Ref: https://www.nationalgeographic.com/environment/2019/01/climate-change-colder-winters-global-warming-polar-vortex/

Why cold weather doesn't mean climate change is fake

Weather and climate aren't the same thing, meaning you can expect harsher winters in a warming world.

By **Sarah Gibbens**, January 23, 2019

A record-breaking cold snap is relentlessly descending on parts of the U.S. this month. It spawned from a split polar vortex that sent cold, Arctic air across the continent.

In a time when climate change is discussed in the context of record highs, droughts, and wildfires, cold weather and blizzards can seem out of place. For those who deny that climate change is happening, it's an opportunity to undermine scientific consensus.

How do you explain a cold winter in a world that scientists say is getting hotter?

First, it's important to understand the difference between climate and weather. Climate is defined as the average weather patterns in a region over a long period of time. It's the difference between Europe's temperate and Mediterranean zones versus the harsh cold conditions of the Arctic tundra. Each of these climate regions experiences day-to-day fluctuations in temperature, precipitation, air pressure, and so on—daily variations known as weather.

How warming can lead to cooling

When the term global warming was popularized a few decades ago, it referred to the phenomenon of greenhouse gases trapping heat in the atmosphere and warming the average temperature of the planet. Though record high temperatures in many places have been one impact of this decades-long shift, scientists now understand that an atmosphere changed by rising levels of gases like carbon and methane leads to more climate changes than just warming.

Scientists believe Earth will experience more extreme, disastrous weather as the effects of climate change play out.

In response to President Trump's January 20 tweet about cold temperatures, Potsdam University physicist Stefan Rahmstorf noted on Twitter that, while North America was experiencing cold Arctic air, the rest of the world was abnormally hot. And, the polar vortex bringing that cold air to the U.S. may actually become increasingly unstable, Rahmstorf noted.

As more Arctic air flows into southern regions, North America can expect to see harsher winters. That was the conclusion of a study published in 2017 in the journal *Nature Geoscience*. It found a link between warmer Arctic temperatures and colder North American winters. A separate study

published in March of last year in the journal *Nature Communications* found the same link but predicted the northeastern portion of the U.S. would be particularly hard hit.

“Warm temperatures in the Arctic cause the jet stream to take these wild swings, and when it swings farther south, that causes cold air to reach farther south. These swings tend to hang around for a while, so the weather we have in the eastern United States, whether it’s cold or warm, tends to stay with us longer," said study author Jennifer Francis in a press release.

A future of extreme weather

Record cold temperatures and blizzards aren't the only extreme weather patterns expected.

High altitude, east-to-west winds known as jet streams rely on the difference between cold Arctic air and warm tropical air to propel them forward. As the air in the Arctic warms, those jet streams slow and prevent normal weather patterns from circulating—floods last longer and droughts become more persistent. One study published in *Science Advances* last October predicted extreme, deadly weather events could increase by as much as 50 percent by 2100.

But we don't have to wait until 2100 to see how climate change is leading to deadly weather.

Scientists have already found climate change contributed to California's historic, deadly wildfires and powerful, destructive hurricanes.