ANALYSIS OF SUMMER TOURISM PERIOD FOR AUSTRIA BASED ON CLIMATE VARIABLES ON DAILY BASIS

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ABSTRACT An analysis of the meteorological and climatological parameters relevant for tourism climatology and human biometeorology is based on climate conditions for 1961 – 1990 and scenarios for the period 2021 – 2050, calculated by the Max-Planck-Institute for Meteorology in Hamburg. For Austria it can be expected that in the future (2021-2050) the summer tourism period will start earlier and end later in the year compared to the current situation. The period for recreation and leisure will be extended; also the months in spring and fall will offer comfortable thermal conditions for outdoor activities. However, this positive trend is opposed by not only an increase of the frequency and intensity of heat stress but also by an increase in days with sultriness in areas below 1000 m above sea level. It is also likely that there will be a slight increase of days with longer rain events. An decrease of the number of days with light or no rain will not compensate for that. The Climatic Tourism Information Scheme CTIS, which we developed, gives an overall view on the climatic conditions in a certain location and makes it also possible to compare the present situation with the future.

KEYWORDS: *Summer tourism, climate change scenarios, CTIS*

INTRODUCTION

Weather and climate as well as topographical and orographical conditions, vegetation and fauna play a prominent part in the assessment of tourism and leisure facilities (Abegg, 1996). However, they are also limiting and controlling factors. Therefore climate change will have considerable consequences on summer tourism in Austria (Rudel et al., 2005). However, several other factors important for tourism also play a significant role: starting from the weather conditions at home and the weather experience during the last holiday to the variety of activities, advertising campaigns and last but not least costs and prices (Harlfinger, 1985, Matzarakis et al., 2004, WTO, 2003). Some existing studies take into account all the influencing factors. The present study focuses on the variability of weather and climate

conditions of specific destination areas, and also on a subjective assessment of the climate sensitivity of different kinds of holidays (Koch et al., 2005).

According to the 4th assessment report 4AR of IPCC the increase of global air temperature in the 21st Century will be strongest for the continents in higher northern latitudes. Here an increase of extremely hot temperatures and heat waves is very likely (probability > 90 %). Austria - situated between 46° and 49° northern latitude - and its economy are strongly affected by climate change and its consequences. Two thirds of the GDP comes from the service sector, where Austria benefits particularly from tourism. The effect of climate change on winter sports has been the topic of many scientific studies, but summer tourism will also be affected. The outcome of most of these studies was that a shortening of the winter sport season will occur over the next decades. The logical consequence is an extension of the summer season. The climatic tourism potential, which can be determined with meteorological parameters, will change in future. In the paper presented here special attention is paid to summer tourism.

METHODS AND DATA

First the question has to be answered as to whether one can use simple climate parameters (Mieczkowski, 1985) like e.g. air temperature, or snow cover, etc. to describe the present and potential future climatic tourism conditions, or has to use interdisciplinary approaches (de Freitas, 2003, Matzarakis et al., 2004, Matzarakis, 2006, 2007). For the project "StartClim 2006" we decided to use an integral approach which is based on climatological, human-biometeorological and climatic – tourism (leisure time and tourism) methods (Matzarakis, 2007). This approach combines the thermal conditions with physical elements (rain, wind) and aesthetic factors (sunshine, clouds, visibility) and thus gives a comprehensive quantitative description of the climatic tourism potential.

The physiologically equivalent temperature PET (Höppe, 1999, Matzarakis et al., 1999, VDI, 1998), which considers the influence of the complete thermal environment (i.e. air temperature, air humidity, wind velocity, as well as short and long-wave radiation) on humans describes the thermal facet of the climate for tourism purposes. The frequency of certain PET classes quantifies thermally suitable conditions for leisure and recreation and gives information about cold and heat stress. Additionally, the term „sultriness" is calculated using the classical criterion of the excess of a certain water vapour pressure.

The aesthetic facet covers factors such as duration of sunshine, cloudiness and fog, range of visibility and day length. We incorporated this aspect into the present study through the use of

the degree of cloudless or number of bright days as well as the number of days with fog (de Freitas, 2003).

The physical facet, which comprises influences such as wind, rain, snow conditions, air quality and extreme weather situations, is described using high wind velocity and precipitation (days with few or no rain as well as long lasting precipitation events) (de Freitas, 2003).

Table 1: Selected stations for StartClim2006.D.2

	geog. Long.	geog. Lat.	Elev. (m)
Obergurgl	11.027	46.868	1938
Vienna Hohe Warte	16.356	48.249	198
Klagenfurt	14.333	46.650	447
Graz Universität	15.448	47.080	366
Innsbruck Univ.	11.385	47.261	577
Sonnblick	12.958	47.054	3105
Villacher Alpe	13.673	46.604	2140
Salzburg Airport	13.002	47.801	430
Badgastein	13.133	47.117	1100
Feldkirch	9.600	47.267	439
Hörsching	14.191	48.241	298

Figure 1: Map of Austria and selected stations

For the investigation we use climate data of the Central Institute for Meteorology and Geodynamics (ZAMG) for eleven selected stations for the period 1950 - 2005 (Tab. 1). The stations are well distributed over the country to give a representative cross-section of the different landscapes and climate regions (Fig. 1). The future climatic tourism potential of Austria is calculated by scenario runs of the REMO model developed by the Max-Planck

Institute for Meteorology in Hamburg and covers the period 1961-2050. We used the A1B emission scenario (Jacob et al., 2001, UBA, 2005).

RESULTS

First we focussed on the thermal bioclimate and on precipitation conditions, as these parameters represent the most important factors for tourism and recreation. Instead of the frequently used monthly average values, the frequencies of these parameters are calculated in a high temporal resolution of 10 days - each month is divided into three time intervals (see figure 2 and 3).

In the next step we developed and applied a flexible Climatic Tourism Information Scheme (CTIS) to obtain an integral description of the climatic tourism potential. Flexible means that one can select the particular climatic parameters that are relevant for a specific tourism-sector in a specific climate region. For summer tourism in Austria we chose CTIS factors as thermal suitability for recreation and leisure (like cold stress, heat stress and sultriness), sunshine duration, precipitation poverty, fog situations, rain conditions as well as stormy days. Because the diagram covers the whole year it can be used also for winter tourism and the skiing potential. It is described here by the days with snow cover of more than 10 cm. Figure 4 shows the CTIS diagram for 1961 to 1990 and Figure 5 for the period 2021 to 2050 both for Vienna.

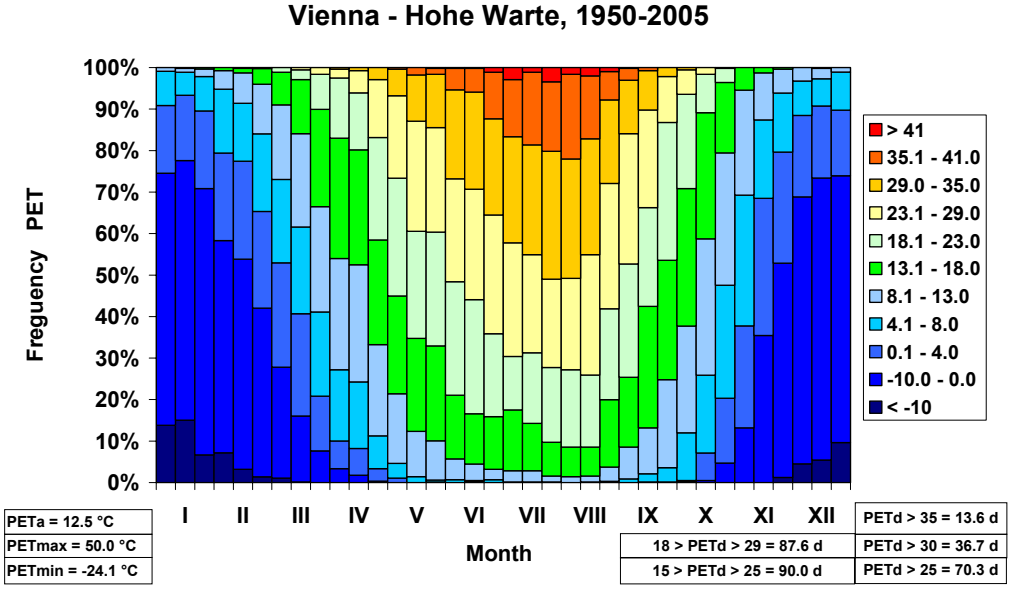

Figure 2: Bioclimate diagram (PET frequencies) for Vienna for 1950 - 2005 and amount of days with PET threshold values

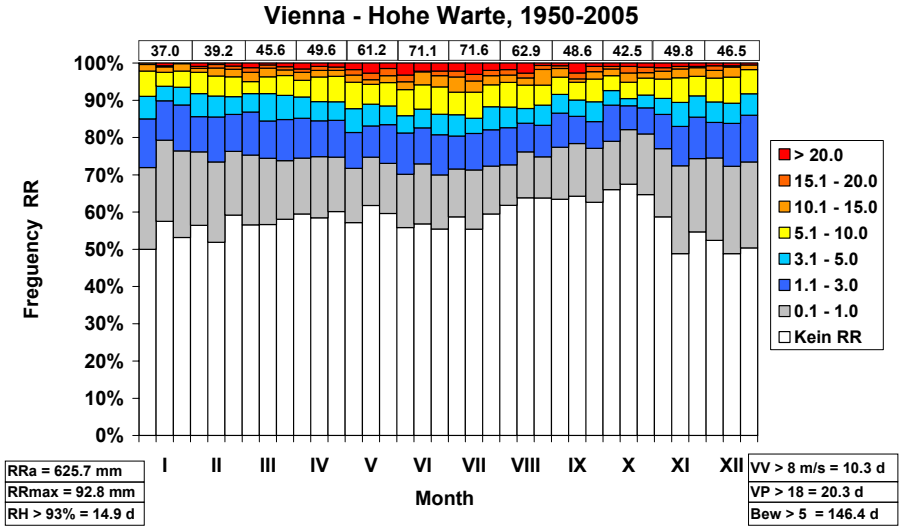

Figure 2: Precipitation frequencies in Vienna for 1950 – 2005

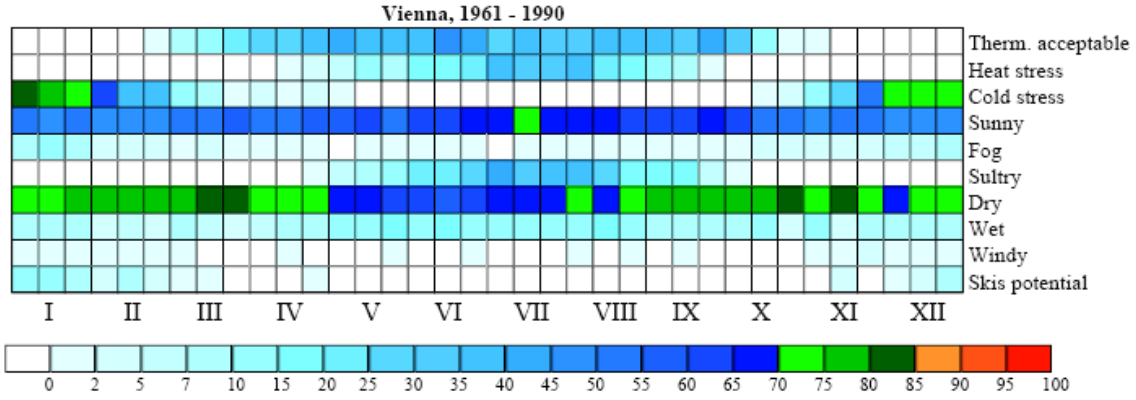

Figure 3: CTIS-Diagram for Vienna based on the A1B-climate scenario for the period 1961 – 1990

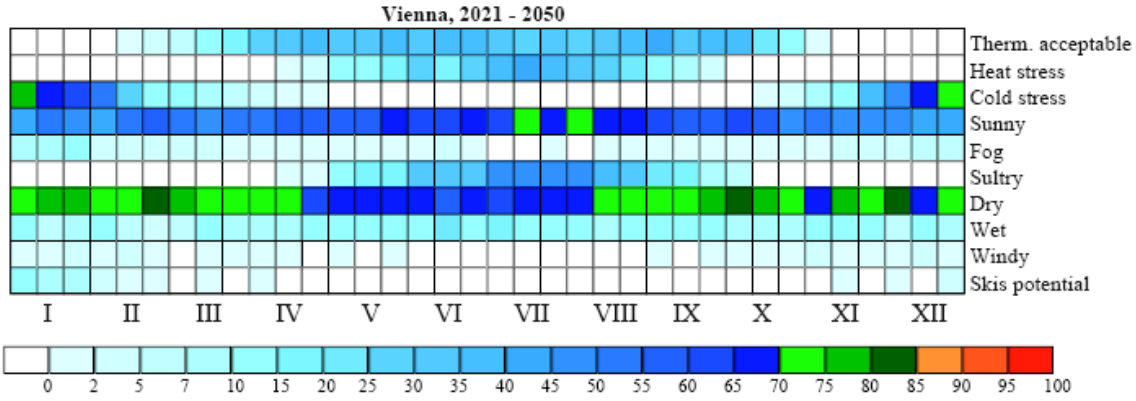

Figure 4: CTIS-Diagram for Vienna based on the A1B-climate scenario for the period 2021 – 2050

DISCUSSION AND CONCLUSIONS

Summarising the climate simulations for the period for 2021-2050 we come to the following conclusion:

- The amount of the days with cold stress decreases by up to 20 days. Especially in the south and south-east of Austria there is a tendency to a shortened period with cold stress.
- Thermally comfortable conditions will increase by up to approx. 10 days. But the trends are ambiguous - urban areas show no positive trend. In the annual course the thermal suitability for recreation and leisure is extended into the late fall.
- According to the scenario the number of days with heat stress will rise in the future. However, areas with an elevation above 1000 m are not affected. In the southeast of Austria more than 40 days with heat stress will occur and, in general, the heat stress periods will extend. Also the days with sultry conditions will increase in about the same manner.
- The number of cloudless and bright days will increase especially in higher elevated areas. The number of foggy days will decrease overall.
- In general there is a slightly increasing trend for the days with high precipitation. The frequency of days with few or no precipitation, as well as of days with long precipitation events, will increase in summer.
- No clear statement about the change of strong wind conditions (especially for recreation and leisure) can be made, but it seems that there is a slightly decreasing trend.
- The potential for skiing, however, decreases in the higher elevated areas (above 1600 m).

The future bioclimatic conditions for summer tourism in Austria show an extension of the season with pleasant thermal conditions into the late fall. The increase of the days with sultriness is positive for the lake tourism in Austria. However, for health and wellness tourism this can represent an impairment. The decrease of the summer precipitation events based on the used climate scenario will affect nearly all sectors of the summer tourism in a positive way.

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