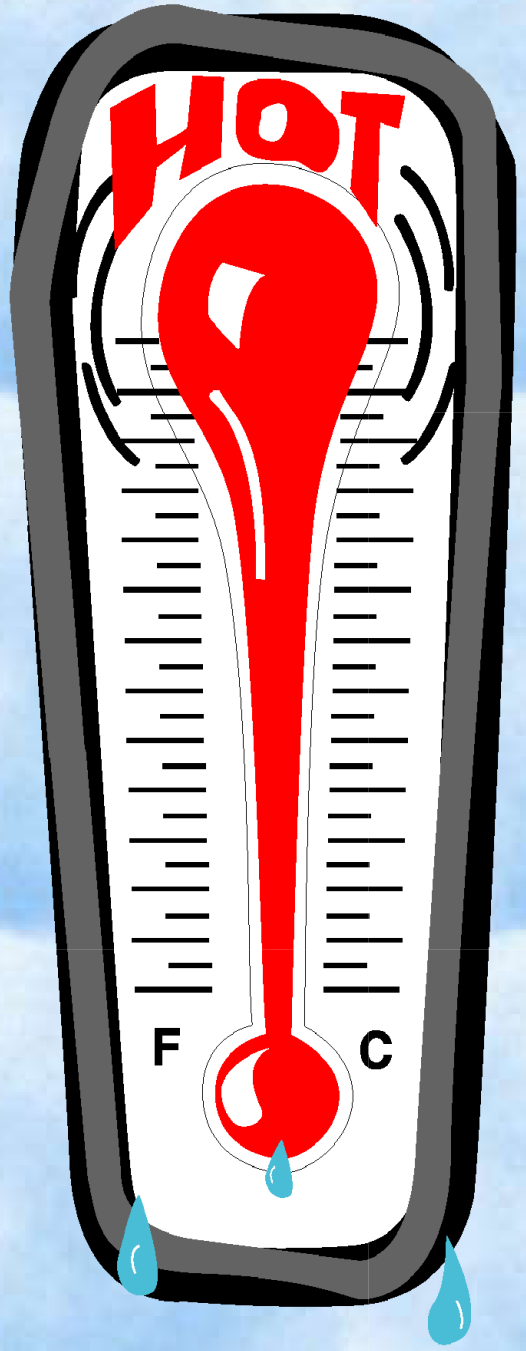


CHILLING CONSIDERATIONS REGARDING GLOBAL WARMING

Stephen E. Schwartz

BROOKHAVEN NATIONAL LABORATORY

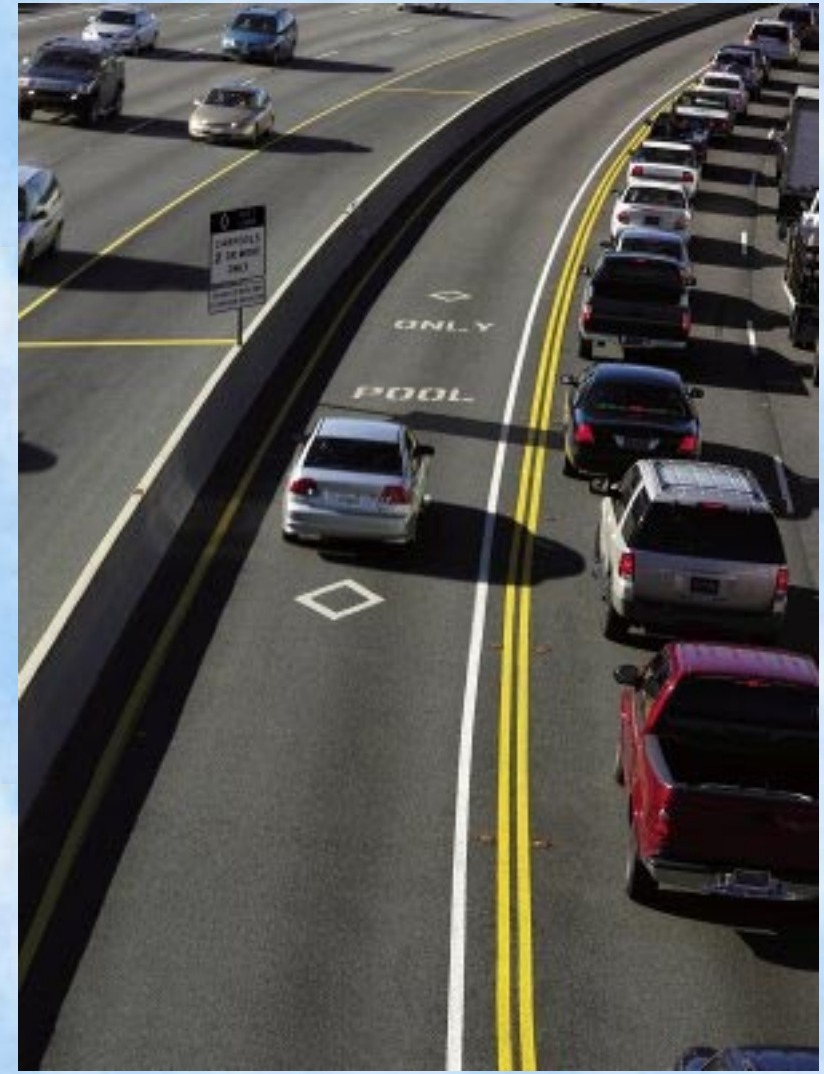
summer sundays

http://www.ecd.bnl.gov/steve

THE MOST EFFECTIVE WAY TO DOUBLE THE FUEL ECONOMY OF A CAR . . .

IS TO PUT TWO PEOPLE IN IT!

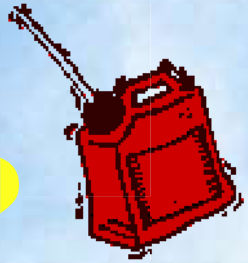
CARPOOLING CAN SAVE MORE THAN GAS



HOW MUCH CARBON IS IN A GALLON OF GASOLINE?

1 lb?

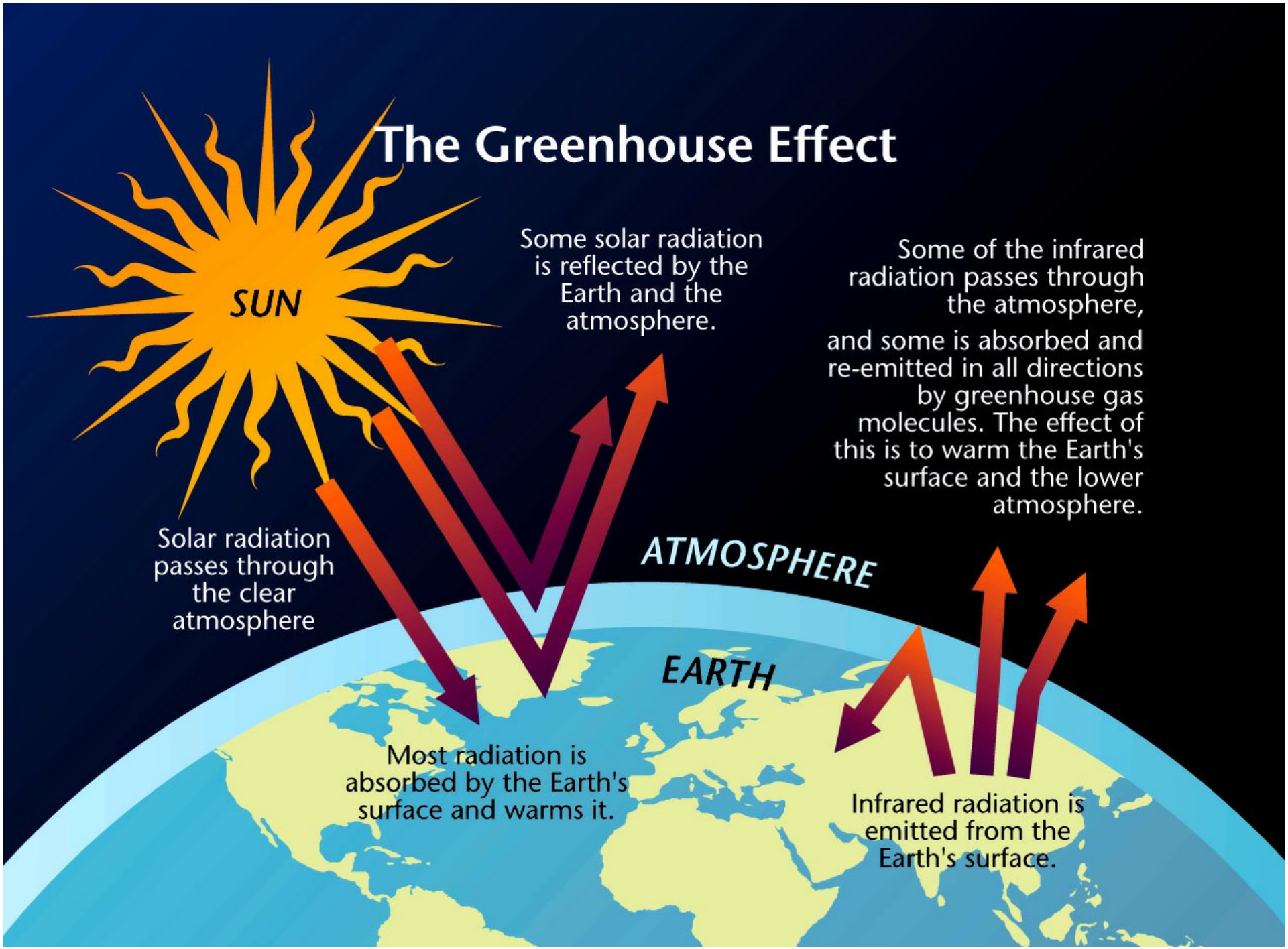
2 lbs?



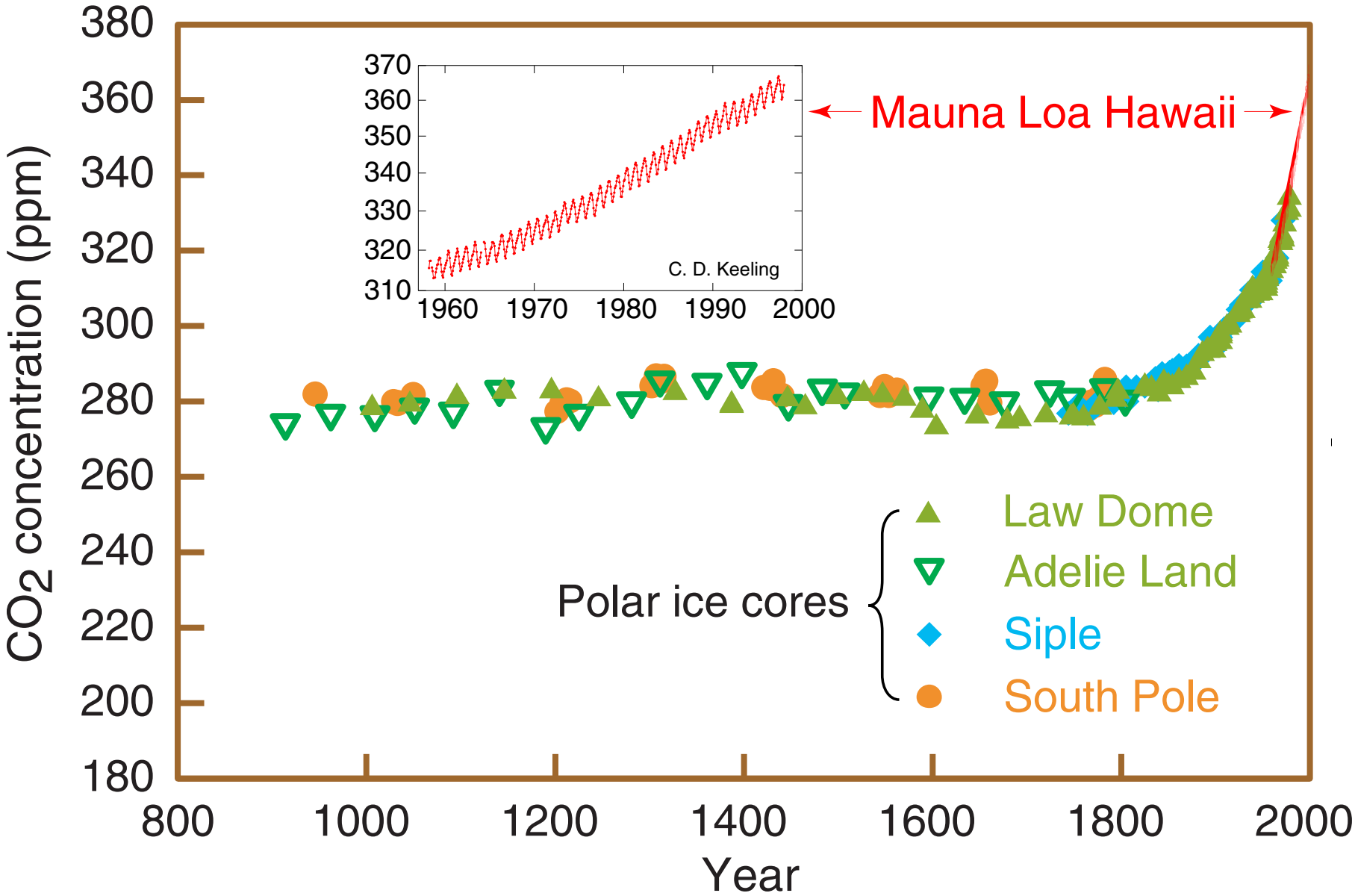
3 lbs!?

5 lbs!?!

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

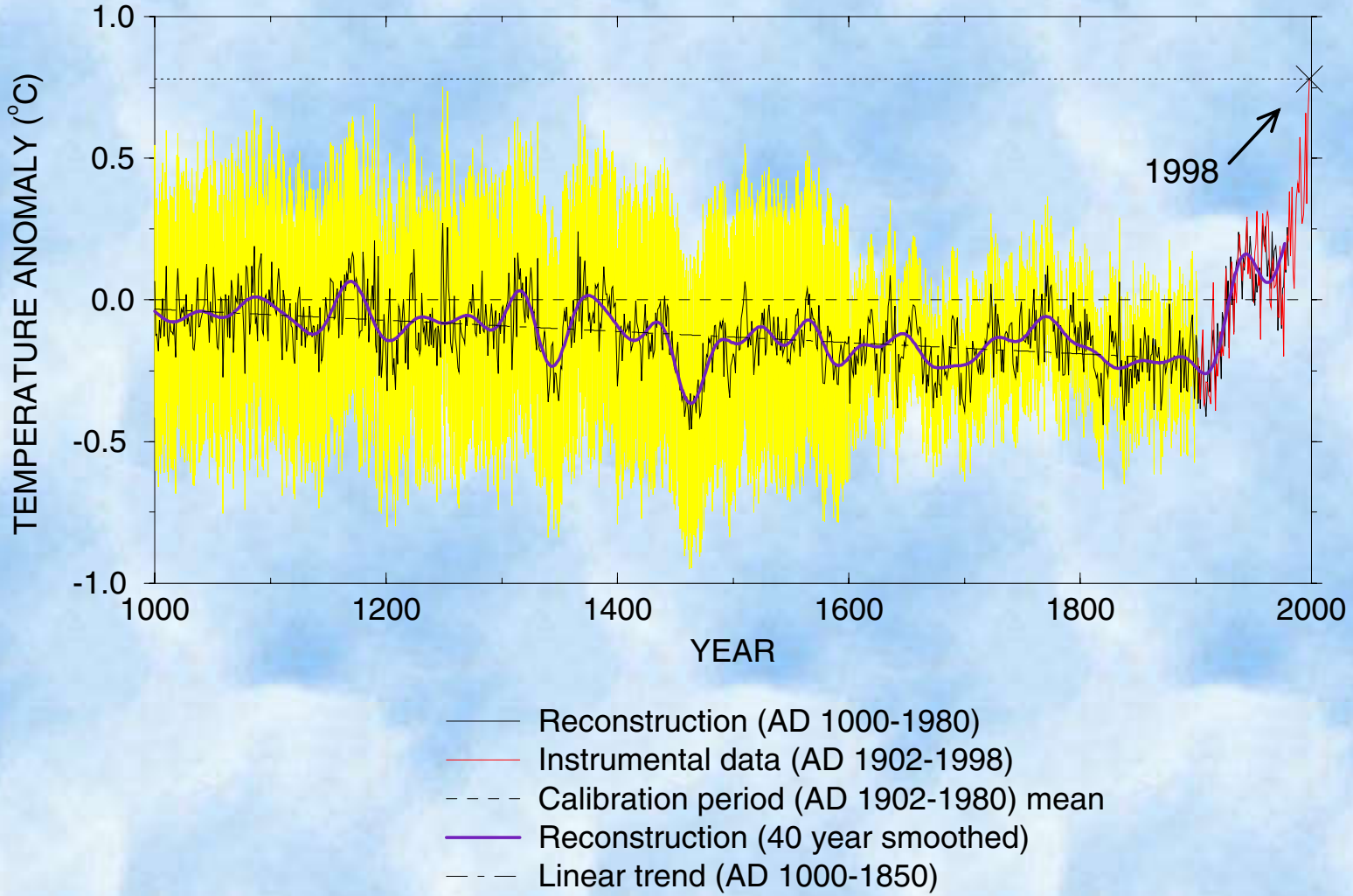

The Greenhouse Effect
SUN
Some solar radiation is reflected by the Earth and the atmosphere.
Some of the infrared radiation passes through the atmosphere,
and some is absorbed and re-emitted in all directions by greenhouse gas molecules. The effect of this is to warm the Earth's surface and the lower atmosphere.
Solar radiation passes through the clear atmosphere
ATMOSPHERE
EARTH
Most radiation is absorbed by the Earth's surface and warms it.
Infrared radiation is emitted from the Earth's surface.

ATMOSPHERIC CARBON DIOXIDE IS INCREASING



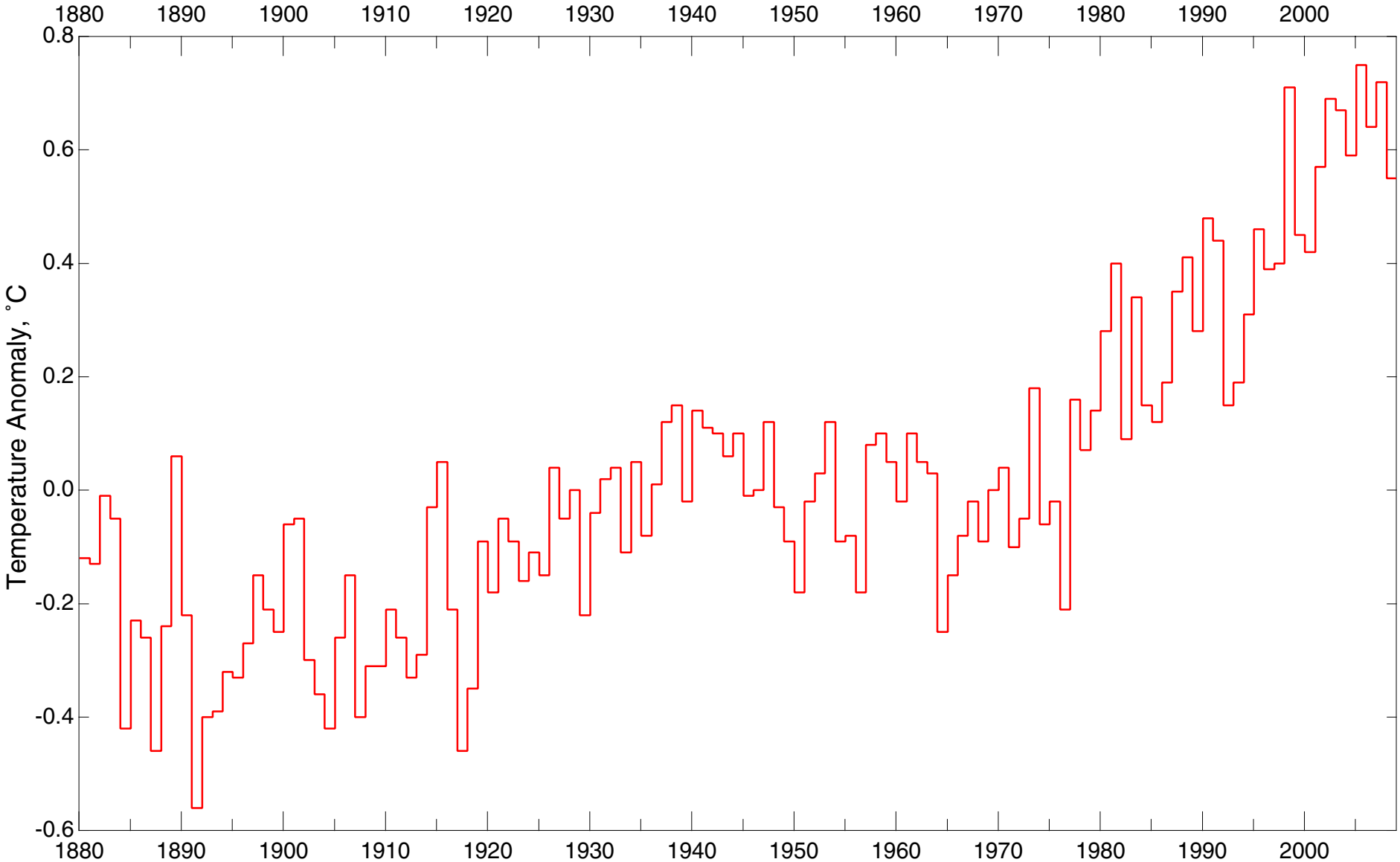
Global carbon dioxide concentration over the last thousand years

THE TEMPERATURE'S RISING



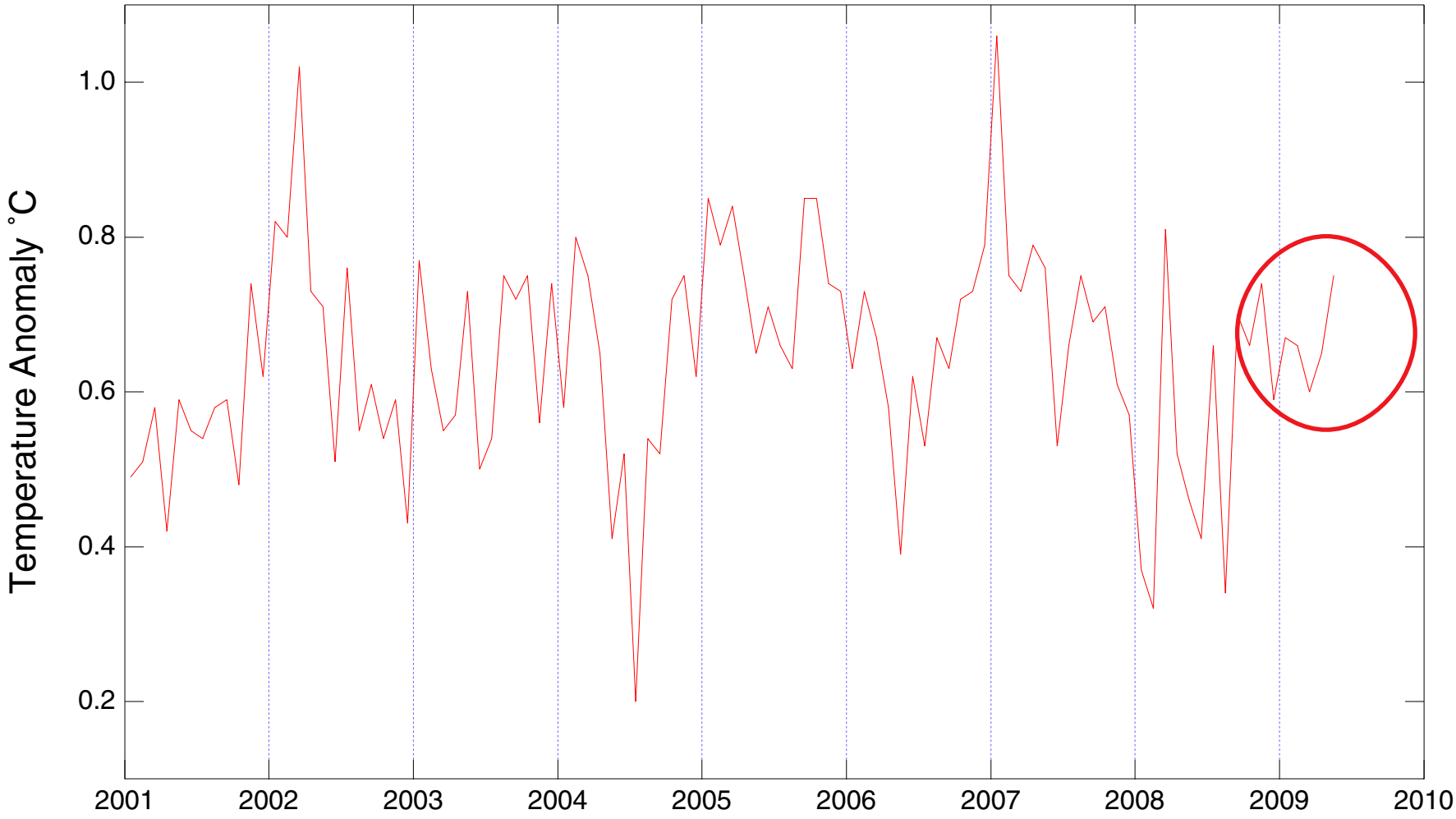
Northern Hemisphere temperature trend (1000-1998), from tree-ring, coral, and ice-core proxy records As calibrated by instrumental measurements. *Mann et al., Geophysical Research Letters, 1999*

GLOBAL ANNUAL TEMPERATURE ANOMALY, 1880-2008



Data: Goddard Institute for Space Studies

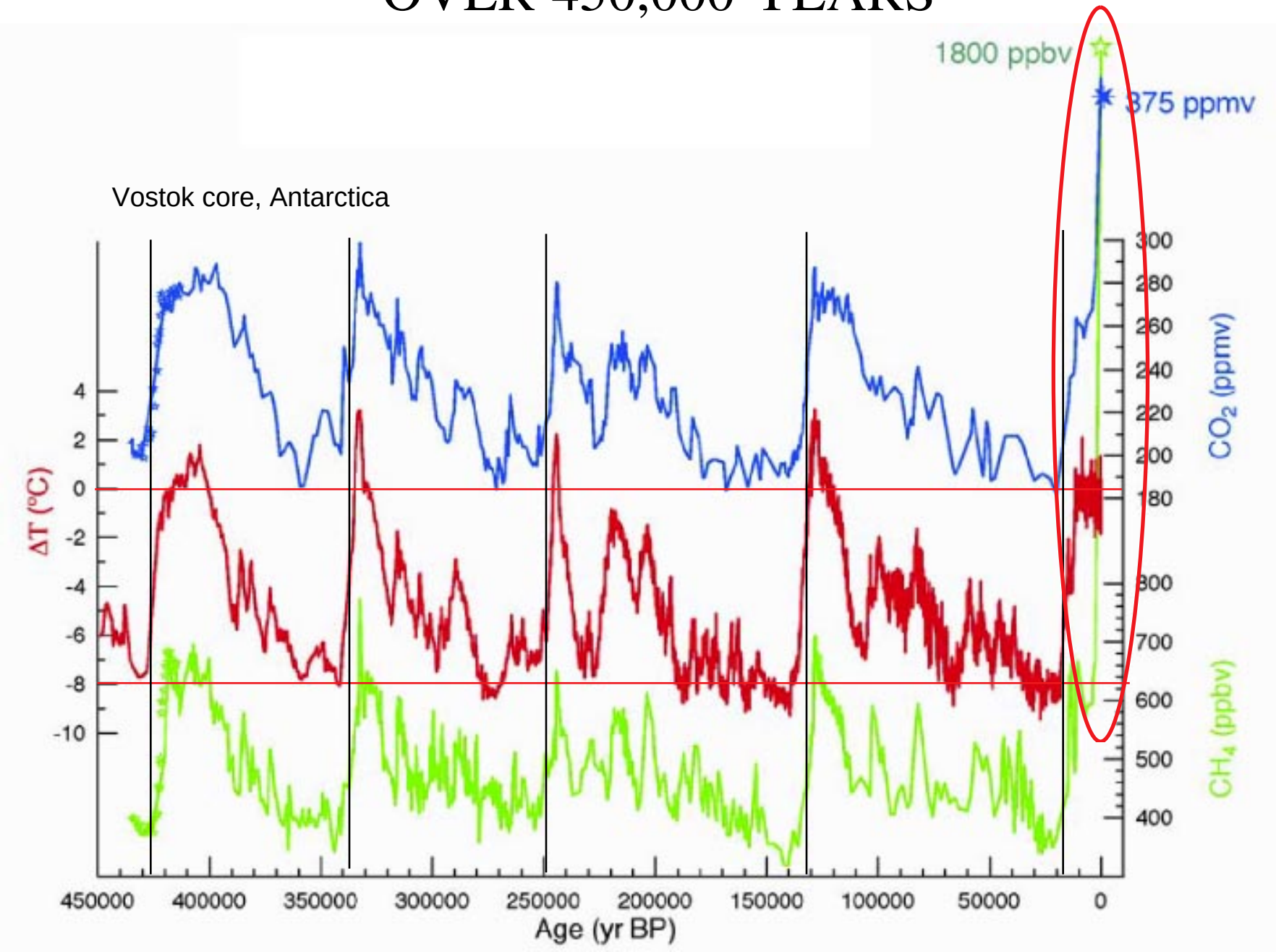
GLOBAL MONTHLY TEMPERATURE ANOMALY, 2001-2009



Data: Goddard Institute for Space Studies

Don't be fooled by a few cool months in a single region. It's still hot.

GREENHOUSE GASES AND TEMPERATURE OVER 450,000 YEARS



Modified from Petit et al., Nature, 1999

G8 Leaders Decide on Warming Limit

Temperatures must not rise by 2° Celsius

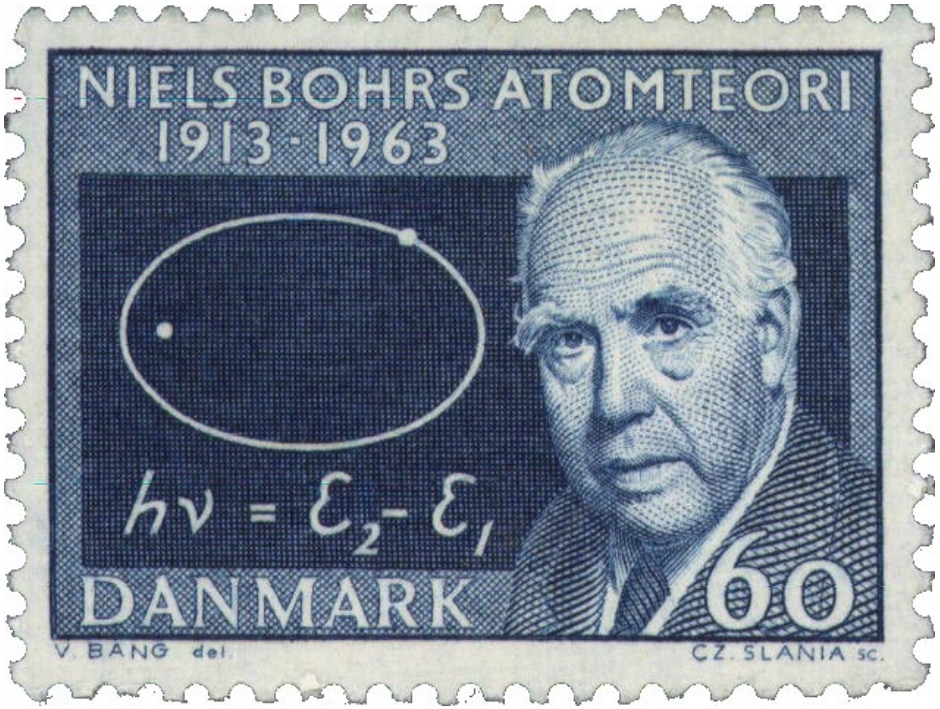
10th of July 2009, 11:02 GMT

ENLARGE

According to a declaration published by the participant nations in the G8 Summit this year, developing and developed nations alike have agreed that global temperatures must not be allowed to increase by more than 2° Celsius from 1990 levels. Leaders of the most powerful countries discussed with presidents and other heads of state from around the world, and convened to take action at the December UN summit, to be held in Copenhagen, Denmark. The announcement is very important, as a failure of these talks would have meant a failure at the UN meeting as well, the BBC News reports.

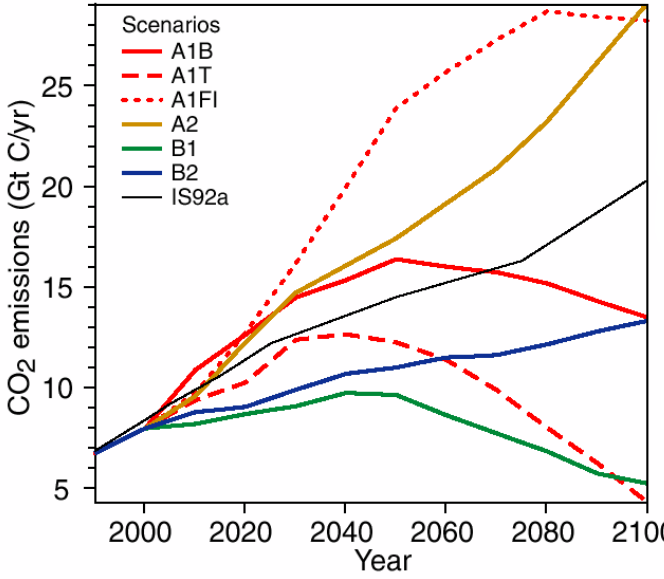
Looking to the Future . . .

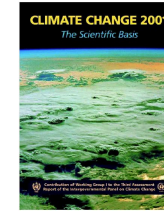
Prediction is difficult, especially about the future.



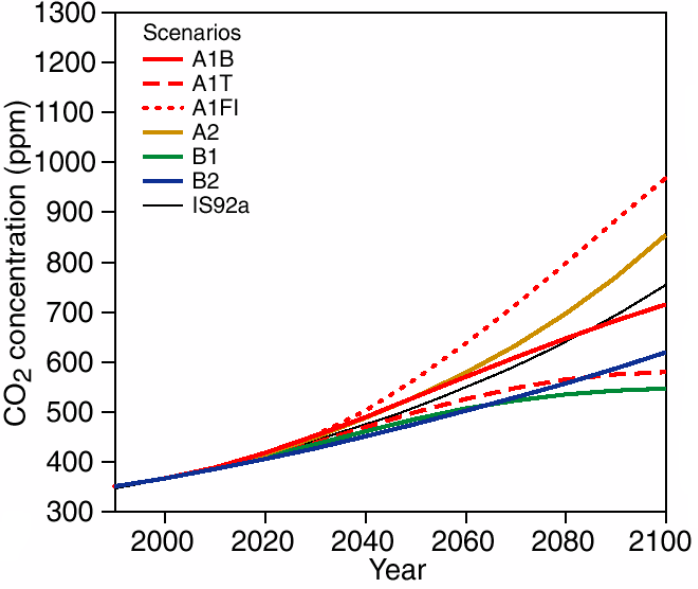
– Niels Bohr

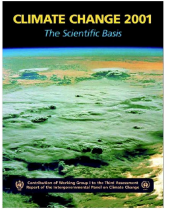
PROJECTIONS OF FUTURE CO2 EMISSIONS



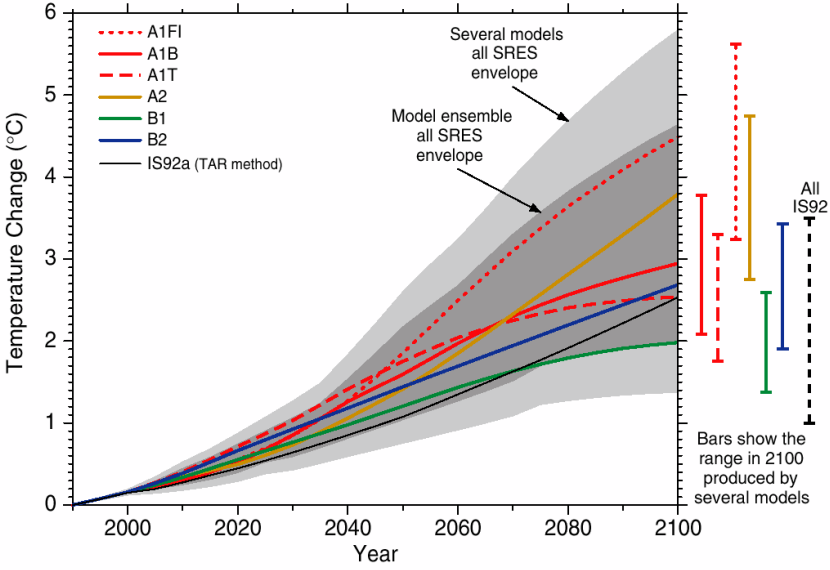


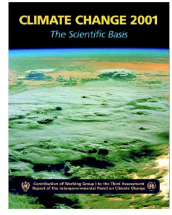
PROJECTIONS OF FUTURE CO2 CONCENTRATIONS



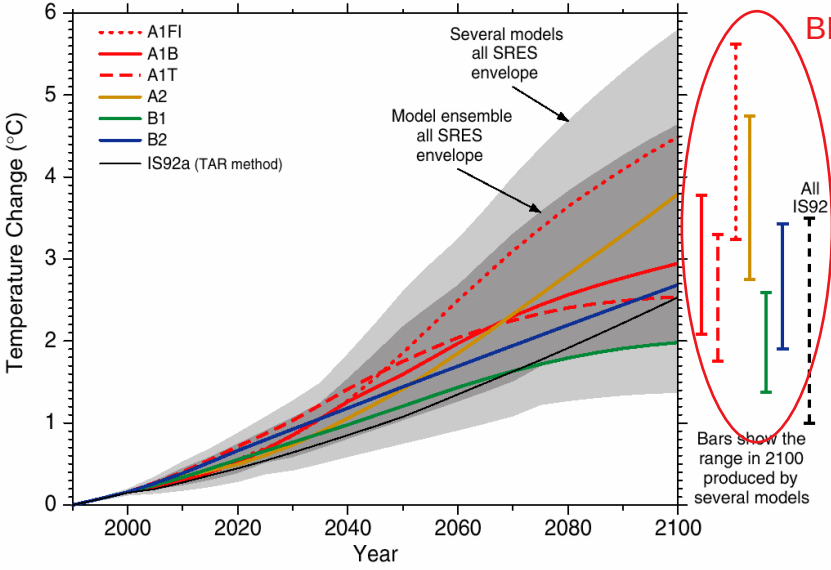


PROJECTIONS OF FUTURE TEMPERATURE CHANGE

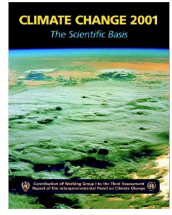




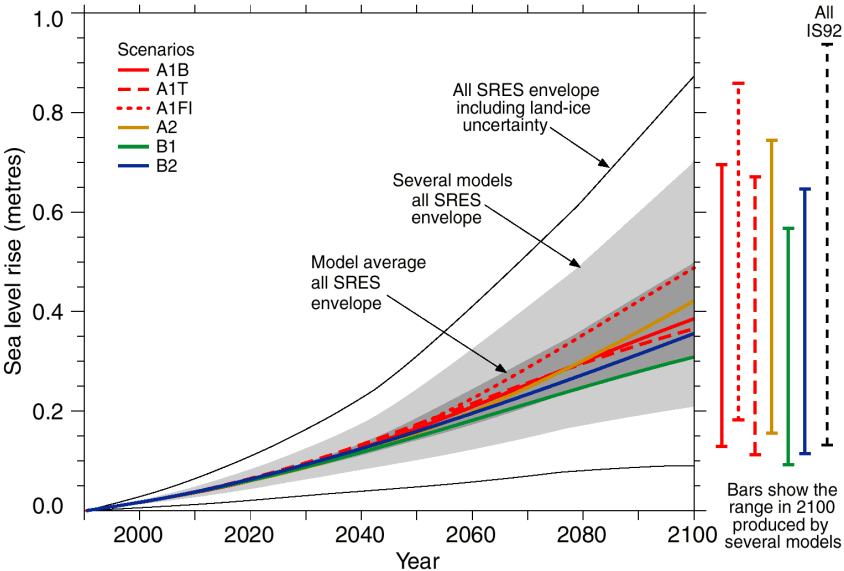
PROJECTIONS OF FUTURE TEMPERATURE CHANGE

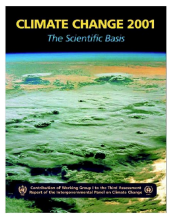


BNL Research



PROJECTIONS OF FUTURE SEA LEVEL RISE

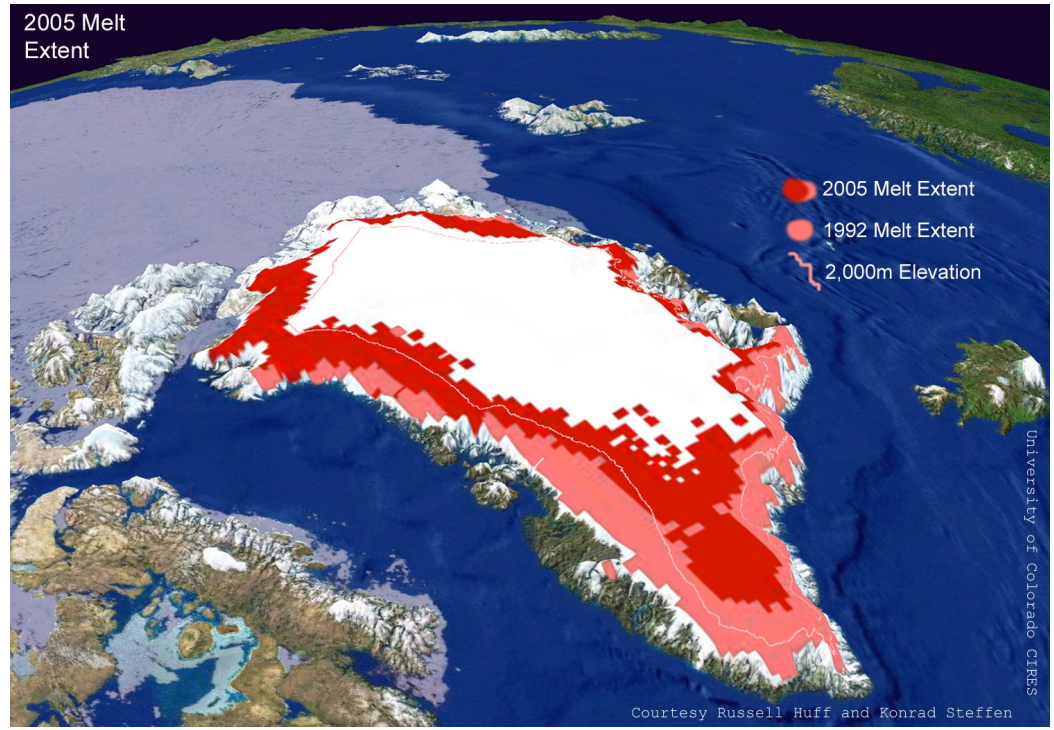


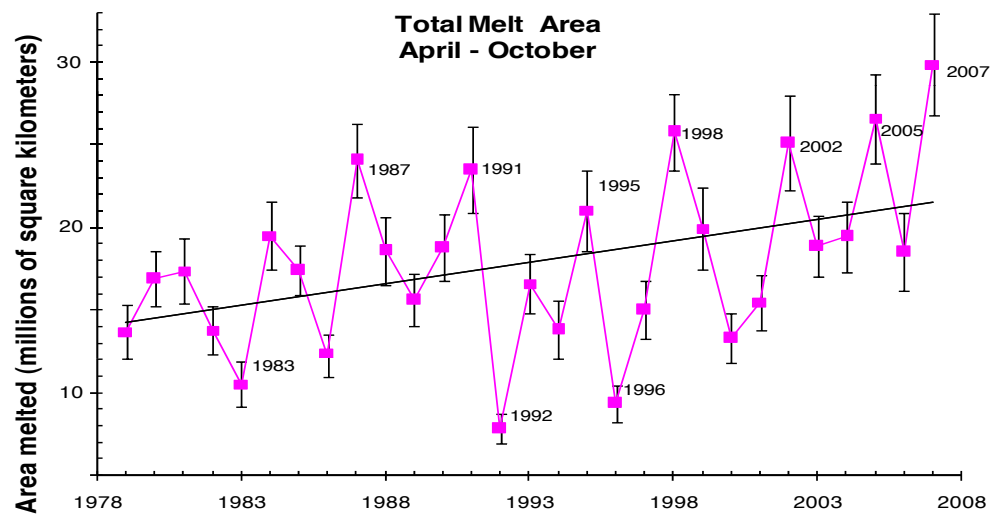


MELTING OF GREENLAND ICE CAP

Satellite determination of maximum extent of glacial melt

NASA





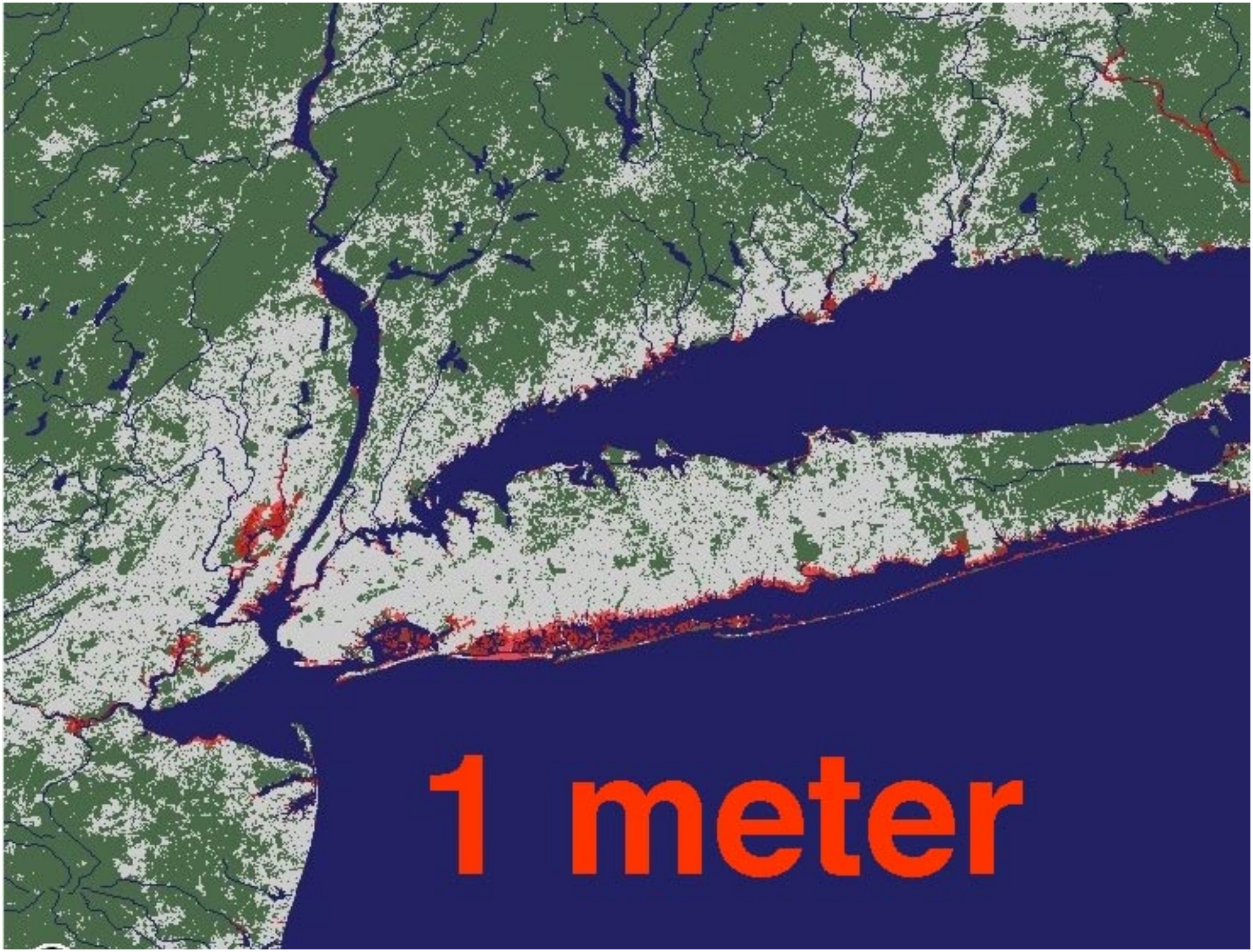
Steffen & Huff , Univ. Colo., 2005

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

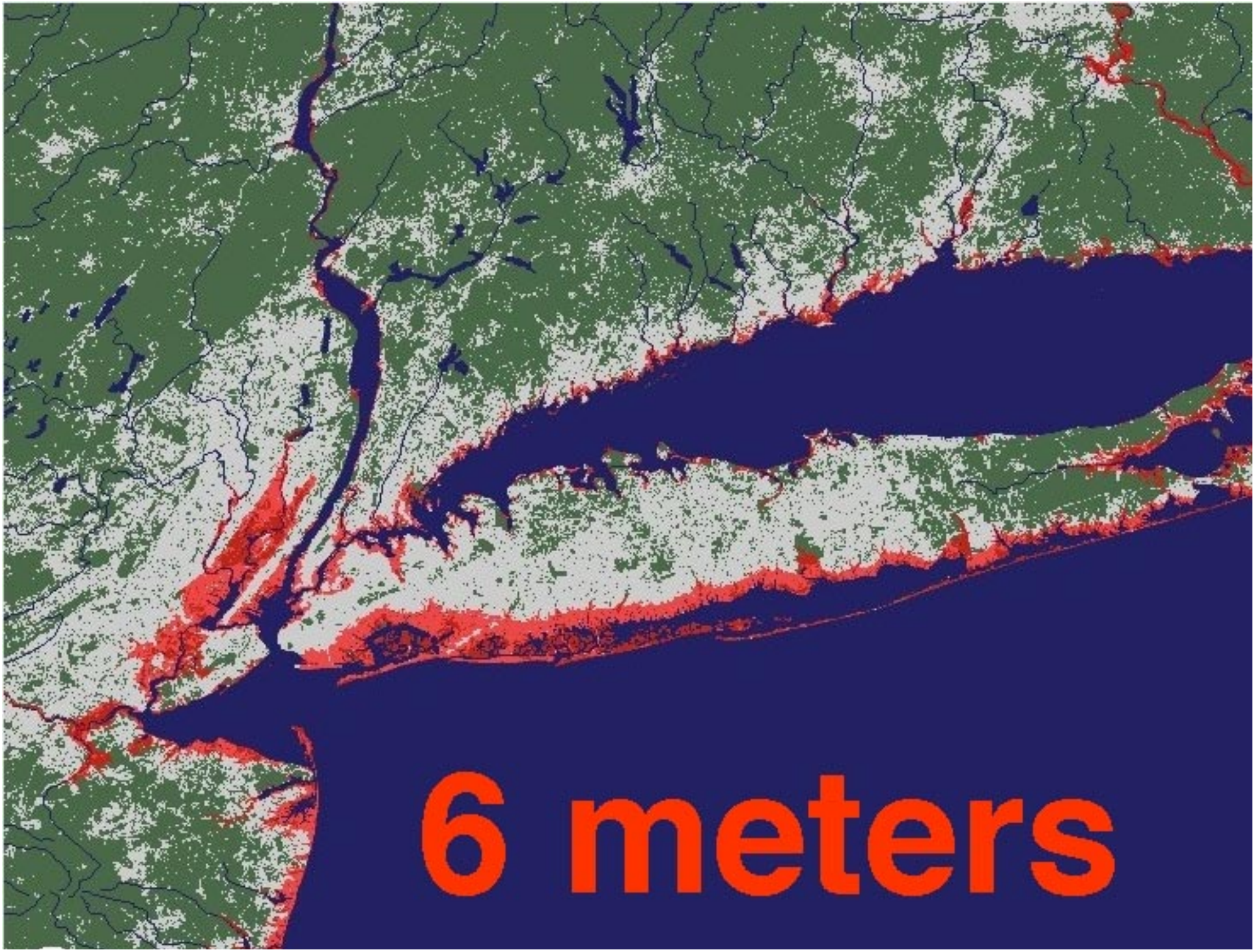

1 meter

2 meters

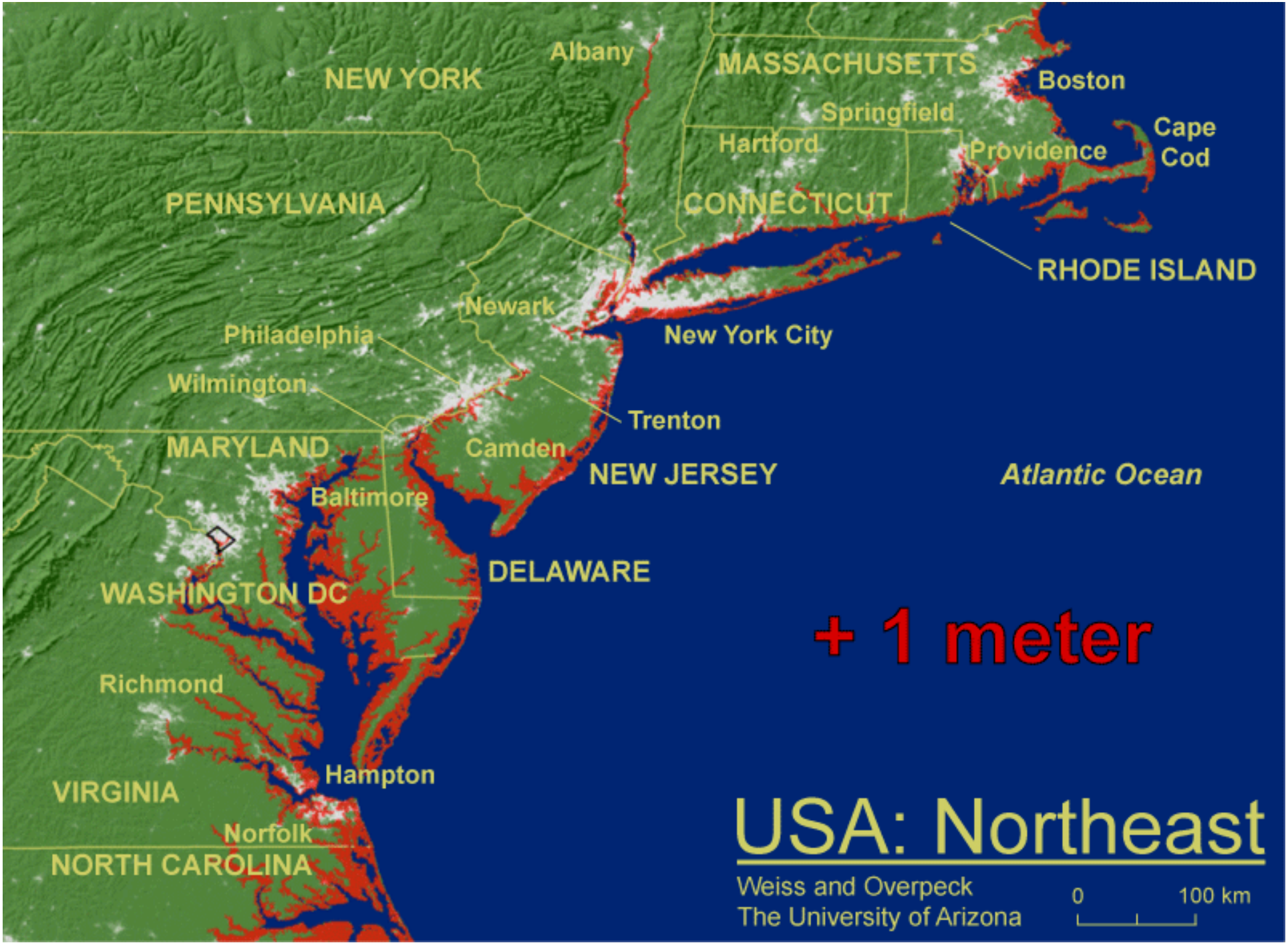
3 meters

4 meters

5 meters

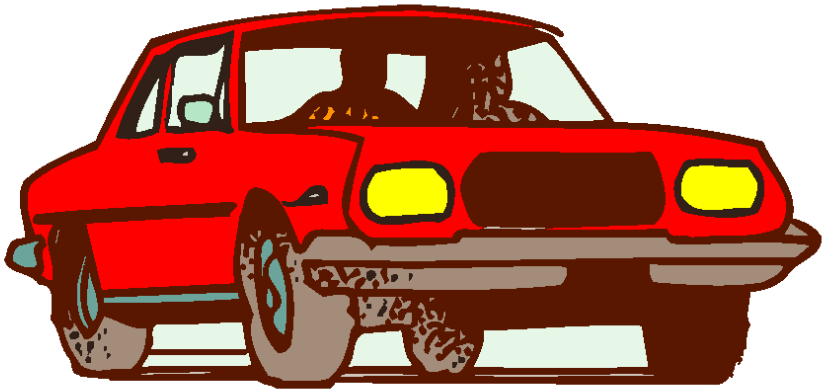

6 meters

NEW YORK
Albany
MASSACHUSETTS
Boston
Springfield
Cape Cod
Hartford
Providence
PENNSYLVANIA
CONNECTICUT
RHODE ISLAND
Newark
Philadelphia
New York City
Wilmington
Trenton
MARYLAND
Camden
NEW JERSEY
Atlantic Ocean
Baltimore
DELAWARE
WASHINGTON DC
Present
Richmond
Hampton
VIRGINIA
Norfolk
NORTH CAROLINA
USA: Northeast
Weiss and Overpeck
The University of Arizona
0
100 km


NEW YORK
Albany
MASSACHUSETTS
Boston
Springfield
Hartford
Providence
Cape Cod
PENNSYLVANIA
CONNECTICUT
RHODE ISLAND
Newark
New York City
Philadelphia
Wilmington
Trenton
MARYLAND
Camden
NEW JERSEY
Atlantic Ocean
Baltimore
DELAWARE
WASHINGTON DC
+ 1 meter
Richmond
Hampton
VIRGINIA
Norfolk
NORTH CAROLINA
USA: Northeast
Weiss and Overpeck
The University of Arizona
0
100 km

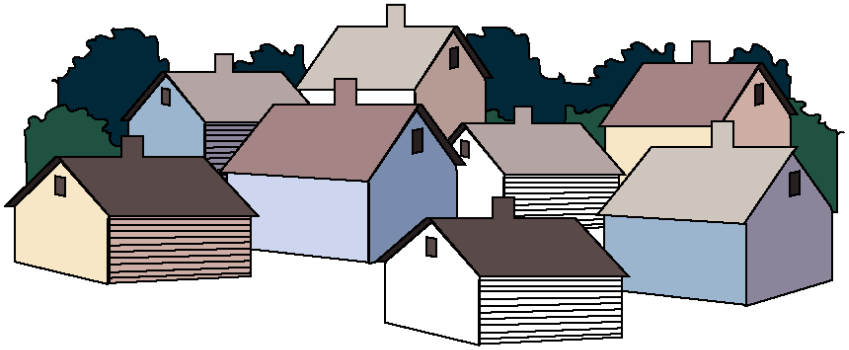
WHERE IS THIS CARBON DIOXIDE COMING FROM?

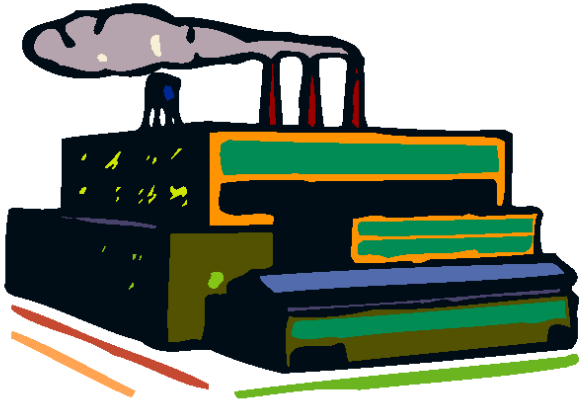
WE ARE ALL RESPONSIBLE.



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.





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

THANK YOU

summer sundays

BROOKHAVEN
NATIONAL LABORATORY

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