

Could climate change have a positive impact in Portugal's west tourism region coast?

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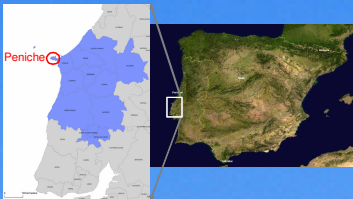
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INTRODUCTION

Climate plays an important role in tourism activities at several levels: it can act as a localization factor for attracting areas, it can influence the activity periods; it can influence the infrastructures and its well functioning; and it influences strongly the tourist comfort and wellbeing.

This tourism region is composed by 11 municipalities (blue area in map below) and it has been defined as a priority area in the National Strategic Plan for Tourism. Coastal tourism (mainly beach and sun) is dominant in this region and is showing signs of great development.



In the present work we focus on the predictable climate change impacts on the tourism activities of Portugal's coastal west tourism region, taking as an example the climate trends around Peniche, aiming to represent the west tourism region coast.

METHODOLOGY

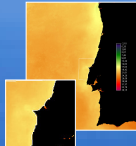
In order to identify the observed summer environmental changes in the last decades, several meteorological parameters and sea surface temperatures were analyzed and a tourism climate index (TCI) was calculated.

Meteorological data

The meteorological parameters analysed were: minimum and mean air temperature; relative humidity; sunshine duration; Sea Level Pressure and sky cover. All this data was obtained from the Meteorological Station of Cabo Carvoeiro in Peniche.



Sea Surface temperature



Sea surface temperatures trends were obtained through the analyses of 136 monthly average NOAA- AVHRR images, since January 1996 to May 2007. This data was obtained from the German Aerospace Center database available online.

Using a GIS (Idrisi Kilimanjaro) average sea surface temperatures were obtained for small rectangle by the west tourism region in Portugal (images in the left).

Comfort Index

The Mieczkowski tourism climatic index (TCI) was calculated for the summer period of 1980/2006 according with the following formula: $TCI = 8 \cdot Cld + 2 \cdot Cla + 4 \cdot R + 2 \cdot S + 2 \cdot W$

Where Cld is a sub index representing the daily comfort, Cla the daytime comfort (Amelung, 2006); R the total amount of rain, S the sunshine duration and W the wind speed. All these sub indexes were analysed in a monthly basis.

TCI was modified, as the original "effective temperature" was replaced with a more recent "Apparent Temperature" according to Scott & McBoyle (2001), Sunshine duration was determined using Rayman (Matzarakis *et al.*, 1999) and wind speed classes were always assumed as 3 (the mode value from 1980 to 2000).

FINAL REMARKS

Although climate change can have several negative impacts to the tourism sector in general (decrease of summer comfort, increase of extreme events, like heat waves and droughts, among others) it is expected that in Peniche, sea proximity can moderate the expected summer discomfort increase to some extent. This "moderating" effect probably indirectly benefits at a medium term the west tourism region coast of Portugal as the region's climate may become more appealing in comparison to the central mainland of the Iberian Peninsula (Hein, 2007).

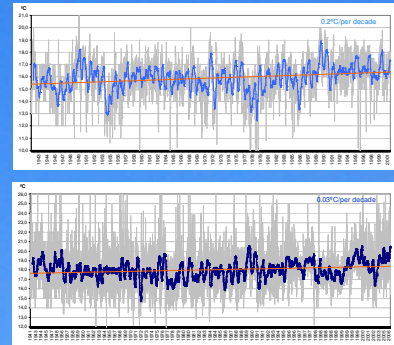
If further data confirm the TCI tendency found in Peniche, it is our belief that in the short and medium terms,

Air temperature

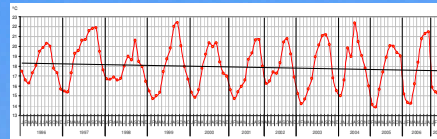
Analysing the meteorological data from Cabo Carvoeiro it was possible to observe an increase of both minimum and mean air temperature in Peniche since the beginning of the 40s.

An asymmetric rate trend in minimum and maximum air temperature is often referred by the literature (Easterling *et al.*, 1997; Vose *et al.*, 2005). The first can have an increase rate three times higher than the second (Karl *et al.*, 1993).

Also in Peniche it was possible to identify a a substantially higher average increase of the minimum (light blue graph, on the right) than the mean air temperature (dark blue graph, on the right), showing an average increase of 0.2°C/decade and 0.03°C/decade, respectively.



Sea surface temperature



Annual sea surface temperature by the west coast of Portugal showed a slight decrease during the last decade (between 1996 and 2007).

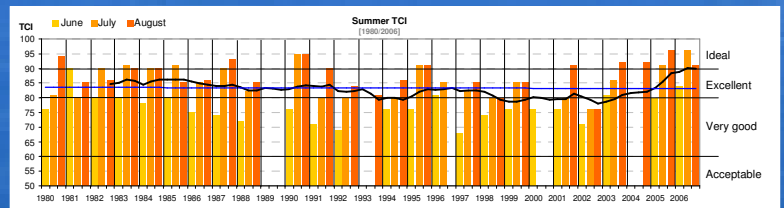
However when analyzing the summer period individually [June (yellow bar); July (orange bar) and August (brown bar)] it was identified a slight increase of the sea surface temperature during the same period. This slight summer increase is highly associated with the average sea surface temperatures of June and July 2006.

This data is to be confirmed with further satellite images and with a wider time scale (e.g. 30 years).

Summer Comfort

Although the Tourism Comfort Index in Peniche Summer has shown a slight decrease since 1980 (blue line in graph), The moving average of 6 months (2 consecutive years) show an appreciable increase from 2001 to 2006, reaching the ideal TCI, 90.

The individual month TCI number shows also a maximum in this period, on July 2005 and June 2006. It can also be observed that the first five years of this decade (2001 to 2006) have showed 7 months of ideal TCI, more than the observed in the earlier 5 year periods.



One may conclude from this graph that the average summer tourism comfort index for the Peniche region is coming from excellent to ideal and that for now the minimum temperature increase has a positive impact in the summer tourism comfort on the Portugal's west tourism region coast.

summer thermal discomfort in this region is going to be less severe than in the Mediterranean coast and therefore it might produce a competitive factor for the region specifically for the "beach and sun" tourism sector in the Iberian peninsula. Hence, one of the following steps should be to compare the latest climatic trends (including Mieczkowski's TCI) in the Mediterranean coast.

It is also important to understand what kind of seasonal shifts might be happening in the region and what are the consequences of those shifts to the tourism sector. Therefore annual TCI is to be calculated.

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