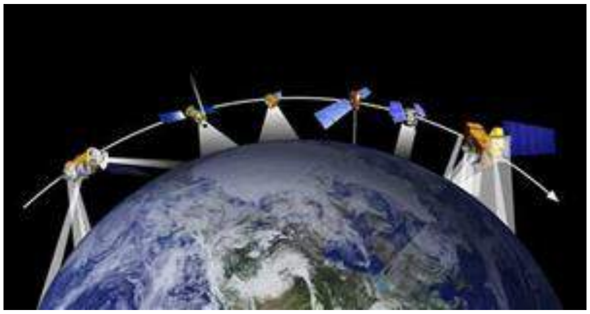
Why Does Climate Change Matter?

The sky is still blue. Trees are still green. Wind still blows. Clouds are still white and fluffy. Rain still pours from the sky. Snow falls, and it still gets really cold in some places. Earth is still beautiful. So, what is the problem? What is the fuss about climate change and global warming?



All these satellites, plus a lot more, are studying Earth and all the changes happening with the air, ocean, land, and ice.

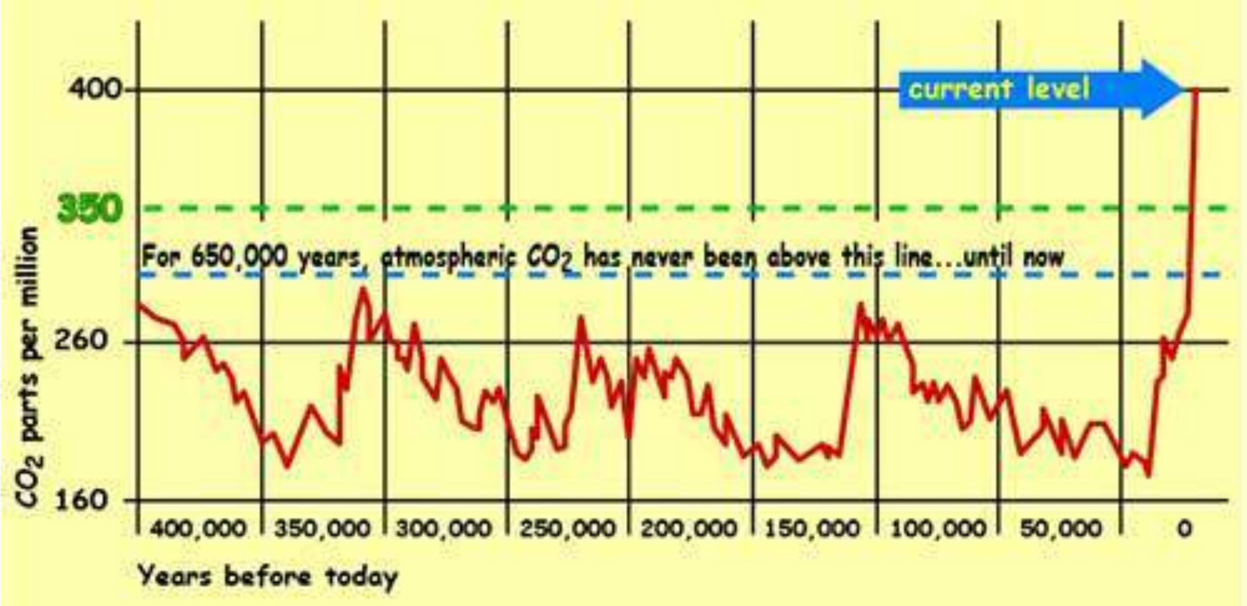
Well, after observing and making lots of measurements, and using lots of NASA **satellites** and special instruments, scientists see some alarming changes. These changes are happening fast—much faster than these kinds of changes have happened in Earth's long past.

Global air temperatures near Earth's surface rose almost one and one-half degrees Fahrenheit in the last century. Eleven of the last 12 years have been the warmest on record. Earth has warmed twice as fast in the last 50 years as in the 50 years before that.

One and one-half degrees may not seem like much. But when we are talking about the average over the whole Earth, lots of things start to change.

Why is the Earth getting warmer?

Carbon dioxide (CO_2) is a **greenhouse gas**, which means it traps heat from the Earth's surface and holds it in the atmosphere. Scientists have learned that, throughout the Earth's history, temperatures and CO_2 levels in the air are closely connected. As the temperature goes up, the amount of carbon dioxide (CO_2) in the air goes up. And as the amount of carbon dioxide goes up, the temperature goes up even more.

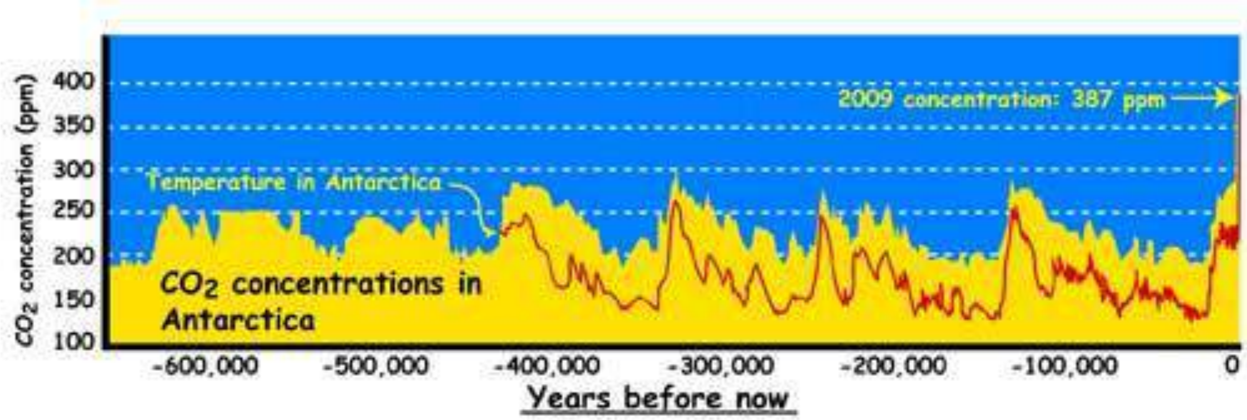


This graph shows carbon dioxide levels over the past 450,000 years.
Notice the sharp increase starting around 1950.
Ref: http://www.ncdc.noaa.gov/paleo/globalwarming/temperature-change.html.

The graph above shows CO_2 levels for the past 450,000 years. As you can see, for 450,000 years, CO_2 went up and down, but the levels never rose over 280 parts per million until 1950. But then, something different happens and CO_2 increases very fast. At the end of 2012, it is 394 parts per million. Why?

Because of us and our **fossil fuels.**

Now look at that graph again, but now the temperatures are added in for that same period of Earth's history. You can see how temperature and CO_2 levels change together. Also, notice what is happening in the graph as of 2009!



The graph shows how carbon dioxide and temperatures have risen and fallen together over the past 450,000 years.
Ref: http://www.epa.gov/climatechange/science/pastcc_fig1.html.

How do we know what Earth was like long ago?

In Antarctica, scientists have drilled down to two miles below the surface and brought up samples of the ice. These samples are called **ice cores**. It's like what you get if you plunge a drinking straw into a slushy drink and pull it out with your finger over the end of the straw. What you would have inside the straw is an ice core— although a very slushy one.

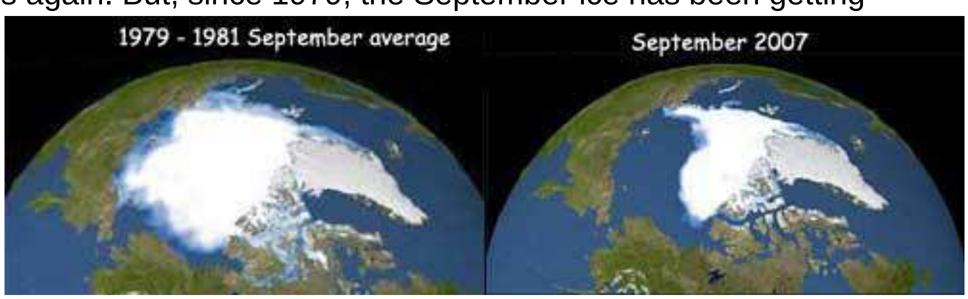
Clockwise from left: Ice coring machine, hole in ice, pulling ice core from machine, man with hands on ice core tube in ground, scientist holding up ice core, man hand drilling ice core.

The layers in an Arctic ice core are frozen solid. They give clues about every year of Earth's history back to the time the deepest layer was formed. The ice contains bubbles of the air from each year. Scientists analyze the bubbles in each layer to see how much CO2 they contain. Scientists can also learn about the temperature each year by measuring relative amounts of different types of oxygen atoms in the water.

Other scientists study cores of sediment from the bottom of the ocean or lakes. Or they study tree rings and layers of rocks to give them clues about climate change throughout history. They compare all their findings to see if they agree. If they do, then their findings are accepted as most likely true. If they don't agree, they go back and figure out what is wrong with their methods. In the case of Earth's climate history, the facts agree from a lot of different kinds of studies.

How can so little warming cause so much melting?

Water can soak up a lot of heat. When the oceans get warmer, sea ice begins to melt in the Arctic and around Greenland. NASA's Earth satellites show us that every summer some Arctic ice melts and shrinks, getting smallest by September. Then, when winter comes, the ice grows again. But, since 1979, the September ice has been getting smaller and smaller and thinner and thinner.



On the left, the ice cap covers a large part of the Arctic Ocean; this image is an average of the ice extent during Septembers 1979-1981. On the right, a much smaller area is covered by ice in September 2007.
Ref: http://www.nasa.gov/topics/earth/sea_ice_nsidc.html.

Glaciers are another form of melting, shrinking ice. Glaciers are frozen rivers. They flow like rivers, only much slower. Lately, they have been speeding up. Many of them flow toward the ocean and then break off in chunks—sometimes really large chunks. In places such as Glacier National Park, the glaciers are melting and disappearing. The air is getting warmer, and less snow is falling during winter to renew the melted parts of the glacier.

Doesn’t rising sea level just bring us closer to the beach?

As more sea ice and glaciers melt, the global sea level rises. But melting ice is not the only cause of rising sea level. As the ocean gets warmer, the water actually expands! Sea level has risen 6.7 inches in the past 100 years. In the last ten years, it has risen twice as fast as in the previous nine years. If Greenland’s ice sheet were to melt completely, sea level all over the world would rise by 16-23 feet. The map of the southeastern United States shows in red the area that would be under water if sea level were to rise by 20 feet.

How does climate change affect other species?

Life is a web, with every strand connected to every other strand. One species of plant or animal changes, and a whole chain of events can follow involving many other species. For example, herds of caribou live in cold, Arctic locations. Caribou hate mosquitoes. In the past few years warmer temperatures in summer have allowed mosquito populations to explode. So, the caribou spend a lot more energy swatting away the mosquitos. All this swatting leaves the caribou less energy to find food and prepare for the next long winter. Female caribou are especially troubled since they need more energy to give birth and raise their young.

Animals that hibernate in the winter also suffer from warming temperatures. Marmots, chipmunks, and bears are waking up as much as a month early. Some are not hibernating at all. These animals can starve if they stay awake all winter, because they can’t find enough food. If they wake up too early and plants haven’t started to grow, they may not have enough food and can starve to death.

Many trees in the western United States are already suffering from climate change. **Droughts** leave trees thirsty and stressed. Pine trees need cold winters, too. With warmer, drier conditions, the trees are more likely to become infected with insects. These bugs bore into the trees and lay their eggs. Eventually, they kill the tree. Some forests in the West have lost over half their trees to pine beetles. When the forest is gone, birds and small mammals that lived there have to find new homes—if they can.

Satellite image of the Station Fire in Los Angeles in 2009. Drought conditions and record hot temperatures could make fires like this more frequent and intense.

Climate change is something that affects all of us. Working to counteract the causes of climate change will help us improve life for many plants and animals; including humans!