

Earth's climate regularly changes in response to natural events. Throughout history, Earth has experienced warm and cold periods. The last ice age, for example, ended about 10,000 years ago. Today's people live during a relatively warm period. So, if Earth naturally experiences warm and cold periods, why all the concern about global warming?

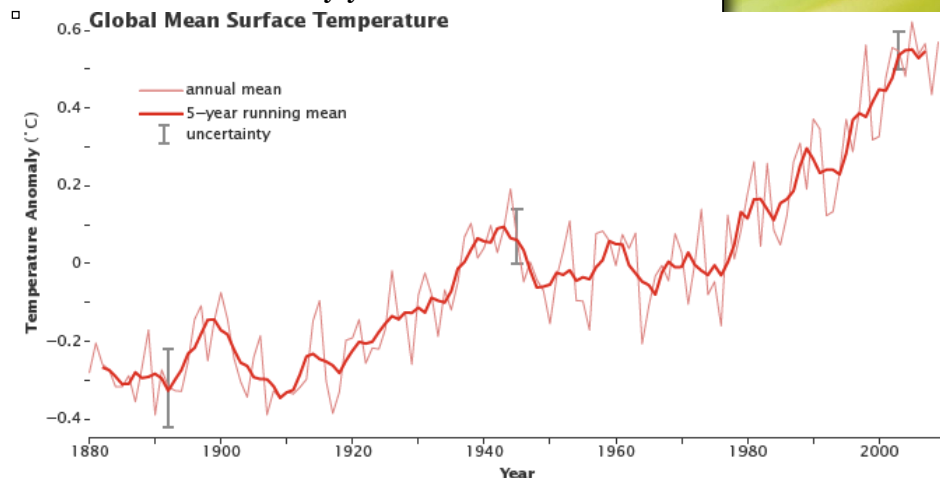
"Global warming is the unusually rapid increase in Earth's average surface temperature over the past century primarily due to the greenhouse gases released as people burn fossil fuels."
– NASA Earth Observatory.

The main reason for concern is that human activity is causing Earth to warm faster than at any time in the past. Scientists have shown that the average surface temperature of Earth has increased as much as 0.9 degrees Celsius over the past century. While less than one degree does not sound like much, the *rate* of change has almost doubled in the last fifty years.

The atmosphere surrounds Earth in a protective layer. In one way, the atmosphere acts like a layer of clothing. It keeps Earth from becoming too cold or too hot. The atmosphere maintains Earth's

temperature through absorbing and radiating energy in a process known as the greenhouse effect.

Important to this "greenhouse" process is the composition of Earth's atmosphere. Specific gases trap the energy that keeps Earth warm. Both natural events and human activities change the types and amounts of gases in the atmosphere. For example, volcanic eruptions spew gas and dust particles into the atmosphere. Human activities, such as the production of materials used by societies, contribute gases to the atmosphere.



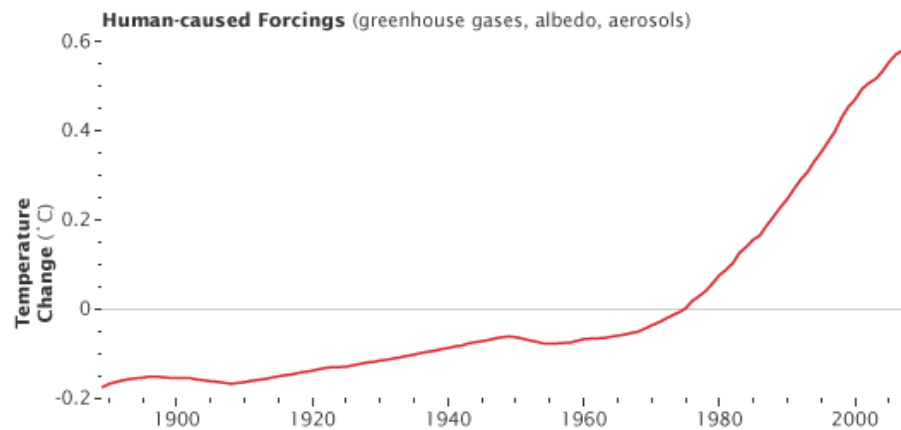
This graph shows the change in the mean surface temperature of Earth. Scientists worry about the increased speed at which the surface of Earth is warming.

Scientists worry that human activities contribute too much gas too fast to the atmosphere. Research shows that since about 1750 both the composition of the atmosphere and Earth's average

temperature have changed very quickly relative to other periods in Earth's past. This period, from 1750 to the present, represents a time of rapid development for human society. In that period, humans have learned to use energy to produce vast amounts of food and materials that aid in creating a comfortable life for large segments of the population. Energy production and consumption, however, releases carbon dioxide (CO_2) into the atmosphere. Raising cattle and other domestic animals to provide food to an increasing population, as well as disposing of waste produced by both animals and humans, produces methane (CH_4). This also changes the composition of the atmosphere. In addition, both methane and carbon dioxide cause the atmosphere to trap more heat near Earth.

Another human activity, cutting down trees, also changes the composition of the atmosphere. Trees remove carbon dioxide from the atmosphere and add oxygen to the atmosphere during respiration. Cutting down forests, also known as deforestation, interrupts a natural process that helps maintain Earth's atmosphere. Cutting down forests results in fewer trees available to remove carbon dioxide from the atmosphere.

Scientists often use computer models to predict future events. Using such models, scientists predict various rates of global warming based on different types of human activity. If humans produce fewer greenhouse gases, the rate of warming decreases. If, on the other hand, they produce lots of greenhouse gases, the



Look at this graph. Notice that the line becomes steep around 1980. The graph shows that around 1980 the rate of warming of Earth's surface began to increase rapidly.

rate of warming increases. Currently, scientists think that, over the next 100 years, Earth will warm between two and six degrees Celsius. The variation between two and six degrees Celsius is entirely dependent upon human activity.

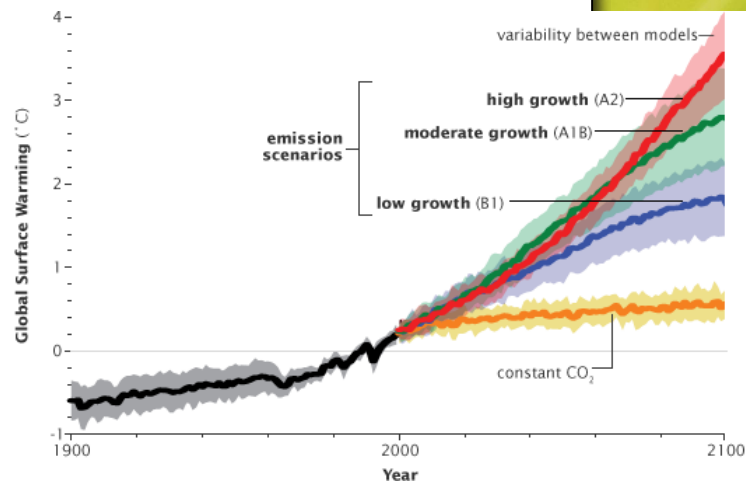
Is it too late to stop global warming? Yes and no. Clearly Earth is in a warming trend, and that is not likely to change. No one, however, knows exactly how fast the Earth will warm over the next century. A lot depends upon human behavior.

Individuals, communities, and nations will need to change their behaviors in order to decrease the rate of global warming.

Most behaviors that need to change are related to using less energy and producing less waste. Energy use, such as electricity for lights and appliances or fuel for vehicles, produces lots of carbon dioxide. Waste, whether from cattle and other domestic animals raised for food or from waste deposited in landfills, produces lots of methane. An increased awareness of these cause-and-effect relationships may sway humans to change their behaviors. Additionally, an understanding of the fact that making changes in behavior can save energy—which will also save money over time—is likely to have an impact. The less energy used, the more money saved. The less waste created, the more money saved.

The following are a few things people can do to reduce energy use:

- Reduce the use of gasoline for transportation: carpool, use public transportation, bike, or walk.



This graph shows several possible rates of change for global warming. The graph was produced based upon computer models of human production of greenhouse gases.

- Replace old appliances with new models that use less energy to do the same job.
- Replace incandescent lightbulbs with L.E.D. or compact fluorescent lightbulbs.
- Increase the efficiency of homes by replacing old windows, adding insulation, and using less hot water.
- Control the temperature of the house with a programmable thermostat.