When Risks Become Reality: Extreme Weather In 2024

CLIMATE CENTRAL

World Weather Attribution

Foreword

Every December, we're asked if it was a bad year with respect to extreme weather. The answer is increasingly clear: yes.

Fossil fuel emissions continue to rise, resulting in higher global temperatures and escalating climate extremes that bring relentless harm across every continent. The past 12 months have provided an unprecedented cascade of heatwaves and floods, wildfires and droughts, underscoring the dangerous reality of living in a 1.3°C warmer world than when we started burning fossil fuels.

This report looks back at 2024, highlighting the devastating consequences of climate change and exposing our collective unpreparedness again and again in the 29 extremes we studied in depth. Heatwaves continue to claim lives, floods devastate communities, and droughts obliterate crops and livelihoods. Although El Niño made some extreme weather events more likely, its influence on extreme weather was often over emphasised.

2024 is set to be the hottest year on record, again. July 22 marked the hottest day in history, and the year saw a 13-month streak of record-breaking monthly temperatures. Every broken record was not just a number, but accompanied by people losing their lives and livelihoods in ever hotter heatwaves and devastating floods.

Yet new oil and gas fields continue to open with increase in subsidies as fossil fuel emissions reach an all-time high. As the latest IPCC report shows clearly, we have the technology and knowledge needed to switch to renewable energy supply, reduce demand, and change transport systems. Implementing these is not only largely cheaper and more reliable than fossil fuels, but has enormous health co-benefits.

Nearly every event we studied in 2024, was made more intense and more frequent because of our continued burning of fossil fuels. New Year's resolution number one is a faster move away from fossil fuels if we want to avoid ever more extreme events that reach the limits of what societies can adapt to.

Given the urgency and severity of the climate crisis at the end of 2024, we cannot get away with only one New Year's resolution. People are dying in large numbers, many more being affected because of the warming we already have. But most of these deaths are preventable. It is clear that the most vulnerable are disproportionately affected by extreme weather events, as they lack the resources and systems to protect themselves. Building resilience to climate change requires creating more equitable societies with robust social services.

At the close of 2024, this report underscores that significant harm from human-induced climate change is not a future threat, but a present day reality.

Dr Friederike Otto,
Co-lead of World Weather Attribution

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Key messages

– Extreme weather reached dangerous new heights in 2024. This year's record-breaking temperatures fueled unrelenting heatwaves, drought, wildfire, storms and floods that killed thousands of people and forced millions from their homes. This exceptional year of extreme weather shows how dangerous life has already become with 1.3°C of human-induced warming, and highlights the urgency of moving awayfrom planet-heating fossil fuels as quickly as possible.

– Globally, climate change added on average 41 additional days of dangerous heat in 2024 that threatened people's health, according to new analysis by Climate Central. The countries that experienced the highest number of dangerous heat days are overwhelmingly small island and developing states, who are highly vulnerable and considered to be on the frontlines of climate change. The analysis highlights the wide reaching impacts of extreme heat that are underreported and not well understood.

– Climate change contributed to the deaths of at least 3,700 people and the displacement of millions in 26 weather events we studied in 2024. These were just a small fraction of the 219 events that met our trigger criteria, used to identify the most impactful weather events. It's likely the total number of people killed in extreme weather events intensified by climate change this year is in the tens, or hundreds of thousands.

– Many extreme events that took place in the beginning of 2024 were influenced by El Niño. However, most of our studies found that climate change played a bigger role than El Niño in fueling these events, including the historic drought in the Amazon. This is consistent with the fact that, as the planet warms, the influence of climate change increasingly overrides other natural phenomena affecting the weather.

– The Amazon rainforest and Pantanal Wetland were hit hard by climate change in 2024, with severe droughts and wildfires leading to huge biodiversity loss. The Amazon is the world's most important land-based carbon sink, making it crucial for the stability of the global climate. Ending deforestation will protect both ecosystems from drought and wildfire, as dense vegetation is able to absorb and retain moisture.

– Record-breaking global temperatures in 2024 translated to record-breaking downpours. From Kathmandu, to Dubai, to Rio Grande do Sul, to the Southern Appalachians, the last 12 months have been marked by a large number of devastating floods. Of the 16 floods we studied, 15 were driven by climate change-amplified rainfall. The result reflects the basic physics of climate change — a warmer atmosphere tends to hold more moisture, leading to heavier downpours. Shortfalls in early warning and evacuation plans likely contributed to huge death tolls, while floods in Sudan and Brazil highlighted the importance of maintaining and upgrading flood defences.

– Hot seas and warmer air fueled more destructive storms, including Hurricane Helene and Typhoon Gaemi. Individual attribution studies have shown how these storms have stronger winds and are dropping more rain. Research by Climate Central found that climate change increased the intensity of most Atlantic hurricanes between 2019 and 2023 – of the 38 hurricanes analysed, 30 had wind speeds that were one category higher on the Saffir-Simpson scale than they would have been without human-caused warming, while our analysis found that the risk of multiple Category 3-5 typhoons hitting the Philippines in a given year is increasing as the climate warms.

Triggered and studied events

We have developed a trigger methodology to guide the selection of extreme weather events to consider for rapid study.

Each hazard type – floods, storms, droughts, heatwaves, fires and cold spells – has unique criteria specific to its distinct impacts. For example, our threshold for floods is met if any of the following criteria are met: more than 100 deaths, more than a million people affected, more than 50% of total population affected, or a declaration of state of emergency or disaster. These thresholds ensure the methodology captures the most impactful events around the world.

The selection process has two steps. The first is identifying events that meet our thresholds. The second is narrowing the selection based on additional factors, such as data availability, previous studies in the area, and regional and hazard diversity. This process ensures the selected events are impactful, relevant, and feasible for analysis, while adding to our understanding of the relationship between global climate change and local extremes. In 2024, 219 extreme weather events met our trigger criteria.

Hazard
- Heatwave: 79
- Cold spell: 8
- Flood: 54
- Storm: 48
- Drought: 11
- Wildfire: 19

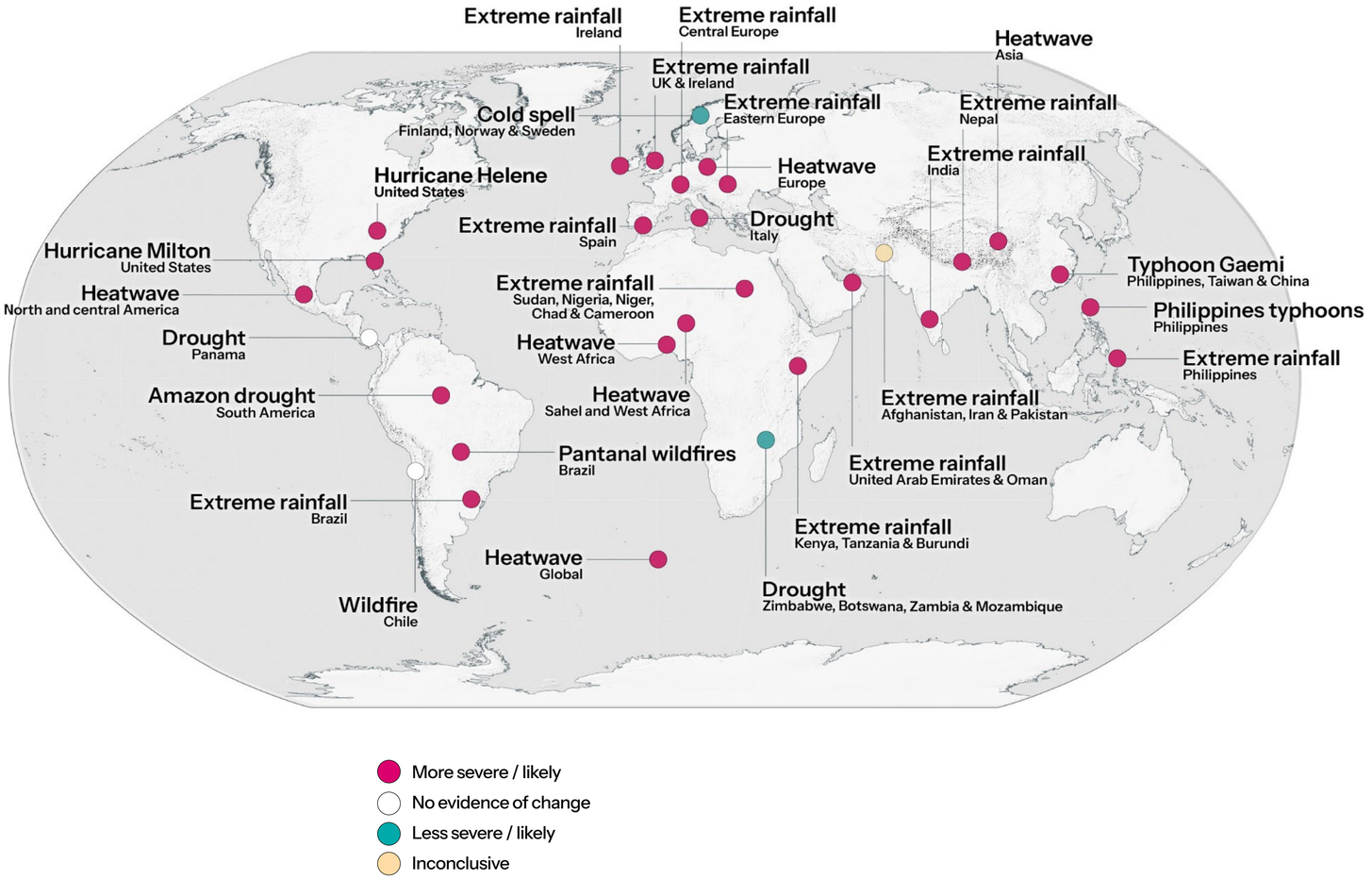
Region
- Africa: 26
- Americas: 68
- Asia: 63
- Europe: 28
- Oceania: 16
- Cross-continental: 18

We studied 29 of these events:

Hazard
- Heatwave: 5
- Cold spell: 1
- Flood: 8
- Storm: 9
- Drought: 4
- Wildfire: 2

Region
- Africa: 5
- Americas: 8
- Asia: 8
- Europe: 8
- Oceania: 0

World Weather Attribution studies 2024



Heatwaves

2024 will be the hottest year on record, and the first year with average global temperatures 1.5°C above pre-industrial levels.

This does not mean we have breached the Paris Agreement's aim of limiting global warming to 1.5°C – several years with temperatures above this threshold are needed before this limit is passed. However, it is a warning that we are getting dangerously close. While El Niño added some heat in the first half of the year, increasing emissions are the primary reason we saw so many record-shattering temperatures.

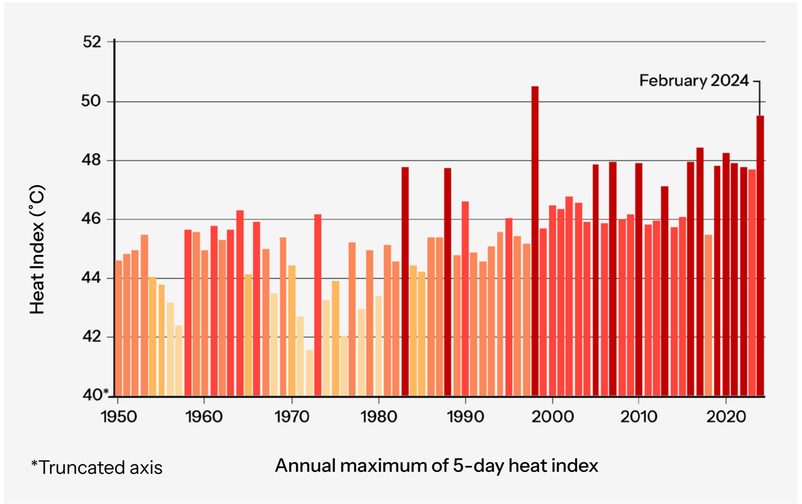
Virtually every heatwave has been made hotter and more likely because of climate change. This signal is so clear and so widespread that in many parts of the world we no longer need individual attribution studies to say this with confidence. However, attribution studies are still necessary to understand the magnitude and drivers of local and regional changes.

The studies carried out by World Weather Attribution in 2024 focussed on extreme heat that occurred in parts of the world that currently do not have systems to define heatwaves and warn the public, with potentially fatal consequences; and that occurred unusually early in the season, which can be particularly dangerous because people are not yet acclimatised to higher temperatures.

For example, In February, West Africa was hit by an unusually intense humid heatwave with temperatures not normally seen until March or April. The Africa Cup of Nations football tournament in Côte d'Ivoire was forced to introduce 'cooling breaks' during matches so players could rehydrate. Our study found that human-caused climate change made similar early-season heatwaves about ten times more likely, and yet many heat waves remain unrecorded and undocumented in Africa.

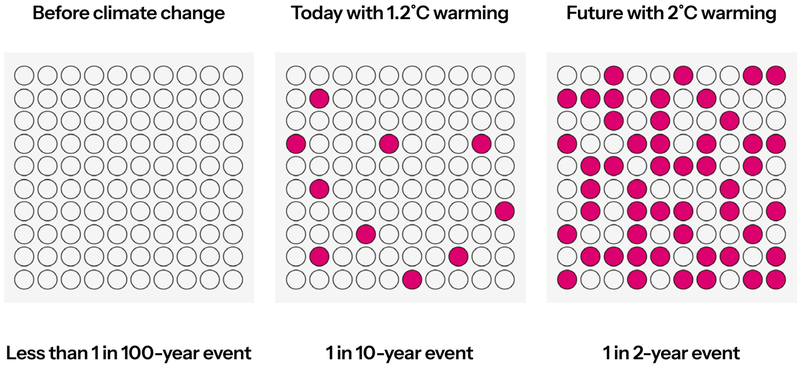
Heatwaves are the deadliest type of extreme weather. Often referred to as 'silent killers,' heatwaves don't leave a trail of destruction like storms or wildfires. This means the danger of extreme temperatures is often underreported and underappreciated. In Europe alone, more than 68,000 deaths have been linked to extreme heat during the summer of 2022, and a recent study estimates the additional heat added by climate change is responsible for more than half of the death toll.

In 2024, medical professionals and government officials in Mali, Mexico, Morocco and Saudi Arabia reported a significant number of deaths due to heat exposure. These reports, widely publicized by the media, highlighted the dangers of extreme heat and may have helped raise awareness.



Dangerous humid heat is increasing in West Africa with climate change. In 2024, it arrived much earlier than normal

Figure 2: Southern West Africa experienced one of its hottest heatwaves on record in February. Our study found that human-caused climate change made the event ten times more likely.



How often should we expect similar five-day humid heatwaves in West Africa?

Figure 3: If warming reaches 2°C above preindustrial levels, southern West Africa will experience similar humid heatwaves in February about once every two years.

Dangerous heat days in 2024

- **In 2024, the average person experienced 41 additional days of dangerous heat added by climate change.**

- **The highest number of people in a single day exposed to temperatures made at least two times more likely to occur due to climate change was 5.3 billion on July 21st. That was the hottest recorded day on Earth, before July 22nd subsequently broke that record.**

Scientists at Climate Central calculated temperatures that people would consider hot based on their local experience: for each location in the dataset, we found the threshold temperature for the warmest 10% of temperatures observed over the 1991-2020 period (also referred to as the 90th percentile temperature). Days above this threshold are referred to as "dangerous heat days", as they correspond to a conservative approximation of the local **minimum mortality temperature** (MMT), an indicator of the local links between temperature and mortality.

We then calculated the number of days that were hotter than this 90th percentile in 2024, and compared it to the number of days that would have been above the 90th percentile in a world without climate change (a more detailed methodology of how we did this is in our **Heat Action Day** report). Subtracting these two numbers, we were able to find in each location the number of days above the 90th percentile added by climate change in 2024. Additionally, we calculated this value on a country/territory by country/territory basis for the typical person in 220 countries or territories.

Download the full data **here**.

We found that in 2024, the average person experienced 41 additional days of dangerous heat added by climate change. The regions with the highest number of added dangerous heat days were closest to the equator. Furthermore, the countries/territories with the highest number of dangerous heat days were overwhelmingly members of the **Small Island Developing States** (SIDS): 18 out of the top 20 countries that experienced the most added days of dangerous heat due to climate change were SIDS, whose residents experienced more than 130 additional risky heat days.

Additionally, we used Climate Central's **Climate Shift Index (CSI)** and NASA's **Gridded Population of the World** to calculate the number of people exposed each day to a CSI of 2 or above. A CSI of 2 or above indicates that temperatures were made at least 2 times more likely to occur in today's climate than in a world without climate change. The highest number of people exposed to a CSI of 2 or above in a single day was 5.3 billion on July 21st. At the time, this was **the hottest recorded day on Earth**, before July 22nd subsequently broke that record.

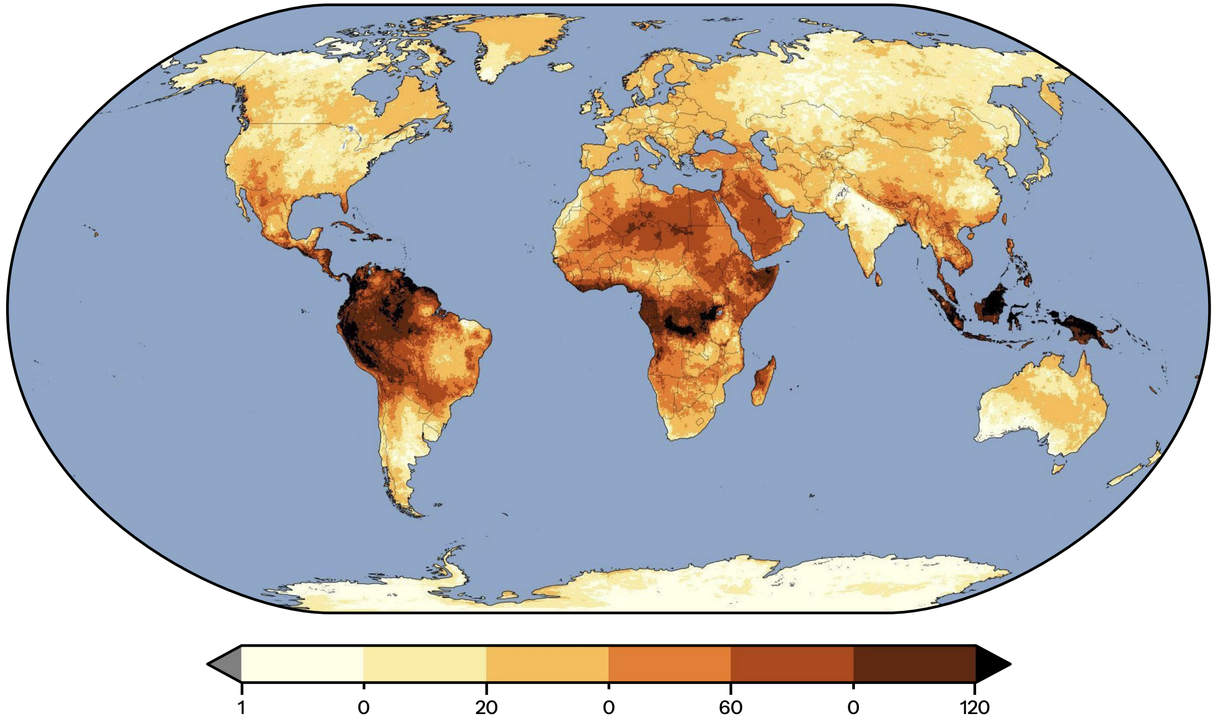


Figure 4: Additional days with temperatures above the 90th percentile in the current climate from January 1, 2024 to December 11, 2024, added primarily by the burning of fossil fuels. Produced December 11, 2024.

Floods

The record-breaking temperatures in 2024 also translated to record-breaking downpours. From **Kathmandu**, to **Dubai**, to **Rio Grande do Sul**, to the **Southern Appalachians**, the last 12 months have been marked by a large number of devastating floods.

This year we studied 16 flooding events. Of these, 15 studies found a clear or probable climate change signal, while our study on the **Afghanistan, Pakistan and Iran floods** was inconclusive due to poor climate model performance. These results are unsurprising and consistent with the expected changes associated with continued global warming.

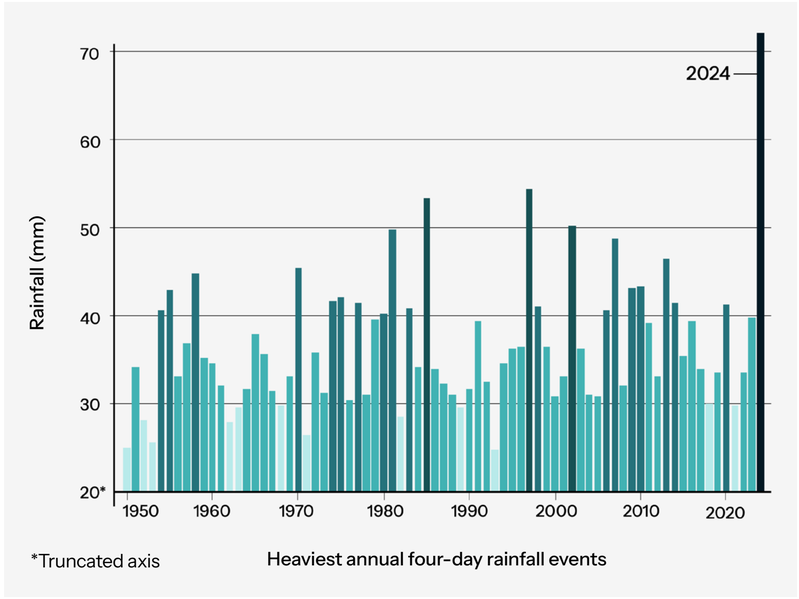
A warmer atmosphere can hold more water vapour, leading to heavier downpours. The Clausius-Clapeyron relation indicates that at 1.3°C of global warming, the atmosphere can hold about 9% more moisture. In addition, the warming of the oceans also contributes to heavy rainfall, as warmer water leads to increased evaporation.

Our studies in 2024 highlighted how early warning is often the difference between life and death. Early warning systems are a critical tool for reducing fatalities by giving people time to act before a hazard strikes. A few months ago a huge region of **Central Europe** was hit by record rainfall. People were warned and evacuated days in advance, reservoirs were drained, and flood defences built. As a result, despite the massive scale of the flooding, less than 30 people lost their lives. This event highlight the need to provide timely warnings, and to prioritise people with mobility issues, who are less able to evacuate and protect themselves during floods. For example, during the Valencia floods, **nearly half of the fatalities** were adults older than 70 years).

The flood in the Southern Appalachians caused by Hurricane Helene highlights that nowhere is safe from climate change. More than 227 people were killed just weeks after it was described as a "**climate haven**". Many were caught off guard by the sheer volume of rainfall, even after days of warnings of "catastrophic and life-threatening" flooding and landslides.

In **Sudan, Nigeria, Niger, Cameroon and Chad**, several months of heavy rain from July led to severe floods that killed at least 170 people and displaced millions. Our study found that these heavy rainfall episodes have become common events due to human-caused warming, expected to occur on average every 3-10 years. In East Africa, a **devastating multi-year drought** was followed by exceptionally **heavy rainfall** from March to May, with serious implications for sustainable development in the region. The risk of similar back-to-back extreme events is expected to increase even further in **several regions across Africa** as the climate warms.

Maintaining and upgrading flood defences is vital as the climate warms. In 2023, the **collapse of dams in Libya** following heavy rain resulted in floods that killed more than 12,000 people. This year, a **dam collapse in Sudan** led to floods that killed dozens of people and in **Brazil** extreme precipitation overwhelmed flood defences amplified impacts. The challenge of ageing flood defences is not just one faced by developing countries. In the US, more than 20% of dams, with an average age of over 60 years, are **rated in poor condition**. As climate change continues, extreme rainfall events that were once considered "rare" are becoming increasingly likely. Flood defences need to be repaired, maintained and upgraded to cope with heavy rainfall of the future climate.



The four days of rainfall that flooded regions of Central Europe is the heaviest ever recorded

Figure 5: Storm Boris brought unprecedented rainfall to Central Europe in September,leading to floods that killed 24 people. Climate change made the rainfall twice as likely. The amount of rain that fell across Central Europe over those four days was the heaviest ever recorded by a significant margin.

Storm Boris unleashed torrential rainfall that impacted an area even greater than the Central Europe floods in 1997 and 2002

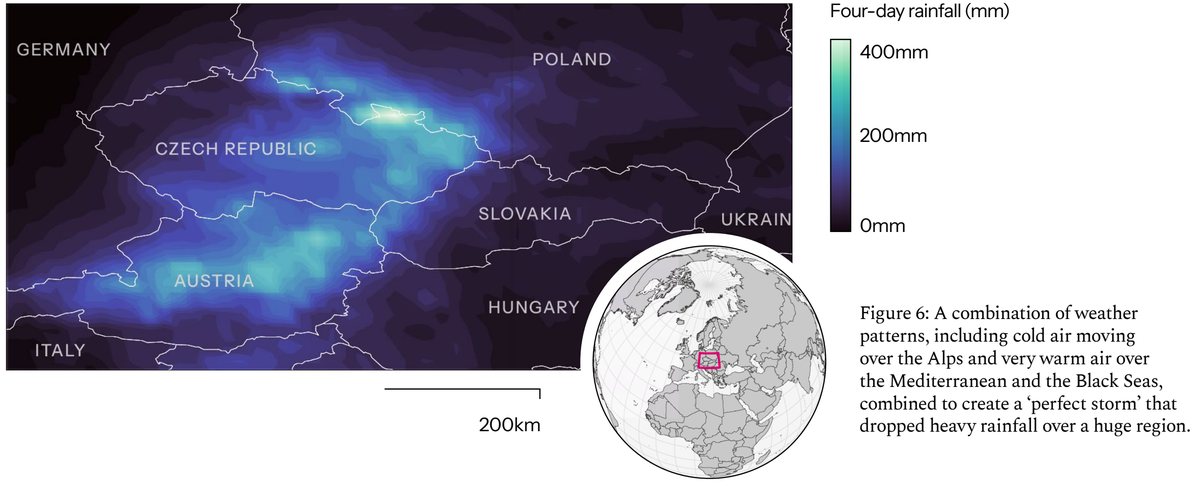


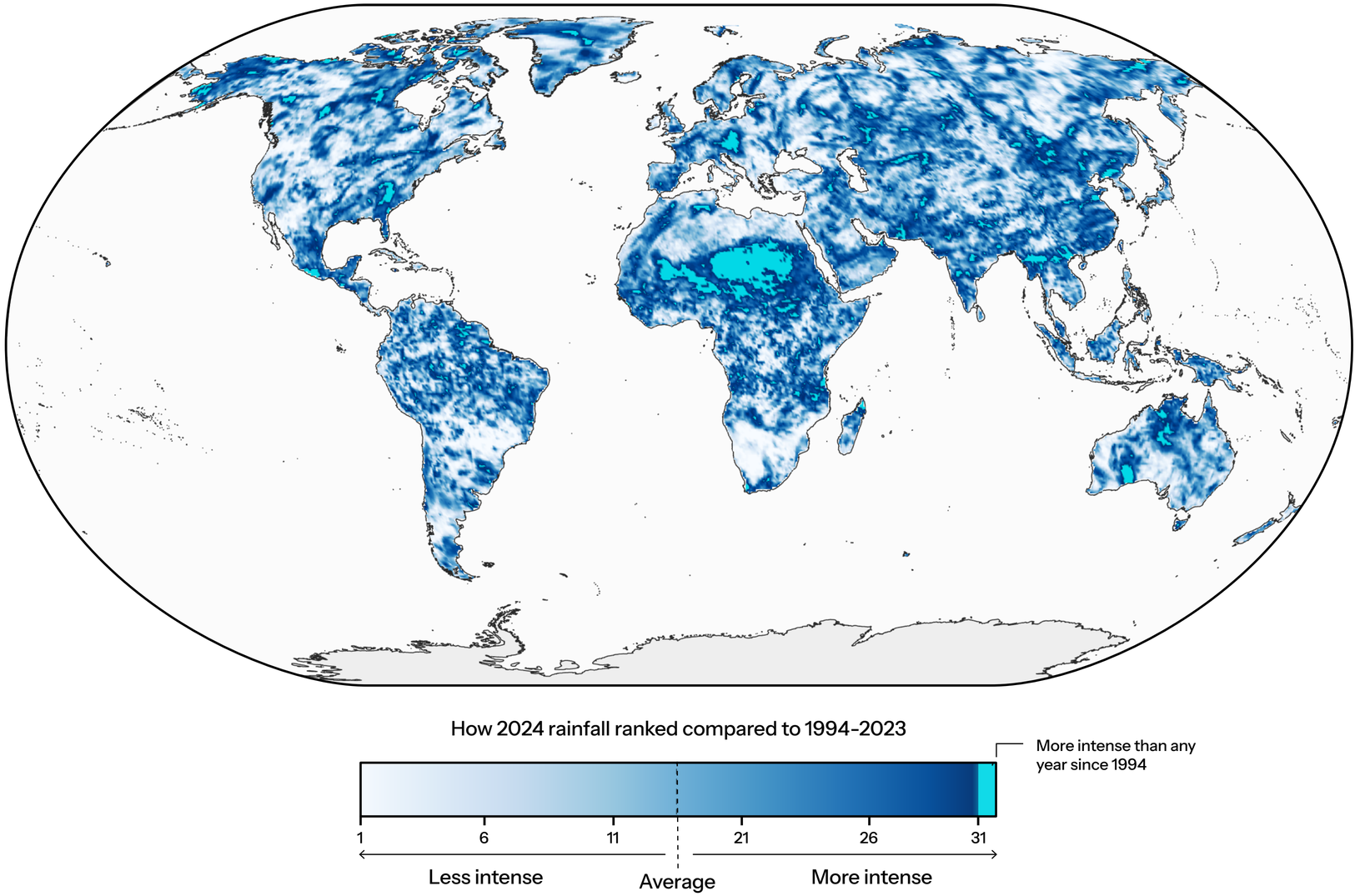
Figure 6: A combination of weather patterns, including cold air moving over the Alps and very warm air over the Mediterranean and the Black Seas, combined to create a 'perfect storm' that dropped heavy rainfall over a huge region.

Rainfall extremes in 2024

Figure 7: To evaluate how extreme 2024 was in terms of rainfall extremes, we computedrx5day (the annual maximum of 5-day accumulated rainfall) in ERA5, aggregated to 0.5 degree grid cells over land.

For each grid cell, we sorted the years from 1994-2024 into ascending order and found the rank of 2024 within this ordering: a rank of 31 indicates that the wettest 5-day period in 2024 was also the wettest 5-day period since 1994.

Extreme rainfall associated with large individual storms is visible in central Europe, Australia and the southeast US. Strikingly, much of the Sahel experienced its wettest 5-day period since 1994, particularly in the east, where Sudan, Chad and large parts of Nigeria experienced significant flooding, but also as far west as Niger and Mali.



Drought

Droughts are “creeping” hazards that develop gradually over time, often persisting for months or years, and with severe and far-reaching impacts. In 2024, droughts affected every continent, with significant impacts on water resources, agriculture, ecosystems, and vulnerable communities.

The water-holding capacity of the atmosphere and ocean and air circulations that drive rainfall systems are changing as the climate warms. This means the **risks of both droughts and floods are increased in different times and places**. Rising temperatures make droughts worse by increasing water loss from soils through evaporation and plant transpiration (together termed ‘evapotranspiration’).

Attribution studies should account for the compounded effects of both high temperature and low rainfall to best represent the event, as highlighted in recent WWA studies. For example, this year, the Italian islands of **Sicily and Sardinia** experienced severe droughts that led to water rationing and huge losses of wheat. Our study found climate change made the droughts 50% more likely, with persistent heat the main driver of the increased risk.

Similarly, prolonged heat intensified the devastating drought in the **Amazon River Basin**. The Amazon is one of the world’s largest rainforests and most important land-based carbon sink, making it crucial for the stability of the global climate. Droughts can be especially devastating for these tropical rainforests that are not resilient to periods of low rainfall and high temperatures. This can cause widespread tree dieback, setting off a feedback process whereby the release of large amounts of carbon dioxide into the atmosphere leads to further acceleration of global warming. **A study this year warned** the Amazon has already passed a safe boundary, and half of the rainforest could hit this tipping point by 2050 unless deforestation is halted, as cutting trees down reduces the forest’s ability to hold water.

Agriculture is often the first sector to be hit during droughts, with smallholder and subsistence farmers the worst affected. In developing countries, crop failures can lead to chronic food shortages and humanitarian crises. For example, the drought in **southern Africa** early this year left 20 million people facing hunger. In the future, droughts are generally expected to become more frequent and severe due to rising global temperatures, and unregulated human interventions further compounding their impacts. Improving long-range forecasting and early warning systems can help vulnerable communities prepare for impactful droughts.

How much more intense was the Amazon drought due to climate change?

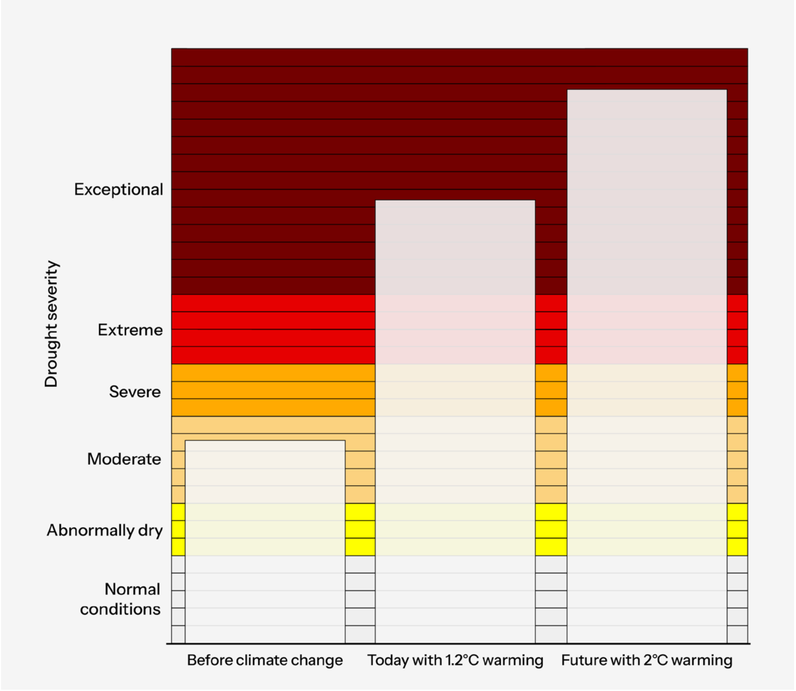


Figure 8: The Amazon drought was classified as an ‘exceptional drought’ in today’s climate. But in a cooler world, without human-caused climate change, the drought would have been much less intense and classified as a ‘moderate drought.’

How often should we expect similar droughts in the Amazon?

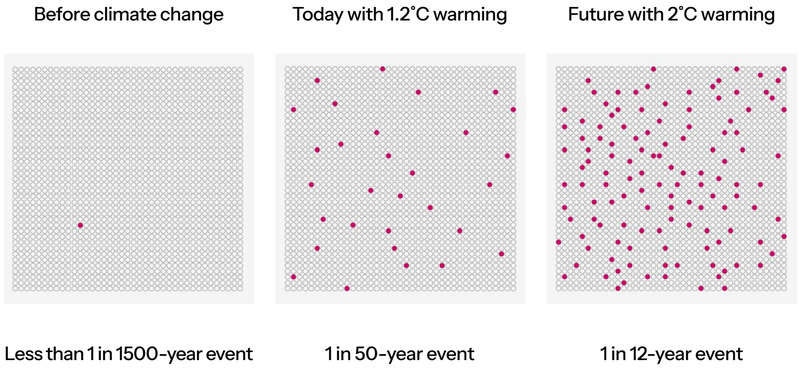


Figure 9: Severe drought will occur more frequently in the Amazon as the climate warms. If warming reaches 2°C, similar events will become another three times more likely, expected to occur about once every 12 years.

Wildfire

Hot, dry, windy conditions are known as ‘fire weather’ and are the focus of our wildfire attribution studies. In many regions of the world, fire weather conditions are becoming more severe due to climate change.

While individual fires may be caused by natural phenomena like lightning, or by human activity, hot and dry conditions mean that if an ignition does occur, the chances of the fire taking hold and spreading are much higher, and any fires will be much harder to control. This increasing fire risk from changing weather patterns is often compounded by other human activity such as **deforestation**.

2024 was an extremely active year for wildfires, particularly in the Americas, where much of the continent experienced drought conditions and extremely high temperatures that have been worsened by climate change.

In February, after two months of unusually high temperatures, **Chile** experienced the world’s deadliest wildfire since 2009, with 132 people killed and over 1,000 injured. While no significant trend in fire weather conditions was detected in the coastal region studied, six of Chile’s seven most destructive fire seasons **have occurred since 2014**. This underlines the country’s vulnerability to wildfires, and notably, the central role of non-weather factors in driving impacts. Fire risk in the region is known to be increasing due to human activity such as the growth of informal settlements in forest zones, and widespread changes in land use from native plant life to foreign and monoculture plantations.

The Brazilian Pantanal wetland experienced its second worst wildfire season in twenty years, with more than 3.5m hectares burned. The region has been in a years-long drought, with river levels at historic lows and precipitation below the climatological normal. This meant fires were able to take hold in June, much earlier than the fire season would usually begin. Our **study** found that similarly severe early-season fire weather conditions in the Pantanal have been made 4-5 times more likely by anthropogenic climate change. Elsewhere in Brazil, the Amazon rainforest experienced its worst year of wildfires amidst a prolonged drought **made more intense by climate change**.

Western Canada and the US also experienced extreme levels of wildfire activity, with Canada’s 2024 wildfire carbon emissions second only to the unprecedented values recorded in 2023. Our **study of Quebec’s early-season wildfires** in 2023 found that such an intense start to the season was at least seven times more likely due to climate change, primarily because of increased warming and lower humidity in the region. While wildfires are destructive in themselves, they also have a secondary effect. Smoke from the 2024 fires in western Canada and the US impacted air quality across North America and as far away as Europe; **recent research** suggests that the number of people dying as a result of inhalation of smoke from wildfires is increasing due to global heating.

The Brazilian Pantanal is seeing increasingly hot and dry conditions as the climate warms

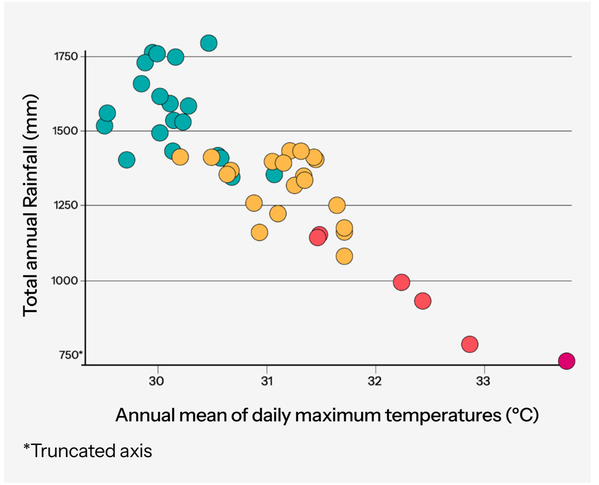


Figure 10: The hot, dry and windy conditions that drove the Brazilian Pantanal wildfires in were 4-5 times more likely due to climate change, with an increase in temperatures and a decrease in rainfall driving the change in risk.

In June, the Pantanal experienced unusually extreme hot, dry and windy conditions that drove wildfire

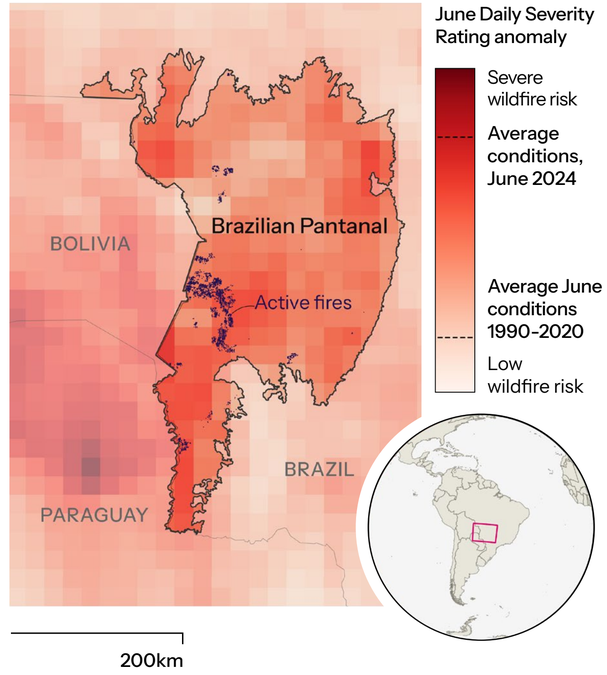


Figure 11: June saw wildfires rip through the Pantanal, with an estimated 440,000 hectares burned, smashing the previous June record of 257,000 hectares, and the June average of 8,300 hectares.

Tropical cyclones

Tropical cyclones, also known as typhoons and hurricanes, are among the deadliest and most damaging natural hazards. In 2024, destructive events occurred around the world, notably in the US and the Philippines.

As the world warms, a greater proportion of the most powerful tropical cyclones are reaching category 3 or above, with **much greater destructive potential**. Hotter oceans are the main driver of increased intensity. Other aspects of tropical cyclones are also changing in different regions, with more storms undergoing rapid intensification, migrating poleward, and moving more slowly over land, often leading to more severe impacts.

Until this year, rapid attribution of tropical cyclones focused on rainfall. In 2024, we devised a new method for rapid attribution using the **Climate Shift Index: Ocean**, which shows how climate change is boosting daily ocean surface temperatures, and the **Imperial College Storm Model**, which shows how climate change is affecting cyclone wind speeds. We also analysed potential intensity, a metric that accounts for the key conditions that allow typhoons to form and intensify: sea surface temperature, sea level pressure, air temperature and air humidity data. This new multi-method approach better captures the complexity of the interaction between climate change and tropical cyclones.

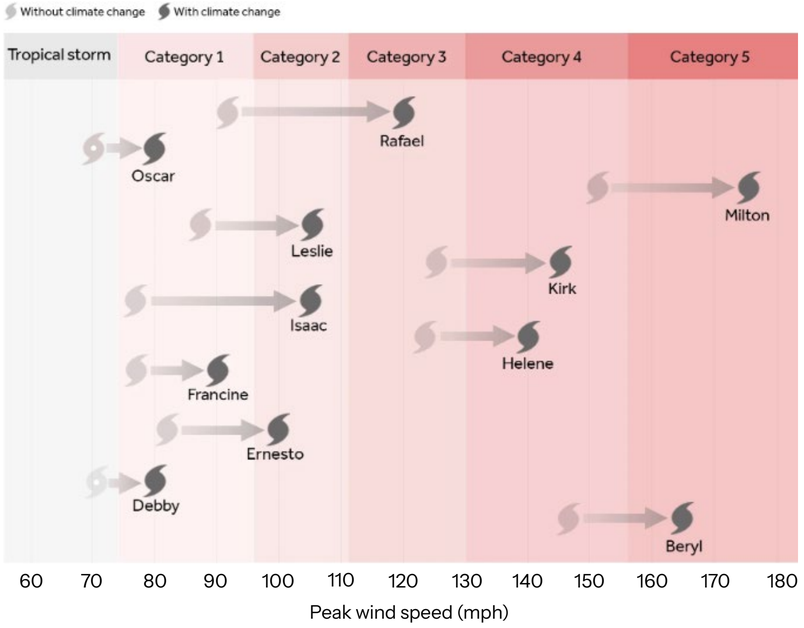
The Western North Pacific is the most active tropical cyclone basin globally and 2024 was no exception. In late July, **Typhoon Gaemi** brought heavy rain and winds to the northern Philippines, Taiwan and China, affecting millions of people and leading to the evacuation of nearly 300,000 in China alone. In Taiwan and Hunan, the rainfall from the storm was amplified by 14% and 9%, respectively, due to human induced climate change, while the wind speeds on landfall in Taiwan were made 4 m/s more intense.

The Philippines experienced a hyperactive late typhoon season. From mid-October to mid-November, six typhoons and a tropical storm affected Luzon island, the country's most populous island. The consecutive storms affected 13 million people and killed more than 160. **Our study** found the likelihood of three or more major typhoons (defined as category 3 or above) making landfall in the Philippines in a given year has increased by about 25% due to human-induced climate change.

In the North Atlantic, Hurricane Beryl was the earliest-forming category 5 hurricane on record. Later in the year, **Hurricane Helene** killed more than 230 people, making it the deadliest hurricane to strike the mainland US since Katrina in 2005. It brought extreme rainfall hundreds of miles inland, affecting communities in the southern Appalachians. Less than two weeks later, **Hurricane Milton** underwent explosive rapid intensification in the Gulf of Mexico, increasing from category 1 to category 5 in only about 24 hours.

Our studies found the rainfall from these two events were made about 10% heavier by climate change, and the winds were about 5-6 m/s faster, while the warm sea surface temperatures that fueled the storms were more than 200 times as likely. A separate analysis by **Climate Central** found that climate change intensified every hurricane in 2024. The wind speeds were increased by 9-28 mph due to the influence of hotter oceans. It is unlikely Beryl and Milton would have become category 5 hurricanes without climate change.

Effective early warning systems that evacuate people into safe shelters have been shown to save thousands of lives, especially from storm surges. When people don't perceive the risk, don't receive or understand warnings, don't have the means to evacuate, or are not safe orcomfortable in the temporary shelters, impacts tend to be higher.



Calculated at the time and location of each storm's peak intensity prior to landfall
Using Climate Shift Index: Ocean data for average sea surface temperatures. Based on NOAA OISST.

Climate Change Fuels Stronger Storms

Change in peak wind speed and storm category due to climate change-driven ocean warming

Figure 12: All eleven hurricanes in 2024 strengthened by 9 to 28 mph during the record-breaking ocean temperatures of the 2024 hurricane season, a Climate Central study found.

The Philippines was hit by five typhoons and a tropical storm within a month

Figure 13: Five typhoons and a tropical storm battered the Philippines in October andNovember within just 23 days. Overall, more than 170 people were killed and 1.4 million displaced.

El Niño

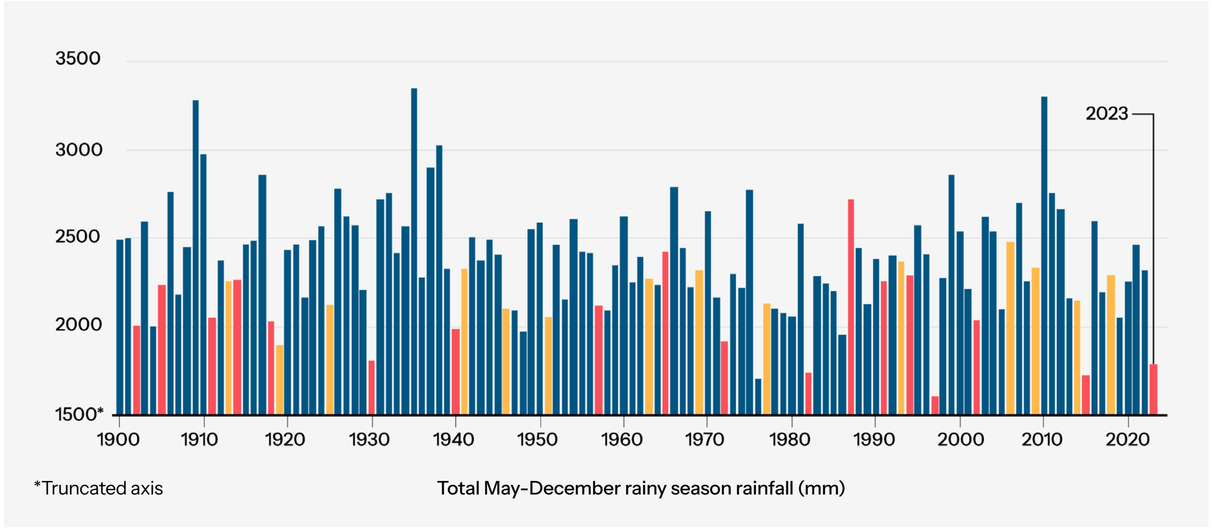
The El Niño Southern Oscillation (ENSO) is a naturally occurring climate phenomenon that affected some extreme weather events in 2024.

In the warmer El Niño phase, the sea surface temperature of the tropical Pacific Ocean increases, resulting in increased global average temperatures and changes to global weather patterns. The influence is greatest in the areas around the Pacific Ocean and in the rest of the tropics. El Niño events typically occur between two and seven years apart and usually last nine to twelve months.

The 2023-24 El Niño was one of the five strongest on record, although it was weaker than the 1997/1998 and 2015/2016 El Niños. Strong El Niño events are associated with record-breaking global temperatures. In the first half of 2024 the strong El Niño contributed to the high global mean surface temperatures, as well as to the magnitude and likelihood of other extreme weather. However, its influence on extreme weather was often over-emphasised as many events were described as 'El Niño driven,' with climate change getting a secondary mention or no mention at all.

Using a newly developed covariate methodology, several World Weather Attribution studies analysed the effect of both climate change and El Niño in conjunction. Most studies found that climate change has a greater influence on extreme weather events than El Niño. For example, in the **Amazon drought**, anthropogenic warming rather than El Niño was found to be the main driver of the exceptional drought. Similarly, studies of the **UAE and Oman floods**, **Brazil floods** and heatwaves in **parts of Asia** found the influence of climate change on these rainfall and heat events was often greater than the influence of El Niño. Exceptions included droughts in **Southern Africa** and **Panama**, where El Niño played a more significant role. The question of whether El Niños are becoming more intense with global warming remains an active **area of research**.

La Niña, the cooler phase of ENSO, is expected **to develop in 2025**. It brings wetter weather, and its arrival is often positively anticipated in regions such as Southern Africa, where it can help alleviate the current drought conditions and improve agricultural outcomes. However, it also brings increased risk of devastating drought in regions of Africa and South America, flooding in other regions of Africa, Asia, and Central America and increased hurricane activity in the Atlantic Ocean.



El Nino is a key driver of low rainfall in Panama. 2023 was one of the driest years on record.

Figure 14: El Niño, rather than climate change, was a key driver of the low rainfall in Panama last year that led to major shipping disruption on the Panama Canal. Since 1900, four of the five driest years in the region have occurred in El Niño years.

Resolutions for 2025

A faster shift away from fossil fuels

The burning of oil, gas and coal are the cause of warming and the primary reason extreme weather is becoming more severe. Last year at COP28, the world finally agreed to ‘transition away from fossil fuels,’ but new oil and gas fields continue to be opened aroundthe world, despite warnings that doing so will result in a long term commitment to more than 1.5°C and therefore costs to people around the world. Extremes will continue to worsen with every fraction of a degree of fossil fuel warming. A rapid move to renewable energy will help make the world a safer, healthier, wealthier and more stable place.

Improvements in early warning

Weather disasters in 2024 highlighted the importance of early warning systems, which are one of the cheapest and most effective ways to minimise fatalities. Warnings need to be targeted, given days ahead of a dangerous weather event, and outline clear instructions on what people need to do. Most extreme weather is well forecast, even in developing nations. Every country needs to implement, test and continually improve early warning systems to ensure people are not in harm’s way.

Real-time reporting of heat deaths

Heatwaves are the deadliest type of extreme weather. However, the dangers of high temperatures are underappreciated and underreported. In April, a hospital in Mali reported a surge in excess deaths as temperatures climbed to nearly 50°C. Reported by local media, the announcement was a rare example of health professionals raising the alarm about the dangers of extreme heat in real-time. Health systems worldwide are stretched, but informing local journalists when emergency departments are overwhelmed is a simple way to alert the public that extreme heat can be deadly.

Finance for developing countries

COP29 recently discussed ways to increase finance for poor countries to help them cope with the impacts of extreme weather. Developing countries are responsible for a small amount of historic carbon emissions, but as our research has highlighted this year, are being hit the hardest by extreme weather. Back-to-back disasters, like the Philippines typhoons, or devastating floods that followed a multi-year drought in East Africa, are cancelling out developmental gains and forcing governments to reach deeper and deeper into their pockets to respond and recover from extreme weather. Ensuring developing countries have the means to invest in adaptation will protect lives and livelihoods, and create a stabler and more equitable world.

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