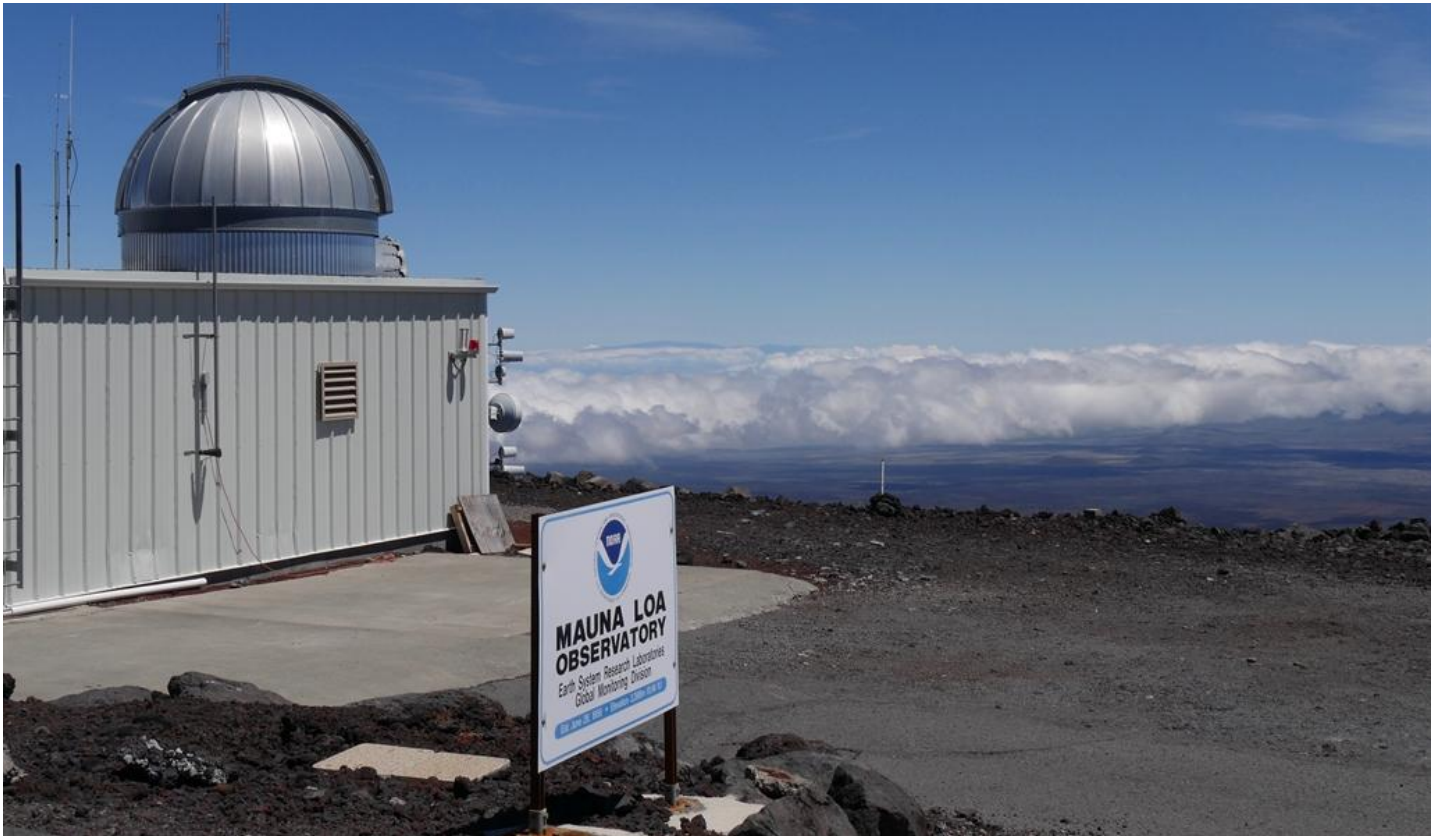


NOAA RESEARCH NEWS



Monday, June 7, 2021

Carbon dioxide peaks near 420 parts per million at Mauna Loa observatory

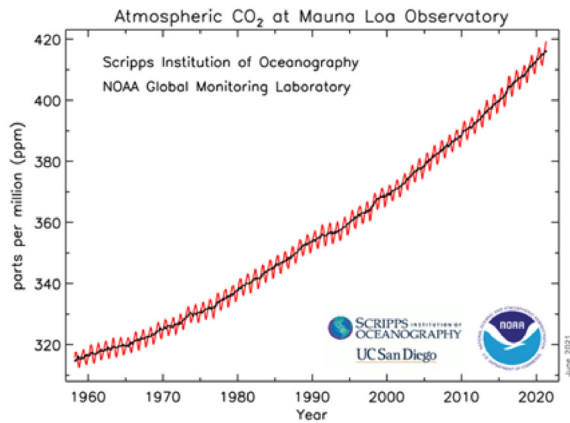
Atmospheric carbon dioxide measured at NOAA's Mauna Loa Atmospheric Baseline Observatory (<https://gml.noaa.gov/obop/mlo/>) peaked for 2021 in May at a monthly average of 419 parts per million (ppm), the highest level since accurate measurements began 63 years ago, scientists from NOAA and Scripps Institution of Oceanography (<https://scripps.ucsd.edu/programs/keelingcurve/>) at the University of California San Diego announced today.

Scripps' scientist Charles David Keeling initiated on-site measurements of carbon dioxide, or CO₂, at NOAA's weather station on Mauna Loa in 1958. NOAA began measurements in 1974, and the two research institutions have made complementary, independent observations ever since.

In May, NOAA's measurements at the mountaintop observatory averaged 419.13 ppm. Scientists at Scripps calculated a monthly average of 418.92 ppm. The average in May 2020 was 417 ppm.

Pieter Tans, a senior scientist with NOAA's Global Monitoring Laboratory, noted that CO₂ is by far the most abundant human-caused greenhouse gas, and persists in the atmosphere and oceans for thousands of years after it is emitted.

III



(/Portals/0/EasyGalleryImages/1/864/co2_data_mlo.png)

“We are adding roughly 40 billion metric tons of CO₂

This graph depicts the upward trajectory of carbon dioxide in the atmosphere as measured at the Mauna Loa Atmospheric Baseline Observatory by NOAA and the Scripps Institution of Oceanography. The annual fluctuation is known as the Keeling Curve. Credit: NOAA Global Monitoring Laboratory

pollution to the atmosphere per year,” said Tans. “That is a mountain of carbon that we dig up out of the Earth, burn, and release into the atmosphere as CO₂ - year after year. If we want to avoid catastrophic climate change, the highest priority must be to reduce CO₂ pollution to zero at the earliest possible date.”

CO₂ pollution is generated by emissions from carbon-based fossil fuels used for transportation and electrical generation, by cement manufacturing, deforestation, agriculture, and many other practices. Along with other greenhouse gases, CO₂ traps outgoing heat from the planet’s surface that would otherwise escape into space, causing the planet’s atmosphere to warm steadily.

While the year-to-year increase of 1.8 ppm in the May CO₂ peak was slightly less than previous years, CO₂ measurements at Mauna Loa for the first five months of 2021 showed a 2.3 ppm increase over the same five months of 2020, close to the average annual increase from 2010 to 2019. There was no discernible signal (<https://gml.noaa.gov/ccgg/covid2.html>) in the data from the global economic disruption caused by the coronavirus pandemic.

What is the Keeling Curve?



(/Portals/0/EasyGalleryImages/1/864/Keeling-plaque-Mauna-Loa-05242019-Susan-Cobb.jpg)

A plaque honoring Charles David Keeling, a Scripps Institution of Oceanography scientist, adorns the wall of NOAA's Mauna Loa Atmospheric Baseline Observatory. Keeling discovered the seasonal fluctuation of carbon dioxide in the global atmosphere after initiating measurements there in 1958. Credit: Susan Cobb, NOAA Global Monitoring Laboratory

the highest the CO₂ value of the entire course in Maunaloa, just before plants in the other hemisphere start to regrow. But CO₂ from the troposphere during the growing season. In the other fall, winter, the spring, plants do not give off CO₂, causing levels to rise through May. Charles David Keeling was the first to observe this seasonal rise and subsequent fall in CO₂ levels ever since, and the curve which is well known as the Keeling Curve (<https://keelingcurve.ucsd.edu/>). Keeling was the first to recognize that despite the seasonal fluctuations, CO₂ levels were rising ever since the Industrial Revolution, the start of the modern era of CO₂ emissions higher than the preceding era.

Keeling's son, George, is the Ralph Keeling, runs the Scripps program at Maunaloa.

"The ultimate carbon knob that controls the CO₂ is fossil-fuel emissions," said Ralph Keeling. "But we still have a long way to go to halt the rise, so the carbon dioxide piles up in the troposphere. We ultimately need cuts that reach a level that is sustained long enough for the COVID-related shutdowns of 2020."

Mauna Loa measurements take the pulse of Earth's atmosphere

Perched on a remote volcanic ridge in the middle of the Pacific Ocean, the Maunaloa observatory is the best place to monitor CO₂. It's a site isolated from pollution, well-ventilated, and undisturbed by the influence of local pollutants such as vegetation, producing a series of measurements that represent the average state of the troposphere in the other hemisphere.

The Maunaloa data, together with the series of measurements from around the world, are reported to NOAA's Global Greenhouse Gas Reference Network (<https://esrl.noaa.gov/gd/cgg/>), funded by the research and development of the climate scientists and the various public agencies that provide the infrastructure.

The tropospheric burden of CO₂ is well represented where it was during the Pleistocene Climatic Optimum, between 4.1 and 4.5 million years ago, when CO₂ was set at about 400 ppm. During that time, sea level was about 78 feet higher than today (<https://www.nature.com/articles/s41586-019-1543-2>), the average temperature was 7 degrees Fahrenheit higher than in pre-industrial times, and studies indicate (https://www.geosciences.edu/client/perspectives/Briggs_Grantee_Science2013.pdf) that the forests occupied the Arctic that were now tundra.

In February, the United States officially rejected the Paris Agreement to climate change, (<https://www.fccc.it/process-and-decisions/the-paris-agreement/the-paris-agreement>) in the treaty signed by 196 countries that have committed to limit global warming to 1.5 degrees Celsius by the end of the century.

Yet, the series of measurements from Maunaloa show, despite decades of negotiations, the global climate has been unable to begin to reverse, and the increase in the tropospheric CO₂ levels.

"The solution is right before our eyes," said Keeling. "Solar energy will be reduced by the use of fossil fuels and the work that the scientists that are required. If we take the action, we might still be able to avoid catastrophic climate change."



or more information, contact Theo Stein, NOAA Communications, at theo.stein@noaa.gov (<mailto:theo.stein@noaa.gov>).

< Previous Article (<https://research.noaa.gov/article/ArtMID/587/ArticleID/2763/NOAA-Boeing-team-up-to-test-greenhouse-gas-measuring-technology>)

Next Article >

125

Print

111855

Tags: Carbon Dioxide (<https://Research.Noaa.Gov/Article/PID/587/Evl/60/TagID/51/TagName/Carbon-Dioxide>)

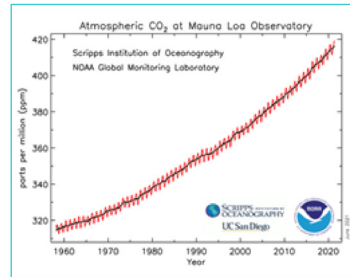
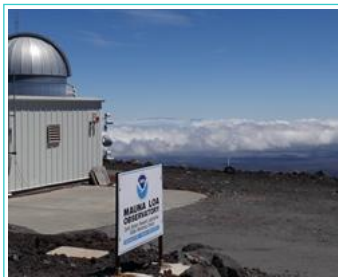
CO2 (<https://Research.Noaa.Gov/Article/PID/587/Evl/60/TagID/67/TagName/CO2>)

Mauna Loa (<https://Research.Noaa.Gov/Article/PID/587/Evl/60/TagID/4970/TagName/Mauna-Loa>)

Keeling Curve ([https://Research.Noaa.Gov/Article/PID/587/Evl/60/TagID/4972/TagName/Keeling Curve](https://Research.Noaa.Gov/Article/PID/587/Evl/60/TagID/4972/TagName/Keeling-Curve))

Scripps Institution Of Oceanography (<https://Research.Noaa.Gov/Article/PID/587/Evl/60/TagID/4973/TagName/Scripps-Institution-Of-Oceanography>)

Atmospheric Baseline Observatory (<https://Research.Noaa.Gov/Article/PID/587/Evl/60/TagID/5047/TagName/Atmospheric-Baseline-Observatory>)



Related articles



Southern Ocean confirmed as strong carbon dioxide sink



Atmospheric carbon dioxide rebounds as global pollution rates approach pre-Covid levels



A new way to measure how Arctic plant communities respond to climate change



Low-oxygen waters off Washington, Oregon coasts risk becoming large 'dead zones'



Deforestation, warming flip part of Amazon forest from carbon sink to source

MORE NEWS ARTICLES >

