

Climate Change: Communicating the Science

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Outline

Coastal Centric Perspective

1. Climate change & climate variability

1. Heavy rain/flooding & hurricanes

2. Sea level rise

→ *Address the latest science*

→ *Discuss an effective way of framing uncertainties in climate projections*

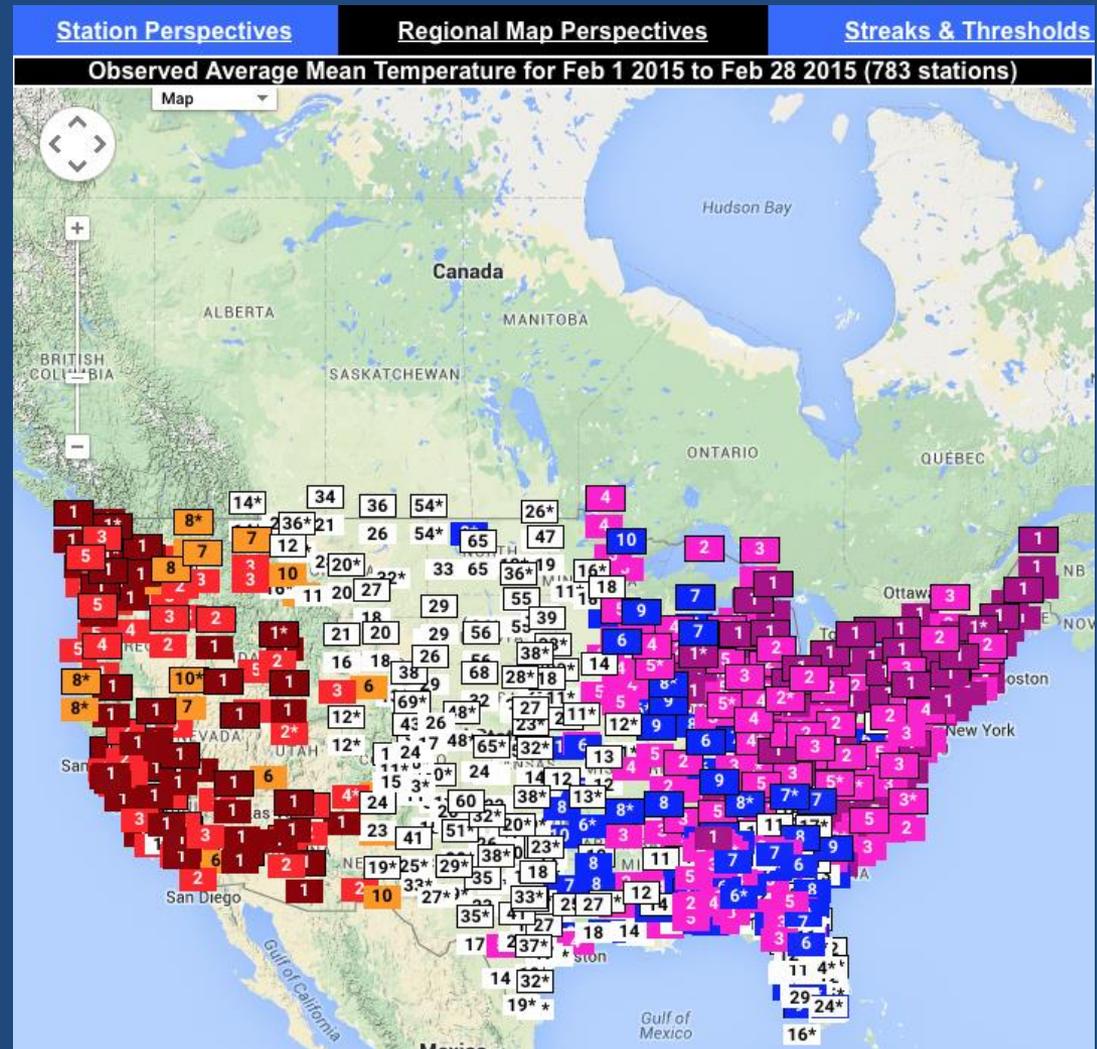
→ *Provide maps, metaphors & images that contribute to a compelling climate change story*

→ *Offer web links to useful climate tools*

Climate change & climate variability

Record cold in February 2015

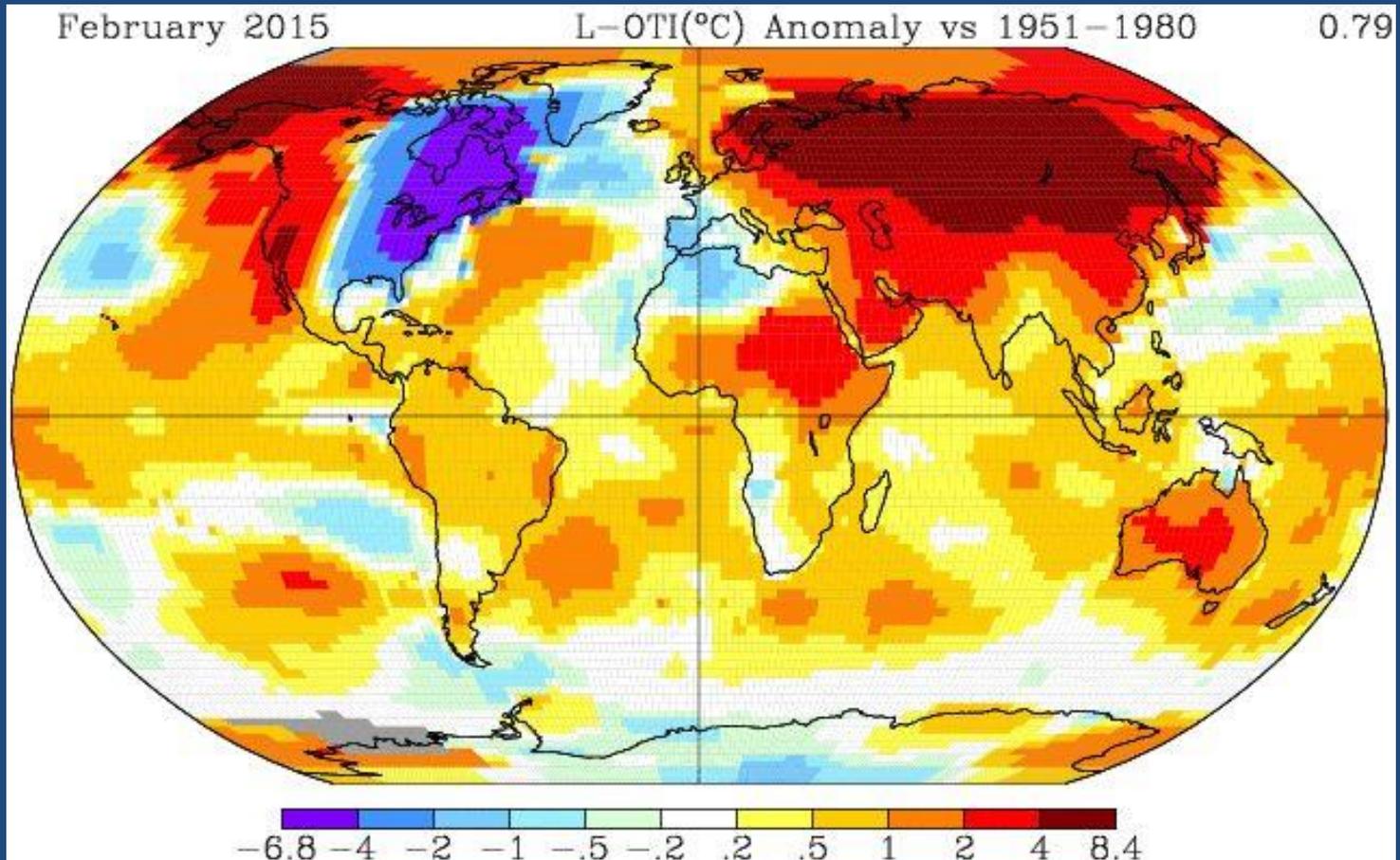
How can you explain climate events that seemingly suggest that the climate is not warming?



SERCC Climate Perspectives:

<http://www.sercc.com/perspectives/?user=true>

If it is unusually cold somewhere, it is likely warmer over much larger areas elsewhere.



NOAA NCEI climate mapping tool

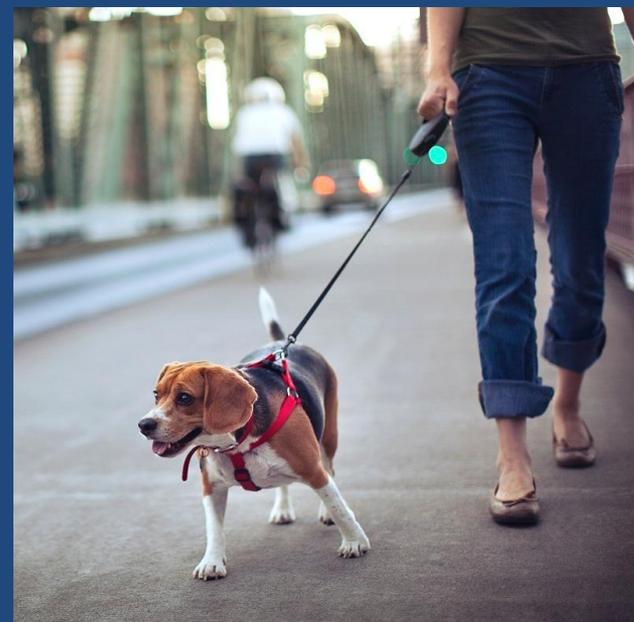
<http://www.ncdc.noaa.gov/temp-and-precip/global-maps/201513#global-maps-select>

- Climate variability - short-term variations in the climate
- Climate change - long-term changes in the average & the character of climate variability

Analogies for distinguishing climate variability vs. climate change

*Climate change is the leash,
climate variability is the dog's nose*

Ryan Boyles NC SCO



Climate change is the batting average, and climate variability is the batter's performance at any given time



Durham Bulls

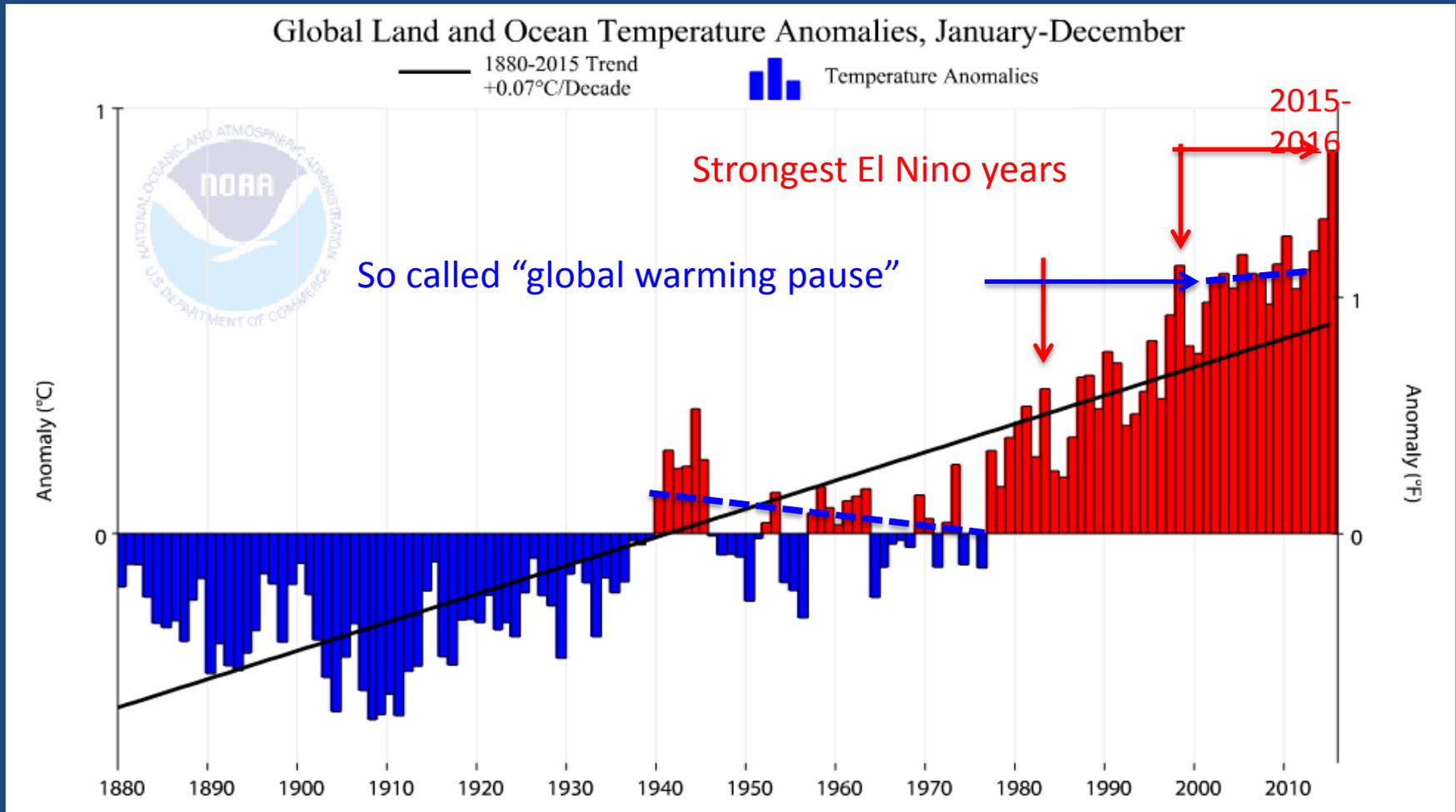
Individual Stats (Batting)

Player	POS	AB	AVG
Luke Scott	DH	8	0.375
Henry Wrigley	1B	225	0.342
Chris Gimenez	C	152	0.336
Leslie Anderson	1B	323	0.316
Stephen Vogt	C	218	0.307
Brandon Guyer	RF	85	0.294
Nevin Ashley	C	48	0.292
Rich Thompson	LF	218	0.289
Cole Figueroa	2B	206	0.286
Jeff Keppinger	2B	21	0.286
Matt Mangini	1B	293	0.276

Ryan Boyles NC SCO

Climate change & climate variability (continued)

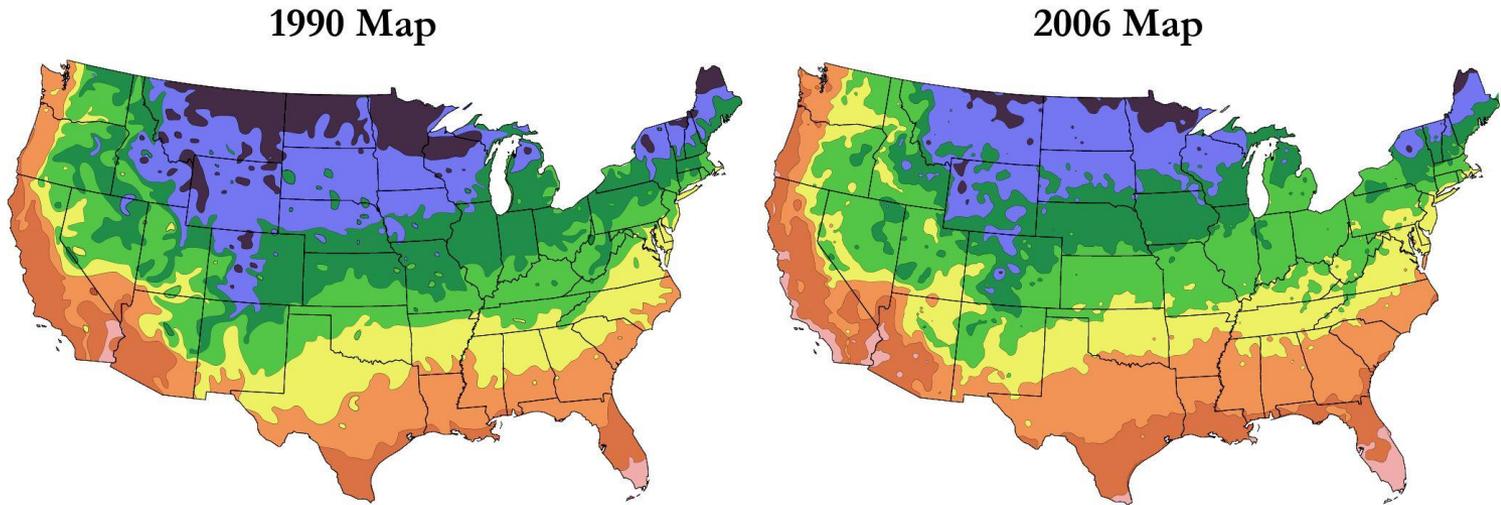
Much short term variability in the climate – e.g. El Nino/La Nina



NOAA mapping tool: <https://www.ncdc.noaa.gov/cag/time-series/global>

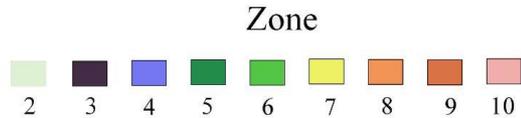
Poignant examples of recent warming

Northward movement of plant hardiness zones



After USDA Plant Hardiness Zone Map, USDA Miscellaneous
Publication No. 1475, Issued January 1990

National Arbor Day Foundation Plant Hardiness Zone Map
published in 2006.

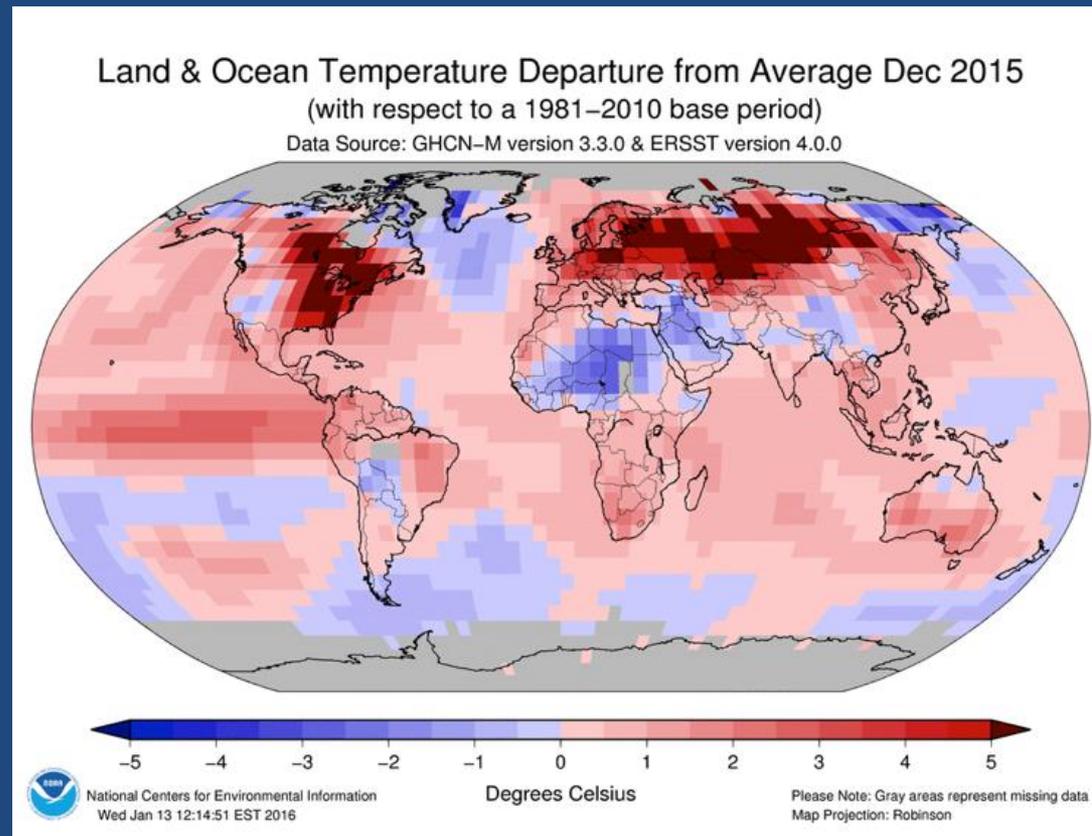


© 2006 by The National Arbor Day Foundation®

<http://planthardiness.ars.usda.gov/PHZMWeb/>

Poignant Indicators of recent warming

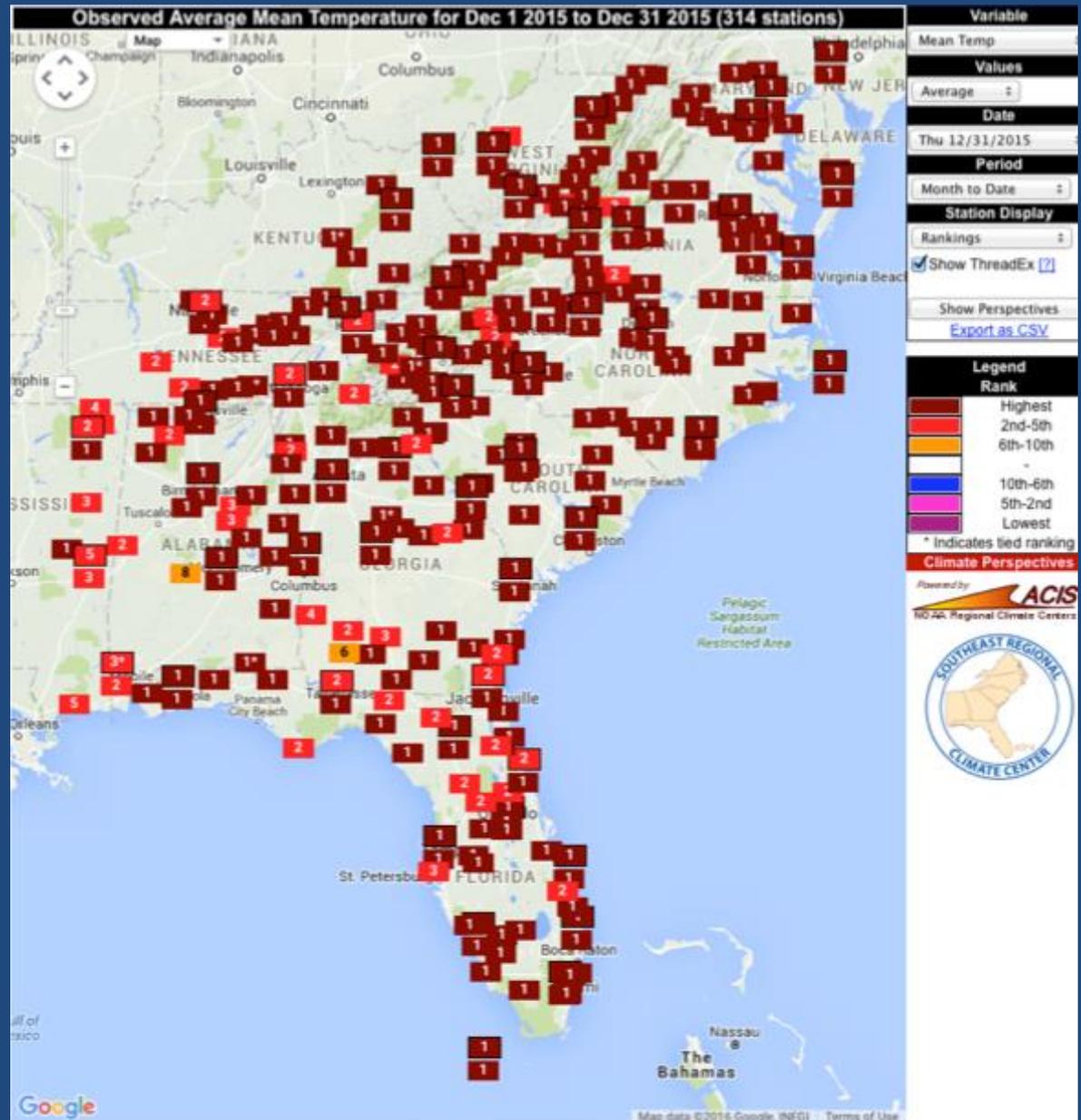
An increasing number of months and seasons with record breaking warm temperatures



<https://www.ncdc.noaa.gov/sotc/service/global/map-blended-mntp/201512.gif>

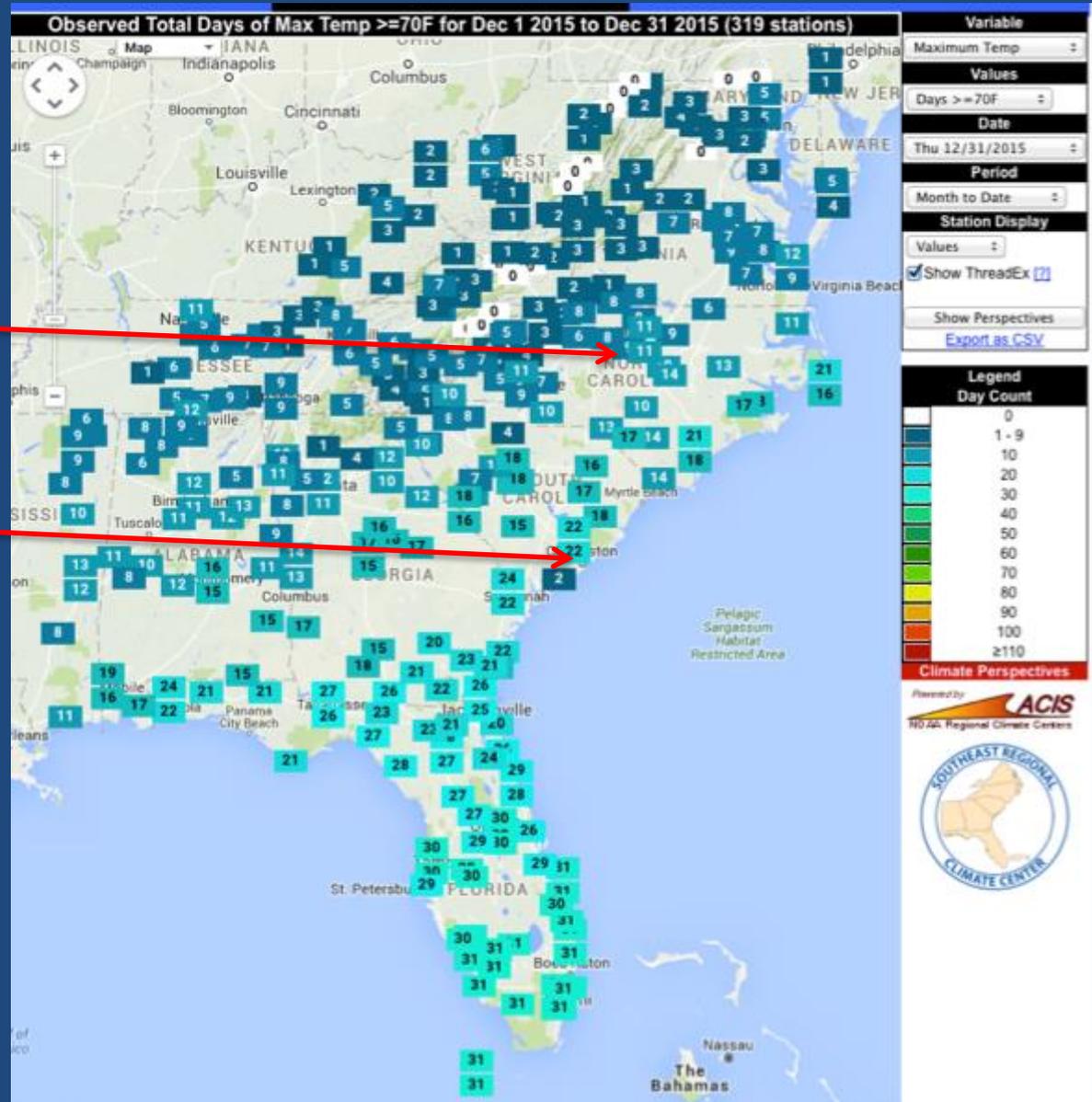
December 2015 temperature ranks

Warmest December on record for most station across the entire SE and beyond



<http://www.sercc.com/perspectives>

December: Daily Frequency of T \geq 70 F

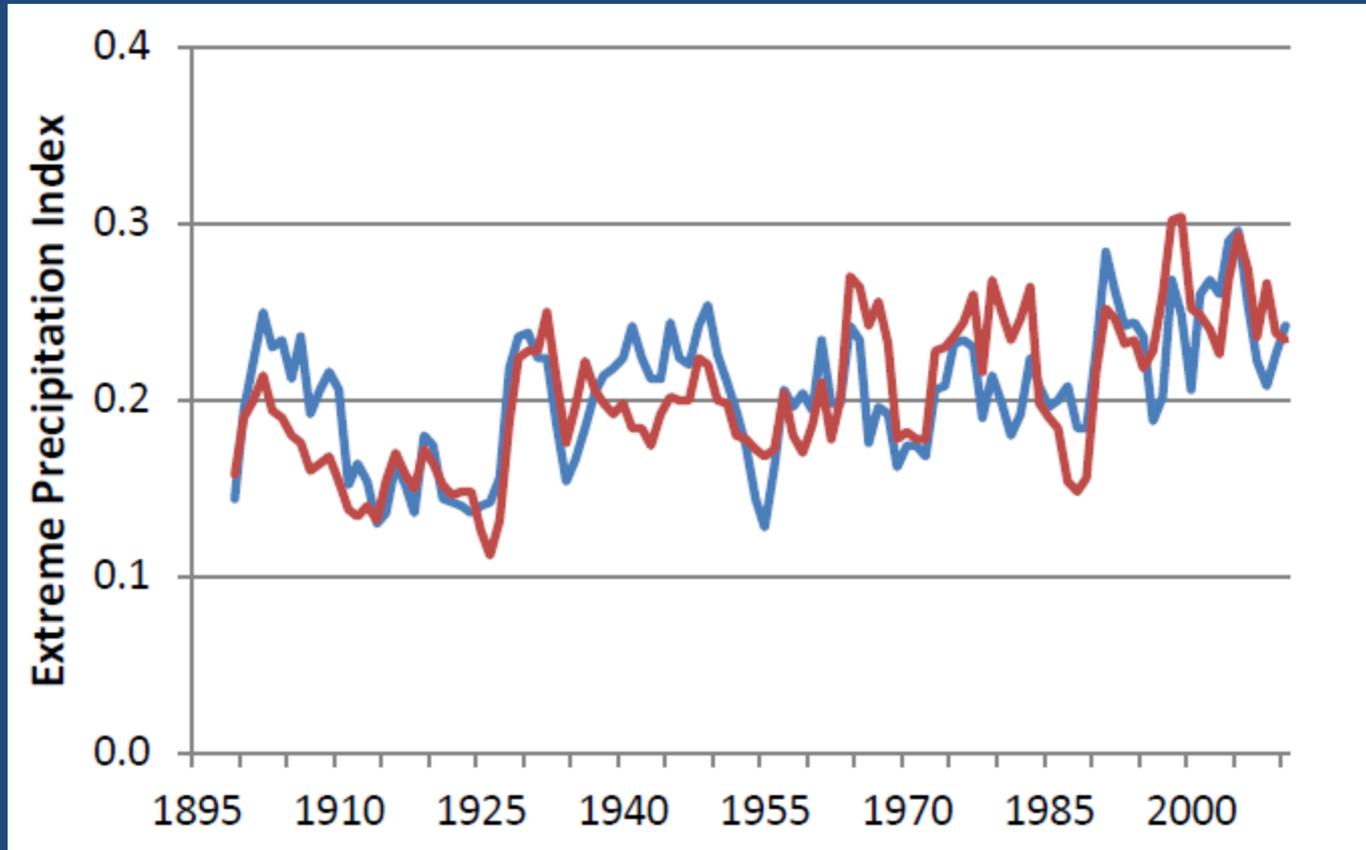


Raleigh, NC: 1 of 3 days

Charleston, SC: 2 of 3 days

Heavy Rain & Flooding

- Warmer atmosphere can hold more water vapor
- Warmer sea surface temperatures -> more evaporation → more water vapor
- Coastal urbanization → More impervious surface area → More flooding

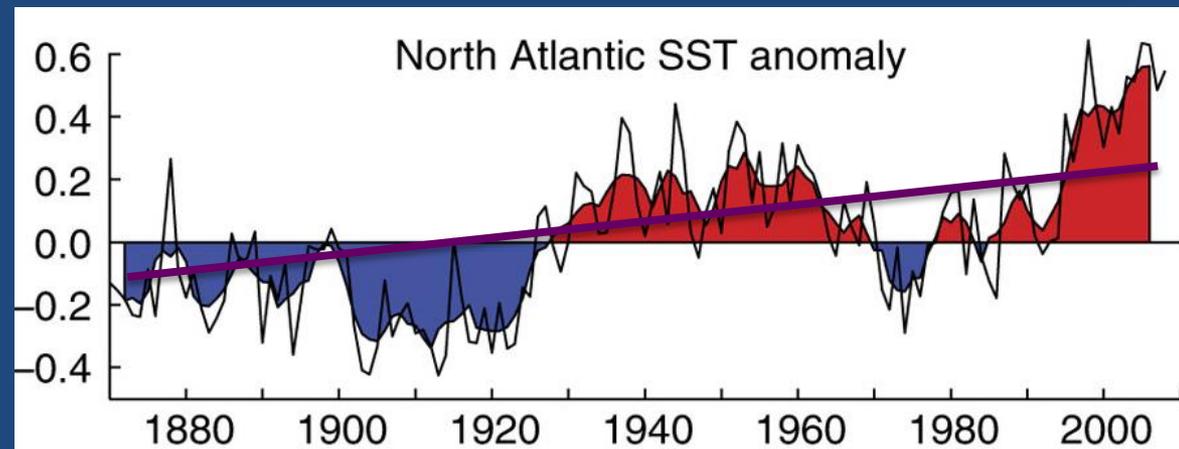
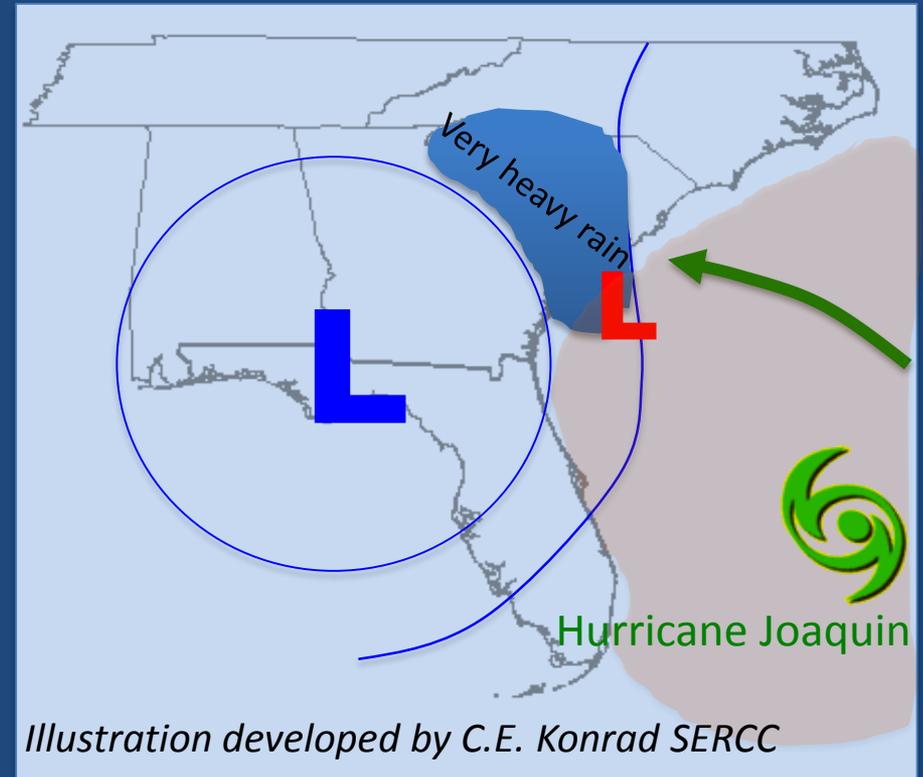


5-yr running mean of extreme precipitation index for SE region.

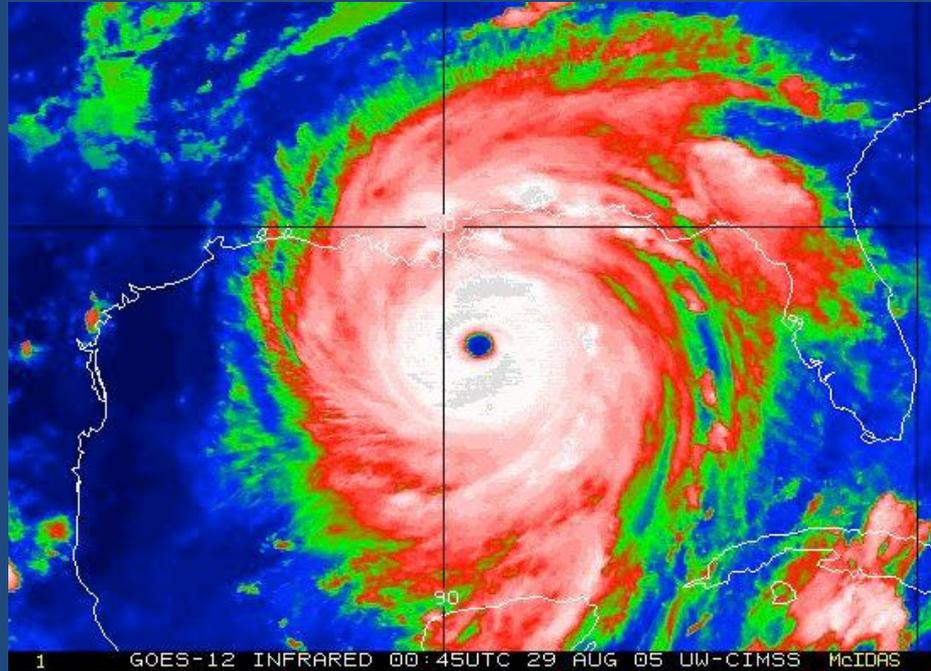
1 day 1 in 5-yr events. 5 day 1 in 5-yr events Constructed by K. Kunkel

South Carolina Flood 2015

- Phasing of a hurricane & stalled out mid-latitude system
- Anomalously warm SSTs contributed to rainfall production and intensification of Joaquin.



Hurricanes



Katrina: The “Perfect Hurricane”

Future Projections

- Slight decrease in the frequency of tropical cyclones and weak hurricanes
- Increase in the frequency of major hurricanes

The costliest hurricanes to affect the United States (1900-2010)

6 of the 7 \$10 billion+ hurricanes have occurred in the past 12 years, all impacting parts of the Southeast region

RANK	TROPICAL CYCLONE	YEAR	CATEGORY	DAMAGE (U.S.)
1	KATRINA (SE FL, LA, MS)	2005	3	\$108,000,000,000
2	IKE (TX, LA)	2008	2	29,520,000,000
3	ANDREW (SE FL/LA)	1992	5	26,500,000,000
4	WILMA (S FL)	2005	3	21,007,000,000
5	IVAN (AL/NW FL)	2004	3	18,820,000,000
6	CHARLEY (SW FL)	2004	4	15,113,000,000
7	RITA (SW LA, N TX)	2005	3	12,037,000,000
8	FRANCES (FL)	2004	2	9,507,000,000
9	ALLISON (N TX)	2001	TS	9,000,000,000
10	JEANNE (FL)	2004	3	7,660,000,000
11	HUGO (SC)	1989	4	7,000,000,000
12	FLOYD (Mid-Atlantic & NE U.S.)	1999	2	6,900,000,000
13	ISABEL (Mid-Atlantic)	2003	2	5,370,000,000
14	OPAL (NW FL/AL)	1995	3	5,142,000,000
15	GUSTAV (LA)	2008	2	4,618,000,000
16	FRAN (NC)	1996	3	4,160,000,000
17	GEORGES (FL Keys, MS, AL)	1998	2	2,765,000,000
18	DENNIS (NW FL)	2005	3	2,545,000,000
19	FREDERIC (AL/MS)	1979	3	2,300,000,000
20	AGNES (FL/NE U.S.)	1972	1	2,100,000,000

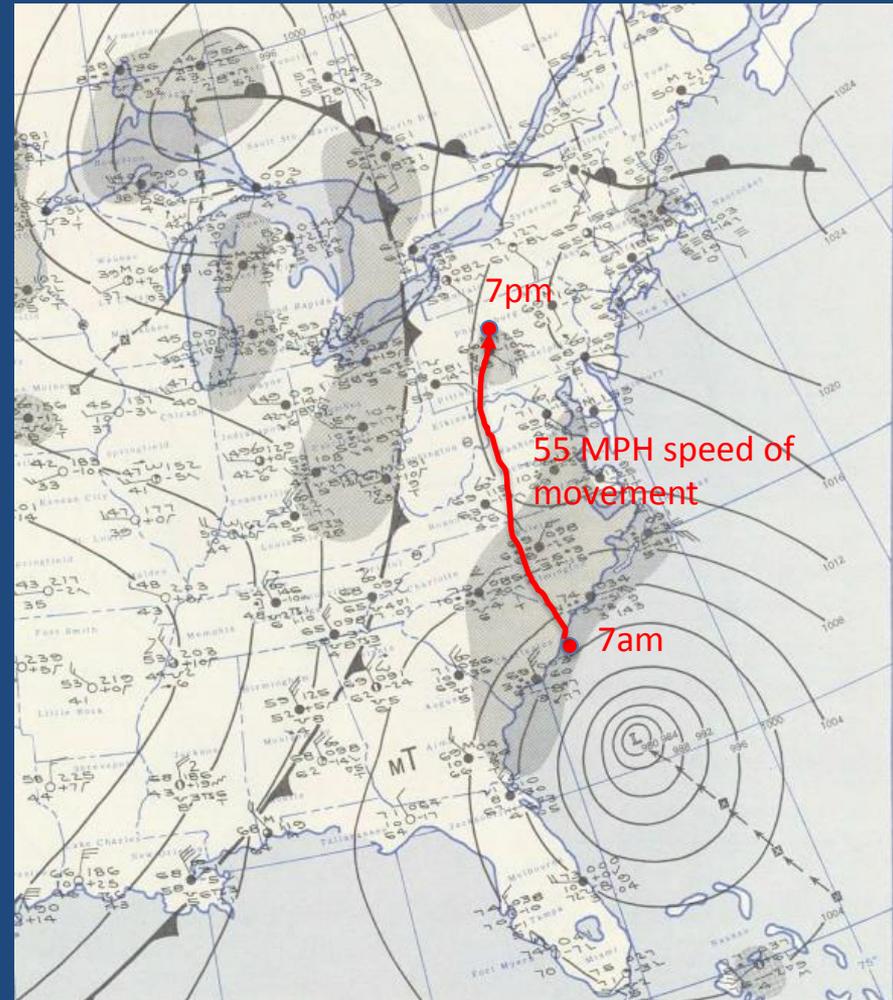
Anything that has happened before will happen again in the future

Example: Hurricane Hazel (1954) that made Landfall near Calabash, NC as a CAT 4

Imagine if a storm of Hazel's strength and size made landfall this coming hurricane season

Inland Maximum Wind Speeds

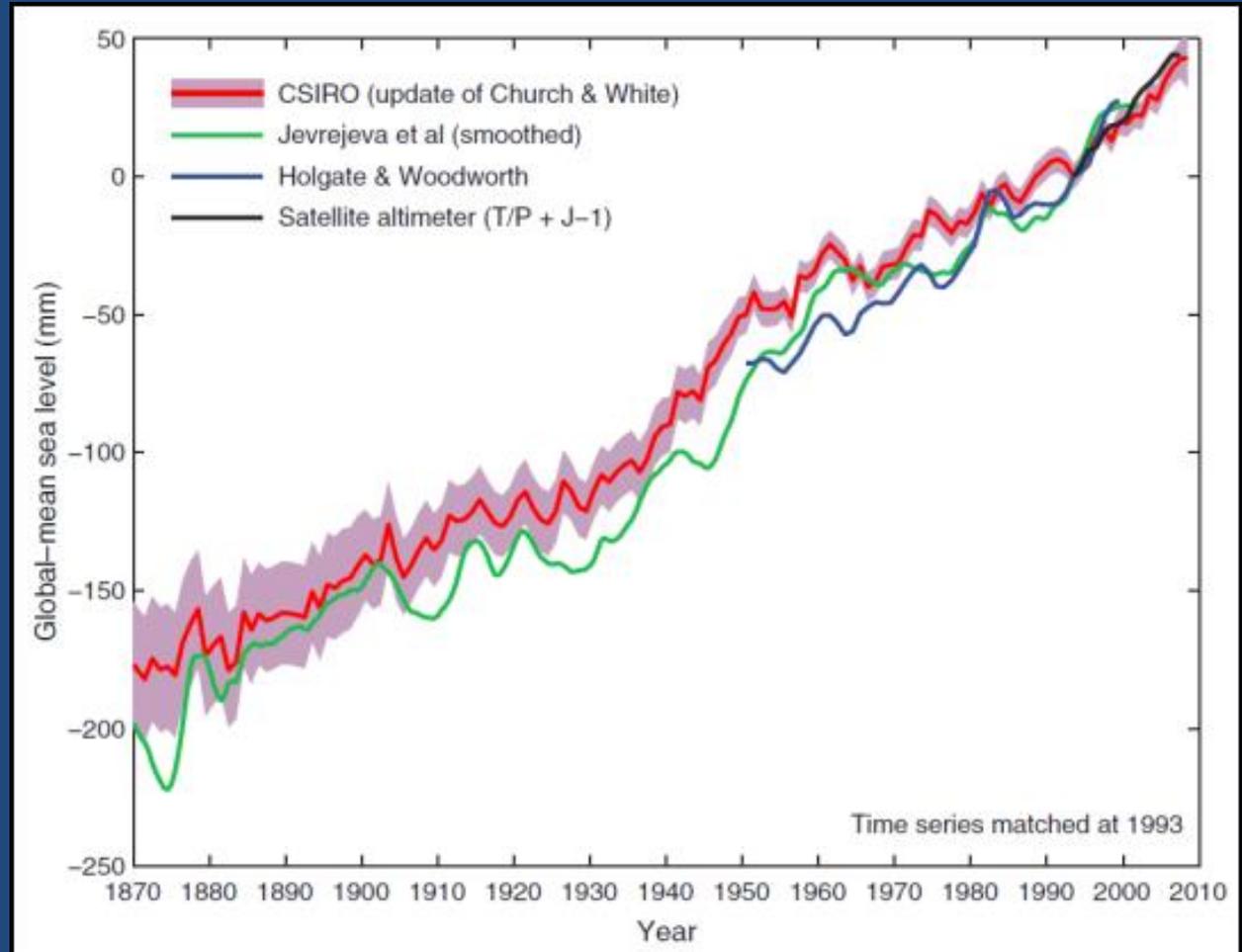
- Raleigh: 78MPH sustained with gusts to 90 MPH
- Goldsboro: Gusts to 120 MPH
- Washington DC: 78 MPH sustained



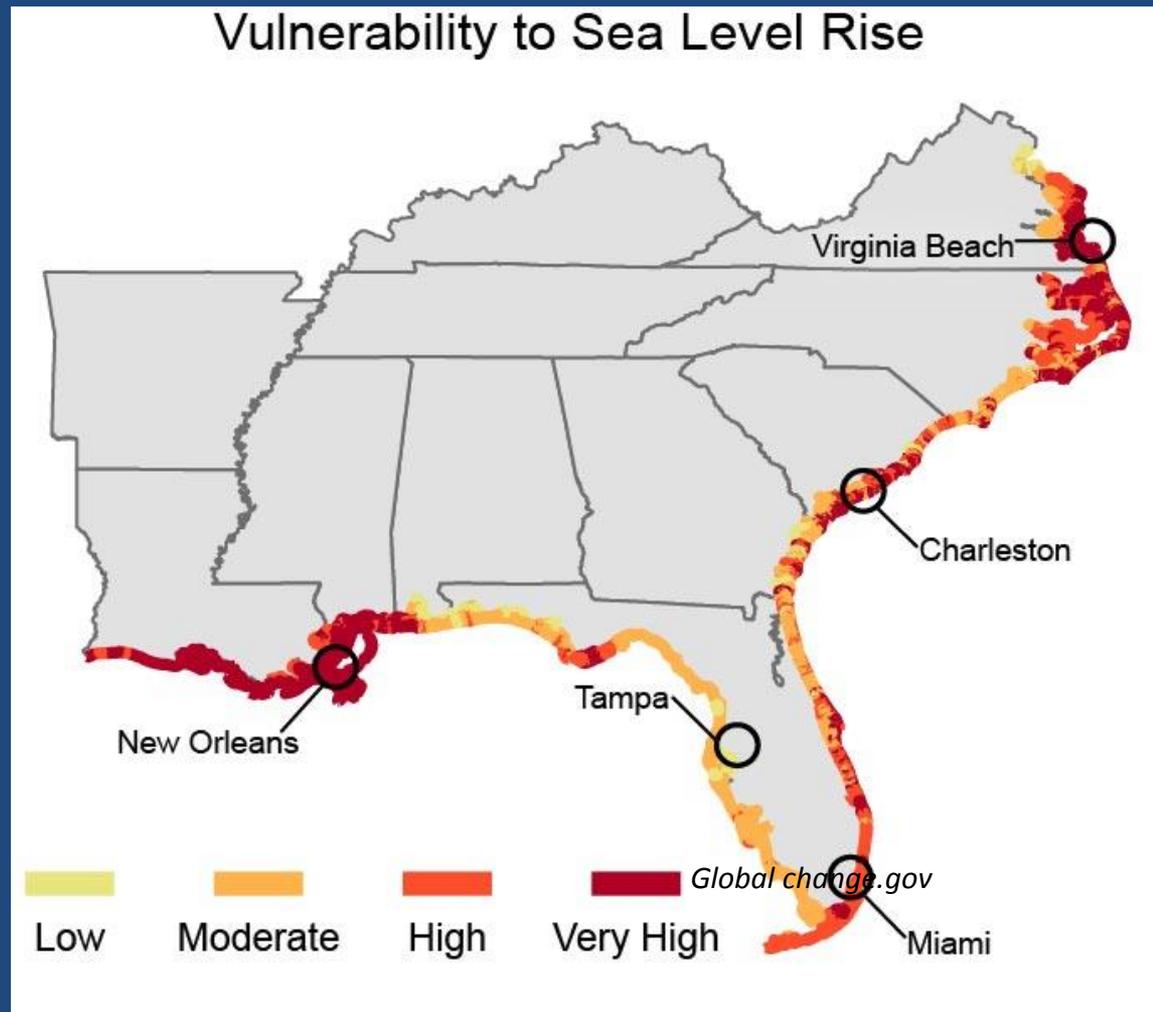
Sea Level Rise

17 mm/decade
(~ 7" last 100 yrs)

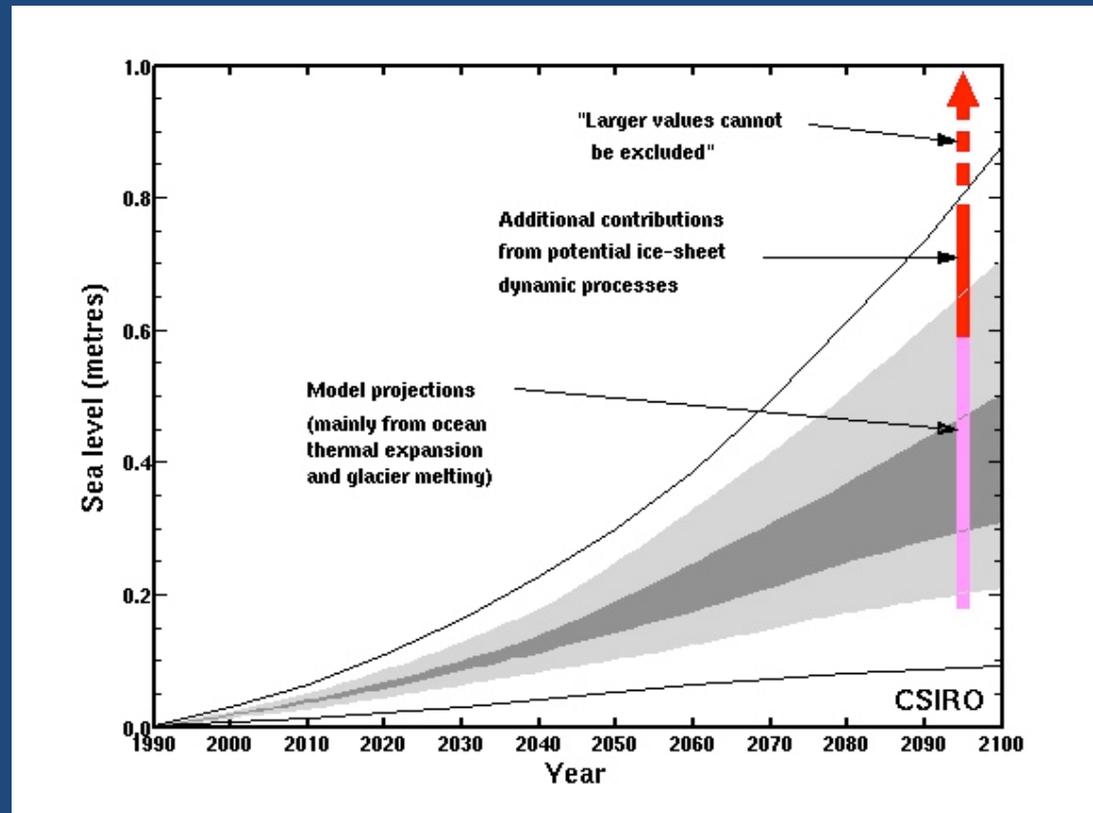
Satellite estimate
33 mm/decade
btwn. 1990-2009



- Local to regional scale variations in seas level rise associated with land subsidence and wind influences.



Projections of Sea Level Rise

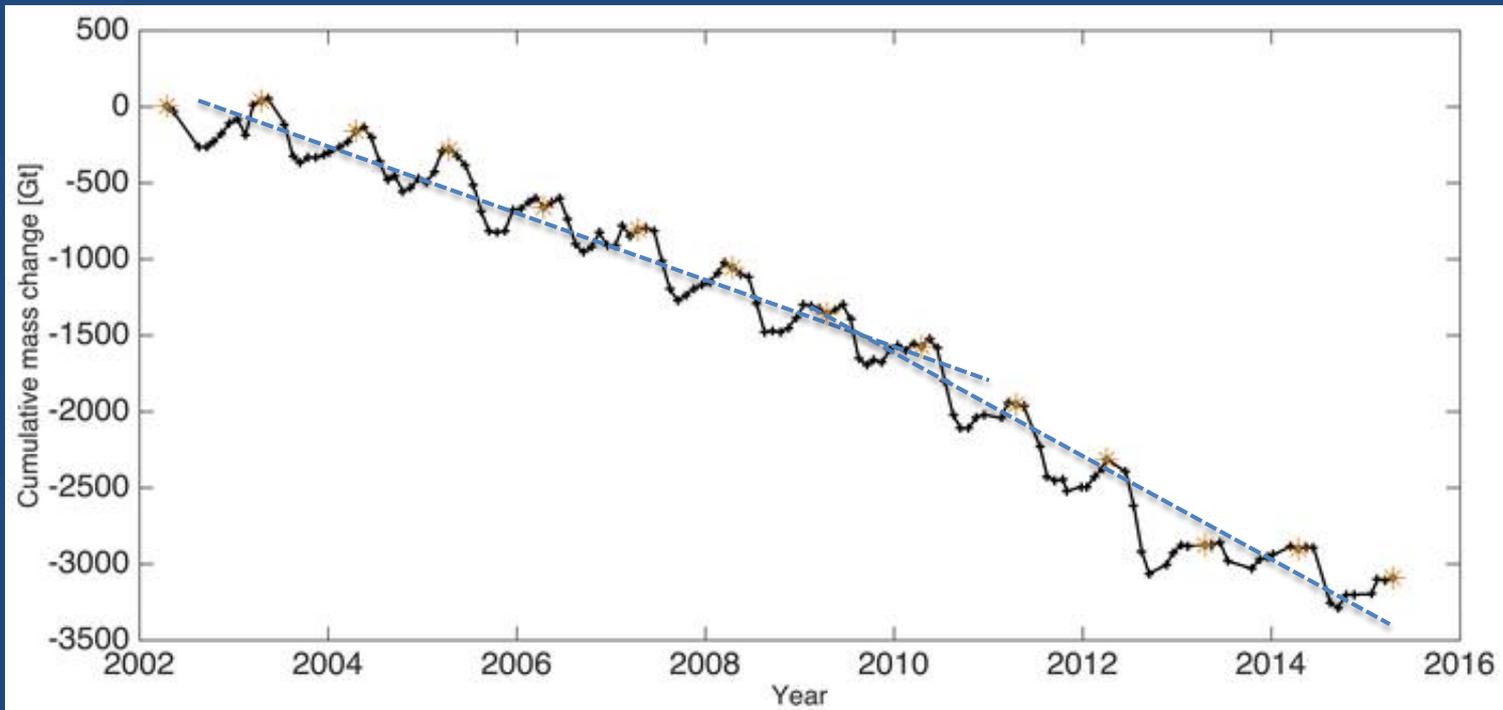


Effectively communicating the cone of uncertainty

“Do you want to take chance that the dire possibilities on the upper end of the cone are realized”

“What we don’t know could really hurt us”

The melting of the Greenland ice mass



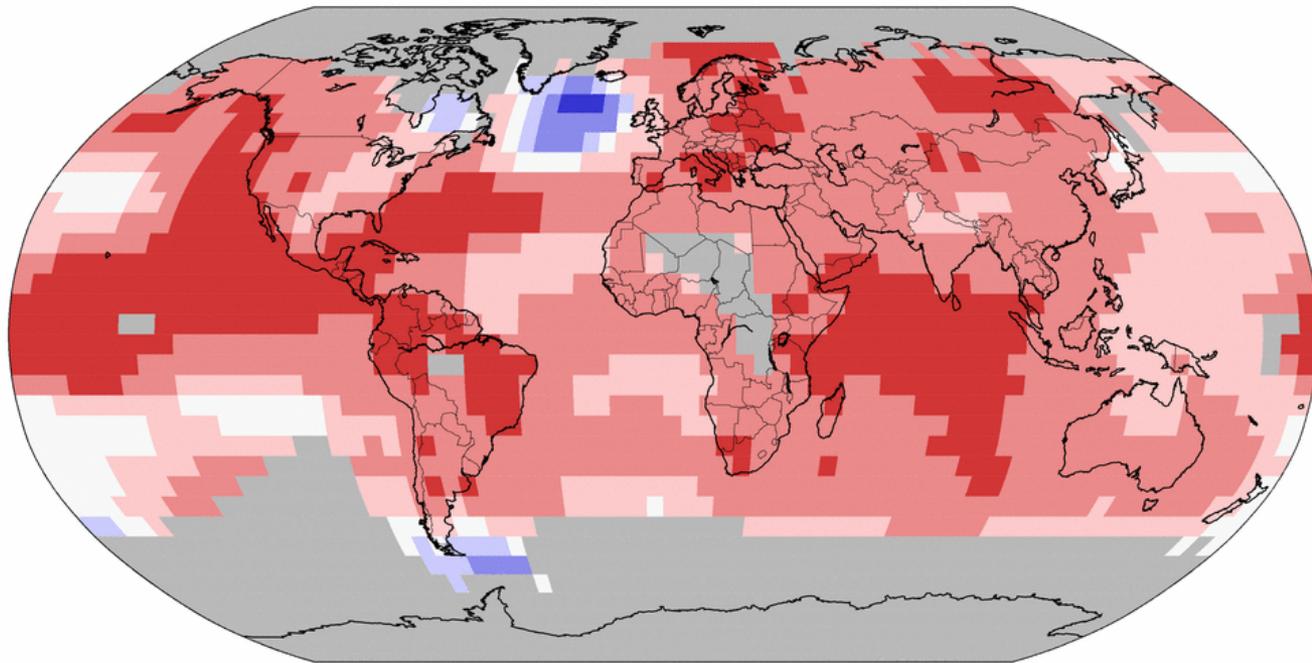
http://www.arctic.noaa.gov/reportcard/greenland_ice_sheet.html

North Atlantic cold blob may be associated with Greenland ice melt

Land & Ocean Temperature Percentiles Jan–Dec 2015

NOAA's National Centers for Environmental Information

Data Source: GHCN–M version 3.3.0 & ERSST version 4.0.0



Record Coldest



Much Cooler than Average



Cooler than Average



Near Average



Warmer than Average



Much Warmer than Average



Record Warmest



THANK YOU

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