

# CLIMATE IMPACTS ON TOURISM IN SPAIN

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## ABSTRACT

Tourism is an important sector of the Spanish economy. The popularity of Mediterranean beaches does not decrease even during the European economic crisis. Rising temperature and extreme weather events may threaten the popularity of summer tourism, both directly and indirectly. Unpleasant heat waves and severe persistent droughts can occur even without a systematic change of the climatic characteristics, but the growing frequency and severity of such events are expected due to the global warming process. Observed data shows that hot spells hardly affect the attractiveness of Spanish beaches in the direct way. However, in connection with extreme climatic events, lack of fresh water and the overload of electrical and transporting system may reduce the exploitation of good geographical conditions. Thus the maintenance and development of tourism facilities are essential for sustainable tourism. With a high level of coordinated regulations and good information transfer the difficulties can be overcome.

**Key words:** Climatic impacts, hotel nights, heat stress, beach-tourism, Spain.

## RESUMEN

El turismo es un importante sector de la economía española. La popularidad de las playas mediterráneas no decrece aún en los años de crisis económica europea. El aumento de la temperatura y fenómenos meteorológicos extremos pueden amenazar la popularidad del turismo de verano, tanto directa como indirectamente. Olas de calor y desagradables graves sequías persistentes pueden ocurrir aún sin cambio sistemático de las características climáticas, pero la creciente frecuencia y gravedad de tales eventos se espera debido al proceso de calentamiento global. Los datos observados muestran que los períodos de calor casi no afectan el atractivo de las playas españolas en la forma directa. Sin embargo, en relación con los fenómenos climáticos extremos, la falta de agua dulce y la sobrecarga del sistema eléctrico y el transporte pueden reducir la explotación de las buenas condiciones geográficas. Así, el mantenimiento y desarrollo de instalaciones turísticas son esenciales para el turismo sostenible. Con un alto nivel de regulaciones coordinadas y la transferencia de información bien las dificultades se pueden superar.

**Palabras claves:** Impactos climáticos, hotel noches, estrés de calor, turismo en playas, España.

## 1. INTRODUCTION

Spain is a popular tourist destination owing to its historical towns, mountains and long coastal lines. The generally pleasant and sunny climate contributes to the prosperity of Spanish tourism. In this study we present a brief characterisation of the Spanish climate and its tourism-impacts relying on observed climatic data and data of hotel nights spent by foreign visitors (HN). We examine the characteristics of foreign tourists' flow in the last 12 years for nine provinces where HN are outstandingly high. Although the time span of HN data is short, the results will allow us to draw some qualitative conclusions.

## 2. DATA AND METHODS

### 2.1. Tourism data

We have the monthly data of HN for the 52 provinces of Spain between 1999 and 2010 provided by the Spanish National Institute, Encuesta de Ocupación Hotelera. For the present examinations we have selected nine provinces. Four provinces are next to the Mediterranean (Balearics, Barcelona, Alicante and Malaga). Two further provinces belong to the Canaries (Las Palmas and St. Cruz de Tenerife), but the data of the latter two were unified before the examinations and they are referred as one province, i.e. Canaries hereafter. The other three provinces are situated in the Peninsula, they do not have Mediterranean coast, but their HN show regional maximum. From the latter three provinces Coruña represents northern Spain, Madrid the central area and Sevilla the southern inland region. Fig. 1 shows the geographical situation of the selected provinces. The large ratio of the Mediterranean provinces selected is reasoned by the fact that approximately 90% of foreign visitors are beach users, but the climate of beaches is various according to their geographical situation. On the other hand, the selected provinces with Mediterranean beaches and the ones in the Canaries had the greatest number of foreign visitors between 1999 and 2010 except that Girona had more visitors than Alicante.

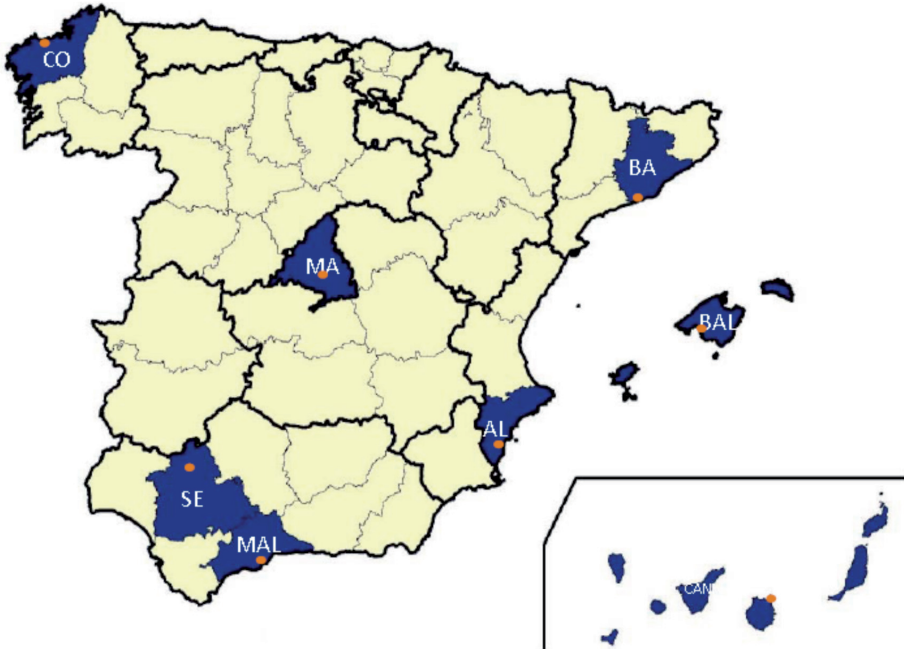


FIG. 1: *The Spanish provinces whose data are analysed in the study. CO: Coruña, BA: Barcelona, MA: Madrid, BAL: Balearics, SE: Sevilla, MAL: Malaga, AL: Alicante, CAN: Canaries.*

### 2.2. Observed climatic data

Monthly climatic time series of Spanish observing stations are used in the study. The data is provided by the Spanish Meteorological Agency in a free web-page ([ftp://ftpdatos.aemet.es/series\\_climatologicas/](ftp://ftpdatos.aemet.es/series_climatologicas/)). Data of 114 stations are available in the website. We examine six climatic variables, namely mean temperature ( $T_m$ ), mean of daily maximum temperatures ( $T_x$ ), precipitation amount ( $P_t$ ), number of precipitous days ( $P_d$ ,  $P_t > 0.1$  mm), sunshine duration in the ratio of astronomical potential ( $S_s$ ), and wind velocity ( $V_v$ ). Note that the data presented in the study are always monthly characteristics, even if the time span is longer than one month. Note also that while HN is always for whole provinces, the climatic data is always for a specific site of a province.

### 2.3. Data preparation and basic quality control

The raw data were checked for their physical reality. The data out of the ranges  $-5^{\circ}\text{C} < T_m < 33^{\circ}\text{C}$ ,  $0^{\circ}\text{C} < T_x < 40^{\circ}\text{C}$ ,  $0\text{mm} < P_t < 3000\text{mm}$ ,  $0 < P_d < 31$ ,  $1\% < S_s < 98\%$  or  $0.5\text{ m/s} < V_v < 12\text{ m/s}$  were checked individually. These controls indicated serious quality problems only with the wind speed data.

### 2.4. Homogenisation of temperature data

Climatic observations often have temporal, systematic biases due to technical errors or environmental changes (Aguilar *et al.* 2003).  $T_m$  and  $T_x$  data have been homogenised, because temperature is generally the most important explanatory variable in holiday destination choice among climatic characteristics (Bigano *et al.*, 2006). For homogenisation purpose data of nearby stations relative to the examined ones (so-called candidate series) were also utilised. The ACMANT homogenisation method (Domonkos, 2011) was applied. It is a fully automatic method, and beyond homogenisation it filters the outliers and fills the data gaps. Note that in an international blind test experiment funded by the European Union, ACMANT turned out to be one of the most reliable and most accurate homogenisation methods (Venema *et al.*, 2012).

## 3. CLIMATIC POTENTIAL OF SPAIN FOR TOURISM

Table 1 presents some midsummer (July & August) climatic characteristics of six Spanish observing sites for the most recent 30-year period (1982-2011). July and August were chosen because it is the high season in tourism.

According to Eugenio-Martin and Campos-Soria (2010)  $P_t = 60\text{mm}$  and  $P_d = 10$  are critical thresholds in tourists' demands. Table 1 shows that the summer climate of Spain is generally very favourable for tourism: the weather is mostly sunny and rainy days are rare or very rare. The oceanic coastline is partly exception, since there the frequency of rainy days is close to the suggested threshold. The mean temperatures are somewhat higher than which would be optimal for heat comfort (Lise and Tol, 2002, Scott *et al.*, 2009), i.e. higher than  $21\text{-}24^{\circ}\text{C}$ , particularly in the southern inland areas. By contrast, northern Spain does usually not have too hot summers, even the oceanic coastline is slightly cooler than the optimal temperature. In the Mediterranean areas and in the Canaries the temperature is slightly higher than the optimal, but for beach tourism a light heat stress is definitely favourable (Freitas, 1990, Hamilton *et al.*, 2005). In the Canaries and in certain sections of the southern Mediterranean the frequently strong wind worsens the climatic potential for summer tourism.

	$T_m$ ( $^{\circ}\text{C}$ )	$T_x$ ( $^{\circ}\text{C}$ )	$P_t$ (mm)	$P_d$ (day)	$S_s$ (%)	$V_v$ ( $\text{ms}^{-1}$ )
<b>Barcelona</b>	24.9	28.8	42.6	4.6	64.3	4.0
<b>P. Mallorca</b>	26.0	29.6	14.0	2.5	75.3	2.0
<b>Alicante</b>	26.1	30.7	5.3	1.7	72.7	2.2
<b>Málaga</b>	26.2	30.8	2.9	0.5	76.7	3.8
<b>Las Palmas</b>	24.6	27.1	0.3	0.3	72.3	11.1
<b>Madrid</b>	25.4	32.0	10.4	2.7	78.8	2.3
<b>Coruña</b>	19.6	22.8	35.8	9.7	53.3	3.3
<b>Sevilla</b>	28.3	35.9	3.9	0.6	78.6	3.1

TABLE 1: Mean monthly climatic characteristics (1982-2011) of the high tourism season (July & August) for eight popular tourist destinations

In the other parts of the year, rainy days are generally more frequent and temperatures are cooler than in summer (not shown), but from autumn to spring Spain has still one of the most pleasant climate in Europe. Winters are particularly mild and sunny in the southeastern and southern Mediterranean areas, and even more in the Canaries.

#### 4. RECENT TENDENCIES IN CLIMATE AND TOURISTS' FLOW

Table 1 showed that temperature can be considered the only factor whose variability might substantially influence the tourists' destination choice, since the other climatic properties are generally favourable with few exceptions. Higher than optimal temperatures in Spain occur mostly in July or August and thus they may affect the tourism activity just in the high season.

Summer temperatures in Spain has increased in the last 50 years (Fig. 2) and further, more intensive increase is projected with the progress of climate change (Cattiaux *et al.* 2012, Déqué *et al.*, 2012, etc.). Here we examine in which degree the observed HN reflects the impact of rising temperature. Figure 2 shows that the temperature changed similarly in the last 50 years in all parts of Spain, i.e. most of the increase happened between 1975 and 1990 and since then there is hardly any trend.

Figure 3 presents the monthly trends of HN between 1999 and 2010 for examining the changes in the seasonal distribution of HN in connection with tourists' climate demands. Although clear warming trend was not observed for this short period, extreme hot spells occurred (not shown) and most midsummer temperatures were higher than the optimal temperatures, therefore the relative decline of midsummer tourism could be expected. In Fig. 3a the changes in the Mediterranean provinces are shown and these trends are clearly opposed with the supposed tourism demands: HN in summer and early autumn increased or stagnated, but in all the other parts of the year HN declined. The trends for Barcelona are exceptional, i.e. HN increased there all the year round. However, the ratio of summer visitors has also increased for Barcelona, since the largest increase is observed for summer. In contrast with the first panel, in Fig. 3b only increasing or stagnating trends can be seen. The greatest increase appears for the winter season of Canaries. It is interesting to compare the HN tendencies between the Canaries and the Mediterranean, since the tourists for these destinations are primarily beach users. The summer tourism has risen in both regions, but the trends for winters are opposed and it seems that the substantial growing in the popularity of the Canaries has happened at the expense of the winter tourism to the Mediterranean. It can be explained with the more pleasant winter climate in the Canaries than at the Mediterranean or with economical factors or with both kinds of factors. The changes of HN in the inland areas are small, except for Madrid, but its main reason is that the absolute numbers of HN are also relatively small for Coruña and Sevilla. For Sevilla, the highest increase of HN occurred in late autumn and early winter, but the increase in July is also relatively large. In Madrid and in Coruña the largest increases of HN happened in May and another seasonal peak appears in October for both provinces. These results are in line with the supposed climate demands in case of Madrid, but for Coruña not at all.

A twelve year period is likely too short for drawing profound consequences about trends and their reasons, therefore we examine also the mean ratios of summer HN (July & August) relative to the all-year HN (HN<sub>a</sub>) and relative to the summer half year HN (from May to October, HN<sub>b</sub>). If HN was evenly distributed throughout the year, HN<sub>a</sub> (HN<sub>b</sub>) would be 16.7% (33.3%). Note that certain concentration of HN to summer should be expected even in neutral climatic conditions, since large number of tourists are forced to spend their holidays in July or August.

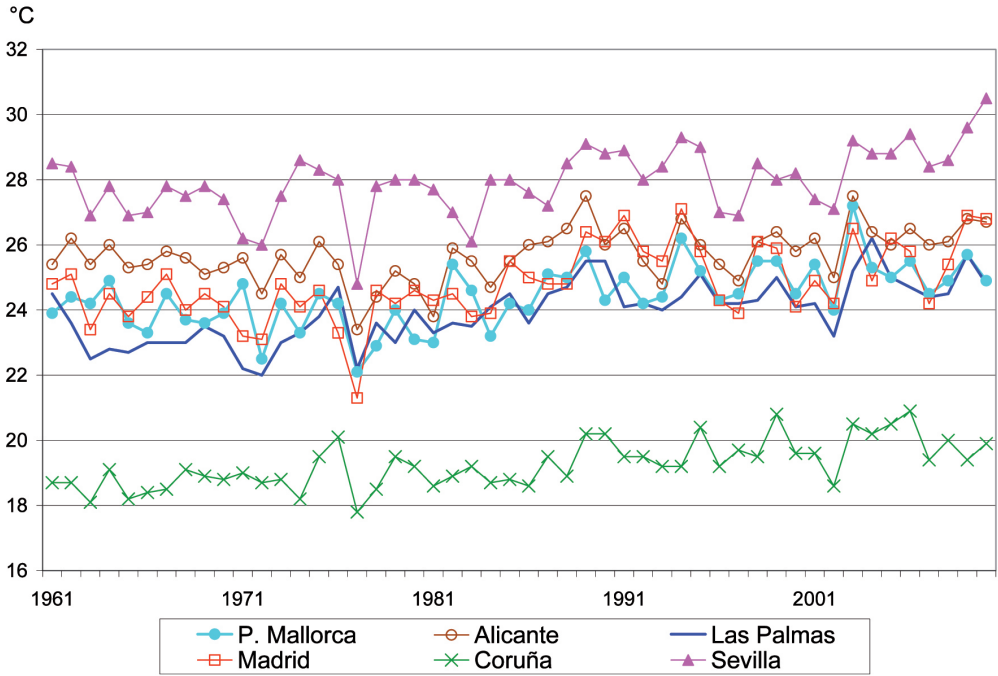
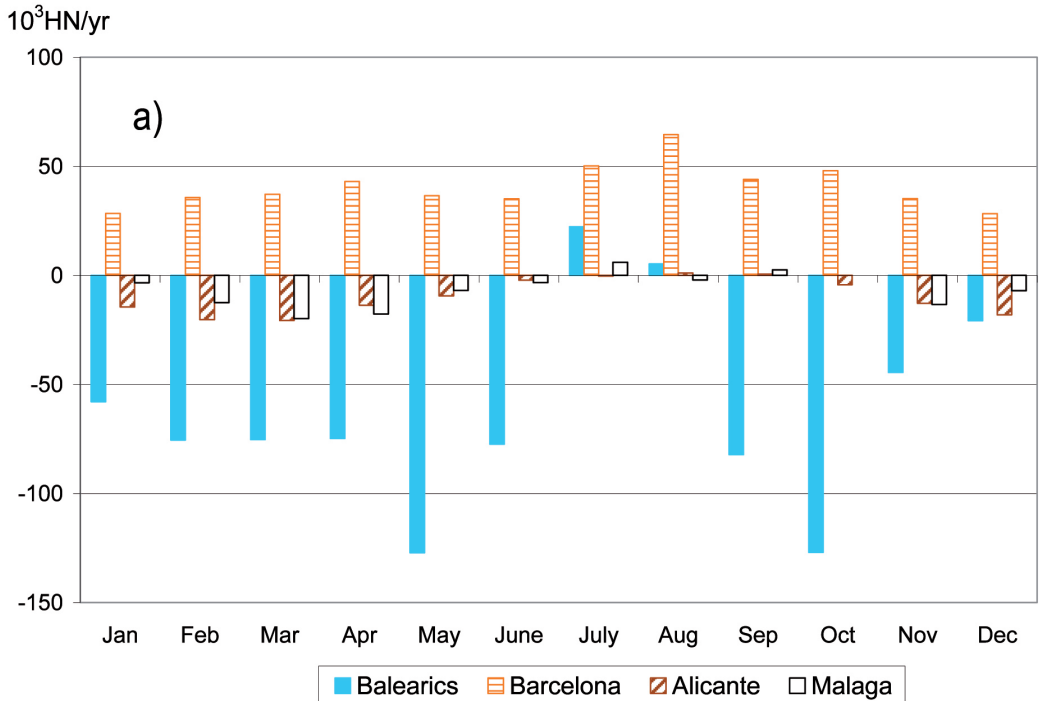


FIG. 2: Mean temperatures for July & August between 1961 – 2010.



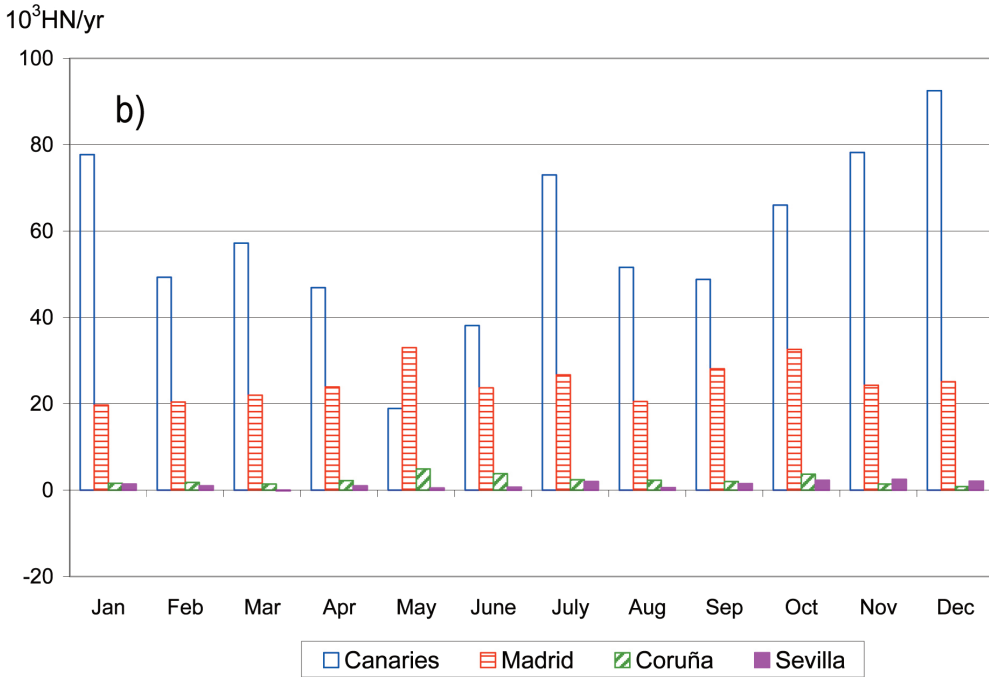


FIG. 3: Mean annual change for monthly hotel nights (HN) in Spanish provinces.

Table 2 shows that the lowest summer concentrations of HN are in Madrid and Sevilla, while the highest ones are for the Balearics and Barcelona. The former results can be reasoned well by the hot summer climate of the tourist destinations, but the causes of the latter results are less obvious. Table 2 and Figure 3 together indicate that most tourists prefer to visit the Mediterranean in summer, in spite of the higher than optimal temperatures. This finding refers particularly to the northeastern coastlines and the Balearics.

	HNa(%)	HNb(%)		HNa(%)	HNb(%)
<b>Barcelona</b>	28.3	41.3	<b>Las Palmas</b>	17.1	36.2
<b>P. Mallorca</b>	35.9	43.3	<b>Madrid</b>	16.4	30.4
<b>Alicante</b>	18.6	33.7	<b>Coruña</b>	28.0	39.8
<b>Málaga</b>	22.3	35.3	<b>Sevilla</b>	16.5	28.1

TABLE 2: Summer concentration of hotel nights: july & august relative to the annual total (HNa) and july & august relative to the period of may – october (HNb)

### 5. DISCUSSION AND CONCLUSIONS

It has been reported that the focus of summer tourists’ flow will shift to the northern part of Europe with the progress of global warming during the 21<sup>st</sup> century (Perch-Nielsen *et al.*2010, Amelung and Moreno, 2012, etc.), because tourists do not like too hot climate. On the other hand, most tourists like the sparkling sunshine of subtropical summers and for beach users slight heat stress is definitely favourable. It is hard to calculate the real heat tolerance of tourists, but the observed data suggests greater tolerance than that would be coincidental with the mentioned prediction of shift in tourists’

flow. The two most important explanations of the great heat tolerance is the air conditioning, which is general in Spanish hotels, and that the vast majority of foreign tourists are beach users. There are further evidences that the Mediterranean is a great tourist attraction and most tourists prefer to visit it in summer when the weather is continuously warm and sunny and the temperature of sea water is pleasant for bathing. Examining the destination choices of English residents, Coshall (2009) found. that i) the number of English visitors to Spain increases, ii) the increasing trend was not influenced at all by the extreme hot event of August 2003, iii) When English citizens spend their holidays in Spain the concentration to summer months clearly increases, while this seasonal concentration has slighter or no increasing trend for the destinations of many other countries. Web-camera observations of Ibarra (2011) indicated that more people spend their holiday during the hottest month (August) in Benidorm (the second most popular beach of the world) than during the seasons of the assumed thermal optimum. Summer visitors of Benidorm could choose one of the numerous less hot and more easily accessible Mediterranean resorts northwards from Benidorm. The web-camera data also showed that the beaches in Benidorm were intensively used in the hottest hours of the days in August (Ibarra, 2011).

Surveys show that the climate is the second most important factor in tourists' destination choice (Shiue and Matzarakis, 2011), but it is also known that the climate is not always a determinant factor (Hamilton *et al.*, 2005). Our data of sight-seeing and rural tourism also tend to confirm the latter finding. Although in the central and southern inland areas the high season shows dual maximum in late spring and autumn, the most recent tendencies also show the increase of summer tourism in the great historical towns. Interesting conclusions can be drawn from the comparison of tourism seasonalities in Barcelona and Coruña. Coruña has much cooler climate than that in most other parts of Spain, e.g. than in Barcelona, but the summer concentration of HN is slightly lower in Coruña than in Barcelona. In addition, the most recent tendencies show that HN in Coruña grows most intensively in May, while in Barcelona in August. One possible explanation is that a part of the visitors of Barcelona province are beach users or can connect the sight seeing with sun-sand-sea tourism. Other explanations can be found in the literature, i.e. it was reported that the destination choice is a complex decision (Crouch, 2011) in which the psychological factors are very important (Ryan, 1991, Lise and Tol, 2002).

Note that low cost tourism is more sensible to too high temperatures than hotel tourism (Perry, 2006), since low cost tourists often do not have air conditioned accommodation. Consequently, our findings cannot be extrapolated to the low cost tourism.

The results of this study show that tourism managers need not to be afraid of the direct effects of warming climate, what is more, the summer tourists' flow to Spain is still increasing. On the other hand, climate change might worsen the conditions of tourism industry. Climate change could cause changes in the capacity (in various ways), in the costs of the maintenance, and even in the aesthetic characteristics of tourist destinations. Indirect impacts can be positive or negative on tourism, but unfortunately, most indirect impacts of the predicted regional climate change in Spain are negative due to the likely intensification of hot spells and drought events (IPCC 2007, Sánchez *et al.*, 2011, etc.). The maintenance of freshwater supply could be one of the most critical factors, since Spain uses a rather large portion of the renewable freshwater (32% was in 2000, Gössling *et al.*, 2012) and it indicates high vulnerability to drought. Severe shortage of freshwater has already occurred in Spain (e.g. in Mallorca, Perry, 2006).

The problems of maintaining good conditions and safety of services in changing climate may be even more difficult where the number of visitors is high and the tourists' flow is increasing. Therefore appropriate regulations and effective information transfer are generally needed (Jang, 2011, Guizzardi and Mazzocchi, 2010). Good regulations must be based on strategic planning that also takes into consideration the local conditions and the needs and intentions of the local residents. With such regulations, many sites of Spain will be able to keep or intensify their attractiveness for tourists in spite of the global warming.



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