

# Climate Science Update

Photo: M. Fitzpatrick

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## Global Thermometer Still Climbing

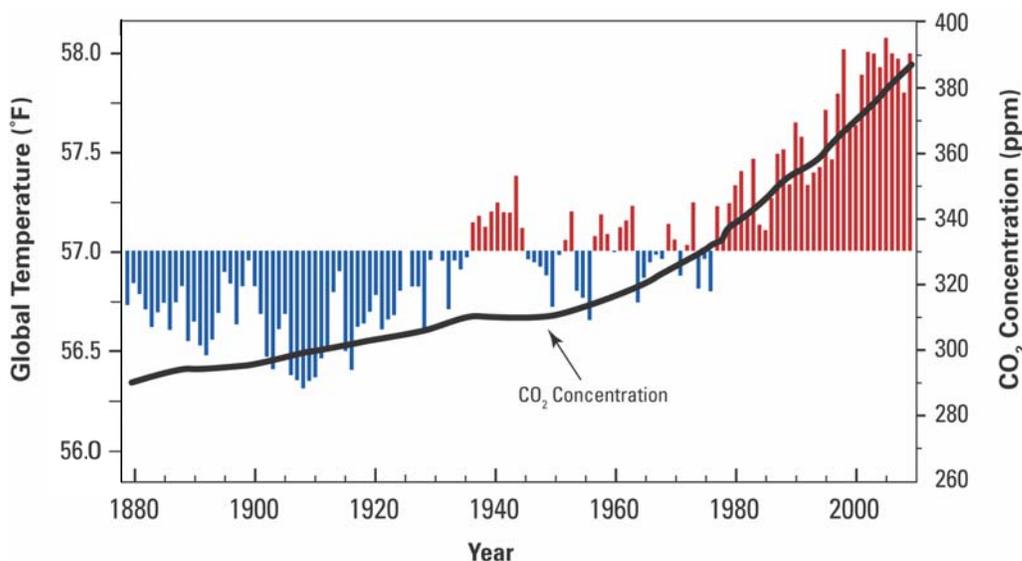
The Earth's average temperature is continuing to rise, regardless of the fact that some parts of the United States now are experiencing an atypically cold winter.

The U.S. land area covers only about 2 percent of the Earth's surface, which means that even when much of the United States is cold, most of the rest of the world may be warmer. This winter, for example, many Americans are experiencing extreme cold, but the oceans and much of the rest of the world are much warmer than usual. Overall, the past 10 years have been the warmest on record globally. Here at home, the continental United States record daily highs have exceeded record daily lows by a margin of two to one from 2000 to 2009.<sup>1</sup>

Despite regional cold, this decade is the hottest ever recorded.

### The Globe is Warming

Burning coal, oil and gas and destroying forests overloads the atmosphere with excess carbon dioxide, adding to heat-trapping gases that already are present in the atmosphere. Combined, these gases act like a blanket covering the earth. The human contribution to this effect is unmistakable. The part of the atmosphere where excess carbon dioxide accumulates has expanded and warmed dramatically in recent years precisely during the period when emissions from human activity have increased. Scientists from NASA and other research institutions routinely collect temperature data from around the world and have records of the Earth's average temperature going back to the 1880s, when temperatures were first recorded. The data shows that, globally, the last decade has been the warmest ever recorded.<sup>1,2</sup>



Global Surface Temperature and Carbon Dioxide

Surface records show global average temperature continuing to rise during the last half century. Natural warming and cooling cycles (of several years to a decade) are also evident. Red (above average) and blue (below average) bars show global temperature compared to the average from 1901-2000.

Source: NOAA/NCDC<sup>1</sup>

Over the last century, global average temperature has increased by more than 1°F (0.6°C). While the record shows significant regional differences in warming, the long-term global upward trend is unambiguous.

However, surface temperature is only one indicator of climate change. Patterns of rainfall and snow, droughts and storms, and lake ice also are changing. Plant and animal behavior are changing. Glaciers are melting and sea level is rising. These shifts are well documented and are largely attributed to human-caused global warming.<sup>3</sup> Scientists can now positively identify the “human fingerprints” associated with these changing patterns.

## Climate and Weather

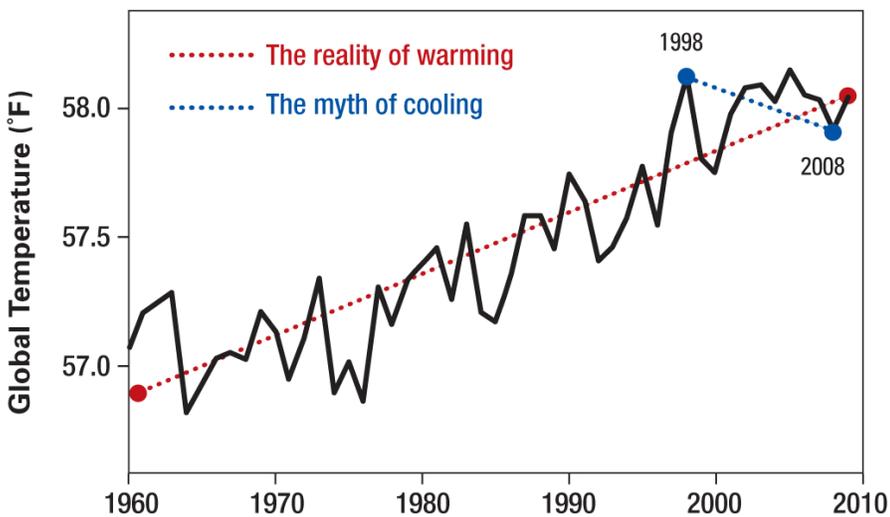
Climate is a good indicator of what to expect in general, such as cold days in February in New England. Weather, on the other hand, is what we actually experience, like a blustery, snowy day with temperatures in the low 20s. In other words, climate describes phenomena observed over long time periods, such as decades and centuries, while weather is observed over short time periods, such as days and weeks.

It is clear that the Earth's climate is changing, largely due to human activity. Over the last 25 years, Earth's global average temperature has been increasing at more than twice the rate of the last century. In fact, nine of the warmest years on record have occurred in just the last 10 years.<sup>1,2</sup> This warming has been accompanied by a decrease in very cold days and nights and an increase in extremely hot days and warm nights. Additionally, the oceans reached their highest recorded temperature in the summer of 2009. Oceans have absorbed much more heat from global warming than the air at the Earth's surface because water is much better at retaining heat.

## The "Long" and the "Short" of Temperature Trends

Relatively short-term natural phenomena that cause global temperatures to fluctuate are occurring at the same time human activity continues to drive up average global temperatures by overloading the atmosphere with heat-trapping emissions.

These short-term effects on climate make it possible to have "cooler" periods in regions even as the general trend of warming continues.<sup>4</sup> For example, during late 2007 and early 2008, the tropical Pacific Ocean was much cooler than normal due to a strong La Niña episode that kept temperatures across much of the globe lower than usual. Nevertheless, both years were still in the top 10 warmest years on record and would have been even hotter without this short-term cooling effect. Conversely, in 1998, a very strong El Niño episode, which made the tropical Pacific Ocean warmer than normal, combined with human-induced global warming to make that year one of the hottest on record.



**Global Surface Temperature Over the Last Fifty Years**

The year 1998 was particularly warm and has been used to falsely claim that the following decade has seen little change or a cooling in temperature. Red shows the correct trend from 1960 through 2008, blue is an erroneous trend over ten years resulting from "cherry-picking" the start and finish dates. Source: NOAA/NCDC data<sup>1</sup>, design idea K. Hayhoe.

Of the ten warmest years ever recorded, nine of them are in the last ten years.



Focusing on relatively short time periods to claim global warming is not happening is a misleading way to use statistics. These false claims have become so persistent that late last year the Associated Press asked a team of independent statisticians to review global temperature data without revealing to them what the data represented.<sup>5</sup> All of the statisticians concluded that the data showed an unmistakable upward trend over time.

## It's Not Too Late

The choices we make today can help determine what our climate will be like. Putting a limit on heat-trapping emissions and encouraging the use of healthier, cleaner energy technologies, such as solar and wind power, would help us to avoid the worst potential consequences of global warming.

A fully referenced version of this fact sheet is available online at [www.ucsusa.org/climatescienceupdate](http://www.ucsusa.org/climatescienceupdate)

The Union of Concerned Scientists is the leading science-based nonprofit working for a healthy environment and a safer world.



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M. Fitzpatrick prepared this update with reviews by B. Ekwurzel, A. Huertas, E. Negin, L. Nurnberger, L. Perera and L. Shultz.

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## References

1. NOAA National Climatic Data Center, accessed January 12<sup>th</sup>, 2010: [www.ncdc.noaa.gov/oa/climate/research/anomalies/index.html](http://www.ncdc.noaa.gov/oa/climate/research/anomalies/index.html)
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Note: The surface temperature of the Earth expressed as a global average is determined from thousands of individual thermometers based on land areas and on ships and buoys in the ocean. To obtain consistent changes over time, scientists compare the different data sets using the departure from the climatological mean at each location. For more information see the UK Met Office: [www.metoffice.gov.uk/climatechange/science/explained/explained5.html](http://www.metoffice.gov.uk/climatechange/science/explained/explained5.html)

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