



Carbon Brief' s 6th Update of Global Heating Attribution Studies

Risk Frontiers Scientists

Cover image source: Tom Wang / Alamy

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Attribution is a term used to describe the science of determining the role of global heating in extreme weather events. In its early days more than a decade ago, relatively subtle influences were detected, and it (climate change) was commonly thought of as something that would have an impact in the distant future. Now, with almost 750 cases having been compiled (Carbon Brief, 2024), the effects of global heating are commonly very large and obvious to the general public.

The 744 attribution studies collated by Carbon Brief used weather data to compare extreme events in today's heated climate with the same events in computer models of the climate that existed before large-scale fossil fuel burning. This comparison allows the scientists to calculate how much more likely and severe the extreme event was today, revealing the role of human-caused global heating in increasing the likelihood and severity of the event.

The Carbon Brief (2024) interactive map provides information on individual events, such as the Australian bushfires of 2019-2020 (van Oldenborgh, 2021), and trends of how extremes are changing, such as a 2020 study into marine heatwaves over the past four decades (Laufkötter et al., 2020). Where a single study covers multiple events or locations, these have been separated out into individual entries on the map (where possible).

Carbon Brief (2024) has recently issued the 6th update of its map, shown in Figure 1. In total, studies calculating the role of the climate crisis in what are now unnatural disasters show 550 heatwaves, floods, storms, droughts and wildfires have been made significantly more severe or more frequent by global heating. A further 9% were made less likely, as would be expected as these were mostly extreme cold and snow events. The rest found either no discernible influence of global heating or were inconclusive, in part due to lack of sufficient data. The analysis includes studies published up to the end of September 2024.

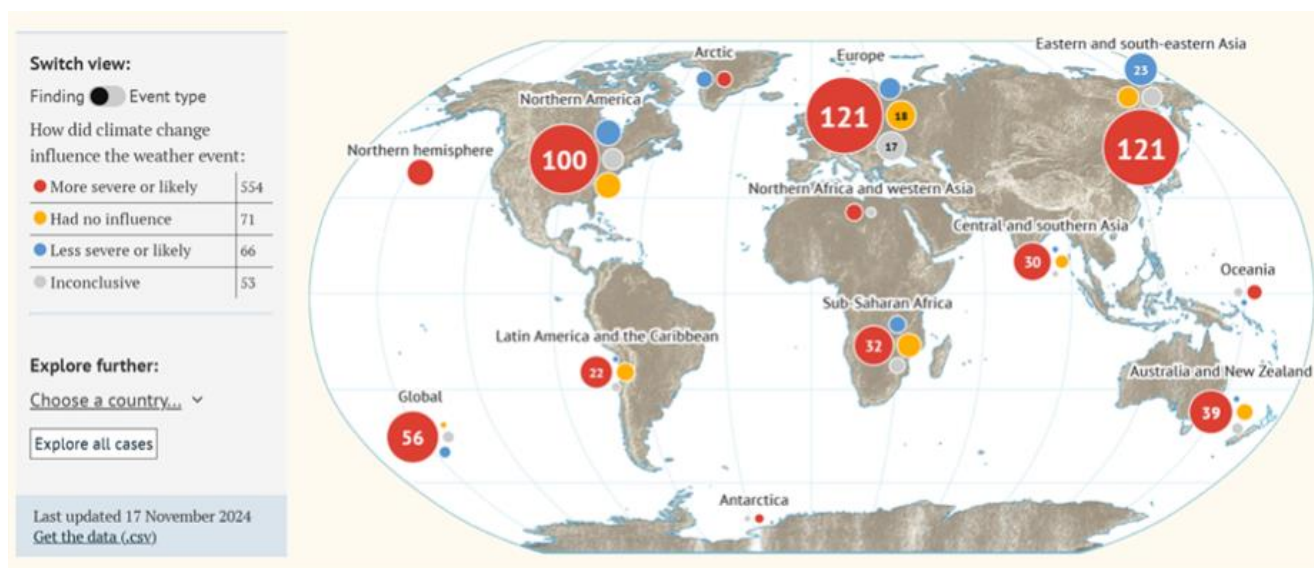


Figure 1. Carbon Brief map of 735 extreme events from 612 studies showing the influence of global heating on the weather event. Source: Carbon Brief, 2024.

Major parts of the world outside Europe, North America and China, have been little studied by attribution scientists, leaving the true impacts of the climate crisis underreported. Issues include lack of long-term weather data and scientific capacity. There are especially few in the Middle East and North Africa, despite these regions having among the greatest impacts.

“Previously Impossible” Events

Carbon Brief (2024) states that at least 24 “previously impossible” heatwaves have struck communities across the planet, providing evidence of the growing severity of human-caused global heating events. “Previously impossible” events are those with a vanishingly low probability of happening without human-caused global heating. The “impossible heatwaves” have taken lives across North America, Europe and Asia, with scientific analyses showing that they would have had virtually no chance of happening without the extra heat trapped by fossil fuel emissions.

The earliest recorded “impossible” heatwaves were in 2016, when the temperature of the entire planet could not have occurred without global heating. The oceans have also suffered, with impossible marine heatwaves striking the Tasman Sea, north-east Pacific and Arctic Ocean in recent years.

Consequences

Further studies have assessed how much worse global heating has made the consequences of extreme weather. This assessment has shown that millions of people, and many thousands of newborn babies, would not have died prematurely without the extra human-caused heat. One study of heat-related deaths in summer from 1991-2018 found a deadly impact of global heating in the 43 countries assessed. Extrapolating these findings to a global figure is not straightforward, but an approximate estimate given by Carbon Brief is more than 100,000 deaths a year. Over the two decades, that implies a toll of millions of lives due to global heating.

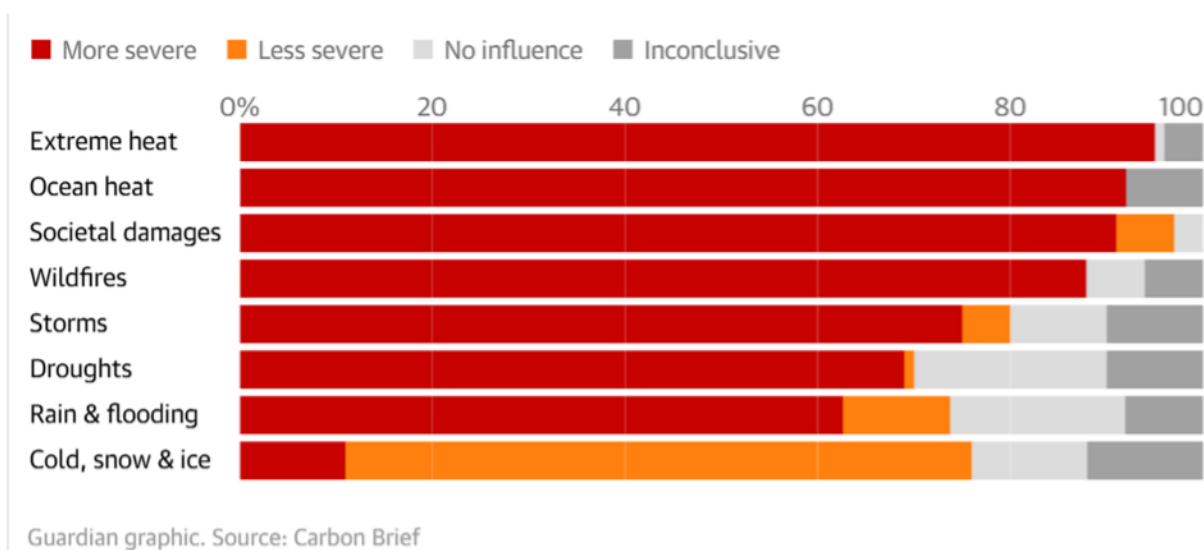


Figure 2. Percentage of attribution studies that found a strong link to global heating for a range of types of extreme weather. Source: The Guardian (2024) using data from Carbon Brief (2024).

Carbon Brief (2024) state that the burning of fossil fuels has changed the climate so much that heatwaves are hitting communities with a severity and frequency never seen during the entire development of human civilisation over the past 5,000 years, causing conditions in which cities, hospitals, roads and farms are unprepared.

Global heating has driven up the costs of hurricane destruction by billions of dollars, such as in Hurricane Sandy in the United States in 2012 and Typhoon Hagabis in Japan in 2019. Four major floods in the United Kingdom would have caused only half the \$18bn of damaged buildings were it not for human-caused global heating (Carbon Brief, 2024).

These attribution studies have examined the impacts resulting from about 1.3C of global heating to date. Carbon Brief (2024) state that the prospect of heating by 2.5C to 3.0C, which is the current trend, may be catastrophic, and they urge deep and rapid cuts to carbon emissions and to fund the protection desperately needed by many communities against now-inevitable climate disasters.

REFERENCES

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