Homework before Lesson 4. Activity 3 CO2

<https://climate.nasa.gov/vital-signs/carbon-dioxide/>

Students explore the site and answer a set of questions to bring to next lesson

**Carbon Dioxide**

**LATEST MEASUREMENT:**

**September 2017**

406.94 ppm

# Orbiting Carbon Observatory-2 (OCO-2)

#### Watching the Earth breathe from space... Measuring carbon dioxide from space

#### [OCO-2 daily Lite files are now available!](http://co2.jpl.nasa.gov/)

#### [Learn more about OCO-3](http://oco3.jpl.nasa.gov/)

<https://airs.jpl.nasa.gov/airs_resources/13>

# Watching Earth Breathe: The Seasonal Vegetation Cycle and Carbon Dioxide

**Human beings are causing climate change, largely by burning fossil fuels.**

**Rising temperatures correlate almost exactly with the release of greenhouse gases.**

Before the 18th century, when humans in the industrial west began to burn coal, oil and gas, our atmosphere typically contained about 280 parts per million of carbon dioxide. Those are the conditions “on which civilization developed and to which life on earth is adapted.”

Now, as the use of fossil fuels spreads through the world, the amount of carbon in the atmosphere is skyrocketing — we’re now well over 400 parts per million CO2 in the atmosphere.

At the same time, the rapid growth in demand for animal-based agriculture by wealthier countries has seen other greenhouse gasses like methane and nitrous oxide rapidly rise. The contribution of agriculture causes about 15% of global emissions. Burning fossil fuels remains by far the biggest single contributor to the problem, causing 57% of global emissions. This is compounded by the fact that carbon dioxide stays active in the atmosphere much longer than methane and other greenhouse gasses.

Fossil fuel companies are taking millions of years worth of carbon, once stored beneath the earth as fossil fuels, and releasing it into the atmosphere. In 2014, CO2 concentrations crossed 400 ppm in the atmosphere for the first time in at least 2.5 million years.

Keeping fossil fuels in the ground is the most important step we can take to prevent further climate change.

<https://climate.nasa.gov/evidence/>

## Global temperature rise

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The planet's average surface temperature has risen about 2.0 degrees Fahrenheit (1.1 degrees Celsius) since the late 19th century, a change driven largely by increased carbon dioxide and other human-made emissions into the atmosphere.[5](https://climate.nasa.gov/evidence/#footnote_5) Most of the warming occurred in the past 35 years, with 16 of the 17 warmest years on record occurring since 2001. Not only was 2016 the warmest year on record, but eight of the 12 months that make up the year — from January through September, with the exception of June — were the warmest on record for those respective months. [6](https://climate.nasa.gov/evidence/#footnote_6)

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## Warming oceans

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The oceans have absorbed much of this increased heat, with the top 700 meters (about 2,300 feet) of ocean showing warming of 0.302 degrees Fahrenheit since 1969.[7](https://climate.nasa.gov/evidence/#footnote_7)

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## Shrinking ice sheets

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The Greenland and Antarctic ice sheets have decreased in mass. Data from NASA's Gravity Recovery and Climate Experiment show Greenland lost 150 to 250 cubic kilometers (36 to 60 cubic miles) of ice per year between 2002 and 2006, while Antarctica lost about 152 cubic kilometers (36 cubic miles) of ice between 2002 and 2005.

Image: Flowing meltwater from the Greenland ice sheet

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## Glacial retreat

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Glaciers are retreating almost everywhere around the world — including in the Alps, Himalayas, Andes, Rockies, Alaska and Africa.[9](https://climate.nasa.gov/evidence/#footnote_9)

Image: The disappearing snowcap of Mount Kilimanjaro, from space.

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## Decreased snow cover

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Satellite observations reveal that the amount of spring snow cover in the Northern Hemisphere has decreased over the past five decades and that the snow is melting earlier.[15](https://climate.nasa.gov/evidence/#footnote_15)

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## Sea level rise

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Global sea level rose about 8 inches in the last century. The rate in the last two decades, however, is nearly double that of the last century.[4](https://climate.nasa.gov/evidence/#footnote_4)

Image: Republic of Maldives: Vulnerable to sea level rise

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## Declining Arctic sea ice

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Both the extent and thickness of Arctic sea ice has declined rapidly over the last several decades.[8](https://climate.nasa.gov/evidence/#footnote_8)

Image: Visualization of the 2012 Arctic sea ice minimum, the lowest on record

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## Extreme events

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The number of record high temperature events in the United States has been increasing, while the number of record low temperature events has been decreasing, since 1950. The U.S. has also witnessed increasing numbers of intense rainfall events.[10](https://climate.nasa.gov/evidence/#footnote_10)

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## Ocean acidification

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Since the beginning of the Industrial Revolution, the acidity of surface ocean waters has increased by about 30 percent.[11,](https://climate.nasa.gov/evidence/#footnote_11)[12](https://climate.nasa.gov/evidence/#footnote_12) This increase is the result of humans emitting more carbon dioxide into the atmosphere and hence more being absorbed into the oceans. The amount of carbon dioxide absorbed by the upper layer of the oceans is increasing by about 2 billion tons per year.[13,](https://climate.nasa.gov/evidence/#footnote_13)[14](https://climate.nasa.gov/evidence/#footnote_14)

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