, Nghi Son rarely experiences severe cold spells compared to inland northern areas [10].

The annual average rainfall ranges between 1,700 mm and 1,900 mm, with precipitation concentrated mainly from June to November. September typically records the highest rainfall. Rainfall frequently occurs in the form of showers and thunderstorms during the late afternoon and evening, which may adversely affect tourism activities if adaptive measures are not adequately implemented. Average relative humidity remains relatively high, ranging from 80% to 90%, creating favorable conditions for vegetation growth while simultaneously posing challenges for tourism infrastructure and services during the humid season [10].

As a coastal area strongly affected by monsoon circulation and climate change, Nghi Son frequently experiences extreme weather phenomena. These include tropical storms and depressions occurring mainly during the summer–autumn season, often accompanied by heavy rainfall and localized flooding; prolonged heatwaves during summer associated with the Southwest foehn wind effect; strong Northeast monsoon winds during winter causing rough sea conditions; and thunderstorms, whirlwinds, and lightning events during transitional seasons. In addition, the area is increasingly affected by saltwater intrusion and sea-level rise, both of which exert considerable impacts on the natural environment and coastal tourism activities.

Overall, the climate of Nghi Son is relatively favorable for the development of coastal tourism, particularly from May to August, which represents the hot season and the peak period for beach tourism activities. However, sustainable tourism development in the area requires the integration of climate adaptation measures, including the improvement of climate-resilient infrastructure, enhancement of disaster warning systems, and protection of natural landscapes in order to ensure service quality and tourist safety.

Table 5. Meteorological Characteristics at Tinh Gia Station Used for TCI Calculation [10], [11]

Month	Average daily rainfall (mm)	Average daily sunshine duration (h)	Average daily wind speed (m/s)	Average daily relative humidity (%)	Average temperature (°C)	Average daily minimum relative humidity (%)	Average daily maximum temperature (°C)
January	38.0	2.32	1.8	87	17.1	50	22.1
February	36.3	2.00	1.7	89	17.8	54	22.7
March	48.7	2.06	1.6	91	20.0	59	24.3
April	59.8	4.00	1.7	89	23.7	61	29.1
May	130.7	6.61	2.0	84	27.4	47	33.4
June	139.2	6.70	2.0	79	29.4	47	34.6
July	179.2	6.93	1.9	80	29.5	47	34.9
August	265.3	5.87	1.7	84	28.5	53	33.7
September	449.8	5.47	1.8	86	27.1	55	32.3
October	359.3	4.87	2.1	86	24.8	51	30.1
November	101.9	4.30	2.1	83	21.8	47	27.2
December	33.5	3.45	1.9	84	18.5	47	23.4
Annual Average	1841.7	4.54	1.9	85	23.8	52	29.0

3.2. Results and Analysis of the Tourism Climate Index (TCI) in Nghi Son Town

Table 6. Tourism Climate Index (TCI) in the Coastal Area of Nghi Son

Month	CID	CIA	R	S	W	TCI	Classification
January	4.2	3.9	4.0	1.0	4.0	60.6	Good
February	4.1	3.8	4.0	1.0	4.0	59.4	Acceptable
March	3.9	3.6	3.5	1.0	4.0	55.0	Acceptable
April	3.8	3.9	3.5	2.0	4.0	58.6	Acceptable
May	3.7	4.2	1.0	3.0	4.0	51.0	Acceptable
June	3.6	4.4	0.5	3.0	4.0	48.4	Marginal
July	3.5	4.3	0.0	3.0	4.0	45.6	Marginal
August	3.6	4.1	0.0	2.5	4.0	45.4	Marginal
September	3.7	4.0	0.0	2.5	4.0	46.6	Marginal
October	3.9	4.0	0.0	2.0	4.0	47.2	Marginal
November	4.2	4.2	2.0	2.0	4.0	57.2	Acceptable

The results of the Tourism Climate Index (TCI) analysis in Nghi Son reveal clear seasonal variations, reflecting the characteristics of the tropical monsoon coastal climate of the North Central region of Vietnam. TCI values range from 45.4 to 64.6, corresponding to classifications from marginal to good climatic conditions for tourism activities.

However, given that Nghi Son possesses significant advantages for coastal tourism, with prominent beaches such as Hai Hoa Beach, Bai Dong Beach, and the Nghi Son coastal area, the assessment of TCI should be considered in relation to the specific characteristics of marine tourism rather than relying solely on general climatic comfort thresholds.

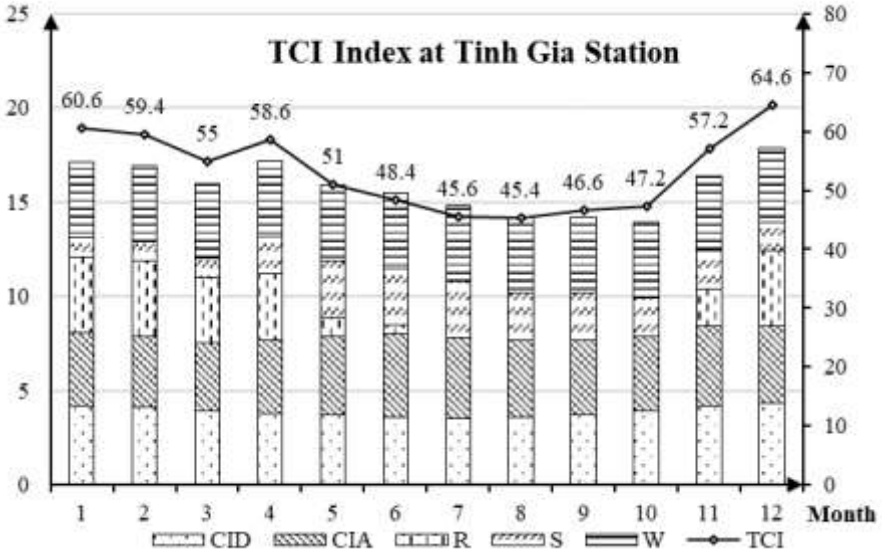

Figure 2. Graph of the TCI and Its Five Component Parameters at Tinh Gia Station

Considering the annual variation, the most favorable climatic conditions for tourism occur during winter and early spring, from December to February, when the TCI reaches relatively high values ranging from 59.4 to 64.6, corresponding to the classifications of "acceptable" to "good." During this period, temperatures remain mild, the diurnal temperature range is relatively small, relative humidity is stable, and rainfall is low. Sunshine duration is relatively high, while the rainfall index (R) attains high values (approximately 4.0), reflecting dry and less interrupted weather conditions, thereby significantly enhancing the overall TCI value. This period is particularly favorable for sightseeing, leisure, and cultural tourism activities. However, due to relatively low air and seawater temperatures, the potential for beach tourism remains limited during this season, highlighting the discrepancy between overall climatic comfort and the specific suitability for marine tourism activities.

The transitional period from March to May and in November exhibits relatively favorable climatic conditions, with TCI values ranging from 51.0 to 58.6, classified as "acceptable." During this time, climatic factors gradually change toward increasing temperatures and rainfall. March and April still maintain relatively comfortable conditions; however, by May, the rapid increase in temperature and humidity, combined with the onset of early seasonal rainfall, reduces climatic comfort. The rainfall index (R) decreases sharply to approximately 1.0, reflecting increased precipitation and reduced sunshine duration. In contrast, November marks the end of the rainy season, when rainfall decreases and sunshine duration increases again, contributing to improved climatic conditions. Notably, during May — the beginning of summer — although the TCI tends to decline, this period also marks the onset of increasing beach tourism demand, as both air and seawater temperatures become

favorable for swimming activities. Consequently, beaches such as Hai Hoa Beach and Bai Dong Beach gradually enter their peak operational season, demonstrating a certain mismatch between TCI values and the actual dynamics of coastal tourism development.

In contrast, the period from June to October represents the least favorable climatic season according to the TCI classification scale, with values ranging from 45.4 to 48.4, mainly corresponding to the "marginal" category. This is the principal rainy season in the area, strongly influenced by the Southwest monsoon, the Intertropical Convergence Zone (ITCZ), and extreme weather phenomena such as tropical storms and depressions. Heavy rainfall (commonly exceeding 150 mm/month) and a substantial reduction in sunshine duration cause the rainfall index (R) to decline to very low levels (0.0–0.5), becoming the primary factor reducing the overall TCI. In addition, the daytime comfort index (CID) decreases due to high temperatures and humidity, creating oppressive thermal conditions. Nevertheless, a notable paradox emerges: this period coincides with the peak beach tourism season in Nghi Son. Owing to its advantageous coastal tourism resources — including attractive beaches, clear seawater, gentle coastal slopes, and relatively unspoiled landscapes — the area continues to attract large numbers of tourists during summer despite climatic conditions that are not particularly favorable according to the TCI. This demonstrates that coastal tourism resources and market demand can partly offset the limitations associated with climatic comfort.

An analysis of the roles of TCI component indices indicates that the rainfall index (R) exhibits the greatest seasonal variability and plays a decisive role in seasonal TCI fluctuations. The decline of R from approximately 4.0 during the dry season to nearly 0.0 during the rainy season may reduce TCI values by 10–15 points. Furthermore, the daytime comfort index (CID) decreases during summer due to high temperatures and humidity, whereas the daily comfort index (CIA) remains relatively stable, reflecting a certain degree of thermal–humidity suitability for beach tourism activities. Meanwhile, sunshine duration (S) and wind speed (W) display relatively limited fluctuations and therefore exert only minor influences on the general TCI trend.

Seasonal synthesis reveals a pronounced inconsistency between climatic comfort conditions and the seasonality of coastal tourism in Nghi Son. While the TCI reaches high values during winter–spring and late autumn, beach tourism activities are concentrated mainly in summer — the period when the TCI is lowest. This finding reflects the limitations of applying the TCI alone in assessing coastal tourism potential and emphasizes the necessity of adopting an integrated approach that combines general climatic indices with specific factors such as seawater temperature, tourism resources, and market demand.

Overall, Nghi Son possesses considerable potential for tourism development, particularly coastal tourism, although it is strongly influenced by climatic seasonality. Effective utilization of tourism resources therefore requires appropriate adjustments in tourism timing and activity types, focusing on beach tourism development during summer while simultaneously diversifying tourism products during other seasons in order to enhance tourism efficiency and promote sustainable development in the context of climate change.

3.3. Discussion

The results of the Tourism Climate Index (TCI) assessment in Nghi Son reveal clear seasonal differentiation while also exposing certain limitations in the application of this index for evaluating coastal tourism potential. Theoretically, the TCI was developed to reflect the overall level of climatic comfort for tourism activities in general, based on the integration of temperature, humidity, rainfall, sunshine duration, and wind conditions. However, in the context of coastal tourism destinations, the conventional application of the TCI may produce discrepancies between assessment outcomes and actual tourism dynamics.

One of the most significant findings is the inconsistency between TCI values and the seasonality of coastal tourism within the study area. Specifically, the TCI reaches its highest values during the winter–spring period, whereas summer — the season with the lowest TCI values — coincides with the peak season for beach tourism. In Nghi Son, with its outstanding coastal tourism resources, particularly beaches such as Hai Hoa Beach and Bai Dong Beach, beach tourism activities continue to thrive during the summer months despite climatic conditions being classified as less favorable according to the TCI. This finding indicates that tourism resources and market demand can substantially modify the relationship between climatic comfort and tourism attractiveness.

In addition, the study confirms the dominant role of rainfall (R) in determining TCI values. The sharp decline of this component during the rainy season leads to a considerable reduction in the overall TCI, indicating that heavy rainfall and extreme weather phenomena such as tropical storms and depressions constitute major barriers to tourism activities. In contrast, temperature — although reducing bioclimatic comfort — exerts a positive influence on coastal tourism by increasing demand for beach and swimming activities. This once again highlights the specific nature of coastal tourism and the limitations of applying a single composite index to all tourism types.

From an applied perspective, these findings provide several important implications for tourism organization and management in Nghi Son. First, tourism development should be clearly oriented according to seasonal conditions, with summer continuing to serve as the primary season for coastal tourism. However, this should be accompanied by climate risk management measures, particularly in the context of increasing frequencies of extreme weather events. Strengthening forecasting systems, early warning mechanisms, and flexible tourism operations adapted to real-time weather conditions are essential measures for minimizing the negative impacts of heavy rainfall and storms.

At the same time, during periods with high TCI values but less favorable conditions for beach tourism (winter–spring and late autumn), greater emphasis should be placed on developing alternative tourism types such as resort tourism, ecotourism, and cultural tourism in order to maximize the benefits of favorable climatic conditions. This approach would not only contribute to extending the tourism season but also help reduce excessive visitor concentration during summer, thereby promoting a more balanced and sustainable utilization of tourism resources.

Furthermore, the study results indicate the necessity of adjusting tourism climate assessment methodologies toward approaches that are more specific to individual tourism types. For coastal tourism areas such as Nghi Son, incorporating additional indicators such as seawater temperature, the number of safe beach days, or the level of storm impact could significantly improve assessment accuracy. This represents an important direction for future research in order to strengthen the scientific basis for tourism planning and development.

In the context of climate change, variations in temperature, rainfall, and the frequency of natural hazards may substantially alter tourism seasonality in coastal areas. Therefore, the integration of climatic factors into tourism planning should not be limited to current condition

assessments but must also incorporate long-term climate change scenarios in order to enhance the adaptive capacity of the tourism sector in response to increasingly complex challenges.

In summary, the study not only confirms the value of the TCI as an effective tool for assessing tourism climate resources but also highlights its limitations when applied within the specific context of coastal tourism. The integration of quantitative analysis with practical application-oriented perspectives has provided an important scientific and practical foundation for promoting efficient and sustainable tourism development in Nghi Sơn.

4. CONCLUSION

The study assessed the climatic comfort conditions for tourism development in Nghi Son using the Tourism Climate Index (TCI), thereby clarifying the seasonal variability and the suitability of climatic conditions for tourism activities. The results indicate that TCI values in the study area range from 45.4 to 64.6, reflecting clear seasonal differentiation throughout the year. The period from December to April exhibits the most favorable climatic conditions, whereas the summer–autumn months (June to October) show lower levels of climatic comfort due to high temperatures, heavy rainfall, and extreme weather phenomena.

However, when considered within the practical context of local tourism development, particularly coastal tourism associated with representative beaches such as Hai Hoa Beach and Bai Dong Beach, the study reveals a discrepancy between climatic comfort levels based on the TCI and the actual seasonality of tourism activities. Specifically, summer — despite having relatively low TCI values — remains the peak season for coastal tourism, highlighting the important roles of tourism resources and market demand in shaping tourism activities. This finding confirms that climatic assessments should adopt a more flexible approach that takes into account the specific characteristics of each tourism type.

In addition, the study emphasizes the dominant role of rainfall in determining TCI values while also indicating that extreme weather events constitute major obstacles to tourism activities in coastal areas. Based on these findings, the effective exploitation of tourism resources in Nghi Sơn should be associated with appropriate seasonal tourism planning, strengthened climate adaptation capacity, and diversification of tourism products in order to minimize seasonal dependence.

Overall, the research findings provide an important scientific basis for evaluating tourism climate resources in Nghi Son and contribute additional scientific evidence for tourism planning and sustainable tourism development in the context of climate change. In the future, further studies should continue toward integrating tourism-specific indicators for coastal tourism in order to improve the accuracy and applicability of tourism climate assessment methods.

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