

Our Changing Florida Climate



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What is Climate Change?

- We hear the term Global Warming used a lot, but this only refers to the Earth's rising surface temperature, while **Climate Change includes warming and the "side effects" of warming** – like melting glaciers, heavier rainstorms, or more frequent drought. Said another way, global warming is one symptom of the much larger problem of human-caused climate change.
- Over Earth's history, indications of climate change have been recorded in fossils and ice core samples.
- At one extreme, climate change can result in extended periods of heat and drought; at the other, extensive glaciation.
- Currently, our planet's global surface temperature is rising. This change is linked to human activities that increase the amount of greenhouse gases (e.g., carbon dioxide and methane) in the atmosphere. It is important to understand climatic processes because they have the potential to affect environmental conditions.



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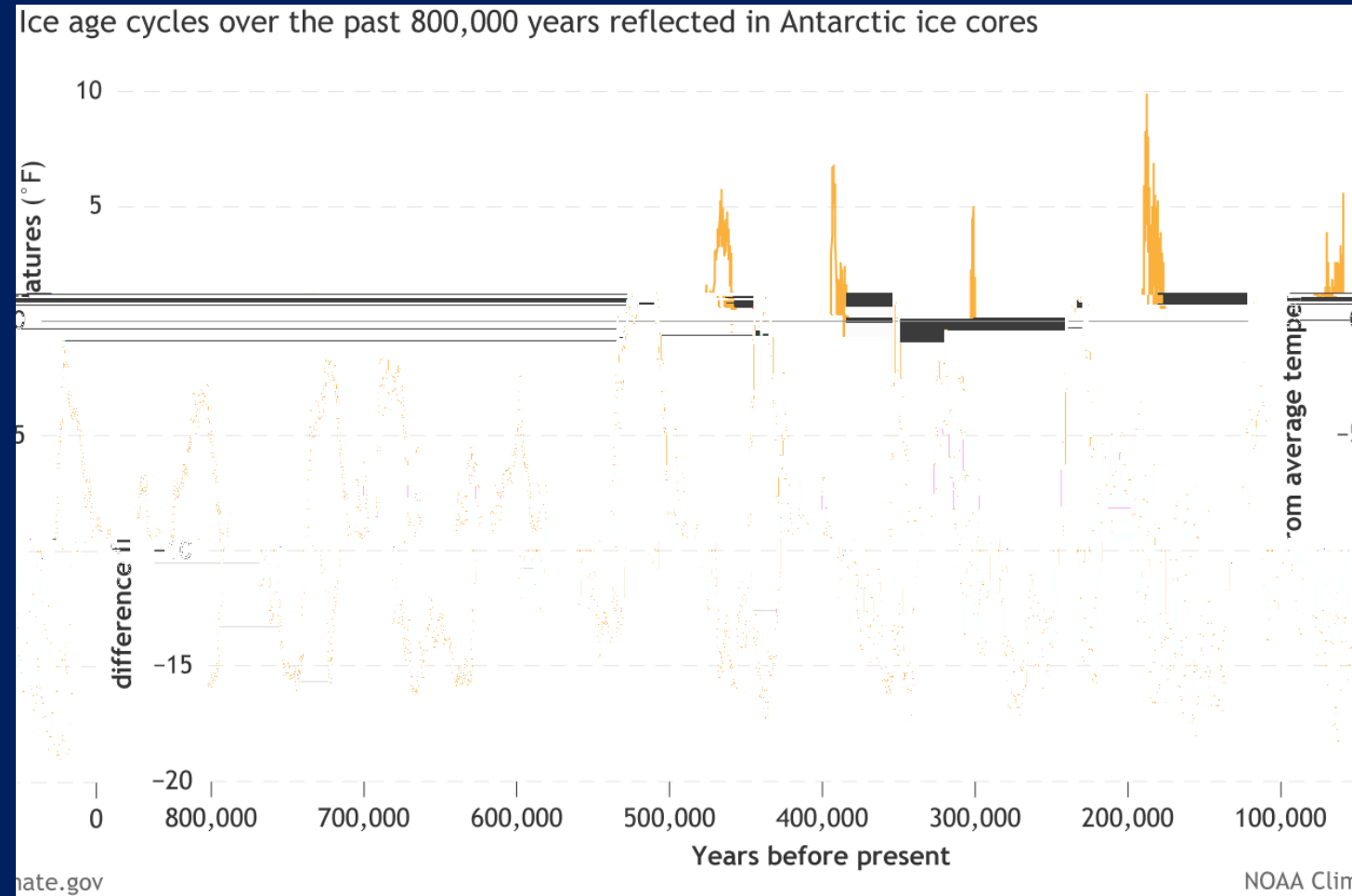


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Natural Climate Cycles

The planet has experienced climate change before. The planet has experienced long cold periods ("ice ages") and warm periods ("interglacials") on 100,000-year cycles for at least the last million years. Over the course of these cycles, global average temperatures warmed or cooled anywhere from 3° to perhaps as much as 8°C (5°-15°F).



Global Climate Change Statistics

We see climate change affecting our planet from pole to pole. NOAA monitors global climate data and here are some of the changes NOAA has recorded.

- Global temperatures rose about **1.8°F (1°C) from 1901 to 2020**.
- Sea level rise has accelerated from 1.7 mm/year throughout most of the twentieth century to **3.2 mm/year (0.13 inches/year) since 1993**.
- Glaciers are shrinking: average thickness of 30 well-studied glaciers has decreased more than 60 feet since 1980.
- The area covered by sea ice in the Arctic at the end of summer has **shrunk by about 40% since 1979**.
- The amount of carbon dioxide in the atmosphere has risen by 25% since 1958, and by about 40% since the Industrial Revolution.
- Snow is melting earlier compared to long-term averages.



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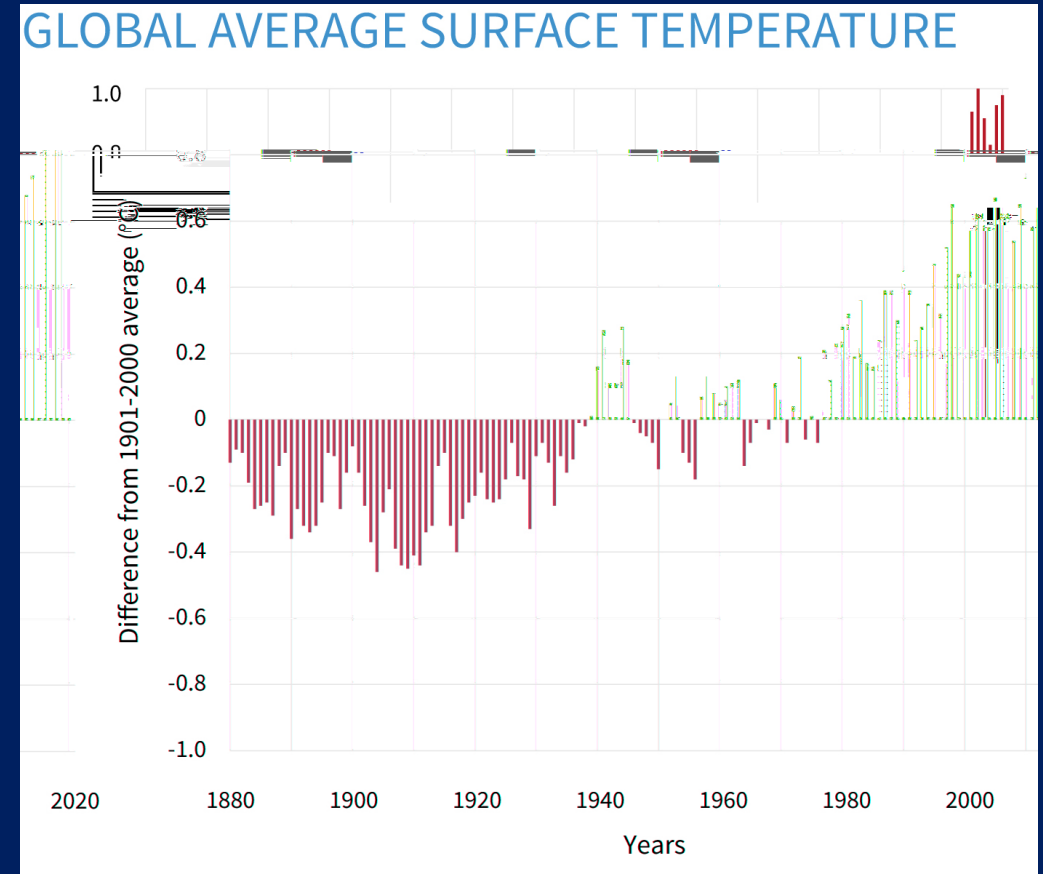


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Global Average Surface Temperature Change

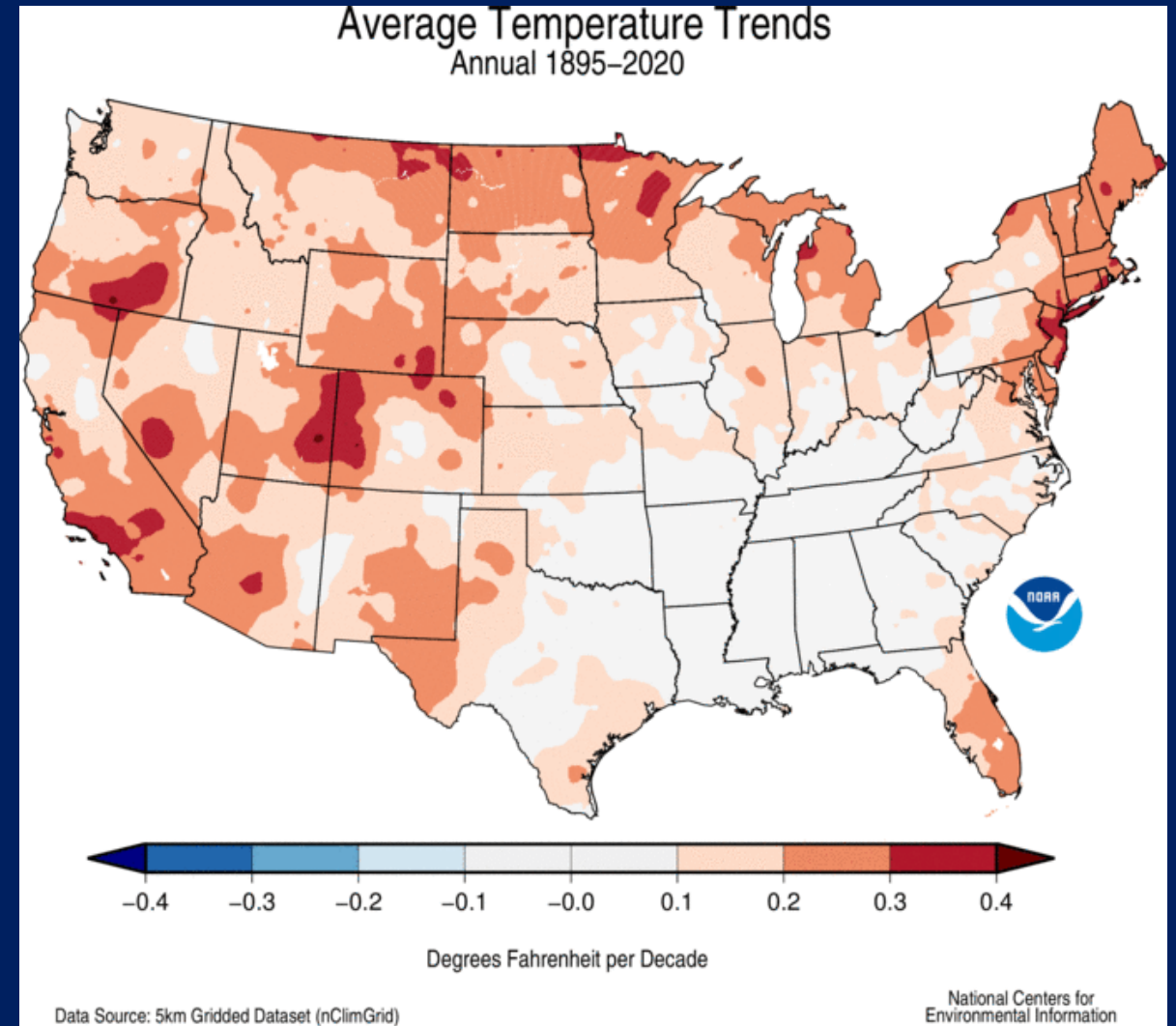
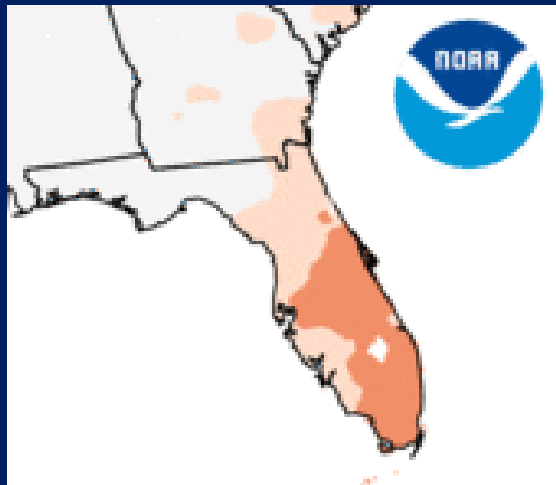
- The earth's temperature has risen by 0.14°F (0.08°C) per decade since 1880, and the rate of warming over the past 40 years, since 1981, is more than twice that at 0.32°F (0.18°C) per decade.
- The **10 warmest years** on record have occurred since 2005.
- Overall the global temperature is increasing faster than expected from natural cycles.



Yearly surface temperature compared to the 20th-century average from 1880–2020. Blue bars indicate cooler-than-average years; red bars show warmer-than-average years. NOAA Climate.gov graph, based on data from the National Centers for Environmental Information.

U.S. Temperature Trends

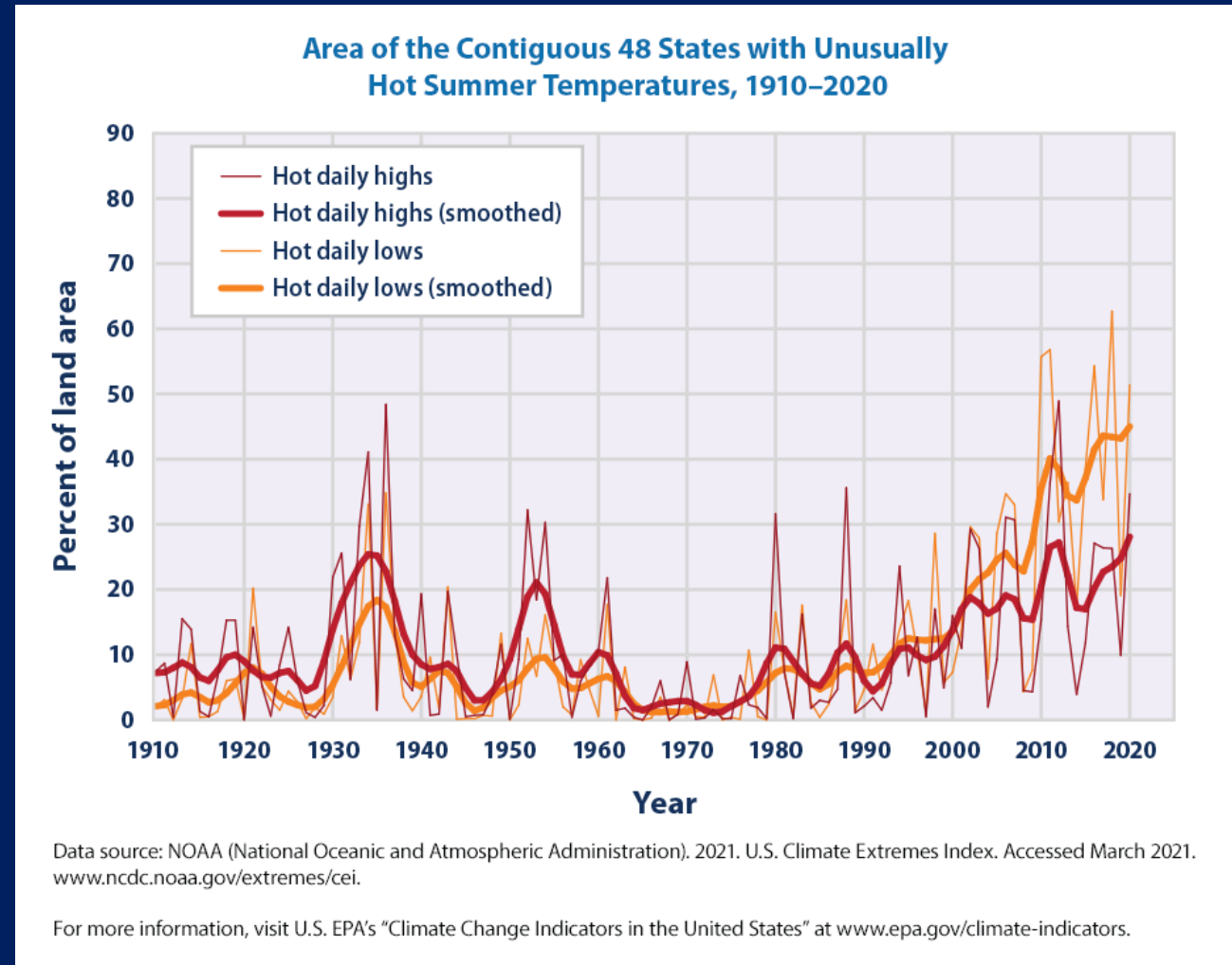
- In the annual average temperature trend, we see warming across many areas, including Florida.
- The nation's midsection – from the Gulf of Mexico to the Missouri Valley and Ohio Valley – are not warming as much as other parts of the country.



U.S. Temperature Trends

This graph shows the percentage of the land area of the contiguous 48 states with unusually hot daily high and low temperatures during the months of June, July, and August. The thin lines represent individual years, while the thick lines show a nine-year weighted average. Red lines represent daily highs, while orange lines represent daily lows. The term “unusual” in this case is based on the long-term average conditions at each location.

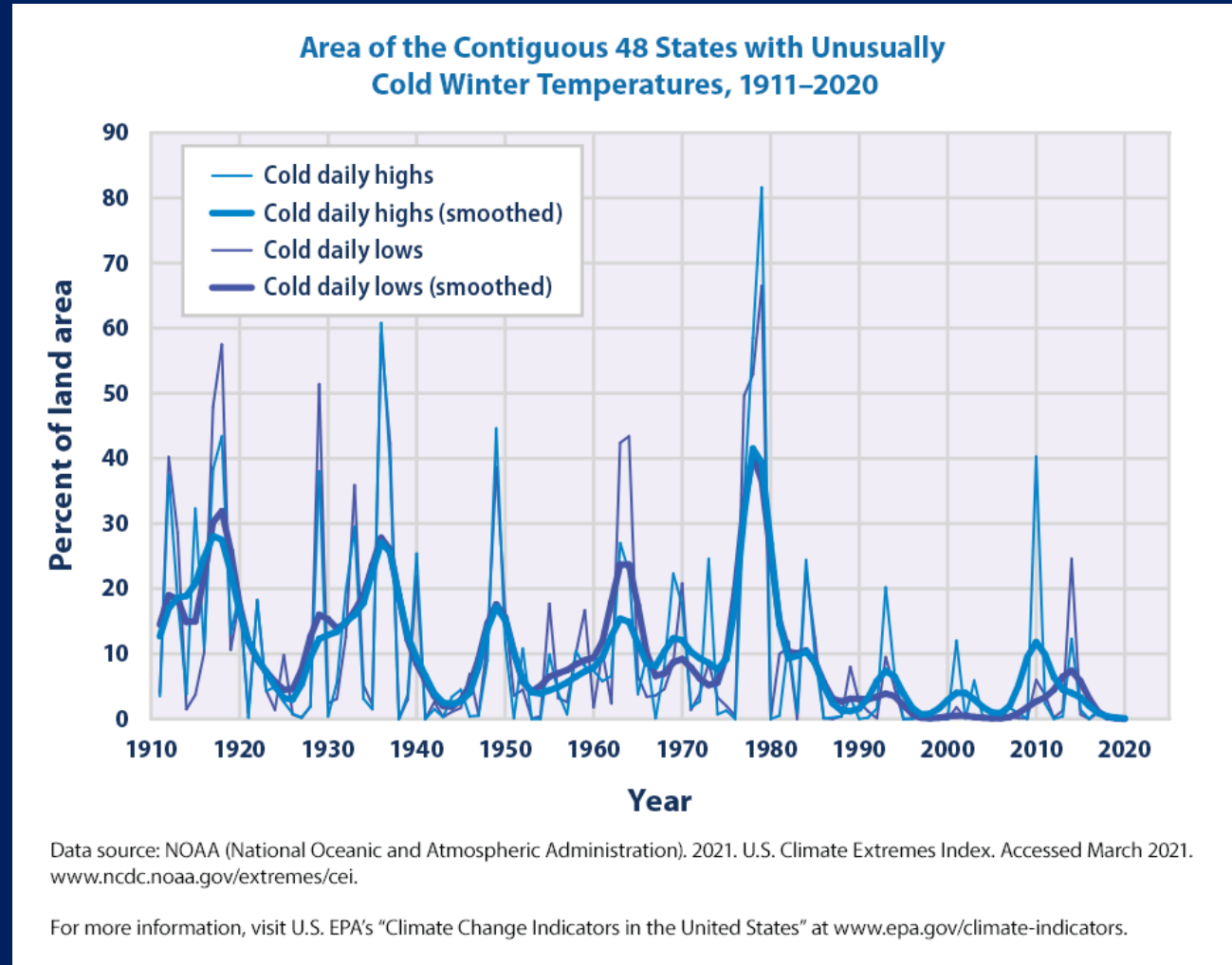
The number of warmer summer nights is increasing faster than the warmer days.



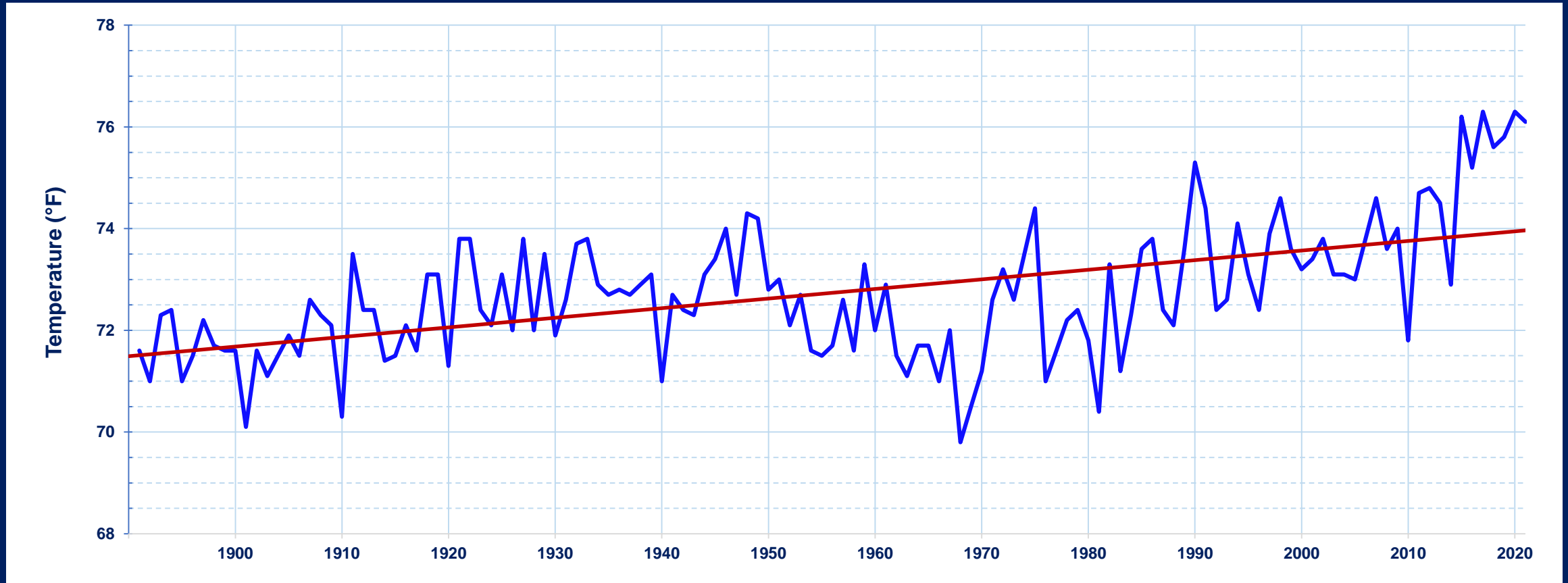
U.S. Temperature Trends

This graph shows the percentage of the land area of the contiguous 48 states with unusually cold daily high and low temperatures during the months of December, January, and February. The thin lines represent individual years, while the thick lines show a nine-year weighted average. Blue lines represent daily highs, while purple lines represent daily lows. The term “unusual” in this case is based on the long-term average conditions at each location.

The number of cold winter days is decreasing.



Mean Average Annual Temperature at Tampa



Average annual temperature at Tampa has **increased by about 2.5°F** since 1891



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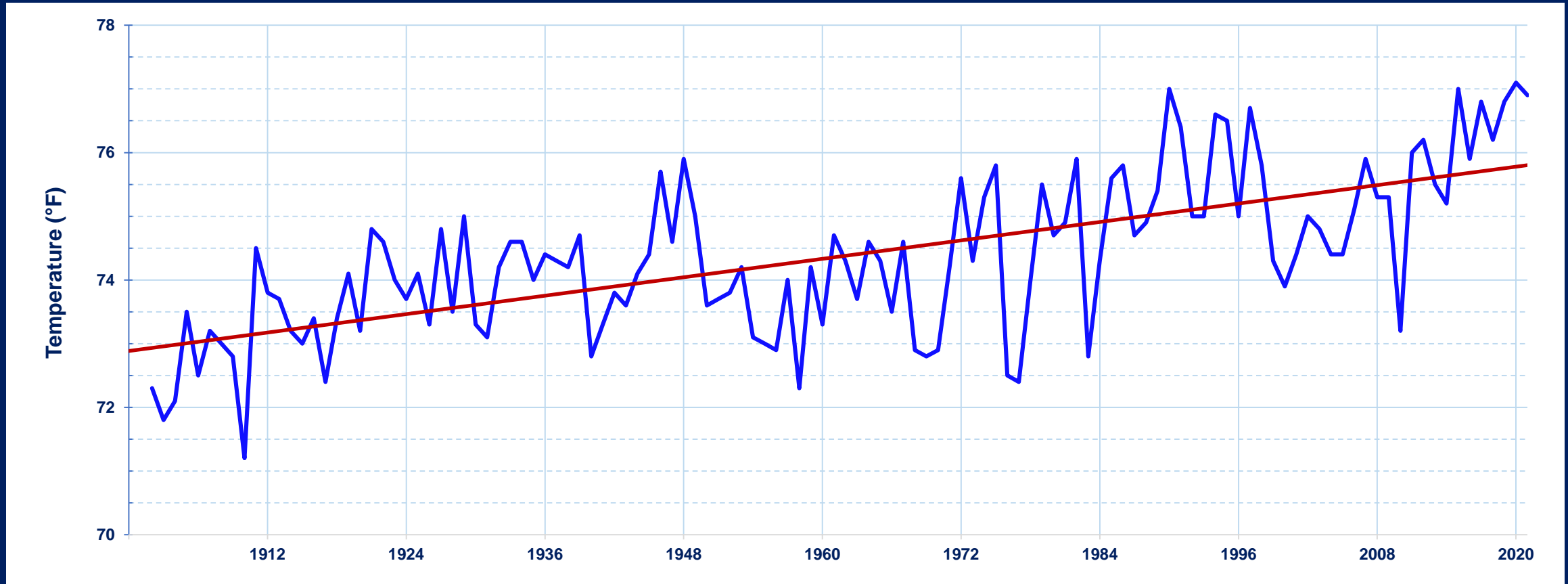
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Mean Average Annual Temperature at Fort Myers



Average annual temperature at Fort Myers has **increased by about 2.9°F** since 1902



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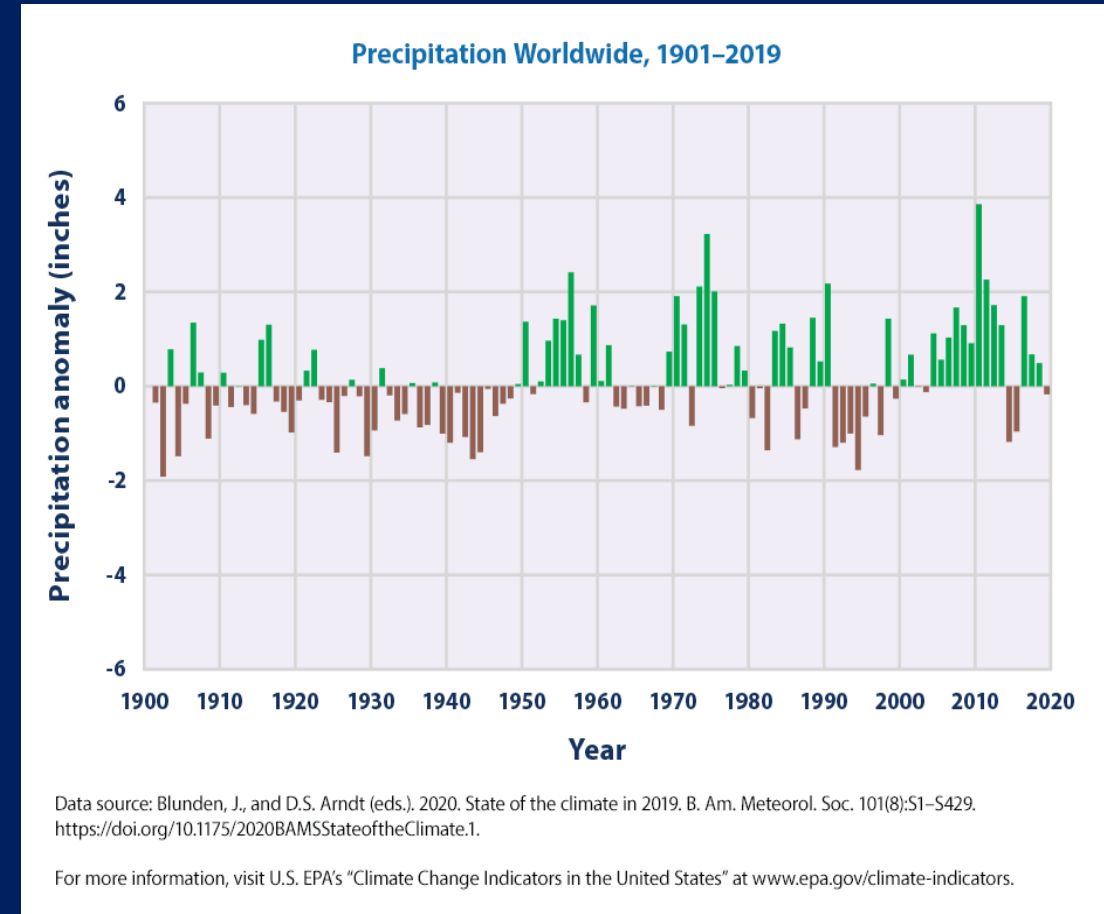


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Global Precipitation Change

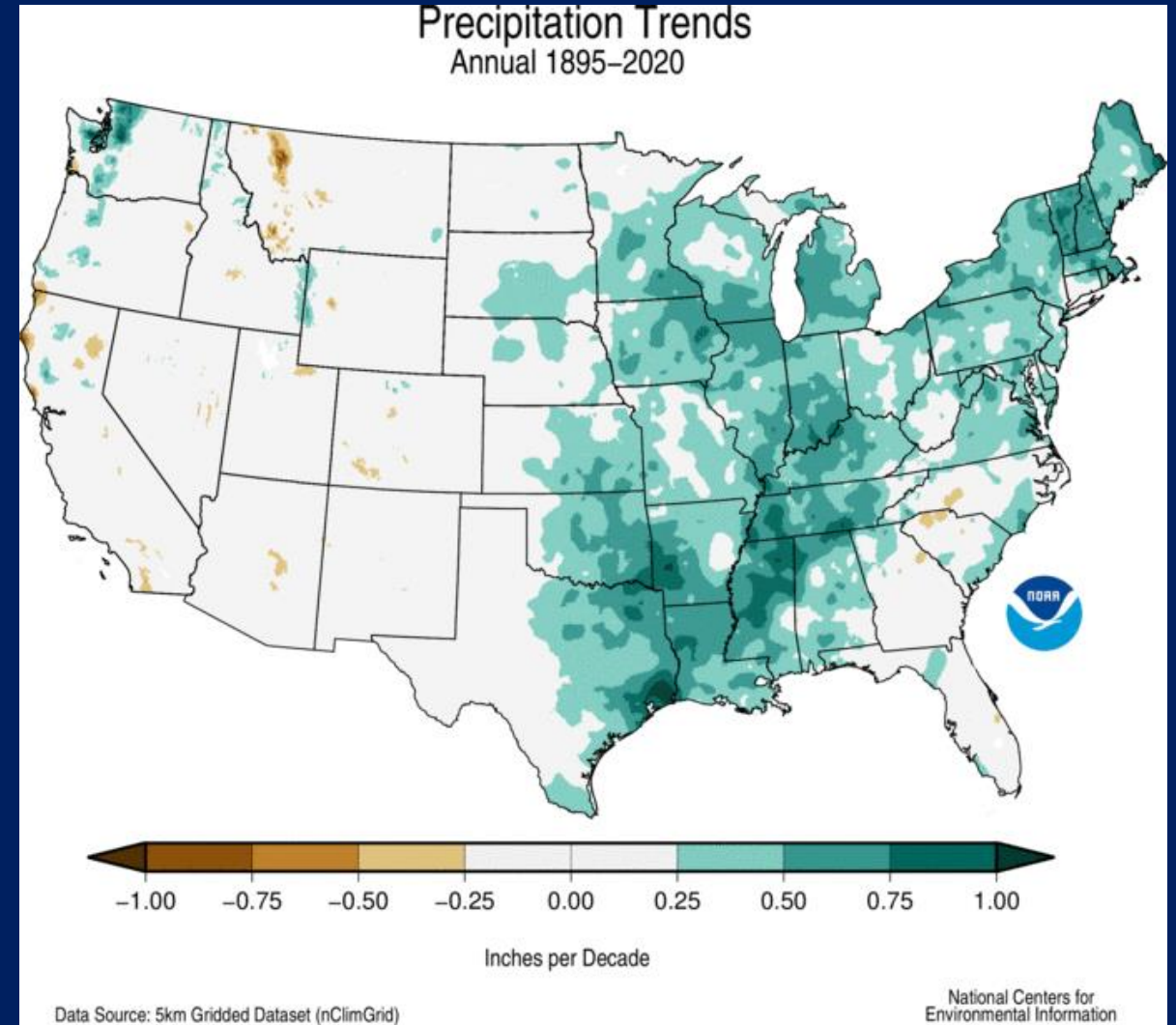
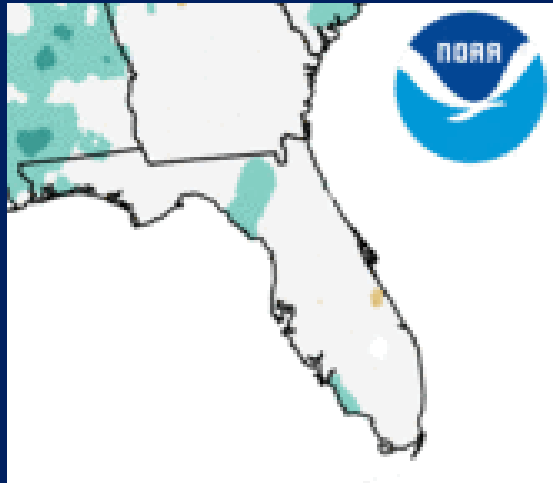
On average, total annual precipitation has increased over land areas in the United States and worldwide. Since 1901, global precipitation has increased at an average rate of 0.10 inches per decade, while precipitation in the contiguous 48 states has increased at a rate of 0.20 inches per decade.



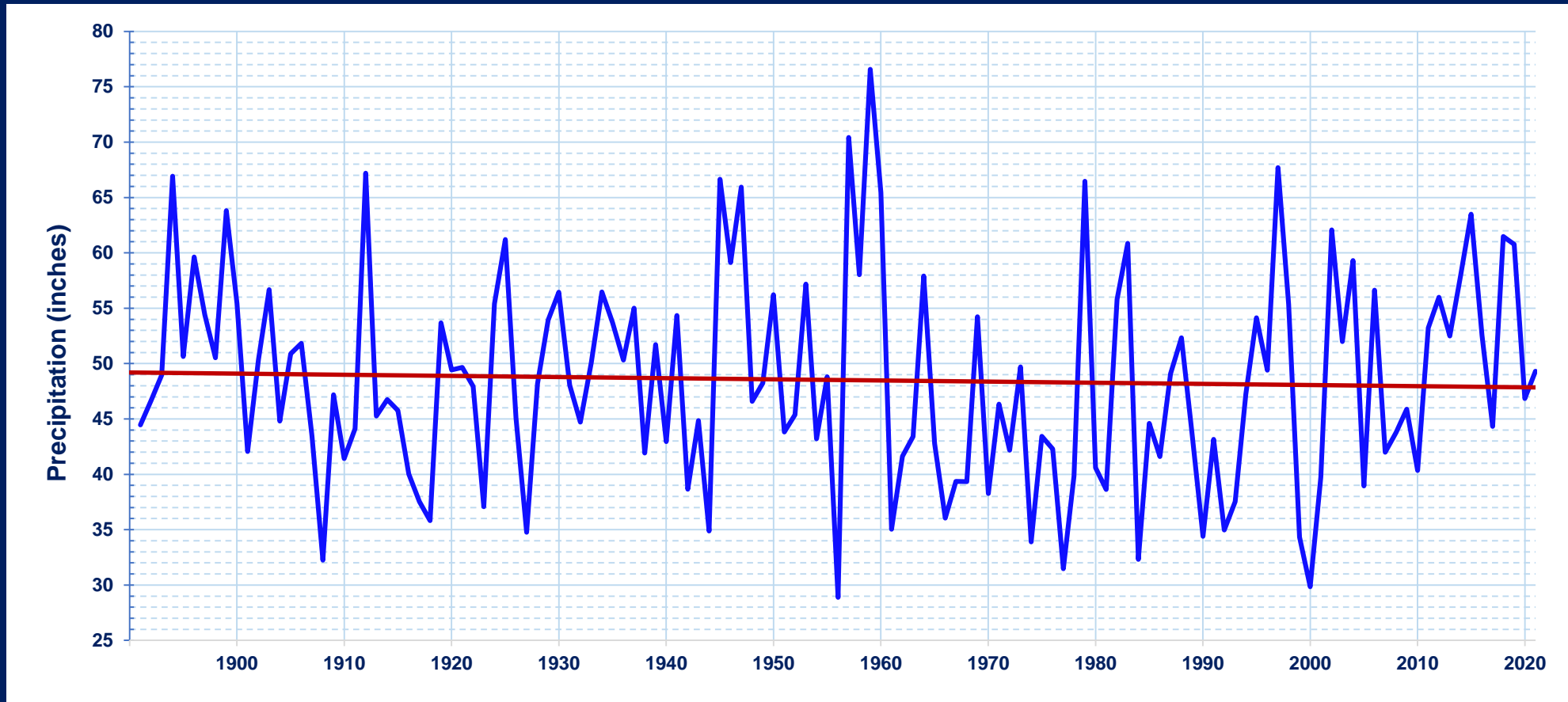
This figure shows how the total annual amount of precipitation over land worldwide has changed since 1901. This graph uses the 1901–2000 average as a baseline for depicting change.

U.S. Precipitation Trends

- Much of the central and eastern U.S. is seeing an increasing trend in the annual precipitation (green areas on map).
- Across most of the west and much of Florida though we're seeing only slight changes in the overall annual precipitation (white areas on map).

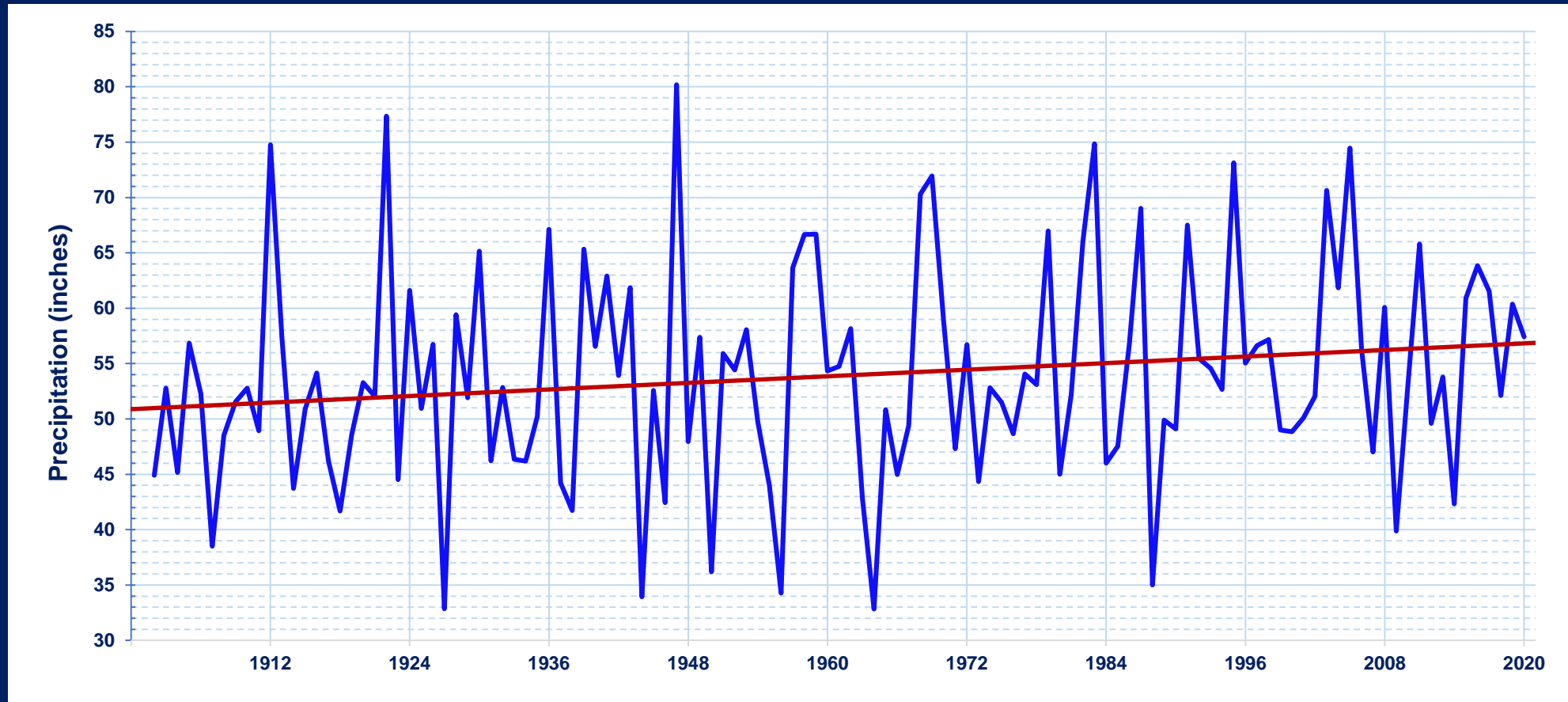


Total Annual Precipitation at Tampa



Total annual precipitation at Tampa has **decreased by 1.34 inches** since 1891, but there is a lot of year to year variability and the change per decade is only **-0.10 inches**

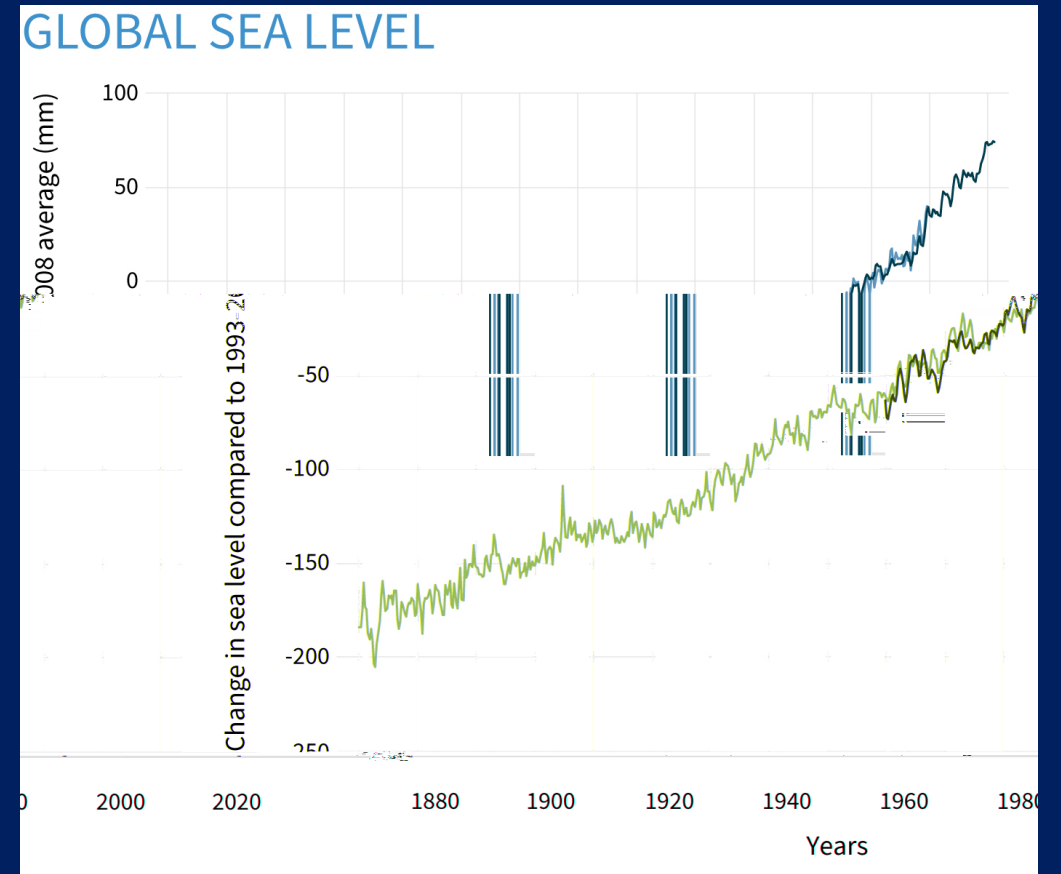
Total Annual Precipitation at Fort Myers



Total annual precipitation at Fort Myers has **increased by 5.75 inches** since 1902, but there is a lot of year to year variability and the change per decade is about **+0.48 inches**

Global Sea Level Change

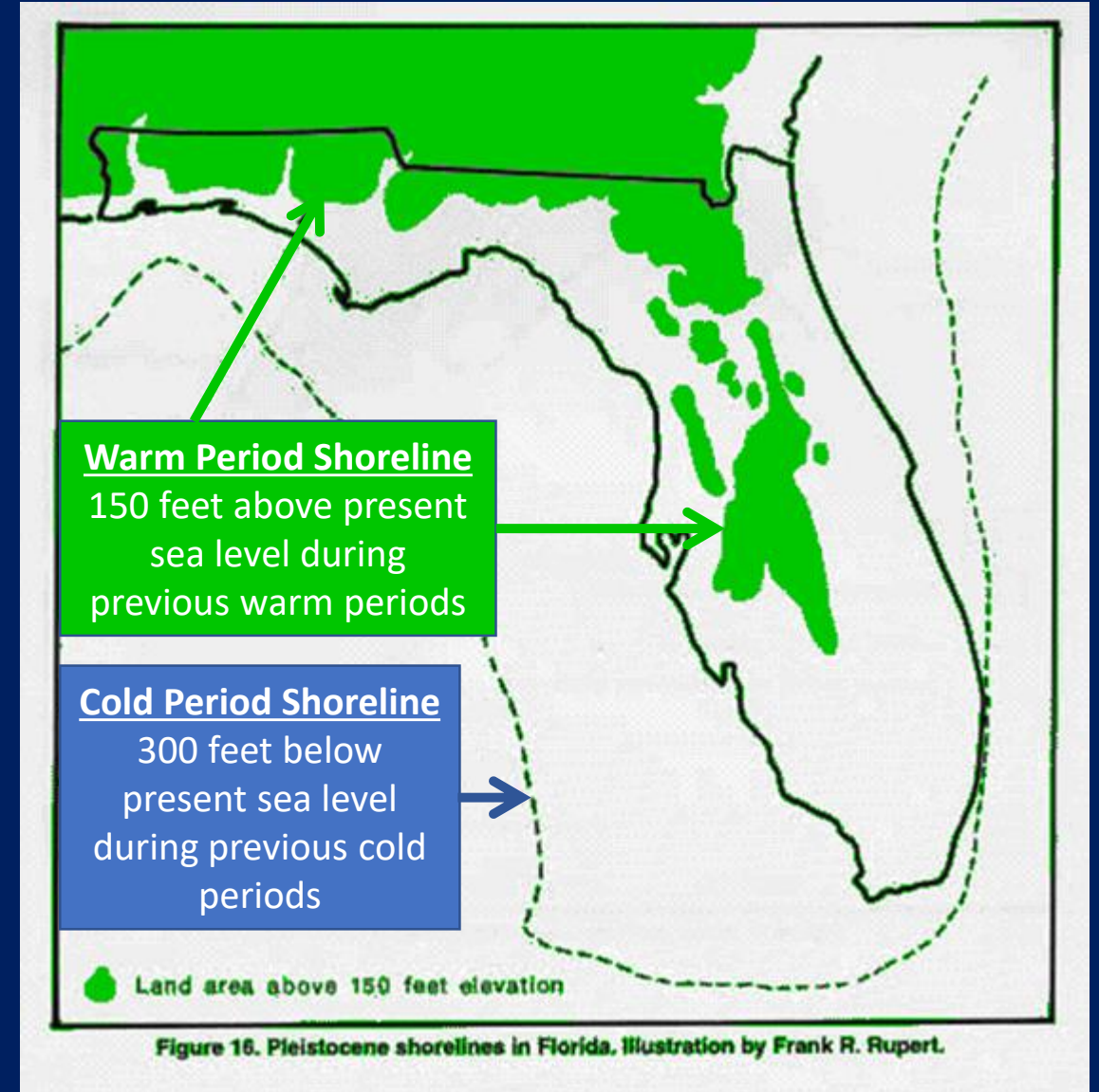
- Sea level has **risen 8-9 inches** (21-24 cm) since 1880.
- In 2020, global sea level set a new record high - 91.3 mm (3.6 inches) above 1993 levels.
- The rate of sea level rise is accelerating: it has more than doubled from 0.06 inches (1.4 millimeters) per year throughout most of the twentieth century to **0.14 inches (3.6 millimeters) per year** from 2006-2015.
- In many locations along the U.S. coastline, high-tide flooding is now **300% to more than 900%** more frequent than it was 50 years ago.



Seasonal (3-month) sea level estimates from Church and White (2011) (light blue line) and University of Hawaii Fast Delivery sea level data (dark blue). The values are shown as change in sea level in millimeters compared to the 1993-2008 average. NOAA Climate.gov image based on analysis and data from Philip Thompson, University of Hawaii Sea Level Center.

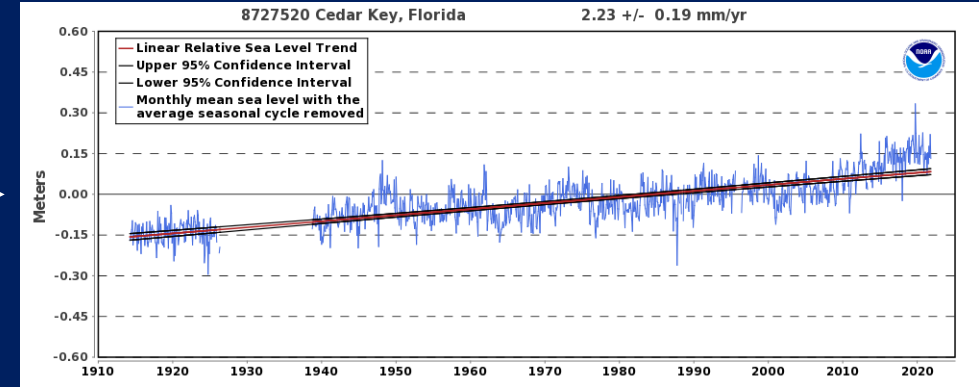
Florida Sea Level Cycles

Thanks to the Natural Climate Cycles the Florida shoreline has varied greatly. During the earth's warm periods (or "interglacials") it has been determined that the Florida shoreline was **nearly 150 feet above the current sea level** while during the cold periods (or "ice ages") it was as much as **300 feet below the present sea level**.

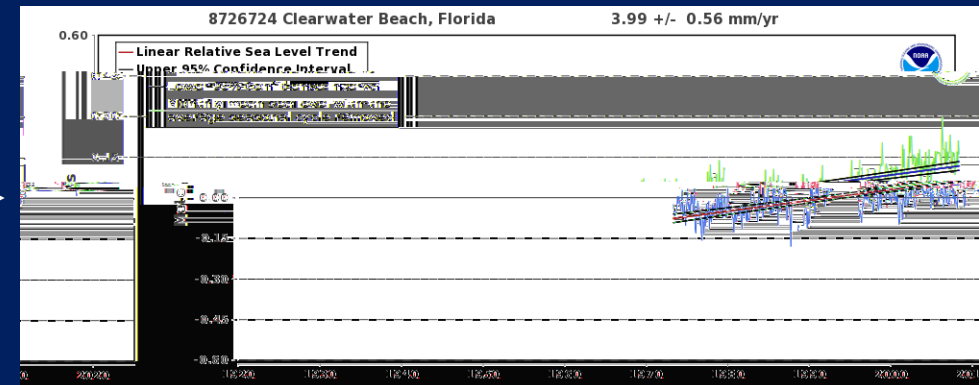


Local Sea Level Change

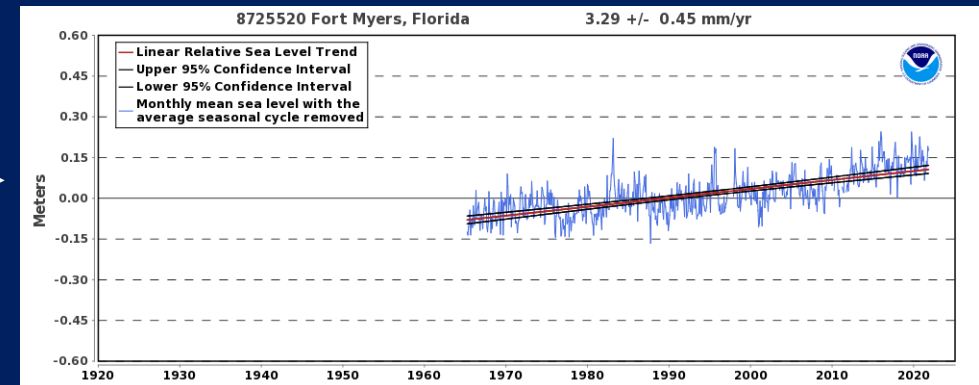
At Cedar Key the relative sea level trend is 2.23 mm/yr with a 95% confidence interval of +/- 0.19 mm/yr based on monthly mean sea level data from 1914 to 2020 which is equivalent to a change of **0.73 feet in 100 years**.



At Clearwater Beach the relative sea level trend is 3.99 mm/yr with a 95% confidence interval of +/- 0.56 mm/yr based on monthly mean sea level data from 1973 to 2020 which is equivalent to a change of **1.31 feet in 100 years**.



At Fort Myers the relative sea level trend is 3.29 mm/yr with a 95% confidence interval of +/- 0.45 mm/yr based on monthly mean sea level data from 1965 to 2020 which is equivalent to a change of **1.08 feet in 100 years**.



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Climate Change Impacts in Florida

Though we often think about human-induced climate change as something that will happen in the future, it is an ongoing process. Ecosystems and communities in the United States and around the world are being impacted today.

For us the biggest issues are going to be:

- Warming temperatures - Higher temperatures can potentially lead to deadly illnesses, such as heat exhaustion and heat stroke. Hot temperatures can also contribute to deaths from heart attacks, strokes, and other forms of cardiovascular disease. Warmer temperatures could affect some agricultural activities.
- Sea Level Rise - If the world follows a low greenhouse gas pathway, global sea level will likely rise at least 12 inches (0.3 meters) above 2000 levels by 2100 and if we follow a pathway with high emissions, a worst-case scenario of as much as 8.2 feet (2.5 meters) above 2000 levels by 2100 cannot be ruled out.



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Any Questions?

Some good website references:

- [Climate.gov](https://climate.gov)
- [Climate \(noaa.gov\)](https://climate.noaa.gov)
- [Climate Change Impacts \(noaa.gov\)](https://climate.noaa.gov/impacts)
- [Climate Change Indicators in the United States \(epa.gov\)](https://www.epa.gov/climate-indicators)



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