



## Timeline Cards (1 of 3)

1824	Jean Baptiste Joseph Fourier (FOO-ree-ey), a French scientist, described Earth's atmosphere as an insulating blanket for the planet. He was the first to use the phrase the "greenhouse effect" to illustrate how the greenhouse gases keep the Earth a comfortable temperature despite our great distance from the sun.
1859	John Tyndall (TIN-dull), an Irish physicist, discovered that carbon dioxide is very good at trapping heat in the atmosphere. He worked with a variety of gases found in the atmosphere and found that carbon dioxide can block heat radiation.
1896	Svante Arrhenius (Suh-VAN-tay Are-REY-nee-oos), a Swedish scientist, was the first to say that increases in carbon dioxide in our atmosphere due to burning coal would cause a global warming effect.
1917	Alexander Graham Bell, a Scottish scientist and inventor of the telephone, wrote, "The unchecked burning of fossil fuels would have a sort of greenhouse effect" and "The net result is the greenhouse becomes a sort of hot-house."
1931	E.O. Hulburt, an American scientist, continued the work of Arrhenius (Are-REY-nee-oos), to include atmospheric water vapor and found that increases in carbon dioxide levels would increase global average temperatures by as much as approximately 4 degrees Celsius.
1938	Guy Callendar, an English engineer, looked at historical temperature records and carbon dioxide levels from around the world and concluded that levels had increased almost 10 percent since the 19th century and temperatures were warming globally.
1956	Gilbert Plass, an American physicist, published <i>The Carbon Dioxide Theory of Climate Change</i> , and said that more carbon dioxide in the atmosphere would increase global warming.
1957	Roger Revelle (Ra-VELL), a scientist in California, said that there is a limit to how much carbon dioxide the ocean could absorb from the atmosphere and remain healthy.
1958	Charles David Keeling (KEY-ling), a scientist from California, used new technology to measure levels of carbon dioxide in the atmosphere. Keeling measured atmospheric carbon dioxide levels to be 315 parts per million in 1958.



## Timeline Cards (2 of 3)

1967	Syukuro Manabe (Shoo-KOO-roo Mah-NAH-bay), a meteorologist from Tokyo University, created the first computer model simulation of Earth's climate. This complex model included many variables and reaffirmed that the climate was changing, not only at Earth's surface but also throughout the atmosphere.
1981	Climatologists Tom Wigley and Phil Jones wrote that "the effects of carbon dioxide may not be detectable until around the turn of the century. By this time, atmospheric carbon dioxide concentration will probably have become sufficiently high that a climatic change significantly larger than any which has occurred in the past century could be unavoidable."
1985	A group of Russian scientists at the Vostok (VAH-stock) Station in Antarctica drilled an ice core about 2 kilometers (more than 1,980 meters or 6,500 feet!) deep. This ice core held approximately 150,000 years of climate history trapped in air bubbles.
1988	The Intergovernmental Panel on Climate Change (IPCC) was started. This international organization includes scientists and government officials from around the world who help synthesize climate science and make recommendations about how greenhouse gas emissions and climate change will impact the Earth and its inhabitants.
1992	A significant number of the world's nations recognized that climate change needed to be addressed globally and formed the United Nations Framework Convention on Climate Change. Nearly every country, including the United States, signed the agreement.
1993	Ice cores from Greenland showed that in the past, drastic climate changes occurred in a span of only 10 years. This greatly changed impressions that a changing climate only happens on a slow, gradual basis.
1997	Negotiations at the United Nations' Conference on Climate Change in Kyoto, Japan, resulted in the Kyoto Protocol, an international agreement to reduce greenhouse gases.
2003	Scientists reported that the increase in atmospheric carbon dioxide resulted in increased absorption of carbon dioxide in the oceans, causing a change in the pH of the oceans. The change in pH, which continues today, is larger than anything in the geological record for the last 300 million years.

## Timeline Cards (3 of 3)

2005	The European Union Emissions Trading System was launched to reduce greenhouse gas emissions through a “cap and trade” program.
2007	Scientists reported that the melting of Arctic sea ice has been faster than models originally predicted. They showed the rate of melting was accelerating.
2007	The United Nations Framework Convention on Climate Change made important decisions on a climate change mitigation solution that seeks to reduce emissions from deforestation in developing countries. That initiative is called REDD+ (Red Plus).
2008	The U.S. Forest Service published a report called a “Strategic Framework for Responding to Climate Change,” which outlined strategies that support adaptation to climate change in our national forests.
2009	The U.S. Interagency Climate Change Adaptation Task Force was created to develop recommendations for the U.S. president to prepare for and adapt to the effects of climate change at the national level.
2013	Scientists measured the mean global temperature at 14.6 degrees Celsius, the warmest it has been in thousands of years.
2013	The United States president, Barack Obama, signed an executive order that created the Council on Climate Preparedness and Resilience. The council works to help federal programs prepare for climate-related changes and provide information for the public.
2014	While much of the eastern United States experienced a colder than normal winter, it was warmer than normal in the Arctic.