Climate Superstars

Learn About Global Climate Change

Student Activity and Educator Guide

EE Week 2021 Special Edition

SAMSUNG | CLIMATE SUPERSTARS

ENERGY STAR

NEEF National Environmental Education Foundation

Welcome!

Climate Superstars is an annual contest and collaborative educational partnership between the National Environmental Education Foundation (NEEF), the Environmental Protection Agency (EPA), and Samsung Electronics America, where educators complete a series of tasks with their students to qualify for a prize drawing.

This document includes a student activity, or task, from the Climate Superstars Challenge and supporting information for Educators.

The learning activities that comprise the contest tasks were developed with the Next Generation Science Standards as a guide. Although alignment with specific NGSS standards is not called out, components of three-dimensional learning (i.e. core disciplinary ideas, science and engineering practices, and cross cutting concepts) are evident throughout. Also embedded but not called out are opportunities for educators to engage learners in development and practice of the 21st century skills set.

Student Activity:
Learn About Global Climate Change

Weather and climate, what's the difference?

Watch this video from NASA to learn more about the difference between weather and climate.

If you have problems with the link, please copy and paste this link directly into your browser:
https://youtu.be/vH298zSCQzY

The difference between weather and climate is a measure of time. Weather is the conditions of the atmosphere are over a short period of time, and climate is how the atmosphere "behaves" over relatively long periods of time. When scientists talk about climate change, they are talking about changes in long-term averages of daily weather.

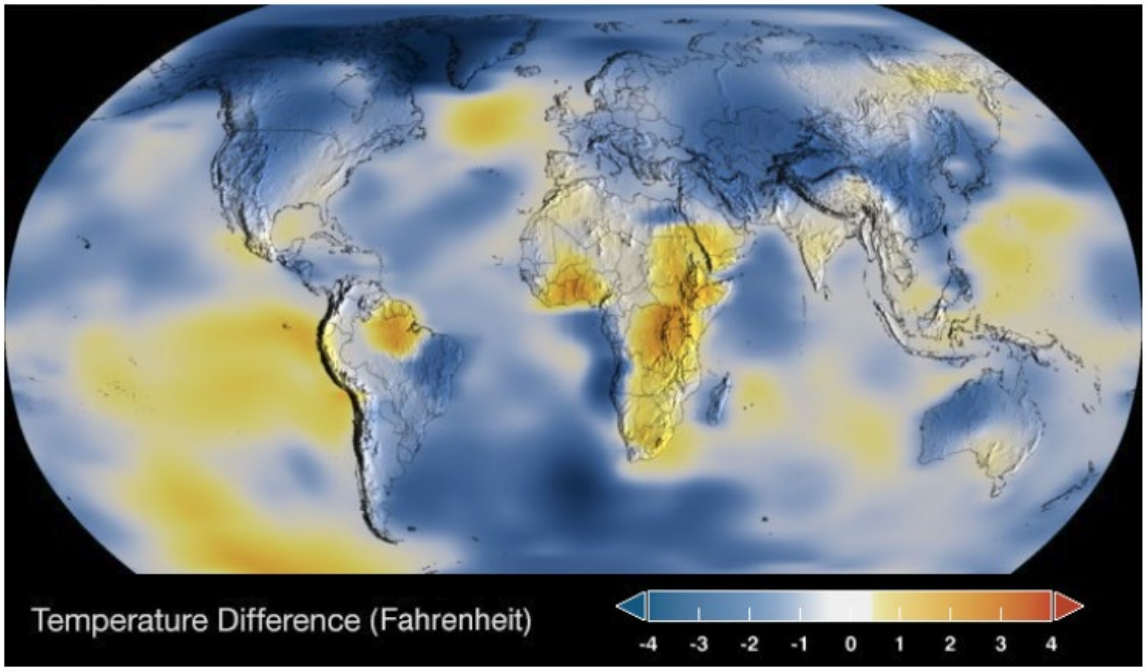
In addition to long-term climate change, there are shorter term climate variations. This so-called climate variability can be represented by periodic or intermittent changes related to El Niño, La Niña, volcanic eruptions, or other changes in the earth system (Source: NASA).

Over long periods of time, weather patterns in an area can gradually change. Scientists studying global climate change watch the weather all over the world. They have made a very important observation: the world is getting warmer! This is what scientists refer to as global warming. The following sequence of data visualizations illustrate the warming trend.

TIME SERIES: 1884 TO 2019

Data source: NASA/GISS
Credit: NASA Scientific Visualization Studio

1899

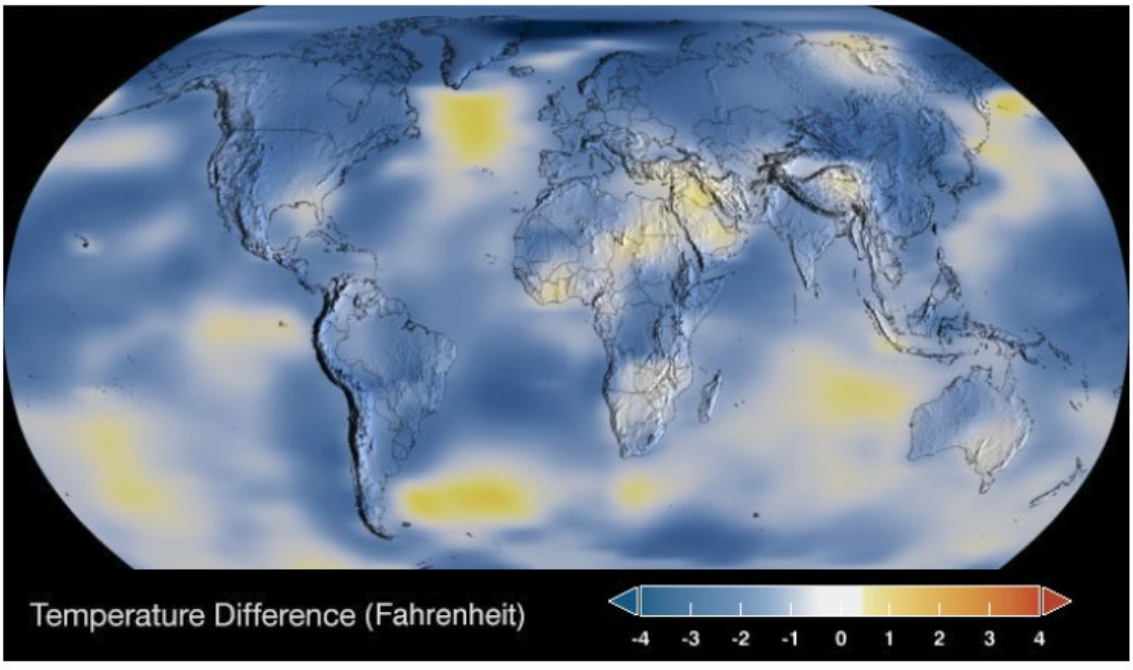


1884 2019

TIME SERIES: 1884 TO 2019

Data source: NASA/GISS
Credit: NASA Scientific Visualization Studio

1919

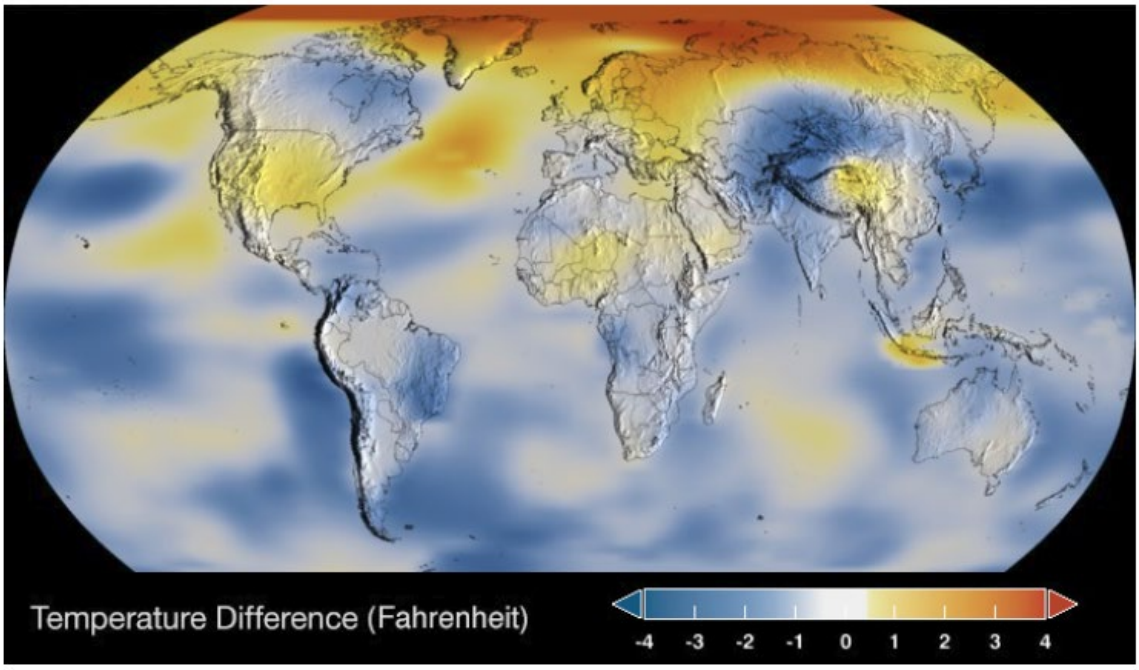


1884 2019

TIME SERIES: 1884 TO 2019

1939

Data source: NASA/GISS
Credit: NASA Scientific Visualization Studio

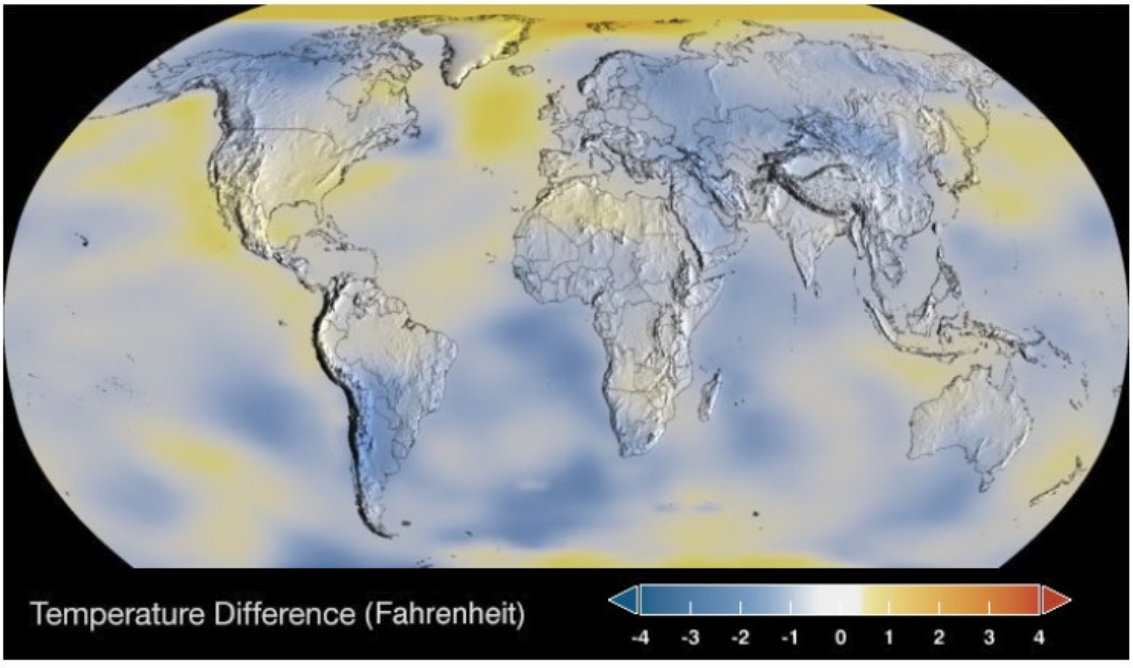


1884 2019

TIME SERIES: 1884 TO 2019

1959

Data source: NASA/GISS
Credit: NASA Scientific Visualization Studio

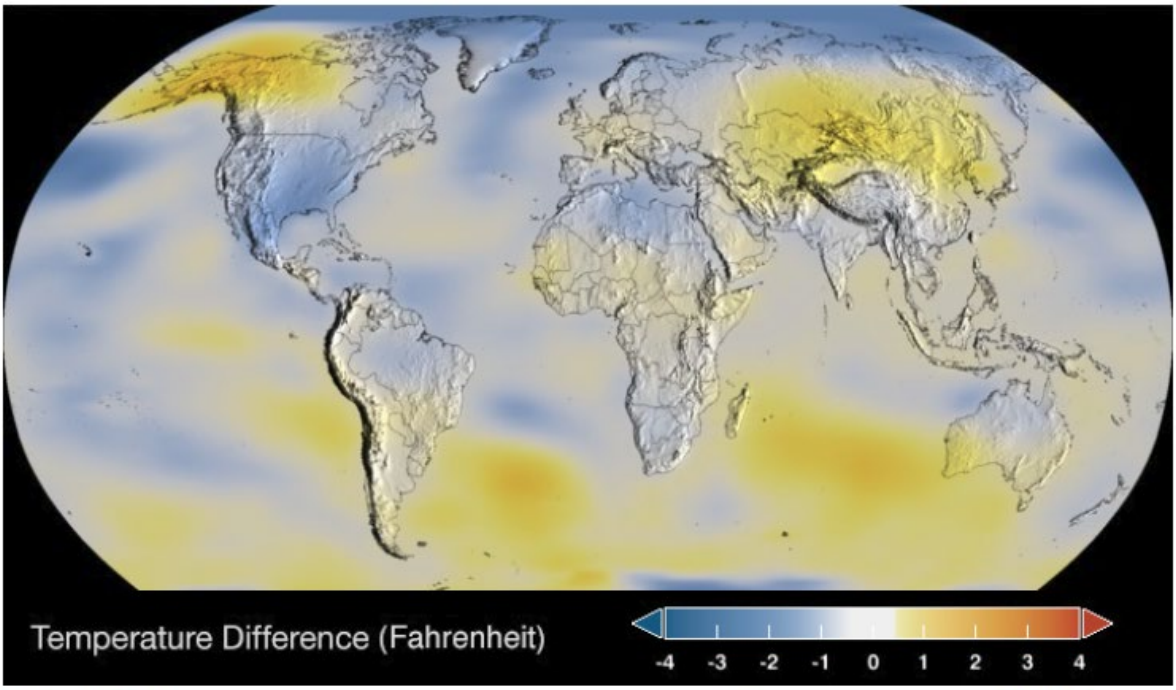


1884 2019

TIME SERIES: 1884 TO 2019

1979

Data source: NASA/GISS
Credit: NASA Scientific Visualization Studio

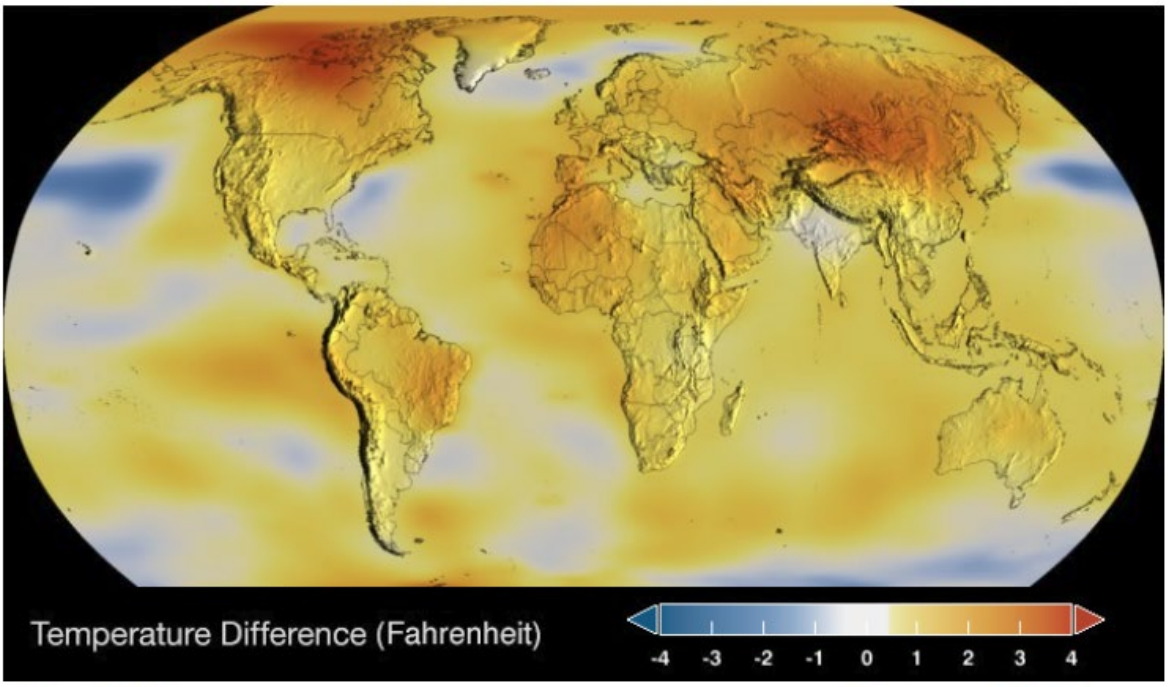


1884 2019

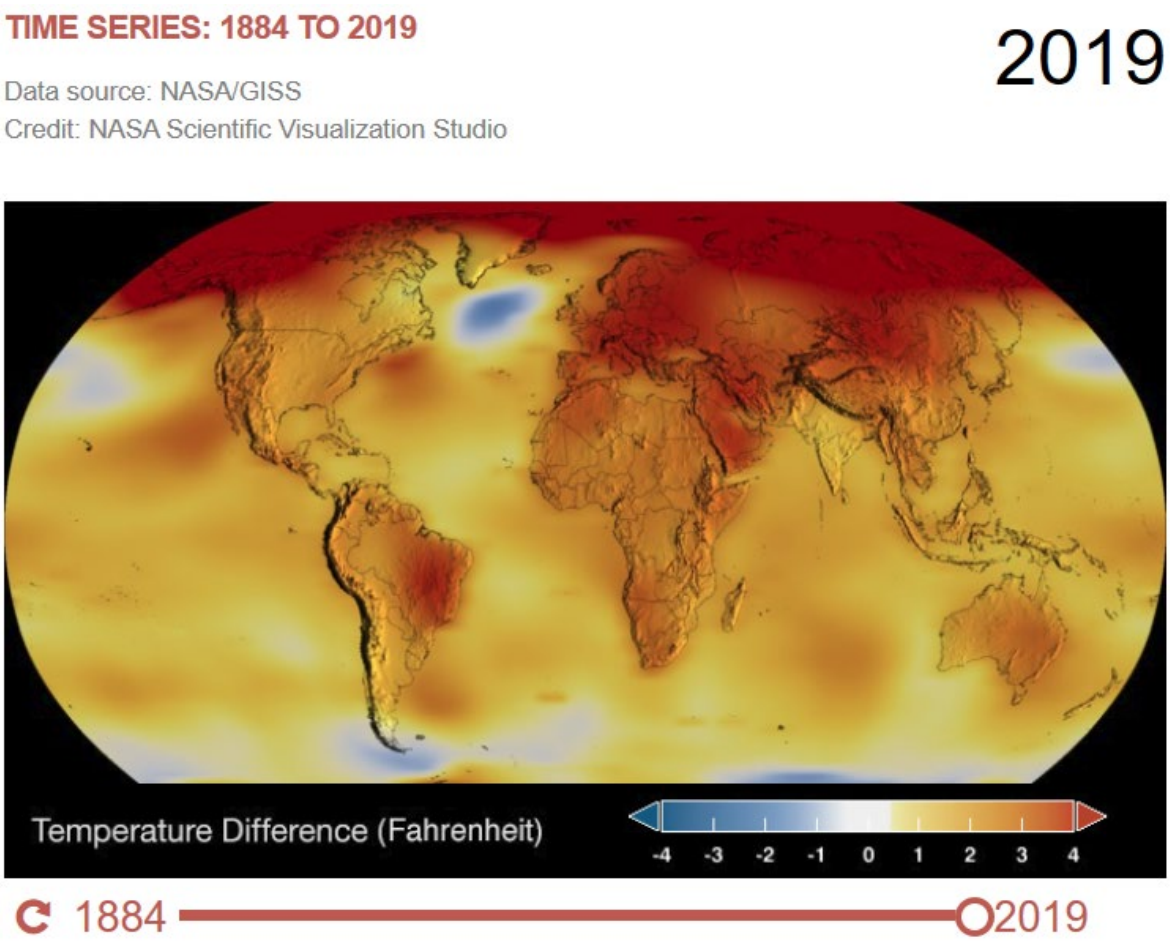
TIME SERIES: 1884 TO 2019

1999

Data source: NASA/GISS
Credit: NASA Scientific Visualization Studio



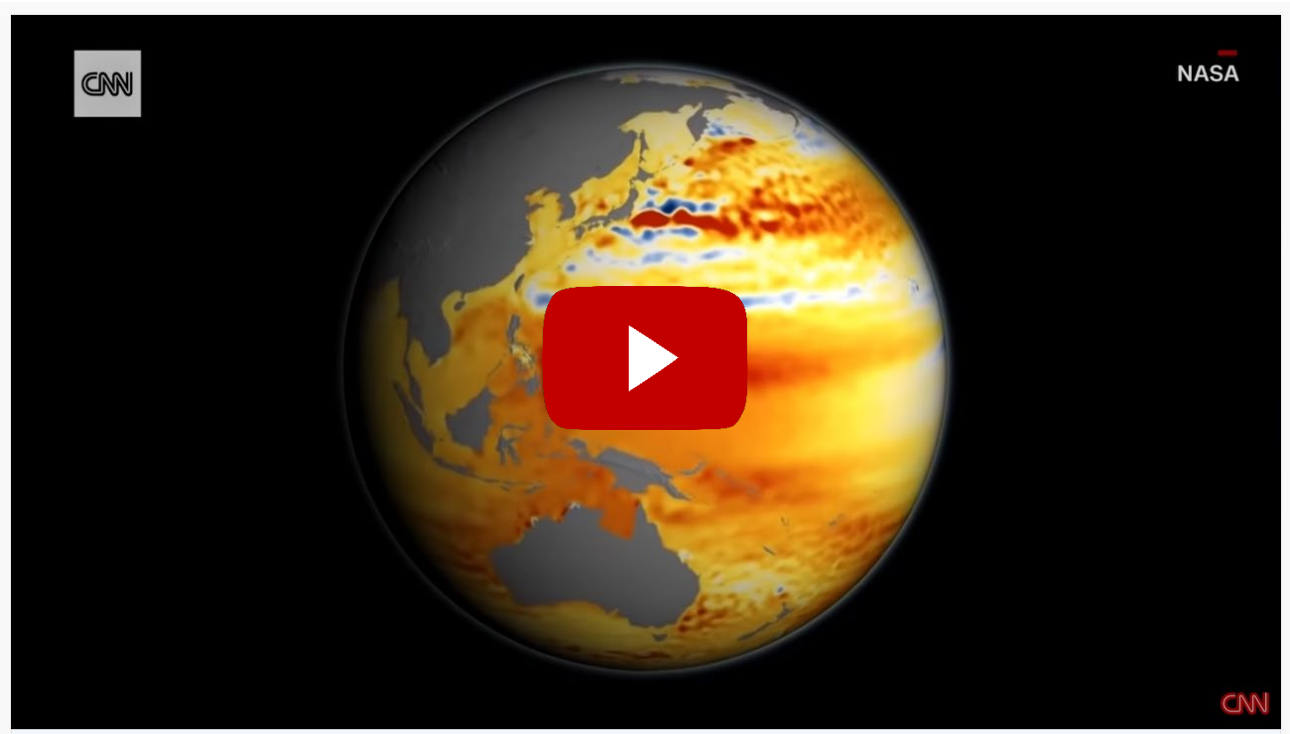
1884 2019



Each year a plethora of new extreme temperature records are set all over the planet. For example, in 2017 alone 10,632 low temperature records were broken in the US. Historically the number of high temperature records broken has been about the same as the number of low temperature records.

However, that pattern hasn't held true since the year 2000. Over the last two decades, on average, more than twice as many high temperature records have been broken than low temperature records. In 2017 alone 36,305 high temperature records were broken in the US. It's clear the ratio has been changing. (Source: NOAA)

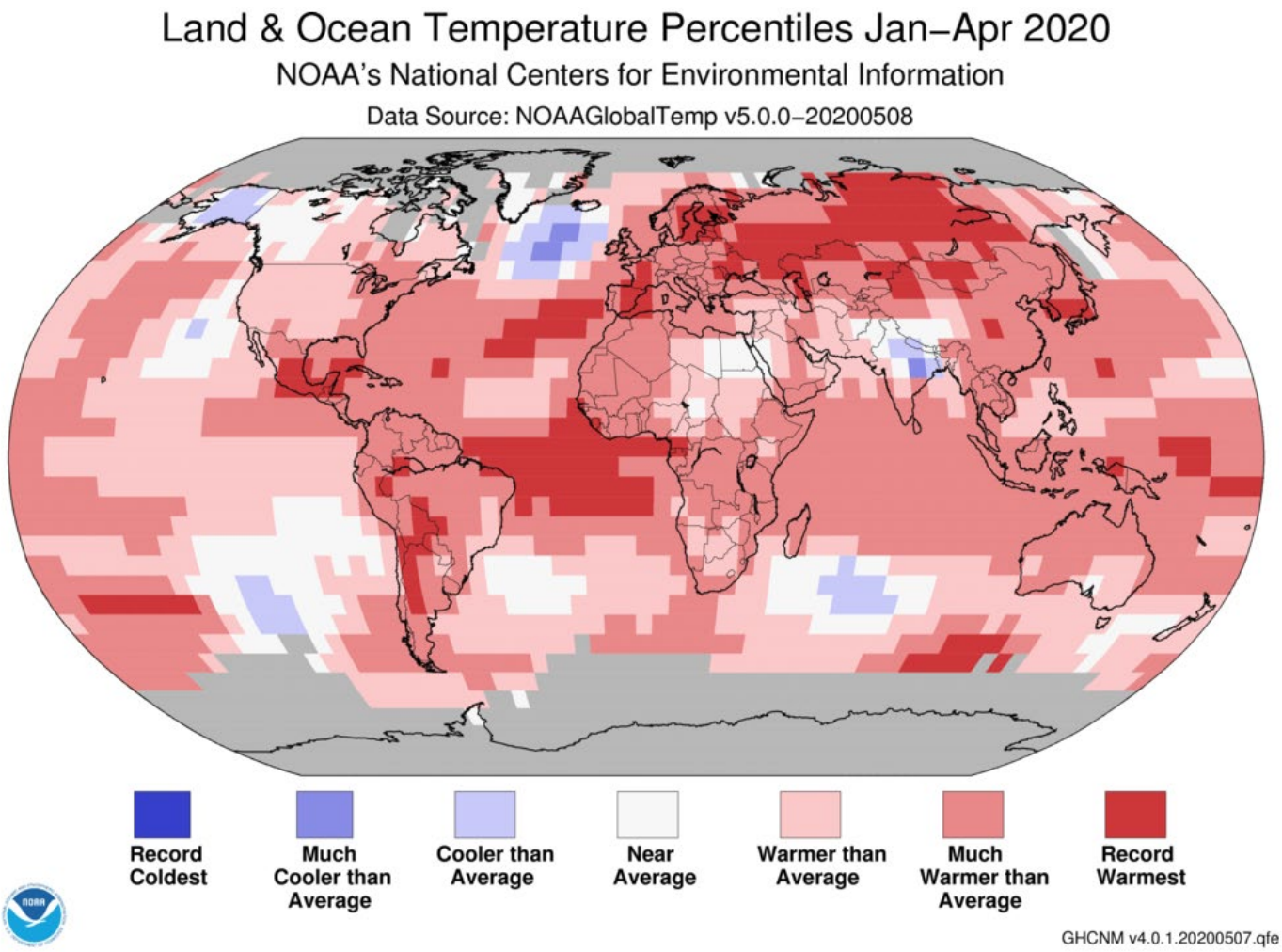
So, what are the impacts of all this warming? Watch this 2018 CNN news report to learn more.



If you have problems with the link, please copy and paste this link directly into your browser:
https://www.youtube.com/watch?v=gXQSyqNGLcI

VIDEO UPDATE: Data recently reported by NASA scientists shows that 19 of the 20 warmest years on record have occurred since 2001, with the exception of 1998. The year 2016 ranks as the warmest on record (Source: NASA).

April 2020 was the third month in a row to rank second-hottest on record for the planet after the year kicked off with the hottest January ever recorded in 141 years of record-keeping, according to scientists from NOAA's National Centers for Environmental Information.



The Jan-Apr 2020 global land and ocean surface temperature was the second highest in the 141-year record at 2.05°F (1.14°C) above the 20th-century average of 54.8°F (12.6°C). This value is only 0.13°F (0.07°C) less than the record set in 2016.

The average global temperature in April was 1.91 degrees F (1.06 degrees C) above the 20th-century average, making April 2020 the second hottest behind April 2016. The eight warmest Aprils have all occurred since 2010, and April 2020 marked the 44th consecutive April above the 20th-century average (Source: NOAA).

Describe the climate where you live.

Need help? Check out the Köppen-Geiger climate classification system using this GLOBE activity

1. Include the name of your local climate type and subtype along with its key characteristics (e.g. details like if the climate is seasonally hot or cold, rainy or dry, sunny or foggy, etc.).

Educator Guide:
Learn About Global Climate Change

Overview

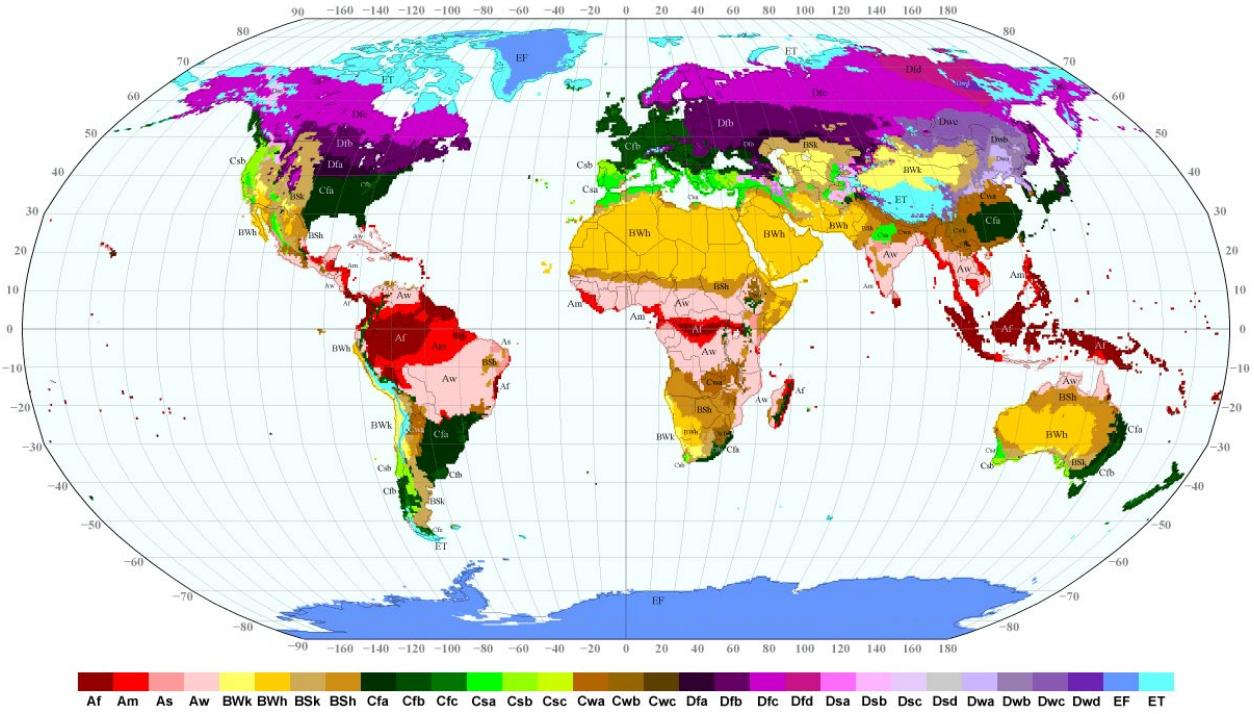
Scientists establish baselines from which to measure changes or make comparisons. The classical length of record to determine the climate for any particular place is 30 years, as defined by the World Meteorological Organization. To understand how climate change is occurring requires monitoring changes to long-term weather patterns and specific meteorological variables, such as average temperature, annual precipitation, etc. Monitoring of the various atmospheric gases (covered in more detail in the *Learn How Humans Contribute to Climate Change* activity) is another way scientists track climate change. Changes to the levels of specific gases in the atmosphere are the basis for many of the climate change impacts scientists predict.

Learning Objectives

- ✓ Students will be able to explain the difference between weather and climate.
- ✓ Students will be able to identify and describe the climate type where they live.
- ✓ Students will be able to define climate change and global warming.

Background Information

The most popular system of classifying climates was proposed by Russian-German scientist Wladimir Köppen. Studying vegetation, temperature, and precipitation data, Köppen and other scientists, like Rudolf Geiger, developed a system for naming climate regions. According to the Köppen-Geiger climate classification system, there are six **climate zones**: **tropical** (A), **dry** (B), **subtropical** (C), **continental** (D), **polar** (E), and **highland** (H).



(Source)

The major climate categories are as follows:

A - Tropical Climates

Tropical moist climates extend north and south from the equator to about 15° to 25° latitude. In these climates all months have average temperatures greater than 64°F (18°C) and annual precipitation greater than 59".

B - Dry Climates

The most obvious climatic feature of this climate is that potential evaporation and transpiration exceed precipitation. These climates extend from 20°-35° North and South of the equator and in large continental regions of the mid-latitudes often surrounded by mountains.

C - Moist Subtropical Mid-Latitude Climates

This climate generally has warm and humid summers with mild winters. Its extent is from 30°50° of latitude mainly on the eastern and western borders of most continents. During the winter, the main weather feature is the mid-latitude cyclone. Convective thunderstorms dominate summer months.

D - Moist Continental Mid-Latitude Climates

Moist continental mid-latitude climates have warm to cool summers and cold winters. The location of these climates is poleward of the "C" climates. The average temperature of the warmest month is greater than 50°F (10°C), while the coldest month is less than -22°F (-30°C). Winters are severe with snowstorms, strong winds, and bitter cold from Continental Polar or Arctic air masses.

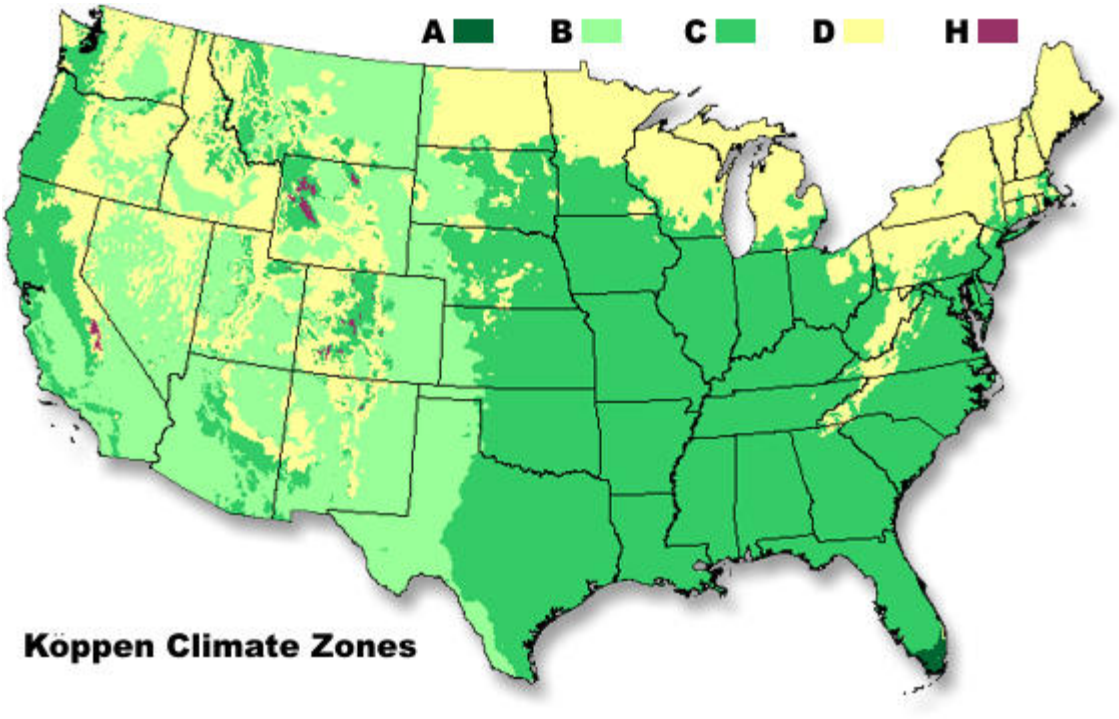
E - Polar Climates

Polar climates have year-round cold temperatures with the warmest month less than 50°F (10°C). Polar climates are found on the northern coastal areas of North America, Europe, Asia, and on the land masses of Greenland and Antarctica.

H - Highlands

Unique climates based on their elevation. Highland climates occur in mountainous terrain where rapid elevation changes cause rapid climatic changes over short distances.

The map (below) shows where these major categories occur in the mainland United States.



(Source)

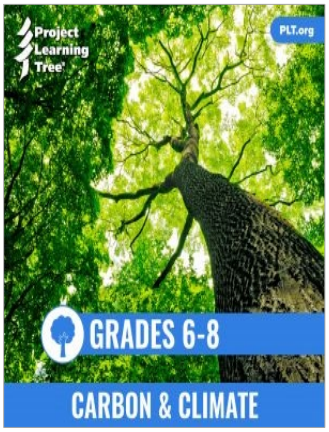
These climate categories are further sub-divided. Learn more about the sub-divisions here.

Vocabulary (Source)

- ✓ **Climate** – a description of the long-term pattern of weather in a geographic area using averages of temperature, humidity, atmospheric pressure, wind, rainfall, and other meteorological elements
- ✓ **Climate Change** – long-term change in the average weather patterns that have come to define earth's local, regional, and global climates (Source)
- ✓ **Climate Variability** – short-term regional changes in temperature and weather patterns (e.g. El Niño, La Niña, etc.) resulting from natural physical processes within earth's climate system
- ✓ **Global Warming** – the long-term heating of earth's climate system observed since the pre-industrial period (between 1850 and 1900) due to human activities, primarily fossil fuel burning, which increases heat-trapping greenhouse gas levels in earth's atmosphere (Source)
- ✓ **Weather** – a description of the short-term condition of the atmosphere in a geographic area using measurements of temperature, humidity, atmospheric pressure, wind, and precipitation

Extension Resources

Middle School: Carbon and Climate



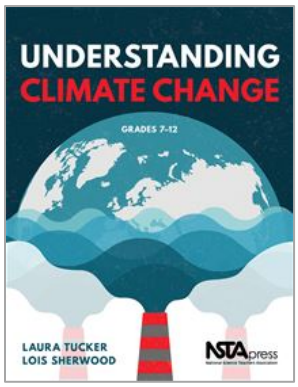
This Project Learning Tree e-unit explores two essential questions, *What is climate? What role does carbon play in climate?* and several others. The unit provides activities and resources to help educators introduce learners to some of the complex issues involved in climate science and its associated challenges.

The unit meets academic standards including: Next Generation Science Standards (NGSS), Common Core State Standards for English Language Arts and Math, and the C3 Framework for Social Studies. Of special note, these Project Learning Tree lessons are not just aligned with NGSS, but have been constructed around NGSS target performance expectations.

GO TO RESOURCE

Additional Reading

Understanding Climate Change



From NSTA Press, *Understanding Climate Change* offers both extensive background and step-by-step directions for using three-dimensional instructional methods to explore this complex subject. Based on what they learn, students can use critical thinking and analysis to draw their own conclusions about what should be done.

The book is easy to use even for teachers with no background in climate science. *Understanding Climate Change, Grades 7–12* is structured as a nine-session module that establishes a conceptual foundation without risking information overload. The material can be covered in three or four weeks or used in part to supplement an existing curriculum.

GO TO RESOURCE