


# EXTREME WEATHER AND CLIMATE CHANGE

# What's the Connection?

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About the Author

Stuart A. Kallen is the author of more than 350 nonfiction books for children and young adults. He has written on topics ranging from the theory of relativity to the art of electronic dance music. In 2018 Kallen won a Green Earth Book Award from the Nature Generation environmental organization for his book *Trashing the Planet: Examining the Global Garbage Glut*. In his spare time, he is a singer, songwriter, and guitarist in San Diego.


Printed in the United States

**For more information, contact:**
ReferencePoint Press, Inc.
PO Box 27779
San Diego, CA 92198
www.ReferencePointPress.com



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LIBRARY OF CONGRESS CATALOGING-IN-PUBLICATION DATA

Names: Kallen, Stuart A., 1955- author.
Title: Extreme weather and climate change: what's the connection? / Stuart A. Kallen.
Description: San Diego, CA : ReferencePoint Press, 2022. | Includes bibliographical references and index.
Identifiers: LCCN 2020056595 (print) | LCCN 2020056596 (ebook) | ISBN 9781678200800 (library binding) | ISBN 9781678200817 (ebook)
Subjects: LCSH: Climatic extremes--Juvenile literature. | Climatic changes--Juvenile literature.
Classification: LCC QC981.8.C53 K35 2022 (print) | LCC QC981.8.C53 (ebook) | DDC 363.34/92--dc23
LC record available at https://lccn.loc.gov/2020056595
LC ebook record available at https://lccn.loc.gov/2020056596

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CHAPTER 1

# Intense Heat

The Siberian region in northern Russia has long been associated with brutally cold winters. And the Siberian town with the tongue-twisting name of Verkhoyansk is known as a "Pole of Cold" in the Northern Hemisphere. This name is given to places where the lowest temperatures on earth have been recorded. Verkhoyansk earned the Pole of Cold title in February 1892, when the thermometer dipped to -90°F (-68°C). Even in years when records are not being broken, Verkhoyansk is one of the coldest inhabited places on earth. Average January temperatures in the small village are close to -50°F (-45°C).

In June 2020 Verkhoyansk set another weather record. During an unprecedented heat wave, local thermometers registered a sweltering 100.4°F (38°C). The extreme heat, called bizarre by climatologists, continued for a week. Daily temperature records kept since 1885 were broken. People in Verkhoyansk hung blankets over their windows to keep out the heat. Some reported skin conditions and headaches related to the hot weather. Local fishers also suffered; while fish are normally plentiful in local lakes and rivers, they became harder to catch when they swam down deep into colder waters. As local scientist Roman Desyatkin said, "Very strange things are happening here. . . . Our plants, our animals and our people are not used to such great heat."[4]

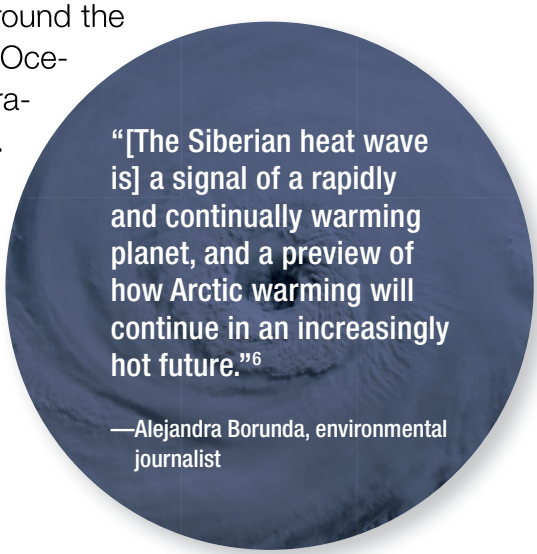
## Blaming Climate Change

An occasional hot summer day is not unusual in Verkhoyansk; the town is located just north of the Arctic Circle, where the sun

shines twenty-four hours a day in the summer. But the record-setting heat followed an unusually warm, snowless winter and the hottest-ever spring when temperatures were 20°F (11°C) above normal. While the extreme heat might have shocked local residents, it was not surprising to scientists. As climatologist Ruth Mottram stated, "For a long time, we've been saying we're going to get more extremes like strong heat waves. . . . The projections are coming true, and sooner than we might have thought."[5]


The extreme heat generated interest among scientists in Germany, who wanted to determine what caused the heat wave. The scientists studied weather models and historical information, which led them to conclude that the Verkhoyansk heat wave was made six hundred times more likely as a result of human-induced climate change. As environmental journalist Alejandra Borunda explains, the record Siberian heat is "a signal of a rapidly and continually warming planet, and a preview of how Arctic warming will continue in an increasingly hot future."[6]

The warming planet is pushing up temperatures far beyond remote villages in Siberia. Average summer temperatures in 2020 were the highest ever recorded around the globe, according to the National Oceanic and Atmospheric Administration (NOAA), a US science agency. At least fifty other cities worldwide set records for extreme heat in Southeast Asia, South America, North America, and elsewhere. In August the temperature in California's Death Valley National Park reached 130.4°F




*Temperatures in Death Valley National Park are often very hot in the summer, but in August of 2020 a reading of 130.4°F (54.7°C) was reached—the highest ever reliably recorded on earth.*

(54.7°C). While this desert region is often very hot in the summer, that record-setting temperature was the highest ever reliably recorded on earth.

## Heat Kills

The five hottest years recorded on earth have all occurred since 2015. This warming follows a sixty-year trend; every decade since the 1960s has been hotter than the previous ten-year period. And while heat waves are a natural occurrence, the number of extended periods of extreme heat is increasing at an alarming rate. In 1960 the fifty largest cities in the United States experienced an average of two heat waves each summer. By 2020 that number had tripled to six, according to the Adrienne Arsht–Rockefeller Foundation Resilience Center. And heat waves often have deadly consequences.

Heat waves sicken people by causing what is called heat exhaustion, a condition marked by excessive sweating, nausea, headaches, dizziness, weakness, and extreme thirst. If left untreated,

## The Permafrost Is Melting

Arctic heat waves are doing more than creating new entries for the record books. The snow that historically covers the Arctic Circle most of the year plays a crucial role in keeping the entire planet cool. The bright, white snow reflects the heat of the sun back into space like a mirror. But as the climate has warmed, the snow has begun melting earlier in the spring and accumulating later in the fall. This heat is melting the frozen layer of soil called permafrost, which makes up about 25 percent of the Northern Hemisphere and about 85 percent of Alaska, Greenland, Canada, and Siberia.

Permafrost is a mixture of soil, rocks, and ice. It also holds four times more $CO_2$ than humanity has produced in the past two hundred years. As climate change accelerates, the permafrost is melting at an astonishing rate. Scientists estimate that around 40 percent of the Arctic permafrost will melt by the end of the century, with dire consequences. Huge amounts of $CO_2$ that have been locked up in the permafrost for millennia will be released into the atmosphere. This will further heat the planet, creating conditions that will increase the number of heat waves in the future.

heat exhaustion leads to heatstroke as body temperatures increase to 104°F (40°C) or more. One of the first symptoms of heatstroke is mental confusion, which often leaves victims unaware of what is happening to them. As the body temperature rises, vital organs shut down, including the heart, kidneys, and brain. Kathy Baughman McLeod of the Adrienne Arsht–Rockefeller Foundation Resilience Center calls heat waves "silent killers"[7] because the deaths largely occur among society's most vulnerable people—the very young, the elderly, the poor, and those who have chronic medical conditions such as diabetes, heart disease, and respiratory illnesses. People who live in urban areas—and lack access to air-conditioning—are most often victims of heatstroke. According to the Centers for Disease Control and Prevention, more than six hundred people in the United States die every year due to heat-related illnesses.

In 2003 Europe experienced one of the deadliest heat waves on record. An extended period of heat through July and August killed more than seventy thousand people in the United Kingdom, Spain,

Italy, Germany, and elsewhere. An estimated fifteen thousand of those deaths occurred in France. Most of the victims were elderly. In the summer of 2019, another heat wave spread across Europe. In July of that year, thermometers in Montpellier, a small village in southern France, topped 114.6°F (45.9°C), the highest temperature ever recorded in France. French winemaker Jerome Despey said his vines looked like they were scorched with a blowtorch: "I've been a winegrower for 30 years. I have never seen a vine burnt by a sudden onset of heat."[8] Temperature records were also broken in Bulgaria, Portugal, Italy, Greece, and elsewhere. Authorities were better prepared for the heat this time. Air-conditioned "cooling rooms" were opened in many areas, schools were closed, and public pools stayed open for extended hours. Despite the precautions, around fifteen hundred people died from heat-related illness in France, and a similar number were stricken in the United Kingdom.

Heat waves can be even more deadly in developing nations, where those sickened by heat-related illnesses have fewer resources like medical care, clean water, and adequate food. And

*People wade in fountains at the foot of the Eiffel Tower in Paris. An extended heat wave in 2003 killed an estimated fifteen thousand people in France.*

the problem is expected to grow. According to the World Health Organization, an increase in the number of heat waves is predicted to cause approximately 250,000 additional deaths per year between 2030 and 2050.

## Changes in the Jet Streams

The growing number of heat waves can be traced to changes in the jet streams—fast-moving currents of air that shape weather patterns around the world. There are two dominant jet streams in the Northern Hemisphere; the northernmost polar jet stream is close to the Arctic Circle, while the subtropical jet stream is near the equator. The Southern Hemisphere also has a polar and a subtropical jet stream.

The polar jet stream exerts a strong influence on weather in the United States, Canada, and Europe. This powerful, high-altitude wind in the stratosphere 5 to 7 miles (8 to 11 km) above earth travels from west to east at speeds of up to 200 miles per hour (322 kph). The jet stream naturally flows in a fairly straight pattern parallel to the equator, moving to the north or south depending on the season. However, the traditional flow of the jet stream is being interrupted due to climate change. The wind currents sometimes develop kinks, coiling into previously unseen patterns and snaking from far north to far south. According to science writer Brian Kahn, the problem could be due to melting ice and snow far to the north: "An increasingly kinky jet stream has to do with rapid Arctic warming, which is reducing the temperature [variable] that usually pulls the jet stream taut between the Arctic and [regions to the south]."[9] When the jet stream wavers, it slows down. This can result in a blocking event, which is when the jet stream gets stuck in a harmful pattern for an extended period of time. A blocking event can hold high pressure, or clear skies and warm temperatures, in one place for weeks or months. It can also do the reverse, keeping low pressure systems in one place and causing extensive rain and flooding.

Meteorologists blamed changes in natural jet stream patterns for the stubborn heat wave that set thermometers soaring in Eu-

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# ORGANIZATIONS AND WEBSITES

**Climate Reality Project**
www.climaterealityproject.org

The Climate Reality Project was founded by former vice president Al Gore to mobilize over nineteen thousand climate reality leaders, who push for practical clean energy policies across the United States and elsewhere.

**Earth Guardians**
www.earthguardians.org

Earth Guardians is a student organization made up of activists, artists, and musicians dedicated to empowering young people to take over as leaders of the environmental movement. The group's website features inclusive information about environmental issues and ongoing campaigns.

**Earth Island Institute**
www.earthisland.org

The Earth Island Institute was founded in 1982 to support activism around environmental issues. The group provides financial sponsorship to young environmental leaders who are searching for solutions to the climate crisis.

**Environmental Defense Fund (EDF)**
www.edf.org

The EDF was founded in 1967 to fight against the use of the pesticide DDT. Today the group is working to stabilize the climate, save ecosystems, and ensure environmental justice for the poor.

# FOR FURTHER RESEARCH

## Books

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