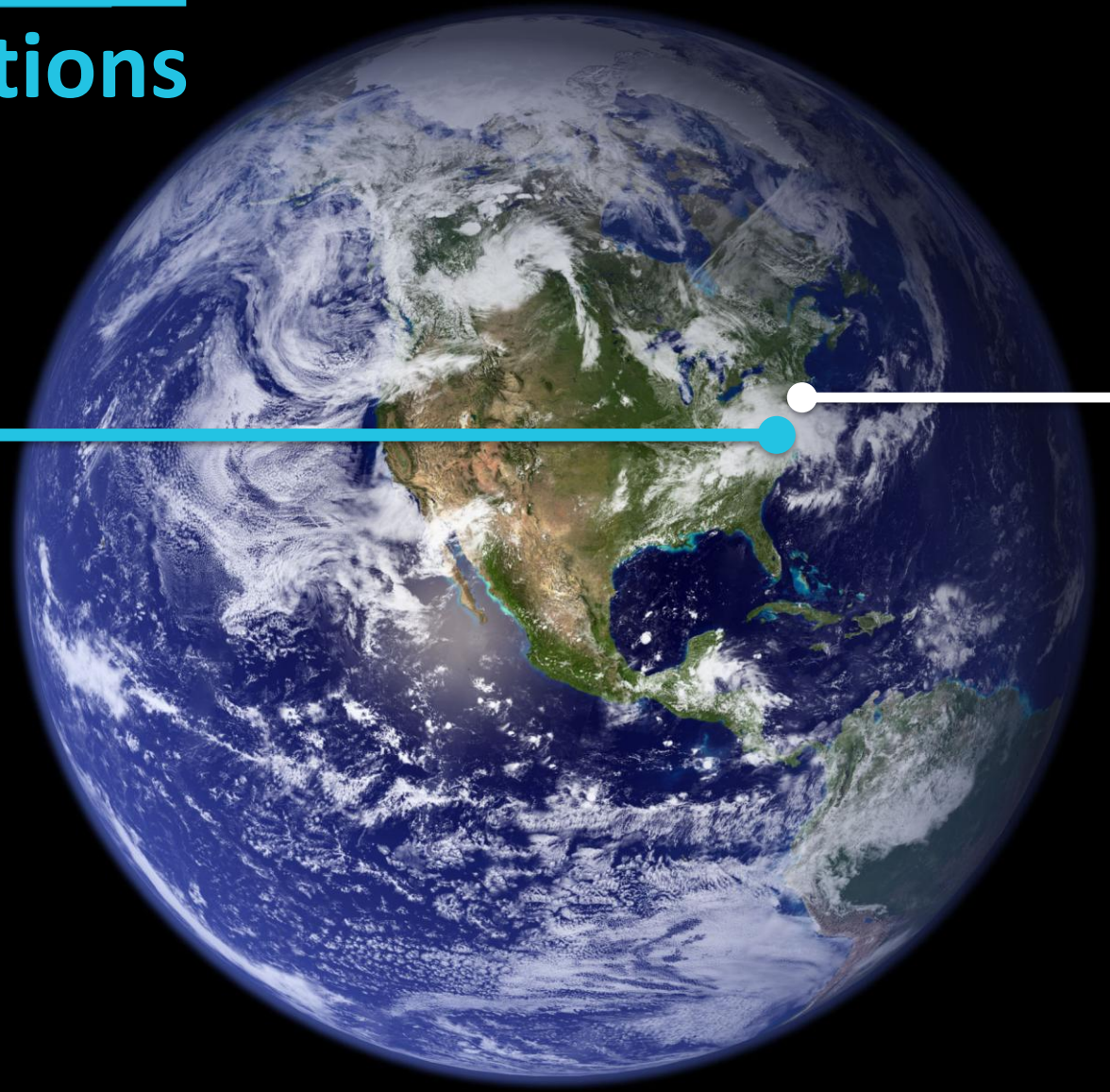
Trucks Carrying Hurricane Relief Supplies Await Distribution Instructions at NASA's Stennis Space Center

A Climate Conversation

Olga Dominguez
AA for Strategic Infrastructure
NASA's Strategic Sustainability Officer

Climate Projections
for
Washington, DC



Goddard Institute for Space Studies

Cynthia Rosenzweig

Climate Adaptation Science Investigators (CASI) Working Group

31 January 2013

Responding to Climate Risks

Mitigate to reduce our impact on natural systems…

…and ***adapt*** where we nevertheless expect impacts.

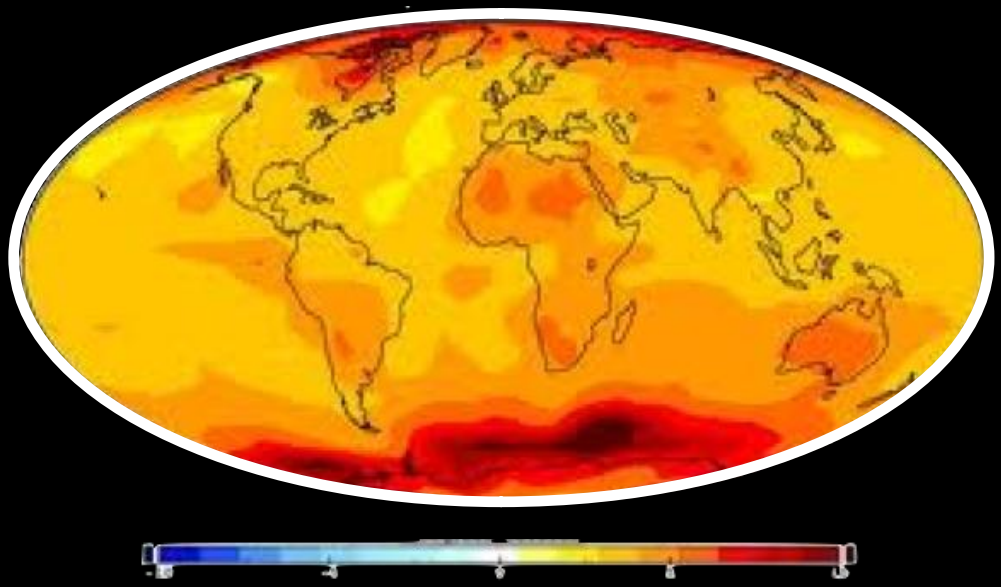
Question

Distinction between weather and climate?

An important distinction

Weather describes current and near-term conditions

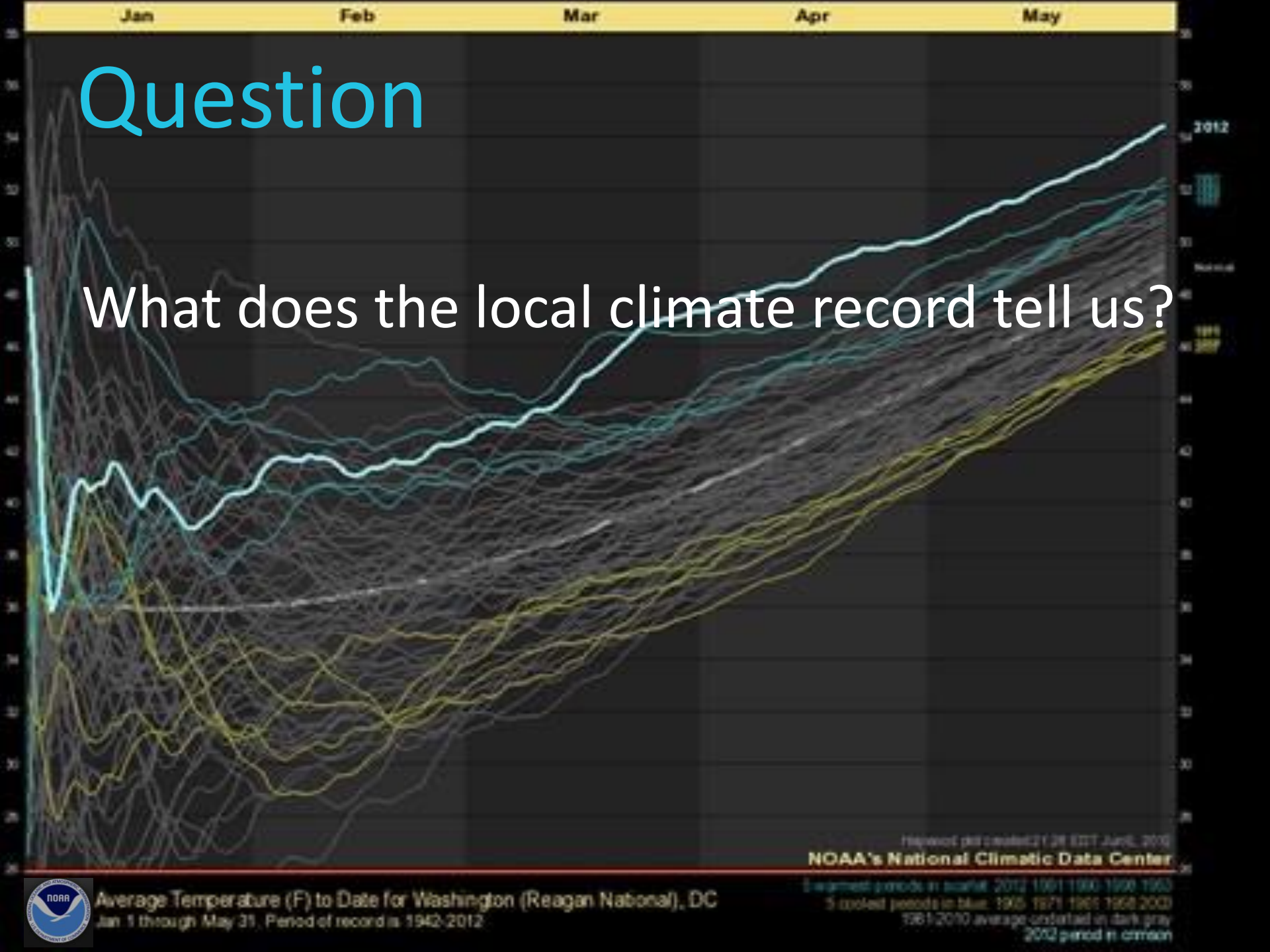
Climate describes weather patterns over a longer term



"Weather is what you get; climate is what you expect."

Question

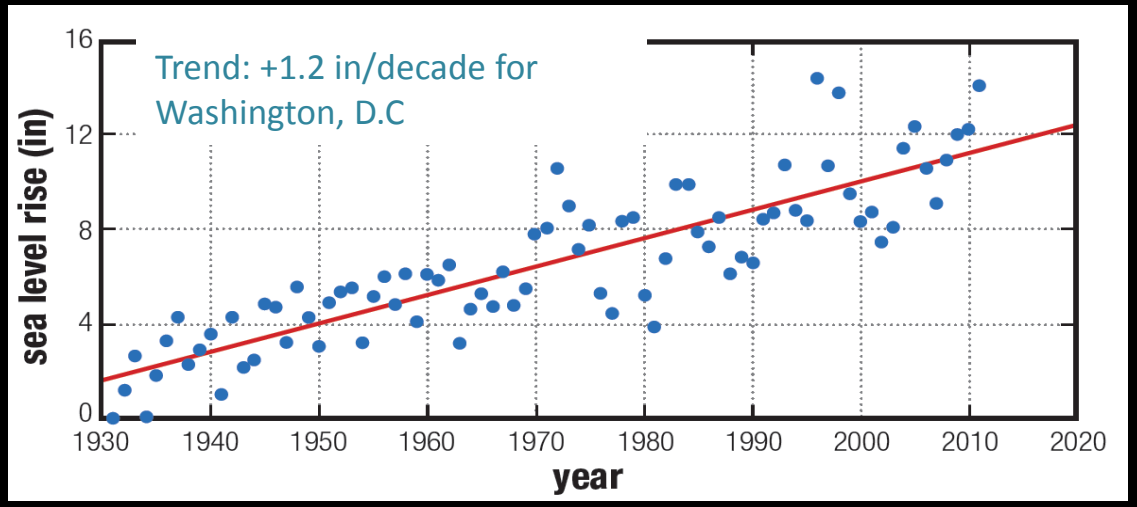
What does the local climate record tell us?



What's already happened ***locally***?

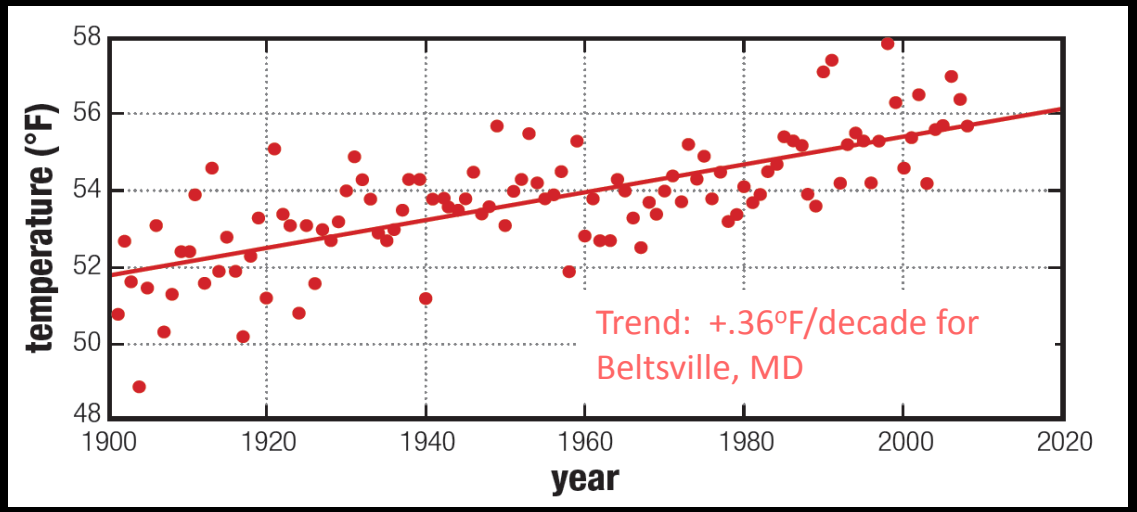
Sea Level

has risen over decades, though individual years vary somewhat



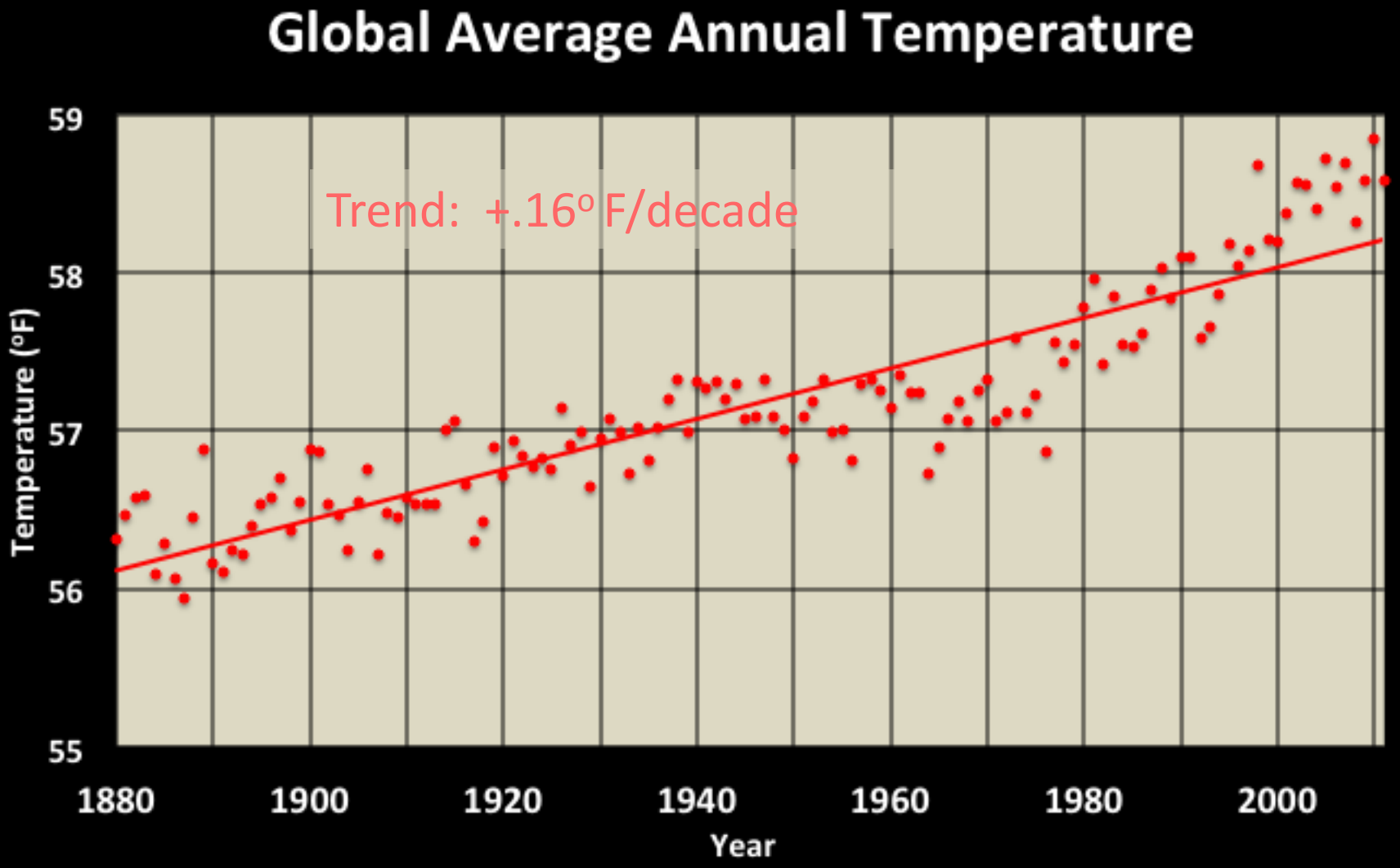
Temperature

has risen too, but the trend varies more year-to-year



A century of local data tells us <u>the climate is changing</u>

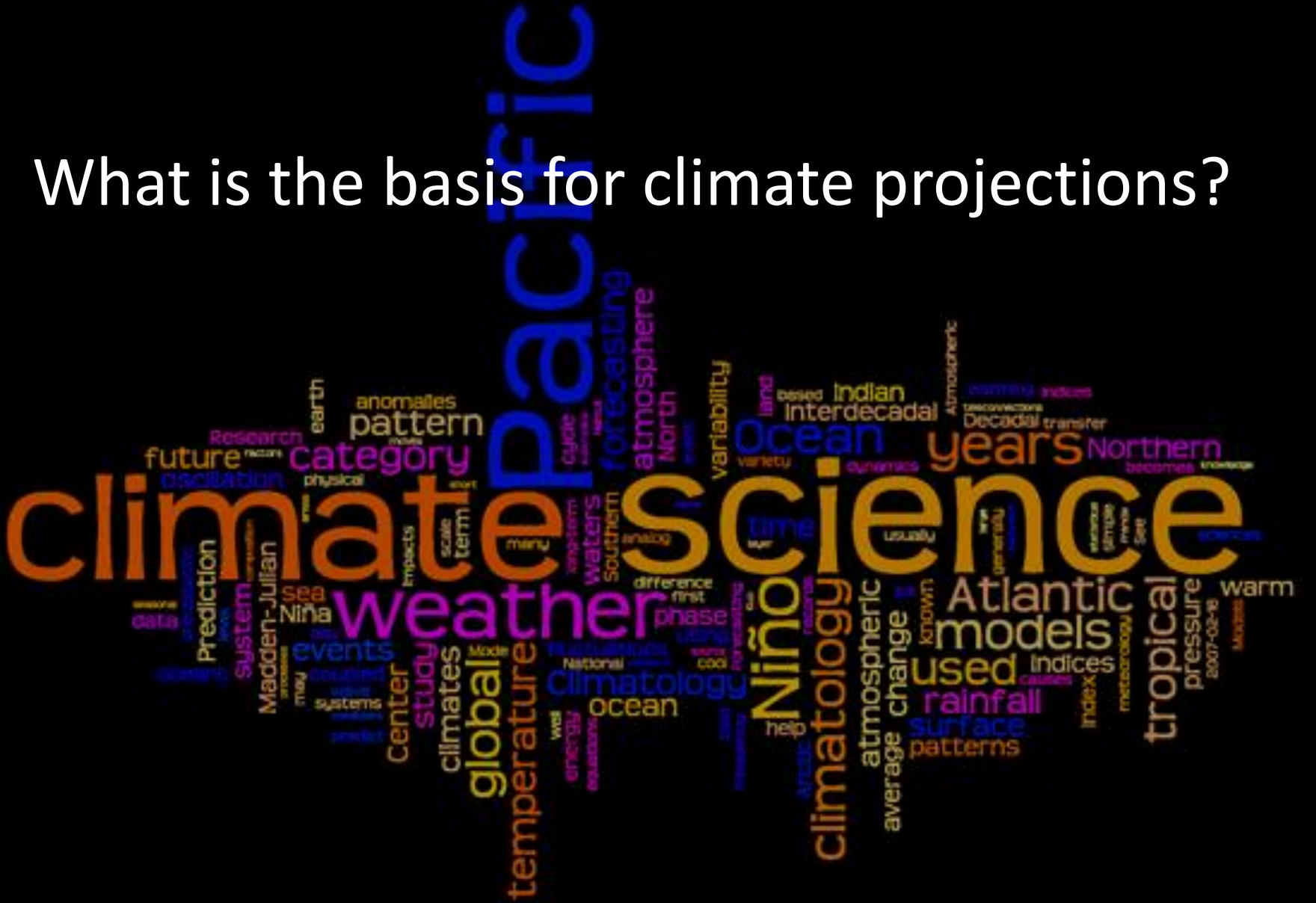
Part of a larger pattern?



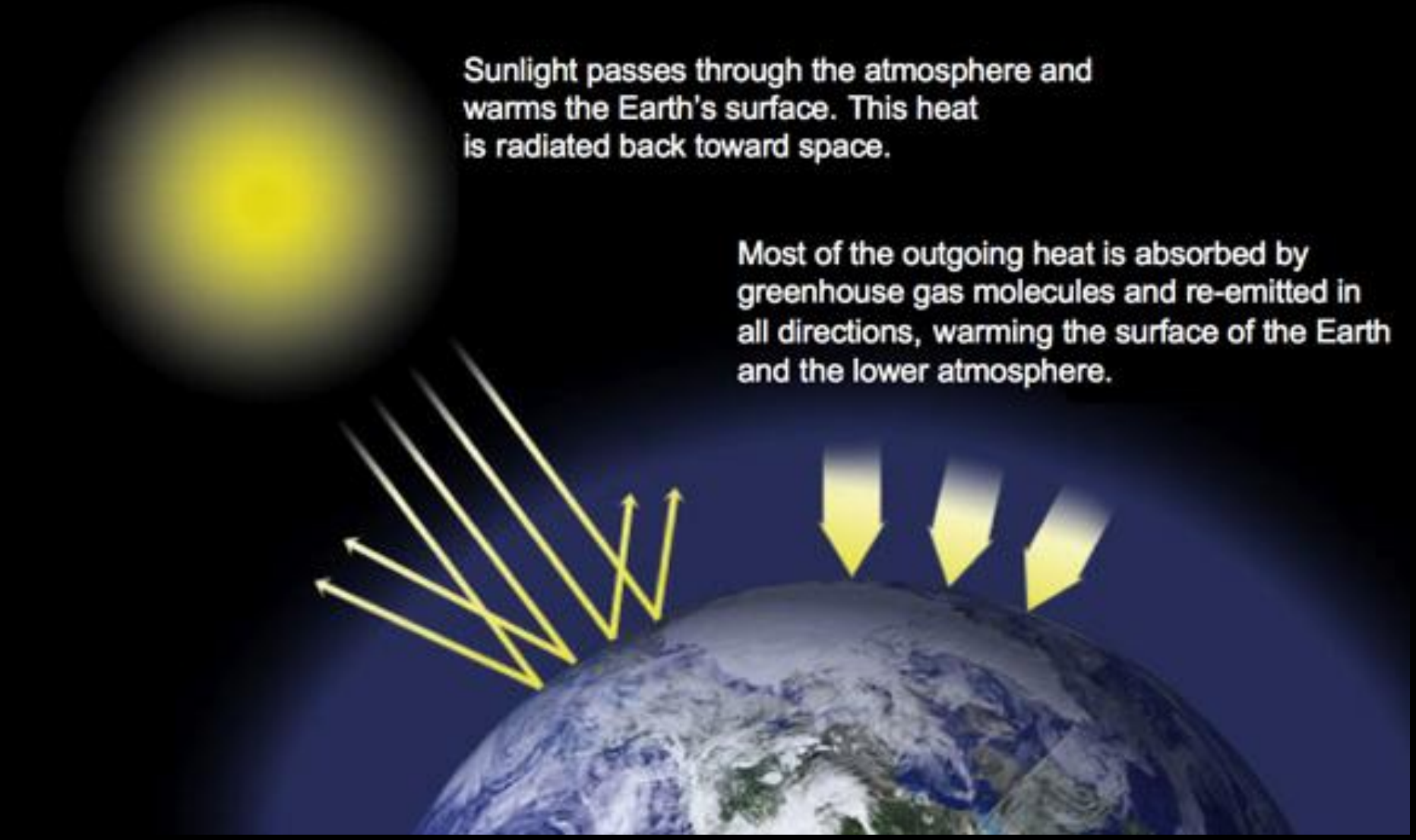
Observed local patterns reflect world-wide trends

Question

What is the basis for climate projections?

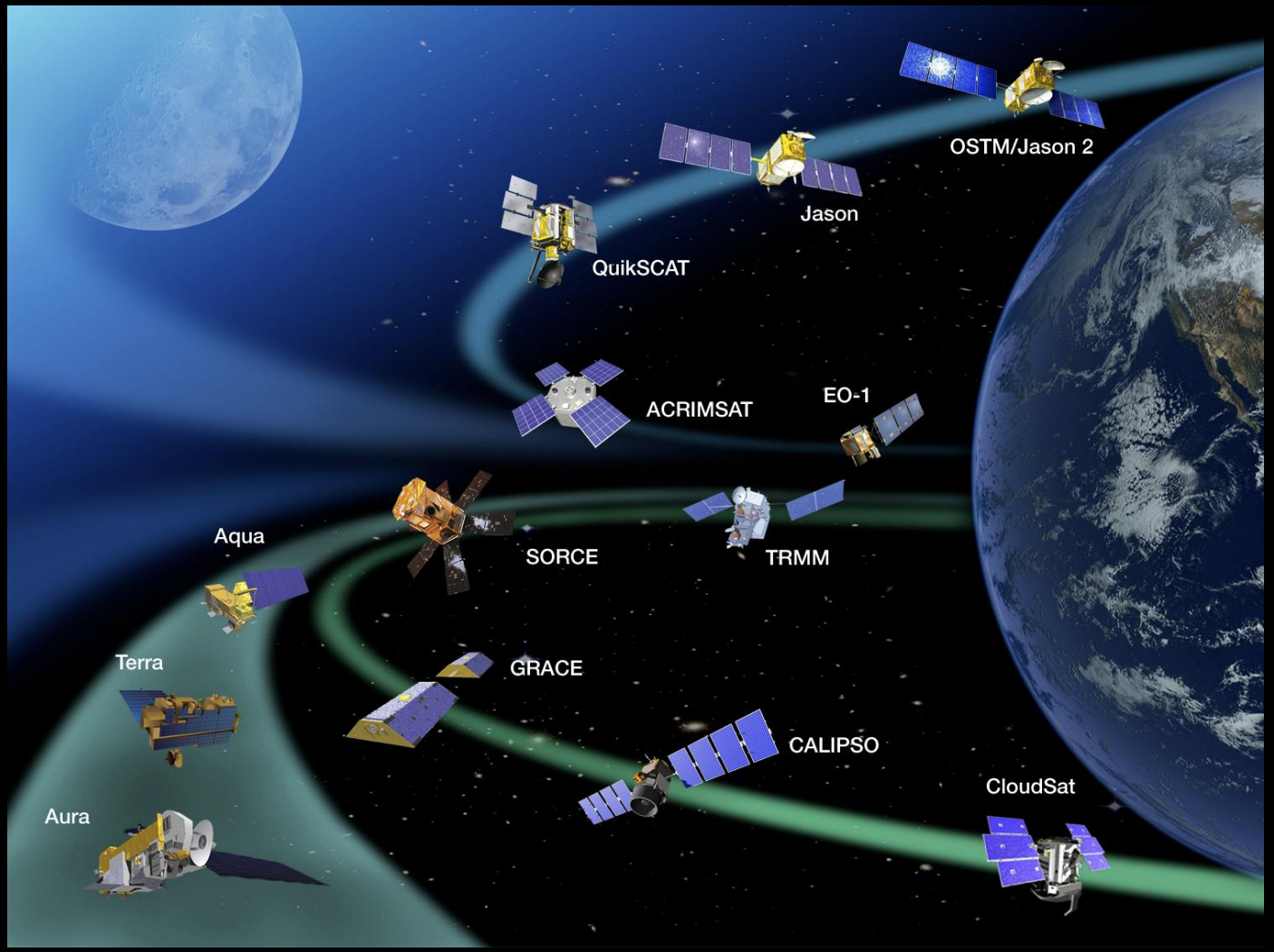


What's behind this?



Scientists have understood this pattern for over a century

Gathering better data

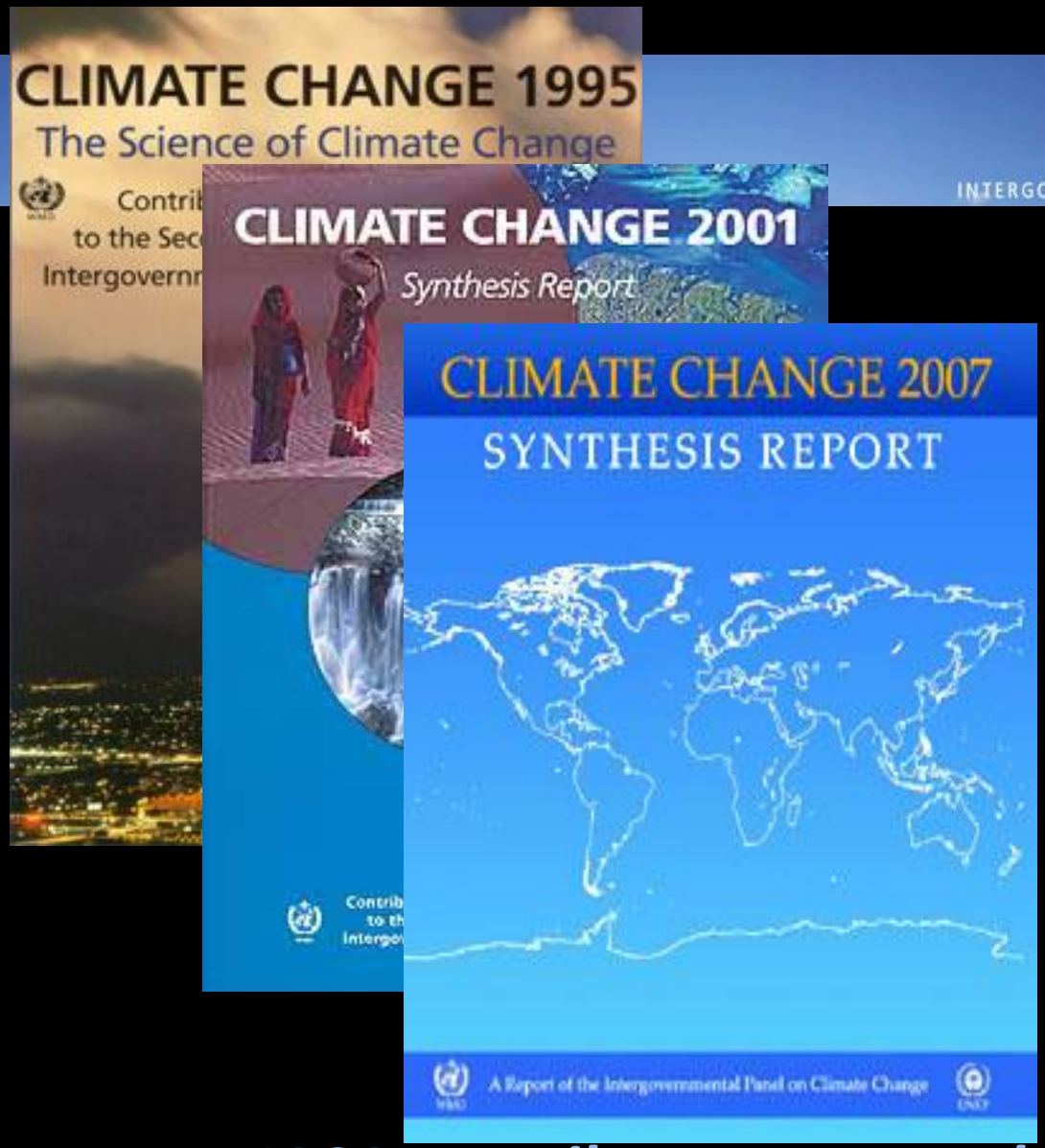


NASA's orbital perspective is a critical vantage-point

Building on a strong foundation

Powerful computer models let us test and refine hypotheses

Intergovernmental Panel on Climate Change



ipcc
INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP

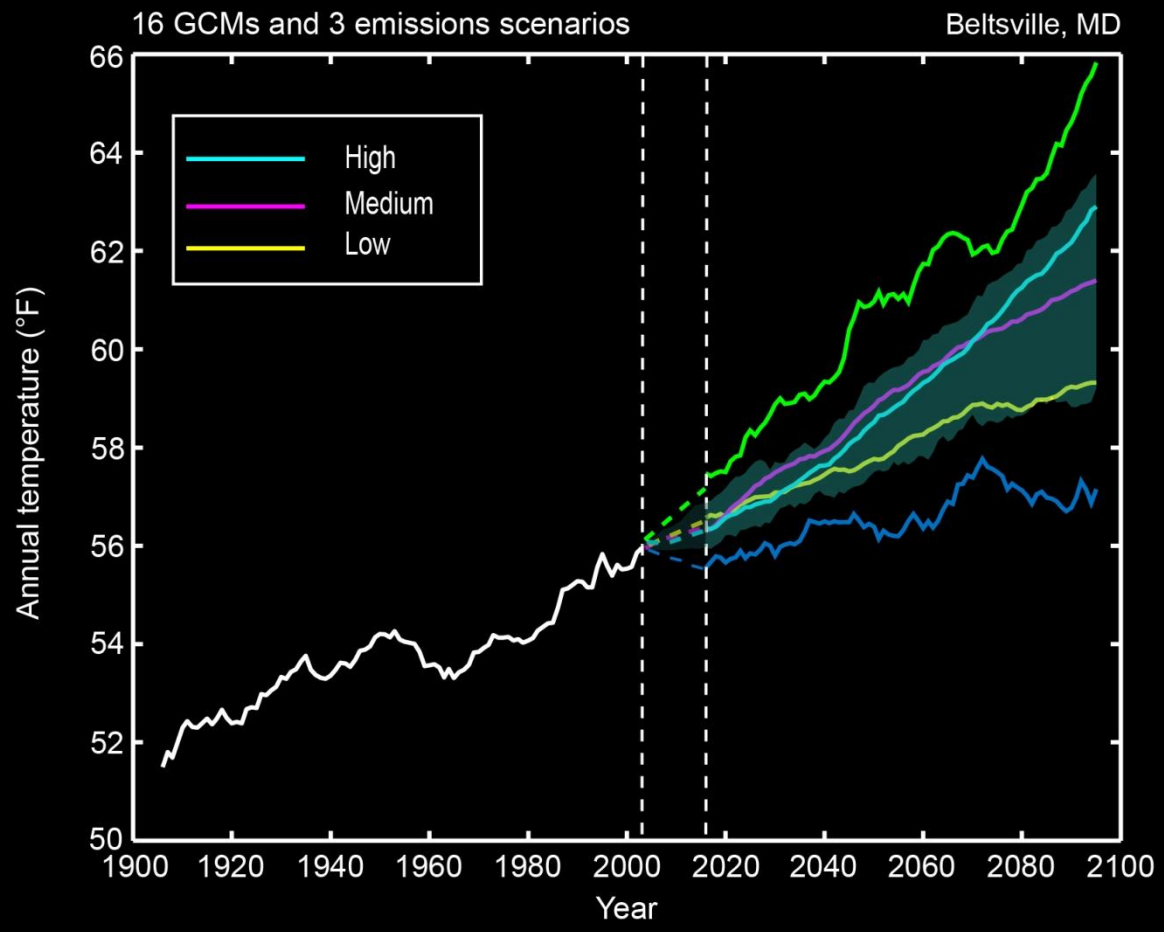
Consensus-based projections using

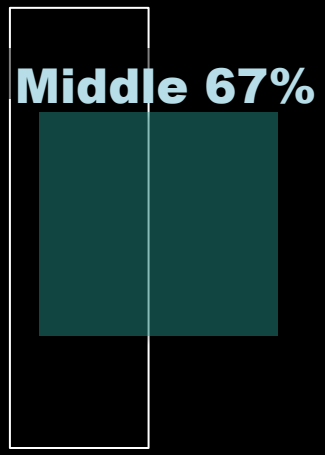
- Several models
- Several future greenhouse gas emission scenarios

Updated as the science advances

NASA contributes to a worldwide consensus

IPCC Models

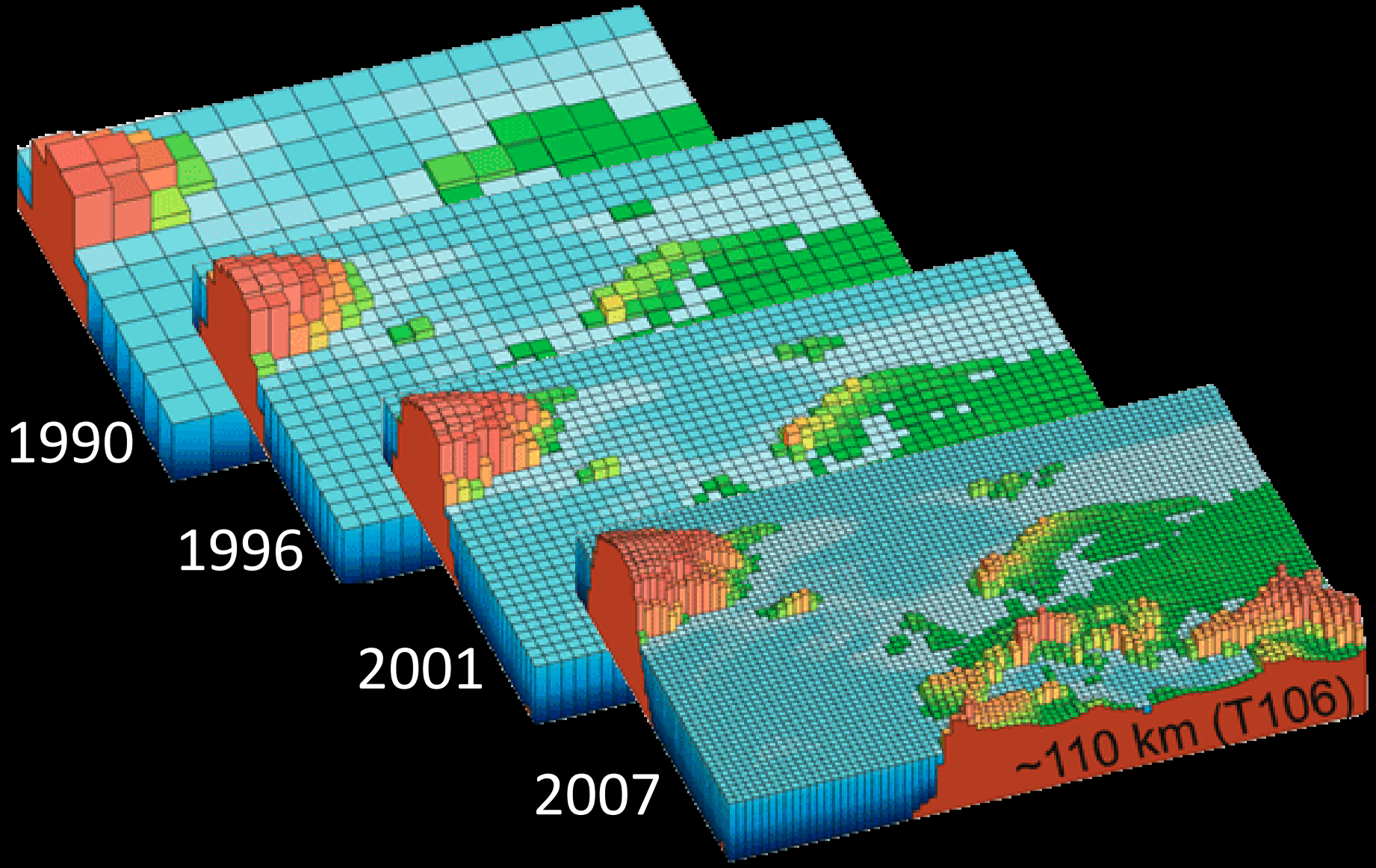




Range of Projections

Central range of models is basis for NASA's projections

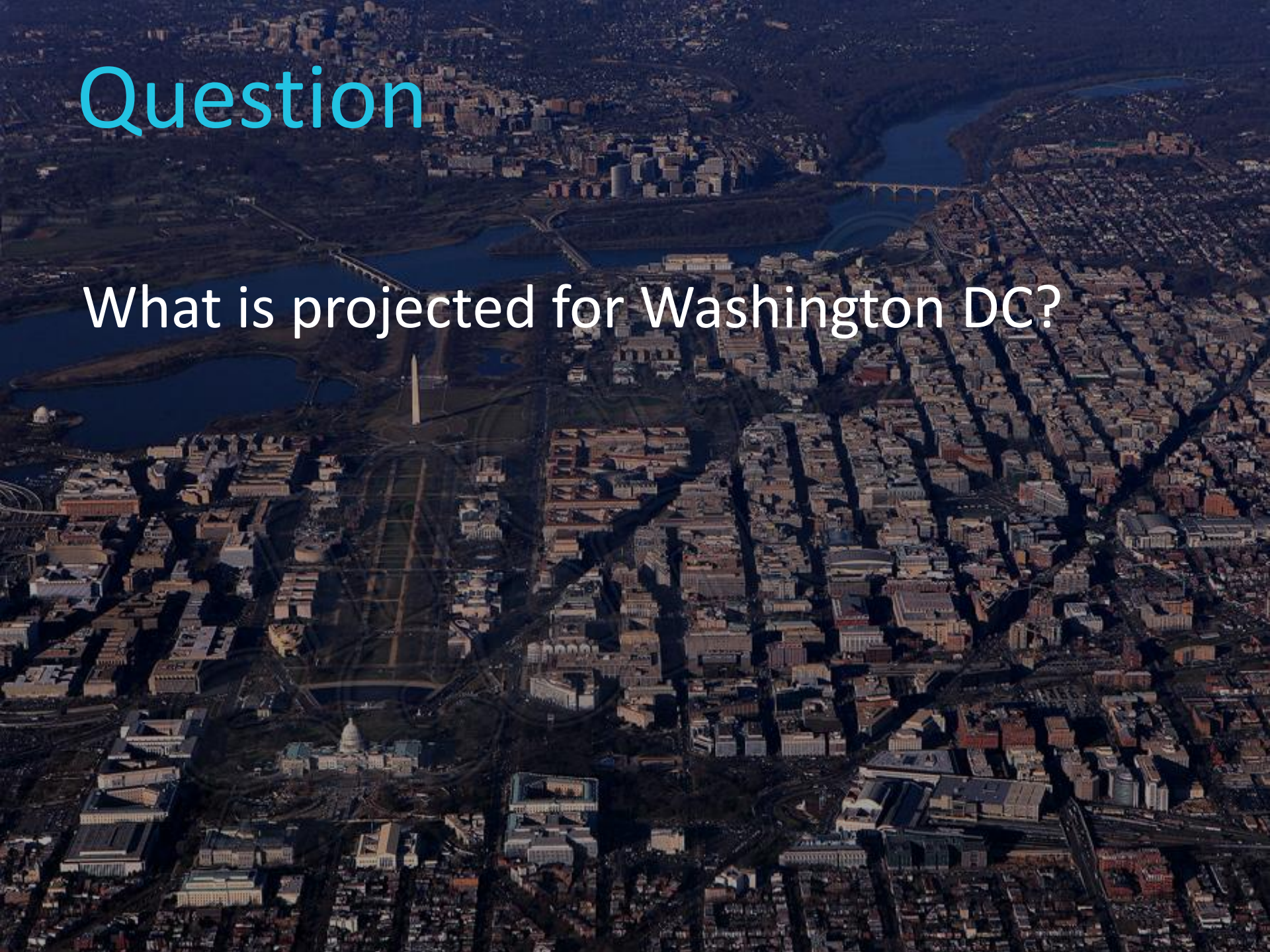
Rising precision/resolution over time



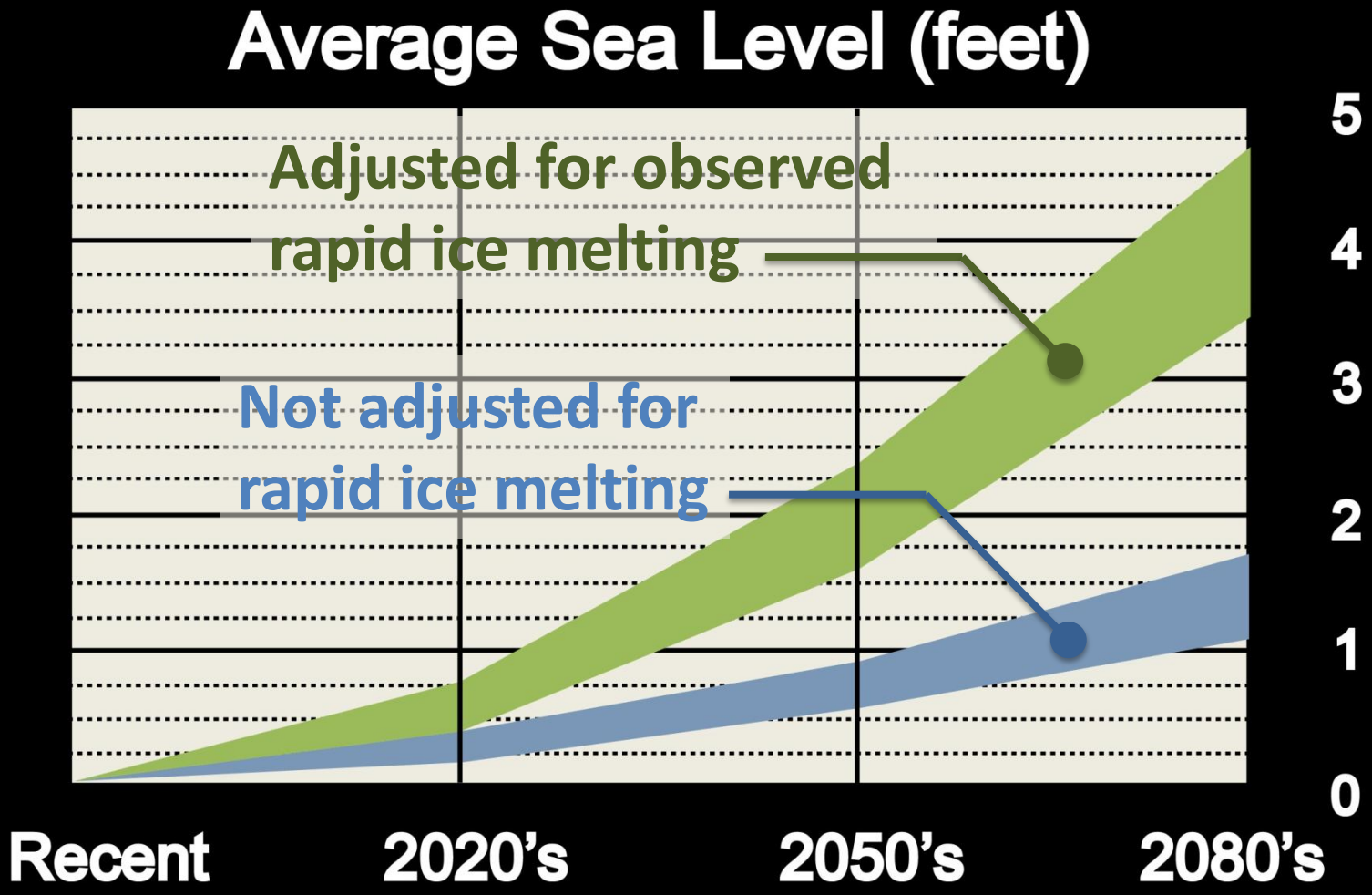
New models + better data = more specific projections

Question

What is projected for Washington DC?

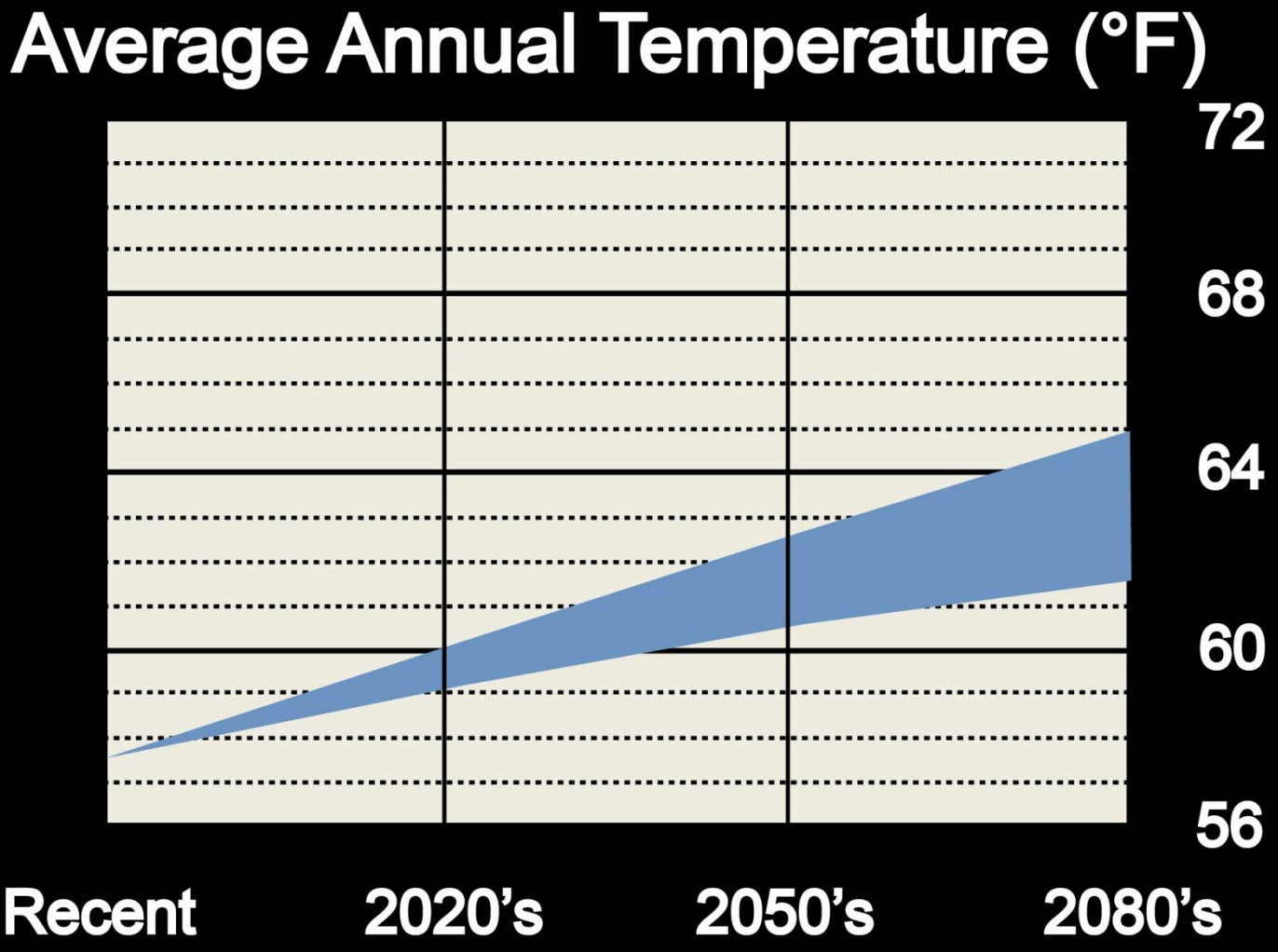


What is projected locally?



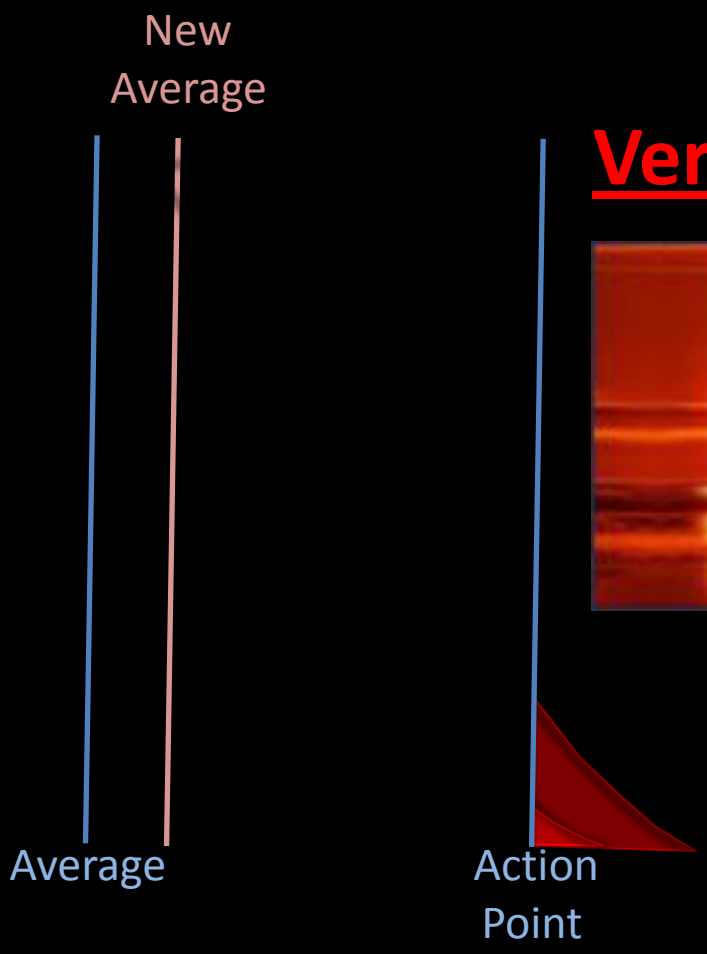
Sea level rise is projected to accelerate this century

What is projected locally?



Average temperatures are projected to rise

What can a few degrees warmer do?



Very Likely Increase:

Days with Extreme Heat

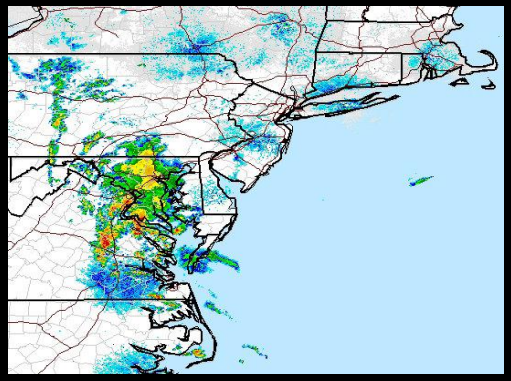
A small average change can mean a big effect on extremes

Question

What other changes are projected?

What other changes are projected?

Likely Increases



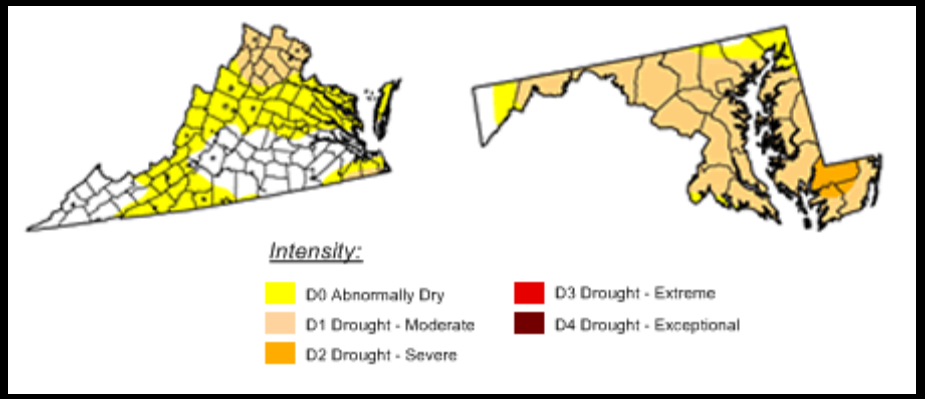
Intense Rainfall Events

Likely Decreases

Snowfall Frequency and Amount

More likely than not

Increases in Drought Events



There's more to consider than averages

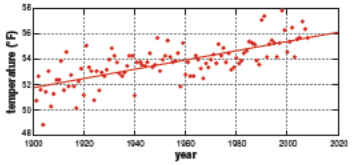
For more information…

National Aeronautics and Space Administration

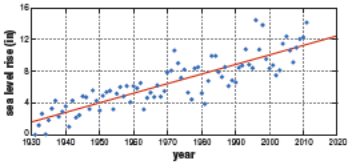
ADAPTIN
Federal Age

What we're seeing now

Weather and climate are changing. Over 100 years of data collected from the area tell the story: the average annual temperature has risen about 4F, as measured in Beltsville, MD. Sea level, measured in the District of Columbia, has risen almost 10 inches over the past 80 years.



Observed Temperature



Observed Sea Level

Scientists project that these trends will continue, and even accelerate, this century. Furthermore, this warming is driving changes in the frequency and intensity of extreme weather events. Changes in extreme events may include more downpours, more drought, and more heat waves. At facilities vulnerable to coastal storms, rising sea levels magnify the effect of intense storms, producing serious potential impacts from storm surge and flooding.

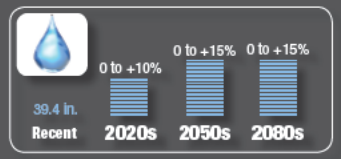
Washington, DC has experienced several extreme weather events in recent years. wThree days of intense tropical downpours in June 2006 swamped the downtown. A cluster of tornadoes in April 2011 put the city on edge. Hurricane Lee in September 2011 produced 7 inches of rain in 3 hours in some parts of the region. A string of days over 100 degrees in July 2012 kinked the tracks of a Metro route, leaving many commuters stranded. And DC residents learned a new word this year – derecho – a widespread and long-lived wind storm that accompanies rapidly moving showers and thunderstorms. The June 29th derecho caused massive tree damage and flooding to the area; power outages across the District disrupted life for several days.

What scientists project

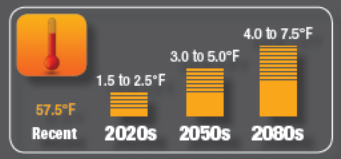
Climate scientists from NASA's Goddard Institute of Space Studies used site-specific climate data from the DC area, combined with climate model outputs, to generate temperature and sea level rise projections for the area. The projections indicate continued rising temperatures and sea levels in the area. Sea levels may rise considerably faster if land-based ice melts faster than most current models project. (See the Rapid Ice Melt projections below.)

Average temperatures and sea levels are projected to rise, but most people are more likely to notice the increase in some kinds of extreme events. Changes in the number of hot days and cold days may affect energy usage patterns, health (e.g., asthma), plant and animal habitats, and infrastructure function (e.g., buckling of concrete roads).

What might the Metro DC area's future look like?



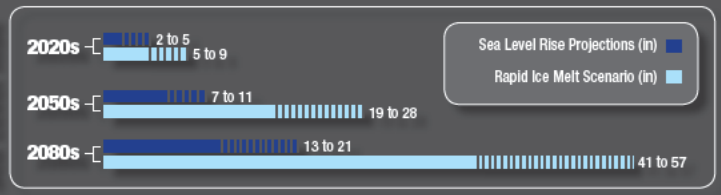
Change in Average Annual Precipitation



Change in Average Annual Temperature

Temperature and precipitation projections reflect a 30-year average centered on the specific decade; sea levels are averages for the specific decade. Temperatures are rounded to the nearest half degree, precipitation projections to the nearest 5%, and sea level rise to the nearest inch. Shown are the central range (middle 67% of values) across the Global Climate Models and greenhouse gas emissions scenarios.

Sea Level Rise



Extreme Event Changes This Century

Event	Direction of Change	Likelihood
Heat Stress	↑	Very Likely
Snowfall Frequency and Amount	↓	Likely
Intense Precipitation Events	↑	Likely
Drought	↑	More Likely than not
Ice Storms/freezing rain	↑	About as Likely as not

Based on global climate model simulations, published literature, and expert judgment. Source: NASA GISS. Likelihood definitions (>90% Very likely, >66% Likely, >50% More likely than not, 33 to 66% About as likely as not) based on IPCC.

Hot/Cold Days