

Climate:

**Recent Developments
& Outlook**





2025: THIRD WARMEST YEAR DESPITE LA NIÑA'S COOLING EFFECT

+1.47°C

above pre-industrial levels in 2025 (Copernicus)

3rd warmest year on record, after 2024 (+1.60°C) and 2023 (+1.48°C)

Despite La Niña

Three consecutively hot years

2023–2025 average exceeds 1.5°C for the first time. Since 1980, each decade has become the warmest ever. The last 11 years are the 11 warmest on record.

Several combined drivers

Structural warming (dominant): long-term GHG rise. Short-term boost: record sea-surface heat amplified by El Niño (2023–H1 2024). Modulating factors: aerosols, La Niña in 2025.

Monthly records in 2025

January 2025: warmest January ever. March, April, May: 2nd warmest for their months. Every month except Feb. and Dec. warmer than any year before 2023.



RECORD OCEAN HEAT, RECORD SEA ICE LOSS

Oceans in persistent overheating

+0.38°C SST above 1991–2020 avg.

9th consecutive year of record ocean heat storage

2024–2025: +23 ± 8 zettajoules absorbed in upper 2,000 m ≈ 200× world's 2024 electricity production

Consequences: marine heatwaves, coral bleaching, ecosystem disruption, stronger tropical cyclones

Mediterranean: critical hotspot

H1 2025: 18.50°C avg. SST (record). June anomalies >+5°C in western basins. Fed severe storms in Spain (Valencia).

Polar regions & sea ice

Feb. 2025: lowest global sea ice extent ever recorded

Arctic & Antarctic intensified anomalies

Antarctic: began 2025 near typical levels, then plummeted by February to one of the lowest minima ever. Remained well below average all year.

Arctic: unusually low sea ice throughout 2025. Annual temperature records reached in Antarctica and nearly reached in the Arctic.

Warming patterns in 2025

Tropics relatively less warm; high latitudes experienced intensified anomalies. Record anomalies in NW/SW Pacific, NE Atlantic, Eastern/NW Europe, Central Asia.

Melting North: permafrost in danger

Rapid warming and thawing of far-northern permafrost. Release of metals such as iron, aluminum, and zinc into rivers, and release of greenhouse-gas emissions, from formerly trapped organic matters. A process amplifying global warming.

\$107 BILLION IN INSURED LOSSES — SIXTH YEAR ABOVE \$100B

\$107B

insured natural catastrophes losses in 2025 (Swiss Re)

6th consecutive year above \$100B. Lower than anticipated: no US hurricane landfall for the first time in 10 years.

Heatwaves

Recurrent 40°C+ in S. Europe, extreme heat across S. Asia and US. 770M people experienced their warmest local year.

Droughts

Mediterranean basin, East Africa, South America. Soil shrink-swell cycles damaging buildings.

Floods & rainfall

Sudden floods, landslides in SE Asia, Central Europe, N. America. Glacier-outburst floods in Nepal, Afghanistan, Pakistan.

Wildfires & cyclones

Major destructive wildfire in Los Angeles. Cat. 5 Hurricanes Melissa, Erin, Humberto.

1.5°C THRESHOLD WITHIN REACH BY END OF THE DECADE

1.5°C

Long-term global mean temperatures projected to reach +1.5°C by end of this decade

Copernicus estimates the long-term warming trend will reach 1.5°C in 2029

2026 forecast

Expected among the hottest years ever: +1.35°C to +1.53°C above 1850–1900 (Canadian Centre). Met Office: 4th consecutive year above +1.4°C. Slightly cooler than 2024 but close to 2023/2025 levels.

WMO 2025–2029

86% chance at least one year exceeds +1.5°C. 70% chance the five-year mean will also exceed +1.5°C.

Paris Agreement context

One or two years above 1.5°C ≠ breach of Paris Agreement (refers to long-term trend). However, the latest three-year average is above 1.5°C for the first time, highlighting proximity to this threshold.

Climate modelling at risk

Need to invest in climate modelling for accurate predictions. Capacity threatened by proposed US budget cuts: >25% reduction to NOAA's budget, job redundancies, and elimination of major climate research offices. Though Congress has pushed back, partial implementation is already underway.



INVESTING IN MODELS TO AVOID INVESTING IN DISASTER

| Current State of the Art | Key Limitations | Innovative Solutions |
|---|---|---|
| CMIP6 Models: coordinated climate model experiments providing the scientific database for IPCC reports. | Cloud-aerosol interactions: largest source of uncertainty, impacting climate sensitivity estimates. | New-gen satellites: EarthCARE (data since early 2025) — unprecedented cloud & aerosol data. AI for pattern recognition and emulators. |
| Standard resolution: 50–100 km for most global models. | Unresolved sub-grid processes: turbulence, individual cloud formation. | km-scale “storm-resolving” models (nextGEMS, TRACCS): explicitly simulate convection. |
| Coupled Earth System Models: atmosphere, ocean, sea-ice, land surface, carbon cycle. | High inter-model variability: significant differences in climate sensitivity projections. | Probabilistic ensembles (SMILEs): separate natural variability from forced climate change. |
| SSP scenarios (SSP1-2.6 to SSP5-8.5): projections based on Shared Socioeconomic Pathways to 2100. | High socio-economic uncertainty: demographics, behaviour, policy, technology pace. | Transdisciplinary co-production: interoperability between data, communication, governance. |