

# ATTRIBUTION SCIENCE: EXTREME WEATHER & CLIMATE CHANGE

## *How Climate Change Shapes Weather*

### What is weather attribution science?

How do we know that increasingly extreme weather events are influenced by human-caused climate change? There is a whole field of study devoted to answering this question: attribution science. Attribution science is the science that determines how today's extreme weather events can be linked – or attributed – to climate change. Attribution scientists do this by using computer models to simulate our world without carbon pollution and then comparing that to today's climate conditions and weather events. Think of it as comparing our world as it exists to an alternate reality or imaginary world without carbon pollution.<sup>1</sup>

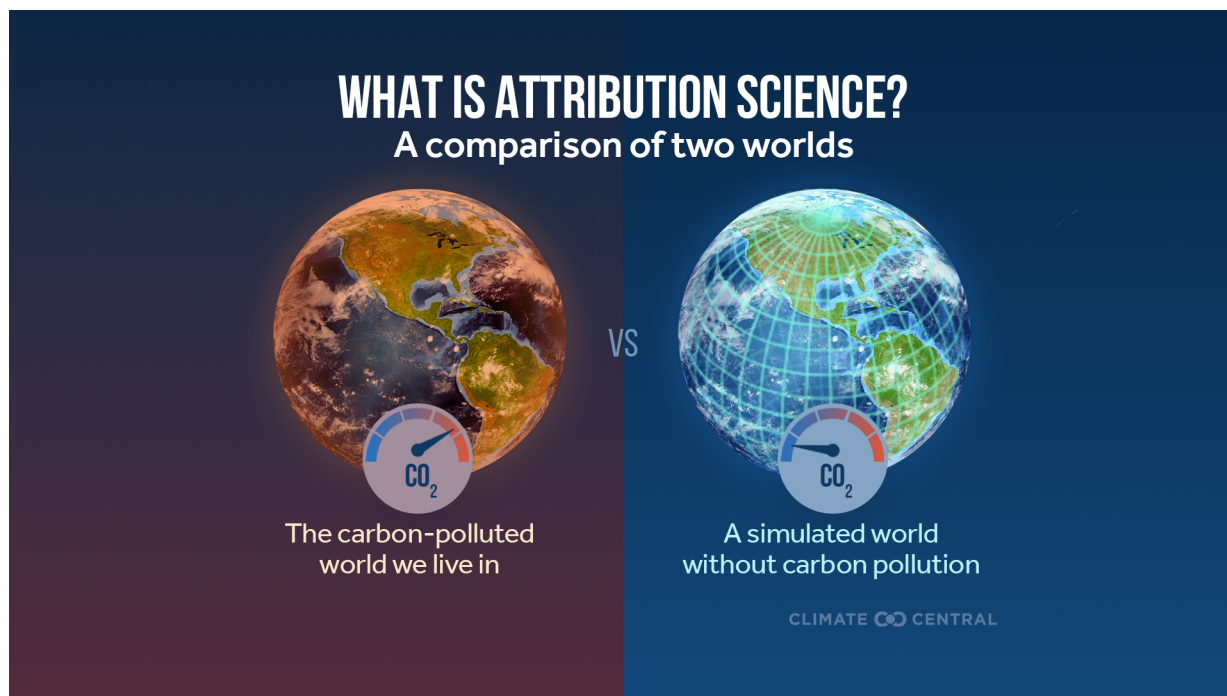


Figure 1: [Climate Central](#)

### Why is attribution science important?

Attribution science is a growing field that is becoming more precise all the time. It is important because the more people understand about how climate change is influencing extreme weather events, the more they can do the following:

- Better prepare for natural disasters
- Make strategic decisions about where to live
- Plan infrastructure to withstand the impacts of extreme weather events
- Develop and implement policies to help us mitigate and adapt to climate change
- Promote awareness of climate change and its impacts on us today
- Motivate others to take action

<sup>1</sup>To learn more about how scientists use computer models to compare our world to a simulated world without fossil fuel emissions, check out Above the Noise's video, [Does Climate Change Cause Extreme Weather?](#)

### Does attribution science show us that climate change affects extreme weather events?

Yes! While many factors can contribute to the occurrence of an extreme weather event, extreme weather attribution science shows us that human-caused climate change creates conditions that make extreme weather events more likely, and more severe. For example...

#### Extreme Heat

Attribution science tells us with high scientific confidence that human-caused climate change has a significant influence on extreme heat events. Humans have been keeping records of temperature for many years, so there is a wealth of data that attribution scientists can use in their models. With so much data, attribution scientists can more accurately compare today's extreme heat events to what those extreme heat events would have been in the absence of human-caused climate change.

The factors that contribute to the occurrence of an extreme heat event are fairly straightforward, as well: we know that when we burn fossil fuels, heat-trapping gases are released, and the temperature of the planet rises. Any naturally occurring extreme heat event is exacerbated by the presence of greenhouse gases in the atmosphere. But attribution science doesn't just tell us that extreme heat in general is significantly affected by climate change – it can also tell us how much worse, or how much more likely, an extreme heat event was because of human-caused climate change.

For example, in March 2026, a record-breaking heatwave impacted much of the western United States, with temperatures reaching over 110°F in California and Arizona. Scientists analyzed the event using a tool called the Climate Shift Index, which quantifies the impact of climate change on local daily temperatures around the world. For many of the major western cities, they determined that climate change made the extreme heat at least 5 times more likely – an "exceptional climate-influenced event" that affected millions of people.<sup>2</sup>

Extreme heat is the leading cause of weather-related deaths in the United States,<sup>3</sup> and heat-related mortality rates have increased dramatically since 2016.<sup>4</sup> It is important to understand the role that human-caused climate change plays in influencing heat waves so that we can better anticipate and prepare for heat waves of increasing frequency and severity.



Figure 2: Credit Ketut Subiyanto

<sup>2</sup><https://www.climatecentral.org/climate-shift-index-alert/March-record-breaking-western-heatwave>

<sup>3</sup><https://www.epa.gov/climatechange-science/extreme-heat>

<sup>4</sup><https://jamanetwork.com/journals/jama/fullarticle/2822854>

### Wildfires

There is less scientific confidence in attribution science that any single wildfire is caused by climate change because there are so many factors that contribute to the occurrence of a wildfire. For many years, humans managed fires by not letting them happen at all, which has led to the buildup of vegetation (wildfire fuel!), and many fires are started by humans directly for reasons that have nothing to do with climate change.

However, we *do* know that hotter weather, increased drought, and increased frequency of lightning strikes – circumstances that *are* attributable to human-caused climate change – are all conditions that give rise to more frequent and more intense wildfires.<sup>5</sup> Take, for example, the Palisades and Eaton Fires in Los Angeles in 2025. Climate models show that climate change increased the length and intensity of the drought that preceded the fires. In addition to drying up more vegetation, this also meant that the dry season overlapped with the windy season in Los Angeles. Climate scientists therefore concluded that there was a high confidence that human-caused climate change increased the likelihood and severity of these two fires.<sup>6</sup>



Figure 3: Credit Matt Palmer

### Hurricanes

Attribution science is also more complicated when it comes to hurricanes. There is much more natural variability in hurricanes, which makes it more difficult for attribution models to disentangle how much a storm was influenced by human-caused climate change, versus how much can just be attributed to natural changes in weather and climate.

Like with wildfires, though, we can attribute the growing intensity of hurricanes to human-caused climate change. We know that climate change is increasing air temperatures, and we also know that warmer air can hold more moisture, which means more precipitation. In fact, for every one degree Celsius (1.8 degrees Fahrenheit) increase in temperature, the atmosphere can hold 7% more moisture.<sup>7</sup> This makes hurricanes increasingly devastating.

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<sup>5</sup><https://www.noaa.gov/noaa-wildfire/wildfire-climate-connection>

<sup>6</sup><https://www.worldweatherattribution.org/climate-change-increased-the-likelihood-of-wildfire-disaster-in-highly-exposed-los-angeles-area/>

<sup>7</sup><https://yaleclimateconnections.org/2021/04/global-warming-is-delivering-heavier-downpours/>

Additionally, warmer oceans provide more "fuel" for storms. Like with air temperatures, scientists can measure temperatures on the surface of the ocean and use attribution models to calculate how much climate change increases (or decreases) a hurricane's wind speeds. In fact, Climate Central estimated that top wind speeds during Hurricane Melissa, which hit Jamaica in October 2025, were about 10mph faster than they would have been in the absence of climate change. Climate Central also found that human-caused climate change made it up to 700 times more likely for the water to be as warm as it was, which supercharged the storm.<sup>8</sup>



Figure 4: Credit CHUYN / Getty Images

### Flooding

The attribution science that shows how human-caused climate change can make hurricanes more likely applies to other rain events, as well. In its analysis of the July 4th, 2025 floods in Central Texas, Climate Central determined that climate change influenced the flooding. The warmer atmosphere held more moisture, which made it possible for the storm to drop as much as 20 inches of rain in Central Texas, which swelled rivers and caused devastating flash floods.<sup>9</sup>



Figure 5: Credit Chris Gallagher

<sup>8</sup><https://www.climatecentral.org/tropical-cyclones/melissa-2025>

<sup>9</sup><https://www.climatecentral.org/climate-shift-index-alert/texas-us-floods>

In addition to human-caused climate change leading to more intense and frequent rainfall, there is strong evidence that climate change influences flooding in coastal communities due to sea level rise. Yale Climate Connections states: Sea level rise is primarily caused by two factors, and global warming is responsible for both. The first way that global warming causes sea level rise is through melting ice sheets. Antarctica and Greenland alone store over 68% of all the fresh water on Earth in their ice sheets. The second way is through the thermal expansion of water: When water heats up, it takes up more space. Because of sea level rise, coastal communities increasingly face flooding during high tides. It also makes storm surge higher and more dangerous during hurricanes.<sup>10</sup>

### Drought

Droughts, like hurricanes, are quite variable, which makes it harder for attribution scientists to measure the impact of climate change on droughts. What we do understand with certainty, though, is that hotter air temperatures lead to drier soil, because water evaporates more when air temperatures are higher. Hotter air temperatures also intensify droughts, making them hotter and drier than they would otherwise have been.<sup>11</sup> The more scientists observe drought happening alongside increasing temperature, the more confident they can be in attributing drought to climate change. Sometimes, scientists determine that drought conditions would not be present at all, were it not for human-caused climate change, as in the case of the multi-year droughts in Syria, Iraq, and Iran.<sup>12</sup>



Figure 6: Credit King Ho

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<sup>10</sup><https://yaleclimateconnections.org/2024/08/sea-level-rise-explained/>

<sup>11</sup><https://yaleclimateconnections.org/2023/05/climate-change-and-droughts-whats-the-connection/>

<sup>12</sup><https://yaleclimateconnections.org/2025/12/six-photos-show-how-climate-change-shaped-our-world-in-2025/>

Does the American public believe that global warming affects extreme weather?

Think global warming is affecting...

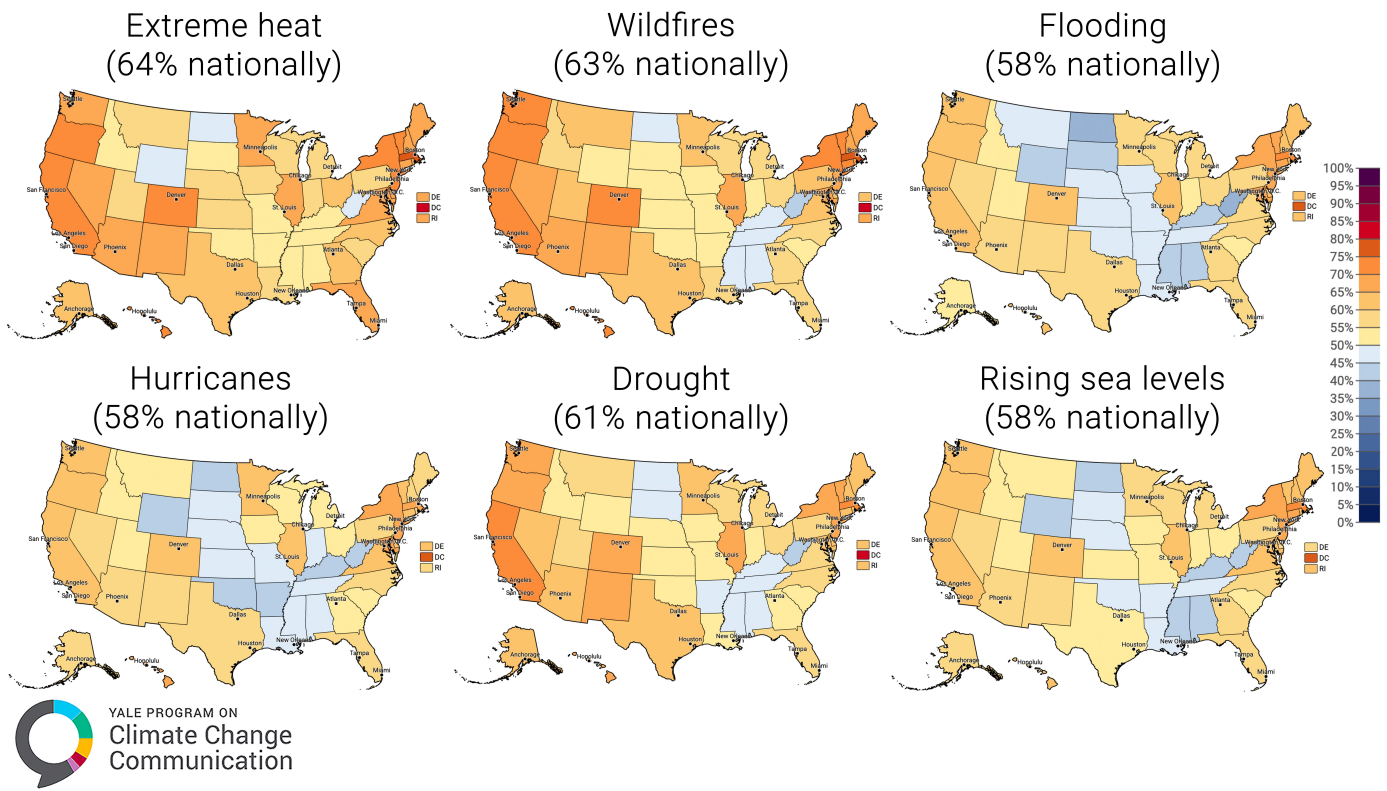


Figure 7. The belief that global warming is affecting extreme weather events varies across geography and extreme weather events. [[Explore the maps](#)]

Research from the Yale Program on Climate Change Communication shows that, in 2024, the majority of Americans believe that global warming is affecting extreme weather events, from extreme heat to hurricanes. These beliefs about climate change attribution, however, vary across the country. What trends do you notice about how Americans attribute climate change to extreme weather events?

- Americans tend to attribute temperature-related events (extreme heat, wildfire, drought) to climate change more than moisture-related events (flooding, hurricanes, rising sea levels).
- Americans living on the East or West Coast are often more likely to attribute extreme weather events to climate change. Americans living in the middle of the country are often less likely to attribute extreme weather events to climate change.
- [Learn more!](#)

Gaps in public knowledge around climate change attribution to extreme weather events

The majority of Americans attribute extreme weather events to climate change. There are many Americans, however, who do not understand that climate change is impacting extreme weather events. As of 2024, 72% of Americans believe that global warming is happening, but only 64% of Americans believe that climate change is causing extreme heat events, for example. This demonstrates a gap in public understanding of how climate change works and how it is impacting us today.

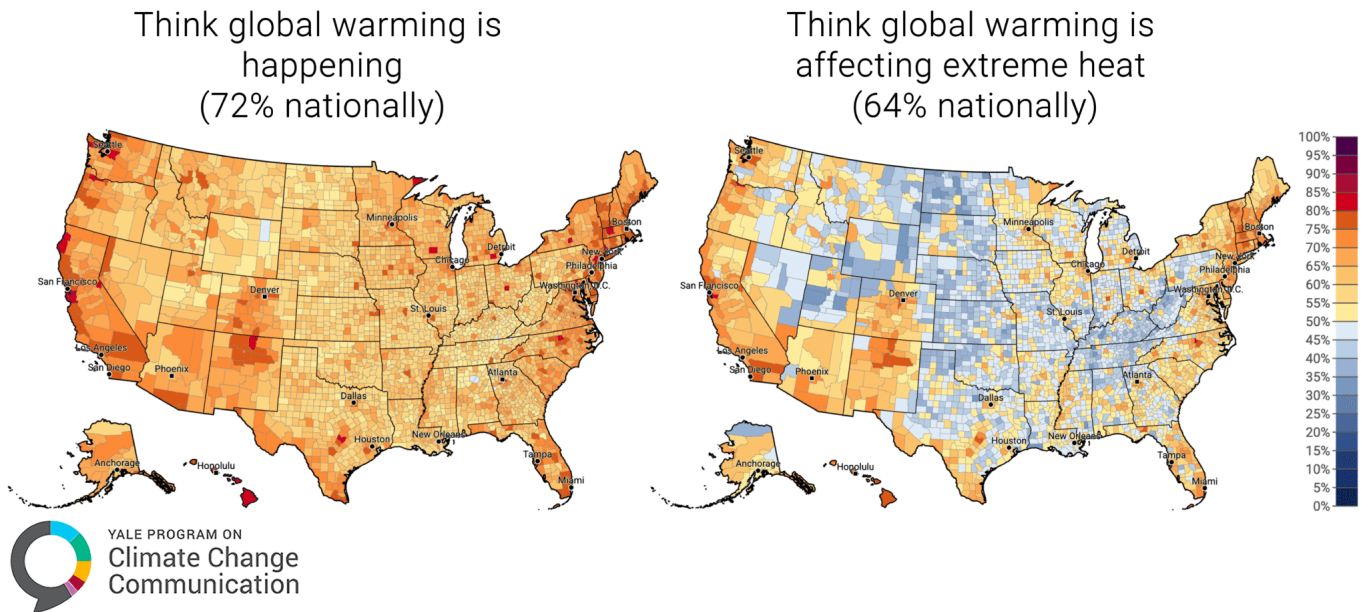


Figure 8. In 2024, 72% of Americans think that global warming is happening, but only 64% of Americans think that it is affecting extreme heat. [[Explore the maps](#)]

There is also a gap in attribution of climate change to extreme weather events between the American public and scientists. According to the IPCC, scientists believe there is a 99%-100% probability that climate change is causing more extreme heat,<sup>14</sup> yet only 64% of Americans believe that climate change is affecting extreme heat in the U.S.

Why is it important to understand public opinion on climate change and extreme weather?

Research shows that many people continue to perceive climate change as distant in time and space, not something that is having an impact on them or their communities in the here and now. This misperception leads many to consider climate change as a low priority concern. However, as global temperatures continue to rise, heat waves, hurricanes, and other extreme weather events are becoming more frequent and severe.

YPCCC's research shows that extreme weather events provide critical "teachable moments" when public, media, and policymaker attention focuses on disasters that often have a direct link to climate change. Communicating how climate change is making these extreme weather events worse can increase public understanding of climate risks, even across political parties. Communicating the connection helps raise the visibility of climate change as an urgent issue that needs to be addressed, and increases public demands for climate action.

<sup>14</sup>[https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC\\_AR6\\_SYR\\_SPM.pdf](https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf)

### More resources on climate attribution science:

- [Climate Central](#)
- [Columbia Climate School](#)
- [Subject to Climate](#)
- [Union of Concerned Scientists](#)