

TOURISM CLIMATOLOGY AND TOURISM POTENTIAL FOR CRETE, GREECE

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1 INTRODUCTION

Crete, the biggest island of Greece, located in the east Mediterranean, is the most frequently visited Greek island by foreign visitors (about 2 millions people) throughout the year. Tourism represents a major economic factor for Crete. Crete is the greatest tourism destination in Greece. The overnight stops in Crete reached the 26.7 % of all Greek Tourism market, in 1999. The number of arrivals in Crete in 2003 during the first six months reached the level of 642.757, while the corresponding overnight stops reached the level of 4.219.738. The most of the arrivals (91.2 %) were recorded during the period April – June, while the rest (8.8 %) the period January – March. So, in general, weather and climate/bioclimate information are required and demanded for the quantification of the existing climate conditions on the one hand, and for the approximate calculation of possible damages and implications to human health resulting from extreme weather events on the other.

Due to its location in the eastern Mediterranean, the island of Crete has a mild climate with only slight variations. Through its geographic location, Crete is protected from the cold air masses of central and western Europe in winter, and the high temperate air masses of North Africa in summer. Thus, the climate of Crete is temperate to maritime, except for most mountainous areas where [the climate] is mountainous. Crete has a very gentle and healthy climate. The winter is mild, particularly in plain and coastal areas. Also summer temperatures are rather pleasant due to the sea breeze and etesian winds (northerly winds from Aegean Sea). The plain and coastlines areas of Crete, and particularly its eastern parts, are one of the warmest areas of the country during winter, due to increased sunshine, scarce snowfalls and absence of frost.

First, an attempt is made in this paper to assess and analyse the thermal sensation and general climate factors of Crete and also their variations and trends for the time period 1960-2000. Secondly, it was attempted to define and quantify the tourism potential of the island.

2 METHODS

In order to quantify the tourism climate conditions, long term data from several stations of the existing climatic network of Crete were used, including daily mean, maximum and minimum temperatures, relative humidity, wind speed and cloud cover over the whole island. From these parameters the daily Physiological Equivalent Temperature (PET) was derived (VDI, 1998, Höppe, 1999, Matzarakis et al., 1999). In addition, possible trends of thermal comfort in annual and seasonal basis and precipitation were taken into account.

Further, geo-statistical methods have been applied and available climate data from the 10 minutes climatology (New et al., 1999, 2000) have been used to construct high resolution maps of basic climatological parameters and the Physiological Equivalent Temperature for the period 1961 - 1990.

3 RESULTS AND DISCUSSION

The analysis of the tourism climate and tourism potential have been analysed through ombro-thermic diagrams for the investigated climate stations (7) and periods. Fig. 1 shows the ombrothermic diagram for Heraklion for the period 1961 – 1990. With regards to air temperature variations in Crete, the data shows that in the first (cold and rainy) period of October to March the coldest months are January and February. The mean minimum air temperature in these months varies between 7 - 9 °C in coastal areas, 4 - 6 °C in the mainland, and even lower in highlands. In general, in this period, the eastern plain parts of Crete along with Dodecanese (the most south-eastern islands of Greece), are the least cold areas of Greece (Fig. 1).

For each station the thermal human-bioclimate conditions in terms of mean conditions, extremes and frequencies of thermal perception classes were analysed. Fig. 2 shows the bioclimate diagram for Heraklion for the period 1955 – 2001. The thermal human-bioclimate conditions are in percentages of the occurrence of classes for ten day intervals (dekas). Results from fig. 2 show that 50 % of the days from the 11th dekas to the 30th dekas are lying in the PET-classes of 18 °C and above. It has to be mentioned that the results of Fig. 2 are based on daily mean values for the meteorological variables. From the 13th to 27th dekas also extreme thermal stress can be observed for the investigated region.

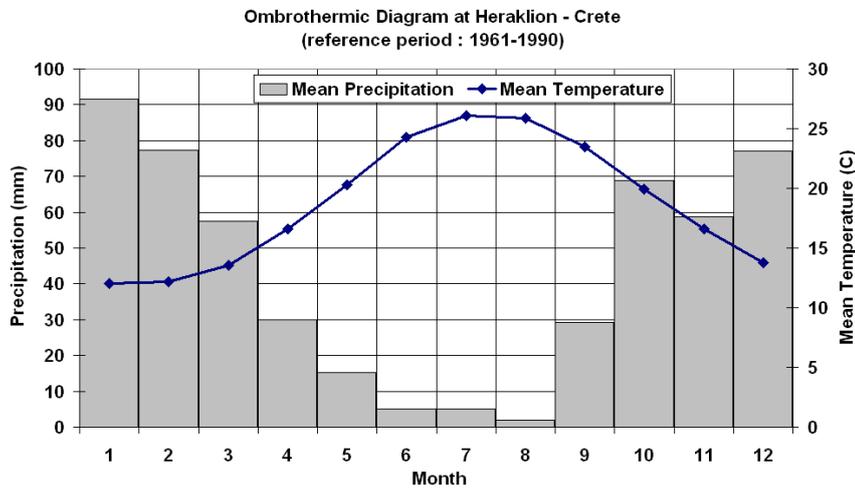


Fig. 1: Ombrothermic diagram at Heraklion for the climate period (1961-1990)

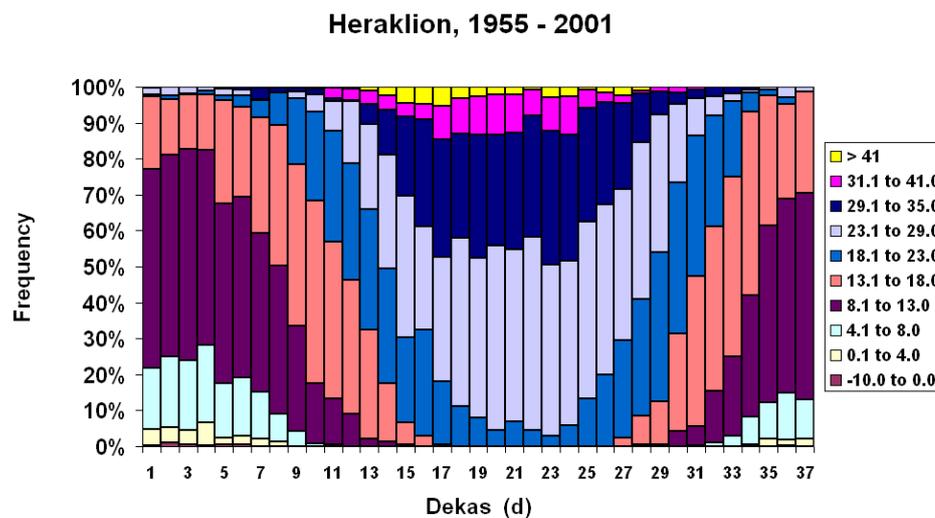


Fig. 2: Bioclimate diagram for Heraklion, Crete for the period 1955 – 2001

The second (warm and dry) period of April to September is characterised by almost no precipitation and slightly hot temperatures. The warmest months of this period are July and August. The mean maximum air temperature in these two months varies between 28 and 32 °C, sometimes reaches 34 - 36 °C and scarcely, mainly in southern Crete, approaches 40 °C, particularly in plain mainland areas. These high temperatures in the southern part of Crete are associated with low air humidity and, thus, the thermal comfort conditions in these areas are still tolerable. June shows approximately the same temperature regime as September, with the later to be considered as summer month in Crete the precipitation increases from East to the West and from the northern coastal areas to the inland regions and the highlands, and then decreases to the southern parts. Maximum annual precipitation levels of 1100 – 1200 mm are observed in mountainous areas of Crete and with 1600 mm even higher levels in the Lefka Ori mountain range (west part). The lowest annual precipitation of about 500 mm or less are recorded in the southern parts of Heraklion Prefecture (central part), particularly in Mesara plain and Viannos area. Snow appears in high frequency in the mountains and particularly in Lefka Ori Mountain

range (west part) and Psiloritis Mountain range (central part), while in the coastal areas snowfall is a sporadic phenomenon.

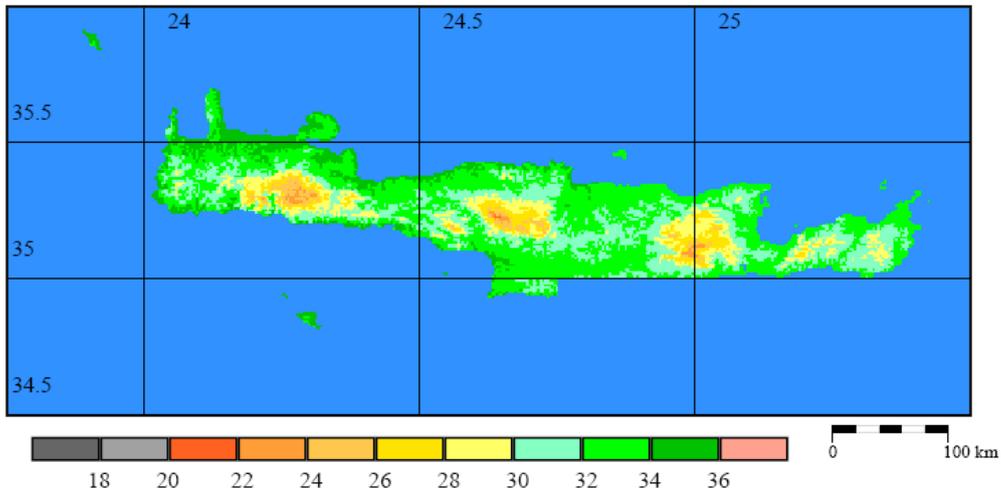


Fig. 3: Map of air temperature (°C) map for Crete for July for the period 1961 – 1990 (resolution: 1 km)

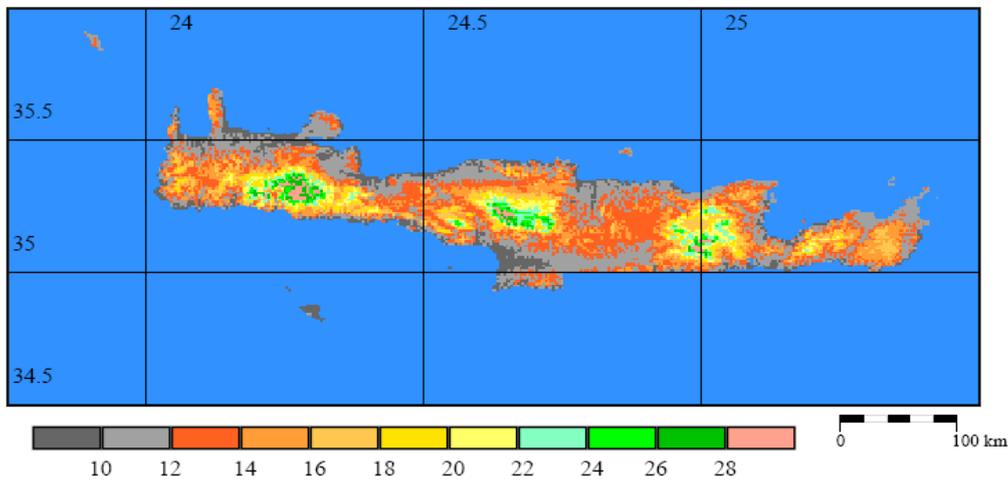


Fig. 4: Amount of days with precipitation (> 1 mm) for the tourism period (April to October) for the period 1961 – 1990 (resolution: 1 km)

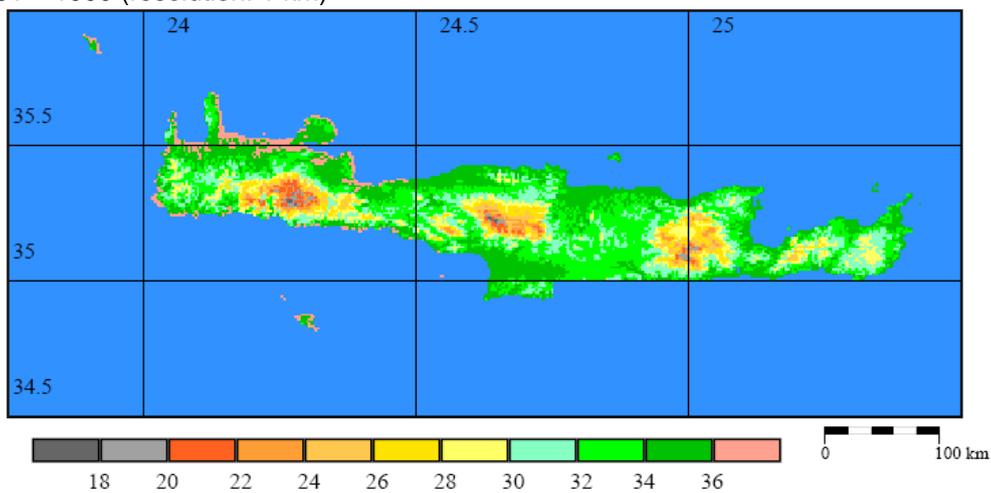


Fig. 5: Map of Physiological Equivalent Temperature (°C) for Crete for July for the period 1961 – 1990 (resolution: 1 km)

Fig. 3 shows the distribution of air temperature for July in a horizontal resolution of 1 km, which provides the possibility of quantification of the conditions for the whole island. Beside the air temperature as an ordinary climatic parameter, in terms of precipitation it is not only important to consider the precipitation sum for the whole year but the sum of precipitation or rain during the tourism period. More appropriate and complementary information for the tourism period can be provided by the amount of days with rain (> 1 mm). Fig. 4 shows the amount of days with precipitation for the tourism period in Crete (April to October) for the period 1961 –1990. From Fig. 4 it can be extracted that the days with precipitation are generally low, with less than 15 days for the areas of low altitude.

As mentioned above, results derived from thermal human-bioclimate data can provide more detailed information about the bioclimatic conditions of an area. They include not only air temperature information, but additional meteorological variables (air humidity, wind speed and also short- and long wave radiation fluxes) and thermo-physiological information. Thermal bioclimate can be quantified by the use of thermal indices. Fig. 5 shows the geographical distribution of the Physiological Equivalent Temperature for July for the period 1961 – 1990. Compared to the map of air temperature from Fig. 3, we can assume that thermal comfort can not be described only by the air temperature or other single meteorological parameters.

4 CONCLUSION

For the identification and quantification of the tourism climate and tourism potential, manifold climatic and bioclimatic information can be provided by applied climatology and biometeorology. The existing information and provided material have to be reliable and accessible. Information can be provided in traditional ways of presentations like ombro-thermal diagrams. The existing climatic networks, beside the synoptical networks from national weather services, offer appropriate data for the regionalisation of climate information by the use of geo-statistical methods. The existing data sets offer also the possibility for the calculation of thermal indices in order to access and to quantify the climate in human-biometeorological terms. The data of the climate networks allow also the calculation of frequencies and extremes i.e. the amount of days with precipitation for the tourism period or the detection of frequencies of heat waves.

Human-biometeorological methods can be adapted for tourism climatology and tourism potential issues. Analysis of single climatic variables and thermal indices in form of means, extremes and frequencies do not present an integral assessment of the tourism potential of an area. Integral assessment should cover diverse facets of the climate and physical environment. UV-Information, sunshine duration and possible extreme events or damages for health should be considered in the tourism climate analysis. The produced maps show that the use of geo-statistical methods and the implementation of data sets from climate models offer possibilities for the construction of results with a high spatial resolution.

The analysis for Crete shows that the natural potential is higher and an extension of the tourism period possible. The milder periods of the year, are suitable for wellness and cultural tourism of specific population groups and extend Crete's tourism period.

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