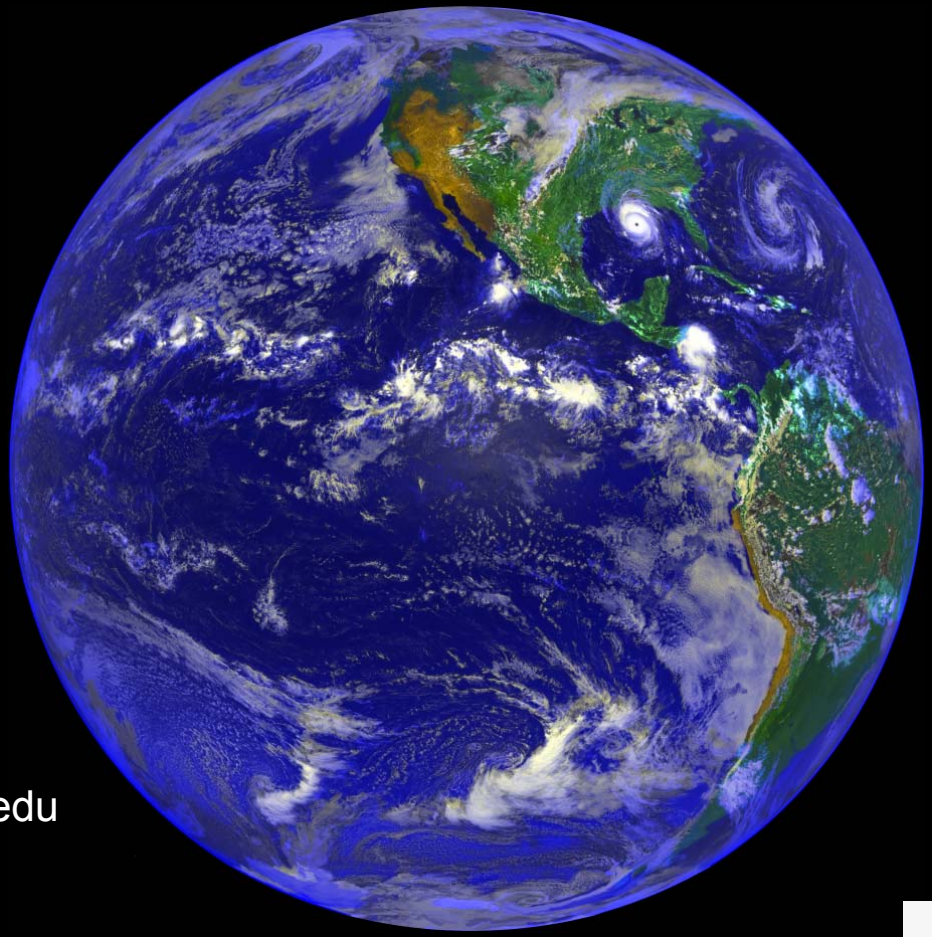
Fact and fiction of global warming



Kim M. Cobb
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Kiwanis Meeting
August 21, 2007

Georgia Tech

versus

The politics of global warming

or

The marketing of global warming

Which of the following are scientific statements?

1) Slowing global warming would hurt the economy.

2) Hurricane Katrina provides direct proof of global warming.

3) A warming of 1ºC over the next 50yrs should be avoided.

4) The Earth was warmer than today 100 million years ago.

5) Improved technology is the best way to mitigate global warming.

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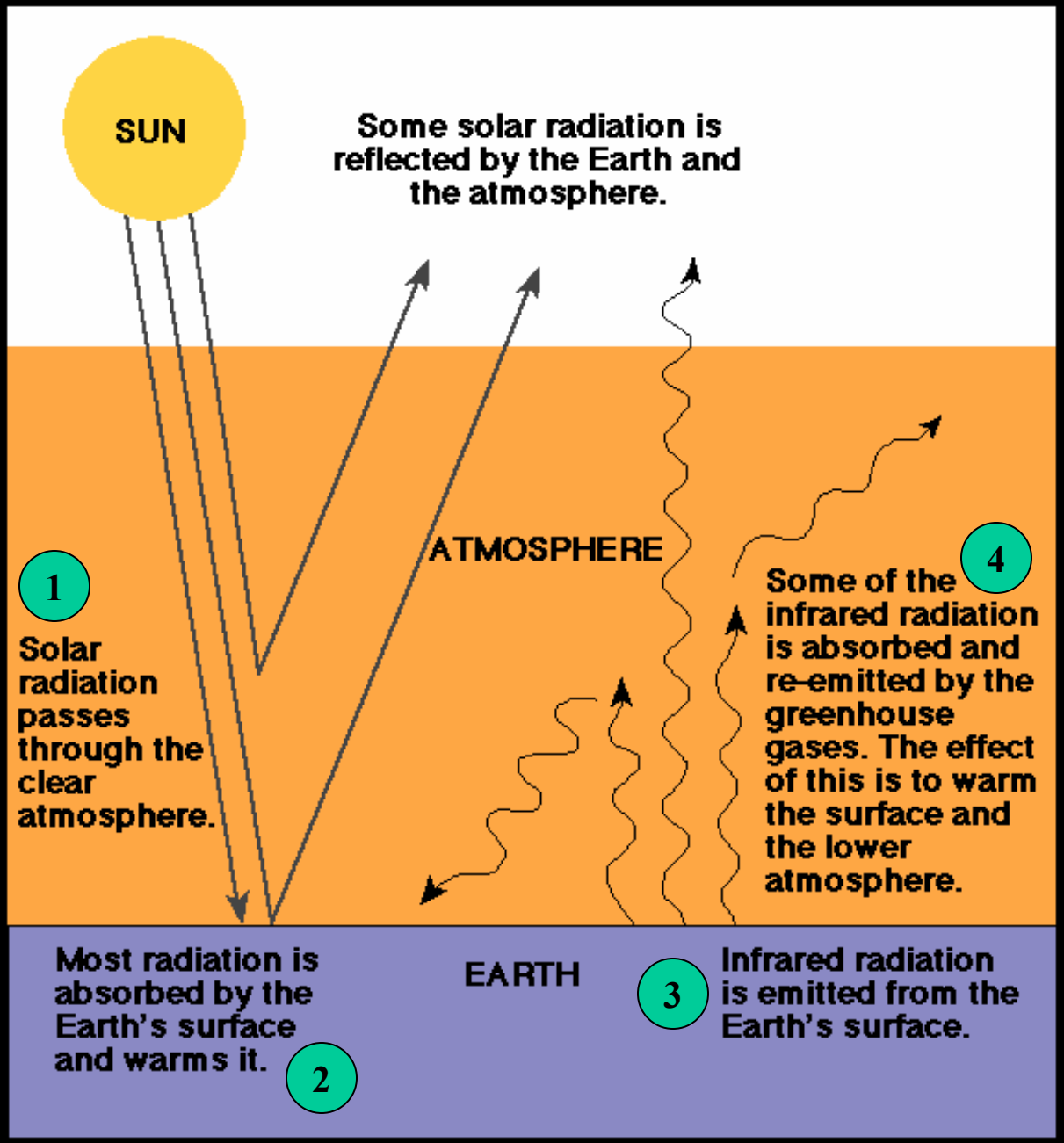
greenhouse gases in the atmosphere trap heat at the Earth's surface and prevent it from escaping.

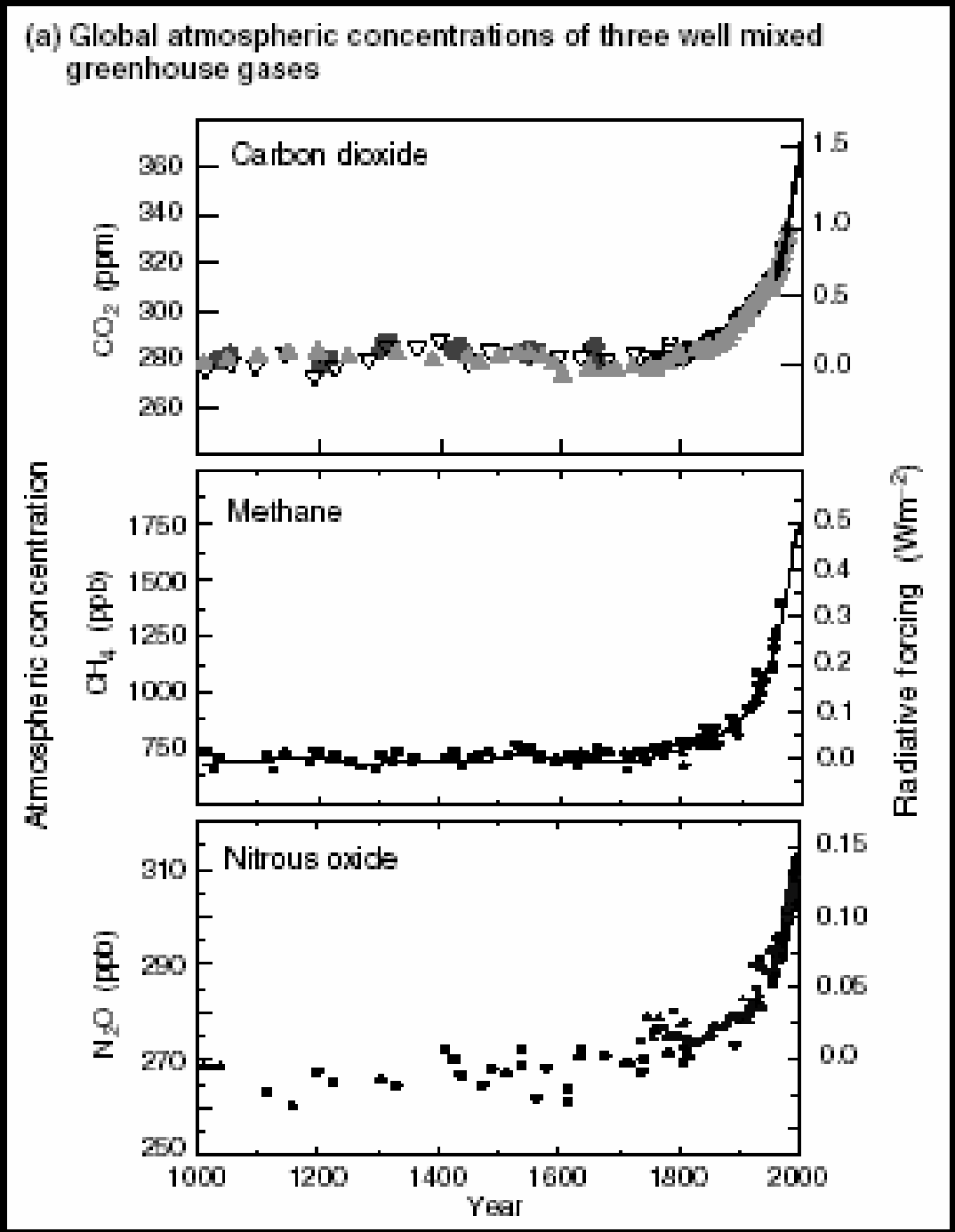
These gases include:

- Carbon dioxide CO_2
- Methane CH_4
- Nitrous oxide N_2O
- Chlorofluorocarbons
- *Water vapor H_2O*

  (this is the most important one, by far!)

without greenhouse gases average temp of Earth would be -18ºC instead of 15ºC

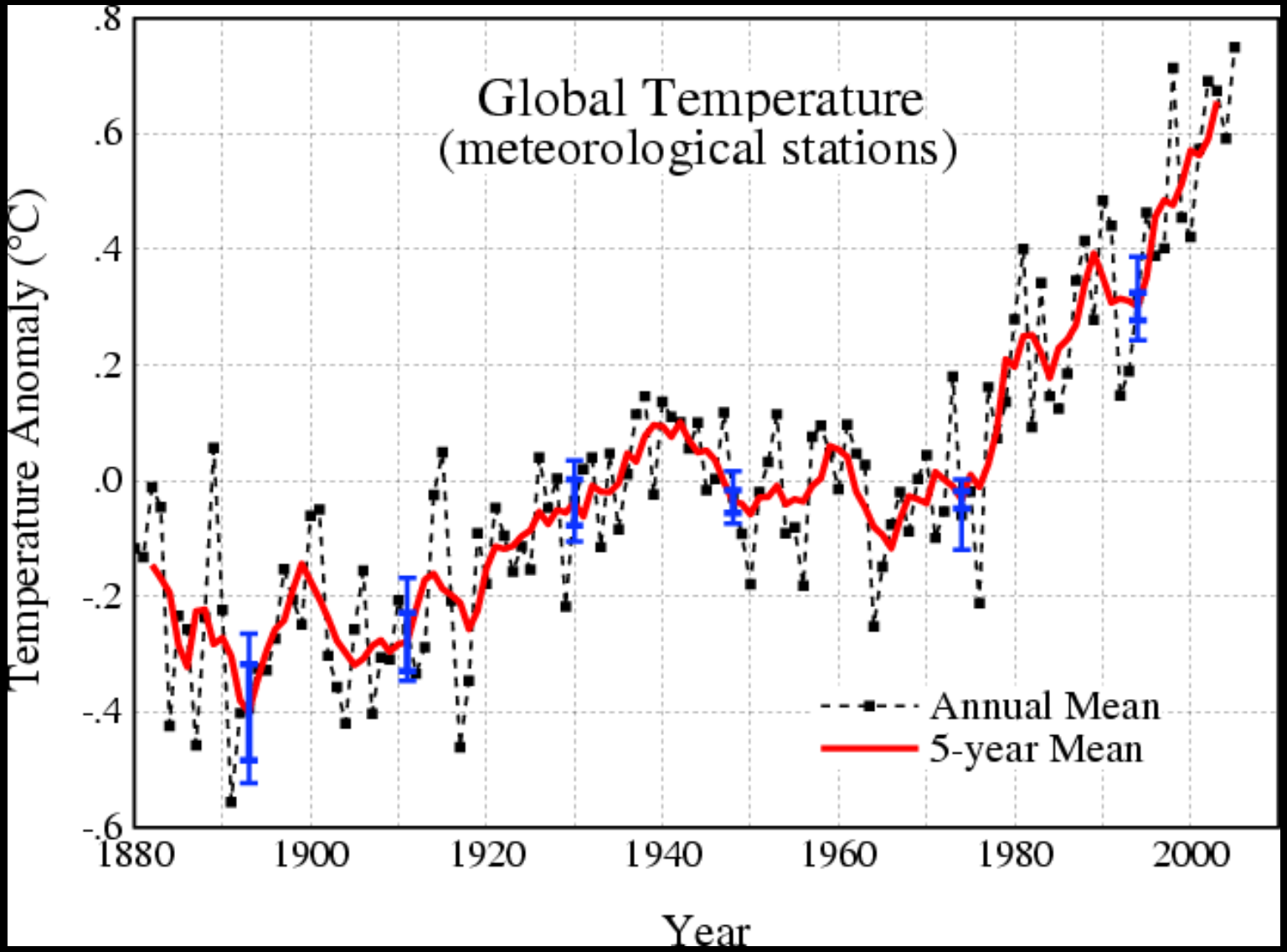




ice core CO2 records confirm that the CO2 trend began in the 1800's

-clear land for agriculture

-Industrial Revolution



The ‘instrumental’ record of climate shows a ~1ºC warming over the last century

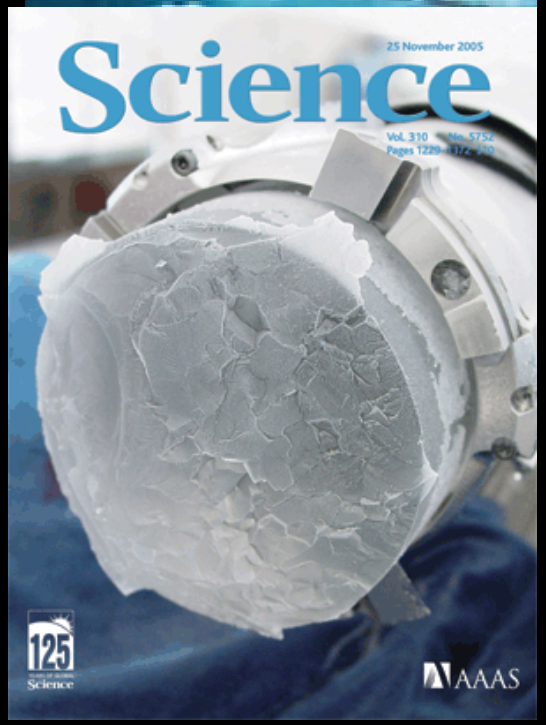
Why do 99.999% of climate scientists believe that CO_2 is warming the planet?

1. Theory predicts that increasing atmospheric CO2 should warm the planet.

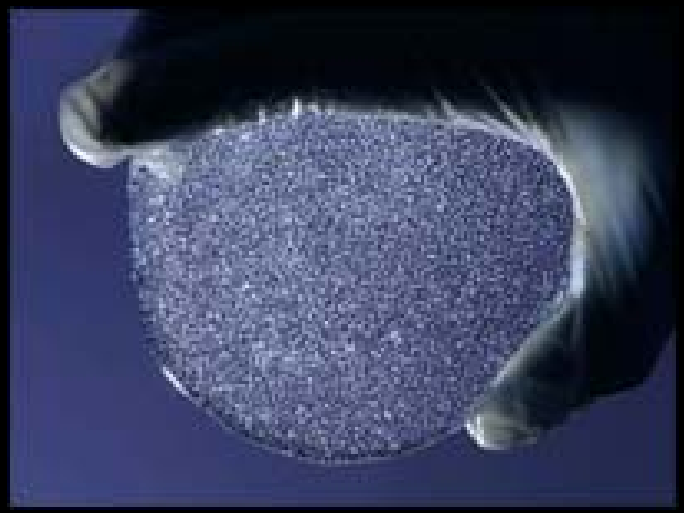
2. Geologic evidence links CO2 and temperature in the past.

3. The warming is unprecedented in the most recent centuries (dwarfs natural variability).

4. Climate models show that rising CO2 is necessary to simulate 20th century temperature trends (solar and volcanic minor players).



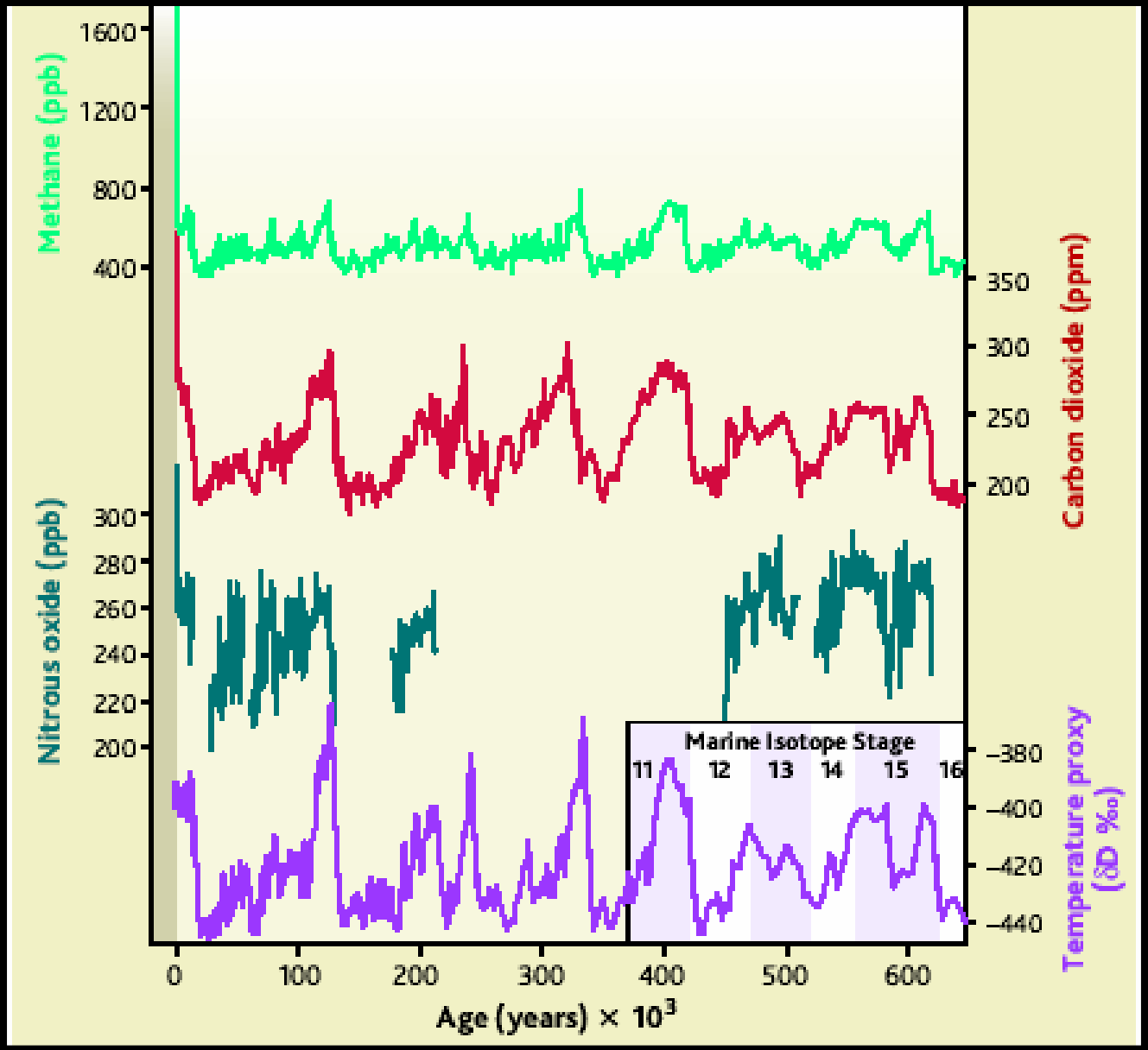
Ice core climate and CO_2 records



tiny gas bubbles
in the ice trap
ancient air samples

#2

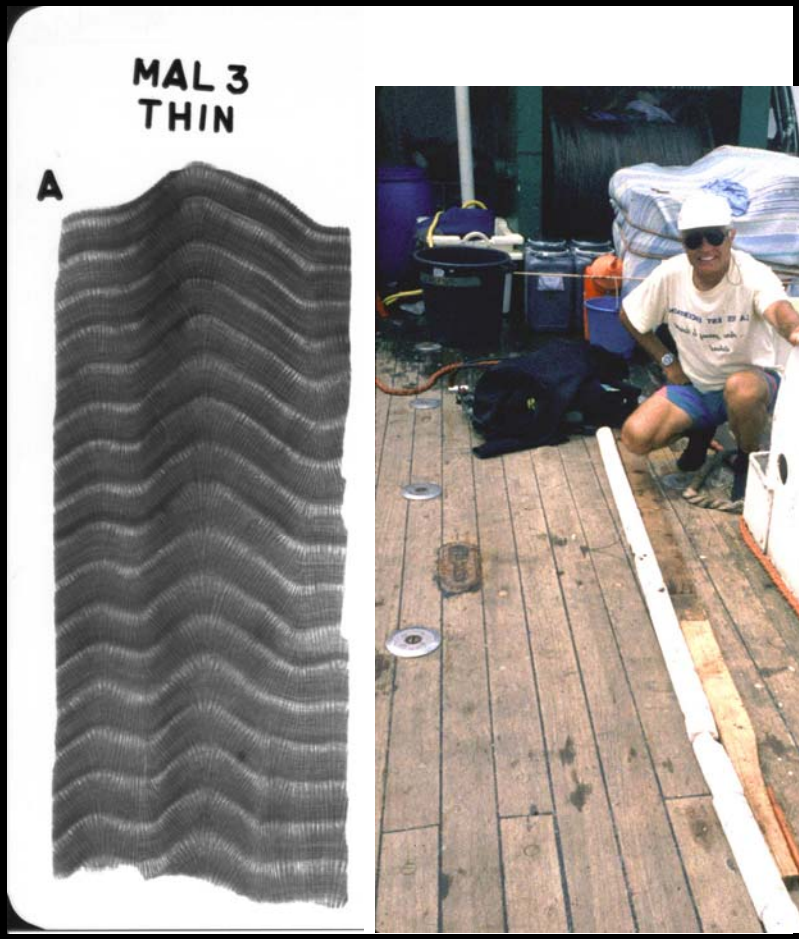
Atmospheric CO_2 and temperature over the past 650 thousand years



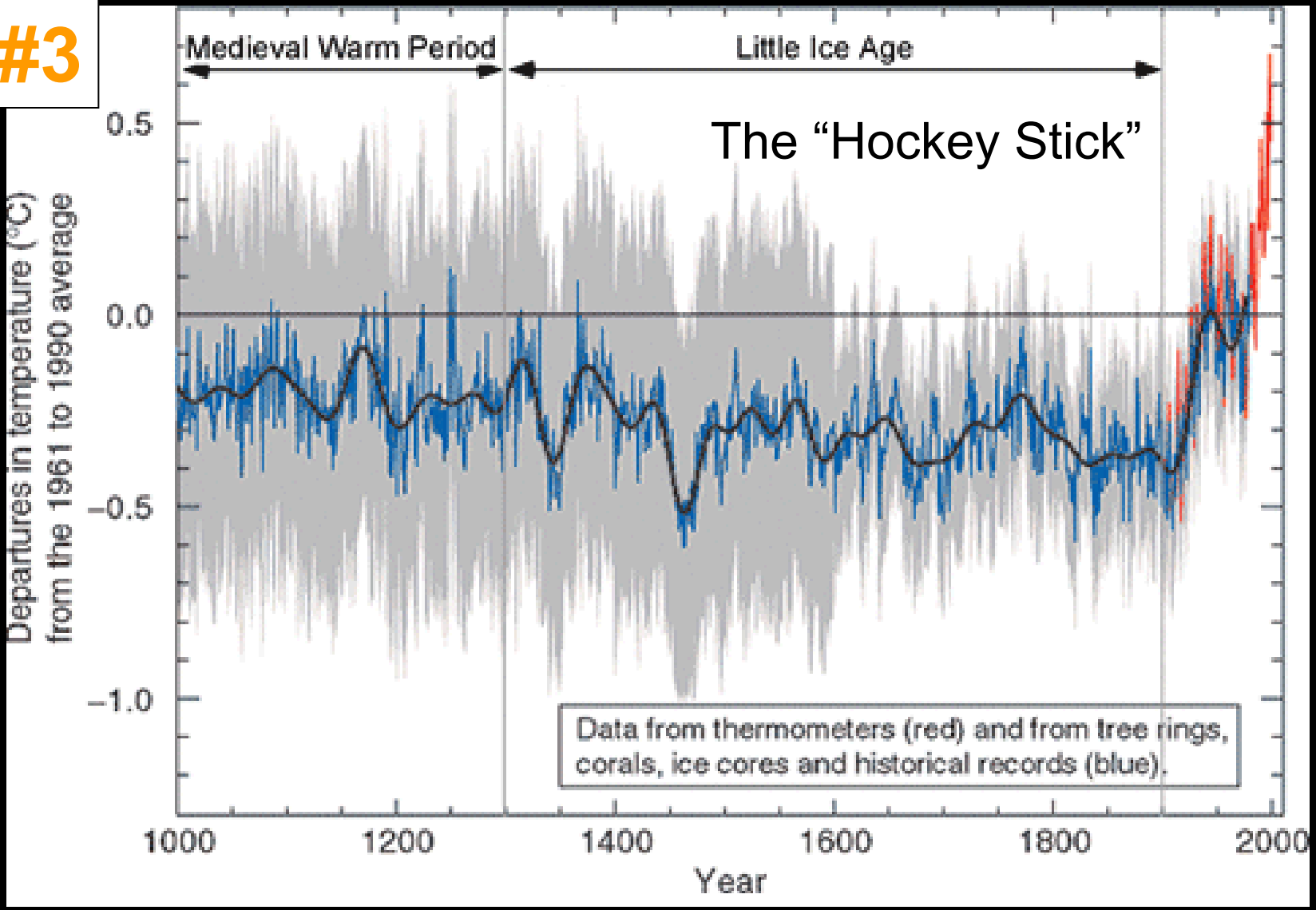
CO_2 and temperature are closely linked on geologic timescales

To understand how climate has changed in the past, we need to use records of climate preserved in ice cores, ancient tree rings, coral bands, and other "**paleoclimatic**" sources:

key is to CALIBRATE to temperature records



#3



Key Points:

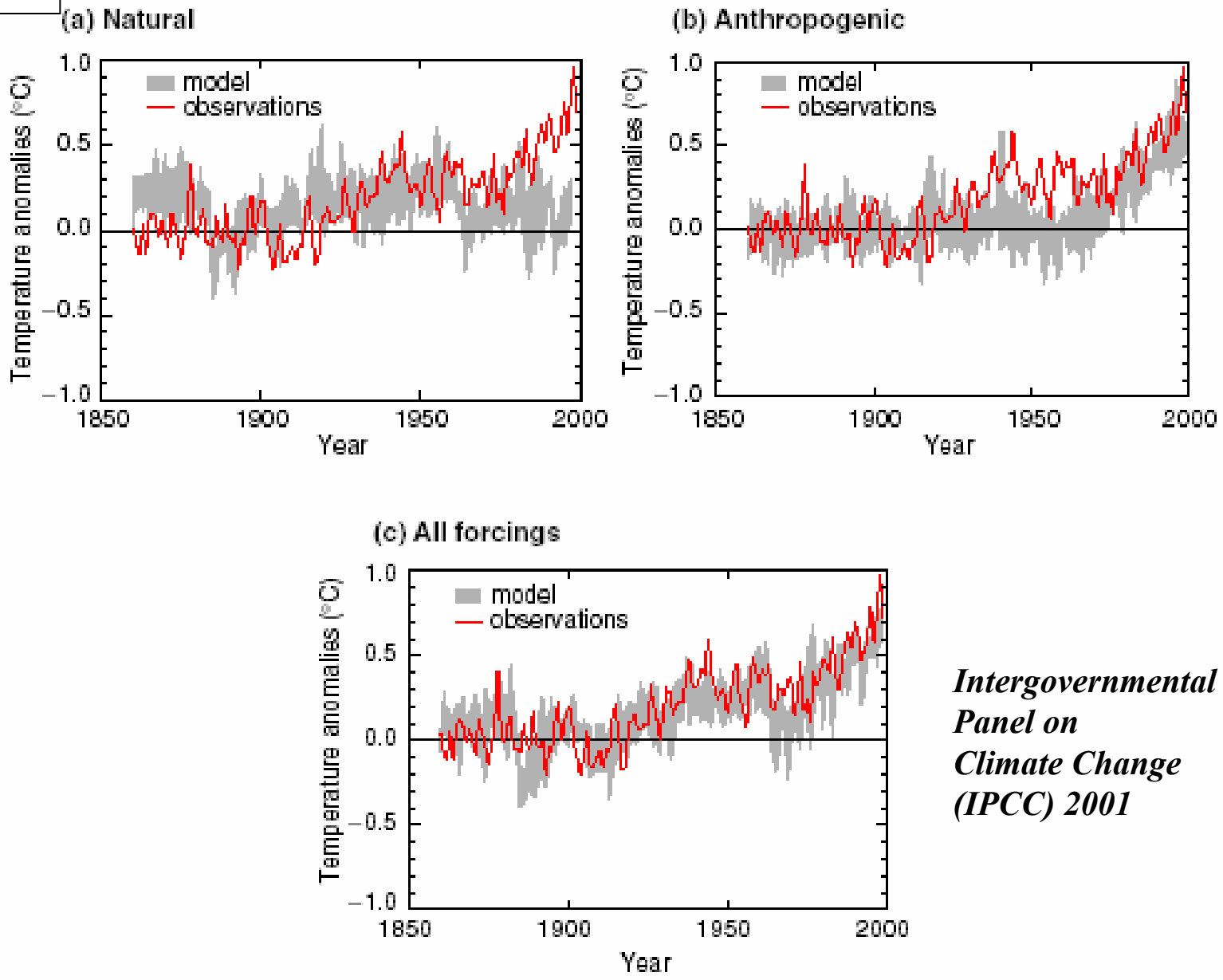
error bars increase as you go back in time

natural variability accounts for <0.5ºC over the last millennium

late 20th century temperature trend is unprecedented

#4

Simulated annual global mean surface temperatures



Intergovernmental Panel on Climate Change (IPCC) 2001

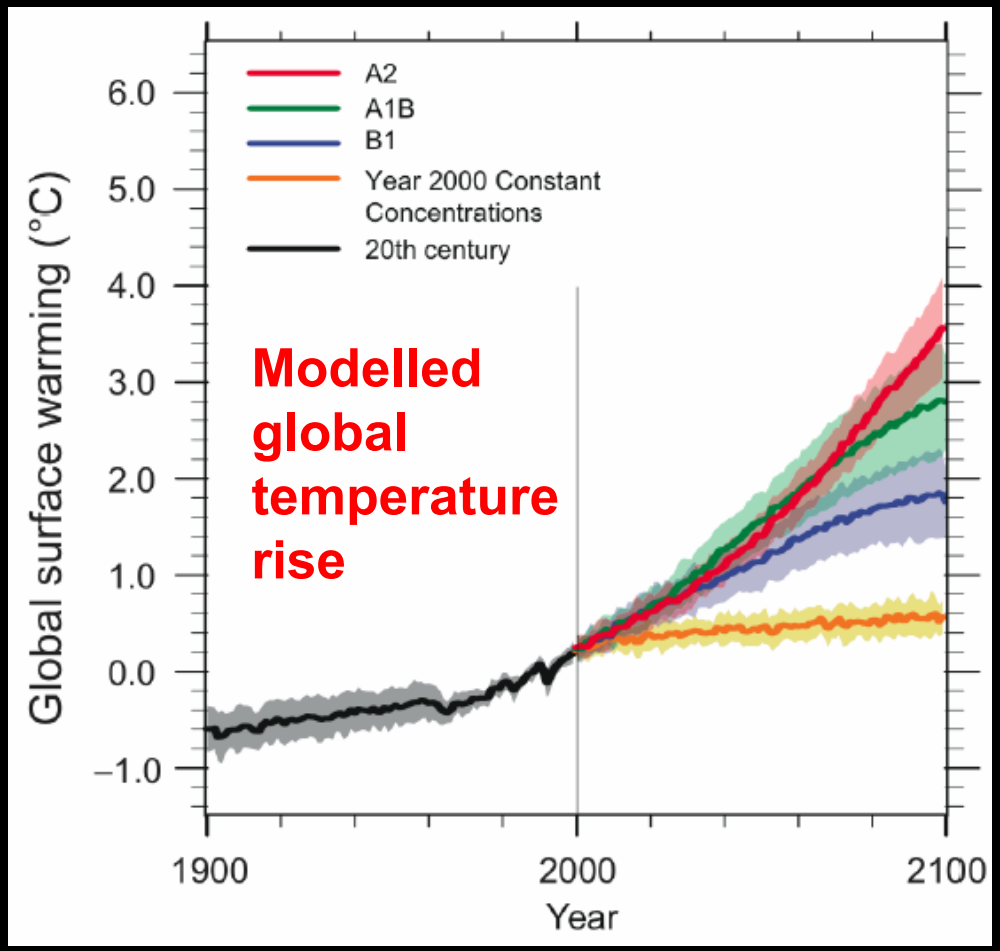
The uncertain climate future

Range of scenarios:

Strict international agreements → CO2 at 600ppm by 2100 *385ppm today

Mid-ground → 850ppm by 2100

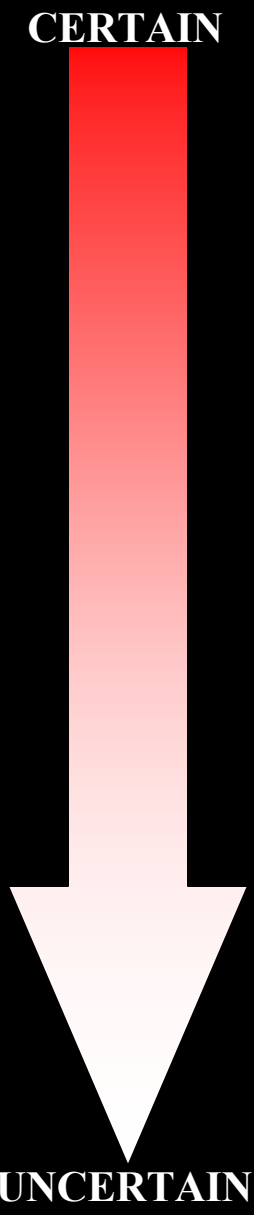
Business as usual → 1550ppm by 2100



Sea level rise:

7” to 22” by 2100, much more if rapid ice sheet collapse occurs

http://www.geo.arizona.edu/dgesl/index.html



Warming of 1-6°C by 2100.

Sea levels will rise by 6 to 30 inches by 2100.

Precipitation patterns will change.

Extreme events will increase.

Prospect of abrupt climate change.

Example: Hurricane Katrina (8/29/05)

Did global warming cause Katrina?

What is CLIMATE? What is WEATHER?

How can we predict temperatures 50 years from now if we can't predict temperatures 5 days from now?

CLIMATE: average of variables over 10-50years
ex: glacial-interglacial climate change
global warming
the 1930's "Dust Bowl"

WEATHER: the day-to-day or month-to-month variability about the climate state
ex: record rains in Seattle in winter 2006
European heat wave of 2003
Hurricane Katrina

Changes in Tropical Cyclone Number, Duration, and Intensity in a Warming Environment

P. J. Webster,[1] G. J. Holland,[2] J. A. Curry,[1] H.-R. Chang[1]

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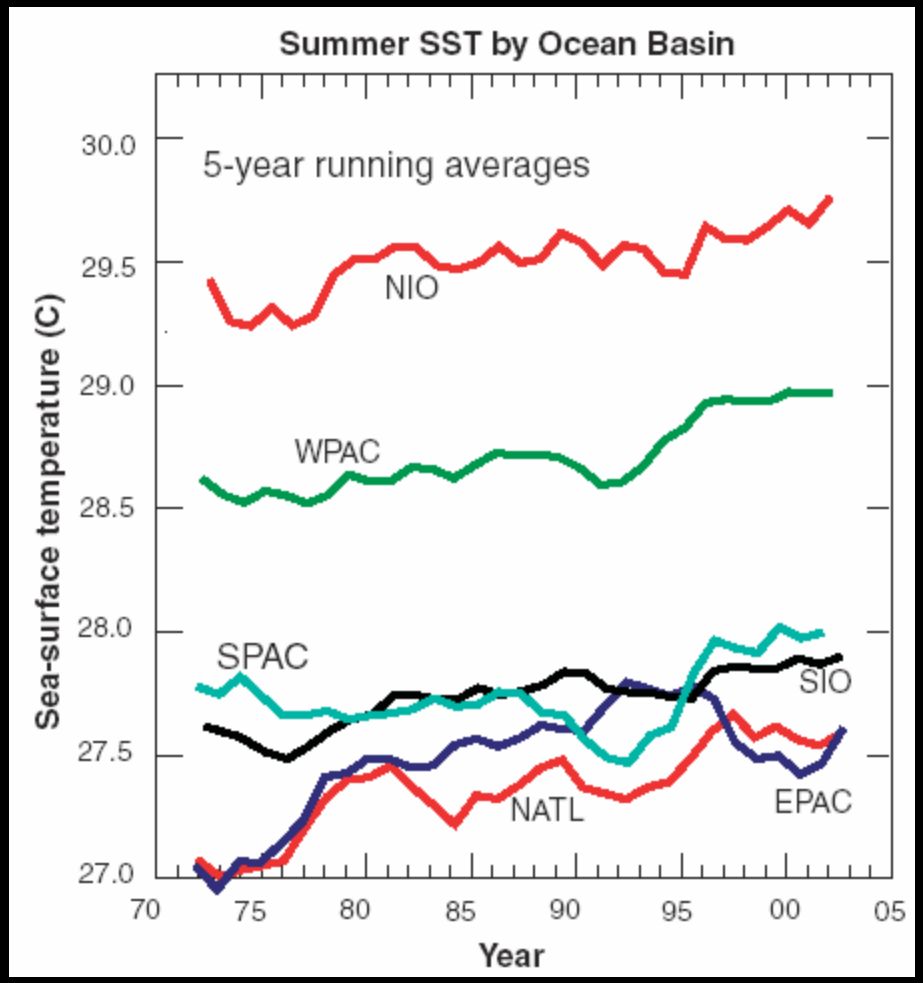

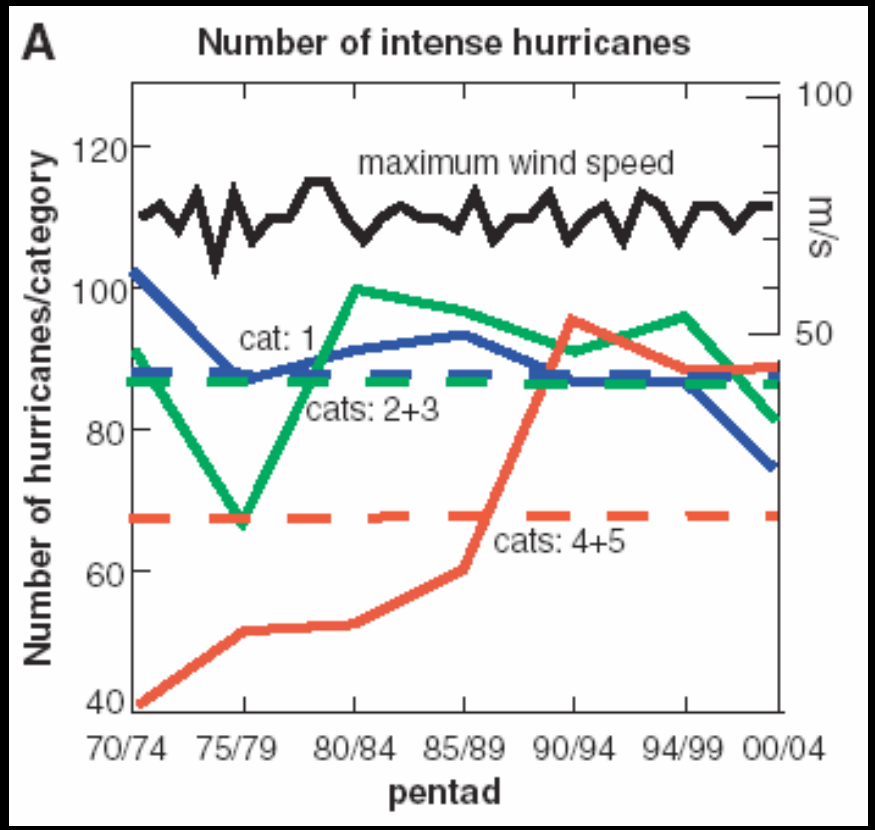

Scientific Summary

Strong evidence supports the idea that anthropogenic CO2 is warming the planet.

Future climate changes in a warming environment are uncertain

-sea level rise certain (but how much by when?)

-prospect for abrupt climate change

-prospect for increasing storm activity

- definite changes in precipitation patterns (but where, how much, etc?)

A Climate Scientist's Plea

Evaluate the scientific evidence for yourselves, from a scientific source.

Distinguish between the science of global warming and the politics/economics of global warming.

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