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Heat protection plan

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1. Meteorological and climatological basis for heat warnings

1.1. Temperature and hot days

In the 20th century, the global mean temperature increased by almost 1°C. In the Alpine region the temperature increase during this period was around 2°C. The results of simulation calculations from global and regional climate models show a continuation of the current trend towards higher temperatures.

Hot days are days with a maximum temperature of at least 30°C. A comparison of the average number of hot days for different periods from 1961 shows a significant increase in the number of hot days and an increase in the number of warm nights for all Austrian state capitals. The climate model calculations show that this trend will continue in the next few decades.

1.2. heat waves

There are different methods for evaluating heat waves. One method comes from the Czech meteorologist Jan Kysely. A heat wave is - to put it simply - defined as a series of at least three consecutive days above 30°C, which is interrupted at most briefly by a day between 25 and 30°C, but with the average maximum temperature during the period being greater than 30° C remains. Every day of such a heat wave is called a Kysely day.

An evaluation of all Austrian state capitals in a historical comparison of the Kysely days shows some regional differences, but a clear trend that heat waves with a series of maximum temperatures around and above 30°C have become significantly more frequent in Austria in the last few decades. The evaluation of weather stations with data series of more than 100 years, such as those in Vienna, Salzburg, Innsbruck and Graz, have shown heat waves almost every year since the 1990s.

The fifth assessment report of the IPCC 5AR [IPCC 2013] states that in the 21st century, warming over the continents will be strongest at higher northern latitudes, and an increase in extremely hot temperatures and heat waves is very likely (probability- ity > 90%).

According to the Austrian assessment report [APCC 2014], climate change will also lead to an increase in heat waves in Austria. It can be assumed that both the duration of heat waves and their intensity will increase.

2. Climate change and health

The influence of meteorological conditions on human health has long been known and has been the subject of numerous scientific studies. For heat stress, such studies show, among other things, increased mortality due to diseases of the cardiovascular system, kidneys and respiratory tract as well as metabolic disorders.

Mortality figures are often used to investigate the influence of thermal stress on human health, as these have been recorded for a sufficiently long time in most industrialized nations. However, thermal stress does not only cause one

increased mortality, but is also known to have negative effects on people's morbidity and performance. However, quantifying these impacts is much more difficult.

At the latest after the catastrophic consequences of the “summer of the century 2003”, the question of the effects of heat stress on human health came into focus. According to a study, the heat wave of 2003 cost over 70,000 lives in Europe [Robine et al.
2008]. As part of a Startclim project, an increased number of deaths was also found for Vienna [Hutter et al. 2006].

The results of the MortKlim project [Muthers et al. 2009, ZAMG 2009] show that in the future the days with thermal comfort conditions will decrease in Austria and, in return, the days with strong or extreme heat stress will increase. This will result in thermal-related mortality increasing by 2100, with the extent of the increase dependent on the implementation of appropriate adaptation measures. According to the MortKlim project, such measures also include better heat warning systems (particularly for risk groups such as older and sick people).

Climate change will present society and health systems with new challenges. In the context of climate change, there is talk of possible mitigation and adaptation strategies in general, but also specifically with regard to the expected increase in thermal stress situations. Also with regard to human

For health, it is important to deal with the expected changes at an early stage, to analyze the possible consequences and to develop strategies to reduce the effects
to develop for adaptation. A series of concrete recommendations for action on how to deal with the consequences of climate change can be found in the Austrian strategy for adapting to climate change [BMLFUW 2012]. A short-term effective measure is the issuing of heat warnings combined with clear and practical instructions for the population.

tion.

3. Meteorological basis for heat warnings

Air temperature alone cannot be used as a trigger for a heat warning.
Only those parameters that take into account the interacting effects of various meteorological and/or environmental hygiene factors as well as other factors are suitable for this.
In this context, various models for so-called temperature or heat indices were developed.

The exchange of energy between the body and the thermal environment takes place via energy flows. People are exposed to a combination of meteorological factors such as air temperature, radiation conditions, wind speed and humidity. All of these factors influence thermal perception to varying degrees. Furthermore, physical activity and factors such as weight, height, gender and age determine the thermal sensation.

Temperature or heat indices such as PET (physiological equivalent temperature) and PT (perceived temperature) take into account both the meteorological and the thermophysiological
Influencing factors. They therefore represent a readily tangible parameter for determining the thermal stress on humans and thus as a trigger for a heat warning. PET includes all important meteorological factors (air temperature, humidity, wind speed, solar radiation) and thermophysiological factors (activity, age , weight, gender) in just one parameter and displays them in the form of a temperature. During the investigation

PT takes temperature, humidity, wind and, indirectly, radiation into account accordingly. Experience shows that the use of PET or PT as well as other temperature or heat indices for predicting heat waves leads to practically the same results.

4. The ZAMG warning system

The ZAMG warns nationwide of extreme weather events for the warning parameters wind, rain, snow, thunderstorms, thunderstorms with hail, black ice, heat stress and cold stress. The intensity of a predicted event, and thus also the extent of the expected effects, are characterized by warning colors. The warning colors are used for heat stress yellow, orange and red are used, which represent caution, caution and danger respectively.

When determining the warning level, factors are also taken into account that can increase or weaken the effects and thus the damage potential of the expected weather situation. For example, the effects of the first heat wave of the year will be stronger than those of other midsummer weather conditions.

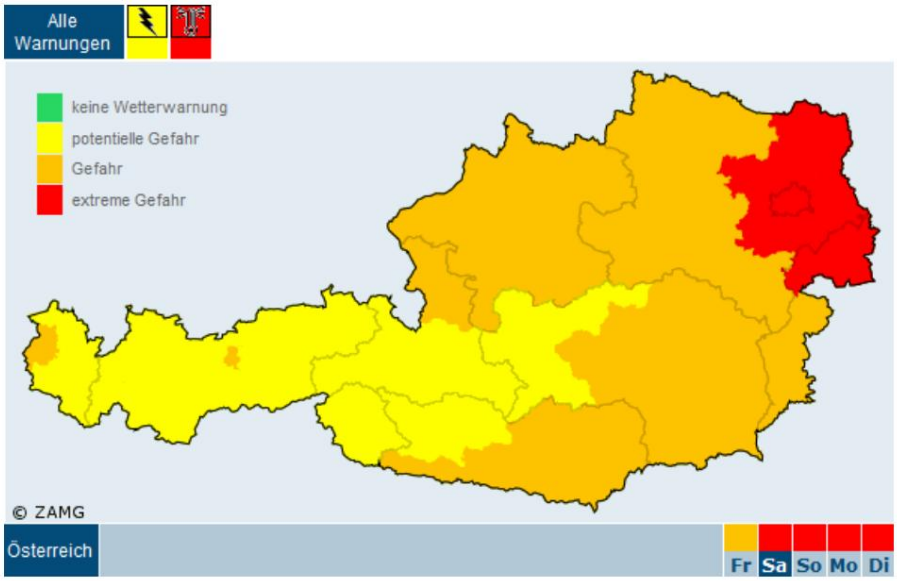
5. Heat warnings from ZAMG

The ZAMG creates heat warnings based on predicted values for the perceived temperature (PT). The basis for this is the forecasts from ZAMG's high-resolution weather forecast models. Heat warnings are issued when, according to these forecasts, predefined warning thresholds are reached or exceeded over a period of several days.

5.1. Heat warnings on the ZAMG homepage

The forecasts of the perceived temperature serve as the basis for the stress levels in hot weather used and evaluated district by district. The “Climate Michel Model” from the DWD (German Weather Service) is used to calculate the perceived temperature. This is an energy balance model for the human organism that takes temperature, humidity, wind and, indirectly, radiation into account.

The warning thresholds are determined based on a weighted average of the predicted daily maximum and daily average perceived temperature. In addition, night-time cooling in the form of temperature minimums is also taken into account. Warnings are issued on a district basis. The following images show an example of the representation of heat warnings and the legend for heat warnings on the ZAMG homepage (www.zamg.ac.at). In this specific case, yellow thunderstorm warnings as well as orange and red heat warnings are active.



Hitzebelastung

Eine längere Phase mit hochsommerlichen Temperaturen in Kombination mit hoher Luftfeuchtigkeit führt zu erhöhter Wärmebelastung des menschlichen Organismus. Bei großer Hitze produziert der Körper mehr Schweiß. Verdunstet der Schweiß auf der Hautoberfläche, kühlt dies die Haut und hilft, die Körpertemperatur trotz Hitze konstant zu halten. Unter extremen Bedingungen wie bei schwülheißem Wetter kann dieses menschliche Kühlsystem überlastet sein, es kommt zu gesundheitlichen Problemen. Ungeeignete Kleidung, Flüssigkeitsmangel sowie Intensität und Dauer von körperlichen Aktivitäten verstärken die Belastung zusätzlich. Vor allem ältere Menschen, chronisch Kranke und Kinder sind betroffen.

Farbe	Bedeutung	
grün	Keine aktive Wetterwarnung	Es ist derzeit mit keiner Hitzebelastung zu rechnen.
gelb	Vorsicht!	Es ist mit leicht erhöhter Hitzebelastung zu rechnen.
orange	Achtung!!	Es ist mit erhöhter Hitzebelastung zu rechnen.
rot	Gefahr!!!	Es ist mit starker Hitzebelastung zu rechnen.

5.2. Special heat warnings from ZAMG

The ZAMG and its regional customer service points also offer special heat warnings. In Styria and Carinthia, for example, heat warnings are sent directly by ZAMG Steiermark and ZAMG Carinthia to various users and stakeholders. For this purpose, an email formulated by the state health directorates with a detailed forecast, instructions, tips and links for further information is sent to specific addressees (retirement homes, kindergartens, hospitals, mobile care services, emergency services, etc.). In Vienna, as part of a preventive heat warning service run by the State Health Directorate in cooperation with the ZAMG, relevant institutions are warned and the population is informed with information and tips from the Vienna Heat Guide.

The countries can also use different criteria for their heat warnings than the ZAMG uses for the warnings on its homepage. These criteria would have to be agreed directly between the states and the ZAMG.

6. Information and warning of the population

6.1. General information about heat stress

The Federal Ministry of Health and Women (BMGF) provides the population with general information about heat stress and the correct behavior when exposed to heat on its homepage.

If possible, the federal states provide specific facilities (retirement homes, hospitals, kindergartens, etc.) with specific information in advance.

6.2. Heat warning from ZAMG

As soon as the ZAMG forecast calculations predict heat stress, the ZAMG issues an automatic heat warning to predefined locations in the affected federal states and to the BMGF. The state offices to which the warnings should be sent must be agreed directly between the states and the ZAMG or their regional customer service points.

The ZAMG also sends a heat warning by email to the respective state office of the Chamber of Pharmacists. From there, the pharmacies are informed directly via chamber information that heat stress is imminent.

6.3. Informing the population in the event of a heat warning

In the event of a heat warning, the states inform the facilities they have specified in advance in a timely manner. In particular, such facilities are:

- ÿ Care and nursing facilities,
- ÿ Hospitals and health resorts,
- ÿ Childcare facilities (kindergartens, schools, etc.),
- ÿ mobile care services,
- ÿ Medical Association as well
- ÿ Emergency organizations.

In the case of heat stress, there is usually sufficient lead time so that setting up an on-call service at the country level is usually not necessary.

The ZAMG informs the population via its homepage.

The pharmacies inform their customers in particular about any problems that may arise in connection with taking certain medicines and heat stress.

If necessary, such as in the case of prolonged or particularly severe heat stress, the BMGF, in collaboration with the Austrian Agency for Health and Food Safety (AGES), sets up a hotline to advise the population.

7. Literature

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