

## **BIOMETEOROLOGICAL BASIS FOR TOURISM**

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**ABSTRACT** Climate is an important resource for tourism and must be taken into account in tourism promotions. Here the biometeorological conditions on the Adriatic coast and in the Croatian inland are compared. The biometeorological conditions are analyzed by means of frequency of thermal sensation based on physiologically equivalent temperature in ten-day periods throughout the year. In combination with some other meteorological parameters, such as air and sea temperature, sunshine duration, amount and number of days with precipitation and wind roses can be valuable for tourists, enabling everyone to choose the most convenient period for holidays, depending on personal conditions and needs.

**KEYWORDS:** *Thermal sensation, physiologically equivalent temperature, meteorological leaflet*

### **INTRODUCTION**

Weather and climate, together with some other natural resources, such as geographical location, orography and landscape, play important roles for tourism and recreation (de Freitas, 2003). Since outdoor recreation is very weather sensitive (Perry, 1972), weather and climate can be one of the most important features attracting tourists, but also present limiting factors. The role of climate in determining the suitability of a region for tourism or outdoor recreation is often assumed to be self-evident and therefore to require no elaboration. Climate-related information is often very poor and barely helps tourists in planning and scheduling their holidays or the promotion of a tourist destination in publicity campaigns.

Climatic information can be useful in decision-making if presented in an appropriate form. Therefore it is important to identify which climate-related criteria people use to make their decisions about holiday destinations, taking into account that the human response to climate depends on individual perception and sensitivity. The atmospheric conditions can be divided into three main groups – thermal, physical and aesthetic (de Freitas, 1990). The “thermal” climate variable is air temperature or thermal sensation, “physical” variables are rain, snow and wind, while sunshine and cloudiness can be treated as the “aesthetic” climate variables (de Freitas, 1990).

## DATA AND METHOD

In the first part, the biometeorological conditions in the period 1961-1990 at six meteorological stations in different climatic regions of Croatia are analyzed. These are Rovinj at Istra Peninsula, island Hvar in the middle Adriatic, Varazdin and Osijek in the continental lowland and Parg (863 m) and Zavizan (1594 m) in the mountain region of Croatia (Fig. 1). The biometeorological conditions are analyzed by means of ten-day mean values of thermal sensation measured at 7am, 2pm and 9pm during the year, and by means of the probability of occurrence of different thermal sensations that enable more detail information about bioclimate. The thermal sensation is defined by means of physiologically equivalent temperature PET as the physiologically significant assessment of the thermal environment derived from the human energy balance (Höppe, 1999, Matzarakis et al., 1999).

The second part of the work here puts together a “presents a climatological leaflet” useful for tourism, based on the analysis of 10-day periods of meteorological parameters important for tourism and recreation. The selection of meteorological parameters used here takes into account the thermal, physical and aesthetic components relevant for tourists.



Figure 1: The position of analysed stations

## RESULTS

### Biometeorological conditions in Croatia

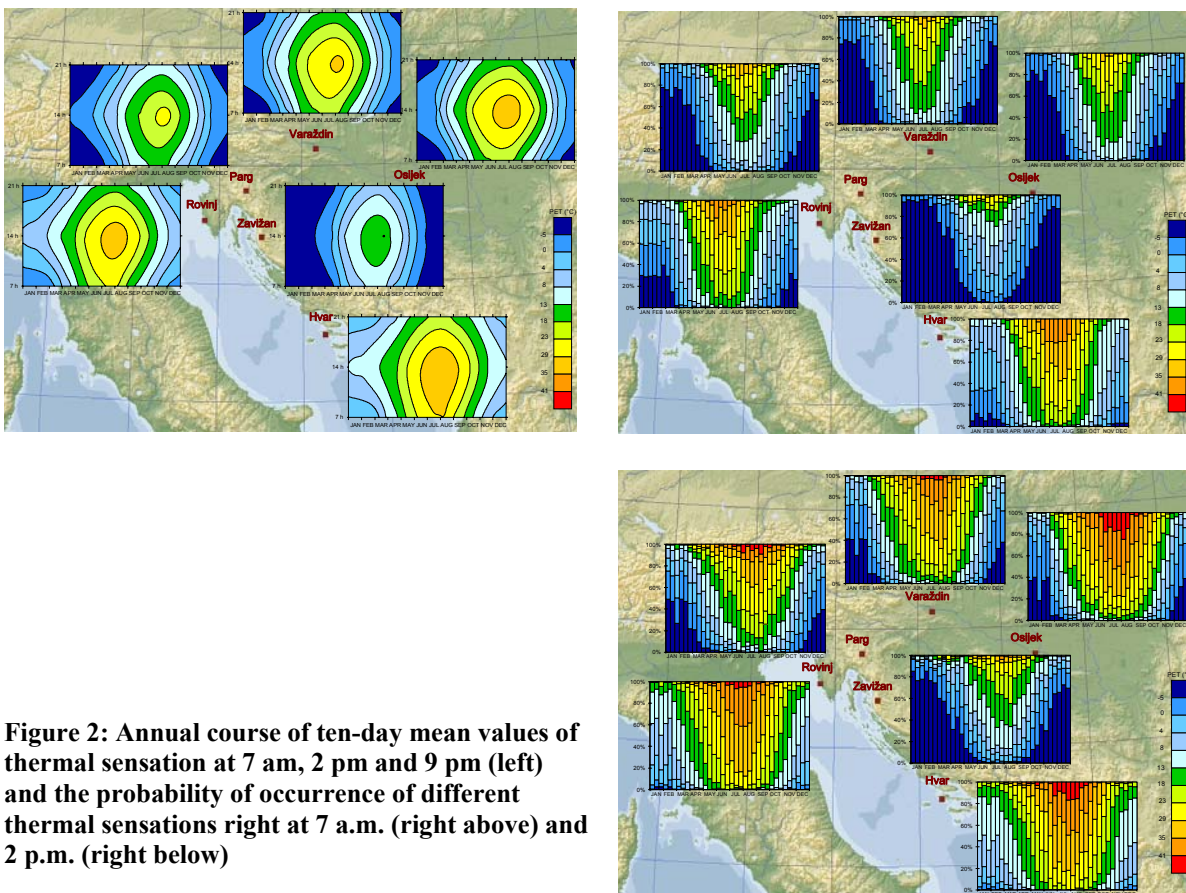
In the relatively small area of Croatia one can find several climates suitable for a variety of tourism activities including recreational walking, fishing or health tourism in spas on the mainland, hiking, rafting and winter sports in the mountainous part, for summer sports as well as different sport activities in other seasons on the coast.

In winter the differences in biometeorological conditions between the continental part and the coastal strip along the Adriatic sea differ are most pronounced (Fig. 2, left). In the continental part it is very

cold with mean values of PET between  $-5^{\circ}\text{C}$  and  $0^{\circ}\text{C}$  and falling below  $-5^{\circ}\text{C}$  only during the morning and evening. On the other hand, along the coast very cold weather is only found in mornings and evenings (PET mainly between  $0^{\circ}\text{C}$  and  $4^{\circ}\text{C}$ ), while it is cold or even cool on the islands in the Mid Adriatic during the day. On the high elevated locations, mean PET is lower than  $-5^{\circ}\text{C}$  for all days from mid November until the end of March.

In summer in the continental lowland and along the Adriatic coast it is mostly slightly warm or warm during the day, while the sensation of hot does not appear in mean values even during the afternoon. However, while the mornings in the continental part are comfortable, at the coast they are slightly warm. In the mountainous area it is mainly comfortable or even slightly cool, while slightly warm afternoons appear only at the end of July and the beginning of August at altitudes below 1000 m.

The probabilities of different thermal sensations according to PET values at 7 a.m. and 2 p.m. in ten-day periods during the year show that, for example, at 7 a.m. PET sometimes drops below  $-5^{\circ}\text{C}$  on the coast although it does not influence the mean annual course. Similarly, during summer one can expect hot or very hot afternoons, especially in the eastern part of Croatia or the mid Adriatic region.



**Figure 2: Annual course of ten-day mean values of thermal sensation at 7 am, 2 pm and 9 pm (left) and the probability of occurrence of different thermal sensations right at 7 a.m. (right above) and 2 p.m. (right below)**

### The leaflet of climate and bioclimate

The climatological and biometeorological leaflet contains the analysis of thermal, aesthetic and physical parameters important for the tourists. In Fig. 3 the meteorological leaflet for Hvar is presented.

The thermal parameters are presented by means of annual trends of mean minimum and mean maximum temperatures and the number of days with different temperature characteristics (warm and tropical days, warm nights and cold days). The aesthetic characteristics of climate are shown using the annual trends of insolation and cloudiness as well as the number of clear and cloudy days. The physical parameters are represented by the means of annual courses of precipitation amounts and the number of days with precipitation. For winter tourism destinations some snow parameters can be presented, such as the number of days with snow cover higher than 30 cm, which is the minimum cover required for skiing. The analysis of biometeorological conditions is presented by means of thermal comfort distribution during the year as well as by the probability of occurrence of different thermal sensations (right column). Finally, the annual wind rose is shown for all terms of observation together. Sometimes, for example for sailors, the roses for different seasons and different terms of observations can be presented separately.

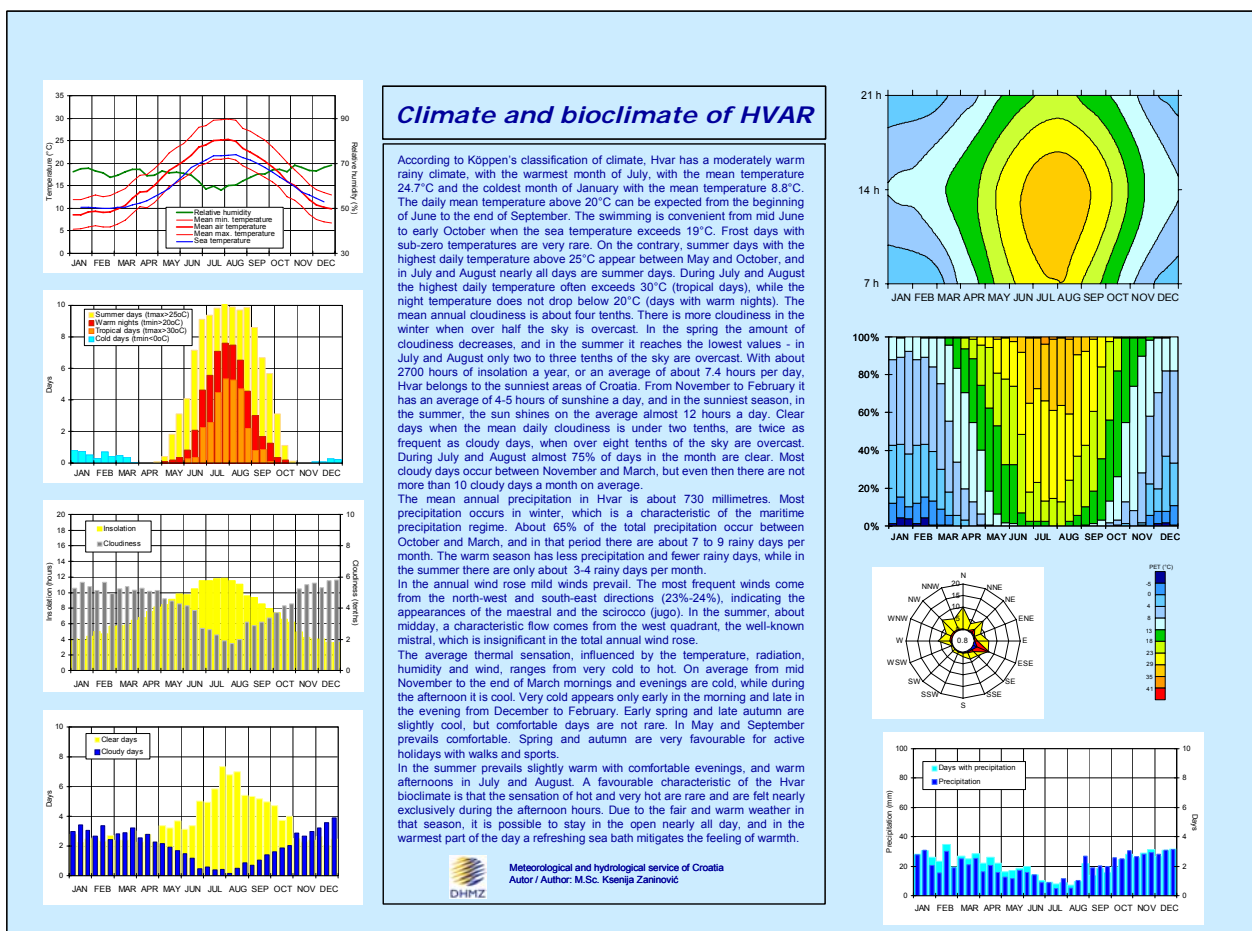


Figure 3: Meteorological leaflet for tourists

## **CONCLUSIONS**

The analysis of climate and bioclimate, especially if presented in a clear and simple way understandable for everyone provides a basis for the promotion of tourism destinations. The information can be used by tourist managers in advertising, by tourists who want to decide as to when to take their holidays and by physicians to warn their patients of periods that are unsuitable or ideal for health therapy. For example, the people who have difficulty tolerating summer heat, such as the elderly and infirm, could choose the best period of biometeorological conditions to take vacation, which prevail at the Adriatic coast during spring and autumn or in the mountains during summer. For sportsmen, who prefer an active vacation, pleasant or even cool conditions would be more convenient than summer heat, when the body has to spend energy for defence from heat.

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