

KI-gestützte Vorhersage von Schlaganfällen zur optimierten Ressourcenplanung: Ergebnisse aus dem WE-STORM-Projekt

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Wed, 01-07-2026

Introduction

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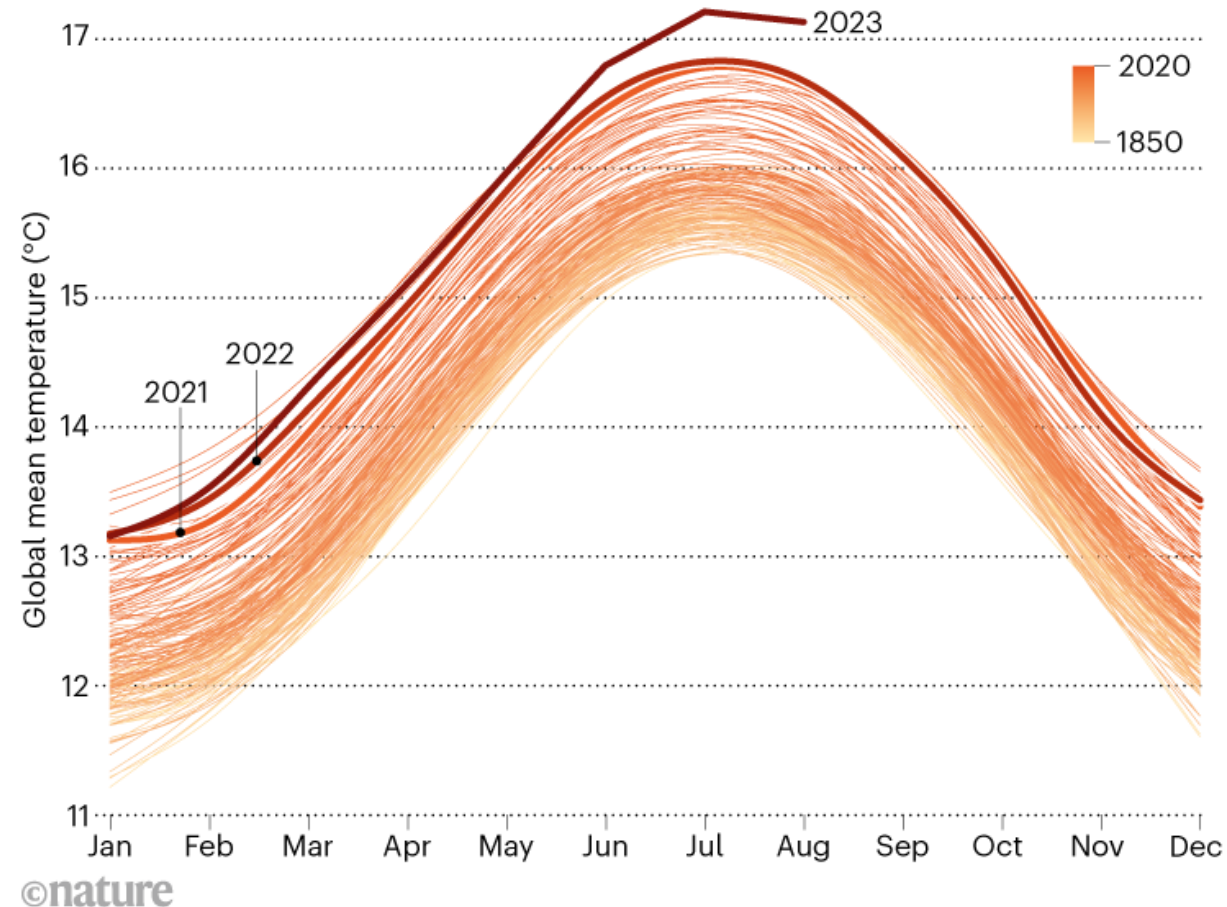
NEWS | 22 September 2023

Earth's average 2023 temperature is now likely to reach 1.5 °C of warming

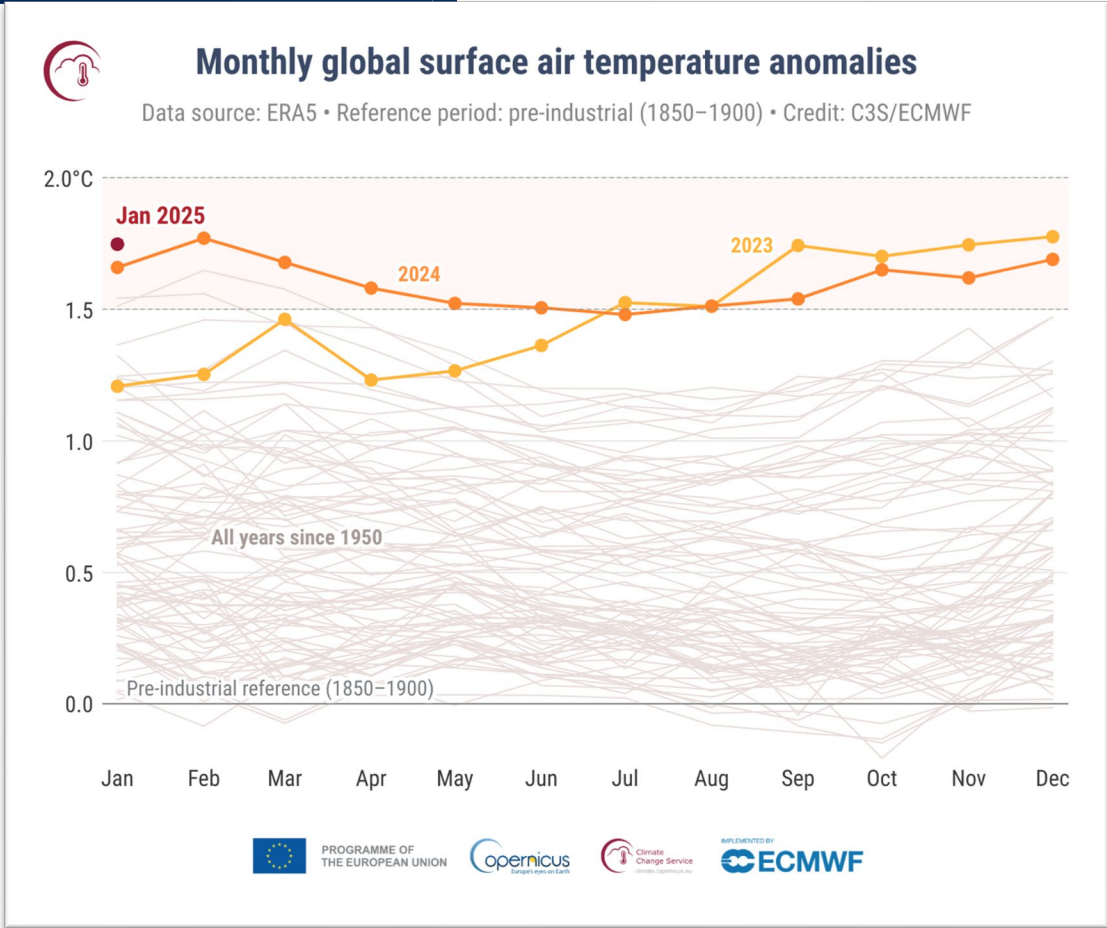
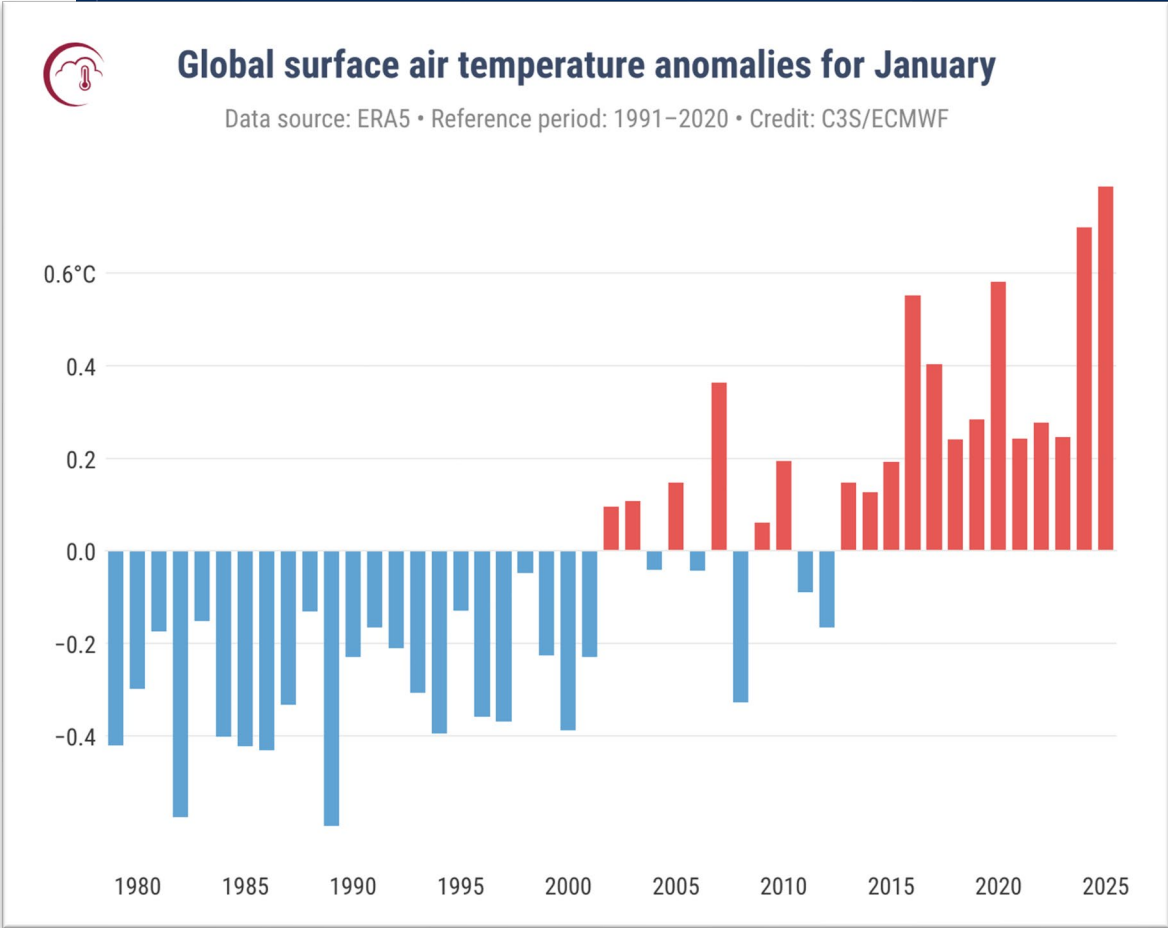
But to breach the Paris agreement's limit, the heating must be sustained for many years.

HEAT RISING

The global average temperatures in the past three months have set new records every month, often by a large margin.



Introduction



Introduction

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NEWS EXPLAINER | 18 August 2023

Earth's hottest month: these charts show what happened in July and what comes next

The planet has warmed 1.2 °C on average, but that's enough to produce big extremes.

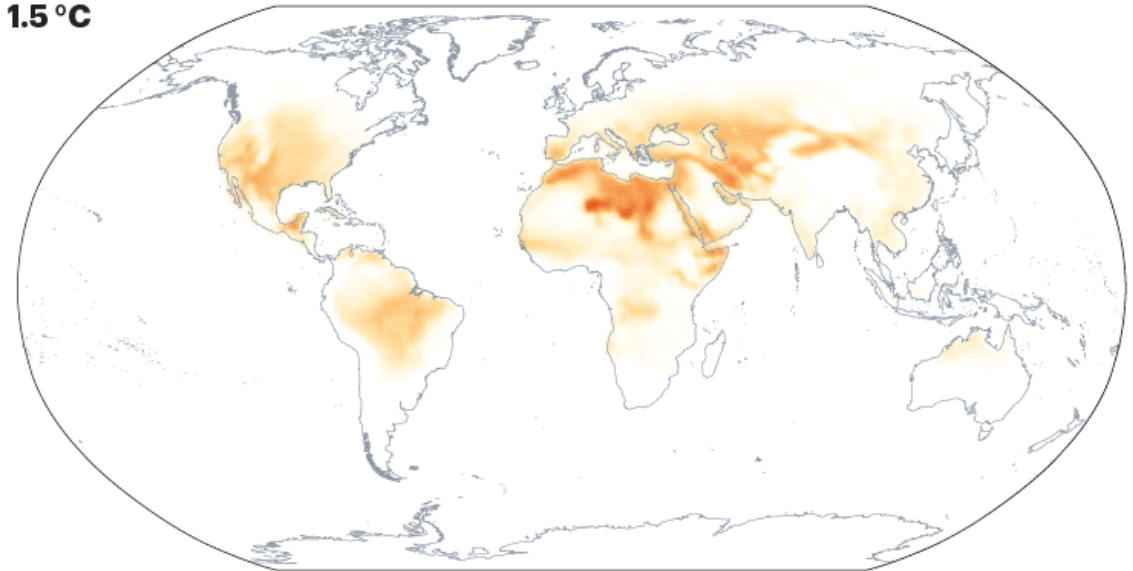
[Jeff Tollefson](#)

30-40 extra **days** / yr @ **>35 °C**

HEATWAVE PROJECTIONS

Researchers think the world could reach a 1.5 °C rise and surpass it in a matter of years, and around 2 °C of warming is likely even if governments were to meet their climate commitments. On the basis of current policies alone, climate scientists estimate that temperatures could rise nearly 3 °C this century. In each of these scenarios, models project that many places on Earth could experience 30–40 extra days each year above 35 °C, affecting public health and ecosystems globally.

1.5 °C



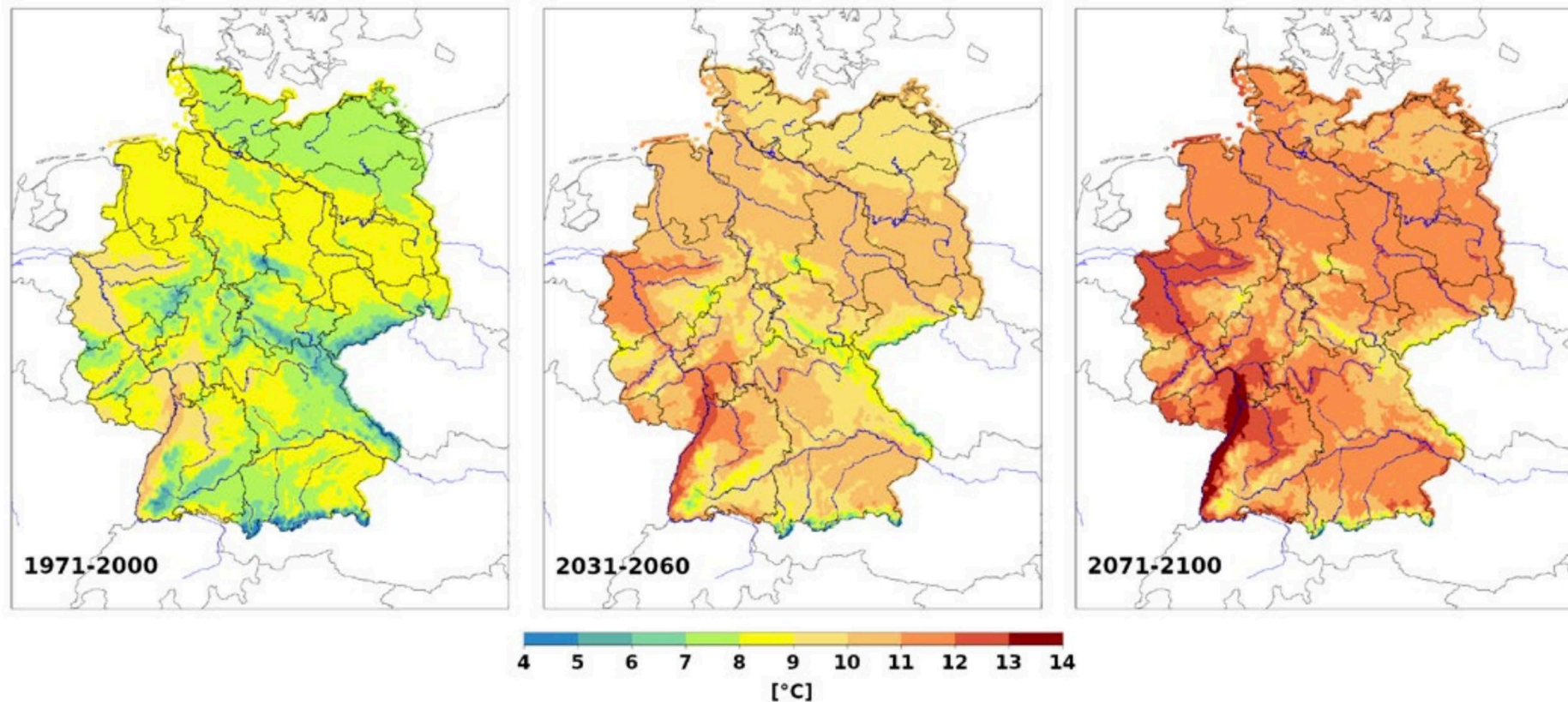
Number of extra days above 35 °C



©nature

Source: Nature, <https://www.nature.com/articles/d41586-023-02552-2>

Introduction



▲ 30-year average of the 2 m temperature taken from COSMO-CLM climate simulations with 3 km grid spacing for the historical period (1971-2000, left), the near future (2031-2060, middle), and the distant future (2071-2100, right). The projections for the near and distant future were calculated on the basis of the RCP8.5 scenario.

nature > news explainer > article

NEWS EXPLAINER | 26 June 2026 | Clarification [26 June 2026](#)

Europe’s record heatwave: does the continent have a new climate?

Nature asks researchers whether scorching summers are the new norm for London, Paris and Berlin.

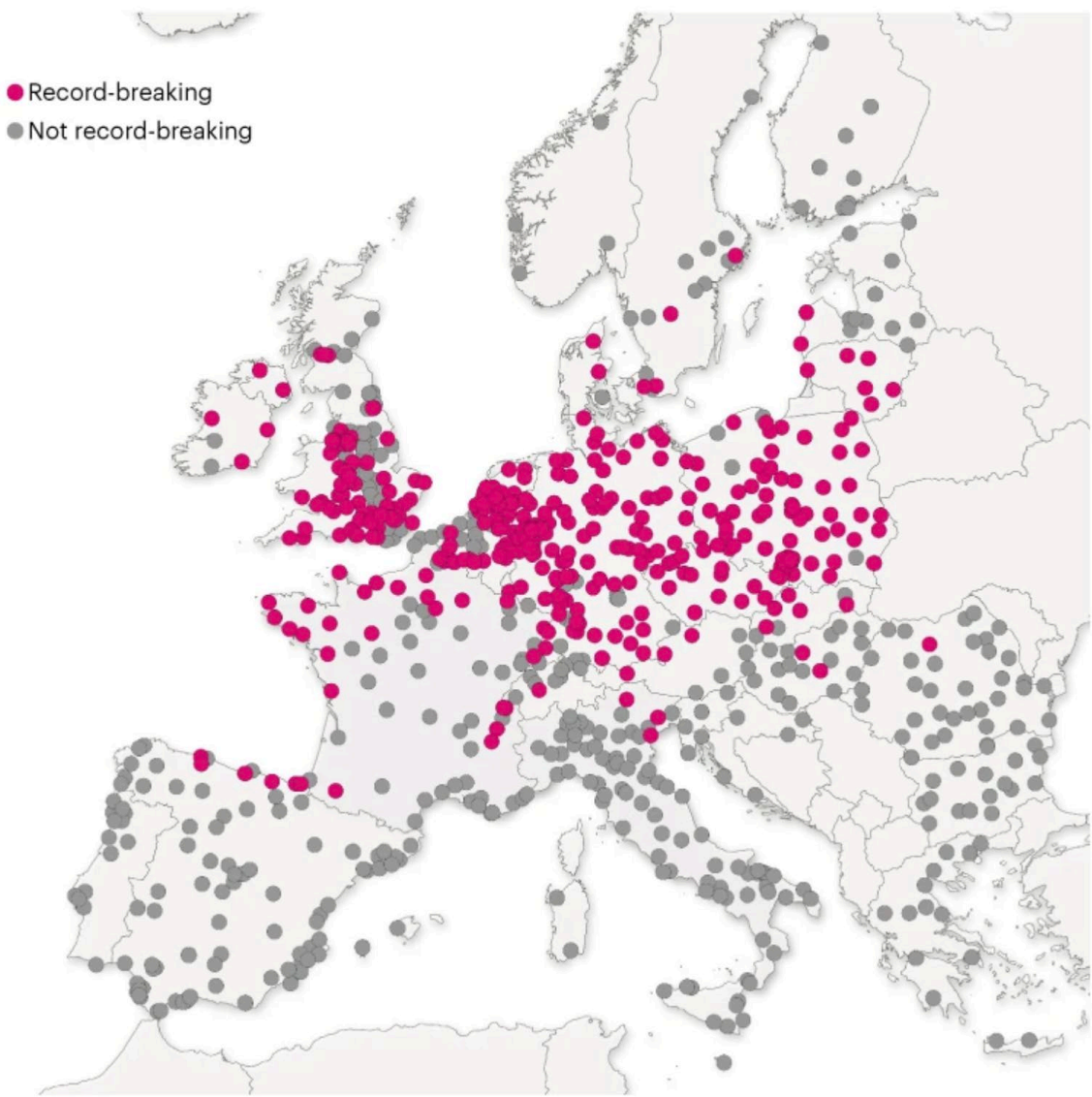
By [Edward Chen](#)



People get relief from a water hose on 25 June in Cologne, Germany, as a record-setting heatwave pummels the nation. Credit: Ina Fassbender/AFP via Getty

EPIC HEATWAVE

Researchers analysed meteorological data from 854 cities across Europe and found that almost half of them have either already broken an all-time heat-stress record since 18 June or are predicted to do so by the end of the month.



Europe's record heatwave: does the continent have a new climate?

Nature asks researchers whether scorching summers are the new norm for London, Paris and Berlin.

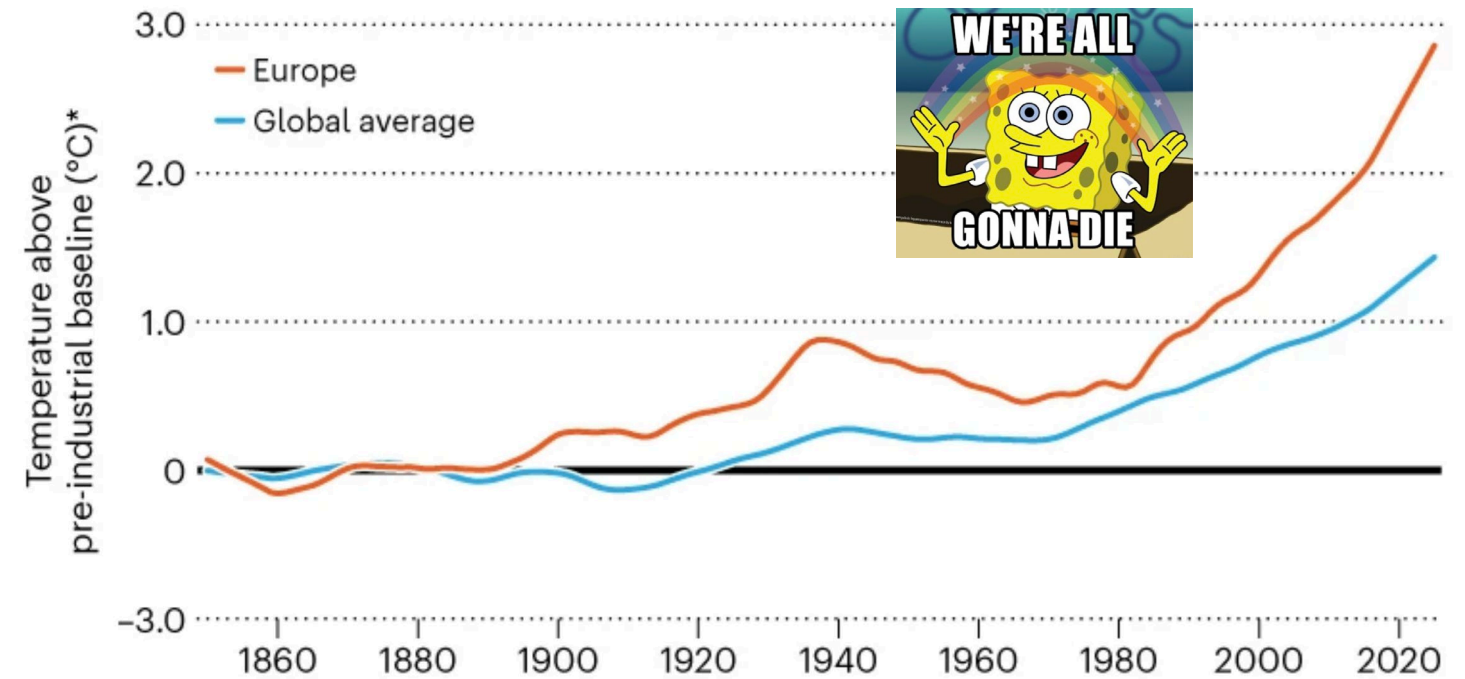
By [Edward Chen](#)



People get relief from a water hose on 25 June in Cologne, Germany, as a record-setting heatwave pummels the nation. Credit: Ina Fassbender/AFP via Getty

CLIMATE SHIFT

Europe is the fastest-warming continent, growing hotter about twice as fast as the global average for all of Earth's land and oceans. On the basis of temperature data such as these, some researchers say that Europe's climate began to shift in the 1980s.



©nature

*Pre-industrial baseline is the mean global temperature between 1850 and 1900.

Source: Zeke Hausfather/Berkeley Earth



06:52

CLIMATE | EUROPE

Extreme heat: Can Europe adapt to climate change?

Gerhard Elfers
06/28/2026

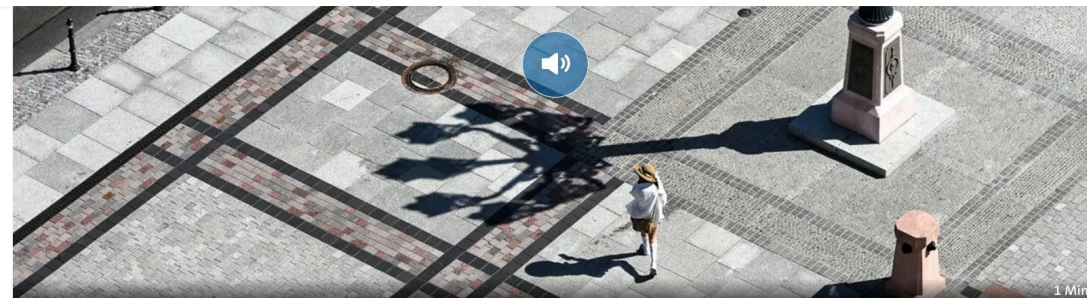
Cracked roads, stalled trains, closed classrooms — Germany and other European states have sweltered in an extreme heat wave. Just another hot summer or the tipping point forcing the continent to prepare for a much warmer future?



tagesschau

tagesschau24 live

Startseite Wissen Deutsche Städte laut Umwelthilfe schlecht auf Hitze vorbereitet



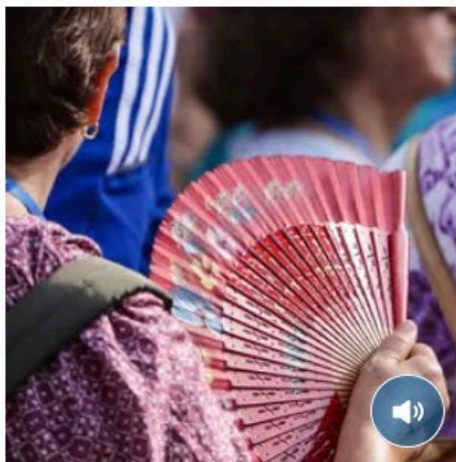
Zu wenig Bäume, zu viel Beton

Umwelthilfe kritisiert Hitzeschutz in Städten

Stand: 09.06.2026 • 14:56 Uhr

Der Klimawandel macht Hitzewellen häufiger und intensiver. Besonders betroffen sind Städte. Viele sind nicht gut darauf vorbereitet, kritisiert die Deutsche Umwelthilfe - und fordert mehr Bäume und weniger Beton.

Deutsche Städte sind nach Darstellung der Deutschen Umwelthilfe durch Versiegelung und den Verlust von Räumen schlecht vor extremer Hitze geschützt. In ihrem jährlichen



17.09.2025

Schätzung zum Sommer 2025

16.500 Hitzetote in Europas Städten durch Klimawandel

Die Erderwärmung hat laut einer Schätzung zu rund 16.500 zusätzlichen Hitzetoten in europäischen Städten geführt. | [mehr](#)

Hitze-Check 2026

Stadt	Land	Gesamt- wertung	Beschirmungs- grad 2025 ¹	Versiegelungs- trend 2018-2025 ²	Hitzebetroffen- heitsindex ³	Baum- verlust 2018-2025 ⁴
			(%)	(%)	(HBI)	(absolut)
Offenburg	BW		12,78 	+ 0,50 	16,57 	
Lahr	BW		13,97 	+ 0,80 	15,88 	
Mannheim	BW		14,14 	+ 0,35 	18,37 	
Ludwigshafen am Rhein	RP		15,77 	+ 0,44 	18,24 	
Rastatt	BW		15,81 	+ 0,52 	16,93 	
Worms	RP		15,91 	+ 0,97 	17,52 	
Aalen	BW		16,31 	+ 0,77 	14,97 	
Neu-Ulm	BY		16,36 	+ 1,48 	16,34 	
Dormagen	NW		17,04 	+ 0,76 	15,49 	
Heilbronn	BW		17,53 	+ 0,51 	17,26 	
Schwäbisch Gmünd	BW		17,55 	+ 0,87 	14,38 	
Böblingen	BW		17,85 	+ 0,23 	16,39 	
Waiblingen	BW		17,87 	+ 0,84 	16,89 	
Bad Kreuznach	RP		17,92 	+ 0,75 	16,74 	
Esslingen am Neckar	BW		17,99 	+ 0,27 	16,17 	
Fürth	BY		18,10 	+ 0,66 	16,50 	
Nürnberg	BY		18,19 	+ 0,42 	16,78 	
Euskirchen	NW		18,26 	+ 1,62 	15,56 	
Lörrach	BW		18,68 	+ 0,84 	16,49 	
Freiburg im Breisgau	BW		18,72 	+ 0,59 	16,71 	
Eschweiler	NW		18,73 	+ 0,76 	14,50 	
Karlsruhe	BW		18,74 	+ 0,35 	16,88 	
Grevenbroich	NW		18,74 	+ 0,88 	15,17 	
Rüsselsheim am Main	HE		18,82 	+ 0,23 	17,02 	
Kerpen	NW		18,97 	+ 1,28 	15,15 	
Heidenheim an der Brenz	BW		18,98 	+ 1,09 	14,40 	
Ulm	BW		19,01 	+ 0,57 	15,88 	
Rosenheim	BY		19,15 	+ 0,57 	15,15 	
Neuwied	RP		19,15 	+ 0,53 	15,97 	
Heidelberg	BW		19,21 	+ 0,56 	16,13 	
Langenhagen	NI		19,31 	+ 1,02 	16,30 	
Pforzheim	BW		19,32 	+ 0,58 	15,65 	
Aschaffenburg	BY		19,59 	+ 0,65 	16,71 	
Koblenz	RP		19,59 	+ 0,70 	15,60 	
Düren	NW		19,66 	+ 0,85 	15,93 	
Bamberg	BY		19,76 	+ 0,59 	16,17 	
Langenfeld	NW		19,85 	+ 0,53 	15,63 	

Stadt	Land	Gesamt- wertung	Beschirmungs- grad 2025 ¹	Versiegelungs- trend 2018-2025 ²	Hitzebetroffen- heitsindex ³	Baumverlust 2018-2025 ⁴
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Offenburg	BW		12,78 	+ 0,50 	16,57 	2.243
Lahr	BW		13,97 	+ 0,80 	15,88 	2.403
Mannheim	BW		14,14 	+ 0,35 	18,37 	7.332
Ludwigshafen am Rhein	RP		15,77 	+ 0,44 	18,24 	3.813
Rastatt	BW		15,81 	+ 0,52 	16,93 	1.438
Worms	RP		15,91 	+ 0,97 	17,52 	2.402
Aalen	BW		16,31 	+ 0,77 	14,97 	2.123
Neu-Ulm	BY		16,36 	+ 1,48 	16,34 	1.825
Dormagen	NW		17,04 	+ 0,76 	15,49 	2.191
Heilbronn	BW		17,53 	+ 0,51 	17,26 	2.155
Schwäbisch Gmünd	BW		17,55 	+ 0,87 	14,38 	1.182
Böblingen	BW		17,85 	+ 0,23 	16,39 	1.356
Waiblingen	BW		17,87 	+ 0,84 	16,89 	742
Bad Kreuznach	RP		17,92 	+ 0,75 	16,74 	1.112
Esslingen am Neckar	BW		17,99 	+ 0,27 	16,17 	965
Fürth	BY		18,10 	+ 0,66 	16,50 	1.493
Nürnberg	BY		18,19 	+ 0,42 	16,78 	9.261
Euskirchen	NW		18,26 	+ 1,62 	15,56 	1.882
Lörrach	BW		18,68 	+ 0,84 	16,49 	773
Freiburg im Breisgau	BW		18,72 	+ 0,59 	16,71 	4.906
Eschweiler	NW		18,73 	+ 0,76 	14,50 	2.378
Karlsruhe	BW		18,74 	+ 0,35 	16,88 	6.102

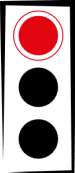
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Mannheim

Ludwigshafen am Rhein



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Climate change is speeding up – the pace nearly doubled in ten years

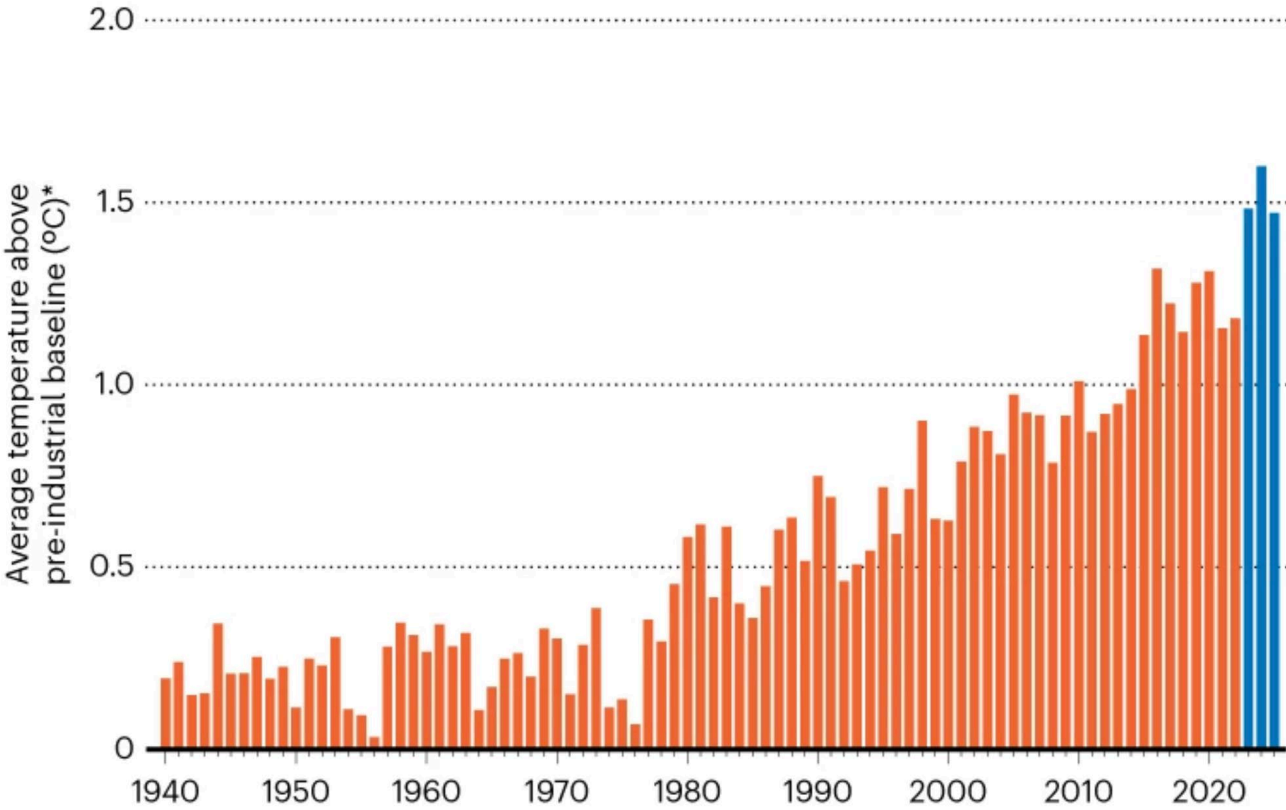
Earth is now warming at a rate of around 0.35 °C per decade, fresh analysis finds.

By [Alexandra Witze](#)



TEMPERATURE BOOST

The past three years have been the hottest on record (blue bars). Scientists are now exploring whether global warming is speeding up.



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*The pre-industrial baseline is averaged over 1850 to 1900.

Source: Copernicus Climate Change Service/European Centre for Medium-Range Weather Forecasts.

NEWS | 06 March 2026

Climate change is speeding up – the pace nearly doubled in ten years

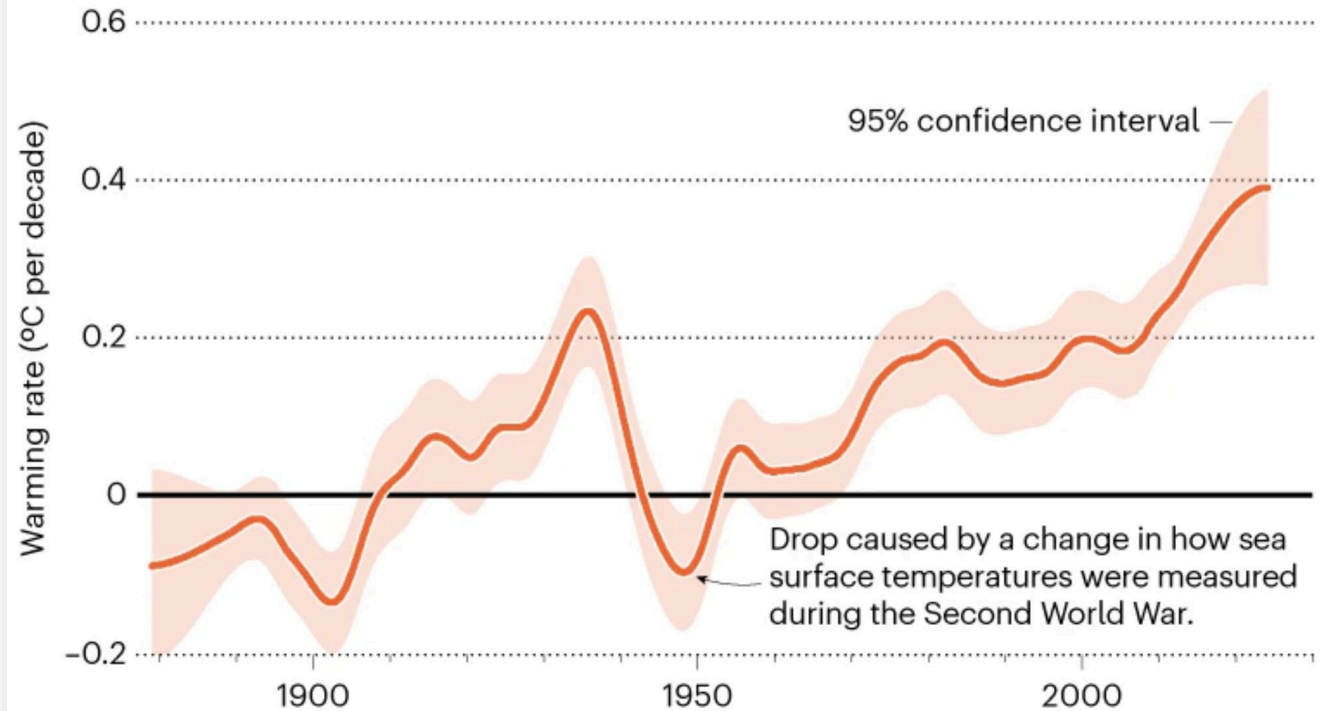
Earth is now warming at a rate of around 0.35 °C per decade, fresh analysis finds.

By [Alexandra Witze](#)



RATE HIKE

The rate of global warming has increased from around 0.2 °C per decade in the 1970s to around 0.35 °C per decade today, according to an analysis of five global temperature data sets (data from NASA are shown here).



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Source: Ref. 1.

Are we really headed for a 'super' El Niño? What the science says

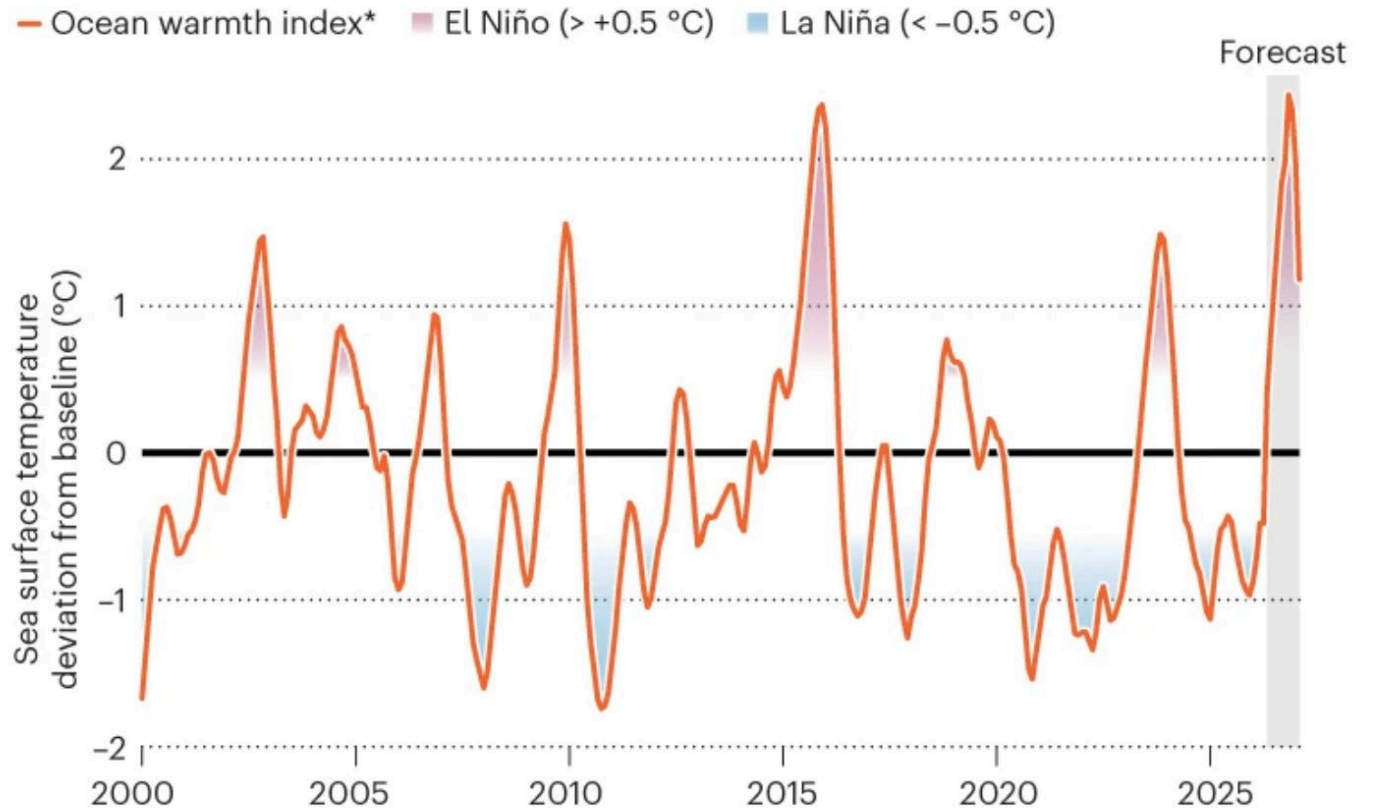
An El Niño is coming, models say, but *Nature* spoke to researchers about when and how we'll know its intensity.

By [Alexandra Witze](#)



EXTREME PREDICTION

Meteorologists are forecasting that a 'super' El Niño might begin this year, with temperatures in the tropical Pacific Ocean rising by at least 2 °C above average. Models are predicting a rise of between 2.4 °C and 3.1 °C. El Niño weather patterns occur around every two to seven years, and La Niñas, when sea surface temperatures dip, occur in between.



*Index calculated by comparing ocean observations in the central tropical Pacific with those made in all tropical oceans at the same time.

©nature

Source: [ENSO Forecast Dashboard](#)/Zeke Hausfather

Article

Open access

Published: 22 June 2026

Global heat stress intensification and its expanding footprint on the human population

Rebecca Emerton

Julien Nicolas

Anna Lombardi

&

Claudia Di Napoli

Nature Climate Change

(2026)

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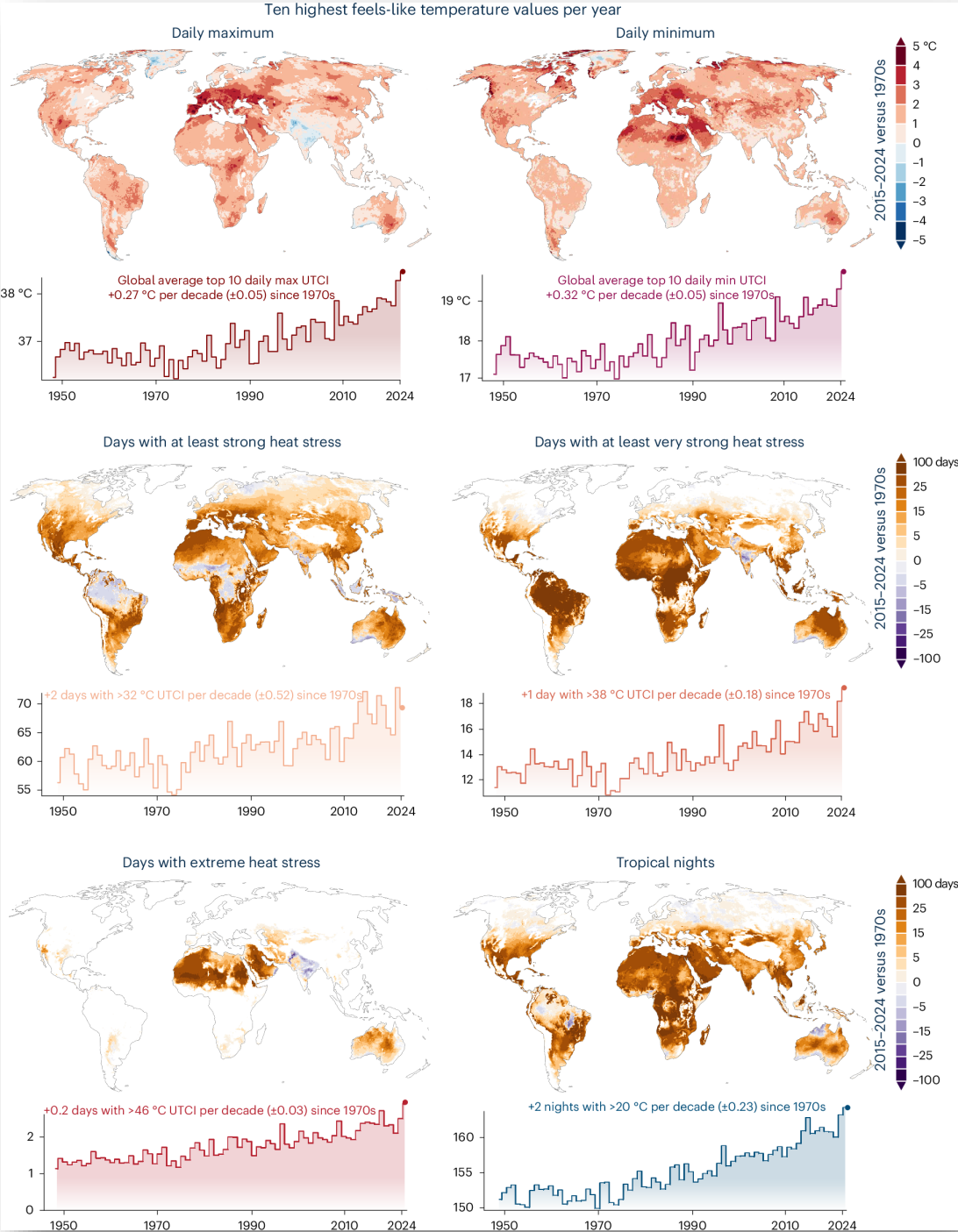
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Altmetric

Metrics

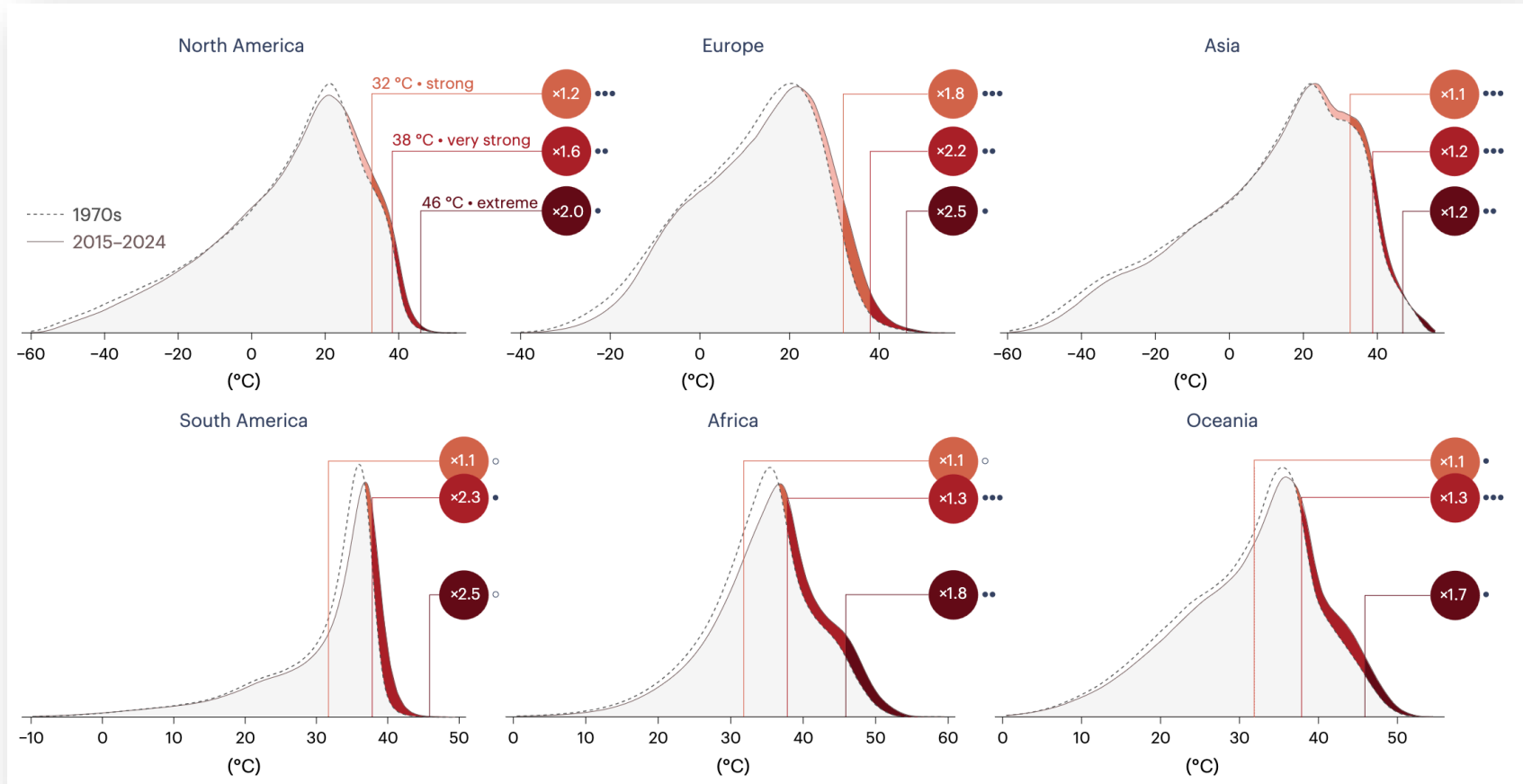
Abstract

Climate warming is driving more frequent and intense heat extremes. Yet, changes in heat stress, the leading cause of weather-related mortality, remain poorly quantified at the global scale. Here, using the Universal Thermal Climate Index, we assess heat stress globally since 1950, examining daytime extremes, nocturnal heat and compound daytime–nighttime events, revealing a pronounced, multidimensional intensification. Extreme ‘feels-like’ temperatures have become more frequent on every continent, and the spatial footprint of hazardous heat has expanded, exposing previously unaffected regions. Heat stress days and tropical nights have increased, with some regions experiencing up to 50 additional heat stress days annually and an extended heat stress season. The hottest nights of the year are warming faster (0.32 °C per decade) than the hottest days (0.27 °C), and compound events are more frequent, severe and prolonged. Population exposure to dangerous heat has increased markedly, driven by intensifying heat stress in addition to population growth.



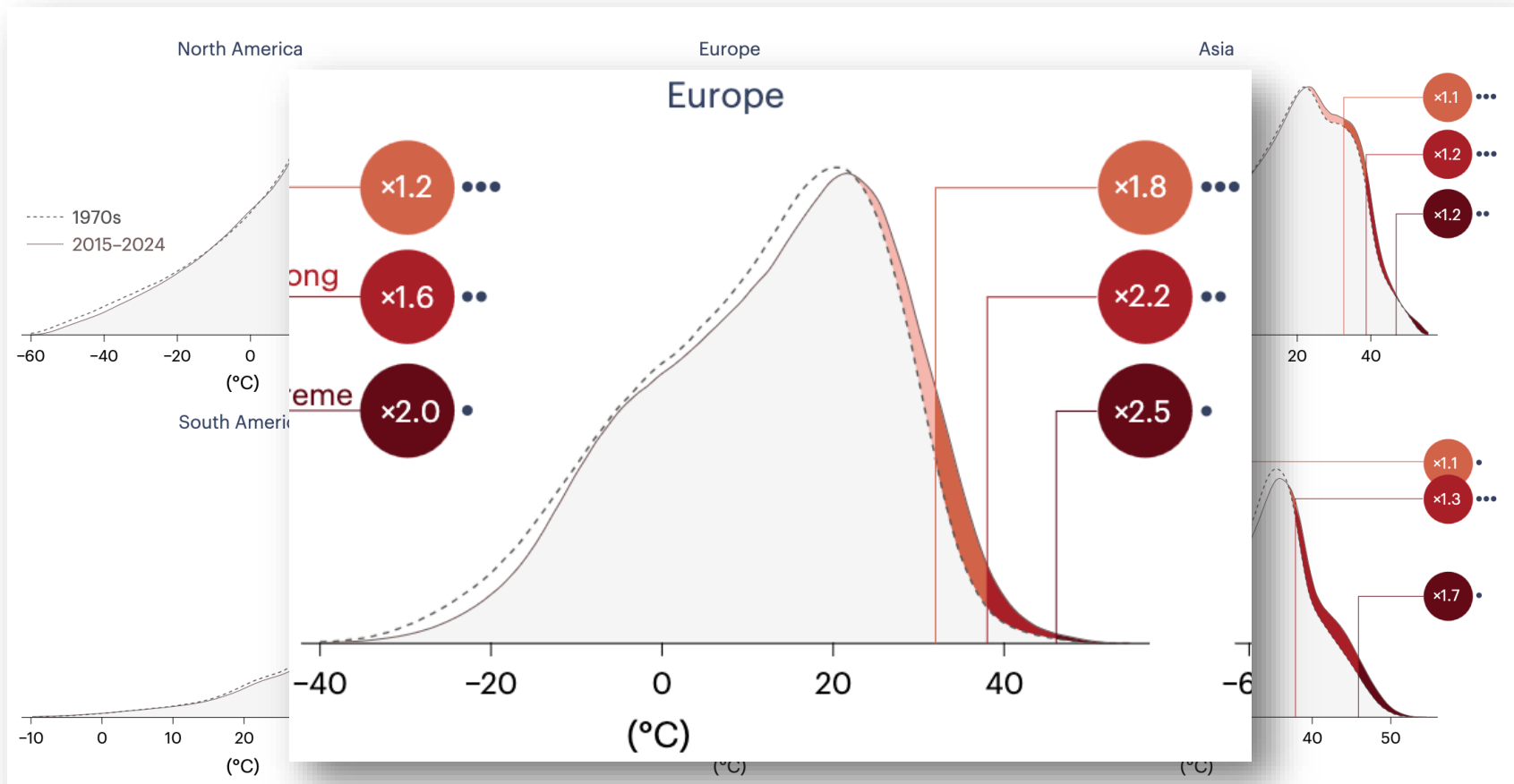
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Global heat stress intensification and its expanding footprint on the human population



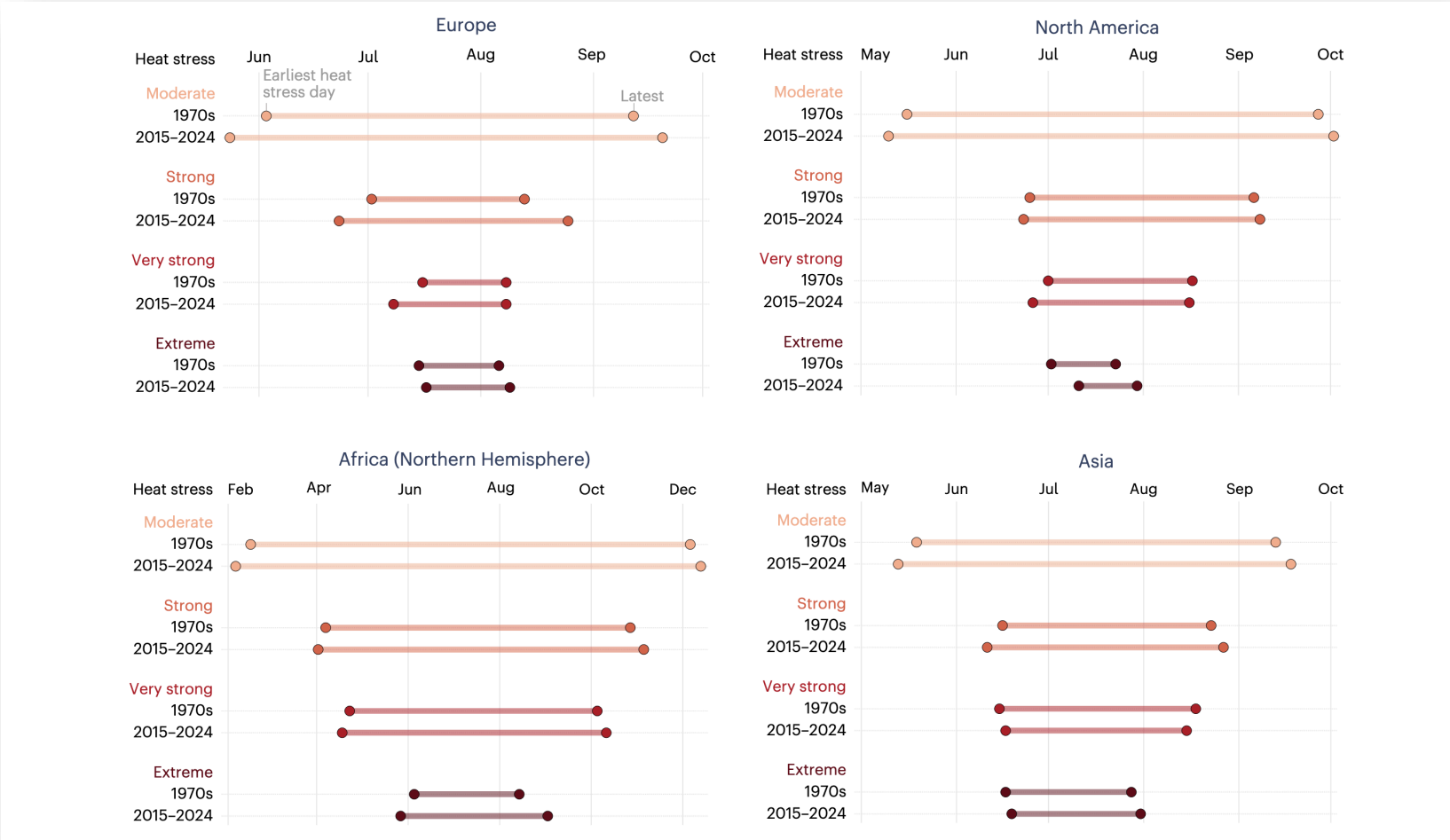
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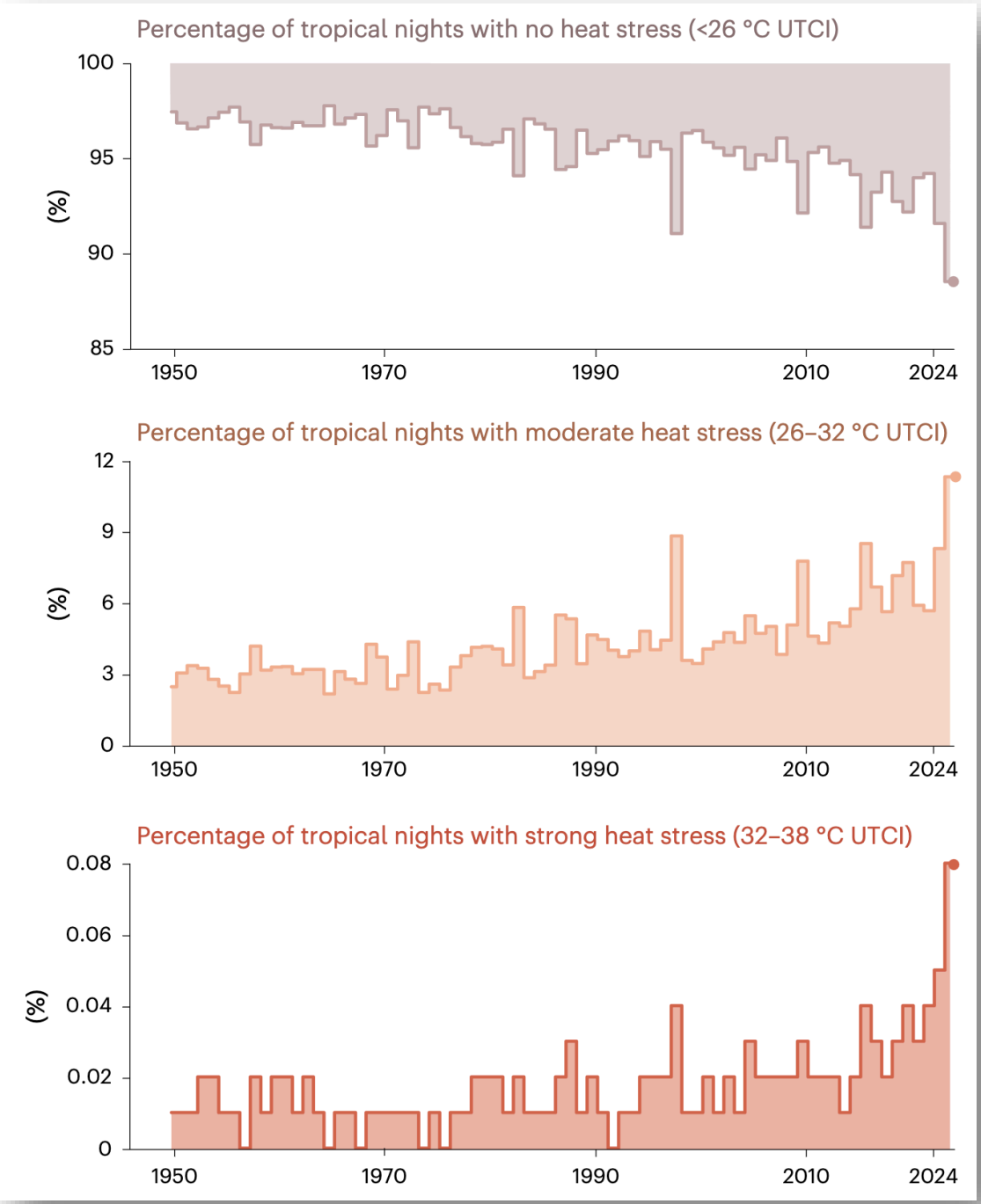
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Global heat stress intensification and its expanding footprint on the human population



WE-STORM > *Stroke & Weather?*

REVIEW ARTICLE | Originally Published 11 December 2017 | 🔒

Check for updates

Ambient Temperature and Stroke Risk: Evidence Supporting a Short-Term Effect at a Population Level From Acute Environmental Exposures

Pablo M. Lavados, MD, MPH, Verón

Stroke • Volume 49, Number 1 •

14,248 / 79

Ambient Temperature as an Exposure Variable

Study Design

Methodology

Effect of Ambient
Temperature on All Strokes

Effect of Ambient
Temperature on IS

Effect of Ambient
Temperature on ICH

Effect of Ambient
Temperature on SAH

Mechanisms

These are times of incre
change and political tur
produces not only hotter
also colder winters, esp
accustomed to these un
physiology and have the
cardiovascular diseases
conflicting, a great num
season rather than tem

In this review, we exami
temperature changes a
subtypes.

RESEARCH ARTICLE | Originally Published 10 February 2015 | 🔒

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Effect of Seasonal and Monthly Variation in Weather and Air Pollution Factors on Stroke Incidence in Seoul, Korea

Myung-Hoon Han, MD, Hyeong-Joong Yi, MD, PhD, Young-Soo Kim, MD, PhD, and Young-Seo Kim, MD, PhD | AUTHOR INFO & AFFILIATIONS

Stroke • Volume 46, Number 4 • <https://doi.org/10.1161/STROKEAHA.114.007950>

7,070 / 57

Abstract

Background and Pur

The purpose of the
monthly variations in
meteorologic and air
environmental cond
Korea.

Methods—

From January 1, 200
were registered in re
South Korea. The au
per month and the r
and air pollution par
confidence interval

Results

JAHA

Journal of the American Heart Association

RESEARCH ARTICLE | Originally Published 16 November 2018 | 🔒 | CC BY-NC-ND

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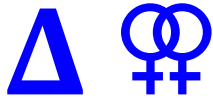
Temperature and Precipitation Associate With Ischemic Stroke Outcomes in the United States

Stacy Y. Chu, MD, Marguerite Cox, MS, MGIST, Gregg C. Fonarow, MD, Eric E. Smith, MD, MPH, Lee Schwamm, MD, Deepak L. Bhatt, MD, MPH, Roland A. Matsouaka, PhD, Ying Xian, MD, PhD, and Kevin N. Sheth, MD | AUTHOR INFO & AFFILIATIONS

Journal of the American Heart Association • Volume 7, Number 22 • <https://doi.org/10.1161/JAHA.118.010020>

4,143 / 22

Stroke ~ Weather



lag 2 – 4 [0 – 30]

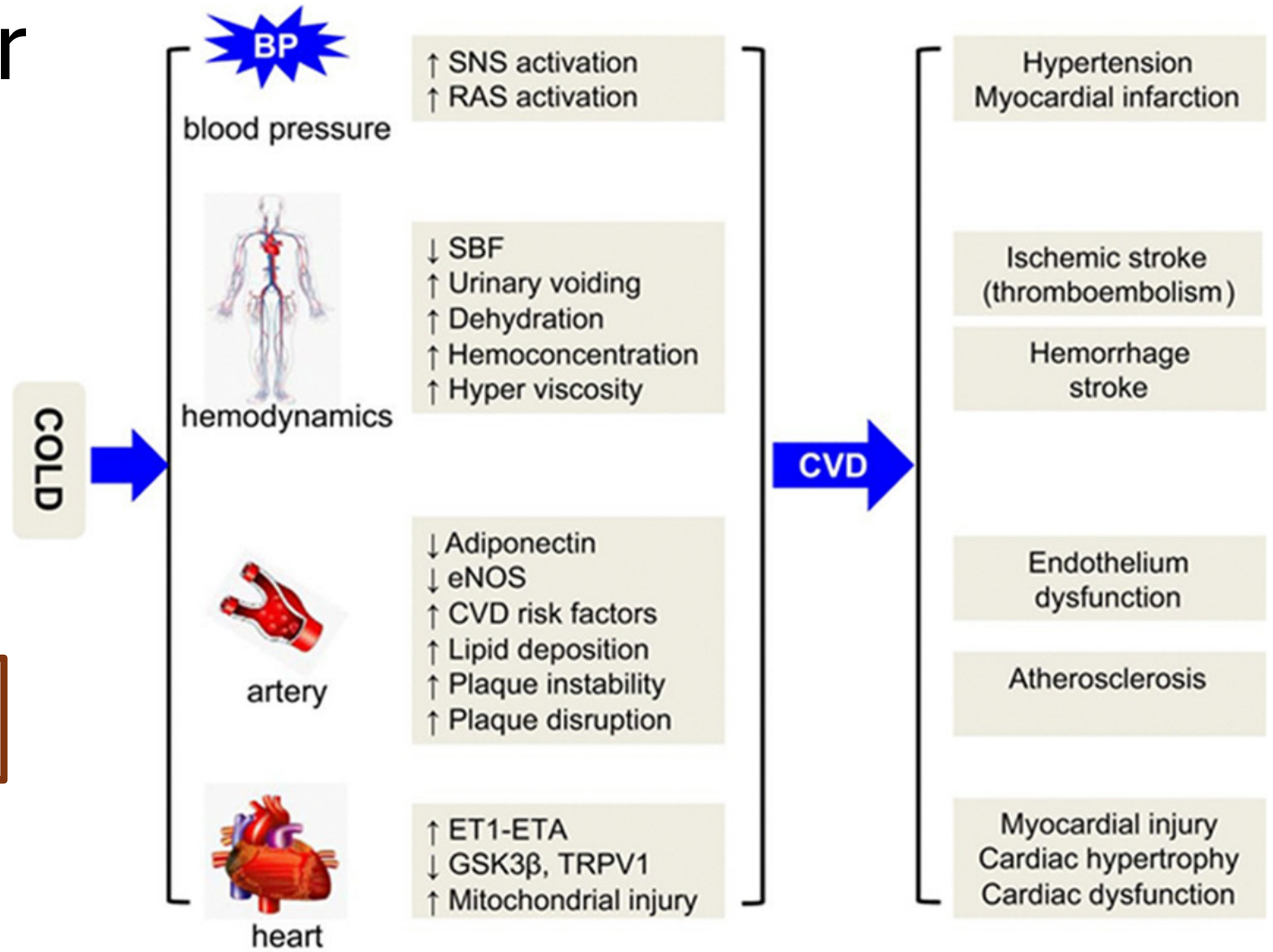


Figure 1. Summary of hypothesized mechanisms by which cold exposures induce cardiovascular

Stroke ~ Weather



lag 0 – 7

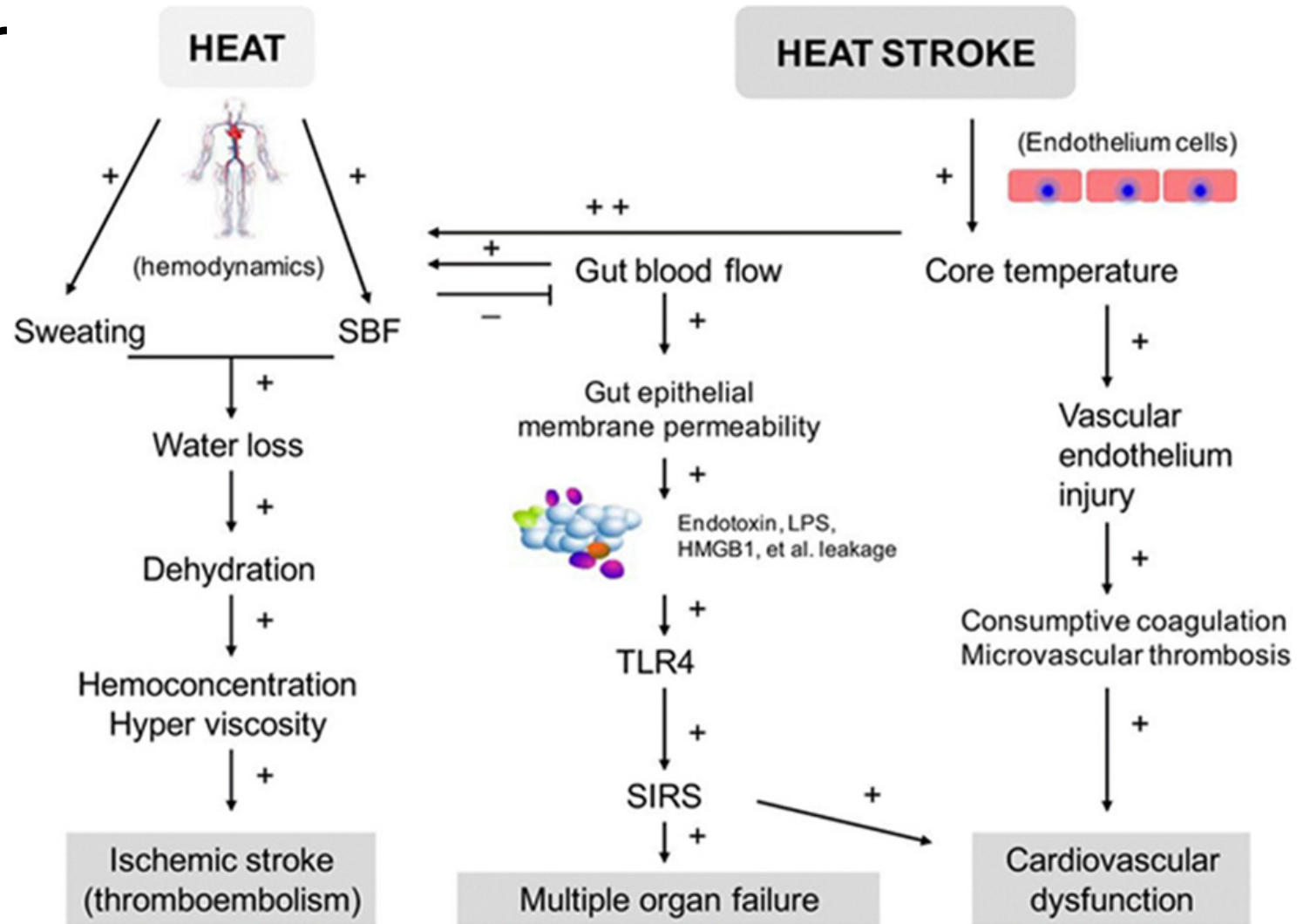
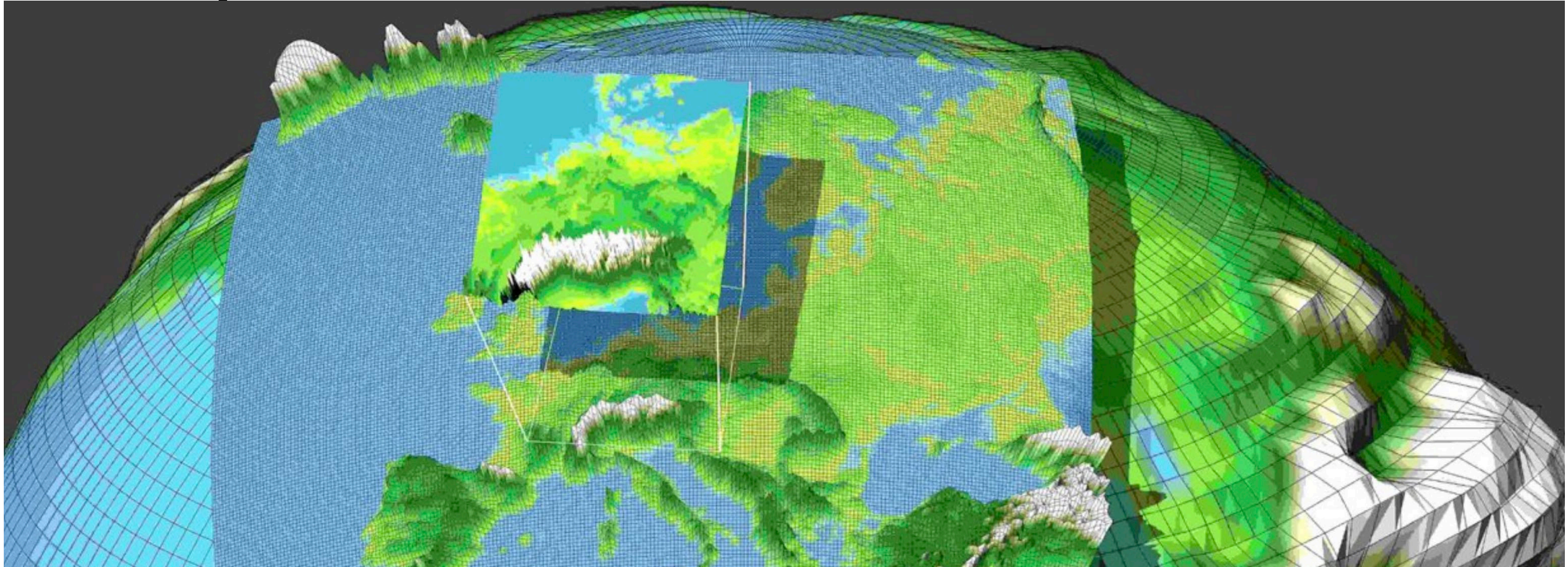


Figure 2. Summary of hypothesized mechanisms by which cold exposures induce cardiovascular disorders.

WE-STORM > *Predictive analytics for hospitals?*



Source: DWD, https://www.dwd.de/SharedDocs/broschueren/EN/climate/brochure_climateresearch.pdf?__blob=publicationFile&v=9

WEather-based STroke event and Outcome Risk Modeling (WE-STORM)

Verantwortliche/r Mitarbeiter/in

Dr. Máté Maros

Projektkürzel

WE-STORM

Projektpartner

Universitätsklinikum Mannheim

>157 000 uq. patients

>318 000 encounters

Schlagwörter:

Wetter

Fachrichtung:

Neurologie, Innere Medizin

Charité - Universitätsmedizin Berlin
Universitätsklinikum Carl Gustav Carus Dresden
Universitätsklinikum Erlangen
Universitätsklinikum Frankfurt
Universitätsmedizin Göttingen
Universitätsmedizin Greifswald
Universitätsklinikum Halle (Saale)
Universitätsklinikum Hamburg-Eppendorf
Universitätsklinikum Jena
Universitätsklinikum Leipzig
Universitätsklinikum Mannheim
LMU Klinikum München
Klinikum rechts der Isar der Technischen Universität München
Universitätsklinikum Tübingen
Universitätsklinikum Ulm
Universitätsklinikum Würzburg

14 University hospitals

~ 90 ML / Site

Σ 1260 site-specific ML models

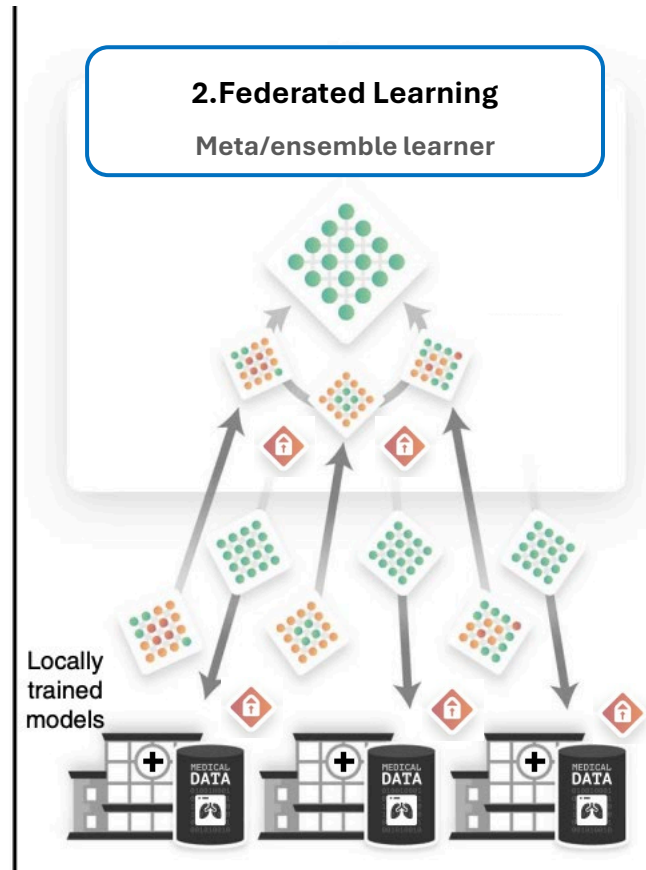
Prozeduren:

Medizinische Fakultät Mannheim
der Universität Heidelberg

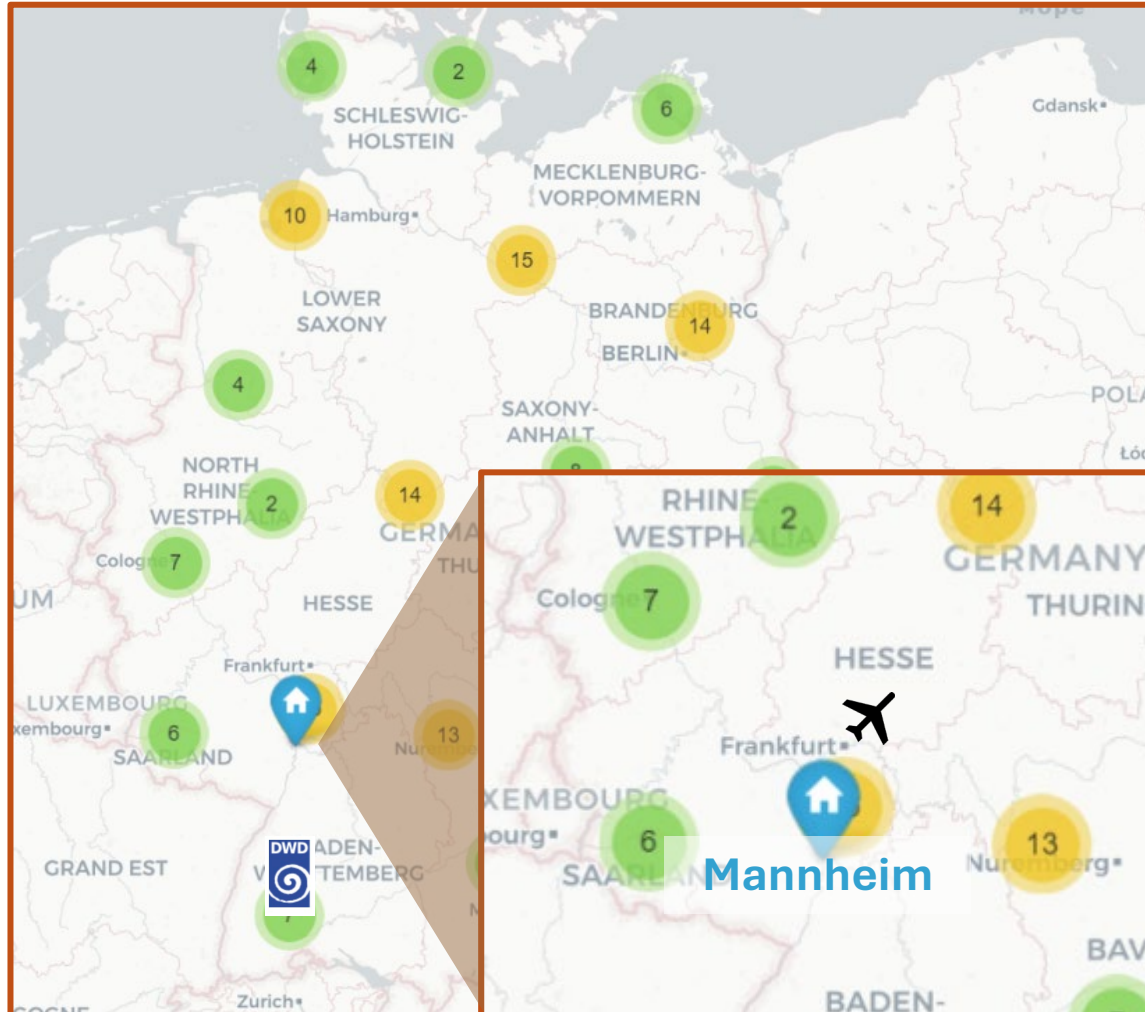
Universitätsklinikum Mannheim



Nandhini Santhanam MSc, cand. PhD



Methods > Data collection



Weather features

- Air temperature
- Pressure
- Humidity
- Precipitation
- Sunshine
- Wind
-

$N_{w.f.}$: **40** $\rightarrow$ **~150**

Δt : **daily & hourly**

Time-series

Cross-Validation



**Research Centre Human Biometeorology
Freiburg**

- Human stressor:
perceived temperature (PET)

WE-STORM: Multicentric extension

*2015-01-01 to 2021-12-31

Σ 157 519 patients



WE-STORM: Multicentric extension

*2015-01-01 to 2021-12-31



Σ 318 609 encounters

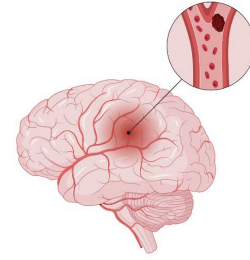
WE-STORM: Multicentric extension



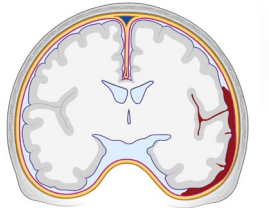
Σ 116 684
69.1 %

Σ 52 294
30.9 %

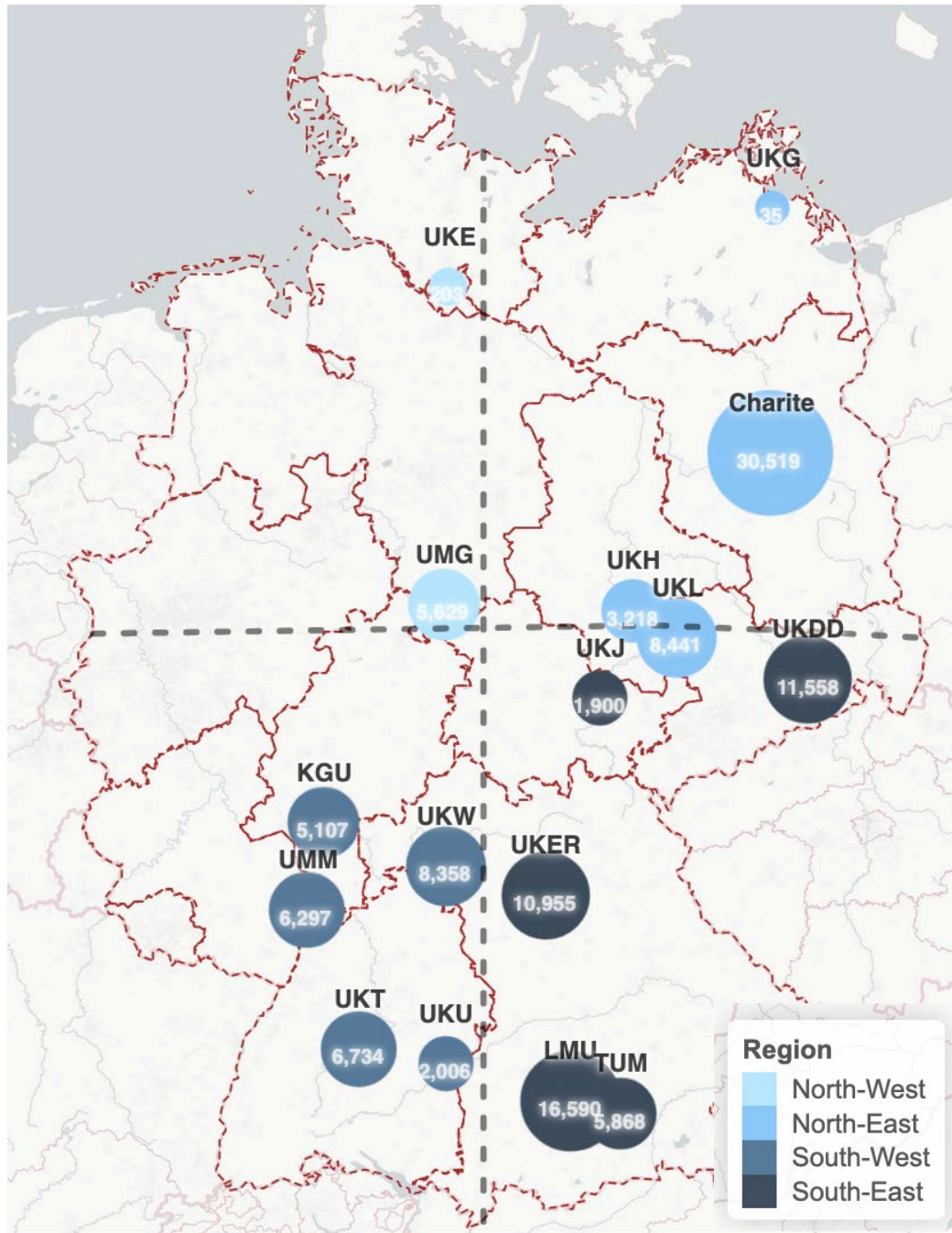
WE-STORM: Ischemic stroke



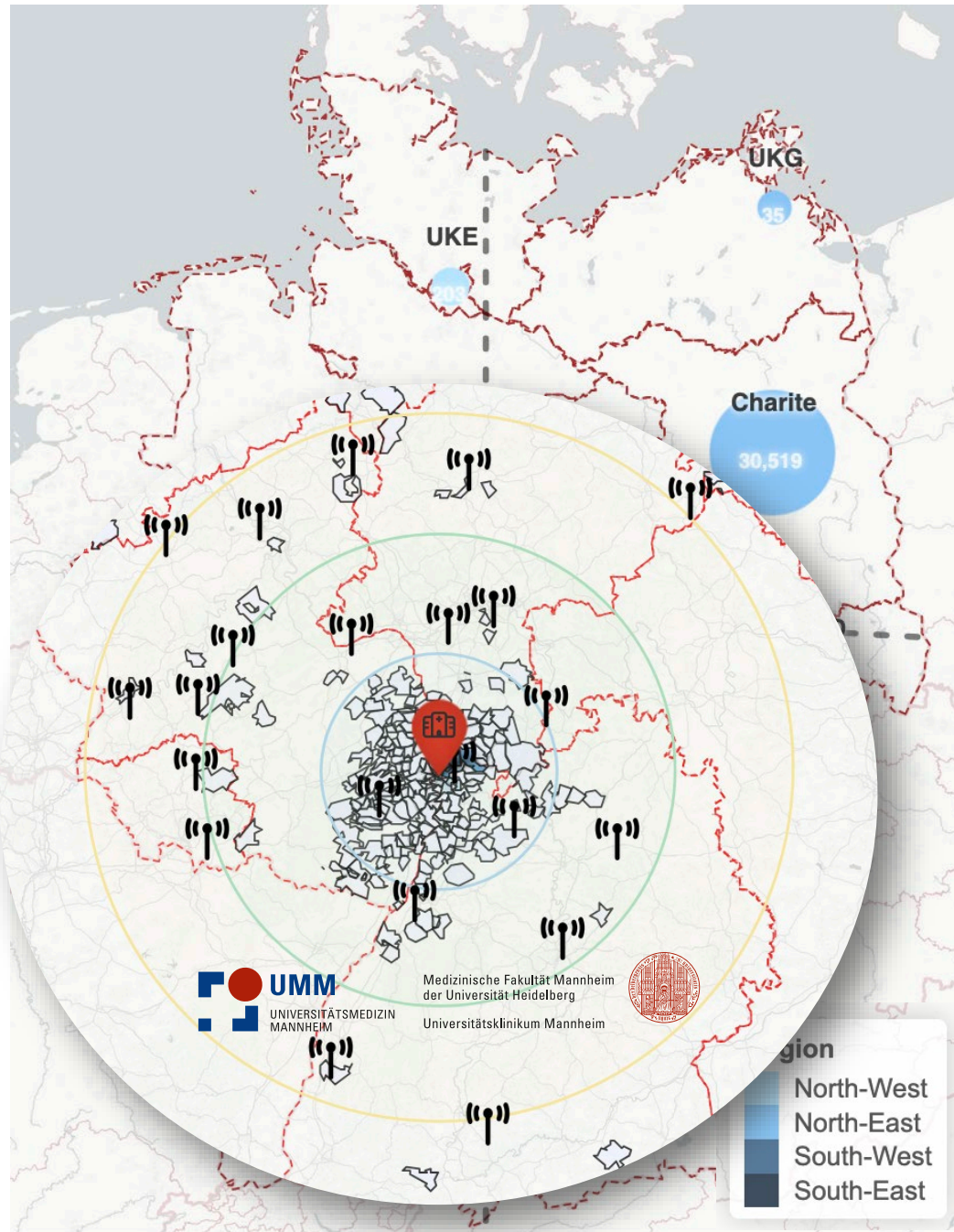
WE-STORM: Bleeding > ICH & SAH



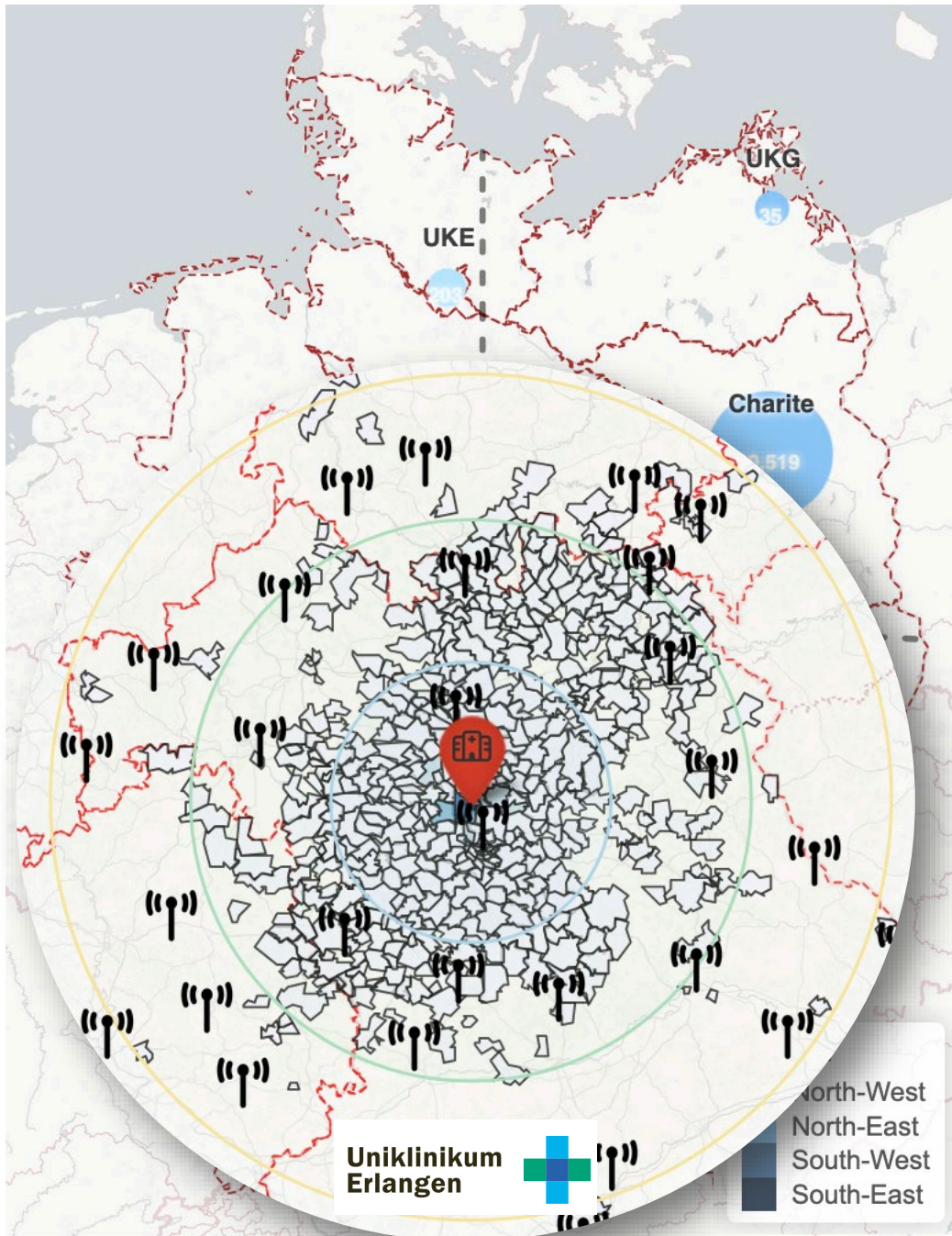
Multicentric *in-depth analytics*



Multicentric *in-depth analytics*



Multicentric *in-depth analytics*



Multicentric & local *in-depth analytics*

Multicentric & local *in-depth analytics*

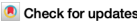
Global & local insights





<https://doi.org/10.1038/s41746-025-01619-w>

Machine learning-based forecasting of daily acute ischemic stroke admissions using weather data



Nandhini Santhanam¹, Hee E. Kim¹, David Rügamer^{2,3}, Andreas Bender^{2,3}, Stefan Muthers⁴, Chang Gyu Cho⁵, Angelika Alonso⁶, Kristina Szabo⁶, Franz-Simon Centner⁷, Holger Wenz⁵, Thomas Ganslandt^{8,1,5}, Michael Platten⁶, Christoph Groden⁷, Michael Neumaier⁹, Fabian Siegel¹⁰ & Máté E. Maros^{1,5}✉

The climate crisis underscores the need for weather-based predictive analytics in healthcare, as weather factors contribute to ~11% of the global stroke burden. Therefore, we developed machine learning models using locoregional weather data to forecast daily acute ischemic stroke (AIS) admissions. An AIS cohort of 7914 patients admitted between 2015 and 2021 at the tertiary University Medical Center Mannheim, Germany, with a 600,000-population catchment area, was geospatially matched to German Weather Service data. Poisson regression, boosted generalized additive models, support vector machines, random forest, and extreme gradient boosting (XGB) were evaluated within a time-stratified nested cross-validation framework. XGB performed best (mean absolute error: 1.21 cases/day). Maximum air pressure was the top predictor, with temperature exhibiting a bimodal link. Cold and heat stressor days ($T_{\min_lag3} < -2^{\circ}\text{C}$; $T_{\text{perceived}} < -1.4^{\circ}\text{C}$; $T_{\min_lag7} > 15^{\circ}\text{C}$) and stormy conditions (wind gusts $> 14\text{ m/s}$) increased stroke admissions. This generalizable framework could aid real-time hospital planning, effective care and forecasting of various weather-related disease burdens.

The intensifying climate crisis poses a severe threat to ecosystems and human well-being, particularly to ageing populations^{1–3}. Stroke is a major contributor to the global burden of cardiovascular disease, requiring prompt treatment for effectiveness⁴. However, current healthcare systems struggle to dynamically adapt to weather related fluctuations in demand⁵. This study leverages machine learning (ML) to develop predictive models using meteorological data to forecast acute ischemic stroke (AIS) admissions, aiming to enhance healthcare planning and accelerate responses to weather-related health incidents.

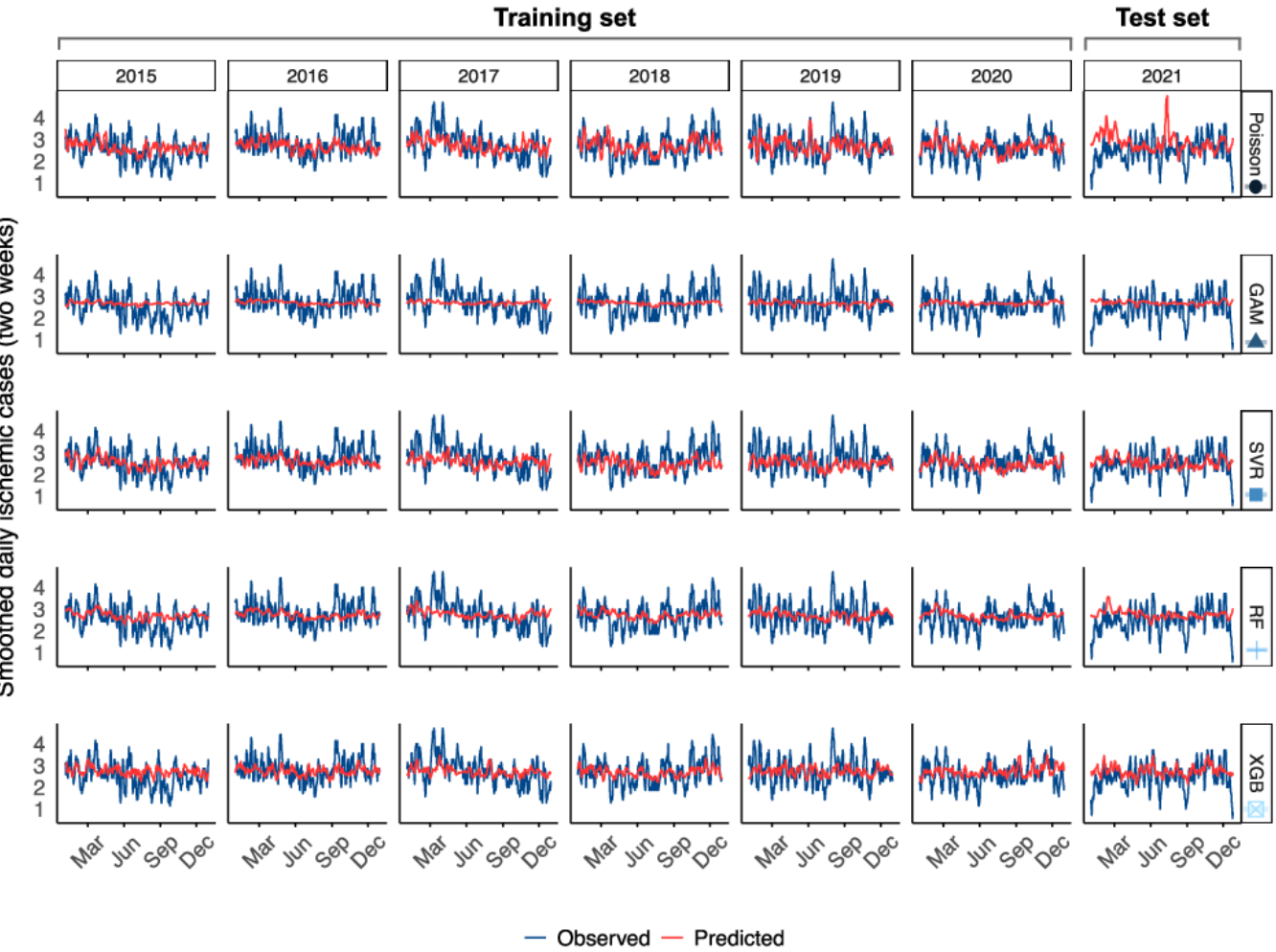
As acute ischemic stroke (AIS) accounts for the majority (60–70%) of all strokes and has a distinct etiology involving vessel thrombosis⁶, along with the availability of highly effective treatment options such as thrombolysis and mechanical thrombectomy⁷, our study explicitly focused on predicting this subcohort. In addition to individual risk factors, various

weather conditions have been linked to stroke occurrences, including extremes of ambient temperature^{8–9}, atmospheric pressure^{10–12}, wind speed^{13,14}, and ambient particulate matter with a diameter of $<2.5\mu\text{m}$ ($\text{PM}_{2.5}$) pollution^{15,16}. Some studies have found a positive association between higher temperatures due to heat stress^{8,9}, higher air pressure^{11,12}, and higher wind speed¹³ leading to an increase in stroke occurrences. In contrast, other studies have established a negative link between AIS admissions and cooler temperatures⁷, lower air pressure¹⁰, as well as lower wind speed¹⁴. While certain studies found no relevant association between weather conditions and the occurrence of stroke¹⁷. These inconsistencies may be attributed to the differing effects of temperature extremes, as temperature influences ischemic stroke risk through distinct mechanisms^{18,19}. Heat stress has an immediate effect, accelerating dehydration, endothelial damage, and rheological changes that promote thrombosis, while cold stress, with a

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a

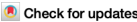
Time-stratified cross-validation setup





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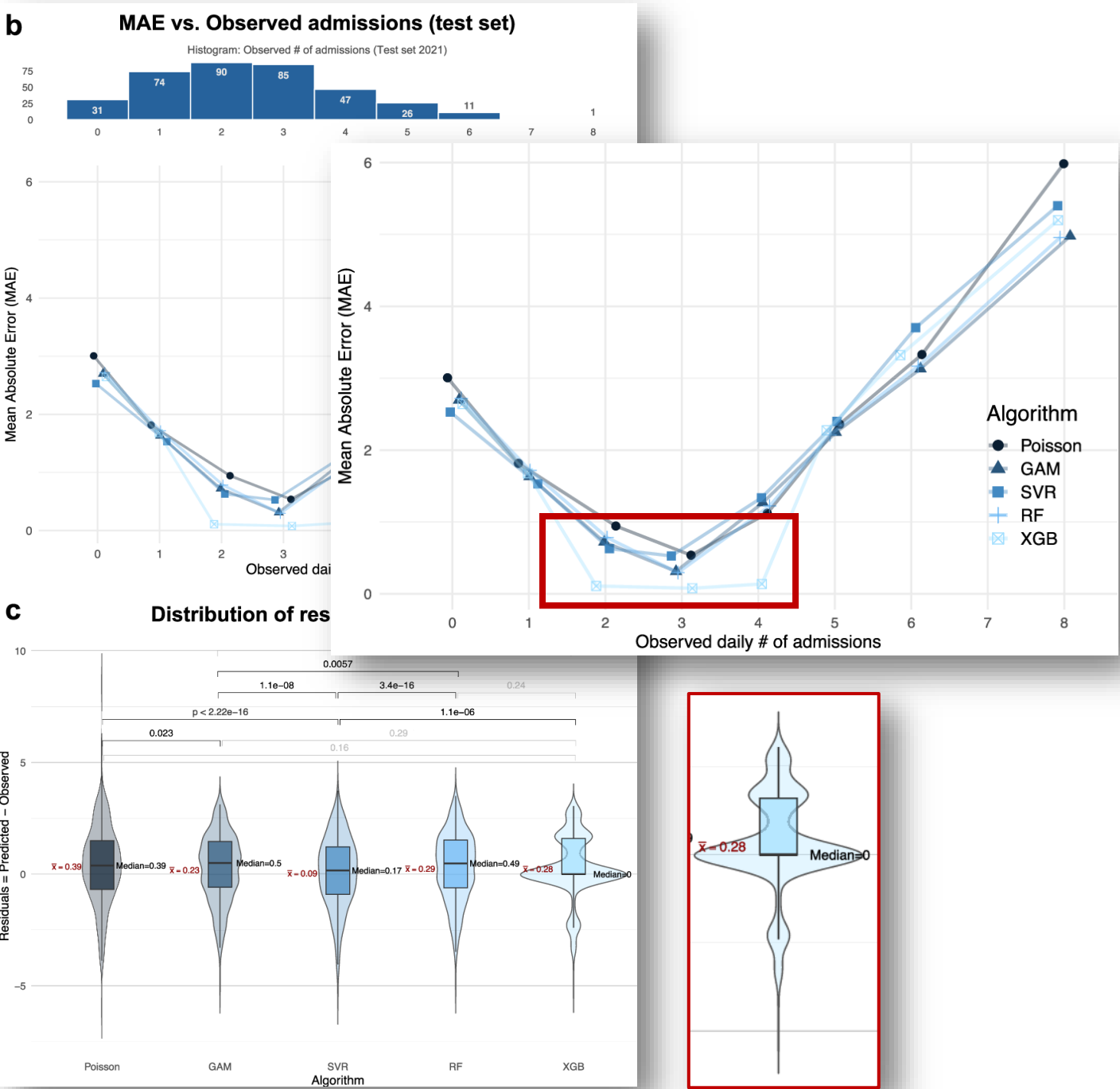
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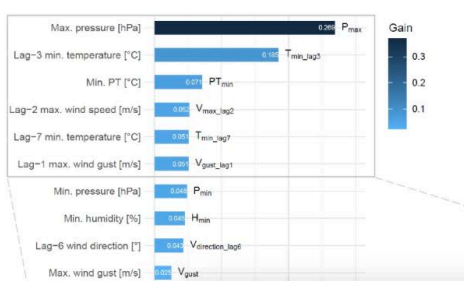
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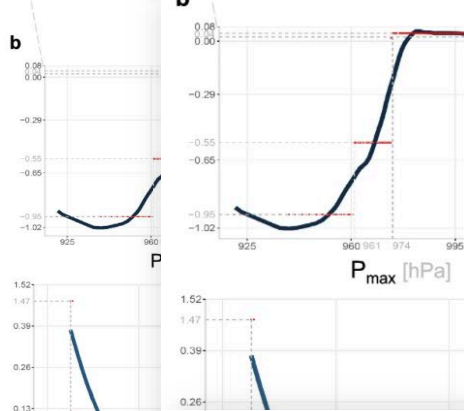
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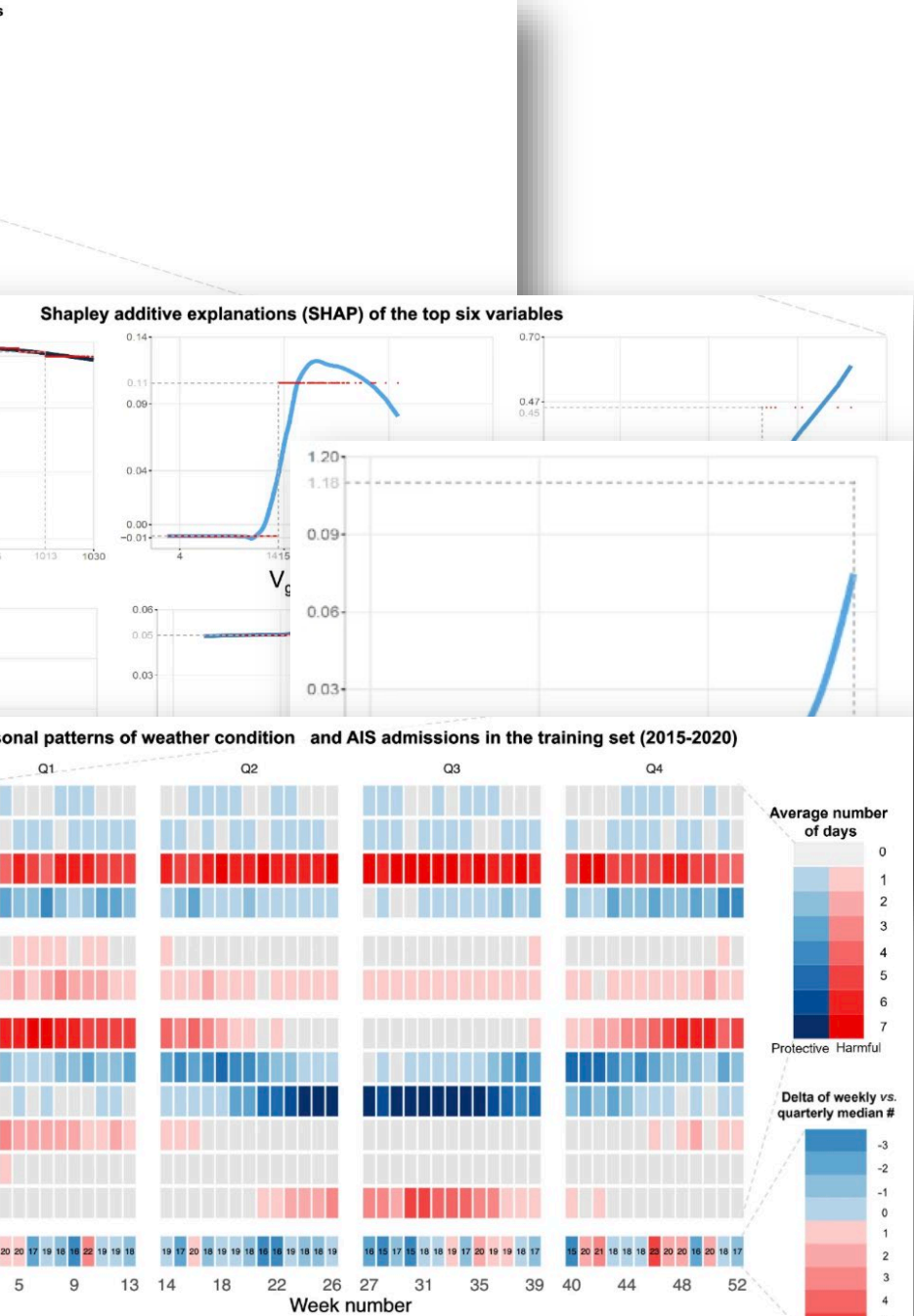
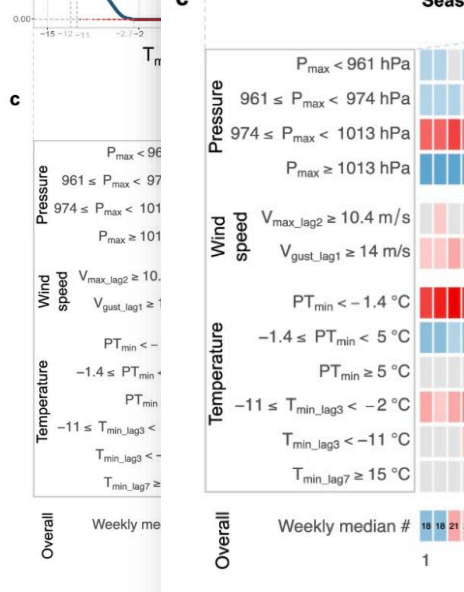
a XGB-based variable importance ranking of top ten features



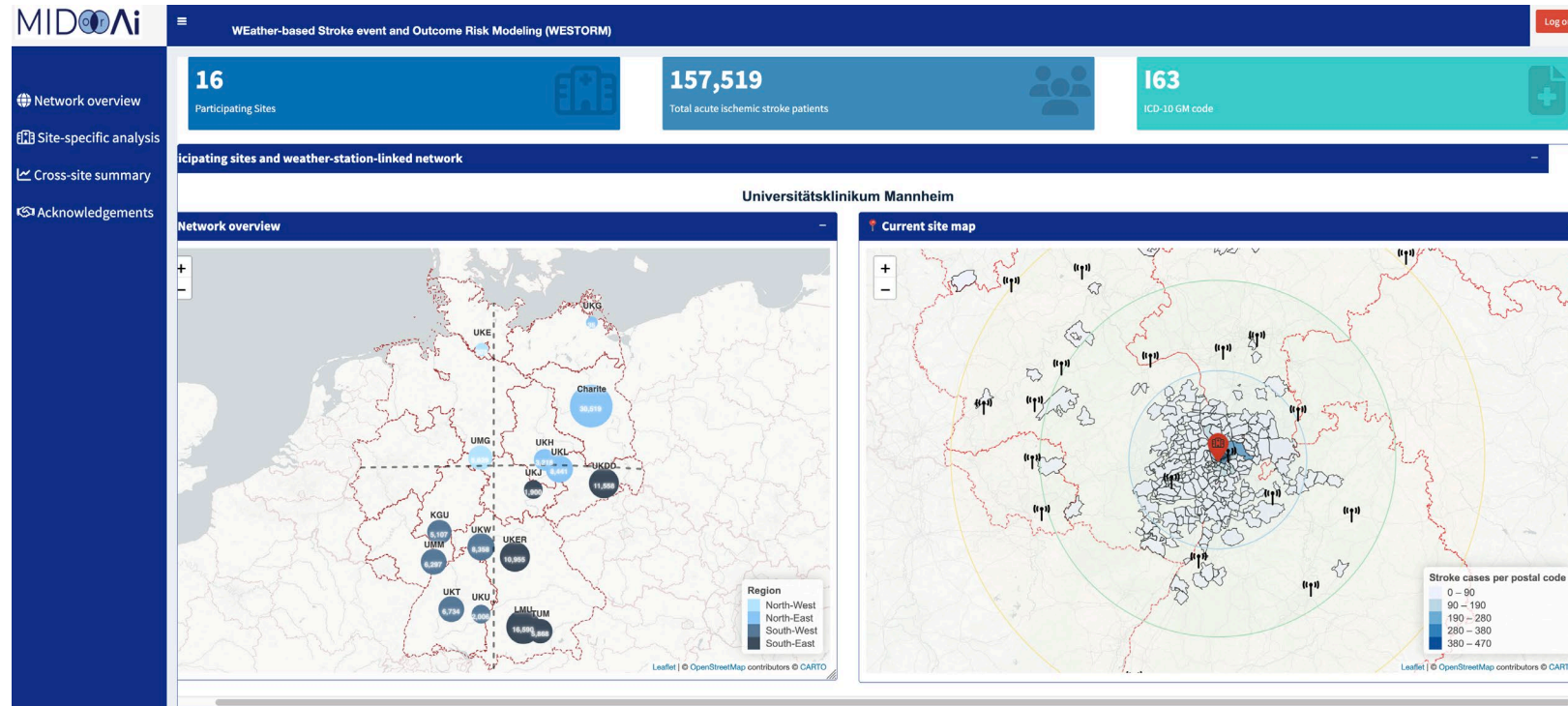
b Shapley additive explanations (SHAP) of the top six variables



c Seasonal patterns of weather condition and AIS admissions in the training set (2015–2020)



WE-STORM > *Dashboard* > *Command Center*



16

Participating Sites



157,519

Total acute ischemic stroke patients



163

ICD-10 GM code



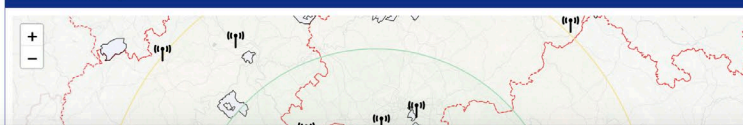
Participating sites and weather-station-linked network

Universitätsklinikum Mannheim

Network overview



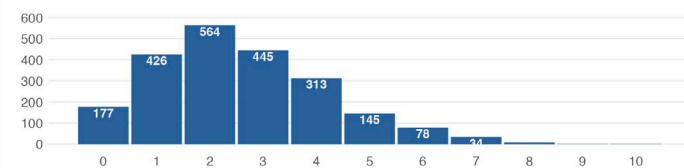
Current site map



Universitätsklinikum Mannheim

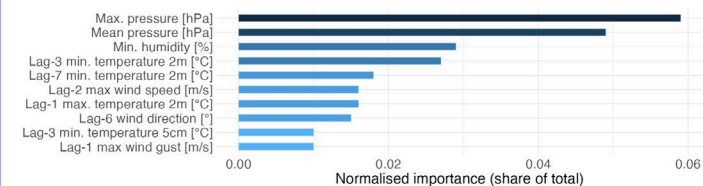
Ischemic admission overview

Admission overview Yearly trend Monthly trend Weekly trend



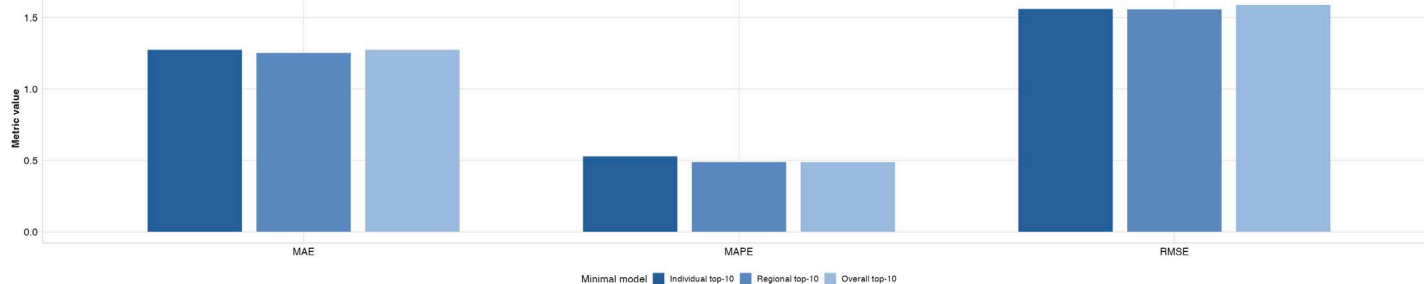
Best model performance

Feature importance Training data observed and predicted Metric performance



Forecasting the daily ischemic admissions

Prediction performance using the best performing model Minimal model prediction Minimal model metrics



16

Participating Sites



157,519

Total acute ischemic stroke patients



163

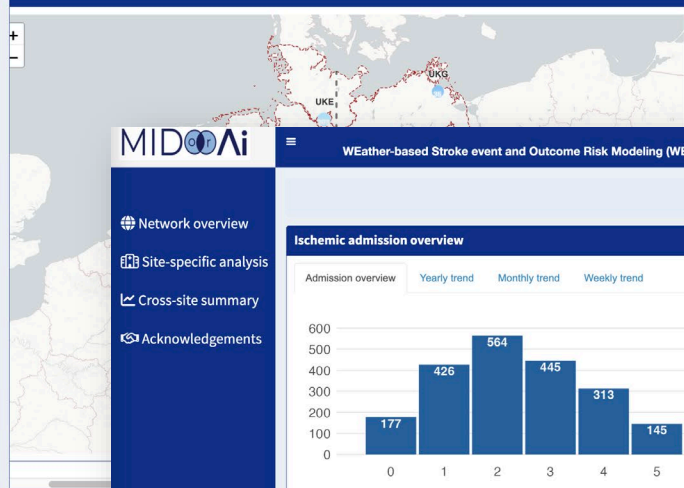
ICD-10 GM code



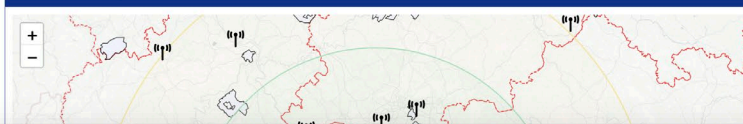
Participating sites and weather-station-linked network

Universitätsklinikum Mannheim

Network overview



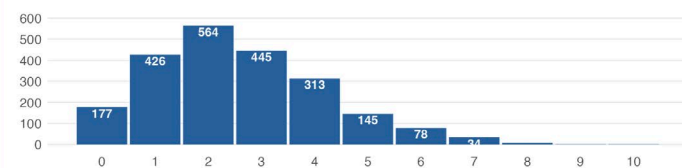
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Universitätsklinikum Mannheim

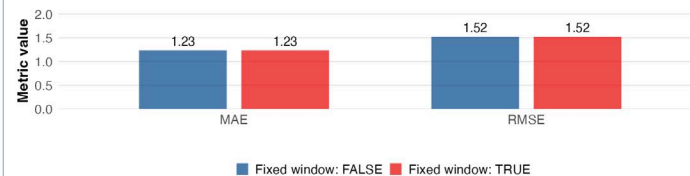
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Admission overview Yearly trend Monthly trend Weekly trend



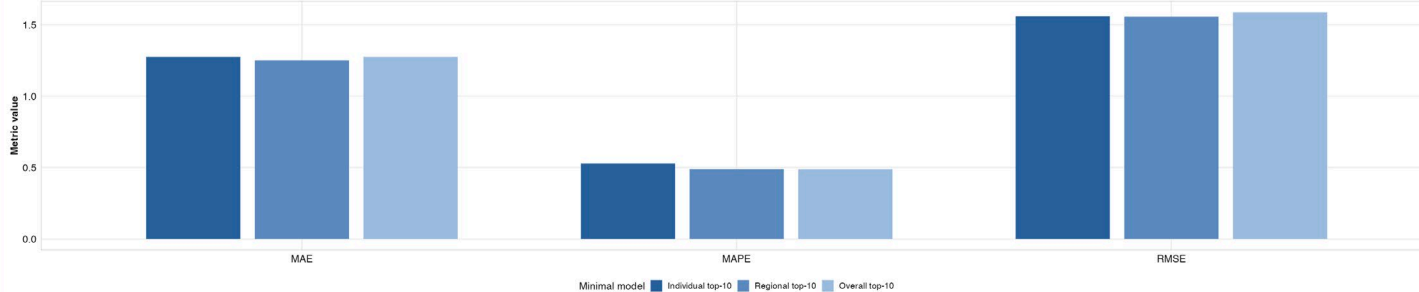
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Forecasting the daily ischemic admissions

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I63

ICD-10 GM code



Participating sites and weather-station-linked network

Universitätsklinikum Mannheim

Network overview



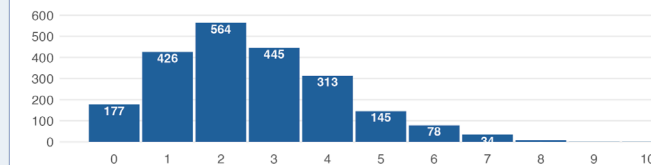
Current site map



Universitätsklinikum Mannheim

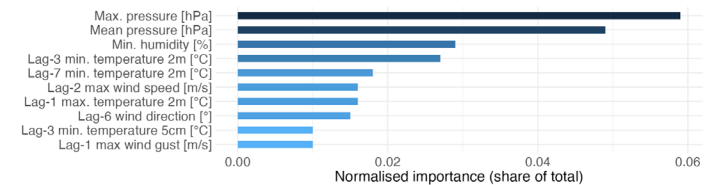
Ischemic admission overview

Admission overview Yearly trend Monthly trend Weekly trend



Best model performance

Feature importance Training data observed and predicted Metric performance



Forecasting the daily ischemic admissions

Prediction performance using the best performing model

Minimal model prediction

Minimal model metrics

Select calendar week (2021):

Week 26 (2021-06-28)



16

Participating Sites



157,519

Total acute ischemic stroke patients



163

ICD-10 GM code



Participating sites and weather-station-linked network

Universitätsklinikum Mannheim

Network overview



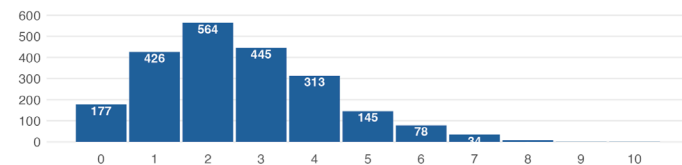
Current site map



Universitätsklinikum Mannheim

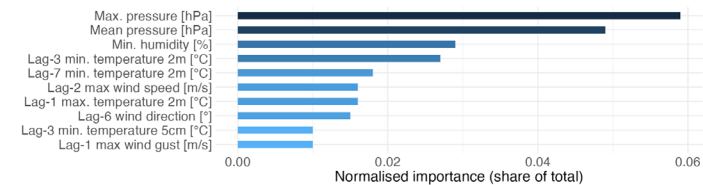
Ischemic admission overview

Admission overview Yearly trend Monthly trend Weekly trend



Best model performance

Feature importance Training data observed and predicted Metric performance

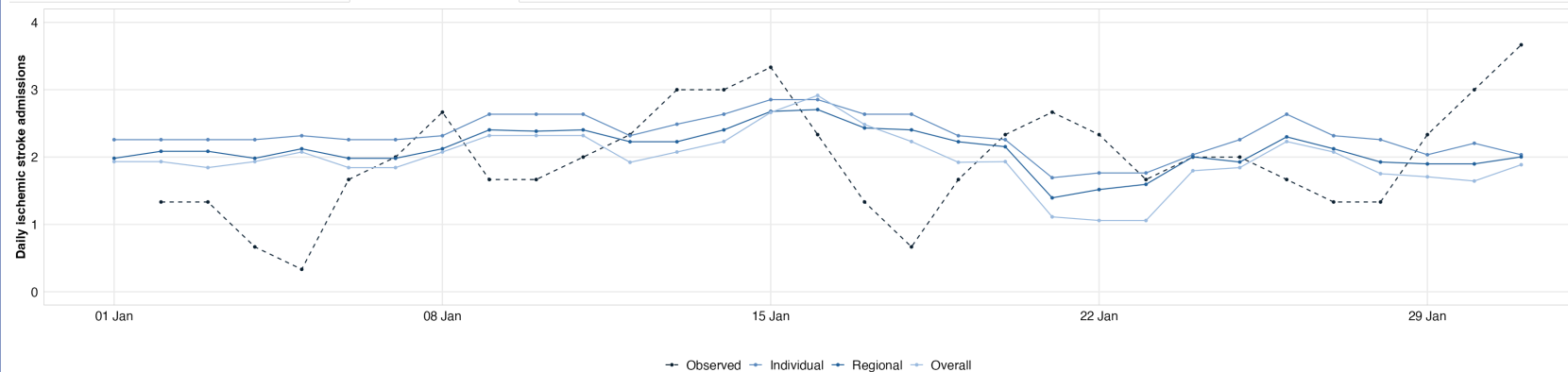


Forecasting the daily ischemic admissions

Prediction performance using the best performing model

Minimal model prediction

Minimal model metrics



16
Participating Sites



157,519

Total acute ischemic stroke patients



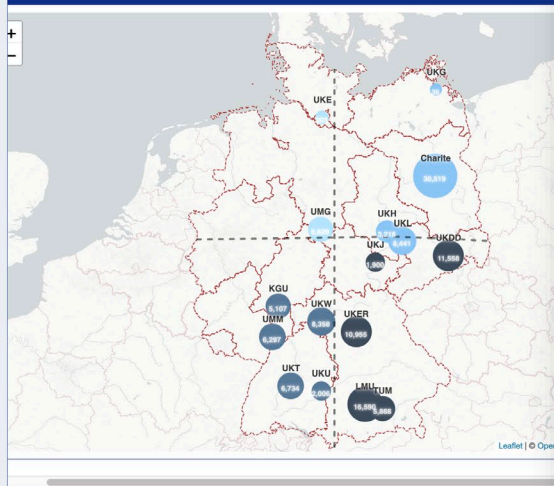
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ICD-10 GM code

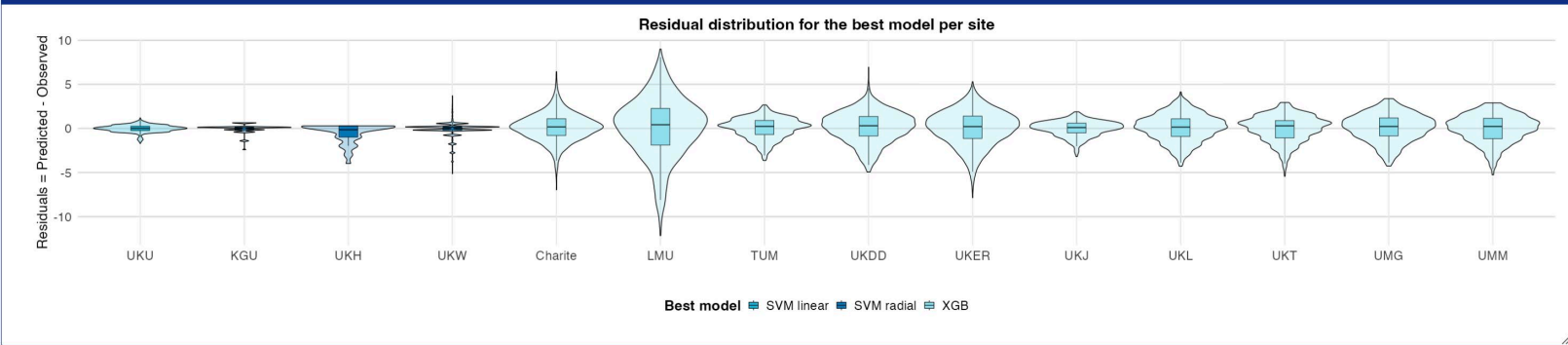


Participating sites and weather-station-linked network

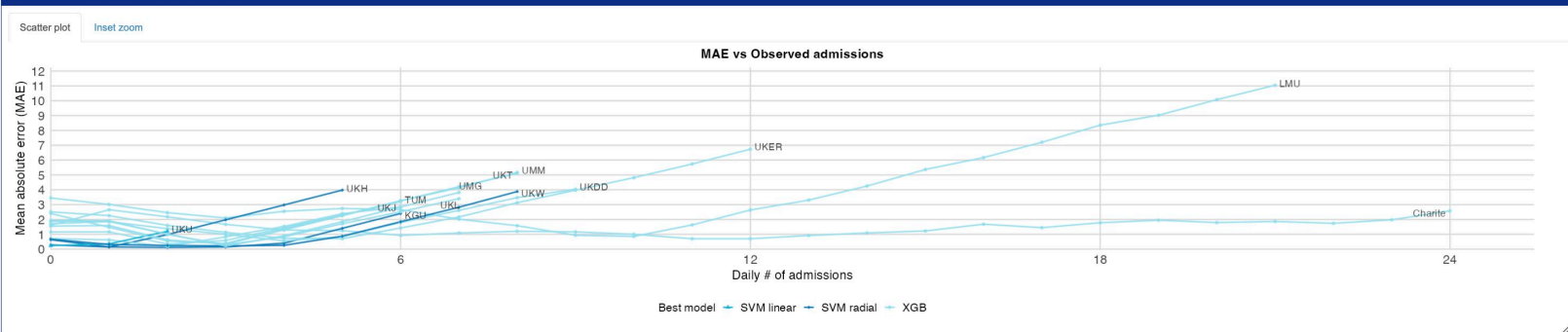
Network overview



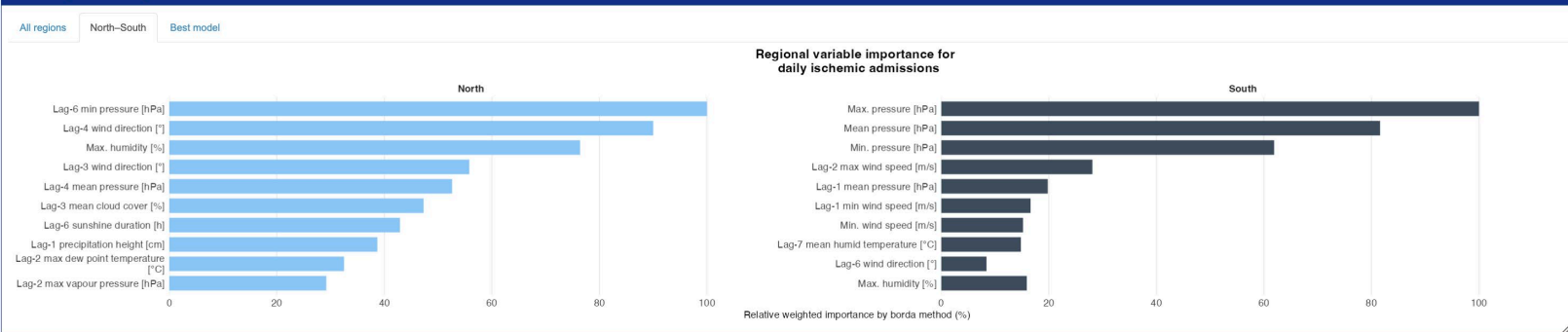
Residual distribution across sites



Mean absolute error vs observed admissions



Feature importance comparison



WEATHER-BASED STROKE OUTCOME RISK MODELLING

Weather moves. So does stroke risk.

WE-STORM traces atmospheric fronts as they sweep off the Atlantic and across Germany — then models how each passing system shifts stroke admissions across the country's university hospitals.

14 university hospitals
318,609 encounters
149,502 patients

Σ **168,978** stroke cases — **116,684** ischemic · **52,294** bleeding

Σ **1,260** site-specific ML models · ~90 per site

Weather flow

Stroke incidence

Combined risk

Case columns

- Weather front — brighter = stronger system
- Stroke cases per site — larger = more
- High-risk hospital catchment

Mannheim

Universitätsklinikum Mannheim

GERMANY

8.031

stroke cases

5.868

ischemic

2.163

bleeding

HOW IT WORKS

01 Ingest

Atmospheric & marine signals across the Atlantic and Europe — pressure, temperature swing, wind fronts.

02 Trace

Track each front as it propagates city-to-city, advancing east toward Germany over hours and days.

03 Correlate

Align front passage with admitted stroke cases per hospital catchment to surface the weather-risk signal.

04 Forecast

Project a 72-hour stroke-risk uplift for each catchment so teams can staff and prepare ahead.

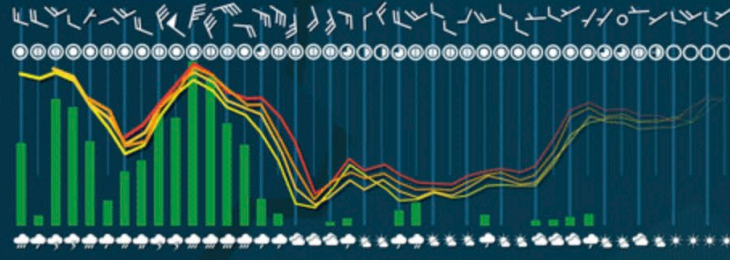


One more thing...

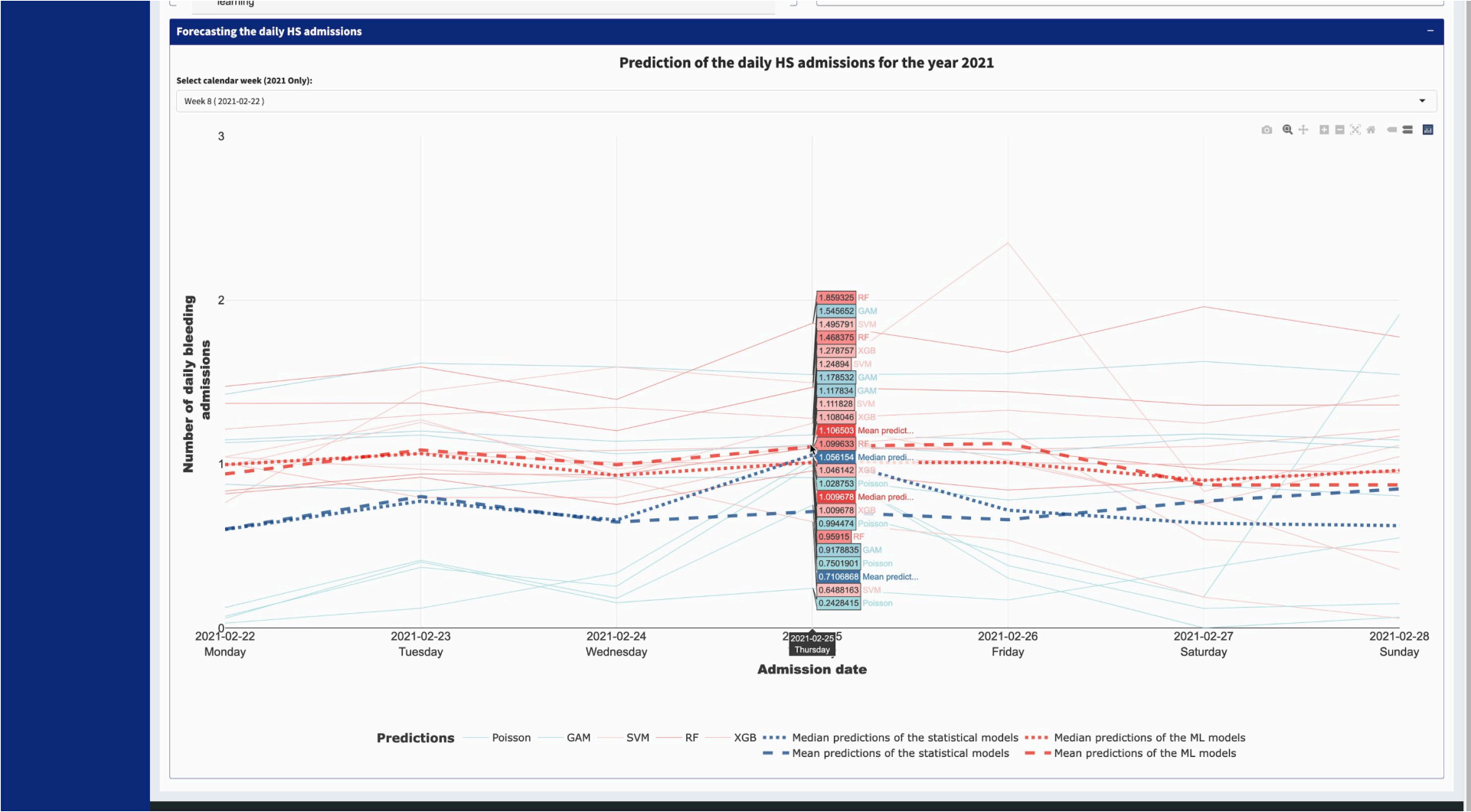




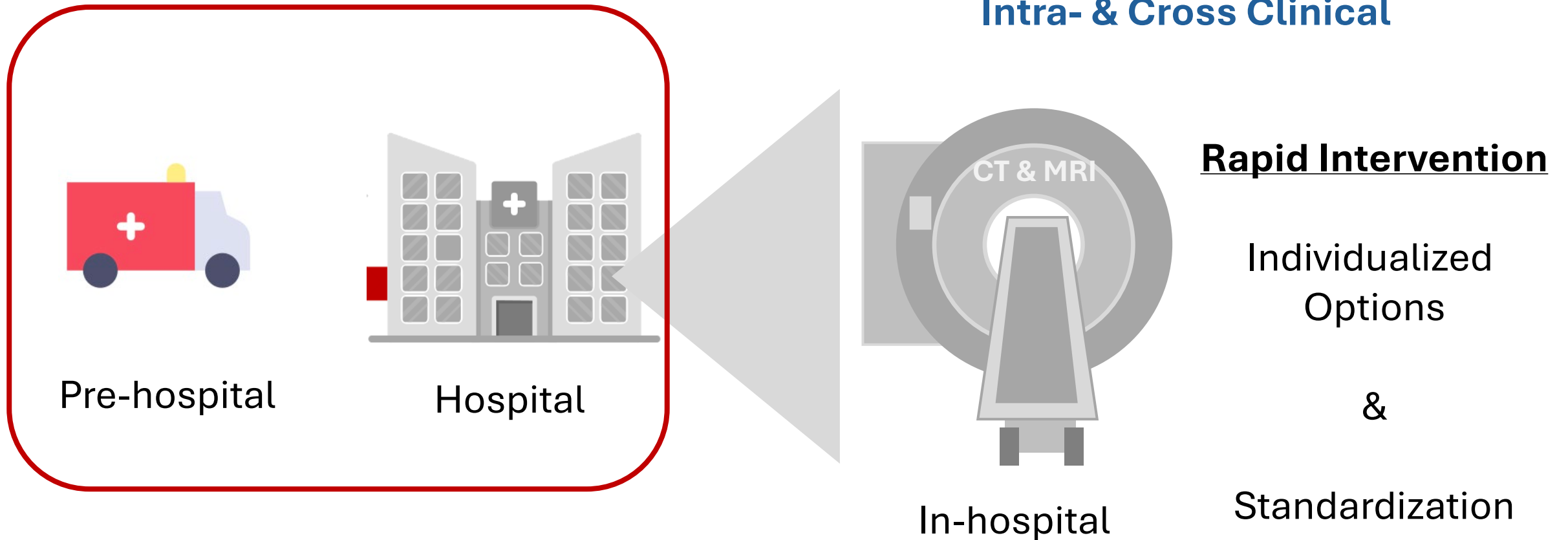
Frankfurt a.M.



Real-time prospective analytics for the future



Process Optimization



19.05.2026

Mobile Stroke Unit fährt CT direkt zu Patienten

Mit der Mobilen Schlaganfalleinheit bringt die Universitätsmedizin Mannheim Schlaganfall-Diagnostik im Forschungsprojekt direkt zum Einsatzort.



Mobile Schlaganfalleinheit der Universitätsmedizin Mannheim

Bei einem Schlaganfall zählt jede Minute!

Mit der Mobilen Schlaganfalleinheit (Mobile Stroke Unit, MSU) bringt die Universitätsmedizin Mannheim gemeinsam mit ihren Partnern hochspezialisierte Schlaganfall-Diagnostik direkt an den Einsatzort.

Das Spezialfahrzeug ist ein Rettungswagen mit integriertem Kopf-CT. Dadurch kann bereits vor Ort festgestellt werden, ob ein Schlaganfall durch ein verstopftes Blutgefäß oder durch eine Hirnblutung ausgelöst wurde. Die Bilder werden über ein 5G-Mobilfunknetz in die Klinik übertragen.

So kann die optimale Behandlung früher eingeleitet und der Transport in ein spezialisiertes Zentrum gezielt vorbereitet werden.



Emergency Department

Stroke Unit

Thrombectomy

WE-STORM

- **Generalizable framework (ICD 10)**
 - for weather/seasonality-dependent *(many) diseases*
- *Embedded models* for **real-time resource allocation**
 - & optimized therapy planning
- **Predictive Healthcare analytics** with *Ai & Machine Learning*
- **Prospective validation study** ➔ *economic benefit*

Healthcare 21st century > Predictive analytics



Acknowledgements & Funding

UMM Clinical partners

- Clinic for Neurology: Prof. Dr. Kristina Szabo, Dr. Matthias Wittayer
- Clinic for Neurosurgery: Prof. Dr. Nima Etminan
- Dept. of Neuroradiology: Prof. Dr. Christoph Groden, Prof. Dr. H. Wenz
- Clinic for Anesthesiology: Dr. Franz-Simon Centner
- Institute of Clinical Chemistry: Prof. Dr. Michael Neumaier
- Data Integration Center (DIZ): Dr. Fabian Siegel
- Data User Access Committee (DUAC)

Cooperation partners

DWD, Research Centre Human Biometeorology
Freiburg (ZMMF), Germany
Dr. Stephan Muthers



LMU Munich, Chair of Statistical Learning & Data Science
Statistical Consulting Unit

Dr. Andreas Bender,
Dr. David Rügamer,
& Prof. Dr. Bernd Bischl (Dept. Chair)



Funding

German Ministry for Education and Research (BMBF)
Medical Informatics Initiative (MII)



MII MIRACUM Consortium,



MII, Junior Research Group, MIDorAI (01ZZ2020)



FDPG, 6th MII Projectathon (WE-STORM)



WEather-based **ST**roke event
and Outcome Risk Modeling
(**WE-STORM**)



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Projektübersicht

WEather-based STroke event and Outcome Risk Modeling (WE-STORM)

Schlagwörter:
Schlaganfall, Hirnblutung, ischämischer Hirninfarkt, Wetter, Hitze

Fachrichtung:
Neurologie, Innere Medizin

Diagnosen:
Schlaganfall

Prozeduren:
-

<https://forschen-fuer-gesundheit.de/projekt2.php>

JRG Team >



Bundesministerium
für Forschung, Technologie
und Raumfahrt



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DIZ
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DAS KONSORTIUM NEWS FORSCHUNG LEHRE WEITERE INFORMATIONEN KONTAKT MIRACUM FORSCHUNGSPORTAL

MIDorAI

Medizinformatik für Ganzheitliche Disease Models in der personalisierten und präventiven Medizin

Über das Projekt

Die Versprechen von KI- und Big Data-basierter individualisierter Präzisionsmedizin mussten in letzter Zeit zunehmend kritisch infrage gestellt werden, obwohl KI-Systeme regulär die Leistungen von medizinischen Experten(pannels) erreichen oder sogar übertreffen.

MIDorAI

<https://www.umm.uni-heidelberg.de/cpd/digitale-gesundheit/biomedizinische-informatik/>

<https://www.miracum.org/forschung/nachwuchsforschergruppen/midorai/>

SOME YEARS AFTER GLOBAL WARMING



ROSE?



THIS IS THE HOTTEST SUMMER OF MY LIFE

**THIS IS THE COLDEST SUMMER
OF THE REST OF YOUR LIFE**

Thank you for your attention!



Source: <https://www.europeanbestdestinations.com/destinations/mannheim/>

