

Climate Change and Energy Use in Today's World: Chilling Considerations Regarding Global Warming

STEPHEN E. SCHWARTZ

www.ecd.bnl.gov/steve

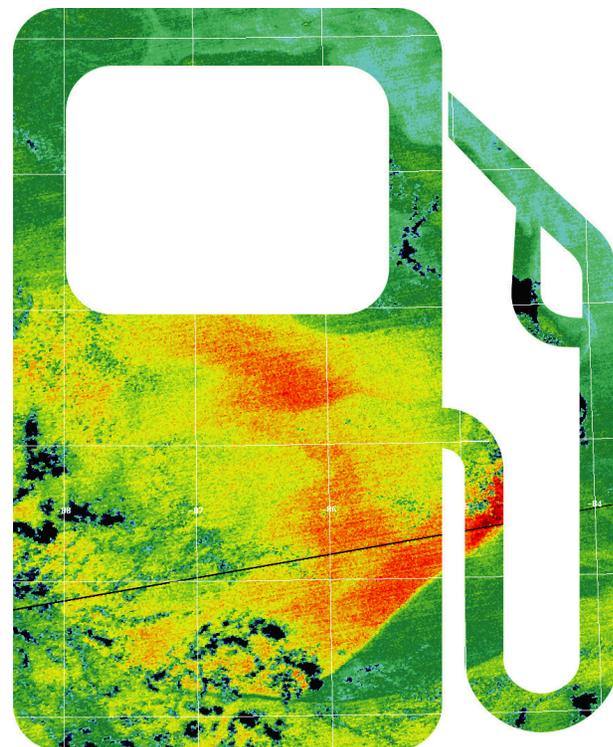
BROOKHAVEN

NATIONAL LABORATORY

Upton, Long Island, New York

University of Nevada, Reno

April 4, 2011

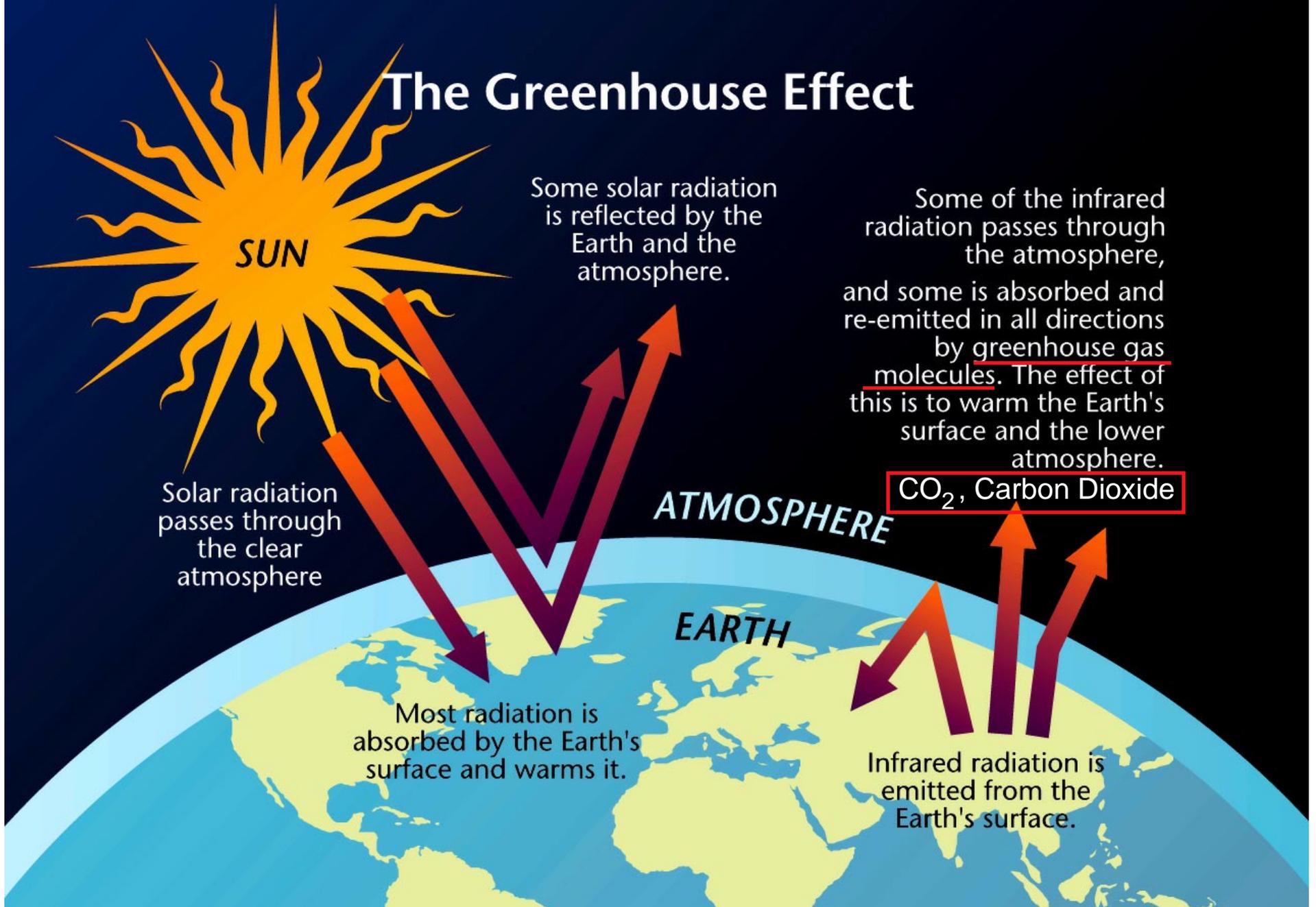


FREE PUBLIC LECTURE SERIES

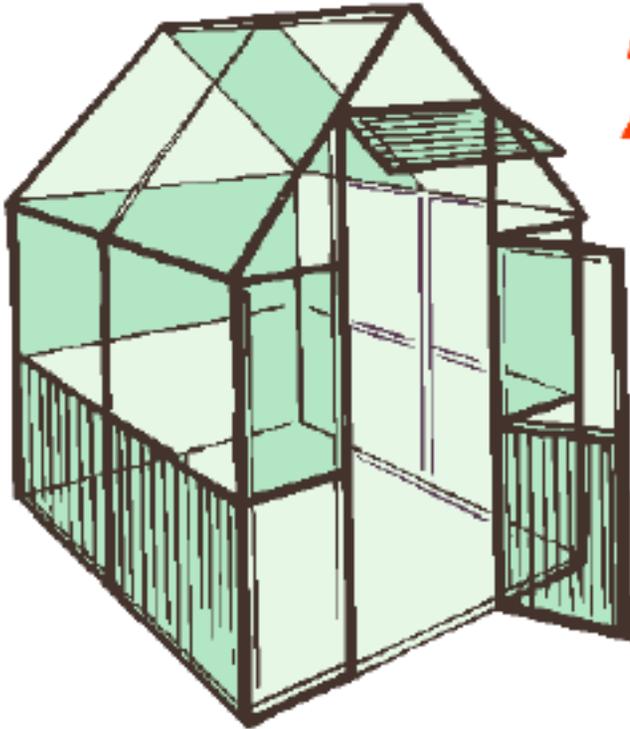


SCIENCE NEVADA.ORG

The Greenhouse Effect



THE GREENHOUSE EFFECT



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.

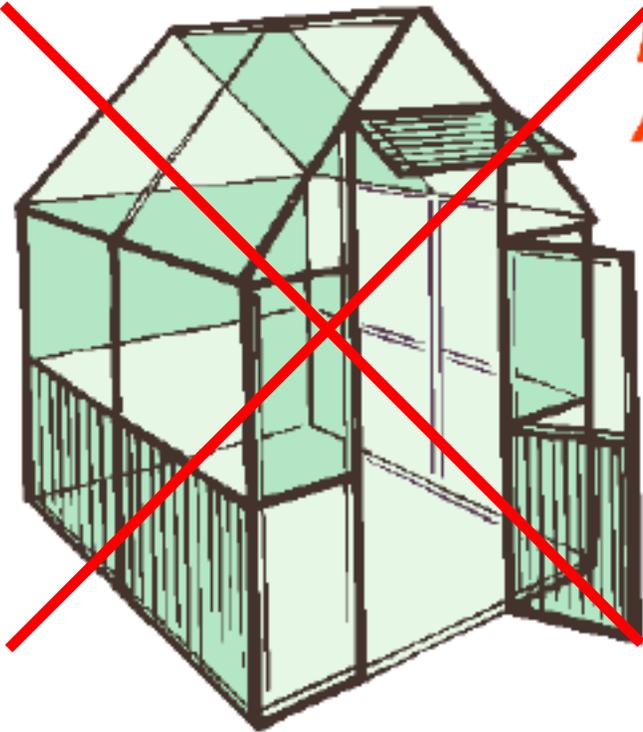
This is the greenhouse effect.

Global average temperature 15°C or 59°F

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

Global average temperature -19°C or -2°F

THE GREENHOUSE EFFECT



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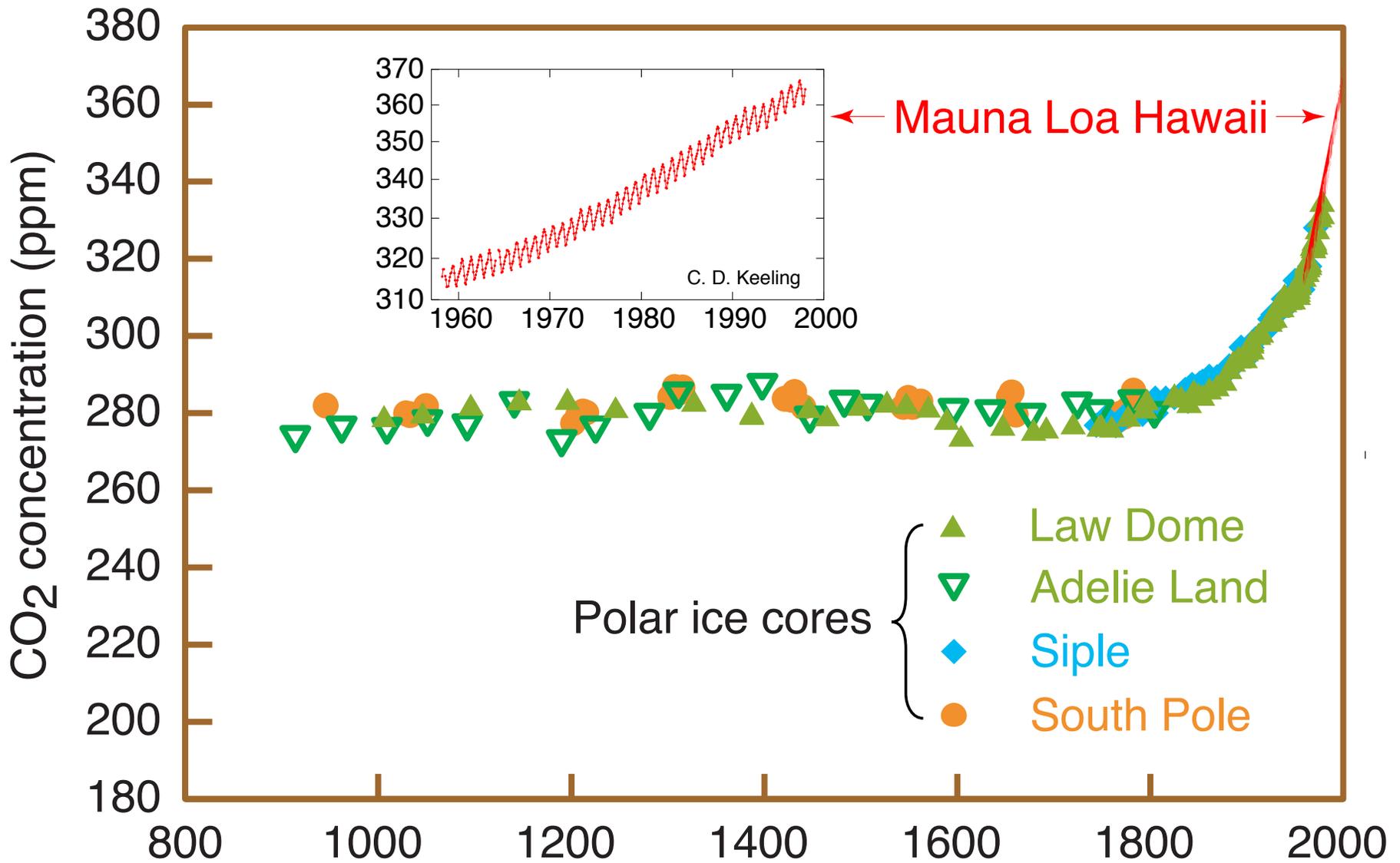
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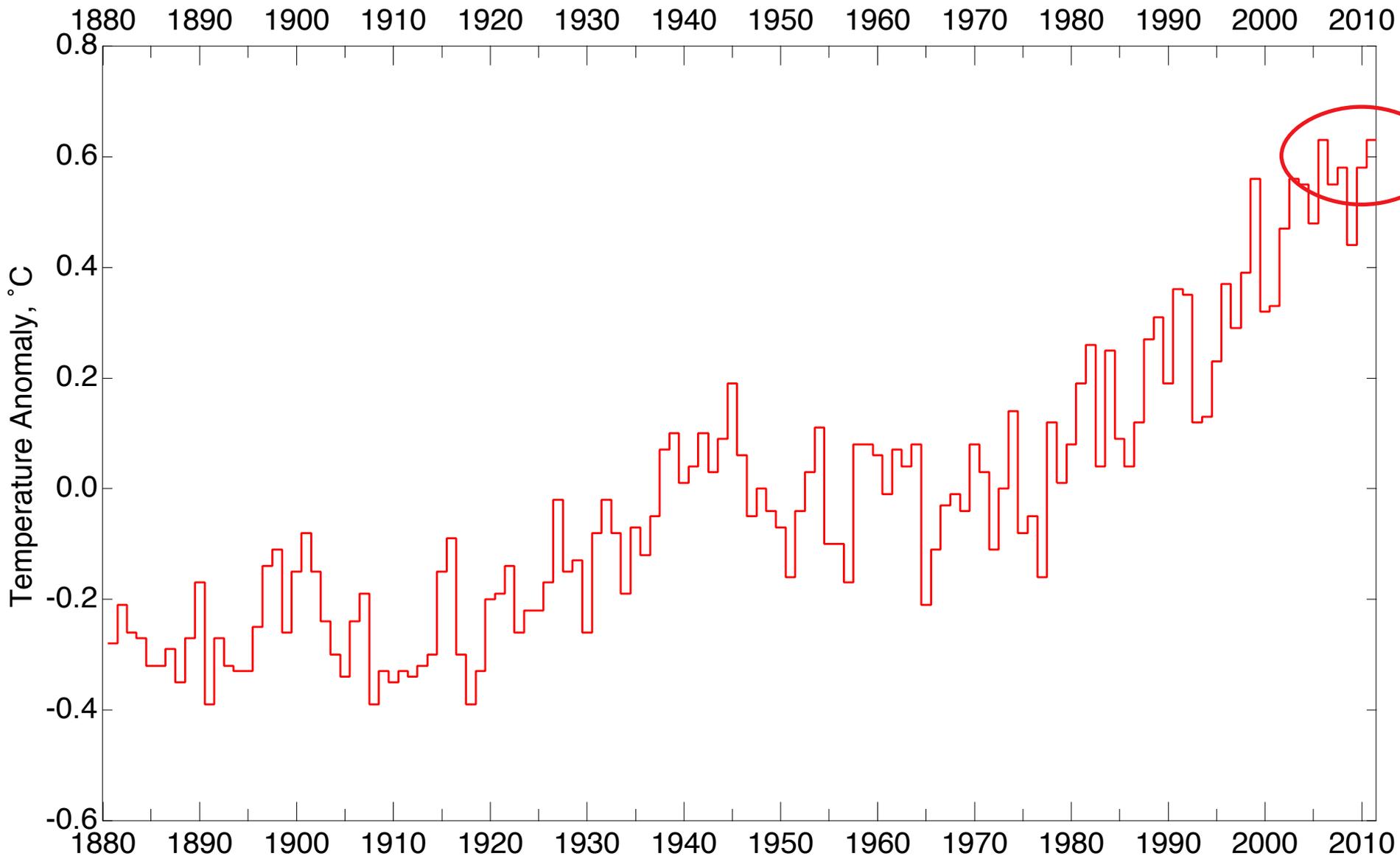
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ATMOSPHERIC CARBON DIOXIDE IS INCREASING



Global carbon dioxide concentration over the last thousand years

GLOBAL ANNUAL TEMPERATURE ANOMALY, 1880-2010



Data: Goddard Institute for Space Studies

PASTERZE GLACIER, AUSTRIA 1875 - 2004



About 2 km shorter.

Terminus replaced by artificial lake.

Decrease in length about 15 meters per year.

In 2003, decrease was 30 m in length and 6.5 m in thickness.

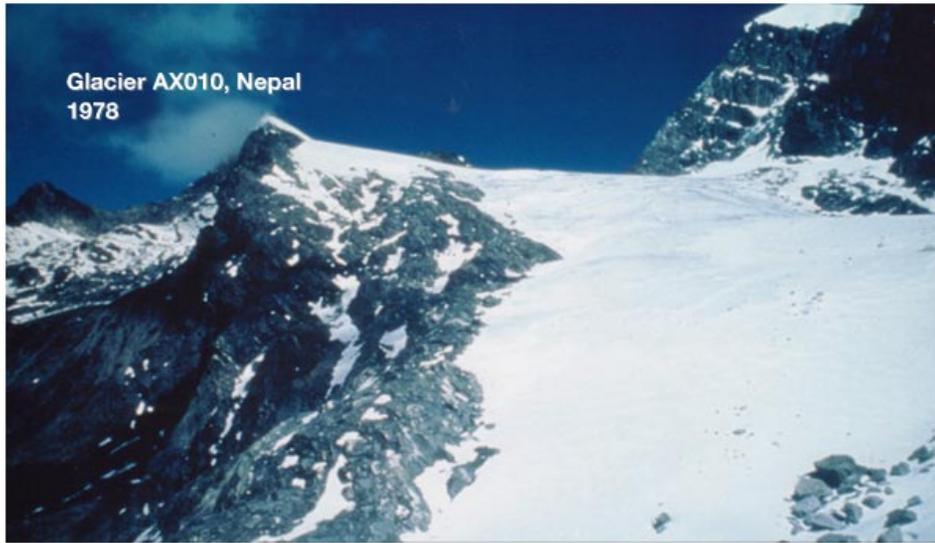
<http://www.worldviewofglobalwarming.org/pages/glaciers.html>

GRINNELL GLACIER GLACIER NATIONAL PARK 1911 - 2000



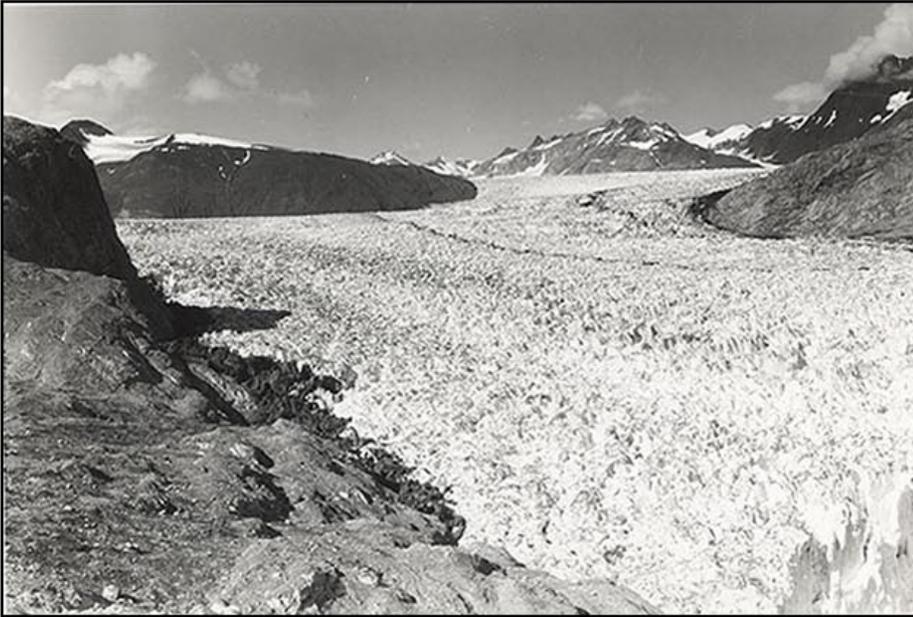
<http://www.worldviewofglobalwarming.org/pages/glaciers.html>

GLACIER AX010, NEPAL, 1978-2004



<http://snowman.ihas.nagoya-u.ac.jp/download/photo/AX010.html>

MUIR GLACIER - MUIR INLET GLACIER BAY NATIONAL PARK, ALASKA 1941 vs. 2004



Muir Glacier, William O. Field on 13 August 1941 and by Bruce F. Molnia on 31 August 2004

UPSALA GLACIER, ANDES, ARGENTINA

1928



2004



RHONE GLACIER, VALAIS, SWITZERLAND 1859 - 2001



Glacial retreat is 2.5 km.

Base is 450 meters higher.

<http://www.worldviewofglobalwarming.org/pages/glaciers.html>

INDIA



The New York Times

Sunday, August 1, 2010 Last Update: 8:08 AM ET

Floods in Pakistan Kill at Least 800



AUSTRALIA



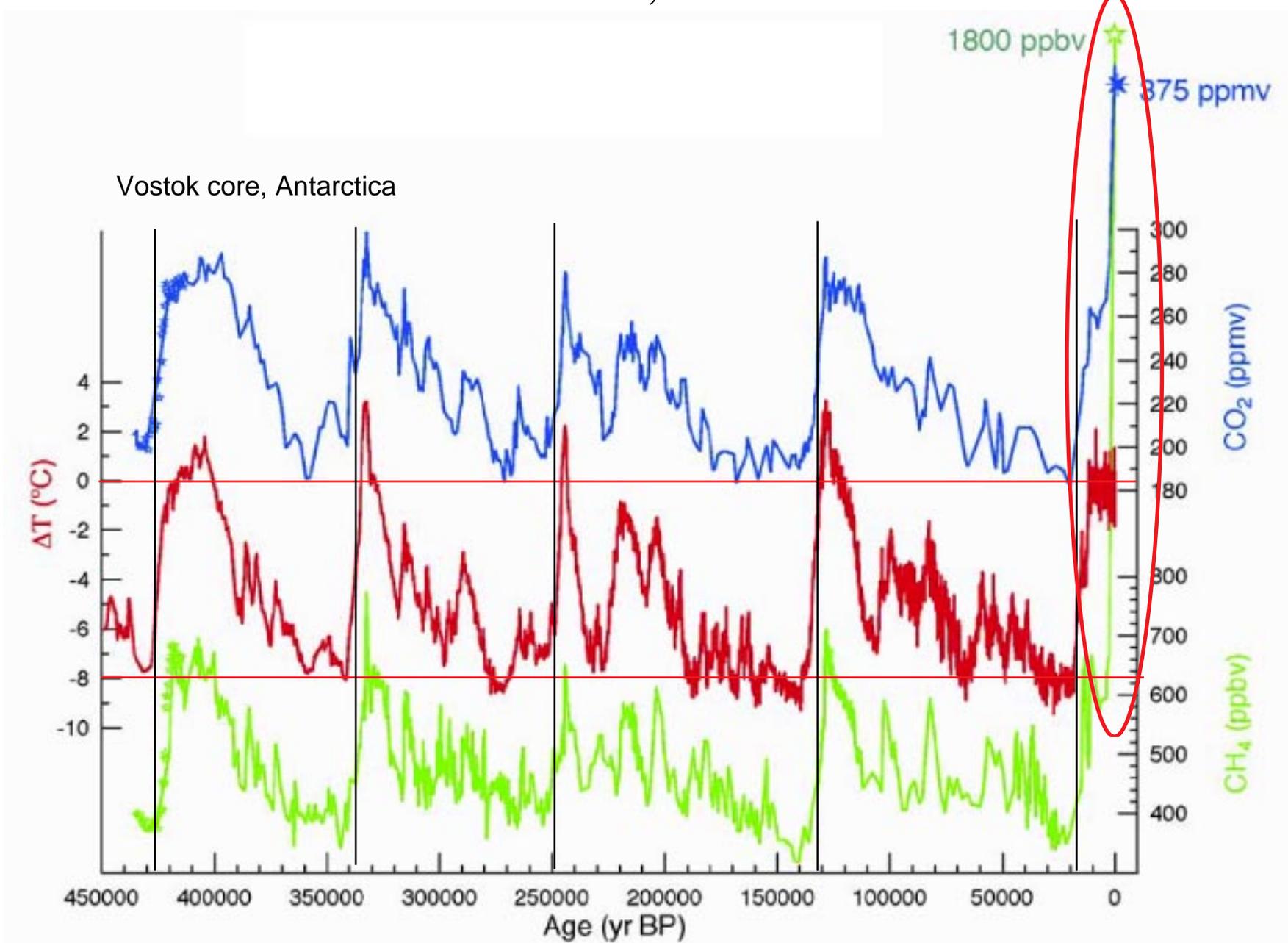
INDIA



ALASKA



GREENHOUSE GASES AND TEMPERATURE OVER 450,000 YEARS



Modified from Petit et al., Nature, 1999



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

***IS TO PUT TWO
PEOPLE IN IT!***



CARPOOLING CAN SAVE MORE THAN GAS



2009 COPENHAGEN ACCORD ENDORSES 2°C (3.6 °F) MAXIMUM TEMPERATURE RISE

The Heads of State, Heads of Government, Ministers, and other heads of the following delegations present at the United Nations Climate Change Conference 2009 in Copenhagen:¹
Albania, Algeria, Armenia, Australia, Austria, Bahamas, Bangladesh, Belarus, Belgium, Benin, Bhutan,

▪ ▪ ▪

Tonga, Trinidad and Tobago, Tunisia, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, United Republic of Tanzania, United States of America, Uruguay and Zambia,

▪ ▪ ▪

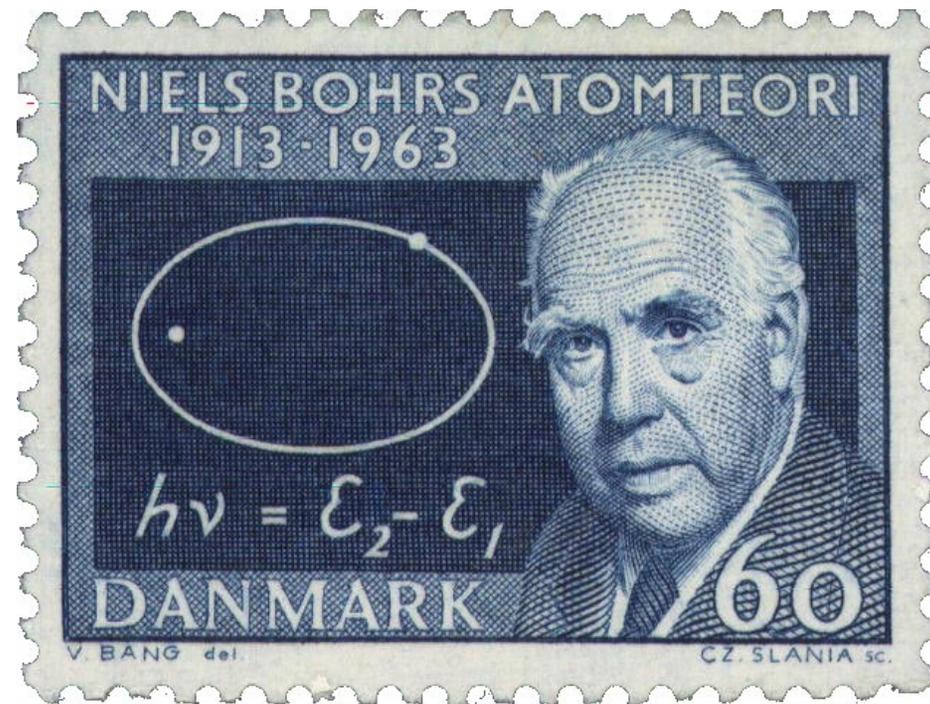
Have agreed on this Copenhagen Accord which is operational immediately.

1. We underline that climate change is one of the greatest challenges of our time. We emphasise our strong political will to urgently combat climate change in accordance with the principle of common but differentiated responsibilities and respective capabilities. To achieve the ultimate objective of the Convention to stabilize greenhouse gas concentration in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, we shall, recognizing the scientific view that the increase in global temperature should be below 2 degrees Celsius, on the basis of equity and in the context of sustainable development, enhance our long-term cooperative action to combat climate change. We recognize the critical impacts of climate change and the potential impacts of response measures on countries particularly vulnerable to its adverse effects and stress the need to establish a comprehensive adaptation programme including international support.

*Looking to the
Future . . .*

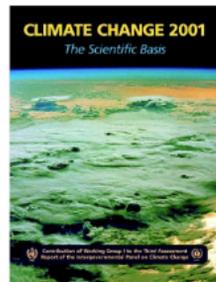
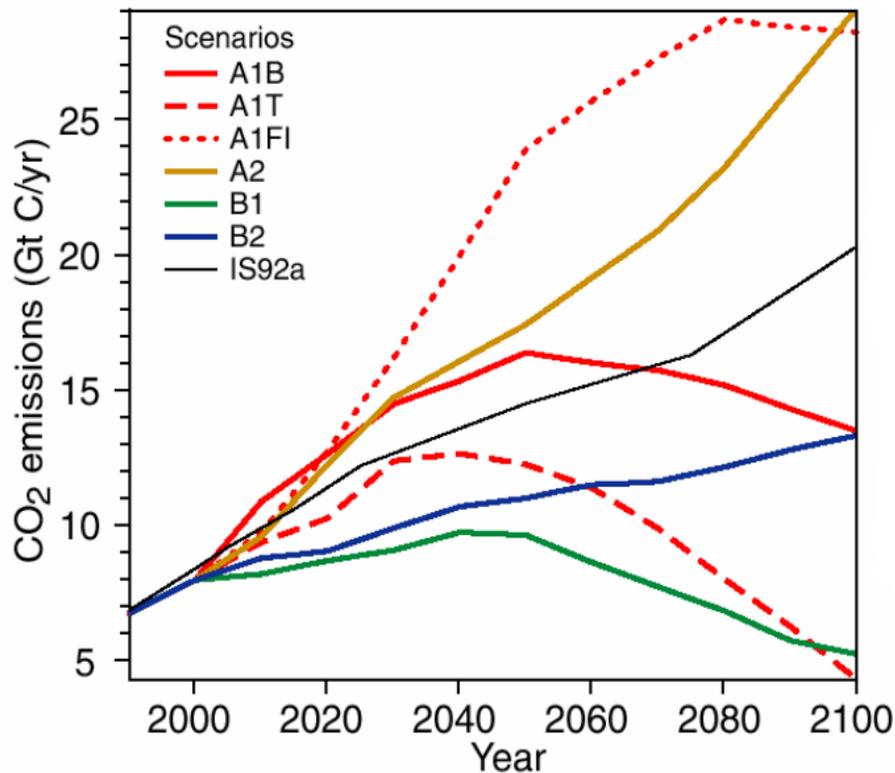


*Prediction is difficult,
especially about the future.*

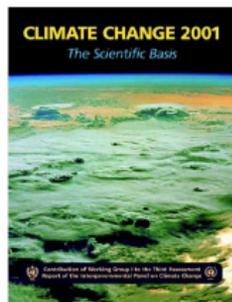
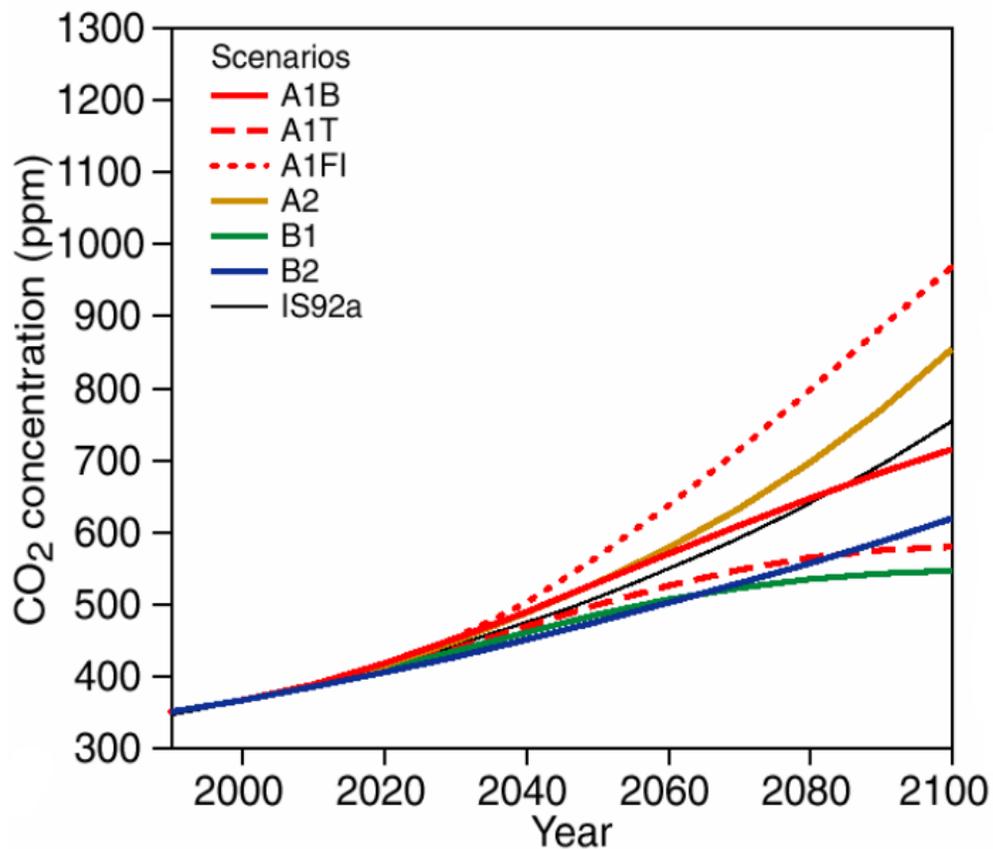


– Niels Bohr

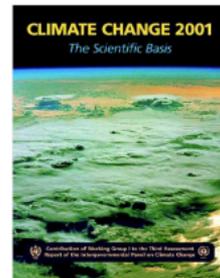
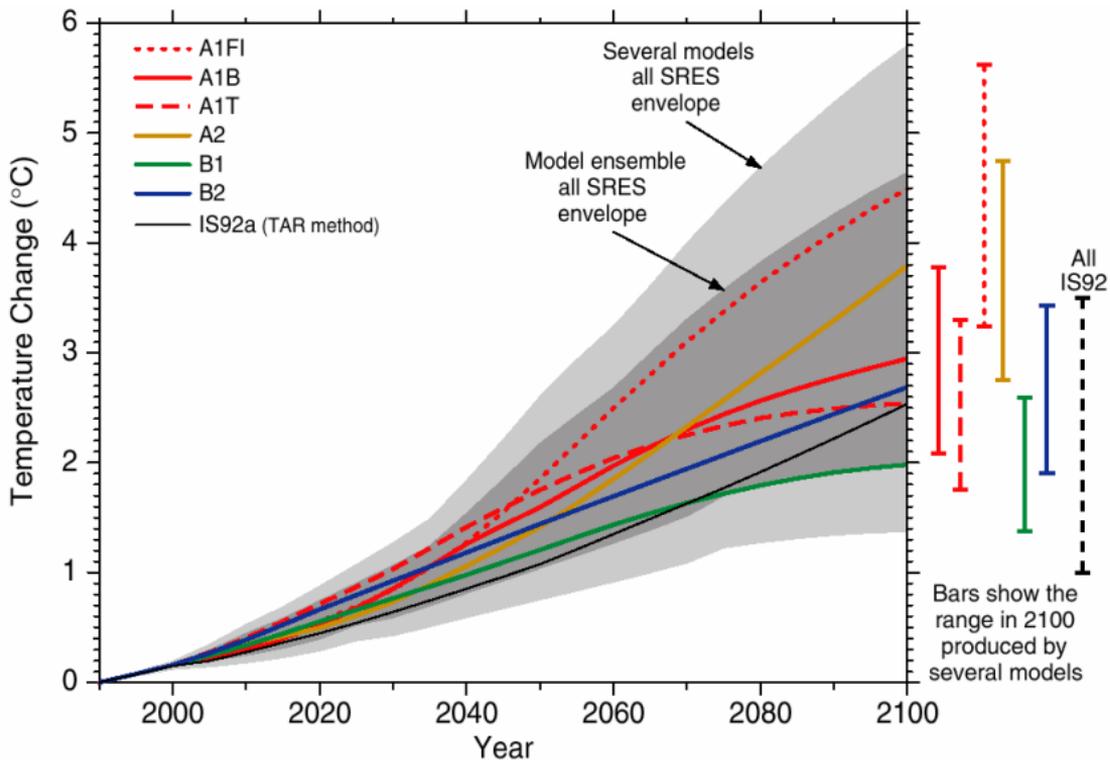
PROJECTIONS OF FUTURE CO₂ EMISSIONS



PROJECTIONS OF FUTURE CO₂ CONCENTRATIONS

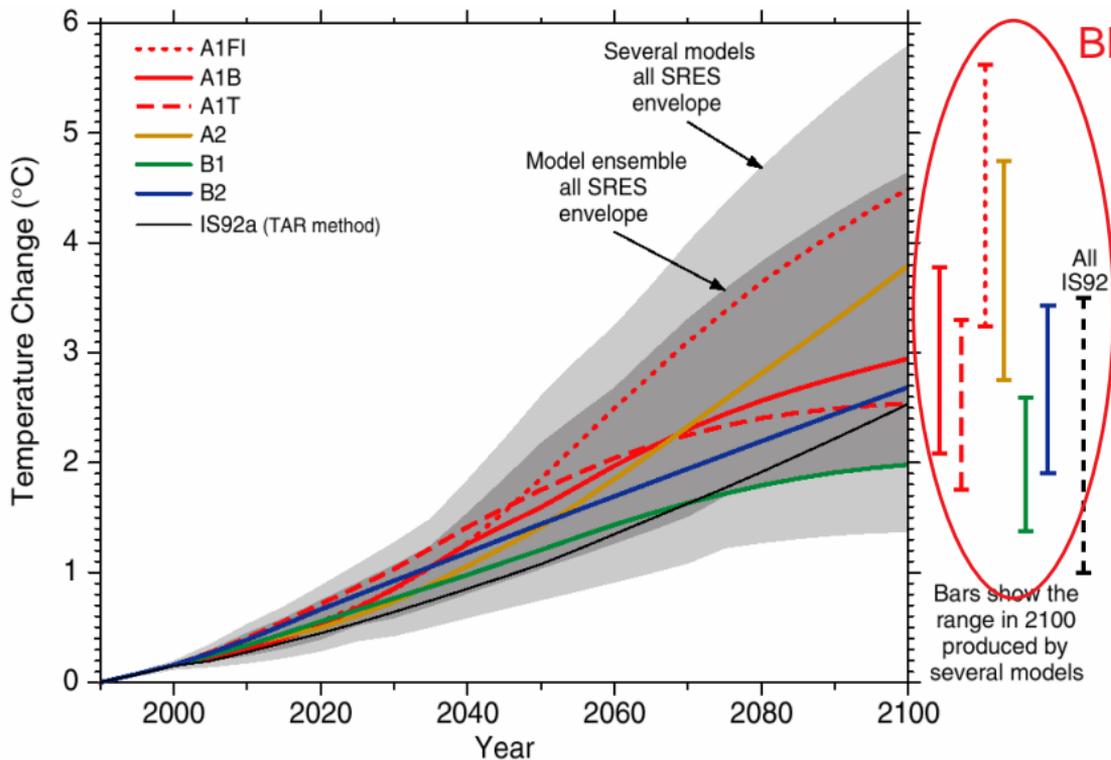


PROJECTIONS OF FUTURE TEMPERATURE CHANGE

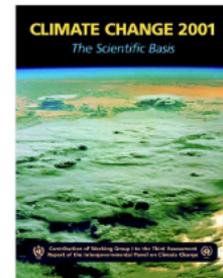


Bars show the range in 2100 produced by several models

PROJECTIONS OF FUTURE TEMPERATURE CHANGE

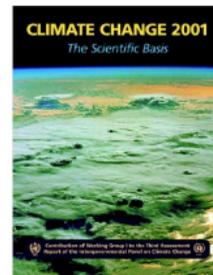
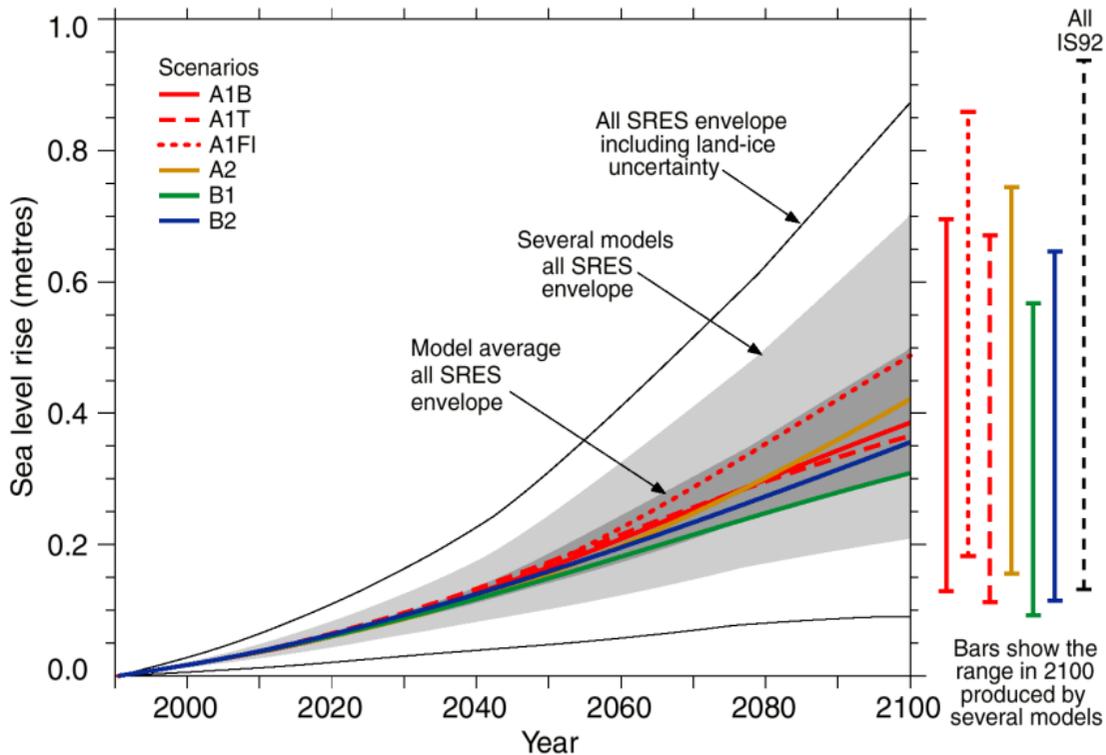


BNL Research



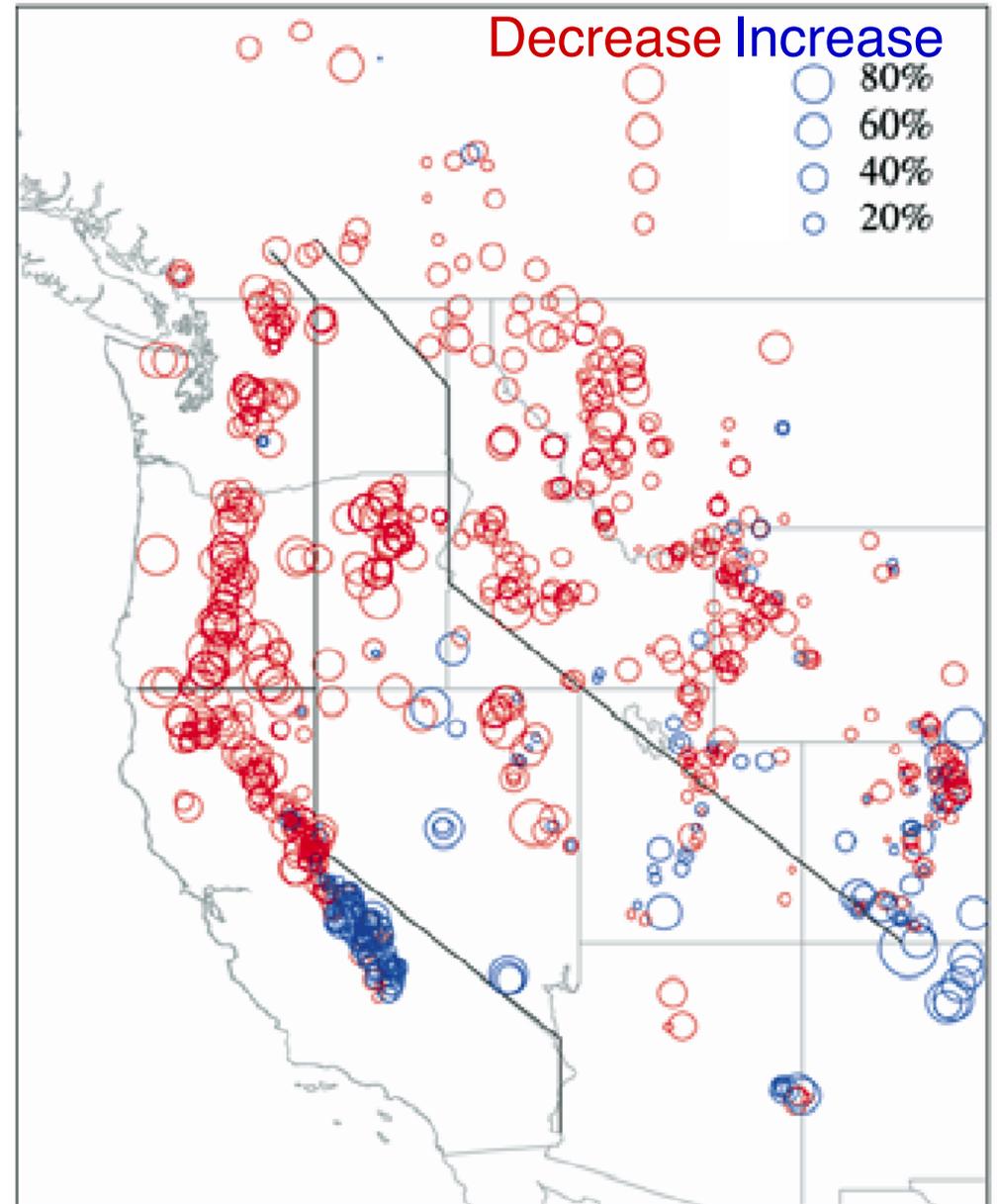
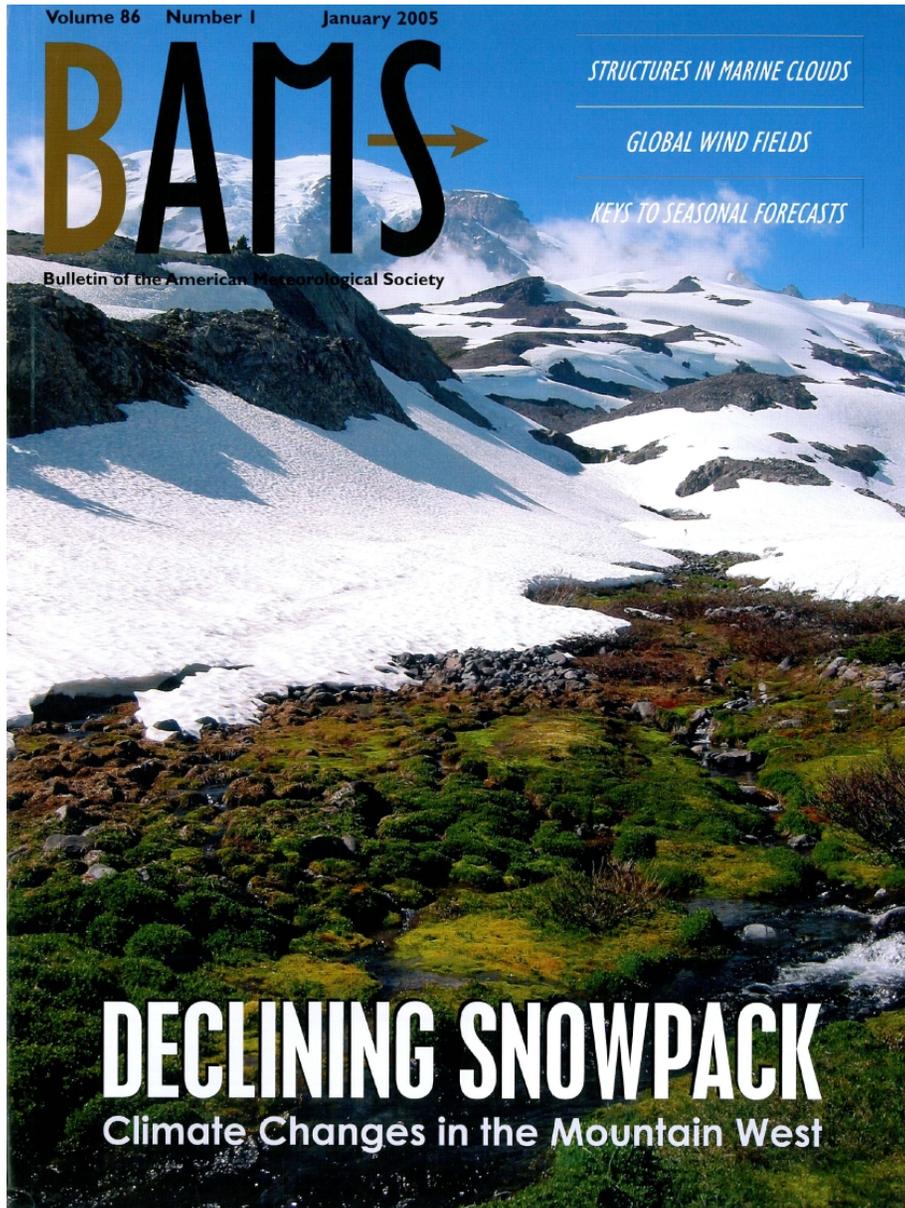
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PROJECTIONS OF FUTURE SEA LEVEL RISE



DECLINING SNOWPACK

A major issue in the West



MELTING OF GREENLAND ICE CAP

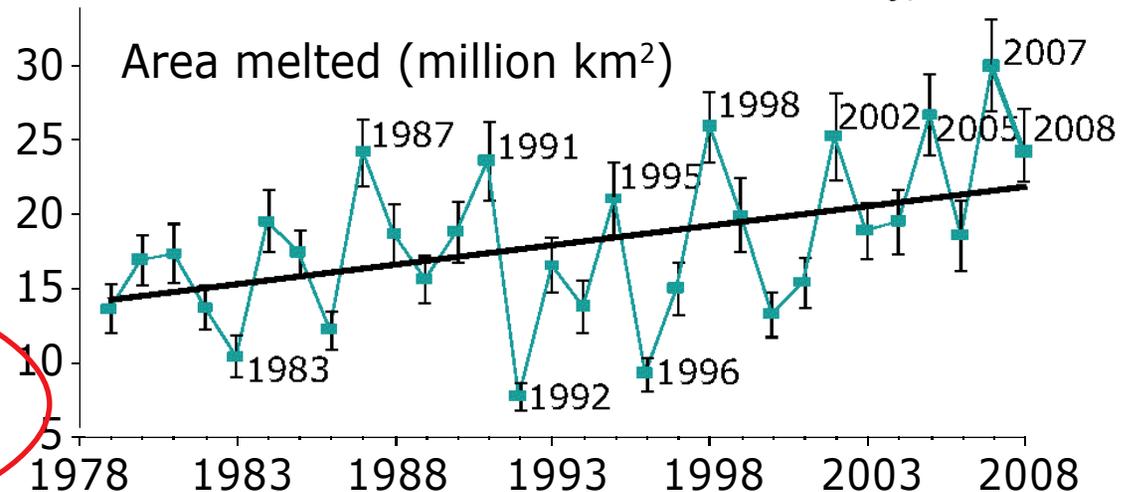
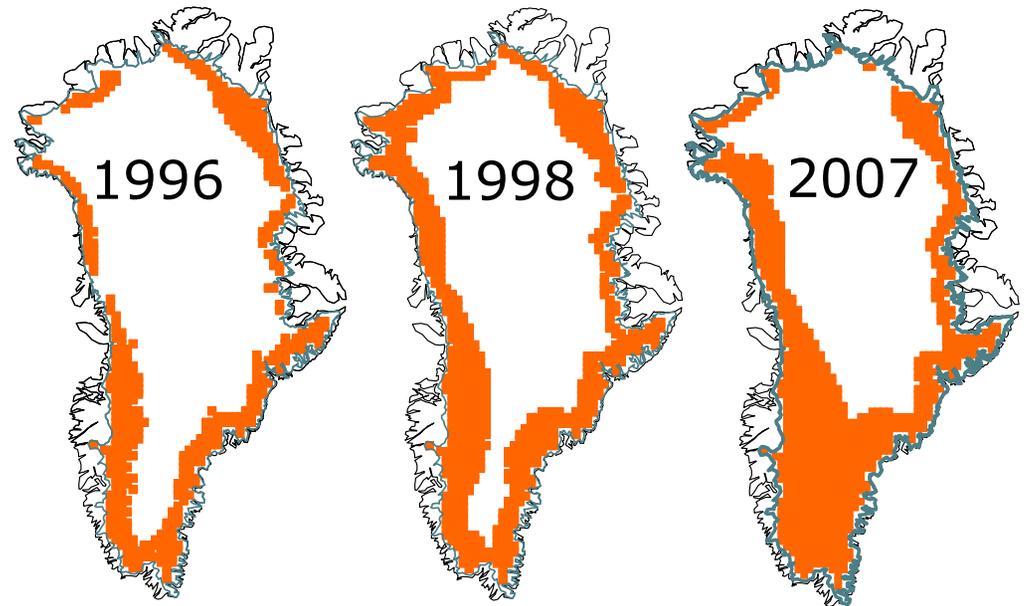
Satellite determination of maximum extent of glacial melt



NASA

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

Total melt area April–October



Steffen & Huff, Univ. Colo., 2011

THE BIG PROBLEM FOR LONG ISLAND . . .

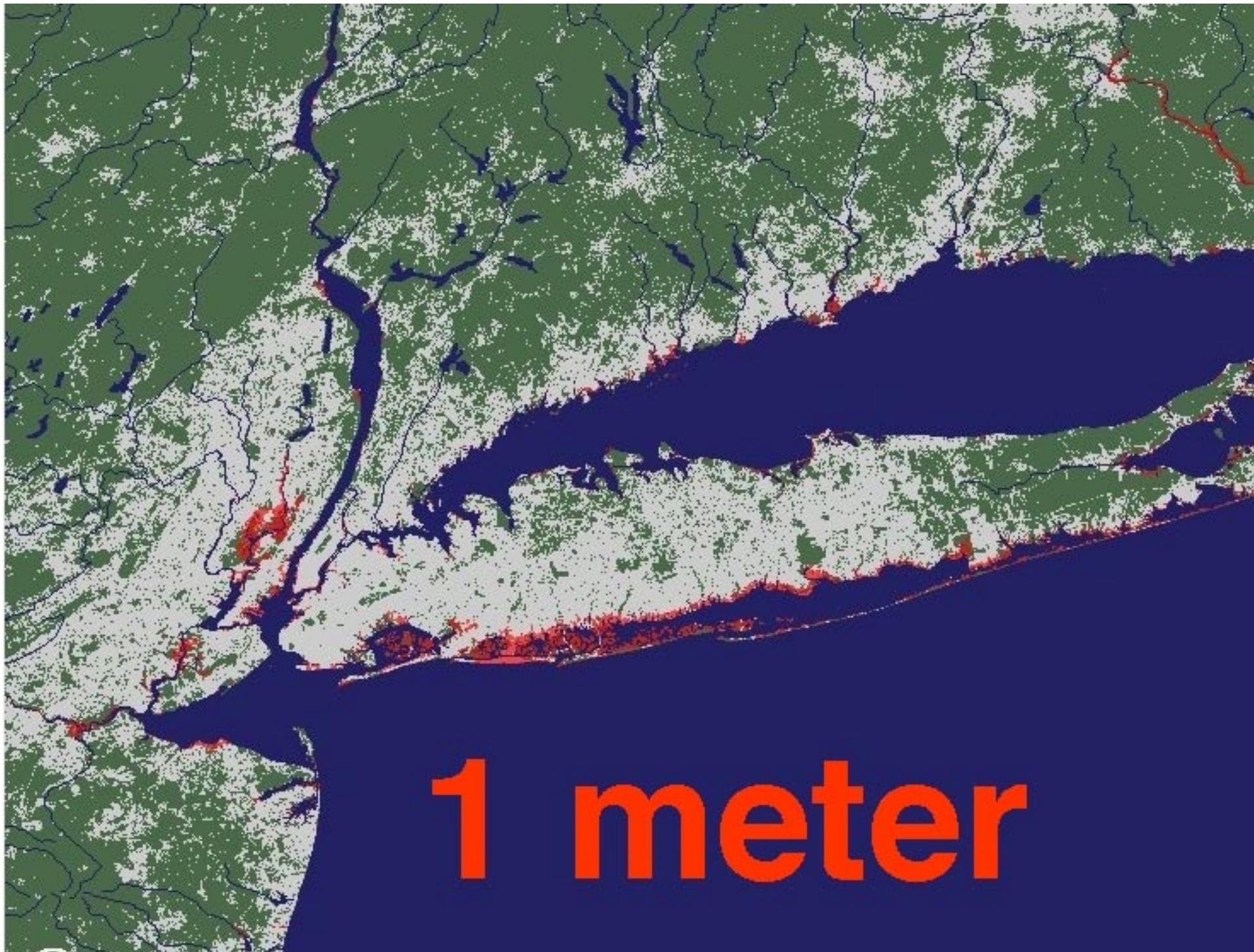


RISING SEA LEVEL

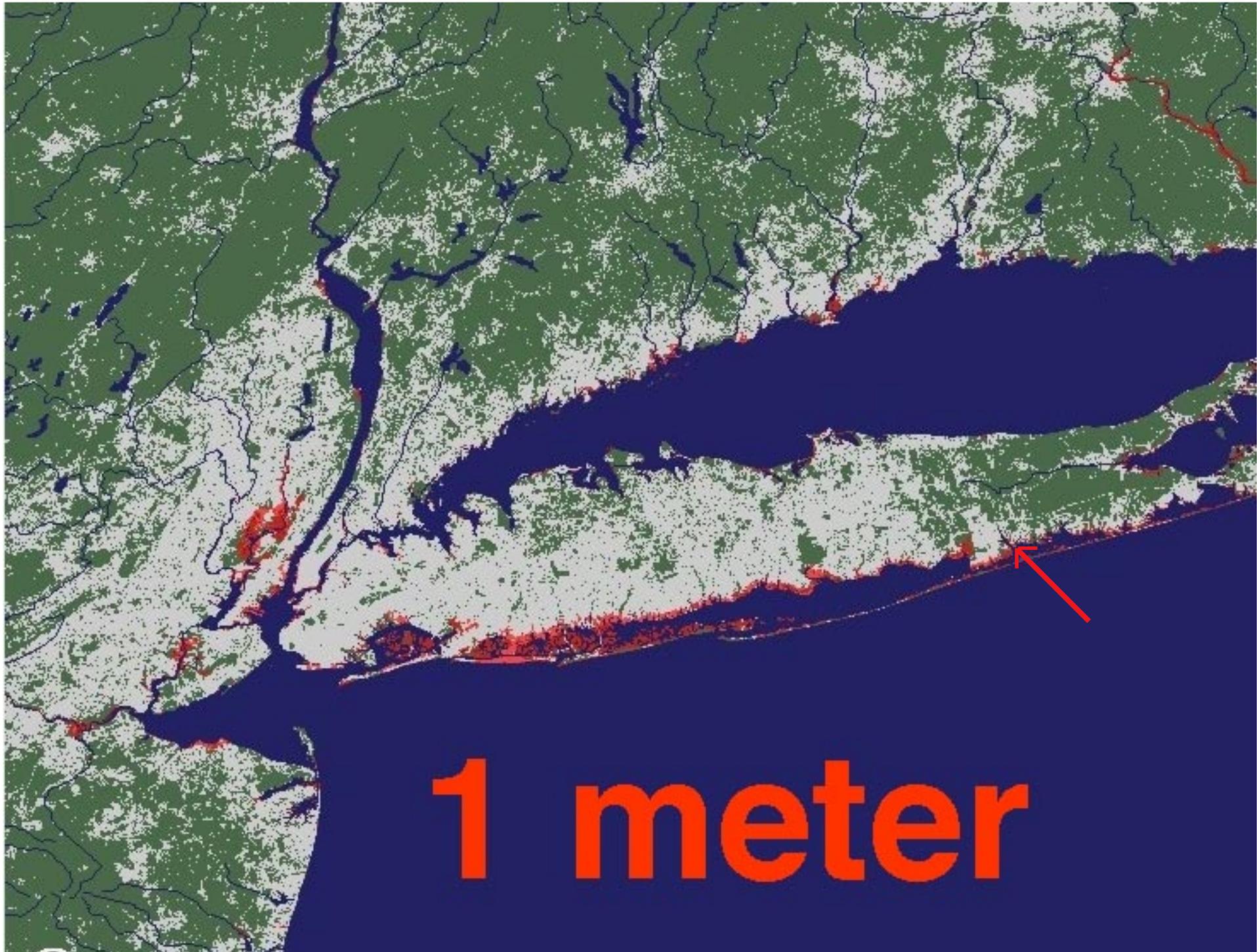




present

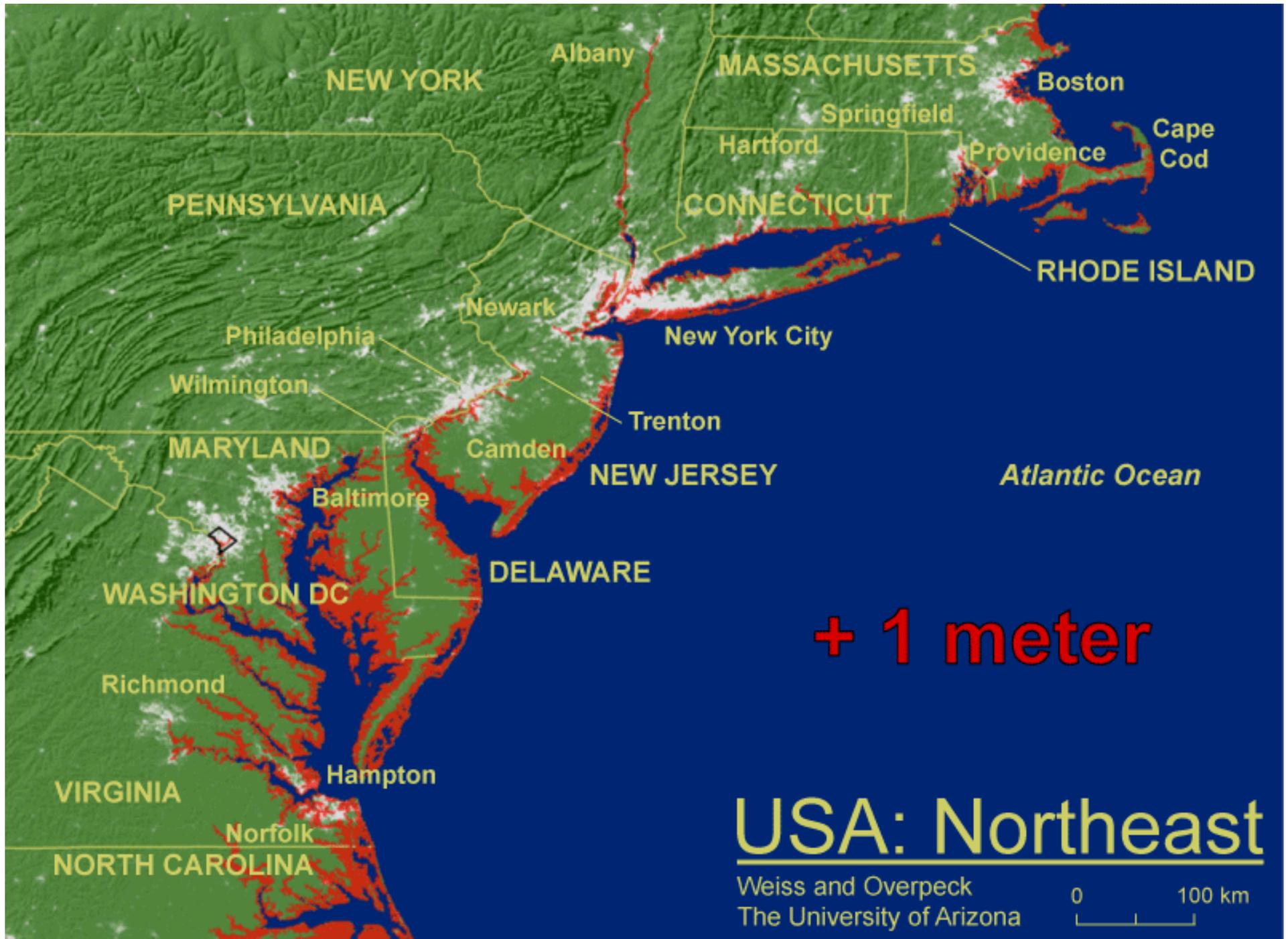


1 meter



1 meter







"Gentlemen, it's time we gave some serious thought to the effects of global warming."

***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 (CO₂), 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 AT BROOKHAVEN
NATIONAL LABORATORY IS HELPING
TO ANSWER THESE QUESTIONS.***

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