ZEPHYRUS
climate change and environmental systems

URBAN TOURISM IN SOUTHERN EUROPE
Assessing present and future climate conditions

Raquel Machete

António Lopes

Hélder Fraga

CEG IGOT UNIVERSIDADE DE LISBOA

ULISBOA UNIVERSIDADE DE LISBOA

FCT Fundação para a Ciência e a Tecnologia

raquelmachete@campus.ul.pt

If rigour and uniformity are ascribed to the mechanisms that study atmospheric circulation, the same can not be said about the research of ideal weather types, subject to the component of perception (Brum Ferreira *et al*, 1983). Hence, the study of the present or future climate potential of any given region should include the tourist point of view, e.g. subjective nuances (Gómez-Martín, 2006)

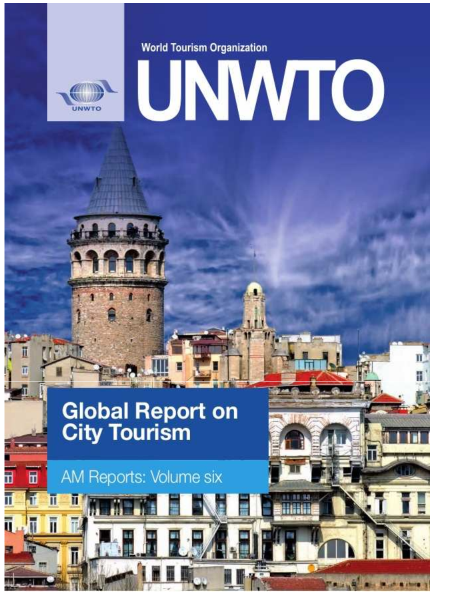
1. CLIMATIC PREFERENCES RESEARCH APPROACHES

1.1.Expert based studies of tourism climate preferences
1.2 Revealed tourism climate preferences
1.3 Stated tourism climate preferences

(Scott *et al*, 2008)

Figures for 2012 show that the number of tourist arrivals in Europe was over half of the world total (534 million). Within Europe, the southern subregion

leaded the way, with almost 40% of that share.



In the same year, a declaration was proposed, aftewards known as "**Istanbul Declaration on City Tourism" and signed by 21 cities, three of which figure** in the current analysis : Athens, Barcelona and Lisbon.

1.1. EXPERT BASED STUDIES OF TOURISM CLIMATE PREFERENCES

Bioclimatological methods that evaluate the climatic potential of different regions for tourism (metrics/indexes that aim to evaluate climate holistically, instead of focusing on one parameter)

a) Weather typing –establishing thresholds for outdoor recreation

1978 Yapp and McDonald

1978 Besancenot *et al*

b) Integrative indexes – rating of the effect of combined climate conditions (Mieczkowski, 1985; Morgan *et al*, 2000; de Freitas *et al*, 2008)

LIMITATIONS:

- Ratings and weightings of each variable were typically based on the opinion of the author
- Insufficient temporal and spatial scale

1.2. REVEALED TOURISM CLIMATE PREFERENCES

Determine statistical relationships between measures of tourism demand (number of tourist arrivals/departures…) and climate to deduce climate preferences of tourists. They provide an objective marker (tourist behaviour)

LIMITATIONS

- Low spatial and temporal resolution of data (quarterly or monthly data)
- Innacuracy of the representation of the destination climate (using the climate of the capital city as representative of the country; using a single variable – often temperature)

1.3. STATED TOURISM CLIMATE PREFERENCES

Methods that directly measure the climatic preferences of tourists – surveys

LIMITATIONS

In situ surveys
-Limited range of weather conditions that can be examined without significant personnel cost
-Response bias

Ex situ surveys
- Heterogeneity of geographical and cultural backgrounds or homogeneity of demographic characteristics (conclusions can not be generalized)

Statement $\neq$ Behaviour

2. METHODS AND DATA

METHOD

Weather types (Besancenot et al, 1978; Gómez-Martín, 2006)

DATA

Observation data: Meteorological observatories

Projections: Model (RCM) SMHI-RCA4 (Swedish Meteorological Institute), forced by the model (GCM) EC-EARTH (Royal Netherlands Meteorological Institute)

RCP 4.5

RCP8.5

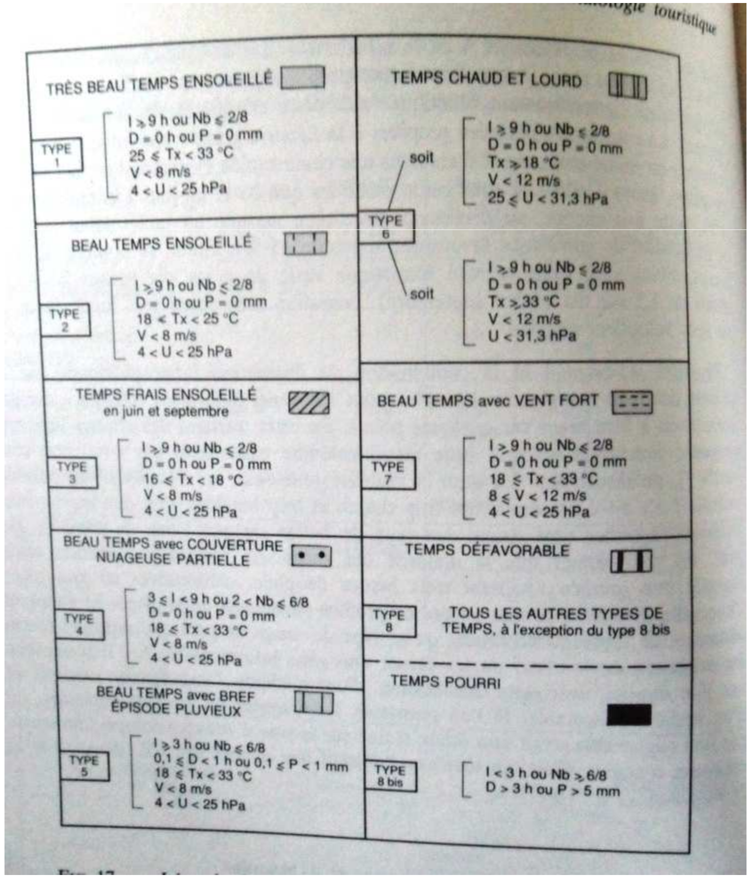
The climate change signal – difference pattern between the rcp 4.5 and the rcp 8.5 for 2041-2060 and 1981-2000 was interpolated, and afterwards it was added to the baseline period (observation data).

WEATHER TYPES (1978)

J P Besancenot, J Mounier and F Lavenne

Tipology of daily frequent combinations of the main climatic elements

The weather preferences of the "average" tourist were used to establish nine types of weather, during the summer, for the temperate latitudes


...ologie touristique

TRÈS BEAU TEMPS ENSOLEILLÉ

TYPE 1
- $I \geq 9$ h ou $Nb \leq 2/8$
- $D = 0$ h ou $P = 0$ mm
- $25 \leq Tx < 33$ °C
- $V < 8$ m/s
- $4 < U < 25$ hPa

BEAU TEMPS ENSOLEILLÉ

TYPE 2
- $I \geq 9$ h ou $Nb \leq 2/8$
- $D = 0$ h ou $P = 0$ mm
- $18 \leq Tx < 25$ °C
- $V < 8$ m/s
- $4 < U < 25$ hPa

TEMPS FRAIS ENSOLEILLÉ
en juin et septembre

TYPE 3
- $I \geq 9$ h ou $Nb \leq 2/8$
- $D = 0$ h ou $P = 0$ mm
- $16 \leq Tx < 18$ °C
- $V < 8$ m/s
- $4 < U < 25$ hPa

BEAU TEMPS avec COUVERTURE NUAGEUSE PARTIELLE

TYPE 4
- $3 \leq I < 9$ h ou $2 < Nb \leq 6/8$
- $D = 0$ h ou $P = 0$ mm
- $18 \leq Tx < 33$ °C
- $V < 8$ m/s
- $4 < U < 25$ hPa

BEAU TEMPS avec BREF ÉPISODE PLUVIEUX

TYPE 5
- $I \geq 3$ h ou $Nb \leq 6/8$
- $0,1 \leq D < 1$ h ou $0,1 \leq P < 1$ mm
- $18 \leq Tx < 33$ °C
- $V < 8$ m/s
- $4 < U < 25$ hPa

TEMPS CHAUD ET LOURD

TYPE 6

soit
- $I \geq 9$ h ou $Nb \leq 2/8$
- $D = 0$ h ou $P = 0$ mm
- $Tx \geq 18$ °C
- $V < 12$ m/s
- $25 \leq U < 31,3$ hPa

soit
- $I \geq 9$ h ou $Nb \leq 2/8$
- $D = 0$ h ou $P = 0$ mm
- $Tx \geq 33$ °C
- $V < 12$ m/s
- $U < 31,3$ hPa

BEAU TEMPS avec VENT FORT

TYPE 7
- $I \geq 9$ h ou $Nb \leq 2/8$
- $D = 0$ h ou $P = 0$ mm
- $18 \leq Tx < 33$ °C
- $8 \leq V < 12$ m/s
- $4 < U < 25$ hPa

TEMPS DÉFAVORABLE

TYPE 8

TOUS LES AUTRES TYPES DE TEMPS, à l'exception du type 8 bis

TEMPS POURRI

TYPE 8 bis
- $I < 3$ h ou $Nb \geq 6/8$
- $D > 3$ h ou $P > 5$ mm

ADVANTAGES OF THIS METHOD

a) Describes real weather conditions, such as experienced by the tourist
b) Allows for the inclusion of risk factors (strong winds, heat stress…)
c) Can be adjusted to different tourism activities /types of destination

APPLICATION TO CATALONIA (Gómez-Martín, 2006)

	Daily Sunshine (h)	Cloud Cover N_b(octas)	Daily precip. (h)	Max. daily temp. (ºC)	Wind speed (m s^{-1})	P (kcal m^{-2} h^{-1})	THI (ºC)
Type 1	≥11	≤2/8	0	22 to <28	<8	≥50	15 to < 28.5
Type 2	5to <11	$5/8>N_b>2/8$	0	22 to <28	<8	≥50	15 to < 28.5
Type 3	> 5	<5/8	0	28 to <33	<8	≥50	20 to < 28.5
Type 4	> 5	<5/8	0	16 to <22	<8	≥50	15 to < 26.5
Type 5	> 5	<5/8	0 to <1	16 to <33	<8	≥50	15 to < 28.5
Type 6	> 5	<5/8	0	22 to <33	8 to <12	≥50	
Type 7	All weather types with the exception of types 1, 2, 3, 4, 5, 6 and 8						
Type 8	≤5	≥5/8	>3	These parameters can adopt any value			

Thresholds were validated by surveys

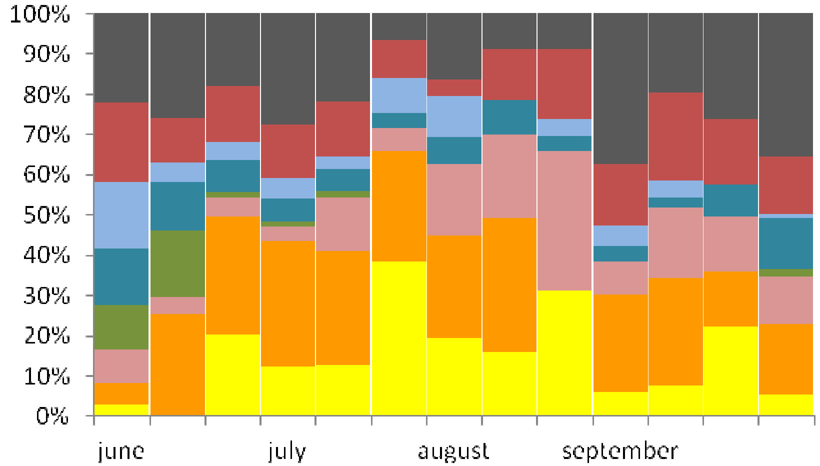
WEATHER TYPE	SUNSHINE (H)	CLOUD COVER (OCTAS)	RAIN (MM)	MAXIMUM TEMPERATURE (°C)	WIND (M/S)	PET (°C)
Type 1. very good, sunny weather	≥ 11	≤ 2/8	0	22 a < 28	< 8	18 < 35
Type 2. Fine weather w/ partial cloud cover	5 < 11	5/8 ≥ 2/8	0	22 a < 28	< 8	18 < 35
Type 3.Fine, hot, sultry weather	› 5	≤5/8	0	22 a < 33	< 8	23 < 35
Type 4. Fine, cool weather	› 5	< 5/8	0	16 a < 22	< 8	18 a < 23
Type 5. Fine weather with short amount of rain	› 5	≤ 5/8	0 ,1 < 1	16 a < 33	< 8	18 a < 35
Type 6. Fine weather w/ strong winds	› 5	< 5/8	0	22 a < 33	8 <12	18 a < 35
Type 7. Extremely hot weather	› 5	< 5/8	0	≥ 33	< 8	≥ 35
Tipo 8. Unfavourable weather for tourism	**Every other weather type**					

CITIES IN THE ANALYSIS – Lisbon, Barcelona, Rome, Athens and Zagreb

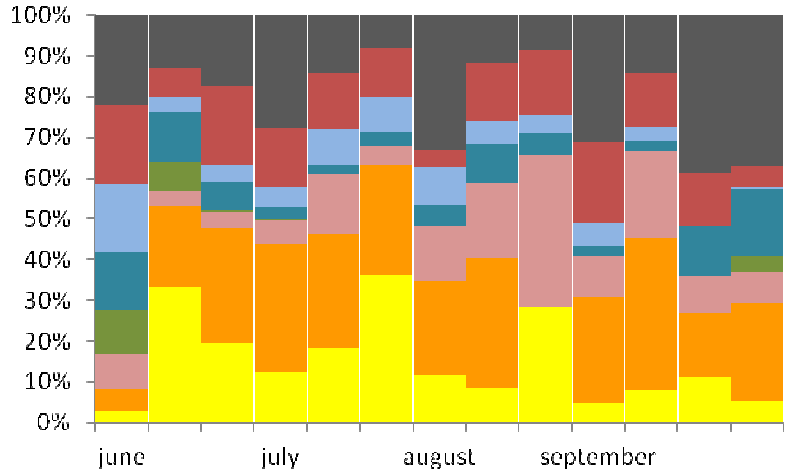
3. RESULTS

LISBON 2041-2060

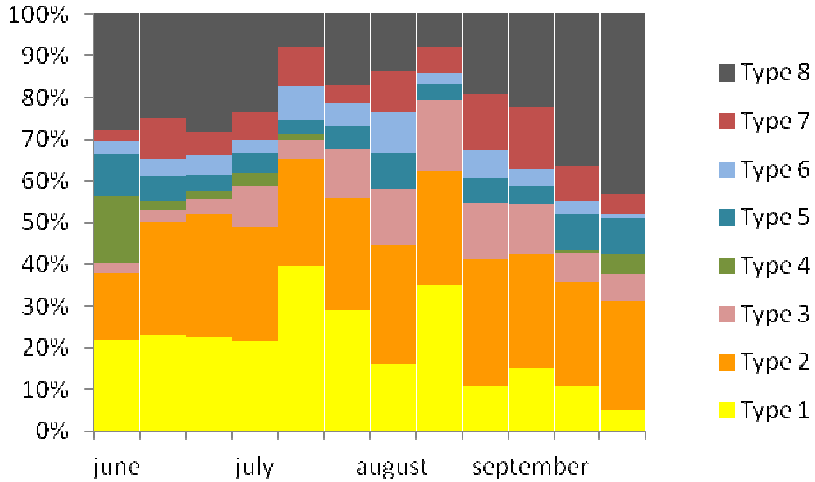
RCP 4.5



RCP 8.5



LISBON (1981-2000)



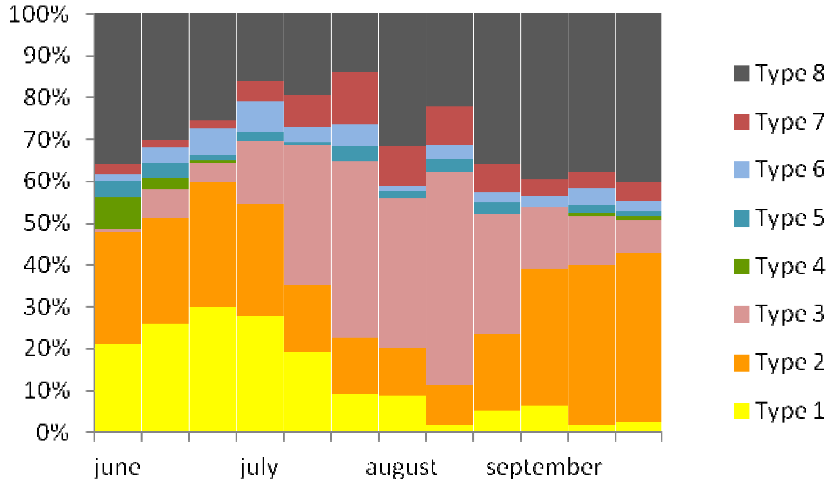
Portela- Loures (38º46’54N 09º 06’51E)

Slight decrease in the average number of favourable days (1-6) from 69% to 65% (rcp 4.5) and 66% (rcp 8.5)

Highest decrease: type 1

Highest increase: type 7

BARCELONA (1981-2000)

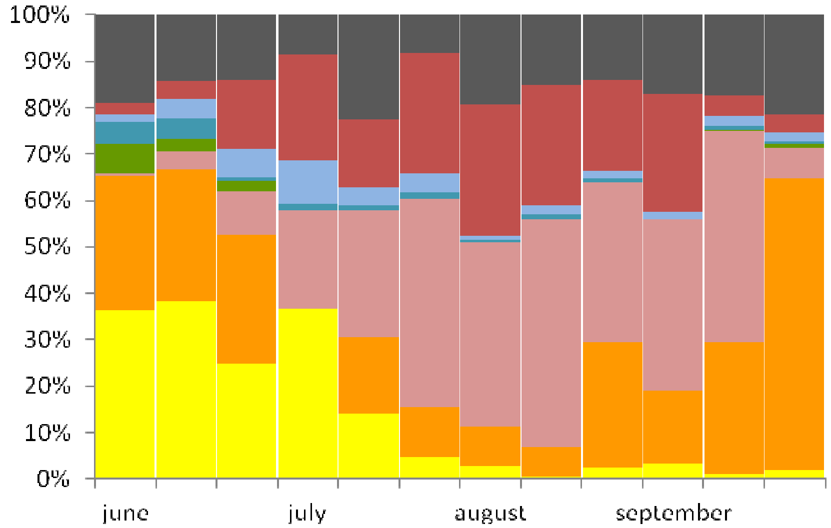


Barcelona – Airport (41º17'34N 2º 4'12E)

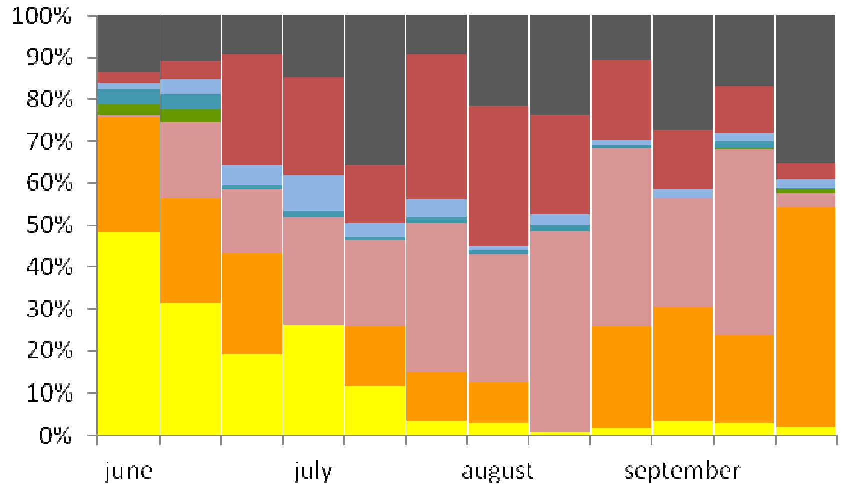
Variations in the average number of favourable days (1-6) from 65% to 68% (rcp 4.5) and 63% (rcp 8.5)
Highest decrease: type 8
Highest increase: type 7

BARCELONA 2041-2060

RCP 4.5

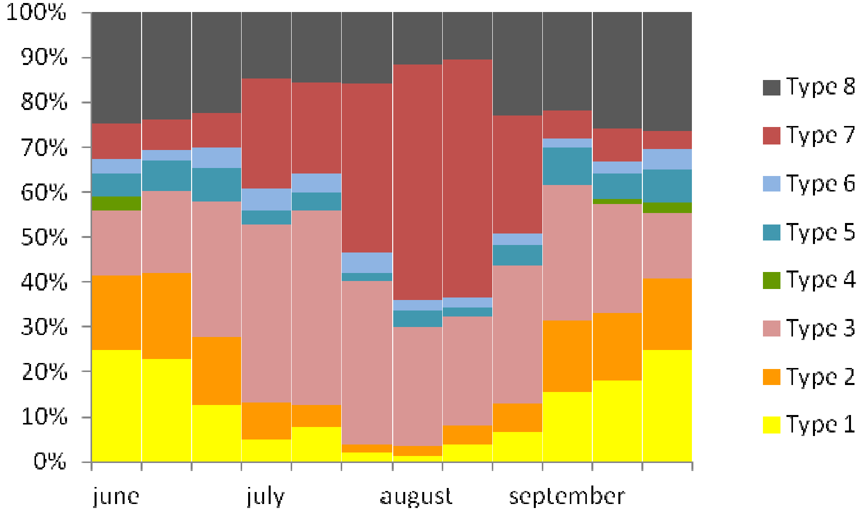


RCP 8.5



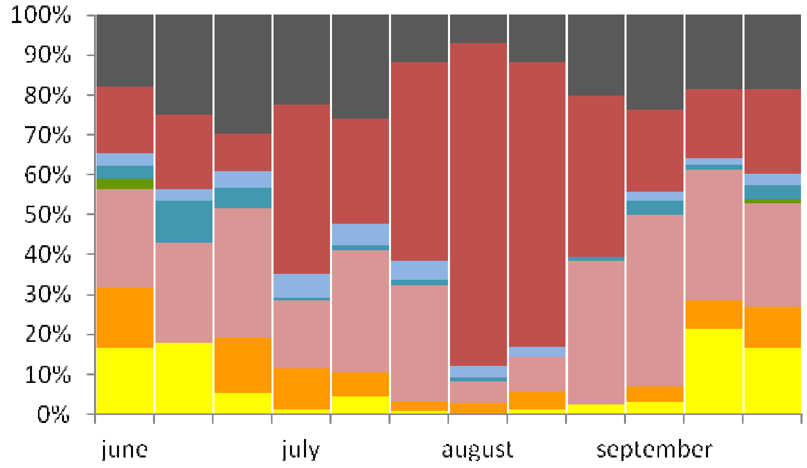
ROME (2041-2060)

ROME (1981-2000)

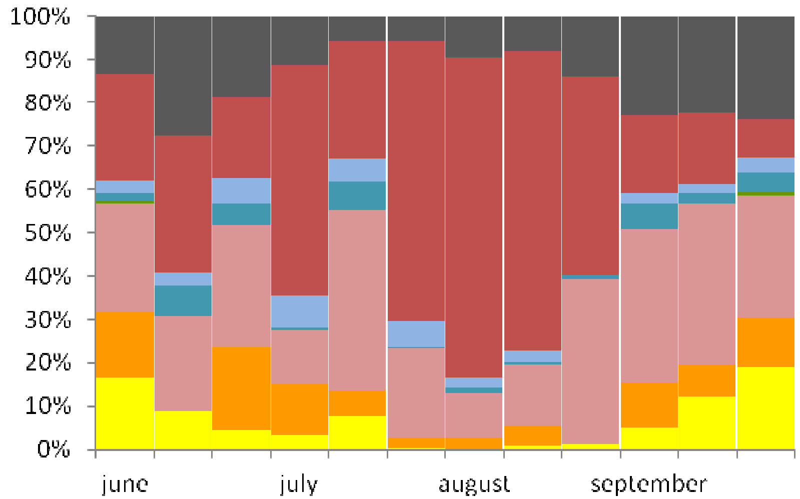


Rome – Airport (41º47’57.7N 12º35’41.77”E)

RCP 4.5



RCP 8.5



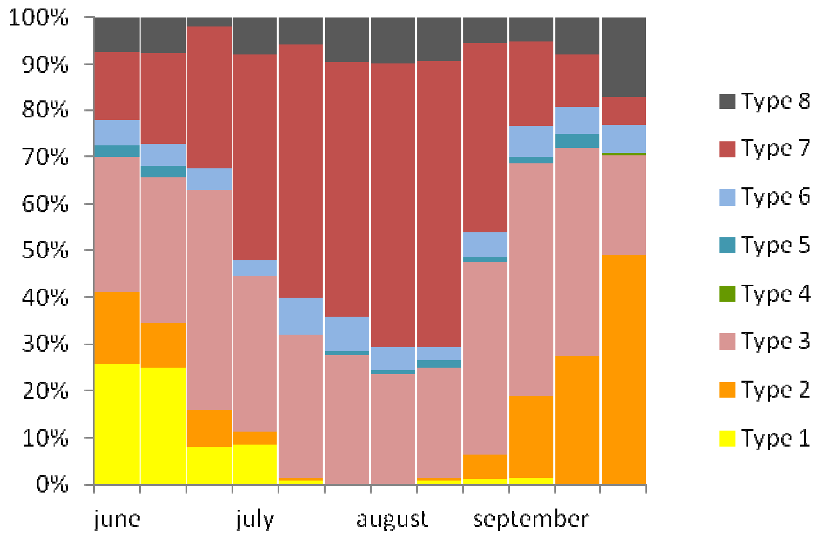
Rome displays the most severe decrease of favourable days for tourism. The average number of favourable days (1-6) declines from 59% to 46% (rcp 4.5) and 47% (rcp 8.5)

Highest decrease: type 1 (followed by 2)

Highest increase: type 7

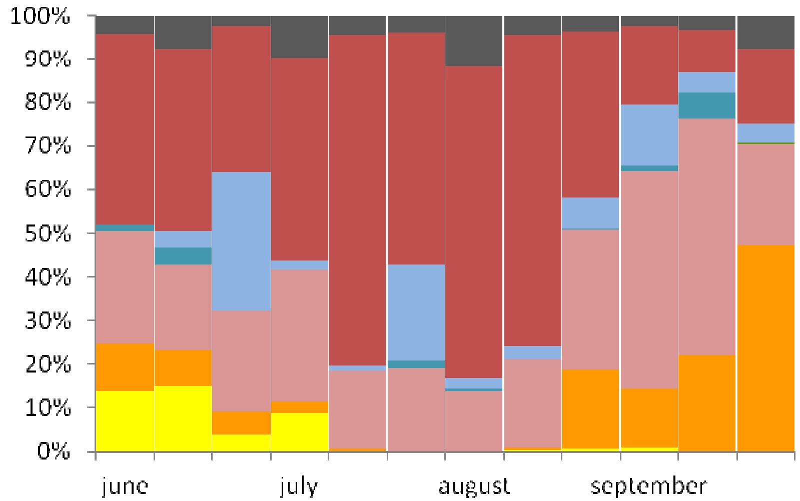
ATHENS (2041-2060)

ATHENS (1981-2000)

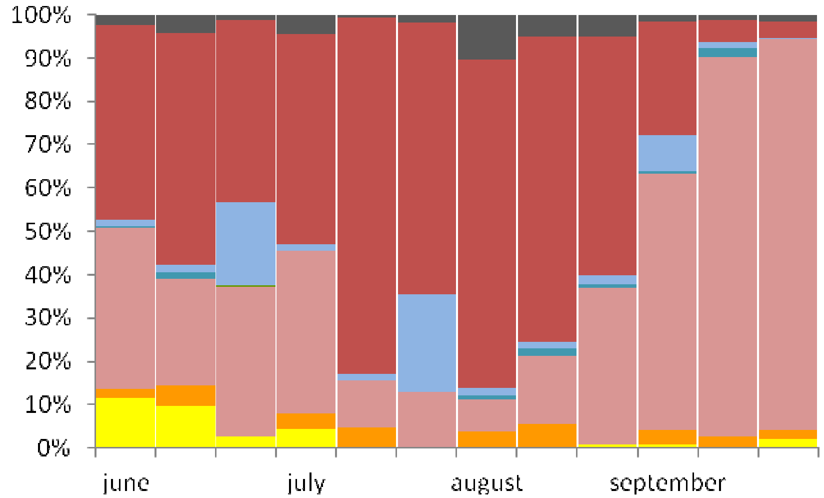


Athens – Airport (37º56’11 N 23º56’50’E)

RCP 4.5



RCP 8.5



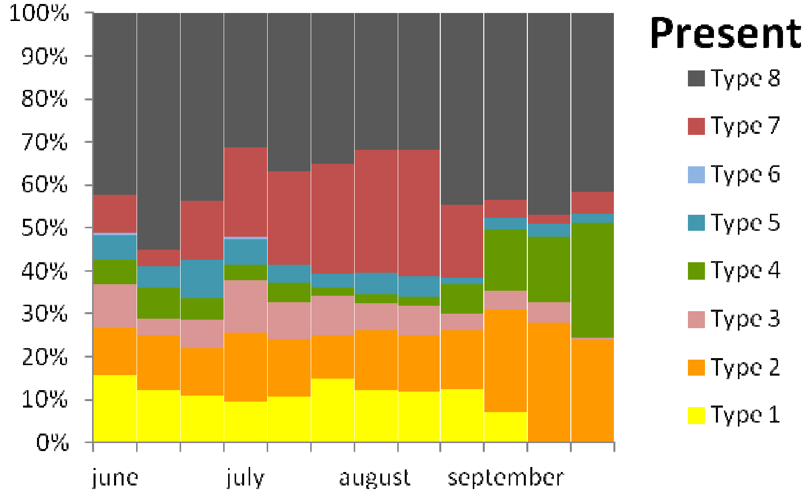
With a departing point of 57% of favourable days (1-6), in 2041-2050 this figure is projected to decline to 51% (rcp 4.5) and 49% (rcp 8.5)

Highest decrease: type 2

Highest increase: type 7

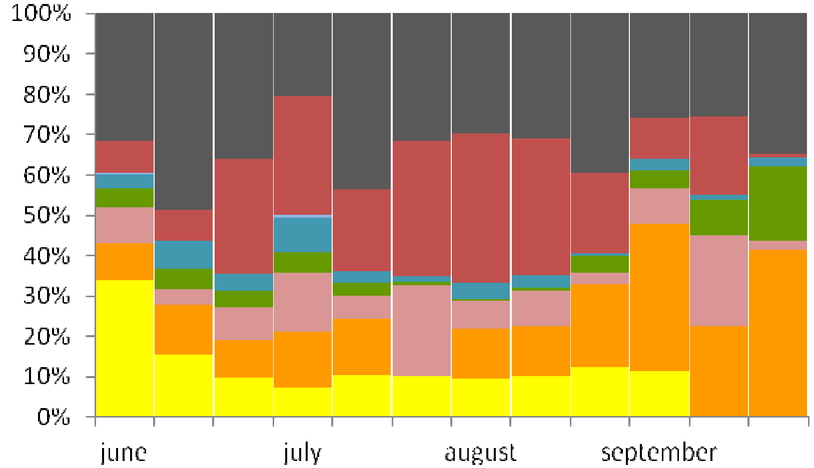
ZAGREB (2041-2060)

ZAGREB (1981-2000)

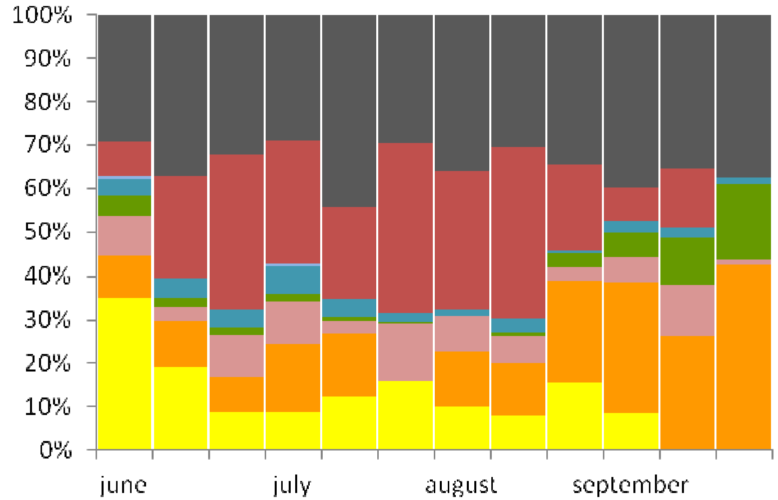


Zagreb – Maksimir (45°49' 0" N 16°2' 0" E)

RCP 4.5



RCP 8.5



The percentage of favourable days in Zagreb has slight variations between the two periods. The average number of favourable days (1-6) varies from 44% to 46% (rcp 4.5) and 43% (rcp 8.5)
Highest decrease:
Highest increase: type 8 (followed by 4)

CONCLUSIONS

- The five selected south European cities display very different patterns of weather types, during the summer. Hence, predicting a decline of the regions' attractiveness under climate change as a whole, is to overlook these nuances.

- At the exception of Zagreb, the share of days with favourable weather (types 1-6) always exceeds the days with unfavourable types (7 and 8) for the baseline period. Under future scenarios, Rome, Athens and Zagreb present almost the same share of favourable and unfavourable days. For Rome and Athens, it is the increase in maximum air temperatures that explains such a decline – the final decade of July and all August are predominantly unfavourable.

- Although we assume type 7 (extremely hot weather) as unfavourable, recent surveys to tourists leads us to question established ideal temperature thresholds (Martínez-Ibarra and Gómez-Martín, 2012; Rutty & Scott, 2014)

Thank you for your attention !

Let’s meet in Lisbon, now that you’ve seen the share of
favourable weather conditions

BIBLIOGRAPHY

- Alcoforado M J, Dias A, Gomes V (1999) Bioclimatologia e Turismo. Exemplo de Aplicação ao Funchal. *Islenha*, 25: 29-37.
- Alcoforado M J, Andrade H, Paulo M J (2004) Weather and recreation at the Atlantic shore near Lisbon, Portugal. A study on applied climatology. *In*: Matzarakis A, DeFreitas CR and Scott D (eds), Advances in Tourism Climatology, Berichte des Meteorologishen Institutes der Universität Freiburg, 12: 38-48.
- Andrade H, Alcoforado M J, Oliveira S (2007) Methodologies to assess the effects of climate on tourism: weather type and individual perception. In: Matzarakis A, De Freitas CR, Scott D (eds) Developments in tourism climatology. Commission on Climate, Tourism and Recreation, International Society of Biometeorology, Freiburg: 74-79.
- Besancenot JP (1985) Climat et tourisme estival sur les côtes de la péninsule ibérique. Revue Géographique des Pyrénées et du Sud-Ouest, 56(4): 427-451.
- Besancenot JP (1990) Climat et tourisme. Masson, Paris.
- Besancenot JP, Mounier J, De Lavenne F(1978) Les conditions climatiques du tourisme littoral: un méthode de recherché compréhensive. Norois, 99: 357-382.
- De Freitas C R, Scott D, McBoyle G (2008) A second generation index for tourism (CIT): specification and verification. Int J Biometeorol, 52:399-407.
- De Freitas C R (2003) Tourism climatology: evaluating environmental information for decision making and business planning in the recreation and tourism sector. Int J of Biometeorol, 48: 45-54.
- Brum Ferreira A, Roxo MJ, Vieira MJ, Quintal R (1983) *Ambiência Atmosférica e Recreio ao Ar Livre. Duas tentativas de classificação e sua aplicação a estações litorais portuguesas*. Linha de Acção de Geografia Física, Relatório nº 17, Centro de Estudos Geográficos, Lisboa.
- Goméz Martín M B (2006) Climate potential and tourist demand in Catalonia (Spain) during the summer season. Climate Research, 37:75-87.

Martínez-Ibarra E, Gómez-Martín M B (2012) Weather, climate and tourist behaviour : the beach tourism of the Spanish Mediterranean Coast as a Case Study. *European Journal of Tourism, Hospitality and Recreation*, 3 (Special Issue ITC'11):77-96.

Rutty M, Scott D (2014) Bioclimatic comfort and the thermal perceptions and preferences of beach tourists. *Int J Biometeorol:* 1-9

Scott D, Gössling S, De Freitas CR (2008) Preferred climates for tourism: case studies from Canada, New Zealand and Sweden. *Climate Research*, 38:61-73.