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# **The Impact of Climate Change on Tourism in the Mediterranean Region**

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## **I. INTRODUCTION**

According to the United Nations World Tourism Organization (2009), the Mediterranean region is the world's leading tourism destination attracting about one fifth of the total international tourism arrivals and accounting for over 30% of the world's total international tourism receipts. The annual flow of Europeans from the temperate northern regions south to the Mediterranean is the largest single flow of tourists around the world involving 116 million tourists (UNWTO, 2003). The predictability of the weather conditions (sun shine hours, temperature, presence/absence of rain...) is the main characteristic feature of the Mediterranean region (Rutty & Scott, 2010). In terms of motivation for tourists, studies have shown that climate is either the most or one of the most important factors that tourists consider when choosing a travel destination (Kozak, 2002; Martín & Belén, 2005; Scott et al., 2008). So this multi-billion euro industry is highly dependent on climate resources. However, it is now undisputable that the global climate is changing. Indeed, by the end of the 21<sup>st</sup> century, annual temperature in the Mediterranean are expected to increase by 1.48 °C to 8.28 °C (Susan, 2007) accompanied by an increase in the risk of heat waves, wildfires and droughts (Parry, 2007). This climatic change might lead to shifts in touristic flows resulting in large economic consequences. Climate change has been identified by some scientists as the number one challenge to tourism in the 21<sup>st</sup> century (Hall & Higham, 2005). The fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC) gave more significance to tourism as compared to previous assessments and stated that "higher summer temperatures may lead to a gradual decrease in summer tourism in the Mediterranean" (Parry, 2007). Tourism in the Mediterranean region is particularly vulnerable to global climate change since climate is one of the most important natural tourism assets in this part of the world. This paper will discuss the impact of global climate change on tourism and the economy in the Mediterranean region.

## **II. TOURISM AND CLIMATE CHANGE IN THE MEDITERRANEAN REGION**

Studies investigating the impact of climate change on tourism can be broadly divided into two main categories: qualitative and quantitative. Qualitative impact studies do not provide estimates of changes in demand but provide information about vulnerabilities and the likely direction of change (Bigano, Hamilton, Tol, & Mattei, 2008). Quantitative impact studies can be

further grouped into four subcategories: (1) studies that predict changes in the supply of tourism services. This type of studies will not be discussed in this paper since it is usually referred to in the winter sport industry which is prominently present at higher latitudes; (2) studies that predict changes in climatic attractiveness mainly by using tourism climate indices; (3) studies that estimate changes in demand by studying the statistical relationship between demand and weather or climate; (4) studies that estimate tourism flows using simulation models (Bigano et al., 2008).

#### **a. Qualitative impact studies**

The main source of information in qualitative studies is the opinions of experts. In this context, several studies discussed the impact of climate change on tourism in the Mediterranean. For instance, Perry (2000) argues that global warming will result in a “doughnut” shaped pattern of demand in that there will be more tourists in the shoulder seasons (fall and spring) than the summer season. His expectation also include that there will be an increase in the demand for long winter holidays especially from the older generations. In addition, the increased erosion of the beaches caused by sea level rise will indirectly result in a reduction in demand and an increase in the need for planning restrictions in the coastal areas (Perry, 2000). In their book, Viner and Agnew (1999) investigate the current most popular destinations of the British tourist and the consequences for demand for these destinations in the 2020s and 2050s under the effect of climate change. They project that, as temperature and humidity increase, current warm resorts including those of the Eastern Mediterranean will become less attractive. Furthermore, tourism is expected to grow in temperate countries as summer weather becomes more favorable (Viner & Agnew, 1999). In a recent study, 70 European experts in tourism planning were surveyed to determine their opinions regarding the impact of climate change on the Euro-Mediterranean tourism industry (Valls & Sardá, 2009). Experts have agreed that climate change has already began and it is now threatening tourist enterprises so an efficient integrated management system in companies and tourist destinations will be required to cope with its damaging effects. The predicted changes in tourists’ behavior and destination assessment will give rise to an increase in the current trend towards shorter average stays by tourists; a greater “deseasonalisation” of demand since certain seasons of the year will offer better climate conditions; a decline in traditional tourism (sun and sea model) and an increase in residential tourism (home and pools);

a reduction in the most important area of tourist attraction due to damage to coastal infrastructures; and an increase in human health hazards (Valls & Sardá, 2009).

## **b. Quantitative Impact Studies**

*i. Impact on climatic attractiveness:* The impact of climate change on the climatic attractiveness of touristic destinations is usually assessed using the index approach (Bigano et al., 2008). The most commonly used index is the Tourism Climatic Index (TCI) devised by Mieczkowski in 1985. The TCI is based on five variables: daytime thermal comfort index, daily thermal comfort index, precipitation, hours of sunshine, and wind speed (Matzarakis et al., 2007). Following a scheme, all the variables are transformed into ratings. The way the scores are mapped to index values depends on the type and level of touristic activity. For example, swimming requires different climatic conditions than skiing. In Matzarakis et al.'s book (2007) evaluating the impact of climate change on tourism, the index developed corresponded to the climatic conditions required for light outdoor activities such as touring. The TCI scale is divided into 10 categories ranging from "ideal" to "impossible" (table 1). An integration of the HadCM3 forced global climate model with the four standard IPCC special report on emission scenarios (SRES) scenarios (A1F, A2a, B1a, B2a) was performed to construct the dataset for future climatic states (Matzarakis et al., 2007).

Results revealed that the impact is potentially large but not necessarily negative. Assuming the SRES scenario A1F (an emphasis on fossil fuel), projections show that in the summer season, tourist comfort in the Mediterranean region will deteriorate immensely, whereas in the countries of the North of Europe conditions will improve (figures 1 and 2). This will result in an important reduction in the flow of tourists and thus revenues from Northern to Southern Europe in the summer. On the other hand, in the spring and autumn tourist comfort will improve in most of the Mediterranean region especially Spain, Greece, and Turkey. However, since the summer season is the prevalent season for tourism in Europe, it is doubtful whether the deterioration in the summer conditions can be compensated by the improvements in the spring and autumn seasons unless institutional changes were taken simultaneously. Although the above mentioned results pertain to only one of the SERS scenarios, the other scenarios are characterized by the same direction of the changes but in a less dramatic fashion. All four scenarios indicate that the Mediterranean will switch from a summer peak zone to a bimodal zone. By 2020s and in the

A1F scenario, these changes will occur only in Spain. But by 2050s, the entire Mediterranean region will have a bimodal distribution (Matzarakis et al., 2007). These climatic changes are not essentially detrimental for tourism in the Mediterranean region. Indeed, one can argue that having a long tourist season with evenly spread demand rather than only a few weeks of very high demand might be beneficial from an economic efficiency perspective (Matzarakis et al., 2007). However, this is only possible if the holiday period in Europe is changed and this is very difficult to happen.

These results are replicated by a recent study also based on the TCI (Perch-Nielsen, Amelung, & Knutti, 2010). According to this study, climate change is expected to shift the latitudinal band of favorable climate northward resulting in better climate resources in Northern and Central Europe in most seasons. There will be a dramatic decrease in the Mediterranean's suitability for sightseeing tourism in the summer holiday months. Yet, a significant improvement will be seen between October and April. In addition, the Mediterranean region is more vulnerable since it is economically more dependent on tourism than northern Europe. The impact of climate change on tourism can be further complicated by the fact that the definition of "favorable climate" varies from culture to another and even in the same culture it can change over time. For example, Europeans might acclimatize with the gradual warming and thus will prefer a warmer climate. Moreover, the suitability of the weather for sightseeing reflected by the TCI is much different than that of skiing or lying on the beach. For instance, "sand and sea" are the main drivers for German tourists' trips to Southern Europe although Germany has a more favorable climate than southern Europe in the summer (Perch-Nielsen et al., 2010).

In the same vein, by means of a survey including 850 university students in five countries that represent source markets for the Mediterranean, perceptions of "too hot" for comfortable tourism activities at beach and urban destinations were quantified for young adult tourists (Rutty & Scott, 2010). The "unacceptably hot" threshold was determined by the majority of respondents and then compared against thermal conditions in a baseline climate (1961–1990), and an early (2011–2035), mid (2046–2065) and late century (2080–2099) climate change SRES A1B for 10 Mediterranean destinations (five beach and five urban destinations). By early century, this study revealed that no additional beach or urban destinations will become unacceptably hot during the peak summer months. Two additional beach and one additional urban destinations will become unacceptably hot by midcentury. By the late century, nine out of the ten destinations will surpass

the “unacceptably hot” thresholds in the summer months. Figures 3 and 4 summarize the baseline (1961–1990) and the projected (2011–2035 and 2046–2065) monthly ratings of average daytime high temperatures for beach holiday (Rutty & Scott, 2010).

*ii. Impact on demand:* This type of studies scrutinizes the effect of climate change on recreation demand. In studying national demand for domestic and international tourism, Maddison (2001) shows that the number of visits and the consumer surplus per year increase as the temperature rise although only until the optimal maximum daily temperature. In other words, a climate change scenario for the 2030s (a temperature increase of 2°C and a reduction in precipitation of 15% in summer) will result in a 1.3% reduction in trips from the UK to Greece and a 2.2% increase in trips to Spain (Maddison, 2001). Another study revealed that Spain, Portugal and Greece have the most attractive climate in August for the period 1961-1991 (Hamilton, 2004). However, under the scenario of climate change (a 2°C temperature increase, a 15% decrease in precipitation and a 10% decrease in the number of wet days per month), the value of the climate index drops for these countries: “it has become too hot”. In contrast, the attractiveness of Germany’s climate in August increases. Hence, a shift away from Mediterranean holidays in the summer months to domestic holidays can be expected according to this study (Hamilton, 2004).

*iii. Impact on global tourism flows:* This type of quantitative studies consists of estimating tourism flows using simulation models. Simulation models allow to cover the global picture instead of focusing on specific areas or specific origin nationalities. Another advantage of models is that they take into consideration the fact that the climate of the tourists’ home country is also changing. So, the need to travel to a place with a suitable climate may be reduced or increased with climate change (Bigano et al., 2008). For example, The Hamburg Tourism Model (HTM) is a global model of flows from and to 207 countries taking into account the climate of countries as a factor in the estimation of demand to travel and the demand for a particular destination as well. Five variables drive the simulation: general attractiveness, distance, population, income, and temperature. HTM simulates tourism demand from countries (how many tourists each country produces) and the demand for countries (how many tourists take a holiday in each country) (Bigano et al., 2008).

Figure 5 summarizes the impact of climate change on domestic tourist numbers in 2100 for the Mediterranean countries and Portugal. The results are expressed as the difference between the

cases with and without climate change, as a percentage of the case without climate change. The effect of climate change will be a reduction in the numbers on the south side of the Mediterranean and the island nations and an increase in the number of holidays spent in the country of residence on the north side. This can be explained by the fact that average temperatures in the colder countries on the north side will move closer to the optimum for domestic holidays, while in the warmer countries on the south side average temperatures will move away from that optimum (Bigano et al., 2008).

The impact of climate change on international tourist arrivals in 2100 is shown in figure 6. A sharp decrease in arrivals will be seen in most Mediterranean countries. About 60% of the Mediterranean countries will experience a drop in visitors of more than 20%. The only two exception countries that will experience an increase in international arrival numbers are Bosnia & Herzegovina and Slovenia. The reason is that these countries have a cooler climate as compared to the rest of the Mediterranean (Bigano et al., 2008).

The impact of climate change on total tourism expenditures is described in figure 7. Thus figure 7 is the result of the sum of figures 5 and 6 weighted by the initial distribution of domestic and foreign tourists. The impact of climate change on tourism will be economically beneficial for 8 countries located on the north side of the Mediterranean Sea. Oppositely, the other 14 countries will economically lose (up to 31% for Cyprus) (Bigano et al., 2008).

### **III. CONCLUSION**

Climate change will have an important impact on tourism and the economy in the Mediterranean region. The magnitude of the impact might be alleviated by the facts that the warm weather tourism season will be much longer and Europeans might acclimatize with the gradual warming. However, the shift in the timing of the tourists' visits depends on several factors including institutional seasonality and the ability of the touristic destinations to cope with the improved shoulder season climate (Scott, McBoyle, & Schwartzentruber, 2004).

Although the climatic conditions of the Mediterranean region are essential for tourists, they are not the only attraction in this area of the world. The popularity of this important touristic destination is also the result of other factors such as landscapes, beaches, and cultural heritage. Besides, the type of recreational activities changes over time affecting the relevance of the TCI (Matzarakis et al., 2007).



The relationship between climate and tourism is very complex and additional research need to be conducted in order to determine the contribution of the changing climate to the broader picture of influences on tourists. These influences include economic growth, political stability, technological advances, demography, and media effects (Matzarakis et al., 2007; Ruddy & Scott, 2010). Additionally, this paper focused on the monthly and annual means of climatic variables. Nevertheless, extreme events, such as heat waves, torrential storms, and gales might be equally important.

#### IV. REFERENCES

- Bigano, A., Hamilton, J. M., Tol, R., & Mattei, F. E. E. (2008). Climate change and tourism in the mediterranean. *Research Unit Sustainability and Global Change FNU-157.Hamburg University and Centre for Marine and Atmospheric Science, Hamburg*.
- Hamilton, J. (2004). Climate and the destination choice of german tourists.
- Higham, J., Hall, C. M., Hall, M., & Higham, J. (2005). Making tourism sustainable: The real challenge of climate change? *Tourism, Recreation and Climate Change*, , 301-307.
- Kozak, M. (2002). Comparative analysis of tourist motivations by nationality and destinations. *Tourism Management*, 23(3), 221-232.
- Maddison, D. (2001). In search of warmer climates? the impact of climate change on flows of british tourists. *Climatic Change*, 49(1-2), 193-208.
- Martín, G., & Belén, M. (2005). Weather, climate and tourism a geographical perspective. *Annals of Tourism Research*, 32(3), 571-591.
- Matzarakis, B. A. B., Blazejczyk, K., & Amelung, B. (2007). Climate change and tourism assessment and coping strategies. *Maastricht-Warsaw-Freiburg.ISBN*, , 978-900.
- Parry, M. L. (2007). *Climate change 2007: Impacts, adaptation and vulnerability: Working group II contribution to the fourth assessment report of the IPCC intergovernmental panel on climate change* Cambridge University Press.
- Perch-Nielsen, S. L., Amelung, B., & Knutti, R. (2010). Future climate resources for tourism in europe based on the daily tourism climatic index. *Climatic Change*, 103(3-4), 363-381.
- Perry, A. (2000). Impacts of climate change on tourism in the mediterranean: Adaptive responses.
- Rutty, M., & Scott, D. (2010). Will the mediterranean become “too hot” for tourism? A reassessment. *Tourism and Hospitality Planning & Development*, 7(3), 267-281.

- Scott, D., Amelung, B., Becken, S., Ceron, J., Dubois, G., Gossling, S., . . . Simpson, M. (2008). Climate change and tourism: Responding to global challenges. *World Tourism Organization, Madrid*, 230
- Scott, D., McBoyle, G., & Schwartzentruber, M. (2004). Climate change and the distribution of climatic resources for tourism in north america. *Climate Research*, 27(2), 105-117.
- Susan, S. (2007). *Climate change 2007-the physical science basis: Working group I contribution to the fourth assessment report of the IPCC* Cambridge University Press.
- United Nations World Tourism Organization (UNWTO). (2003). *Climate change and tourism, Proceedings of the 1st International Conference on Climate change and Tourism. Djerba, Tunisia, 9-11 April 2003*. (Madrid: United Nations).
- United Nations World Tourism Organization (UNWTO). (2009). *World Tourism Barometer* (Madrid: United Nations).
- Valls, J., & Sardá, R. (2009). Tourism expert perceptions for evaluating climate change impacts on the euro-mediterranean tourism industry. *Tourism Review*, 64(2), 41-51.
- Viner, D., & Agnew, M. (1999). *Climate change and its impacts on tourism* Climatic Research Unit, University of East Anglia.

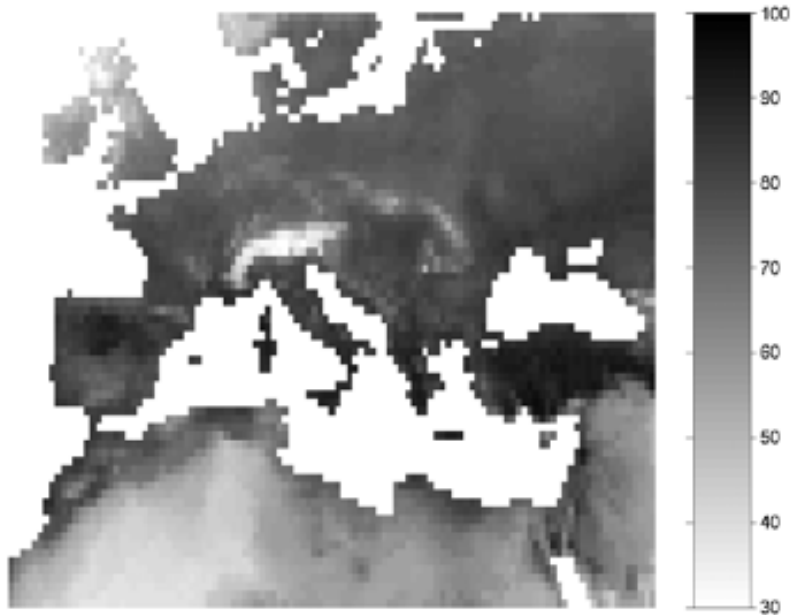
## VI. APPENDIX

**Table 1:** Tourism Climatic Index Rating System

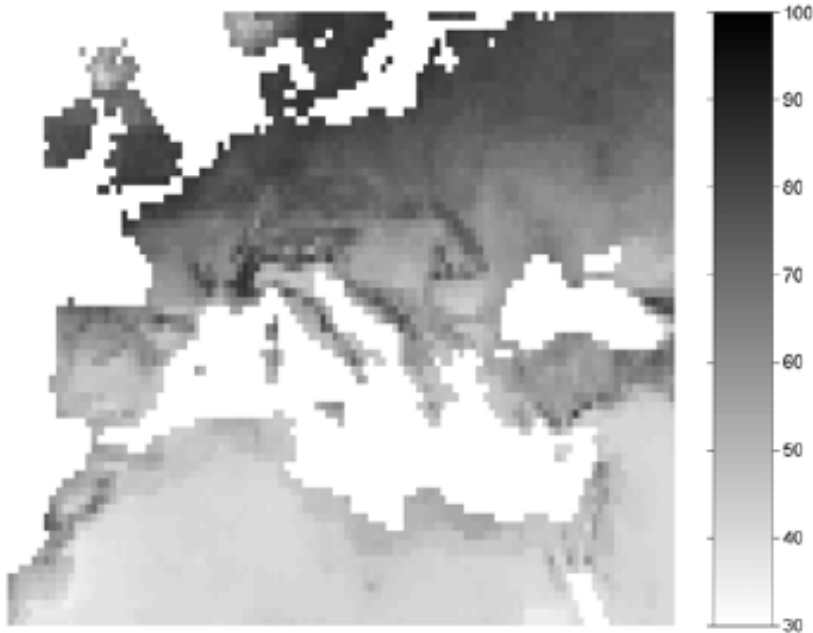
<b>Numeric value of index</b>	<b>Description of comfort level for tourism activity</b>
90 – 100	Ideal
80 – 89	Excellent
70 – 79	Very good
60 – 69	Good
50 – 59	Acceptable
40 – 49	Marginal
30 – 39	Unfavourable
20 – 29	Very unfavourable
10 – 19	Extremely unfavourable
Below 9	Impossible

Source: Mieczkowski (1985).

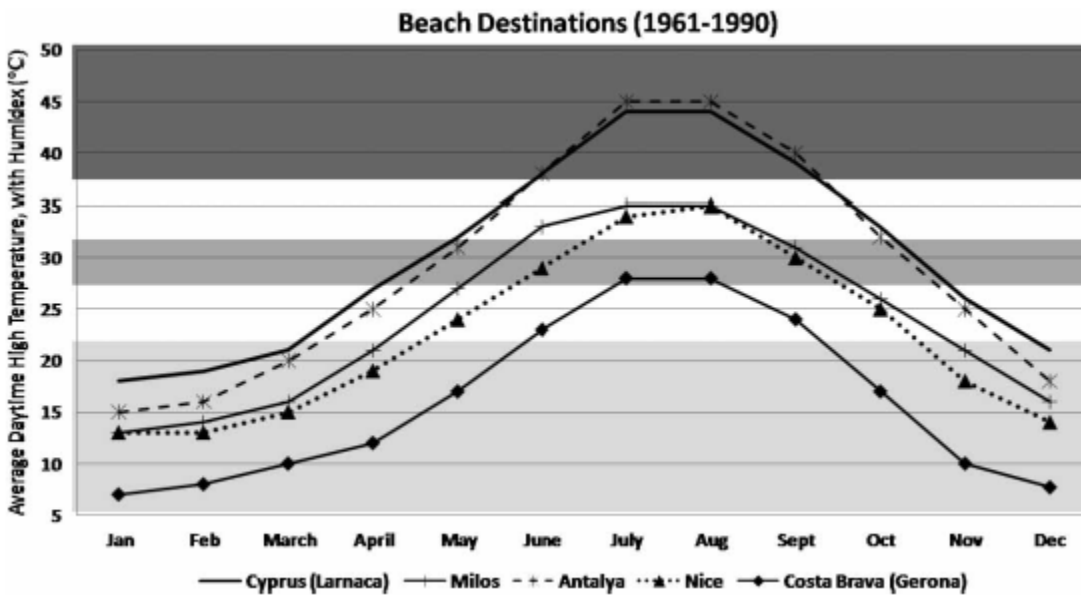
**Figure 1:** TCI scores in summer, 1961-1990 (Matzarakis et al., 2007)



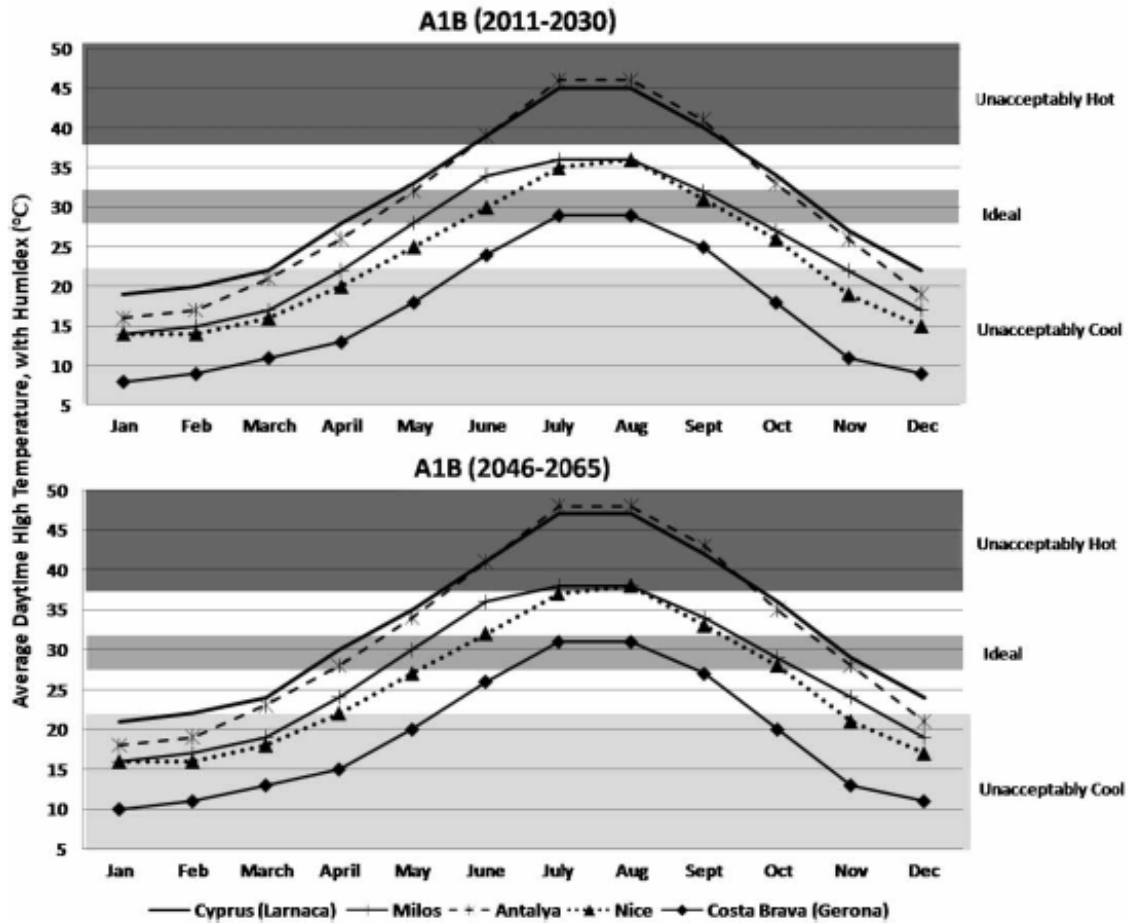
**Figure 2:** TCI scores in summer, 2070-2099, A1F scenario (Matzarakis et al., 2007)



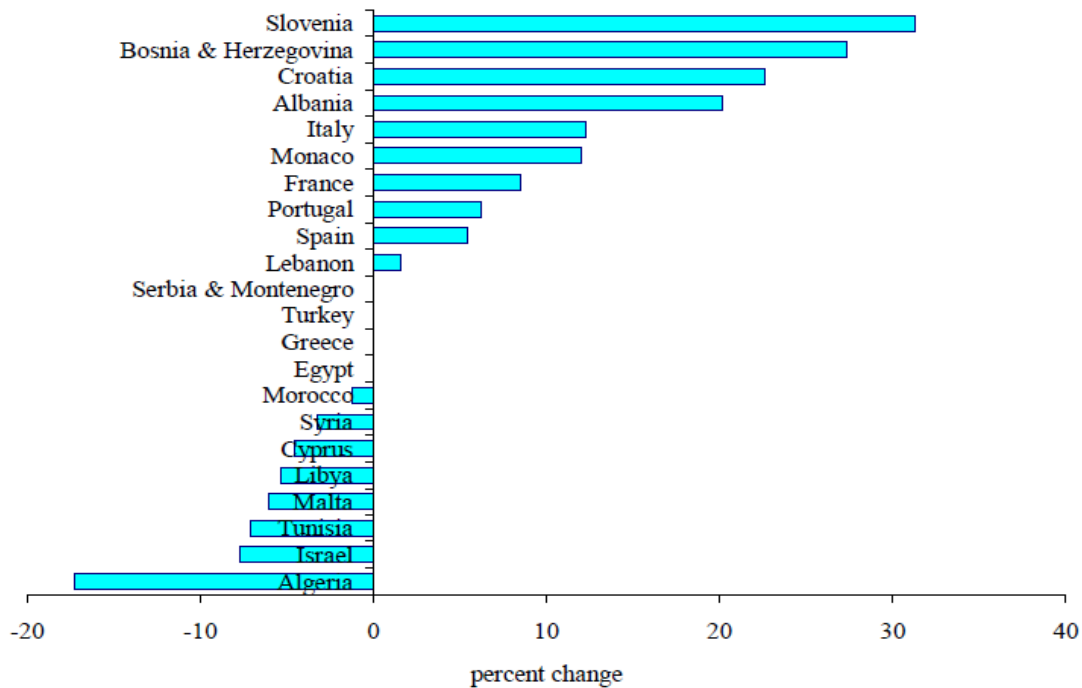
**Figure 3:** Baseline monthly ratings of average daytime high temperature (1961–1990) for beach holiday destinations (Rutty & Scott, 2010)



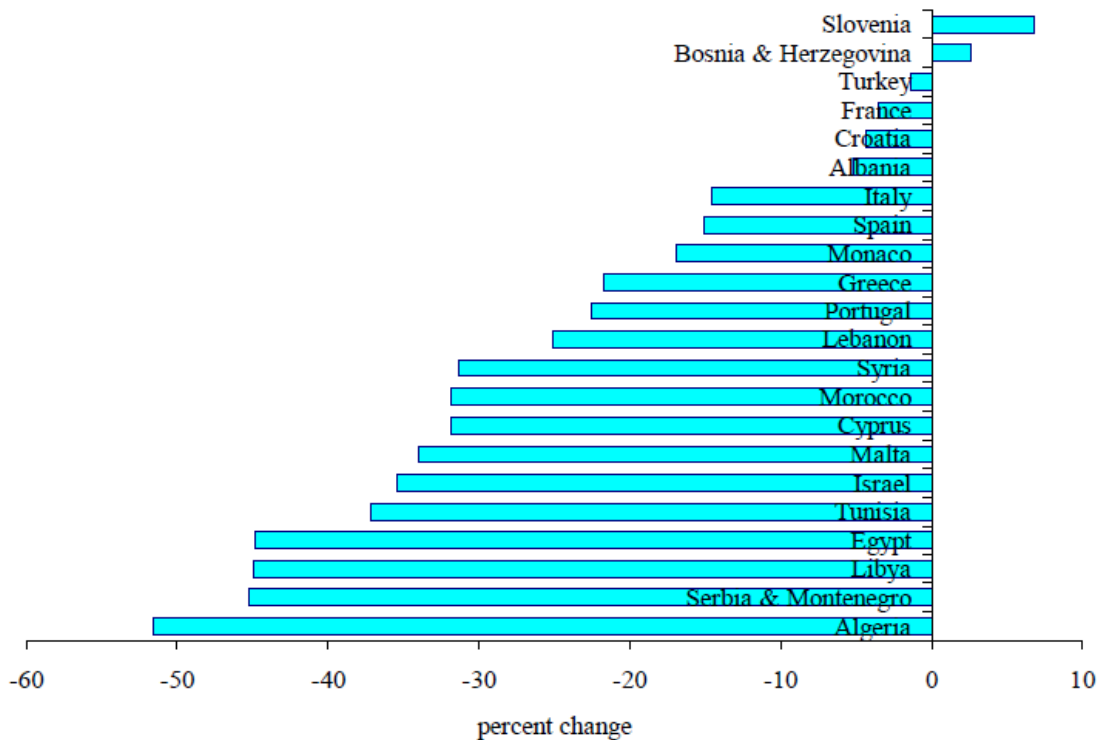
**Figure 4:** Projected monthly ratings of average daytime high temperatures for 2011–2030 and 2046–2065 for beach holidays (Rutty & Scott, 2010)



**Figure 5:** The effect of climate change on domestic holidays in 2100, as a percentage of holiday numbers without climate change, for the countries on the Mediterranean and Portugal (Bigano et al., 2008)



**Figure 6:** The effect of climate change on international arrivals in 2100, as a percentage of arrival numbers without climate change, for the countries on the Mediterranean and Portugal (Bigano et al., 2008)



**Figure 7:** The effect of climate change on total tourism expenditures in 2100, as a percentage of expenditure without climate change, for the countries on the Mediterranean and Portugal (Bigano et al., 2008)

