






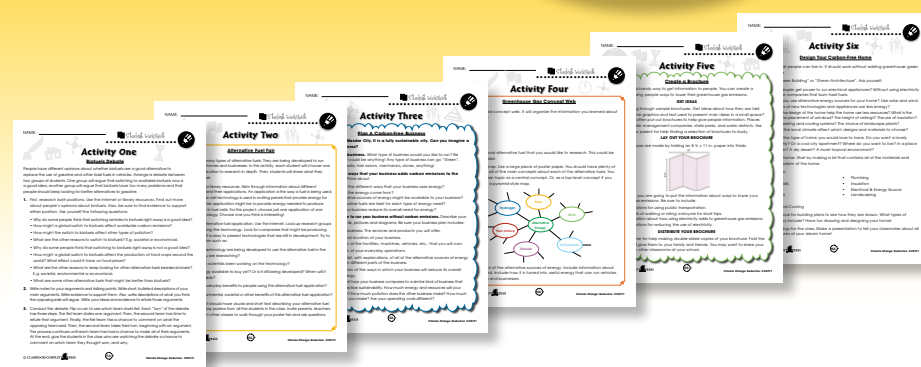
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How Warm Will Earth Get?

1. Complete each sentence with a word from the list. Use a dictionary to help you.

average	evaporate	atmosphere	decade
reflects	clouds	concentration	system

- Water vapor in the atmosphere condenses into tiny droplets that form _____.
- A period of ten years is called a _____.
- A surface that _____ light bends the light back.
- The _____ is the thin layer of gas that surrounds Earth.
- _____ is the amount of a substance per volume.
- A _____ is a set of natural objects or forces that interact together.
- The value that represents the middle of a set of values is the _____.
- To _____ is to change from a liquid to a gas.

2. Look up the meaning of the word **emissions**. Rewrite the meaning in your own words.



How Warm Will Earth Get?

The amount of greenhouse gases in Earth's atmosphere continue to rise. They have been rising for several decades. The average temperature of Earth's atmosphere has also been rising. How warm Earth's atmosphere will get depends on a few things. It depends on how long it takes people to lower greenhouse gas **emissions**. This is the amount of gas that is put into the atmosphere. It also depends on how the Earth responds to warming.



Industrial emissions from power plant

Will people continue to emit greenhouse gases at a steady rate? Or will we lower our emissions? If people can lower emissions, Earth's average temperature will go up more slowly. If we do nothing, or if emissions increase, Earth's average temperature will go up more quickly. Even if people could stop all greenhouse gas emissions right away, Earth's average temperature will continue to rise slowly. This is because of the effects of the greenhouse gases people have already added to the atmosphere.

Greenhouse gas emissions are increasing. What will happen to Earth's average temperature?



The way the Earth system responds to increasing temperatures will also affect how fast Earth's average temperature changes. These responses include negative and positive feedbacks. A **negative feedback** may act to balance changing temperatures. For example, increasing temperatures cause more water to evaporate. This leads to more clouds. Clouds reflect light and lead to more cooling. A **positive feedback** leads to faster warming. For example, ice caps reflect a lot of sunlight. As they melt, more heat is absorbed by the water and land that were beneath the ice caps. More heat in the Earth system leads to faster warming.



How Warm Will Earth Get?

1. Circle the word **TRUE** if the statement is TRUE OR Circle the word **FALSE** if it is FALSE.

- The concentration of gases in the atmosphere has stayed the same for several decades.
TRUE **FALSE**
- If people lower emissions, then Earth's average temperature will go down.
TRUE **FALSE**
- If people could stop all emissions, Earth's average temperature would still go up slowly.
TRUE **FALSE**
- Negative feedback responses may act to balance changing temperatures.
TRUE **FALSE**
- Melting ice caps will create a negative feedback.
TRUE **FALSE**

2. Put a check mark (✓) next to the answer that is most correct.

- Which change could lead to a faster rise in Earth's average temperature?
 - A Melting polar ice caps.
 - B Lower greenhouse gas emissions.
 - C Faster evaporation of ocean water.
 - D More clouds in Earth's atmosphere.
- In which period of time has Earth's average temperature been rising?
 - A Several thousand years.
 - B Several million years.
 - C Several centuries.
 - D Several decades.
- Which characteristic of clouds leads to cooling of Earth's atmosphere?
 - A They bring rain.
 - B They reflect light.
 - C They move quickly.
 - D They are made of water.



How Warm Will Earth Get?

3. Answer each question with a complete sentence.

- Describe **two** factors that determine how much Earth's temperature will rise.

- How do positive feedback changes affect Earth's average temperature?

Research

4. Why would Earth's temperature most likely continue to rise slowly even if greenhouse gas emissions end today?

Use the library or Internet resources. Find out more about how long different greenhouse gases stay in Earth's atmosphere. Look for the answers to one or more of the following questions:

- What is residence time?
- What are the residence times of the major greenhouse gases?
- How long will it take for the greenhouse gases already in the atmosphere to be removed? Or, to go back to their natural concentrations?
- How does the ocean absorb greenhouse gases like carbon dioxide? What role does this play in climate change?

Write a short report. Explain why Earth's average temperature will probably keep rising for a number of years after greenhouse gas emissions stop.

Design Your Alternative Fuel Dream Car

If you could have any car, what would it be? Would you like a rugged, off-road truck? Maybe a sports car? In this activity, you will find a way to make your dream car "green."

First, research different vehicles that are already made. Look at magazines or the Internet. Find photos of vehicles that appeal to you. Don't forget to look at "concept" cars. These are futuristic vehicles designed by car makers.

Next, list the elements that you would like in your dream vehicle. Think about the following questions:

- What do you want the vehicle to look like?
- Where do you want to drive your vehicle?
- How many passengers do you want your vehicle to carry?
- What do you want the inside of the vehicle to be like?
- What special features do you want in your vehicle?

Now, research ways to make all of the parts of your vehicle "green." Think about the following questions:

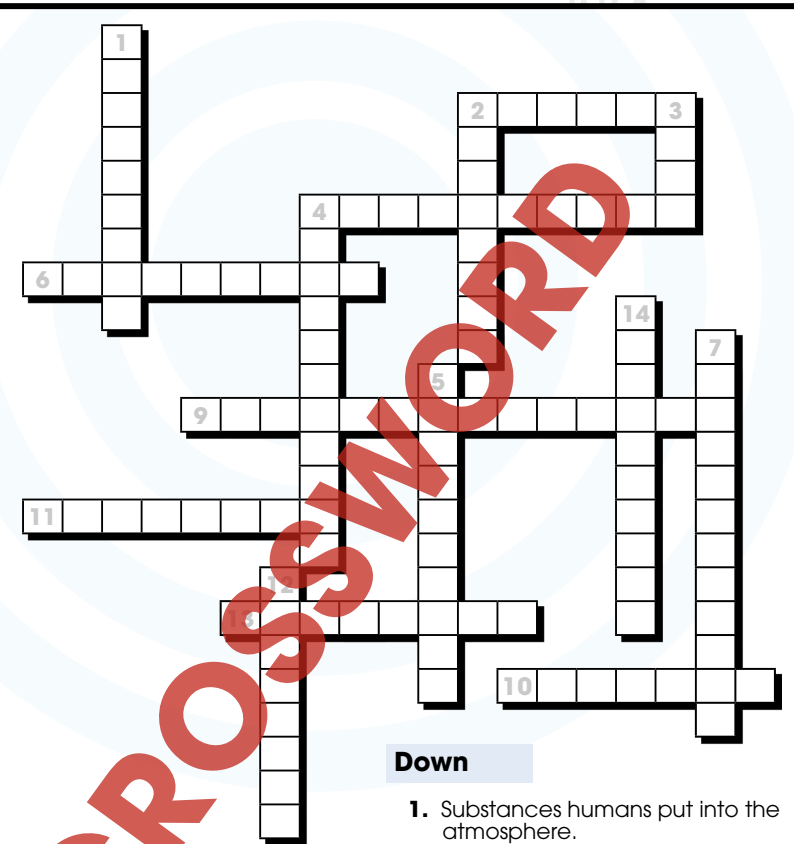
- How will your vehicle be powered? Is there a way to power your vehicle with little or no greenhouse gas emissions?
- What materials do you need to build your vehicle? What choices can you make for materials that would result in less pollution, waste and greenhouse gas emissions? Don't forget that you need materials for the vehicle's frame, tires, seats, dashboard, carpet, and any other special parts it may have.
- What design features could you incorporate to lessen your vehicle's need for power? For example, a heavier vehicle takes more power to move. What other features of your vehicle could help lessen its need for power?

Finally, design your vehicle. Use drawings and labels to explain your design features. Create a poster to display your design. Invite your classmates to look at your poster and ask questions. For an extension, you may also want to build a model of your vehicle.

Crossword Puzzle!

WORD LIST

biofuel
dams
efficiency
emissions
fuel cell
hybrid
hydrogen
manufactured
planning
pollutants
renewable
solar cells
solar energy
transportation
turbines



Across

- A car that uses electricity as power.
- Objects that change energy from sunlight into electricity (two words).
- Most alternative fuels are also _____.
- The movement of people or goods from one place to another.
- An alternative fuel made of vegetable oil or plant parts.
- Urban _____.
- Wind _____ change energy from wind into electricity.

Down

- Substances humans put into the atmosphere.
- A common gas in the atmosphere used for energy in fuel cells.
- Structures that block the flow of rivers.
- Energy from the Sun (two words).
- A substance or condition that contaminates air, water or soil.
- Products that are made by people are _____.
- Technology that uses hydrogen as a source of energy to power vehicles.
- Fuel _____ describes how far a car can go on a certain amount of fuel.

Comprehension Quiz

Part A

Circle the word **TRUE** if the statement is TRUE OR Circle the word **FALSE** if it is FALSE.

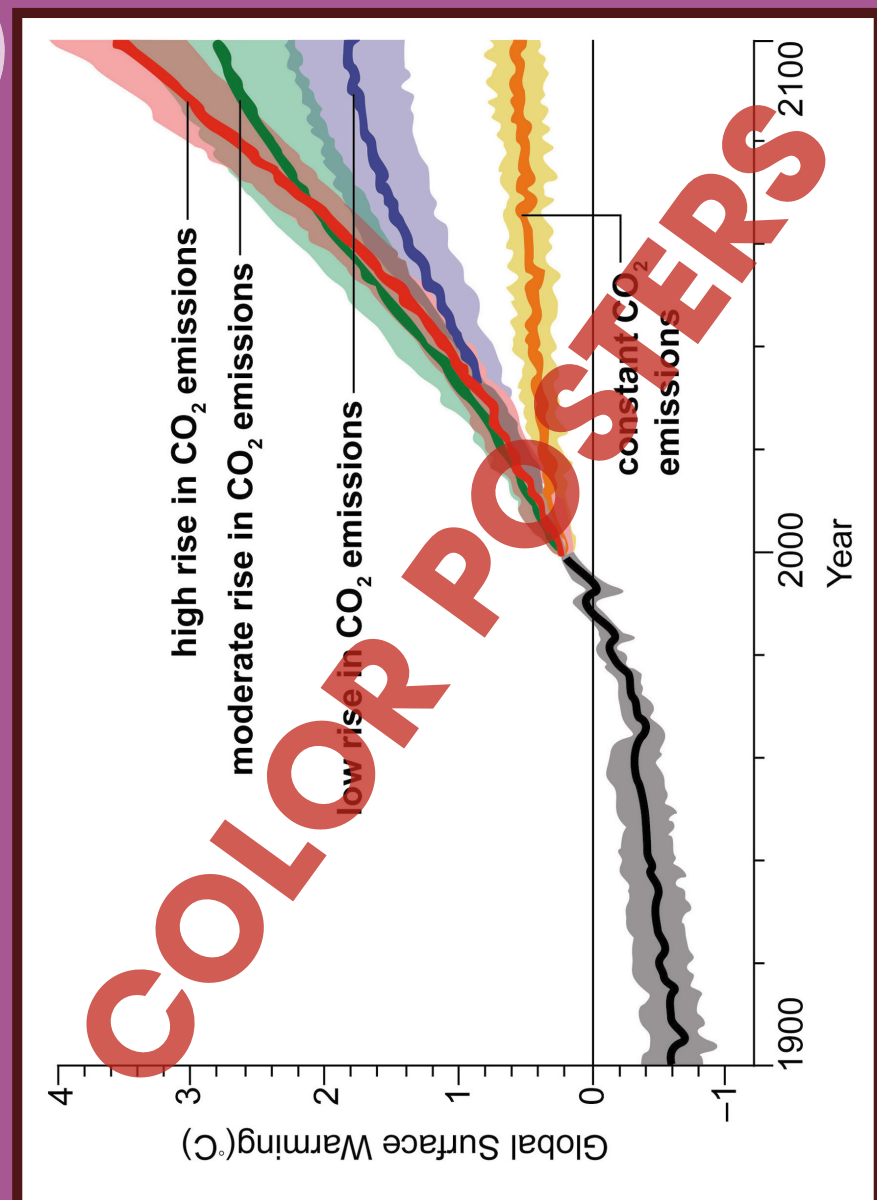
- Most greenhouse gas emissions come from burning fossil fuels.
TRUE **FALSE**
- If people stop emitting greenhouse gases today, Earth's average temperature will start to go down right away.
TRUE **FALSE**
- Alternative fuels release more greenhouse gases than fossil fuels.
TRUE **FALSE**
- Renewable sources of energy are replaced by nature faster than they are used up.
TRUE **FALSE**
- Hydroelectric generators change energy from sunlight into electricity.
TRUE **FALSE**
- A product made with recycled materials most likely used less energy to make than the same product made with raw materials.
TRUE **FALSE**
- Products that are manufactured are made by people using raw materials.
TRUE **FALSE**
- Buying fruits and vegetables grown near where you live is one way to help lower greenhouse gas emissions.
TRUE **FALSE**

Part B

List five transportation choices that result in less greenhouse gas emissions than driving individual vehicles.

SUBTOTAL: /13

Projections for Climate Change





How Warm Will Earth Get?

3. Answer each question with a complete sentence.

a) Describe **two** factors that determine how much Earth's temperature will rise.

b) How do positive feedback changes affect Earth's average temperature?

Research

4. Why would Earth's temperature most likely continue to rise slowly even if greenhouse gas emissions end today?

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Write a short report. Explain why Earth's average temperature will probably keep rising for a number of years after greenhouse gas emissions stop.

3.

a) How greenhouse gas emissions change. How Earth's system responds to changing temperatures.

b) They will make it rise faster.

EASY MARKING

ANSWER KEY





How Warm Will Earth Get?

The amount of greenhouse gases in Earth's atmosphere continue to rise. They have been rising for several decades. The average temperature of Earth's atmosphere has also been rising. How warm Earth's atmosphere will get depends on a few things. It depends on how long it takes people to lower greenhouse gas **emissions**. This is the amount of gas that is put into the atmosphere. It also depends on how the Earth responds to warming.



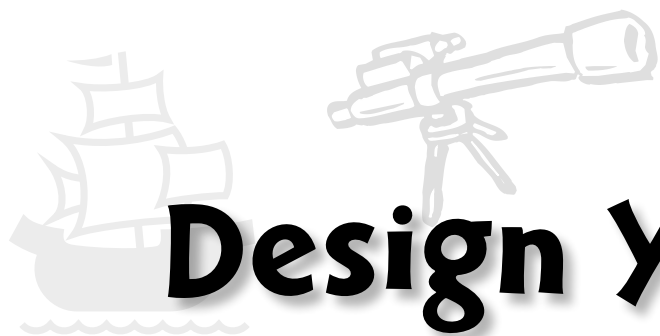
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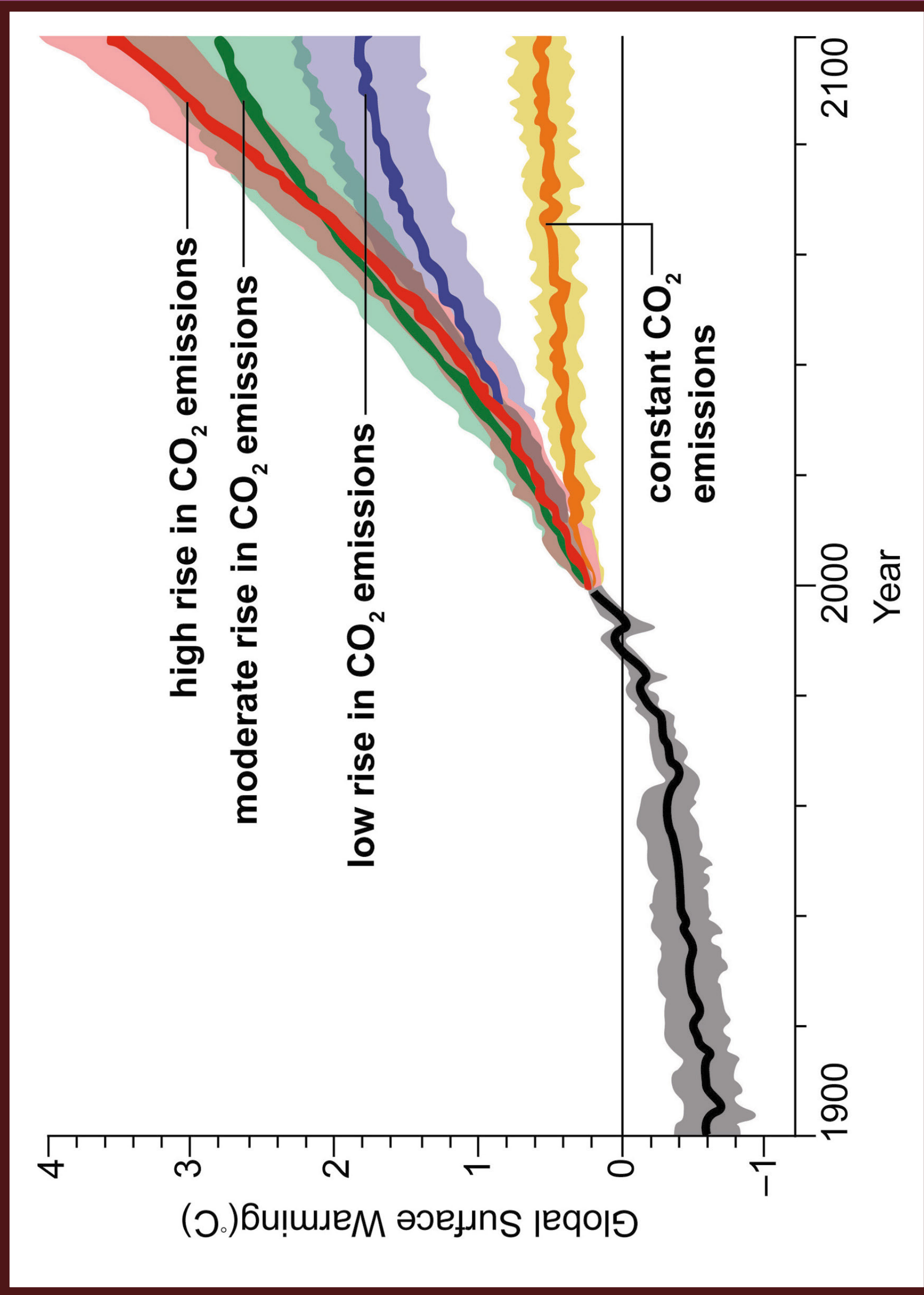
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Projections for Climate Change



Source: NASA Earth Observatory