

# Climate change glossary

**ATMOSPHERE** – The mixture of gases surrounding the Earth, held in place by gravity. It forms distinct layers at different heights. The Earth's atmosphere consists, in ascending order, of the troposphere, the stratosphere, the mesosphere, the thermosphere and the exosphere. The atmosphere is composed primarily of nitrogen (78 percent) and oxygen (21 percent).

**CLIMATE** – The general or average weather conditions of a certain region, including temperature, rainfall and wind. On Earth, climate is affected most by latitude, the tilt of the Earth's axis, the movement of the Earth's wind belts, the difference in temperatures of land and sea, and topography.

**CARBON CYCLE** – The continuous process by which carbon is exchanged between organisms and the environment. Carbon dioxide is absorbed from the atmosphere by plants and algae and converted to carbohydrates by photosynthesis. Carbon is then passed into the food chain and returned to the atmosphere by the respiration and decay of animals, plants and other organisms. The burning of fossil fuels also releases carbon dioxide into the atmosphere.

**CORIOLIS EFFECT** – The deflection of objects or substances (such as air) moving along the surface of the Earth, rightward in the Northern Hemisphere and leftward in the Southern Hemisphere, because of the Earth's rotation.

**EL NINO** – A warming of the surface water of the eastern and western central Pacific Ocean, occurring every four to 12 years and causing unusual global weather patterns, including heavy rain in western South America and drought in Eastern Australia and Indonesia.

**GLACIER** – A large mass of ice moving very slowly through a valley or spreading outward from a center under the influence of gravity. Glaciers form over many years from packed snow in areas where snow accumulates faster than it melts. A glacier is always moving, but when its forward edge melts faster than the ice behind advances, the glacier as a whole sinks backward.

**GLOBAL WARMING** – An increase in the average temperature of the Earth's atmosphere, especially a sustained increase great enough to cause changes in the global climate. The Earth has experienced numerous episodes of global warming throughout its history, and appears now to be undergoing such warming. Expected long-term effects of current global warming are rising sea levels, flooding, melting of polar ice caps and glaciers, fluctuations in temperature

and precipitation, more frequent and stronger El Ninos and La Ninas, drought, heat waves and forest fires.

**GREENHOUSE EFFECT** – The retention of part of the sun's energy in the Earth's atmosphere in the form of heat as a result of greenhouse gases. Solar energy penetrates the Earth's atmosphere and is absorbed by the Earth's surface. The heated surface then radiates some of that energy into the atmosphere. Although some of this radiation escapes into space, much of it is absorbed by greenhouse gases in the lower atmosphere, which in turn re-radiate a portion back to the Earth's surface. The atmosphere thus acts in a manner roughly analogous to the glass in a greenhouse. The greenhouse effect is essential to life on Earth; however, the intensification of its effect because of increased levels of greenhouse gases in the atmosphere is considered a contributing factor to global warming.

**GREENHOUSE GASES** – Any of the atmospheric gases that contribute to the greenhouse effect. They include carbon dioxide, methane, nitrous oxide and water vapor. Although greenhouse gases occur naturally in the atmosphere, the elevated levels that have been observed in recent decades are directly related, at least in part, to human activities such as the burning of fossil fuels and the deforestation of tropical forests.

**GULF STREAM** – A warm ocean current of the northern Atlantic Ocean off eastern North America. It flows northward and eastward from the Gulf of Mexico, eventually dividing into several branches. A major branch continues eastward to warm the coast and moderate the climate of northwest Europe.

**ICE AGE** – 1. Any of several cold periods during which glaciers covered much of the Earth. 2. The most recent glacial period, which occurred during the Pleistocene Epoch and ended about 10,000 years ago. During the Pleistocene Ice Age, great sheets of ice up to 2 miles thick covered most of Greenland, Canada and the northern United States, as well as northern Europe and Russia.

**JET STREAM** – A narrow current of strong wind circling the Earth from west to east at altitudes of about seven to eight miles above sea level. There are usually four distinct jet streams, two each in the Northern and Southern hemispheres. They are caused by significant differences in the temperatures of adjacent air masses. These differences occur where cold, polar air meets warmer, subtropical air.

**LA NINA** – A cooling of the surface water of the eastern and central Pacific Ocean, occurring somewhat less frequently than El Nino, but causing similar, generally opposite disruptions to global weather patterns.

**MONSOON** – A system of winds that influences the climate of a large area and that reverses direction with the seasons. Monsoons are caused primarily by the much greater annual variation of temperature over land than over large areas of adjacent ocean water. This variation causes an excess of atmospheric pressure over the continents in winter, and a deficit in the summer. The disparity causes strong winds to blow between the ocean and the land, bringing heavy seasonal rainfall.

**PRECIPITATION** – A form of water, such as rain, snow or sleet, that condenses from the atmosphere, becomes too heavy to remain suspended and falls to the Earth's surface. Different atmospheric conditions are responsible for the different forms of precipitation.

\* **THERMOHALINE CURRENT** – A current driven by density differences caused by variation in temperature and/or salinity and responsible for deep ocean circulation

**WEATHER** – The state of the atmosphere at a particular time and place. Weather is described in terms of variable conditions such as temperature, humidity, wind velocity, precipitation and barometric pressure.

**WIND** – A current of air, that moves parallel to the ground, from an area of high pressure to an area of low pressure. The large-scale patterns of winds on Earth is governed primarily by differences in the net solar radiation received at the Earth's surface, but it is also influenced by the Earth's rotation, by the distribution of continents and oceans, by ocean currents and by topography. Prevailing global winds are classified into three major belts in the Northern Hemisphere and corresponding belts in the Southern Hemisphere. The **trade winds** blow generally east to west toward a low-pressure zone at the equator throughout the region from 30 degrees north to 30 degrees south of the equator. The **westerlies** blow from west to east in the temperate mid-latitude regions (from 30 degrees to 60 degrees north and south of the equator), and the **polar easterlies** blow from east to west out of high-pressure areas in the polar regions.

*Sources:*  
**American Heritage Science Dictionary, 2005**  
**\* New Penguin Dictionary of Geology, 2001**

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Climate can evolve over millions of years or bring drastic change in as little as two years. Some scientists believe that, if not for the part of global warming caused by humans, the globe might have remained in a cooler phase or even slipped into a more permanent freeze.

The fact remains that, by some estimates, the Earth's average temperatures are higher than at any other point in the last 400,000 years, said Kates.

"It's the hardest question in the world: How do you recognize change when you're in the middle of it?" he said.

## 'What are the consequences?'

Four hours up the face of Hamlin Peak in Baxter State Park, a hiker is rewarded with a glimpse of what could be lost if Maine's climate is, in fact, warming.

Tiny denizens of the tundra are clustered along the trail not far from Baxter Peak, the state's mile-high apex. Alpine bilberry, mountain cranberry and diaspensia crawl across the bare granite boulders.

Bigelow's sedge and Labrador tea grow in mountaintop meadows where the Katahdin Arctic butterfly, an invertebrate on the state's endangered species list, lives its few weeks — the only place in the world where this subspecies is known to breed.

Each of these organisms lives in one of the harshest climates Maine has to offer, yet they could be the first victims of a warming climate. As temperatures rise, alpine plants migrate to higher altitudes, but as they run out of habitat near the peaks, Katahdin's rare species could simply disappear. Volunteers from the Appalachian Mountain Club are keeping a close eye on their populations.

Meanwhile, all across the world, flowers are blooming earlier, songbirds are sticking around through the fall, and glaciers are melting away.

"What we're doing now is a global story," said Jacobson, referring to humanity's role in climate change. "We're changing the whole chemistry of the Earth in a way that's going to have consequences.

"We've already changed the atmosphere," he said. "The question is: What are the consequences of all that heat?"

Between 1895 and 1999, New England's average temperature increased by 0.7 degrees Fahrenheit. Data from Maine over the past century show that temperatures are rising in the southern third of the state, holding steady in the central regions and dropping slightly in the north.

"What people want to know is: 'How is it going to affect them?' But that's the hardest thing," said Zielinski, the state climatologist. "Maine is tough, because we are at a zone of climate boundaries," he said. "It's not an easy place to forecast."

Climatologists have used historical data and weather observations from recent centuries to build models or computer programs that predict climate change.

Some day these models may be able to foresee droughts and anticipate floods.

But today there isn't enough data to paint a precise view of the future. Some climate models predict a wetter Maine, some drier. Major models forecast that New England's temperature could rise somewhere between 6 and 10 degrees in the next century. At the extreme end, such a change would transform Boston's winters to something akin to Atlanta today.

Even if the exact impacts of climate change can't be defined, clearly something is happening. The Pentagon was concerned enough about drastic climate change that in 2004, officials issued a report warning of war and famine.

Despite lingering questions about what the exact consequences may be, one thing is clear: Interfering with a complex natural system that we don't yet understand is irresponsible, Kates said.

"The evidence keeps piling up more and more," he said. "How can we play dice with the planet?"

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**Page 3:** The Ice Age in Maine – Jonathan Ferland, Eric Zelz/BDN GRAPHIC, source: Climate Change Institute, Maine Geological Survey – "Glaciers & Granite," by David L. Kendall.

**Page 4:** Bangor, Storm of 1962 – BDN FILE PHOTO; Kirk Maasch – John Clarke Russ/BDN PHOTO; Robert Kates – John Clarke Russ/BDN PHOTO; Marion Staples – John Clarke Russ/BDN PHOTO; Birdwatchers – John Clarke Russ/BDN PHOTO.

**Page 5:** Storm of 1962 – BDN FILE PHOTOS; "The Census at Bethlehem" by Brueghel, Pieter the Elder (c. 1515-69), Musees Royaux des Beaux-Arts de Belgique, Brussels.

**Page 6-7:** The fate of solar radiation/Layers of the atmosphere, sources: "Arctic Climate Impact Assessment," "DK Ultimate Visual Dictionary of Science," "Reporting on Climate Change," Climate Change Institute, Texas A&M University's Web site oceanworld.tamu.edu, "The Audubon Field Guide to North American Weather," Earth's orbital mechanics, sources: National Geographic Society, "Reporting on Climate Change," "The Ice Chronicles" – Mayewski and White, oceanworld.tamu.edu; Glacial and interglacial periods, sources: "Nature," 399, Vol. 399 (6735), June 3, 1999, "Evolution of the Earth," McGraw Hill, Inc., Reporting on Climate Change; Earth's circulatory system, sources: "DK Ultimate Visual Dictionary of Science," "Reporting on Climate Change," Climate Change Institute, "The Audubon Field Guide to North American Weather," The Great Ocean Conveyor Belt, sources: "The Ice Chronicles," Mayewski and White, "Reporting on Climate Change," oceanworld.tamu.edu, "Arctic Climate Impact Assessment," Earth's greenhouse effect, sources: "Reporting on Climate Change," Environment magazine, December 2004, "Arctic Climate Impact Assessment," National Geographic Society, Climate Change Institute; Predictions for the next century, source: "Reporting on Climate Change," Science News Online; Atmospheric carbon dioxide, source: "Arctic Climate Impact Assessment" – Jonathan Ferland, Eric Zelz/BDN GRAPHICS.

**Page 8:** Paul Mayewski – John Clarke Russ/BDN PHOTO; A changing coastline, sources: MODIS images courtesy of NASA's Terra satellite, supplied by Ted Scambos, National Snow and Ice Data Center, University of Colorado, Boulder; Change of Greenland Ice Sheet, source: Arctic Climate Impact Assessment; GISP2 project, sources: Climate Change Institute, "The Ice Chronicles," Mayewski and White.

**Page 9:** Arctic climate trends, increasing global concentrations of carbon dioxide, source: "Arctic Climate Impact Assessment;" The Arctic melt, source: "Arctic Climate Impact Assessment;" Surface reflectivity, source: "Arctic Climate Impact Assessment;" Florida inundation, source: "Arctic Climate Impact Assessment" – Jonathan Ferland, Eric Zelz/BDN GRAPHICS; Global positioning system receivers – Climate Change Institute PHOTO.

**Page 10:** Fei Chai – John Clarke Russ/BDN PHOTO; Great Ocean Conveyor Belt, sources: "The Ice Chronicles," Mayewski and White, "Reporting on Climate Change," oceanworld.tamu.edu, "Arctic Climate Impact Assessment" – Jonathan Ferland, Eric Zelz/BDN GRAPHICS; John Hunt map – Maine Historical Society; Valley Forge, reproduction of a 1907 painting, St. Paul, Brown and Bigelow, copyright 1907, Prints and Photographs Division, Library of Congress; Bangor, Storm of 1962 – BDN FILE PHOTO.

**Page 11:** Hurricane Katrina – Eric Gay/AP PHOTO.

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### 1988

A heat wave and drought grip the Great Plains, resulting in a major fire at Yellowstone National Park. Climatologist James Hansen presents data to a U.S. Senate committee, proof that Earth's climate had been warming for nearly a century, and testifies that he believes fossil fuels are the major cause.

### 1998

The warmest year of the 20th century occurs, based on global temperature averages.

The El Nino climate phenomenon hits a landmark during the winter of 1997-98, with various storms causing more than \$10 billion in damage worldwide.

Maine is crippled by "the Ice Storm," several days of sleet and hail that leave tens of thousands without heat and power. With several inches of ice encasing cars, doors and utility lines, it takes days for life in Maine to return to any semblance of normality.

### 2005

The Kyoto Protocol, an international agreement among industrialized nations to attempt to slow human-caused climate change, takes effect. The United States is not among its signatories.



Hurricane Katrina, a Category 4 hurricane, strikes the Gulf Coast of the United States, flooding the below-sea-level city of New Orleans. Bodies were still being found in December – four months after the storm struck – elevating the death toll to more than 1,300.