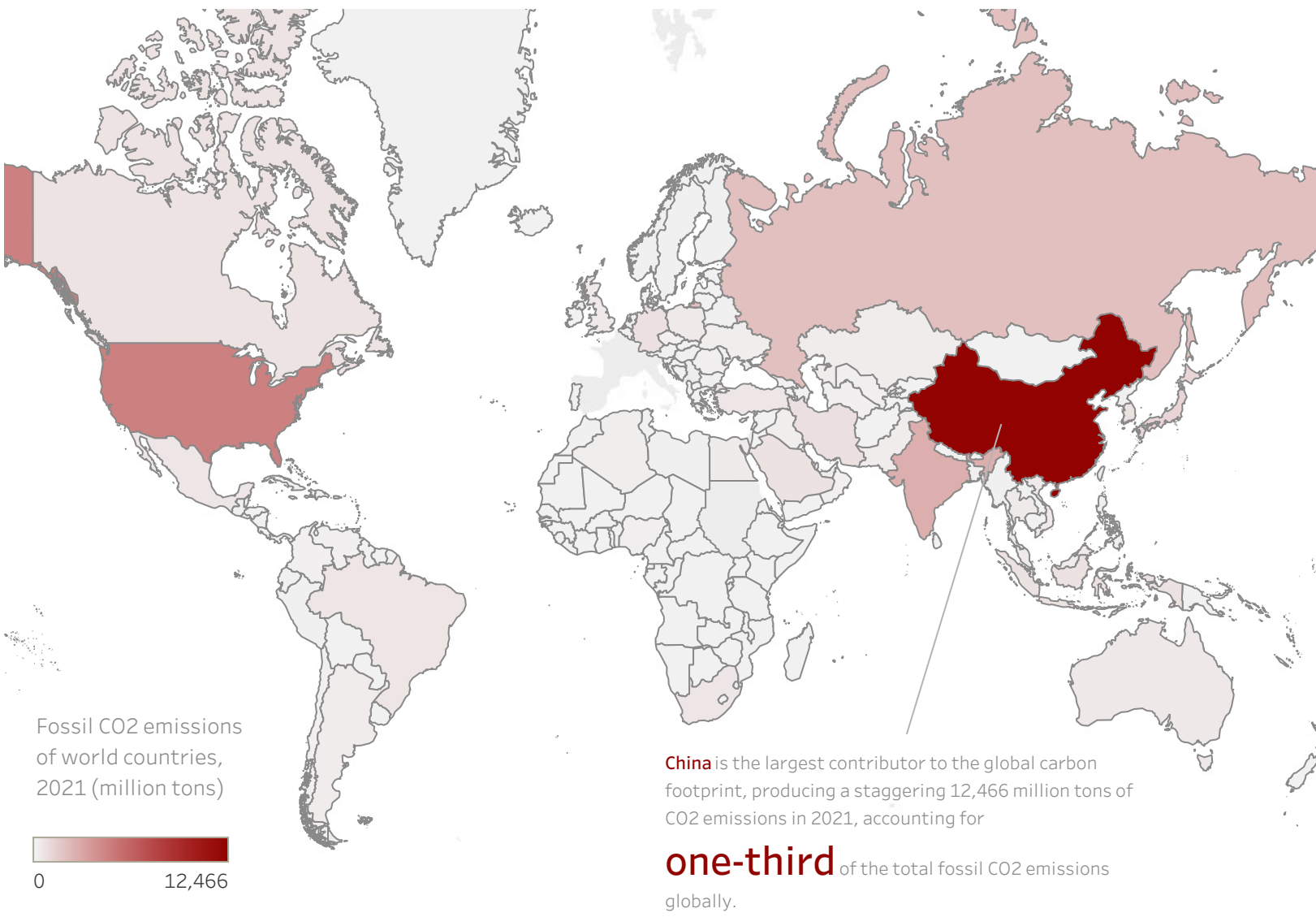


Global Warming

Greenhouse gases act as a natural blanket that keeps the Earth’s climate at a comfortable temperature. They allow the sun’s rays to warm the planet during the day, while trapping heat that is released back into the atmosphere at night to keep the Earth warm. However, human activities have led to an excessive increase in greenhouse gas levels, causing a buildup of heat in the atmosphere and resulting in global warming. Carbon dioxide is the primary contributor to this phenomenon, followed by methane, nitrous oxide, and other gases known as fluorinated gases.

Greenhouse gases by percentage of total emissions



Carbon dioxide emissions by source



The driving forces behind the rise of CO2 emissions, accounting for over 70% of total emissions, are the electricity, heat and transportation industries fueled by the consumption of non-renewable fossil fuels such as oil, natural gas, and coal.

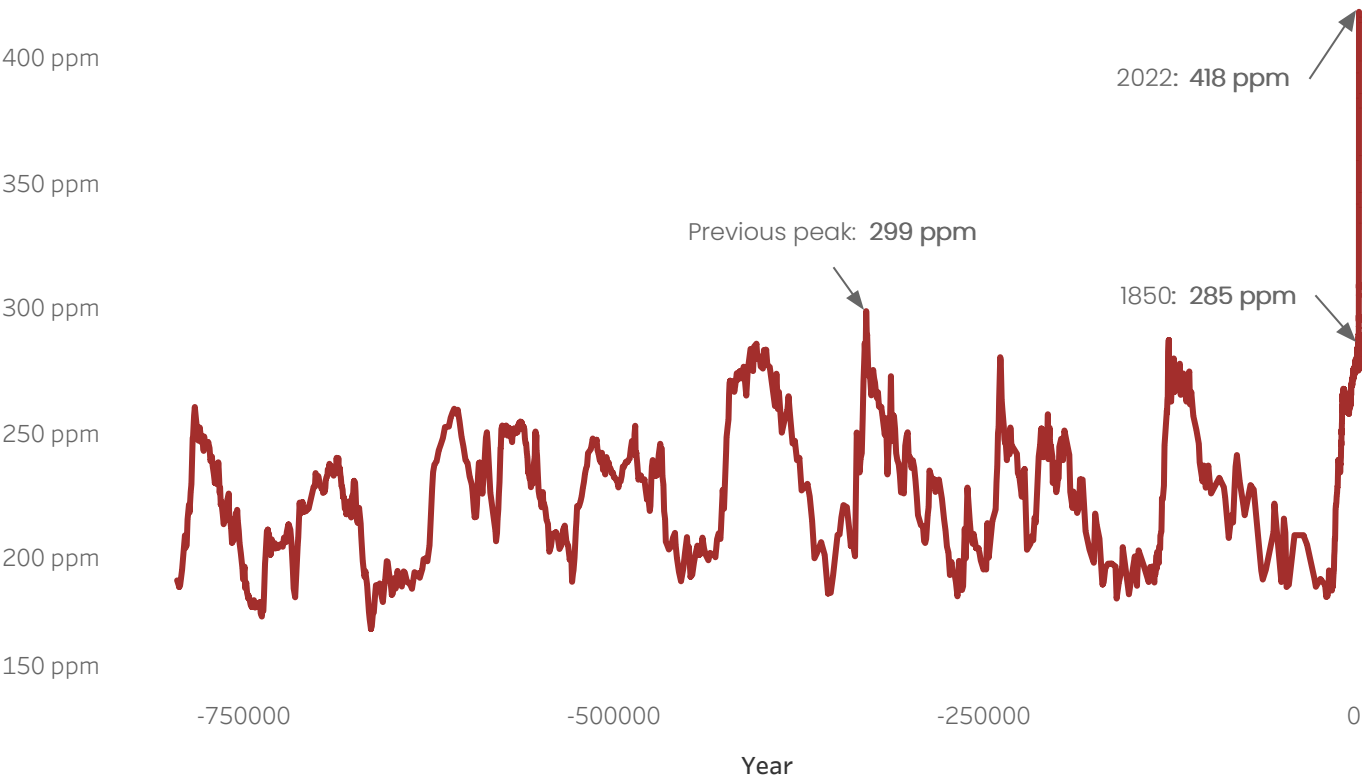
With the increasing demand for global travel and technology, unless alternative energy sources are embraced, CO2 emissions will continue to rise in correlation to these industries.

Scientific studies of ice cores in Antarctica reveal a shocking trend of CO2 concentration levels over the past 800,000 years. Measured in parts per million (ppm), the number of CO2 molecules per million air particles remained below 300 ppm for nearly a million years.

However, with the advent of the “technological era” in the mid-19th century and increased consumption of fossil fuels, CO2 levels skyrocketed and have been continuously increasing every year, currently standing at over 100 ppm higher than pre-human levels.

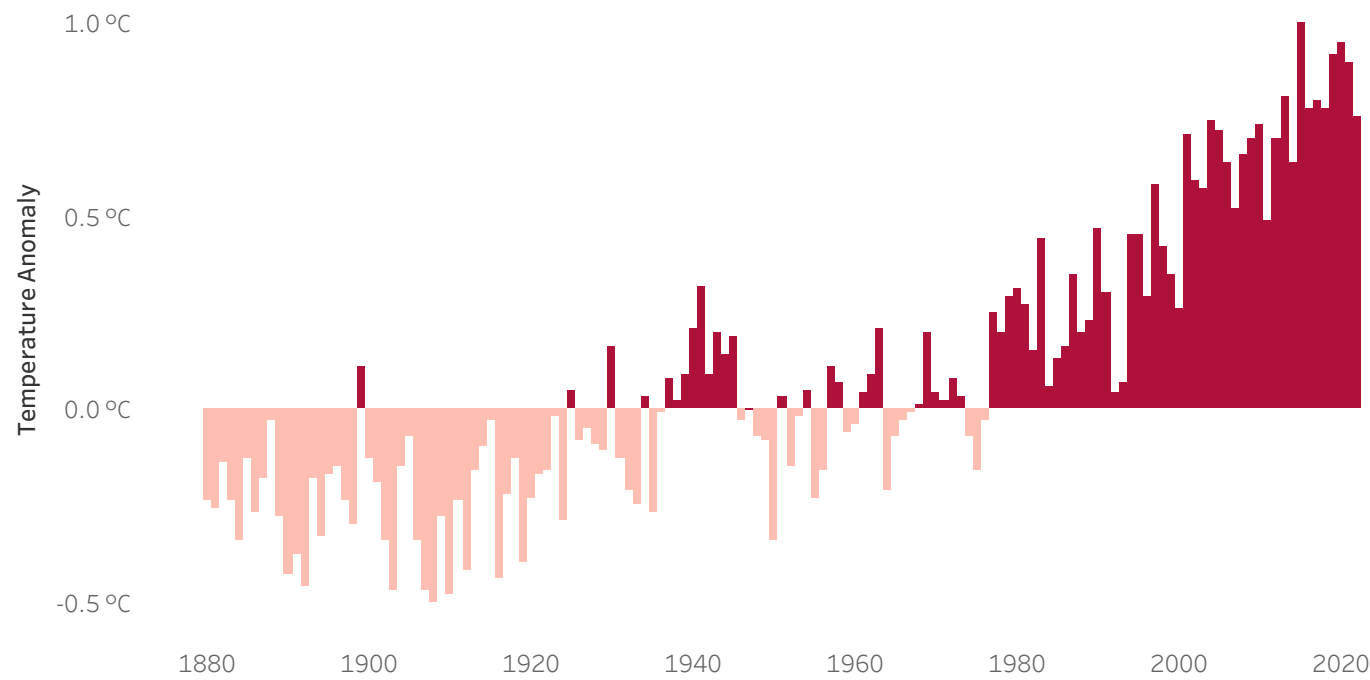
Carbon dioxide concentration over the past 800,000 years

Based on CO2 molecules in air



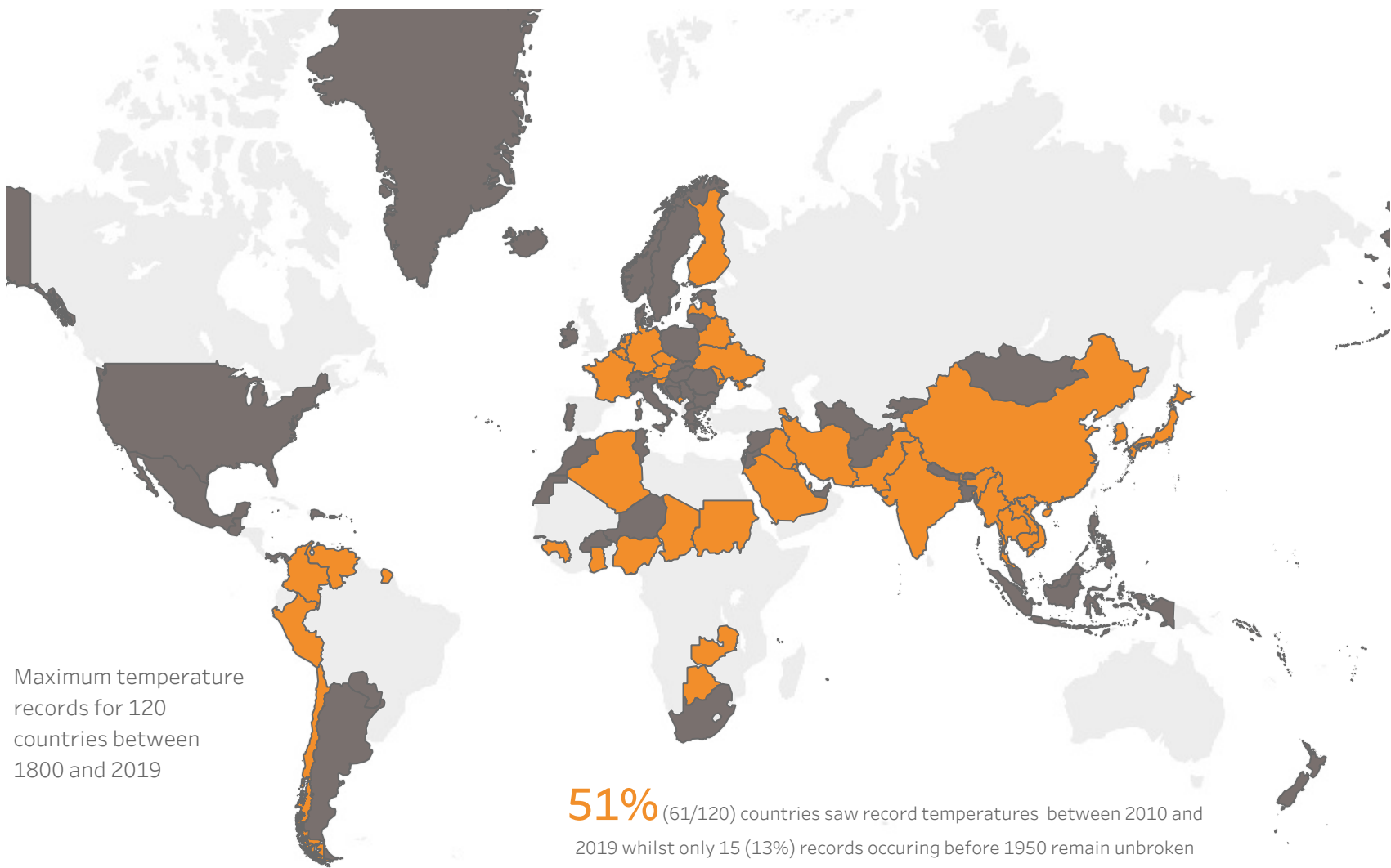
Annual anomalies in global surface temperature from 1880 to 2021

Based on temperature difference compared to 20th century average



The trend of rising surface temperatures, driven by the buildup of greenhouse gases in the atmosphere, is evident in the analysis of the Earth’s surface temperatures. With no year since 1980 falling below the average temperature of the 20th century.

Temperatures are now approaching a 1 degree Celsius increase compared to the previous century’s average, emphasizing the pressing issue of climate change.

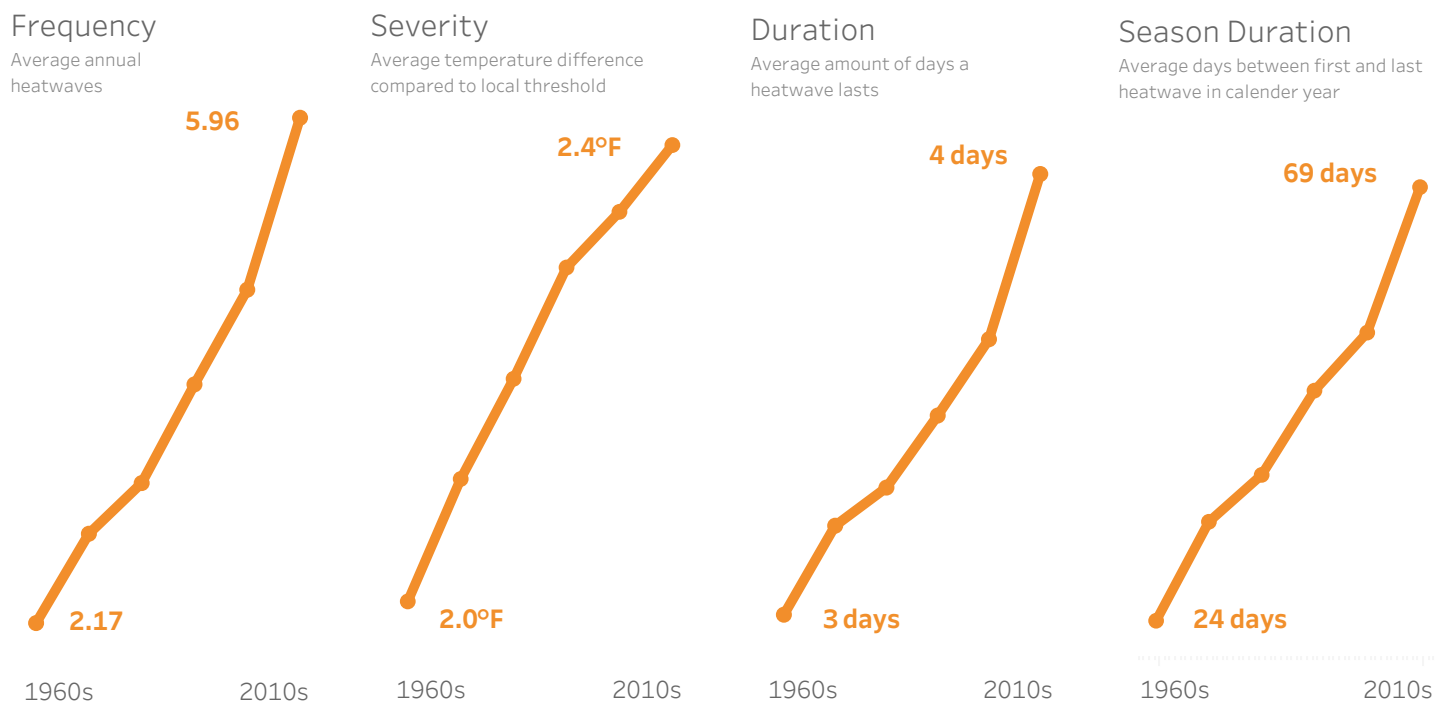


Rising Temperatures

As the Earth’s temperature rises, we’re witnessing a surge in extreme heat-related weather conditions - setting new heat records and intensifying the frequency, severity, and longevity of heatwaves, droughts, and wildfires. Currently over

700 million people are affected by heat related weather events events every year.

US heatwaves between 1960 and 2019, by decade average



An analysis of heatwave metrics in the US reveals a rising trend in their impact. From 2010 to 2019, the average number of annual heatwaves reached 6, compared to only 2 in the 1960s.

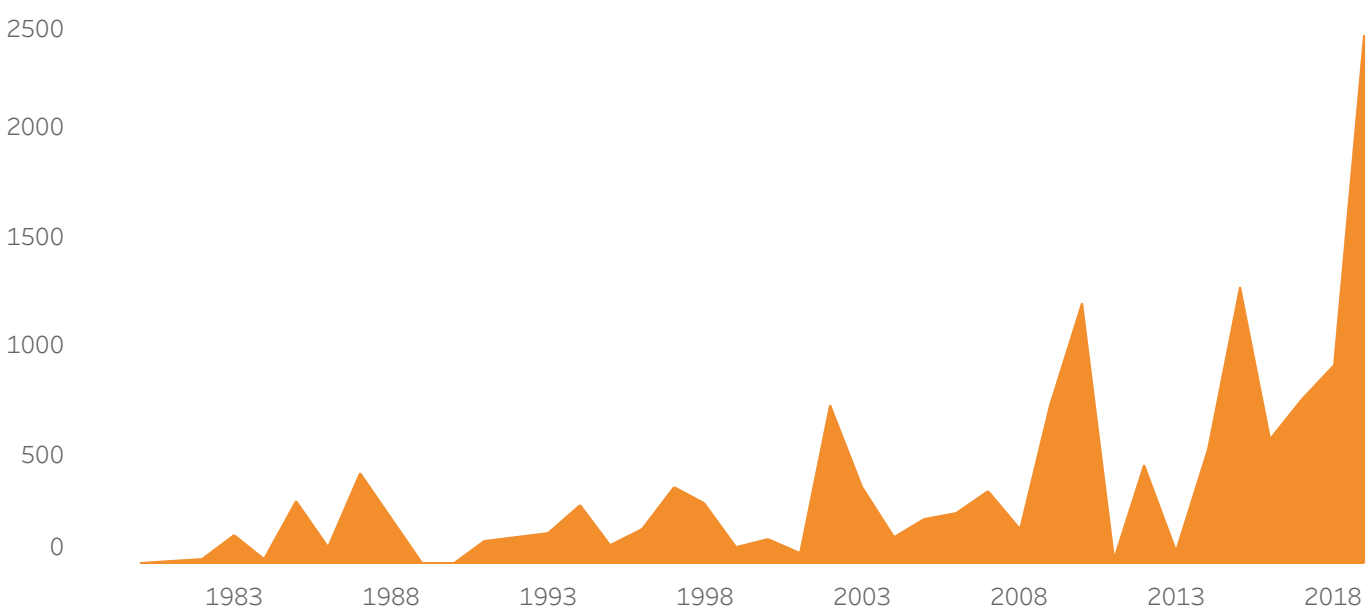
Furthermore, heatwaves in the 2010s were more intense than those in the 60s, with average temperature deviations rising by 0.4 degrees.

The length of heatwaves and the heatwave season have also expanded, with the average heatwave duration increasing by 33% and the heatwave season tripling between the 1960s and the 2010s.

Rising heat and reduced rainfall result in increased evaporation, making soil and vegetation dryer, thus making them more vulnerable to wildfires. These wildfires then become more intense and widespread, resulting in a rise in the frequency of catastrophic fires and the number of people being affected by them.

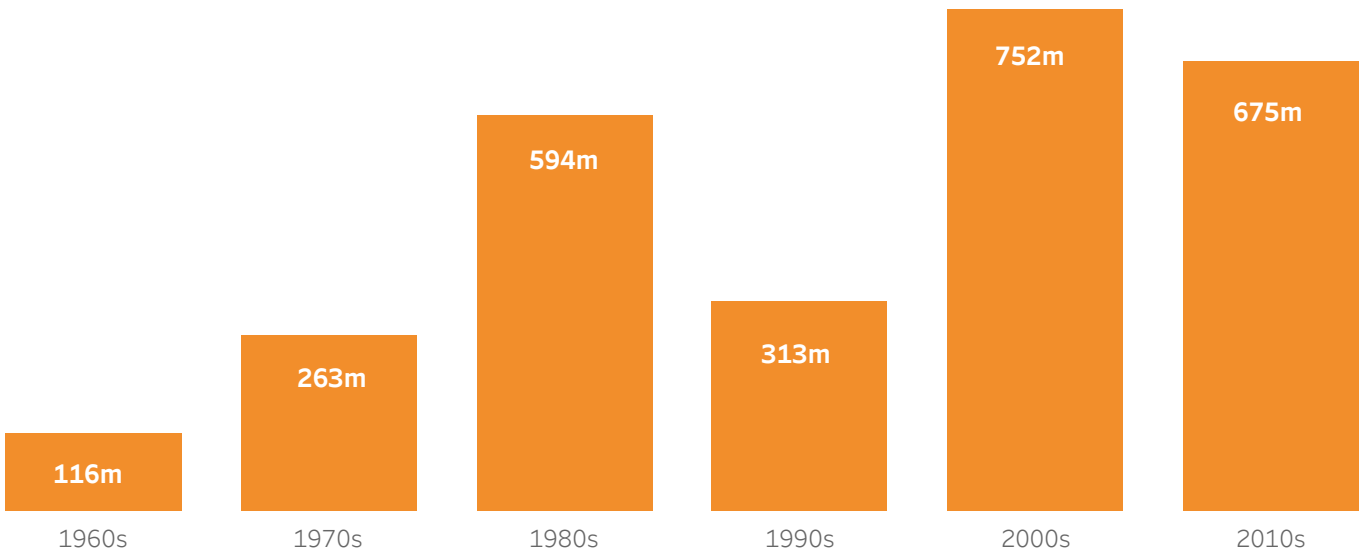
In 2019 almost 2500 people were injured or killed by wildfires with the number of people displaced or left homeless reaching the six figures, far higher than any other year on record.

Number of people injured or killed by wildfires worldwide between 1980 and 2019



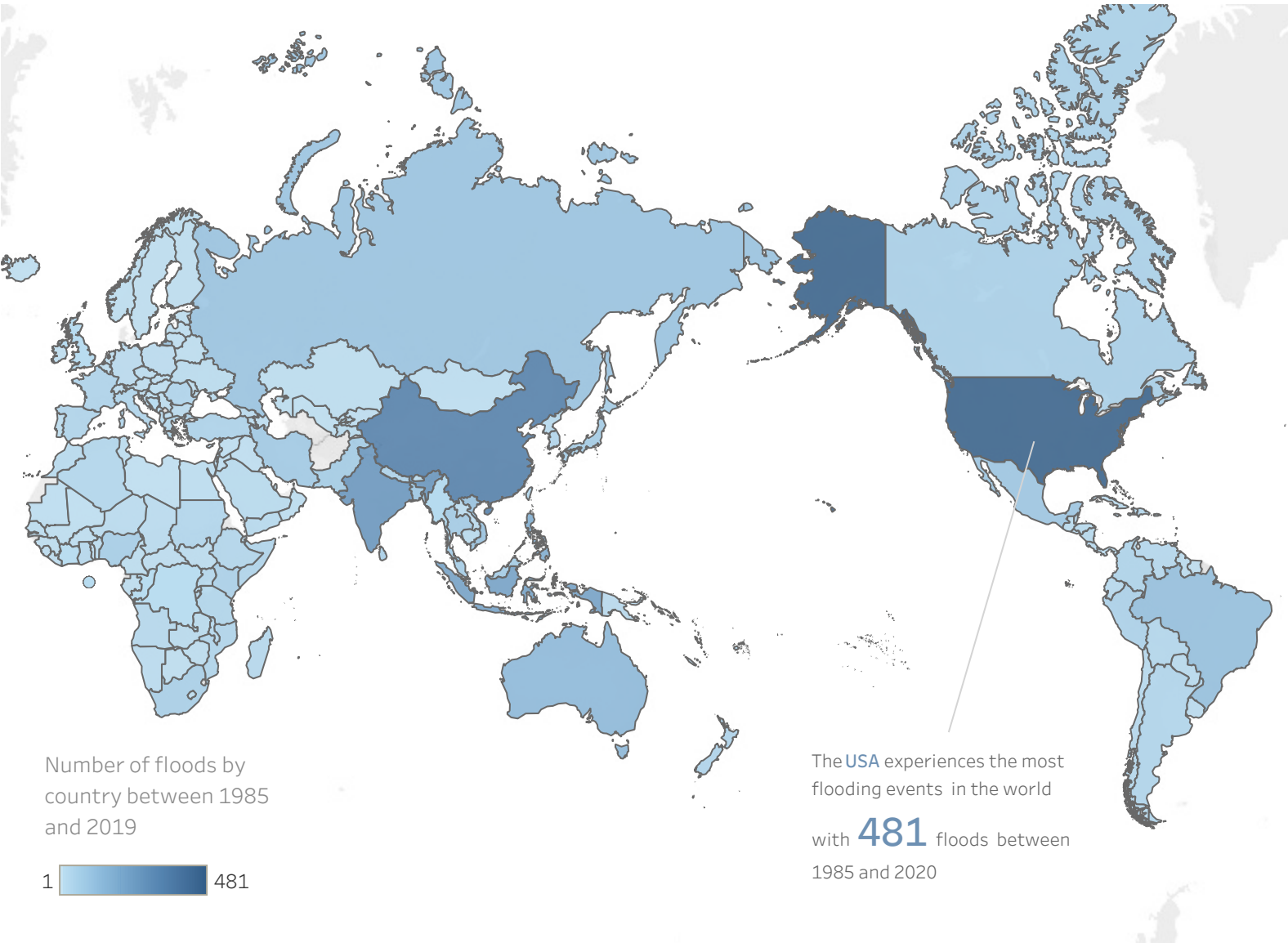
People affected by droughts worldwide between 1960 and 2019, by decade average (millions)

People affected are the sum of injured, requiring assistance and homeless due to event



The drying soil due to high temperatures removing liquid water from soil and plant leaves, transforming it into water vapor is resulting in an increase in ground level drying in some parts of the world. This drying causes harsher conditions for agriculture and increases the likelihood and severity of droughts.

Since 2000 over 1.5 billion people have required assistance as a consequence of a drought.

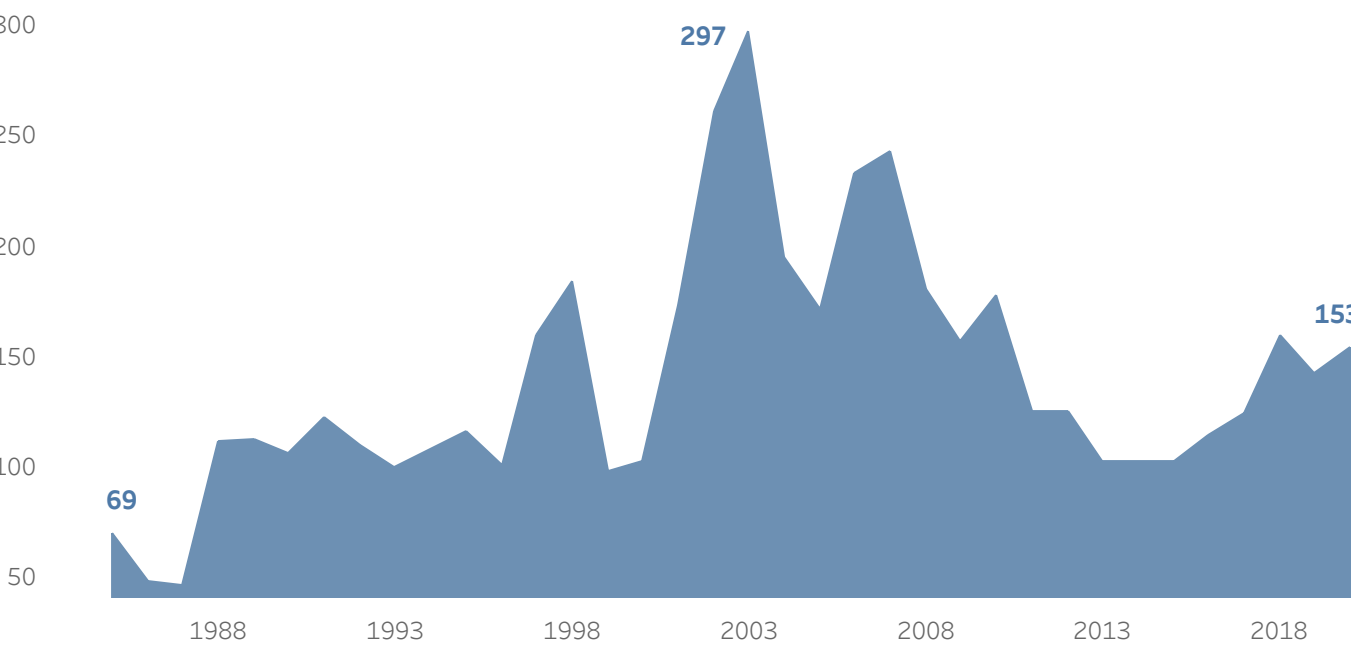


Floods

As climate change warms up the atmosphere, the air can hold 7% more water vapour for every one-degree Celsius rise in temperature. When this air rapidly cools, water vapour turns into droplets which join together to form heavy rainfall resulting in increasing frequency and severity of global flooding events.

Precipitation worldwide from 1985 to 2020
Based on difference in inches compared to 20th century average

Flooding event frequency worldwide from 1985 to 2020

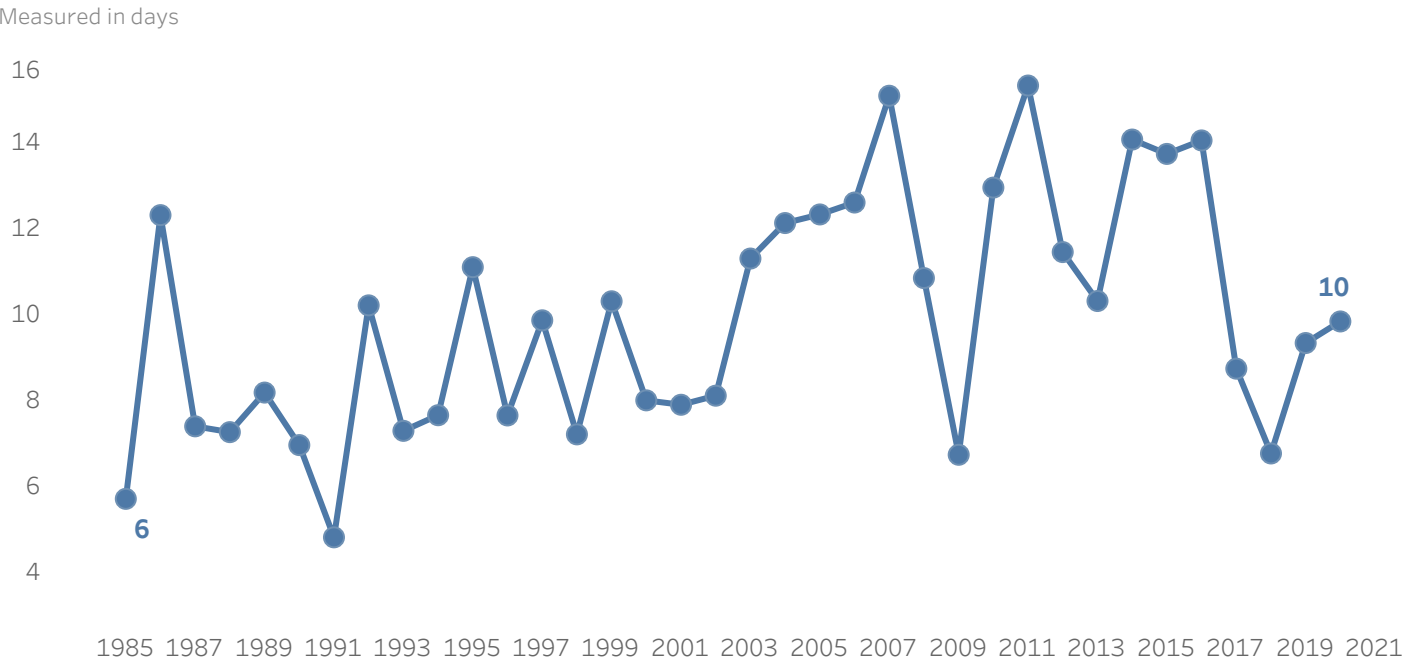


Contrary to the drying of soils in some regions due to elevated temperatures resulting in droughts, the evaporated water in other areas causes heavier rainfall and results in flooding.

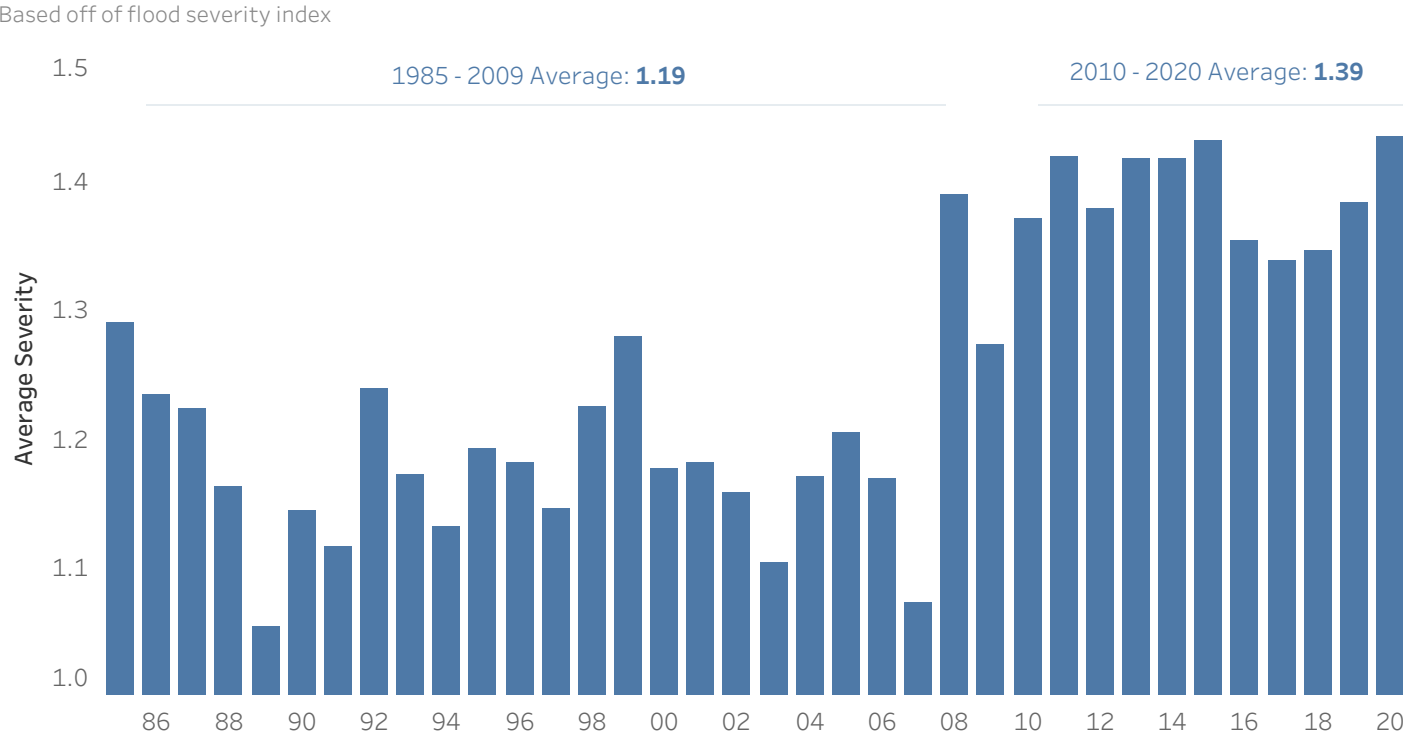
4 out of the 5 years with the most flooding events globally have occurred after the year 2000.

In addition to a rise in the frequency of global flooding events, the average length of each flood is also increasing, reaching a high of an average duration of 15.3 days in 2011.

Length of flooding events worldwide from 1985 to 2020

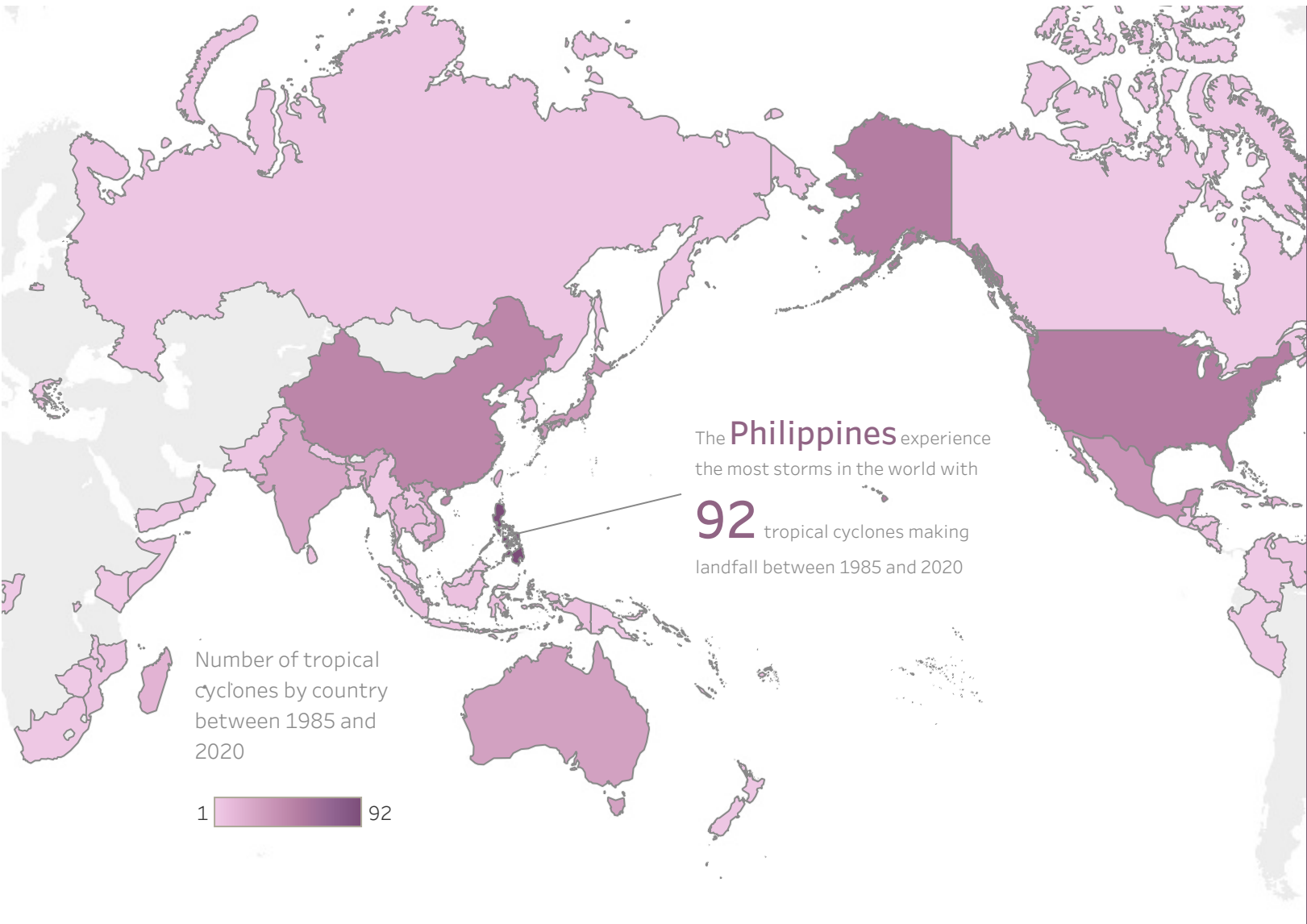


Severity of flooding events worldwide from 1985 to 2020



The Severity Index is used to evaluate the intensity of individual flooding events. It rates each event based on the estimated time interval between similar events, with scores of 1 (less than 10 years), 1.5 (between 10 and 100 years), or 2 (at least 100 years).

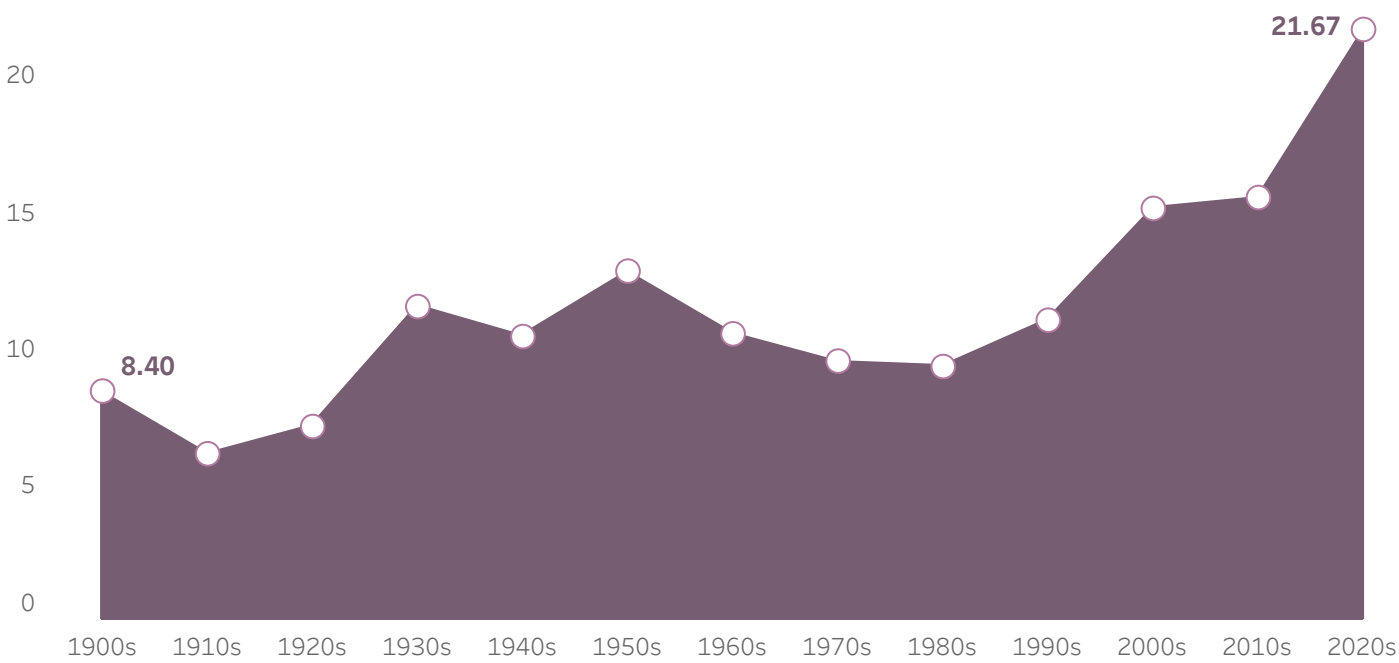
Since 2010, the average severity of floods have been higher annually than all years prior.



Tropical Cyclones

More than **125 million people**, have been displaced by tropical cyclones between 1985 and 2020 with a further **300 thousand** people losing their lives to these ferocious weather events. These powerful weather events can be classified into three categories: tropical depressions, with maximum sustained winds of 38 mph or less, tropical storms, with sustained winds between 39 mph and 73 mph and hurricanes, the strongest type of tropical storm, with sustained winds of 74 mph or higher. As global temperatures rise and atmospheric moisture increases, we are witnessing more frequent and severe tropical cyclon..

Frequency of annual named storms in the North Atlantic Ocean between 1900 and 2022, by decade average



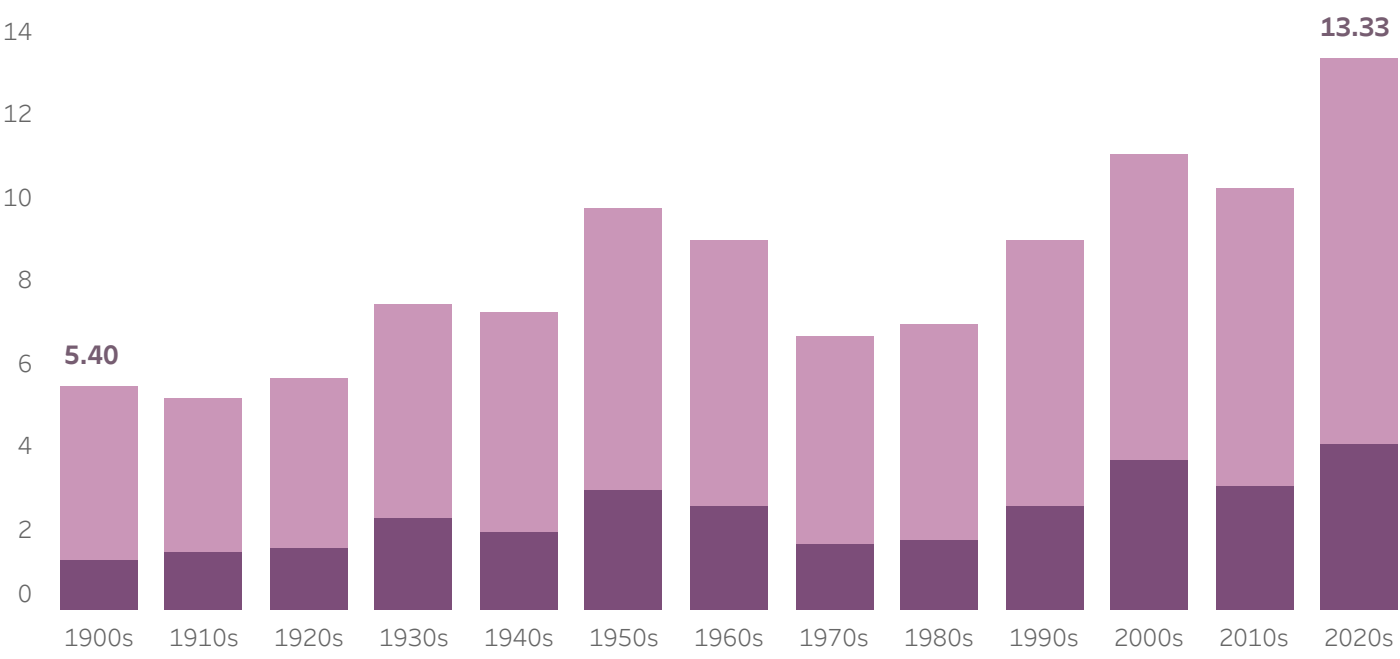
The most severe and dangerous tropical cyclones that are either tropical storms or hurricanes are often given names in order to make it easier to communicate between meteorologists and the public.

In 2020, there were 30 named storms witch set a record for the number of named storms in a calendar year.

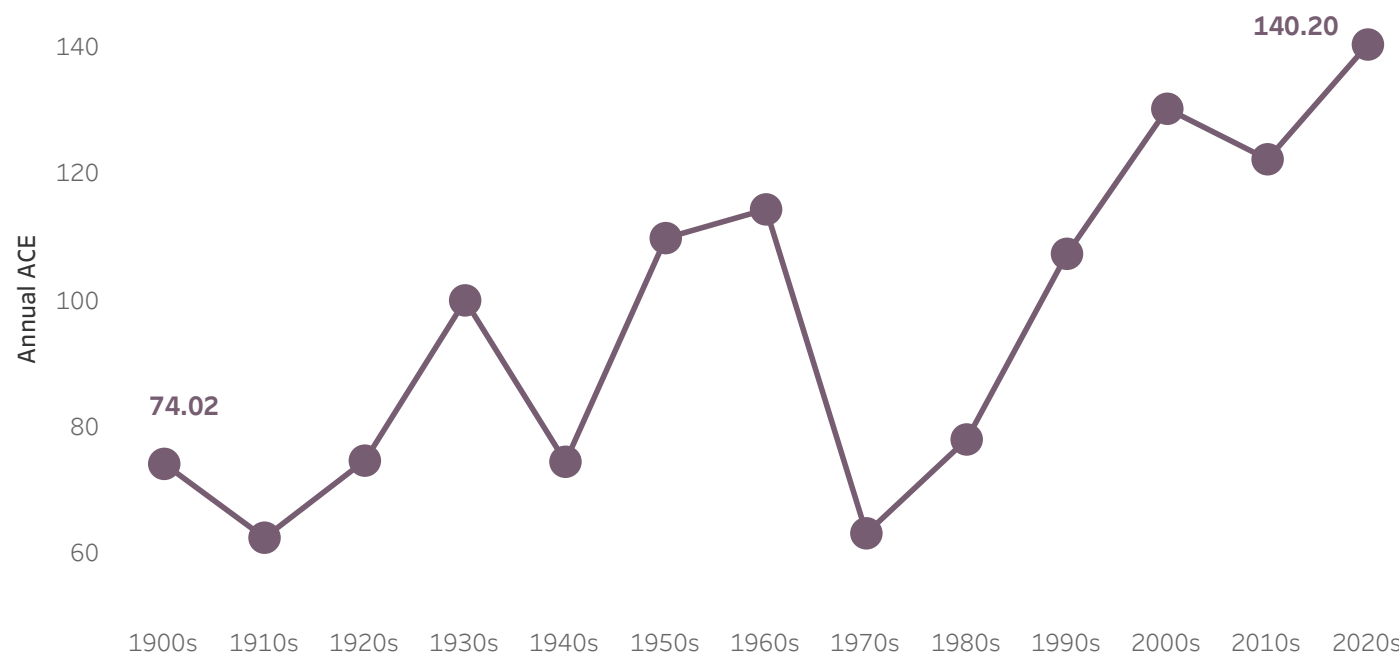
Hurricanes, the most deadly type of tropical storms, are assigned a category between 1 and 5 based on their wind speeds and severity. The most dangerous hurricanes, known as major hurricanes, are those that are at least a category 3.

So far, the 2020s, have seen an average of 9.33 annual hurricanes in the North Atlantic, setting a record for the highest frequency of the most dangerous storms of any decade on record.

Frequency of **Hurricanes** and **Major Hurricanes** in the North Atlantic Ocean, 1900-2022, by decade average



Annual accumulated Cyclone energy in the North Atlantic, 1900-2022, by decade average



Accumulated Cyclone Energy (ACE) is a metric used to express the energy released by a tropical cyclone during its lifetime. It is calculated by summing the square of a storm's maximum sustained winds, measured every six hours. The annual accumulated cyclone energy refers to the sum of all tropical cyclones' energy over a calendar year.

Once again, we see a record average annual ACE in the 2020s, with an average of 140



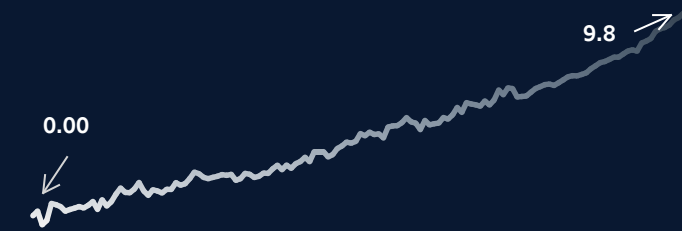
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A Rising Ocean

Climate change, driven by rising global temperatures, poses a significant threat to coastal communities and ecosystems through rising sea levels. The two primary causes of rising sea levels are thermal expansion, caused by the ocean absorbing heat and causing water molecules to expand, and the melting of ice into water, which results in increased ocean levels.

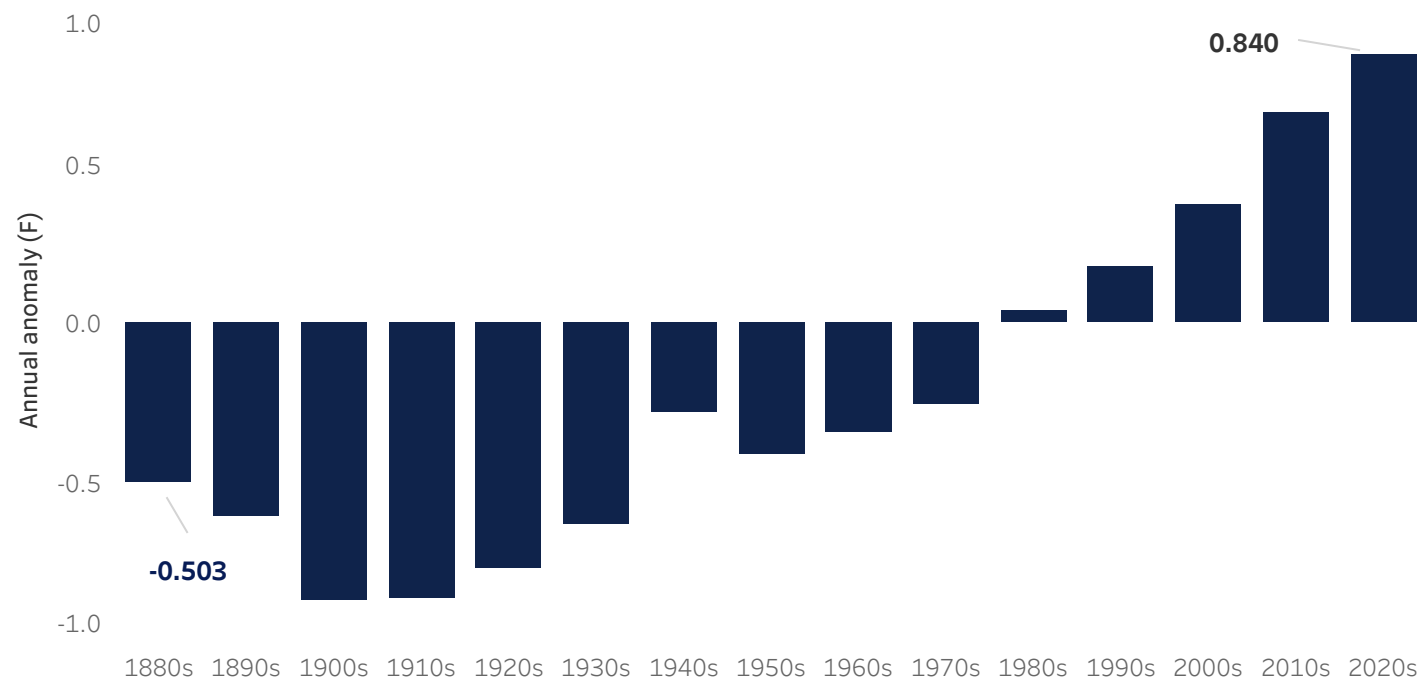
Annual sea level change between 1880 and 2021

Based on adjusted sea level measured in inches



Ocean surface temperature between 1880 and 2020, by decade average

Based on temperature compared to 1970-2000 average in degrees Fahrenheit



Since the 1950s, the average ocean temperature has consistently risen, exceeding the 1970-2000 average in the 1970s and approaching 1 degree Fahrenheit above that average in the current decade.

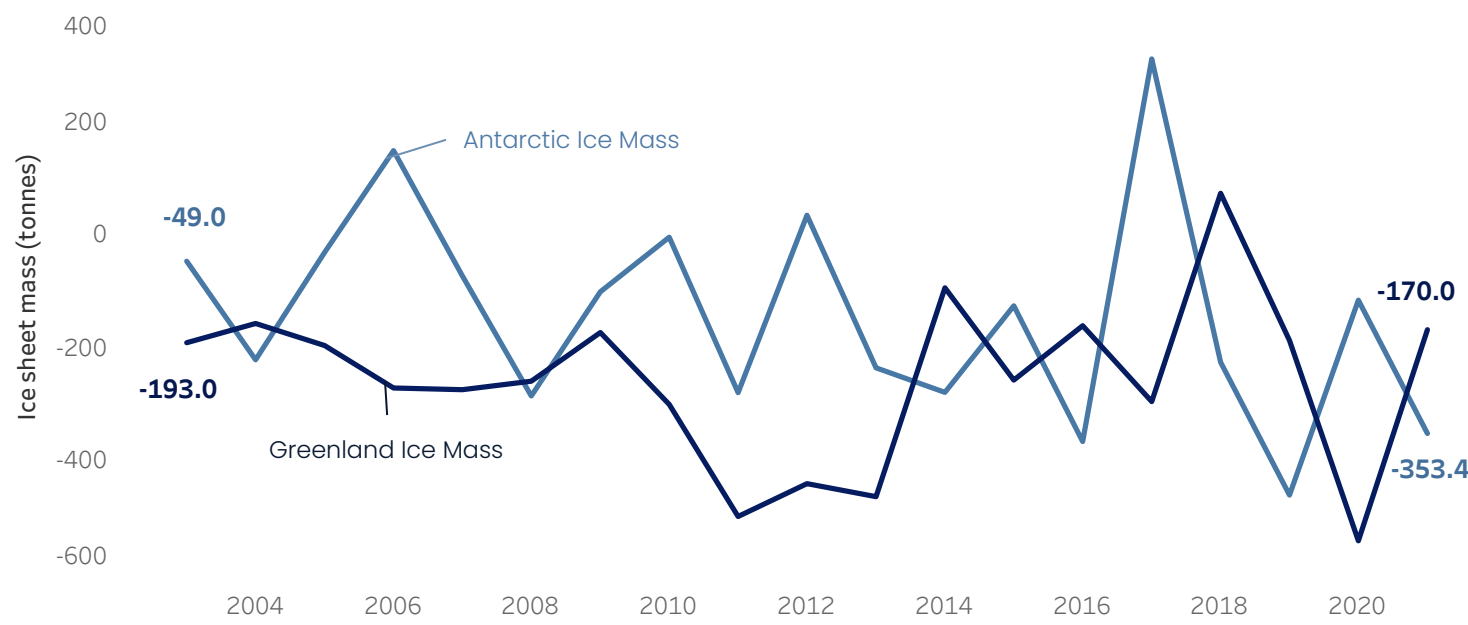
This ocean warming is resulting in thermal expansion, leading to rising sea levels. If this trend continues, the impact on sea level will increase with the ocean’s temperature.

The two dominant sources of global ice mass, the Antarctic and Greenland ice sheets, play a crucial role in regulating our planet’s climate. However, due to its location over land and warmer air temperatures, Greenland is experiencing a more rapid rate of ice loss.

In 2021, an unprecedented 550 billion tons of ice melted from Greenland, marking a new record in ice loss.

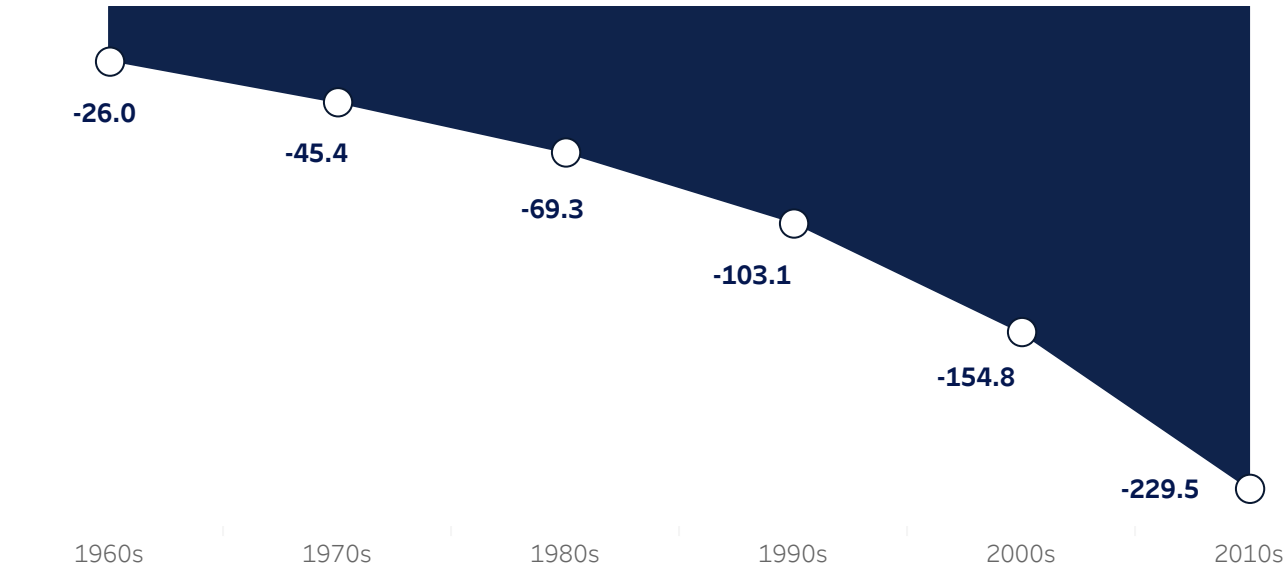
Annual ice sheet mass change in Greenland and Antarctica from 2003 to 2021

Measured in tons (billions)



Annual change in glacier mass balance worldwide between 1960 and 2019, by decade average

Measured in meters of water (equivalent)



The continued rise in global temperatures is causing widespread glacial melting, leading to a noticeable increase in sea levels.

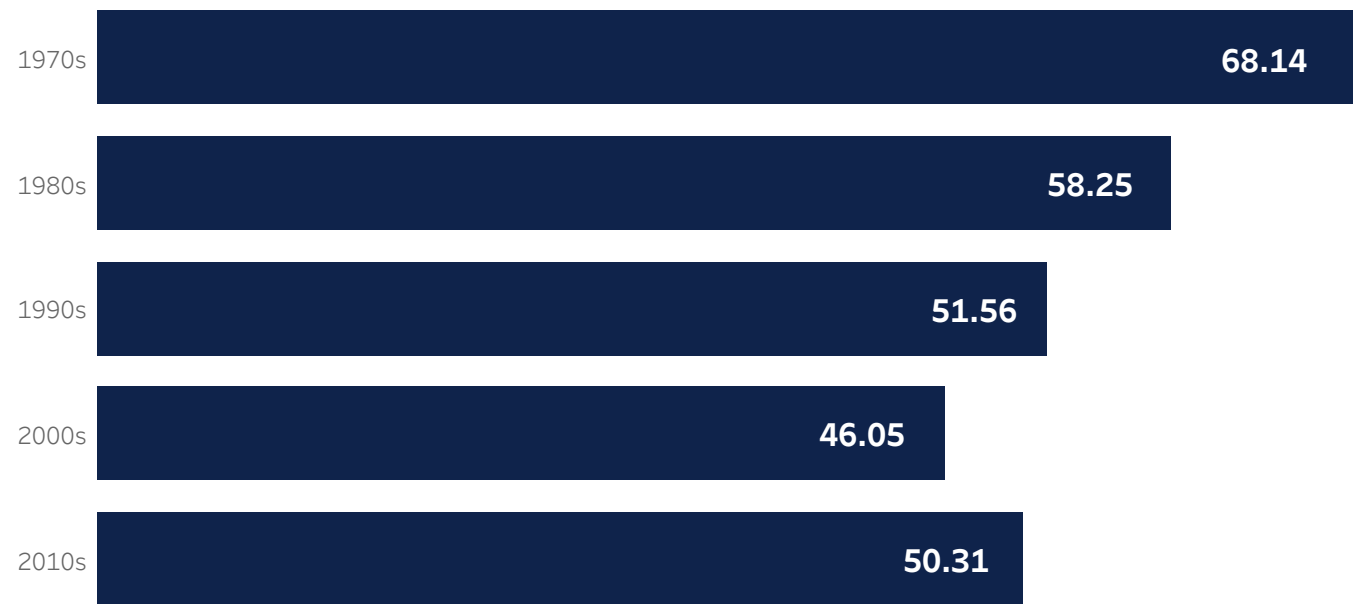
In the 2010s, the average loss of water from global glaciers was over 200 meters, and this trend of mass loss is expected to escalate as temperatures continue to rise.

The ‘Great Lakes’ of the United States (Lake Michigan, Ontario, Huron, Superior and Erie), which hold a staggering 84% of North America’s fresh water and 21% of the world’s total, are facing the impacts of rising temperatures. As a result, the lakes are experiencing less and less ice coverage each winter.

In the 2010s, the average ice coverage on the most frozen day of the year was only 50%, compared to a much larger coverage of nearly 70% in the 1970s.

United States ‘Great Lakes’ ice coverage between 1970 and 2019, by decade average

Measured by the day with the highest percentage of the lake that was frozen





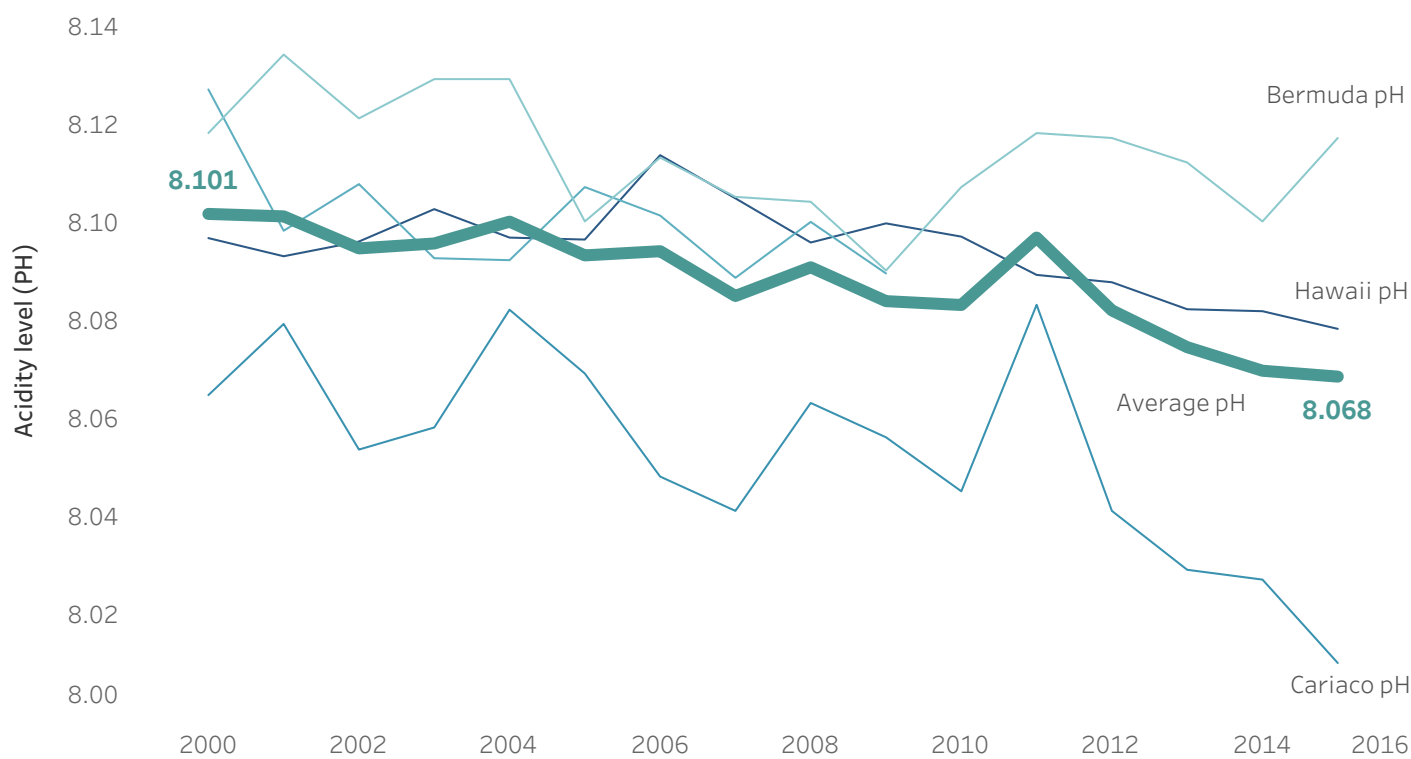
The Great Barrier Reef, located on the east coast of Australia, is the largest coral reef in the world and a critical component of the planet’s marine ecosystem. A devastating **91%** of reefs surveyed in 2022 were impacted by coral bleaching, largely due to the effects of climate change.

Biodiversity

The effects of a changing climate are not limited to human populations, as the **entire living ecosystem** is being impacted. The acidification and warming of the world’s oceans, along with increasingly **harsh climates** in the form of extreme weather events and a scarcity of drinking water, are transforming the way animals live and interact with their habitats. For some species, these changes are so drastic that they are struggling to survive and may even **face extinction**.

Annual Ocean acidity levels worldwide from 2005 to 2015

Measured in pH level



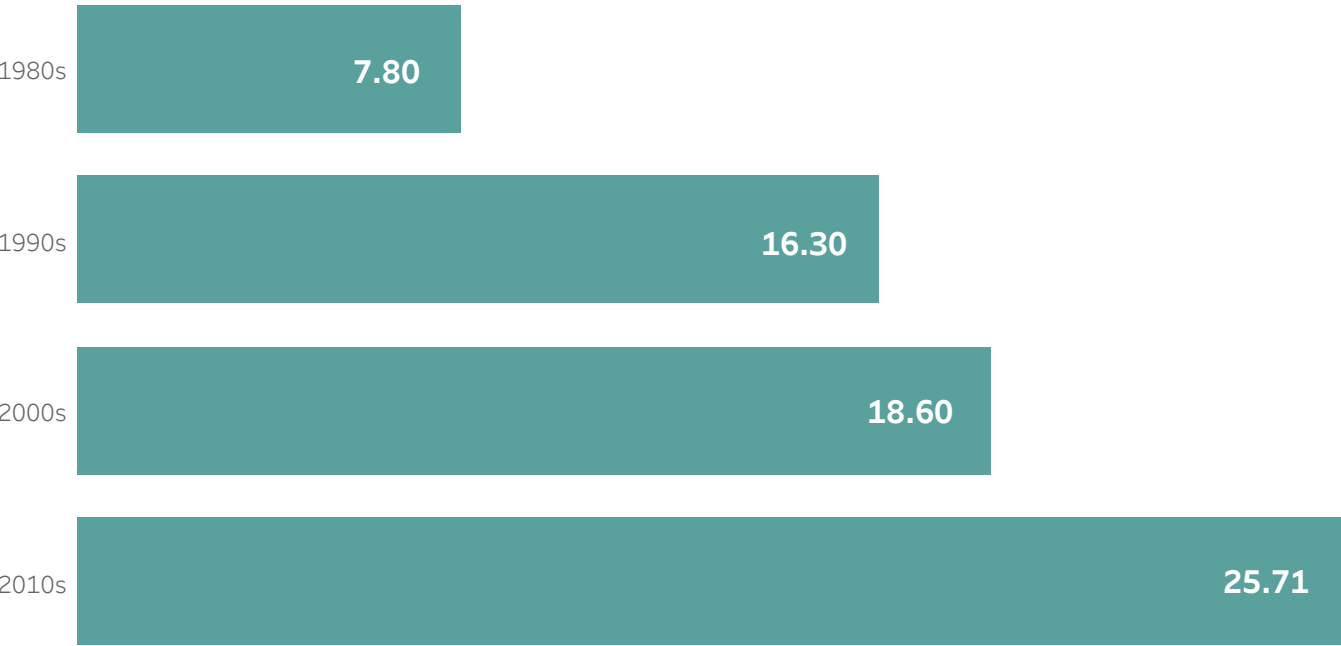
As carbon dioxide emissions continue to rise, a significant portion of these emissions end up dissolving into the ocean. This process leads to chemical reactions that increase the concentration of hydrogen ions and decrease the concentration of carbonate ions, resulting in an overall rise in ocean acidity.

Even small changes in pH levels can have far-reaching impacts, disrupting chemical reactions and negatively affecting entire species and ecosystems.

Coral bleaching is a devastating process where corals, unable to tolerate increased ocean temperatures, are forced to expel the algae they rely on for nourishment, causing them to lose their vibrant colors and turn a ghostly white. These events not only rob the oceans of their natural beauty but also have serious consequences for the delicate ecosystem they support.

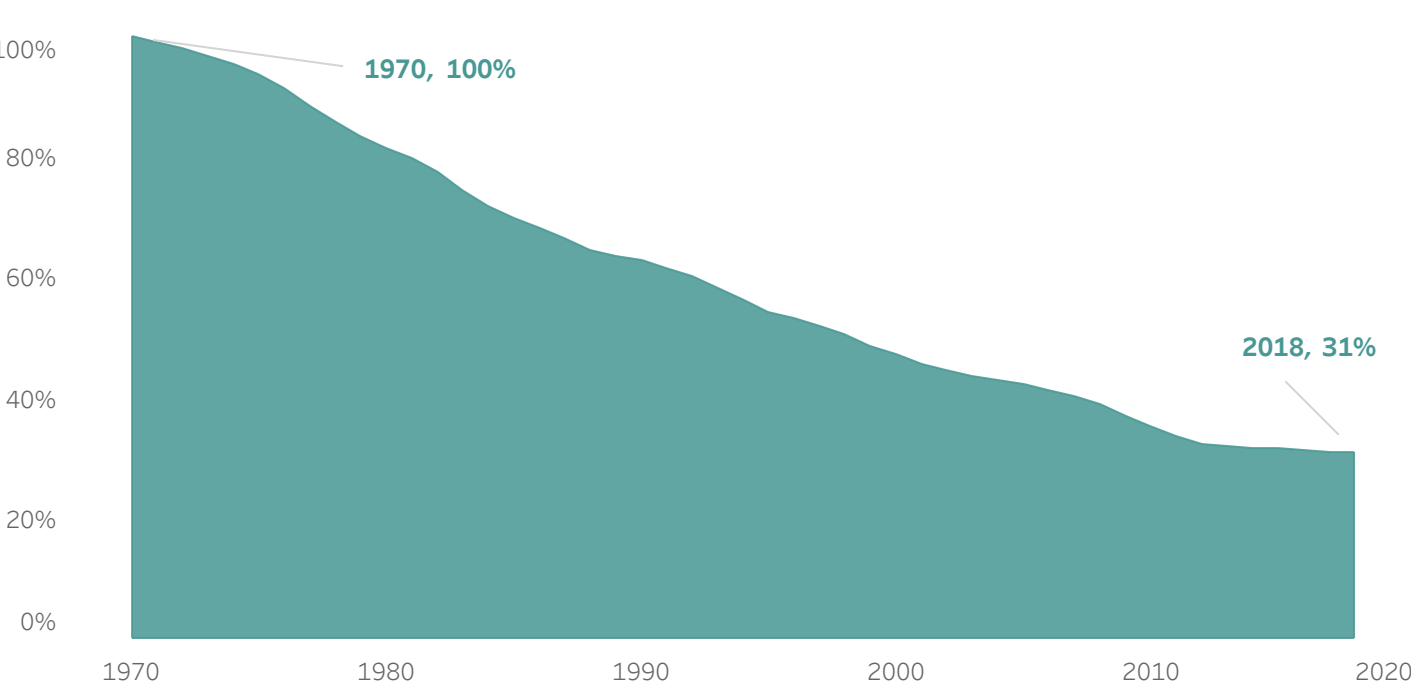
The alarming frequency of these events has risen considerably over the years, There were 26 bleaching events recorded on average annually in the 2010s, a significant increase from the average of just 8 events in the 1980s.

Annual frequency of coral bleaching events worldwide between 1980 and 2016, by decade average



Annual living planet index from 1970 to 2018

Measured in percentage of 1970 wildlife population abundance



The Living Planet Index serves as a comprehensive indicator of the overall health of the planet’s biodiversity. It monitors the abundance of over 30,000 species across the globe. The report highlights a concerning trend of decreasing wild animal populations, primarily driven by human activities such as hunting, habitat destruction, and climate change.

In 2018, the report revealed a marked decline in wildlife, with populations reaching only 30% of the levels recorded in 1970.