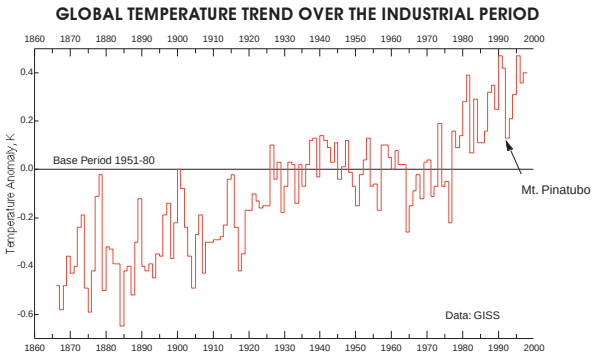
# Global Atmosphere, Global Warming

## QUESTIONS ABOUT GLOBAL WARMING

- IS IT REAL?
- IS IT IMPORTANT?
- WHAT IS IT DUE TO?
- HOW MUCH MORE CAN WE EXPECT?
- ARE WE SEEING JUST THE TIP OF THE ICEBERG?

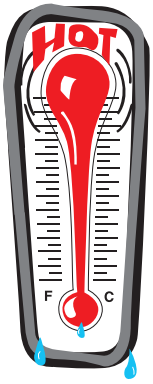
## BROOKHAVEN LAB'S RESEARCH IS HELPING TO ANSWER THESE QUESTIONS

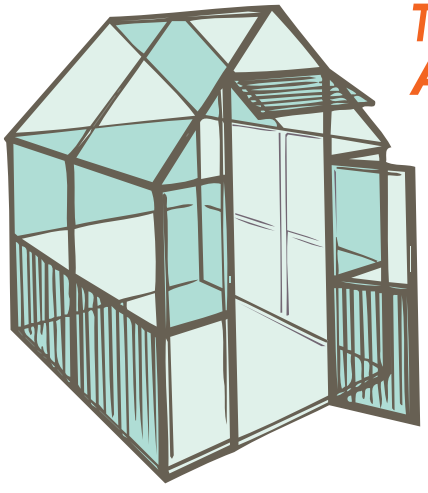
## THE EARTH'S TEMPERATURE IS RISING




THE EARTH'S AVERAGE TEMPERATURE HAS INCREASED BY ABOUT 1°C (2° F) OVER THE PAST 150 YEARS.

THE GLACIAL ICE AGES WERE JUST 5°C COLDER THAN PRESENT TEMPERATURES.



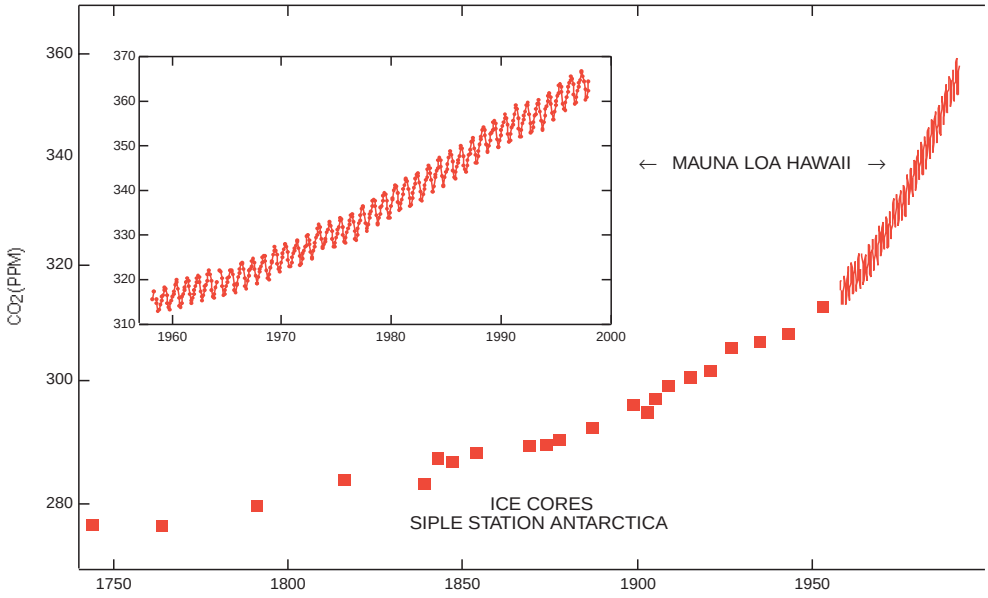
## THE EARTH'S ENERGY BUDGET: A DELICATE BALANCE

- Sunlight heats the Earth.
- The warm Earth radiates energy (in the form of infrared radiation, or heat) back out to space.
- Some of this infrared radiation is trapped in the atmosphere, giving Earth its temperate climate.

This is the greenhouse effect. Without it, the Earth's climate would be like the moon's, harsh and severe.

# Atmospheric Carbon Dioxide is Increasing

## GLOBAL CARBON DIOXIDE OVER THE INDUSTRIAL PERIOD

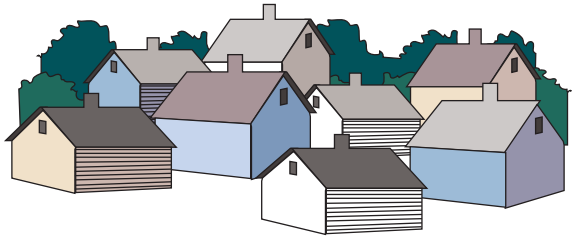


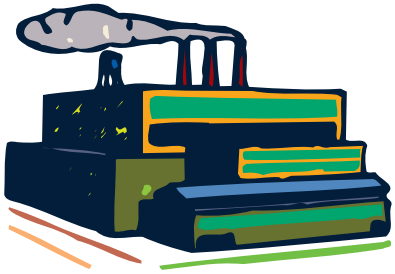

## WHERE IS THIS CARBON DIOXIDE COMING FROM?

## WE ARE ALL RESPONSIBLE.

Burning a gallon of gasoline in your car puts 5 pounds of carbon in the atmosphere as carbon dioxide ($CO_2$), and it will stay there for decades — maybe a century!

Other sources are home heating and electric power production.



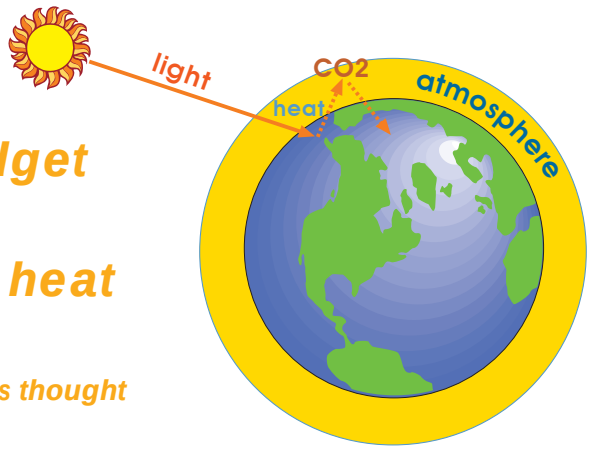


# Are We "Forcing" the Climate to Change?

## Probably, but how much?

### Scientists define forcing as:

*a change in Earth's atmospheric radiation budget*




### Example:

*increased $CO_2$ traps more heat in the atmosphere.*

*The effect is small (less than 1 percent) but is thought to be very important.*

### Other things can "force" the climate, too:

- Increases in other greenhouse gases (methane, nitrous oxide, chlorofluorocarbons)
- Decreases in stratospheric ozone.
- Increases in light-scattering particles (aerosols) in the atmosphere.
- Possible increase in the sun's energy output.

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## PLUS. . .

Our actions may be forcing the climate even more than we think, or even less.

In fact, some forces may be cooling the climate even as others are heating it!

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## The Aerosol Mystery

In the atmosphere, particles of dust, volcanic ash and pollutants scatter light back into space. Together, these are called aerosols.

Are aerosols **masking** the detection of global warming from increased concentrations of greenhouse gases?

### NOBODY KNOWS FOR SURE!

Scientists at Brookhaven Lab and elsewhere are looking for clues in this mystery, by studying the chemistry and physics of aerosols.

## BECAUSE. . .

Even if aerosols are hiding the effects of greenhouse gases, they aren't a cure for global warming!

Aerosols only last a short while in the atmosphere, they would have to be constantly replaced. And, they can affect health and visibility, and contribute to acid rain.