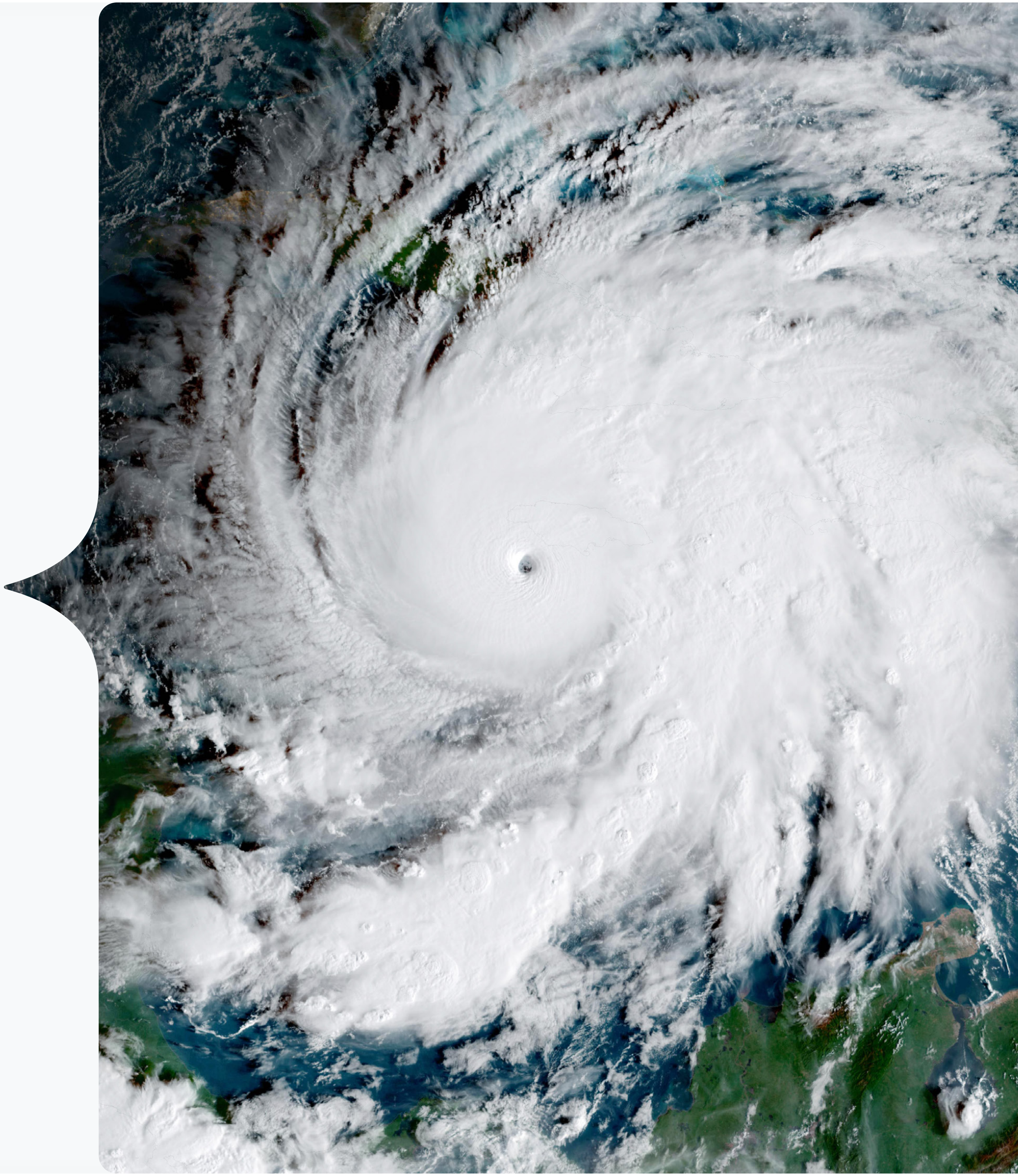
DATASETS AND METHODS

Regional Supplement



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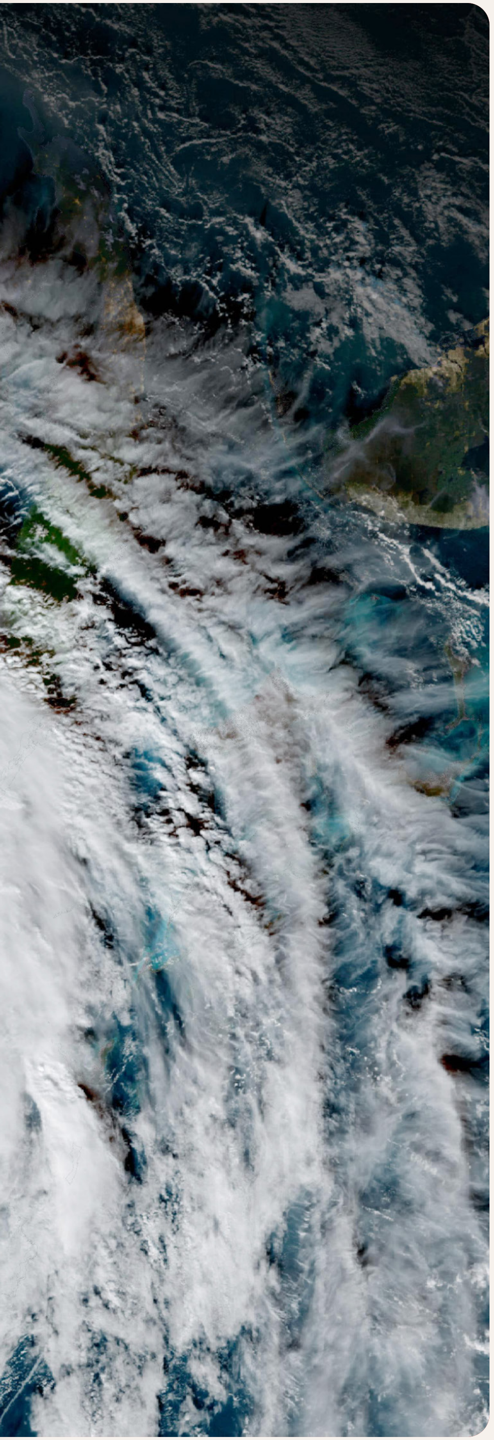

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We need your feedback
This year, the WMO team has launched a process to gather feedback on the State of the Climate reports and areas for improvement. Once you have finished reading the publication, we ask that you kindly give us your feedback by responding to this short survey. Your input is highly appreciated.

Contents

Introduction

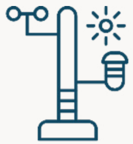
The WMO State of the Climate reports present a set of indicators and essential climate variables that together characterize the climate system and track changes over time. These indicators are designed to communicate complex scientific information in a clear and policy-relevant way, while remaining firmly grounded in internationally agreed scientific standards.

The selection, calculation and presentation of the indicators in this report are guided by **widely accepted principles for climate indicators**, as articulated in the scientific literature and used across international climate assessments. Each indicator was chosen based on the following considerations:

Relevant	Each indicator provides a clear and understandable signal of the state of the climate system, with broad relevance for a wide range of audiences. Headline indicators are expressed as a single value that summarizes large-scale change, while remaining meaningful for interpretation at regional or national scales, where appropriate.
Representative	Taken together, the indicators provide a balanced picture of changes across the Earth system, including in the atmosphere, ocean, cryosphere and biosphere. No single indicator captures climate change on its own; the strength of the assessment lies in the combined evidence from multiple, complementary indicators.
Traceable	All indicators are derived using published and internationally recognized methods, based on data that are openly available, verifiable and maintained by national and international institutions. Clear references are provided so that users can trace headline values back to their underlying data sources and methodologies.
Timely	Indicators are updated regularly, typically on an annual basis, using the most recent observations available at the time of publication. Efforts are made to minimize the time lag between the end of the reporting period and the release of updated values, while maintaining scientific robustness.
Data adequacy	The underlying observations and datasets used to calculate each indicator are assessed for robustness, reliability and long-term consistency. Known limitations related to data coverage, uncertainty or methodological differences are transparently communicated to support appropriate interpretation.

To support users with different levels of technical expertise, each indicator section includes a short **"Meet the data"** description that explains, in accessible terms, what the indicator shows, where the data come from and how they should be interpreted. More detailed information on datasets, methods and references is provided in accompanying **technical notes** for expert users and in sections on **data calculation and sources**. This approach aims to provide transparency for the State of the Climate indicators, showing in accessible language that they are based on sound scientific sources and methods and that they are fit for purpose to support informed decision-making.

Sources of climate data

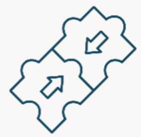


In situ

Measurements from an instrument located at the point of interest, such as at a land station, at sea or in an aeroplane

Remote sensing

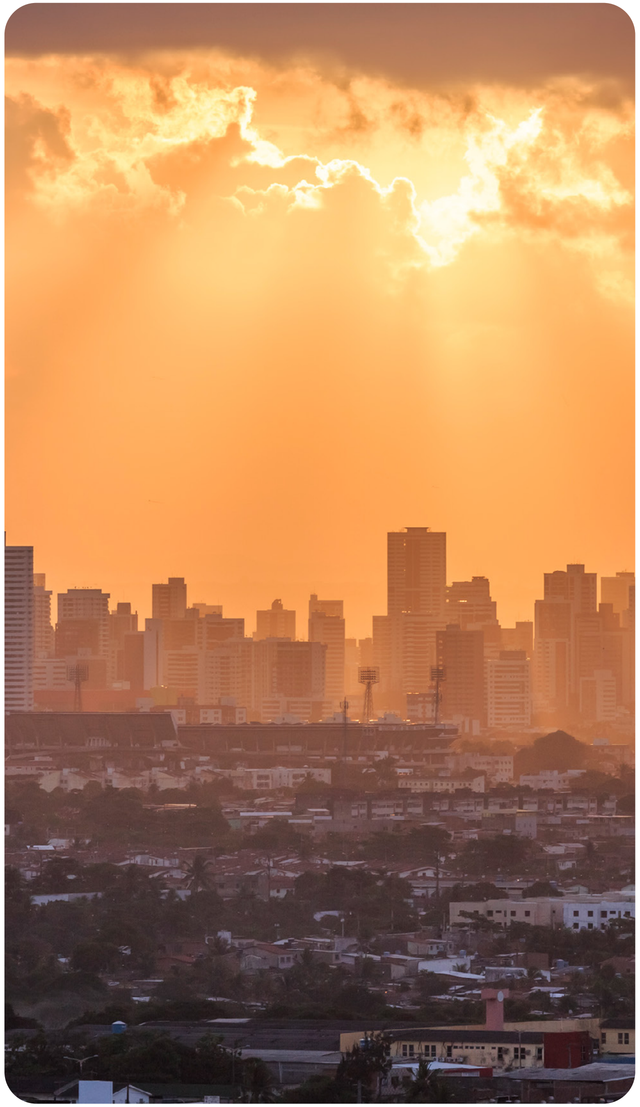
Information about the Earth's surface and its atmosphere gathered from a distance, including via satellites and radar



Reanalysis

Historical climate conditions recreated using a combination of observations and computer models

Mean near-surface temperature



Meet the data

What does this indicator show?	• Changes in the average temperature near the Earth's surface (land and ocean) over time, expressed as a temperature change relative to a baseline.
Where do the data come from?	• This indicator is based on temperature measurements made at weather stations on land and by ships and buoys over the oceans. Statistical methods are used to fill gaps in the data. • Temperature can also be calculated using reanalyses which use a weather forecasting system to combine data from a wide variety of sources, including satellite data. • This indicator is derived from nine global temperature datasets which are peer-reviewed, address known biases and are near-globally complete in the modern era. • Instrumental temperature records extend back to 1850, with increasingly comprehensive spatial coverage over time. Regular monitoring of Antarctica started in 1958, extending coverage to all continents.
What should readers keep in mind?	• Individual datasets differ slightly due to methodological choices and data coverage, particularly in earlier periods and in regions with sparse observations. • While year-to-year variability is influenced by natural climate fluctuations, the long-term increase in global mean temperature is unequivocal and driven by human activities.

Technical notes

Multiple global temperature datasets are used in the assessment. Each of the datasets:

- Provides global or near-global coverage in the modern period using statistical methods to fill gaps or using data from a reanalysis;
- Has been adjusted to minimize the effect of known systematic errors associated with changes in how measurements were made over time or is otherwise free from known systematic errors;
- Is described by a peer-reviewed paper;
- Is publicly available and routinely updated.

Data calculation and sources

Nine datasets met the above criteria and were used in the calculation of regional temperature. These include seven traditional datasets: Berkeley Earth, CMA-GMST, CMST v3, DCENT-I, GISTEMP v4, HadCRUT5, NOAAGlobalTemp v6, and and two reanalyses: ERA5 and JRA-3Q.

Traditional datasets

Berkeley Earth
Rohde, R. A.; Hausfather, Z. The Berkeley Earth Land/Ocean Temperature Record. *Earth System Science Data* 2020, *12* (4), 3469–3479. https://doi.org/10.5194/essd-12-3469-2020.

CMA-GMST
Chen, L.; Xu, W.; Zhou, Z. et al. A New Global Land–Ocean Merged Surface Temperature Dataset since the 1850s: The CMA-GMST dataset. *Climate Dynamics* 2025, *63*. https://doi.org/10.1007/s00382-025-07614-x.

CMST v3
Sun, W.; Yang, Y.; Chao, L. et al. Description of the China Global Merged Surface Temperature Version 2.0. *Earth System Science Data* **2022**, *14* (4), 1677–1693, https://doi.org/10.5194/essd-14-1677-2022.

DCENT-I
Chan, D.; Gebbie, G.; Huybers, P. et al. *DCENT: Dynamically Consistent ENsemble of Temperature at the Earth Surface*. 2024. https://doi.org/10.7910/DVN/NU4UGW.

Chan, D.; Chan, S. C.; Siddons, J. T. et al. *DCENT-I: A Globally Infilled Extension of the Dynamically Consistent ENsemble of Temperature Dataset*. 2025. https://doi.org/10.7910/DVN/ZY0WM8.

Chan, D.; Chan, S. C.; Siddons, J. T. et al. DCENT-I: A Globally Infilled Extension of the Dynamically Consistent ENsemble of Temperature Dataset. *Geoscience Data Journal* **2026**, *13* (2). https://doi.org/10.1002/gdj3.70054.

GISTEMP v4
GISTEMP Team. *GISS Surface Temperature Analysis (GISTEMP), version 4*. NASA Goddard Institute for Space Studies, 2022. https://data.giss.nasa.gov/gistemp/. Lenssen, N.; Schmidt, G.; Hansen, J. et al. Improvements in the GISTEMP Uncertainty Model. *Journal of Geophysical Research: Atmospheres* **2019**, *124* (12), 6307–6326. https://doi.org/10.1029/2018JD029522.

HadCRUT5: Morice, C. P.; Kennedy, J. J.; Rayner, N. A. et al. An Updated Assessment of Near-surface Temperature Change From 1850: The HadCRUT5 Data Set. *Journal of Geophysical Research: Atmospheres* **2021**, *126* (3). https://doi.org/10.1029/2019JD032361. HadCRUT.5.1.0.0 data were obtained from http://www.metoffice.gov.uk/hadobs/hadcrut5 on 22 January 2026 and are © British Crown Copyright, Met Office 2026, provided under an Open Government Licence, https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/.

NOAAGlobalTemp v6
Huang, B.; Yin, X.; Menne, M. J. et al. *National Oceanic and Atmospheric Administration (NOAA) Global Surface Temperature Dataset (NOAAGlobalTemp), Version 6.0.0*. NOAA National Centers for Environmental Information, 2025. https://doi.org/10.25921/rzxg-p717.

Reanalyses

ERA5
Hersbach, H.; Bell, B.; Berrisford, P. et al. *ERA5 Monthly Averaged Data on Single Levels from 1940 to Present*; Copernicus Climate Change Service (C3S), 2023. https://doi.org/10.24381/cds.f17050d7.

JRA-3Q
Kosaka, Y.; Kobayashi, S.; Harada, Y. et al. The JRA-3Q Reanalysis. *Journal of the Meteorological Society of Japan, Ser. II* **2024**, *102* (1), 49–109. https://doi.org/10.2151/jmsj.2024-004.

Regional mean temperature anomalies were calculated relative to the 1961–1990 and 1991–2020 baselines using the following steps:

- Read the gridded dataset;
- Regrid the data to 1° latitude × 1° longitude resolution. If the gridded data are higher resolution, take a mean of the grid boxes within each 1° × 1° grid box. If the gridded data are lower resolution, copy the low-resolution grid box value into each 1° × 1° grid box that falls inside the low-resolution grid box;
- For each month, calculate the regional area-weighted average using only those 1° × 1° grid boxes whose centres fall over land within the region;
- For each year, take the mean of the monthly area averages to get an annual area average;
- Calculate the mean of the annual area averages over the periods 1961–1990 and 1991–2020;
- Subtract the 30-year period average from each year to obtain the anomalies relative to that base period.

ANNUAL TEMPERATURE MAPS

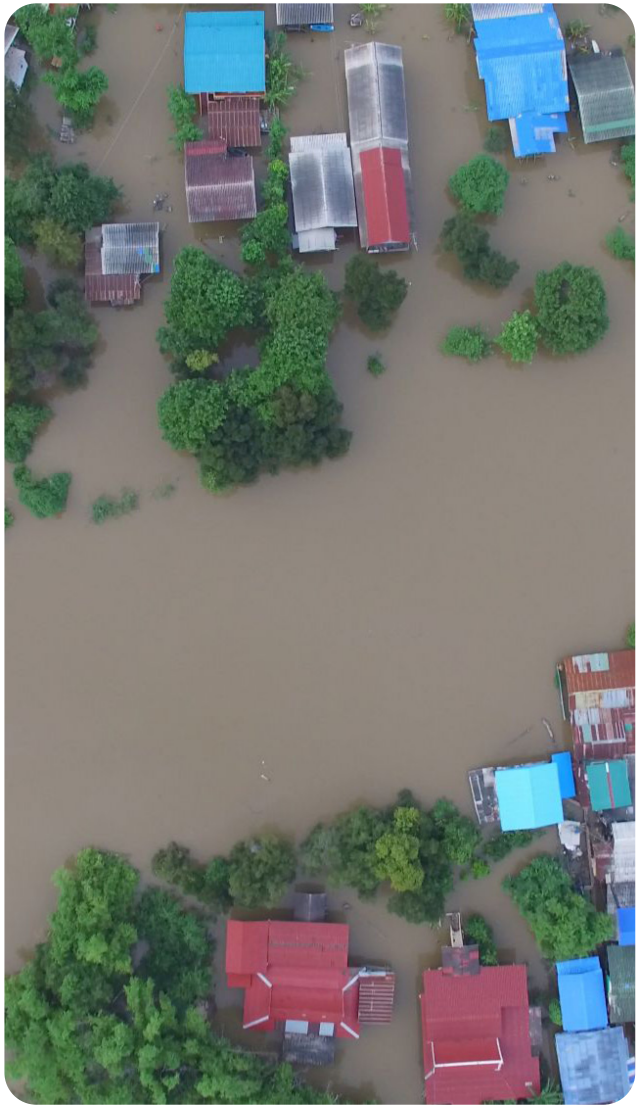
For the map of temperature anomalies for 2025, each dataset was converted to anomalies from the 1991–2020 average, and a median of the available datasets was used, re-gridded to the spatial grid of the lowest resolution datasets (NOAAGlobalTemp, HadCRUT5, DCENT-I and CMST) and presented on a 5° latitude by 5° longitude grid. The median is used in preference to the mean to minimize the effect of potential outliers in individual grid cells. The half-range of the datasets provides an indication of the uncertainty. The spread between the datasets is typically larger at high latitudes and in regions with sparser data coverage and is generally larger over land than over the ocean.

Unusually high and low anomalies were identified based on the temperature rankings. Areas which were among the five warmest on record for the year were interpreted as unusually warm, and areas which were among the five coldest on record for the period 1979 to 2025 were interpreted as unusually cold.

REGION-SPECIFIC DATA

Latin America and the Caribbean: The above data are complemented by in situ temperature data from the National Meteorological and Hydrological Services (NMHSs) or equivalent meteorological services of Argentina, Belize, Bermuda, Bolivia, Brazil, Cayman Islands, Chile, Colombia, Costa Rica, Cuba, Curaçao, Dominican Republic, Ecuador, El Salvador, French Guiana, Grenada, Guatemala, Guyana, Honduras, Jamaica, Martinique, Mexico, Nicaragua, Panama, Paraguay, Peru, Saint Kitts and Nevis, Saint Lucia, Suriname, Trinidad and Tobago, Uruguay and Venezuela.

Precipitation



Meet the data

What does this indicator show?	• Variations in precipitation compared with the long-term climatological average, indicating wetter- or drier-than-normal conditions across regions.
Where do the data come from?	• Primarily based on rain gauge observations collected by NMHSs and compiled into global datasets such as the Global Precipitation Climatology Centre (GPCC) dataset operated by the German Meteorological Service, Deutscher Wetterdienst (DWD).
What should readers keep in mind?	• Observational coverage varies across regions, with fewer measurements in some parts of the world. Estimates are based on station observations. Interpolation methods are used, and these can introduce additional uncertainties, particularly in data-sparse areas.

Technical notes

Stations observing precipitation are not evenly distributed on the global land surface. To some extent, station density correlates with population density – there tend to be more stations where population density is higher. The reliability of the calculated precipitation amount per grid cell depends on the number of stations used and increases as more data become available.

Data calculation and sources

For near-real-time analyses, in situ precipitation data were taken from the WMO Global Telecommunication System (GTS)/WMO Information System, version 2.0 (WIS 2.0) and data portals operated by NHMSs. For non-real-time analyses, additional data collected and provided by NHMSs were used. The collected data passed a quality control procedure. Gridded analyses, representing the mean precipitation amount for the grid cell, were calculated using the collected data by means of a statistical technique known as modified SPHEREMAP.[1]

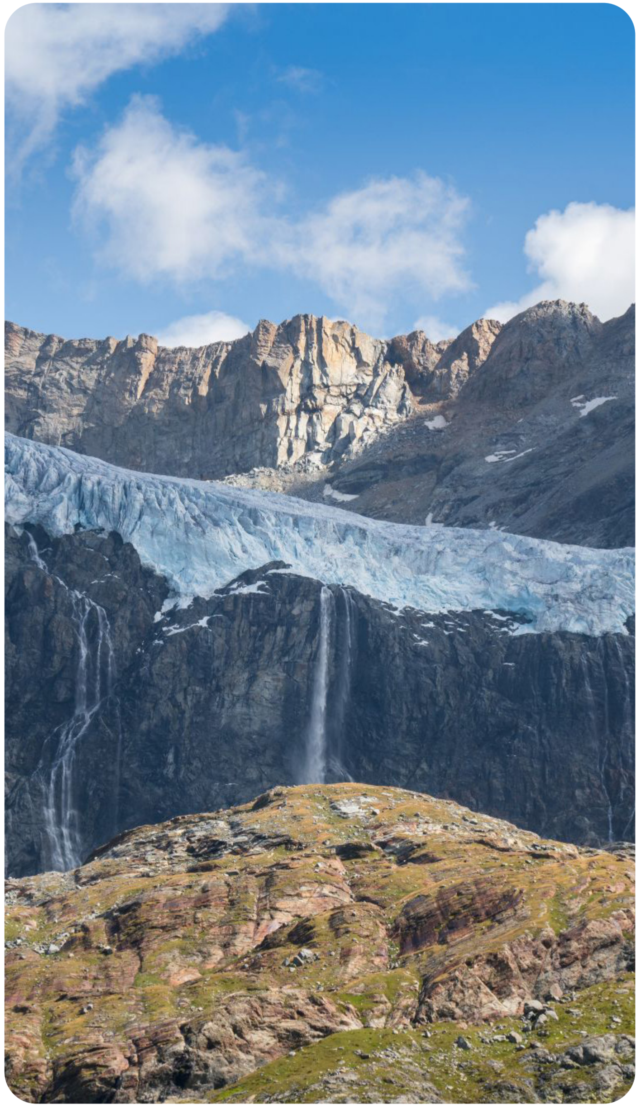
The map for the precipitation quantiles of 2025 is based on data from GPCC. Data for 2025 and reference data, to rank the 2025 annual total, were taken from the GPCC Monthly Product: (**https://opendata.dwd.de/climate_environment/GPCC/html/gpcc_precipitation_analysis_monthly_v2025_doi_download.html**) for the years 1991 to 2020. A spatial resolution of 1° latitude/longitude was used. To calculate quantiles, the precipitation amounts in the climatology period are sorted. The quantile is calculated from the position (rank) of the analysed amount in the sorted precipitation amounts.

REGION-SPECIFIC DATA

Latin America and the Caribbean: The above data are complemented by in-situ precipitation data from NMHSs or equivalent meteorological services of Argentina, Belize, Bermuda, Bolivia, Brazil, Cayman Islands, Chile, Colombia, Costa Rica, Cuba, Curaçao, Dominican Republic, Ecuador, El Salvador, French Guiana, Grenada, Guadeloupe, Guatemala, Guyana, Honduras, Jamaica, Martinique, Mexico, Nicaragua, Panama, Paraguay, Peru, Saint Kitts and Nevis, Saint Lucia, Suriname, Trinidad and Tobago, Uruguay and Venezuela.

1. See Becker, A.; Finger, P.; Meyer-Christoffer, A. et al. A Description of the Global Land-surface Precipitation Data Products of the Global Precipitation Climatology Centre with Sample Applications Including Centennial (Trend) Analysis from 1901–Present. *Earth System Science Data* **2013**, *5* (1), 71–99. **https://doi.org/10.5194/essd-5-71-2013**.

Glaciers



Meet the data

What does this indicator show?	• Glacier mass balance refers to the mass gained or lost from the glacier system expressed as a change in thickness measured in a consistent manner (metres water equivalent).
Where do the data come from?	• Global glacier observations are based on standardized in situ measurements of glacier mass balance and length changes reported by national and regional monitoring programmes worldwide. • Systematic glacier observations extend back to the mid-twentieth century, with some individual glacier records beginning earlier. The length and continuity of records vary by region and glacier. • Reference glaciers are glaciers which have more than thirty years of ongoing glaciological measurements. They are representative of nineteen mountain regions.
What should readers keep in mind?	• The reference glaciers used in calculations are only a small fraction of the world's glaciers and are unevenly distributed geographically. Nevertheless, more globally complete observed trends from satellite data consistently show widespread and accelerating glacier mass loss. • Glacier mass balance measures the change in thickness of the glacier, and while this is related to the amount of mass gained or lost by the glacier, it is not possible to directly estimate the mass loss from the glacier mass balance without also knowing the area of the glacier.

Data calculation and sources

World Glacier Monitoring Service (WGMS). *Fluctuations of Glaciers (FoG) Database*. WGMS: Zurich, Switzerland. https://doi.org/10.5904/wgms-fog-2026-02-10.

REGION-SPECIFIC DATA

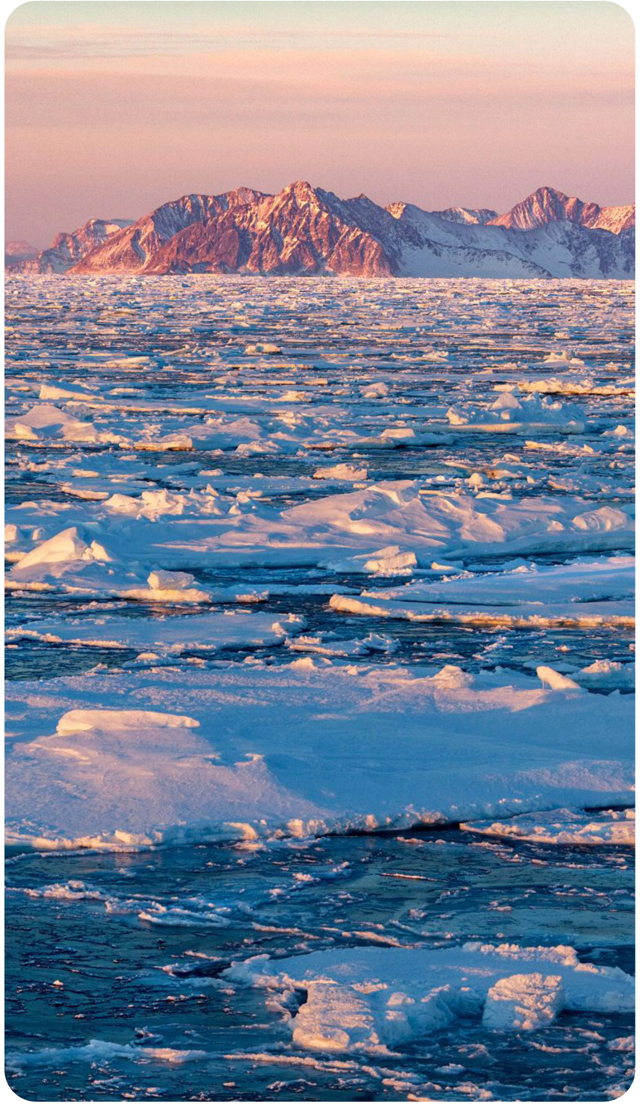
Africa: Glacier data from Mount Kilimanjaro and Mount Kenya are provided from the following sources:

- Hinzmann, A.; Mölg, T.; Braun, M. et al. Tropical Glacier Loss in East Africa: Recent Areal Extents on Kilimanjaro, Mount Kenya, and in the Rwenzori Range from High-resolution Remote Sensing Data. *Environmental Research: Climate* **2024,** *3 (1).* **https://doi.org/10.1088/2752-5295/ad1fd7**.
- Park, S.-H.; Lee, M.-J.; Jung, H.-S. Spatiotemporal Analysis of Snow Cover Variations at Mt. Kilimanjaro Using Multi-temporal Landsat Images during 27 Years. *Journal of Atmospheric and Solar-Terrestrial Physics* **2016,** *143–144, 37–46.* **https://doi.org/10.1016/j.jastp.2016.03.007**.

Asia: The above data are complemented by information from the following sources:

- United Nations Environment Programme (UNEP). *A Scientific Assessment of the Third Pole Environment*; UNEP, 2022. **https://wedocs.unep.org/20.500.11822/39757**.
- Yao, T.; Xue, Y.; Chen, D. et al. Recent Third Pole's Rapid Warming Accompanies Cryospheric Melt and Water Cycle Intensification and Interactions between Monsoon and Environment: Multidisciplinary Approach with Observations, Modeling, and Analysis. *Bulletin of the American Meteorological Society* **2019**, *100* (3), 423–444. **https://doi.org/10.1175/BAMS-D-17-0057.1**.

Arctic sea-ice extent



Meet the data

What does this indicator show?	• Sea-ice extent is the total area where sea-ice concentration exceeds 15%.
Where do the data come from?	• Sea-ice extent is derived from satellite observations of microwave radiation, which are processed into sea-ice concentration and extent products by multiple independent centres. • Continuous satellite-based sea-ice records extend back to 1978, providing more than four decades of consistent observations.
What should readers keep in mind?	• Different datasets show modest differences in absolute sea-ice extent due to methodological choices, but they agree closely on year-to-year variability, long-term trends and rankings. • The calculation of the extent depends on the grid used to aggregate the data.

Data calculation and sources

Fetterer, F.; Knowles, K.; Meier, W. N. et al. *Sea Ice Index, Version 3*. National Snow and Ice Data Center (NSIDC): Boulder, USA, 2017. **https://nsidc.org/data/G02135/versions/3**.

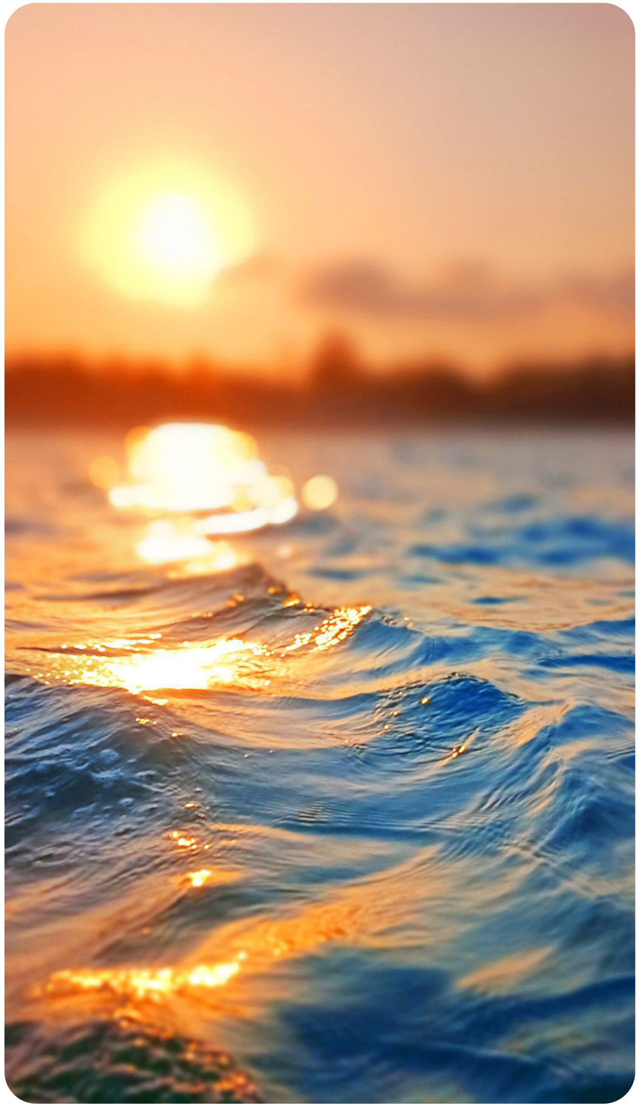
Analysis provided by:

- Arctic Climate Forum (ACF). *15th Arctic Climate Forum Consensus Statement: Summary of 2024/2025 Arctic Winter-Spring Season and the 2025 Arctic Summer Seasonal Climate Outlook*. Arctic Regional Climate Centre Network (ArcRCC-N). **https://arctic-rcc.org/sites/arctic-prcc/files/2025-09/ACF15-consensus-statement_final.pdf**.
- Arctic Climate Forum (ACF). *16th Arctic Climate Forum Consensus Statement: Summary of 2025 Arctic Summer Season and the 2025/2026 Arctic Winter-Spring Seasonal Climate Outlook*. Arctic Regional Climate Centre Network (ArcRCC-N). **https://arctic-rcc.org/sites/arctic-prcc/files/2025-12/ACF16-consensus-statement.pdf**.

REGION-SPECIFIC DATA

Asia: Snow cover: Data come from the Interactive **Multisensor Snow and Ice Mapping System (IMS)** at 4 km spatial resolution, provided by the National Snow and Ice Data Center (NSIDC). The system provides analysts with multiple in situ and satellite data sources that are used to produce a consolidated analysis of weekly snow cover.

Sea-surface temperature



Meet the data

What does this indicator show?	• Changes in sea-surface temperature relative to the long-term average, reflecting warming or cooling of the upper few metres of the ocean.
Where do the data come from?	• Derived from global analyses that use satellite observations and/or in situ measurements from ships, drifting buoys and moored buoys.
What should readers keep in mind?	• Sea-surface temperature estimates integrate multiple observation systems and analysis methods. Differences between datasets are used to estimate uncertainty, represented by the ensemble spread. • Sea-surface temperature is different from **ocean heat content**, which measures ocean temperature down to 700 metres.

Technical notes

A baseline of 1991–2020 is used for the sea-surface temperature time series.

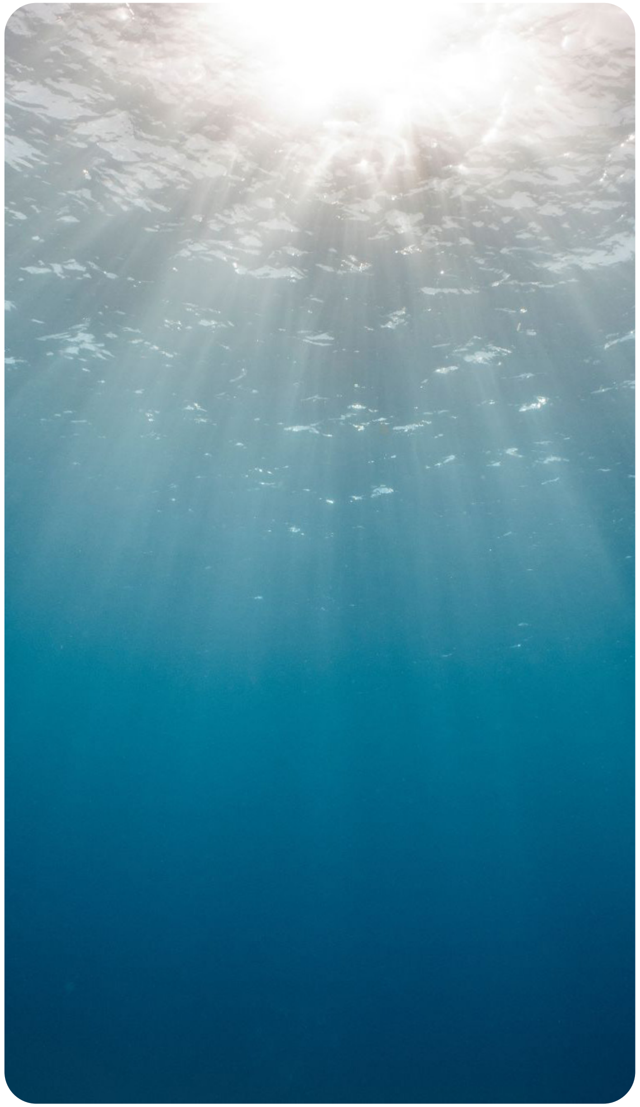
Data calculation and sources

The Copernicus Marine Operational Sea Surface Temperature and Ice Analysis (OSTIA) product was used for the analysis, and an ensemble including this product and the products listed below was used to provide the annual mean ensemble spread (two standard deviations). (Note: Data from the European Space Agency Sea Surface Temperature Climate Change Initiative (ESA SST CCI) was available to 2024.)

- Copernicus Marine Service. *ESA SST CCI and C3S Reprocessed Sea Surface Temperature Analyses*; Copernicus Marine Service, 2025. https://doi.org/10.48670/moi-00169.
- Copernicus Marine Service. *Global Ocean OSTIA Sea Surface Temperature and Sea Ice Analysis*; Copernicus Marine Service, 2025. https://doi.org/10.48670/moi-00165.

- Copernicus Marine Service. *Global Ocean OSTIA Sea Surface Temperature and Sea Ice Reprocessed*; Copernicus Marine Service, 2025. **https://doi.org/10.48670/moi-00168**.
- Huang, B.; Liu, C.; Banzon, V. et al. Improvements of the Daily Optimum Interpolation Sea Surface Temperature (DOISST) Version 2.1. *Journal of Climate* **2021**, *34* (8), 2923–2939. **https://doi.org/10.1175/JCLI-D-20-0166.1**.

Ocean heat content



Meet the data

What does this indicator show?	• Ocean heat content measures the amount of heat stored in the upper 700 m of the ocean.
Where do the data come from?	• This indicator is based on temperature measurements in the upper 700 m of the ocean obtained from in situ observations, including from the Argo profiling float network and earlier ship- and buoy-based measurements. • Near-global coverage is available from 2005 onward with Argo; estimates extend back several decades using sparser data, with greater uncertainties prior to the Argo era and robust global estimates from around 1960. • Global ocean heat content is derived using multiple independent analysis methods applied to these observations.
What should readers keep in mind?	• Ocean heat content (top 700 metres of the ocean) is different from sea-surface temperature, which measures temperature in the upper few metres of the ocean. • Values are reported for the ocean between 60°S and 60°N and for depths greater than 300 m, where observations are most reliable. • While year-to-year variability occurs, it is much less marked than the variability in surface temperature. Long-term increases in ocean heat content are unequivocal and reflect persistent, human-driven warming of the climate system.

Technical notes

A baseline of 1991–2020 is used for the ocean heat content time series.

Warming rates in watts per square metre refer to the ocean surface area in the region.

Ocean heat content values are given in units of Joules per square metre (J/m^2). Changes are expressed in Watts per square metre. 1 W m^{-2} corresponds to 31.5 MJ per year. For the global ocean, 1 W m^{-2} corresponds to 11.35 ZJ per year.

Data calculation and sources

The Copernicus Marine CORA5.2 product was used for the analysis, and an ensemble including this product and the products listed below was used to provide the annual mean ensemble spread (two standard deviations).

- Cheng, L.; Pan, Y.; Tan, Z. et al. IAPv4 Ocean Temperature and Ocean Heat Content Gridded Dataset. *Earth System Science Data* **2024**, *16* (8), 3517–3546, **https://doi.org/10.5194/essd-16-3517-2024**, 2024.
- Copernicus Marine Service. *Global Ocean in Situ - Delayed Mode Temperature and Salinity CORA -Objective Analysis*; Copernicus Marine Service, 2026. **https://doi.org/10.48670/mds-00383.**
- Copernicus Marine Service. *Global Ocean in Situ - Near Real Time Temperature and Salinity - Objective Analysis*; Copernicus Marine Service, 2026. **https://doi.org/10.48670/moi-00168.**
- Good, S. A.; Martin, M. J.; Rayner, N. A. EN4: Quality Controlled Ocean Temperature and Salinity Profiles and Monthly Objective Analyses with Uncertainty Estimates. *Journal of Geophysical Research: Oceans* **2013**, *118* (12): 6704–6716. **https://doi.org/10.1002/2013JC009067**.
- Levitus, S.; Antonov, J. I.; Boyer, T. P. et al. World Ocean Heat Content and Thermosteric Sea Level Change (0–2000 m), 1955–2010. *Geophysical Research Letters* **2012**, *39* (10). **https://doi.org/10.1029/2012GL051106**.

Sea level

Meet the data

What does this indicator show?	• Sea level shows changes in the average height of the ocean surface over time.
Where do the data come from?	• This indicator is based on satellite altimetry measurements from the French National Centre for Space Studies (CNES)/AVISO+ global mean sea-level record, which provides the height of the sea surface with respect to a reference surface (typically a reference ellipsoid). • The satellite-based global mean sea-level record begins in 1993, with continuous coverage to the present. The sea-level record based on tide gauges extends back to the nineteenth century, although coverage is limited.
What should readers keep in mind?	• Global mean sea level represents a global average. Regional variations can be substantially different from one region to another due to ocean temperature and salinity changes driven by ocean circulation; smaller effects come from atmospheric loading and gravitational effects. • While satellite altimetry provides absolute sea-level changes, tide gauges also record land motions (and therefore measure relative sea level).

Technical notes

The data have been adjusted to account for a number of factors, including how the atmosphere affects radar signals, the state of the ocean surface, tides and the continuing long-term rebound of the solid Earth following the last ice age, and the responses of the ocean to the atmosphere.

Data calculation and sources

An instrumental drift of the TOPEX-A radar, one of the first satellite altimeters used in the series covering the period 1993–1998, has been corrected using an empirical correction (Ablain et al., 2017). The radiometer drift on Jason-3 has also been corrected (Brown et al., 2023). For details, see **the AVISO+ web page**.

The data have been de-seasonalized and smoothed using a filter that reduces noise at timescales shorter than a few months. Trends in the data are estimated using ordinary least squares.

Global mean sea level from CNES/AVISO+: **https://www.aviso.altimetry.fr/en/data/products/ocean-indicators-products/mean-sea-level/data-acces.html#c12195**

The data file used is: "MSL_Serie_MERGED_Global_AVISO_GIA_Adjust_Filter2m_NRT.nc". It can be found at: **Index of /aviso-gateway/data/indicators/msl**.

Regional sea-level trends (for all regional reports) are based on gridded C3S altimetry data averaged from 50 km offshore to the coast by the Laboratory of Space Geophysical and Oceanographic Studies (LEGOS).

References

Ablain, M.; Jugier, R.; Zawadki, L. et al. The TOPEX-A Drift and Impacts on GMSL Time Series [Poster]. Presented at the Ocean Surface Topography Science Team Meeting (OSTST), Miami, USA, 23–27 October 2017. **https://meetings.aviso.altimetry.fr/fileadmin/user_upload/tx_ausyclsseminar/files/Poster_OSTST17_GMSL_Drift_TOPEX-A.pdf**.

Brown, S.; Willis, J. K.; Fournier, S. *Jason-3 Wet Path Delay Correction* [Dataset]. National Aeronautics and Space Administration (NASA) Physical Oceanography Distributed Active Archive Center, 2023. **https://doi.org/10.5067/J3L2G-PDCOR**.

REGION-SPECIFIC DATA

Asia: Data on the state of the Caspian Sea were provided by the National Hydrometeorological Service of Kazakhstan (KAZHYDROMET).

Ocean pH

Meet the data

What does this indicator show?	• Ocean pH shows changes in the acidity of the ocean surface, indicating the degree to which seawater is becoming more acidic as it absorbs carbon dioxide from the atmosphere.
Where do the data come from?	• This indicator is produced by the Copernicus Marine Service and is based on ensemble reconstructions that combine in situ ocean biogeochemical observations with measurements of physical variables and models to estimate surface ocean carbonate chemistry at global and regional scales. • The annual global mean surface ocean pH time series extends from 1985 to the present.
What should readers keep in mind?	• Changes in global ocean pH are gradual but persistent. However, there are regional variations depending on circulation, biological activity and freshwater inputs. Local conditions, particularly in coastal areas, may therefore differ substantially from global averages. • Due to data availability, surface pH is used for this indicator, though changes to ocean acidity are also occurring at depth.

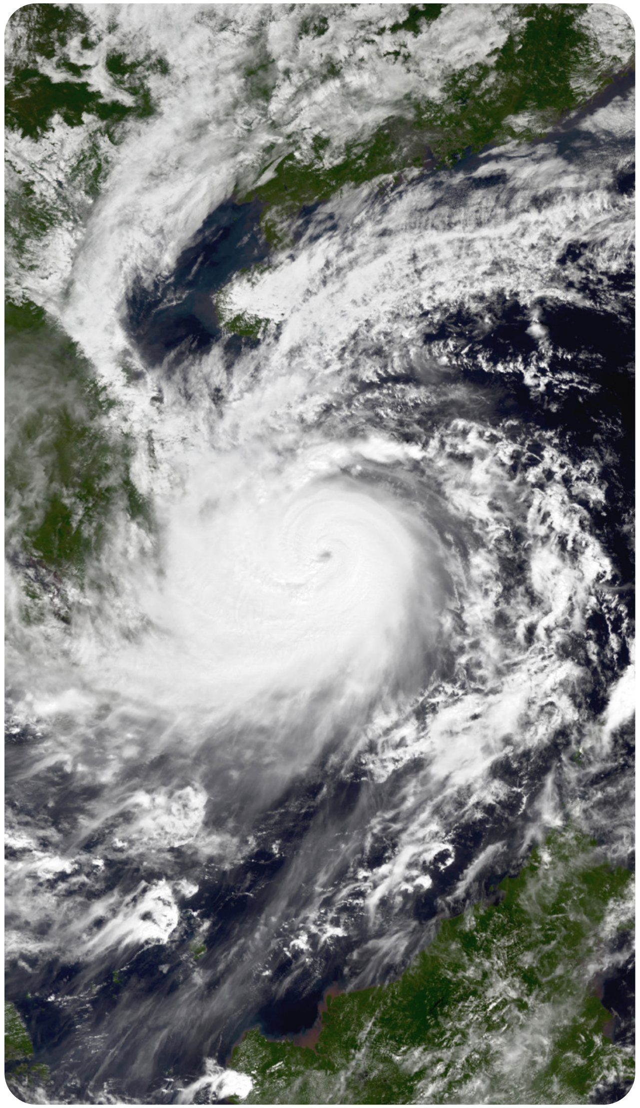
Technical notes

For processing details, see:

Chau, T. T. T.; Gehlen, M.; Chevallier, F. A Seamless Ensemble-based Reconstruction of Surface Ocean pCO_2 and Air–Sea CO_2 Fluxes over the Global Coastal and Open Oceans. *Biogeosciences* **2022**, *19* (4), 1087–1109. https://doi.org/10.5194/bg-19-1087-2022.

- This indicator is produced by the Copernicus Marine Service:
  Copernicus Marine Service. *Surface Ocean Carbon Fields*; Copernicus Marine Service, 2026. https://doi.org/10.48670/moi-00047.

Selected extremes



Meet the data

What does this indicator show?	• A selection of significant extreme weather and climate events that occurred during the year, providing context to the broader climate indicators and illustrating their impacts at the regional and national levels.
Where do the data come from?	• Information on extreme events is primarily collected through an annual survey distributed to NMHSs. • Key events are identified and contextualized by regional lead authors based on reported impacts, spatial extent and relevance. • These events are then visualized on the accompanying map to provide a geographic overview of notable extremes during the year. • Additional information on individual events may be supplemented by publicly available sources, including national reports and international databases.
What should readers keep in mind?	• The selection of events is not exhaustive and reflects available information at the time of reporting, as well as the judgement of contributing experts. • Reporting capacity and data availability vary between countries and regions, which may influence the number and type of events included.

Technical notes

More detailed and regularly updated information on extreme events as reported by NMHSs to WMO can be found on the interactive dashboard and in the accompanying supplement.

Data calculation and sources

Marine heatwaves

- Copernicus Marine Service. Global Ocean in Situ - Near Real Time Temperature and Salinity - Objective Analysis; Copernicus Marine Service, 2024. https://doi.org/10.48670/moi-00037.

- Copernicus Marine Service. Global Ocean Physics Analysis and Forecast; Copernicus Marine Service, 2024. https://doi.org/10.48670/moi-00016.

Tropical cyclones

Tropical cyclones are described using analyses from WMO Regional Specialized Meteorological Centres and Tropical Cyclone Warning Centres, complemented by global datasets and national meteorological services.

Drought

Latin America and the Caribbean: The Integrated Drought Index (IDI) developed by the Brazilian National Centre for Monitoring and Early Warning of Natural Disasters (CEMADEN) uses Standardized Precipitation Index (SPI) data calculated using Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS) and the Vegetation Health Index from the Center for Satellite Applications and Research (STAR/NOAA). Drought data were also provided by the United States Drought Monitor (USDM), CEMADEN and the Drought Information System for Southern South America (SISSA).

Wildfires

Latin America and the Caribbean: Burned area data for South America come from the Laboratory for Environmental Satellite Applications of the Federal University of Rio de Janeiro.

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