

# **Climate Change History: 1712 to 2022**

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GLO 505  
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# Climate Change History

## 1712 - The steam engine

British iron worker Thomas Newcomen invented the first widely used steam engine, beginning the Industrial Revolution<sup>1</sup>

## 1800 - World population

World population reaches one billion.<sup>1</sup>

## 1824 - Earth's energy balance

French mathematician and physicist Joseph Fourier proposed that energy reaching Earth as sunlight must be balanced by energy returning to space because heated surfaces emit radiation. He concluded that some of the energy is retained by the atmosphere, keeping Earth warm, like a greenhouse.<sup>2</sup>

## 1850 - Proof that global temperatures are rising

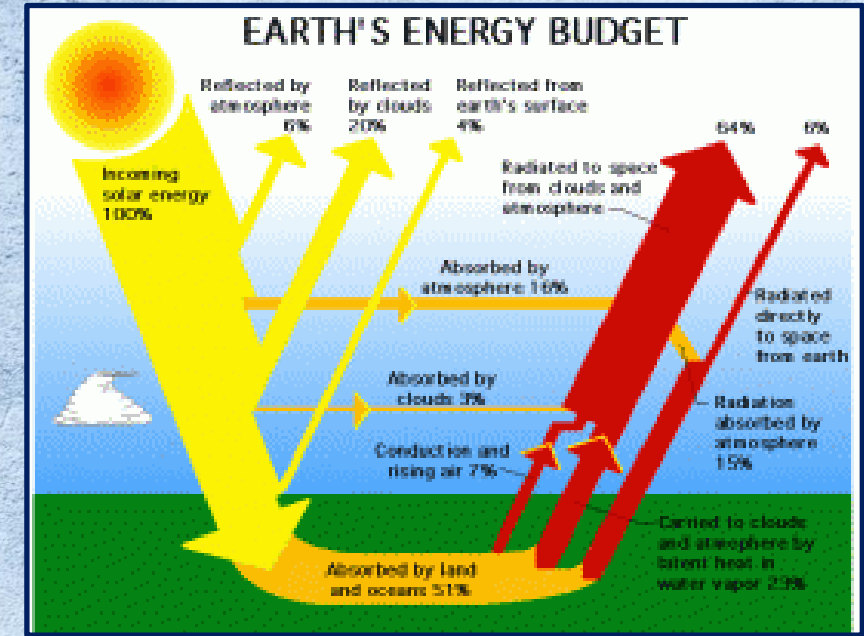
A New York amateur scientist and a women's rights activist, Eunice Newton Foote, put two glass jars in sunlight. One contained regular air and the other included just carbon dioxide. Foote found that the CO<sub>2</sub> jar heated up more quickly than the one containing air.<sup>3</sup>

### Sources:

<sup>1</sup>BBC News. (Sep. 20, 2013). A brief history of climate change. <https://www.bbc.com/news/science-environment-15874560>

<sup>2</sup>History. (Aug. 8, 2022). Climate change history. <https://www.history.com/topics/natural-disasters-and-environment/history-of-climate-change>

<sup>3</sup>Witze, A. (Mar. 10, 2022). How did we get here? The roots and impacts of the climate crisis. ScienceNews. <https://www.sciencenews.org/article/climate-change-crisis-history-research-carbon-human-impact>



## Earth's energy budget

Source: NASA. (n. d.). Precipitation education. <https://gpm.nasa.gov/education/lesson-plans/global-energy-budget>



# Climate Change History

## 1856 - Foote publishes her findings

Foote wrote "An atmosphere of that gas would give to our earth a high temperature."<sup>1</sup>

## 1861 - Gases absorb heat

Irish scientist John Tyndall showed that gases, including carbon dioxide and water vapor, can absorb heat. His heat source was radiation from a copper cube containing boiling water.<sup>2</sup>

## 1865 - Rain follows the plow

This myth among Great Plains farmers turned into an accepted scientific theory during the next ten years. Journalists, scientists and government officials were convinced that by farming, they had convinced nature to provide water wherever they chose to plow. This was a disastrous assumption, finally proven wrong, evidenced by crop deaths.<sup>3</sup>



## The disastrous assumption that rain follows the plow

Source: Simon, M. (Jun. 24, 2014). Fantastically Wrong: American Greed and the Harebrained Theory of 'Rain Follows the Plow.' Wired.

<https://www.wired.com/2014/06/fantastically-wrong-rain-follows-the-plow/>

### Sources:

<sup>1</sup>Witze, A. (Mar. 10, 2022). How did we get here? The roots and impacts of the climate crisis. ScienceNews. <https://www.sciencenews.org/article/climate-change-crisis-history-research-carbon-human-impact>

<sup>2</sup>BBC News. (Sep. 20, 2013). A brief history of climate change. <https://www.bbc.com/news/science-environment-15874560>

<sup>3</sup>Simon, M. (Jun. 24, 2014). Fantastically wrong: American greed and the harebrained theory of 'rain follows the plow.' Wired. <https://www.wired.com/2014/06/fantastically-wrong-rain-follows-the-plow/>



# Climate Change History

## 1886 - Motorwagen

Karl Benz creates the Motorwagen, considered the first real car.<sup>1</sup>

## 1896 - Effects of changing atmospheric CO<sub>2</sub>

Swedish physical chemist Svante Arrhenius determined that halving the amount of CO<sub>2</sub> in the atmosphere could cause an ice age and that doubling CO<sub>2</sub> would raise global temperatures by around 5°C to 6°C.<sup>2</sup>

## 1900 - Greenhouse warming

Swede Knut Angstrom found that small amounts of atmospheric CO<sub>2</sub> absorb infrared light, demonstrating that a trace gas can produce greenhouse warming.<sup>1</sup>

## 1927 - Fossil fuel emissions

Fossil fuel emissions reach 1 billion tons per year.<sup>1</sup>

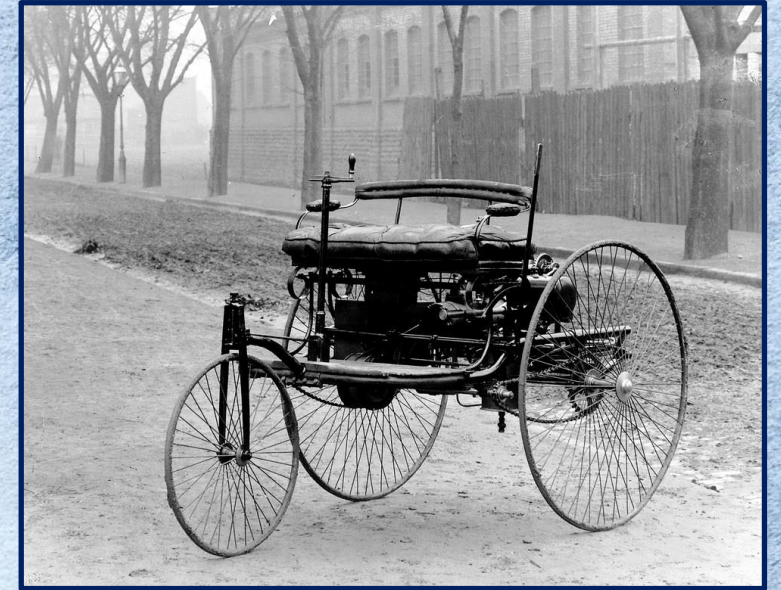
## 1930 - World population

World population reaches two billion.<sup>1</sup>

### Sources:

<sup>1</sup>BBC News. (Sep. 20, 2013). A brief history of climate change. <https://www.bbc.com/news/science-environment-15874560>

<sup>2</sup>Witze, A. (Mar. 10, 2022). How did we get here? The roots and impacts of the climate crisis. ScienceNews. <https://www.sciencenews.org/article/climate-change-crisis-history-research-carbon-human-impact>



## The Benz motorwagen

Source: Mercedes-Benz. (Apr. 8, 2016). Benz-patent Motorwagen. Wikipedia. [https://en.wikipedia.org/wiki/Benz\\_Patent\\_Motorwagen](https://en.wikipedia.org/wiki/Benz_Patent_Motorwagen)



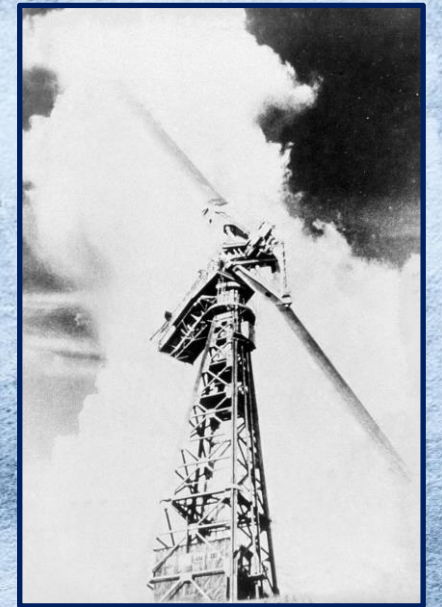
# Climate Change History

## 1938 - CO<sub>2</sub> emissions

Amateur scientist and steam engineer Guy Callendar began collecting records from 147 world weather stations. He accurately calculated that global temperatures had risen 0.3°C over the previous 50 years, arguing CO<sub>2</sub> emissions were responsible for global warming.<sup>1</sup>

## 1941 - First megawatt-size wind turbine

is connected to a local electrical distribution grid. The 1.25-MW Smith-Putnam wind turbine is erected in Castleton, Vermont. It has blades 75 feet in length.<sup>2</sup>



**The first megawatt-size wind turbine, in Castleton, Vermont**

Source: United States Government. (Jan. 1, 1941). The world's first megawatt-size wind turbine on Grandpa's Knob. Wikipedia. [https://en.wikipedia.org/wiki/Smith%E2%80%93Putnam\\_wind\\_turbine#/media/File:Wind\\_turbine\\_1941.jpg](https://en.wikipedia.org/wiki/Smith%E2%80%93Putnam_wind_turbine#/media/File:Wind_turbine_1941.jpg)

## 1949 - UN Scientific Conference

Lake Success, New York conference was the first to address depletion of natural resources.<sup>3</sup>

## 1954 - Birth of the solar cell

Bell Labs scientists Daryl Chapin, Calvin Fuller and Gerald Peterson created high-current solar cells that converted 6% of solar energy into electricity.<sup>1</sup>

### Sources:

<sup>1</sup>U.K. Research and Innovation. (n. d.). A brief history of climate change discoveries. <http://www.discover.ukri.org/a-brief-history-of-climate-change-discoveries/index.html>

<sup>2</sup>Witze, A. (Mar. 10, 2022). How did we get here? The roots and impacts of the climate crisis. ScienceNews. <https://www.sciencenews.org/article/climate-change-crisis-history-research-carbon-human-impact>

<sup>3</sup>Jackson, P. (n. d.). From Stockholm to Kyoto: A brief history of climate change. United Nations. <https://www.un.org/en/chronicle/article/stockholm-kyoto-brief-history-climate-change>



# Climate Change History

## 1955 - Doubling CO<sub>2</sub>

Researcher Gilbert Plass discovers that doubling CO<sub>2</sub> concentrations would increase global temperatures between 3°C and 4°C.<sup>1</sup>

## 1956 - The first general circulation model

Scientist Norman Phillips, produced the world's first general circulation model, capturing how energy flows between the oceans, atmosphere and land.<sup>2</sup>

## 1957 - Geophysical experiment

Oceanographer Roger Revelle and chemist Hans Suess discover that sea water will not absorb all the CO<sub>2</sub> entering the atmosphere, meaning that humans are undertaking a "large scale geophysical experiment..."<sup>1</sup>

## 1958 - CO<sub>2</sub> levels are rising

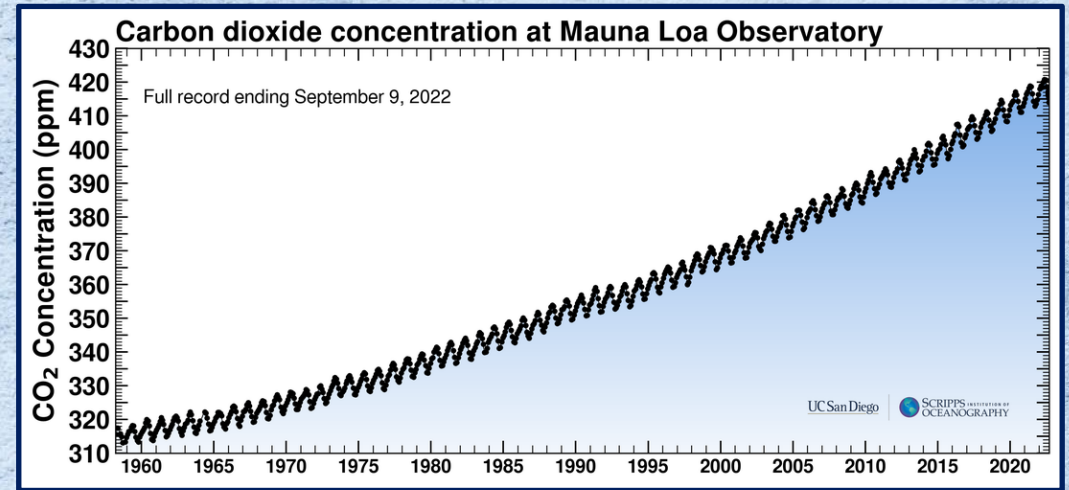
Geochemist Charles David Keeling designed equipment to measure CO<sub>2</sub> levels on Mauna Loa, confirming that increases were due to fossil fuels. The Keeling Curve documents changes in CO<sub>2</sub> levels over time.<sup>3</sup>

### Sources:

<sup>1</sup>BBC News. (Sep. 20, 2013). A brief history of climate change. <https://www.bbc.com/news/science-environment-15874560>

<sup>2</sup>Witze, A. (Mar. 10, 2022). How did we get here? The roots and impacts of the climate crisis. ScienceNews. <https://www.sciencenews.org/article/climate-change-crisis-history-research-carbon-human-impact>

<sup>3</sup>U.K. Research and Innovation. (n. d.). A brief history of climate change discoveries. <http://www.discover.ukri.org/a-brief-history-of-climate-change-discoveries/index.html>



## Carbon dioxide concentration at Mauna Loa Observatory

Source: Scripps Institution of Oceanography. (n. d.). The Keeling curve. <https://keelingcurve.ucsd.edu/>



# Climate Change History

## 1960 - World population

World population reaches 3 billion.<sup>1</sup>

## 1962 - Silent Spring

Author Rachel Carson's book, *Silent Spring*, condemned the pesticide DDT for its ecological impacts. The book started environmental activism in the U.S.<sup>2</sup>

## 1965 - Real concern

A U.S. President's Advisory Committee warns that the greenhouse effect is a matter of "real concern."<sup>1</sup>

## 1967 - Earth's changing climate first modelled

Researchers Syukuro Manabe and Richard Wetherald produced the world's first accurate computer model of planet Earth's climate.<sup>3</sup>

### Sources:

<sup>1</sup>BBC News. (Sep. 20, 2013). A brief history of climate change. <https://www.bbc.com/news/science-environment-15874560>

<sup>2</sup>Witze, A. (Mar. 10, 2022). How did we get here? The roots and impacts of the climate crisis. ScienceNews. <https://www.sciencenews.org/article/climate-change-crisis-history-research-carbon-human-impact>

<sup>3</sup>U.K. Research and Innovation. (n. d.). A brief history of climate change discoveries. <http://www.discover.ukri.org/a-brief-history-of-climate-change-discoveries/index.html>

### Population growth

- The UN projects that the global population will increase from about 8 billion in 2022 to 10.4 billion by 2100, when fast global population growth will come to an end.
- The global population growth rate has already slowed down, reaching its peak at over 2% in the 1960s.
- Improving health leads to falling mortality, increasing the population.
- Fertility rates are declining.

Source: Roser, M. (Nov. 2019). Future population growth. Our World in Data. <https://ourworldindata.org/future-population-growth#global-population-growth>



# Climate Change History

## 1968 - Scientist predicts melting ice caps

Glaciologist John Mercer's fieldwork at the Reedy Glacier in West Antarctica showed that the entire West Antarctic Ice Sheet had once melted. He found evidence of six-meter sea level rise around 120,000 years ago when temperatures were 6-7°C higher. He warned that current atmospheric warming could again cause ice shelves to disintegrate, causing a sea level rise of about five meters.<sup>1</sup>

## 1969 - Satellite collects data related to global temperatures

NASA's Nimbus III satellite is launched, providing the world's first accurate measurement of global atmospheric temperatures.<sup>1</sup>

## 1970 - Earth Day

The U.S. celebrates its first Earth Day.<sup>2</sup>

## 1972 - First Earth Summit

This UN Scientific Conference in Stockholm, Sweden, adopted a declaration of principles for preservation and enhancement of the human environment and recommendations for international environmental action.<sup>3</sup>

### Sources:

<sup>1</sup>U.K. Research and Innovation. (n. d.). A brief history of climate change discoveries. <http://www.discover.ukri.org/a-brief-history-of-climate-change-discoveries/index.html>

<sup>2</sup>Witze, A. (Mar. 10, 2022). How did we get here? The roots and impacts of the climate crisis. ScienceNews. <https://www.sciencenews.org/article/climate-change-crisis-history-research-carbon-human-impact>

<sup>3</sup>BBC News. (Sep. 20, 2013). A brief history of climate change. <https://www.bbc.com/news/science-environment-15874560>



## Nimbus III provides accurate Earth temperatures

Source: NASA. (n. d.). Nimbus III. Radioisotop Power Systems.

<https://rps.nasa.gov/missions/8/nimbus-iii/>



# Climate Change History

## 1973 - Endangered Species Act

Federal agencies, the U.S. Fish and Wildlife Service and NOAA Fisheries Service were required to ensure that actions they authorize, fund, or carry out will not jeopardize existence of any listed species or result in destruction or adverse modification of critical habitat of such species.<sup>1</sup>

## 1975 - World population

World population reaches four billion.<sup>2</sup>

## 1975 - Global warming

U.S. scientist Wallace Broecker uses the term "global warming" in a scientific paper.<sup>2</sup>

## 1979 - Convention on long-range transboundary air pollution

First international instrument on climate, the Convention on Long-Range Transboundary Air Pollution, was adopted.<sup>3</sup> This was the first multilateral agreement addressing transboundary air pollution, creating a regional framework applicable to Europe, North America, Russia and former East Bloc countries for reducing transboundary air pollution.<sup>4</sup>

### Sources:

<sup>1</sup>U.S. Environmental Protection Agency. (Sep. 12, 2022). Summary of the Endangered Species Act. <https://www.epa.gov/laws-regulations/summary-endangered-species-act>

<sup>3</sup>BBC News. (Sep. 20, 2013). A brief history of climate change. <https://www.bbc.com/news/science-environment-15874560>

<sup>3</sup>Jackson, P. (n. d.). From Stockholm to Kyoto: A brief history of climate change. United Nations. <https://www.un.org/en/chronicle/article/stockholm-kyoto-brief-history-climate-change>

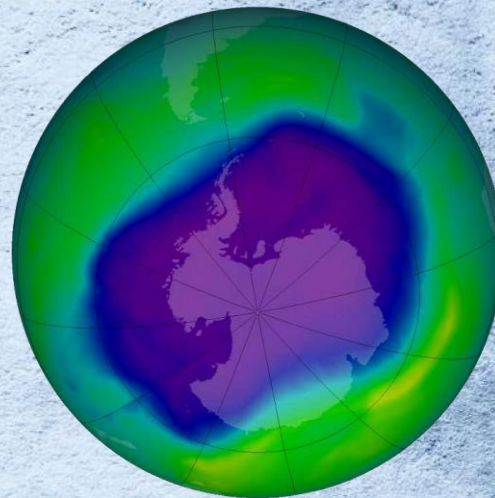
<sup>4</sup>U.S. Department of State. (n. d.). Convention on Long-range transboundary air pollution. <https://www.state.gov/key-topics-office-of-environmental-quality-and-transboundary-issues/convention-on-long-range-transboundary-air-pollution/#:~:text=The%201979%20Convention%20on%20Long,pollution%20and%20better%20understanding%20air>



# Climate Change History

## 1985 - Ozone hole discovery

Scientists discovered a hole in the ozone layer above Antarctica. They suggested that chlorofluorocarbons (CFCs), were responsible.<sup>2</sup>



## The ozone hole

Source: NASA. (Sep. 24, 2006). NASA and NOAA announce ozone hole is a double record breaker. [https://www.nasa.gov/vision/earth/lookingatearth/ozone\\_record.html](https://www.nasa.gov/vision/earth/lookingatearth/ozone_record.html)

## 1985 - Drilling 150,000 years deeper into the ice

Ice cores extracted from Antarctica confirmed that CO<sub>2</sub> and temperature have gone up and down together over the past 150,000 years.<sup>2</sup>



## 1985 - Vienna Convention for the protection of the ozone layer

The convention promoted cooperation among nations by exchanging information on the effects of human activities on the ozone layer, hoping policymakers would adopt measures to combat activities responsible for ozone depletion. The countries involved meet once every three years to make financial and administrative decisions.<sup>1</sup>

## Ice cores reveal atmospheric constituents

Source: NASA Global Climate Change. (Sep. 1, 2022). Core questions: An introduction to ice cores. <https://climate.nasa.gov/news/2616/core-questions-an-introduction-to-ice-cores/>

### Sources:

<sup>1</sup>U.N. Environment Programme. (2020). The Vienna Convention for the protection of the ozone layer. <https://ozone.unep.org/treaties/vienna-convention>

<sup>2</sup>U.K. Research and Innovation. (n. d.). A brief history of climate change discoveries. <http://www.discover.ukri.org/a-brief-history-of-climate-change-discoveries/index.html>



# Climate Change History

## 1985 - Lithium ion battery invented

Professor Akira Yoshino developed the world's first rechargeable lithium battery, starting an energy-storage revolution. These batteries power a variety of portable devices.<sup>1</sup>

## 1987 - Montreal Protocol

The successful protocol raised awareness of climate change and called for reduction and ban of CFCs. The protocol is one of the most successful global environmental policies of the twentieth century. The Antarctic ozone hole is now slowly healing.<sup>1</sup>

## 1987 - Environmental Perspective to the Year 2000 and Beyond

UN General Assembly adopted this framework to guide international action and cooperation on policies and programs to achieve environmentally sound development.<sup>2</sup>

### Sources:

<sup>1</sup>U.K. Research and Innovation. (n. d.). A brief history of climate change discoveries. <http://www.discover.ukri.org/a-brief-history-of-climate-change-discoveries/index.html>

<sup>2</sup>Jackson, P. (n. d.). From Stockholm to Kyoto: A brief history of climate change. United Nations. <https://www.un.org/en/chronicle/article/stockholm-kyoto-brief-history-climate-change>



# Climate Change History

## 1988 - Global warming has arrived

In June, NASA scientist James Hansen delivered testimony and presented models to Congress, saying he was "99 percent sure" that global warming was upon us.<sup>1</sup>

## 1988 - The Intergovernmental Panel on Climate Change (IPCC)

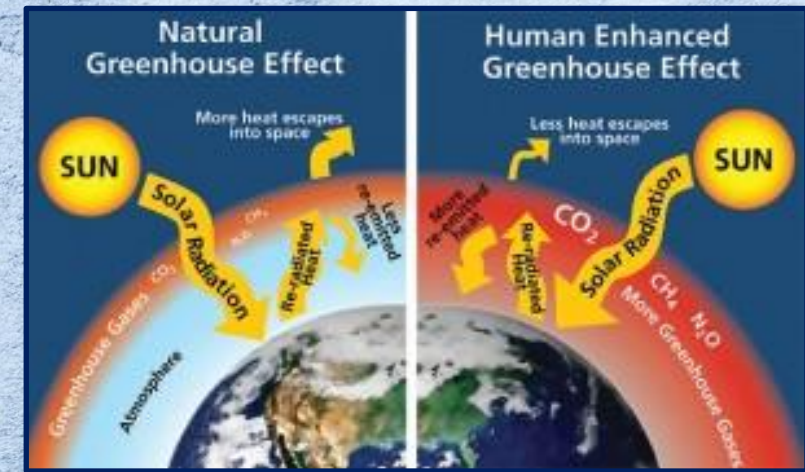
Established by the U.N. Environment Program (UNEP) and the World Meteorological Organization (WMO), IPCC provides policymakers with scientific assessments on current knowledge about climate change. IPCC has published several comprehensive world climate assessment reports.<sup>2</sup>

## 1989 - Vast increases in CO<sub>2</sub>

In a U.N. speech, U.K. Prime Minister and chemist Margaret Thatcher warns that "We are seeing a vast increase in the amount of carbon dioxide reaching the atmosphere..The result is that change in the future is likely to be more fundamental and widespread than anything we have known hitherto."<sup>3</sup>

## 1989 - More CO<sub>2</sub>

Atmospheric fossil fuel carbon emissions reach 6 million tons per year.<sup>3</sup>



## Natural versus human greenhouse gas effects

Source: Land Trust Alliance. (2021). Carbon dioxide, methane, nitrous oxide, and the greenhouse effect. Conservation in a Changing Climate. <https://climatechange.lta.org/get-started/learn/co2-methane-greenhouse-effect/>

### Sources:

<sup>1</sup>History. (Aug. 8, 2022). Climate change history. <https://www.history.com/topics/natural-disasters-and-environment/history-of-climate-change>

<sup>2</sup>U.K. Research and Innovation. (n. d.). A brief history of climate change discoveries. <http://www.discover.ukri.org/a-brief-history-of-climate-change-discoveries/index.html>

<sup>3</sup>BBC News. (Sep. 20, 2013). A brief history of climate change. <https://www.bbc.com/news/science-environment-15874560>



# Climate Change History

## 1990 - IPCC reports

Since 1990, IPCC reports have consistently identified human-produced greenhouse gases as the source of Earth's increasing temperatures.<sup>1</sup>

## 1990 - Second world climate conference

In its Ministerial Declaration, the Conference stated that climate change was a global problem of unique character for which a global response was required. It called for negotiations to begin on a framework convention without further delay.<sup>2</sup>

## 1992 - United framework convention on climate change

At the Rio de Janeiro Earth Summit, governments agree that stabilizing atmospheric greenhouse gas concentrations at a level preventing dangerous anthropogenic interference with the climate system was a key objective.<sup>3</sup>

## 1992 - Coral reefs at threat

Professors Stephen Smith and Robert Buddemeier discovered that higher levels of ocean CO<sub>2</sub> increase water acidity and damage coral reefs because corals have difficulty absorbing calcium carbonate, which they use to build their skeletons. Oysters, mussels, clams, sea urchins and some planktonic species are also vulnerable.<sup>1</sup>



## Dead coral at the Great Barrier reef

Source. Williams, J. (Apr. 18, 2018). Damage to Great Barrier Reef from global warming is irreversible, scientists say. *The New York Times*. <https://www.nytimes.com/2018/04/19/world/australia/australia-barrier-reef.html>

### Sources:

<sup>1</sup>U.K. Research and Innovation. (n. d.). A brief history of climate change discoveries. <http://www.discover.ukri.org/a-brief-history-of-climate-change-discoveries/index.html>

<sup>2</sup>Jackson, P. (n. d.). From Stockholm to Kyoto: A brief history of climate change. United Nations. <https://www.un.org/en/chronicle/article/stockholm-kyoto-brief-history-climate-change>

<sup>3</sup>BBC News. (Sep. 20, 2013). A brief history of climate change. <https://www.bbc.com/news/science-environment-15874560>



# Climate Change History

## 1994 - First climate change legislation comes into force

197 countries sign up to the first global treaty to combat climate change, The United Nations Framework Convention on Climate Change (UNFCCC) was the first international treaty designed to limit greenhouse gas emissions and prevent climate change. It entered into force on March 21, 1994, and has been ratified by 197 countries.<sup>1</sup>

## 1995 - IPCC Second Assessment Report

The report showed that there was a “discernable human influence” on there Earth’s climate.<sup>2</sup>

## 1995 - Rechargeable lithium-ion battery

Materials scientist Peter Bruce, funded by the Engineering and Physical Sciences Research Council (EPSRC), led the development of a light, reliable, efficient, rechargeable lithium-ion battery that was greener than the Nickel Cadmium (NiCad) battery used extensively at the time.<sup>1</sup>

## 1996 - Capturing carbon underground

The world’s first carbon capture (CC) underground storage project began operating at the Sleipner gas field in the North Sea. About 1 million tons of CO<sub>2</sub> from natural gas have been captured and stored every year. This equates to more than 20 million tons of CO<sub>2</sub>, equivalent to the annual emissions from 10 million cars.<sup>1</sup>

### Sources:

<sup>1</sup>U.K. Research and Innovation. (n. d.). A brief history of climate change discoveries. <http://www.discover.ukri.org/a-brief-history-of-climate-change-discoveries/index.html>

<sup>2</sup>BBC News. (Sep. 20, 2013). A brief history of climate change. <https://www.bbc.com/news/science-environment-15874560>



# Climate Change History

## 1997 - Kyoto Protocol

Additional commitments from industrialized countries to limits on and reductions to greenhouse gas emissions by an average of 5% per year between 2008 and 2012.<sup>1</sup>

## 1997 - Hybrid cars invented

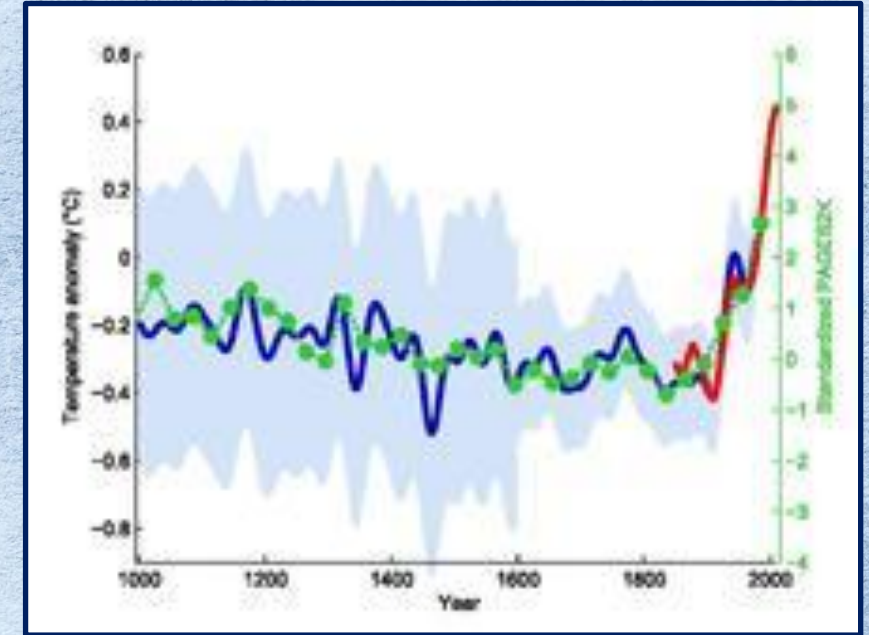
Toyota produces the first mass-market electric hybrid car for sale in Japan. Jaguar plans to sell only electric cars from 2025, Volvo from 2030, Lotus from 2028, General Motors by 2035, Ford plan to only sell electric cars in Europe by 2030, and VW says 70% of its sales will be electric by 2030.<sup>2</sup>

## 1998 - 420,000 ice core extracted

An older ice core showed a clear positive relationship between levels of atmospheric greenhouse gases and Antarctic temperature over time, and that present atmospheric CO<sub>2</sub> and methane levels are above anything seen in the past 420,000 years.<sup>2</sup>

## 1998 - Hockey stick graph

Publication of the controversial "hockey stick" graph demonstrating northern hemisphere temperature rise.<sup>1</sup>



Source: Wikipedia. (Aug. 30, 2022). Hockeystick graph.  
[https://en.wikipedia.org/wiki/Hockey\\_stick\\_graph](https://en.wikipedia.org/wiki/Hockey_stick_graph)

### Sources:

<sup>1</sup>BBC News. (Sep. 20, 2013). A brief history of climate change. <https://www.bbc.com/news/science-environment-15874560>

<sup>2</sup>U.K. Research and Innovation. (n. d.). A brief history of climate change discoveries. <http://www.discover.ukri.org/a-brief-history-of-climate-change-discoveries/index.html>



# Climate Change History

## 1999 - Human population

Human population reaches six billion.<sup>1</sup>

## 2001 - U.S. declines to follow the Kyoto Protocol

President George W. Bush announced the U.S. would not implement the Kyoto Protocol, saying the protocol was "fatally flawed in fundamental ways" and citing concerns that the deal would hurt the U.S. economy.<sup>2</sup>

## 2001 - IPCC third assessment report

The report finds "new and stronger evidence" that humanity's greenhouse gas emissions are the main cause of global warming in the second half of the 20<sup>th</sup> century.<sup>1</sup>

## 2003 - Scientists link extreme weather to climate change

A heatwave, the result of climate change, in Europe kills tens of thousands of people in Europe.<sup>2</sup>

## 2004 - 3 kilometer ice core extracted

Scientists at British Antarctic Survey (BAS) extracted a three-kilometer ice core from the Antarctic. The core contains an 800,000 record of the Earth's climate.<sup>3</sup>

### Sources:

<sup>1</sup>BBC News. (Sep. 20, 2013). A brief history of climate change. <https://www.bbc.com/news/science-environment-15874560>

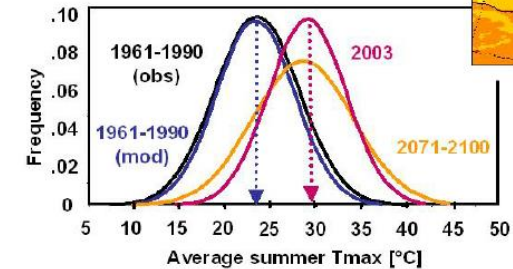
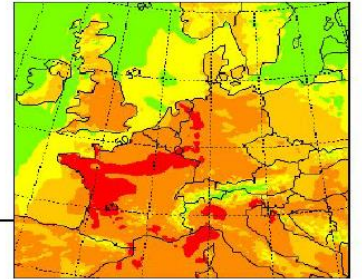
<sup>2</sup>U.K. Research and Innovation. (n. d.). A brief history of climate change discoveries. <http://www.discover.ukri.org/a-brief-history-of-climate-change-discoveries/index.html>

<sup>3</sup>History. (Aug. 8, 2022). Climate change history. <https://www.history.com/topics/natural-disasters-and-environment/history-of-climate-change>

## The heat wave 2003 in Europe: A unique feature?

IPCC WGI, 2001:

"Higher maximum temperatures and more hot days over nearly all land areas are very likely"



⇒ Need to adapt

Beniston, 2004

## 2003 European heat wave

Source: Endlicher, W. R., et al. (Jan. 2008). Heat waves, urban climate and human health.

[https://www.researchgate.net/figure/The-heat-wave-2003-in-Europe-Actually-a-unique-feature-but-a-normal-event-in-2071-2100\\_fig1\\_226092728](https://www.researchgate.net/figure/The-heat-wave-2003-in-Europe-Actually-a-unique-feature-but-a-normal-event-in-2071-2100_fig1_226092728)



# Climate Change History

## 2005 - Hurricane Katrina

Katrina became one of the most powerful Atlantic storms on record, with winds in excess of 170 mph (275 km/hr) on August 27. On the morning of August 29, the storm landed as a category 4 hurricane approximately 45 miles (70 km) southeast of New Orleans, producing a storm surge more than 26 feet (8 meters) at Gulfport and Biloxi.<sup>1</sup> It was the most expensive in U.S. history, causing \$186.3 billion in damages (in 2022 dollars).<sup>2</sup>

## 2006 - Carbon emissions

Fossil fuel carbon emissions reach eight billion tons per year.<sup>3</sup>

## 2006 - An Inconvenient Truth

Former vice president Al Gore warned the world about the dangers of global warming with his film *An Inconvenient Truth*. He won the 2007 Nobel Peace Prize.<sup>4</sup>

## 2006 - The Stern Review

Sir Nicholas Stern, Head of the UK Government Economic Service and a former Chief Economist of the World Bank, concluded that unchecked climate change could damage GDP by 20%.<sup>3</sup>

### Sources:

<sup>1</sup>Editors of Encyclopedia Britannica. (Aug. 16, 2022). Hurricane Katrina. Encyclopedia Britannica. <https://www.britannica.com/event/Hurricane-Katrina>

<sup>2</sup>NOAA. (n. d.). Costliest U.S. tropical cyclones. <https://www.ncei.noaa.gov/access/billions/dcmi.pdf>

<sup>3</sup>BBC News. (Sep. 20, 2013). A brief history of climate change. <https://www.bbc.com/news/science-environment-15874560>

<sup>4</sup>History. (Aug. 8, 2022). Climate change history. <https://www.history.com/topics/natural-disasters-and-environment/history-of-climate-change>



## The destruction from Hurricane Katrina

Source: Horowitz, A. (Aug. 26, 2020). Hurricane Katrina showed us how spectacularly the government can fail its people. Fifteen years later, the pattern continues. Time. <https://time.com/5883614/hurricane-katrina-coronavirus/>



# Climate Change History

## 2007 - IPCC Fourth Assessment Report

The IPCC report found that it is was than 90% likely that human greenhouse gas emissions are responsible for global warming.<sup>1</sup>

## 2007 - Bali meeting

During U.N. negotiations in Bali, governments agreed to the two-year Bali roadmap designed to create a new global climate change treaty by 2009.<sup>1</sup>

## 2007 - Arctic is warming twice as fast as the rest of the planet

During the International Polar Year, 2007-2008, around 50,000 scientists, students and support staff from over 60 nations met to study the Arctic and Antarctic. They found that the Greenland ice sheet, parts of the Antarctic ice sheet, and Arctic sea ice are melting faster than any time during the last 10,000 years, faster than anywhere else on Earth.<sup>2</sup>



## Melting Arctic

Source: Souders, P. Getty Images. In Baker, H. (Jan. 11, 2021). Towering ice arches in the Arctic are melting, putting 'Last Ice Area' at risk of vanishing. LiveScience. <https://www.livescience.com/arctic-ice-arches-melting-fast.html>

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<sup>1</sup>BBC News. (Sep. 20, 2013). A brief history of climate change. <https://www.bbc.com/news/science-environment-15874560>

<sup>2</sup>Editors of Encyclopedia Britannica. (Aug. 16, 2022). Hurricane Katrina. Encyclopedia Britannica. <https://www.britannica.com/event/Hurricane-Katrina>



# Climate Change History

## 2008 - UK Climate Change Act becomes law

The act was the world's first long-term legally binding framework for tackling climate change and required the government to set binding five-year carbon budgets.<sup>1</sup>

## 2008 - President Barack Obama

Two months before taking office, Barack Obama pledges to work with other leaders on climate change issues.<sup>2</sup>

## 2008 - Hockey stick

The half-century old Mauna Loa Keeling project demonstrates that CO<sub>2</sub> concentrations have risen from 315 parts per million in 1958 to 380 parts per million in 2008.<sup>2</sup>



## Mauna Loa Observatory measures CO<sub>2</sub> concentrations

Source: Laderman, R. (Jan.-Feb. 2020). Mslama Mokupuni– caring for our island environment: Mauna Loa Observatory's Keeling curve reveals carbon dioxide rise to the world. Ke Ola. <https://keolamagazine.com/malama-mokupuni/keeling-curve/>

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<sup>2</sup>BBC News. (Sep. 20, 2013). A brief history of climate change. <https://www.bbc.com/news/science-environment-15874560>



# Climate Change History

## 2009 - China

China overtakes the U.S. as the world's biggest greenhouse gas emitter.<sup>1</sup>

## 2009 - U.N. Climate Summit

192 government representatives meet in Copenhagen, creating the controversial Copenhagen Accord.<sup>1</sup>

## 2009 - Climategate scandal

In November, more than 1,000 e-mails between scientists at the Climate Research Unit of the U.K.'s University of East Anglia were stolen and made public by a hacker. Climate skeptics falsely claimed they showed scientific fabrication of man-made global warming.<sup>2</sup>

## 2009 - American Clean Energy and Security Act

Established clean energy and energy efficiency standards to reduce global warming pollution, transitioning to a clean energy economy, and providing for agriculture and forestry related offsets. Required retail electricity suppliers to meet 20% of their demand through renewable and electricity savings by 2020, set a goal of improving U.S. energy productivity by at least 2.5% per year by 2012 and maintain that rate through 2030.<sup>3</sup>

### Sources:

<sup>1</sup>Henig, J. (Dec. 10, 2009). 'Climategate.' FactCheck.org. <https://www.factcheck.org/2009/12/climategate/>

<sup>2</sup>BBC News. (Sep. 20, 2013). A brief history of climate change. <https://www.bbc.com/news/science-environment-15874560>

<sup>3</sup>Congress.gov. (n. d.). H.R.2454 - American Clean Energy and Security Act of 2009. <https://www.congress.gov/bill/111th-congress/house-bill/2454#:~:text=American%20Clean%20Energy%20and%20Security%20Act%20of%202009%20%2D%20Sets%20forth,agriculture%20and%20forestry%20related%20offsets.>



# Climate Change History

## 2010 - Merchants of doubt

The story of a group of high-level scientists and scientific advisers, with deep connections in politics and industry. They ran effective, misleading campaigns over four decades. The same group claimed the science of global warming was not settled, denied truth about links between smoking to lung cancer, coal smoke to acid rain and CFCs to the ozone hole.<sup>1</sup>

## 2010 - Heartland Institute

Hundreds of animated climate change deniers met to denounce climate change science, aiming their denial at climate scientist Michael Mann, author of the well-known "hockey stick" graph. The group accused Mann of manipulating data.<sup>2</sup>

## 2011 - Human population

Earth's population reaches seven billion.<sup>3</sup>

## 2011 - Real warming

A new analysis of Earth's temperature performed by scientists concerned about ClimateGate allegations proves that Earth's surface has warmed over the last century.<sup>3</sup>

### Sources:

<sup>1</sup>Oreskes, N., & Conway, E. M. Merchants of doubt. <https://www.bloomsbury.com/us/merchants-of-doubt-9781608193943/>

<sup>2</sup>Bohr, J. (n. d.). The structure and culture of climate change denial. Footnotes, 49(3). American Sociological Association. <https://www.asanet.org/structure-and-culture-climate-change-denial>

<sup>3</sup>BBC News. (Sep. 20, 2013). A brief history of climate change. <https://www.bbc.com/news/science-environment-15874560>



# Climate Change History

## 2012 - Unabomber analogy

The Heartland Institute put up a billboard in Chicago equating global warming activists to the terrorist "Unabomber" Ted Kaczynski.<sup>1</sup>

## 2012 - Trump called climate change a hoax

On Nov. 6, 2012, Trump tweeted, "The concept of global warming was created by and for the Chinese in order to make U.S. manufacturing non-competitive."<sup>2</sup>

## 2012 - Arctic sea ice

Arctic sea ice reaches a minimum of 1.32 million square miles (3.41 million square kilometers), a record for the lowest summer coverage since satellite measurements began in 1979.<sup>3</sup>

## 2013 - Atmospheric CO<sub>2</sub>

The Mauna Loa Observatory on Hawaii reported that daily mean concentration of CO<sub>2</sub> in the atmosphere surpassed 400 parts per million (ppm) for the first time since measurements began in 1958.<sup>3</sup>



## The Unabomber analogy billboard

Source: Taylor, J. (May 16, 2012). Giving the global warming bully a free pass. Forbes. <https://www.forbes.com/sites/jamestaylor/2012/05/16/giving-the-global-warming-bully-a-free-pass/?sh=5d77b724727d>

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<sup>1</sup>Oreskes, N., & Conway, E. M. Merchants of doubt. <https://www.bloomsbury.com/us/merchants-of-doubt-9781608193943/>

<sup>2</sup>Bohr, J. (n. d.). The structure and culture of climate change denial. Footnotes, 49(3). American Sociological Association. <https://www.asanet.org/structure-and-culture-climate-change-denial>

<sup>3</sup>BBC News. (Sep. 20, 2013). A brief history of climate change. <https://www.bbc.com/news/science-environment-15874560>



# Climate Change History

## 2013 - IPCC fifth report

The first part of the IPCC's fifth assessment report said scientists were 95% certain that humans are the "dominant cause" of global warming since the 1950s.<sup>1</sup>

## 2015 - Senate snowball

Oklahoma Republican senator James Inhofe, chair of the Senate Environment and Public Works Committee, appeared with a snowball on the Senate floor, claiming that it demonstrated that climate change did not exist.<sup>2</sup>

2015 - Landmark international Paris agreement reached to cut carbon  
196 countries signed the Paris Agreement, agreeing to limit global warming to less than 2°C above pre-industrial levels. It was adopted on Dec. 12, and entered into force on Nov. 4, 2016. Its goal is to limit global warming to 1.5°C, compared to pre-industrial levels. Nations set their own legally binding targets for greenhouse gas cuts and report their progress every five years.<sup>3</sup>



## Jim Inhofe's Senate snowball

Source: Bump, P. (Feb. 26, 2015). Jim Inhofe's snowball has disproven climate change once and for all. Washington Post. <https://www.washingtonpost.com/news/the-fix/wp/2015/02/26/jim-inhofes-snowball-has-disproven-climate-change-once-and-for-all/>

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<sup>1</sup>BBC News. (Sep. 20, 2013). A brief history of climate change. <https://www.bbc.com/news/science-environment-15874560>

<sup>2</sup>Leber, R. (Feb. 26, 2018). 3 years ago we all laughed at James Inhofe's snowball. The joke was on us. Mother Jones. <https://www.motherjones.com/environment/2018/02/3-years-ago-we-all-laughed-at-james-inhofes-snowball-the-joke-was-on-us/>

<sup>3</sup>U.K. Research and Innovation. (n. d.). A brief history of climate change discoveries. <http://www.discover.ukri.org/a-brief-history-of-climate-change-discoveries/index.html>



# Climate Change History

## 2017 - Withdrawal from the Paris Climate Accord

The Trump administration formally notified the U.N. that it would withdraw the U.S. from the Paris Agreement on climate change, leaving global climate diplomats to find a way to proceed without the cooperation of the world's largest economy.<sup>3</sup>

## 2017 - Growing famine

U.N. agency announced that the number of chronically malnourished people in the world, after a decade of decline, grew by 38 million, to 815 million, "largely due to the proliferation of violent conflicts and climate-related shocks."<sup>2</sup>

## 2018 - Child labor increases driven by climate disaster

In June, the Food and Agriculture Organization of the U.N. found that child labor, after years of falling, was growing, "driven in part by an increase in conflicts and climate-induced disasters."<sup>2</sup>

## 2019 - Ice collapse 'irreversible'

An IPCC report warned that part of the Amundsen Sea embayment of West Antarctica may no longer be stable. Its collapse could destabilize the rest of the West Antarctic ice, causing sea level to rise by three meters over centuries to millennia.<sup>1</sup>

### Sources:

<sup>1</sup>U.K. Research and Innovation. (n. d.). A brief history of climate change discoveries. <http://www.discover.ukri.org/a-brief-history-of-climate-change-discoveries/index.html>

<sup>2</sup>McKibben, B. (Nov. 16, 2018). How extreme weather is shrinking the planet. The New Yorker. <https://www.newyorker.com/magazine/2018/11/26/how-extreme-weather-is-shrinking-the-planet>

<sup>3</sup>Friedman, L. (Feb. 19, 2021). Trump serves notice to quit Paris climate agreement. The New York Times. <https://www.nytimes.com/2019/11/04/climate/trump-paris-agreement-climate.html>



## Famine in the South Sudan

Source: TRTWorld. (Dec. 29, 2017). South Sudanese struggle to cope with famine. <https://www.trtworld.com/mea/south-sudanese-struggle-to-cope-with-famine-13735>



# Climate Change History

## 2018 - Climate activist

Fifteen-year-old Greta Thunberg protested outside the Swedish parliament, holding a "School Strike for Climate" sign, pressuring the government to meet carbon emissions targets. Her campaign inspiring thousands of young people across the world to organize their own strikes. By December, more than 20,000 students worldwide joined her by skipping school to protest.<sup>1</sup>

## 2019 - The first net zero commitment

The UK became the first major economy to commit to a 'net zero' greenhouse gas emission target.<sup>2</sup>

## 2019 - Variety of life on Earth being lost at "unprecedented" pace

A UN report, written by 145 experts from 50 countries, found that at least 680 vertebrate species have been driven to extinction since the 16th century and species extinction rates are accelerating because of climate change and invasive species.<sup>2</sup>

## 2020 - World record set for solar power

Oxford PVC, started at the University of Oxford, set a world record with a solar cells that can convert 29.52% of solar energy into electricity.<sup>2</sup>

### Sources:

<sup>1</sup>Kraemer, D. (Nov. 5, 2021). Greta Thunberg: Who is the climate campaigner and what are her aims? BBC News. <https://www.bbc.com/news/world-europe-49918719>

<sup>2</sup>U.K. Research and Innovation. (n. d.). A brief history of climate change discoveries. <http://www.discover.ukri.org/a-brief-history-of-climate-change-discoveries/index.html>



## Greta Thunberg leads a student strike

Source: Umair, I. (sep. 20, 2019). Greta Thunberg is leading kids and adults from 150 countries in a massive Friday climate strike. Vox. <https://www.vox.com/2019/9/17/20864740/greta-thunberg-youth-climate-strike-fridays-future>



# Climate Change History

## 2021 - Climate change inevitable and irreversible

An IPCC Assessment Report predicted the world will reach 1.5°C of warming by 2040, earlier than initial warnings, leading to more heatwaves, intense storms, droughts, floods, sea level rises in coastal areas, permafrost thawing and ocean acidification. The report concluded that climate change is due to irreversible human fossil fuel burning.<sup>1</sup>

## 2021 - Return to the Paris Climate Agreement

Hours after being sworn in, president Joe Biden's executive action returned the U.S. to the agreement.<sup>2</sup>

## 2021 - COP26 meeting

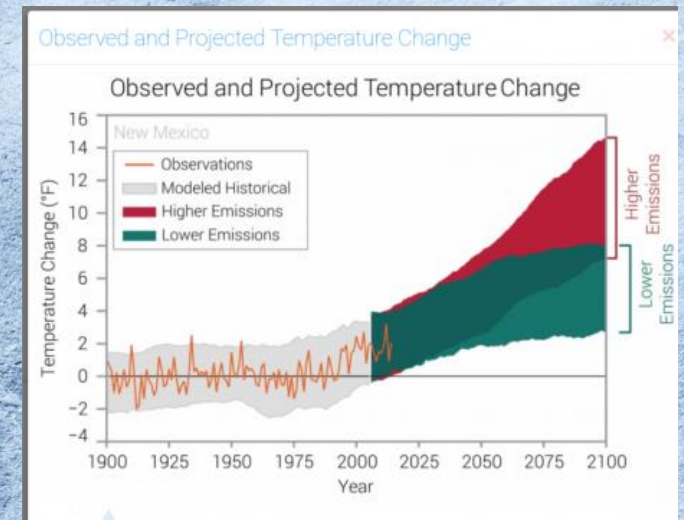
Tens of thousands of negotiators, government representatives, businesses and citizens were involved in 12 days of climate-related talks in Glasgow. They approved several goals: secure global net zero by mid-century and keep 1.5°C within reach, protect communities and natural habitats, mobilize fundings and work together.<sup>3</sup>

### Sources:

<sup>1</sup>U.K. Research and Innovation. (n. d.). A brief history of climate change discoveries. <http://www.discover.ukri.org/a-brief-history-of-climate-change-discoveries/index.html>

<sup>2</sup>Milman, O. (Jan. 20, 2021). Biden returns US to Paris climate accord hours after becoming president. The Guardian. <https://www.theguardian.com/environment/2021/jan/20/paris-climate-accord-joe-biden-returns-us>

<sup>3</sup>U.N. Climate Change Conference. (n. d.). COP26 goals. <https://ukcop26.org/cop26-goals/>



## Climate change warning

Source: Paskus, L. (Oct. 10, 2018). International climate report warns of drastic, irreversible changes. NM Political Report. <https://nmpoliticalreport.com/2018/10/10/international-climate-report-warns-of-drastic-irreversible-changes-en/>



# Climate Change History

## 2022 - COP27

The conference will be held in the green city of Sharm El-Sheikh on Nov. 7 and 8, marking this the 30th anniversary of the adoption of the United Nations Framework Convention on Climate Change. In the last 30 years the world has recognized humans' negative impact on our planet and begun to understand the science behind climate change, better assess its impacts, and better develop tools to address its causes and consequences.<sup>1</sup>

## 2023 and beyond - How will we care for our planet?

Tens of thousands of negotiators, government representatives, businesses and citizens were involved in 12 days of climate-related talks in Glasgow. They approved several goals: secure global net zero by mid-century and keep 1.5°C within reach, protect communities and natural habitats, mobilize fundings and work together.<sup>3</sup>

### Sources:

<sup>1</sup>U.N. (2022). COP27. <https://cop27.eg/#/>



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