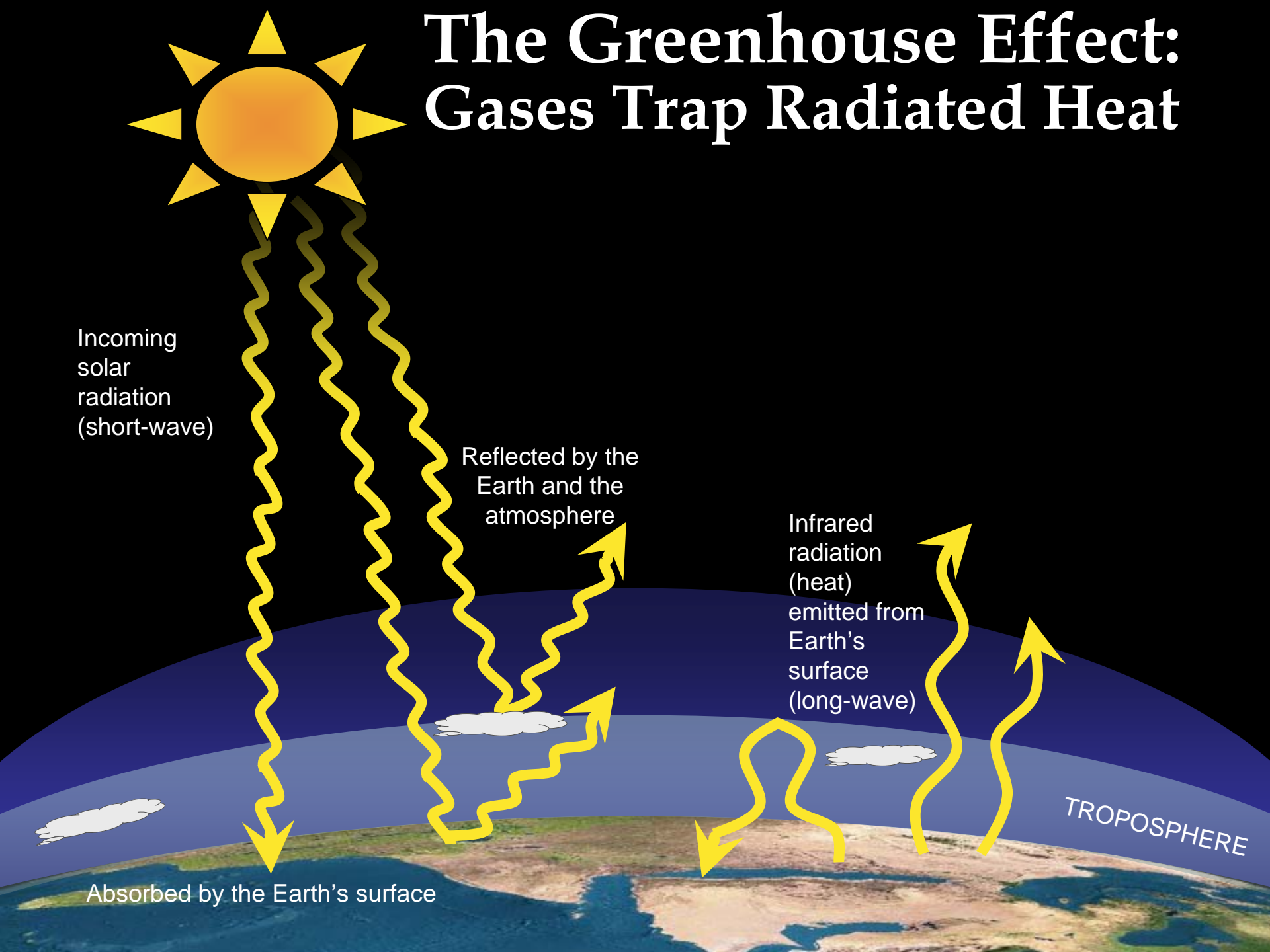


An aerial photograph of a coastal region. The top half shows a large, dark blue body of water. A narrow, light-colored strip of land runs diagonally from the top left towards the bottom right. On the left side of this strip, there is a complex network of waterways and marshes. In the lower part of the strip, there is a large, densely packed area that appears to be a residential or industrial development. The bottom right corner of the image is a solid, bright blue color.

Climate Change and Sea Level Rise

Alan Belensz
NYSDEC Office of Climate Change

The Greenhouse Effect: Gases Trap Radiated Heat



Incoming solar radiation (short-wave)

Reflected by the Earth and the atmosphere

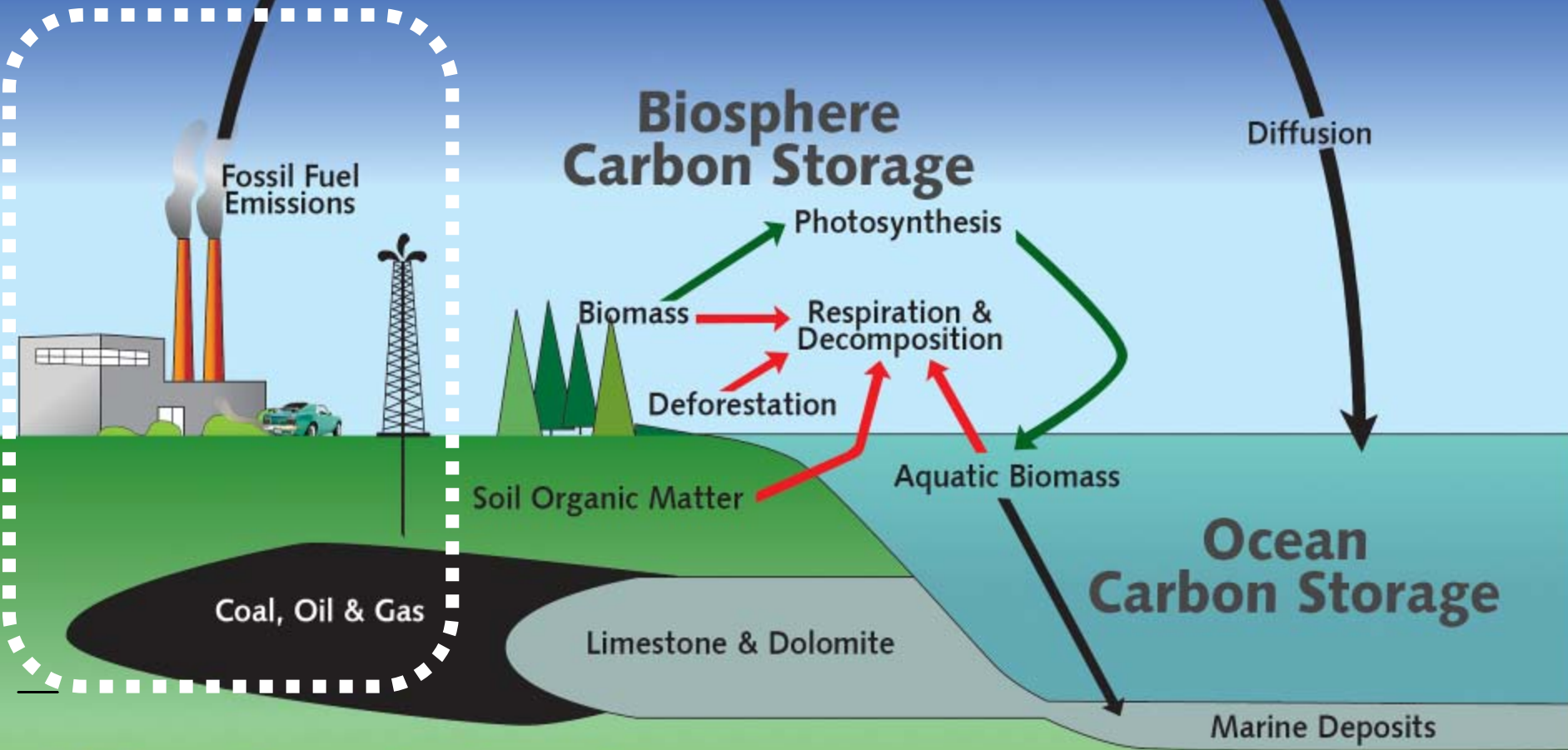
Infrared radiation (heat) emitted from Earth's surface (long-wave)

TROPOSPHERE

Absorbed by the Earth's surface

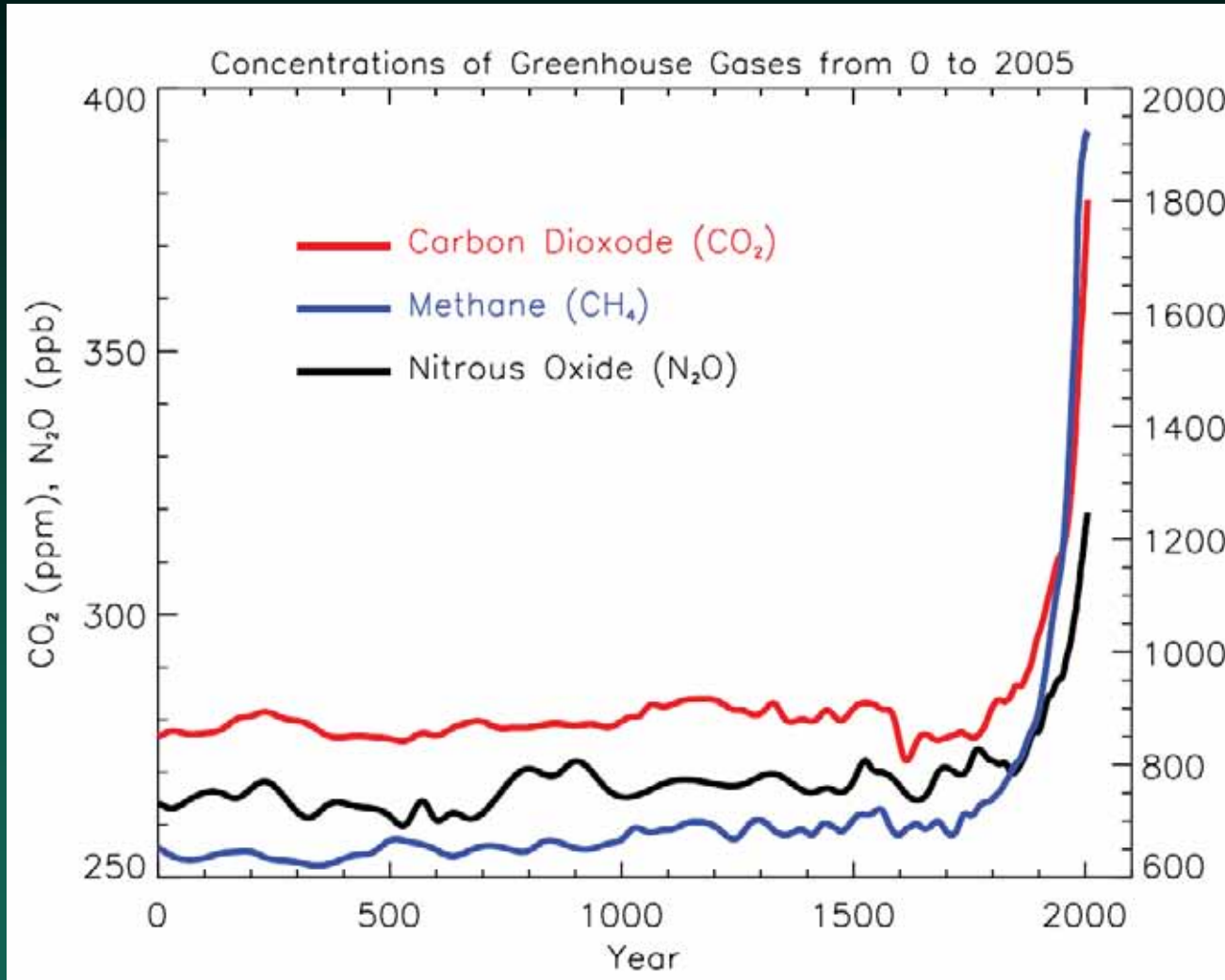
Earth's Carbon Cycle

Atmosphere Carbon Storage



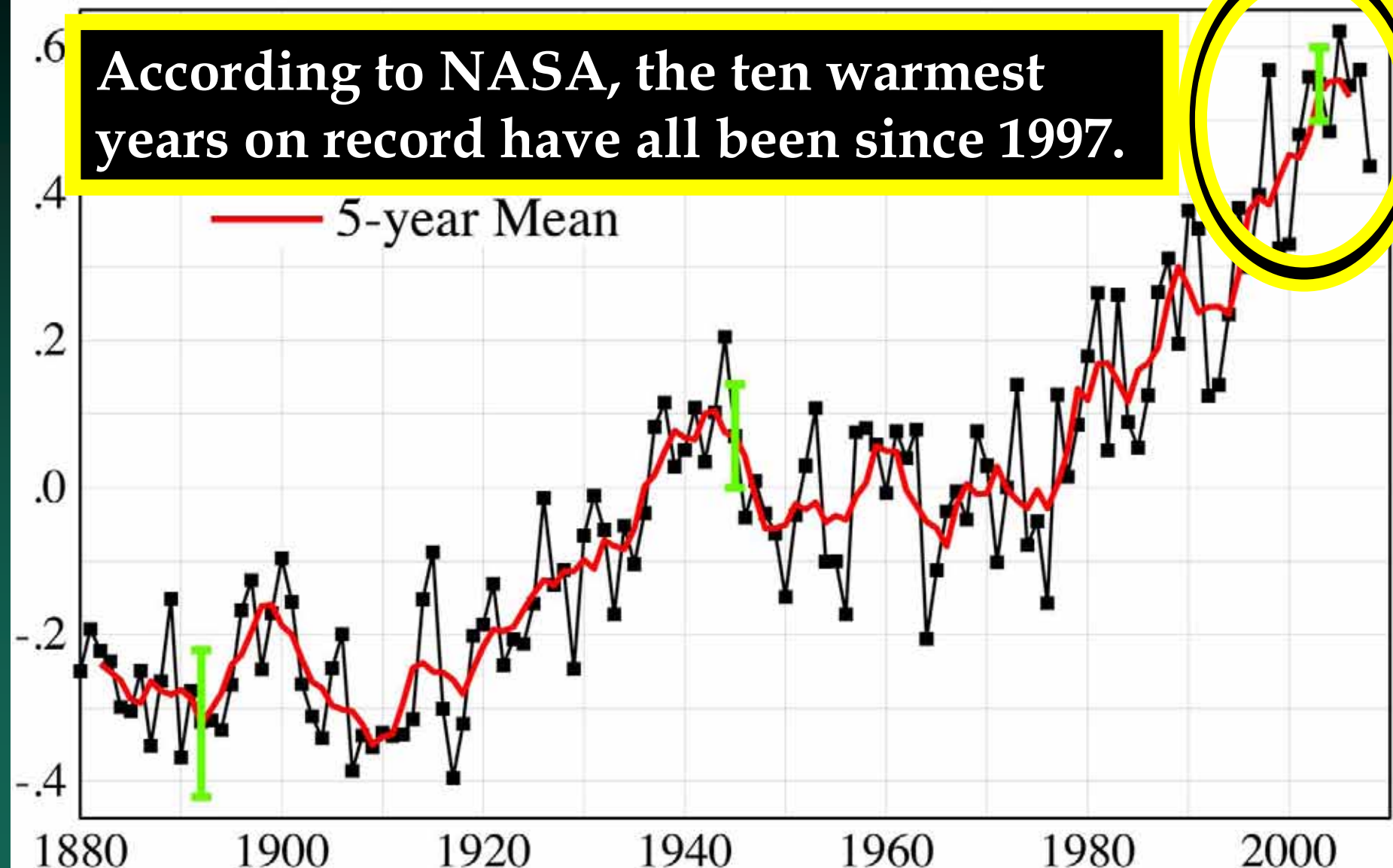
Lithosphere Carbon Storage

Greenhouse Gases - Past 2000 Years



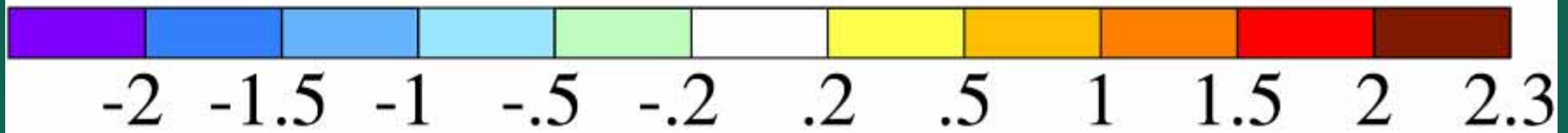
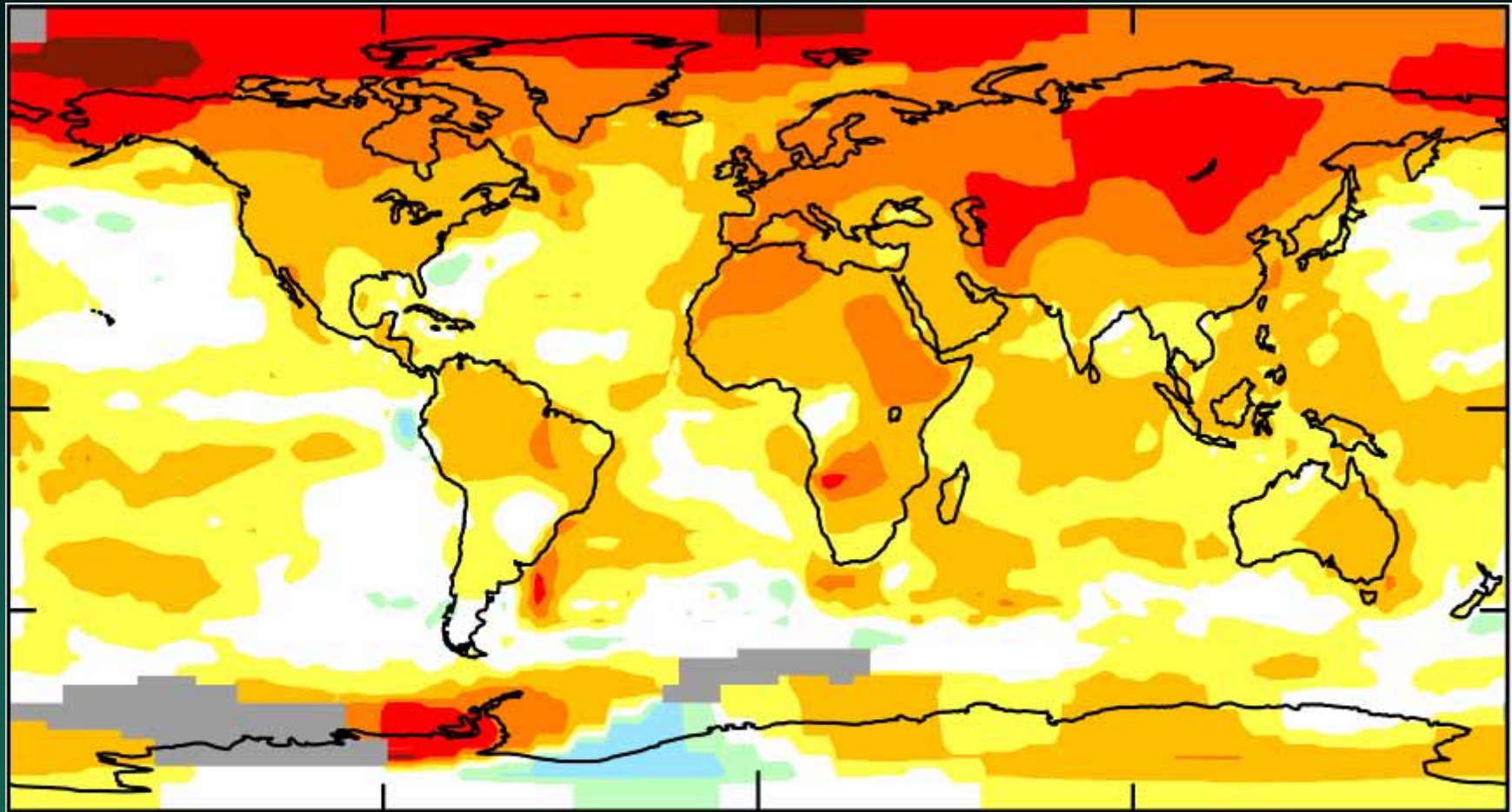
Thermometer Record 1880-Present

According to NASA, the ten warmest years on record have all been since 1997.



Surface Temperature Anomaly (Change)

Base period 1951-1980, 2001-2007 mean, Global mean = 0.54



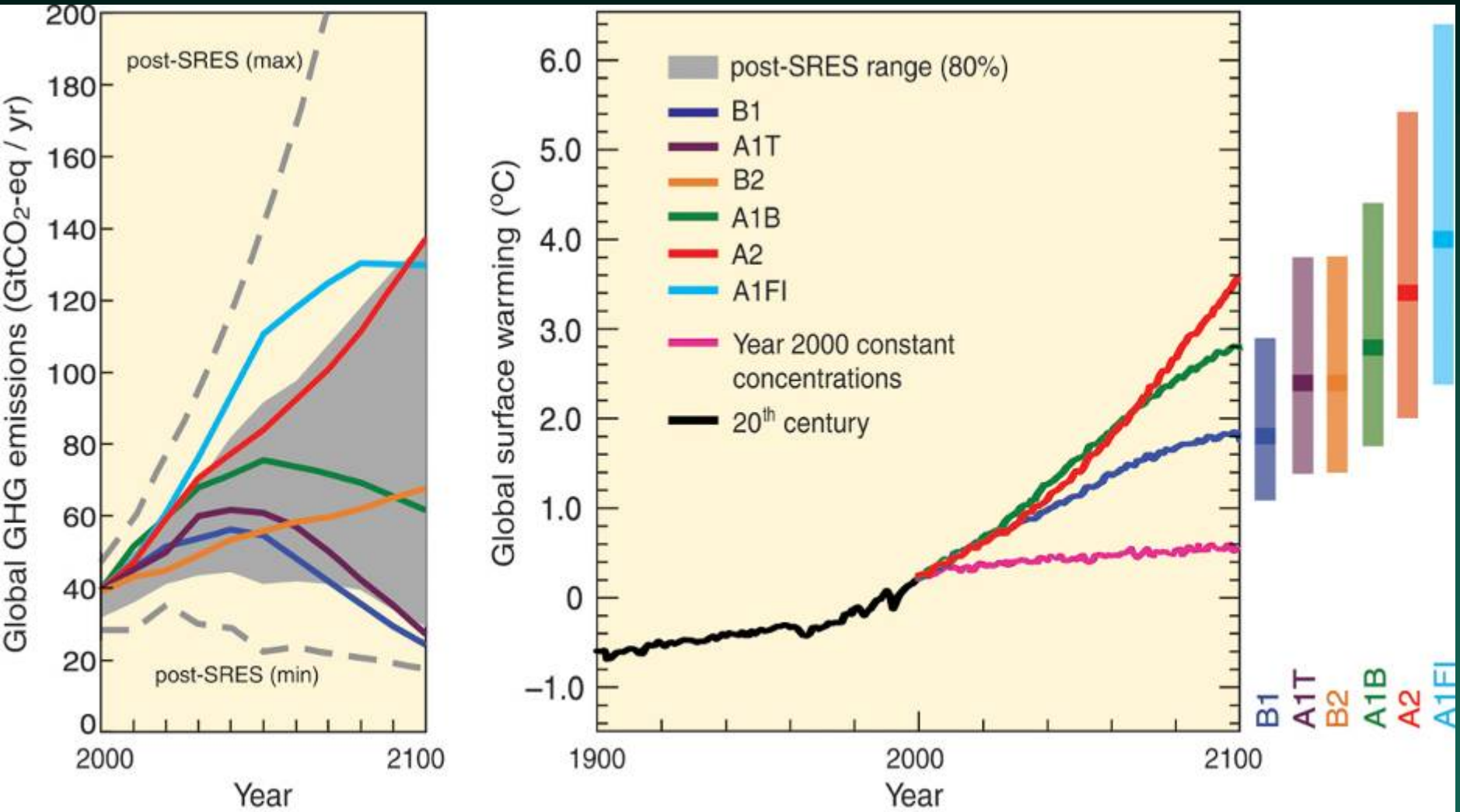
Joint* National Science Academies' Statement

“There will always be uncertainty in understanding a system as complex as the world’s climate. **However there is now strong evidence that significant global warming is occurring.** The evidence comes from...rising surface air temperatures and subsurface ocean temperatures and from...increases in average global sea levels, retreating glaciers, and changes to many physical and biological systems. **It is likely that most of the warming in recent decades can be attributed to human activities. This warming has already led to changes in the Earth's climate.”**

*U.S., U.K., Russia, China, India, Japan, Canada, France, Germany, Italy, Brazil
June, 2005

“The understanding of anthropogenic [human-induced] warming and cooling influences on climate has improved...leading to very high confidence (> 90%) that the globally averaged net effect of human activities since 1750 has been one of warming...”

Scenarios for GHG Emissions from 2000 to 2100 and Projections of Surface Temperatures

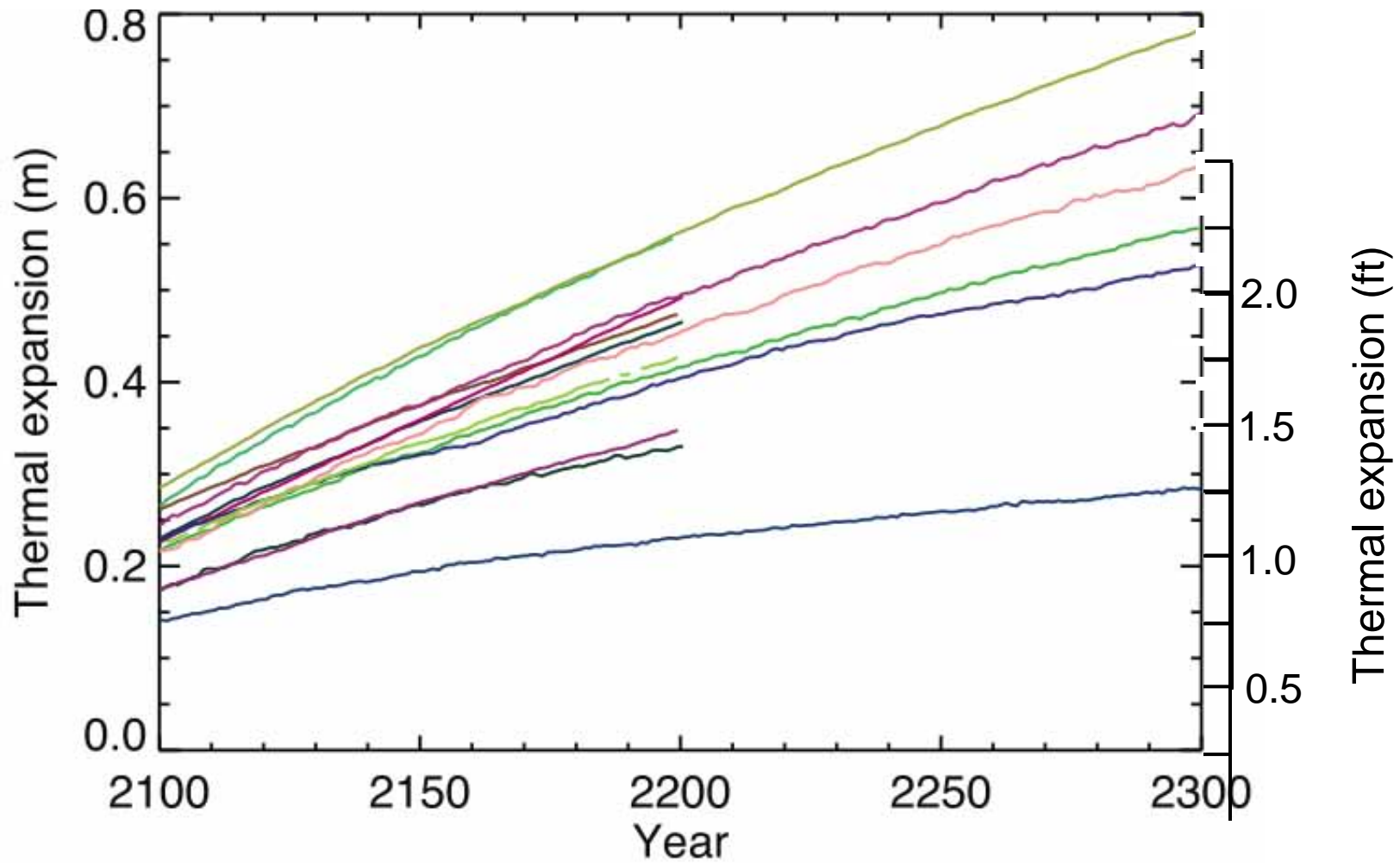


An aerial photograph of a glacier stream. The water is a vibrant blue, flowing through a narrow channel cut into the white, textured ice. In the distance, several people are standing on the ice, providing a sense of scale. The sky is a pale blue, and the horizon is visible in the far distance.

Contributors to Sea Level Rise

- Thermal Expansion

Sea Level Rise from Thermal Expansion Will be an Issue for Centuries



— CCSM3 — CNRM-CM3
— CSIRO-MK3.0 — ECHAM5/MPI-OM



Contributors to Sea Level Rise

- Thermal Expansion
- Glaciers and Ice Caps

Glacier National Park



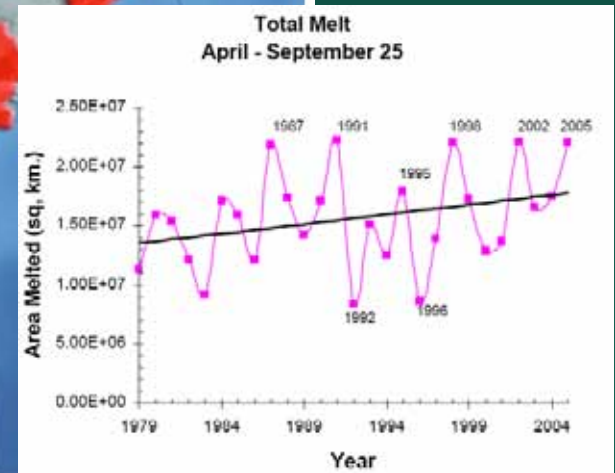
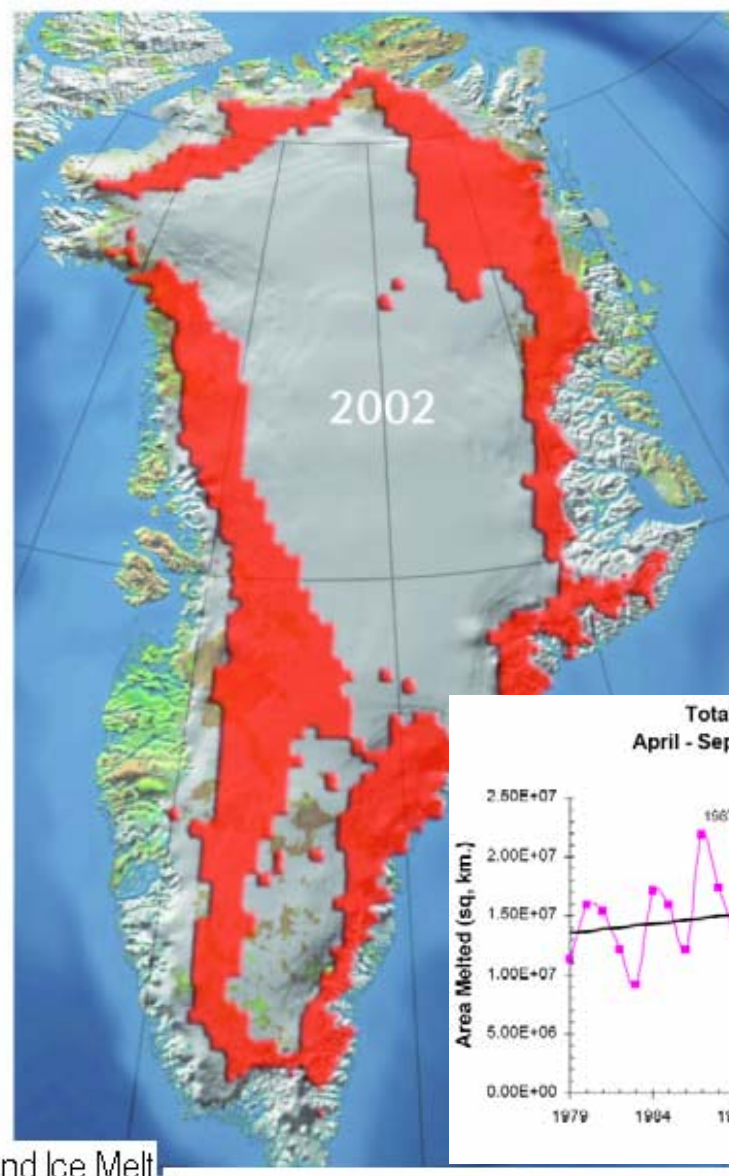
Glacier National Park, 1988



Contributors to Sea Level Rise

- Thermal Expansion
- Glaciers and Ice Caps
- Ice Sheets – Antarctica & Greenland

Increasing Melt Area on Greenland



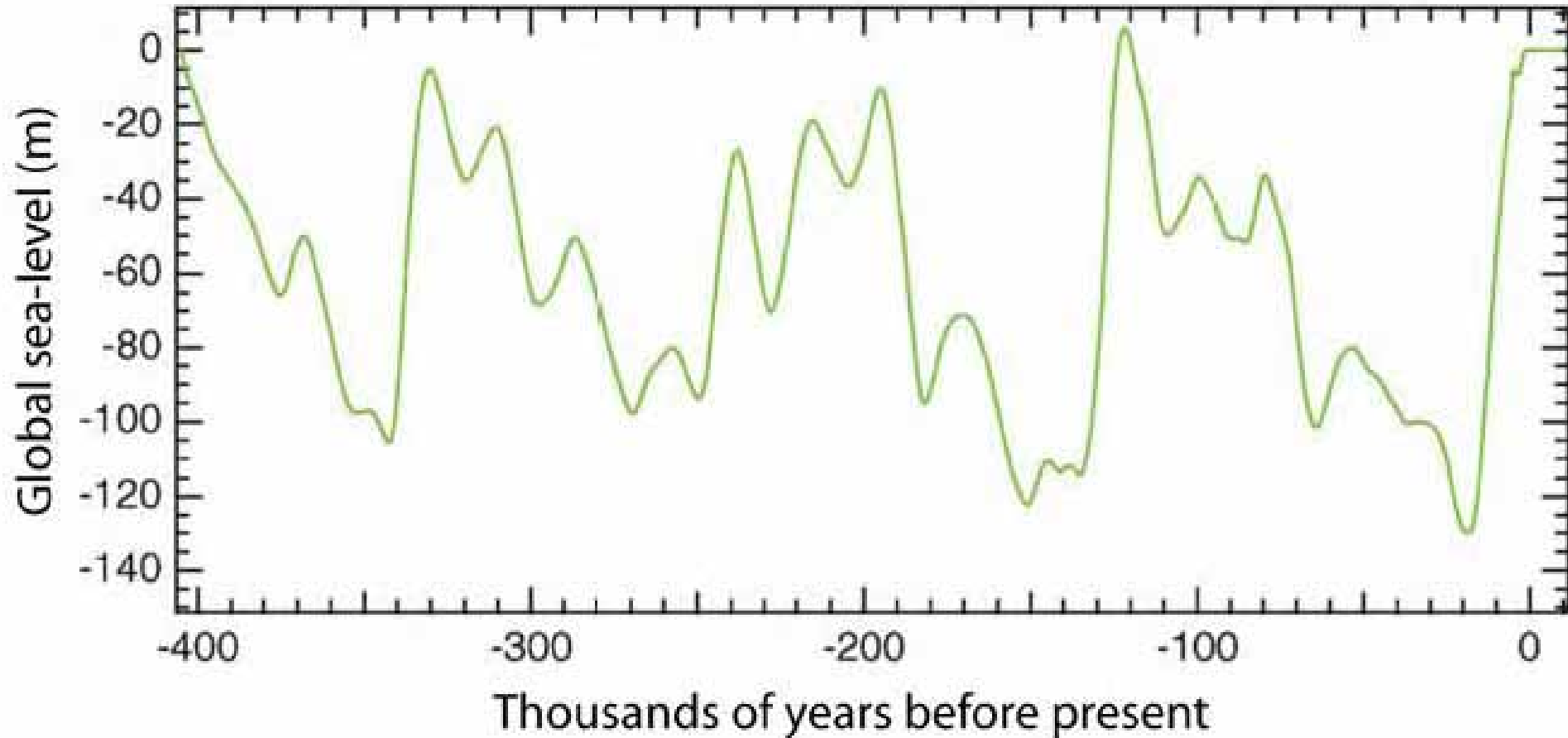
Greenland Ice Melt



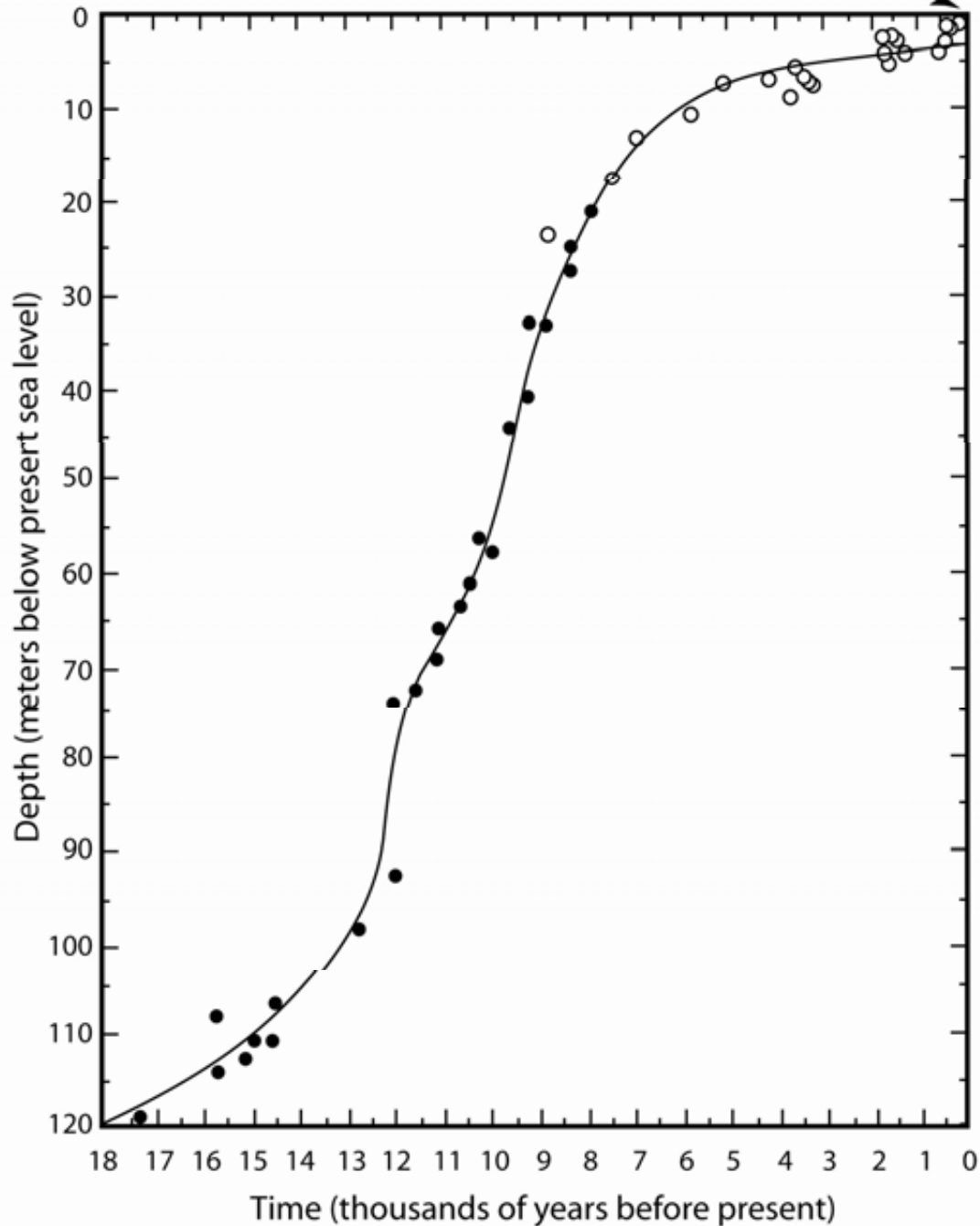
Contributors to Sea Level Rise

- Thermal Expansion
- Glaciers and Ice Caps
- Ice Sheets – Antarctica & Greenland
- Land Movement

Sea Level Rise – last 400,000 years



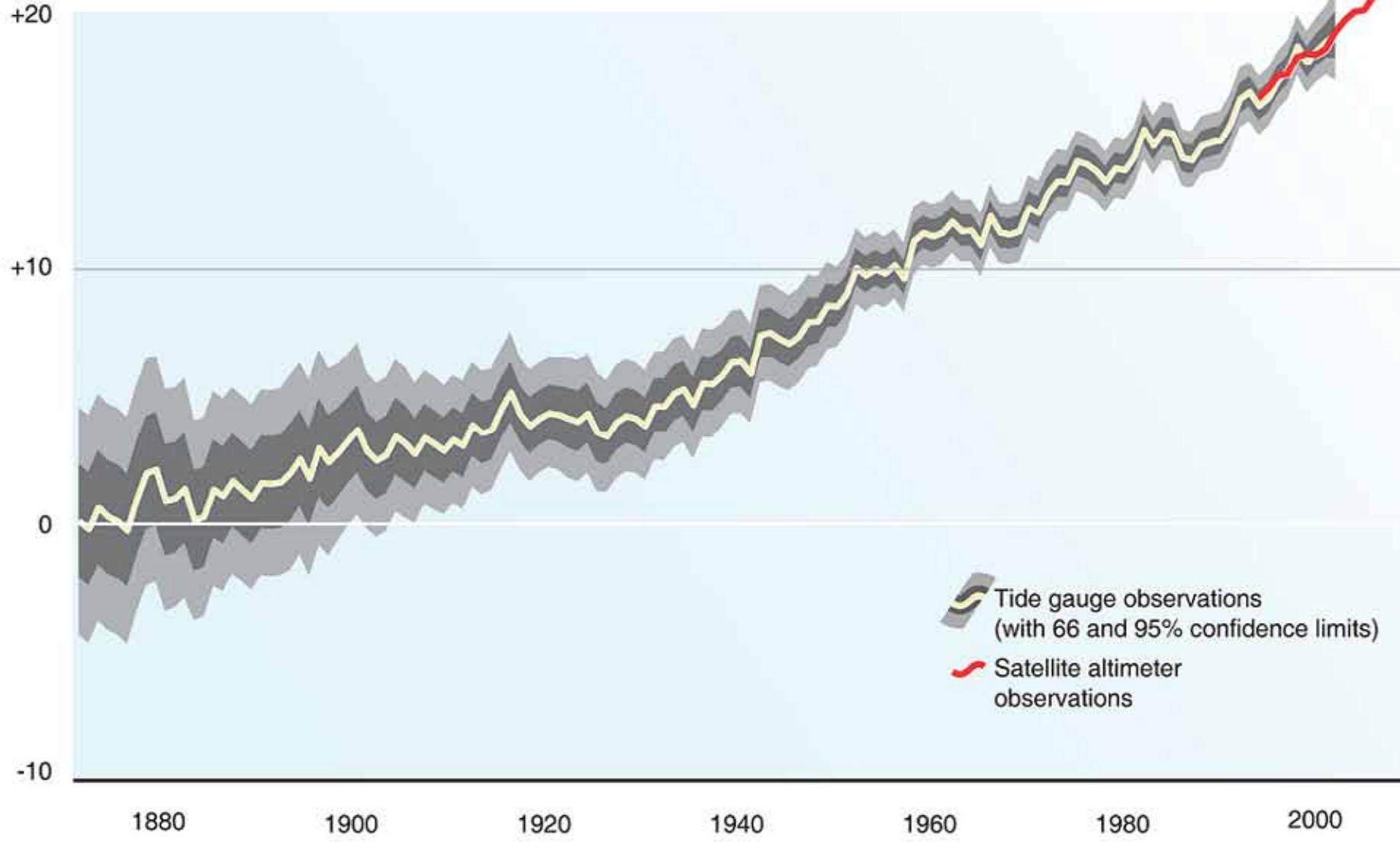
Present-Day Sea Level



Sea Level Rise: last 18,000 years

Source: Fairbanks, *Nature*
342, 637 – 642, 07
December 1989 in EPA
CCSP 2009.

Global mean
Sea Level (cm)



Trends in sea level, 1870-2006

NY Metro Area – Sea Level Rise

Station	Relative Sea Level Rise		Record Length Year
	<i>mm/yr</i>	<i>in/yr</i>	
New London, CT	2.10	0.083	64
Bridgeport, CT	2.57	0.101	32
New Rochelle, NY	2.05	0.081	25
Montauk, NY	2.27	0.089	49
Port Jefferson, NY	2.20	0.087	32
Willets Point, NY	2.30	0.091	64
New York City, NY	2.73	0.107	140
Sandy Hook, NJ	3.85	0.152	64
Atlantic City, NJ	3.97	0.156	85

Source: Rosenzweig and Solecki (eds), 2001, Climate Change and a Global City.

Draft Sea Level Rise Projections: South Shore Long Island

Columbia University CCSR data developed for the The Nature Conservancy

<u>Decade</u>	<u>IPCC-Adapted Methodology</u>	<u>High-End Scenario</u>
2020s	2 to 5 in	7 in
2050s	7 to 12 in	22 in
2080s	12 to 23 in	45 in

- Based on 7 Global Climate Models (GCMs) and 3 emissions scenarios (low, medium, and high). The central range corresponds to the middle 67% of GCM based values. “High End Scenarios” are based on more rapid rates of ice melt in Greenland and West Antarctic Ice sheets than are projected to occur by GCMs.
- Using methodology being developed for the New York City region as part of the New York City Panel on Climate Change, further projections will be made for New York City, eastern Long Island, the north shore of Long Island, and the lower Hudson River. These expanded projections are part of the City’s adaptation planning efforts and a NYSERDA-funded study.
- Data Source: Goddard Institute for Space Studies and Columbia Center for Climate Systems Research (2008). Draft projections developed for The Nature Conservancy on Long Island's Coastal Resilience Project (coastalresilience.org).

Atlantic Storms – Hurricanes & Nor'easters



Storm Parameters:

- Intensity
- Frequency
- Track

Current scientific understanding of future storm predictions is inadequate to provide a consensus opinion.

An aerial photograph of a vast, flat, rocky landscape. The foreground is dominated by a path of large, flat, light-colored stones, possibly volcanic, arranged in a somewhat regular pattern. The path leads towards the horizon. The surrounding terrain is a mix of light and dark rocks, with some areas appearing more sandy or silty. The sky is clear and blue, and the overall scene is one of a desolate, open landscape.

Thank You

Draft Sea Level Rise Projections: South Shore Long Island

Columbia University CCSR data developed for the The Nature Conservancy

<u>Decade</u>	<u>Current Global Rate*</u>	<u>IPCC-Adapted</u>	<u>High-End Scenario</u>
2020s	1.3 in	2 to 5 in	7 in
2050s	4.6 in	7 to 12 in	22 in
2080s	8.0 in	12 to 23 in	45 in

*Average of 2.5 and 3.1 mm/yr SLR, no land subsidence included

- Based on 7 Global Climate Models (GCMs) and 3 emissions scenarios (low, medium, and high). The central range corresponds to the middle 67% of GCM based values. “High End Scenarios” are based on more rapid rates of ice melt in Greenland and West Antarctic Ice sheets than are projected to occur by GCMs.
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