CLIMATE CHANGE THEN vs NOW

Earth's climate has changed before, how do we know today's climate change is human caused?

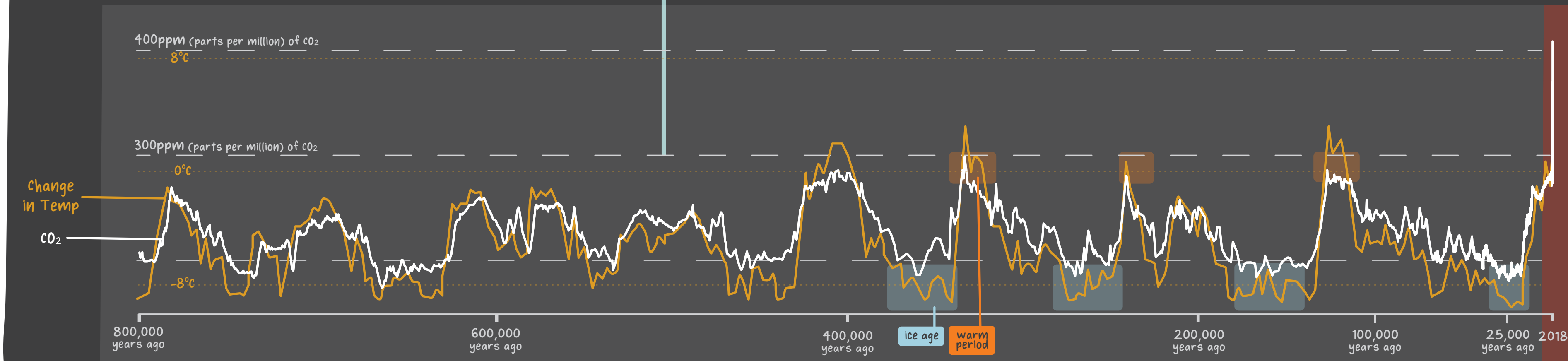
UP NORTH ON CLIMATE
Climate Change Impact and Adaptation Study for the North of Ontario

Information from ancient dust and air bubbles trapped in ice cores tells us about Earth's climate over the last 800,000 years. Past changes happened very slowly, with Earth's temperature rising by 1°C every 1,500 years & carbon dioxide (CO_2) never going above this line.

In only 100 years, Earth's temperature has risen by nearly 1°C, a rate that is 30 times faster! No natural event explains this much faster rate of warming.

THE PAST 800,000 YEARS

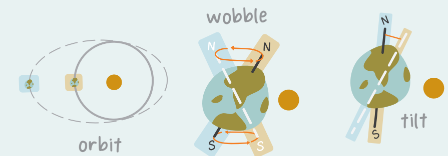
NOW



* For past climate, this graph uses CO_2 and temperature values calculated from Antarctic ice cores. Starting in 1958, measurements of CO_2 in the atmosphere have been taken at the Mauna Loa observatory in Hawaii.

Why did Earth's climate change in the past?

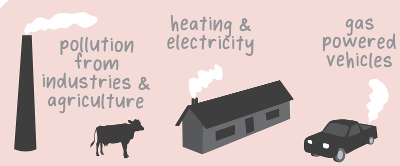
Changes in climate in the last 800,000 years were driven mostly by changes in the Earth's orbit, wobble & tilt, called the Milankovich cycles.



These cycles, which happen very slowly, change how much sunlight (ie. heat energy) reaches the northern part of the Earth.

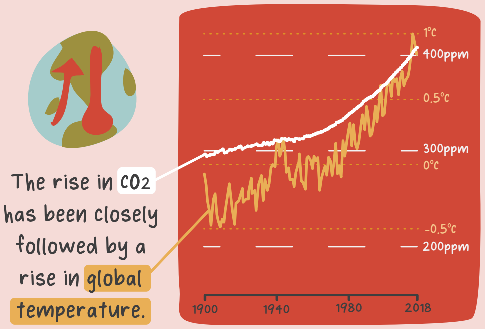
With less heat energy, snow can slowly build up, leading to an ice age. With more heat energy, the snow slowly melts again (warm period).

Why is Earth's climate changing so fast now?



As humans started burning more coal, oil & gas (fossil fuels), the amount of carbon dioxide (CO_2) & other greenhouse gases in the atmosphere got higher & higher.

The rise in CO_2 has been closely followed by a rise in global temperature.



*Temperature difference from 1951-1980 global average

There is still time to act! We can replace fossil fuels with other energy options to lower CO_2 emissions and plan for climate challenges with community adaptations!

Q&A CLIMATE CHANGE THEN vs NOW

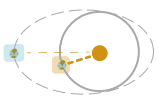
How do ice cores tell us about past climate?

Ice sheets, like those in the Antarctic and Greenland, are made up of snow that has collected over thousands of years. New snow layered on top of old snow and eventually turned into ice under its own weight, creating layers of ice that provide a historical timeline, with the oldest layers at the bottom and the newest on top. Within the layers of the ice core are bubbles of air and particles of dust from the atmosphere that became trapped as the layers formed.

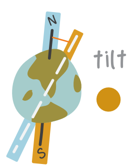
Scientists drill into ice sheets and remove ice cores, cylinders of the ice sheet that let them study the layers in detail. By measuring oxygen, carbon dioxide and other gases in the bubbles, we can get an idea of what past climate was like. Ice cores from Antarctica give us the longest climate record, with layers dating as far back as 800,000 years.

What are the Milankovich cycles and how do they drive climate?

How the Earth moves as it travels around the Sun has a big influence on how much of the Sun's heat energy reaches different parts of the planet.

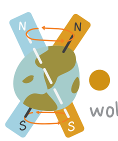

orbit

Earth's orbit (its path around the Sun) stretches and contracts like an elastic band. It changes from being nearly a circle to being a bit of an oval every 100,000 years. When the Earth's orbit is more oval, Earth is closer to the Sun (and warmer) at one end of its orbit compared to the other.



tilt

Earth's axis (around which we turn, giving us day and night) is tilted, which points one part of the Earth towards the Sun. Summer in the north happens because the tilt of the axis points us towards the Sun giving us more heat. The degree of this tilt also slowly shifts over about 40,000 years.

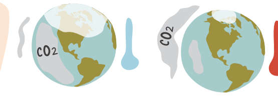


wobble

As the Earth turns, it wobbles a bit around its axis, like a spinning top. This wobble also changes the tilt of the Earth, pointing it more directly or less directly towards the Sun. One wobble takes about 23,000 years.

Combinations of these movements have led to times where parts of the planet get less of the sun's warmth and become cool enough that snow stays on the ground even in summer. Over hundreds of years, the snow builds up, leading to more cooling and, eventually, an ice age. As the Earth's orbit and axis continue to shift, the Earth warms again and the ice sheet slowly melts.

If ice ages were triggered by Milankovich cycles, why did CO_2 change?



When changes in Earth's orbit and axis make the planet cooler, Earth's oceans absorb more carbon dioxide (CO_2) from the atmosphere. This is because cold water can hold more CO_2 than warm water. With less CO_2 in the atmosphere, the Earth cools even more. As the orbit and axis continue to change, Earth eventually gets enough heat from the sun that a warming period begins. This heats the oceans and leads to a release of CO_2, which causes even more warming. As warming melted the ice sheets over the north, forests grew. This pulled CO_2 from the atmosphere and helped keep it from rising above 300ppm.

What is parts per million (ppm)?

Parts per million (ppm) is a measurement of the amount of something. Imagine a herd of 1 million caribou. If you replace one caribou with a wolf, the wolf represents 1 part per million. A measurement of 300ppm would mean 300 caribou were replaced by wolves. Similarly, a measurement of 300ppm of carbon dioxide means that if you looked at 1 million molecules in the atmosphere, 300 of them would be carbon dioxide.

Why does going from 300ppm CO_2 to 415ppm CO_2 matter?

Just like adding more wolves to a herd of caribou has an impact, adding more carbon dioxide (CO_2) to the atmosphere impacts Earth's climate. CO_2 levels have changed over the past 800,000 years but have never been above 300 ppm. In the past 100 years, CO_2 levels have risen to 415ppm and the average global temperature has increased by 1°C. 1°C may not seem like much but it has led to the climate impacts we see today, and more warming will mean more severe impacts. For example, a heat wave that only happened once every 50 years could happen every 10 years at 1°C warming, every 3 or 4 years at 2°C warming, or every 1 to 2 years at 4°C warming. If CO_2 keeps rising, we could reach 500ppm in 50 years and see average global temperature increase by 3°C or more, with temperatures in the north rising even higher.

Grand Council Treaty #3 · Keewaytinook Okimakanak · Matawa First Nations Management · Mushkegowuk Council · Nokiiwin Tribal Council · Shibogama First Nations Council · Laurentian University / Université Laurentienne

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