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ORIGINAL PAPER

The Spanish tourist sector facing extreme climate events: a case study of domestic tourism in the heat wave of 2003

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Abstract This research explores, by means of a questionnaire-based survey, public knowledge and perception as well as the behaviour of young Spanish tourists before, during and after the summer holiday period affected by an episode of extreme heat in 2003. The survey was administered between November and December 2004. The extraordinary heat wave of the summer of 2003 can be seen as an example of a normal episode in terms of the predicted intensity and duration of European summers towards the end of the twenty-first century. It can therefore be used as the laboratory setting for this study. In this context, the use of the climate analogue approach allows us to obtain novel perspectives regarding the future impact that this type of event could have on tourist demand, based on a real experience. Likewise, such an approach allows the strategies of adaptation implemented by the different elements in the tourist system in order to cope with the atmospheric episode to be evaluated. Such strategies could prove useful in reducing vulnerability when faced with similar episodes in the future. The main results indicate that Spanish tourists (young segment market) are flexible in adapting to episodes of extremely high temperatures. Their personal perception of the phenomenon, their behaviour and the adaptation measures implemented to a greater or lesser extent before that time, reduce the vulnerability of the sector when faced with this type of event, at least from the point of view of this young segment of the internal national market. In Spain, the episode of extreme heat of 2003 has led to the implementation or improvement of some adaptive measures after the event, especially in the fields of management, policy and education.

Keywords Heat wave · Tourism · Adaptation · Climate change · Mediterranean

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Introduction

Knowledge of the average global warming affecting the Earth's surface in the course of the last century has meant that the phenomenon of climate change has today become one of the main subjects of debate and reference in the context of the world economic policies that are to govern the future of the planet in the years to come. The importance of tourism as part of the global economy, and the undeniable links that this activity has with atmospheric factors, make it advisable to look at climate change in all its manifestations: any kind of alteration to current climate patterns in the different regions of the planet will bring about considerable changes in a fair proportion of current tourist sites. The Spanish mainland and islands, the geographical framework for our research, is in this respect one of the areas where predicted changes in climate will generate more significant alterations (Ministerio de Medio Ambiente 2005).

In the case of Spain, one aspect of future climate predictions that is just as important as changes in the average values for temperature and rainfall is the possible alteration in the intensity and frequency of extreme climate events. What is interesting about this type of analysis is that the impact of alterations in future climate due to changes in climate extremes would generally be more serious than that associated with changes in the average climate (Ministerio de Medio Ambiente 2005). In this investigation, of the various extreme climate events of interest in our geographic area of study, we will focus our attention on what are known as “heat waves”.

The damage caused by these types of episode on the physical environment, socio-economic activities and human health are usually considerable, as pointed out in a number of studies (Díaz et al. 2006; García et al. 2005; Martínez et al. 2004). In the case of tourism, it is known that tourist behaviour is influenced by, among other things, the weather (Butler 2001; Crouch 1994; Gómez-Martín 2005). Atmospheric factors have a significant influence on all stages that make the holiday experience (Gössling et al. 2012). For example, in the pre-holiday period, both in destination and in origin, atmospheric factors are taken into account when selecting where and when to travel, confirming notable differences depending on the origin of tourists and tourist modalities practiced (Eugenio-Martin and Campos-Soria 2010; Hu and Ritchie 1993; Jönsson and Devonish 2008; Kozak 2002; Lohmann and Kaim 1999; Shoemaker 1994). In the holiday period, the weather has a significant influence on the behaviour of tourists at the destination, in the feeling of enjoyment-comfort-security and scheduling of leisure and tourism (Agnew and Palutikof 2001, 2006; Gómez-Martín and Martínez-Ibarra 2012; Koenig and Abegg 1997; Maddison 2001; Ploner and Brandenburg 2003; Scott and Jones 2006). In the post-holiday period, the weather during the tourist experience influences the final assessment of the trip and satisfaction rates. This latter factor can condition future choice of destination and the degree of customer loyalty (Coghlan and Prideaux 2009; Silberman and Klock 1988). Considering this, heat waves—as an extreme weather event—can compromise the normal behaviour of tourists at different holiday periods and can cause unexpected changes.

Studies that try to relate behaviour of tourism demand with extreme weather events such as heat waves or abnormal temperature increases are still quite rare. Some studies directed at different European tourist source markets found that abnormally high summer temperatures promote domestic tourism, with more benefit to coastal destinations than inland destinations. Similarly, international departures are diminished during abnormally hot summers (Agnew and Palutikof 2006; Bigano et al. 2005; Eugenio-Martin and Campos-Soria 2010; Giles and Perry 1998). Research also indicates that domestic movements are more determined by present weather conditions, compared with international movements, which are influenced by the atmospheric conditions registered in previous holidays (Agnew and Palutikof 2006; Bigano et al. 2005; Jørgensen and Solvoll 1996). In addition, Rutty’s (2009) warning that notable differences can be observed depending on the demographic segment of tourists and modality practiced should be noted.

Studies carried out by Gómez-Martín and Martínez-Ibarra (2012) and Martínez-Ibarra (2011) on sun and beach tourism on the Spanish Mediterranean coast have shown a positive correlation between maximum temperatures and attendance of the beaches without finding a “ceiling” temperature that marks a reversal in the trend. However, there are several reports that warn of the negative effects that future increases in temperature and extreme events such as heat waves will have on tourism in the Mediterranean sun and sand (Ehmer and Heymann 2008; IPCC 2007). Perhaps, as some authors warn, it is necessary to define what “too hot” means for tourists before making such major statements (Rutty 2009; UNWTO-UNEP-WMO 2008).

This research aims to explore, by means of a questionnaire-based survey, public knowledge and perception as well as the behaviour of young Spanish tourists before, during and after the summer holiday period affected by an episode of extreme heat in 2003. The extraordinary heat wave of the summer of 2003 can be seen as an example of a normal episode in terms of the predicted intensity and duration of European summers towards the end of the twenty-first century. It can therefore be used as the laboratory setting for this study. In this context, the use of the climate analogues approach allows us to obtain novel perspectives regarding the future impact that this type of event could have on tourist demand, based on a real experience. Likewise, such an approach allows the strategies of adaptation implemented by the different elements in the tourist system in order to cope with this atmospheric episode to be evaluated. Such strategies could prove to be useful in reducing vulnerability when faced with similar episodes in the future. The climate analogue approach gave us access to knowledge concerning two of the research dimensions involved in studies of tourist demand: behaviour and perception (Gómez-Martín and Martínez-Ibarra 2012). These aspects can be very useful in interpreting the present and future impact on tourist activity of extreme atmospheric events (in the case of the future impact, with the limitation of being unable to consider changes that may take place in terms of technology, society and the behaviour of tourists). This approach has been used in several studies in the field of tourism climatology (Dawson et al. 2009; Giles and Perry 1998). Furthermore, it has been used widely in the field of agronomy (Darwin et al. 1995; Mendelsohn and Dinar 1999; Parry and Carter 1988), urban planning (Hallegatte et al. 2007; Kopf et al. 2008), regional planning (Kellett et al. 2011) and ecology (Saxon et al. 2005; Williams et al. 2007).

The episode analysed here was one of the most important to occur on the Spanish mainland in the period 1968–2010 (Gómez-Martín et al. 2012). From analysis of the summer of 2003, it can be seen that, except for specific locations on the coast, during practically the whole summer (June, July and August) the prevailing weather conditions were those of a heat wave, reaching records both in terms of maximum and minimum temperatures in many meteorological observatories on the mainland and in the Balearic Islands (Tables 1, 2). The

Table 1 Records of absolute maximum temperatures recorded in summer 2003

Weather station	2003	Previous record	
	Temperature (°C)	Temperature (°C)	Year
Oviedo	35.6	35.5	2000
San Sebastian	38.6	38.2	1928
Barcelona	37.3	35.0	1948
Girona	41.2	39.0	1982
Badajoz	44.8	44.4	1995
Huelva	43.4	43.2	1946

AEMET 2007

hottest period of the summer of 2003 lasted for approximately 15 days and corresponds to the first half of August (with slight variations according to area). It constituted one of the longest and most intense heat waves since records began. Furthermore, it should be noted that the episode analysed here fits the average duration of heat waves forecast for the period 2041–2070 according to scenarios B1 and E1 (E1 Scenario considers emission levels that could implicate a 2 °C rising in world average temperature by 2100).

This paper presents the most significant results of work that aims to explore, by means of a questionnaire, public knowledge, and the perception and behaviour of Spanish tourists (young segment market) before, during and after the summer holiday period affected by the heat wave of 2003.

Table 2 Tropical summer nights (minimum temperature equal to or above 20 °C). Source: AEMET 2007

Weather station	Average value for the period 1971–2000	2003[a]
A Coruña	0.2	2
Albacete	2.8	6
Badajoz	8.7	20
Cordoba	17.9	39
Granada	7.2	10
Ibiza	54.3	83
Madrid	20.2	46
Malaga	38.0	67
Murcia	28.7	60
San Sebastian	1.4	13
Santander	1.7	14
Seville	29.4	57
Tortosa	36.2	67
Valencia	52.4	85
Zamora	1.8	9
Zaragoza	13.9	47

[a] The values for 2003 are the highest in the series except in the cases of Badajoz (22 nights in 1989), Albacete (11 nights in 1994) and Granada (24 nights in 1994)

To that end, following on from this introduction, we characterise the phenomenon that is the subject of this study, paying special attention to the episode that occurred in 2003. The methodology used in the survey is then presented together with the answers that resulted from the questionnaire, and the initial conclusions of this exploratory study.

The heat wave: characterisation of this extreme phenomenon in Spain

There is no one single concept of a heat wave, which explains why there are different definitions (Kalkstein and Valimont 1986). Nevertheless, heat waves are characterised by certain common patterns. They are often defined as extreme high-temperature events that last for several days (UNWMO 1999). So, heat waves are restricted to the simultaneous fulfillment of two conditions: (1) temperatures above a certain threshold, which establishes whether a day is considered to be hot or not; and (2) a certain persistence in the number of consecutive hot days (Folland et al. 1999). From an atmospheric point of view, they are associated with mechanisms that operate at the synoptic scale, often related with stationary, or almost stationary, zones of high pressure that are of subtropical origin (Koffi and Koffi 2008).

This research adopts the proposals of the working group on extreme indexes CC1/CLIVAR (Pongrácz and Bartholy 2006). Thus, a day is considered hot when the maximum daily temperature surpasses the 90th percentile, which is calculated from all the values of the maximum daily temperatures for the reference period; in this case 1968–1996. Heat waves have been defined based on this definition of a hot day; following the proposals of Koffi and Koffi (2008), they consist of a period of at least 6 consecutive hot days. According to the indications of those latter authors, the following factors are considered here: (1) two frequency indexes; (2) one duration index; and (3) two intensity indexes. The frequency indexes represent, on the one hand, the total number of days that are considered to be included within heat waves, and, on the other hand, the number of heat wave episodes. The duration characterises the length of each episode. Finally, intensity is analysed in terms of daily calculations, in terms of the result of the difference between the recorded temperature and the 90th percentile, and the cumulative value based on the sum of the daily intensity throughout the episode.

Following the precepts given above, heat waves in mainland Spain have been characterised throughout the period 1968–2010, paying special attention to the year 2003. For the study, several observatories run by the Spanish Meteorology Agency (AEMET) were selected as representative of large geographic–climate units in Spain: the Atlantic-Cantabrian coast, the Mediterranean coast and inland Spain (see Fig. 1). For the Atlantic–Cantabrian coast, three observatories were selected; two in the north of Spain and one

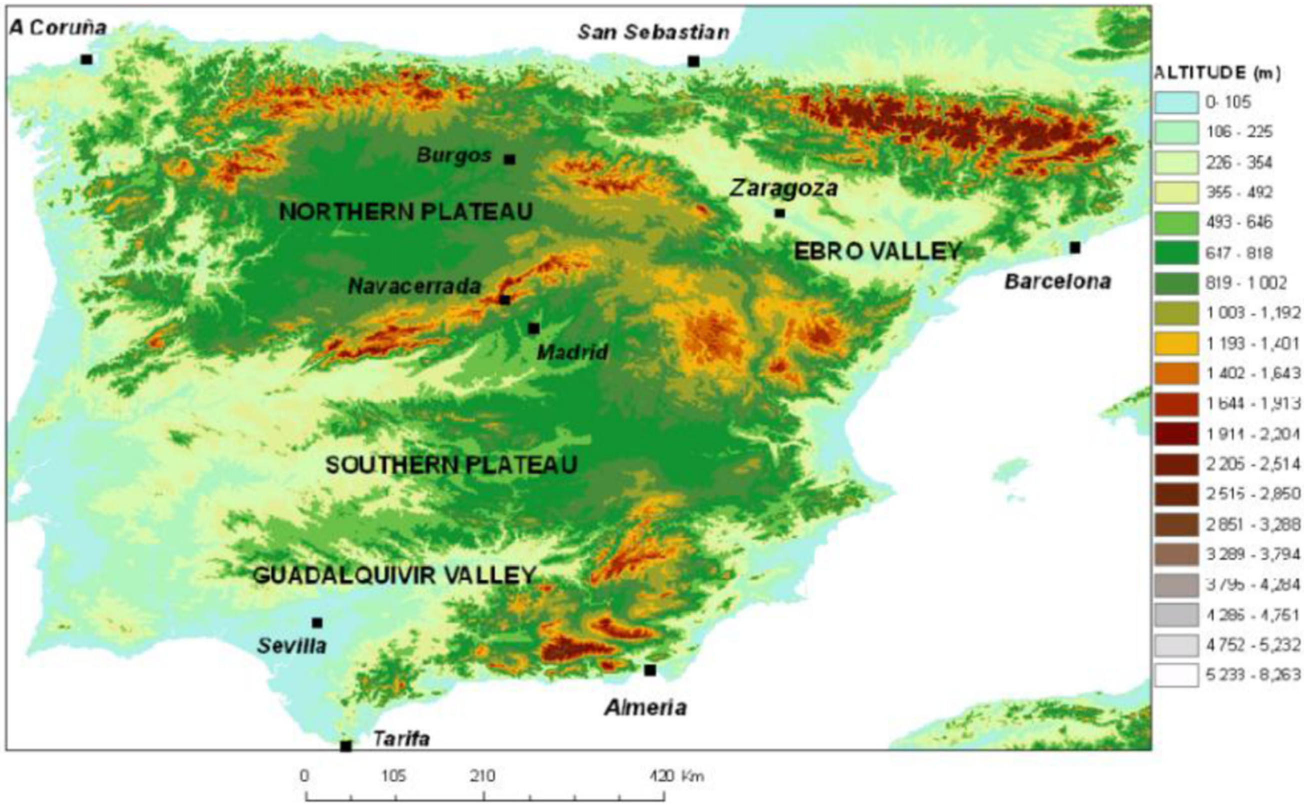


Fig. 1 Physiographic context of the observatories analysed

in the south: A Coruña, for the northern Atlantic coast, San Sebastian as an example of the Cantabrian coast, and Tarifa to represent the southern Atlantic coast. This latter observatory has a very characteristic local–regional climate, marked by the Venturi effect (Scorer 1952). On the Mediterranean coast, two observatories are included: Barcelona, as a northern location; and Almeria on the southern coast. For inland Spain, two observatories that represent inland depressions (Zaragoza and Seville) were chosen, with two more to represent the large plains (Burgos and Madrid) and one in the mountains (Navacerrada).

The choice of observatories was subject to some restrictions but followed certain rules: (1) on the one hand, we distinguished between coast and inland because coastal thermo-regulator power should be subject to a lower incidence of heat waves compared to inland areas. (2) We also differentiated the Atlantic and the Mediterranean coast because the Mediterranean coast is warmer than the Atlantic. Therefore, the thermo-regulator power of the Atlantic coast is more pronounced and should lead to increased expression of heat waves on the Mediterranean coast; (3) for the Southern Atlantic coastal area we had data from only the Tarifa Observatory. For this reason, that station was chosen. Moreover, we considered analysis of behaviour during the heat waves in Tarifa—a place with very singular climatic features in the southern Spanish context (high wind exposure, moderate temperatures, etc.); (4) To analyse inland Spain, we chose meteorological stations that could represent the three main physiographic regions of this big area (inland depressions, large plains and mountains). We distinguished between inland depressions and large plains by differences in altitude above sea level (a.s.l.) and especially because inland depressions use to be surrounded by sea. So it is logical to think that these areas have a greater maritime influence and a lesser importance of heat waves compared to large plains. On the other hand, we included data from an inland mountain station (located in Navacerrada, 1,894 m.a.s.l.) to check if mountain responses differ from those of other inland areas; also (5), we wanted to highlight the influence of latitude, as northern areas are less exposed to warm air invasions due to their greater distance from the sources of tropical air masses.

In addition, it should be noted that the meteorological summer was studied, which in this (temperate) setting comprises June, July and August, according to the Glossary of Meteorology of the American Meteorological Society (2011). The work is based on daily data, as is the case in other work that analyses heat waves (D'Ippoliti et al. 2010; Frich et al. 2002; Koffi and Koffi 2008; Pongrácz and Bartholy 2006; Zhao and Chu 2010) and none of the series analysed included gaps of more than 0.05 %.

During the period analysed (1968–2010), heat waves occurred relatively frequently on the Spanish mainland, particularly in the inland area (73–97 cases of heat waves); that frequency is even higher if we consider only the southern inland area (82–97 cases of heat waves) (see Table 3). In relation to the coastal areas, the Atlantic–Cantabrian coast experienced fewer heat waves than the Mediterranean coast. Two specific cases from the coastal regions considered stand out: Tarifa and Barcelona—the former due to the small number of heat waves recorded, which was as few as 12 (the lowest value of any of the observatories analysed); the latter, in contrast, saw a very high frequency of heat waves (70 episodes in total, despite its northern and maritime character). In the case of Tarifa, the cause of the low number of episodes is clear: a local–regional climate marked by the Venturi effect; while the case of Barcelona remains unexplained.

A positive trend in the number of episodes was confirmed at all observatories, once again more marked inland, with an increase of just over one case per decade. The case of Barcelona is the only coastal location which, once again, experienced similar conditions to those experienced inland, with an increase of 1.2 days/decade. The Atlantic–Cantabrian coast is the zone that experienced the gentlest increase, at below 0.5 days/decade.

The average intensity of the episodes showed no clear spatial pattern, but was between 2 °C and 4 °C, although there was a much stronger increasing trend inland, of 2–3 °C/decade, which is very slight in the unique case of Tarifa: 0.2 °C/decade. The cumulative average intensity again shows a greater effect of the phenomenon in the inland area than on the coast, except in the case of Barcelona, with a trend that clearly reflects the coast–inland duality, with an increase of 1.5–12.5 °C/decade compared to 19.6–32.8 °C/decade, respectively.

The average duration of heat wave episodes was between 7 and 10 days, except in Barcelona (13.9 days/episode). The trend in all cases was positive, particularly inland, with the only exception being Zaragoza, which is located in a northern valley in the interior of the Iberian Peninsula, where the trend was more moderate.

The results agree with recent studies showing that summer temperatures in Europe are particularly sensitive to climate change, and that both the frequency and the duration of heat waves have increased, and are forecast to continue to do so in the future (Della-Marta et al. 2007; Founda and Giannakopoulus 2009; Meehl and Tebaldi 2004; Nogaj et al. 2006; Schär et al. 2004). In this context, for the specific case of Spain, in accordance with the projections of the Spanish Meteorology Agency (AEMET), average temperatures will increase by around 1 °C during the period 2011–2040 compared to the reference period 1961–1990. This warming will speed up during the period 2041–2070, with estimates of temperatures that will be between 1.9 °C and 2.6 °C higher than they were during the reference period 1961–1990. In summer, this rise in temperature is expected to be sharper. So, for the period 2011–2040, the forecast is for an increase in summer of between 1.3 °C and 1.8 °C, which will be around 2.2 °C to 3.2 °C for 2041–2070. In this context, heat waves are also forecast to be more intense and longer lasting. In relation to the latter aspect, it should be borne in mind that, for the period 2011–2040, the duration will increase by between 4.8 and 5.8 days, and between 8.4 and 13.3 days for 2041–2070 (see Table 4). We can therefore say that the duration of the extraordinary heat wave of 2003, in the majority of the observatories analysed (7 out of 10), fits the average duration expected for the period 2041–2070,

Table 3 Characterisation and evolution of heat waves recorded at different mainland Spanish observatories (1968–2010)

Geographical area	No. episodes/ trend	Average episode intensity/trend	Cumulative episode intensity/trend	Average episode duration/trend
Atlantic–Cantabrian coast				
North (Atlantic)	30; +0.5/decade	2.8 °C; +0.9/decade	24.9 °C; +6.1/decade	9.2 days; +2.1/decade
North (Cantabrian)	25; +0.3/decade	3.3 °C; +0.9/decade	26.6 °C; +6.5/decade	7.8 days; +1.9/decade
South (local climate markedly very windy)	12; +0.2/decade	1.9 °C; +0.2/decade	16.4 °C; +1.5/decade	8.7 days; +0.9/decade
Mediterranean coast				
North	70; +1.2/decade	1.78 °C; +1.1/decade	28.72 °C; +12.5/decade	13.9 days; +7.6/decade
South	34; +0.6/decade	3.2 °C; +1.23/decade	26.1 °C; +8.8/decade	7.8 days; +3.2/decade
Inland				
Major valleys				
Ebro (north, Mediterranean opening)	77; +1.2/decade	3.7 °C; +3.0/decade	32.0 °C; +23.9/decade	8.8 days; +2.7/decade
Guadalquivir (south, Atlantic opening)	82; +1.4/decade	2.9 °C; +2.2/decade	28.1 °C; +20.0/decade	9.4 days; +7.2/decade
Large plains				
Northern central plateau	73; +1.5/decade	4.1 °C; +3.9/decade	35.8 °C; +32.8/decade	8.6 days; +8.3/decade
Southern central plateau	97; +1.5/decade	2.8 °C; +2.5/decade	28.2 °C; +24.2/decade	9.8 days; +8.8/decade
Mountains	97; +1.4/decade	3.2 °C; +2.2/decade	29.2 °C; +19.6/decade	9.3 days; +7.3/decade

Table 4 Projections for climate change in Spain. Based on data from AEMET 2012 (http://www.aemet.es)

Average annual temperature	2011–2040	2041–2070
A1B (11)[a]	1.1	2.4
A2 (4)	1.2	2.6
B1 (5)	1.1	1.8
E1 (4)	1.4	1.9
Average summer temperature	2011–40	2041–2070
A1B (11)	1.4	3
A2 (4)	1.6	3.2
B1 (5)	1.3	2.2
E1 (4)	1.8	2.2
Heat waves (duration change)	2011–40	2041–2070
A1B (11)	5.12	12.5
A2 (4)	5.81	13.3
B1 (5)	4.8	8.5
E1 (4)	5.7	8.4

[a] Climate change scenario (the number of models used to arrive at the average is given in parenthesis)

scenarios B1 and E1, since in Spain the duration of the longest episode in 2003 was, in most cases, between 5 and 10 days more than the average value.

The 2003 heat wave in Spain

The summer of 2003 was defined by its extreme character in Europe (Campbell 2009; D'Ippoliti et al. 2010; Kovats et al. 2004; Levinson and Waple 2004; Luterbacher et al. 2004; Matzarakis et al. 2009; Schär and Jendritzky 2004; Schär et al. 2004), including in Spain (Díaz et al. 2006; Martínez et al. 2004). In fact, the most important heat wave episode of 2003 is one of the most significant in mainland Spain in the time series analysed (1968–2010). Specifically, in the coastal observatories, except in the unique case of Tarifa, the most important heat wave of 2003 was also the most important from the whole of the period studied, and it was particularly extraordinary in San Sebastián and Barcelona (see Fig. 2). According to the data studied, in San Sebastián the most significant heat wave in 2003 marked a high in duration (18 days) and, consequently, in cumulative intensity, 93 °C, compared to those that went before it. In Barcelona, it also reached records of duration, 59 days, and cumulative intensity, 250.2 °C, for the whole of the period 1968–2010.

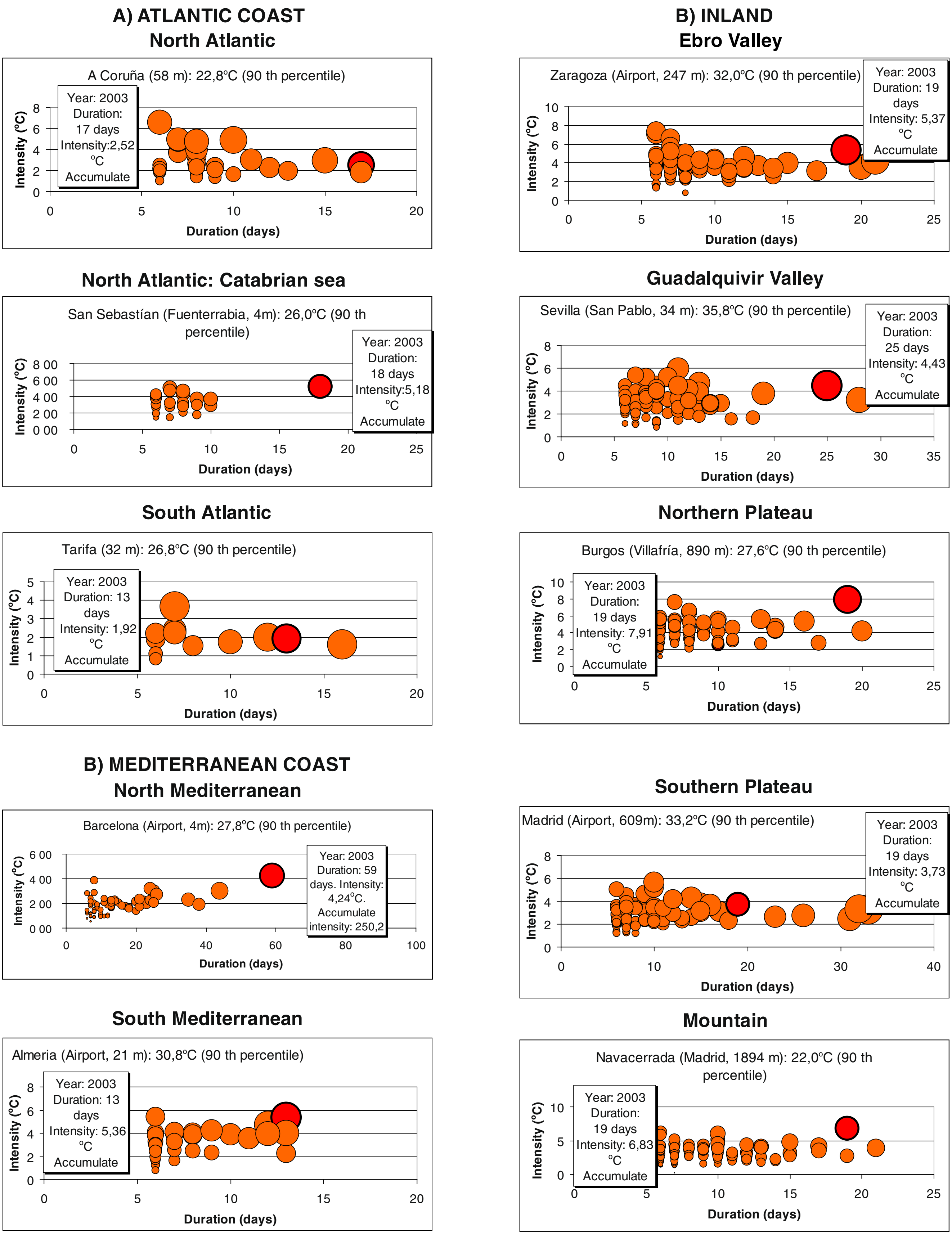
Throughout the whole summer (June, July and August) of 2003, a heat wave engulfed the whole of Spain, but did not affect the Spanish coast, with the exception of Barcelona. In general, the most intense period of heat was during the first half of August (see Fig. 3). In the inland area of the mainland, it is justified to state that there were five heat waves during the summer of 2003: (1) 6–16 June; (2) 17–28 June; (3) 5–15 July; (4) 17 July–15 August; and (5) 17–28 August. In the Mediterranean, specifically at the Barcelona observatory, there were two episodes: (1) 9 June–2 July; and (2) 4 July–31 August. Meanwhile, at the Almería observatory (southern Mediterranean), the two recorded episodes were much shorter, and occurred only in August: (1) 1–13 August; and (2) 19–24 August. On the Atlantic–Cantabrian coast, we can consider a single heat wave, from 29 July to 27 August.

Fig. 2 Comparison of the 2003 heat wave's duration and intensity to previous heat waves during the period 1968–2010. *Circle* size is proportionate to cumulative intensity; *red circle* most important heat wave of the summer of 2003

The impact associated with the 2003 heat wave in Spain

In relation to the impact of the heat wave episode of 2003, it should be noted that there are no specific economic studies that evaluate its consequences on the Spanish tourist sector. However, the official statistics show notable changes in the trends of flows of tourists, which lead one to consider a possible cause–effect relationship. We must always bear in mind, though, that we are dealing with a complex reality in which many other structural factors played a role at the time. Those factors were political (such as, for example, insecurity and instability at an international level as a consequence of the conflict in Iraq), economic (such as, for example, the setting of fixed exchange rates, the appearance of the Euro and the effects on the increase in relative prices; and the expansion in the offer of competitive holiday destinations) and social (such as, for example, changes in the traditional attraction of sun, sea and sand destinations; and the evolution of consumer habits).

The demand for tourist services stagnated in Spain in 2003, compared to the rate of growth that had been experienced in previous years. In 2003, the main bastion of the Spanish tourist industry was the strength of its own domestic market. The Spanish tourist was the main element responsible for preventing worse results in a good number of companies and Spanish tourist destinations, given the fall in the number of foreign tourists arriving in Spain. In terms of international tourists, after 7 consecutive years of continued growth—with annual increases of over 2 %—2003 recorded virtually no growth (0.2 %). The good weather in many countries in central Europe, traditionally one of the areas that tourists come to the Mediterranean from, favoured domestic tourism in those countries. That was detrimental to the tourist industry in countries such as Spain, which are highly dependent on visitors from those markets. At the same time, the alarming news stories concerning the heat wave that was punishing southern Europe—from an atmospheric point of view, with greater intensity than the heat wave that the rest of the continent was suffering from—may also have had a



A) ATLANTIC COAST
North Atlantic
A Coruña (58 m): 22,8ºC (90 th percentile)
Year: 2003 Duration: 17 days Intensity:2,52 ºC Accumulate
Intensity (ºC)
Duration (days)
North Atlantic: Catabrian sea
San Sebastían (Fuenterrabia, 4m): 26,0ºC (90 th percentile)
Year: 2003 Duration: 18 days Intensity:5,18 ºC Accumulate
South Atlantic
Tarifa (32 m): 26,8ºC (90 th percentile)
Year: 2003 Duration: 13 days Intensity: 1,92 ºC Accumulate
B) MEDITERRANEAN COAST
North Mediterranean
Barcelona (Airport, 4m): 27,8ºC (90 th percentile)
Year: 2003 Duration: 59 days. Intensity: 4,24ºC. Accumulate intensity: 250,2
South Mediterranean
Almeria (Airport, 21 m): 30,8ºC (90 th percentile)
Year: 2003 Duration: 13 days Intensity: 5,36 ºC Accumulate
B) INLAND
Ebro Valley
Zaragoza (Airport, 247 m): 32,0ºC (90 th percentile)
Year: 2003 Duration: 19 days Intensity: 5,37 ºC Accumulate
Guadalquivir Valley
Sevilla (San Pablo, 34 m): 35,8ºC (90 th percentile)
Year: 2003 Duration: 25 days Intensity: 4,43 ºC Accumulate
Northern Plateau
Burgos (Villafría, 890 m): 27,6ºC (90 th percentile)
Year: 2003 Duration: 19 days Intensity: 7,91 ºC Accumulate
Southern Plateau
Madrid (Airport, 609m): 33,2ºC (90 th percentile)
Year: 2003 Duration: 19 days Intensity: 3,73 ºC Accumulate
Mountain
Navacerrada (Madrid, 1894 m): 22,0ºC (90 th percentile)
Year: 2003 Duration: 19 days Intensity: 6,83 ºC Accumulate

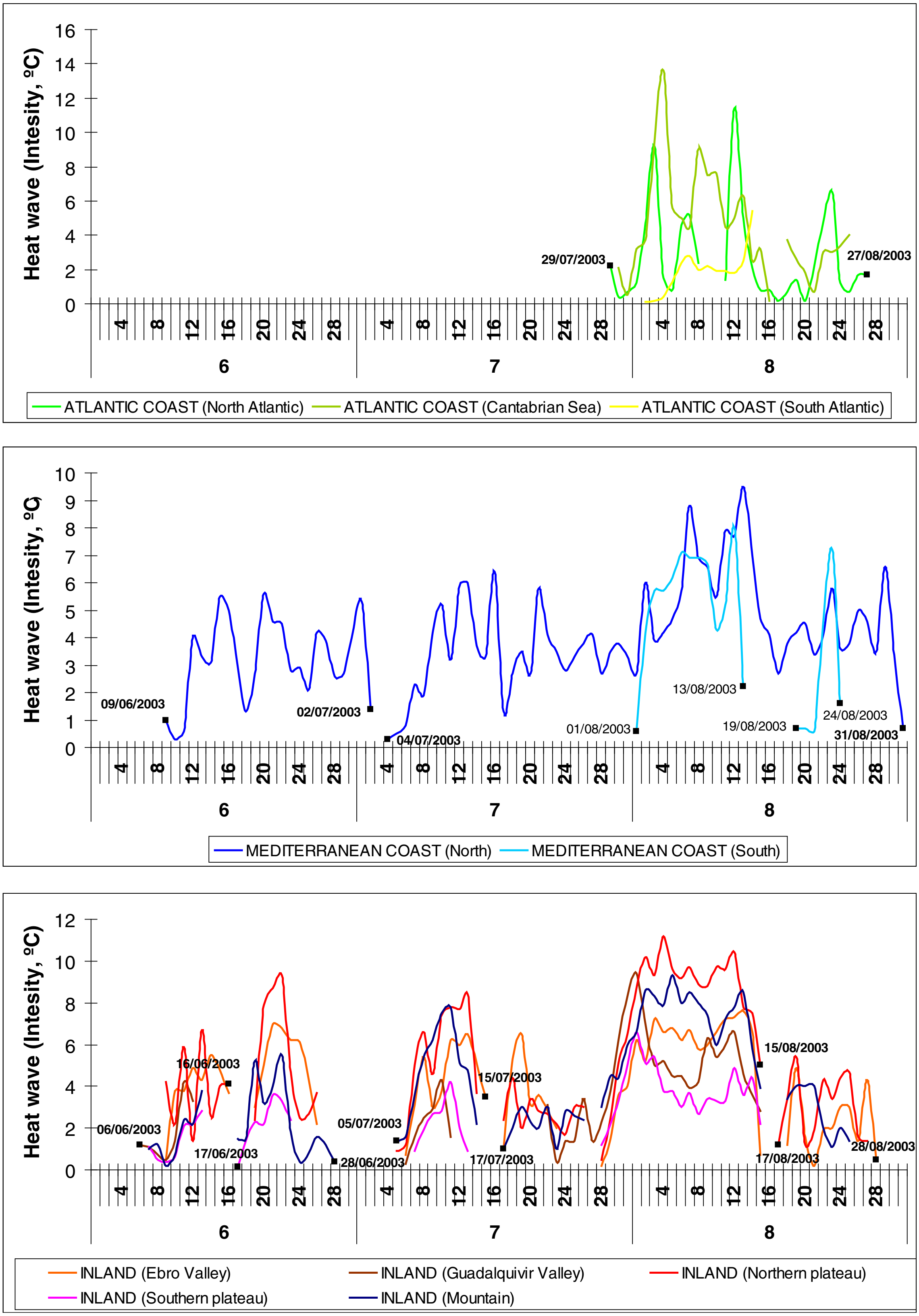


Fig. 3 Intensity and evolution of heat waves recorded at different mainland Spanish observatories in the summer of 2003

negative effect on the number of people travelling to the region on holiday. In contrast, the heat did not seem to put the Spanish off from embarking on tourism within their own borders. The number of domestic Spanish tourists saw a notable increase (3.7 %, according to official statistics from FAMILITUR) up until the month of September (IET 2003a). This finding is confirmed by the information from the Spanish National Institute of Statistics' Hotel Occupancy Survey (*Encuesta de Ocupación Hotelera* -INE 2003a), which indicated in data from the close of 2003 that the total number of overnight stays, by the Spanish and in this type of accommodation over the whole year, rose by 5.1 %; while foreign overnight stays increased by only 0.7 %.

The excessive heat also helps to explain, partially, some of the changes in the access routes in international tourism. During the months of July and August 2003, there was a considerable fall in the arrival of tourists by road (17.6 %), which above all affected the two markets that had seen important growth the previous year—the number of French tourists who arrived this way fell by 9.2 %, while the fall in the number of German tourists arriving by road was a staggering 49.3 %—while there was a recovery in the numbers arriving in Spain by aeroplane (a 6.8 % increase). The magnitude of the fall in the number of tourists arriving by road (965,784 in just 2 months, according to FRONTUR statistics; IET 2003b) continues to be a great surprise and introduces certain doubts regarding the records from the previous year. Even so, it is quite possible that the figures for these months of 2003 were affected by factors such as the good weather in the countries of origin, the effect of the heat on travelling by road and the fires that affected the main access routes into Spain. The reduction in the influence of the events of 11 September 2001 on the use of air transport should also be taken into account.

In contrast, and according to the Spanish Federation of Hostelry, the excessive temperatures had their positive side for sectors such as restaurants and hostelry. Many businesses in this sector saw large increases in their takings, thanks in part to the prevailing weather conditions (INE 2003b).

This extraordinary episode also had an important impact on other aspects and sectors that affected tourism indirectly, due to their indirect relation with it. According to data from town councils and the companies that manage water resources (Sistema Español de Información sobre el Agua; http://hispagua.cedex.es/), the high temperatures in the summer of 2003 caused increases in water consumption in different Spanish tourist towns and cities that ranged from 4 % to 16 % compared to the same period of the previous year. At a time when water resources were at a low due to drought, the heat caused an increase in the demand for water for personal hygiene, for consumption, to water parks and gardens, and to supply certain recreational facilities such as swimming pools, water parks and golf courses, which experienced increased use. This meant that some tourist towns and municipalities, faced with the shortage of water, were affected by restrictions and minor supply problems which, had they become more serious, could have had a negative effect on the tourist sector.

In relation to the increase in energy demand, it should be noted that, according to data from the Spanish national grid (Red Eléctrica de España 2003a, b, c), the high temperatures in the summer of 2003 were also the cause of the notable increase in the demand for electrical energy in Spain, which was associated particularly with the use of air conditioning units. The statistics show increases of around 10–12 % for those months in mainland Spain and of 14 % for the rest of the country, compared to the previous year (Red Eléctrica de España 2003a, b, c). In fact, according to the Spanish Association of Air-conditioning Manufacturers (*Asociación de Fabricantes Españoles de Climatizadores*; AFEC) the annual number of domestic air-conditioning units sold grew considerably from 514,000 units in 1999 to 942,207 in 2003 and 1,308,233 in 2004 (AFEC 2004, 2005). The increase in demand as a consequence of the heat led to more than 300,000 users in the Balearic Islands finding themselves without electricity for more than 5 h at the end of July; also cuts in the electrical supply in Andalusia increased 32 % between June and August, compared to the previous summer. These interruptions, which are due more to distribution problems than to problems related to power generation, had a negative effect on the image of Spanish tourism. However, it is not just the demand for electricity that was affected by the increased temperature. The generation of electricity was also affected, to a greater or lesser extent, by changes in the prevailing weather conditions. So, for example, Spanish hydro-electric plant power generation, which is related directly to rainfall and the capacity of the reservoirs that feed them, had an influence on the price of electricity on the wholesale market (which does not affect the rate that the individual small consumer pays). Thus we see that, for example, the month of August 2003 was particularly dry, with a hydroelectric production that was 7 GWh less than that of a typical August (OMEL 2003). This fact, combined with the heat wave, meant that the average price of electricity in that month was almost 4.0 cents per KWh; 25.3 % more than 1 year earlier and the highest price in the 13 months leading up to that August, according to the Electricity Market Operator (*Operadora del Mercado Eléctrico*, OMEL 2003).

Finally, the public health sector was also affected by the extreme heat episode of 2003. The Spanish National Statistics Institute (INE 2005: 1–2) notes that in 2003 there were 384,828 deaths in Spain, 16,210 more than recorded in 2002. The gross mortality rate stood at 916.16 deaths per 100,000 inhabitants, representing an increase of 2.7 % over 2002. This increase in mortality was concentrated in the months of June, July and August, in which there were more than 12,919 deaths in the same period of 2002. These deaths affected mainly the age group 70 or older, and more women than men (8,231 women and 4,688 men). Causes related directly to the heat were heat stroke (169 cases compared with nine in 2002) and dehydration (191 vs 71). However, the greatest impact occurred in other causes of death that match previous chronic diseases considered at risk in situations of high temperatures. The increase in deaths during the summer of 2003 was 15.2 % for the whole country. During the rest of 2003 the variation in death number was considerably smaller, with levels similar to those of previous years.

Materials and methods

The survey

This study focuses on domestic Spanish tourism (young segment market): the importance that these tourist flows have for the Spanish economy justify that this should be a subject of research.[1] So, the analysis presented here is based on the results of 351[2] personal questionnaires, using Lexis random stratified sampling,[3] completed by Spanish university students attending the University of Barcelona (Spain) who engaged in tourism[4] within the Spanish national borders during the summer affected by the heat wave of 2003. The survey was administered between November and December of 2004 (see Table 5).

Table 5 Technical details of the survey

Technical description	
Methodology	Quantitative; personal questionnaire
Size of sample	351 personal questionnaires
Type of sample	Lexis random stratified
Sampling error	±5 %
Confidence interval	95.5 % (2σ)
Variance (p, q)	P=50 %; q=50 %
Validation systems	random probe (n=30)
Period:	November, December 2004

The questionnaire was semi-structured (with both open and closed questions). The questions were asked in Spanish. It was aimed at exploring public knowledge and perception, and the behaviour of the people surveyed (who engaged in tourism within Spain) before, during and after the summer holidays in question. A number of authors have pointed out the usefulness of questionnaires in studying extreme episodes and natural risks (Drabek 1986; Enders 2001; Haynes et al. 2008; Johnston et al. 2005; Rohrmann 2004). For example, Bird (2009) states that, as tools, questionnaires are fundamental for acquiring information about public knowledge and the perception of extreme natural events that may be useful for developing procedures and management strategies so as to reduce the vulnerability of a population to the phenomenon in question. Bulmer (2004), too, points to the usefulness of questionnaires in obtaining information about past and present behaviour in the face of a particular extreme natural episode, about standards of behaviour in a group, about attitudes, beliefs and reasons for action. Taking all this into account, the questions were designed to explore the following aspects of interest in this investigation:

- Public knowledge and perceptions of the individuals, in their role as tourist-consumers, as regards the impact of the target episode of extreme heat on tourist activity.
- Behaviour of individuals, in their role as tourist-consumers, before the holiday experience affected by the target episode of extreme heat.
- Behaviour of individuals, in their role as tourist-consumers, during the holiday experience affected by the target episode of extreme heat.
- Perception, attitude and behaviour of individuals, in their role as tourist-consumers, after the holiday experience affected by the target episode of extreme heat.

Results

Being offered specific options, respondents were asked about those sectors of activity in the geographic area of the study that they perceived as being most affected by the 2003 heat wave (without specifying whether they were positively or negatively affected). The results showed tourism to be in third place with 11.6 %, after agriculture (33.9 %) and the livestock sector (26.1 %). These were followed by construction (9.7 %), fishing (6.9 %), commerce (5.9 %), the energy sector (3.0 %) and industry (2.4 %). Only 0.5 % of respondents thought that no sector of activity was affected by the extreme episode in question.

[1] According to FAMILITUR statistics, in 2011 the Spanish went on 160.8 million trips, the majority of which (91.7 %) were to destinations within Spain (IET 2011). Likewise, in 2003, Spanish residents went on a total of 129.2 million trips, with Spain itself as the most common destination (91.2 %) (IET 2003a).

[2] 400 questionnaires were completed: 49 of them were not included in the analysis since the holiday destinations indicated in them did not fall under the influence of the heat wave.

[3] In the Lexis stratified random sample, a stratum of the population (in this case young Spanish university students over 18 who travelled on holiday within Spain during the summer affected by the heat wave of 2003) is sampled to represent all strata (young Spaniards over 18 who travelled on holiday within Spain during the summer affected by the heat wave of 2003).

[4] 44.7 % of students surveyed were female and 55.3 % were men. 72.1 % of the students surveyed were aged between 18 and 24 years old, 23.8 % were aged between 25 and 35 years old, and 4.1 % were between 35 and 40 years old. Of the students surveyed, 53.2 % worked, and 46.8 % did not work. It should be pointed out that the main types of tourism for respondents during the summer in question were: 28.6 % sun and sand tourism, 3.8 % nautical tourism, 24.1 % nature tourism, 27.4 % cultural tourism, 5.7 % adventure sport tourism and 10.4 % other types of tourism.

Role of the extreme heat episode in decision-making during the pre-holiday period

An interest in looking into the holiday experience as a whole led us to determine three specific moments: the pre-holiday period, the holiday period itself and the post-holiday period. In this sense it is interesting to explore in the context of our study what role the extreme event in question played in decision-making and how information sources were used during the event.

Respondents were therefore asked whether this extreme event had the effect of making them modify their holiday plans. The responses showed that only 7.1 % of the respondents altered their initial plans (see Table 6). Replies to the question "How did you modify your initial plans?" indicated that it was mainly by changing destination (generally, for a cooler one in mountain areas or in northern Spain) or postponing the holiday until later in the summer.

As far as information is concerned, the respondents stated that, during the period before their holidays, they had increased their consultation and use of different information sources in order to follow meticulously the evolution, manifestations and recommendations relating to this extreme meteorological event (see Table 7).

Respondents also indicated that the information was of quite an acceptable level as regards appropriateness (see Table 8). To the open question: "Why?", the people surveyed indicated that, despite occasionally becoming sensationalist and there being rather a lot of it, the information was complete, correct in its forecasts and, especially, necessary (see Table 8). In their role as consumer-tourists, the respondents show that they accept alarmist and sensationalist headlines as positive as long as these succeed in making individuals aware of the event's various implications and of the measures to be taken to try to mitigate its effects without having to change destination.

Impact of the episode of extreme heat during the holiday period

On asking respondents what effect these conditions of extreme heat had on the way their holidays developed, we obtained a great many replies in the middle category (55.56 % did not affect the development of the holidays either positively or negatively), although after this it is the categories on the negative side that take on slightly greater importance (25.93 %) compared to the positive side (16.52 %) (see Table 9). It therefore seems that, once in the holiday location, the extreme episode did not generate too many setbacks for the respondents apart from those 25.93 %.

When the people surveyed were asked to what extent, during the holidays, the extreme conditions of heat affected their sensation of enjoyment, comfort and safety, the answers were chiefly in the central categories; with the exception of comfort, which was clearly negatively affected (see Table 10). It can be seen that the enjoyment variable achieves a fairly balanced score around the central value.

In answer to the question "What effect did the extreme conditions have as regards more or less time spent on the following activities during your holiday?", the replies indicate that the conditions of extreme heat caused changes to be made in certain activities carried out by the tourists. Hence, according to the correspondents, the use of beaches, swimming pools and water parks increased in comparison to normal summers; the same happened as regards more time spent inside the accommodation and on outdoor and indoor leisure activities. Visits and walks around parks and countryside along with visits to museums and exhibitions remained stable compared to other years, but there was a fall in visits to cities, towns and villages and above all in playing outdoor and indoor sports (see Table 11).

In the same way, tourists also recognised having modified certain daily habits during their holidays. So, to the question, "What daily habits did you change during the holidays affected by the heat wave of 2003?": 25.6 % said they had modified—increased—their water consumption; 17.6 % reported having changed their timetable of activities; 14.0 % reduced the intensity of their activity; 13.4 % increased their energy consumption; 10.9 % changed the type of activity they indulged in; 10.8 % adapted their diet; 2.9 % increased their spending; and 0.4 % did not answer. Only 4.4 % claimed not to have modified any habits.

Table 6 The extreme episode's influence on modifying holiday plans

Did the extreme episode influence you to modify your holiday plans?	%
No	92.6
Yes, this summer's holiday plans were altered due to the extreme episode	7.1
Don't know/Doesn't apply	0.3

Table 7 Use of different sources of information in order to find out about the extreme heat episode (period before the holiday)

In order to find out about the extreme episode, my use of different sources of information …	%
Decreased a lot	2
Decreased	1.7
Neither decreased nor increased	42.5
Increased	29.9
Increased a lot	22.2
No answer	1.7

Table 8 Degree of appropriateness of the information relating to the extreme episode (pre-holiday period)

Do you think the information you were given was adequate?	%
0 Highly inadequate	2.9
1	8.8
2	39.6
3	36.8
4 Completely inadequate	8.8
No answer	3.1
Why?	%
Respondents considering that the information provided by the press, radio and television was excessive in volume: the presence in the media was constant, ranking first magazine covers and many minutes of news and reporting time	63
Respondents considering that the information was necessary to develop their activities normally	81
Respondents pointing out utility of information to avoid risks related to health (especially for risk groups) and schedule their activities	87
Respondents referring to the good level of precision and accuracy in maximum and minimum temperature's forecasts	73
Respondents considering that the information provided by the media was sensationalist and alarmist: they indicate or remember alarming headlines about temperature records; alarming headlines referring to the collapse of the hospitals' emergency services and the number of deaths due to heat; respondents also pointing out that the news linked the heat wave to climate change and the constant references to the "blackouts" and its future impact on the tourism sector	92

Post-holiday assessment and impact on future decision-making

As to the assessment respondents make of their holidays taking into account the effects of the extreme episode on their tourist experiences and activities, it is striking how positive the results were: 0.9 % opted for an assessment of very bad, 5.1 % bad, 26.8 % normal, 37.3 % good and 28.8 % very good. To the open question: "Why?", those who gave a negative evaluation indicated that the main cause was the increased spending that they had incurred in order to offset the effects of the heat (in general, they indicated that they had spent more than expected on soft drinks, at bars, on terraces, on ice-creams, etc.) Most of those who gave a positive evaluation indicated two main issues: first, they enjoyed the heat; and second, the weather increased their sensation of enjoyment.

Perhaps the level of preparation and the suitability of the tourist services, installations and infrastructures at Spanish tourist destinations when faced with such an extreme episode also had something to do with this issue. This is reflected in the answers to the question: "To what degree do you think that the tourist services, installations and infrastructures were suited to coping with the extreme episode?" (see Table 12).

Table 9 How did the conditions of extreme heat affect the development of your holidays?

How did the conditions of extreme heat affect your holidays?	%
0 Very negatively	6.3
1	19.7
2	55.6
3	11.1
4 Very positively	5.4
No answer	2.0

Using an open question, respondents were asked about the types of adaptation they had observed in the tourist destinations visited. So, the adjustments indicated by the people surveyed in terms of frequency of implementation and effectiveness were: the temperature control of closed spaces by air conditioning, the temperature control of open spaces by evaporative cooling, the increased watering of urban green spaces, the modified scheduling of certain outdoor activities and the extension of opening hours for swimming pools and water parks.

Respondents were also asked about measures that had not been implemented in the destinations, or had been implemented to a lesser extent. As regards these missed adaptations, respondents mentioned the need to extend permanent awning-covered areas in the historic centres of towns, to increase the areas of shade in gardened areas of the tourist destinations through replacing herbaceous and bushy species by tree species, to improve the electricity distribution network and make free water consumption possible by providing public water fountains. Some respondents who stayed on campsites or in tourist apartments reported the need to create areas of dense shade in camping areas and to install air conditioning in tourist apartments. The need to intensify fire prevention campaigns and information campaigns related to health is also worth noting.

They were asked whether, compared to a normal summer, they stayed for more or fewer days at their holiday destination. The answers show the "no influence" that this episode had on modifying the length of stay at the holiday destination (see Table 13).

Table 10 During the holidays, how did the conditions of extreme heat affect your feelings of enjoyment, safety and comfort?

	1 Decreased noticeably	2	3	4	5 Increased noticeably	Don't know/ no answer
Comfort	17.1 %	37.9 %	33.9 %	7.1 %	2.6 %	1.4 %
Safety	6.8 %	14.5 %	69.5 %	6.3 %	1.7 %	1.2 %
Enjoyment	7.7 %	17.7 %	49.3 %	16.2 %	8.0 %	1.1 %

Finally, respondents were asked whether the atmospheric conditions experienced during this extreme summer made them change their future choice of destination or holiday period. The replies indicate that in 90.8 % of cases they did not. Only 7.2 % say that this extreme summer had an effect on future decisions, while 2 % of respondents gave no opinion either way.

Discussion

From a methodological point of view, the questionnaires proved a good tool for obtaining information about the behaviour, attitude and opinion of a particular group in connection with an actually experienced natural episode of extreme heat. Those who completed the questionnaires responded satisfactorily to both the closed and the open questions (the latter receiving lengthy answers), enabling a great deal of information to be obtained. The answers allowed us to gain knowledge of the behaviour of tourists and to explore the strategies of adaptation adopted by different elements of the tourist system to cope with the weather episode at hand. In the same way, they revealed some weaknesses of the system that should be improved in order to reduce the vulnerability of the sector when faced with episodes of this type.

The people surveyed saw tourism as one of the three sectors of activity most affected (in either a positive or a negative way) by the extreme heat wave episode, within the geographical area of interest. They showed their awareness of the high degree of sensitivity of tourism to atmospheric elements. Even so, despite being so affected, they also showed personal awareness of the phenomenon and demonstrated the wide range of options for adapting that existed within their tourist setting. This made it possible that the influence of the prevailing conditions on holiday planning was less than the influence on programming and, consequently, few people changed their initial holiday plans by opting for a different tourist destination or postponing their holiday until another time of year, during the summer affected by the heat wave. We are dealing with an extreme phenomenon that the Spanish tourist system is often exposed to and highly sensitive to, but which, thanks to the perception of the phenomenon by Spanish tourists—young market segment—and to the spontaneous and planned adjustments undertaken by the different elements in the tourist system, has a reduced capacity to have an impact on domestic tourism. That reduced capacity to have an impact decreases the vulnerability of the Spanish tourist sector when faced with heat waves, at least from the point of view of this internal national market segment. This is in line with the results of other recent investigations which, also based on analysis of questionnaires, concluded that tourists see high temperatures and heat waves as the extreme episodes that generate the least negative impact on tourism (Agnew and Palutikof 1999, 2001; Bigano et al. 2005; Moreno 2010). In a similar way, some contributions denote that residents in regions with warm climate conditions have a higher probability of travelling domestically and a lower probability of travelling abroad (Giles and Perry 1998, Eugenio-Martin and Campos-Soria 2010).

Table 11 During the holidays, how did the extreme conditions affect the increase or decrease of time spent on these activities?

	1 Decreased noticeably	2	3	4	5 Increased noticeably	Don't know/ no answer
Use of beaches, pools, water parks	5.4 %	4.3 %	27.4 %	25.1 %	37.0 %	0.8 %
Visits to museums, exhibitions, etc.	14.5 %	14.0 %	44.7 %	14.8 %	11.1 %	0.9 %
Visits to cities, towns, villages, etc.	12.8 %	18.2 %	44.2 %	16.0 %	8.5 %	0.3 %
Visits and walks around parks, countryside	10.0 %	19.4 %	39.0 %	20.2 %	10.8 %	0.6 %
Time spent inside the accommodation	13.4 %	13.1 %	41.9 %	18.2 %	12.5 %	0.9 %
Playing outdoor sports	22.8 %	23.6 %	32.5 %	13.1 %	7.7 %	0.3 %
Playing indoor sports	26.5 %	18.8 %	39.9 %	9.1 %	3.1 %	2.6 %
Outdoor leisure activities	9.1 %	12.2 %	36.8 %	24.2 %	16.8 %	0.8 %
Indoor leisure activities	9.7 %	12.5 %	35.3 %	24.5 %	17.7 %	0.3 %

Table 12 To what extent do you think tourist infrastructures, facilities and services were adapted to cope with the extreme episode?

Level of adaptation	%
0 not adapted	6.8
1 little adaptation	19.7
2 moderately adapted	31.9
3 highly adapted	25.1
4 complete adaptation	14.5
Don't know/no answer	2.0

Adaptation and mitigation are the responses that the tourist system can offer in order to cope with the positive and negative impacts generated by climate change. Adapting can allow opportunities to be maximised, at the same time reducing the threats posed by the phenomenon. In the field of adaptation, the tourist sector can work in six areas of intervention (technology, management, policy, knowledge, education and behaviour), while always remaining aware that the measures taken within each area can be directed towards different actors involved in the tourist experience, and also understanding that measures of adaptation must be implemented at all levels (UNWTO-UNEP-WMO 2008). The range of adaptation responses available in the Spanish tourist system when faced with this type of event is broad according to the people surveyed, and they are implemented to a greater or lesser degree in the different elements of the tourist system (market operators, agents, supply, and demand) and at different levels (in the case at hand, it was chiefly at the local, regional—autonomous community—and state level). So, in the light of the responses, young tourists seem to be highly flexible, adapting quickly to excesses of heat through modifying their behaviour, generally related to changes in recreation options and changes in daily habits.

In relation to changes in recreational options, attention should be drawn to an indirect aspect that can be deduced from the tourists' responses that is of great interest from the point of view of adaptation. That is, the fact that tourists can modify their recreational practices at their destination implies that there is a varied offer of tourist activities and that, therefore, there is (or has been) a territory-wide process of diversification of tourist activity that has made this option possible. The diversification of tourism products is indicated as one of the basic strategies for adapting to climate change in the field of management practices and business models. This measure, which allows the product lines at a given tourist destination or region to be widened—and therefore more products with different requirements and with less dependency on weather conditions—reduces the sector's vulnerability in the face of climate change and also when faced with prevailing weather conditions and their current variability. The diversification of tourism products that has taken place within the Spanish geographical setting for different reasons (since the 1990s diversification of product lines has been a basic practice in order to cope with the decline of the mass model of sun, sea and sand; more recently, since the year 2000, as an adaptation strategy in the face of weather and climate change) has been promoted at the state and the regional level by the plans that have defined state and the regional tourism policy in the last two decades, and at a local level by the municipalities, especially through the policy documents known as *Local 21 Agendas*.

Table 13 Compared to a normal summer, did you stay for longer or shorter at your holiday destination?

Length of stay	%
0 Many days shorter	6.5
1 A few days shorter	6.3
2 The same	70.9
3 A few days longer	5.7
4 Many days longer	8.3
No answer	2.3

In relation to the modification of daily habits, it should be noted that the tourists were able to modify the time and intensity of the activities or patterns of consumption, but they also recognised that, in this change of habits, they increased their consumption of both water and energy. That is why the 2003 heat wave episode was an important wake-up call and was the basis for implementing, in a more intensive manner, active policies of water saving and efficiency throughout Spain (designing gardens with species that consume less water; having gardens and golf courses that make use of purified waste water from treatment plants or rainwater; improving irrigation techniques; applying progressive tariff scales; improving distribution networks; etc.) and more policies to increase the availability of the resource (greater use of desalination plants or the transfer of water between river systems). In the same way, faced with the problems that could emerge from increased electricity demand due to the greater frequency and intensity of this type of event in a future, in recent years many administrative proposals have been presented, both to promote renewable energy and to increase efficiency and energy saving (e.g. the *Plan de Fomento de las Energía Renovables*, the *Estrategia Española de Ahorro y Eficiencia Energética*, etc.) that aim to strengthen conversion of the energy sector to sustainability and that encourage adaptation to future scenarios and contribute to mitigation.

Although flexibility is less in the remaining elements of the tourism system, the people surveyed recognised and positively evaluated the adaptation that those elements have undertaken within the Spanish setting. According to the tourists, they have developed basic mechanisms of adaptation that are technological (for example, the use of air conditioning in closed spaces, or the use of evaporative air cooling systems in open spaces), administrative or management-based (for example, changes in the opening and closing hours of certain tourist attractions or installations, modifying the programming of certain activities, etc.) and planning (urban planning, gardens, improvement and enlargement of shaded areas, fire prevention campaigns, health information campaigns, etc.). Adaptation in the field of planning is where, according to the people surveyed, the Spanish tourist system needs to improve the most. In fact, it should be noted that the heat wave episode of 2003 was responsible for intensifying or implementing, from the public administration, warning systems and prevention plans capable of helping to reduce the vulnerability of the population when faced with the effects of this type of event. The events that occurred in the summer of 2003 led the Spanish Ministry of Health and Consumption (in coordination with the regional and local governments) to create the so-called Plan of Preventive Actions across Spain, with the objective of establishing the measures necessary to reduce the harmful effects on health of excessive temperatures . The Plan, as well as containing promotion and prevention measures, establishes a system of meteorological alerts once the 95th percentile of average temperatures is reached, as measured in each province over the last 25 years as well as a system of monitoring of daily mortality rates. On a different note, the tendency to implement technological measures that may well be effective from the point of view of adaptation, but do not contribute at all to mitigation should be seen as a weakness of the Spanish tourist sector.

As in previous studies (Hamilton and Lau 2005; Rutty and Scott 2010; Scott et al. 2011; Smith 1981) the respondents said that they needed information to enable them to track the evolution of the extreme weather event and to follow recommendations. They also considered that the information was appropriate; although on occasions it took on a sensationalist character and was very extensive, it was thorough, accurate in its forecasts and above all necessary. In their role as consumer-tourists, respondents have shown that they accept alarmist and sensationalist headlines as positive if they heighten awareness of the event's various implications and of the measures to be taken to try to offset its effects without having to change destination. Our results for Spanish domestic tourism contrast with those obtained by other authors for the tourism originating in the countries of central and northern Europe with the Mediterranean as destination (Rutty and Scott 2010). In this case the harmful role that alarmist information can play in the consumer-tourist's decision-making is clear, especially when the holiday has not been booked or paid for.

Conclusions

In the light of the survey (based on the analysis of reported behaviour in response to a real experience), young Spanish tourists show themselves to be flexible and able to adapt to episodes of extremely high temperatures. Their particular perception of the phenomenon, their behaviour and the adaptation measures implemented to a lesser or greater extent, reduce the vulnerability of the sector when faced with this type of episode, at least from the point of view of this segment of the internal national market. It should be noted that in Spain, the episode of extreme heat of 2003 served as the springboard to implement or improve, after the fact, some adaptive measures, especially in the fields of management, policy and education. It remains to be studied how other tourists segments who travel in or come to Spain behave when faced with this type of event and, more importantly, what the results would be if the questionnaire were analysed according to the type of tourist activity embarked on during the episode.

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