

# Global Climate Highlights 2024

## Copernicus Climate Change Service Annual Climate Summary

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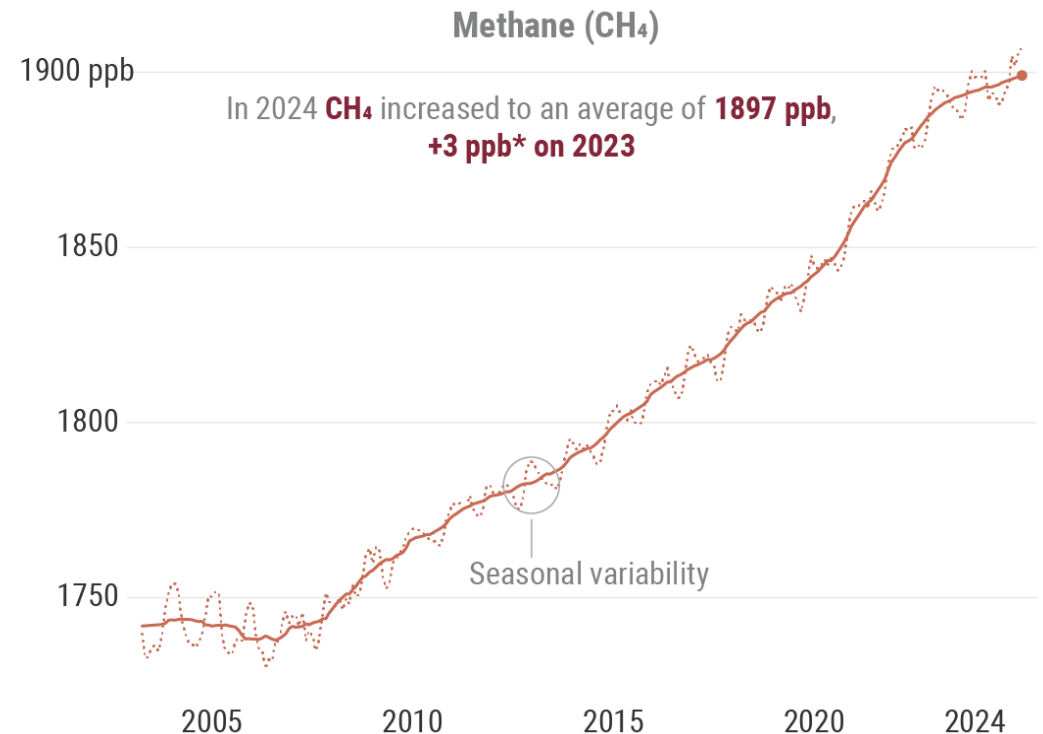
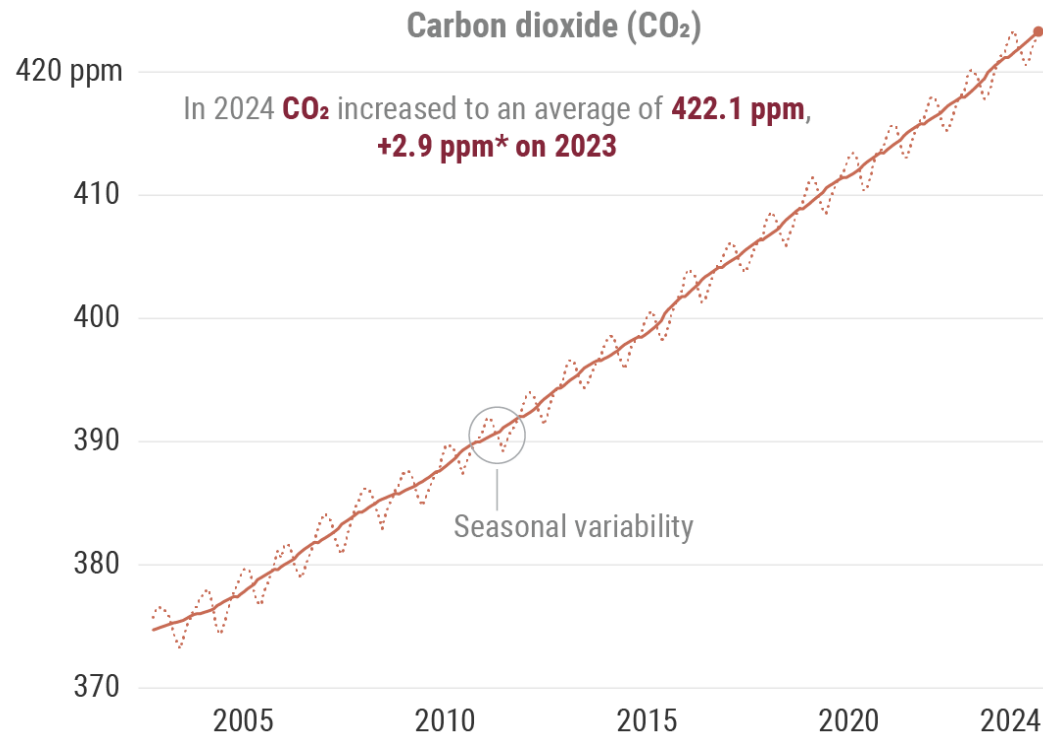


# Greenhouse gas concentrations are the highest in at least 800,000 years



## Global atmospheric concentration of greenhouse gases

..... Monthly global mean column-average concentration —●— 12-month average



\* The uncertainty of the annual increase is CO<sub>2</sub> ±0.3 ppm and CH<sub>4</sub> ±2 ppb

Data: C3S/Obs4MIPs (v4.5) consolidated (2003–2022), CAMS preliminary near real-time data (2023) GOSAT (CH<sub>4</sub>) and GOSAT-2 (CO<sub>2</sub>) records. Spatial range: 60°S–60°N over land.  
Credit: C3S/CAMS/ECMWF/University of Bremen/SRON

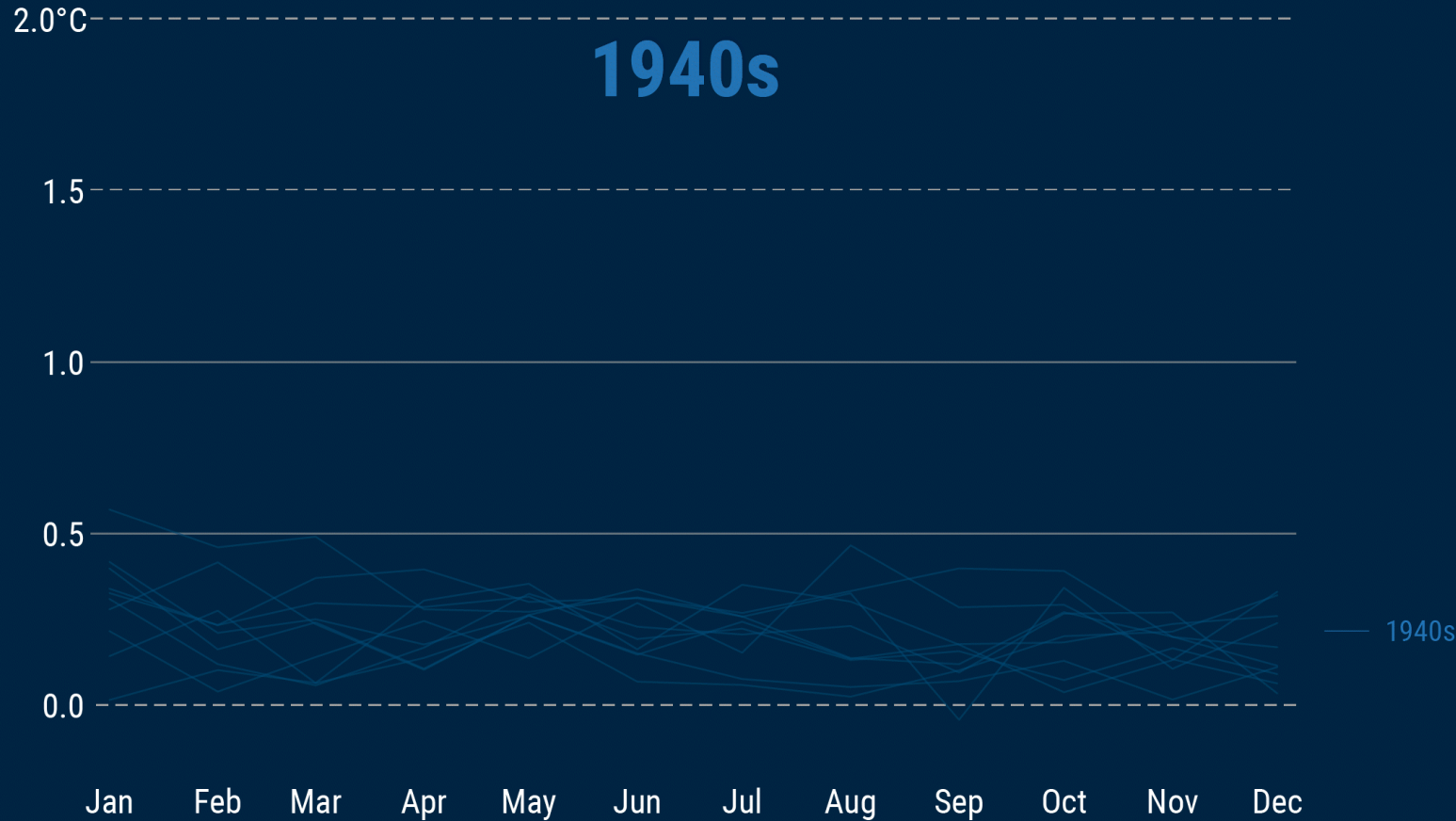
\* IPCC 6<sup>th</sup> Assessment Report, 2021

# 2024 was the hottest year on record



## Global surface air temperature increase above pre-industrial

Data: ERA5 • Reference period: pre-industrial (1850–1900) • Credit: C3S/ECMWF



## 2024

Global average temperature

- **1.60°C** above 1850-1900
- **0.72°C** above 1991-2020
- **0.12°C** higher than 2023



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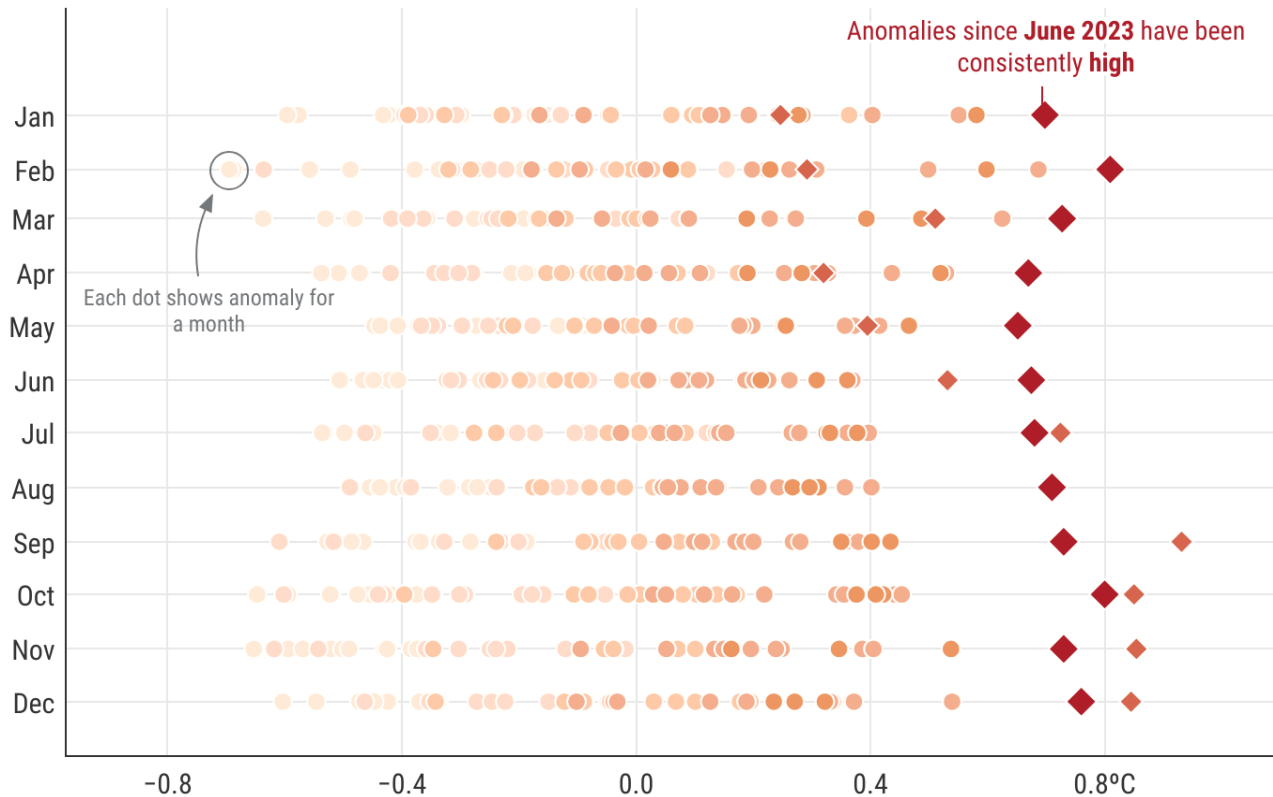
# 2024 global monthly extremes



## Monthly global air temperature anomalies

Source: ERA5 • Reference period: 1991–2020 • Credit: C3S/ECMWF

1980s 1990s 2000s 2010s 2020s 2023 2024



## 2024

Global average temperature

- **11 months** above **1.5°C**
- **Jan-June** broke records
- **July-Dec** were second warmest on record
- New daily record on **22 July 17.16°C**



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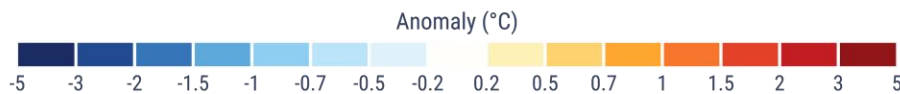
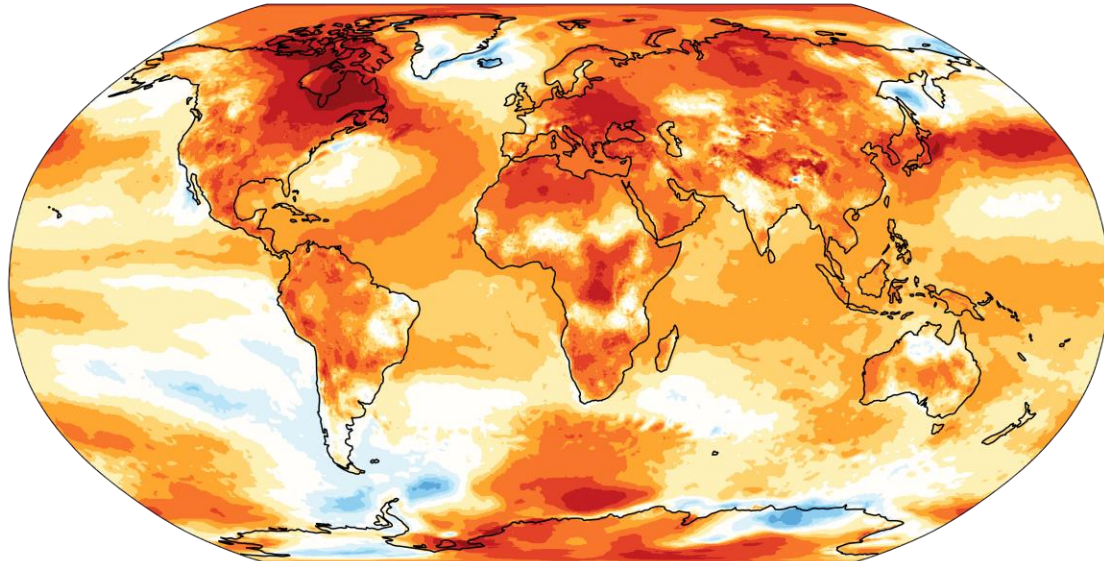


# 2024 global surface air temperature anomaly



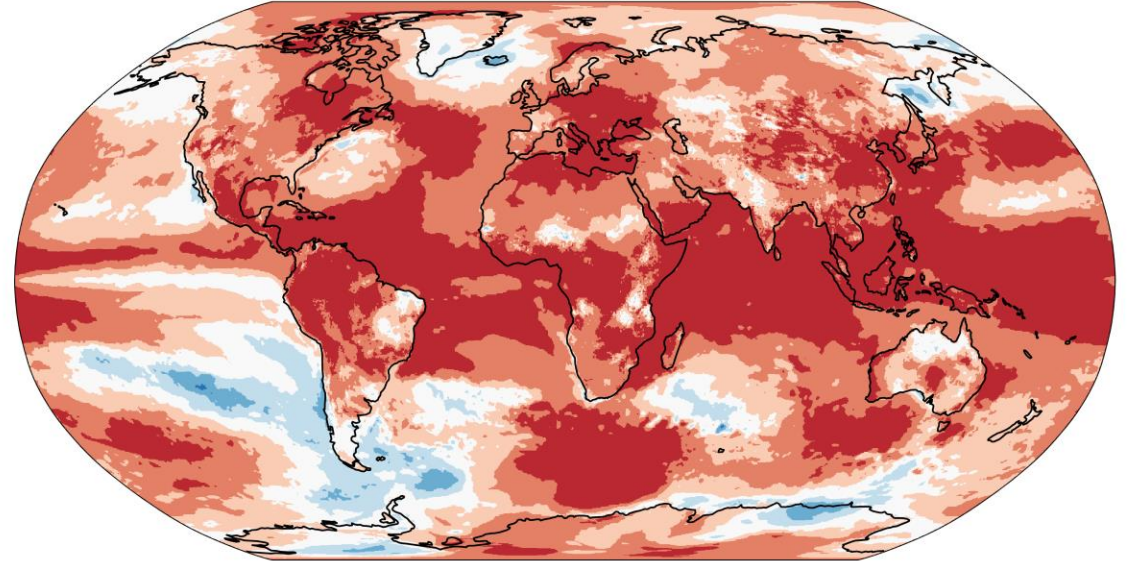
## Surface air temperature anomalies in 2024

Data: ERA5 • Reference period: 1991–2020 • Credit: C3S/ECMWF



## Anomalies and extremes in surface air temperature in 2024

Data: ERA5 1979–2024 • Reference period: 1991–2020 • Credit: C3S/ECMWF



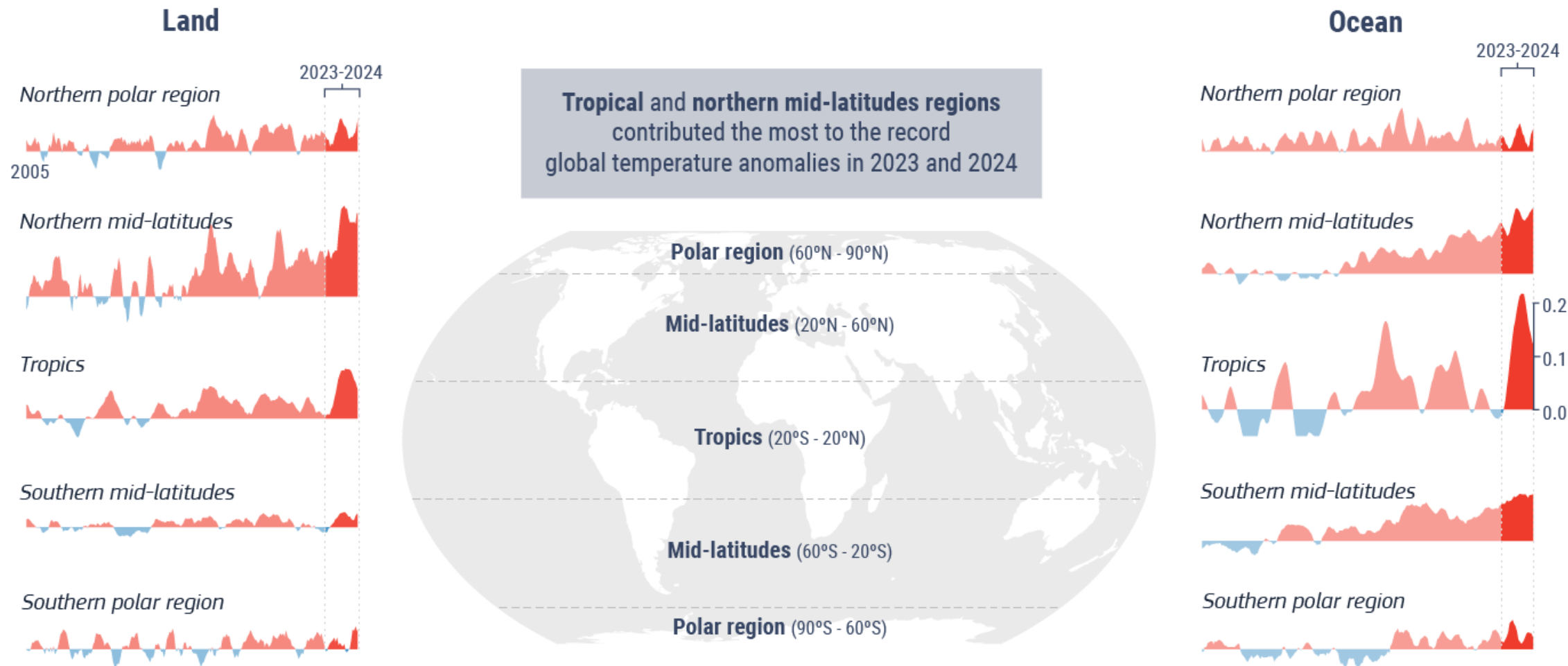
2024 was the warmest year for all continental regions, except Antarctica and Australasia

2024 saw three record-warm seasons: boreal winter (December 2023-February 2024), boreal spring (March-May) and boreal summer (June-August)

# Monthly surface air temperature anomalies by latitude bands (2005–2024)

Anomalies are weighted by each region's area to reflect its contribution to the global anomalies

Data: ERA5 • Reference period: 1991–2020 • Credit: C3S/ECMWF



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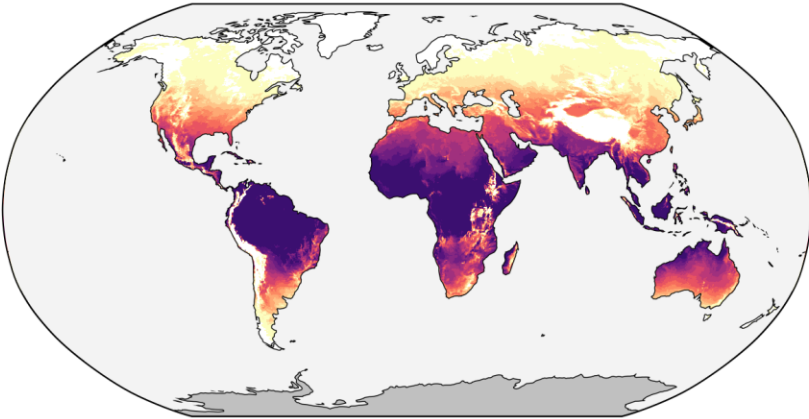
# Record heat stress in 2024



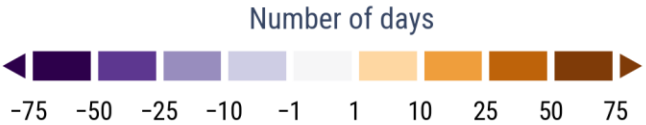
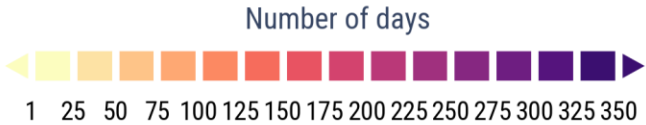
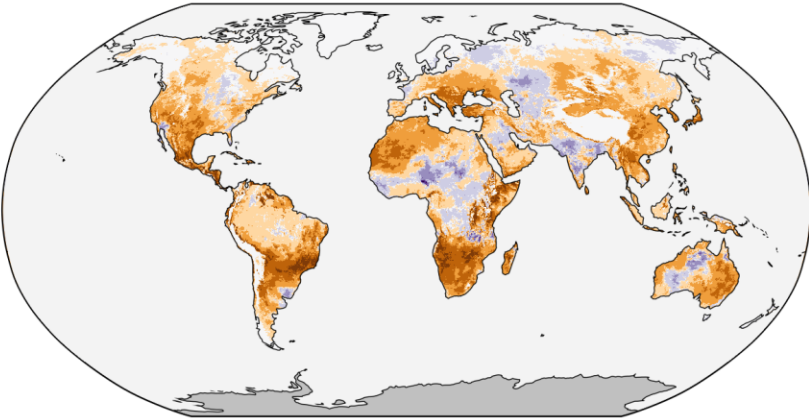
## Number of days with at least 'strong heat stress' in 2024

A day with at least 'strong heat stress' has a maximum feels-like temperature (UTCI) exceeding 32°C

Total number



Anomaly



Data: ERA5-HEAT Universal Thermal Climate Index (UTCI) • Reference period: 1991–2020 • Credit: C3S/ECMWF



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Extreme temperatures and high humidity contribute to increased levels of heat stress

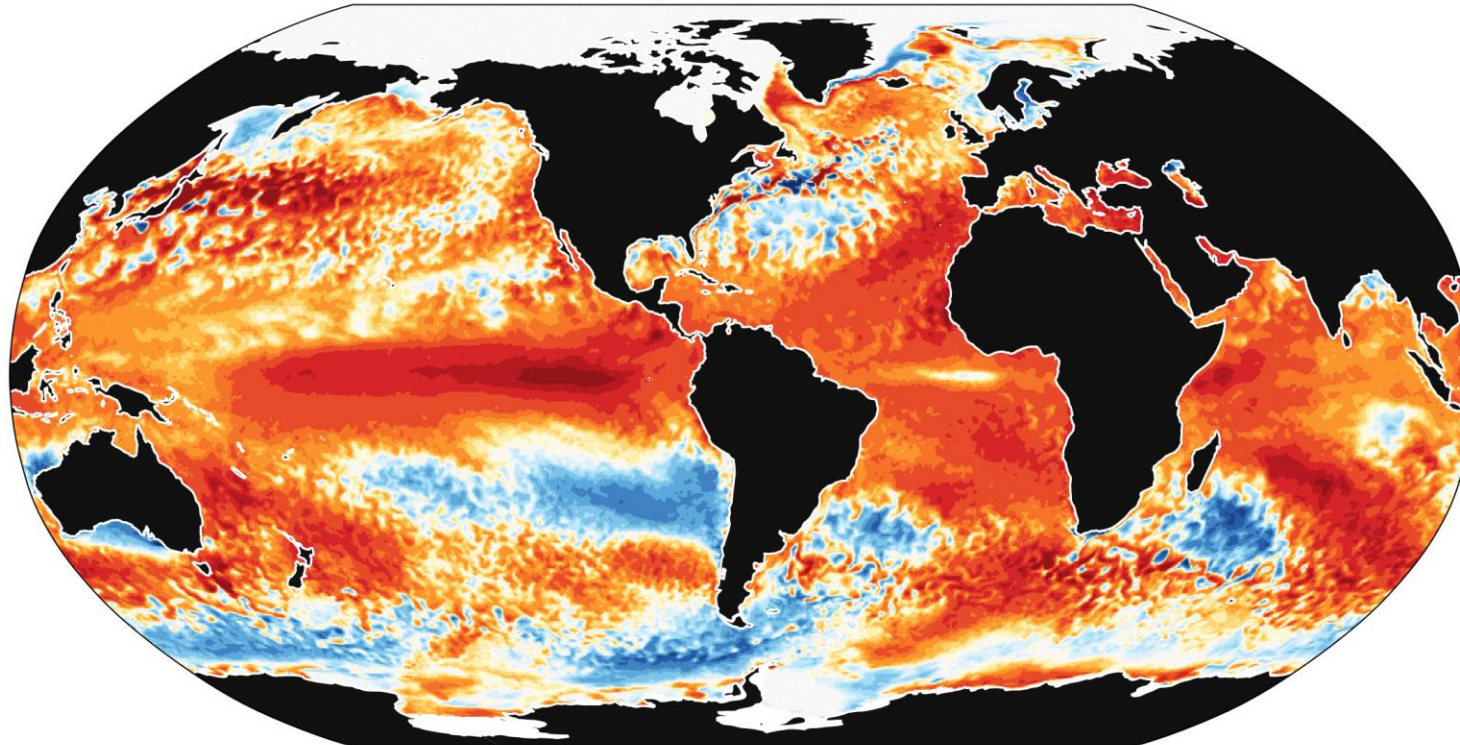


# Record sea surface temperatures

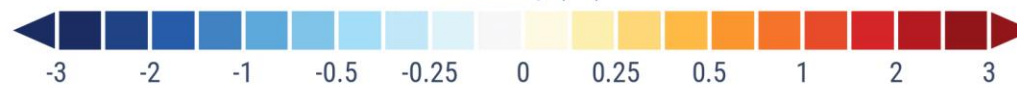


## Sea surface temperature anomalies in January 2024

Data: ERA5 • Reference period: 1991–2020 • Credit: C3S/ECMWF



Anomaly (°C)



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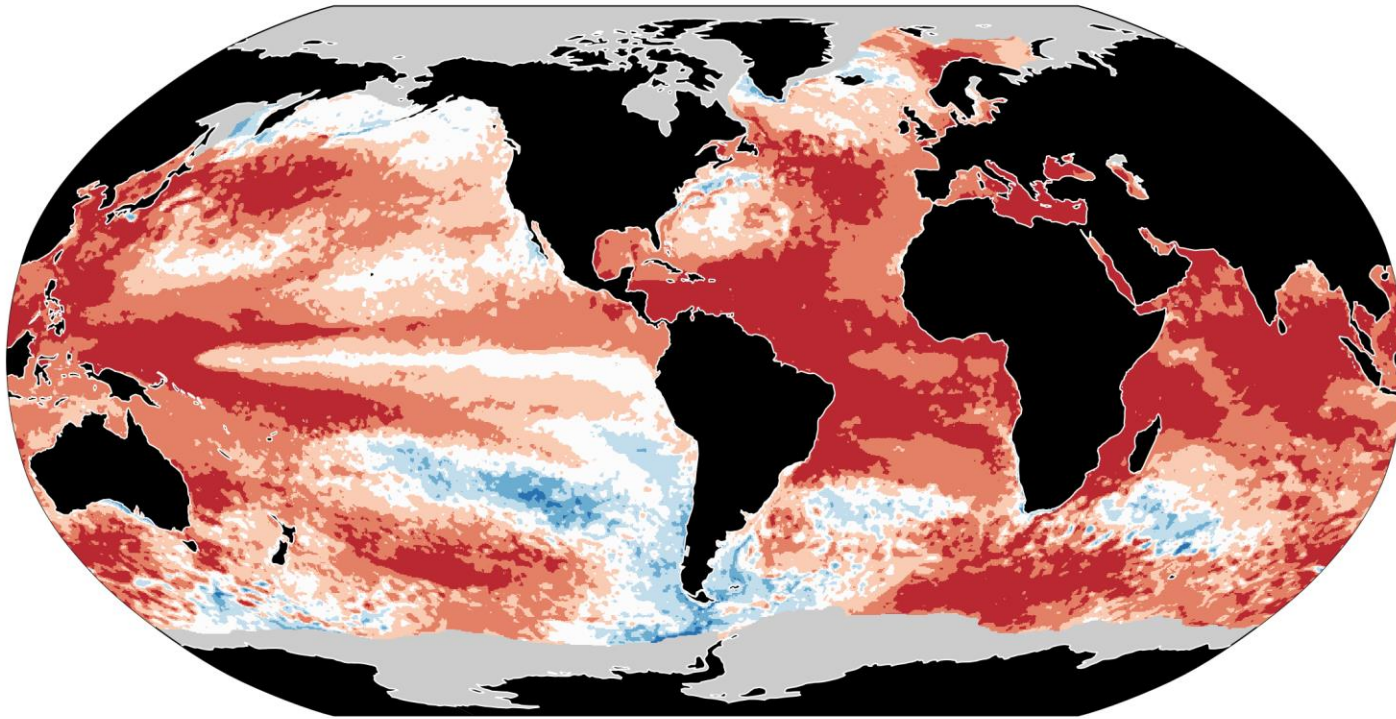


# Record sea surface temperatures



## Anomalies and extremes in sea surface temperature in 2024

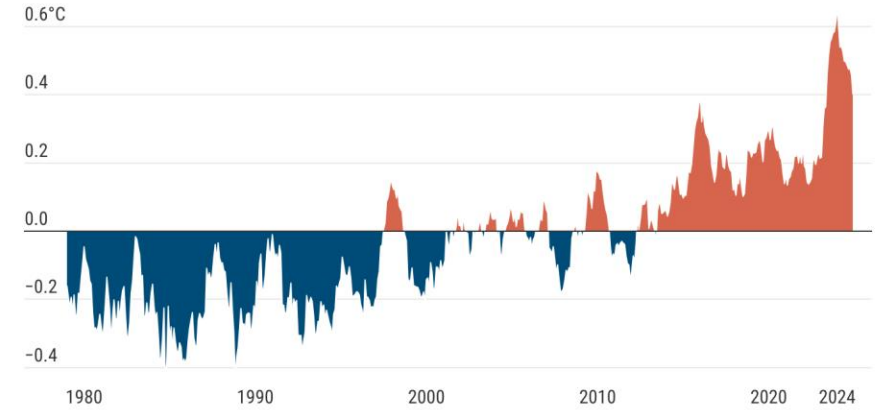
Data: ERA5 (1979–2024) • Reference period: 1991–2020 • Credit: C3S/ECMWF



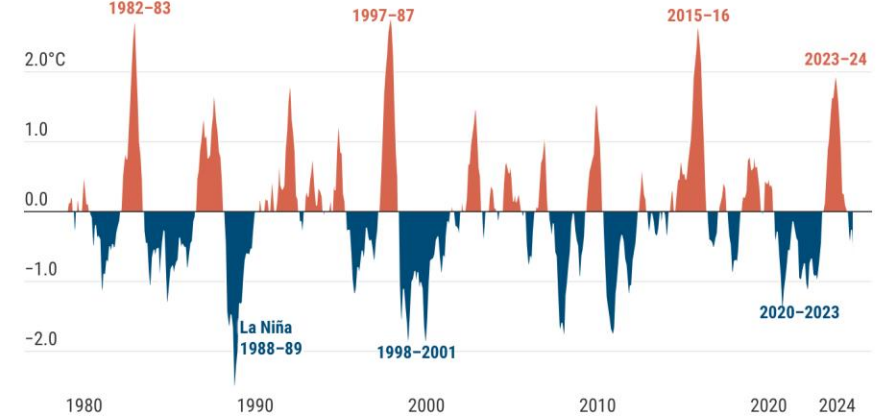
## Sea surface temperature anomalies

Data source: ERA5 • Reference period: 1991–2020 • Credit: C3S/ECMWF

### Global (60°S–60°N)



### Niño3.4 region



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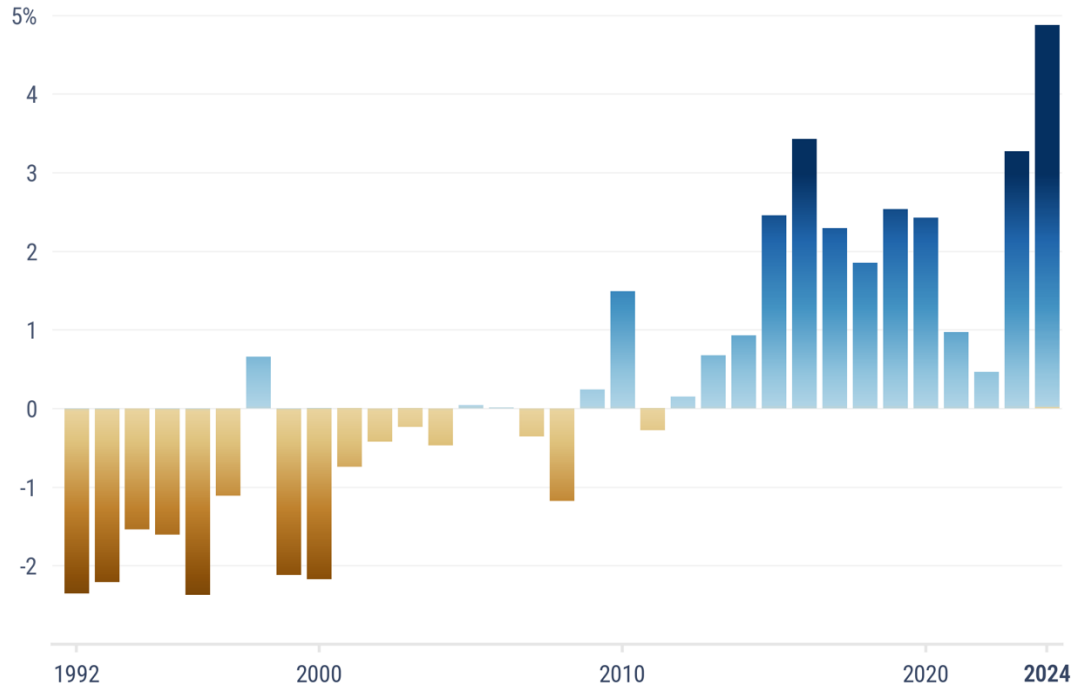
# Record water vapour in 2024



## Record amount of water vapour in the atmosphere in 2024

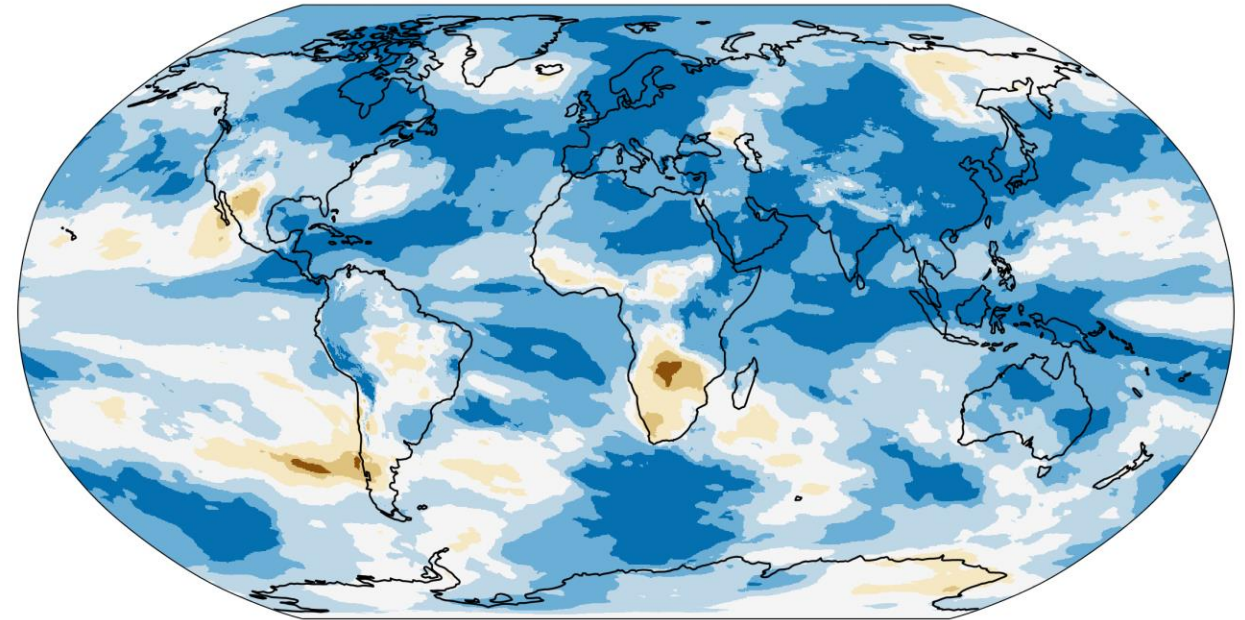
Annual global mean total column water vapour anomalies for 60°S–60°N

Data: ERA5 • Reference period: 1992–2020 • Credit: C3S/ECMWF



## Anomalies and extremes in total column water vapour in 2024

Data: ERA5 (1992–2024) • Reference period: 1992–2020 • Credit: C3S/ECMWF



The total amount of water vapour in the atmosphere reached a record value in 2024, at about 5% above the 1991–2020 average

# Thank you

<https://climate.copernicus.eu/global-climate-highlights-2024>



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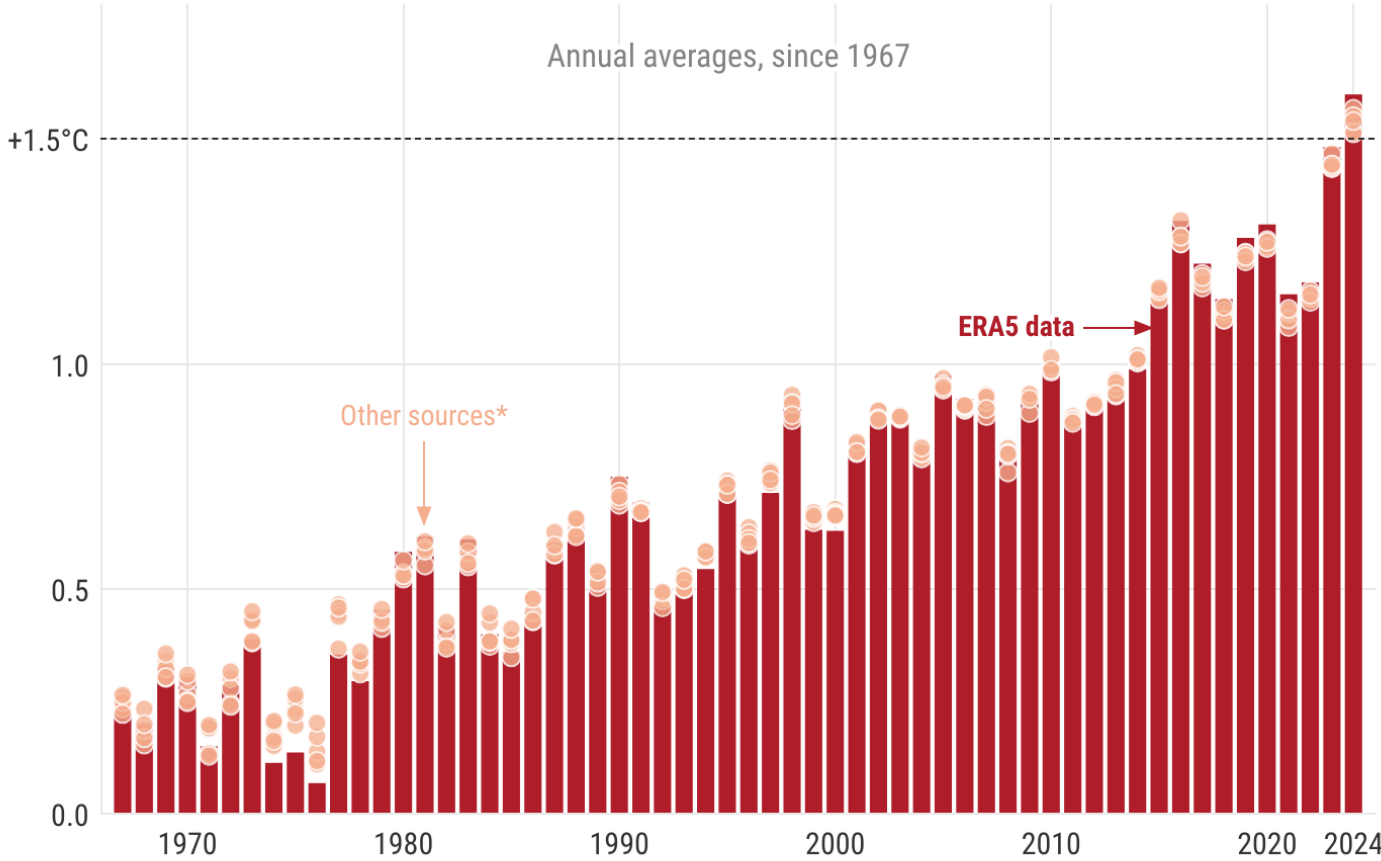


# Other datasets



## Global surface temperature: increase above pre-industrial

Reference period: pre-industrial (1850–1900) • Credit: C3S/ECMWF



\*Other sources comprise JRA-3Q, GISTEMPv4, NOAA GlobalTempv6, Berkeley Earth, HadCRUT5.



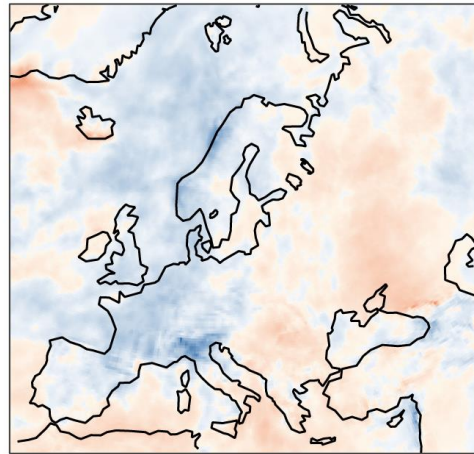
# Europe: hydrological variables and and temperature



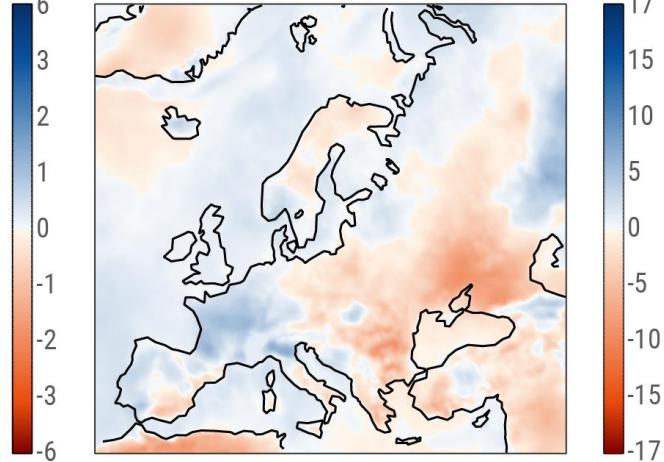
## Hydrological variables and temperature anomalies in 2024

Data: ERA5, soil moisture ERA5-Land • Reference period: 1991-2020 • Credit: C3S/ECMWF

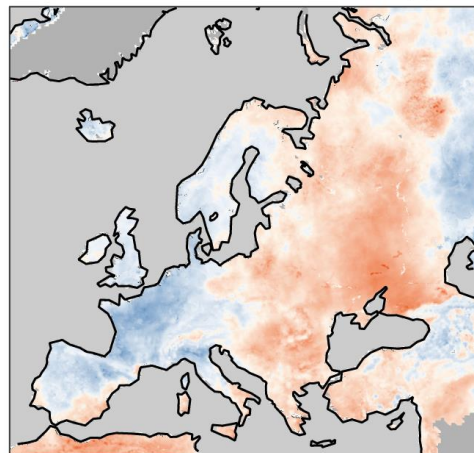
Precipitation (mm/day)



Surface air relative humidity (%)



0-7 cm volumetric soil moisture (%)



Surface air temperature (°C)

