National Weather Service Overview

And

Climate Information and Communication

Sarah Spiegler and Erik Heden

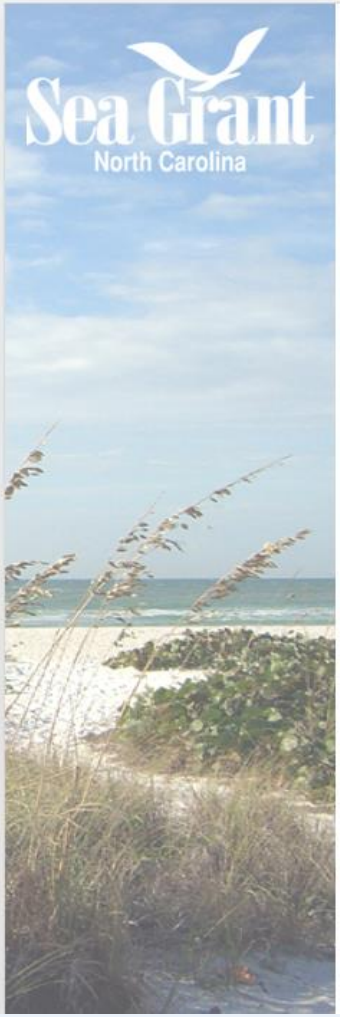
Climate Section Credit:

Barb Mayes Boustead, Ph.D.

NWS/OCLO/Warning Decision Training Division

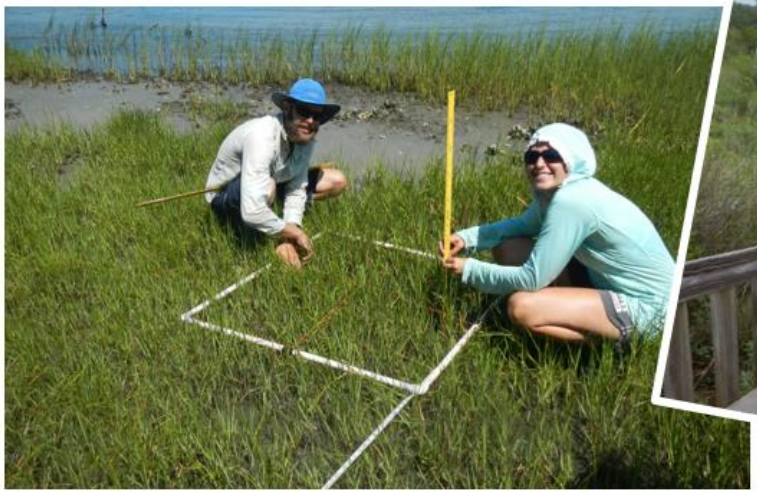
Erik Heden
NWS Morehead City

Warning Coordination Meteorologist
Liaison between the community and the local National Weather Service office. Conduct community outreach and preparedness activities.



Morehead City
Sarah Spiegler
N.C. Sentinel Site Coop. Coordinator &
Marine Education Specialist

Focus Areas:
Leverages resources and provides information related to the impacts of sea level rise on coastal habitats and communities in North Carolina; Hosts trainings, workshops and partner meetings.



Our Mission

The National Weather Service (NWS)

Weather.gov > About the NWS

About the NWS
National Program

About

Serving you in every community in the U.S. Check out who we are and what we do!

NWS Mission

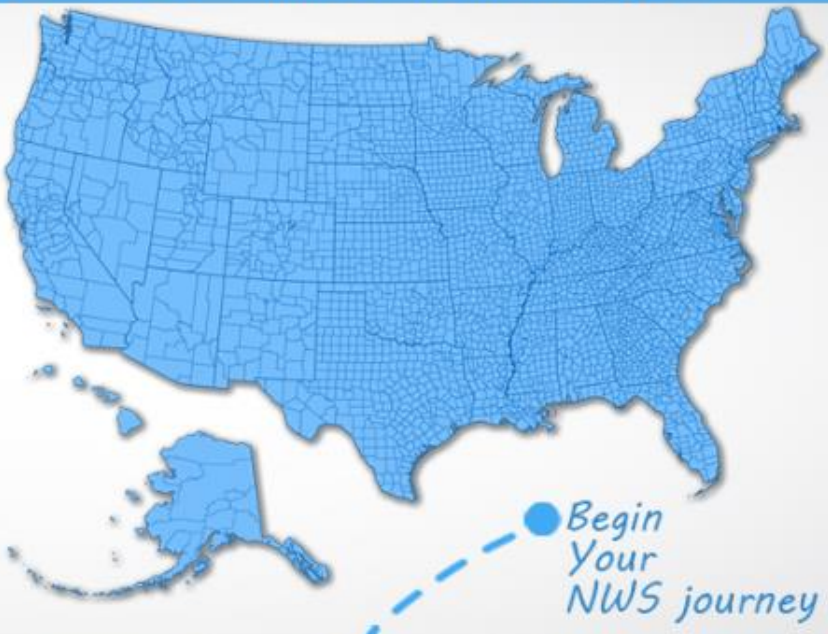
Provide weather, water, and climate data, forecasts and warnings for the protection of life and property and enhancement of the national economy.

NWS Vision

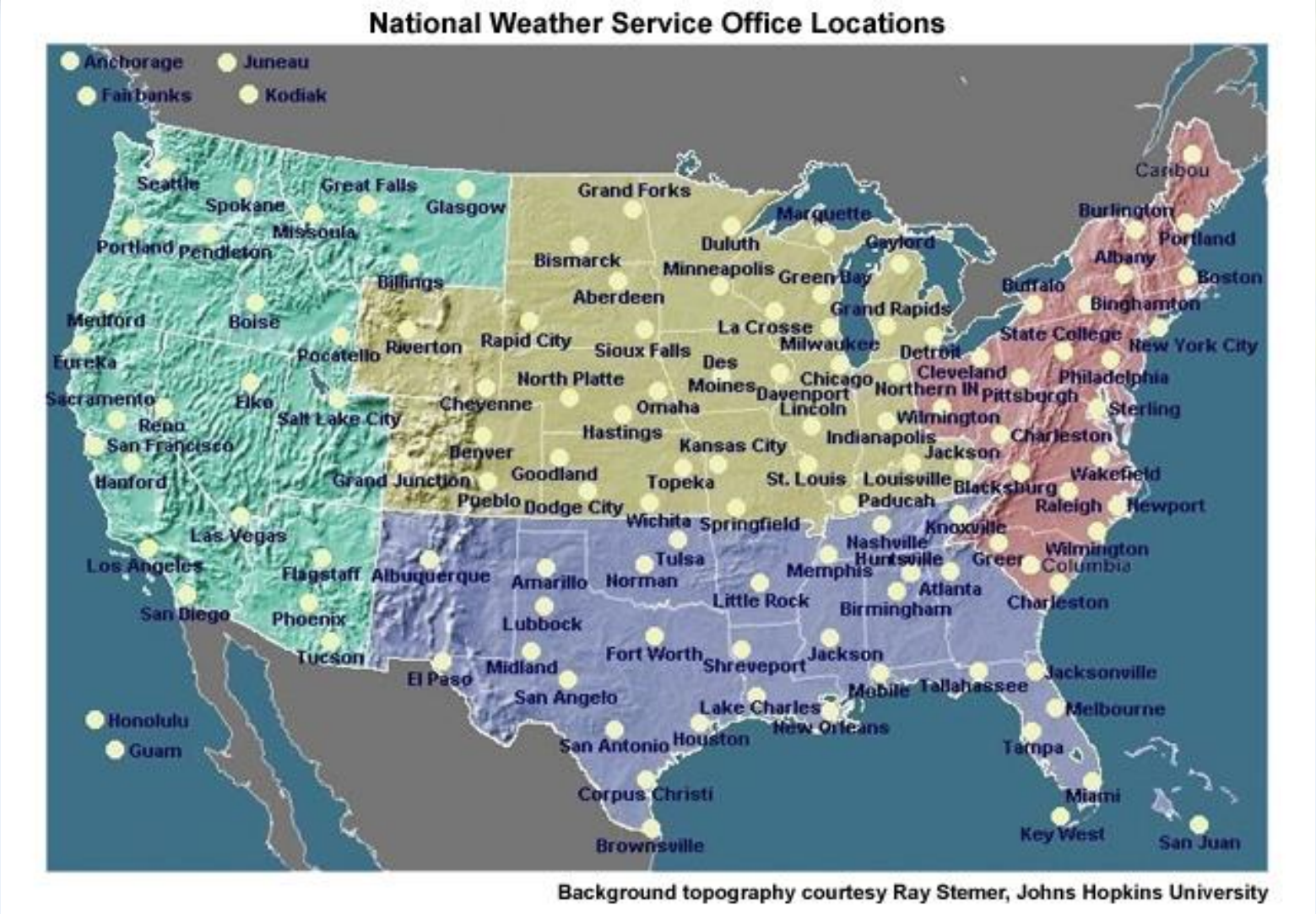
A Weather-Ready Nation: Society is prepared for and responds to weather, water, and climate-dependent events.

Weather-Ready Nation Story

Accurate weather forecasts do not always result in a good outcome. The National Weather Service (NWS) learned this difficult... Read more



Office Locations



Our Local Office

Eastern part of North Carolina

Includes: Land areas, inland rivers, sounds, and adjacent ocean

Other parts of the state covered by other local offices (Raleigh, Wilmington, etc)

Open 24/7/365

Hurricane Florence

Staff here for 3 to 7 days

Our building is designed to withstand storms

We stay when the weather is bad

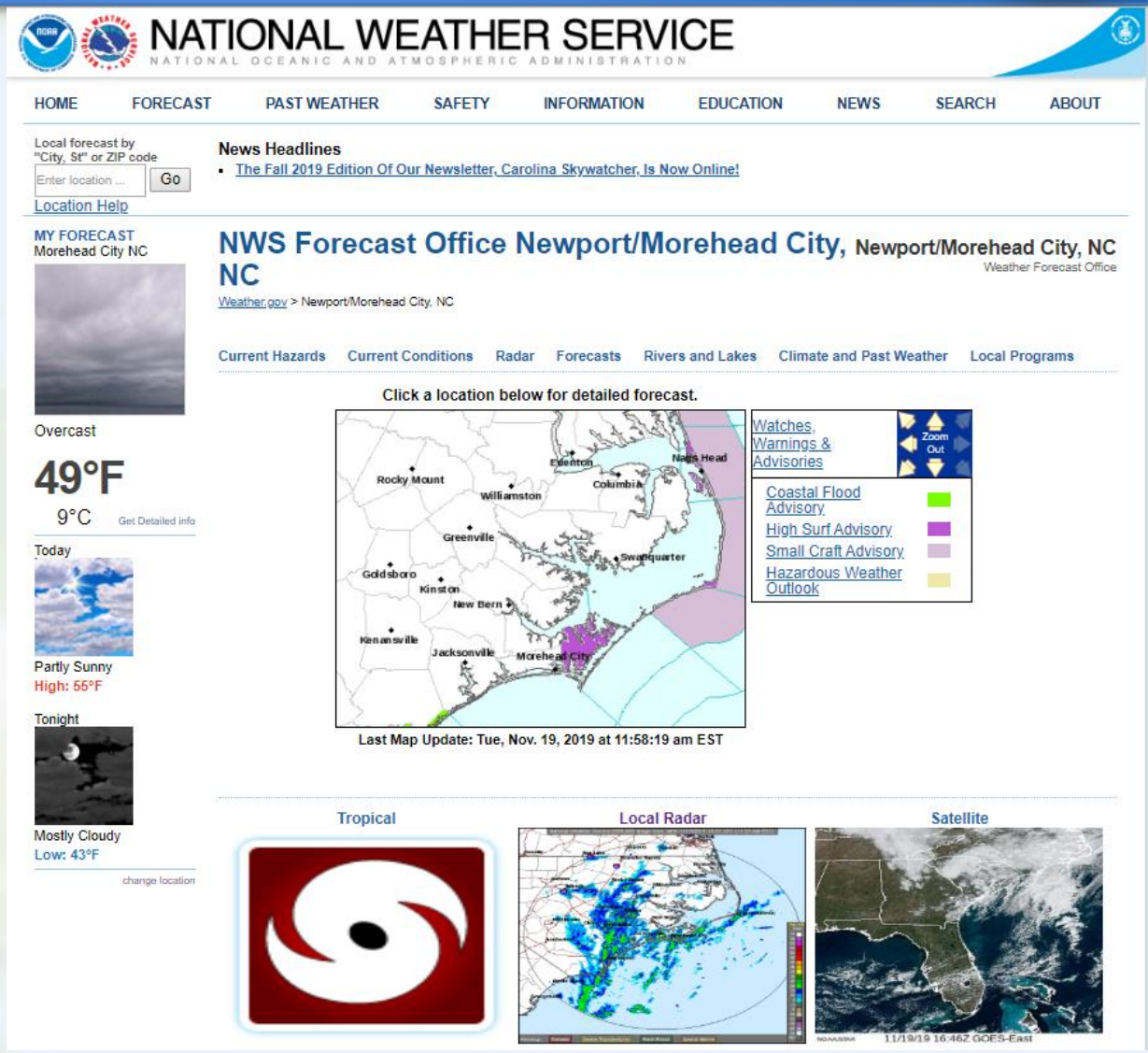
Our Website

weather.gov/newport

Weather information from past events, current weather, and forecast

Explore the website and bookmark or save what you like

Go in depth as much as you need



7- Day Forecast

weather.gov/newport

Sky cover

High/low temperatures

Winds

Chance of precipitation

Detailed Forecast

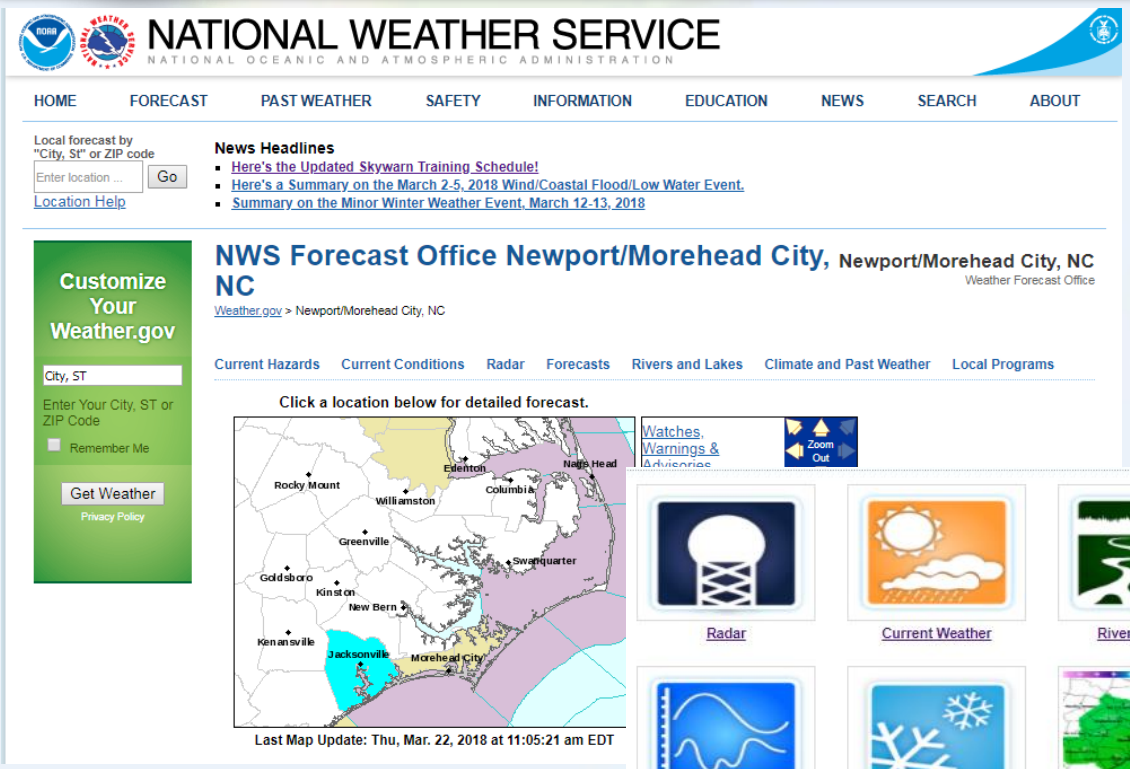
Today	Mostly cloudy, with a high near 54. Light northwest wind.
Tonight	Mostly cloudy, with a low around 38. West wind 5 to 7 mph.
Wednesday	Sunny, with a high near 60. Northwest wind 7 to 9 mph.
Wednesday Night	Mostly clear, with a low around 38. Light north wind.
Thursday	Sunny, with a high near 60. Light and variable wind becoming northwest around 5 mph.
Thursday Night	Partly cloudy, with a low around 44.
Friday	Mostly sunny, with a high near 67.
Friday Night	Mostly cloudy, with a low around 48.
Saturday	A chance of showers. Mostly cloudy, with a high near 64. Chance of precipitation is 50%.
Saturday Night	A chance of showers. Mostly cloudy, with a low around 44. Chance of precipitation is 50%.
Sunday	Partly sunny, with a high near 58.
Sunday Night	Mostly clear, with a low around 39.
Monday	Sunny, with a high near 60.

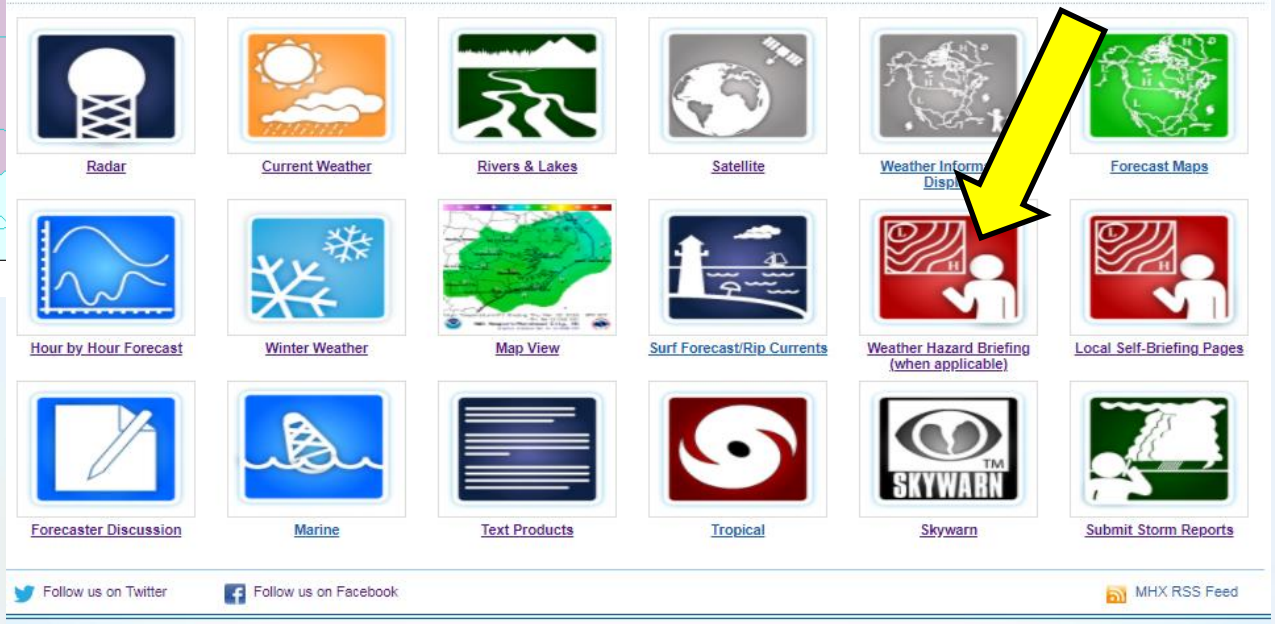
Extended Forecast for
New Bern NC

Today	Tonight	Wednesday	Wednesday Night	Thursday	Thursday Night	Friday	Friday Night	Saturday
Mostly Cloudy	Mostly Cloudy	Sunny	Mostly Clear	Sunny	Partly Cloudy	Mostly Sunny	Mostly Cloudy	Chance Showers
								50%
High: 54 °F	Low: 38 °F	High: 60 °F	Low: 38 °F	High: 60 °F	Low: 44 °F	High: 67 °F	Low: 48 °F	High: 64 °F

Weather Briefings

weather.gov/newport

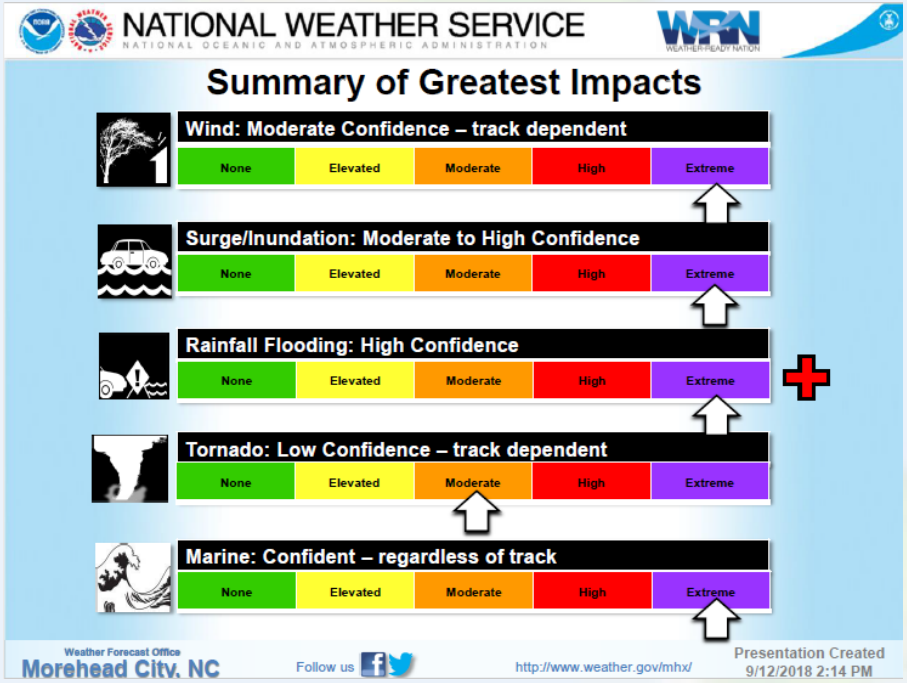




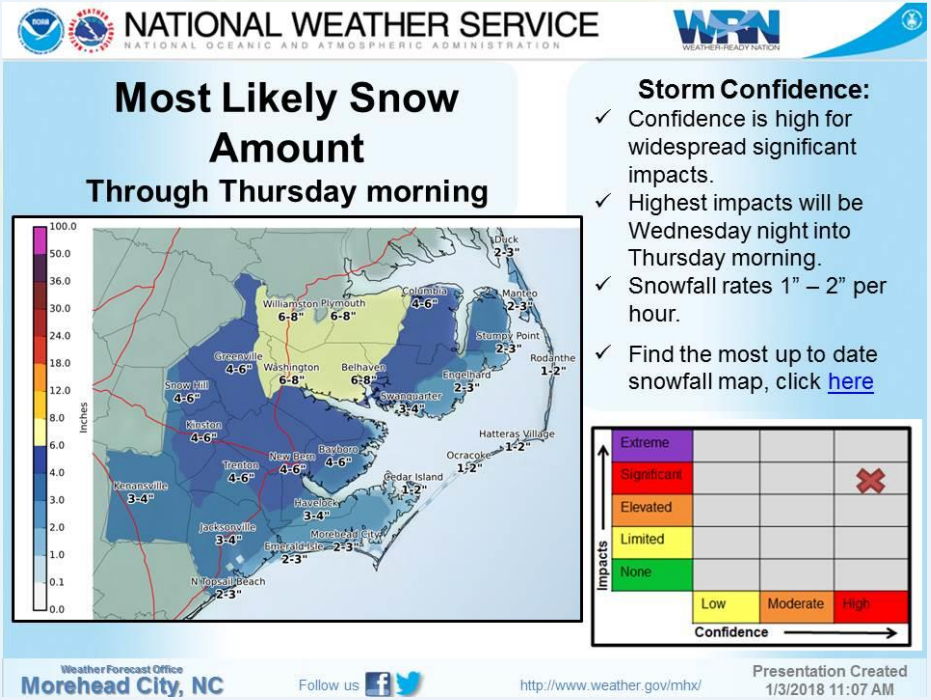
Created prior to bigger events of severe weather

Weather Briefings

weather.gov/newport



January 2018 Winter Storm



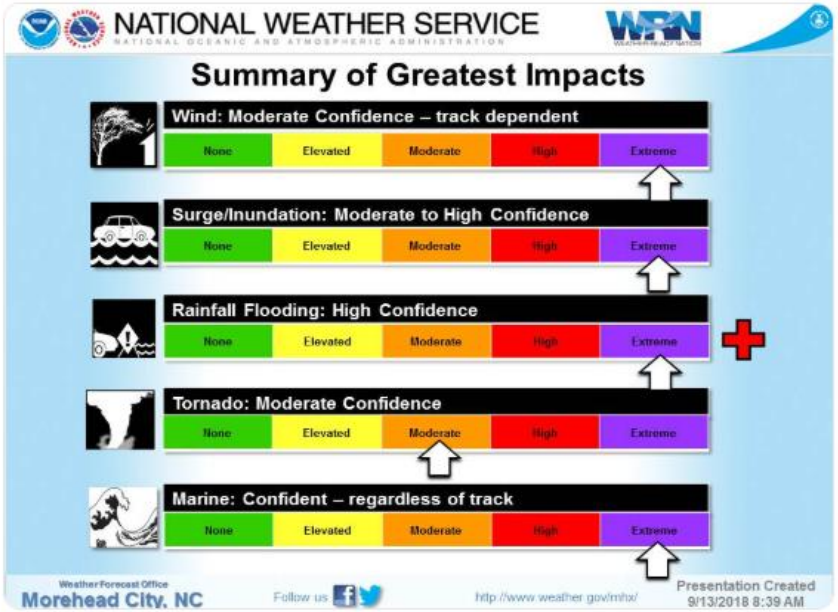
Hurricane Florence Impacts

Social Media

Search NWS Morehead City

NWS Newport/Morehead
@NWSMoreheadCity

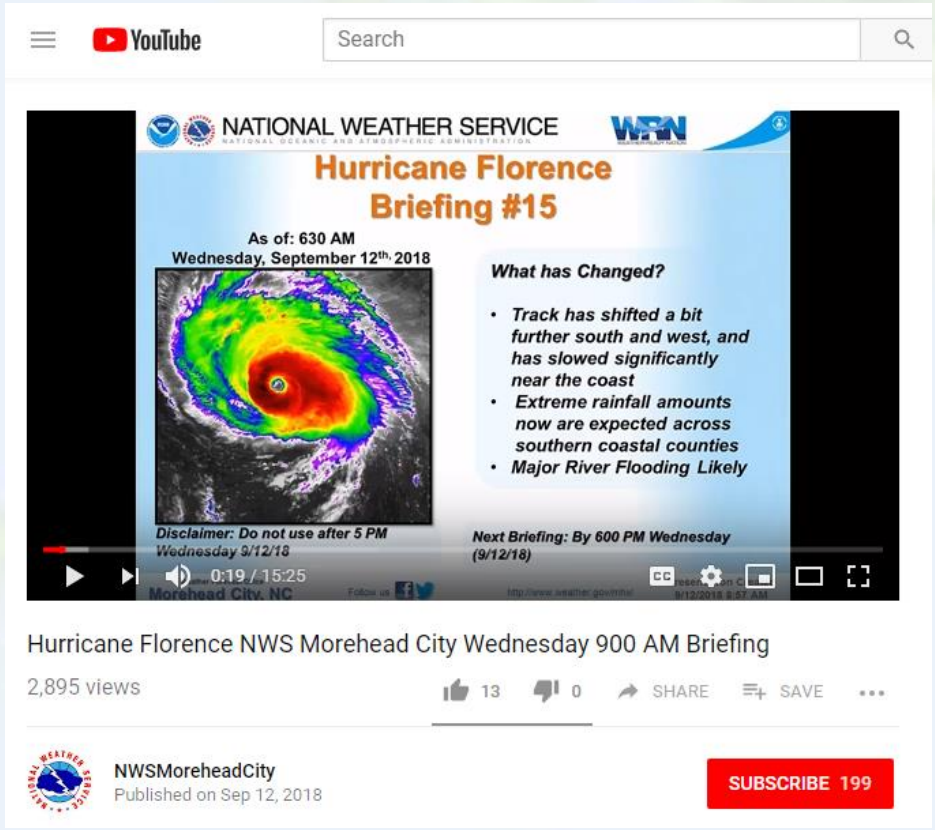
Category of the storm is only related to wind, it does not tell you about all of the impacts with a #hurricane like #florence. Our impacts have not changed with storm surge and catastrophic flooding. Do not let your guard down. weather.gov/media/mhx/Late ...



8:44 AM - 13 Sep 2018

765 Retweets 1,078 Likes

40 765 1.1K



Hurricane Florence NWS Morehead City Wednesday 900 AM Briefing

2,895 views 13 0 SHARE SAVE

NWSMoreheadCity
Published on Sep 12, 2018

SUBSCRIBE 199

Hurricane Florence Lead Up

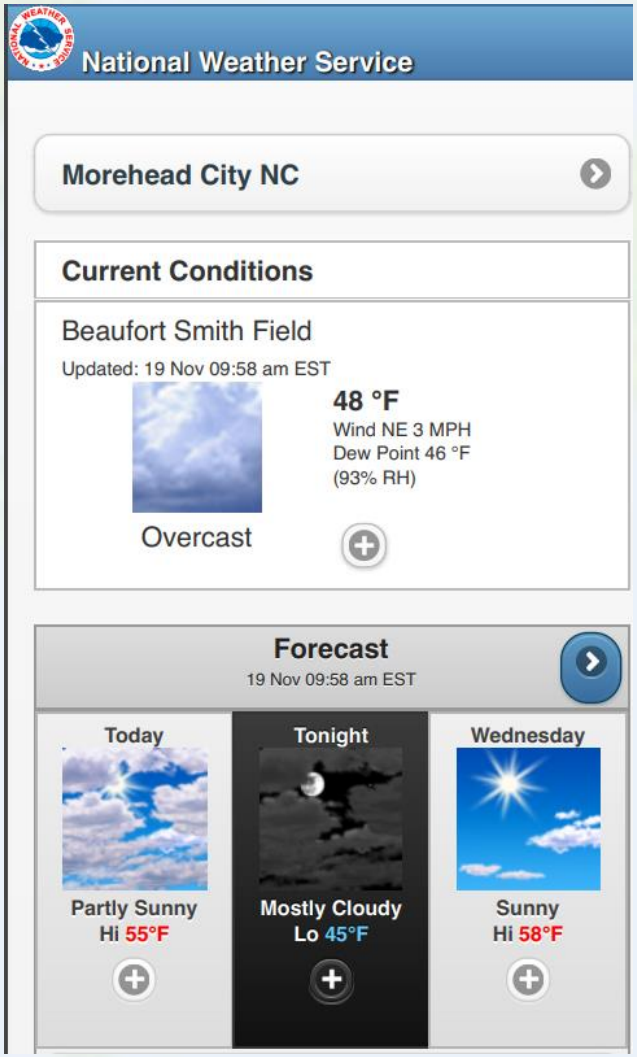
Mobile Forecasts

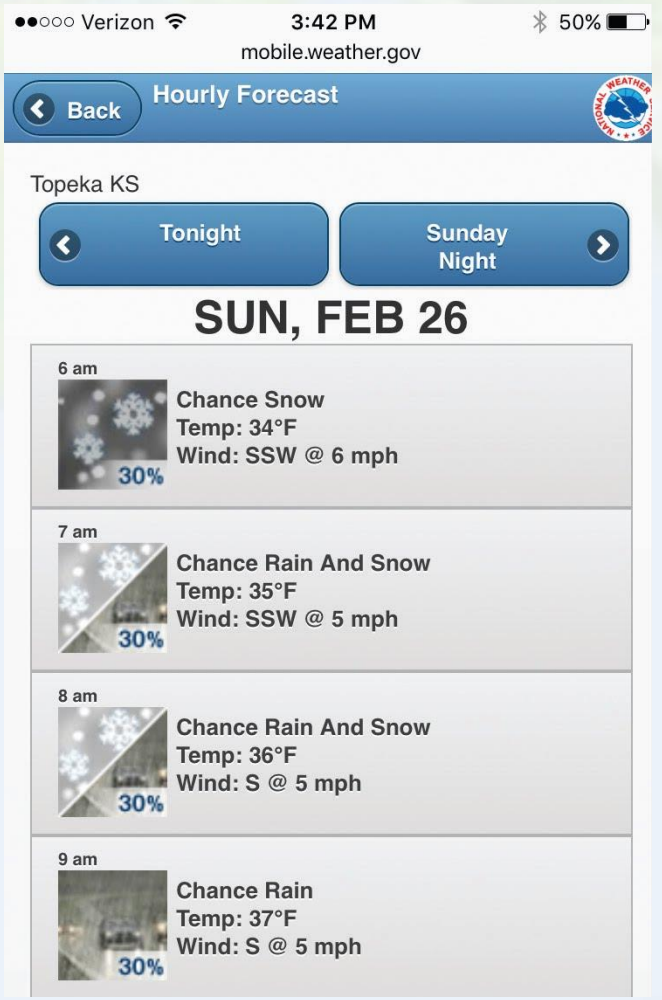
mobile.weather.gov

Quickly access hourly forecasts, radar, and more from your local office, ANYWHERE in the country

Can work like a weather "APP" by adding it to home screen

Also works on PCs



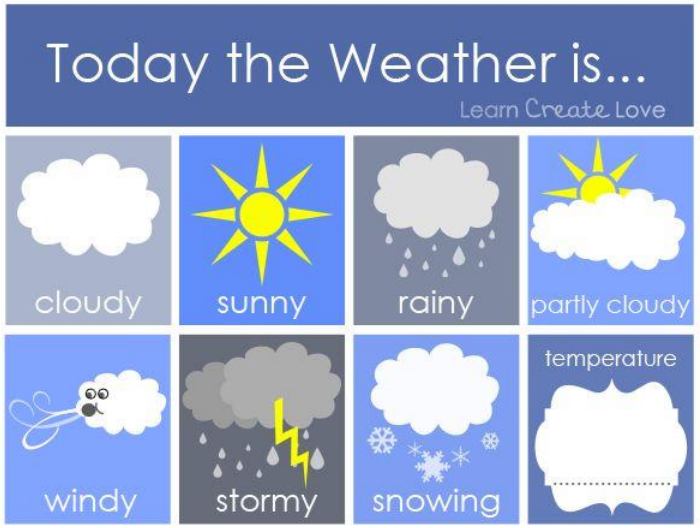


What Is Climate?

Weather vs. Climate

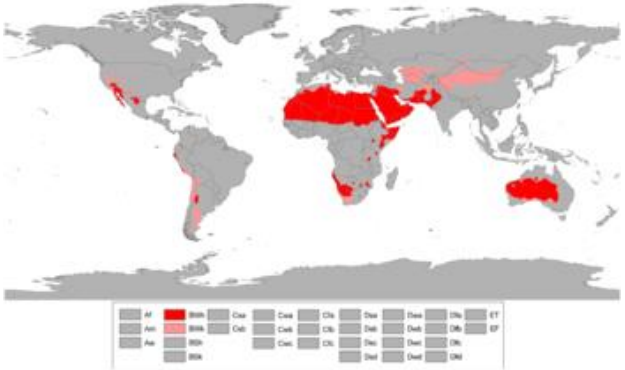
- **Weather**: temperature, wind, clouds, precipitation; what's happening outside right now

- **Climate**: average of weather conditions over a long time period



https://speechfoodie.com/weather-definition-for-kids/

https://www.worldatlas.com/articles/what-is-a-desert-climate.html



https://en.wikipedia.org/wiki/Desert_climate

Weather vs. Climate

Weather happens at a particular time and place.

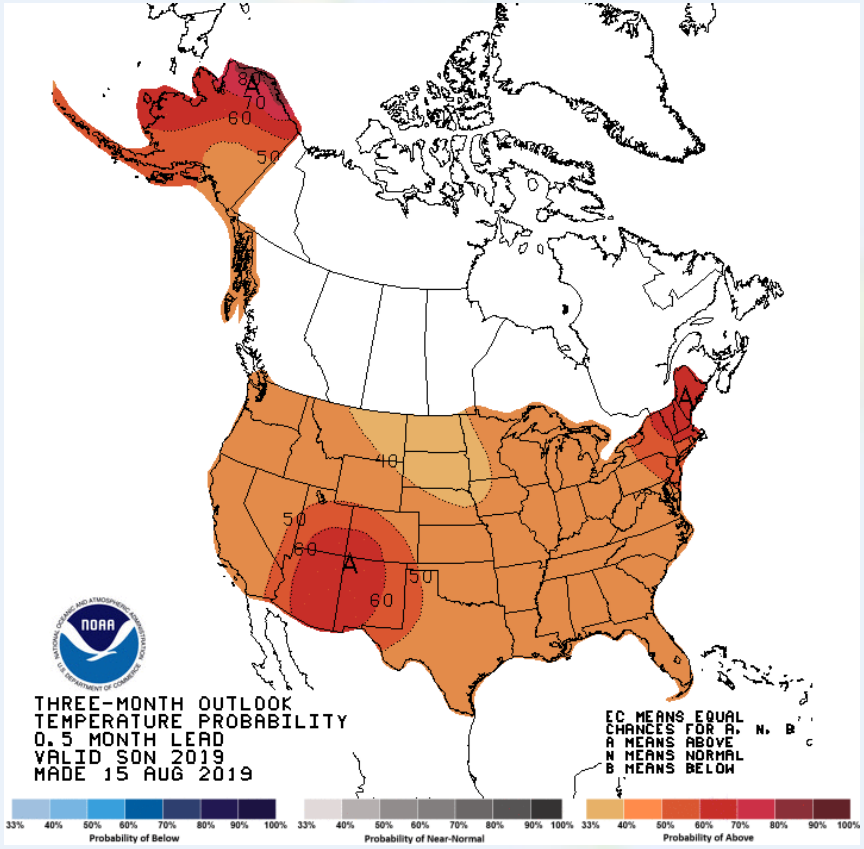
Climate is regional and long-term.

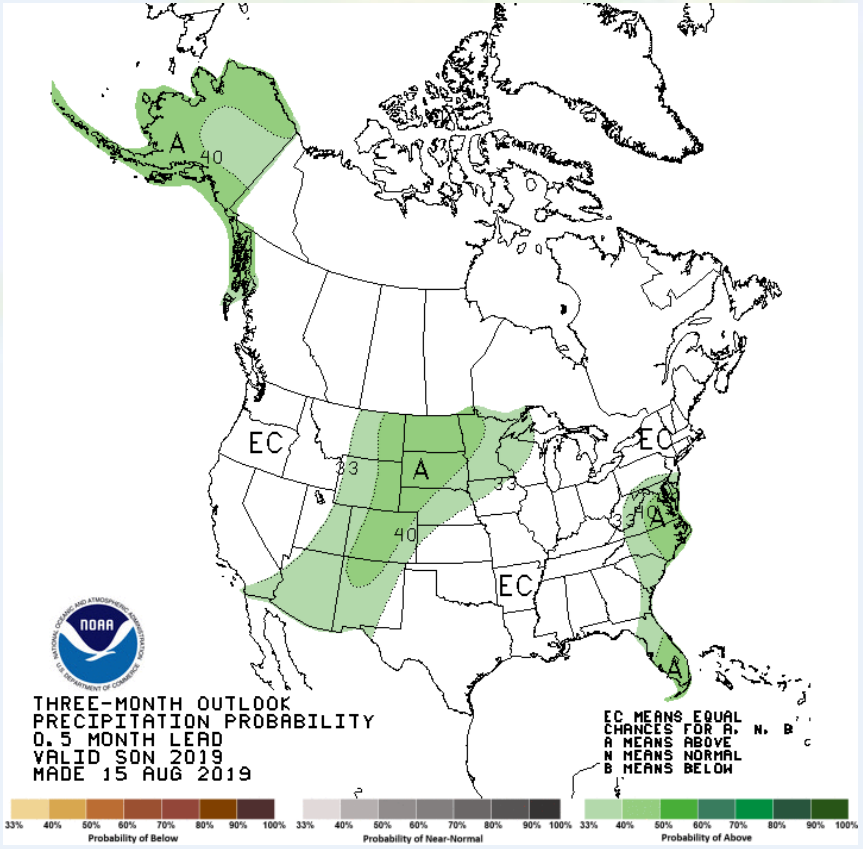
Is it news (weather) *or history* (climate)?

Climate Outlooks

Climate Prediction

- Not quite like weather prediction
  - In terms of odds (probabilities)
  - Averaged over longer periods of time (weeks to months)

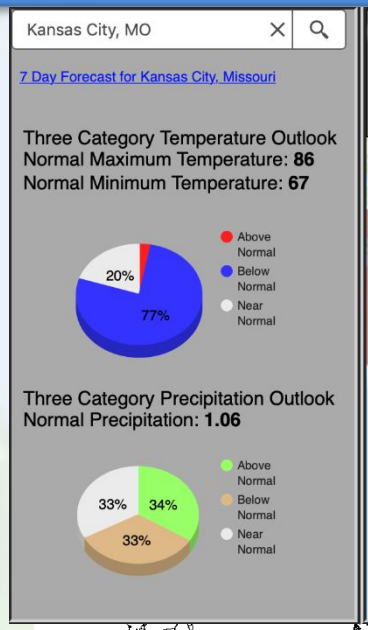


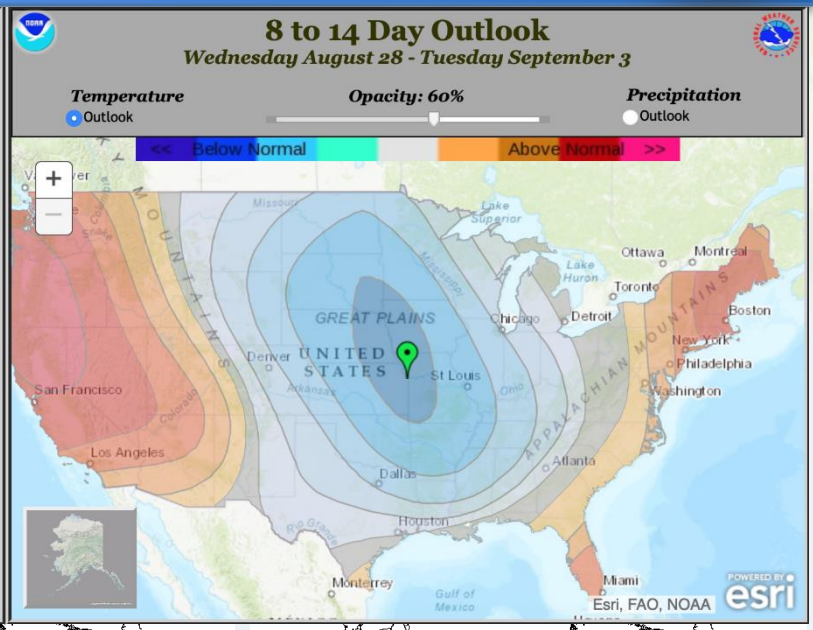


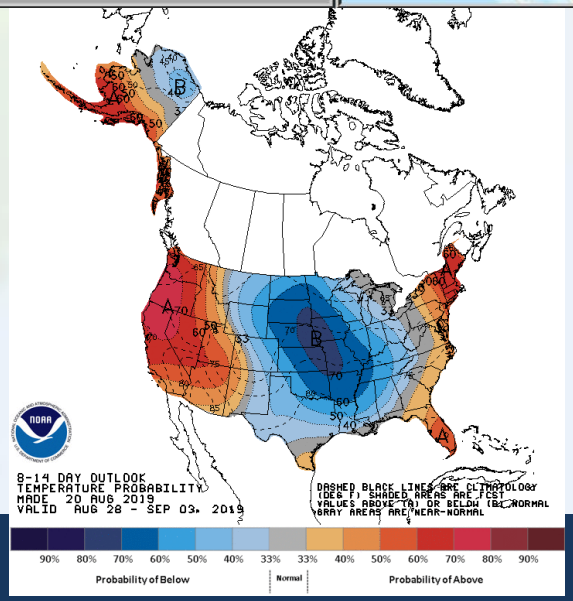
http://www.cpc.ncep.noaa.gov/

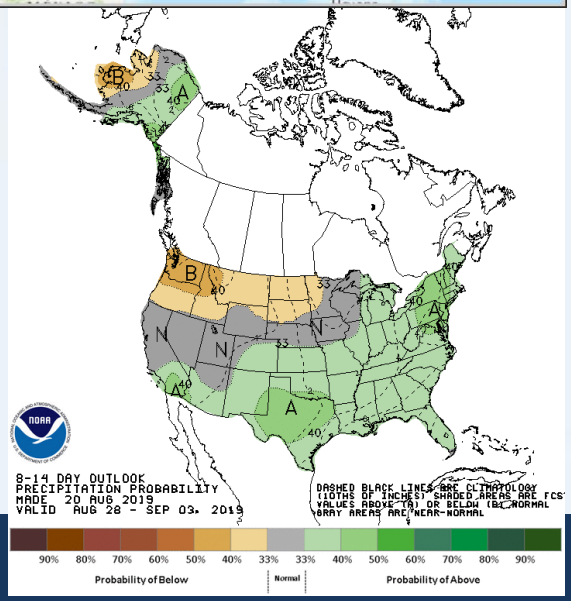
CPC Outlooks: 6- to 10-Day and 8- to 14-Day

- Predicting chances for *temperatures* and *precipitation* to fall in the *upper, middle, and lowest thirds*.
  - "40%" = 40-50% chance of that category (instead of the usual 33%)
- Issued every afternoon
  - Automated on weekends
- Mainly based on weather and climate models
- Interactive and static displays

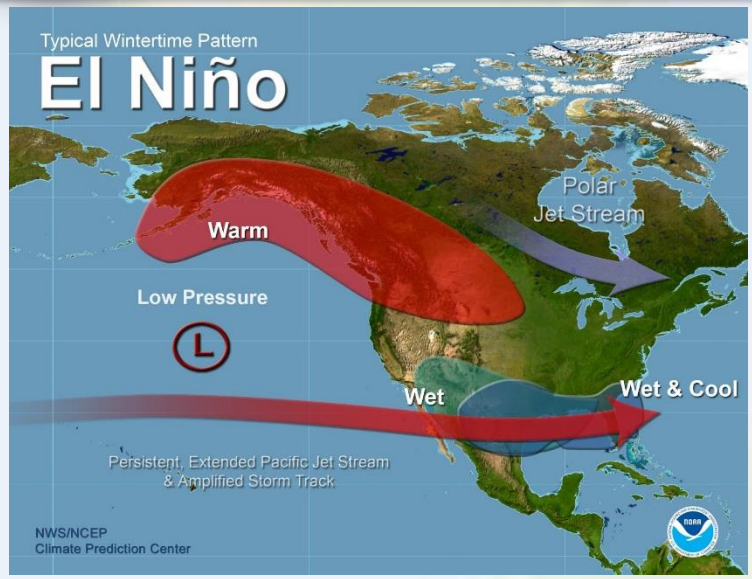


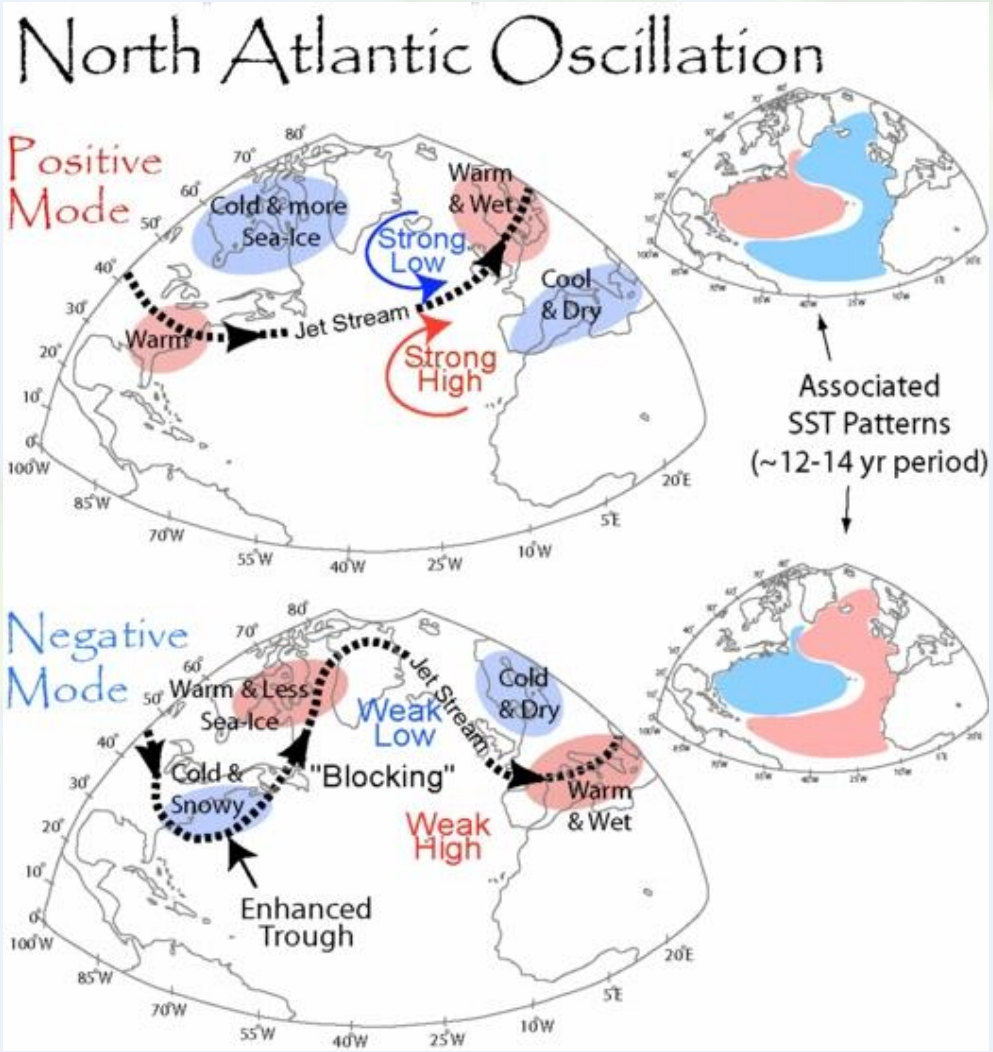






Climate Variability: Influencing Seasons

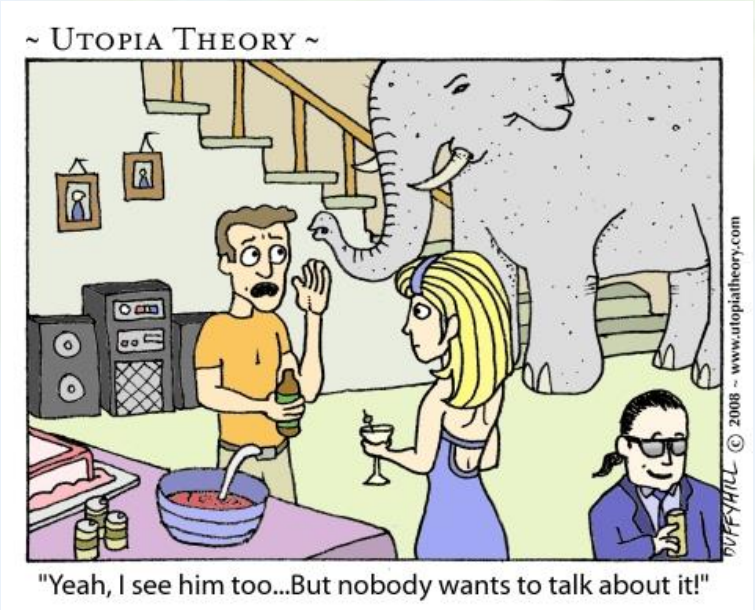


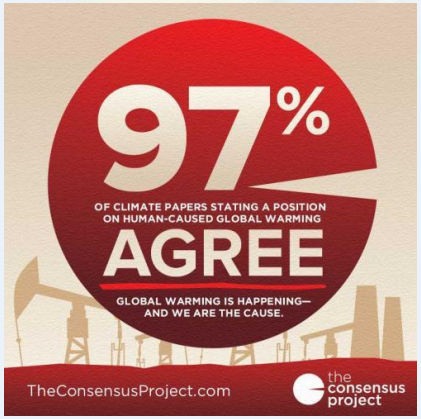


Climate Change

Climate Change

- Get comfortable with terminology
  - The terms "climate change" and "global warming" are often used interchangeably
  - Scientists prefer "climate change" because it describes the changes to the whole system, not just temperatures
  - Many people still say "global warming"
- Be careful about your information sources!
  - Blogs, news commentators, politicians often (usually) not trained in climate
  - Would you go to a dentist to get heart surgery?

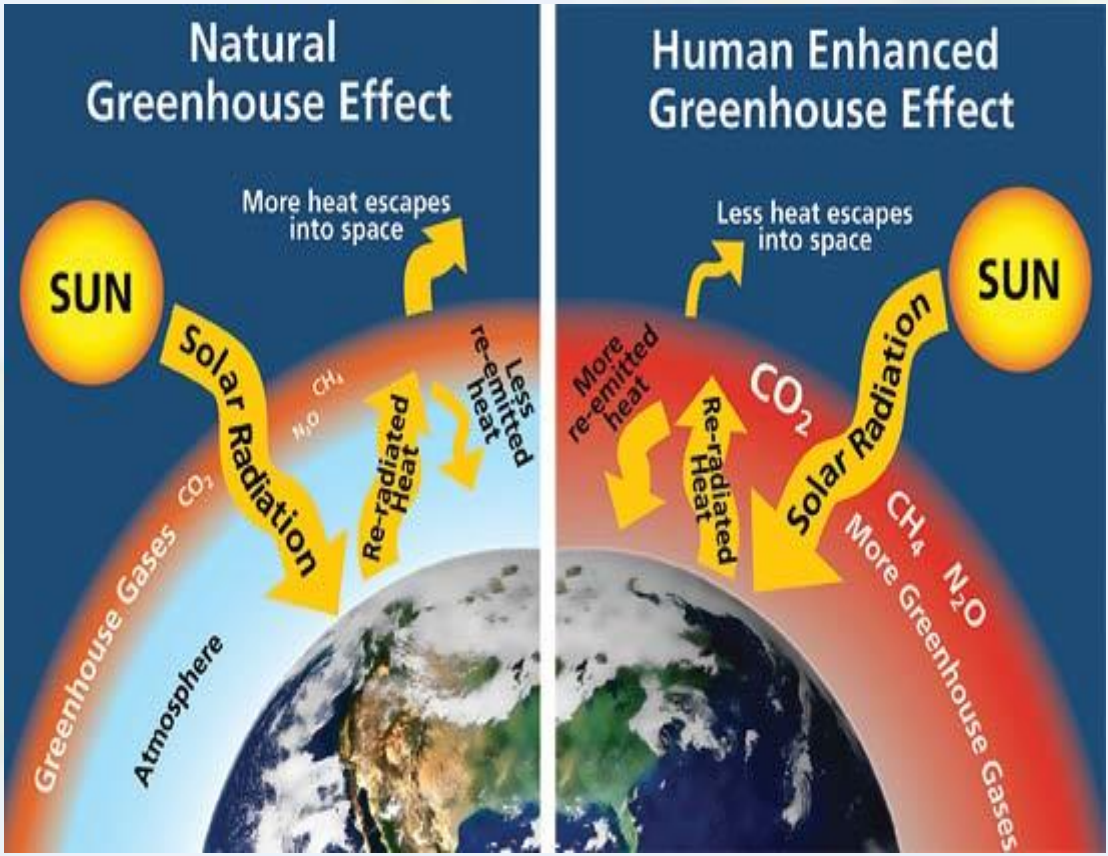




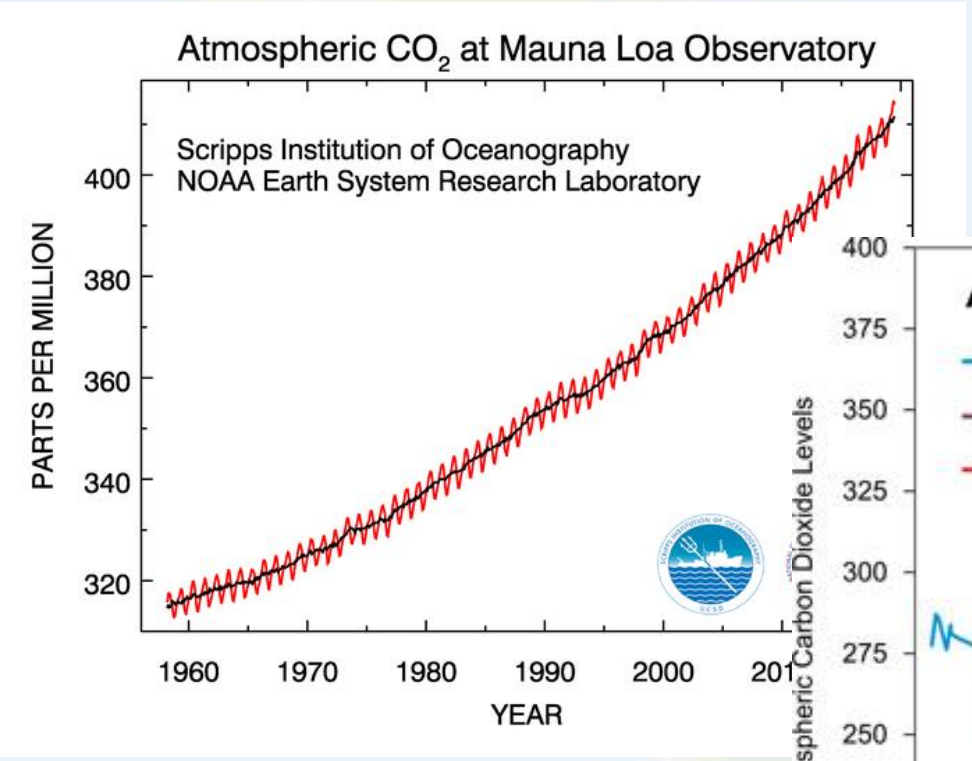
Climate and the Greenhouse Gases

Greenhouse Effect

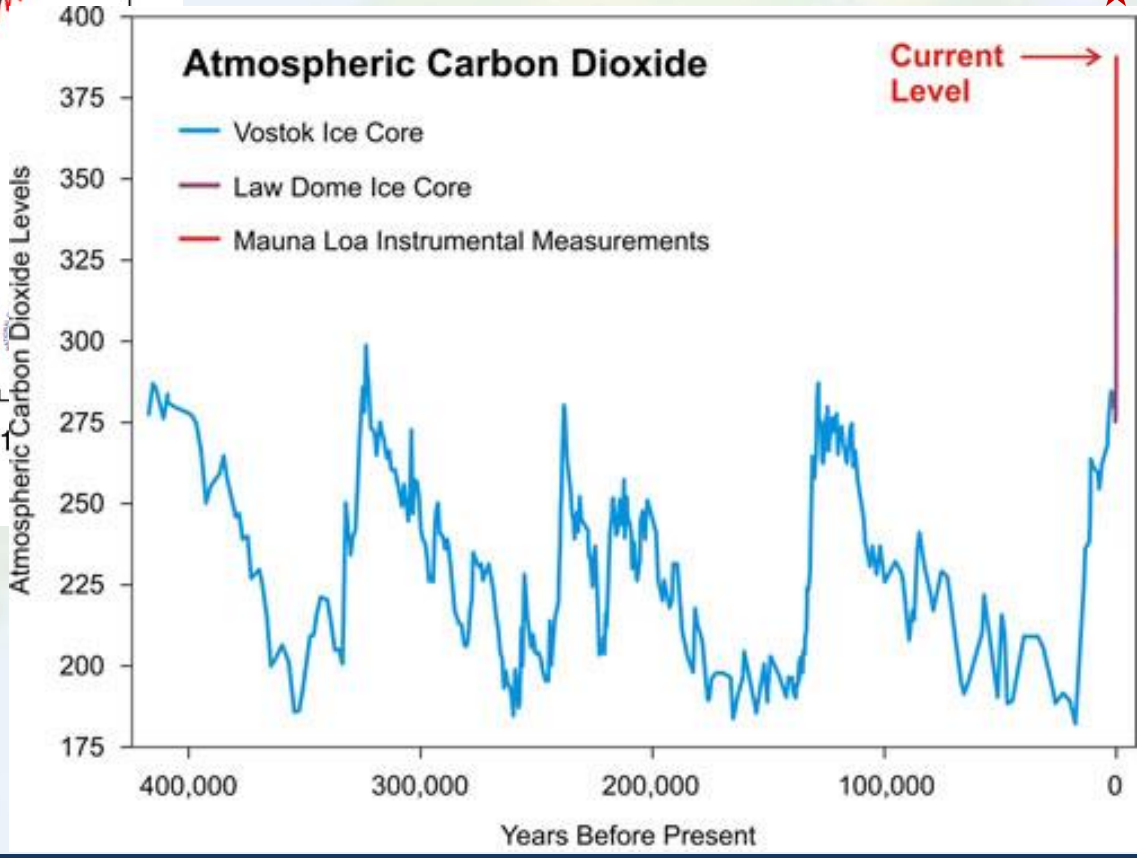
- Greenhouse gases absorb heat (solar radiation)
  - Radiate heat back to Earth's surface
  - Major greenhouse gases include carbon dioxide (CO_2) and water vapor (H_2O)
  - Trace gases include methane, ozone, nitrous oxide, and CFCs
- Natural greenhouse effect is necessary for life on Earth
- Concern: Human activities are *enhancing* the greenhouse effect.



Carbon Dioxide Increasing Due to Human Activity

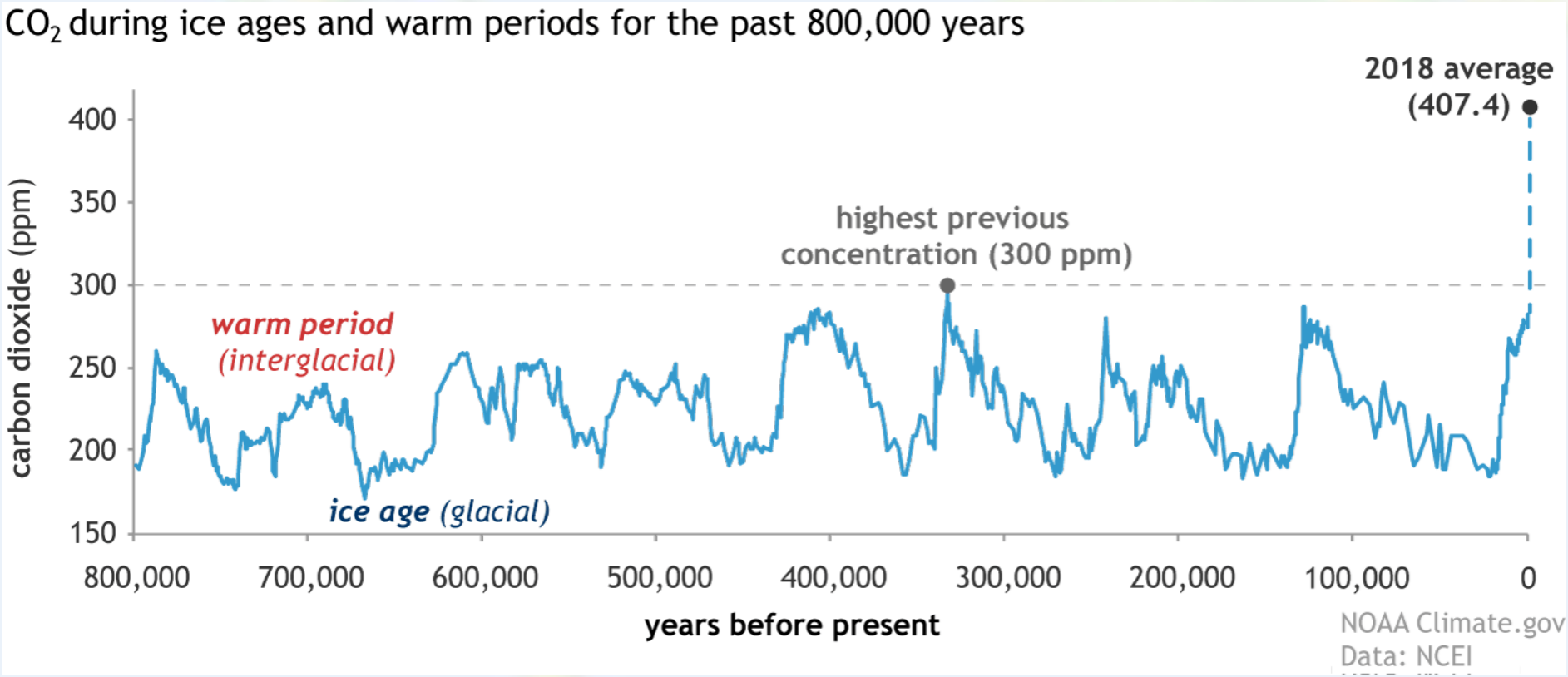


2019 peak: 411.6 PPM ★



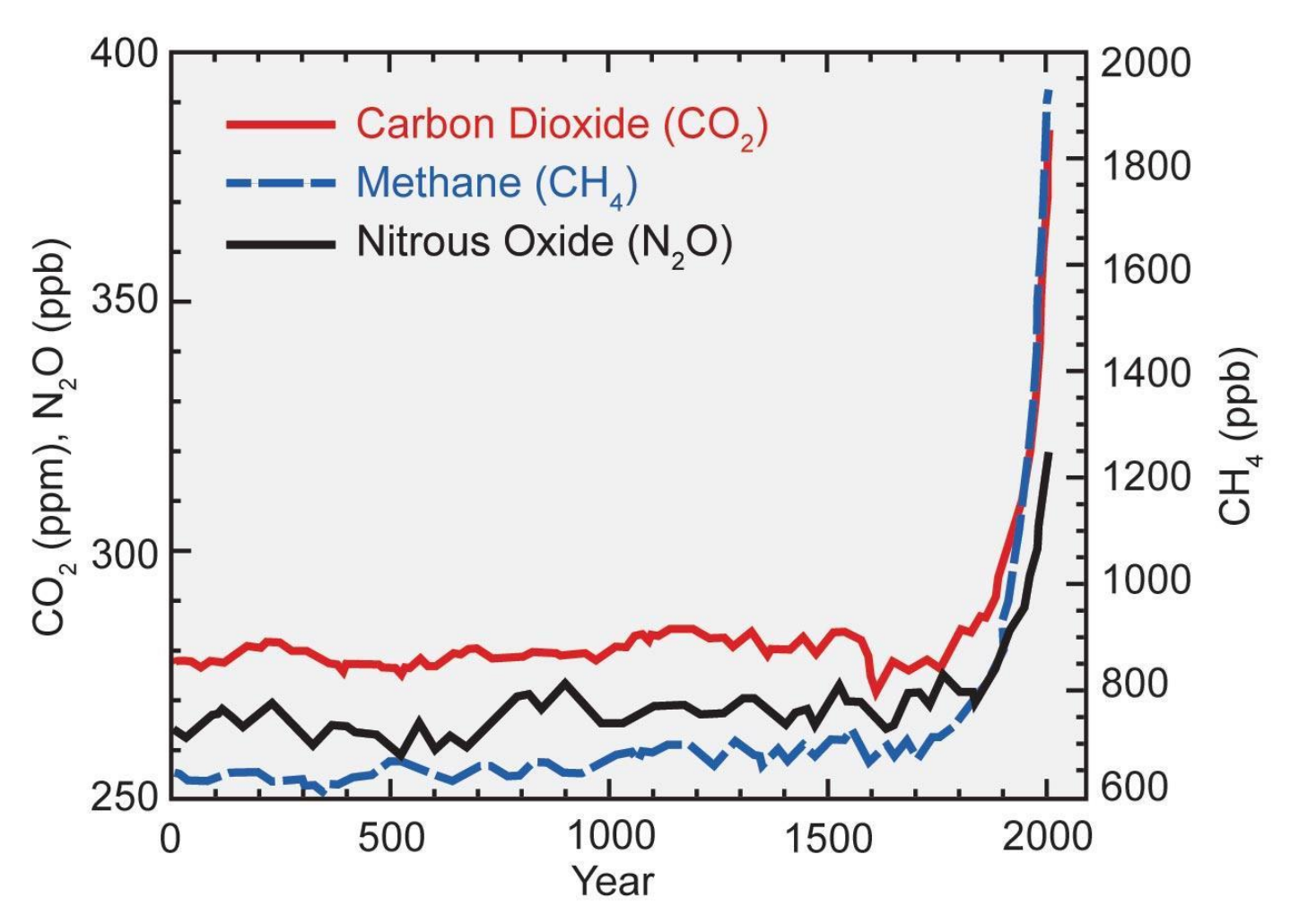
http://www.esrl.noaa.gov/gmd/ccgg/trends/

Carbon Dioxide Increasing

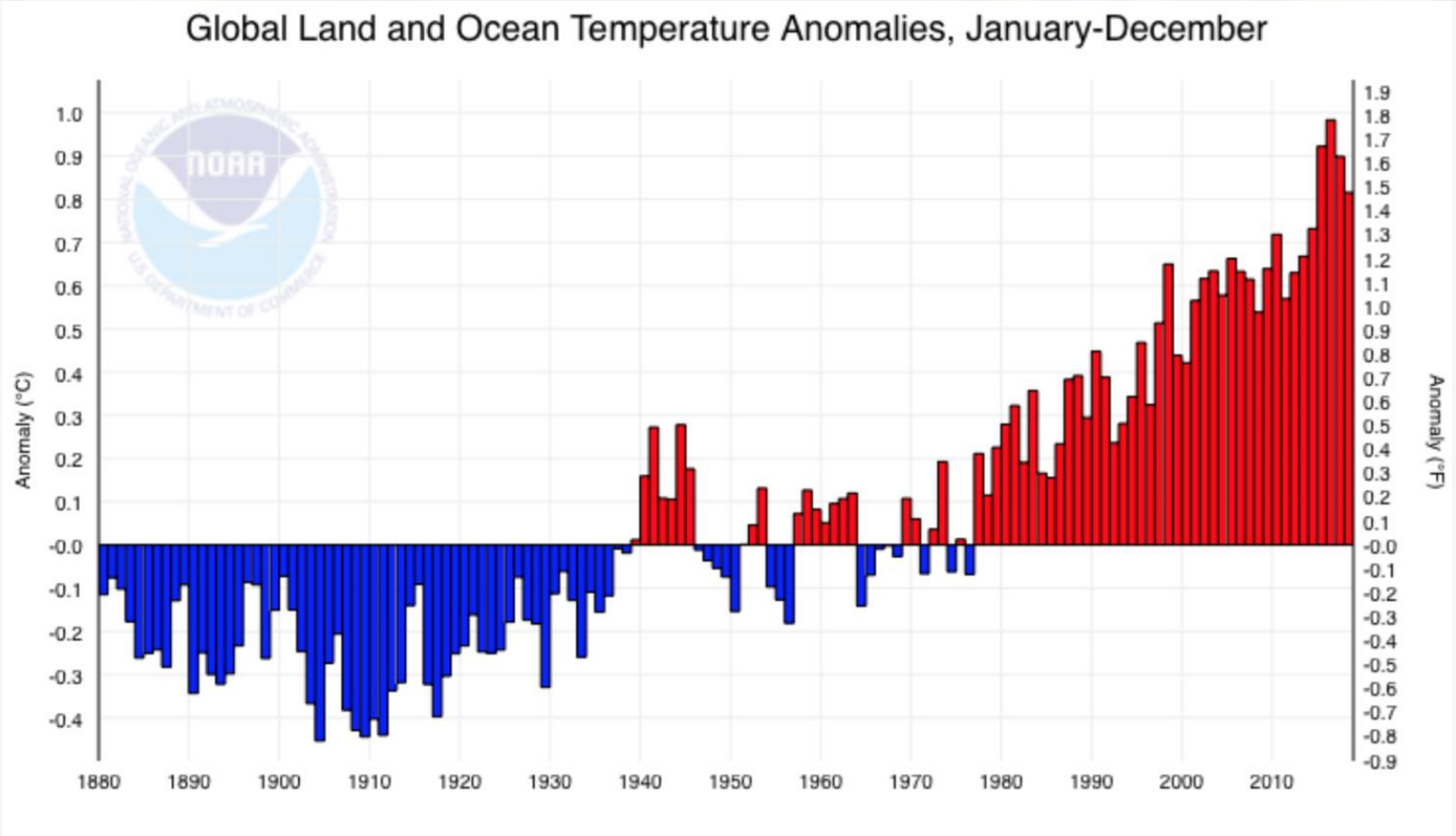


Climate.gov https://www.climate.gov/sites/default/files/paleo_CO2_2018_1500.gif

…And So Are Other Greenhouse Gases



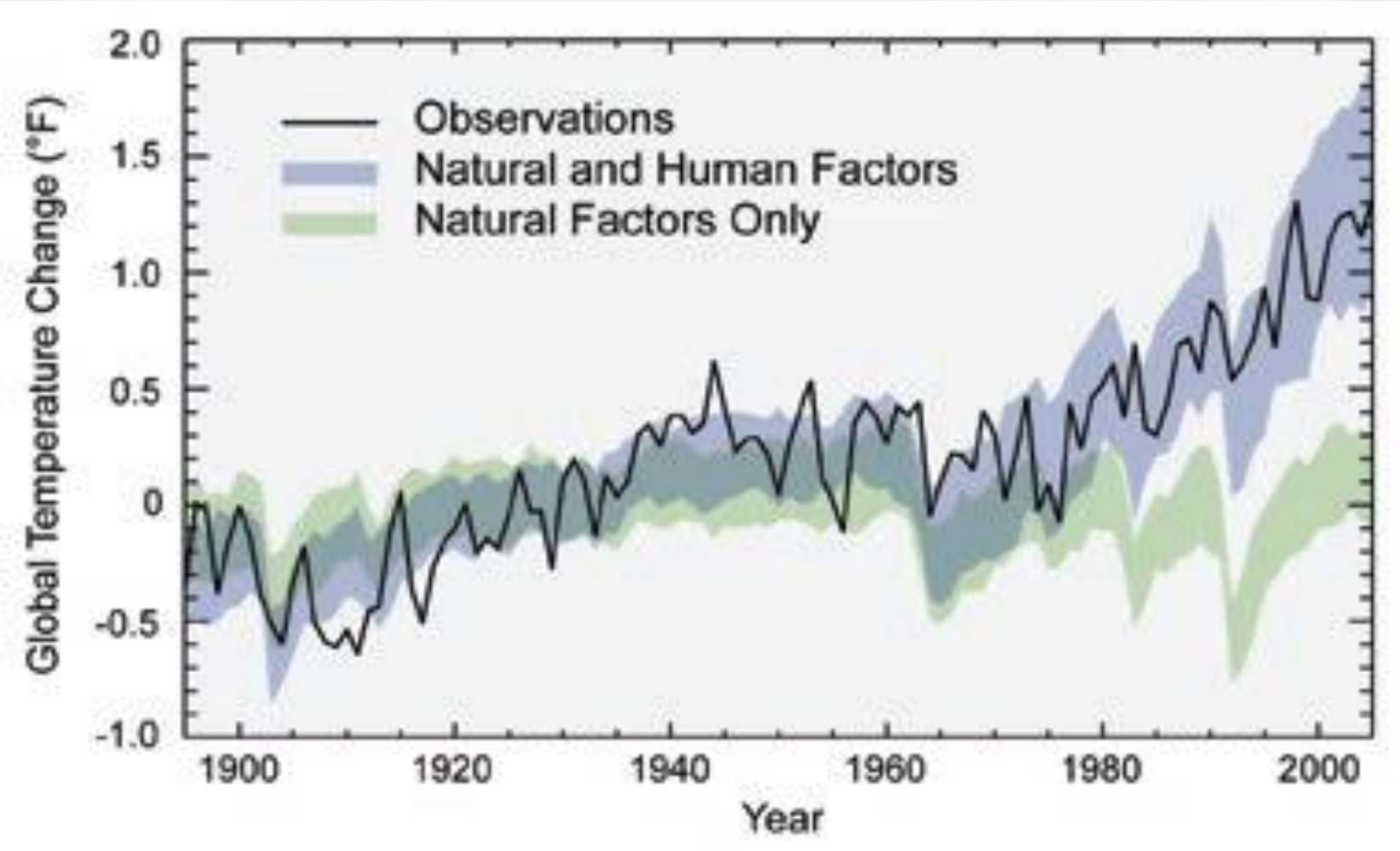
Global Temperatures Are Increasing



Most obvious **and most discussed** impact of climate change

http://www.ncdc.noaa.gov/sotc/global/2015/13

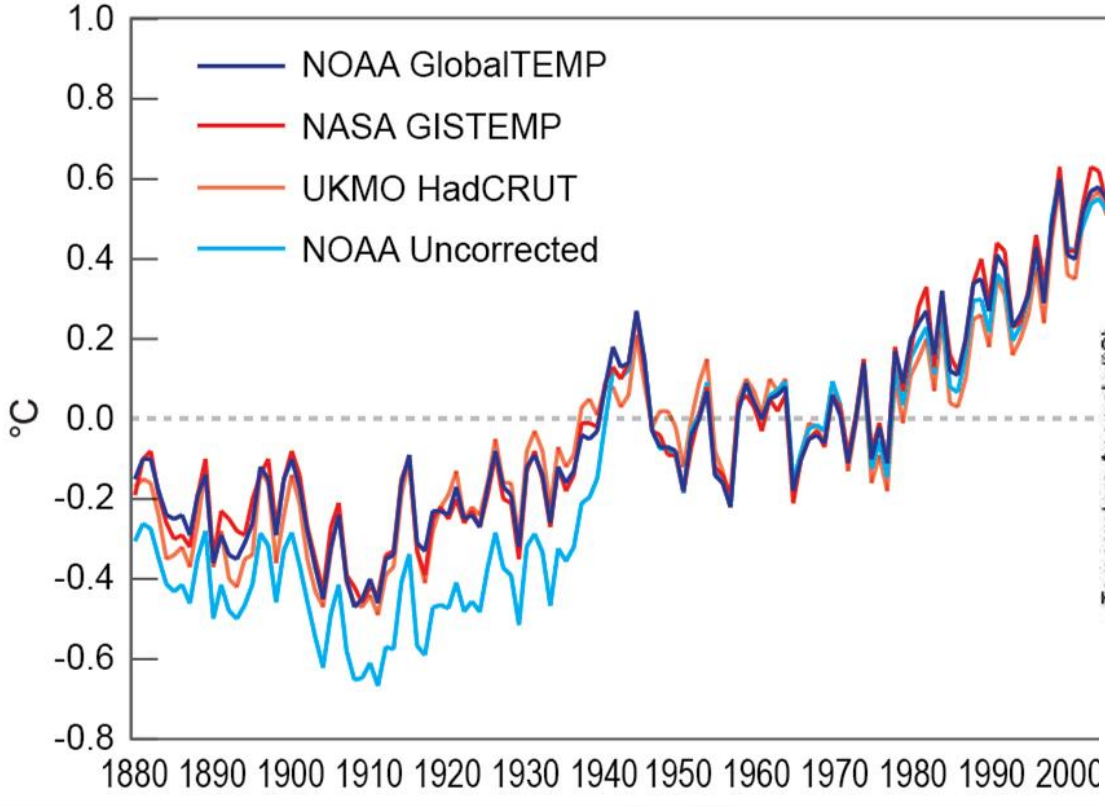
…And Are Explained Only When Including Increased Greenhouse Gases

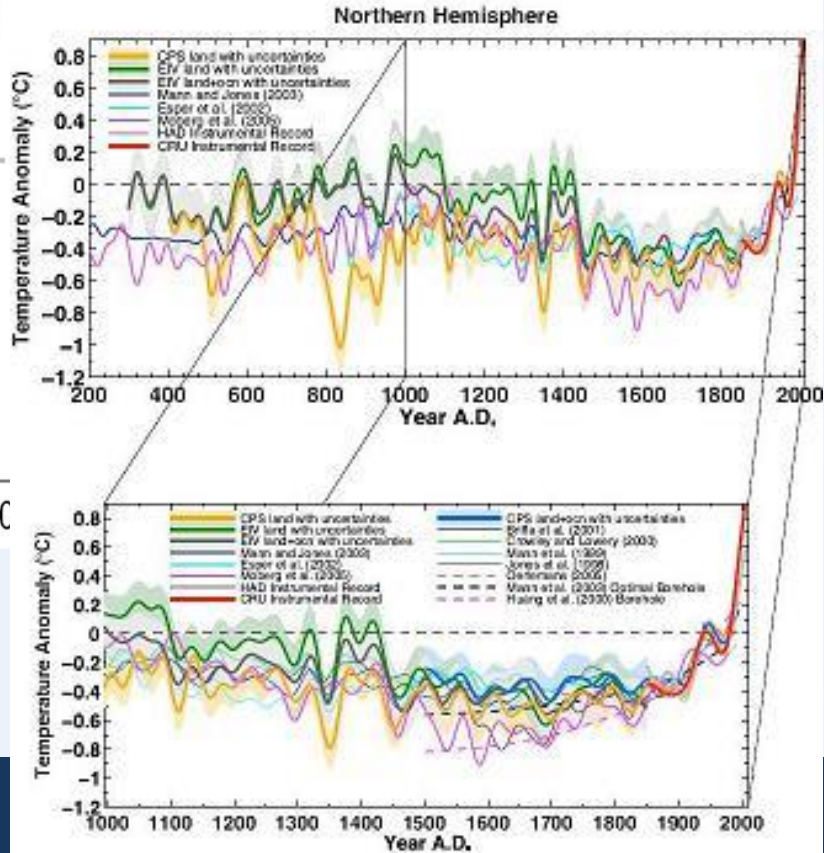


Source: **IPCC**

Global Temperature Analyses Agree

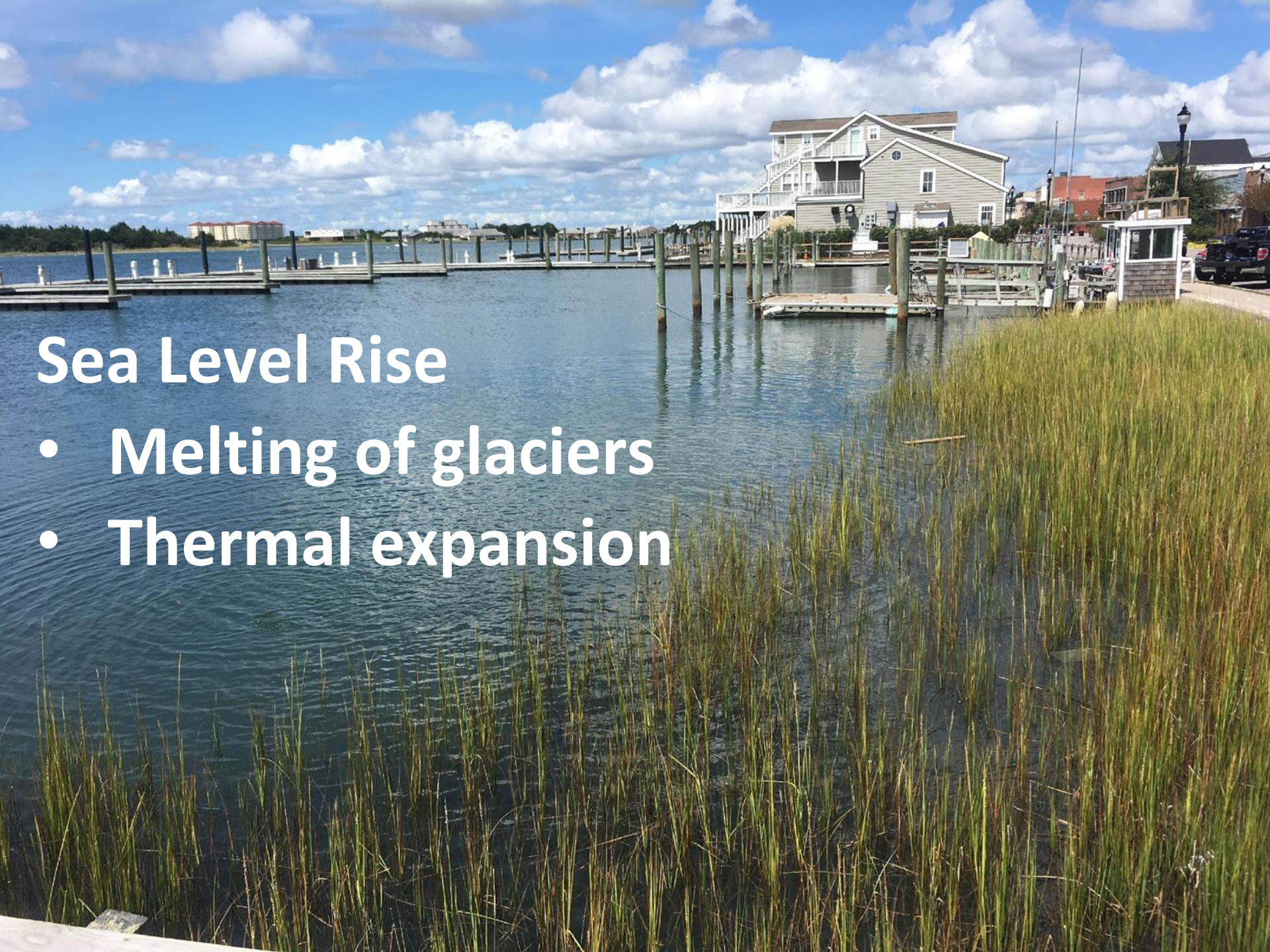
NASA, NOAA, MetOffice: relative to a common 1951 – 1980 base period



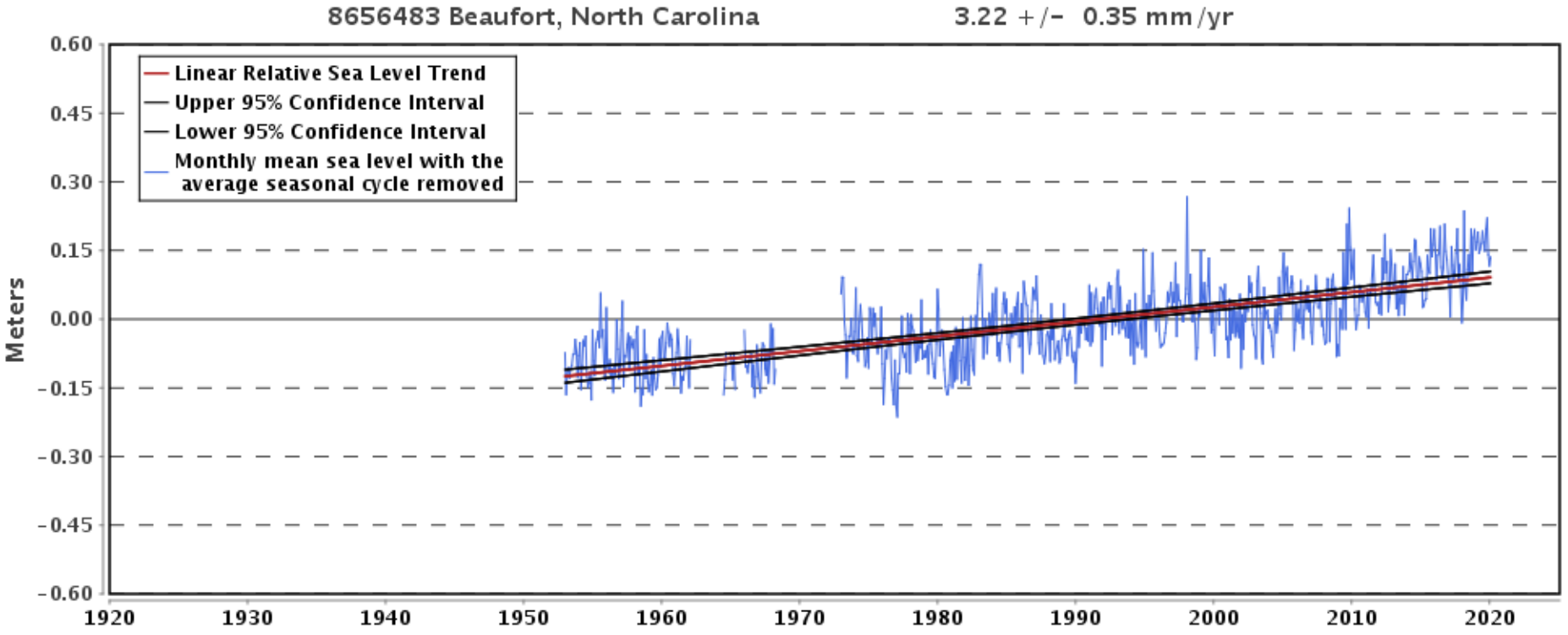


Right: Temperature over the past 1000-2000 years. Uncertainty increases farther back in time, when temperature reconstructions are based on "proxy" data (ice cores, tree rings, corals, lake sediments, glaciers, boreholes, stalagmites, etc.). Agreement improves with the instrumental records, beginning around 1850 A.D.

Symptoms of Climate Change


Sea Level Rise
• Melting of glaciers
• Thermal expansion

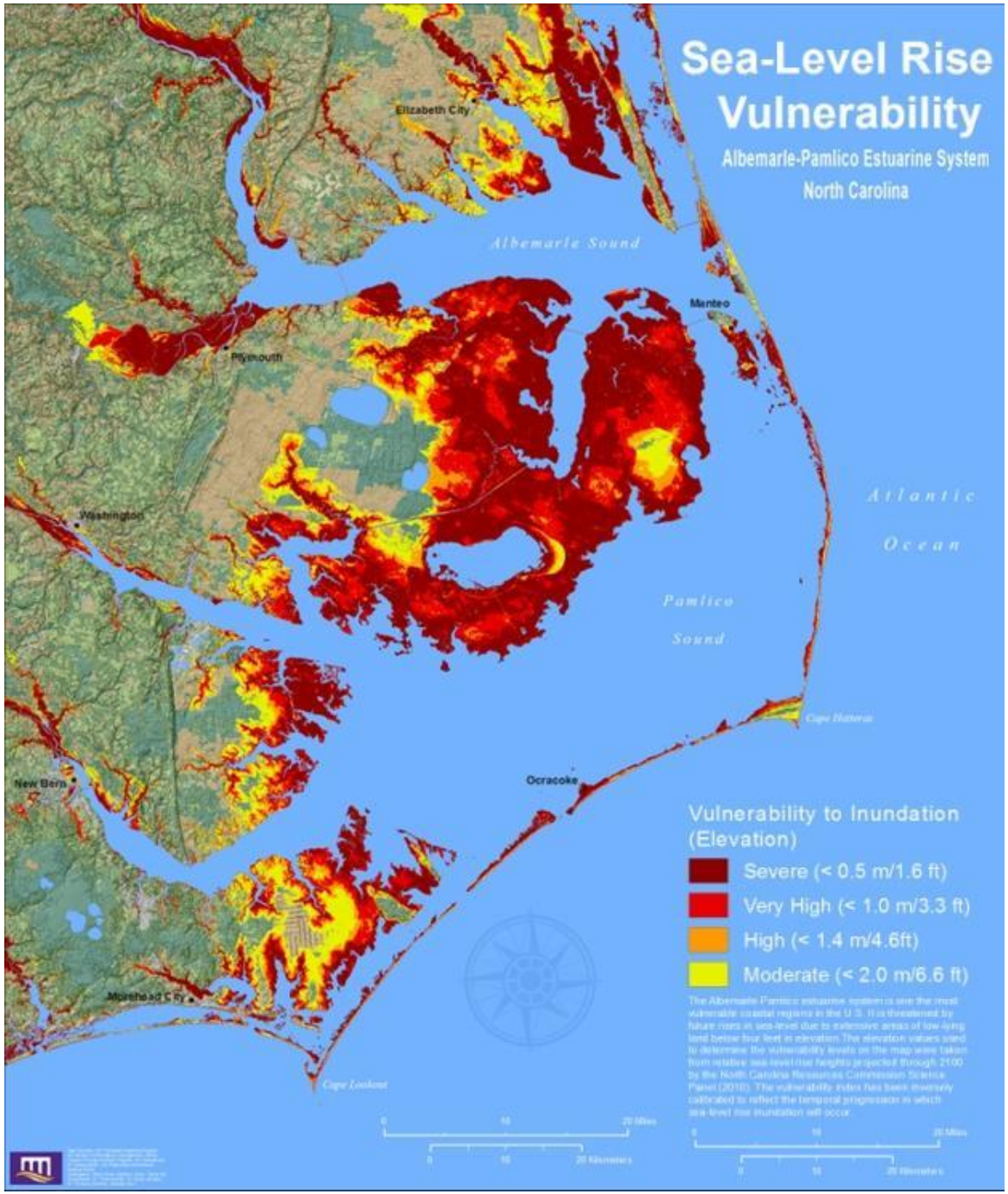
Sea Levels are Rising



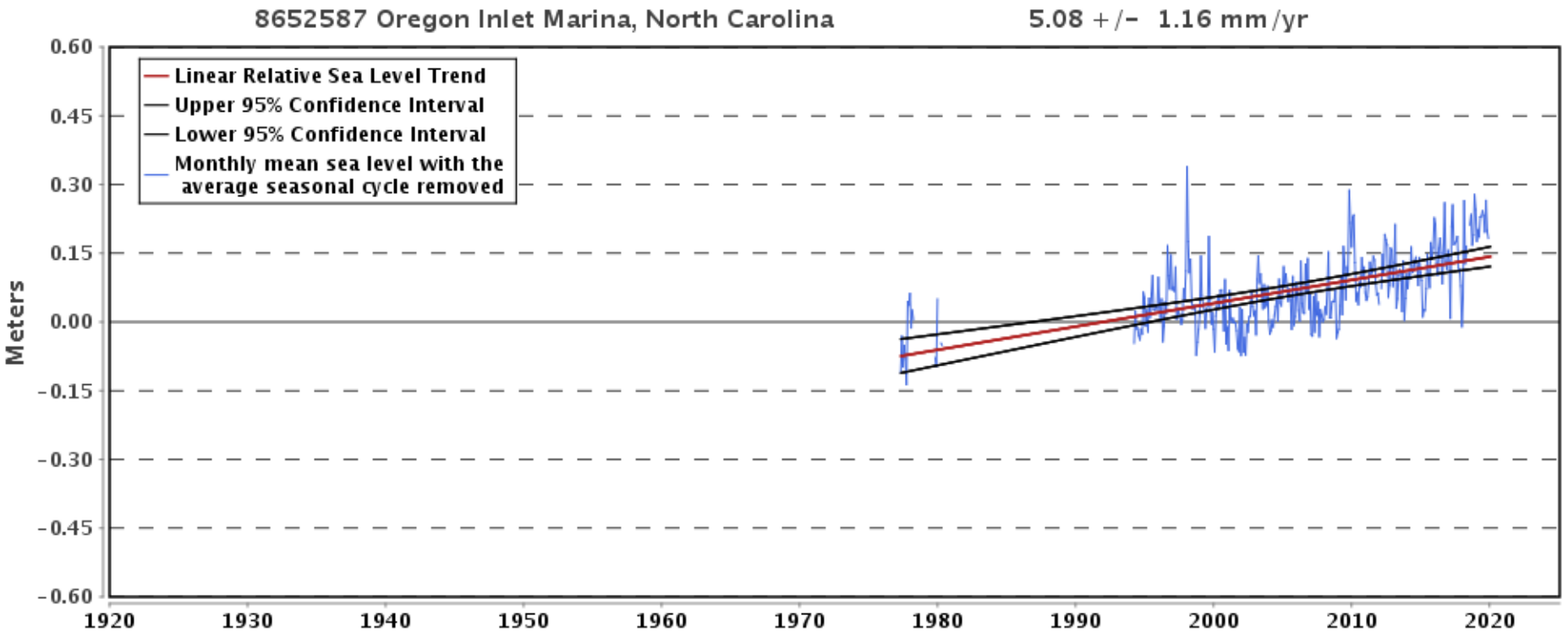
Relative Sea Level Trend: Beaufort, North Carolina

The relative sea level trend is **3.22 millimeters/year** with a 95% confidence interval of +/- 0.35 mm/yr based on monthly mean sea level data from **1953 to 2019** which is equivalent to a change of 1.06 feet in 100 years.

https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=8656483


Sea-Level Rise Vulnerability
Albemarle-Pamlico Estuarine System
North Carolina
Elizabeth City
Albemarle Sound
Manteo
Plymouth
Washington
Atlantic Ocean
Pamlico Sound
Cape Hatteras
New Bern
Ocracoke
Morehead City
Cape Lookout
Vulnerability to Inundation (Elevation)
Severe (< 0.5 m/1.6 ft)
Very High (< 1.0 m/3.3 ft)
High (< 1.4 m/4.6ft)
Moderate (< 2.0 m/6.6 ft)
The Albemarle-Pamlico estuarine system is one the most vulnerable coastal regions in the U.S. It is threatened by future rises in sea-level due to extensive areas of low-lying land below four feet in elevation. The elevation values used to determine the vulnerability levels on the map were taken from relative sea-level rise heights projected through 2100 by the North Carolina Resources Commission Science Panel (2010). The vulnerability index has been inversely calibrated to reflect the temporal progression in which sea-level rise inundation will occur.
0 10 20 Miles
0 10 20 Kilometers

Sea Levels are Rising

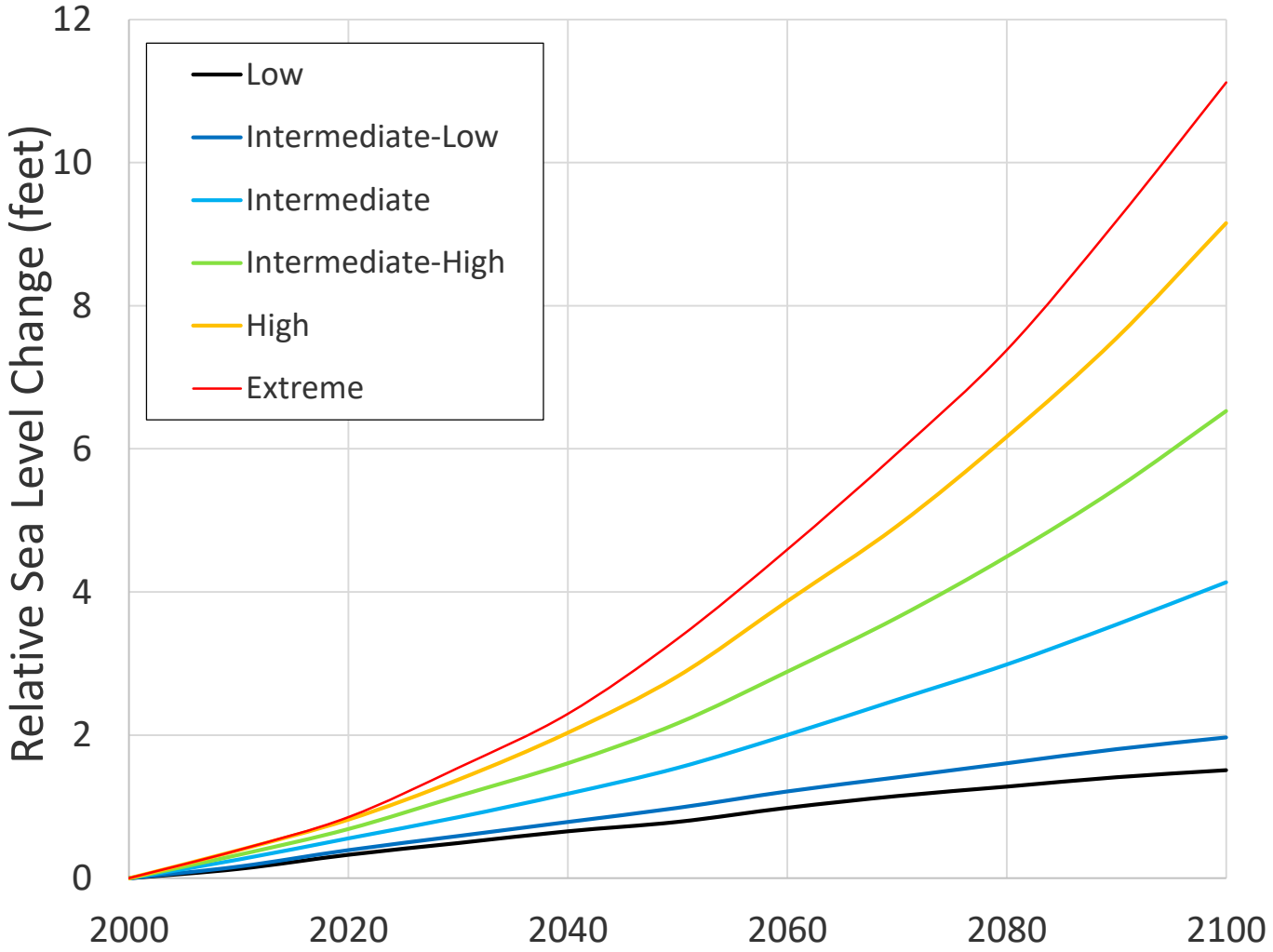


Relative Sea Level Trend: Oregon Inlet, NC

The relative sea level trend is **5.08 millimeters/year** with a 95% confidence interval of +/- 0.35 mm/yr based on monthly mean sea level data from **1977 to 2019** which is equivalent to a change of 1.67 feet in 100 years.

https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=8652587

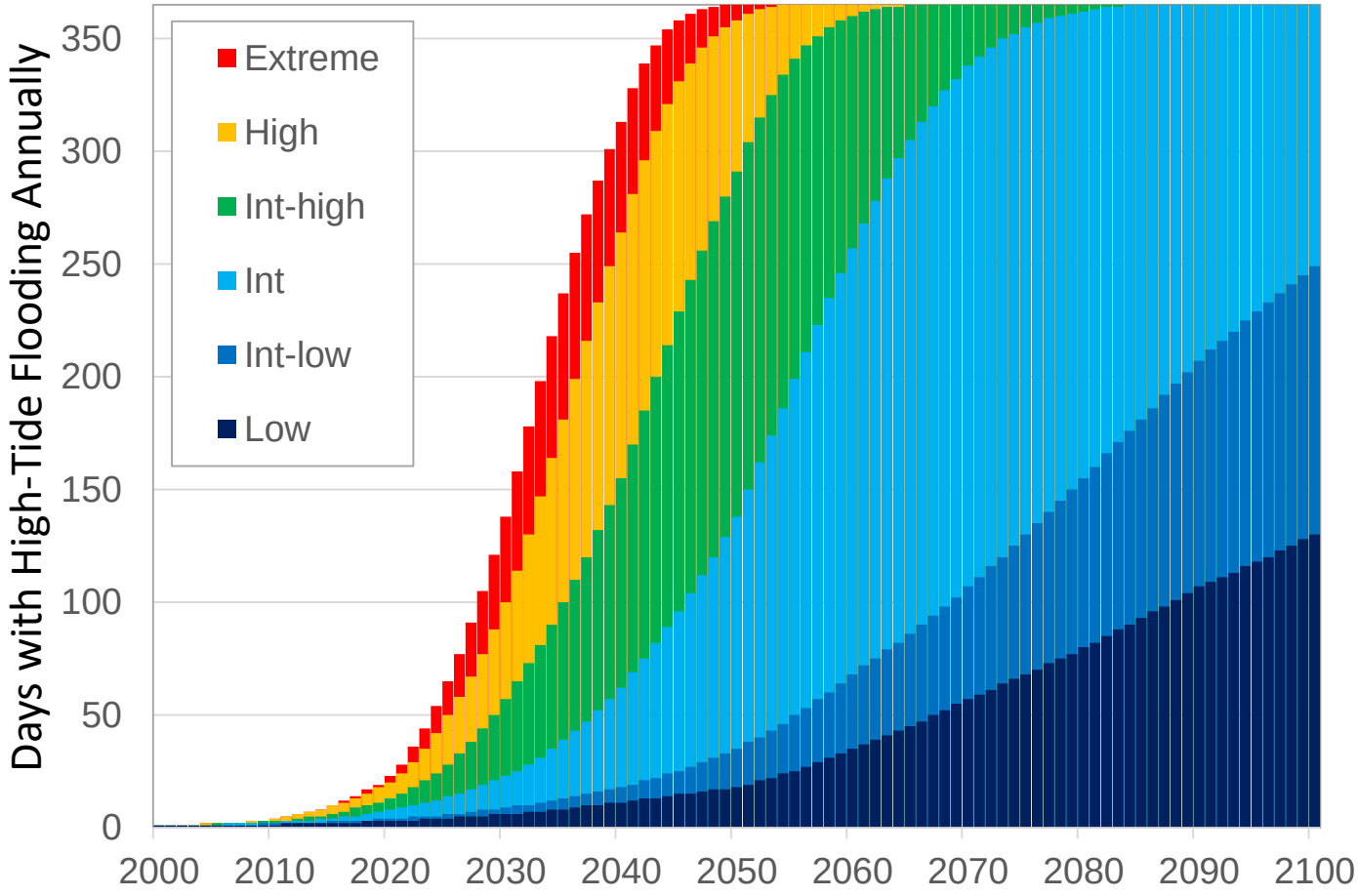
Projected Increase in Mean Sea Level



Relative sea level change scenarios for **Beaufort, NC** associated with 6 different sea level rise scenarios. The low and extreme scenarios represent the minimum and maximum of plausible future sea level rise.

Data source: NOAA Technical Report NOS CO-OPS 083; Site: 2295.

Projected Days of Future Flooding with Sea Level Rise in Beaufort, NC



Projected future days of **minor flooding** based on derived levels at Beaufort, NC under different sea level-rise scenarios.

Data source: NOAA Technical Report NOS CO-OPS 086.

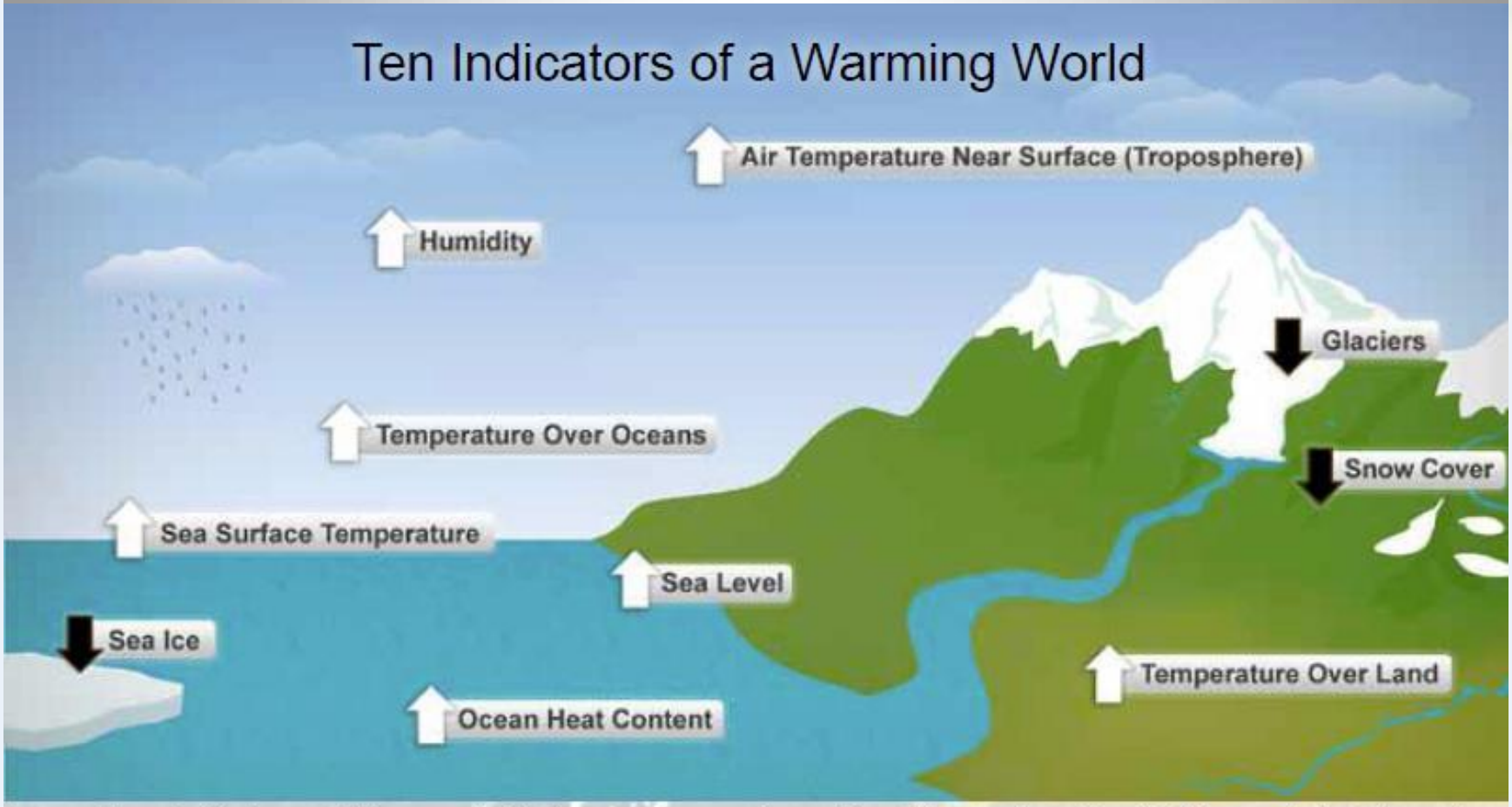

SALE
SALE

Six of the seven highest precipitation events on record in North Carolina have occurred within the last 20 years.

https://sph.unc.edu/sph-news/north-carolina-tropical-cyclone-driven-coastal-flooding-is-worsening-with-climate-change-population-growth/

10 11 Indicators of a Warming World

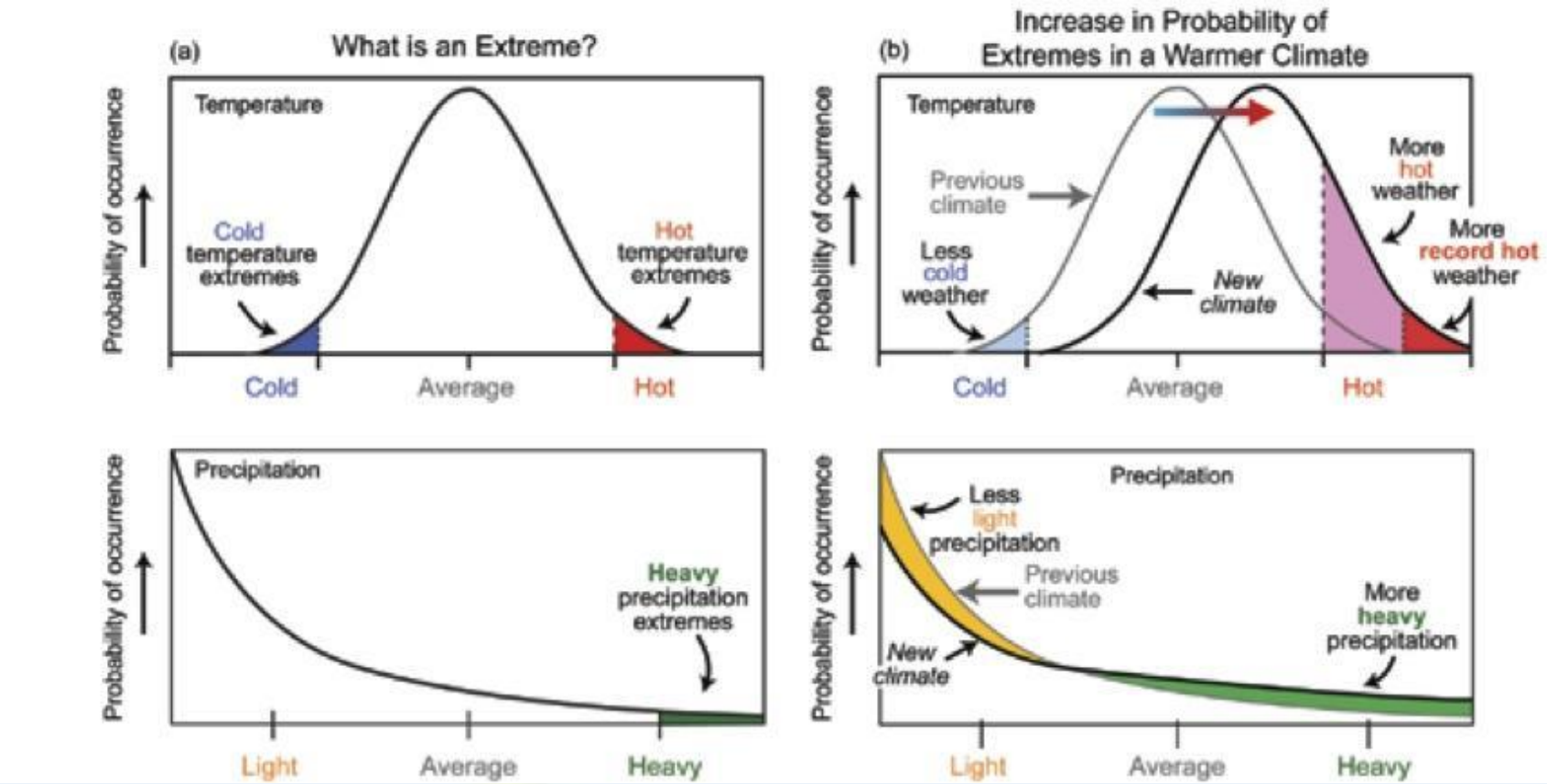
The stratosphere (up here!) is cooling



Seven of these indicators would be expected to increase in a warming world and observations show that they are, in fact, increasing. Three would be expected to decrease and they are, in fact, decreasing.

Download or order posters of this at http://cpo.noaa.gov/warmingworld/

How the Averages Affect the Extremes



Recent Temperature Trends

- Temperatures have warmed over the last century across the region.

- The warming is strongest during winter and for northern tier states.

Recent temperatures (1991-2012) compared to 1901-1960

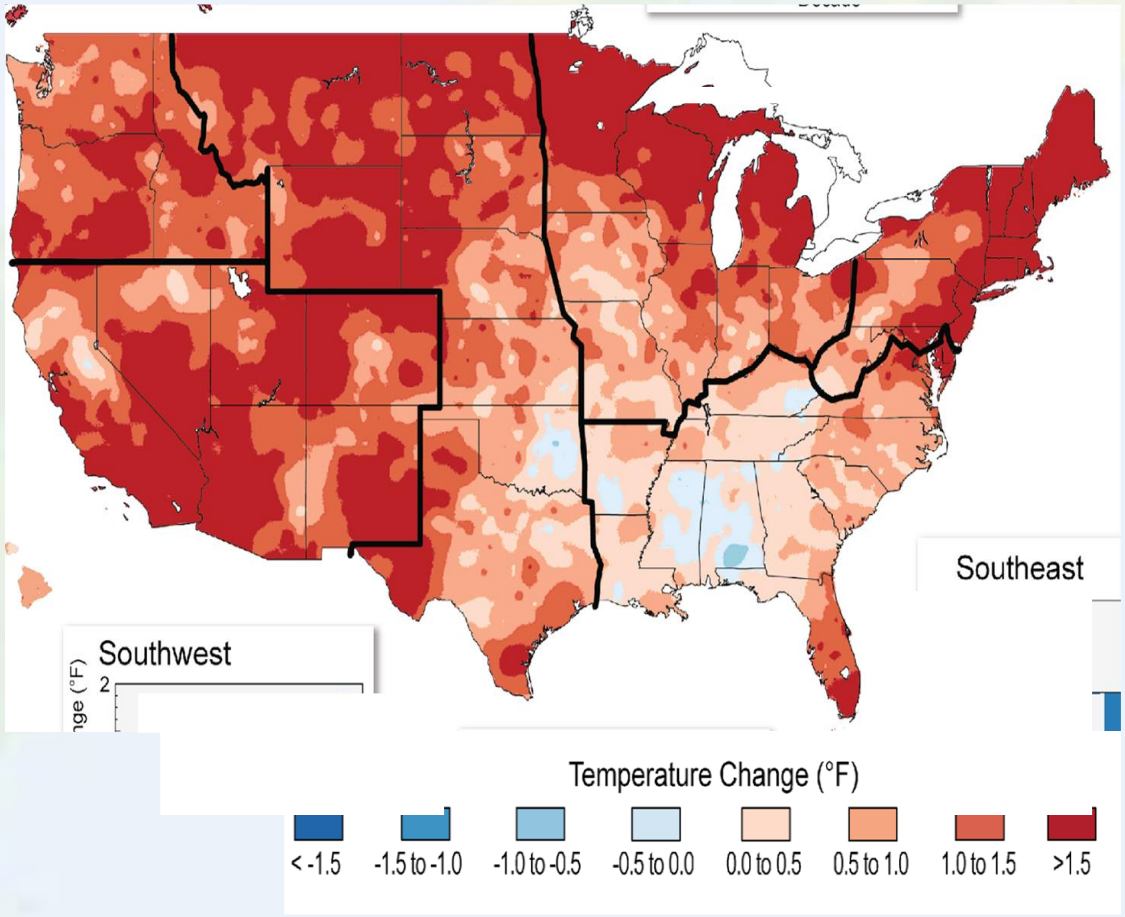


Figure 2.7 *Our Changing Climate*, National Climate Assessment. http://nca2014.globalchange.gov

Recent Precipitation Trends

- Wetting in the north.
- Drying in the west and south.

Recent precipitation (1991-2012) compared to 1901-1960

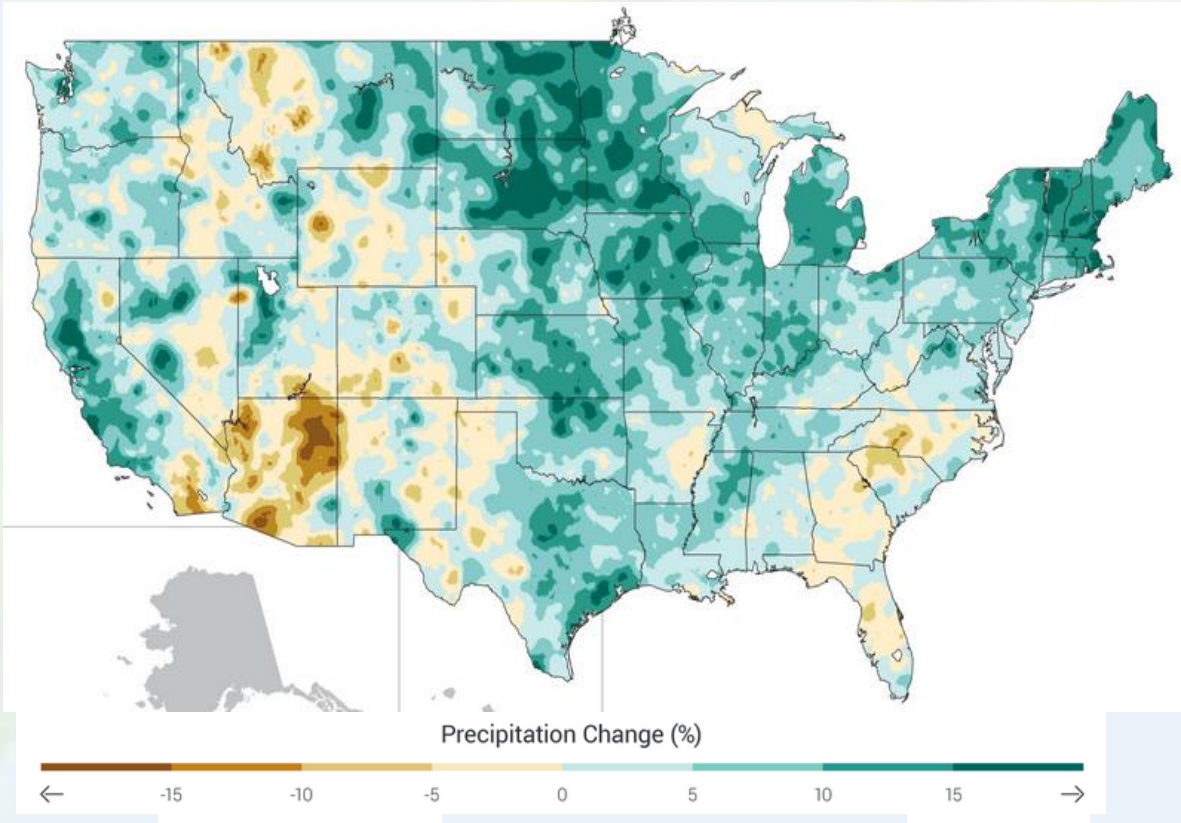
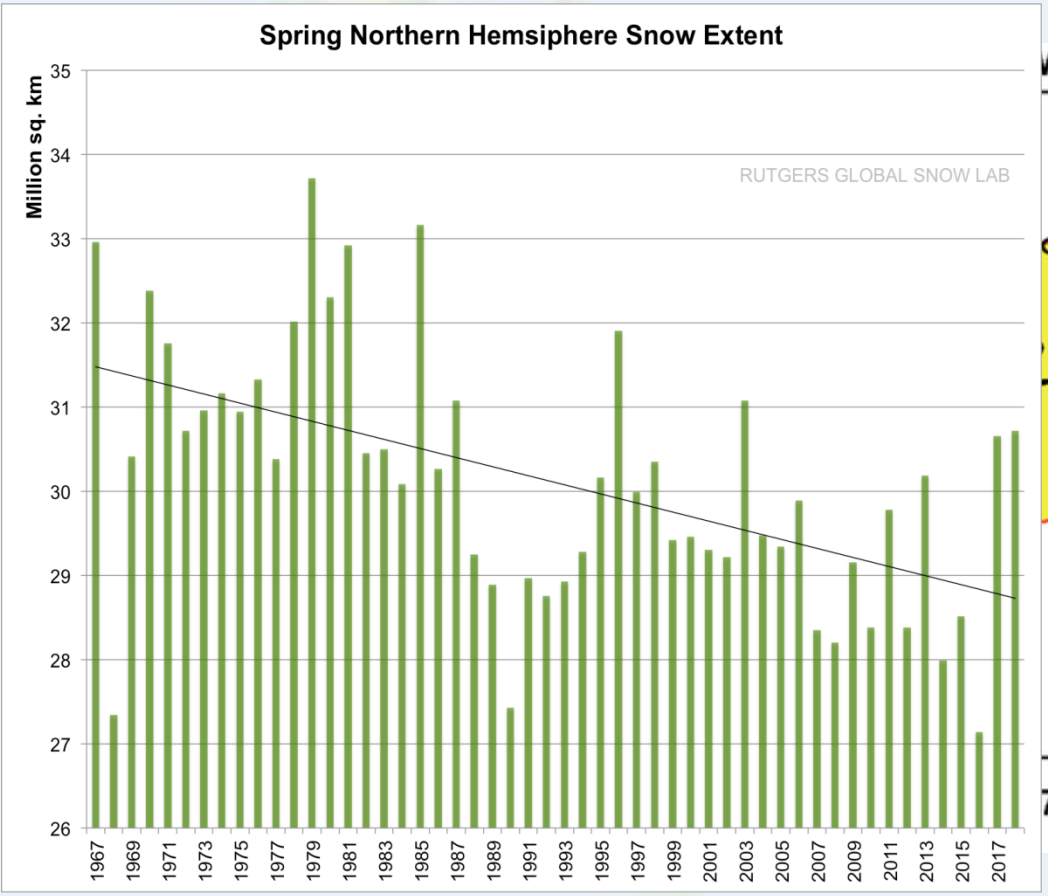
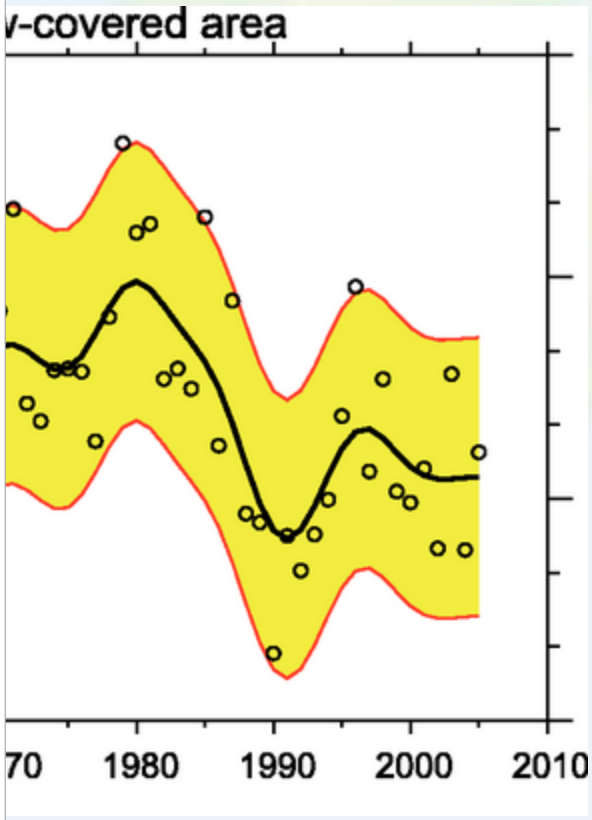


Figure 2.12 Our Changing Climate, National Climate Assessment. http://nca2014.globalchange.gov

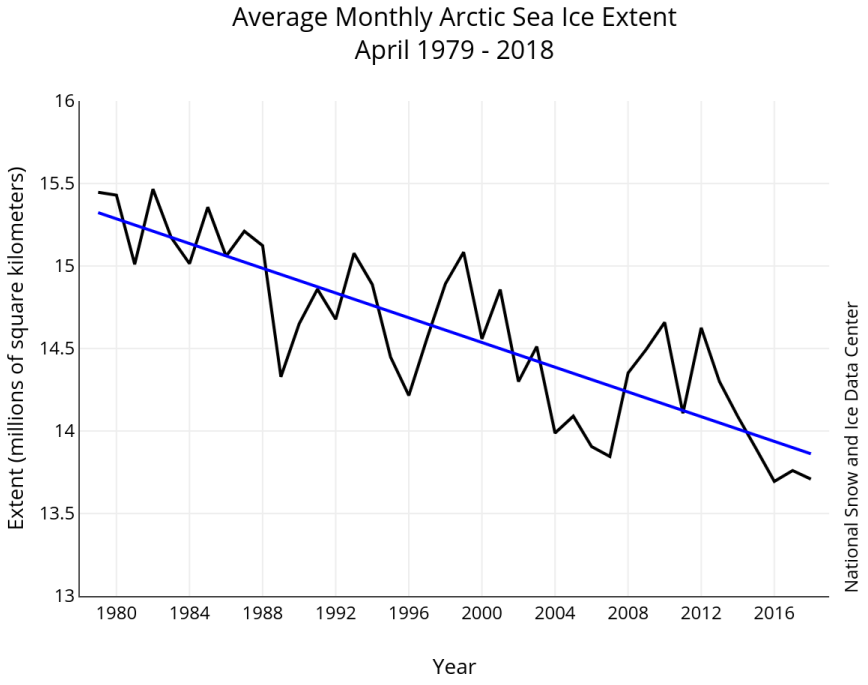
Snow Is Melting Early

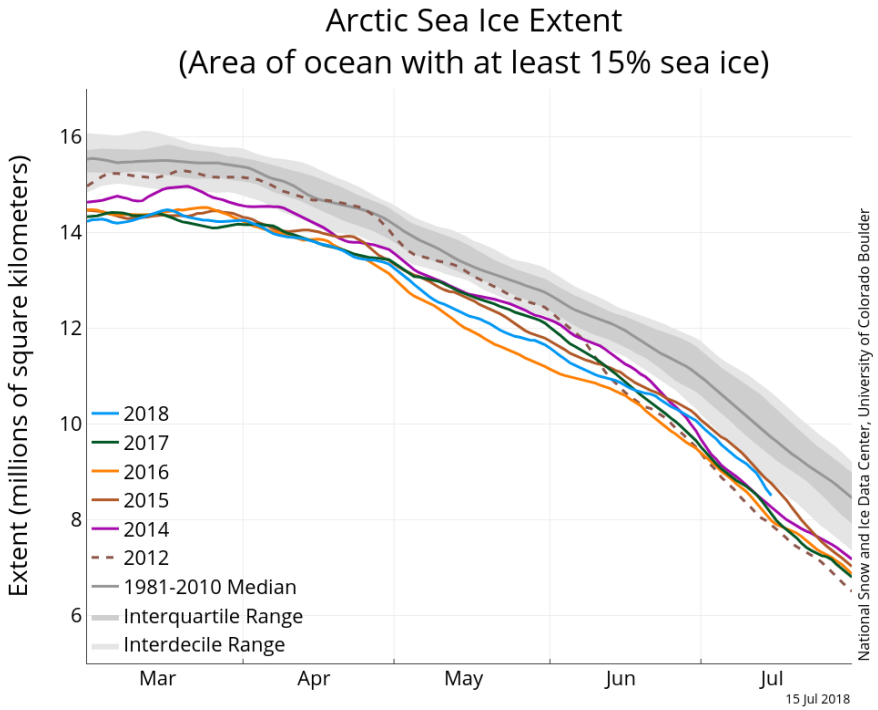
- In 2014, snow melt occurred 20–30 days earlier over North America than the 1998–2010 average.





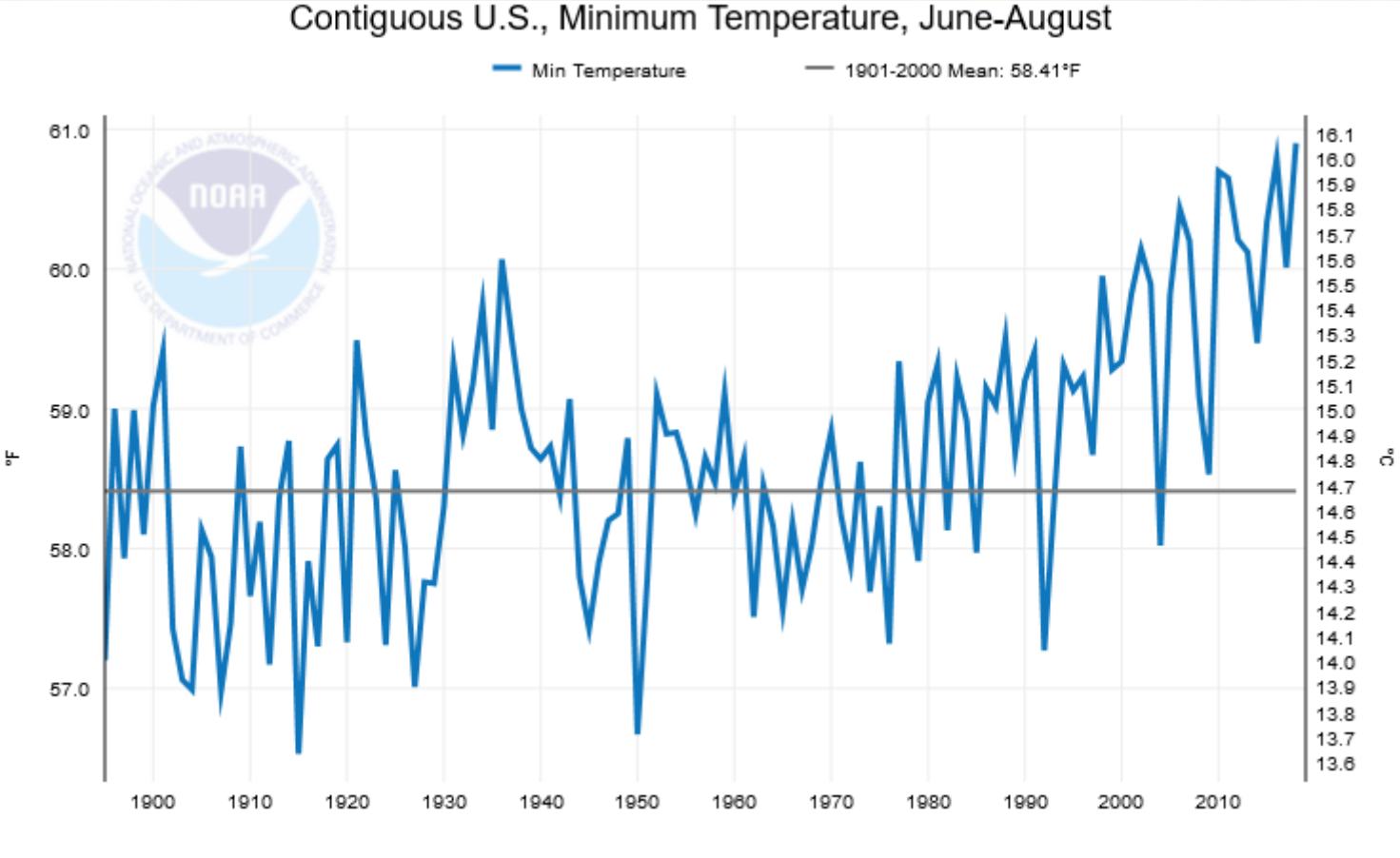
Arctic Sea Ice Is Melting





- 10 lowest minimum sea ice extents are the last 10 years.
- Multi-year ice is decreasing (ice is thinning).
- September Arctic sea ice extent is declining at a rate of -13.3% per decade.

Big Heat Is Increasing



(Big Cold is generally decreasing)

NOAA/NCEI Climate Extremes Index: http://www.ncdc.noaa.gov/extremes/cei

Frost-Free Season Is Lengthening

Recent length (1991-2012) compared to 1901-1960

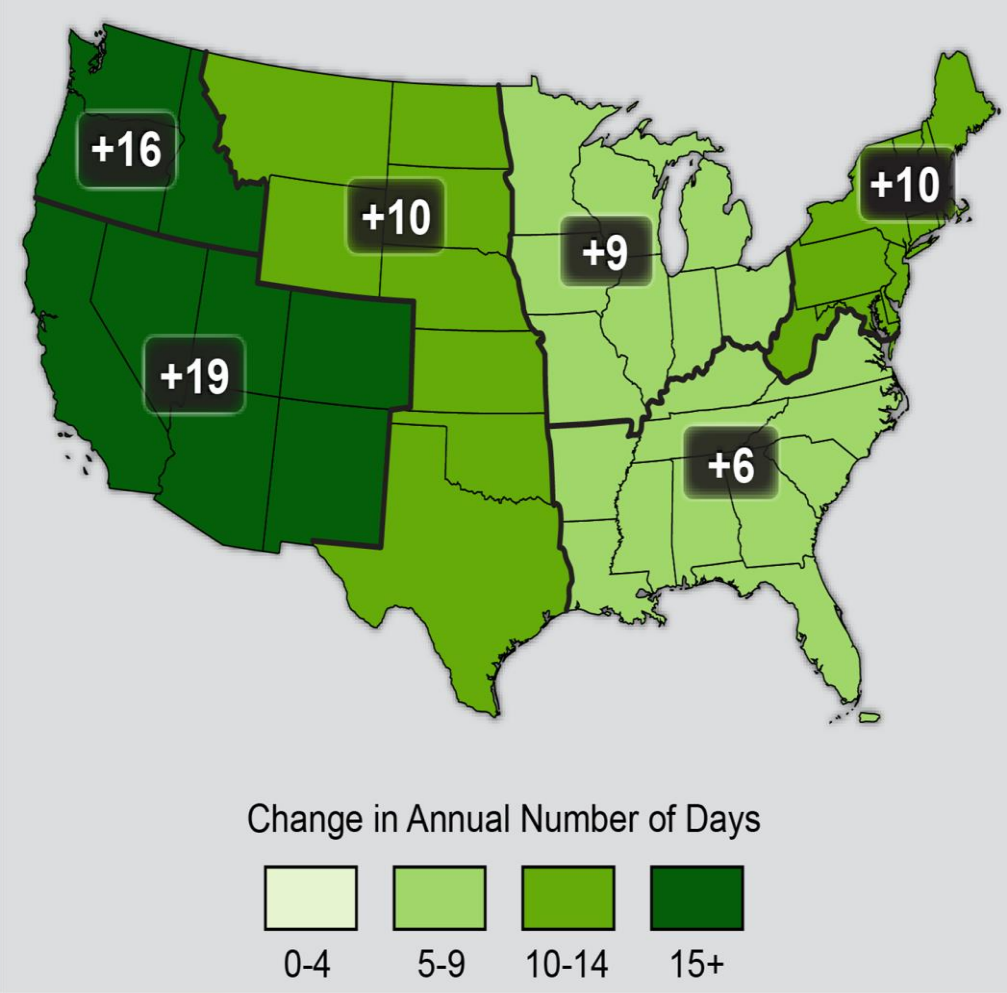
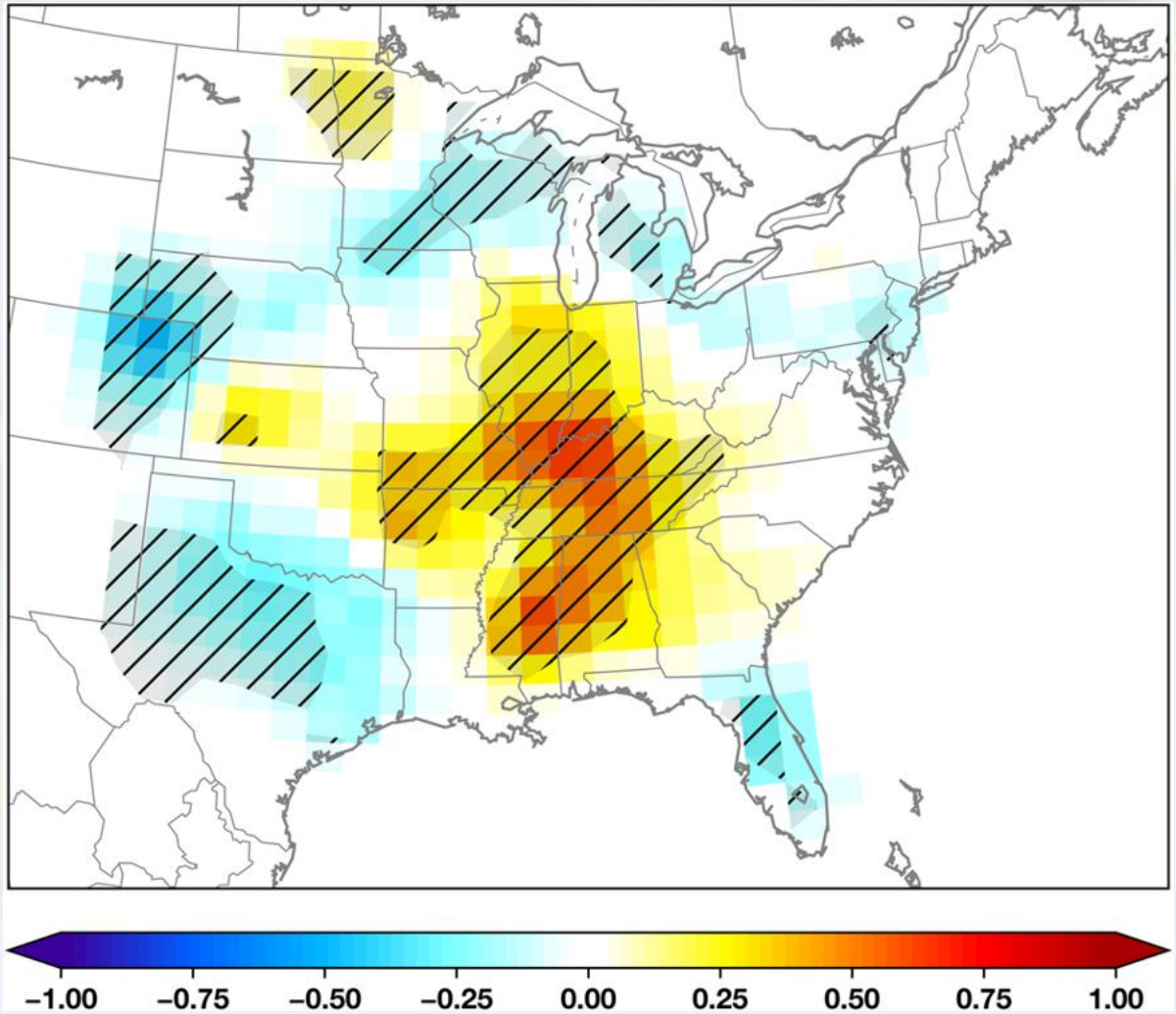


Figure 2.10 Our Changing Climate, National Climate Assessment. http://nca2014.globalchange.gov

Tornado Trends

1979-2017

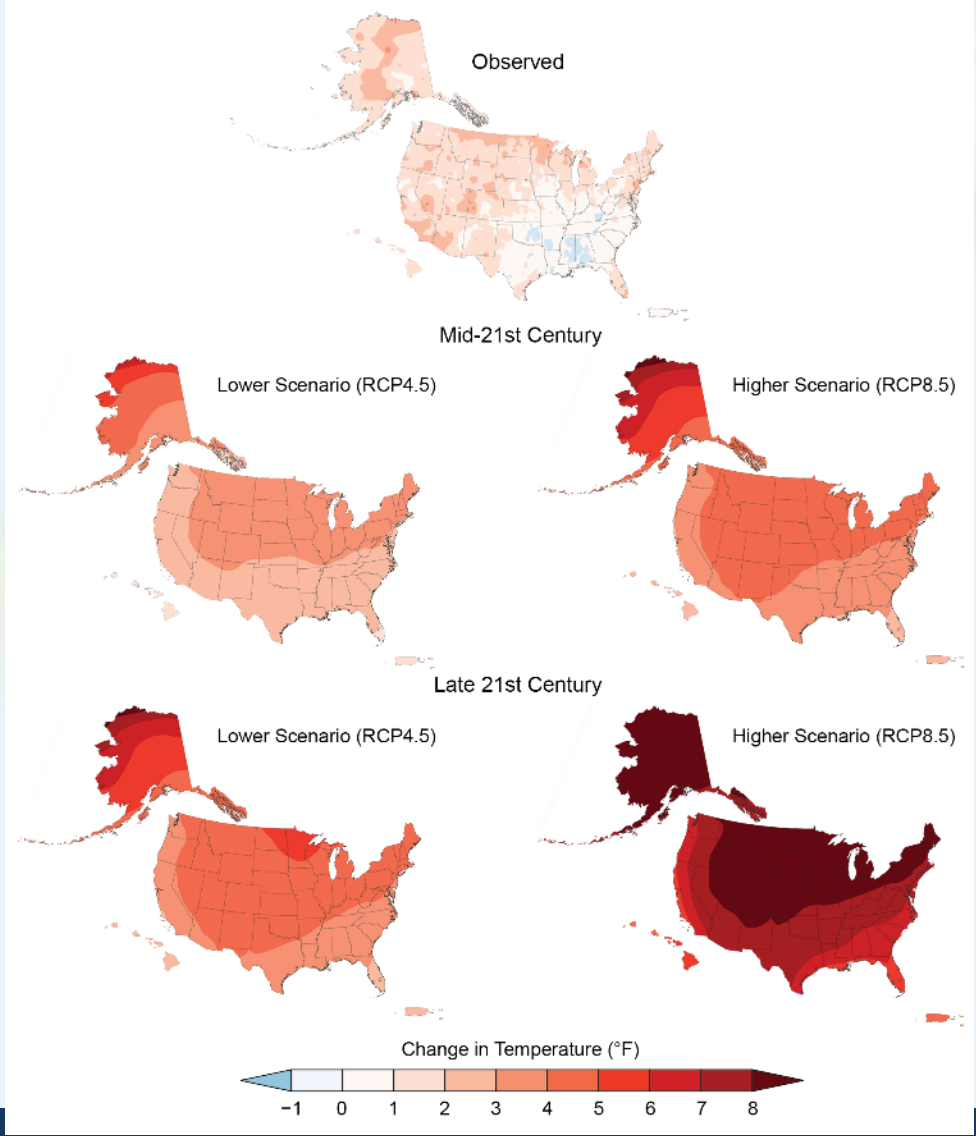
- Shifts in where tornadoes occur



Gensini and Brooks 2018

Projected Temperature Change

- Average temperatures will warm across the region, annually and for all seasons
- Warm temperature extremes will continue to occur more frequently than cold extremes
- Uncertainty lies in greenhouse gas emissions scenarios



Top: 1986-2016 temperatures, compared to 1901-1960
Middle: Projected annual average temperature change in 2036-2065, compared to 1986-2015
Bottom: Projected annual average temperature change in 2070-2099, compared to 1986.2015

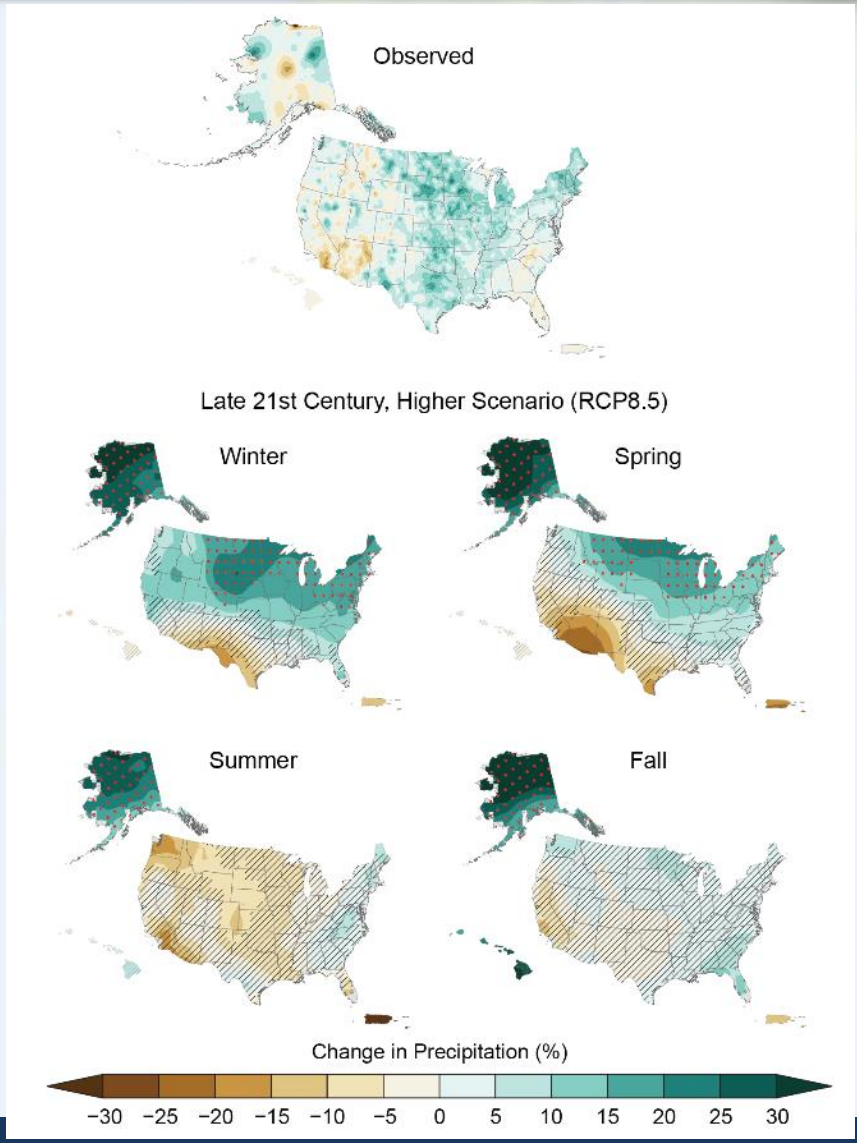
Figure 2.4, Our Changing Climate
National Climate Assessment: https://nca2018.globalchange.gov/

Projected Precipitation Change

- Wetting trend north, especially winter and spring.

- Drying trend south, especially winter and spring.

- Drying trend in the central US in the summer.



Top: 1986-2016 precipitation, compared to 1901-1960
Middle: Projected annual precipitation change in 2036-2065, compared to 1901-1960
Bottom: Projected annual precipitation change in 2070-2099, compared to 1901-1960
Red dots: changes large compared to natural variability
Hatched: changes are small and relatively insignificant

Figure 2.5, Our Changing Climate
National Climate Assessment: https://nca2018.globalchange.gov/

Takeaway Messages

- It's real.
- It's us.
- Experts agree.
- It's mostly bad.
- It's not too late to fix it.

Adapted from Ed Maibach, George Mason University's Center for Climate Change Communication

Climate Tools

Climate.gov
Global Climate Dashboard

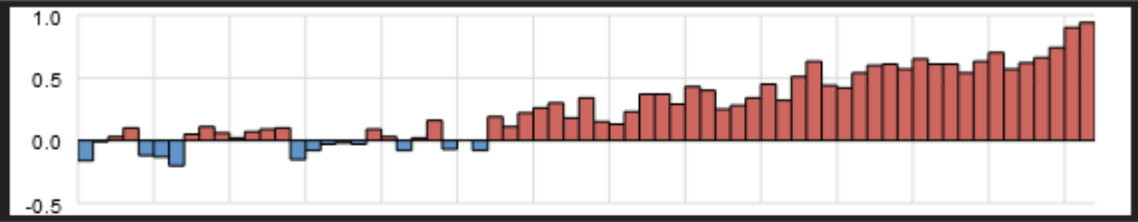
Global Climate Dashboard

▼ Climate Change | ► Climate Variability | ► Climate Projections

Global Average Temperature (˚C)

The temperature near Earth's surface is rising: the bars show each year's average temperature compared to the 20th century average.

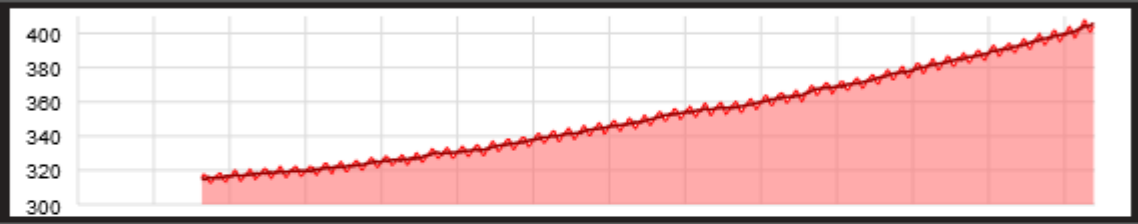
learn more >>



Carbon Dioxide (ppm)

The amount of carbon dioxide in the atmosphere has risen by 25% since 1958, and by about 40% since the Industrial Revolution.

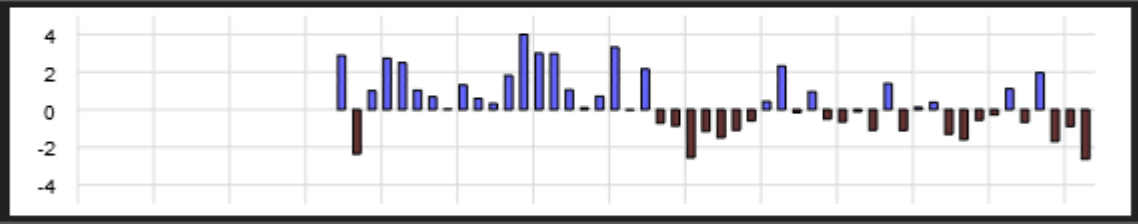
learn more >>

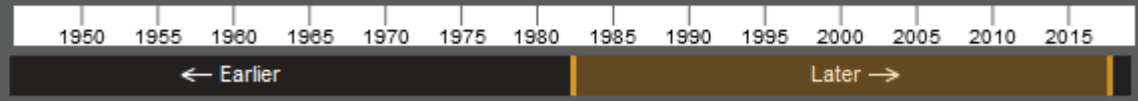


Spring Snow Cover (million km^2)

Snow is melting earlier: each bar shows spring snow cover in the Northern Hemisphere compared to the long-term average.

learn more >>

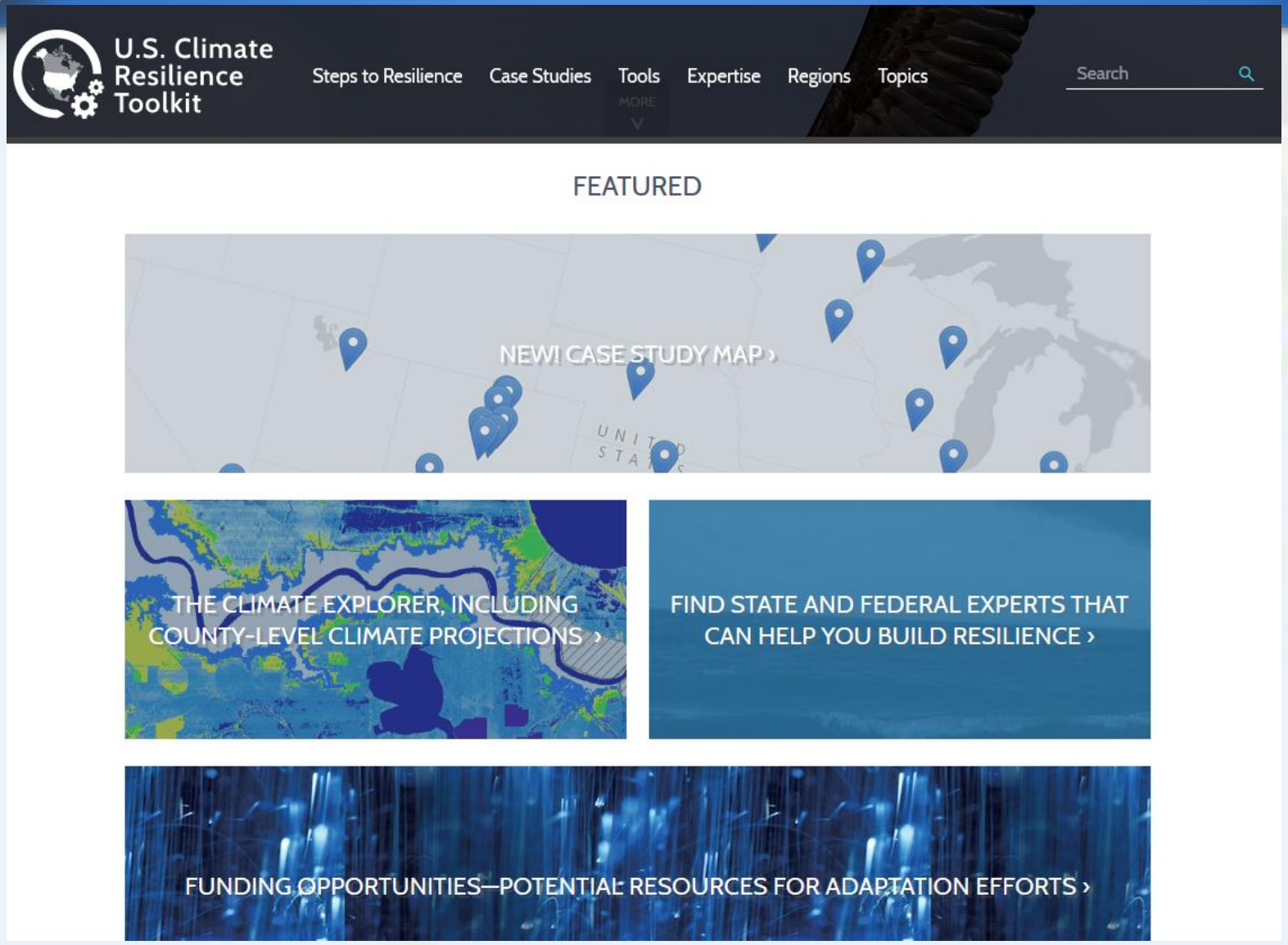




▲ Temperature	▲ Carbon Dioxide	▲ Snow
► Sea Level	► Arctic Sea Ice	► Ocean Heat
► Sun's Energy	► Glaciers	► Heat-Trapping Gases

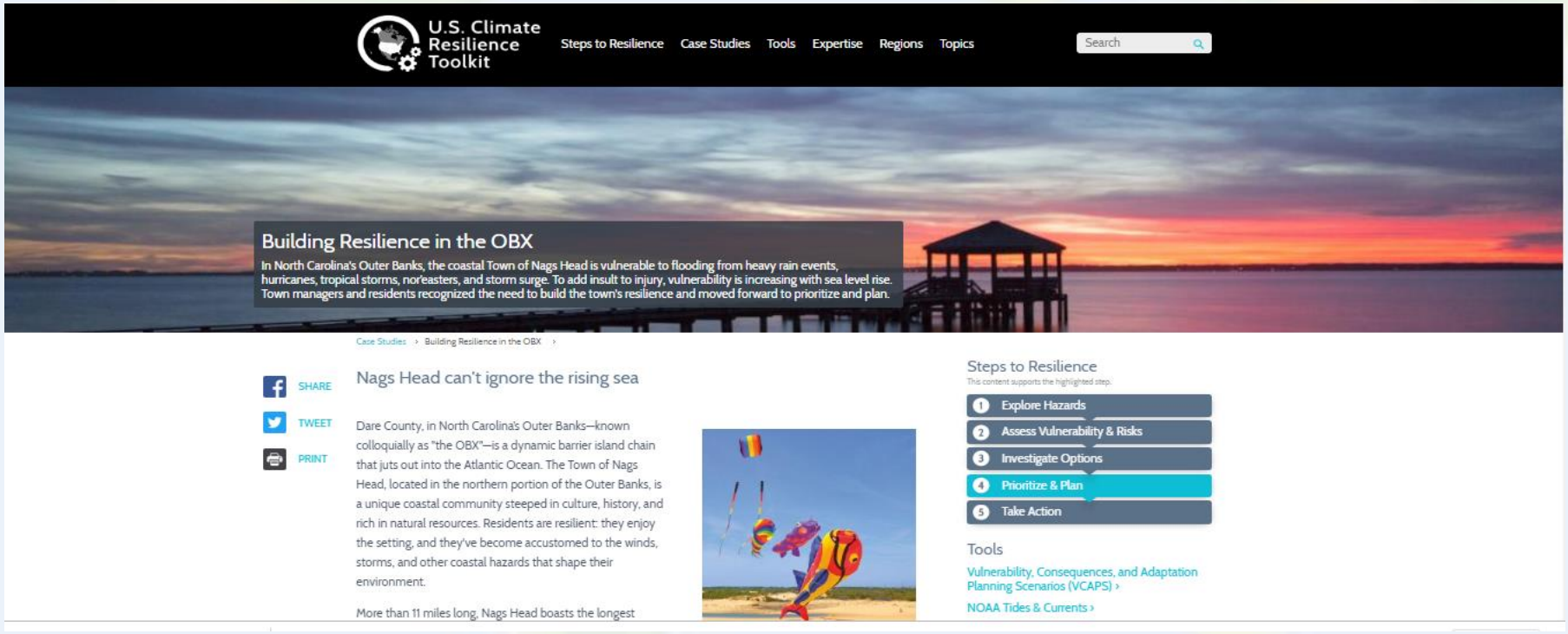
https://www.climate.gov/

Climate Resilience Toolkit



https://toolkit.climate.gov/

Nags Head Case Study



Nags Head can't ignore the rising sea

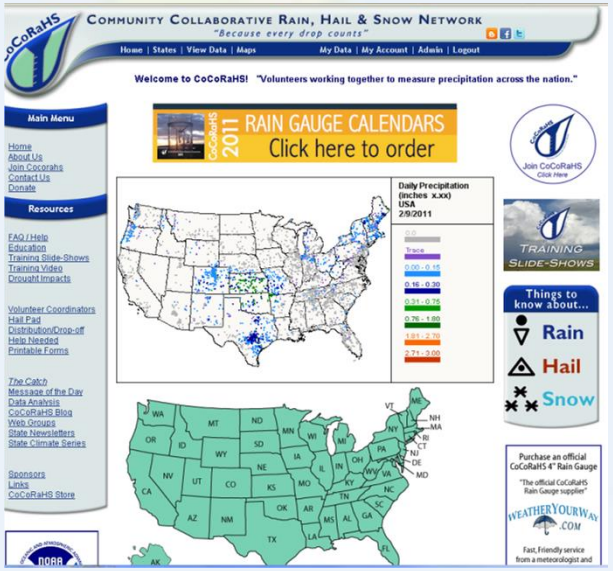
- Adaptation to coastal hazards, including sea level rise, is an important step to becoming resilient

NC King Tides Project

Snap the shore *See the future*

CoCoRaHS!

- Volunteer precipitation observation network
- Use standard, low-cost tools
- Report observations online
- Data used by weather, water, and climate experts
- Provides access to educational webinars, materials



http://www.cocorahs.org/

Thanks for Your Interest!

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www.weather.gov/moreheadcity