

One Sheet

Heat Dome & Deep Freeze Explainer

2021 Focus: Texas Freeze & Pacific Northwest Heatwave

July 2021 Prepared by Rev. Richenda Fairhurst

Faiths4Future.org/climate-cafe

The Jet Stream, Polar Vortex, and Climate Change.

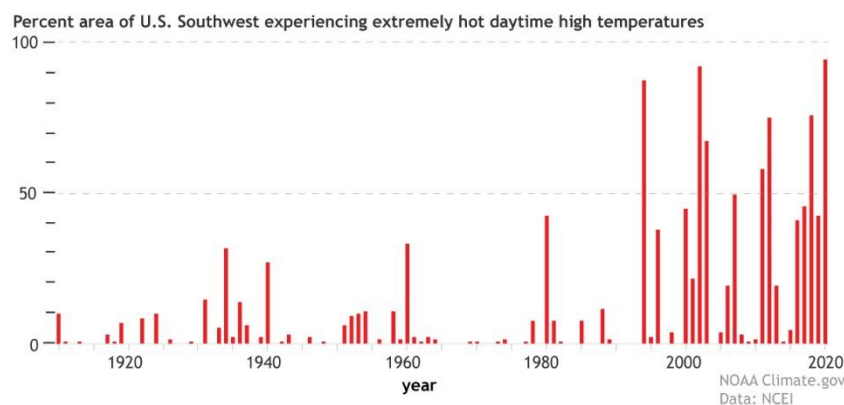
“...the late June heatwave in the U.S. Pacific Northwest...was a roughly 1-in-1,000-year event in today’s climate. ...it would have been at least 150 times rarer [a 1-in-150,000-year event] before global warming. ...[and] “virtually impossible” in pre-industrial times.” [Preliminary Analysis, Climate.gov](#)

Heat Dome – Explainer

CO₂ is warming the earth and disrupting the temperature balance between the warmer (equator) and cooler (north and south pole) areas on the planet. The extra heat trapped by the CO₂ disrupts the temperature balance of the jet stream—which is the swirl of winds that blow across the seas and continents around the world. The jet stream has a general pattern, but it is affected by changing temperatures on earth. The effects of climate change can exaggerate weather patterns.

One example is the 2021 Pacific Northwest heat dome: Sometimes the swirls of the jet stream are blocked by a section of warm air. This block ‘parks’ itself over an area of the globe and just sits there, like a pot, simmering. Usually, there is ‘no parking’ along the jet stream and all the air moves around with the winds. All this movement keeps weather systems moving along, and aids in dissipation of one weather system to another. But when this block ‘parks’ itself, the jet stream has to blow around it. The jet stream in this case makes a pattern called an Omega Ω pattern, because the winds blow up against the block, then has to blow up and around and down again the other side. Meanwhile the block of warm air continues to heat up, and the pressure, like a lid, further raises the temperature within it. (Also see, [What is the jet stream](#) from Carbon Brief)

Expanding footprint of extreme summer heat



The heat dome in the Pacific Northwest was extreme. Even so, it was part of a 40 year trend of demonstrably rising temperatures. This chart shows the temperature trend for the U.S. Southwest which was also part of [a record breaking June 2021](#). Climate.gov.

[Preliminary Analysis Concludes Pacific Northwest heat wave was a 1,000 year event... hopefully.](#) Climate.gov

[Record breaking June 2021 Heatwave Impacts the U.S. West.](#) Climate.gov

[A dangerous Omega Block is Trapping Scorching Air.](#) Livescience.com.

2021 Texas Freeze

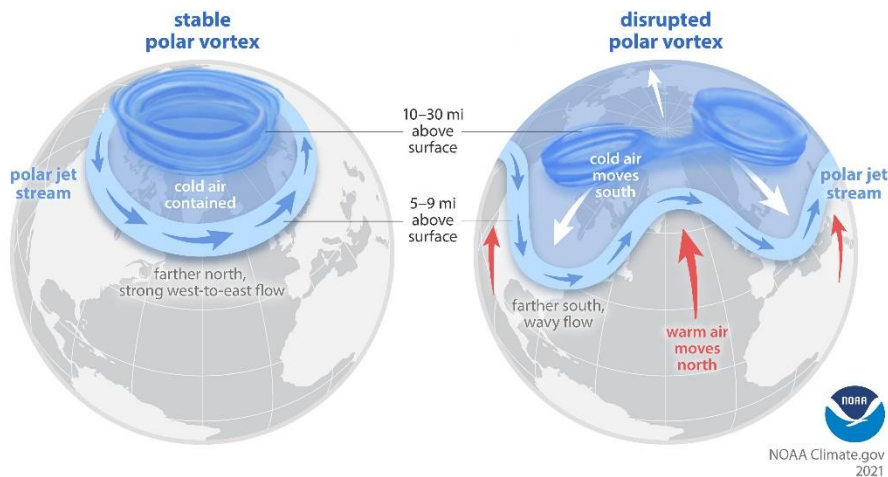
“First came the power grid failures, which left millions without electricity and heat in the cold. Then, as power began to be restored, millions more Texans discovered that their taps had run dry, pipes had burst or water treatment plants had failed, and that they had to boil their water before using it.” [New York Times](#).

Polar Vortex - Explainer

The jet stream is a wind current of dips and swirls that wraps itself in a general pattern around the planet. The jet stream moves in currents of air over land, ocean and ice, and consists of the air generally warmer in the middle (at the equator) of the planet.

The polar vortex is the wind currents circulating over the poles during the wintertime. If the planet were a cupcake, then the polar vortex would be the icing on top. In the wintertime, the poles are farthest from the sun and freezing cold. Usually, the polar vortex has a steady pattern, as if our earth-cupcake had a nice round dollop of frosting on top. Climate change has impacted the steady circular dollop, and sometimes the polar vortex will split in two or three parts, sending cold air south while warmer air comes up into the arctic.

One example, Texas 2021: With climate change, temperature variations have impacted the winds of the jet stream and polar vortex, both. Instability has set in, as if someone set that cupcake under a heat lamp and the frosting began to melt, dripping in chunks down the sides while a bald spot showed up nearer the top. If you were to draw the outline of these drips, it would make a wavy path along the upper half of the cupcake. This is our new ‘wavier’ polar vortex. Wherever these drips drip down, they can bring cold arctic air with them. In winter 2021, one of these drips ‘parked’ over Texas, bringing snow and ice then freezing sunny skies to the state for two weeks.



This diagram, [from NOAA Climate.gov](#) shows the stable polar vortex as a nice round dollop circulating clockwise at the north pole. Contrasted to the disrupted polar vortex, with wavy drips to the south, and two areas of split on top.

[Long Road to Recovery: Effects of the devastating winter freeze to haunt Texas for years.](#) The Guardian.

[What exactly is a Polar Vortex](#) from The Conversation.

[Understanding the Arctic Polar Vortex](#), from NOAA Climate.gov

[Polar Vortex: How the Jet Stream and Climate Change bring on Cold Snaps](#) from InsideClimate News.