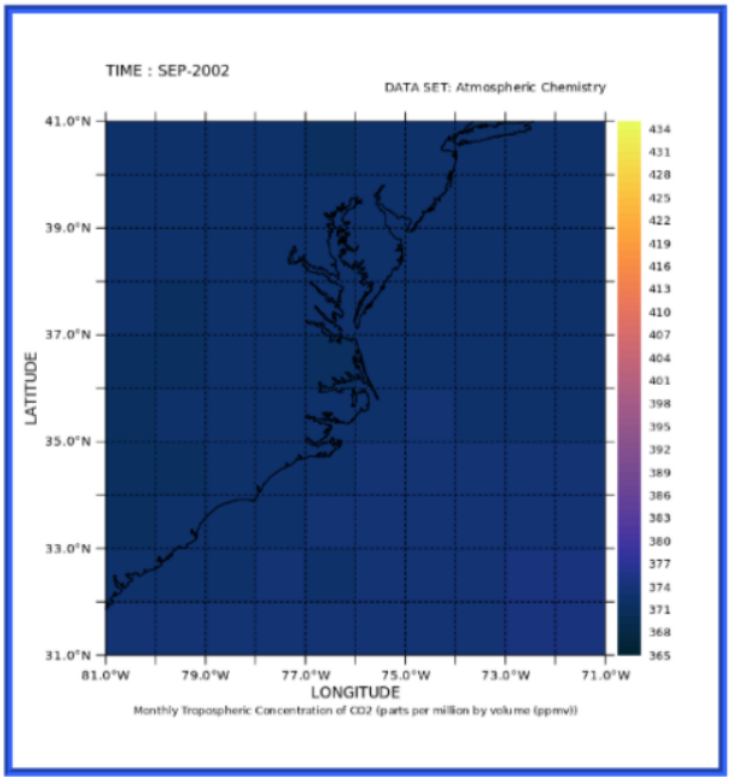
My NASA Data - Lesson Plans

Investigating CO2 Levels at Your Location



Overview

Students will explore existing CO_2 levels at their given location or city. By using Earth System Data Explorer, the teacher will create an animation and line graph of CO_2 levels at their location. Students will analyze these data resources to eventually write a C-E-R response.

Learning Objectives

- Analyze data that connect the rising concentration of CO_2 levels in the troposphere directly to human activities.
- Determine whether the evidence presented is sufficient enough to show a relationship between human activities and higher CO_2 emissions in the troposphere.
- Create a claim supported by evidence to approve or disprove the idea that human activity is causing an increase in CO_2 levels.

Procedure

1. Prior to the lesson, create an animation and line graph of your city or region of the world by going to Earth System Data Explorer. Step by step directions on how to construct an animation and line graph can be accessed at Creating an Animation & Line Plot of Your Location.
2. Start off the lesson by engaging students into a discussion about the burning of fossil fuels and the consequences of burning these nonrenewable resources.

    1. Explain to students that when fossil fuels are burned, CO_2 is added to the Earth's atmosphere. Since our planet naturally traps CO_2 gases to keep the temperature suitable for life, the addition of extra CO_2 could be warming up our planet.
3. Play the animation (you created in step 1) of monthly tropospheric concentration of CO? (parts per million by volume (ppmv)) of your location. Ask students the following questions:

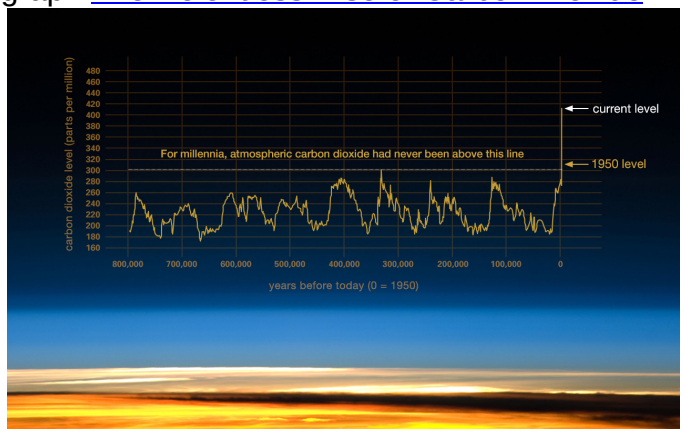
    1. What does the animation show you?
    2. Why is this data shown in the animation?
    3. Which pattern(s) do you see?
    4. Who could use this data? How could they use it?
4. Next, have students view the Line Graph of Monthly Tropospheric Concentration of CO? of your city or region (created in step 1). Ask students the following questions:

    1. Identify the variables shown on this map (x and y axis).
    2. As of 2022, what is the current level of CO? in our location (ppmv)?
    3. Estimate the change in CO? levels from 2002 to 2022.
    4. What factor or factors do you think is causing this increase?
5. Afterwards, have students watch the NASA video A Breathable Planet Off Balance. To check for understanding, pose some of the following questions.

NASA Climate Change: A Breathable Planet Off Balance| https://docs.google.com/document/d/1IU5OWfD7xSU89JBqtx8ubfEJm98RKnZKwpVkf86SSYg/edit | Video Length 2:33

1. What do we call the thin layer of gases that surround our planet and absorb solar radiation?
2. Explain what happens if Earth's mixture of gases gets out of balance.
3. What is the primary driver of our warming climate?
4. Identify human activities that contribute to the amount of carbon dioxide that is released into the atmosphere.
5. Only half of the carbon dioxide released by humans stays in the atmosphere, warming our planet and contributing to climate change. What removes the other half from our planet?
6. Droughts, fires, and deforestation contribute to the release of what greenhouse gas?
7. Ocean water absorbs carbon dioxide from fossil fuel emissions. How does this affect seawater?
8. Discuss the mission of NASA's Orbiting Carbon Observatory-2 (OCO-2).

6. Pair students up with a partner to analyze the graph [The Relentless Rise of Carbon Dioxide].



This graph, based on the comparison of atmospheric samples contained in ice cores and more recent direct measurements, provides evidence that atmospheric CO2 has increased since the Industrial Revolution. (Credit: Luthi, D., et al.. 2008; Etheridge, D.M., et al. 2010; Vostok ice core data/J.R. Petit et al.; NOAA Mauna Loa CO2 record.) https://mynasadata.larc.nasa.gov/sites/default/files/inline-images/co2-graph-051619.jpg

Have students answer the following questions:

1. Identify the variables found on both the x and y axis.
2. How would you describe carbon dioxide levels from 800,000 years ago to 100,000 years ago?
3. By 1950, we started to see an increase in the level of carbon dioxide that history has never seen before. What do you think may have caused this change?
4. Explain what may have caused the spike in carbon dioxide levels from 1950 until today.
5. Scientists believe that human activities are causing rising CO2 levels. Elaborate on which human activities may be causing increasing CO2 levels.
6. Predict what you think will happen to the amount of CO2 in Earth's atmosphere in the future.

7. Lastly, students will create a C-E-R Response (Claim, Evidence, Reasoning) to the following question: Are humans affecting CO2 levels? All evidence should come from the class discussion and the partner analysis of rising CO2 levels over the centuries.

Sources:

1. https://climate.nasa.gov/climate_resources/24/graphic-the-relentless-rise-of-carbon-dioxide/ (*Graphic: The Relentless Rise of Carbon Dioxide – Climate Change: Vital Signs of the Planet*,

n.d.)

2. Data: Luthi, D., et al.. 2008; Etheridge, D.M., et al. 2010; Vostok ice core data/J.R. Petit et al.; NOAA Mauna Loa CO_2 record. Some description adapted from the Scripps CO2 Program website, "Keeling Curve Lessons."