Heat related illness in a changing climate and demography of Florida

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Impact of Hurricane Irma 2017

Florida's elderly struggle in Irma's sweltering aftermath

By ASSOCIATED PRESS / SEPTEMBER 14, 2017

Mary Della Ratta, 94, sits by a battery powered lantern in her home three days after Hurricane Irma knocked out power in Naples, Fla.
DAVID GOLDMAN/AP

- Disruptions caused by weather can be fatal!
- Hurricane is a wet weather event.
- And yet casualties from heat related illness becomes somewhat obvious and ominous

13th and 14th Residents Die From Florida Nursing Home That Lost A/C After Hurricane Irma

by Associated Press / Oct.09.2017 / 4:42 PM EDT

Impact of Hurricane Maria 2017 in Puerto Rico

Causes of death	Sept./ Oct. 2015	Sept./ Oct. 2016	Sept./ Oct. 2017	Pct. change
Essential hypertension and hypertensive renal disease	88	84	134	+56
Sepsis	138	117	197	+55
Suicide	31	35	49	+48
Alzheimer's and Parkinson's Diseases	370	343	524	+47
Diabetes	441	473	666	+46
Chronic Lower Respiratory Diseases	143	175	225	+42

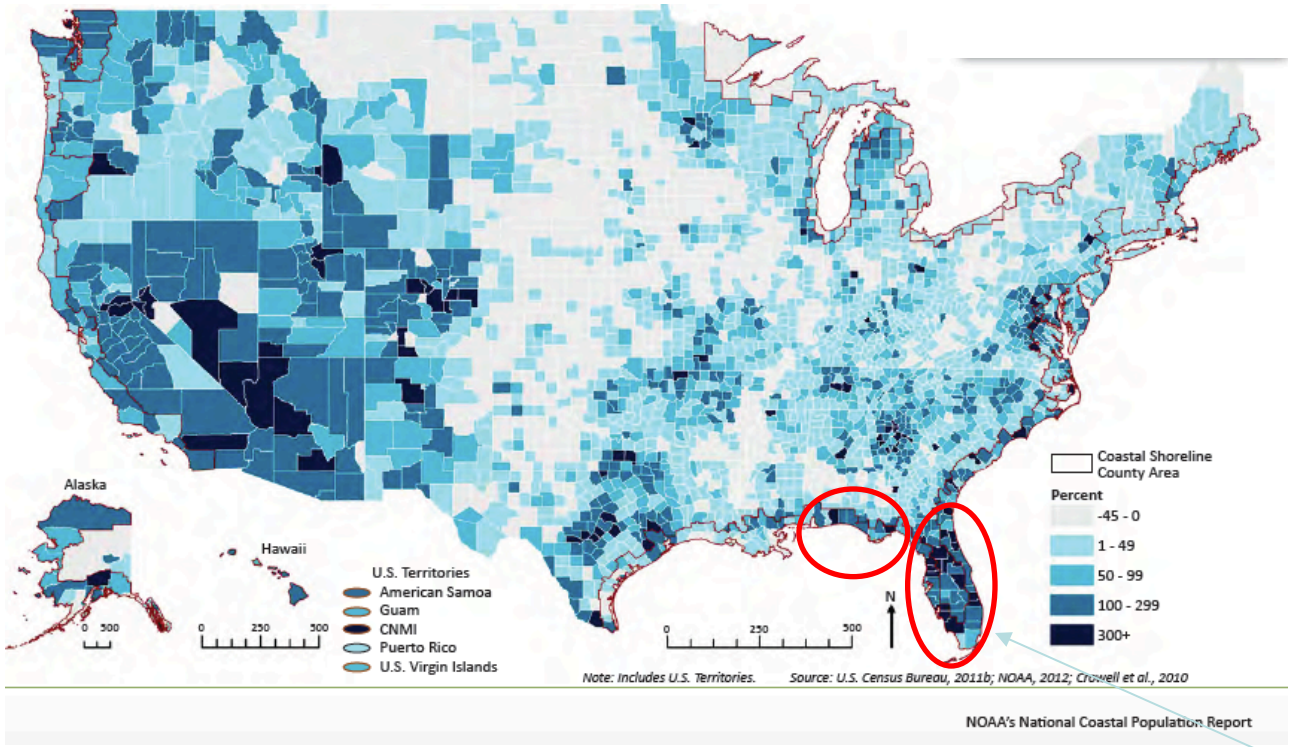
The New York Times | Source: Demographic Registry of Puerto Rico, Health Department of Puerto Rico (causes of death as of May 31) | Note: Percentage change is the number of deaths in September and October 2017 compared with the average of the number of deaths in the same months in 2015 and 2016.

Outline

- Why Florida?
- How is the future climate changing?
- Example of future events in current climate?
- Conclusions

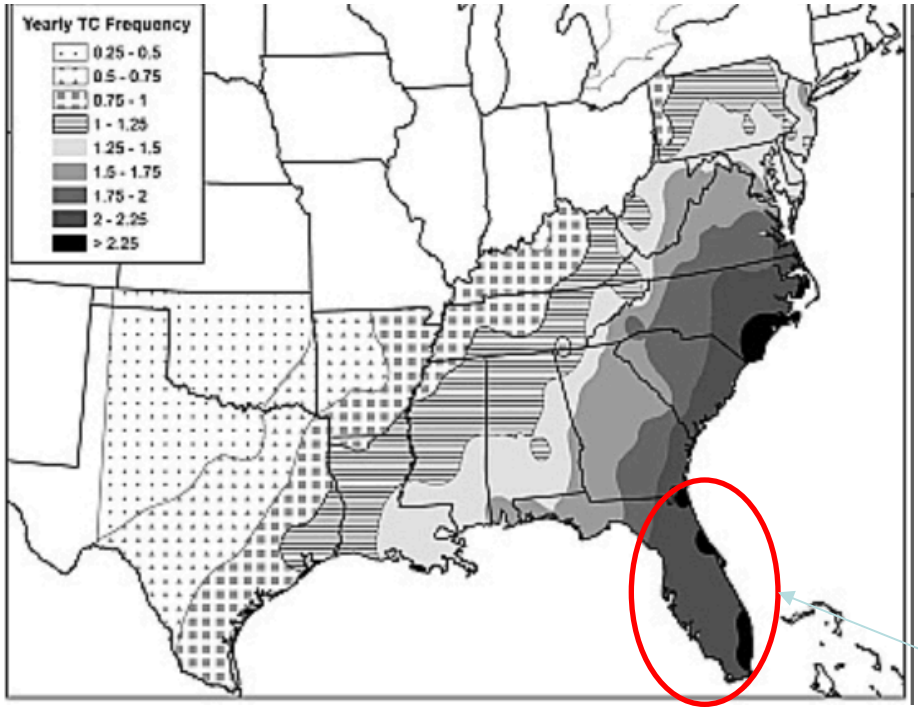
Why Florida?

Percent population change in U. S. Counties (1970-2000)



One of the largest increases in population of coastal shoreline counties in the nation

Why Florida?

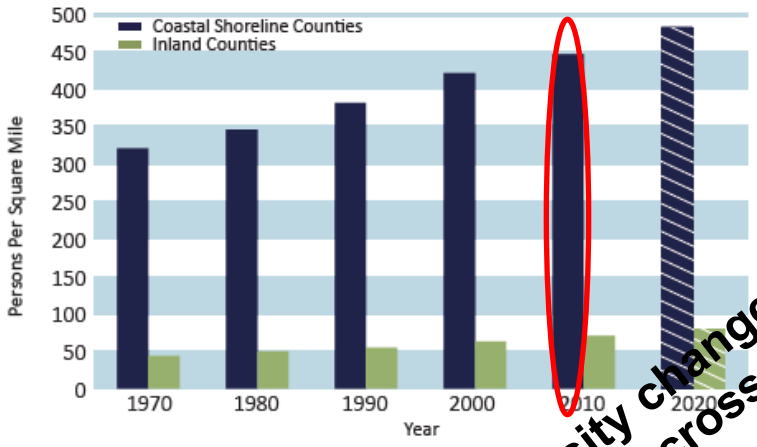


Yearly tropical cyclone frequency
(Knight and Davis 2009)

Some of the highest frequencies of landfalling tropical cyclones in the nation

Why Florida?

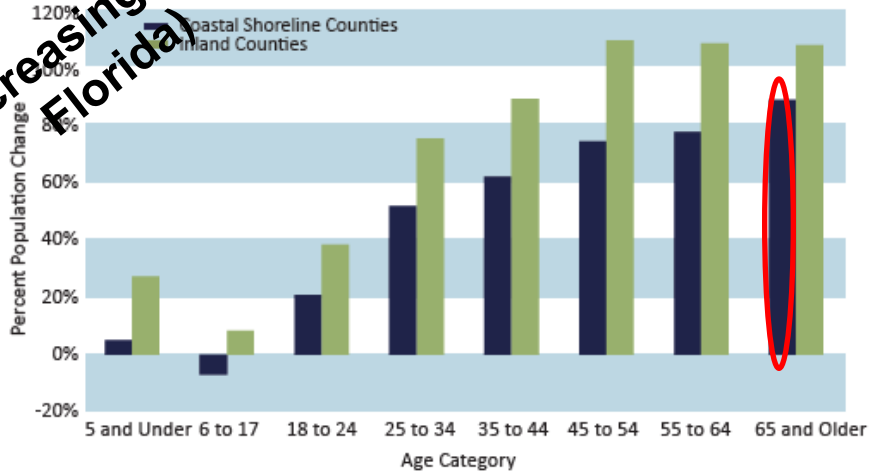
Figure 5 | Population Density Change in Coastal Shoreline Counties and Inland Counties from 1970 to 2020



The population density change in coastal shoreline counties has increased by 45% across the nation over the last 40 years

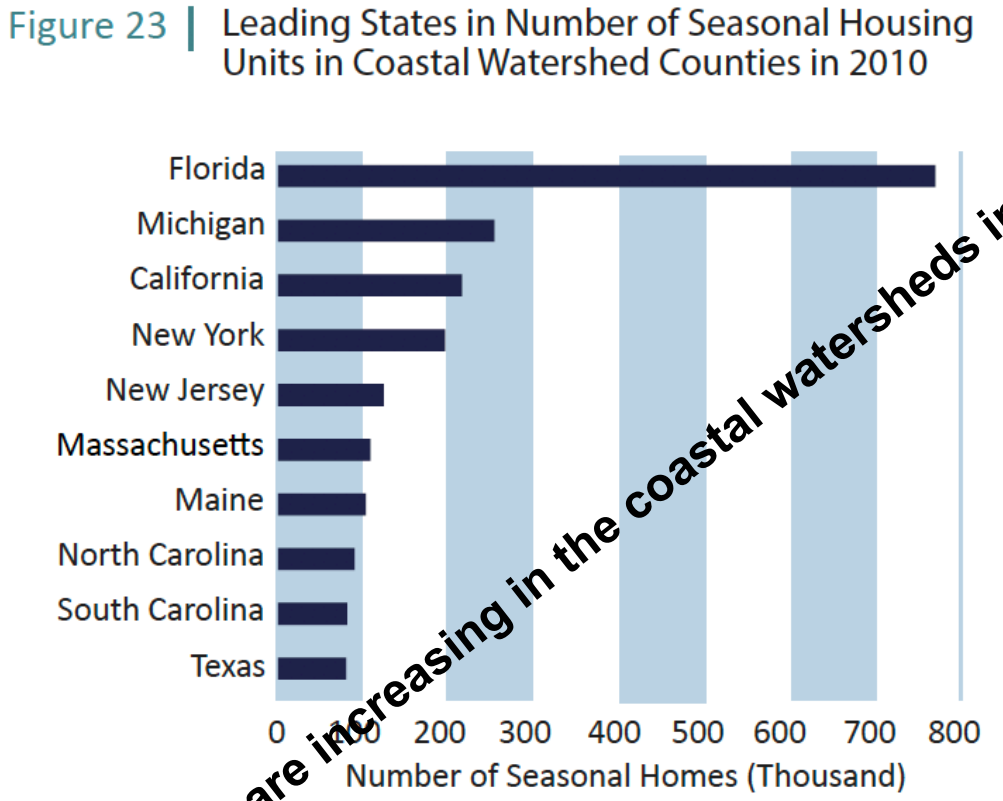
The senior population is increasing by over 80% (and by 208% in Florida)

Figure 6 | Percent Population Change of Coastal Shoreline Counties and Inland Counties by Age from 1970 to 2010



From NOAA coastal population report (2013)

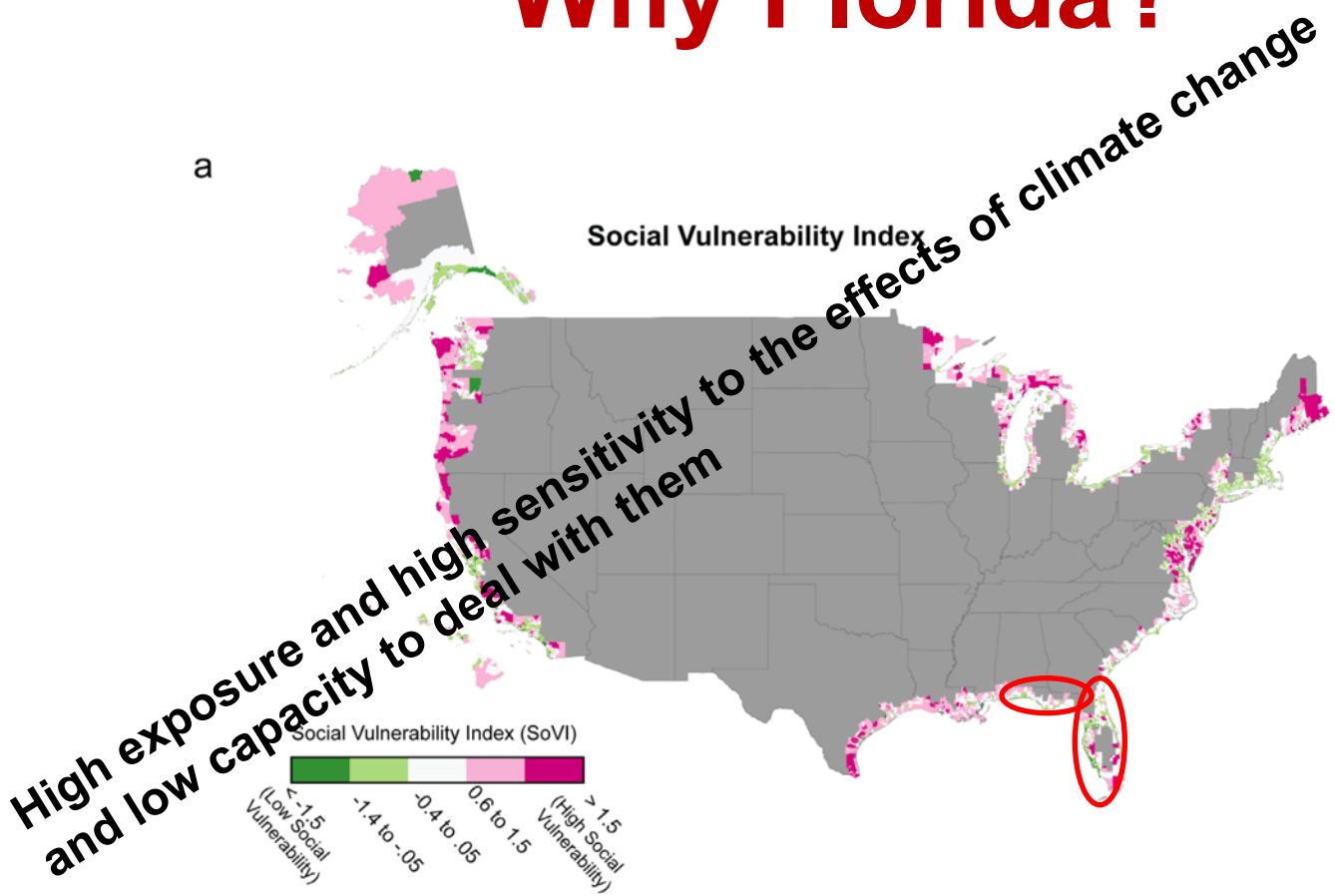
Why Florida?



Dwelling units are increasing in the coastal watersheds in Florida

From NOAA coastal population report (2013)

Why Florida?



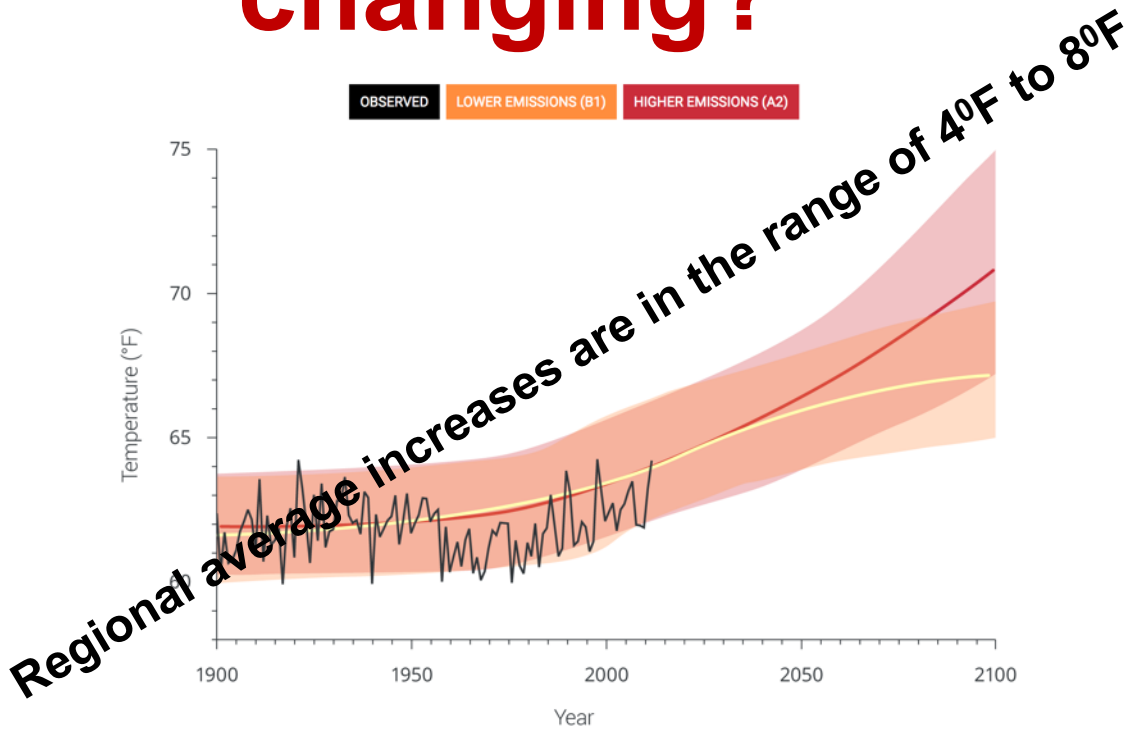
The Social Vulnerability Index (SoVI) provides a quantitative, integrative measure for comparing the degree of vulnerability of human populations across the nation. A high SoVI (dark pink) typically indicates some combination of **high exposure and high sensitivity to the effects of climate change and low capacity to deal with them**. From Moser et al. (2014)-NCA2014

Why Florida?

- The population has increased by over 300% in the last 40 years
- The senior population along the coastal watershed counties in Florida has increased by over 208% in the last 40 years
- As of 2010 Florida has the highest number of dwelling units in the coastal watershed counties in the Nation
- SoVI is high in Florida coastlines
- Florida is home to many extreme weather events: tropical cyclones, droughts, heat waves, deep freeze events, and wildfires

How is the future climate changing?

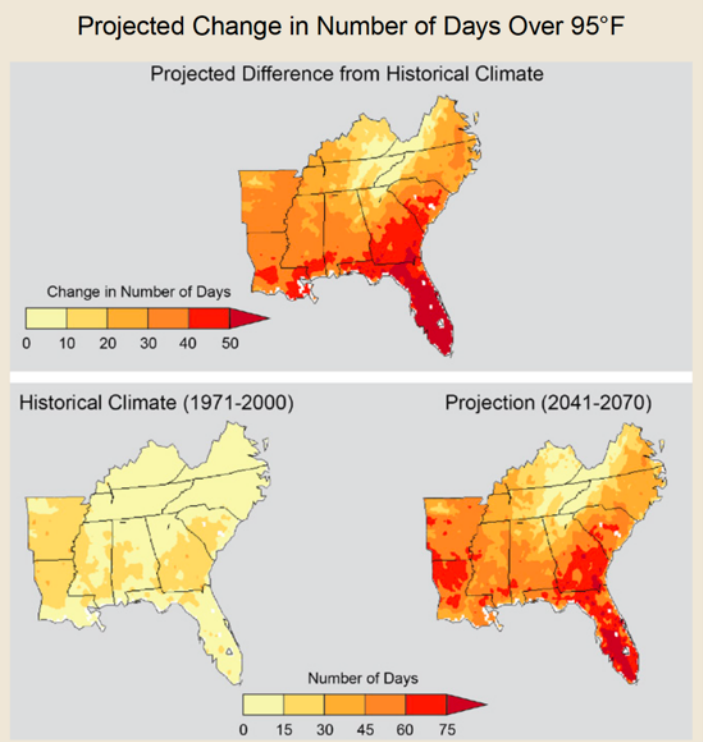
How is the future climate changing?



Observed annual average temperature for the Southeast US and projected temperature changes for two different emission scenarios

From Carter et al. (2014)-CH17; NCA2014

How is the future climate changing?



Projected average number of days per year with maximum temperatures above 95^0F for 2041-2070 compared to 1971-2000 for A2 emissions scenario

From Carter et al. (2014)-CH17; NCA2014

How is the future climate changing?

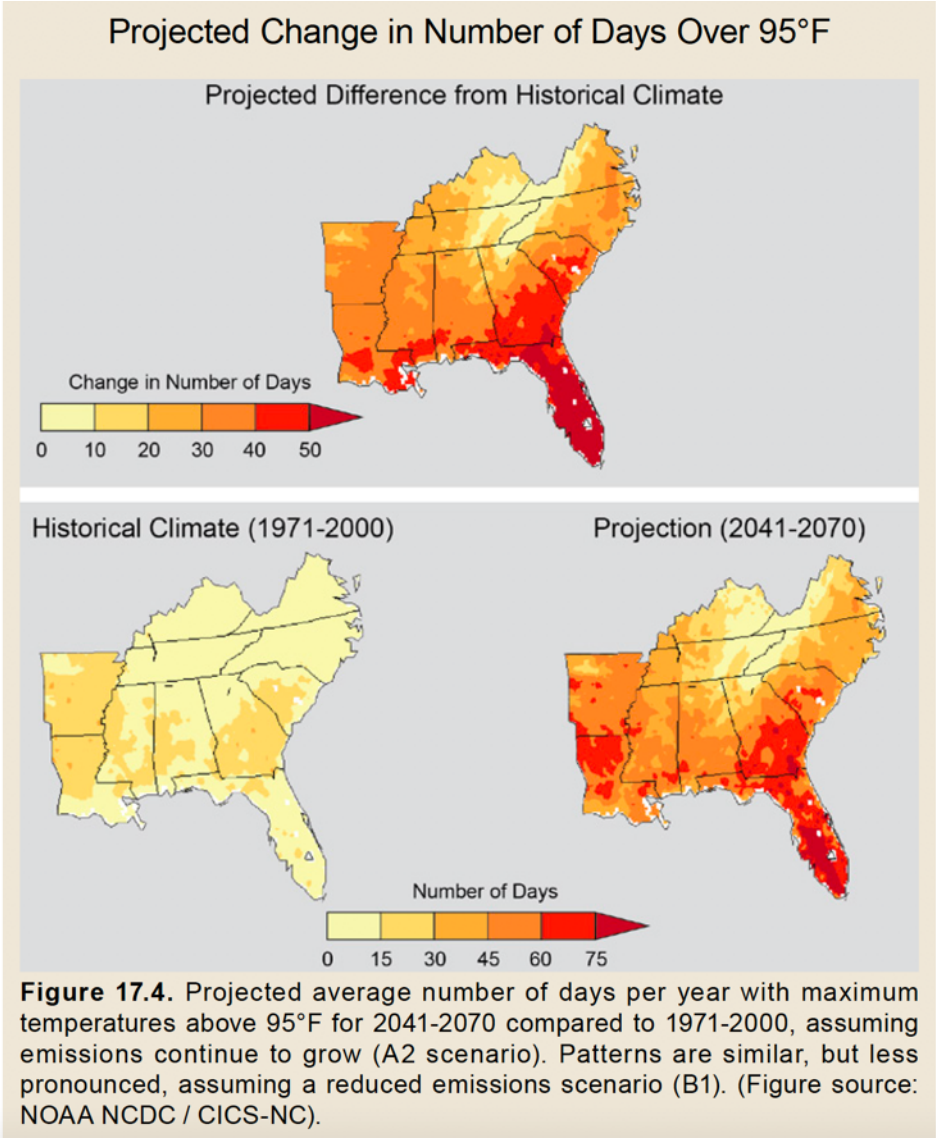
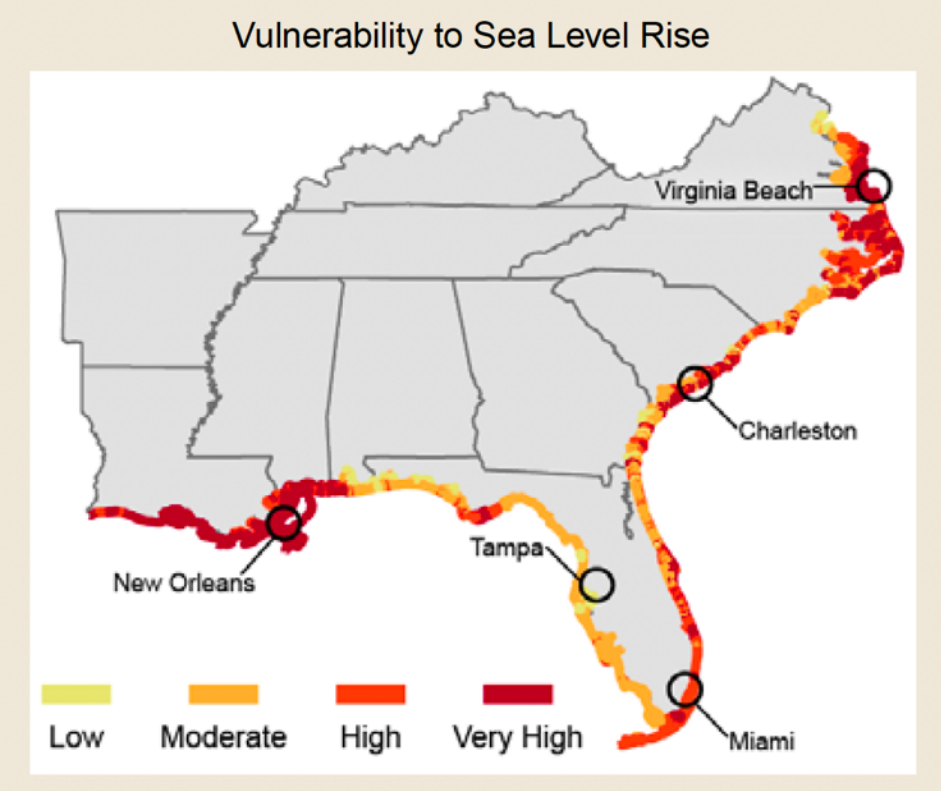


Figure 17.4. Projected average number of days per year with maximum temperatures above 95°F for 2041-2070 compared to 1971-2000, assuming emissions continue to grow (A2 scenario). Patterns are similar, but less pronounced, assuming a reduced emissions scenario (B1). (Figure source: NOAA NCDC / CICS-NC).

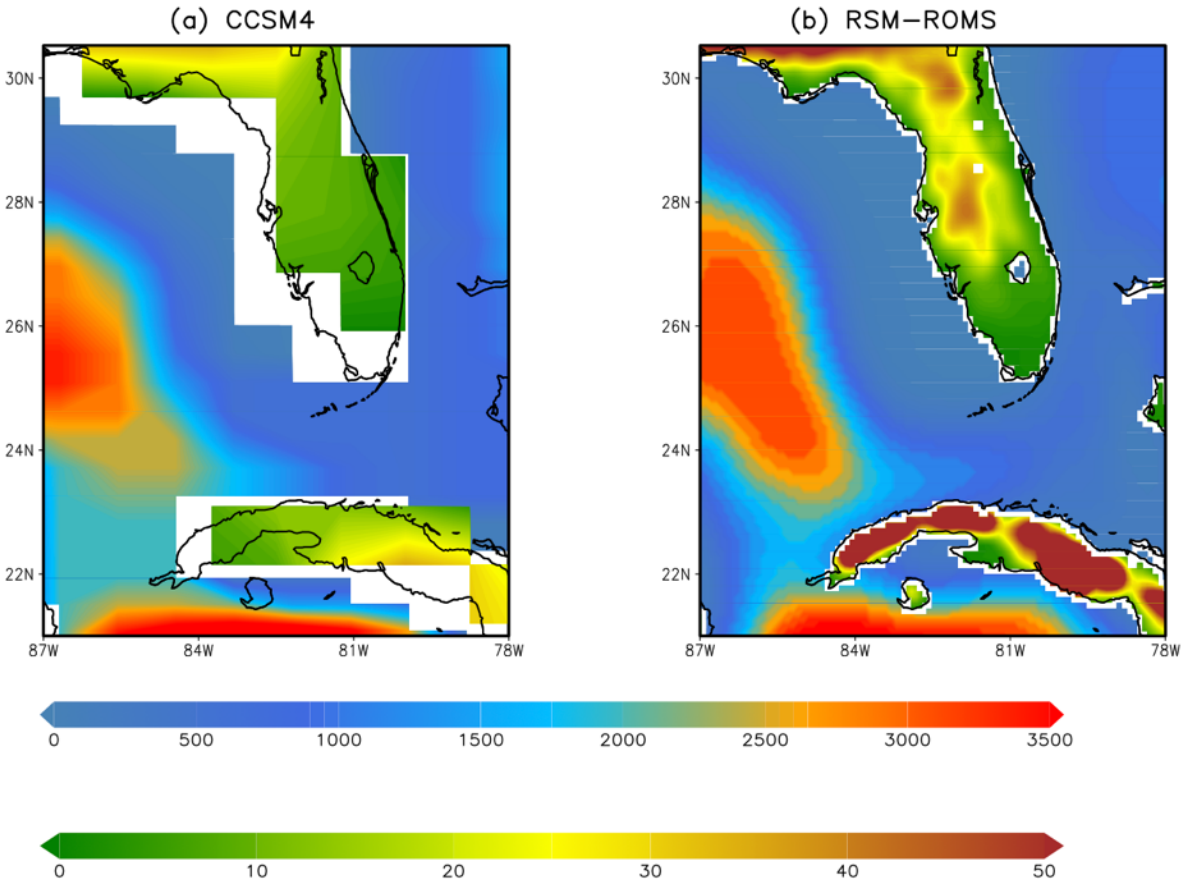
From Carter et al. (2014)-CH17; NCA2014

How is the future climate changing?



From Carter et al. (2014)-CH17; NCA2014

How is the future climate changing?

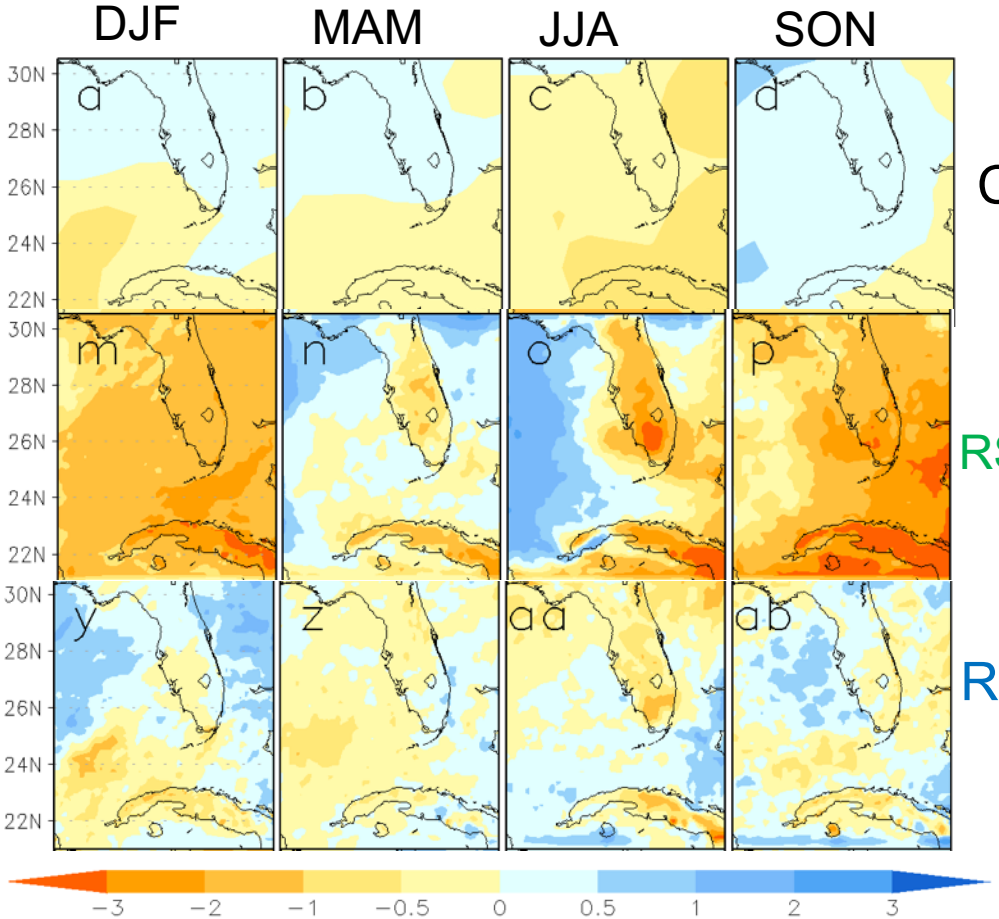


Grid spacing: 139km x 100km for land
123km x 45km for ocean

Grid spacing: 10km x 10km

How is the future climate changing?

21st century change (2041-2060) of precipitation with respect to 20th century (1986-2005) simulation



CCSM4

Insignificant to moderate increase in rainfall

RSM-ROMS

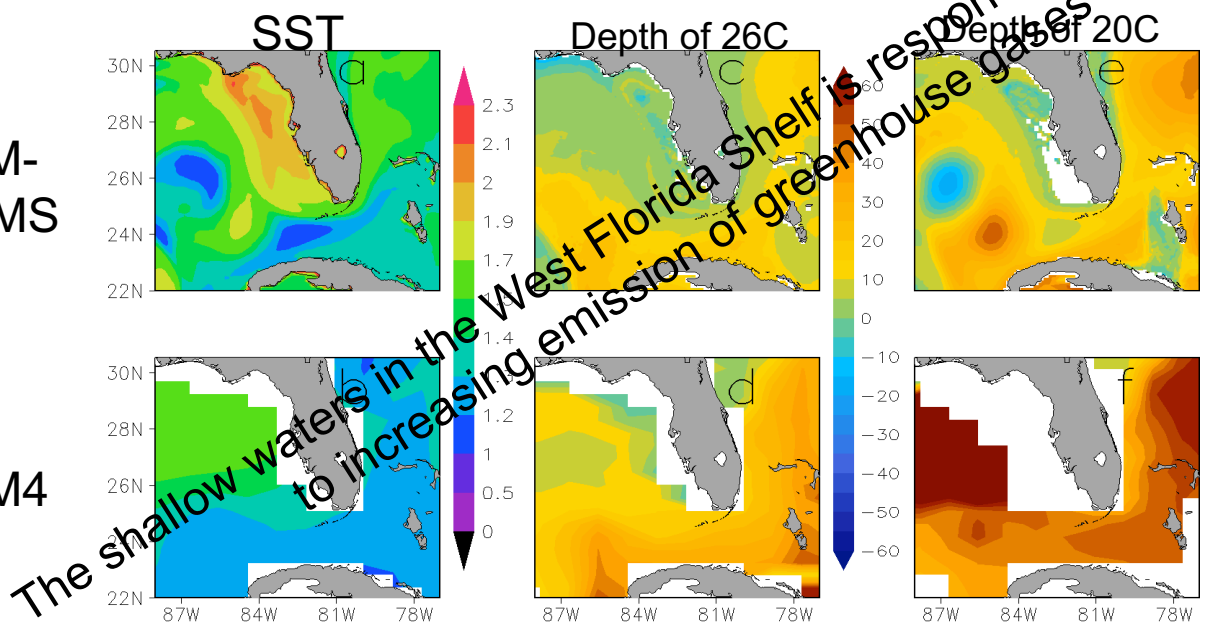
Much drier climate throughout the year in a future climate

RSM

Insignificant to moderate decrease in rainfall

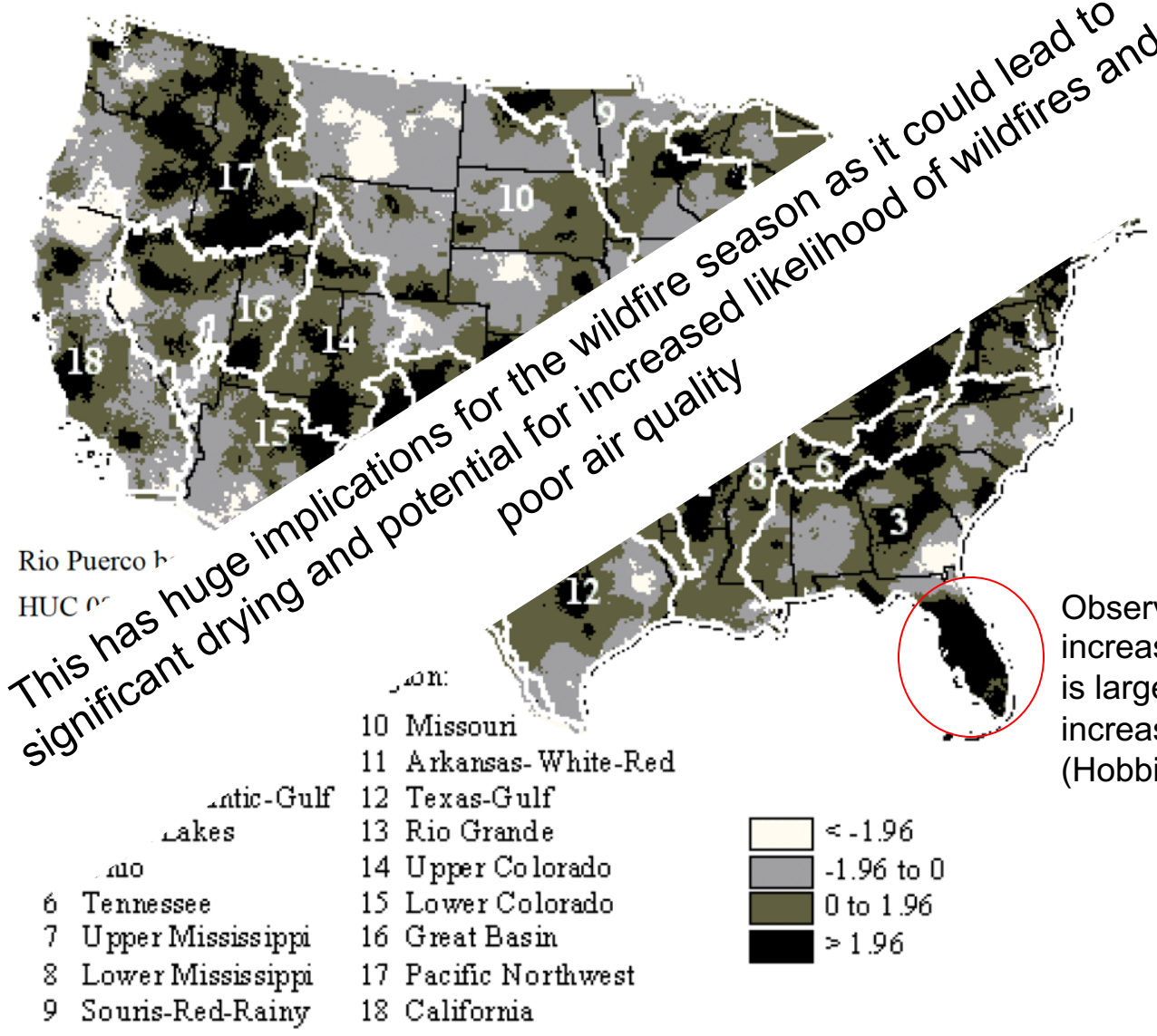
How is the future climate changing?

21st century change (2041-2060) of SST with respect to 20th century (1986-2005) simulation



The shallow waters in the West Florida Shelf is responding aggressively to increasing emission of greenhouse gases

Observed trends in actual Evapotranspiration



This has huge implications for the wildfire season as it could lead to significant drying and potential for increased likelihood of wildfires and poor air quality

Observed ET trends are increasing in Florida, which is largely forced by increasing temperature (Hobbins et al. 2001)

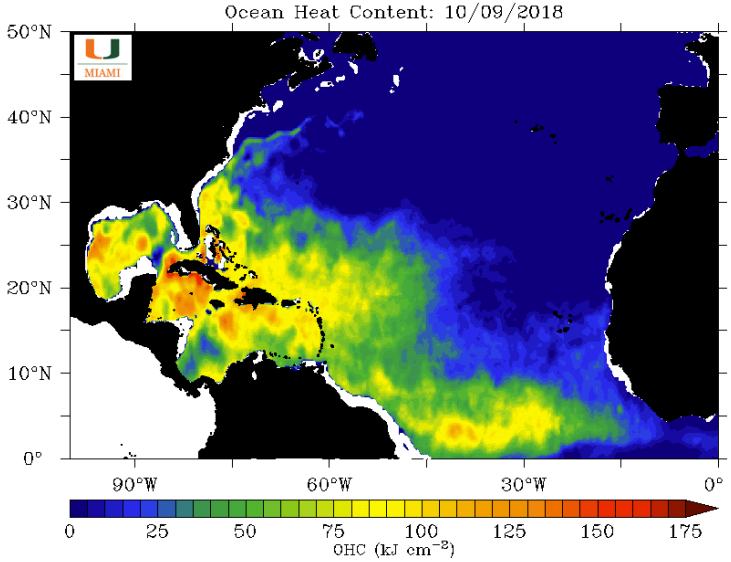
How is the future climate changing?

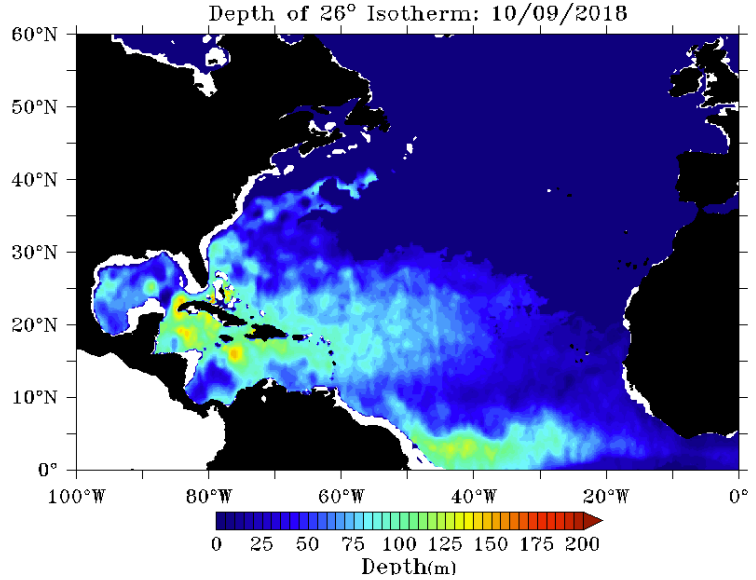
- The surface temperature is projected to increase by approximately 4^0F to 8^0F by 2100
- Vulnerability to heat waves, days with maximum temperatures exceeding 95^0F is projected to increase
- Increased likelihood for wildfires in the dry season
- Disruptions to essential services on account of the projected increase in frequency of severe weather impacts are going to raise the vulnerability of the population

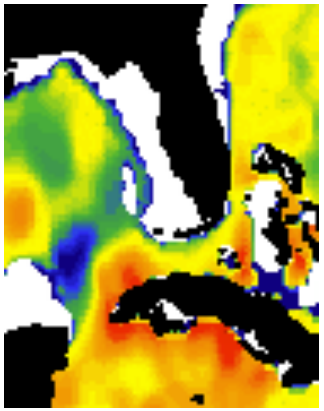
Examples of future events in current climate

1. Hurricane Michael
2. Memorial day heat wave (2019)!
3. Vector borne diseases
4. Rising agricultural production

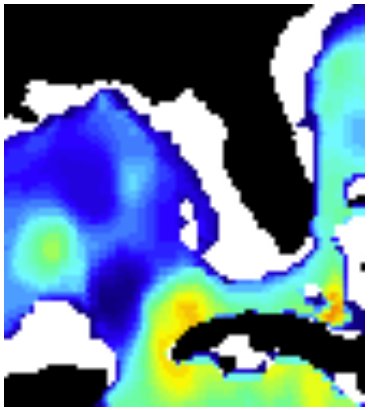
Hurricane Michael, 10/10/2018







The warming in the West Florida Shelf is reminiscent of the warming expected from increased radiative forcing from increased greenhouse gas emissions by 2060.



ENVIRONMENT

Hurricane Michael Was A Category 5, NOAA Finds — The First Since Andrew In 1992

April 19, 2019 · 1:04 PM ET

LAUREL WAMSLEY

Debris from Hurricane Michael rests along a canal on Oct. 18, 2018, in Mexico Beach, Fla. NOAA upgraded the storm to a Category 5 after completing its analysis.

Scott Olson/Getty Images

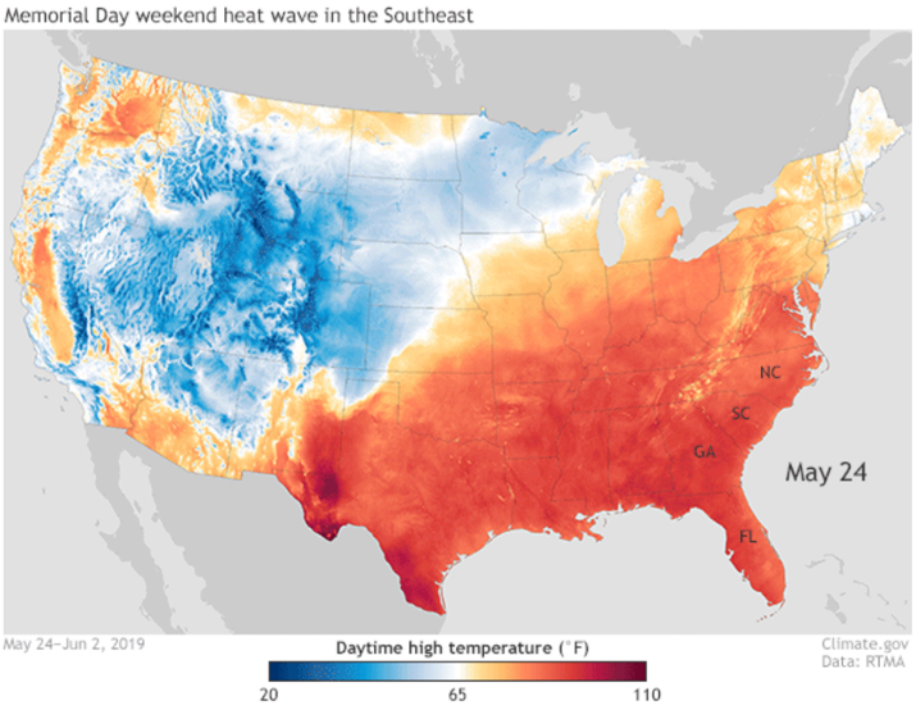
Heat wave broils the U.S. Southeast over Memorial Day weekend 2019

Author: Tom Di Liberto

June 4, 2019

Print

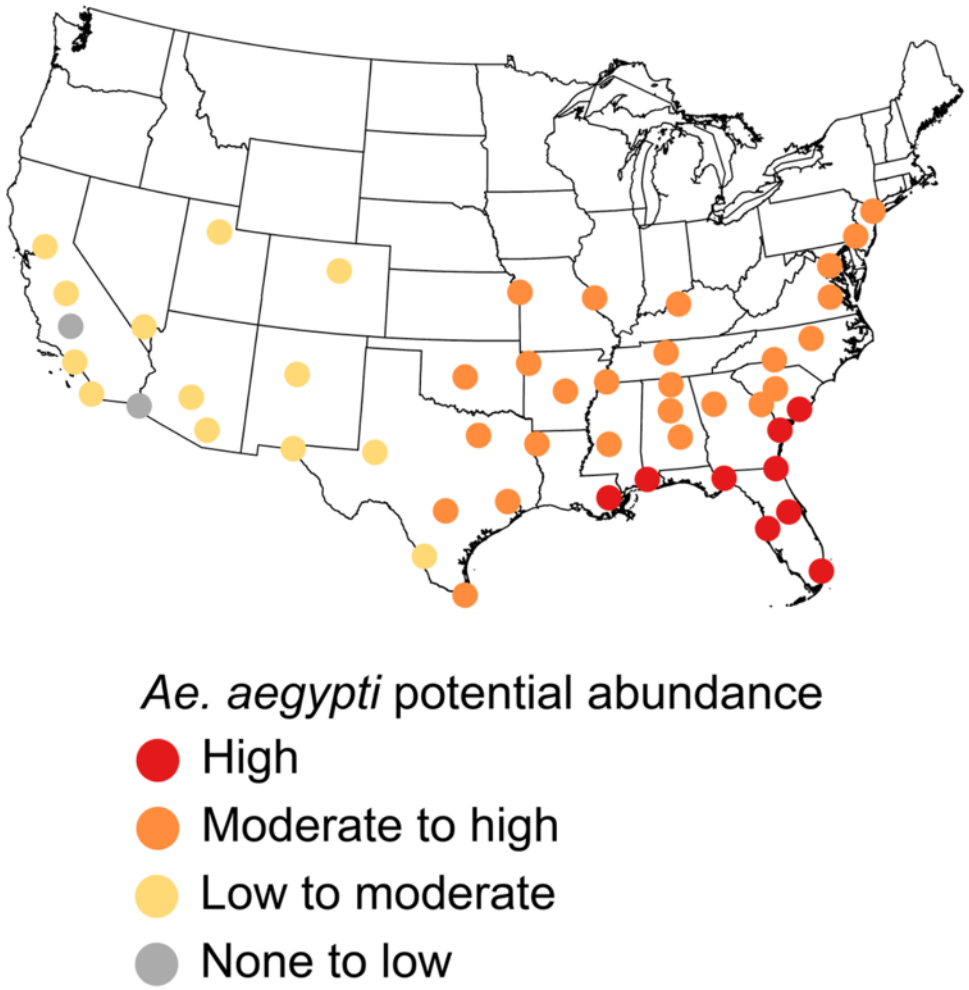
Alongside its somber meaning, Memorial Day weekend is also widely thought of as the unofficial kick-off to the summer: charcoals are lit, grills get hot, and burgers get cooked. This year, across the southeastern United States, the atmosphere decided to send an early preview of what it can actually cook up in terms of summer heat, as record-breaking temperatures soared to the triple digits across parts of Florida, Georgia, and South Carolina.



Source: NOAA.gov

Heat wave in May! May 17, 2019 was the first day of the year with 90+ and it remained so for a few after breaking many temperature records!

Current suitability for Aedes Aegypti mosquito in July in 50 different cities.



Ae. aegypti potential abundance

- High
- Moderate to high
- Low to moderate
- None to low

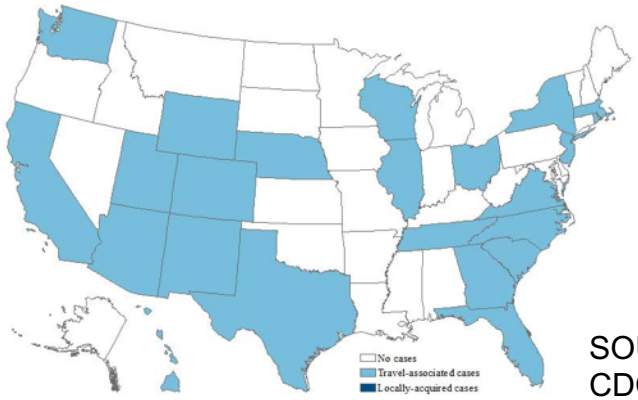
SOURCE: Monaghan et al. (2016)

Three more dengue fever cases in Miami-Dade; county under mosquito-borne illness alert

BY CARLI TEPROFF

OCTOBER 04, 2019 07:13 PM, UPDATED OCTOBER 04, 2019 07:00 PM

States reporting chikungunya virus disease cases – United States, 2019 (as of October 3, 2019)



SOURCE: CDC.gov

Collective opinion of 6 southeastern state climatologists!

The southeastern region is well poised to increase agricultural productivity:

- Despite increased likelihood of droughts, rainy seasons will produce adequate fresh water for ag production if it is used efficiently
- Recent legislative actions give greater impetus to farmers to consider sustainable agricultural practices
- The length of the growing season, availability of open land, ample sunshine is attractive to maximize agricultural production through dual cropping and new crop varieties
- Citrus industry is reappearing

There are challenges however:

- Greater competition for water resources with increasing population
- Several crops in southeast are already growing at their thermal limits—increased demand for irrigation
- Changes in farm size to larger farm lands effect resiliency to climate through changes in crop choices and cropping patterns
- Raises vulnerability of ag workers to climate change

SOURCE: Knox et al. (2014)

Conclusions

- Florida is heading to be a complex region to combat mitigation of future impacts of climate change, especially related to heat related illness
- The rising development and population of coastal regions in the state is a challenge in itself
- The meteoric rise in the senior population along the coast should raise red flags in terms of health care
- Expansion of ag productivity in Florida is going to raise the vulnerability of ag workers to impacts of climate change
- Several current weather events have played out a scene from the future
- Other anthropogenic impacts like urbanization and irrigation show moderate changes to local climate—could we engineer ourselves out from impacts of climate change?