WORLD METEOROLOGICAL ORGANIZATION

State of the Climate 2024 Update for COP29

Information at a glance on:

State of the Climate

- Greenhouse Gases
- Global Temperature
- Approaching 1.5°C
- Sea ice extent
- Glacial mass
- Ocean heat content
- Sea level
- Precipitation
- State of global water
- Extreme events

Climate Action

- State of Climate Services
- Early Warning for All
- Renewable Energy

Foreword

The WMO has produced a State of the Global Climate report every year since 1993 to provide an annual summary and update of key climate indicators. These reports complement the more detailed, less frequent synthesis provided by the IPCC's Assessment Reports.

Since 2016 WMO has also been reporting preliminary findings on key climate indicators to inform the UNFCCC Conference of Parties (COP) before the end of each year. In July 2024, an international workshop organized by WMO and kindly hosted by the Deutscher Wetterdienst in Germany, agreed to a more condensed format, focusing on key messages for policymakers' needs at COP. The State of the Climate Update 2024 for COP29 highlights preliminary headline climate indicators consolidating the most up-to-date datasets available at the time of writing, along with examples of extreme events and progress in climate actions.

The headlines in the State of the Climate Update 2024 give cause for great concern. Greenhouse gas concentrations continue to steadily rise, driving further long-term temperature increases, highlighting the rapid changes in our climate system in the space of a single generation. We are on track for 2024 to be the hottest year on record joining 2023 as the two hottest years on record. Ocean heat content values continued an upward trend in 2023 and 2024, contributing to other changes in the climate system such as sea level rise and fueling intense storms. Antarctic and Arctic sea ice extent in 2024 have both been well below average.

The record-breaking rainfall and flooding, rapidly intensifying tropical cyclones, deadly heat, relentless drought and raging wildfires that we have seen in different parts of the world this year are unfortunately our new reality and a foretaste of our future.

We must continue to strive to limit warming as much as possible, recognizing that staying well below 2°C above pre-industrial levels and pursuing efforts to limit warming to 1.5°C remains critical to significantly reduce the risks and impacts of climate change. At the same time, we need to step up support for climate change adaptation through climate services and early warnings.

(Prof. Celeste Saulo)
Secretary General

Key messages

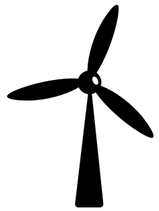
Greenhouse gases reached record observed levels in 2023. Real time data indicate that they continued to rise in 2024.

January - September 2024 global mean surface air temperature was 1.54±0.13°C above the pre-industrial average. Boosted by the El Niño, 2024 is on track to be the warmest year on record. Long-term warming, measured over decades, still remains below 1.5°C.

Antarctic and Arctic sea ice extent in 2024 have both been well below average. In 2023, globally, glaciers lost an estimated water equivalent to about 5 times the amount water in the Dead Sea.

Ocean heat content and sea level continue to rise. In 2023, the ocean absorbed around 3.1 million TWh of heat, equal to approximately 18 times the world's total energy consumption.

In the last five years, there has been substantial progress in climate service capacity globally. 108 countries reported having a Multi-Hazard Early Warning System.



Understanding climate variability and change is crucial for optimizing renewable energy generation

Greenhouse gases reached record observed levels in 2023.

Real time data indicate that they continued to rise in 2024.

Concentrations of the three key greenhouse gases in the atmosphere (WMO 2024a) – carbon dioxide, methane, and nitrous oxide – reached record high observed levels in 2023, the last year for which there are global consolidated figures. Measurements from individual locations, such as Mauna Loa and Kennaook/Cape Grim, suggest that concentrations of the three greenhouse gases will be higher again in 2024. The atmospheric concentration of carbon dioxide (CO_2) has increased from around 278 ppm in 1750 to the current level of 420 ppm, an increase of 51%. The average CO_2 growth rate during the past decade was 2.4 ppm per year. Emissions from fossil fuels have been the largest source of human emissions since the 1950s. Global averaged methane (CH_4) concentrations increased from 729 ppb during preindustrial time to 1934 ppb in 2023, which represents an increase of 165%. Nitrous oxide (N_2O) concentration increased from 270 ppb in 1750 to 336.9 ppb in 2023, which represents 24% increase.

CO_2 420.0 ppm ± 0.2

151% of pre-industrial levels

CH_4 1934 ppb ± 2

265% of pre-industrial levels.

N_2O 336.9 ppb ± 0.1

124% of pre-industrial levels

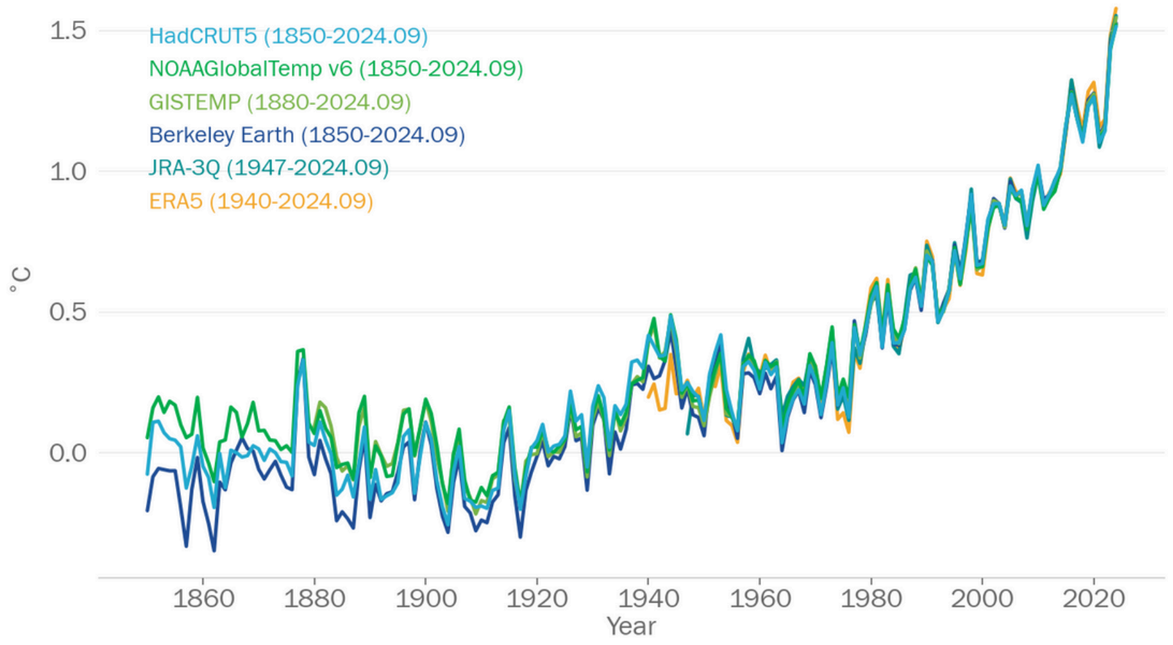


Figure 1: Annual global mean temperature anomalies (relative to 1850–1900) from 1850 to 2024 from six datasets. The 2024 average is based on data from January-September.

January-September 2024 was 1.54±0.13°C above the pre-industrial average.

Following a prolonged La Niña, which is typically associated with a temporary reduction in global temperatures, from late 2020 to the early months of 2023, a strong El Nino event boosted global temperature to record observed levels later in 2023 and through 2024. For 16 consecutive months (June 2023 to September 2024), the global mean exceeded anything recorded before 2023 and often by a wide margin. 2023 and 2024 will be the two warmest years on record, with the latter being on track to be the warmest, making the past 10 years, 2015 to 2024, the warmest ten years in the 175-year observational record.

Approaching 1.5 °C: How will we know when warming has surpassed the lower limit of the Paris Agreement Long Term Temperature Goal?

One or more individual years exceeding 1.5°C does not necessarily mean that "pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels" as stated in the Paris Agreement is out of reach. The IPCC defines climate change as a change in the state of the climate that persists for an extended period, typically decades or longer. Therefore, the exceedance of 1.5°C and 2.0°C warming levels referred to in the Paris Agreement should be understood as an exceedance over an extended period, typically decades or longer, although the Agreement itself does not provide a specific definition.

In addition, global average temperature doesn't increase smoothly from year to year (see figure 1). There is considerable interannual variability, owing to natural climate variability (for example caused by El Niño and La Niña events, volcanic activity, and changes in ocean circulation), superimposed upon long-term warming principally driven by ongoing greenhouse gas emissions. This emphasizes the need to focus on sustained trends over time.

However, as the world continues to warm there is a growing need to clearly define, measure and monitor an indicator to report on where the warming is relative to the goal specified in the Paris Agreement. The latest IPCC assessment report, AR6, defined global warming levels in terms of 20-year averages relative to the average for 1850–1900. The year of exceedance of a particular level, such as 1.5°C or 2.0°C, is typically considered to be the midpoint of the 20-year period at that level. By this definition, 1.5 °C of warming would be confirmed once the observed temperature rise has on average reached that level over a 20-year period, which would therefore only be possible to report a decade after crossing the 1.5 °C level. Clearly this would lead to a 10-year delay in recognizing and reacting to exceedance of the long-term temperature goal set in the Paris Agreement. Even taking the shorter average of 10 years, as done in IPCC AR6 and the First Global Stocktake, results in a 5-year delay.

Several alternative approaches are under active consideration by WMO and the international scientific community to enable more timely reporting on the year of exceedance of global temperature levels such as 1.5°C or 2°C. These approaches fall broadly into three categories. The first category combine observed historical warming with climate model projections. The second category aims to fit a trend or function, such as Locally Estimated Statistical Smoothing (LOESS), to the historical data to better estimate where the long-term warming is today. The third category aims to estimate the human factor in the historical change by estimating the underlying warming resulting from historical changes in key human drivers of the climate system such as greenhouse gases.

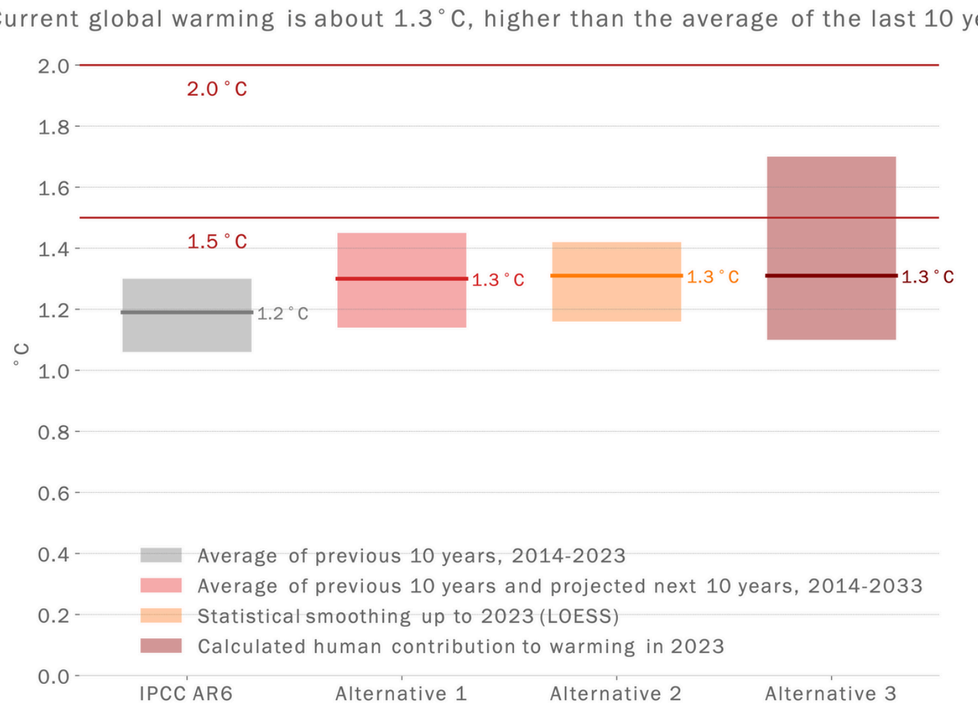
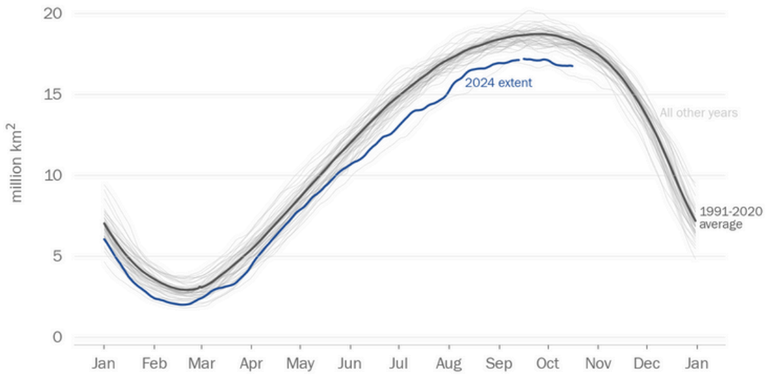


Figure 2. Various methods of assessing the level of global warming. Figure provided by Matthew Palmer. For further details see Betts et al (2023), Forster et al (2024) and the Met Office Climate Dashboard https://climate.metoffice.cloud/current_warming.html.

All three of these approaches indicate that global warming up to 2023 is at about 1.3°C compared to the 1850-1900 baseline (Figure 2). By comparison, taking the average of the last 10 years (2014-2023) following the IPCC AR6 approach and the WMO State of the Global Climate 2023 gives a warming of about 1.2°C. Taking the average for 2011-2020, as was used in the First Global Stocktake, gives a warming of about 1.1°C. To further prospect best use of these approaches, and potentially others as they emerge, WMO has established an international team of experts to consider and define the metric, along with proposing a methodology for monitoring the metric aligned with IPCC methodologies to ensure consistent, reliable tracking of global temperature increases.

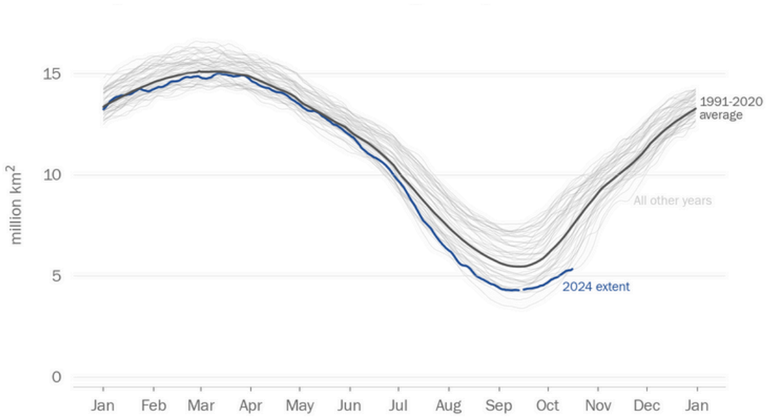
Ultimately, it is essential to recognize that, regardless of the methodology used to track, every fraction of a degree of warming matters. Whether it is at a level below or above 1.5°C of warming, every additional increment of global warming leads to changes in extremes and risks becoming rapidly larger.

Antarctic and Arctic sea ice extent in 2024 have both been well below average.



Antarctic sea-ice extent reached its annual minimum of 2.0 million km^2 on 20 February, the second lowest extent in the satellite record (1979-2024), the lowest being in 2023. The annual maximum Antarctic sea-ice extent was reached around 19 September, with an extent of 17.2 million km^2 . The 2024 maximum is the second lowest extent in the satellite record, the lowest being in 2023.

Figure 3: Daily Antarctic (top) and Arctic (bottom) sea ice extents in 2024 compared to the average and historical records since 1978. Source: National Snow and Ice Data Center



Arctic sea-ice extent reached its annual maximum of 15.01 million km^2 on 14 March, slightly below the long-term average (1991-2020) of 15.2 million km^2. On 11 September, Arctic sea-ice likely reached its annual minimum extent of 4.3 million km^2. The 2024 minimum is the seventh lowest in the satellite record.

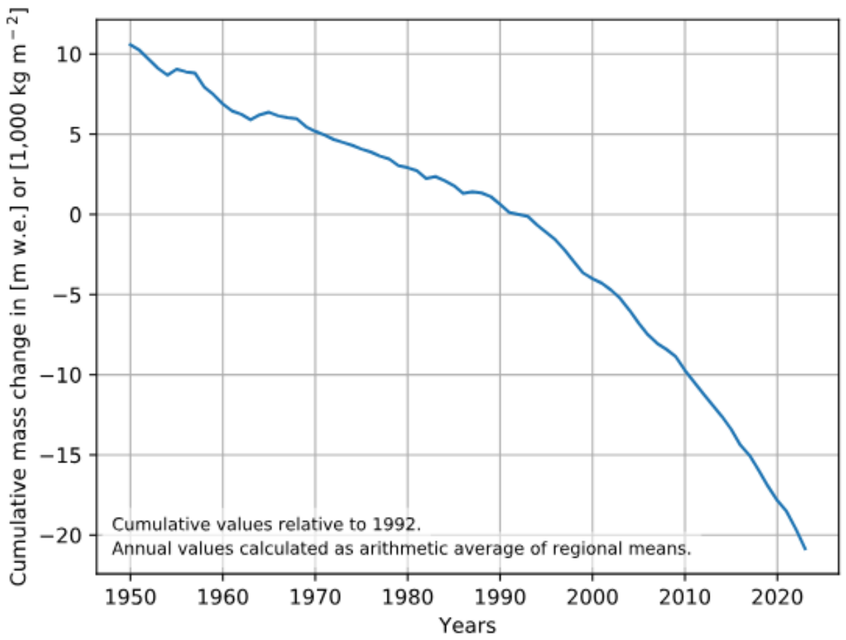


Figure 4: Global cumulative mass change of reference glaciers since 1950. 0 = 1992. Shown in meter water equivalent. Source: World Glacier Monitoring Service.

Glacier loss is accelerating. In 2023, glaciers lost an observed record 1.2 meter water equivalent of ice.

That's approximately 5 times as much water as there is in the Dead Sea.

For the hydrological year 2022/2023 data from a set of reference glaciers monitored by the World Glacier Monitoring Service (WGMS) indicate a global annual mass balance of -1.2 m of water equivalent. This is nominally the largest loss of ice on record (1950-2023), driven by an extremely negative balance in both western North America and Europe. The glacier mass loss in 2022/2023 corresponds to a volume of water discharged by the Amazon River in about one month, or approximately 5 times as much water as there is in the Dead Sea. In Switzerland, glaciers have lost about 10% of their remaining volume in 2021/2022 and 2022/2023.

About 90% of the energy that has accumulated in the Earth system is stored in the ocean. As energy has accumulated in the ocean, it has warmed, and global ocean heat content has increased.

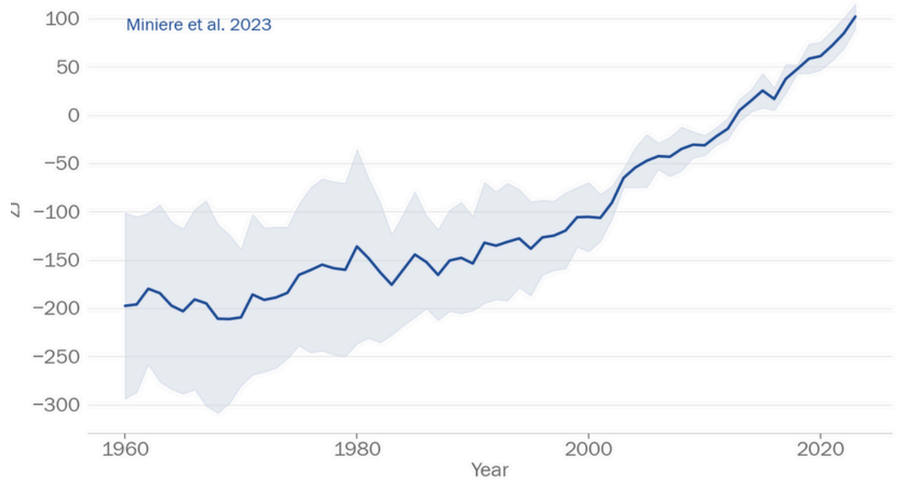


Figure 5: Ocean heat content from 1960-2023, shown as a difference from the 2005-2020 average: Source: Miniere et al. 2023.

Ocean heat content in 2023 was the highest on record. Preliminary data show 2024 has continued at comparable levels.

18X

The ocean absorbed around 3.1 million TWh of heat in 2023, 18x the world's total energy consumption.

It is expected that ocean warming will continue – a change that is irreversible on centennial to millennial timescales. Ocean heat content in 2023 was the highest annual value on record, exceeding the 2022 value by 13 ± 9 ZJ. Preliminary data from the early months of 2024 indicate that ocean heat content this year has continued at levels comparable to those seen in 2023. Ocean warming rates show a particularly strong increase in the past two decades. The rate of ocean warming for the 0–2 000 m layer was 0.7 ± 0.1 W m-2 from 1971 to 2023 on average, but 1.0 ± 0.1 W m-2 from 2005 to 2023. This rate corresponds to an average absorption of approximately 3.1 million terawatt-hours (TWh) of heat each year from 2005-2023, more than 18 times the world's energy consumption in 2023.

As water warms, it expands. This thermal expansion, combined with the melting of glaciers and ice sheets, contribute to sea level rise.

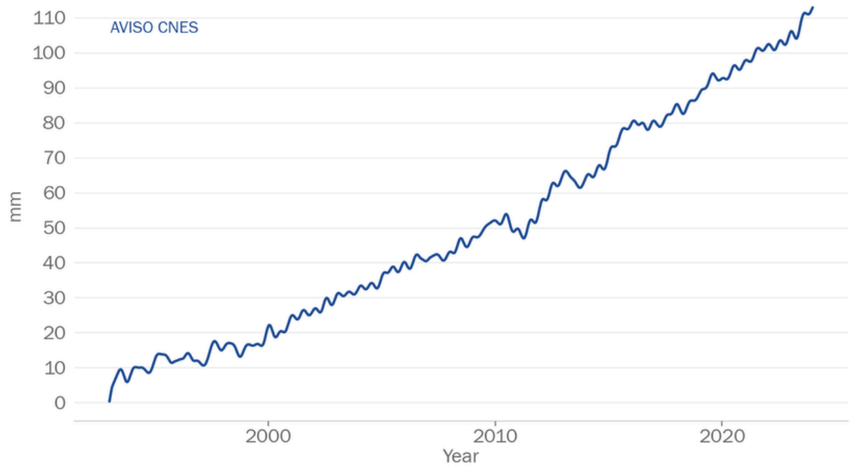


Figure 6: Global mean sea level from 1993-2023: Source: AVISO CNES

Sea level rise is accelerating. From 2014-2023, global mean sea level rose at a rate of 4.77 mm per year.

2X

That's more than double the rate from 1993-2002 (2.13 mm/yr).

The long-term rate of sea-level rise has more than doubled since the start of the satellite record, increasing from 2.13 mm yr-1 between 1993 and 2002 to 4.77 mm yr-1 between 2014 and 2023. This reflects continued ocean warming and thermal expansion, as well as the melting of glaciers and ice sheets. 2023 set a new observational record for annual global mean sea level with a rapid rise probably driven largely by El Niño. Preliminary 2024 data shows that the global mean sea level has fallen back to levels consistent with the rising trend from 2014 to 2022, following the declining El Niño in the first half of 2024. This will be reported on in the annual State of the Global Climate 2024 report to be produced around March 2025.

Below average precipitation

amounts were observed in northern and central South America, Northwest Africa as well as central southern Africa, Northwest and Northeast North America, Southeast Europe, northern Asia and on Pacific Islands .

Unusually high precipitation

was recorded in the Sahel region, around the Greater Horn of Africa and parts of eastern Africa. Furthermore, some spots at the eastern coast of South America, some of the Caribbean Islands, and some spots in North America received exceptional more rain than on the long-term mean. An unusual high precipitation excess was also recorded on the Arabian Peninsula, the Indian Monsoon region as well as western and central Asia. The Maritime Continent as well as northern and Central Australia received more than usual rainfall totals. Abnormal high precipitation totals were also recorded in Central and southwestern Europe.

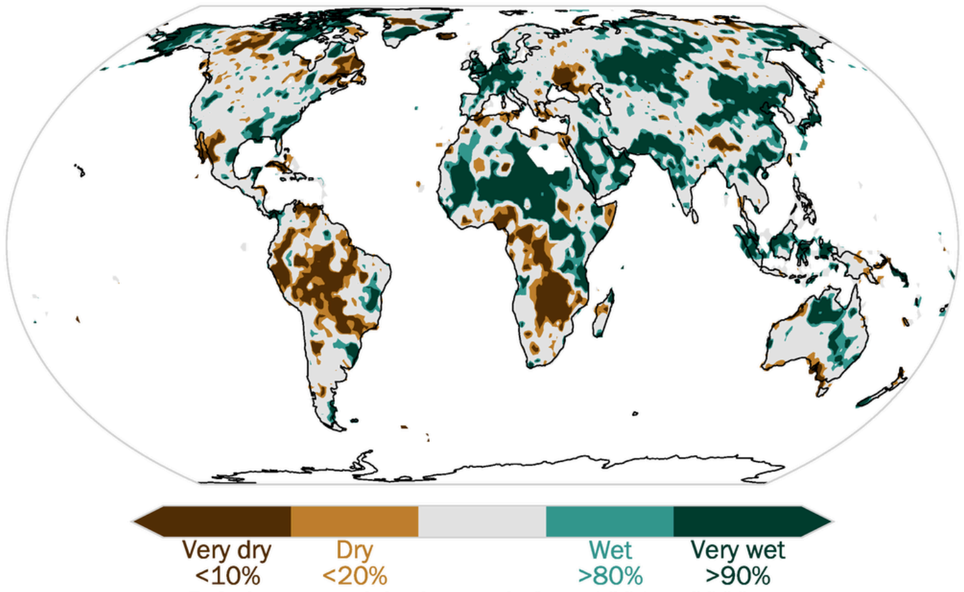


Figure 7: Precipitation worldwide from January to September 2024, relative to precipitation totals from 1991 to 2020. Source: GPCC

Extreme precipitation events

While the departure from the annual averages provides a global distribution pattern, extreme precipitation events are usually recorded at daily-to-monthly timescales. They are associated with heavy rain events that might lead to floods. Some of these extreme precipitation events are depicted on the map in the Extreme Events section below.

Global rivers experience driest year in over three decades

The 2023 State of Global Water Resources report (WMO, 2024b) provides a quantitative overview of the status of various components of the global water cycle--such as river flow, groundwater, soil moisture, snow and ice, lakes and reservoirs. The report reveals that 2023 was the driest year for global rivers in over three decades, coinciding with record-high observed temperatures (WMO, 2024c). The last five years have seen some of the lowest percentages of areas under normal river flow conditions, with reservoir inflows following a similar pattern, further reducing water availability for communities and ecosystems. Despite the dominance of dryness globally, flooding in connection with extreme precipitation events continued to induce severe loss and damage in many places of the world. Despite improvements in the availability and accessibility of in-situ data shared by WMO Members, significant gaps remain, particularly in Africa, South America, and Asia. The report underscores the potential of satellite-based observations and modeling systems to assist countries, especially those with limited monitoring capabilities, and large data gaps, to address these challenges and improve hydrological data collection.

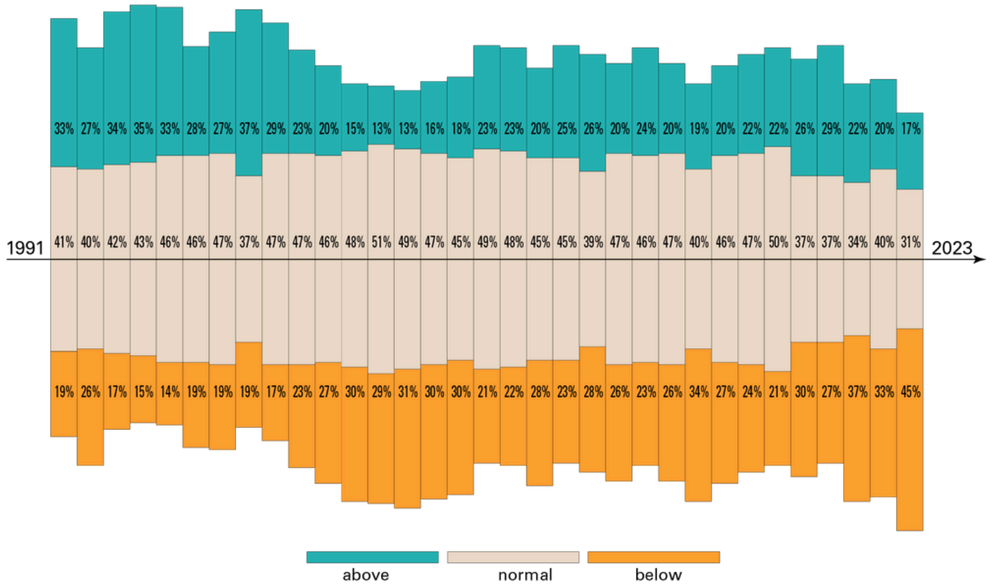
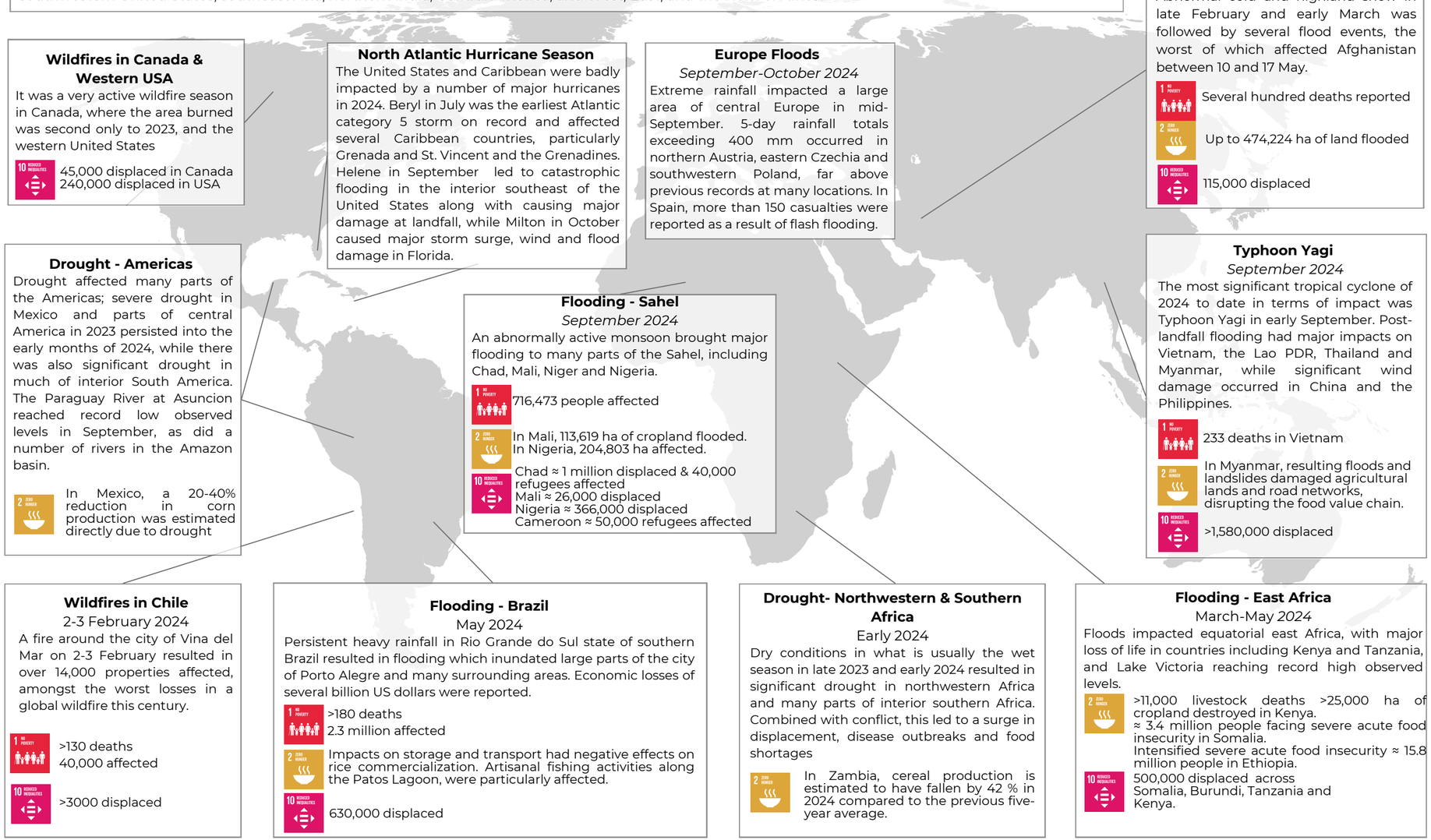


Figure 8: River River discharge condition distribution from 1991-2023. Note: 7% of the area has no data. Source: WMO, 2024 (in press)

Extreme events led to extensive damage worldwide

Droughts, floods, tropical cyclones, heatwaves, and cold waves cause significant damage, loss of life, and hinder sustainable development. The map below highlights some of the most notable events from January to September 2024, with data on impacts collected from various UN agencies. Although many areas of development are affected by extremes, SDGs 1, 2 and 10 were chosen for this summary due to the timely availability of data from UN partners.



Heatwaves

Worldwide throughout 2024

There were numerous significant heatwaves in 2024. Particularly affected areas included east Asia, southeast Europe, the Mediterranean and Middle East, the southwestern United States, southeast Asia, northern India, Central America, and West, East, and the Horn of Africa.

Wildfires in Canada & Western USA

It was a very active wildfire season in Canada, where the area burned was second only to 2023, and the western United States

45,000 displaced in Canada
240,000 displaced in USA

North Atlantic Hurricane Season

The United States and Caribbean were badly impacted by a number of major hurricanes in 2024. Beryl in July was the earliest Atlantic category 5 storm on record and affected several Caribbean countries, particularly Grenada and St. Vincent and the Grenadines. Helene in September led to catastrophic flooding in the interior southeast of the United States along with causing major damage at landfall, while Milton in October caused major storm surge, wind and flood damage in Florida.

Europe Floods

September-October 2024

Extreme rainfall impacted a large area of central Europe in mid-September. 5-day rainfall totals exceeding 400 mm occurred in northern Austria, eastern Czechia and southwestern Poland, far above previous records at many locations. In Spain, more than 150 casualties were reported as a result of flash flooding.

Cold Waves & Flooding - Afghanistan

February-May 2024

Abnormal cold and highland snow in late February and early March was followed by several flood events, the worst of which affected Afghanistan between 10 and 17 May.

Several hundred deaths reported

Up to 474,224 ha of land flooded

115,000 displaced

Drought - Americas

Drought affected many parts of the Americas; severe drought in Mexico and parts of central America in 2023 persisted into the early months of 2024, while there was also significant drought in much of interior South America. The Paraguay River at Asuncion reached record low observed levels in September, as did a number of rivers in the Amazon basin.

In Mexico, a 20-40% reduction in corn production was estimated directly due to drought

Flooding - Sahel

September 2024

An abnormally active monsoon brought major flooding to many parts of the Sahel, including Chad, Mali, Niger and Nigeria.

716,473 people affected

In Mali, 113,619 ha of cropland flooded.
In Nigeria, 204,803 ha affected.

Chad ≈ 1 million displaced & 40,000 refugees affected
Mali ≈ 26,000 displaced
Nigeria ≈ 366,000 displaced
Cameroon ≈ 50,000 refugees affected

Typhoon Yagi

September 2024

The most significant tropical cyclone of 2024 to date in terms of impact was Typhoon Yagi in early September. Post-landfall flooding had major impacts on Vietnam, the Lao PDR, Thailand and Myanmar, while significant wind damage occurred in China and the Philippines.

233 deaths in Vietnam

In Myanmar, resulting floods and landslides damaged agricultural lands and road networks, disrupting the food value chain.

>1,580,000 displaced

Wildfires in Chile

2-3 February 2024

A fire around the city of Vina del Mar on 2-3 February resulted in over 14,000 properties affected, amongst the worst losses in a global wildfire this century.

>130 deaths
40,000 affected

>3000 displaced

Flooding - Brazil

May 2024

Persistent heavy rainfall in Rio Grande do Sul state of southern Brazil resulted in flooding which inundated large parts of the city of Porto Alegre and many surrounding areas. Economic losses of several billion US dollars were reported.

>180 deaths
2.3 million affected

Impacts on storage and transport had negative effects on rice commercialization. Artisanal fishing activities along the Patos Lagoon, were particularly affected.

630,000 displaced

Drought- Northwestern & Southern Africa

Early 2024

Dry conditions in what is usually the wet season in late 2023 and early 2024 resulted in significant drought in northwestern Africa and many parts of interior southern Africa. Combined with conflict, this led to a surge in displacement, disease outbreaks and food shortages

In Zambia, cereal production is estimated to have fallen by 42 % in 2024 compared to the previous five-year average.

Flooding - East Africa

March-May *2024*

Floods impacted equatorial east Africa, with major loss of life in countries including Kenya and Tanzania, and Lake Victoria reaching record high observed levels.

>11,000 livestock deaths >25,000 ha of cropland destroyed in Kenya.
≈ 3.4 million people facing severe acute food insecurity in Somalia.
Intensified severe acute food insecurity ≈ 15.8 million people in Ethiopia.

500,000 displaced across Somalia, Burundi, Tanzania and Kenya.

Highlights on socioeconomic impacts from UN agencies

Food Security

Input provided by FAO

- The compounded effect of shocks, such as intensifying conflict, El Niño-induced drought and high domestic food prices drove worsening food crises in 18 countries by mid-2024. In Nigeria, Sudan, Myanmar, Ethiopia, Zimbabwe, Malawi, Chad and Yemen all had at least 1 million more people facing high levels of acute food insecurity than during the 2023 peak.
- Global hunger levels rose sharply from 2019 to 2021 and persisted at the same level in 2023.
- Africa had the highest prevalence of undernourishment (PoU) in 2023 (20.4%), with even higher levels (about 30%) along middle and eastern Africa.
- The reduced cereal harvest across the globe is the result of a widespread El Niño linked drought that caused crop failures, steep declines in yields and reductions in harvested areas.

Migration & Displacement

Joint input by IOM, UNHCR & IDMC

Extreme weather events in the first half of 2024, including flooding, droughts, cyclones, typhoons, and hurricanes have led to new, onward and protracted displacement of significant numbers of people in diverse places across the globe. Alongside the destruction of homes, critical infrastructure, forests, farmland and biodiversity loss, such extreme weather events undermine resilience and pose significant protection risks to people on the move and those already living in displacement – who are often excluded from national preparedness and response plans.

As the impacts of climate change worsen, climate services are increasingly needed for decision making.

There has been substantial progress in terms of climate service capacity in the last five years. The implementation of National Frameworks for Climate Services (NFCS) has increased from 36 countries in 2019 to 98 in 2024, reflecting a 63% increase. The WMO 2024 State of Climate Services report (WMO, 2024d) highlights that the number of National Meteorological and Hydrological Services (NMHSs) providing 'advanced' climate services nearly doubled from 8 in 2019 to 15 in 2024, and those providing services at 'full capacity' increased from 11 to 17. As a result, the number of NMHSs that are able to only provide basic climate services has been nearly cut in half, reflecting a clear trend towards more sophisticated climate services. Notably, Asia and Africa, which are highly vulnerable to climate change, have made remarkable progress, supported by the most funds for enhancing their climate service capacity.

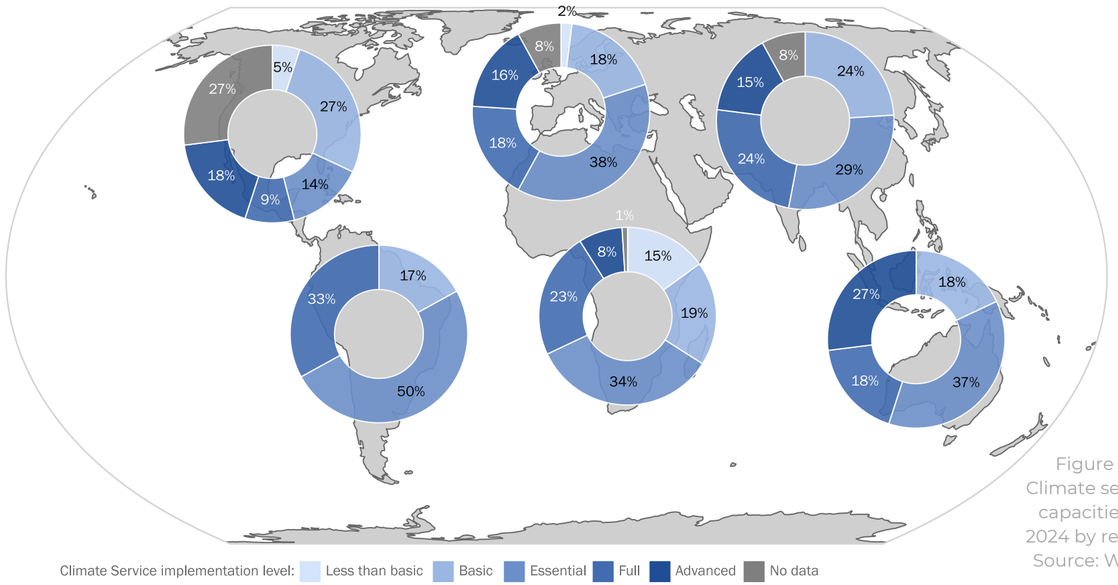


Figure 9: Climate service capacities in 2024 by region. Source: WMO

Nevertheless, improvements are still needed for other categories of climate services. According to the 2024 State of Climate Services report, the progress made on the provision of "advanced" climate services and services at "full capacity" still only represent nearly one third of NMHSs and only one third of NMHSs are providing climate services at an "essential" level. Increasing the capacity of NMHSs is needed in under-resourced regions. Significant gaps remain in observing network coverage, especially in Least Developed Countries (LDCs) and Small Island Developing States (SIDS), which only collect and internationally exchange 9% of Global Basic Observing Network data.

Early Warning for All advances

Early Warnings for All (EW4All) is a groundbreaking initiative aimed at ensuring that every individual on Earth is protected from hazardous weather, water, or climate events through life-saving early warning systems by the end of 2027. Early warning systems have proven to be a cost-effective and reliable solution to protect lives and livelihoods from natural hazards. Giving just 24 hours notice of an impending hazardous event can reduce damage by 30%.

Current Status of Multi-Hazard Early Warning Systems (MHEWS):

- Despite progress, gaps remain with only 55% of countries reporting Multi-Hazard Early Warning System (MHEWS) existence as of March 2024.
- Where MHEWS exist, there may be substantial gap along the value chain. For example, 98 countries reported the existence of 'Warning dissemination and communication' (Pillar 3, Indicator G- 3), but only 53 countries reported on 'Disaster Risk Knowledge' (Pillar1, Indicator G-5).
- Gaps are most pronounced in countries in special conditions. 20 Least Developed Countries (LDC) have reported having MHEWS (44% of all LDCs), compared to 14 Small Island Developing States (38%), and 20 Landlocked Developing Countries (63%).
- MHEWS coverage is notably lower in the Americas and the Caribbean region as well as the the Africa region.
- National Adaptation Plans (NAPs) from LDCs all include MHEWS as a priority. 88% of LDCs have included EWS in their Nationally Determined Contribution (NDC) thus far. EW4All is a vital mechanism to meet this demand.

The EW4All initiative aims to further integrate its efforts into the UNFCCC agenda, focusing on key issues such as the Global Goal on Adaptation, NDCs, Loss and Damage, and the New Collective Quantified Goal on Climate Finance (NCQG), which will be active under the TROIKA until 2030.

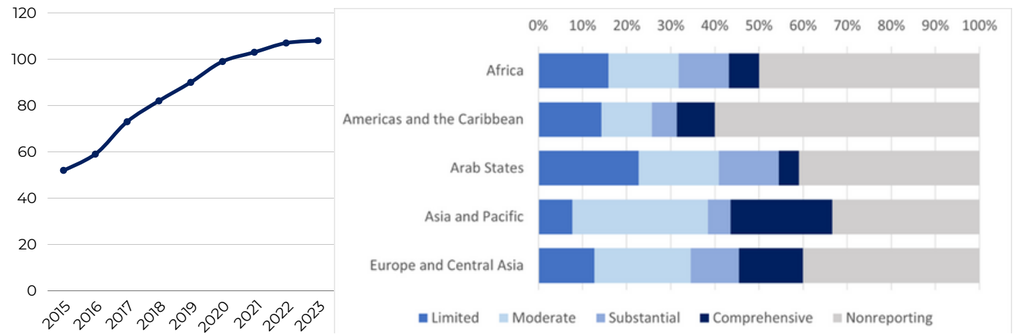


Figure 10: MHEWS coverage and comprehensiveness by region. Source: Sendai Framework Monitor, 31 March 2024.

As of March 2024, 108 countries reported having a Multi-Hazard Early Warning System.

Climate insights are vital to achieving renewable energy targets

A significant outcome of COP28 was the ambitious target to triple renewable energy capacity and double energy efficiency by 2030. Understanding climate variability and change is crucial for optimizing renewable energy generation, ensuring energy system resilience, and analyzing energy demand patterns, especially for heating and cooling.

A forthcoming publication between WMO, the International Renewable Energy Agency (IRENA) and Copernicus will examine the changes in four key energy indicators (as defined in "WMO-IRENA 2022 Year in Review on Climate-driven Global Renewable Energy Potential Resources and Energy Demand) — wind, solar, hydropower, and energy demand— for 2023 compared to the recent long-term climate reference period 1991–2020 . The indicators vary considerably geographically, driven largely by climatic factors.

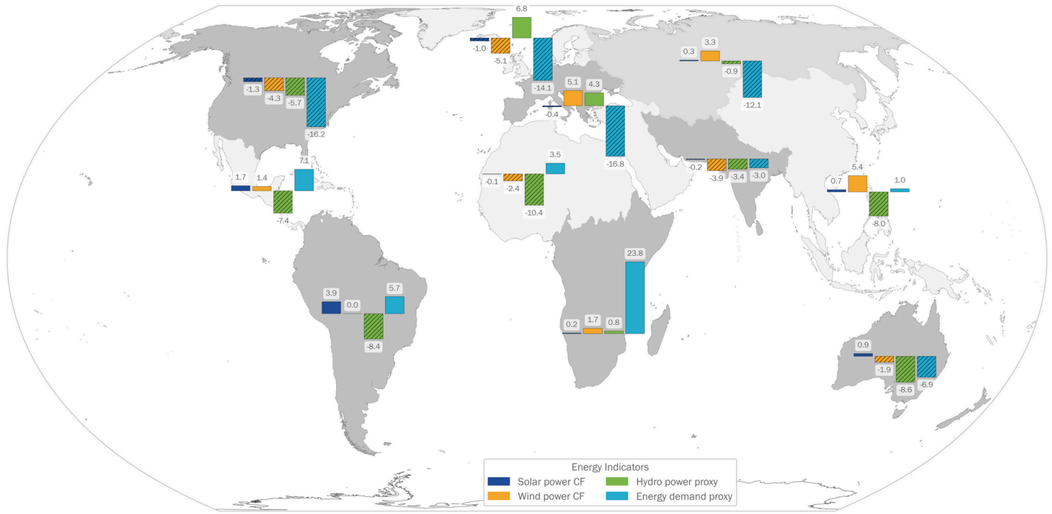


Figure 11: Renewable energy generation and demand in 2023, expressed as a percentage change from the 1991 - 2020 baseline. Source: WMO

For instance, **South America saw a 3.9% increase in solar photovoltaic (PV) capacity factor**, likely resulting from drier and warmer-than-normal conditions driven by El Niño. This anomaly, while small, reflects an increase in generation of approximately 3.5 TWh/year from the region's 50 GW of installed PV capacity (currently just 3.5% of the global installed capacity in 2023). Similarly, **in East Asia, wind power showed a 5.4% increase** for 2023. With an installed onshore wind capacity of 420 GW (95% in China, representing over 40% of global capacity), this translates to an additional 60 TWh of generation for the year (IRENA, 2024a and 2024b). Complementary to the previous study, the report "Water for Climate Mitigation: Estimating the Global Freshwater Requirements of Climate Mitigation Measures", published by IUCA, UN-Water, WMO, UNECE, and UNESCO, highlights the freshwater needs for renewable energy deployment, including green hydrogen for balancing the fluctuations of wind and solar energy. This global assessment demonstrates that water can be an enabler for climate mitigation efforts and the need for integrated water and climate policies.

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Acknowledgements

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