TransformAr

Living in a hot house?

The impact of climate change on heat, health and outdoor productivity in Europe

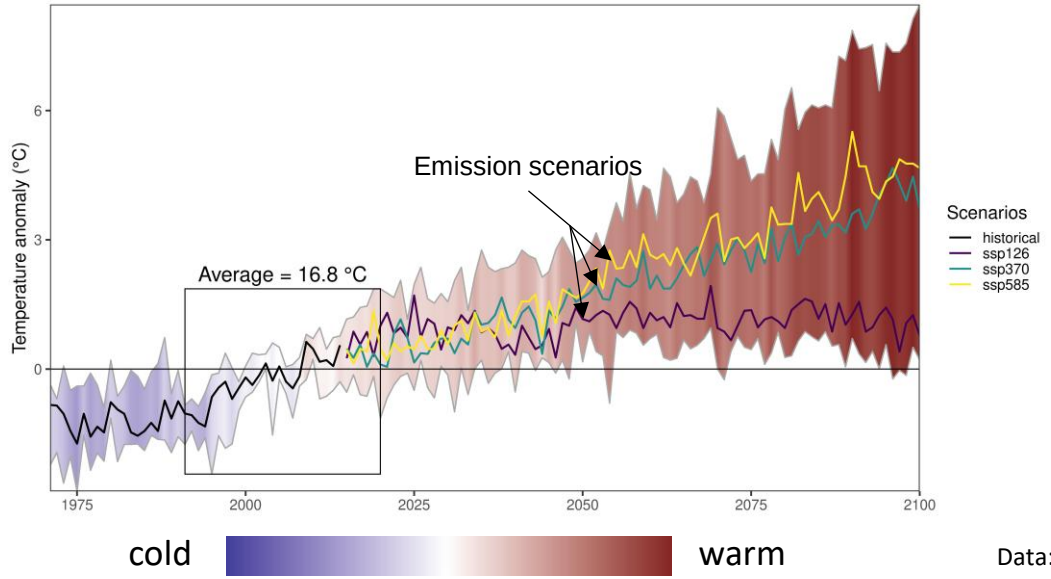
Fred F. Hattermann, Potsdam Institute for Climate Impact Research

This project has received funding from the European Union's Horizon H2020 innovation action programme under grant agreement 101036683.

Demonstrators

Projected climate changes for Egaleo
relative to 1991-2020

Temperature



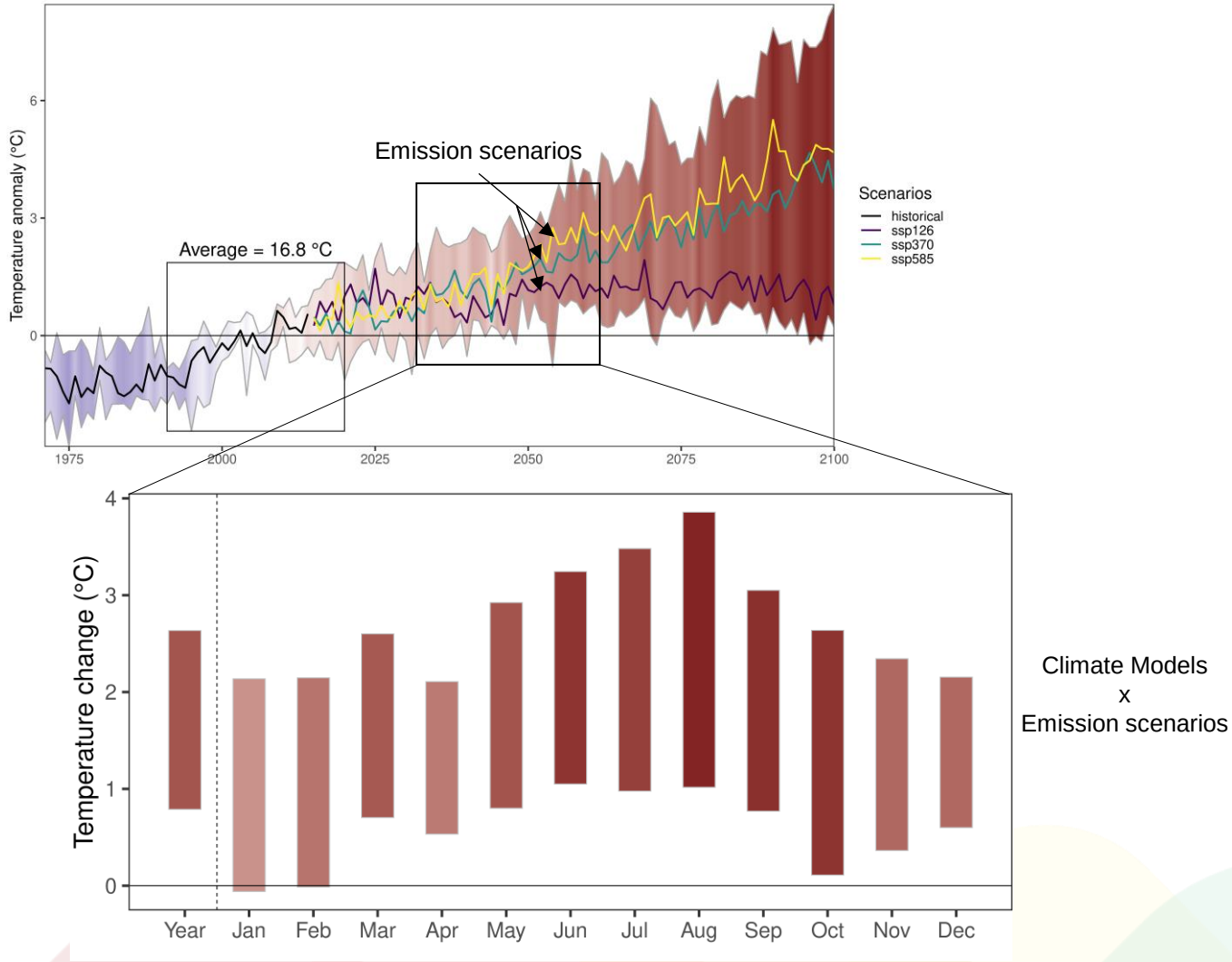
Data: ISIMIP 3b

Very strong temperature increase over 21st century relative to current conditions.

Increase depends much on the emission scenario → Time for action!

Projected climate changes for Egaleo
relative to 1991-2020

Temperature (2031-2060)



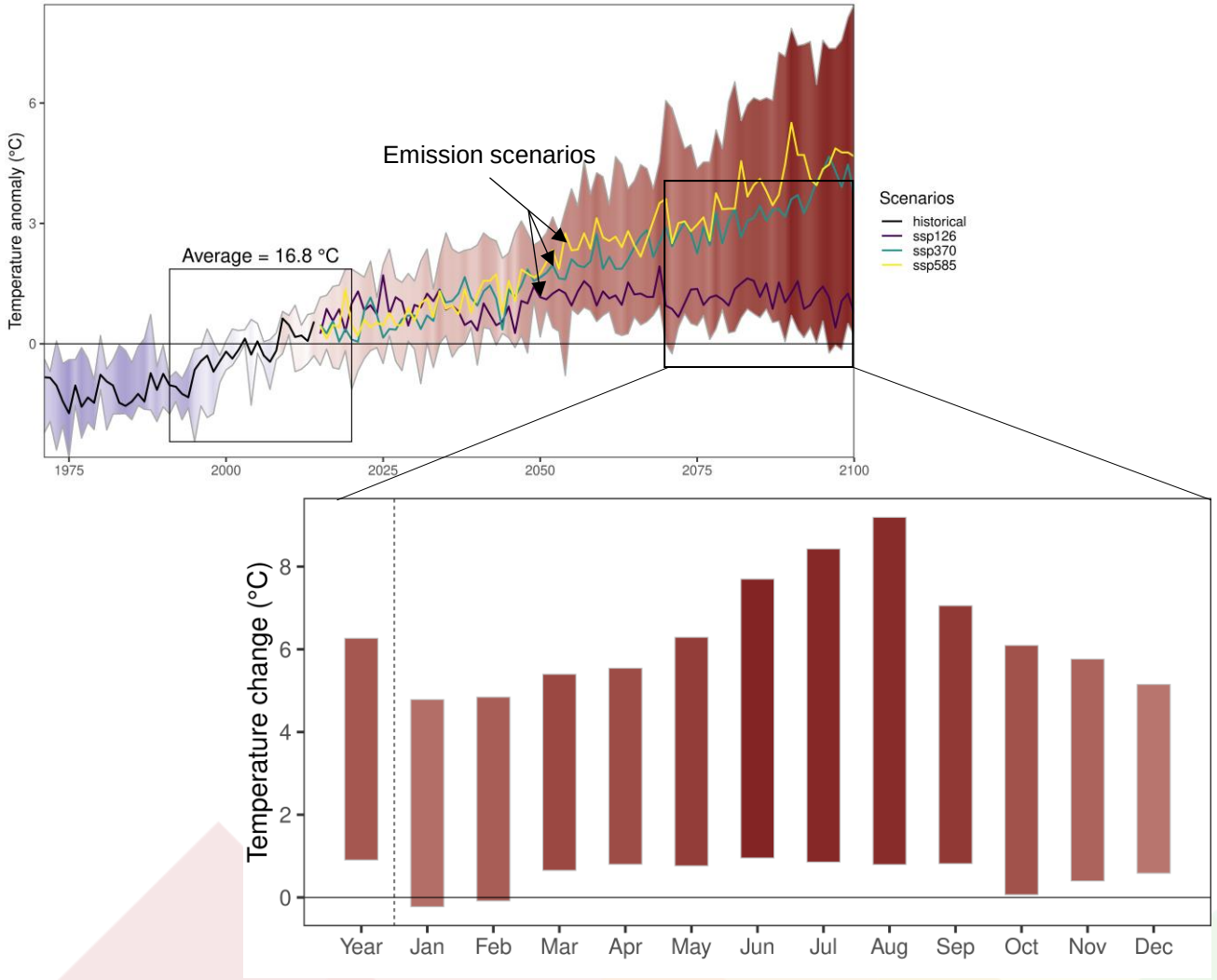
Climate Models
x
Emission scenarios

Near future: + 1.5 °C.
Temperature increase stronger in summer (+ 1.9 °C in Aug) than in winter (+ 0.95 °C in Jan) here as well.

Data: ISIMIP 3b

Projected climate changes for Egaleo
relative to 1991-2020

Temperature (2071-2100)



Climate Models
x
Emission scenarios

Data: ISIMIP 3b

Far Future: + 2.7 °C

- A high increase in summer temperature (+ 3.4 °C in Aug)
- In winter (Jan) the rise in temperature about + 2.3 °C
- Uncertainty is also higher than previous time slices.

Projected climate changes for Egaleo
relative to 1991-2020

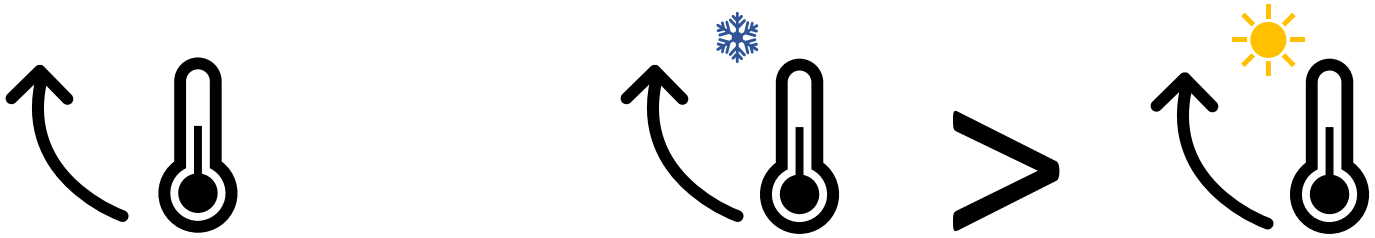
Heat stress

	2021-2050	2031-2060	2071-2100
summer days (T_{max} > 25 °C):	+10% (4 – 17%)	13% (4–20%)	24% (4 –50%)
frost days (T_{min} < 0 °C)	-42% (-70 – -10%)	-49% (-82 – -25%)	-71% (-98 – 3%)
icing days (T_{max} < 0 °C)	--	--	--
warm spells (at least 6 consecutive days with very high temperatures	338% (113 – 648%)	480% (135 – 956%)	1161% (191 – 2408%)
cold spells (at least 6 consecutive days with very low temperatures)	-64% (-61 – -21%)	-74% (-96 – -37%)	-87% (-100 – -45%)

Data: ISIMIP 3b

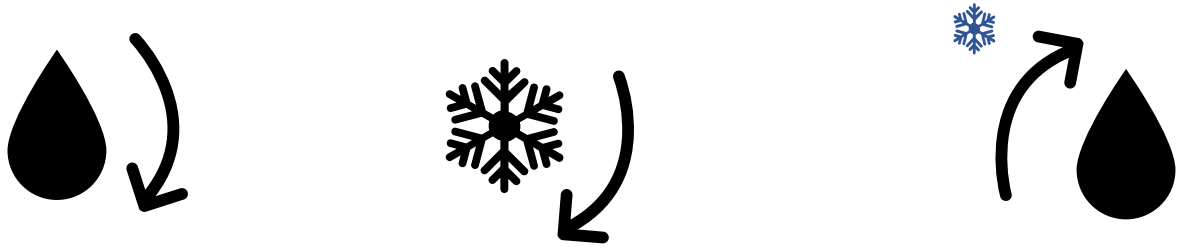
Summary

According to projections, **Egaleo** is likely to deal with



The increase of average temperatures will depend on emissions

Hotter summers, milder winters



Overall precipitation decrease

Overall less rain

The Web Bulb Globe Temperature (WBGT)

Different environmental factors have an impact on our body temperature:

- **Air temperature** and **sunlight** affect our skin temperature.
- **Humidity** affects sweating and cooling.
- **Wind speed** can blow away heat from our bodies and helps sweat evaporate which cools us down.

To determine how much stress heat is putting on our bodies, scientists combine all these factors together into one measurement, the **Wet Bulb Globe Temperature.**

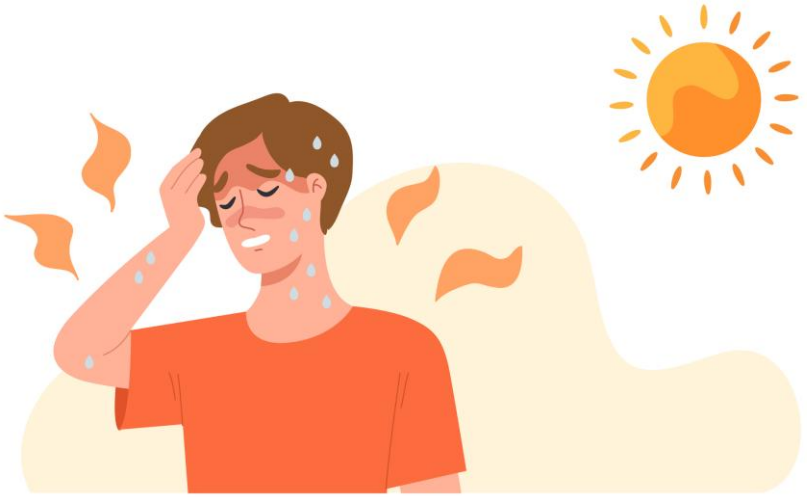
https://nicholasinstitute.duke.edu/project/heat-policy-innovation-hub/what-is-wet-bulb-globe-temperature-wbgt

Indicator for heat exposure

The WBGT is widely applied to establish guidelines on the danger of physical activity due to the current heat stress exposure.

There are five different WBGT levels :

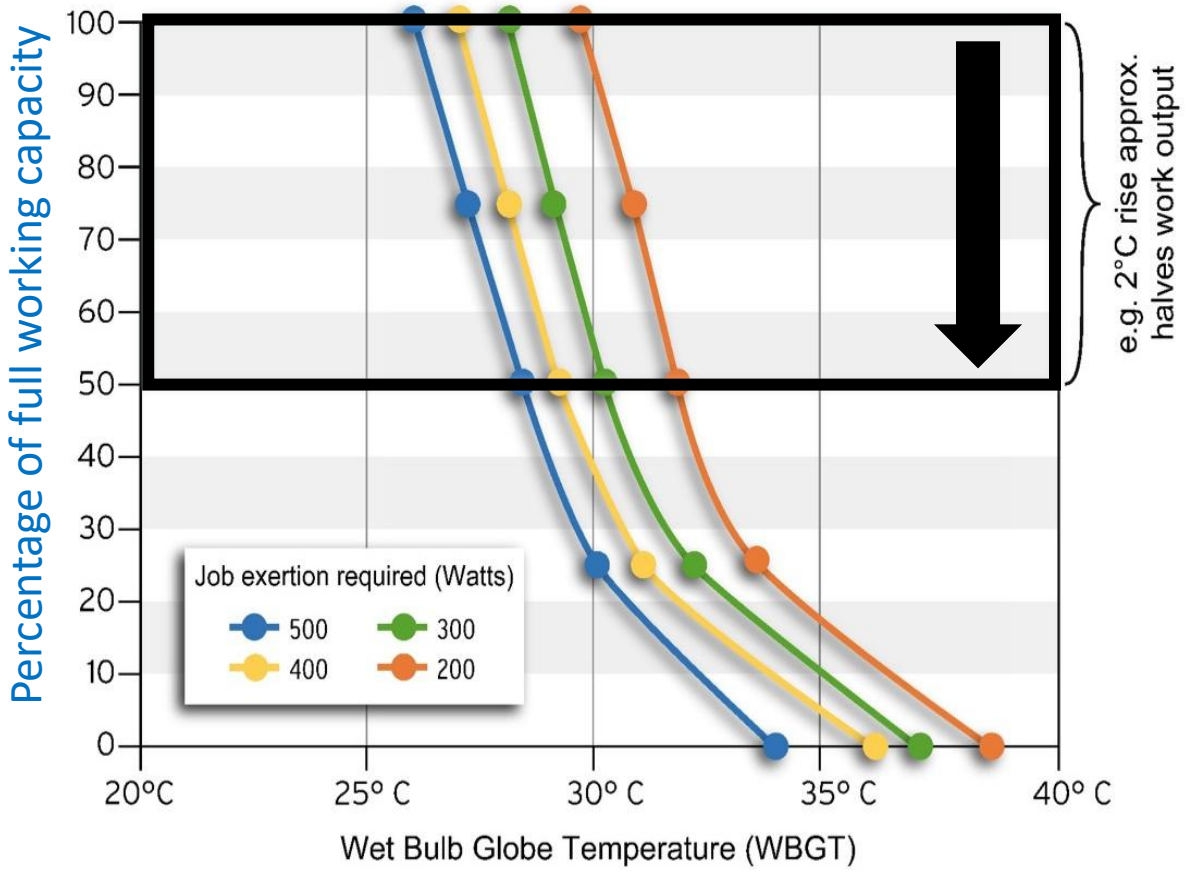
< 25.6°C - 27.7°C	= White: 5 min rest every 30 min
27.8°C - 29.4°C	= Green: 5 min rest every 25 min
29.5°C - 31°C	= Yellow: 5 min rest every 20 min
31.1°C - 32.1°C	= Red: 5 min rest every 15 min
> 32.2°C	= Black: Suspend heavy activities recommended



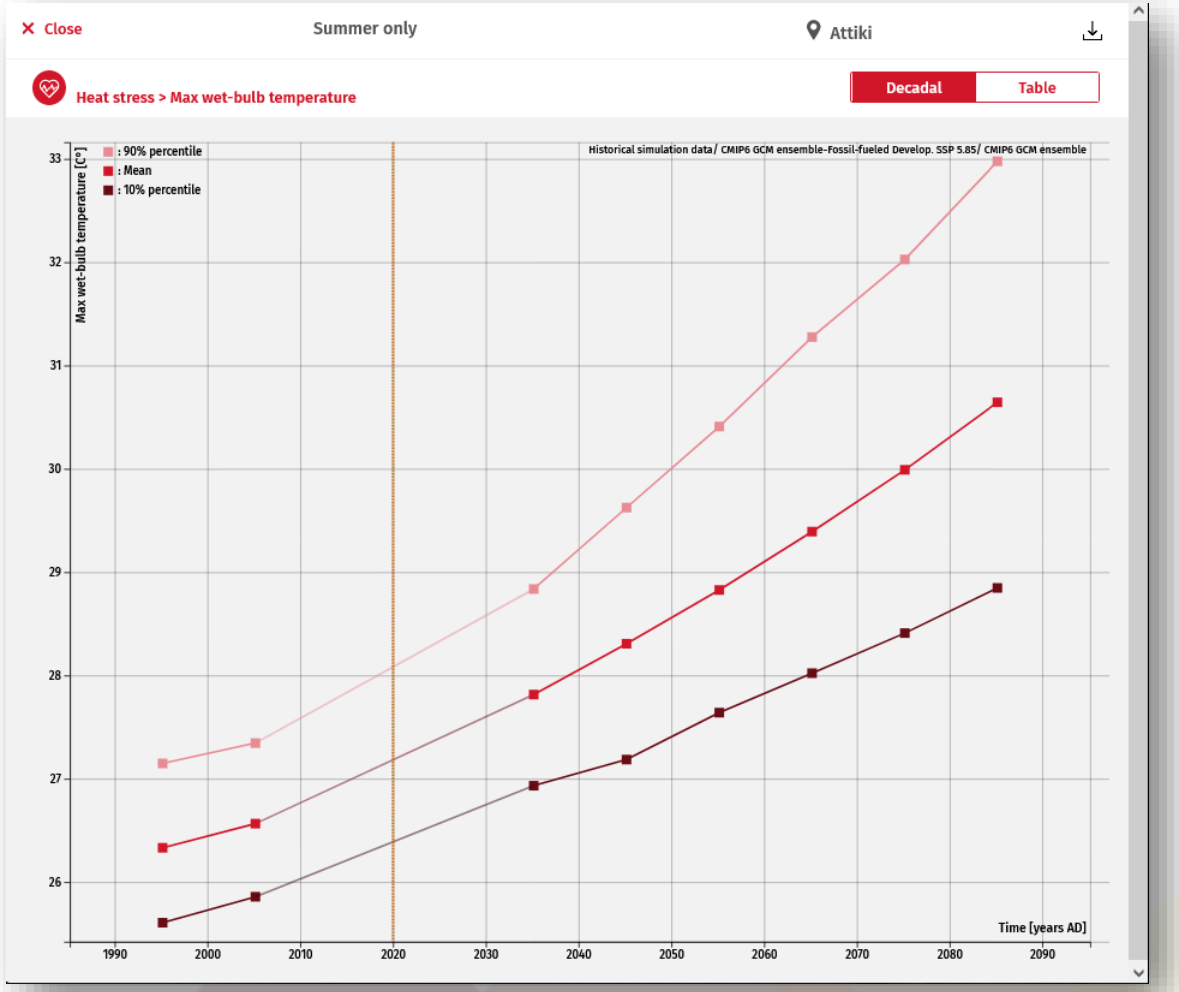
https://nicholasinstitute.duke.edu/project/heat-policy-innovation-hub/what-is-wet-bulb-globe-temperature-wbgt

WBGT and outdoor productivity

Percent of full working capacity with changing WBGT and different workloads



Health: Wet Bulb Globe Temperature



Wet Bulb Globe Temperature (WBGT) is a measurement used to assess the risk of heat related illnessess due to exposure to the current temperature, humidity, wind speed and solar radiation parameters.

Max WBGT corresponds to the daily maximum values of WBGT.

< 25.6°C - 27.7°C = White: 5 min rest every 30 min

27.8°C - 29.4°C = Green: 5 min rest every 25 min

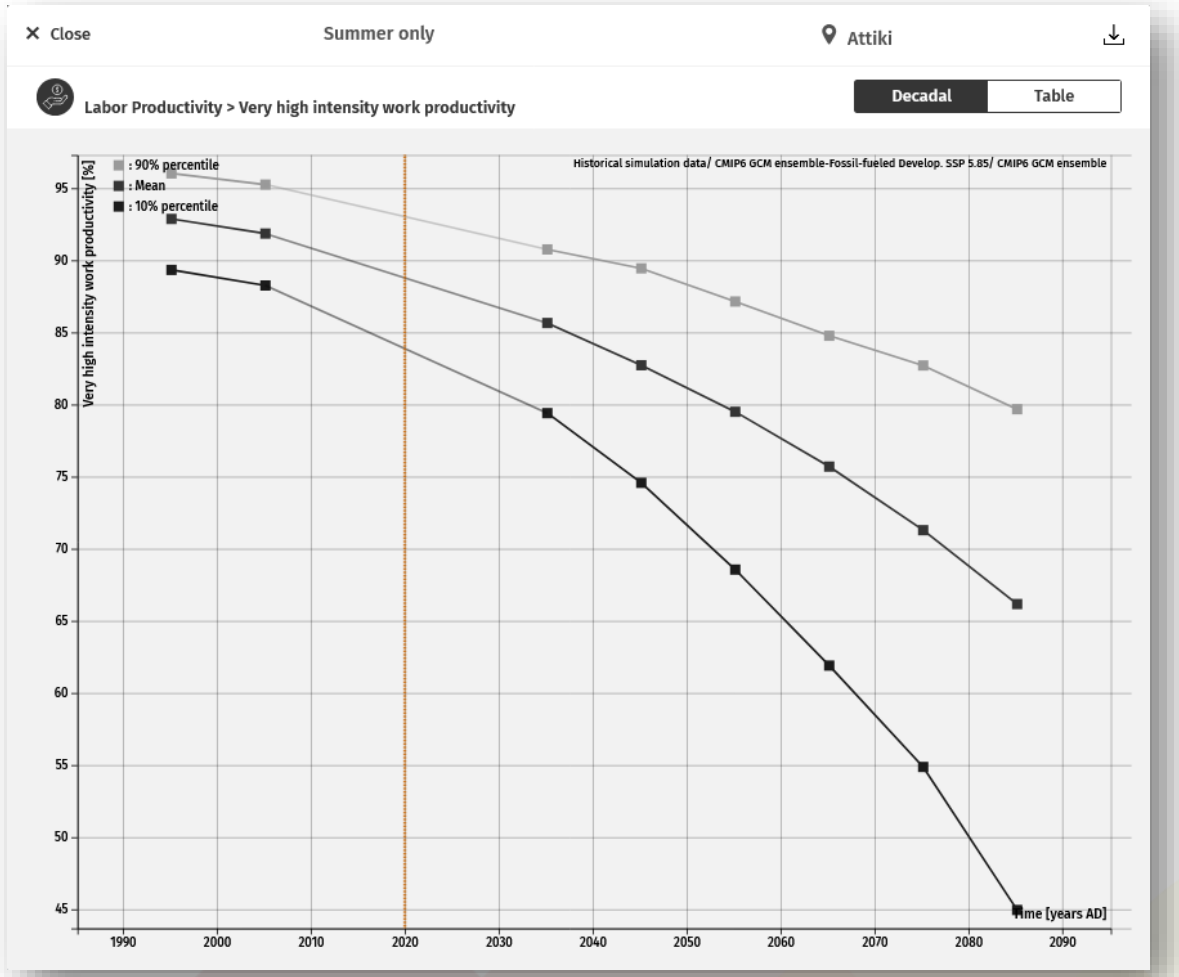
29.5°C - 31°C = Yellow: 5 min rest every 20 min

31.1°C - 32.1°C = Red: 5 min rest every 15 min

> 32.2°C = Black: Suspend athletic activities recommended

Heat and outdoor productivity

Outdoor productivity



Labor productivity denotes the maximum potential work output achievable by an individual in a day. This measure is represented as a percentage (%) to indicate the proportion of work that can be achieved under current climatic conditions. It is mainly derived from the impact of heat on productivity, as exposure to heat stress tends to diminish the average worker's capacity to perform tasks efficiently.

There are 4 different levels of labor productivity levels, each corresponding to a certain amount of work intensity:

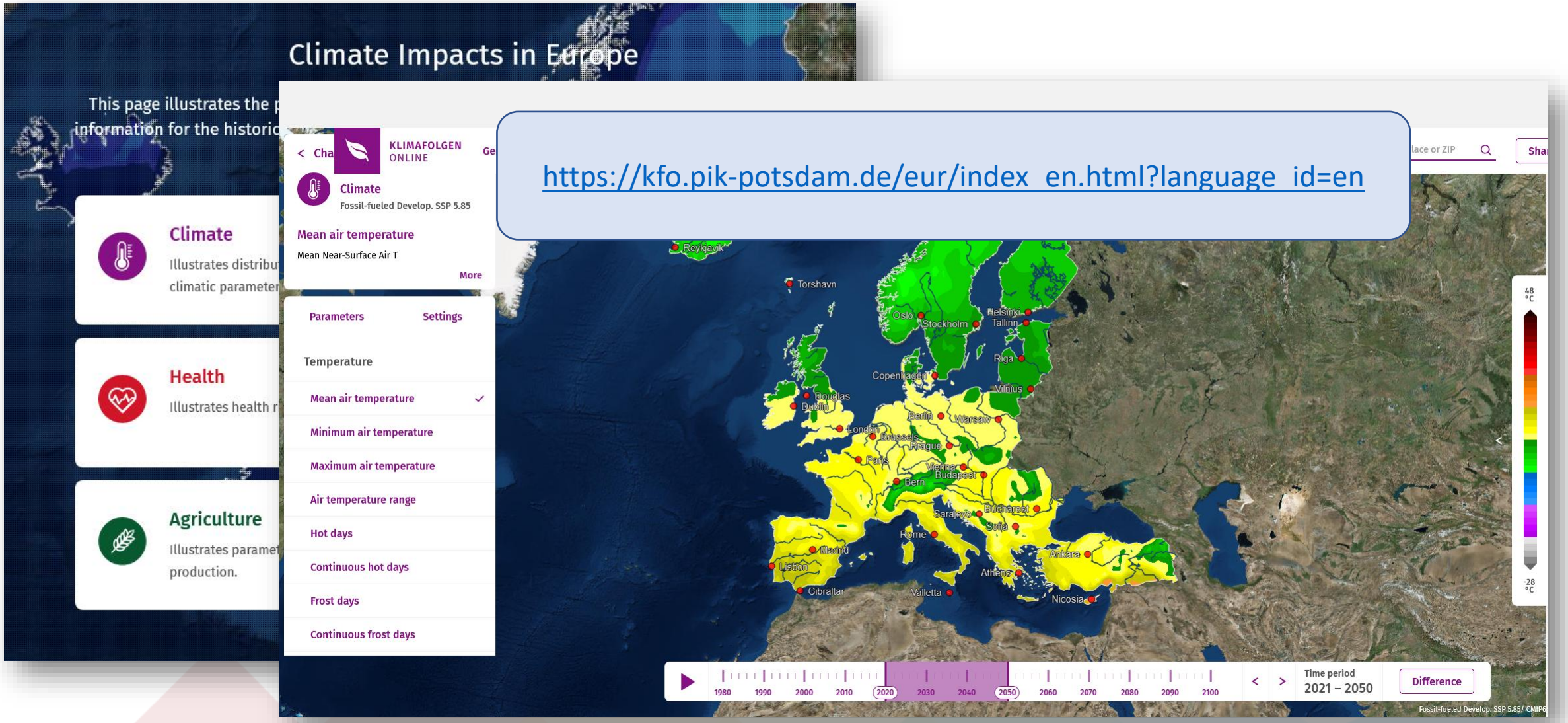
200W = Low intensity work

300W = Medium intensity work

400W = High intensity work

500W = Very high intensity work

Web portal for data and information



https://kfo.pik-potsdam.de/eur/index_en.html?language_id=en

Summary

- Climate change will significantly increase the heat load, this will increase the exposure of vulnerable people.
- This is particularly problematic if the air quality also decreases, e.g. due to forest fires.
- Overall, also outdoor productivity is projected to decrease due to the increasing exposure to heat.

Thanks!