

“A Climate Conversation”

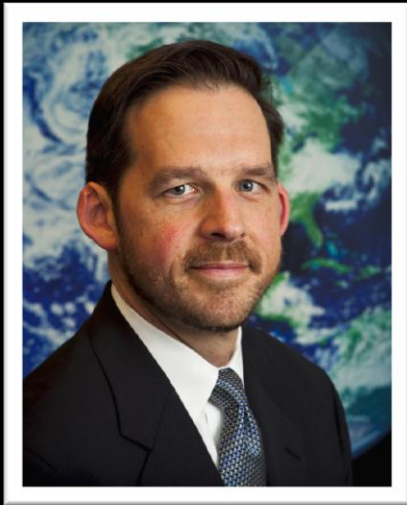
Introduction to Climate Science Webinar

Part of the “Building a Climate Resilient National Capital Region” series of webinars and workshops

<http://www.mwcog.org/environment/climate/resilience.asp>

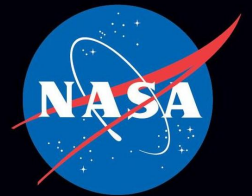


Opening Remarks



Lawrence Friedl

Director, Applied Sciences Program,
Earth Science Division
National Aeronautics and Space
Administration (NASA)

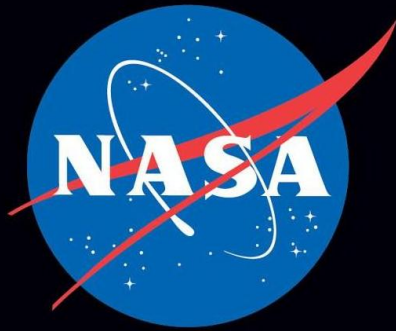


Earth Science Serving Society

NASA Applied Sciences Program



A Climate Conversation: The Decision-Maker



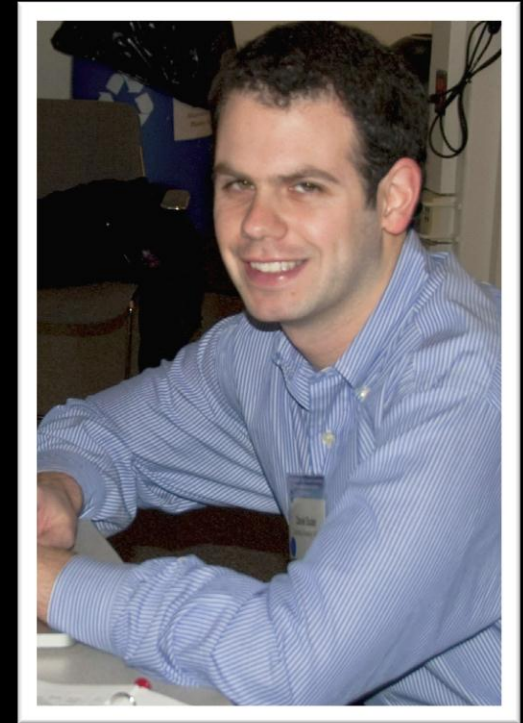
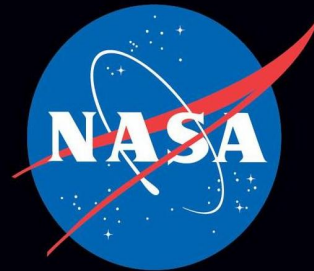
Olga Dominguez

Associate Administrator for Strategic Infrastructure
NASA's Strategic Sustainability Officer

A Climate Conversation: The Scientist



Goddard Institute for Space Studies



Dan Bader

Research Analyst

NASA Goddard Institute for Space Studies

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



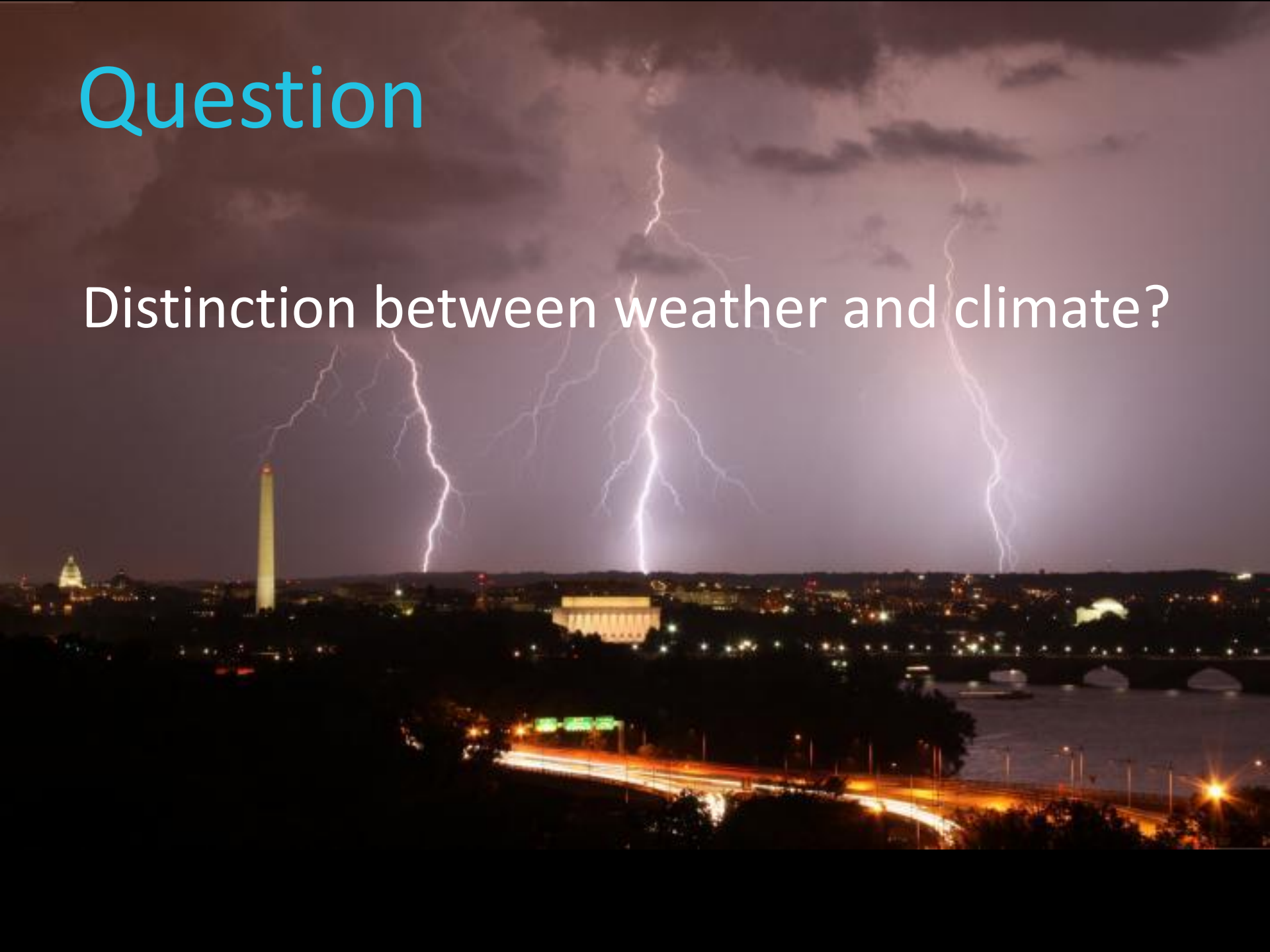
Responding to Climate Risks

Mitigate to reduce our impact on natural systems...
...and *adapt* where we nevertheless expect impacts.



Question

Distinction between weather and climate?

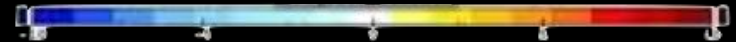
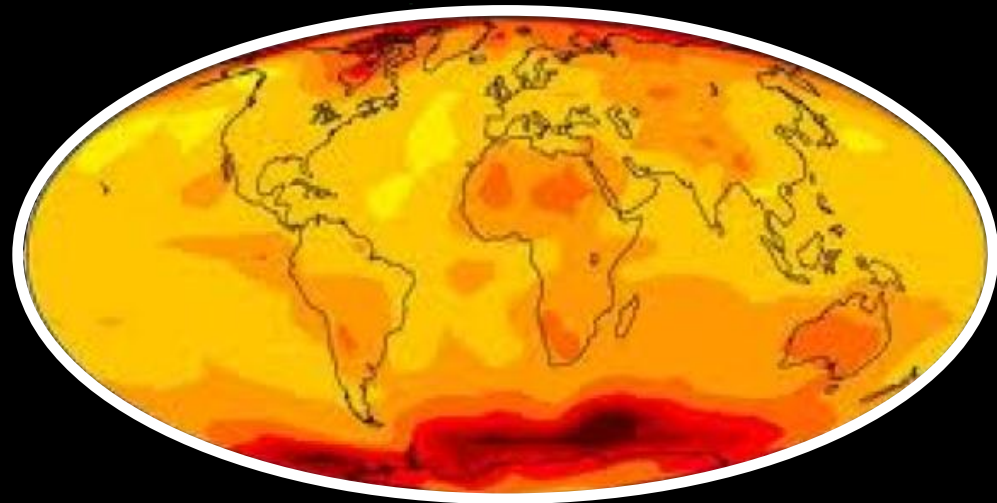


Comparing Weather and Climate

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.”

January

February

March

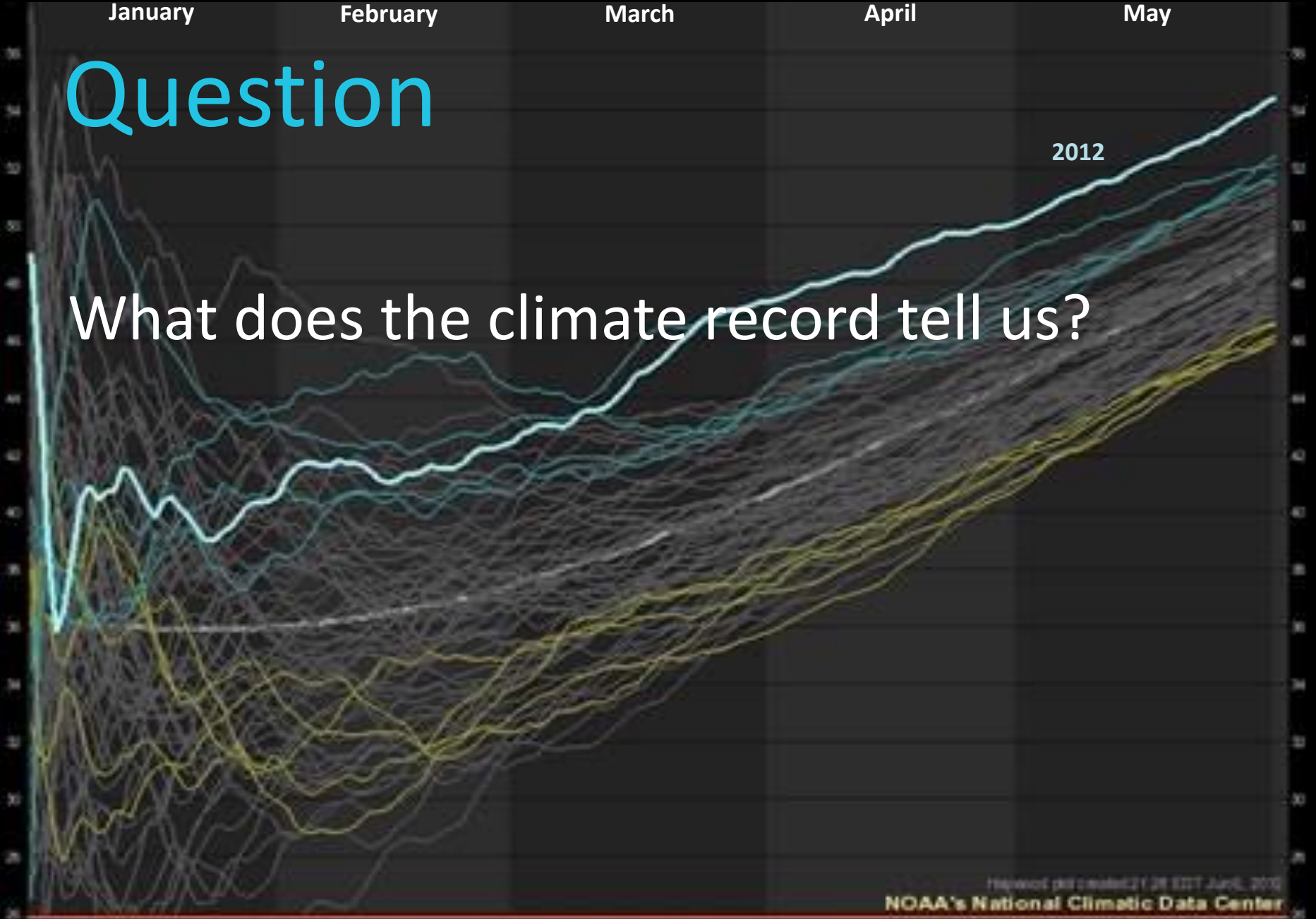
April

May

Question

What does the climate record tell us?

2012



Report created 21:28 EDT, June, 2012
NOAA's National Climatic Data Center

5 warmest periods in world: 2012 1991 1990 1999 1993
5 coolest periods in blue: 1965 1971 1966 1968 2003
1961-2010 average overlaid in dark gray
2002 period in orange

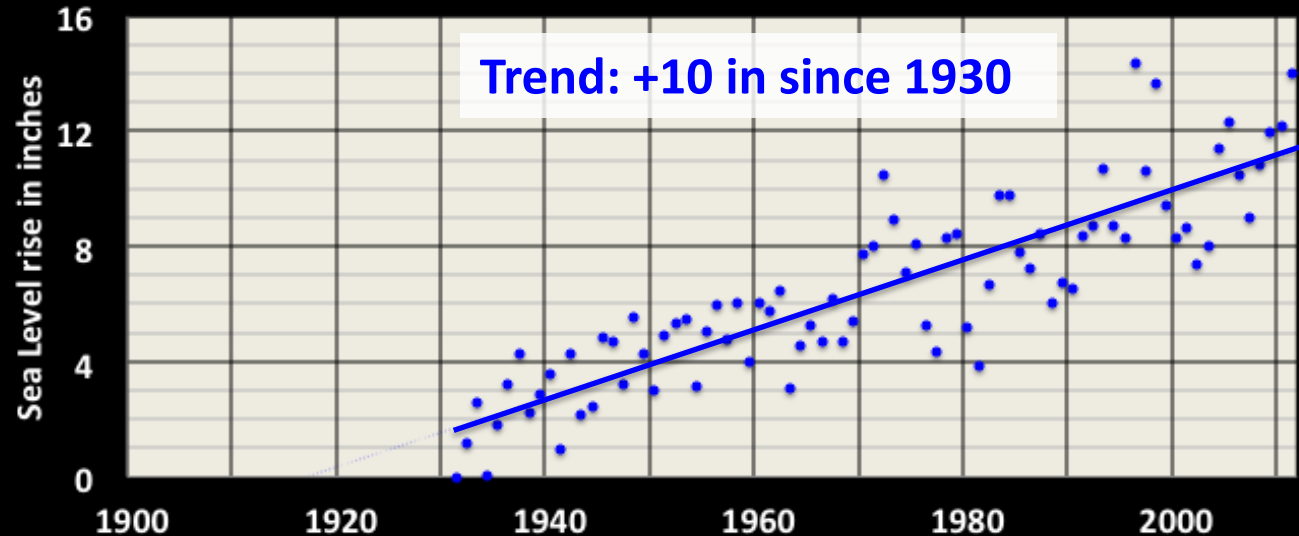


Average Temperature (F) to Date for Washington (Reagan National), DC
Jan. 1 through May 31, Period of record is 1942-2012.

What's already happened *locally*?

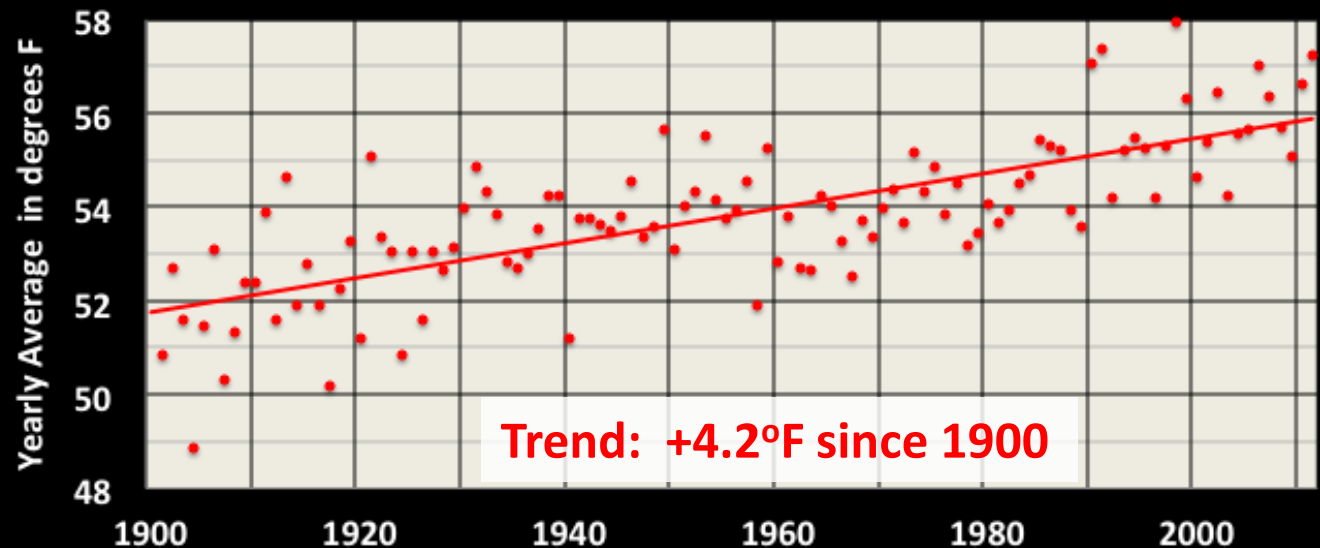
Sea Level

has risen over decades, though individual years vary somewhat



Temperature

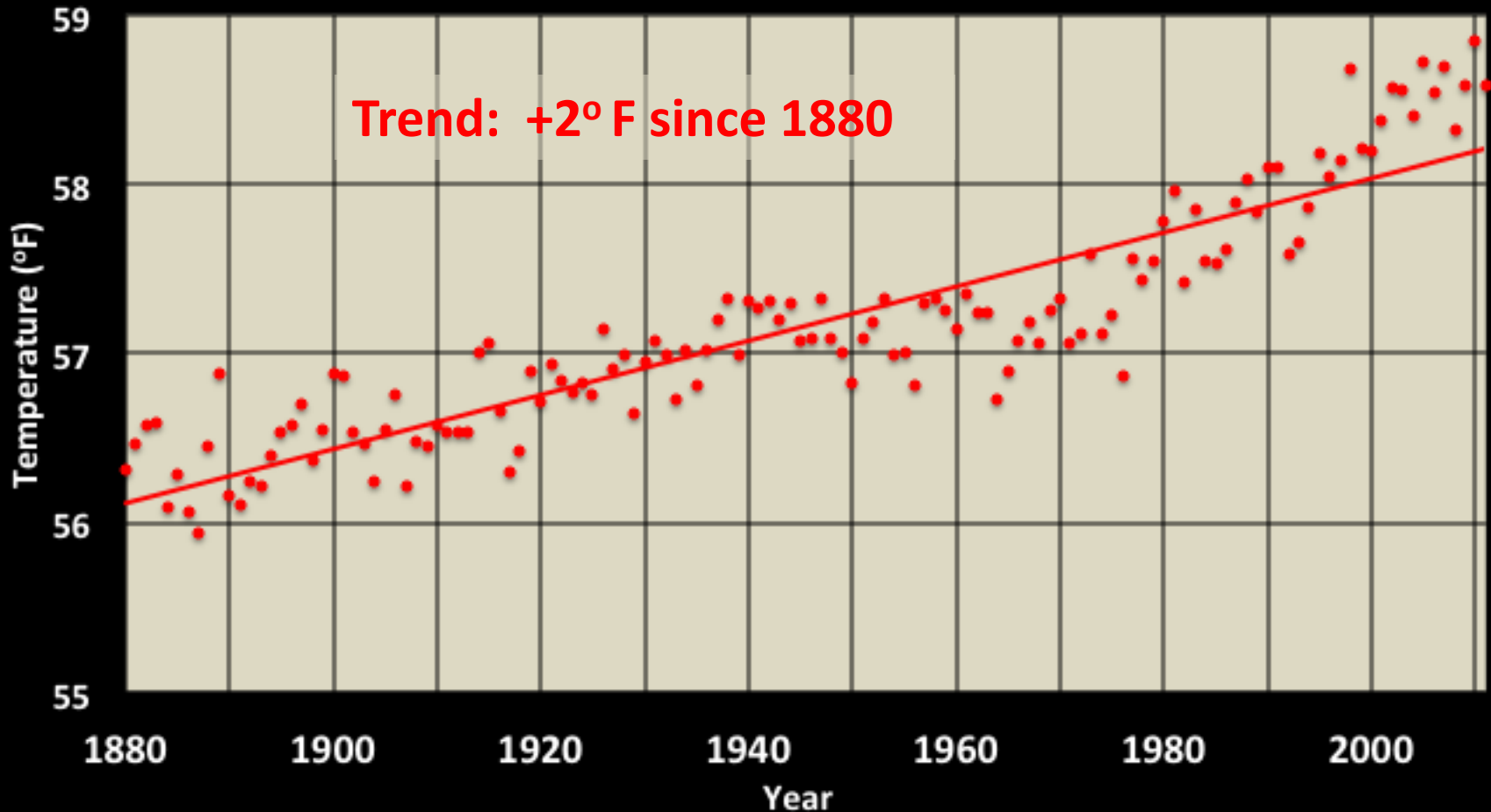
has risen too, but the trend varies more year-to-year



A century of local data tells us the climate is changing

Part of a larger pattern?

Global Average Annual Temperature

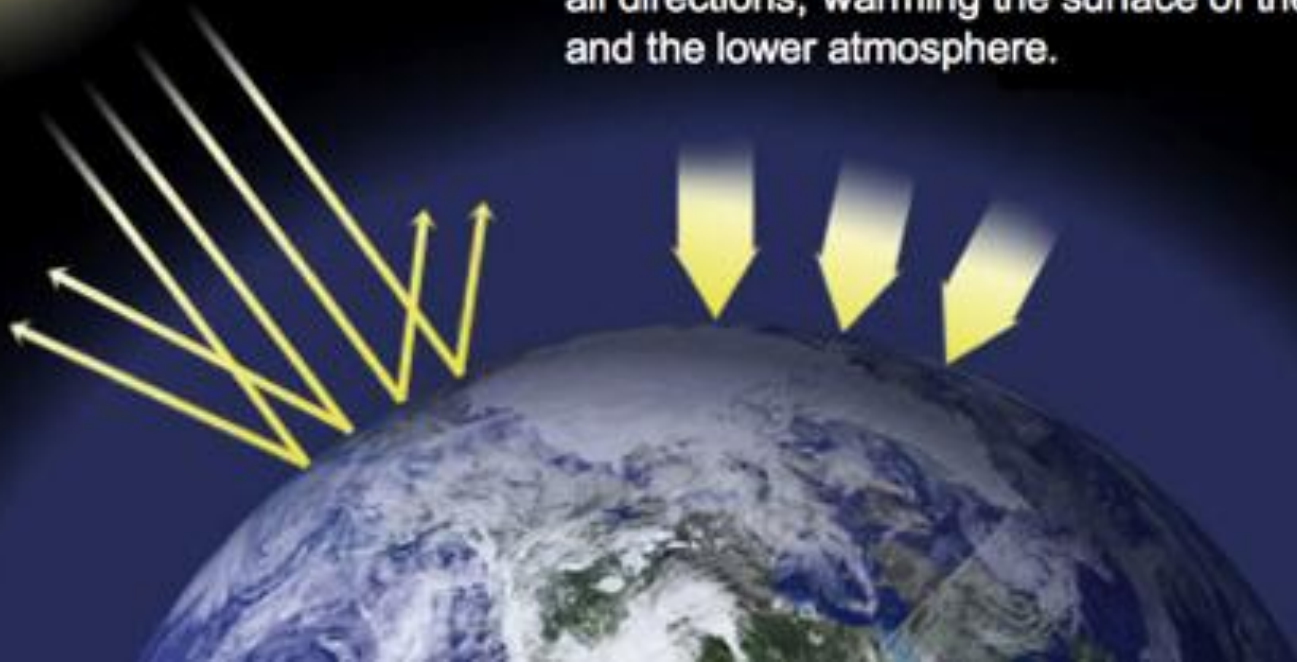


Observed local patterns reflect world-wide trends

First principles

Sunlight passes through the atmosphere and warms the Earth's surface. This heat is radiated back toward space.

Most of the outgoing heat is absorbed by greenhouse gas molecules and re-emitted in all directions, warming the surface of the Earth and the lower atmosphere.



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

CLIMATE CHANGE 1995

The S

to th
Interge

CLIMATE CHANGE 2001

CLIMATE CHANGE 2007

SYN

ipcc

INTERGOVERNMENTAL PANEL ON climate change

CLIMATE CHANGE 2013

The Physical Science Basis

WG I

WORKING GROUP I CONTRIBUTION TO THE
FIFTH ASSESSMENT REPORT OF THE
INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

ipcc
INTERGOVERNMENTAL PANEL ON climate change

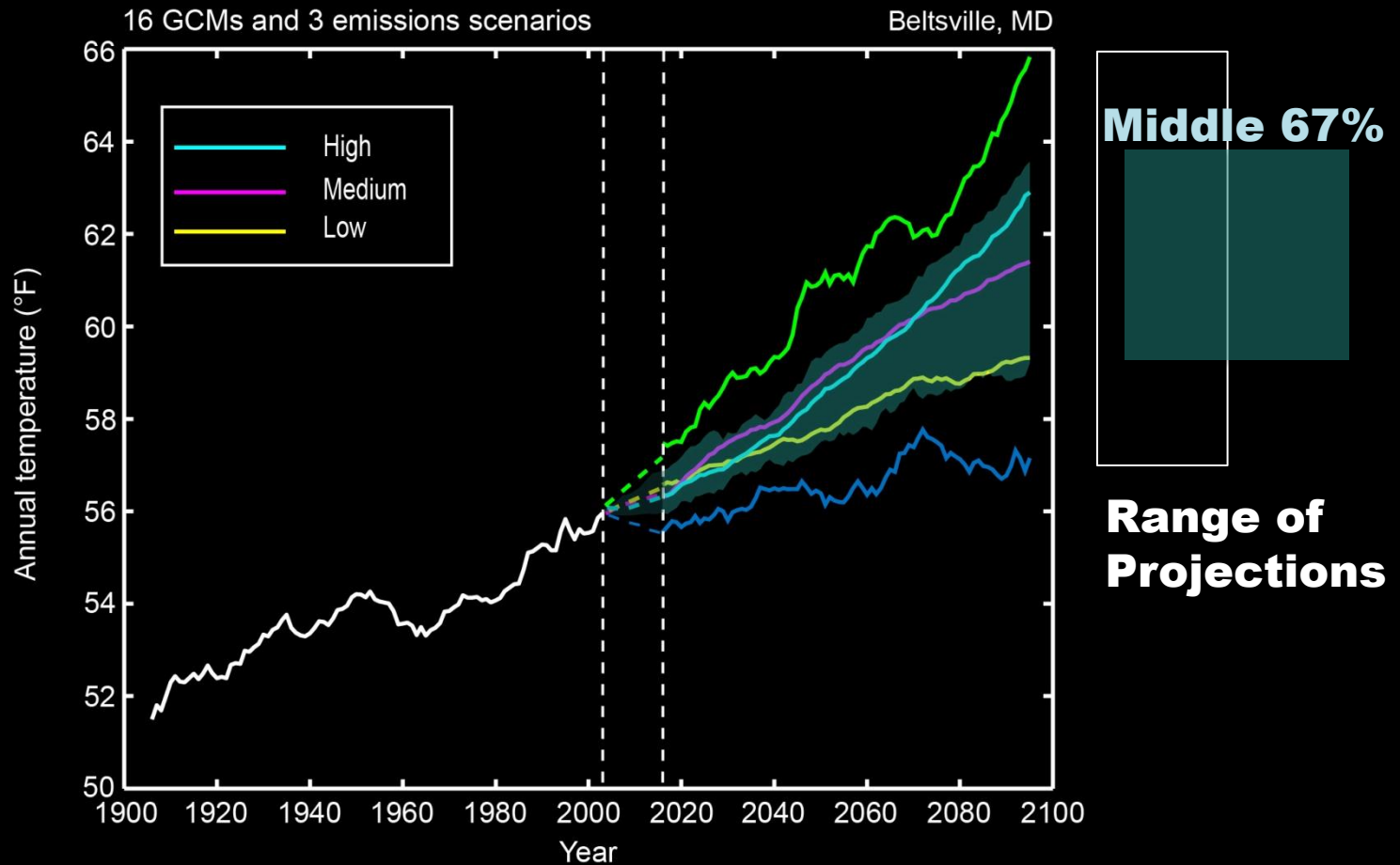


Consensus-based
projections using

- Several models
- Several future greenhouse gas emission scenarios

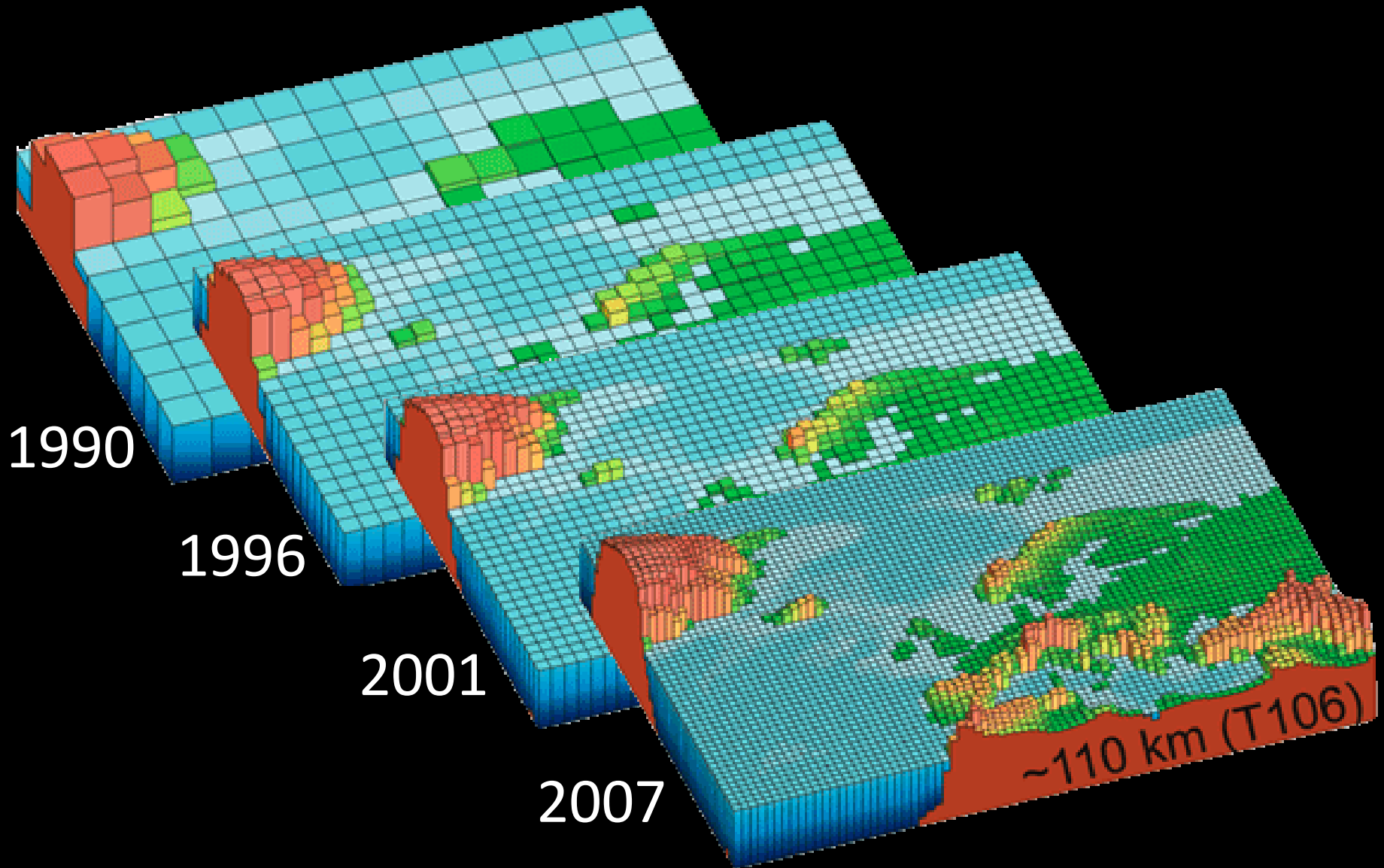
Updated as the
science advances

IPCC Models



Central range of models is basis for NASA's projections

Rising precision/resolution over time



New models + better data = more specific projections

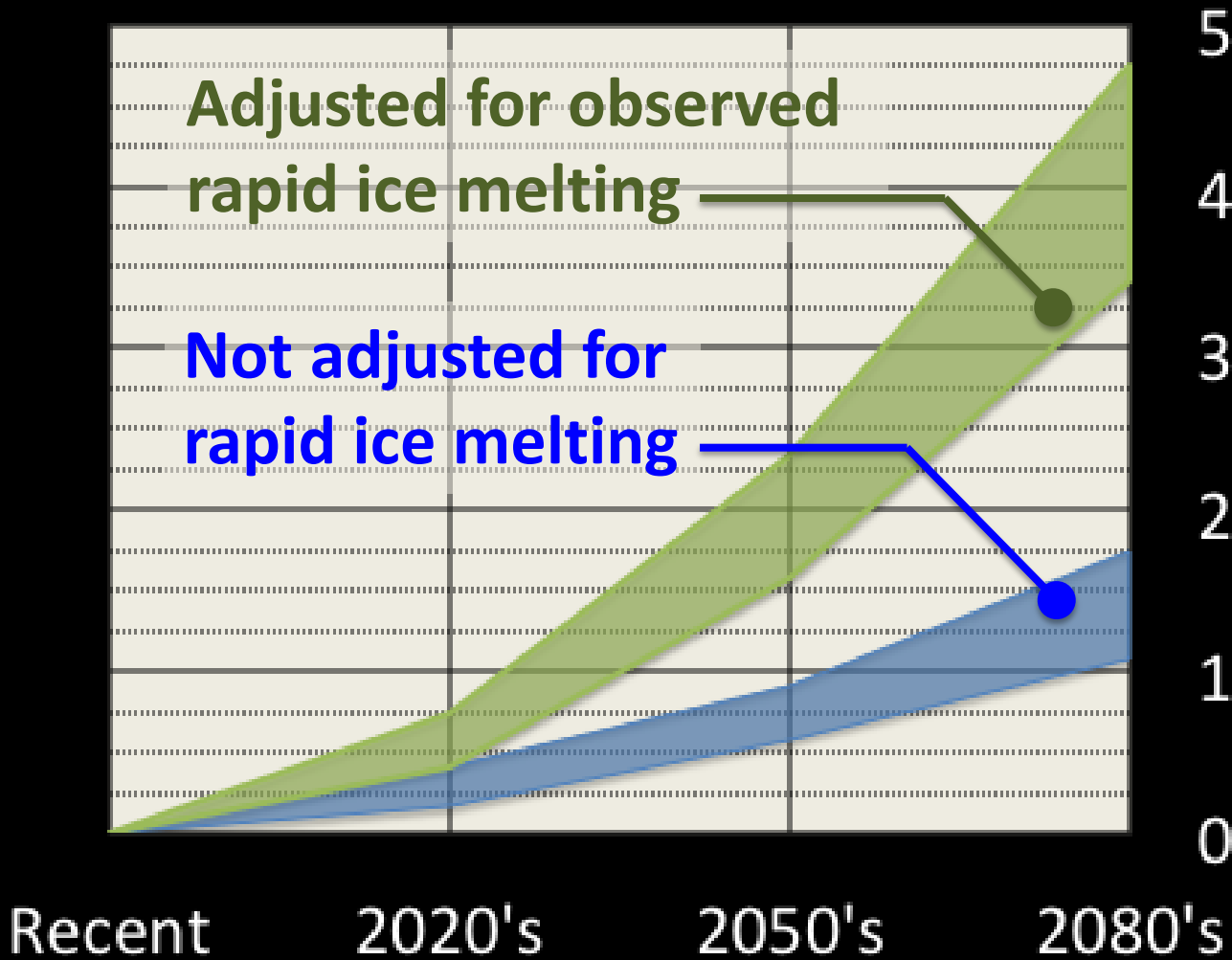
Question

An aerial photograph of Washington, D.C., showing the city's grid pattern, the Washington Monument, the U.S. Capitol, and the Potomac River. A large, semi-transparent 'X' is overlaid on the city, extending from the top-left to the bottom-right and from the top-right to the bottom-left, crossing in the center of the city.

What is projected for Washington DC?

What is projected locally?

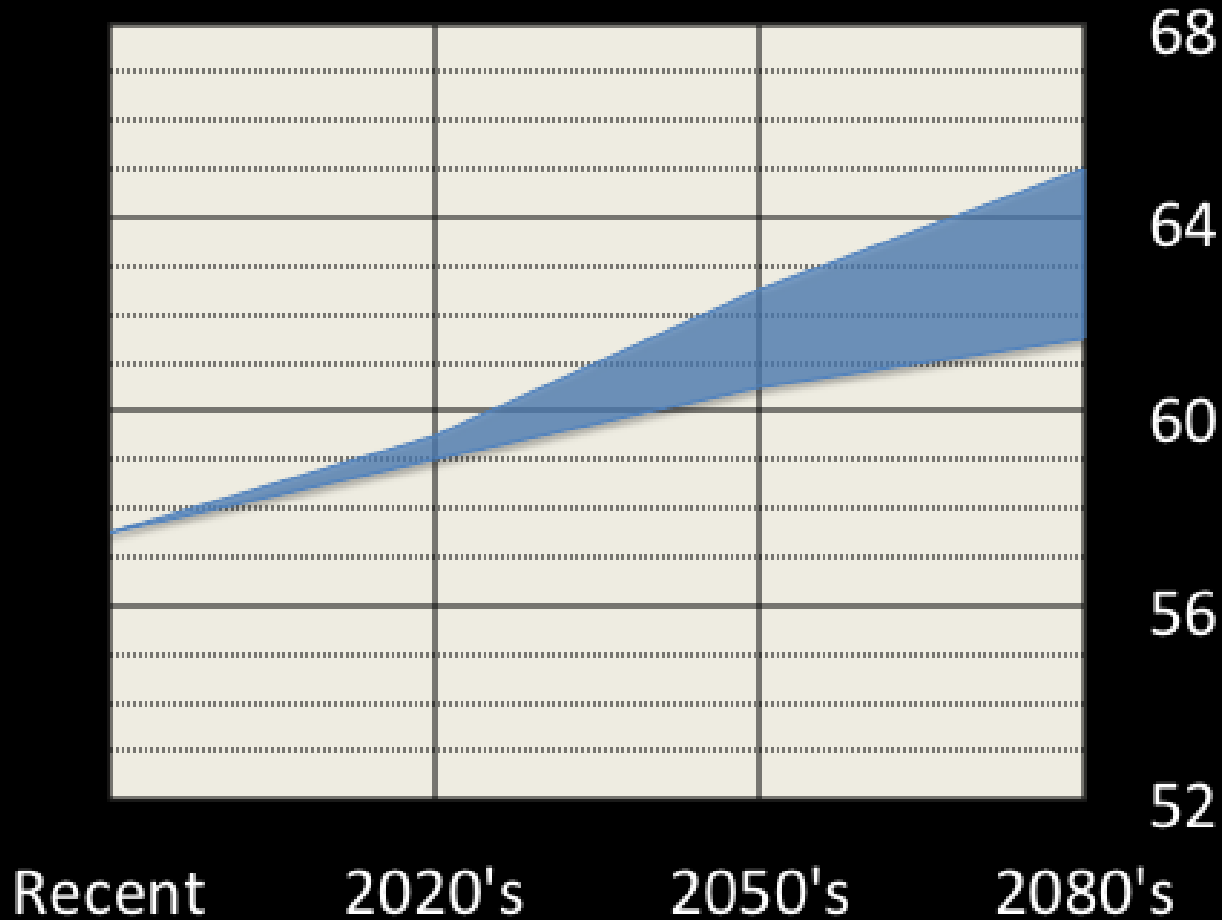
Average Sea Level (feet)



Sea level rise is projected to accelerate this century

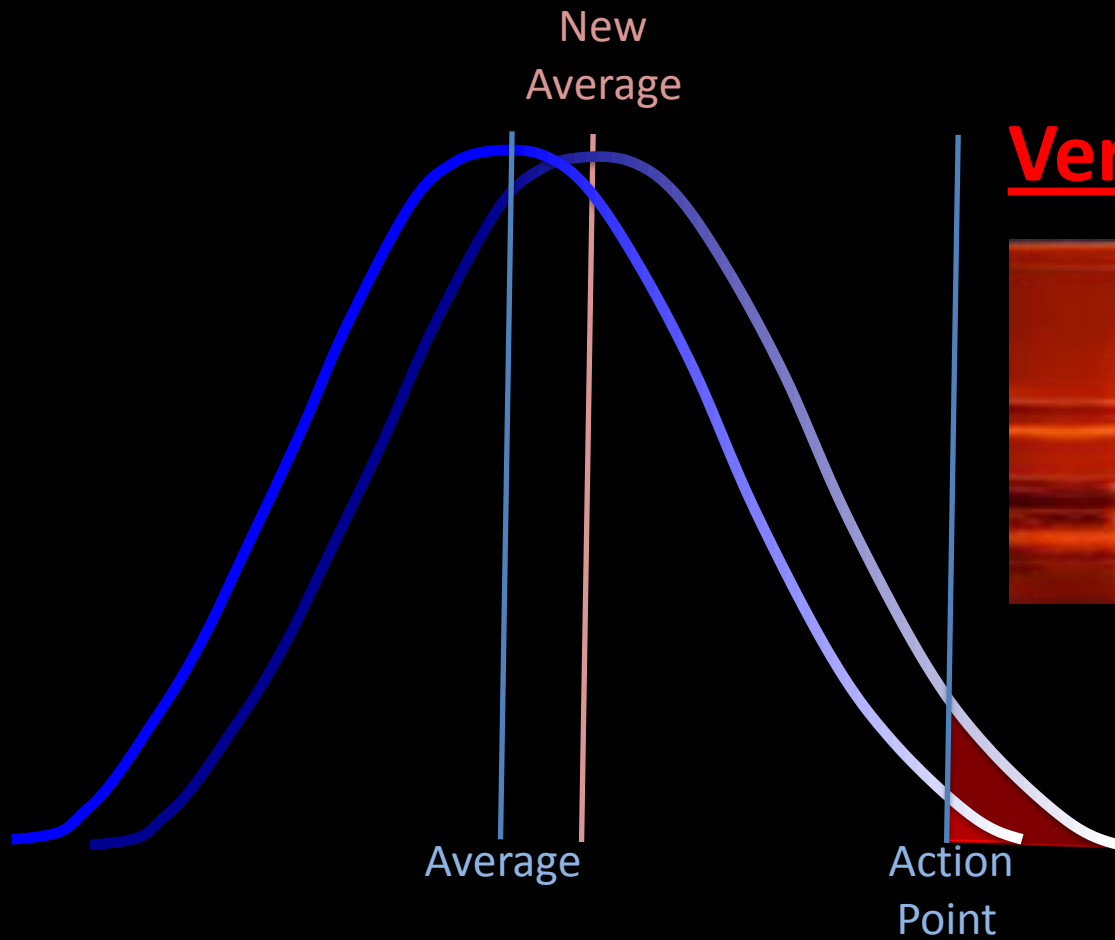
What is projected locally?

Average Annual Temperature (°F)



Average temperatures are projected to rise

What can a few degrees warmer do?



Very Likely Increase:

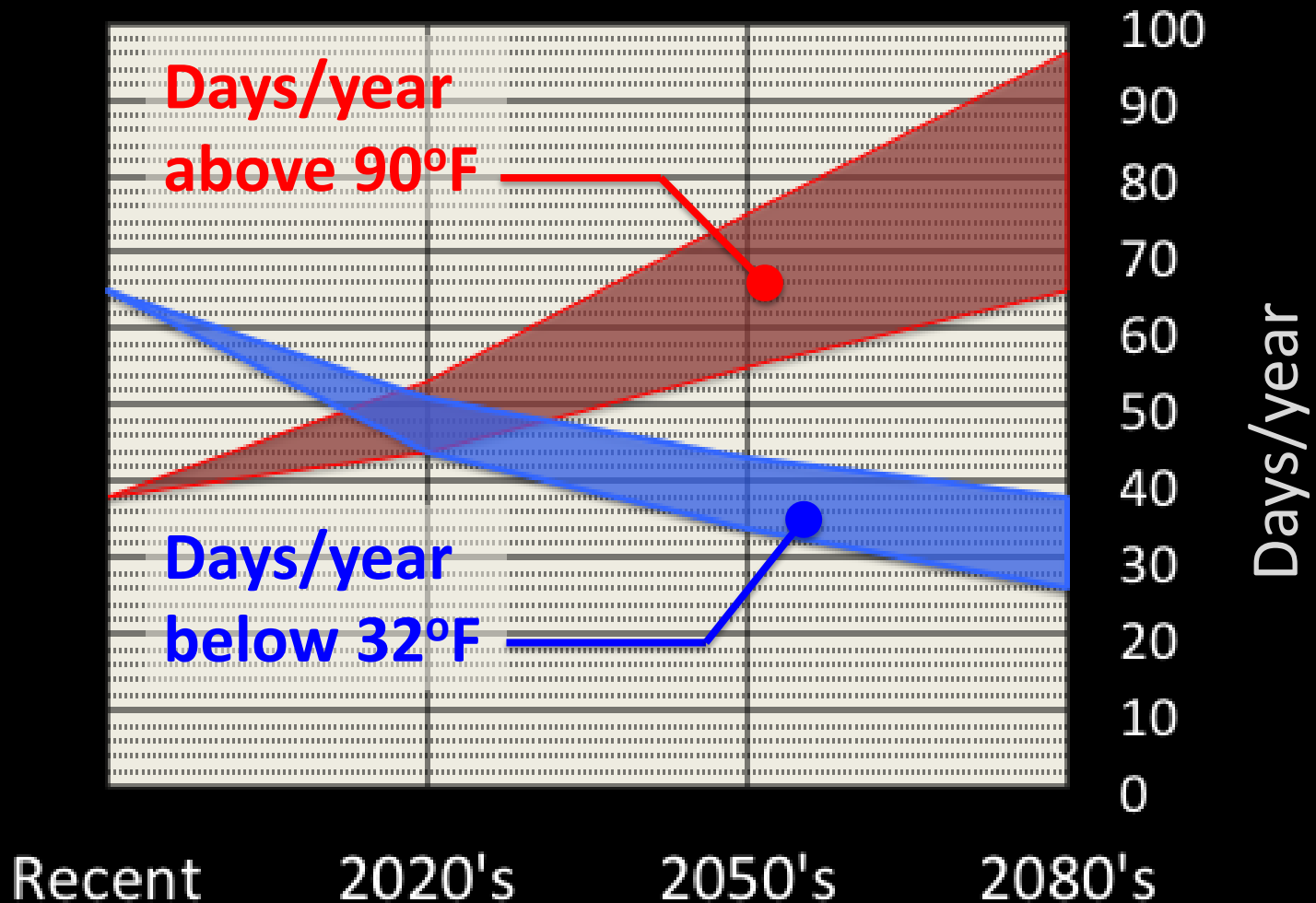


**Extremely
warm
days**

A small average change can mean a big effect on extremes

What can a few degrees warmer do?

Extreme Temperature Events

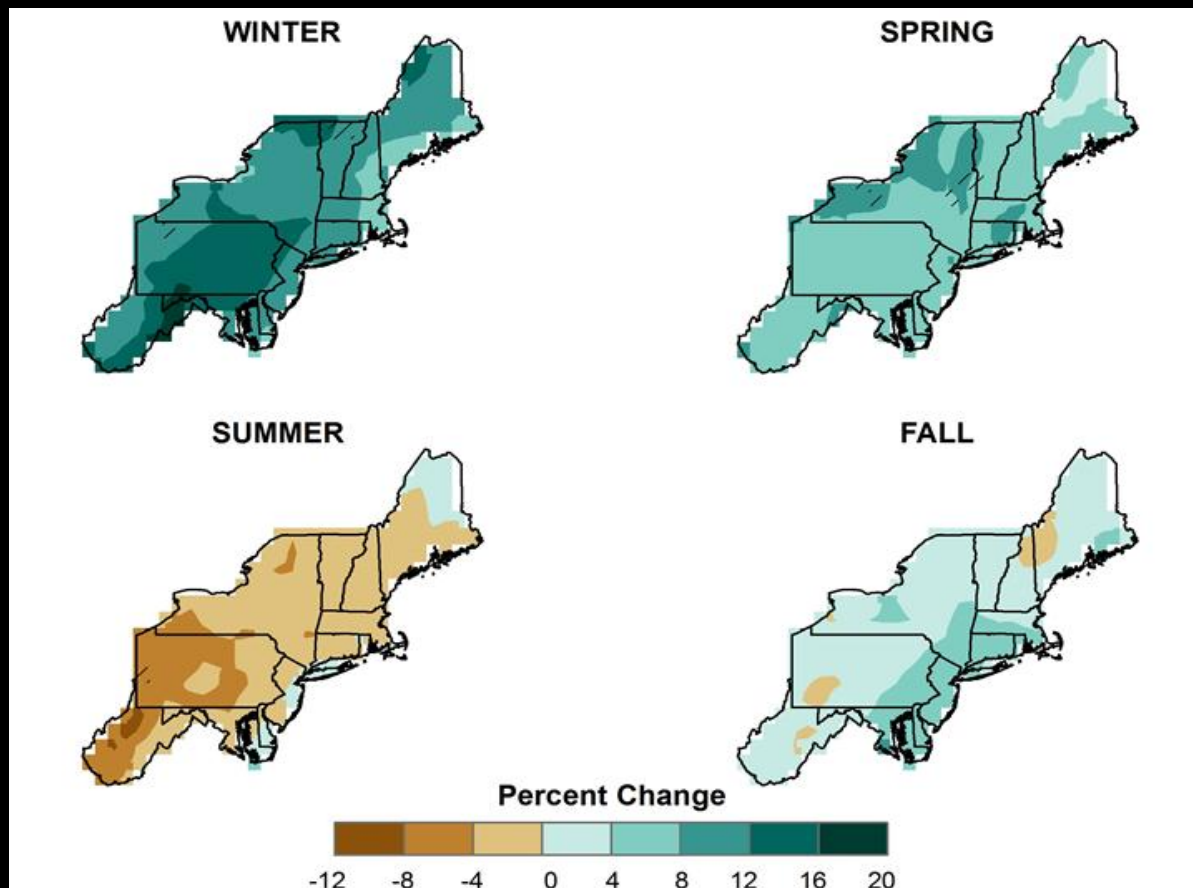


Extremes can change much faster than averages.

NCA Regional Climate Scenarios

- Information on precipitation are illustrated here for the Northeast Region. Other regions available at:

<http://scenarios.globalchange.gov/node/1155>



Seasonal changes simulated by NARCCAP* indicate an increase in precipitation for winter, spring, and fall, but a decrease for summer

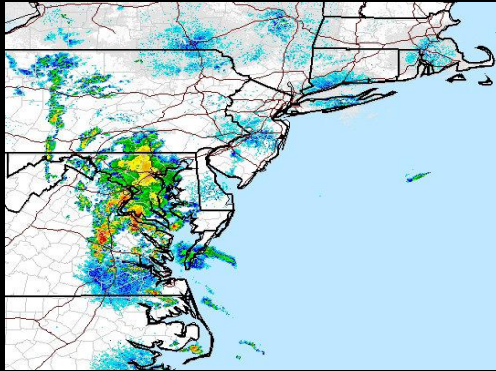
Question

What other changes are projected?



What other changes are projected?

Likely Increase



Intense
rainfall
events

More likely than not

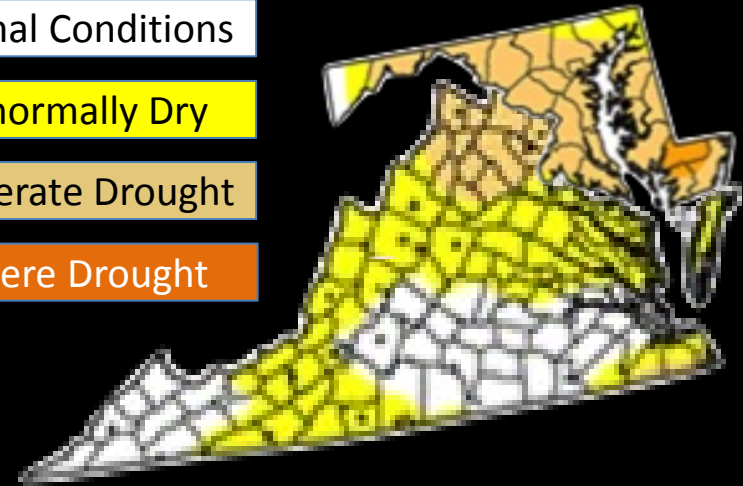
Increases in
drought events

Normal Conditions

Abnormally Dry

Moderate Drought

Severe Drought



Likely Decrease



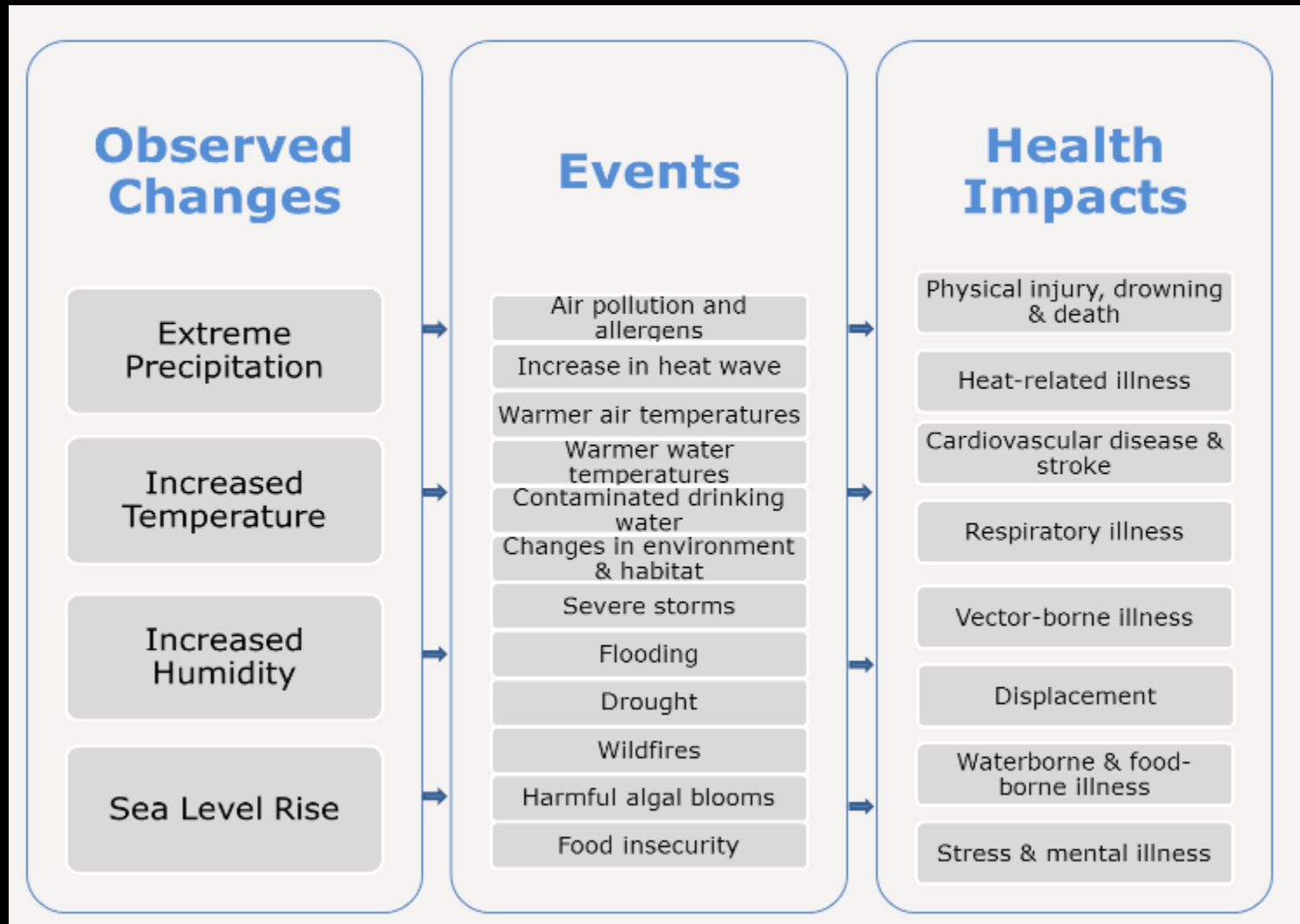
Snowfall
frequency
& amount

There's more to consider than averages

Question

What types of impacts might these projected changes have on us in terms of workforce, communities, and natural systems?

Public Health Impacts



The Most Immediate Climate-Related Threats to Public Health in this Region



- Air quality
- Extreme heat
- Floods, droughts, and extreme weather events
- Vector borne diseases
- Food borne illness
- Sea level rise
- Contaminated drinking water
- Malnourishment & food insecurity

The Most At-Risk Populations

- Young children
- Elderly 65 years old and older
- Elderly people that live alone
- Communities already stressed by environmental justice and health factors
- Socially isolated persons
- Chronically ill people or people with respiratory diseases
- Persons living in low-lying land areas
- Persons that have a low socioeconomic status

Natural Systems Impacts

EXAMPLES:

- Inundation of wetlands and low-lying areas.
- Native species may be forced out of the area.
- Dead zones in the Chesapeake Bay will likely increase.
- Establishment of invasive populations of species.
- Degraded water quality in coastal bays due to increases in winter-spring runoff.
- Increased length of the growing season early in century.
- Milk and poultry production negatively impacted by heat stress later in the century.
- Increased forest vulnerability to drought, insect pests, and forest fires.

For more information...

<http://www.mwcog.org/environment/climate/resilience.asp>

National Aeronautics and Space Administration

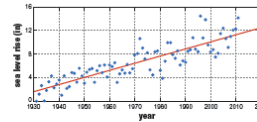
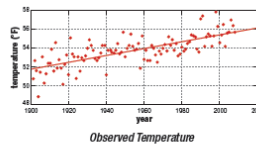


ADAPTING TO A CHANGING CLIMATE Federal Agencies in the Washington, DC Metro Area



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 4°, as measured in Beltsville, MD. Sea level, measured in the District of Columbia, has risen almost 10 inches over the past 50 years.



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.



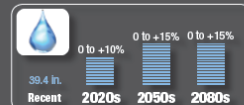
Washington, DC has experienced several extreme weather events in recent years. Three days of intense tropical downpours in June 2006 swamped the downtown. A cluster of tornadoes in April 2011 put the city on edge. Hurricane Lee in September 2011 produced 7 inches of rain in 3 hours in some parts of the 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 – *desercho* – a widespread and long-lived wind storm that accompanied rapidly moving showers and thunderstorms. The June 29th *desercho* caused massive tree damage and flooding to the area; power outages across the District disrupted life for several days.

What scientists project

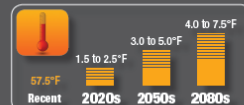
Climate scientists from NASA's Goddard Institute for Space Studies used site-specific climate data from the DC area, combined with climate model outputs, to generate temperature and sea level rise projections for the area. The projections indicate continued rising temperatures and sea levels in the area. 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., bucking of concrete roads).

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



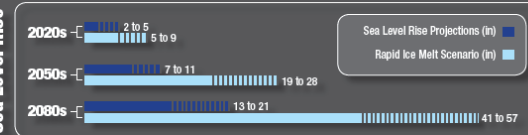
Change in Average Annual Precipitation



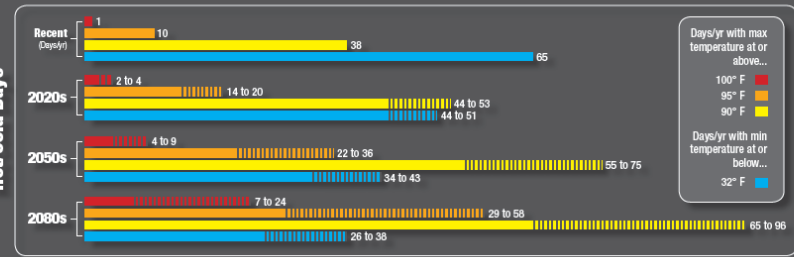
Change in Average Annual Temperature

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



Hot/Cold Days



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.

Days/yr with max temperature at or above...

- 100° F
- 95° F
- 90° F

Days/yr with min temperature at or below...

- 32° F

For more information...

COMING SOON, mobile app with basic location-specific info:



QUESTIONS*?

*You may also pose questions to NASA climate scientists at any time during the course of this series of webinars and workshops using the link under the Questions & Feedback section on:

<http://www.mwcog.org/environment/climate/resilience.asp>

