

Counting The Cost: A Year of Climate Breakdown

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Executive summary

Extreme weather hit every populated continent in 2018, killing, injuring and displacing millions, and causing major economic damage. Throughout the year, and across the world, droughts, floods, fires, heatwaves, typhoons and hurricanes have made the news and captured public attention.

This report identifies 10 of the most destructive weather events of 2018, each of which caused damage of over US\$1 billion. Four of the events cost more than \$7 billion each. These figures are likely to be underestimates: in some cases they show only insured losses and do not take into account the costs of lost productivity and uninsured losses.

In many developing countries the human cost of climate change to vulnerable communities is much higher than the financial cost, and there are many slow-onset droughts, weather change and sea encroachment that are progressively and devastatingly impacting millions of people worldwide. However, this report focuses on the high impact events of the year as they present the dramatic impacts across countries, rich and poor.

10 of the most expensive climate-change driven weather events of 2018

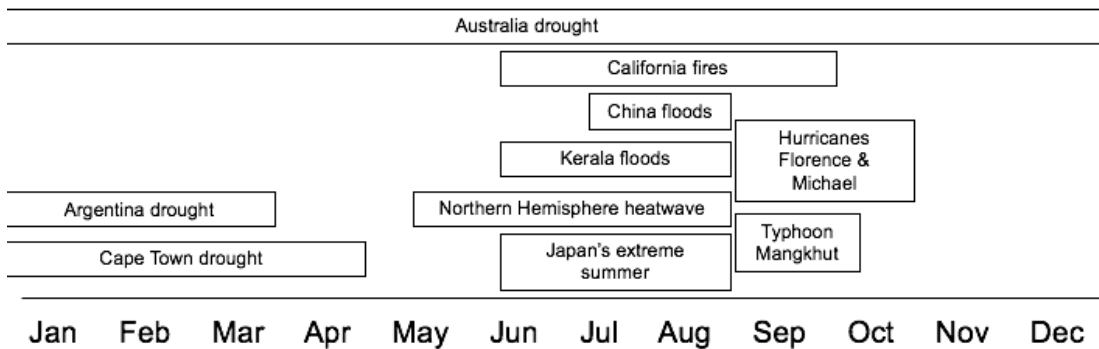
Event	Estimated cost (US\$)
US - Hurricanes Florence & Michael	\$17 billion (Florence) \$15 billion (Michael)
California, US – fires	\$7.5-10 billion (Camp Fire) \$1.5-3 billion (Woolsey Fire)
Europe – drought	\$7.5 billion
Japan – floods	\$7 billion (June-July floods) \$2.3-\$5.5 (Typhoon Jebi)
Argentina – drought	\$6 billion
China – floods	\$3.9 billion (July floods) \$5.4 billion (Tropical Storm Rumbia floods)
Australia – drought	\$5.8-9 billion

Kerala, India – floods	\$3.7 billion
Cape Town, South Africa – drought	\$1.2 billion
Philippines & China - Typhoon Mangkhut	\$1-2 billion

All of these disasters are linked with human-caused climate change. In some cases scientific studies have shown that climate change made the particular event more likely or stronger, for example with warmer oceans supercharging tropical storms. In other cases, the event was the result of shifts in weather patterns - like higher temperatures and reduced rainfall that made fires more likely - that are themselves consequences of climate change.

2018 was the fourth-hottest year on record, with average global temperatures nearly 1°C above the pre-industrial average.¹ The warming trend is clear, with the last four years the hottest on record, and matches scientific projections of the results of human emissions of greenhouse gases.² This report highlights some of the disastrous consequences of this warming that are already striking.

10 climate-change related weather disasters of 2018



Climate Costs

Argentina: Drought

Below-average rainfall for several months, from late 2017 to April 2018, tipped Argentina into severe drought. Rainfall in parts of the country was less than 50% of normal from December to February and down to 25% of normal levels in March.³ It was reportedly the country's worst drought in 50 years.⁴

The effects of the drought on agriculture caused significant economic problems in Argentina. The soybean harvest was 31% down on the previous year and corn production was 20% down.⁵ The two crops together make up 37% of Argentina's exports.⁶ The lost production cost Argentina \$6 billion,⁷ and the economy contracted 2.7% from March to April,⁸ helping tip the country into recession.⁹

While the world's food systems were able to make up for the poor harvest in Argentina, further climate change will increase the risk that extreme events, such as floods, droughts, heatwaves and fires, could significantly reduce food production across the globe, at the same time. A report by Lloyd's of London warned that climate change increases the chances of the combination of extreme weather events in different food-growing areas, which could lead to global shortages.¹⁰

Cape Town, South Africa: Drought

At the start of 2018 Cape Town faced the worst drought in recorded history¹¹ and came close to being the world's first major city where the taps ran dry. Residents and businesses were hit with extreme water restrictions in efforts to avoid "Day Zero", when authorities planned to shut off the water supply to 75% of the city, leaving residents only able to get 25 litres a day from 200 designated water points protected by armed soldiers (for comparison, the average American uses about 400 litres of water a day; this excludes "virtual water" used to produce food and consumer goods¹²). With wide-ranging water-saving measures that aimed to restrict water usage to 50 litres a day, like showering over a bucket to catch water for toilet flushes, the city was able to cut its water consumption enough to avoid Day Zero hitting before the rains returned. The drought cost the country at least \$1.2 billion, according to AON.¹³

The drought was the result of three consecutive years of low rainfall - a rare multi-year drought event that would normally only occur less than once every 1000 years. Climate change made the drought three times as likely to happen, according to a scientific study published in July.¹⁴ The scientists found that future emissions, and

rising global temperatures, would make a similar drought even more likely.

Eastern Australia: Drought

Eastern Australia spent 2018 in an exceptional drought, which has been developing since 2012, and was particularly intense this year. Rainfall in the Murray-Darling Basin, which covers much of southeast Australia was among the lowest on record for the first nine months of the year, while temperatures were hotter than average - New South Wales had its warmest January to November on record¹⁵ and the entire state was in drought by mid-August¹⁶. The low rainfall and high temperatures also extended the fire season. This is only the second time since 1900 that such dry conditions have persisted for two years across the Murray-Darling Basin.¹⁷

The cost of the drought to the Australian economy could be between US\$5.8-9 billion, according to the Commonwealth Bank.¹⁸ The country's wheat crop is expected to be the lowest in a decade; in New South Wales it will be the lowest since 1995.¹⁹ With animal feed increasingly expensive, farmers have slaughtered more cattle and cut the size of their herds to a record low.²⁰

The drought reflects long-term trends that are caused by human-caused greenhouse gases. Rainfall in southeastern Australia has fallen 15-25% over recent decades, while rising temperatures have increased evaporation and made more rain fall in short, heavy downpours. Continued emissions will lead to increasingly severe droughts in Australia, according to scientific projections.²¹

Northern Hemisphere: Heatwave, drought and fires

Summer 2018 broke records across the Northern Hemisphere. It was among the hottest summer on record in many countries, including the Czech Republic,²² England,²³ Japan²⁴ and Sweden.²⁵ Top temperatures broke records in many places, particularly in northern Europe where some records were exceeded by several degrees Celsius.²⁶ Parts of southern California also faced record heat.²⁷ As well as hot daytimes, it also stayed hot at night, with records broken for minimum night-time temperatures; a town in Oman set a new world record with a night-time low of 42.6°C.²⁸

The summer's extreme weather killed many people. While it will be some time before final figures are available initial estimates of increased deaths during the heat include nearly 1,500 people in France,²⁹ 250 in Denmark,³⁰ 70 in Canada,³¹ 42 in South Korea³² and 23 in Catalonia, Spain.³³ The heatwave and dry conditions also

set off fires, including in Greece, where 99 people were killed,³⁴ and as far north as the Arctic Circle.³⁵ Drought in Northern and Central Europe cost insurers at least \$7.5 billion, according to AON.³⁶ Higher fuel prices from disruption caused by drought on the Rhine have cost German drivers at least €650 million in higher diesel prices, according to Wood Mackenzie, and forced major manufacturers to shut down production.

Climate change made the heatwave more likely to happen. In the UK, the heatwave was 30 times more likely as a result of human-caused warming, according to analysis by the Met Office.³⁷ A separate scientific study, published in late July,³⁸ showed that human emissions increased the chances of the European heatwave occurring by a factor of between two and five. This result matches other scientific projections, which find that heatwaves will become more severe and frequent, with more record hot days and nights, if emissions continue to increase.³⁹

Kerala, India: Floods

Heavy monsoon rain led to the worst flooding in the Indian state of Kerala for more than 80 years. After above-average rain in June and July the state received more than 2.5 times its normal rainfall during the first half of August. In mid-August some areas in the state received 60cm of rain over just three days.⁴⁰

The flooding that resulted from the intense rainfall killed about 500 people⁴¹ and forced more than a million people into camps.⁴² More than 10,000 houses were destroyed, with about 100,000 damaged, and 83,000km of roads also damaged. Repairing the damage will cost \$3.7 billion, according to state's Chief Minister.⁴³

The Kerala floods are an example of one of the consequences of continued greenhouse gas emissions. As the planet's atmosphere warms it can hold more water, which means heavy rainfall will become more common. Projections of future climate change have shown that, unless emissions fall rapidly, floods will become increasingly frequent in many parts of the world, including in India.⁴⁴

Japan: Summer of extremes

Among the countries hit by the summer heatwave, Japan's experience was particularly severe. More than 30,000 people were admitted to hospital for heatstroke in August - a national record⁴⁵ - and 105 heatstroke deaths were recorded in Tokyo alone.⁴⁶ The heatwave came just after record-breaking torrential rain and landslides killed at least 230 people and destroyed thousands of

homes, in June and July.⁴⁷ The cost of the flooding has been estimated at \$7 billion.⁴⁸

Japanese scientists have linked the summer's extreme heat with climate change. The heatwave could not have happened without human-caused global warming, according to research by the University of Tokyo and the Meteorological Research Institute at the Japan Meteorological Agency.⁴⁹ Further warming could lead to similar heatwaves striking every year, according to researchers at the University of Tokyo.⁵⁰

In August, Typhoon Jebi, the most powerful storm to hit the country for 25 years, caused widespread destruction and killed 11 people. Kansai Airport at Osaka was flooded and cut off from the mainland when a tanker was swept into a bridge, stranding thousands of people. The cost to insurers has been estimated as between \$2.3 billion and \$5.5 billion.⁵¹

California, US: Wildfires

The Camp Fire, in November 2018, was the deadliest and most destructive in California's history, and the deadliest in the entire country for nearly 90 years. It killed at least 85 people and destroyed about 14,000 homes, including almost the entire town of Paradise.⁵² The fire is estimated to have caused \$7.5-\$10 billion worth of damage.⁵³ A California insurance company, Merced, which was founded in 1906, was forced into liquidation by its liabilities from the fire.⁵⁴

The Camp Fire was just one of several major fires in California this year; others included the Mendocino Complex Fire, which was the largest in the state's history,⁵⁵ and the Woolsey Fire, which caused further damage worth \$1.5-\$3 billion.⁵⁶

Scientists have shown that human-caused climate change has increased wildfires in the western US.⁵⁷ Climate change has made forests in the region hotter and drier, which has increased the chance of fires. The amount of area that has burned in the western US has nearly doubled in the last 30 years because of human greenhouse gas emissions. These trends were a factor behind the fires this year: the Camp Fire would not have occurred if it had not been for the below-average rainfall this year, which reflects changes to the climate over recent decades.⁵⁸

China: Floods

China was hit by severe flooding across the country in July and August, brought on by extreme rainfall. In early July, authorities declared a state of emergency and at least 15 people⁵⁹ were killed by floods and landslides.⁶⁰ The cost of the damage was estimated at about \$3.9 billion.⁶¹

In the northwest Xinjiang Uygur Autonomous Region, rainfall more than doubled the previous record, with 11cm falling in just one hour in late July. The resulting flood was more than three times the level expected in a one-in-300-year flood,⁶² and 20 were reported killed.⁶³

In late August, flooding from Tropical Storm Rumbia killed 31 people in eastern China.⁶⁴ The damage from the storm was estimated at about \$5.4 billion.⁶⁵ Among the areas affected was the city of Shouguang, China's biggest producer of vegetables.⁶⁶

A warmer atmosphere holds more water so global warming generally leads to more heavy rain and flooding. China's eastern and coastal areas are vulnerable to increased flood risk, according to climate change projections. As these are densely populated and economically important, the flooding would mean the country would lose \$389 billion over 20 years if it fails to adapt to increased flooding that would be caused by climate change, more than any other country, according to a recent study.⁶⁷

Philippines & China: Typhoon Mangkhut

One of the strongest storms of recent years hit the Philippines and south China in September. Typhoon Mangkhut had gusts of up to 330km/h and was the equivalent of a category five hurricane.⁶⁸

The typhoon killed 127 people in the Philippines⁶⁹ and six people in China,⁷⁰ and destroyed 10,000 homes.⁷¹ The cost of the damage to insurers was between \$1-2 billion, according to AIR, mostly from damage in China and Hong Kong.⁷² The damage to agriculture and infrastructure in the Philippines was estimated to have cost about \$644 million.⁷³ Christian Aid is working with partners in the Philippines to support families affected by the typhoon in hard-to-reach and remote areas.

Storms like Typhoon Mangkhut are made more destructive by climate change. Warmer atmospheres and seas increase wind speeds and rainfall levels;⁷⁴ oceans are becoming steadily hotter, with global ocean heat content in recent years regularly breaking records.⁷⁵ Rising sea levels also mean that storm surges from tropical storms will cause increasing damage. Storms hitting the Northwest Pacific have increased in frequency and intensity over the

last four decades, and storms in the region could increase in intensity by another 14% by the end of the century, with devastating impacts.⁷⁶

US, Central America and Caribbean: Hurricanes Florence & Michael

The 2018 hurricane season in the north Atlantic was above average in the number of hurricanes that formed and the overall strength of the storms.⁷⁷ It also included two of the most destructive hurricanes in US history.

Hurricane Florence brought record rainfall in the Carolinas when it struck in September. The hurricane stalled over land, meaning the rainfall was particularly severe, with some places receiving more than 90cm of rain. This made Florence the third-wettest storm on record in the US (all of the top three have happened since 2016).⁷⁸ At least 51 people were killed by the storm⁷⁹ and the damage in North Carolina cost \$17 billion, according to the state's governor.⁸⁰

Hurricane Michael was the strongest storm ever to hit the Florida Panhandle, with winds reaching about 250 km/h and was the fourth-strongest storm on record in the US.⁸¹ The storm killed 45 in the US⁸² and at least 13 in Honduras, Nicaragua and El Salvador, while also causing damage in Cuba.⁸³ Damage from the storm were expected to cost at least \$15 billion, according to AON.⁸⁴

Human greenhouse gas emissions worsened these hurricanes. Climate change increased by 50% the heaviest rainfall during Hurricane Florence and made the storm 80km larger, according to a scientific study published before it had even made landfall.⁸⁵ Sea-level rise, caused by climate change, also increased the number of homes hit by Florence by 11,000.⁸⁶ Previous studies have shown that climate change also increases the frequency of the most powerful Atlantic hurricanes.⁸⁷

Conclusion

Despite the severity of the extreme weather that struck the world, 2018 is unlikely to be exceptional. In fact, it may soon seem a mild year. Rising temperatures mean that existing temperature records will almost certainly soon be broken. Projections that 2019 will see an El Niño,⁸⁸ - a natural weather phenomenon that temporarily increases global temperatures - means that next year is likely to be even hotter.

The disasters in this report are not normal: they were worsened or made more likely by climate change, or both. But neither are they the new normal. There will not be any new normal as long as greenhouse gas emissions continue to push up global temperatures - extreme weather events will constantly become increasingly common and more extreme.

The report by the UN's Intergovernmental Panel on Climate Change, published in October 2018, showed that the only way to prevent the escalation of extreme weather is to immediately rapidly cut greenhouse gas emissions.⁸⁹ Overall global emissions must reach zero - meaning human activities absorb as much greenhouse gases as they release - by the middle of the century if the world is to limit warming to 1.5°C, a target set in the 2015 Paris Agreement.

Despite these warnings and the experience of climate change, greenhouse gas emissions are rising. After emissions in 2017 were the highest in human history,⁹⁰ it is likely that 2018 emissions will again break the record.⁹¹ Current plans for controlling emissions put the world on course for catastrophic warming by the end of the century, with the planet heating three to five times as much as it has already. The fires, storms, heatwaves, floods and droughts of 2018 would seem insignificant in comparison, with the poorest and most vulnerable communities across the world at the forefront of these disasters.

Unless governments worldwide increase their ambition and work to cut emissions, the world will fail to prevent this disaster. Each country must take their fair share of that global action with wealthier countries supporting the global shift to net-zero emissions through finance and technology, so that less developed countries come out of poverty in a low-carbon and sustainable way. Next year will be crucial - countries must start increasing their emission-cutting pledges under the Paris Agreement, ahead of the 2020 global review, if the world is to build momentum to stop events like those of 2018 becoming ever more common and extreme.

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