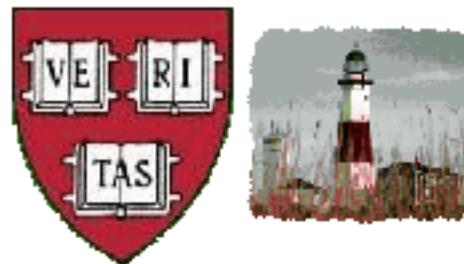


# CLIMATE CHANGE AND ENERGY IN TODAY'S WORLD

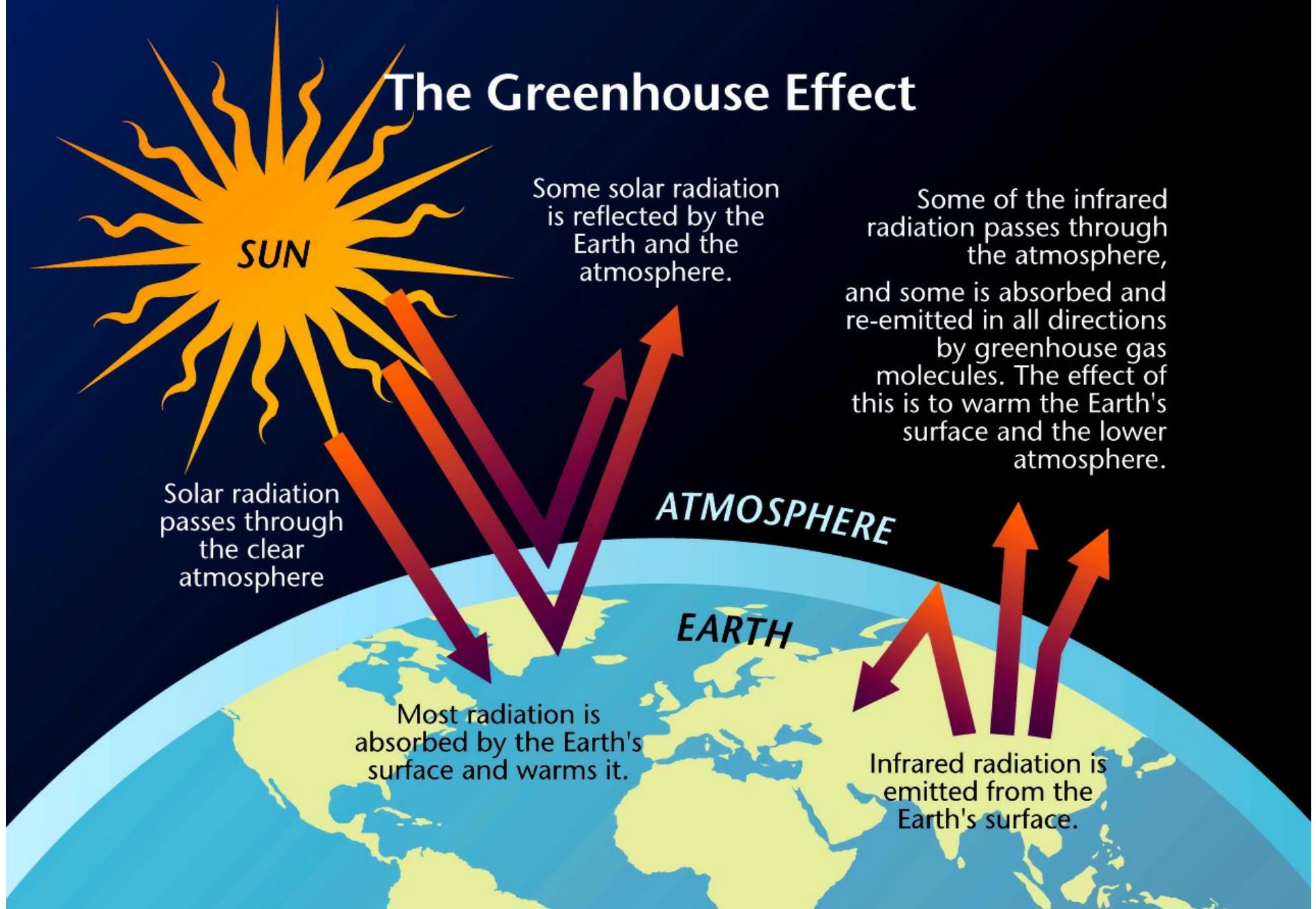
Stephen E. Schwartz



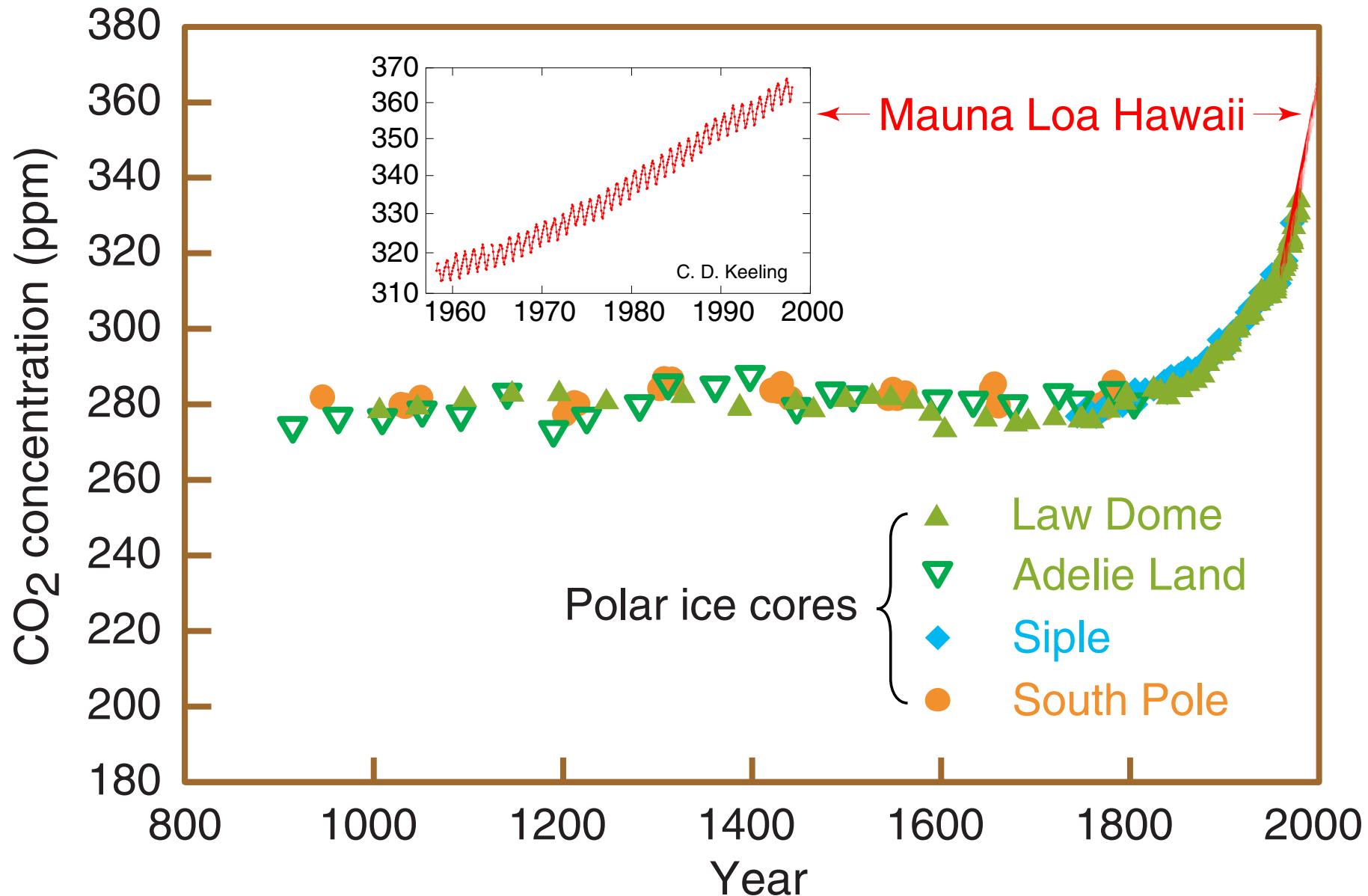
Harvard Club of Long Island  
April 30, 2010

*[www.ecd.bnl.gov/steve](http://www.ecd.bnl.gov/steve)*

# The Greenhouse Effect



# ATMOSPHERIC CARBON DIOXIDE IS INCREASING



Global carbon dioxide concentration over the last thousand years

?



?



?

# HOW MUCH CARBON IS IN A GALLON OF GASOLINE?



?

1 lb?

3 lbs!?



2 lbs?

5 lbs!?!?

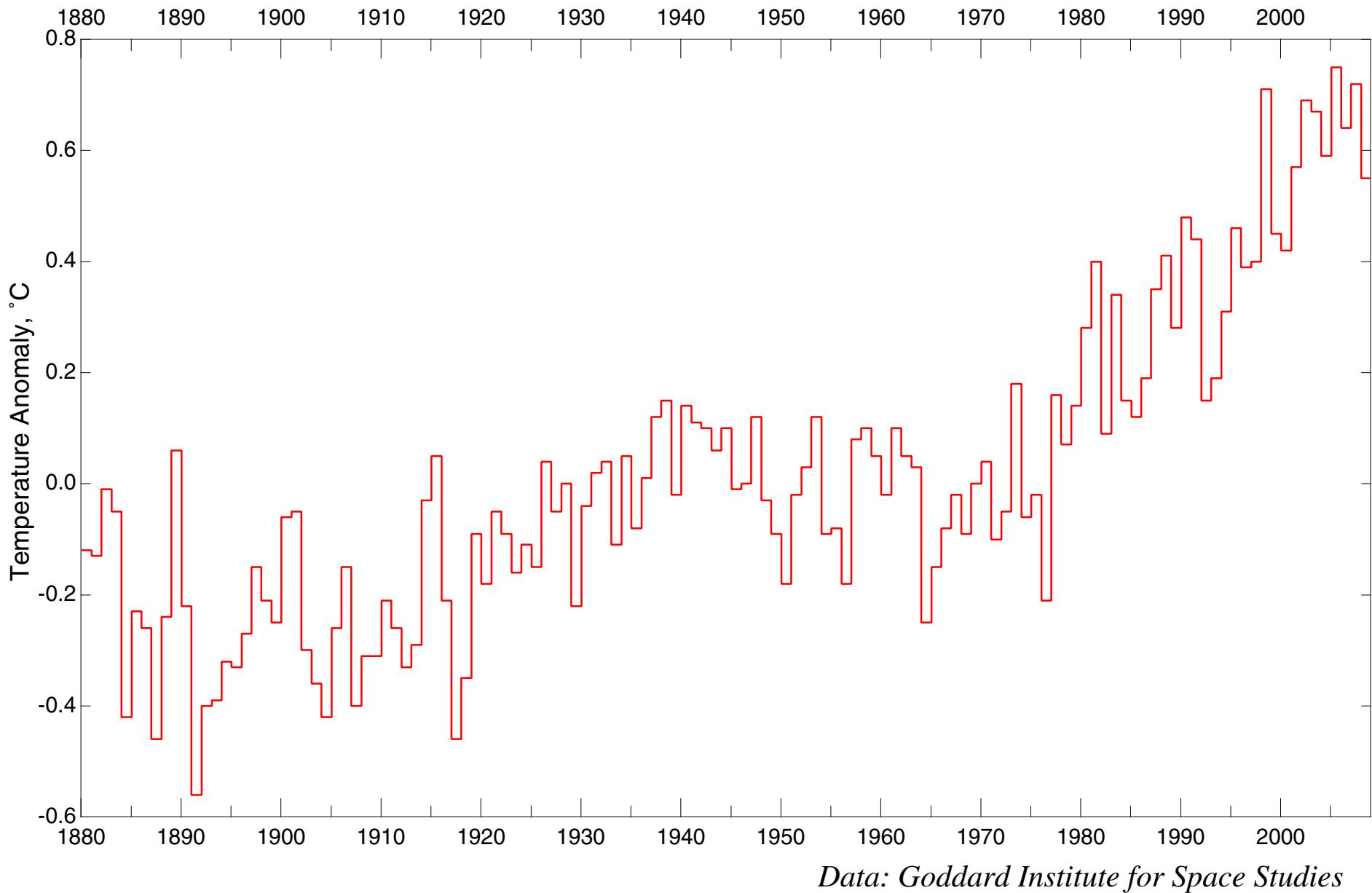


All of this carbon goes into the atmosphere as carbon dioxide when you burn the gasoline in your car.

?

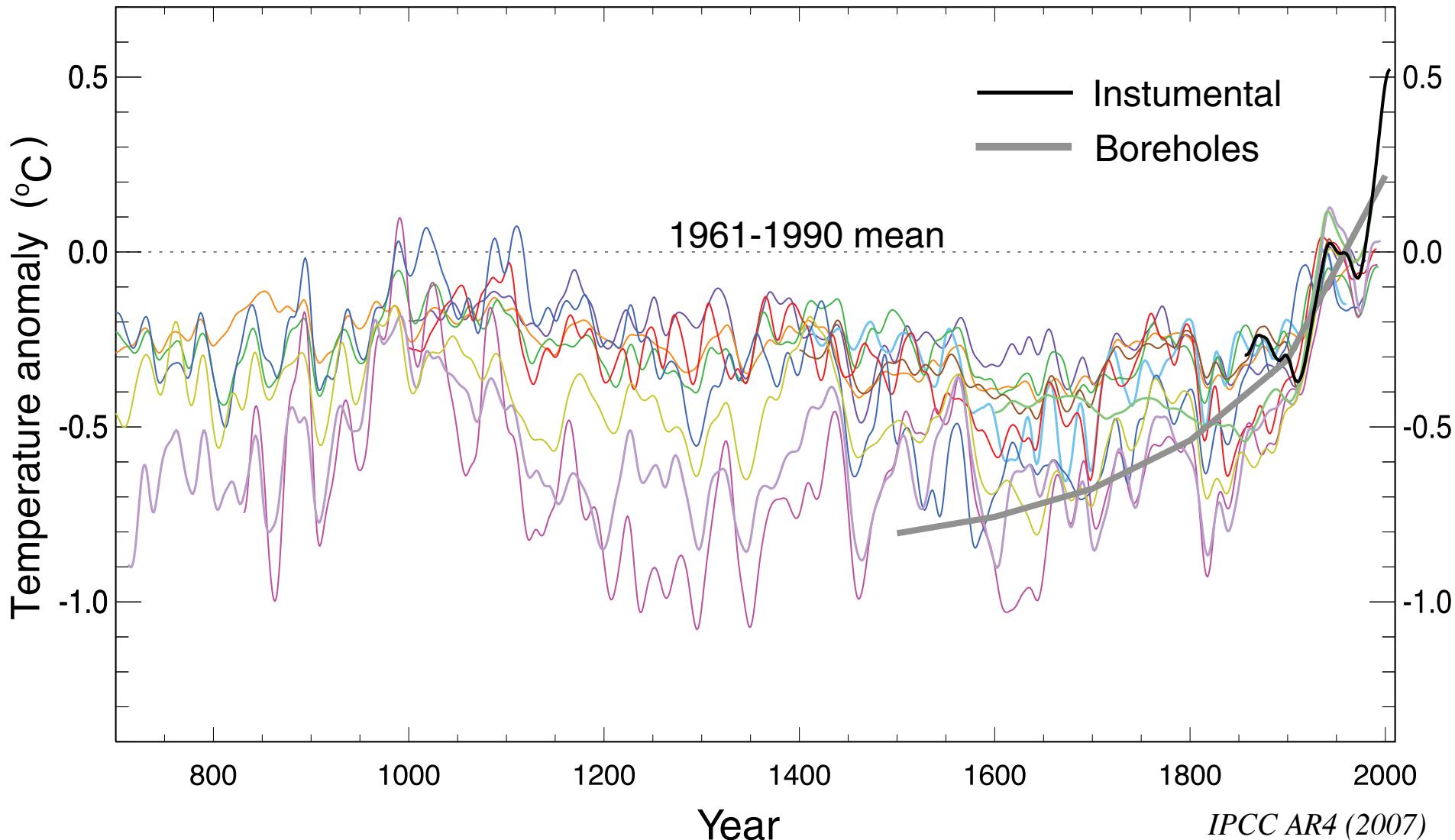
?

# GLOBAL ANNUAL TEMPERATURE ANOMALY, 1880-2008



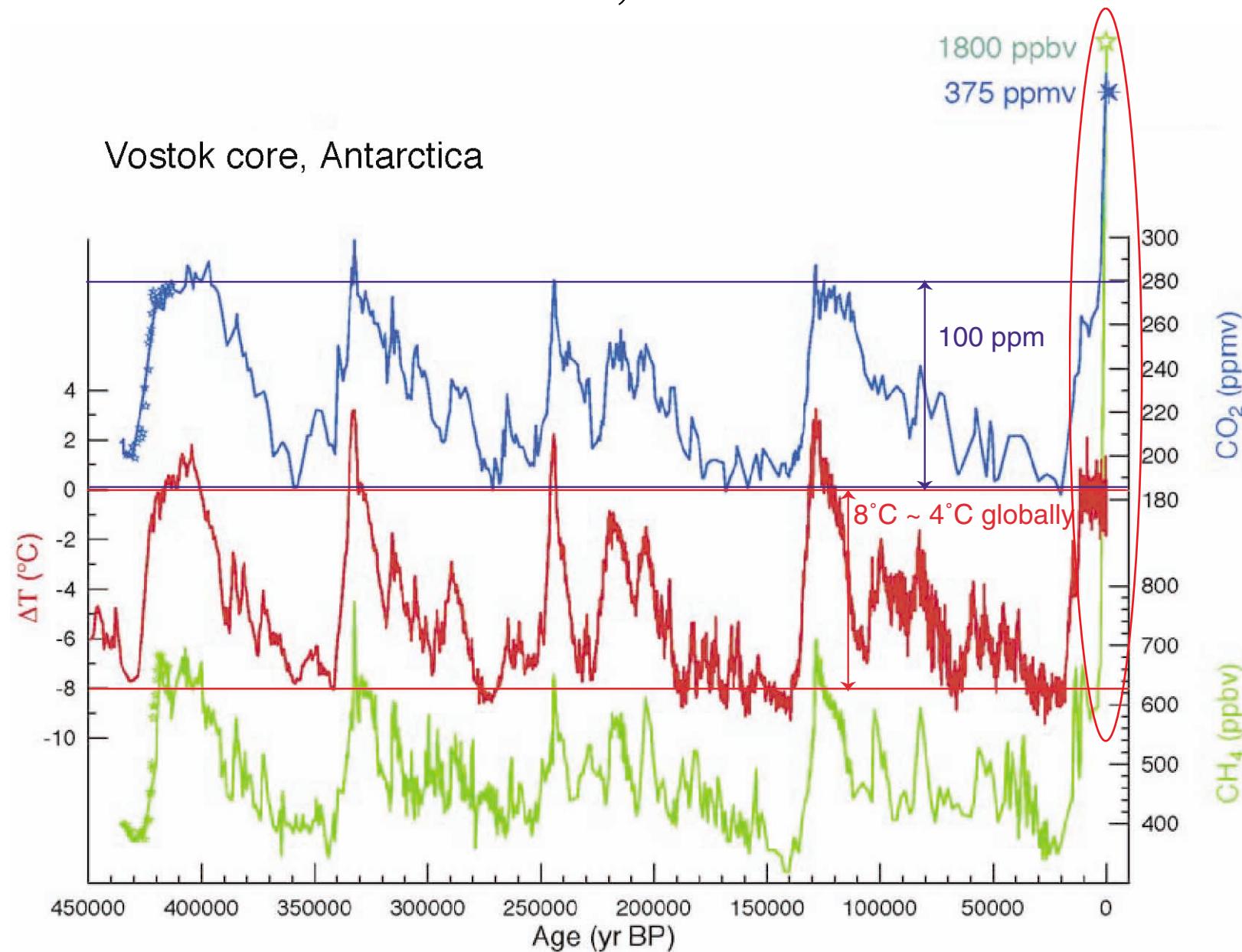
# NORTHERN HEMISPHERE TEMPERATURE

Instrumental measurements and proxies: tree rings, pollens, isotopes, etc.



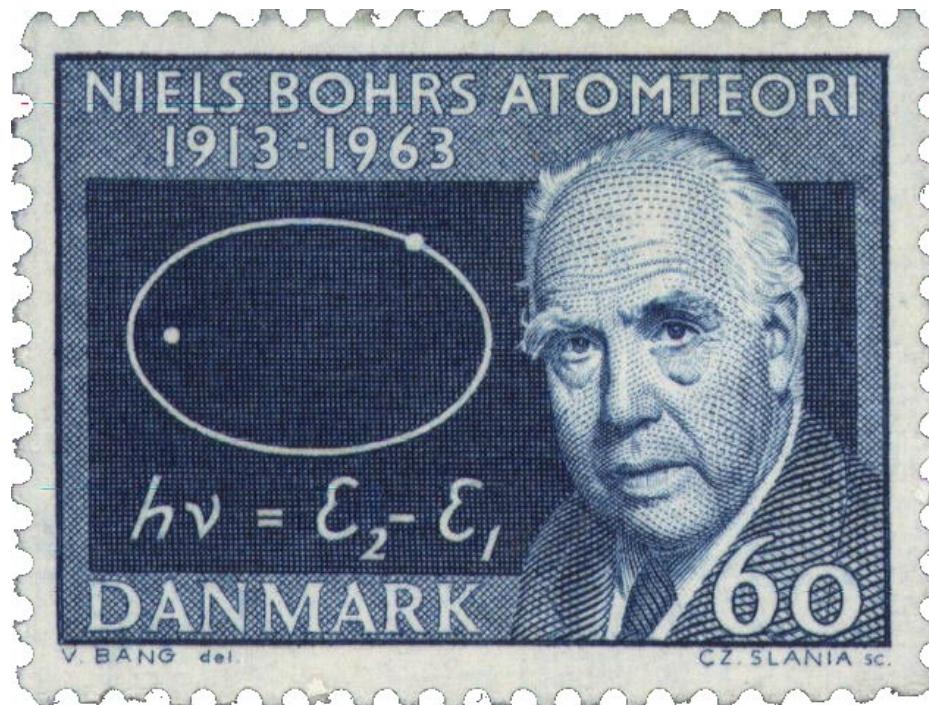
Increase over twentieth century is extraordinary.

# GREENHOUSE GASES AND TEMPERATURE OVER 450,000 YEARS



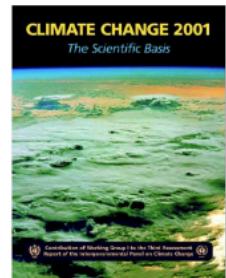
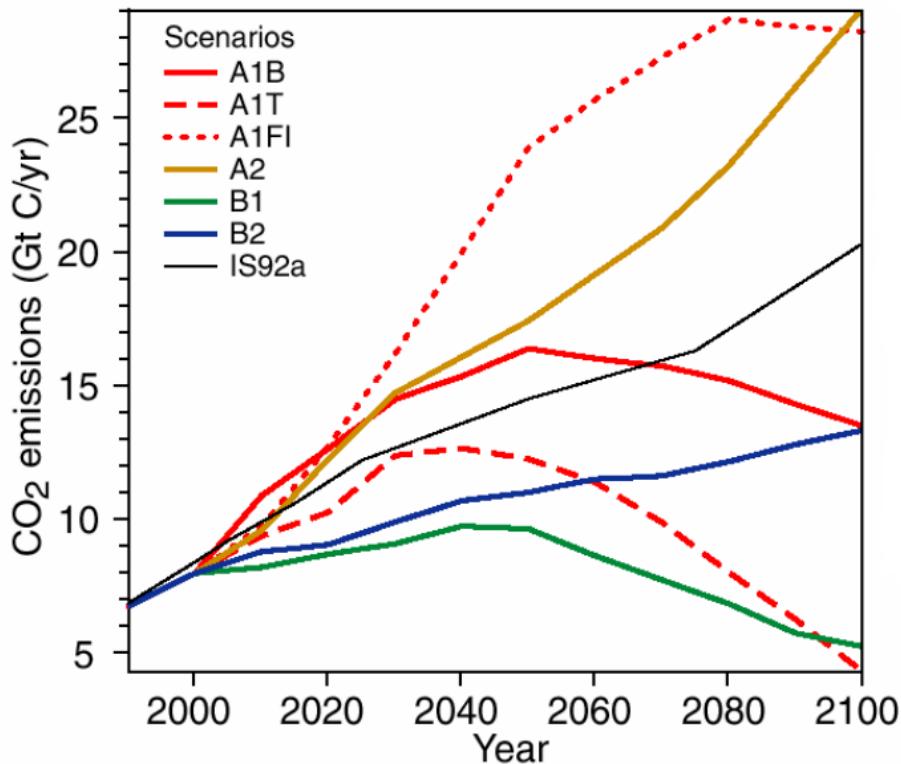
Modified from Petit et al., Nature, 1999

*Prediction is difficult,  
especially about the future.*

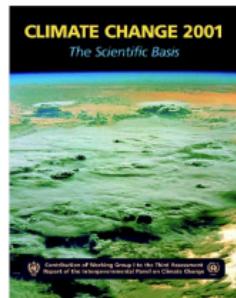
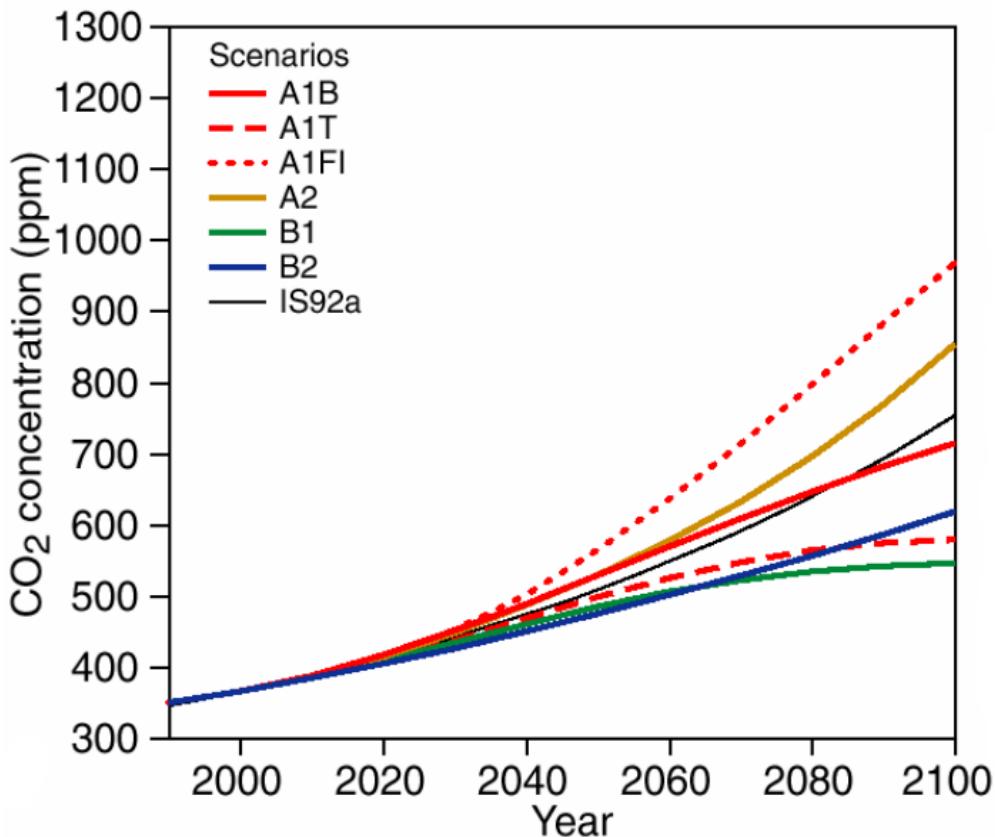


*– Niels Bohr*

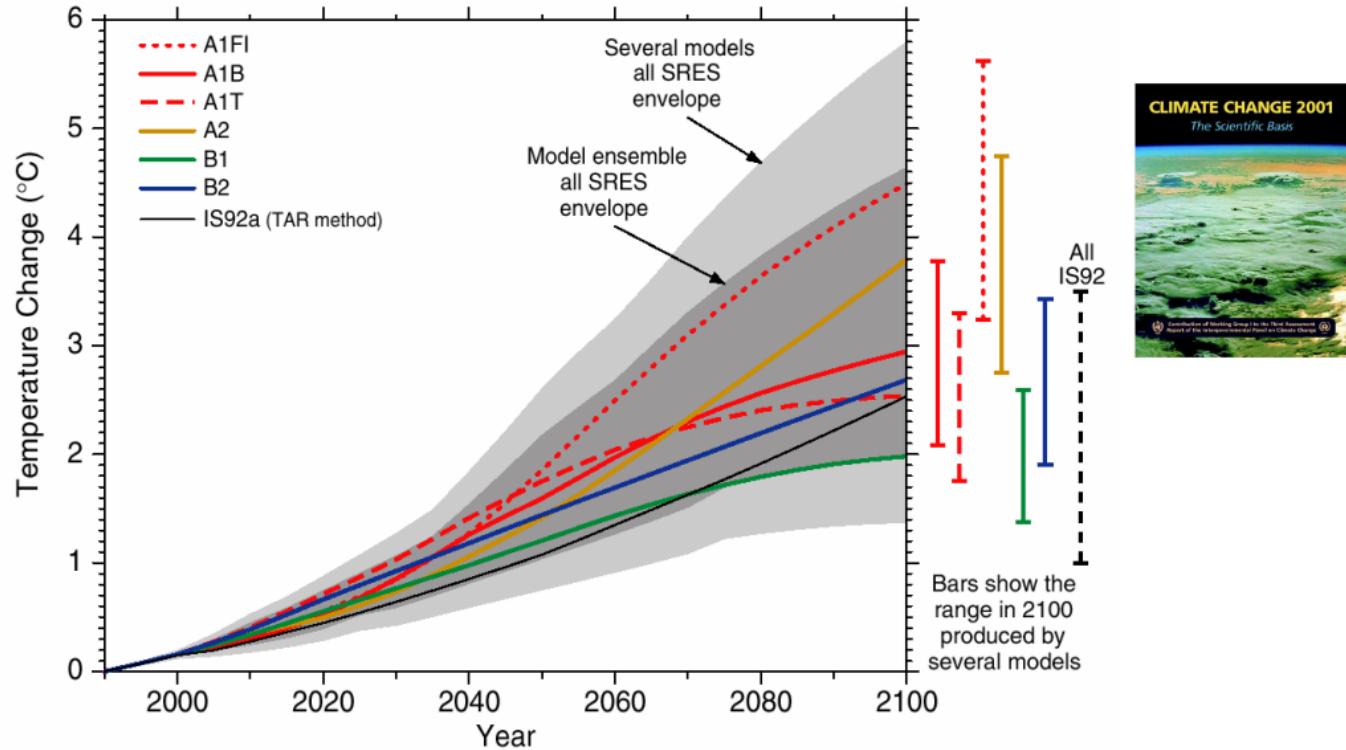
# PROJECTIONS OF FUTURE CO<sub>2</sub> EMISSIONS



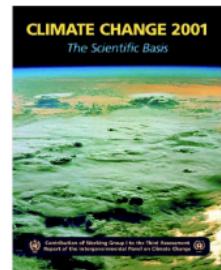
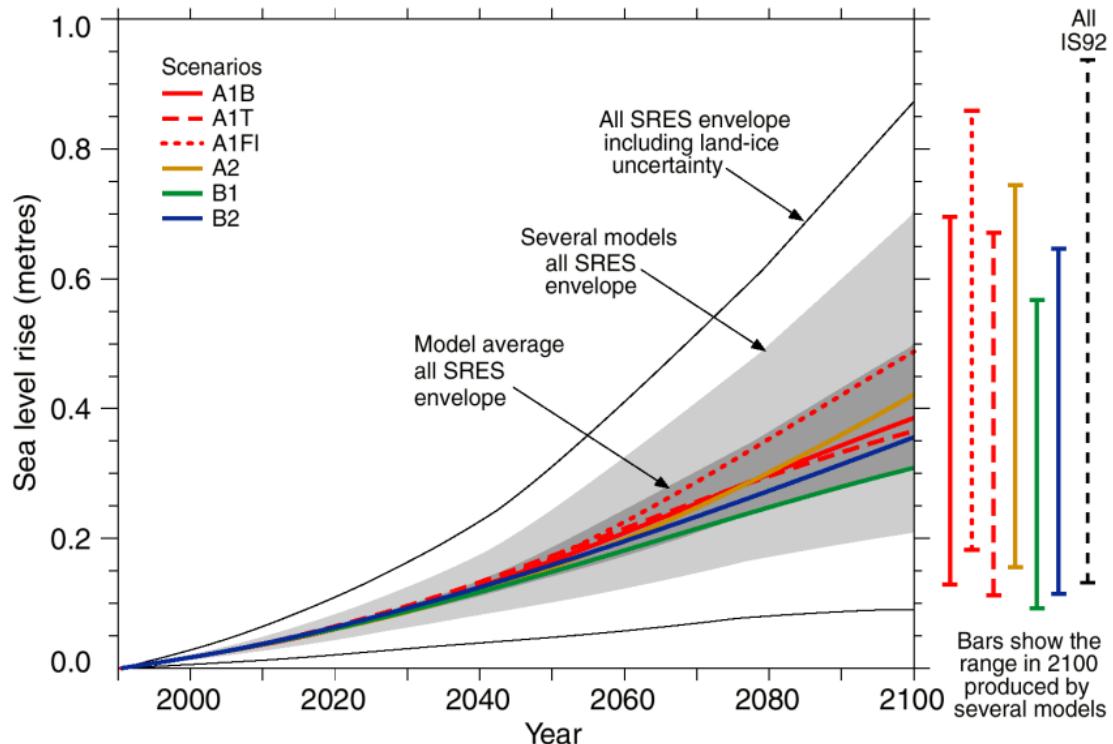
# PROJECTIONS OF FUTURE CO<sub>2</sub> CONCENTRATIONS



# PROJECTIONS OF FUTURE TEMPERATURE CHANGE

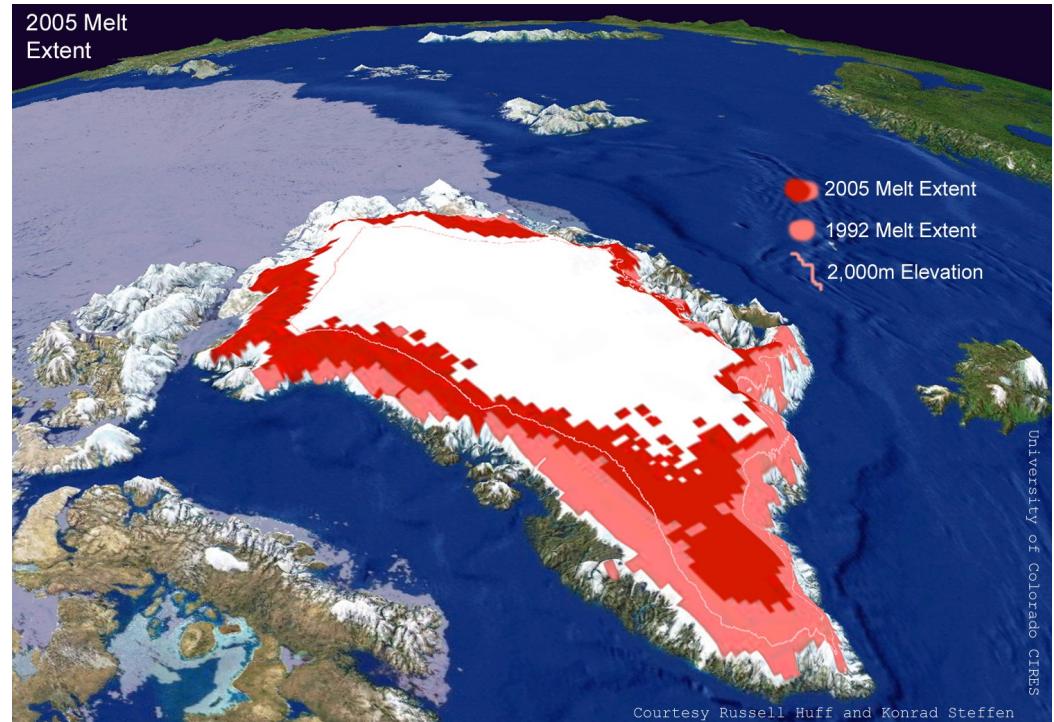


# PROJECTIONS OF FUTURE SEA LEVEL RISE

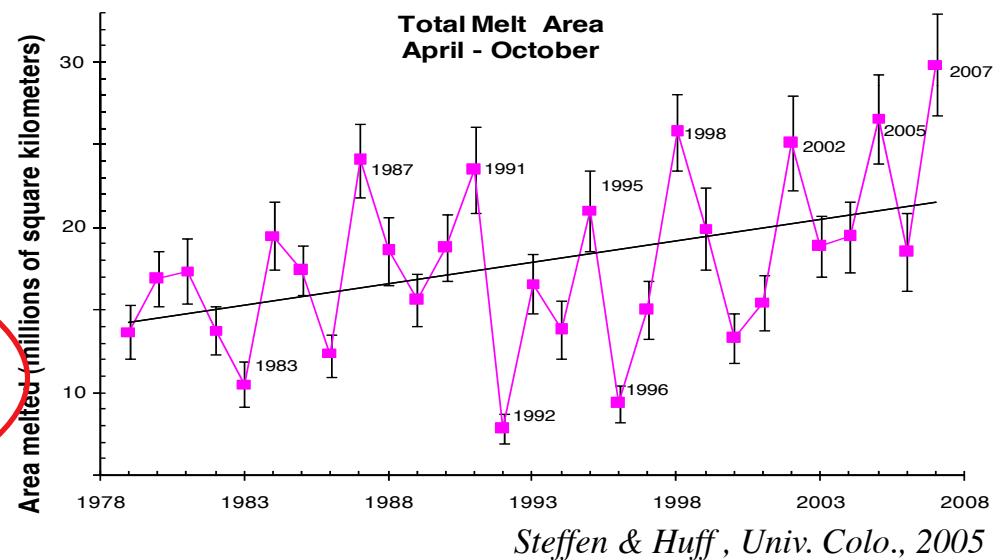


# MELTING OF GREENLAND ICE CAP

## Satellite determination of maximum extent of glacial melt



NASA  
Complete melt of the Greenland ice sheet would raise the level of the global ocean 23 feet.



# *THE BIG PROBLEM FOR LONG ISLAND . . .*

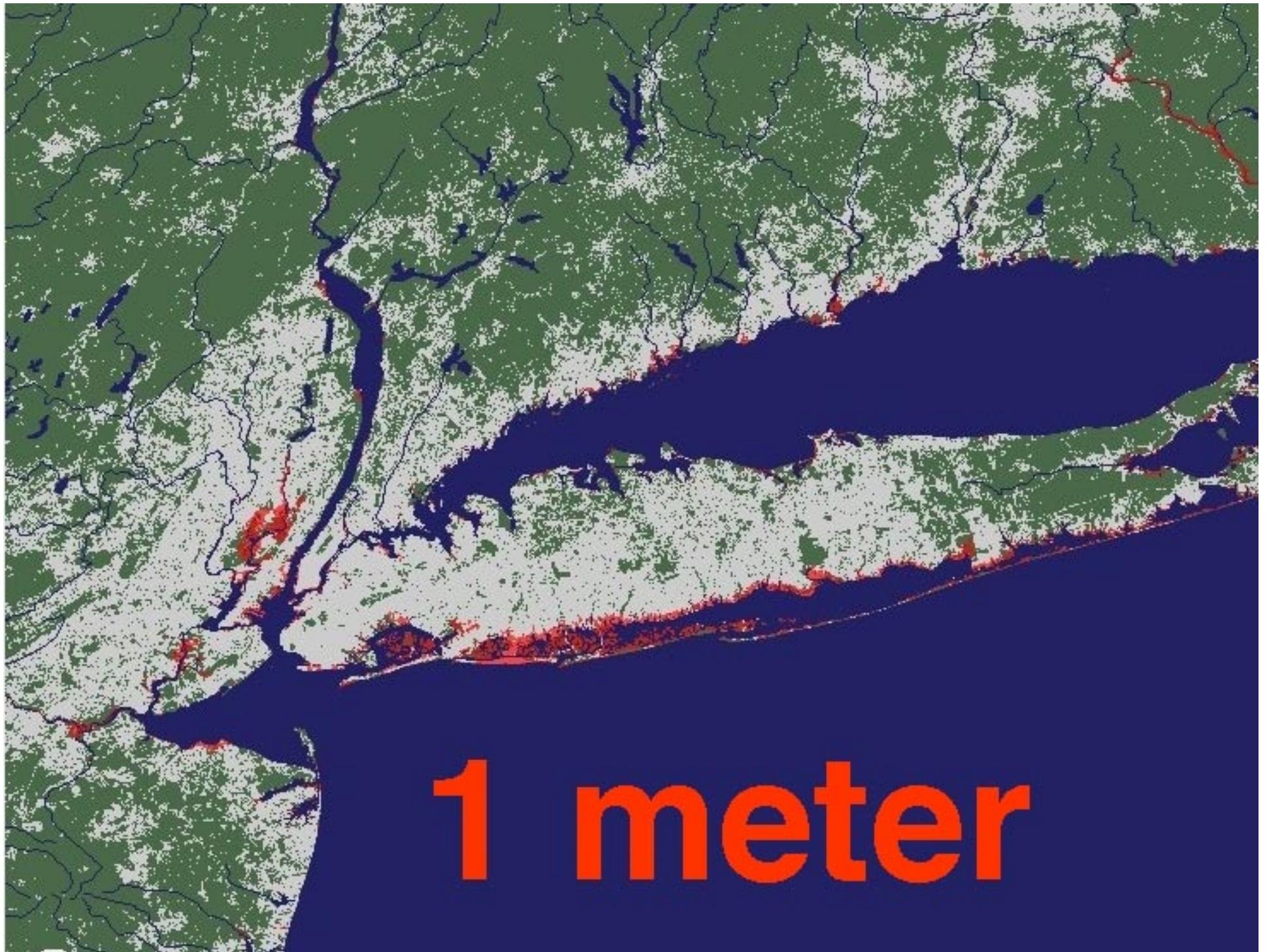


# RISING SEA LEVEL





**present**

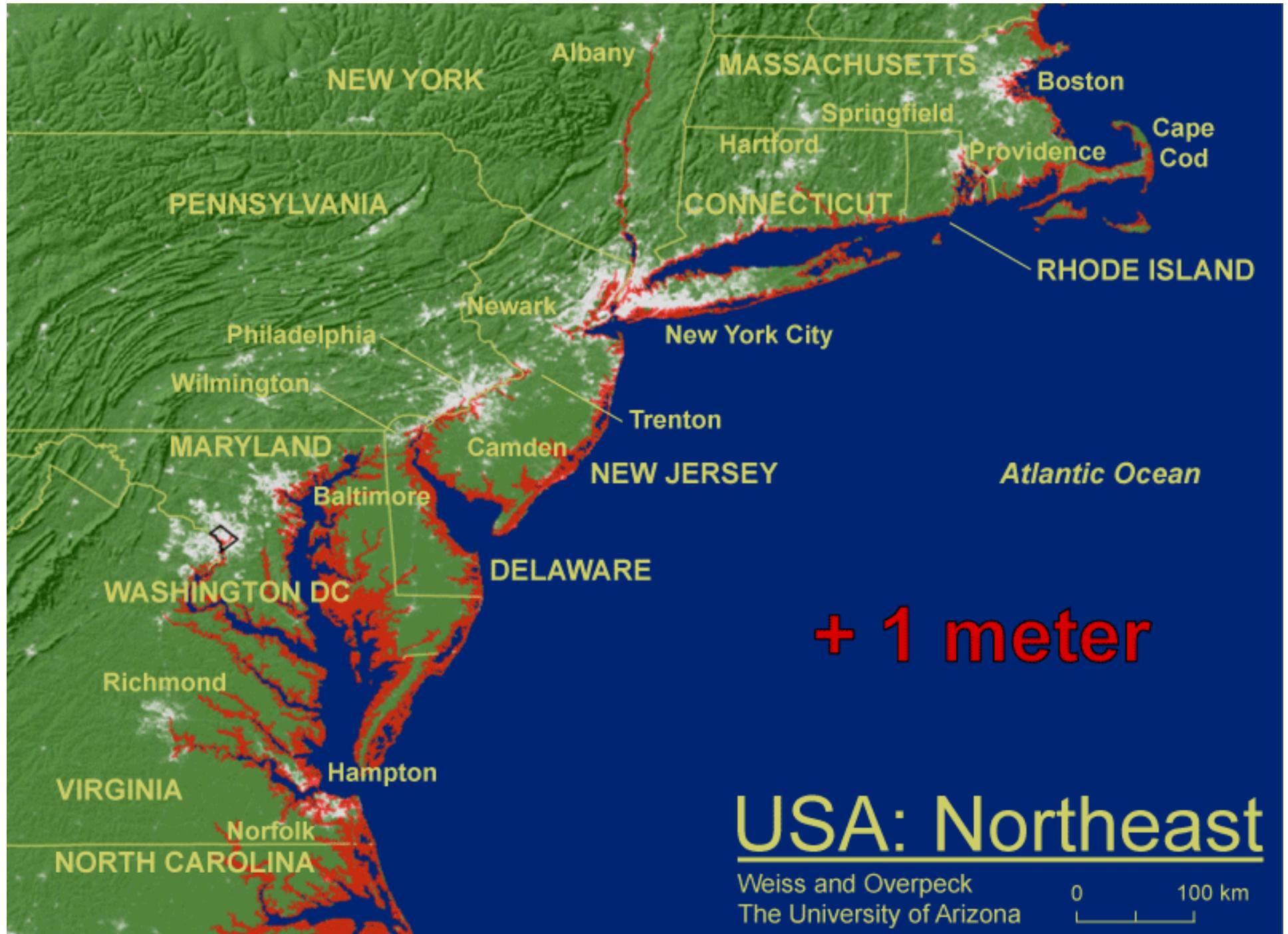


1 meter



**6 meters**

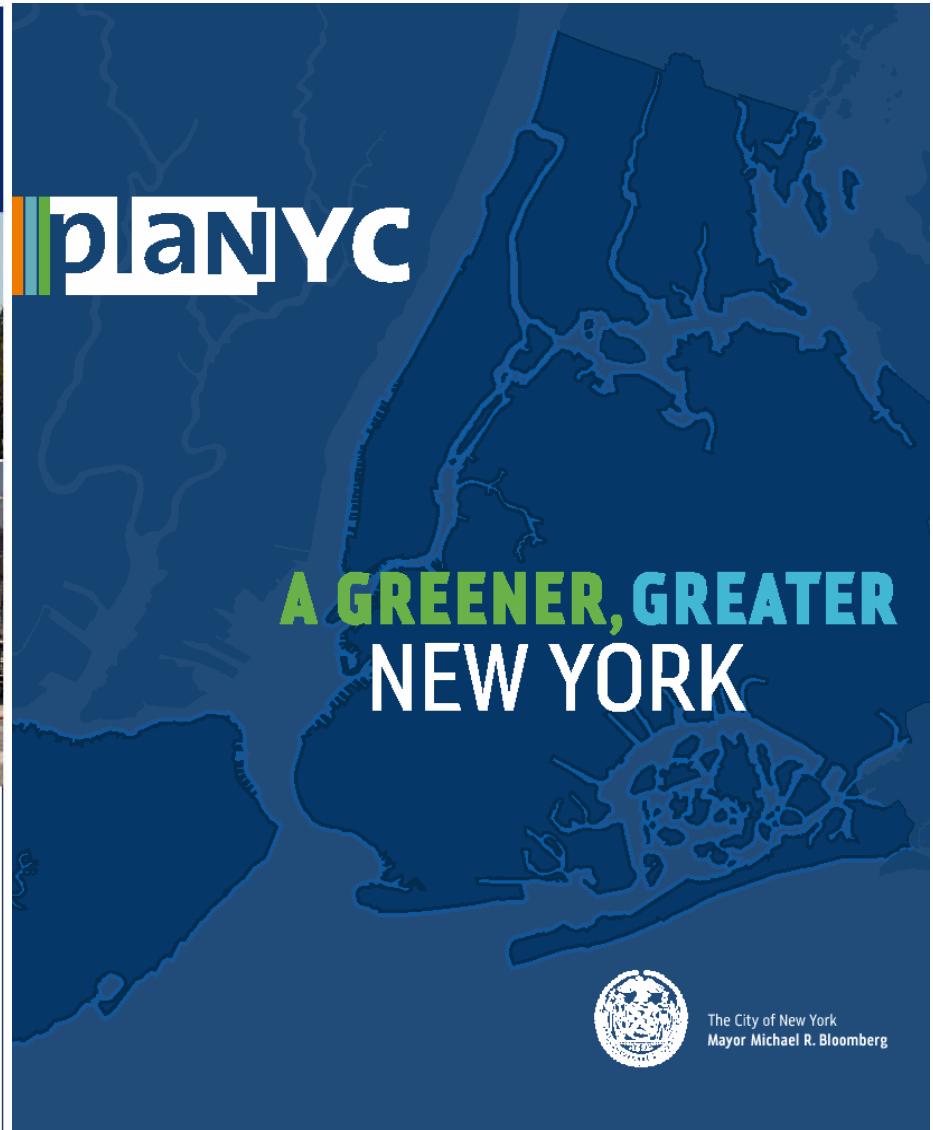
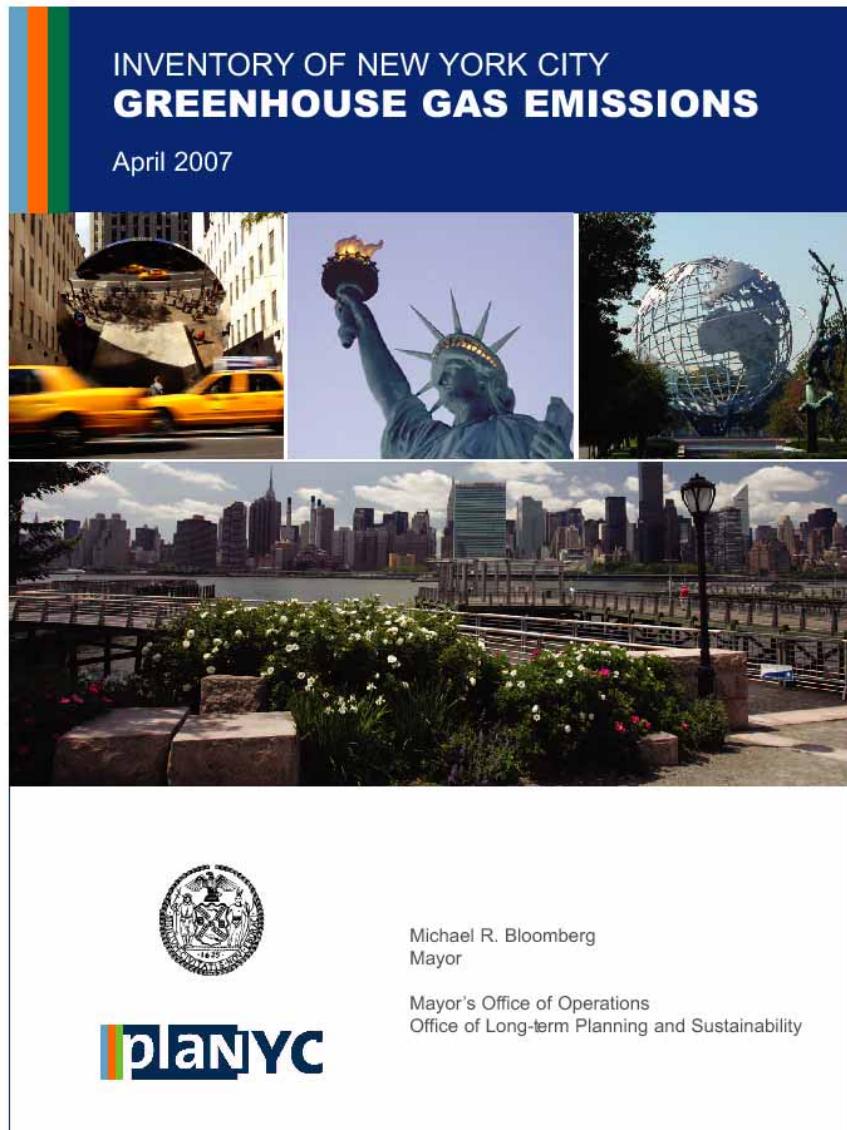




# WHAT CAN WE DO?

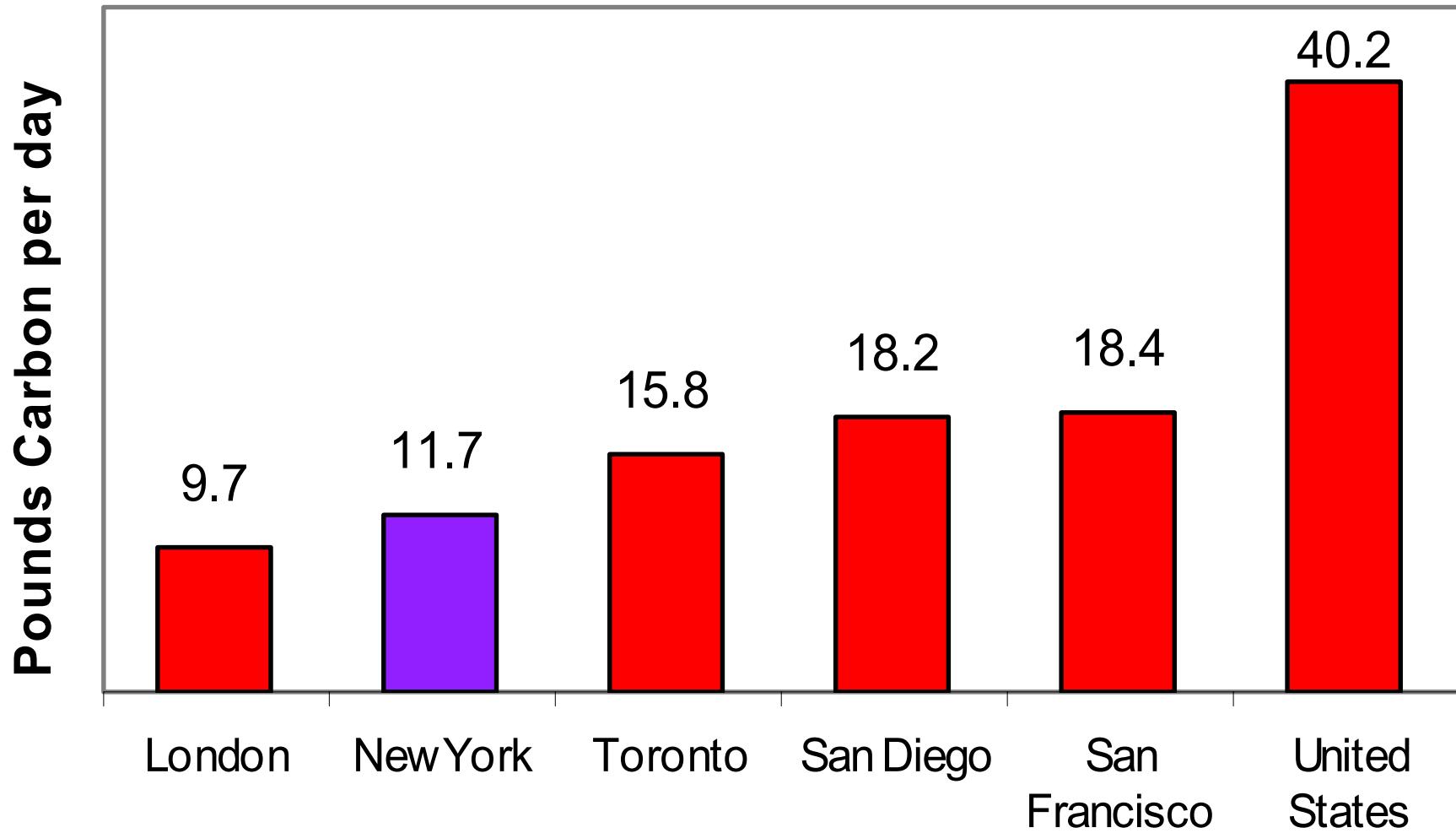
# NEW YORK CITY AS EXAMPLE

Survey of emissions and plan to reduce emissions 30% by 2030



# CARBON DIOXIDE EMISSIONS IN SELECTED CITIES

Pounds of carbon per person per day



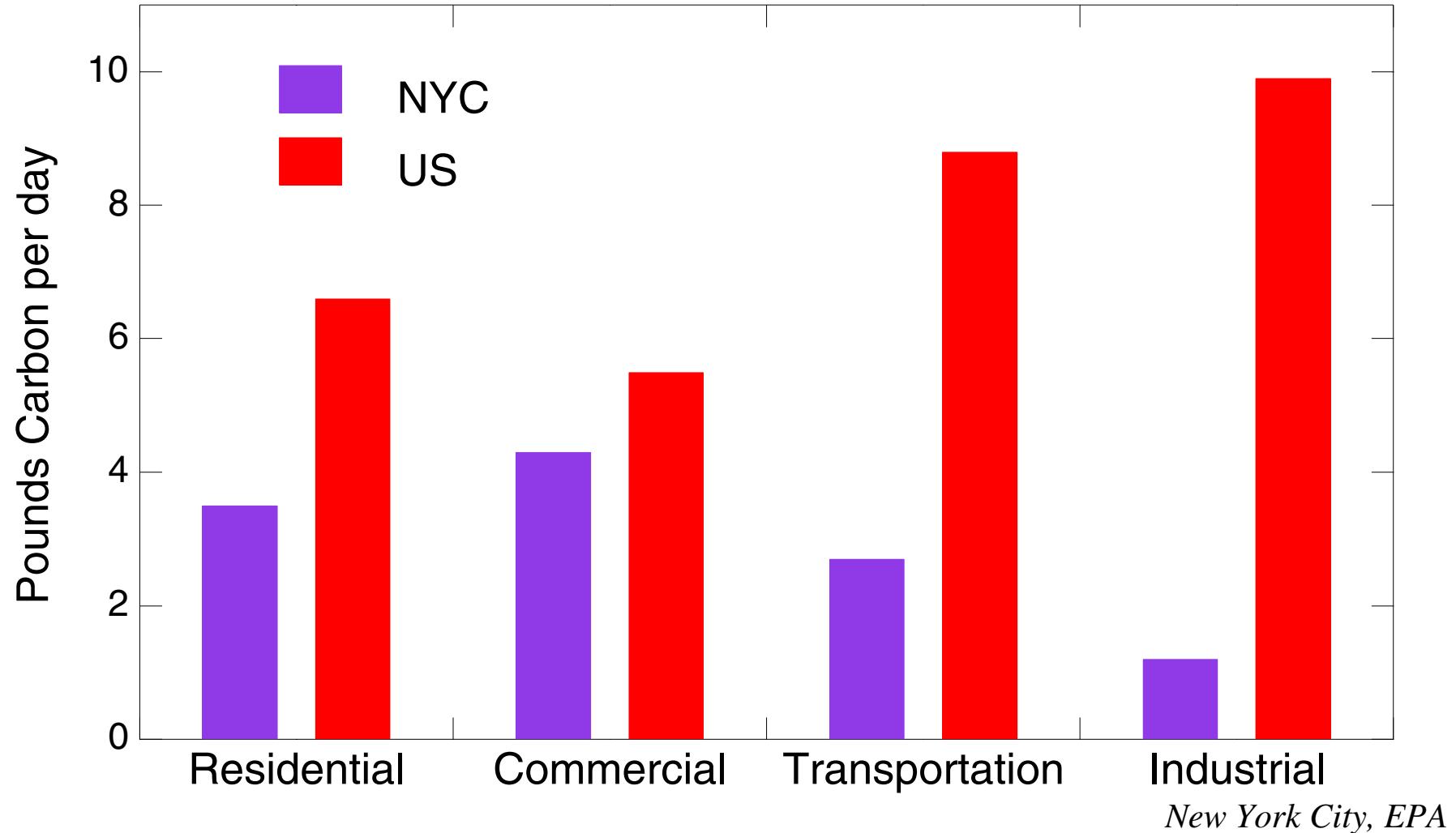
*New York City Greenhouse Gas Emissions, April, 2007*

Cities are energy efficient.

# CARBON DIOXIDE EMISSIONS BY SECTOR

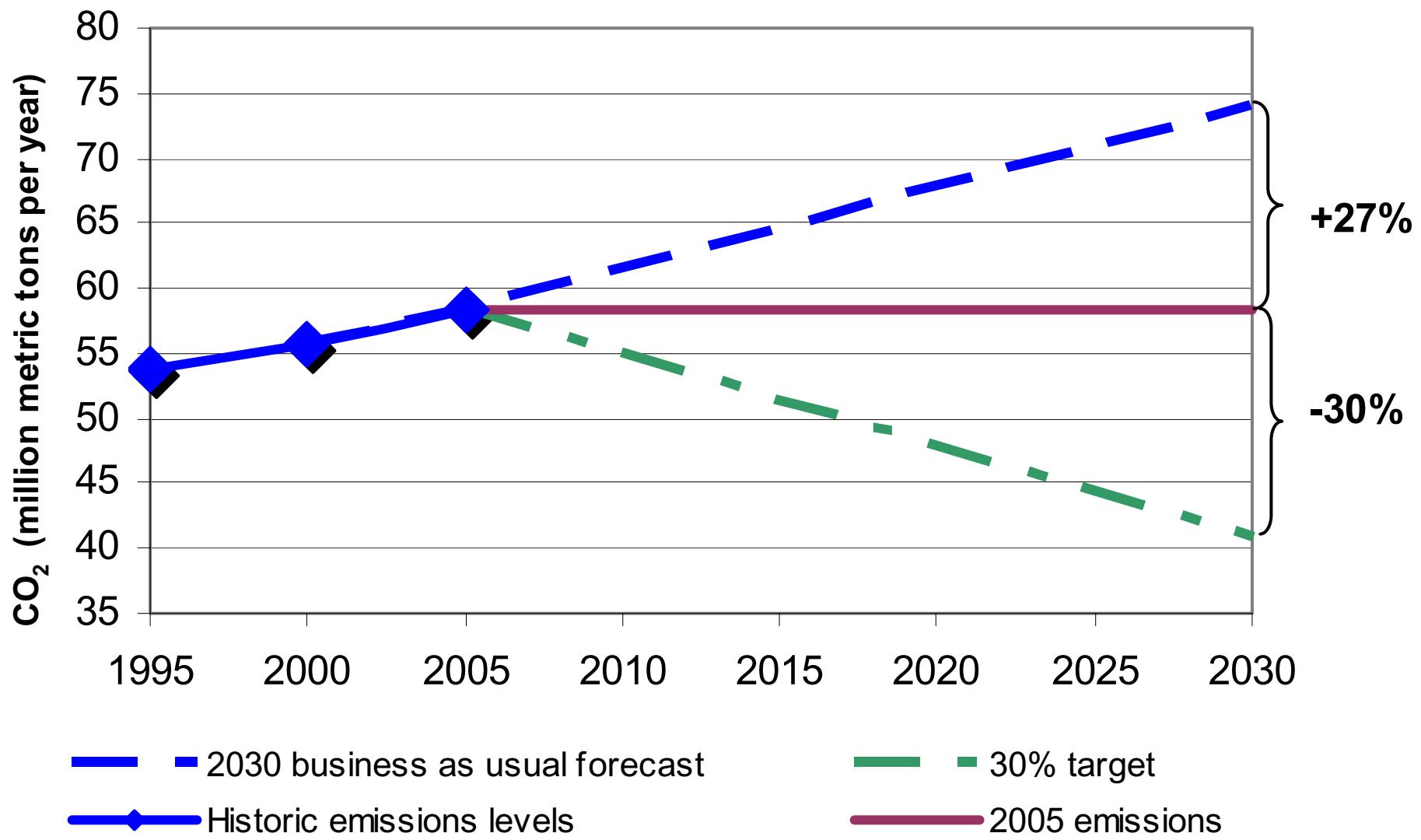
Comparison of New York City vs. United States Average

Pounds of carbon per person per day



# PROJECTED CARBON DIOXIDE EMISSIONS FOR NEW YORK CITY

2005 - 2030



New York City Greenhouse Gas Emissions, April, 2007

# ***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 ( $\text{CO}_2$ ), and it will stay there for decades — maybe a century!

Other sources are home heating and electric power production.



# **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?



**RESEARCH IS HELPING  
TO ANSWER THESE QUESTIONS.**

**[www.ecd.bnl.gov/steve](http://www.ecd.bnl.gov/steve)**