

Towards human-centric weather forecasting

Heat and cold stress indices at ECMWF

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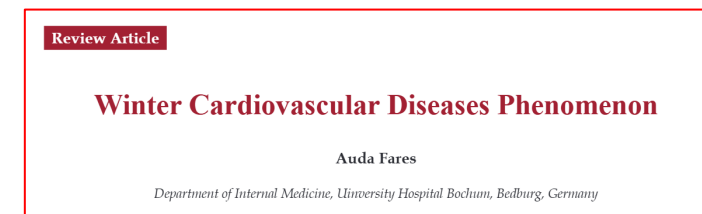


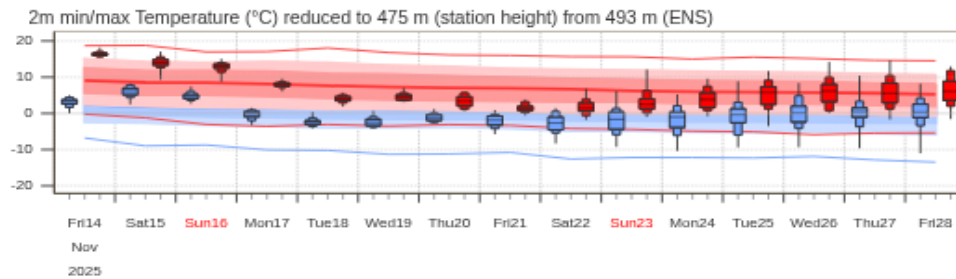
Introduction

Air temperature is the core figure of any weather forecast but...

... *seldom* is the only atmospheric parameter affecting the wellbeing of an individual!

How we feel is determined by the interplay between external meteorological factors and the human body's ability to maintain its internal temperature within the range of optimal physiological performance

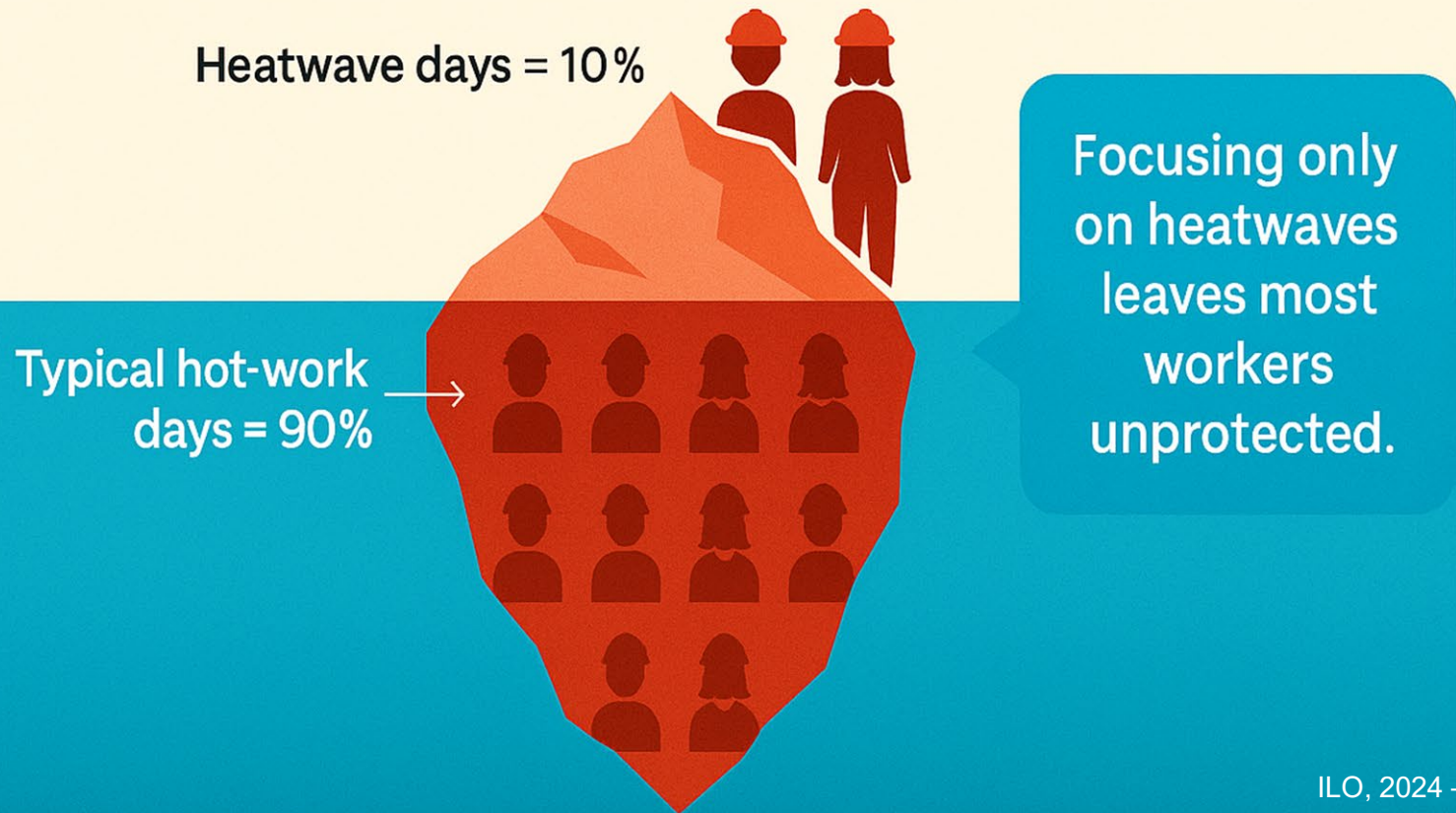




You don't feel air temperature. What you feel is the **temperature of your body**

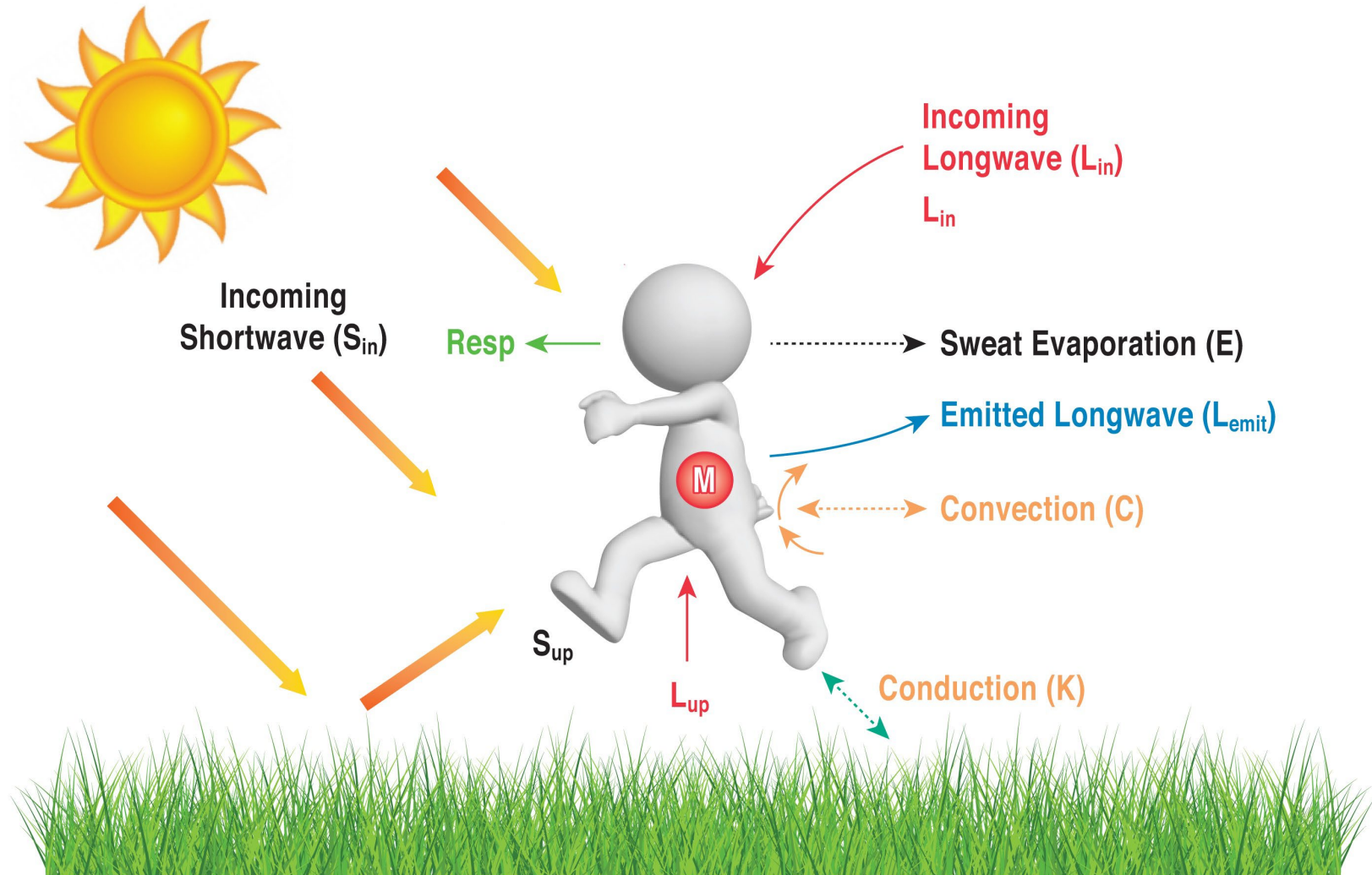
Not only extremes

Only 1 in 10 Heat Exposures Happens in a Heatwave



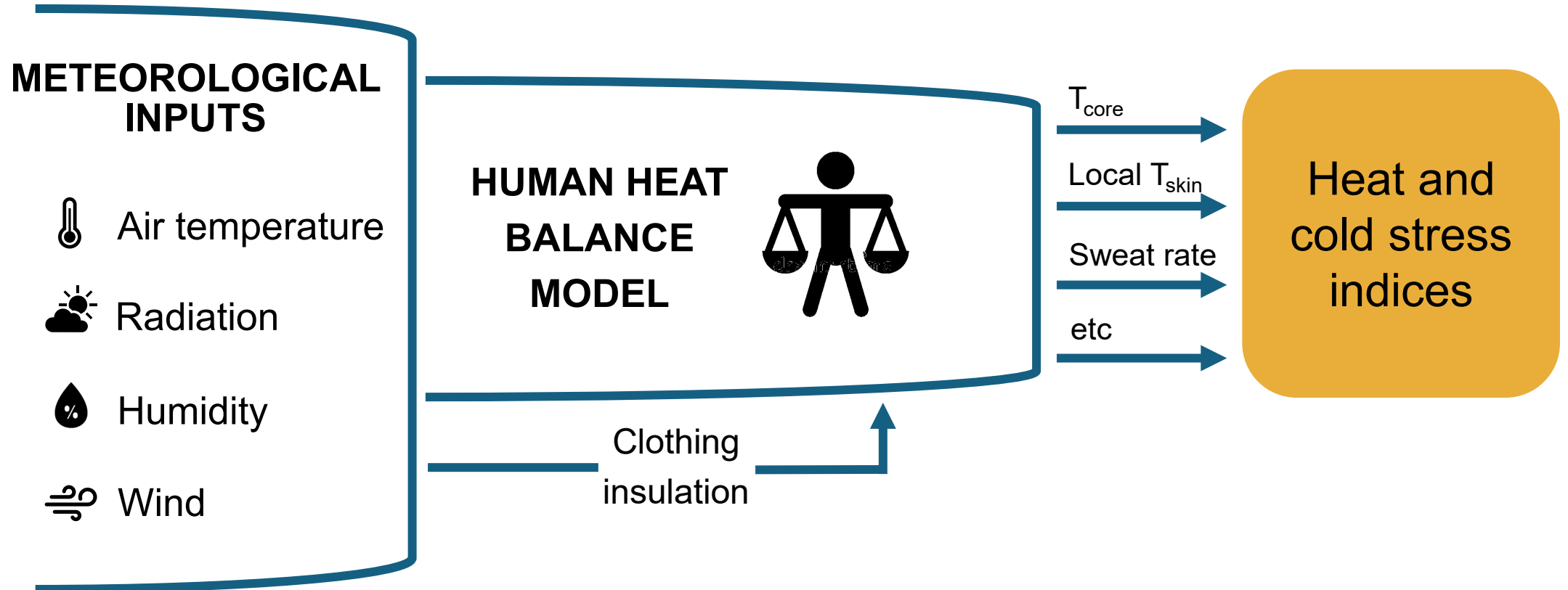
ILO, 2024 – Graphics credits to Andreas Flouris

Human heat balance



Adapted from McGregor and Vanos 2018

Heat and cold stress indices



Thermofeel indices



Wind chill

Apparent Temperature

Heat Index

Humidex

Normal Effective Temperature

Wet Bulb Globe Temperature (WBGT)

Universal Thermal Climate Index (UTCI)

<https://github.com/ecmwf/thermofeel>

Thermofeel forecasts

Ensemble

Medium range

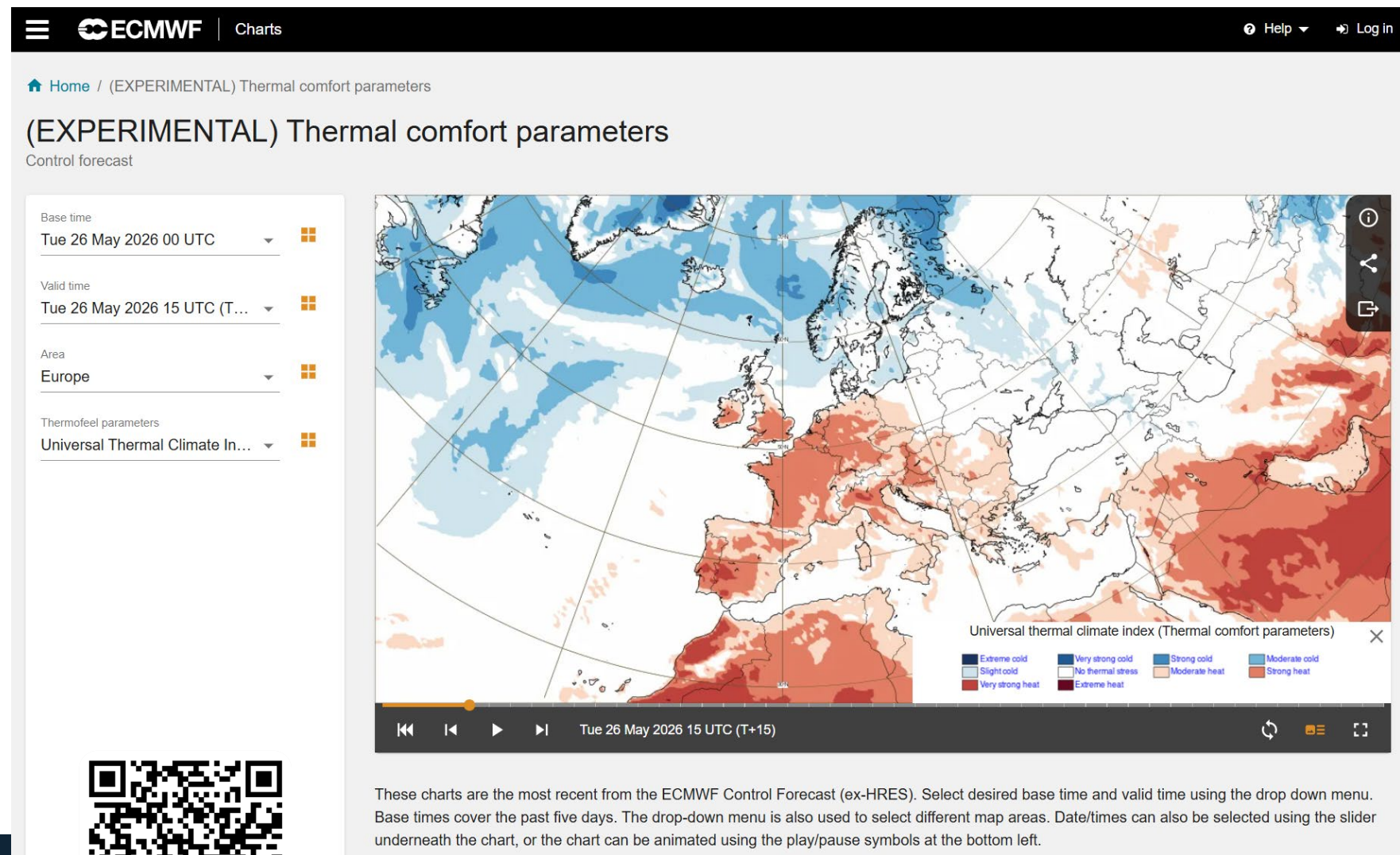
00, 06, 12, 18 UTC runs

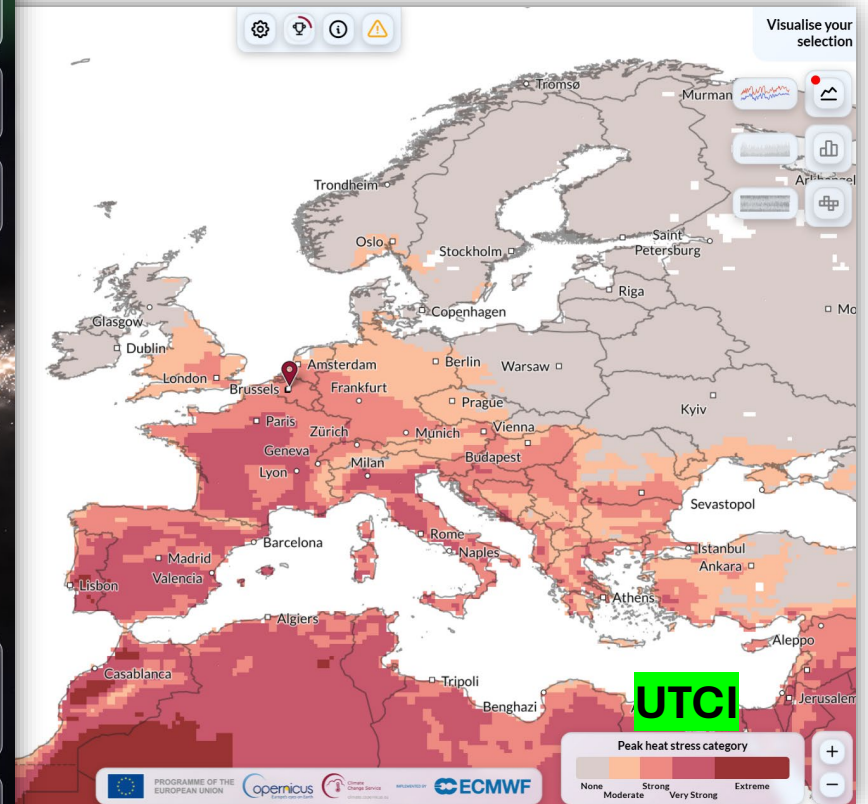
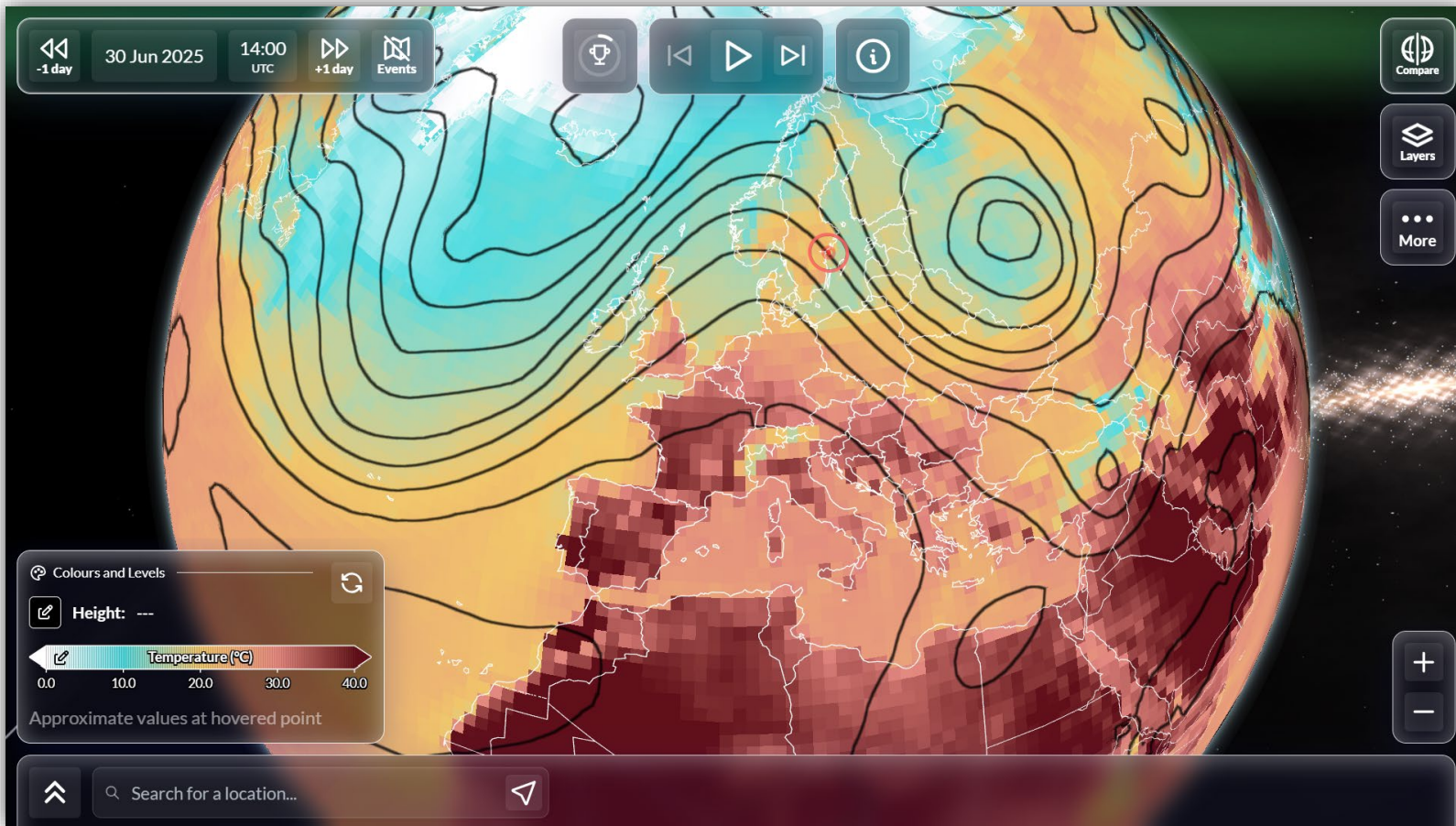
9 km x 9 km

0 to 4 days by 1 hour

4 to 6 days by 3 hours

6 to 15 days by 6 hours



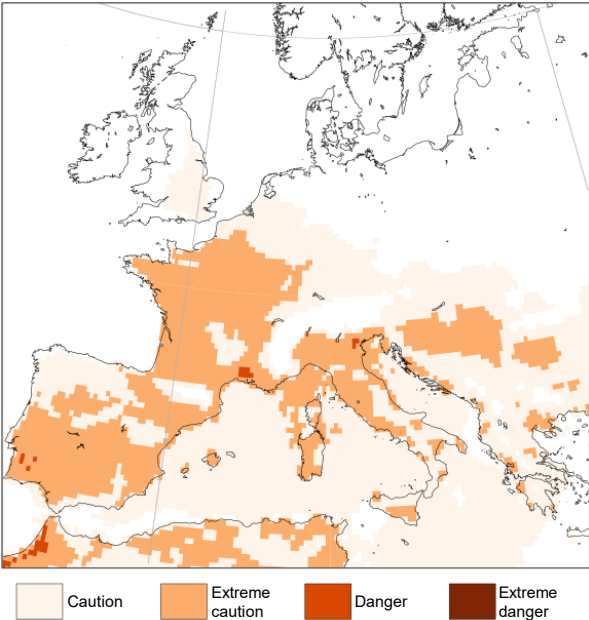


JUNE 2025 EUROPEAN HEATWAVE

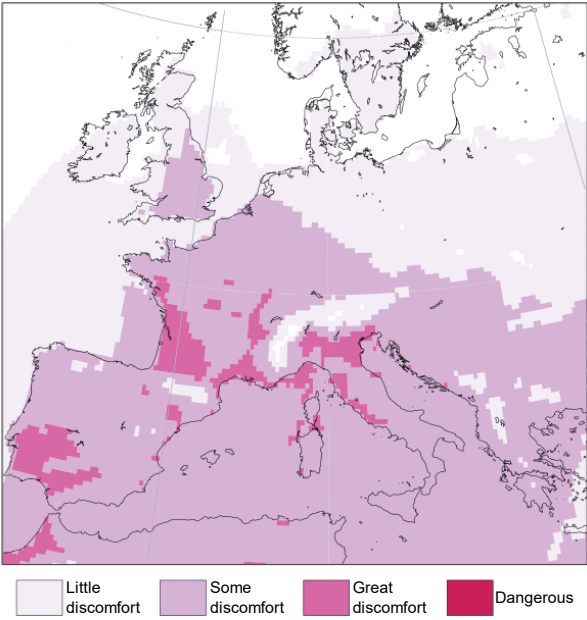
CONTEXT

30 June 2025 – 12 UTC

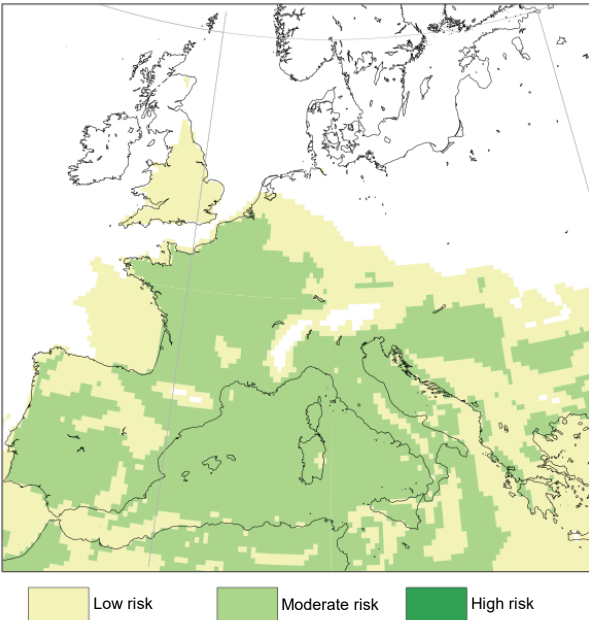
Heat index



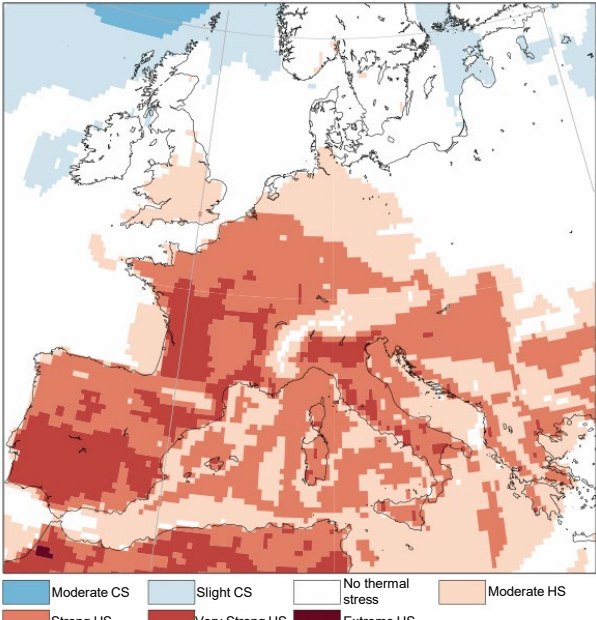
Humidex



WBGT



UTCI

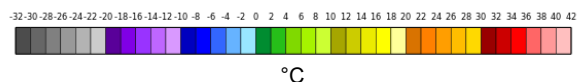
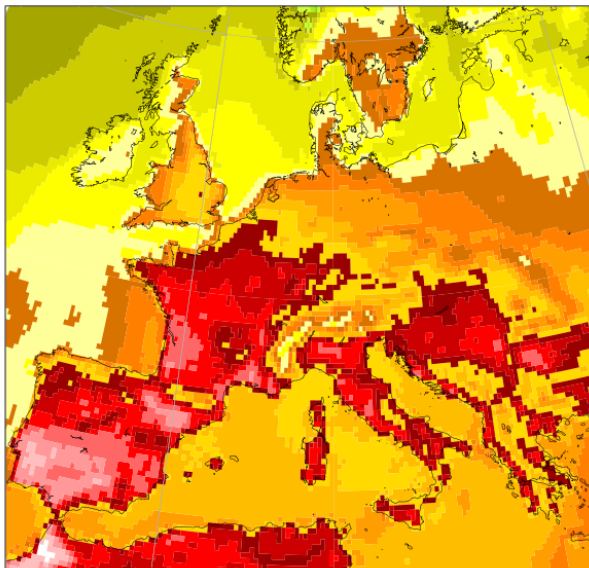


Source: ERA5/ERA5-HEAT

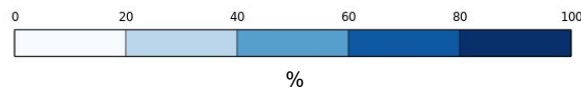
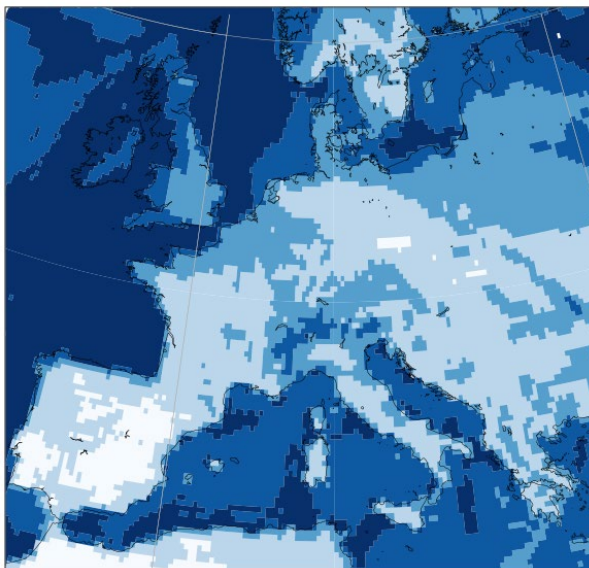
JUNE 2025 EUROPEAN HEATWAVE THERMO-CONTEXT

30 June 2025 – 12 UTC

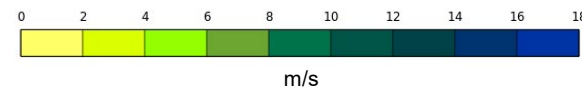
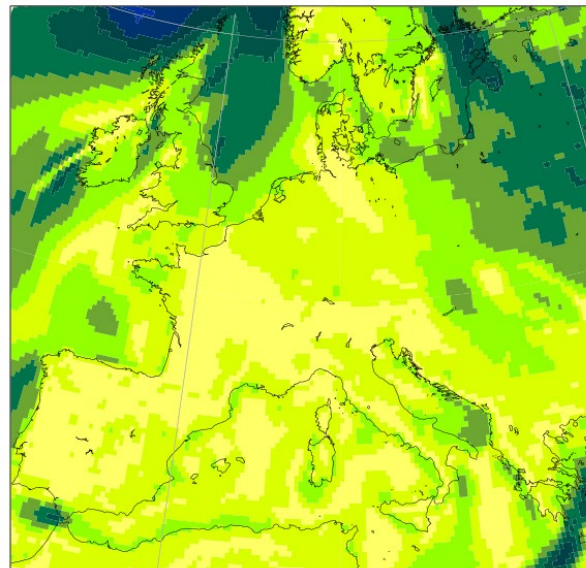
2m air temperature



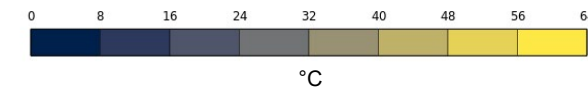
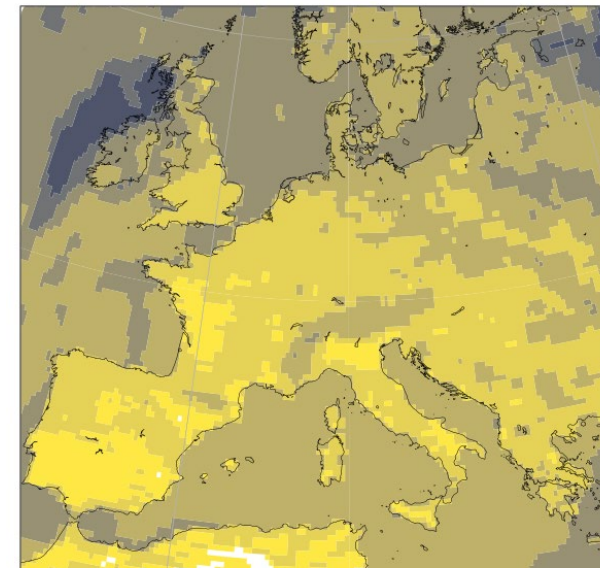
Relative humidity



10m wind speed



Mean radiant temperature



Source: ERA5/ERA5-HEAT

JUNE 2025 EUROPEAN HEATWAVE

THERMO-DRIVERS

Reanalysis

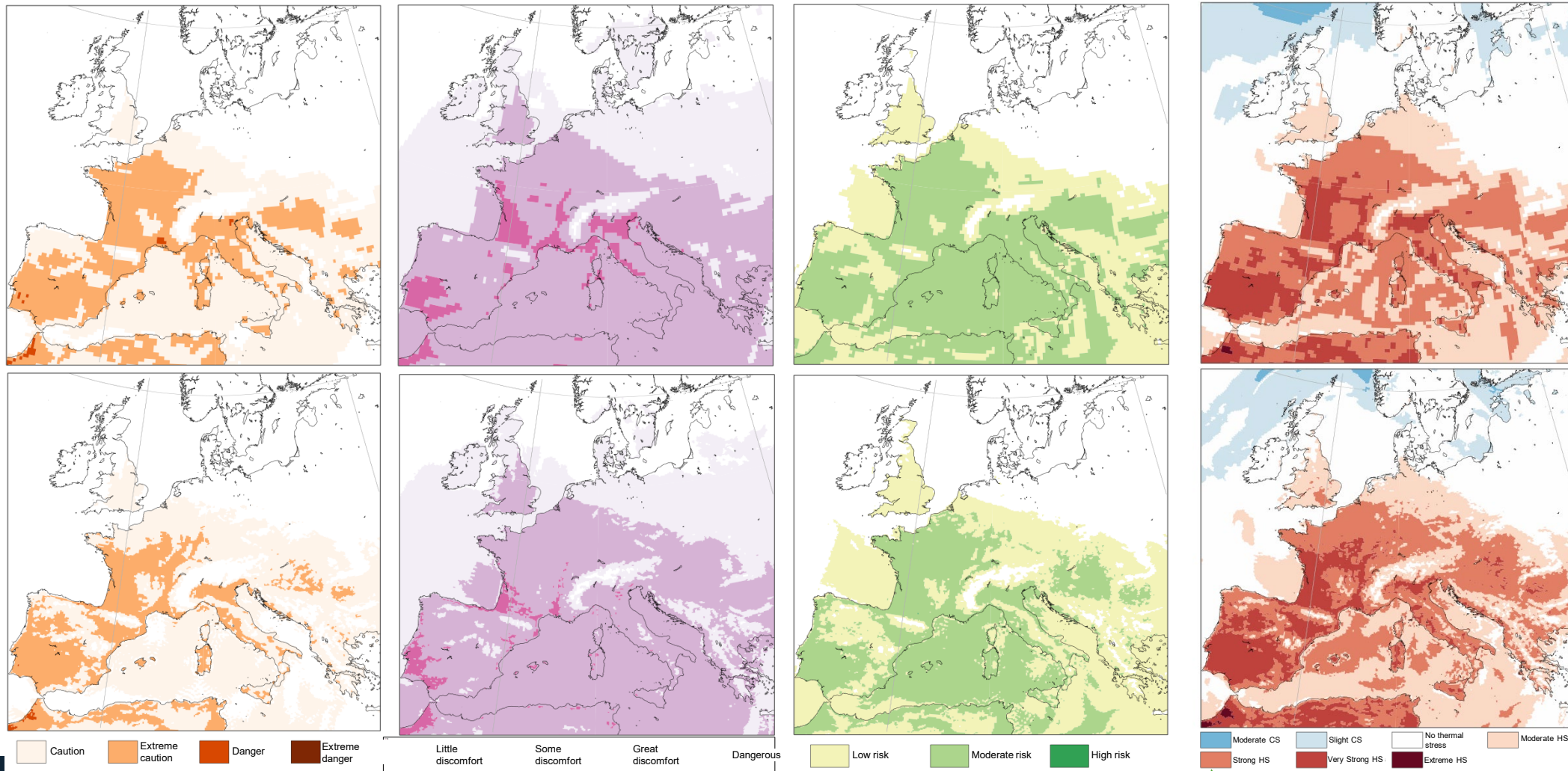
Control

Heat index

Humidex

WBGT

UTCI



30 JUNE 2025 @ 12 UTC (+108H)

THERMOFEEL FCS

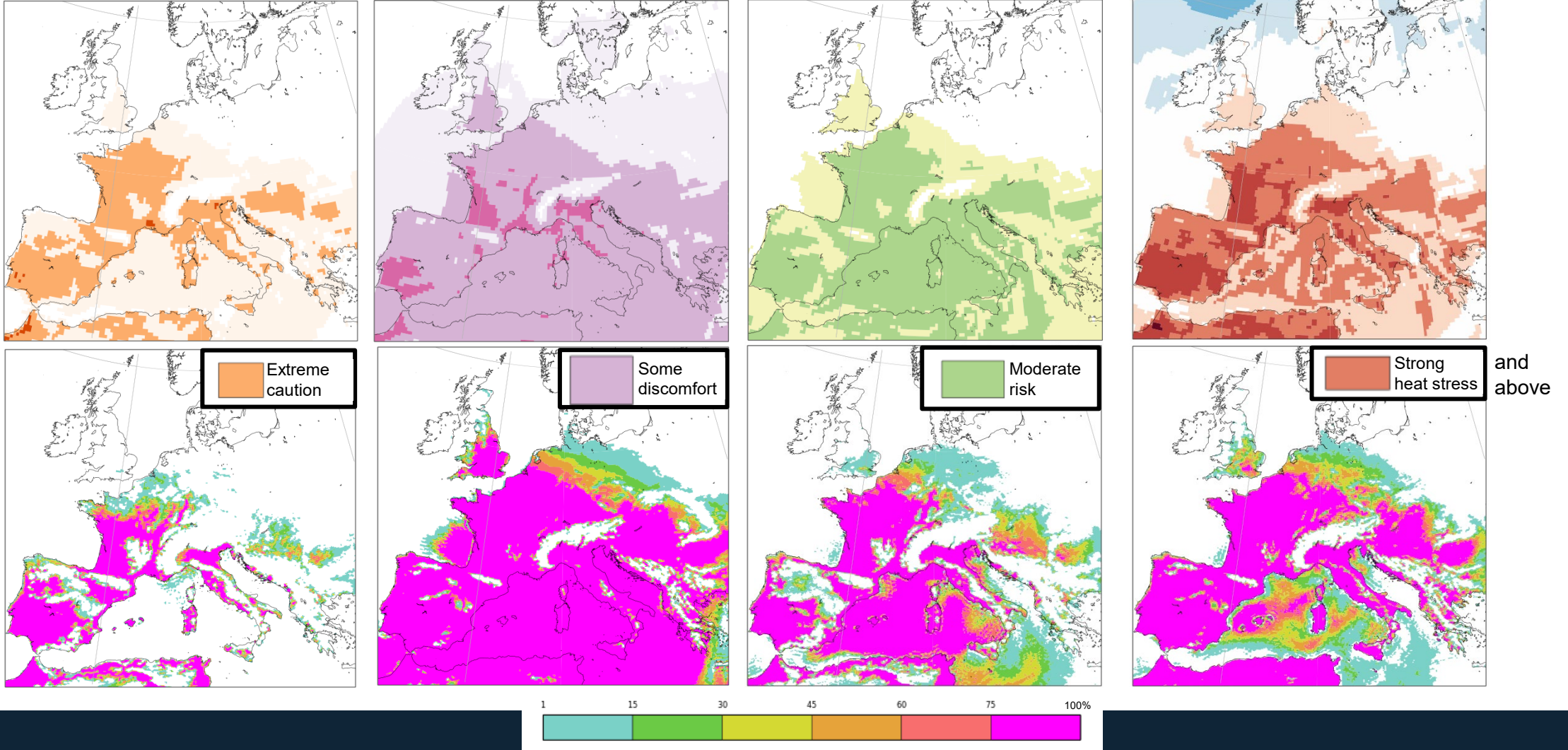
Ensemble prob. (darker colours)

Heat index

Humidex

WBGT

UTCI

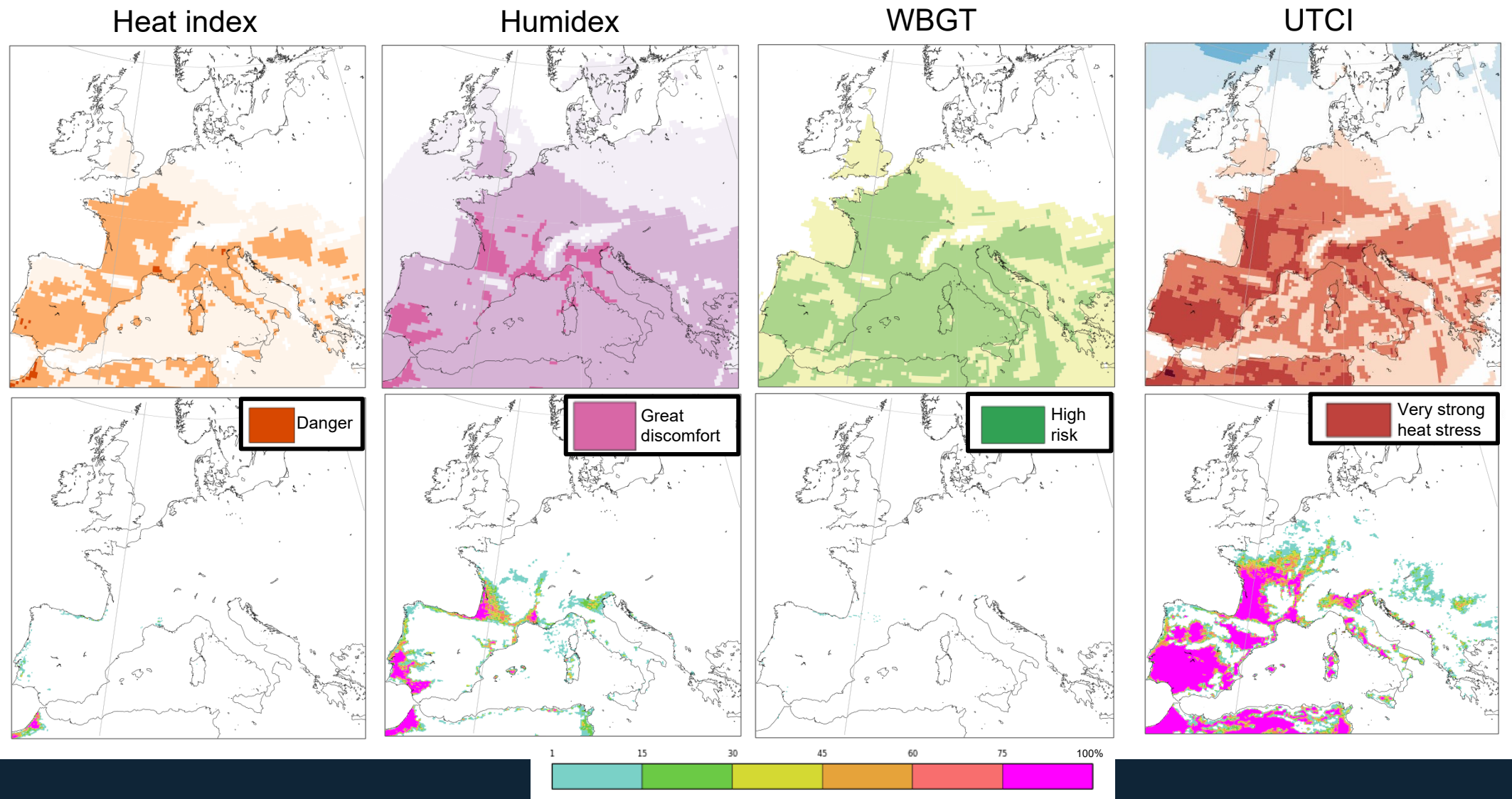


30 JUNE 2025 @ 12 UTC (+108H)

THERMOFEEL FCS

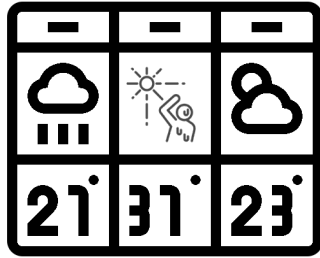
Ensemble prob.
(darker colours)

Reanalysis



30 JUNE 2025 @ 12 UTC (+108H) THERMOFEEL FCS

Take-home messages



Forecasts of
human thermal
stress indices are
now available



Global,
from cold
to heat



Forecast
evaluation
ongoing – stay
tuned!



Want to know
more? Happy to
have a chat
and... come to
our training
course!

Thank you!

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