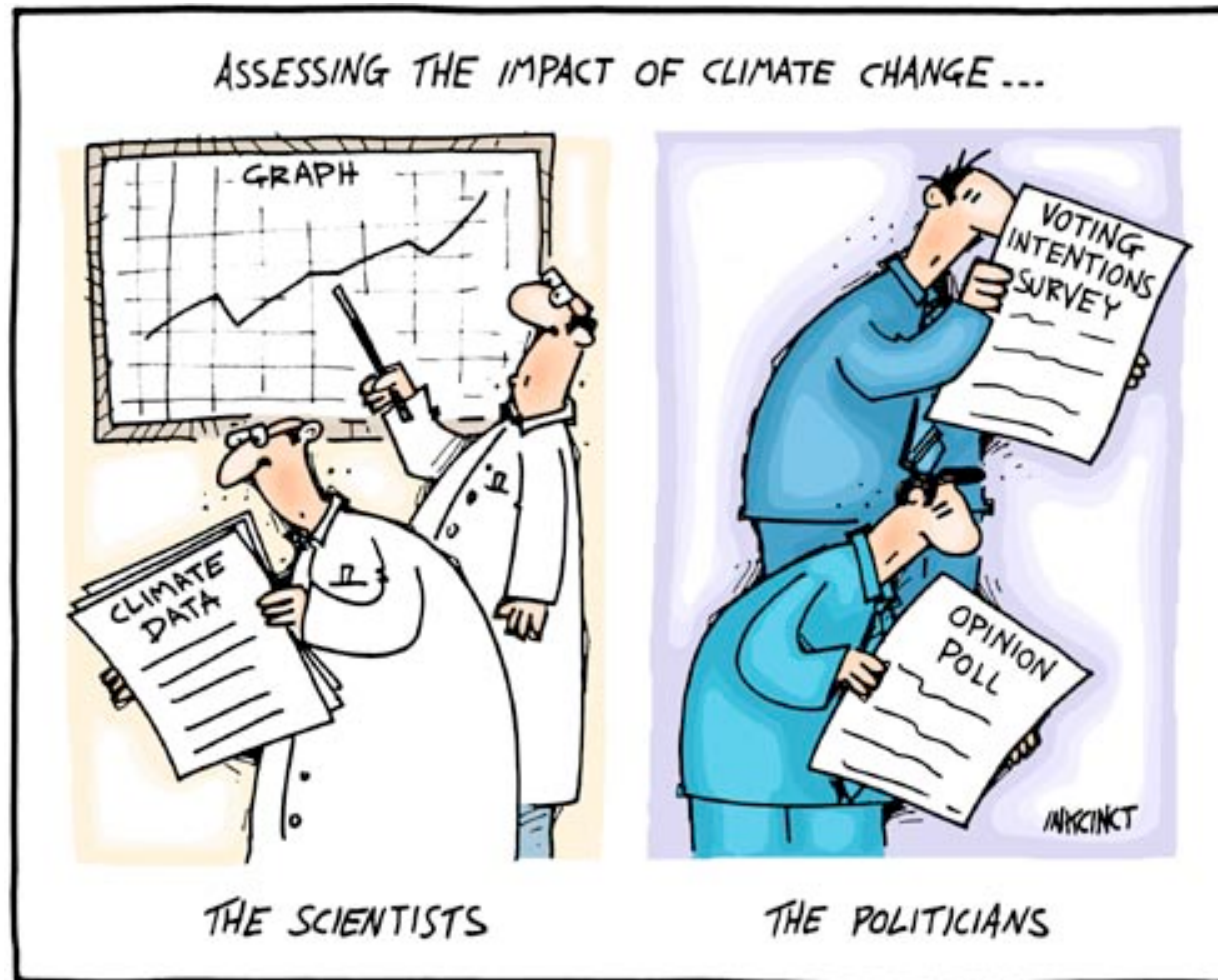


# Climate Box Activity

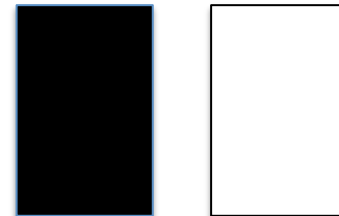
## Effect of Albedo and Greenhouse Gases



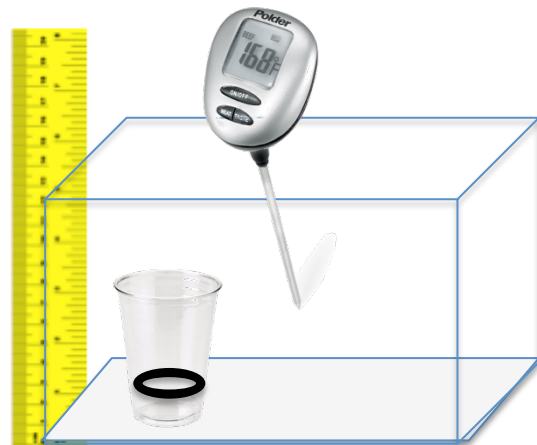
# Climate Box - Materials

## Materials

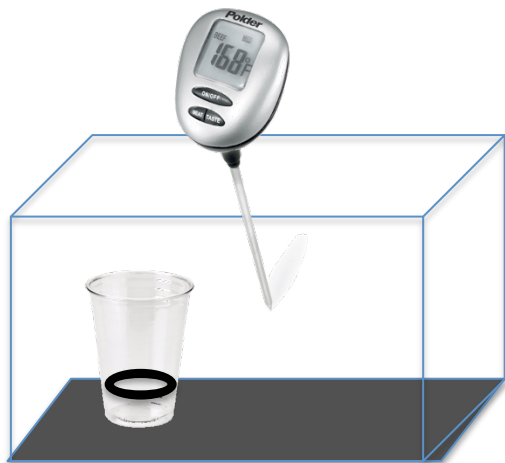
Plastic Bin  
Thermometer (°F)  
Lamp  
Light Bulb (100 W)  
Ruler  
Plastic Cup  
Measuring spoon  
  
Black Foam  
White Foam  
  
Vinegar (50 ml)  
Baking Soda (1 tsp)



# Climate Box - Procedure



Place white foam in plastic bin  
 Fill cup to line with vinegar  
 Place vented top on the bin  
 Place thermometer in vent in the bin top  
 Position light above bin, 12 inches off the floor  
 Take initial temperature reading and record on sheet  
 Turn on lamp and record every minute for 7 minutes  
 Turn off lamp and let box cool down for 3 minutes



Replace white foam w/ black foam and repeat process

Add 1 tsp baking soda to the vinegar  
 Replace lid and wait 1 minute before initial reading  
 Turn on lamp and record every minute for 7 minutes  
 Turn off lamp and let box cool down for 3 minutes

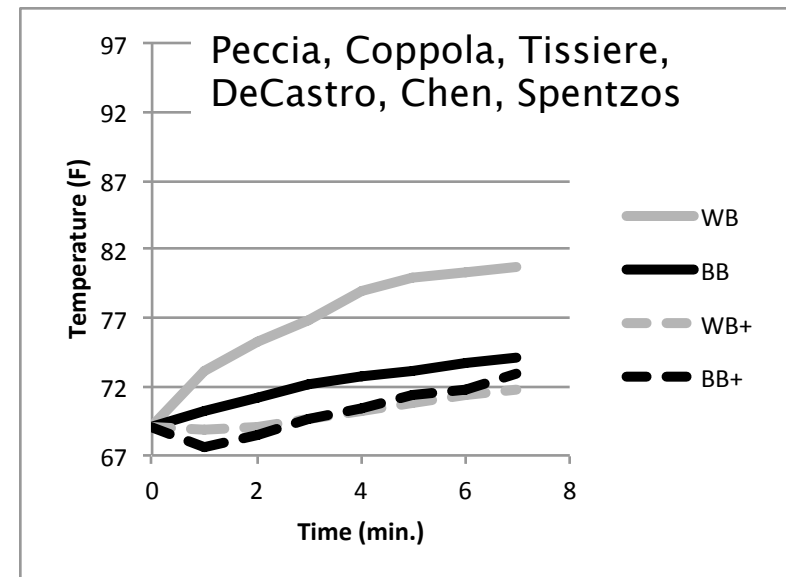
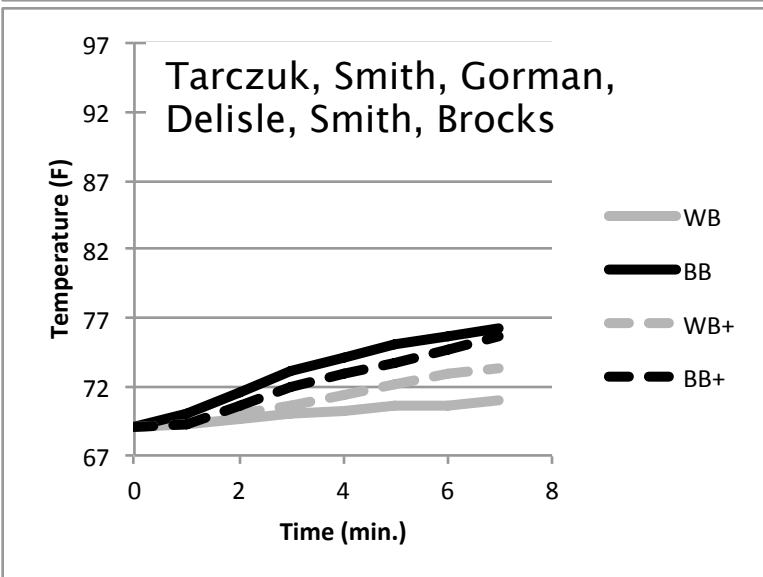
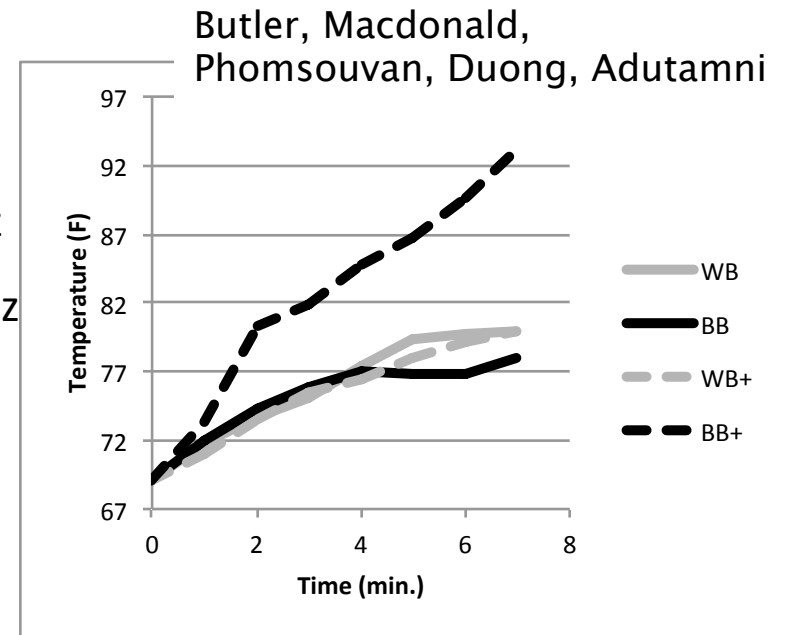
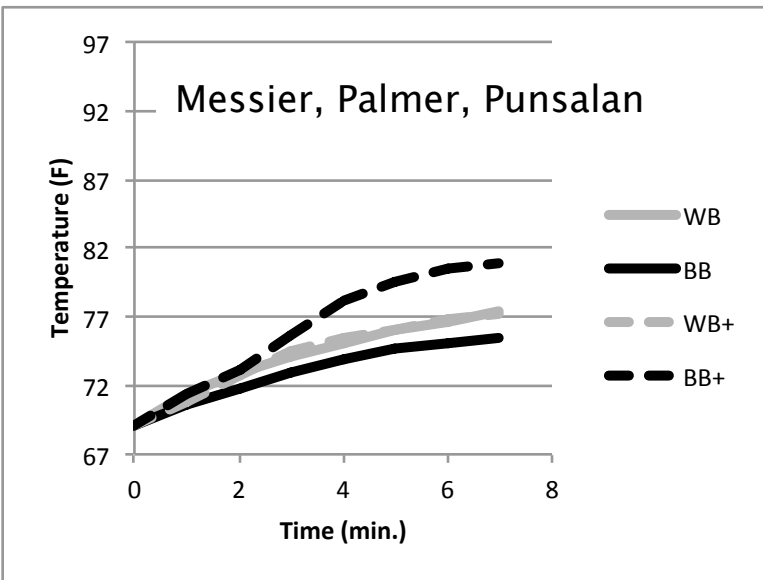
Replace black foam with white foam  
 Refill/replace vinegar  
 Add 1 tsp baking soda to the vinegar  
 Repeat steps above

Team Members\_\_\_\_\_

| Time (min.) | White Bottom<br>No mixing | Black Bottom<br>No mixing | White Bottom<br>Add powder | Black Bottom<br>Add powder |
|-------------|---------------------------|---------------------------|----------------------------|----------------------------|
| 0           |                           |                           |                            |                            |
| 1           |                           |                           |                            |                            |
| 2           |                           |                           |                            |                            |
| 3           |                           |                           |                            |                            |
| 4           |                           |                           |                            |                            |
| 5           |                           |                           |                            |                            |
| 6           |                           |                           |                            |                            |
| 7           |                           |                           |                            |                            |

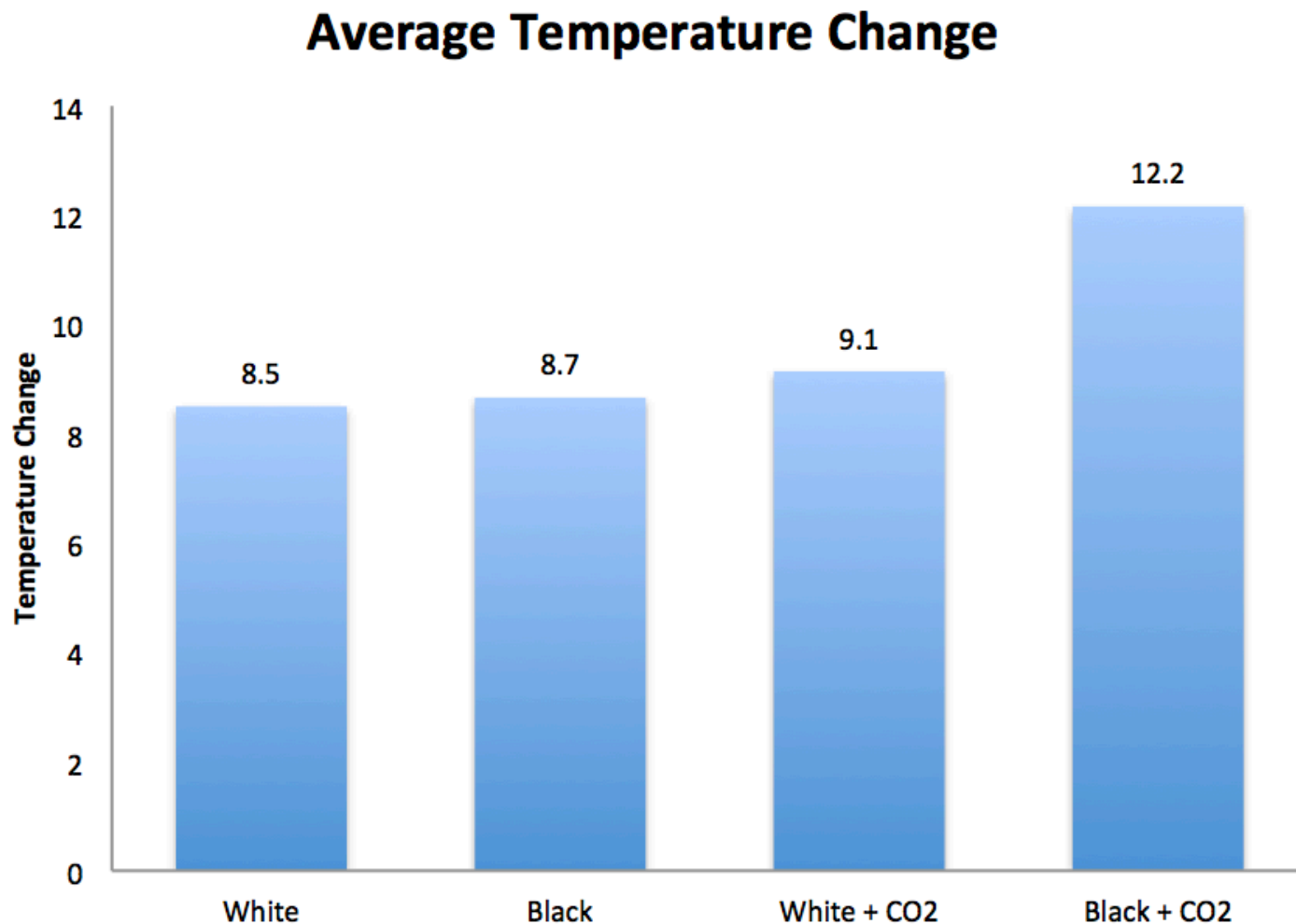
# Climate Box Review – Overview

## Results



# Climate Box Review – Black & White

## Results



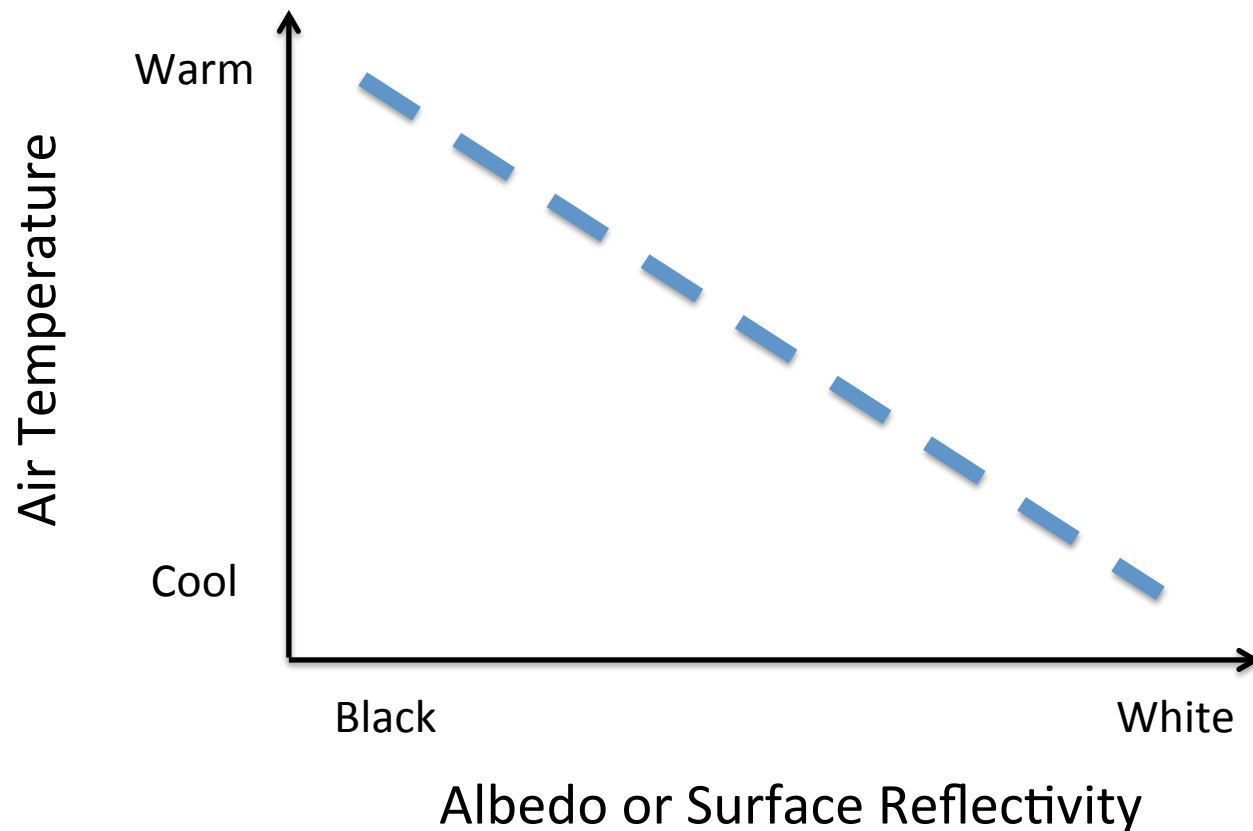
What patterns do you see?

# Climate Box Review

## Key Relationship

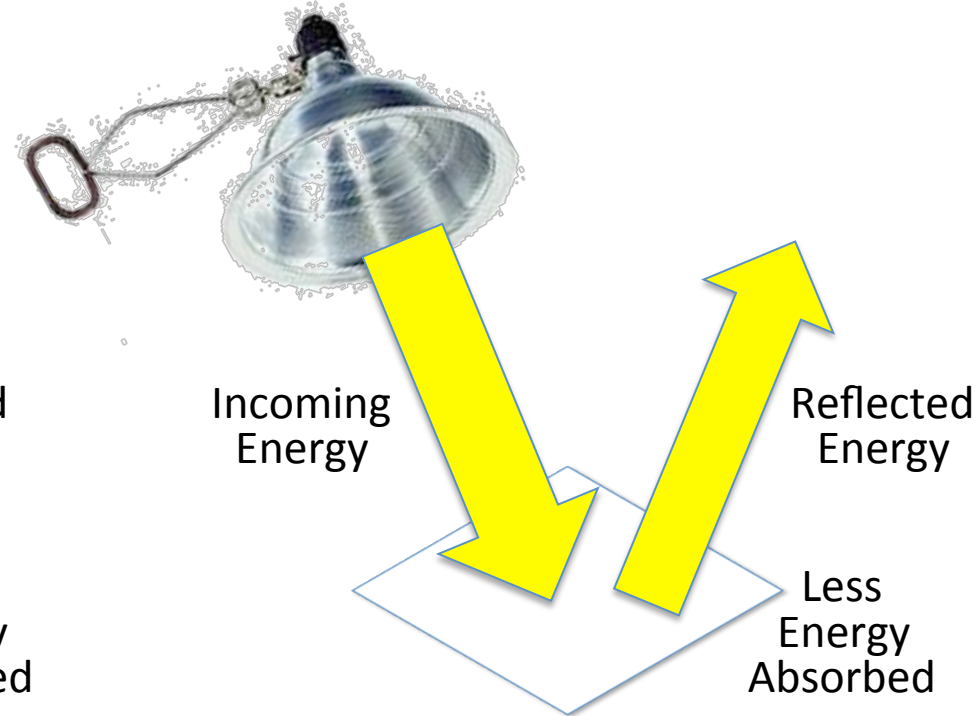
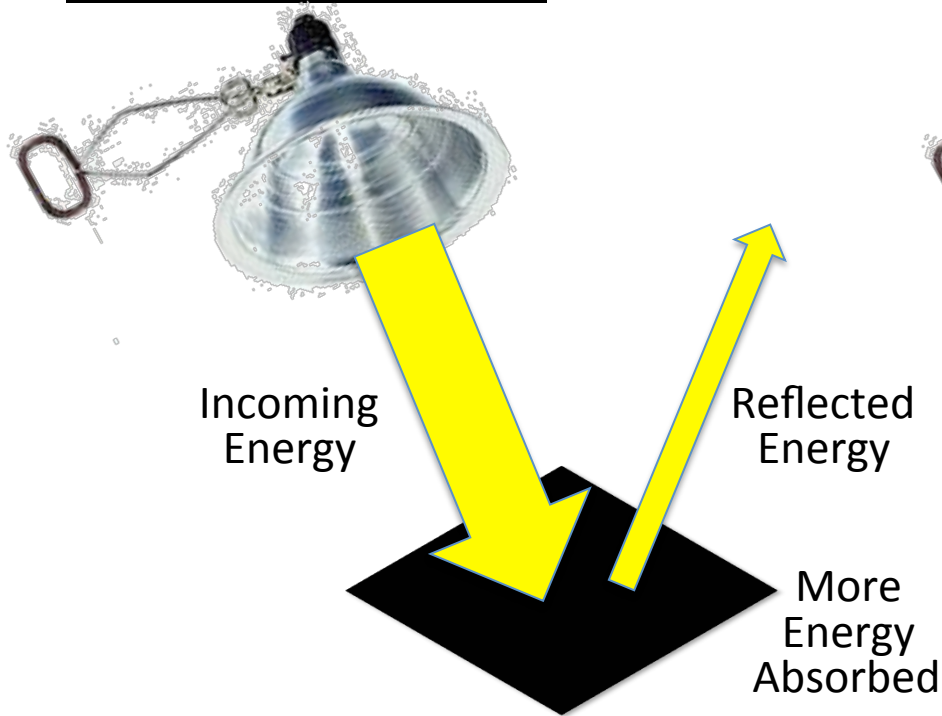
### Temperature & Reflectivity

- darker background => increase air temperature

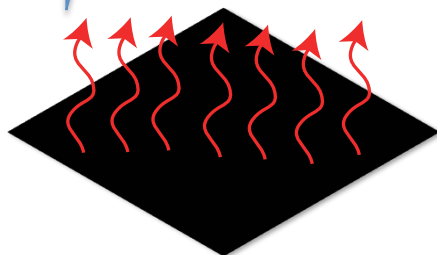


# Climate Box Review – Black & White

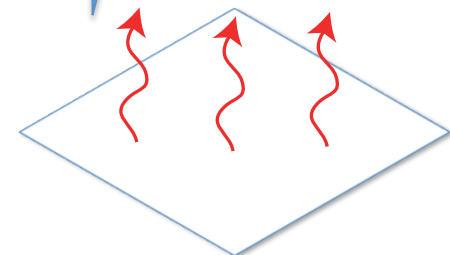
## What's Happening



More Energy Absorbed → Plastic Warms Faster → Adjacent Air Warmed Faster & More



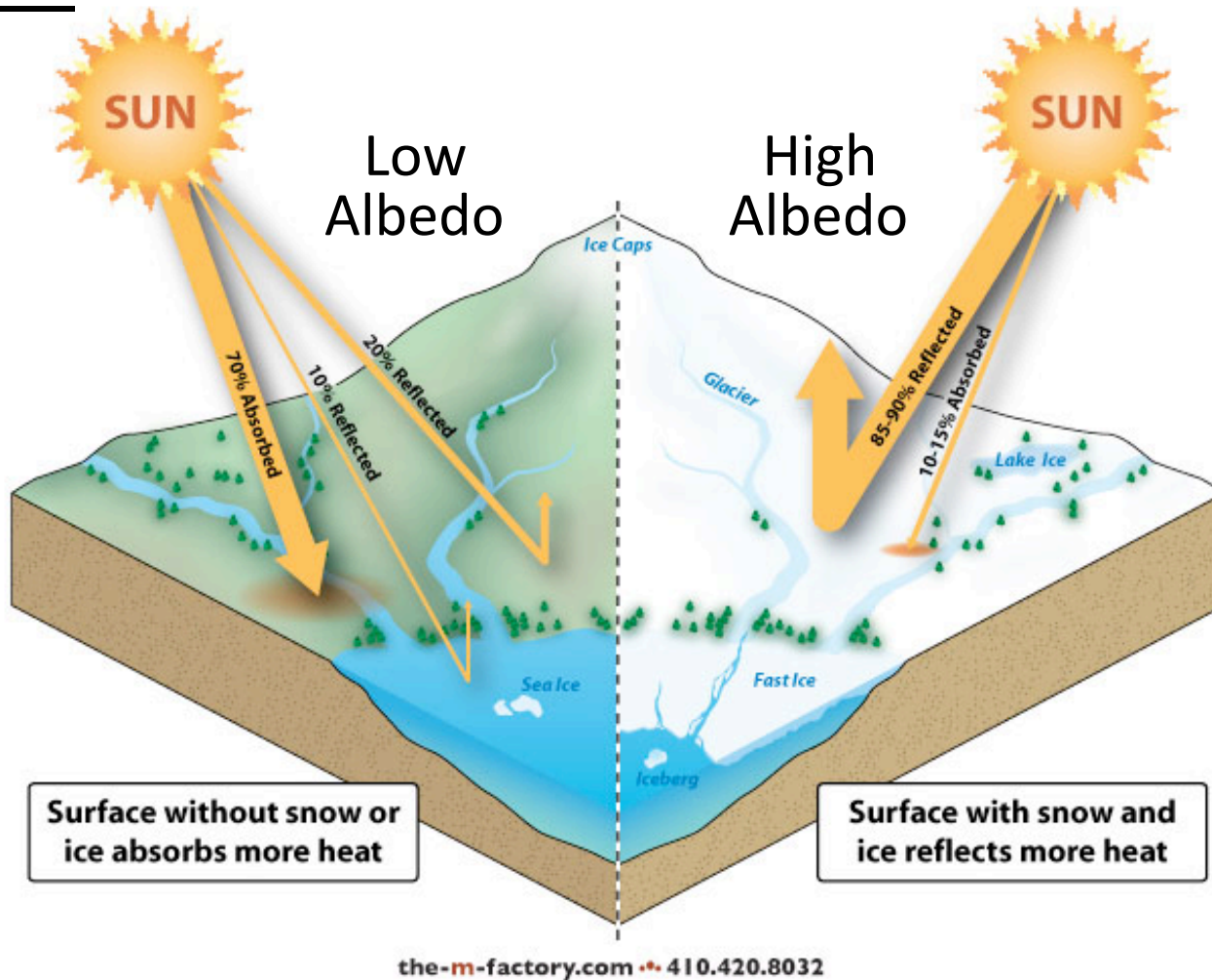
Less Energy Absorbed → Plastic Warms Slower → Adjacent Air Warmed Slower & Less





# Climate Box Review – Black & White

## Implications

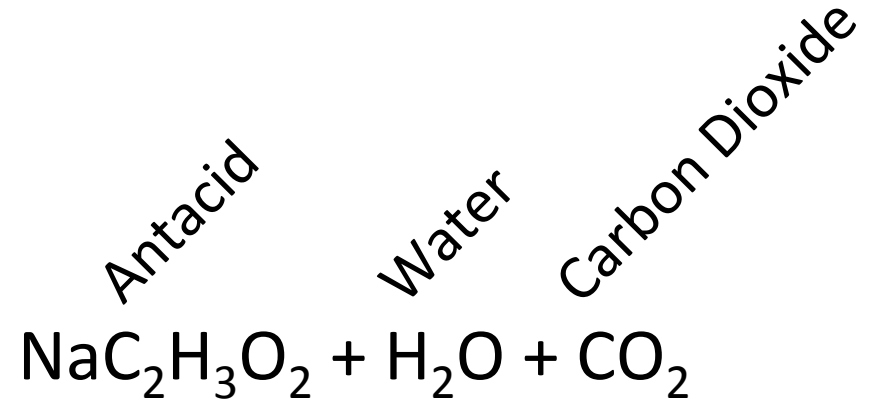
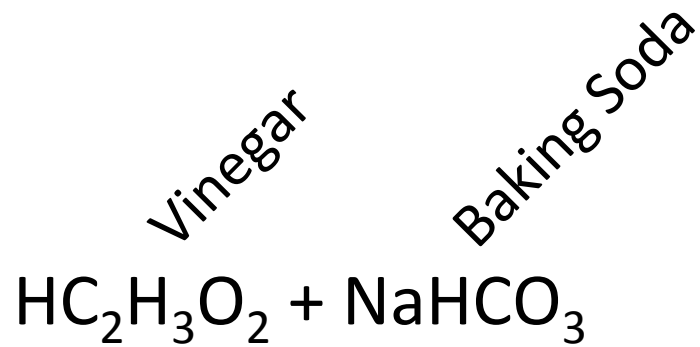


Asphalt => Black => Low Albedo

Snow => White => High Albedo

# Climate Box Review

## What's Happening ?

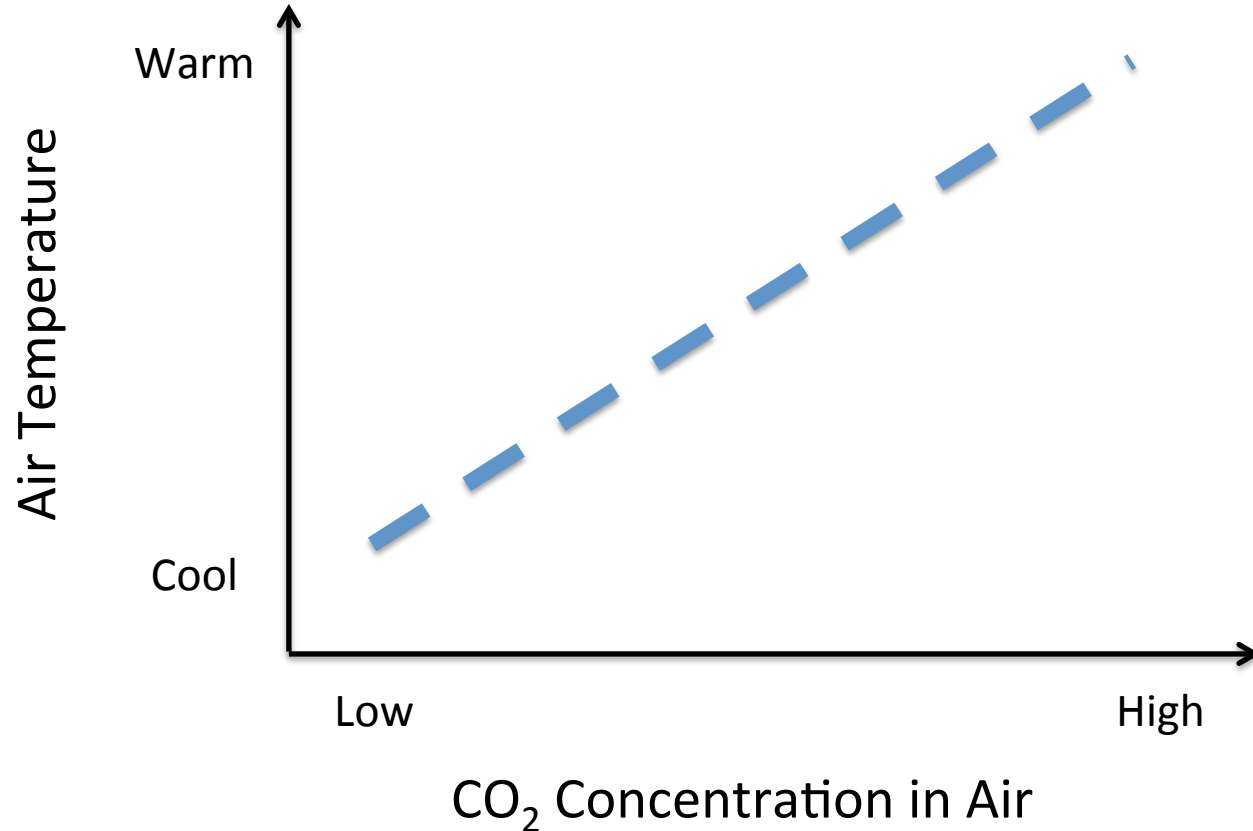


# Climate Box Review

## Key Relationship

### Temperature & CO<sub>2</sub> Correlation

- increase in atmospheric CO<sub>2</sub> => increase air temperature

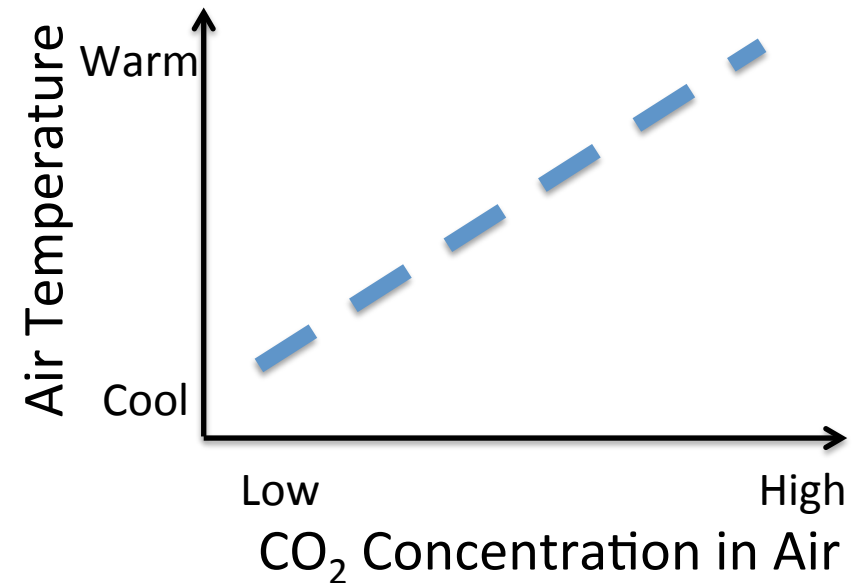
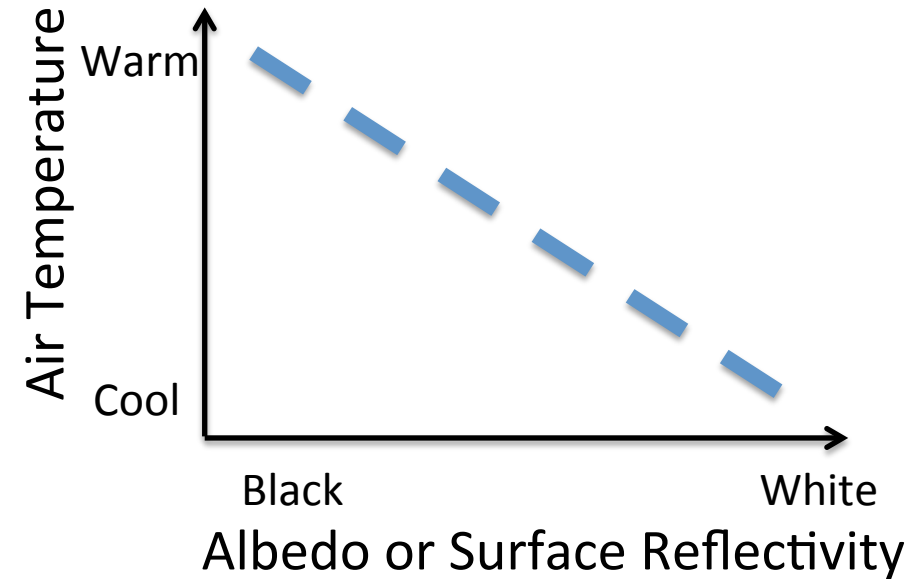
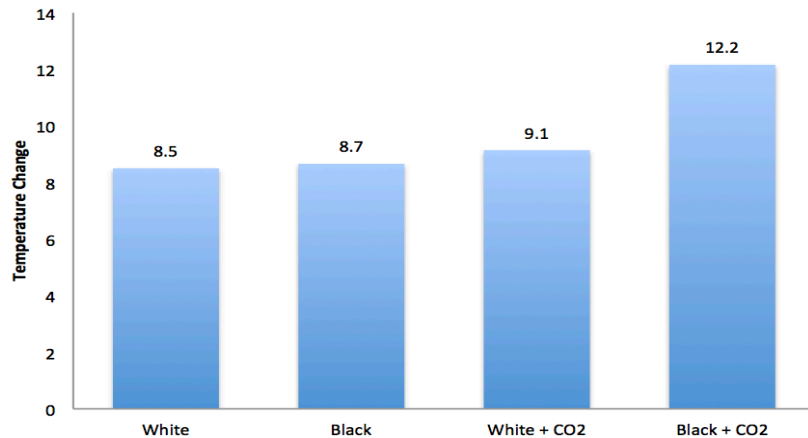
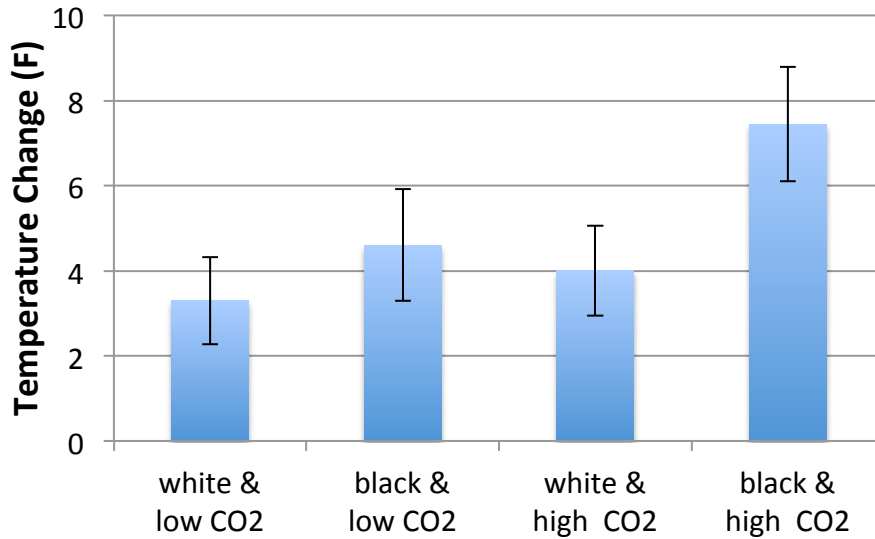


# Climate Box Review – Multiple Factors

## Implications

Factor 1 → Albedo

Factor 2 → Carbon Dioxide (CO<sub>2</sub>)



# Climate Box Review – Summary

## Key Points

Surface Reflectivity (Albedo) is an important factor in the Earth's temperature

Carbon Dioxide (CO<sub>2</sub>) and other greenhouse gases are also important factor in the Earth's temperature

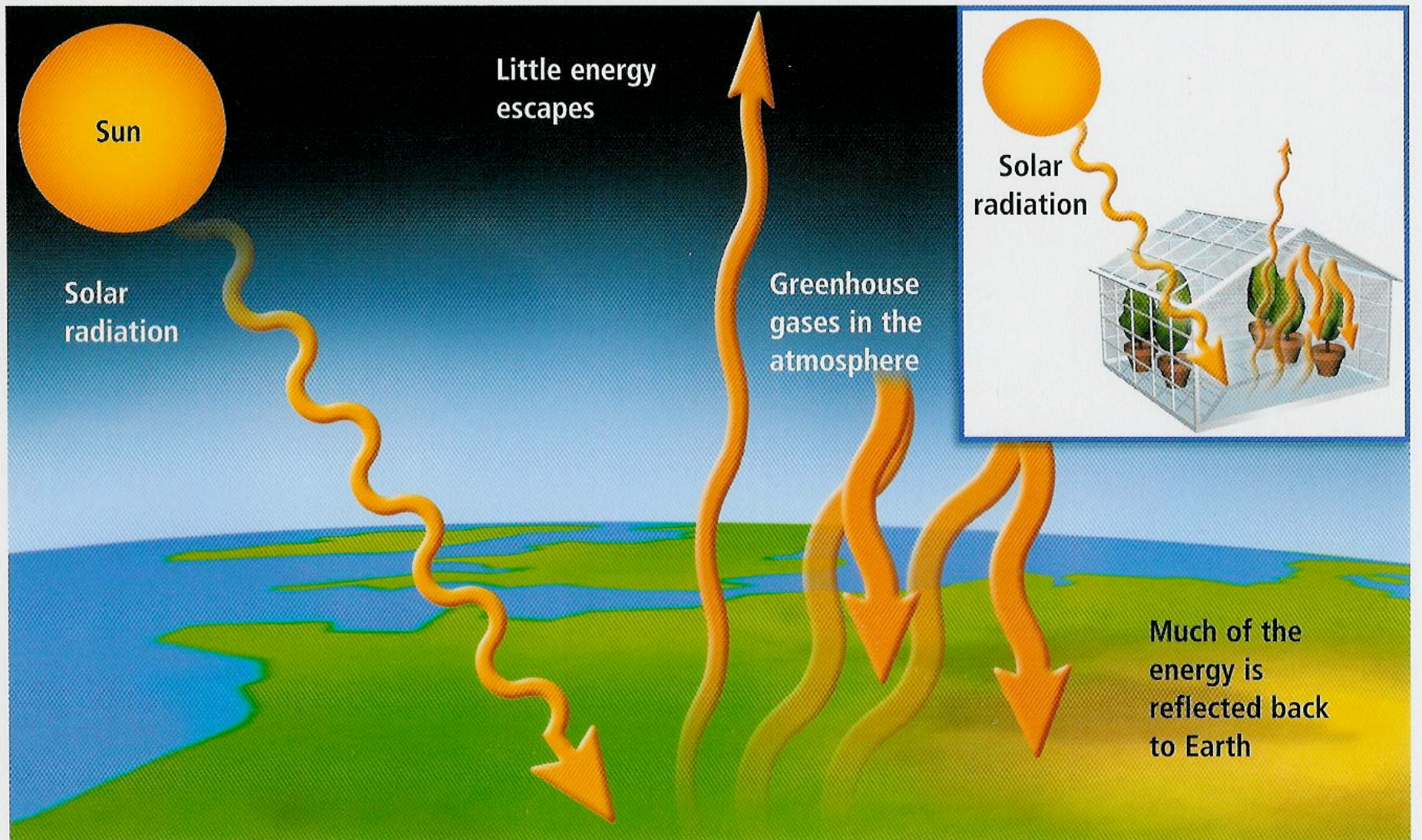
High reflectivity and Low CO<sub>2</sub> => cooler temperatures

Low reflectivity and High CO<sub>2</sub> => warmer temperatures



# Greenhouse Effect

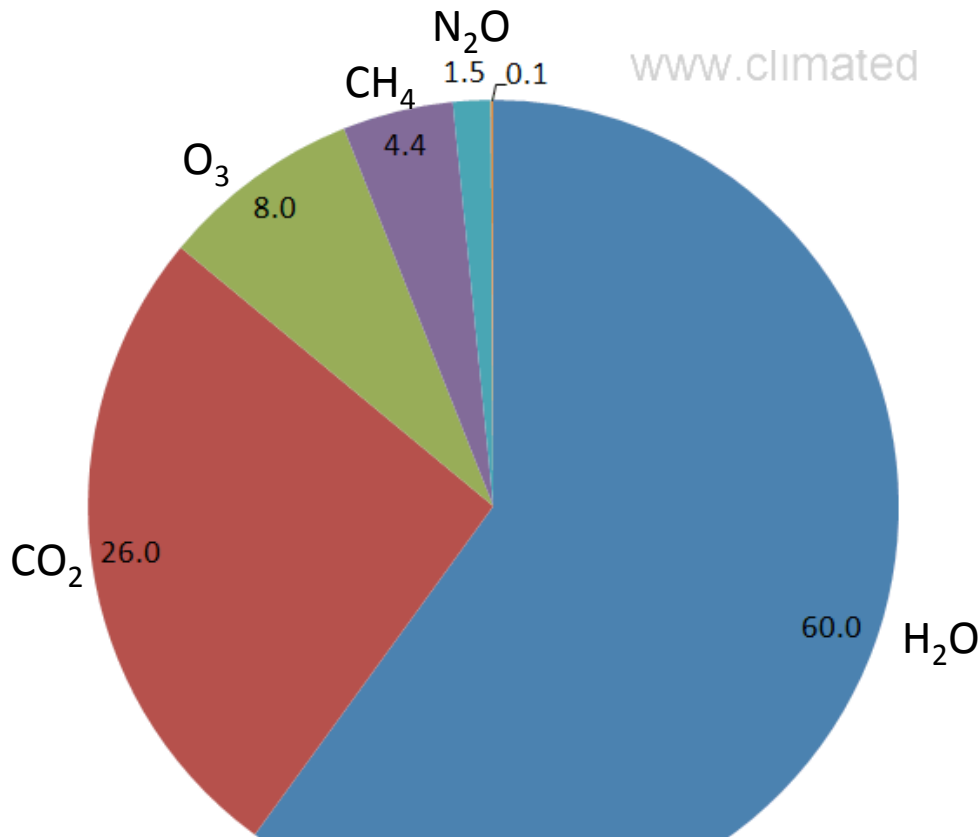
What is the greenhouse effect?



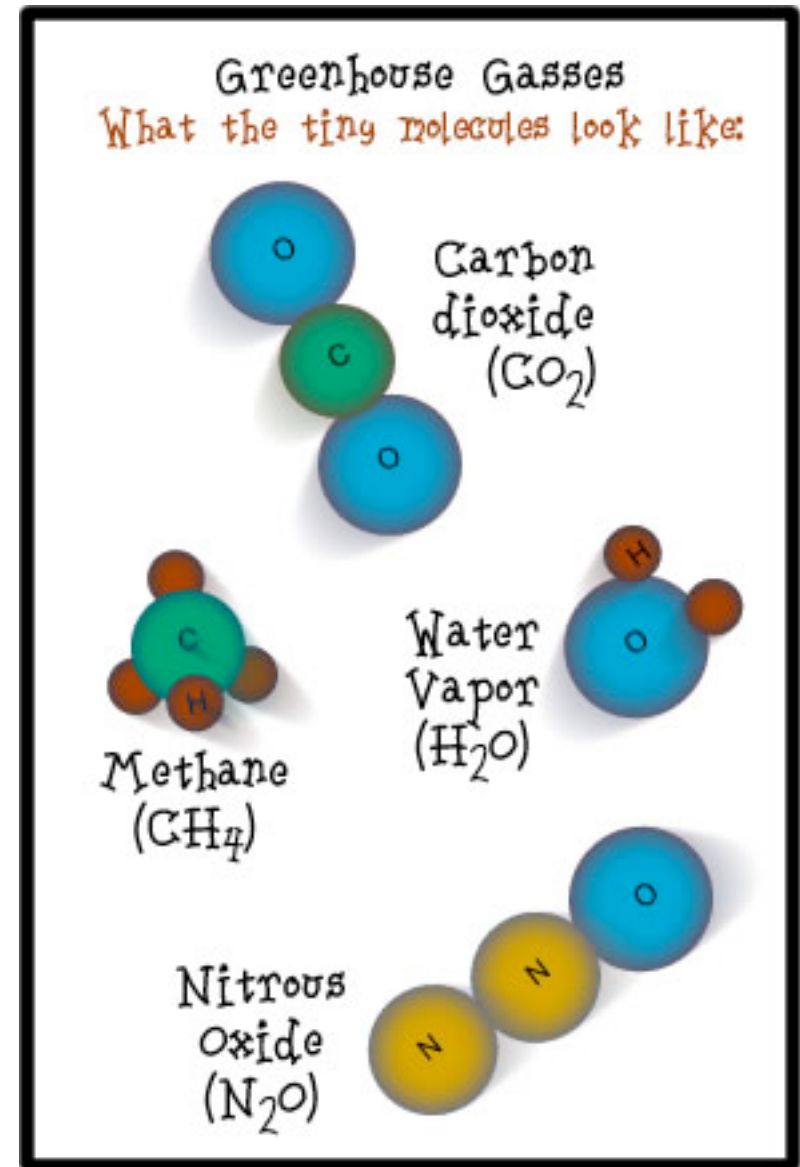
# Greenhouse Effect

## Greenhouse Gases (GHG)

Water Vapor ( $\text{H}_2\text{O}$ )  
Carbon Dioxide ( $\text{CO}_2$ )  
Nitrous Oxide ( $\text{N}_2\text{O}$ )  
Methane ( $\text{CH}_4$ )  
Ozone ( $\text{O}_3$ )

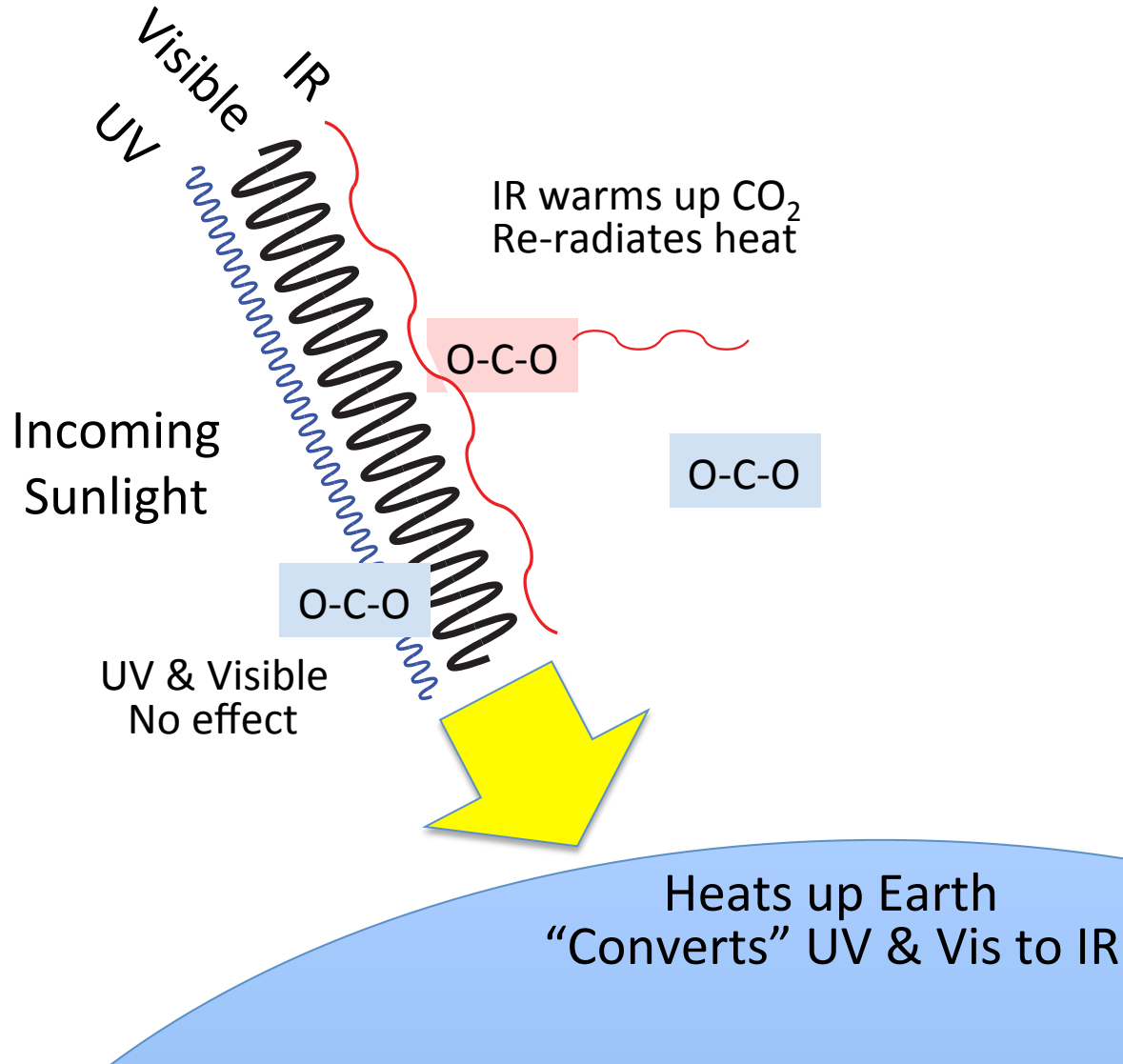


Contribution to Greenhouse Effect



# Greenhouse Effect

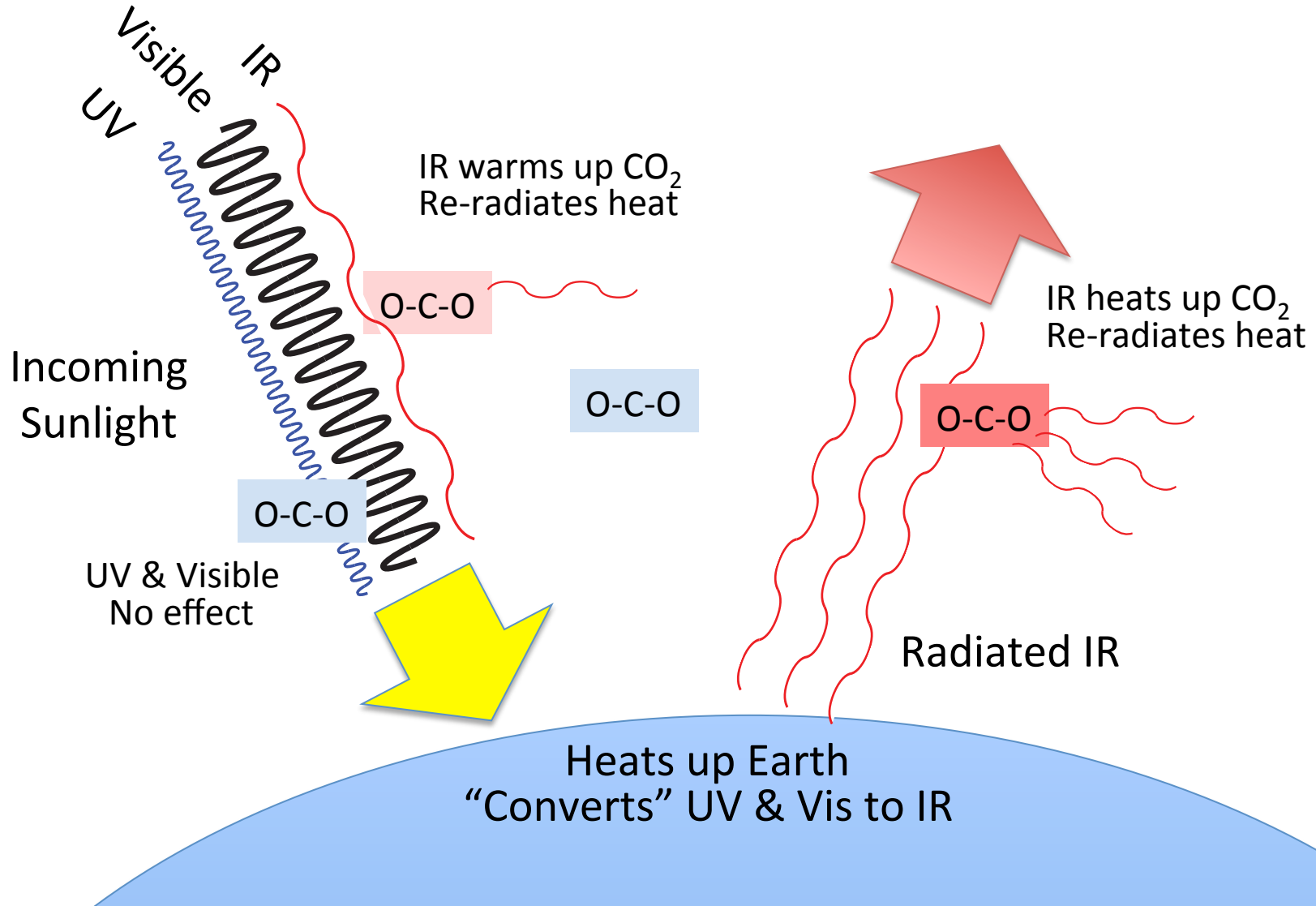
## Greenhouse Gases





# Greenhouse Effect

## Greenhouse Gases



# Greenhouse Effect - Trends

## Greenhouse Gases (GHG)

Water Vapor ( $\text{H}_2\text{O}$ )  
Carbon Dioxide ( $\text{CO}_2$ )  
Nitrous Oxide ( $\text{N}_2\text{O}$ )  
Methane ( $\text{CH}_4$ )  
Ozone ( $\text{O}_3$ )

