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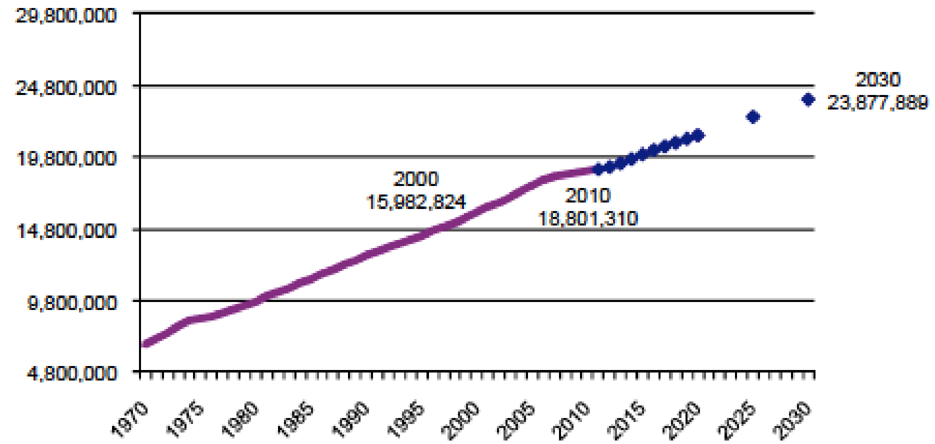
Urban water supply and demand in a changing demography

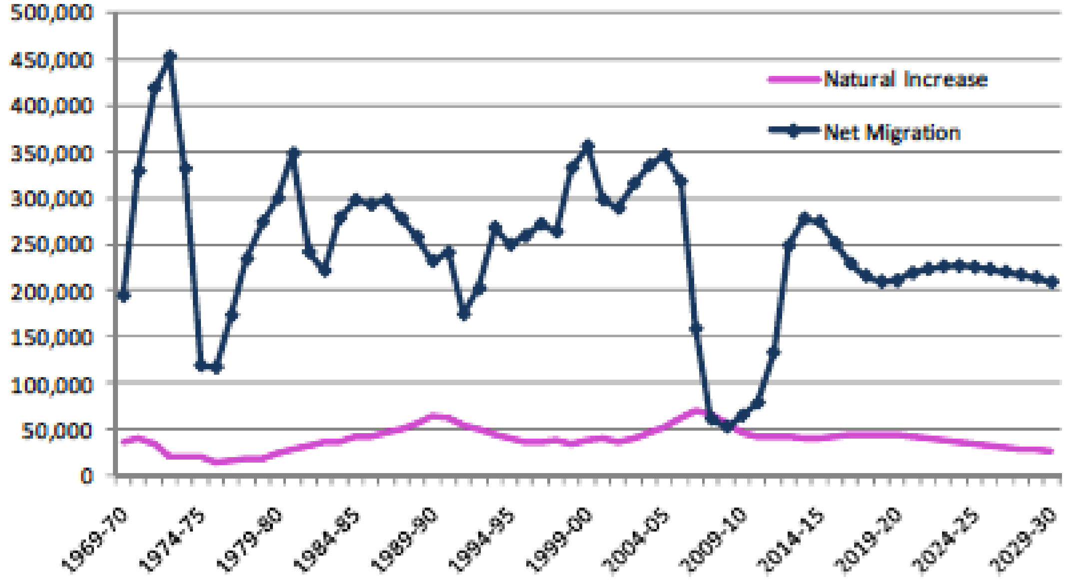
Florida's April 1 Population



Florida's population:

- was 15,982,824 in 2000
- was 18,801,310 in 2010
- is forecast to grow to 23,877,889 by 2030

Florida's Population Growth

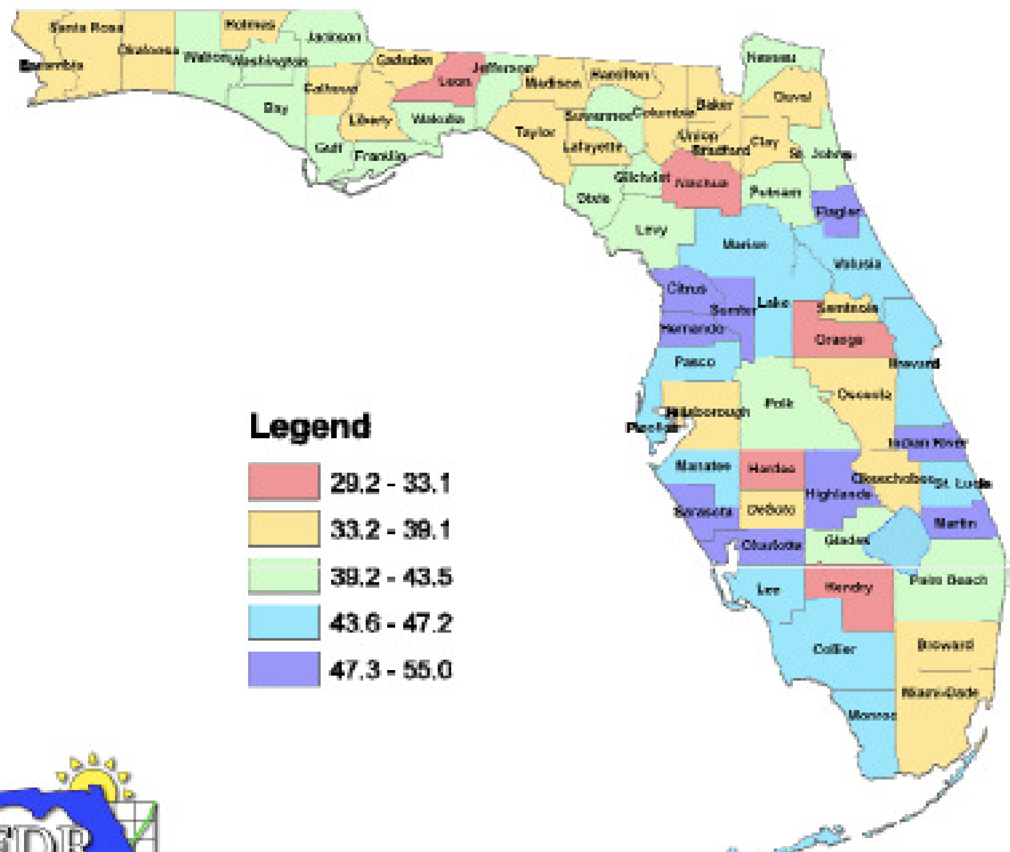


- Typically, most of Florida's population growth is from net migration.
- In 2030, net migration is forecast to represent 88.6 percent of Florida's population growth.

DATA SOURCE: EDR AND LATER RELEASE OF CENSUS INFO

Median Age of Floridians

(April 1, 2009)



- The median age of Florida residents was estimated at **40.4** years as of April 1, 2009.
- There were 3 counties with a median age below 30: Hendry (29.2), Leon (29.3), and Alachua (29.7).
- There were 8 counties with a median age of 50 and older: Charlotte (55.0), Citrus (54.6), Sarasota (53.2), Highlands (51.6), Flagler (50.9), Hernando (50.7), Martin (50.5), and Sumter (50.1).

DATA SOURCE: CENSUS

Population Density

Most Dense County:
Pinellas 3,348

Least Dense County:
Liberty 10

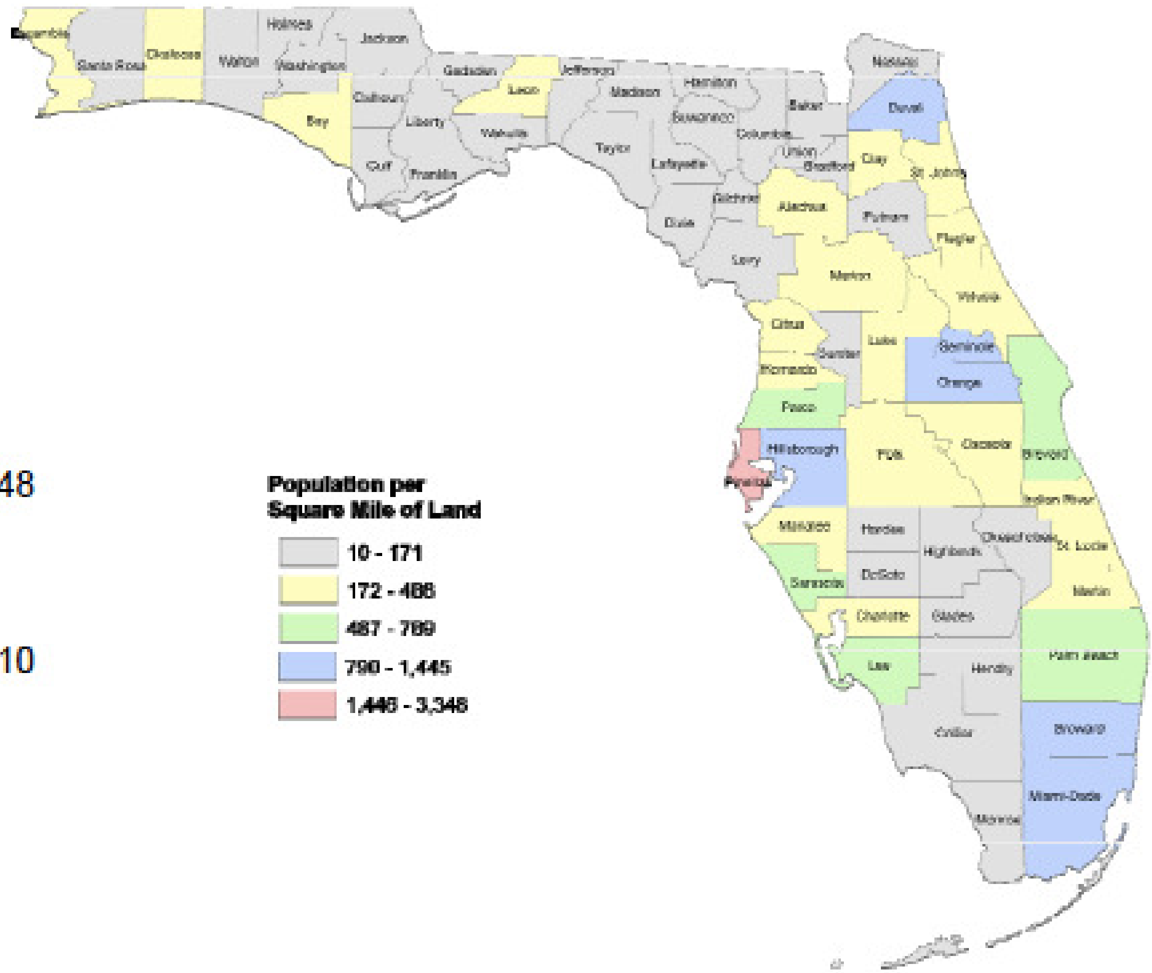
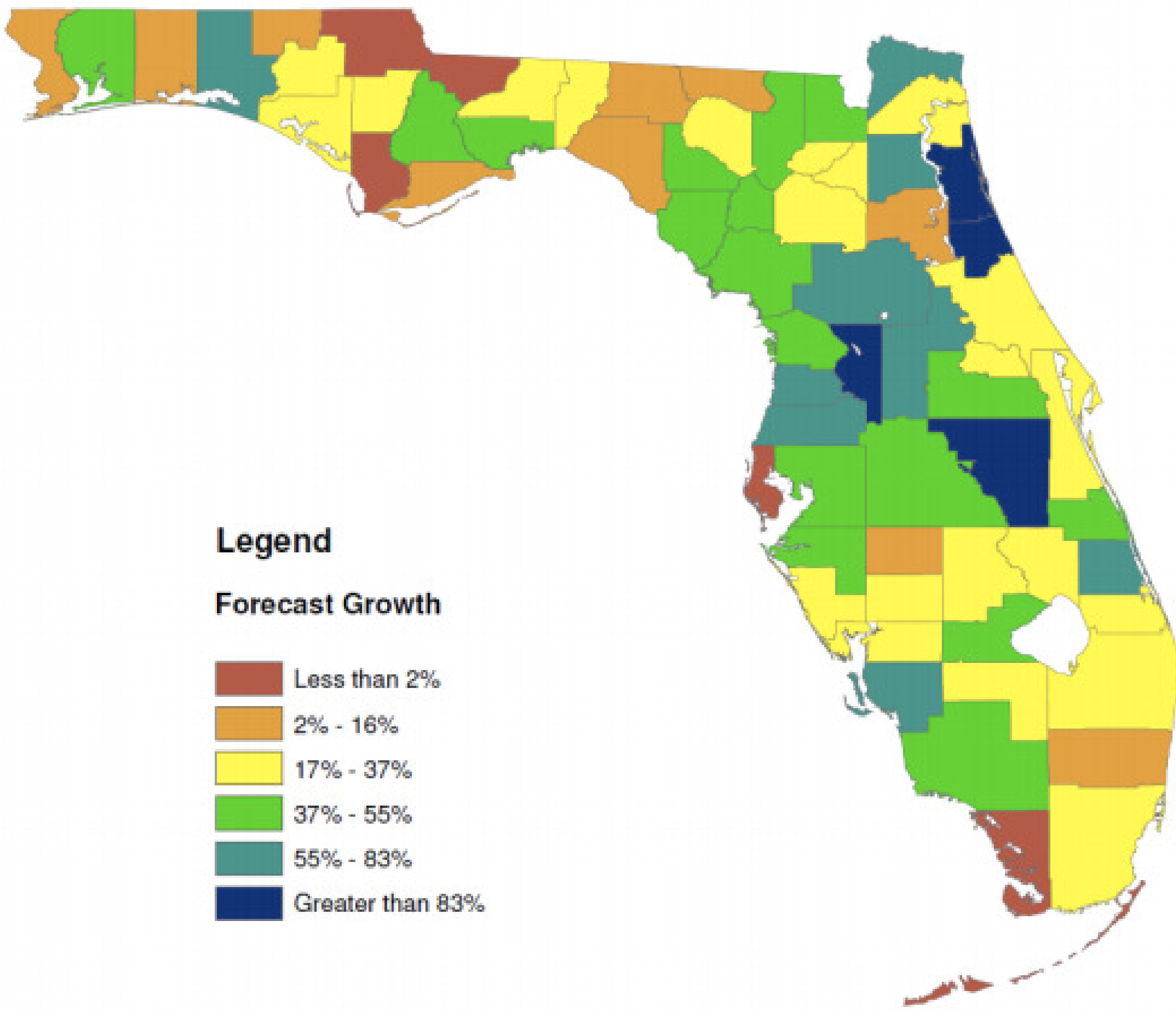
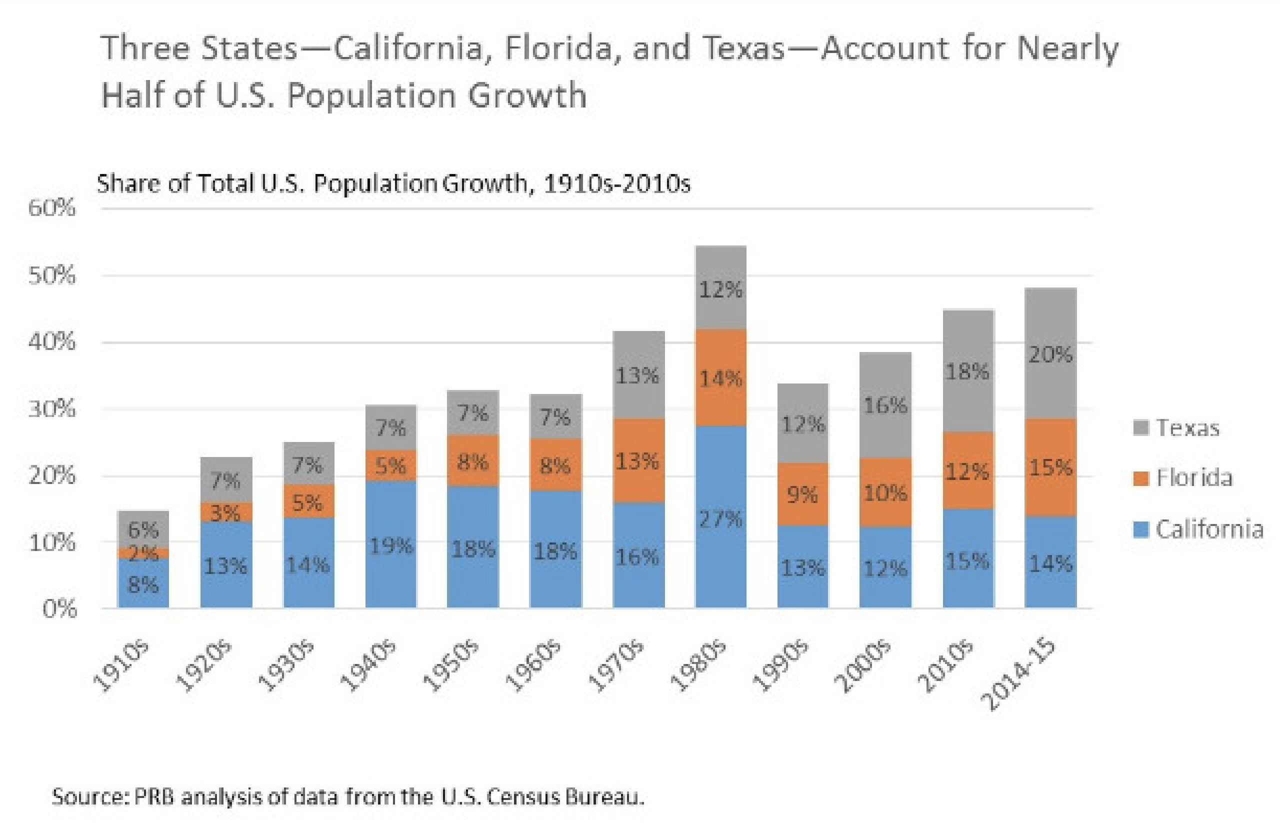


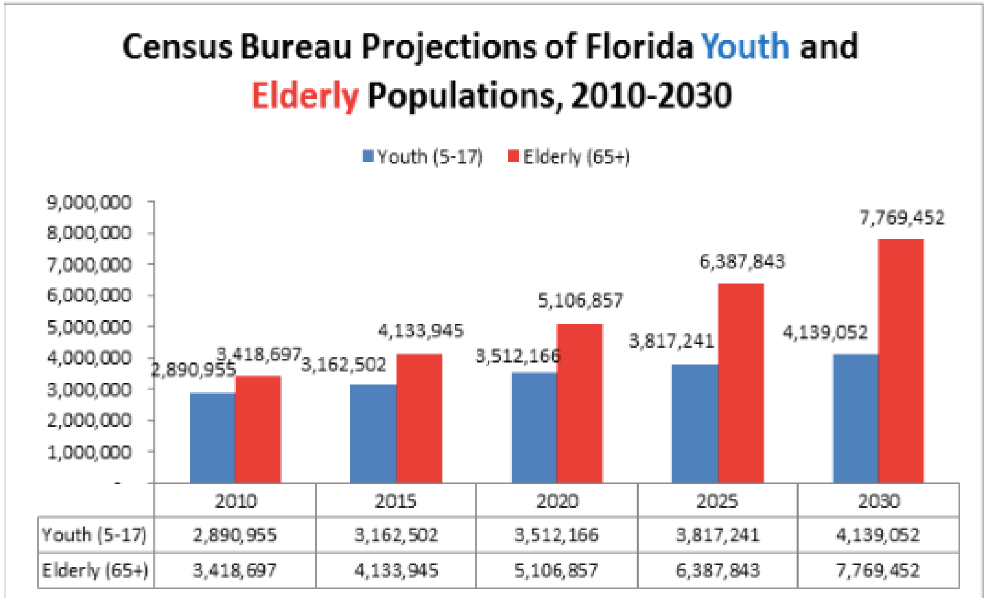
Figure 12 – Forecast Growth by County, 2012 – 2040

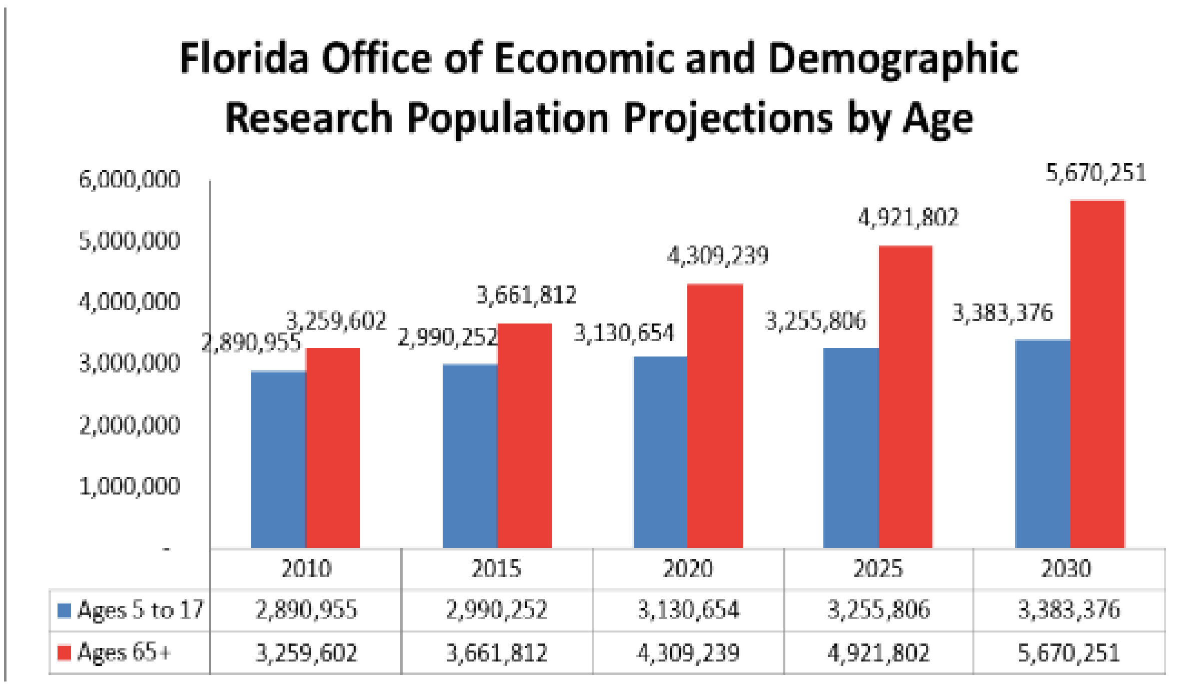


Source: U.S. Census Bureau, *U.S Census*, 2010; University of Florida – Bureau of Economic and Business Research, *Projections of Florida Population by County*, 2012-2040.



- The three states account for 27% (81 million) of the current US population
- They account for 48% of US population growth between 2014-15 (rebounding economy; rapid growth in first and second generation immigrants)
- By 2030 the population is projected to exceed 100 million


Census Bureau Projections of Florida Youth and Elderly Populations, 2010-2030
Youth (5-17)
Elderly (65+)
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
-
2,890,955
3,418,697
3,162,502
4,133,945
3,512,166
5,106,857
3,817,241
6,387,843
4,139,052
7,769,452
2010
2015
2020
2025
2030
Youth (5-17) 2,890,955 3,162,502 3,512,166 3,817,241 4,139,052
Elderly (65+) 3,418,697 4,133,945 5,106,857 6,387,843 7,769,452


Florida Office of Economic and Demographic Research Population Projections by Age
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
-
2,890,955
3,259,602
2,990,252
3,661,812
3,130,654
4,309,239
3,255,806
4,921,802
3,383,376
5,670,251
2010
2015
2020
2025
2030
Ages 5 to 17 2,890,955 2,990,252 3,130,654 3,255,806 3,383,376
Ages 65+ 3,259,602 3,661,812 4,309,239 4,921,802 5,670,251

Challenges for urban water supply in Florida

- Getting supply of fresh water to meet the growing demand
- Meeting the standards of water quality and reliable supply for a fragile (senior) population in adverse weather
- Demands of power generation under adverse weather

Clusters analysis of North Atlantic Tropical Cyclones

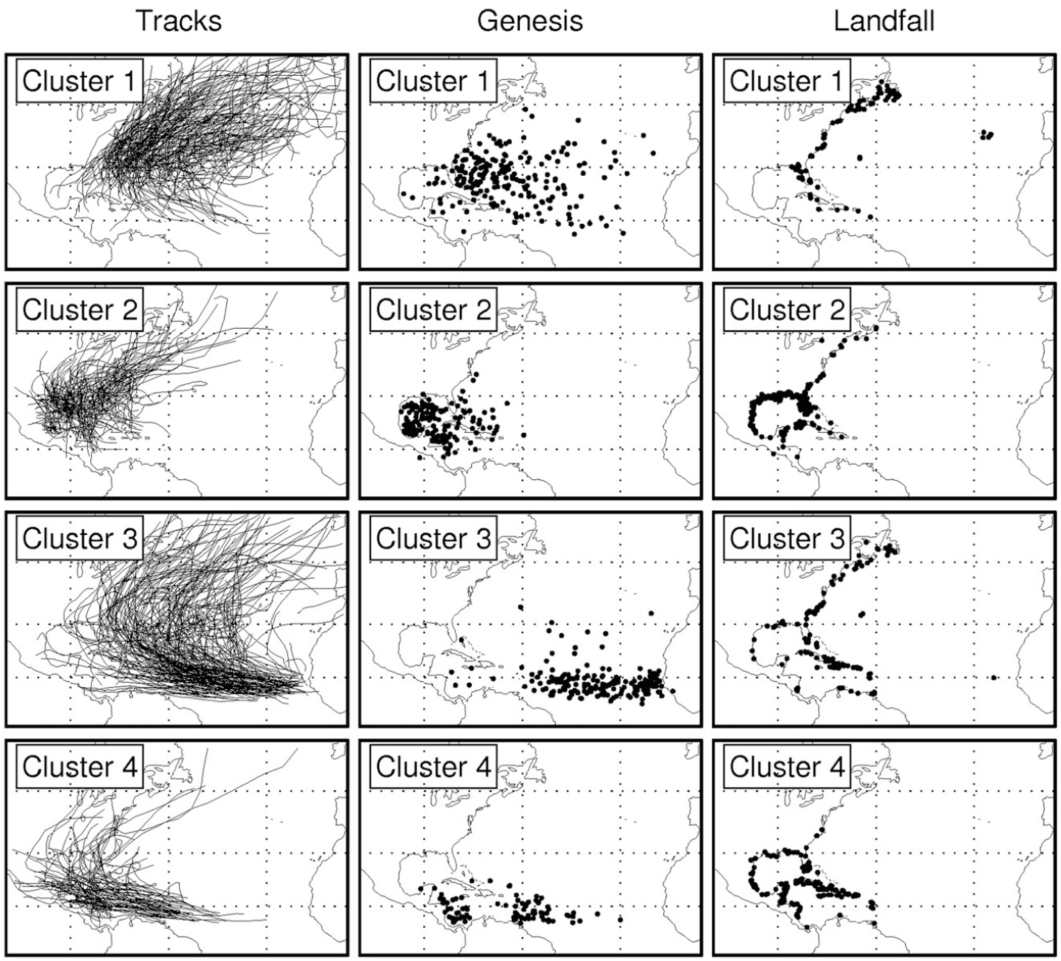


FIG. 1. North Atlantic tropical storm and hurricane tracks, genesis locations, and landfall locations during the period 1950–2007, as separated by the cluster analysis.

From Kossin et al. (2010)

Using HURDAT from 1950-2007

The clusters are based on storm position and time

Storms in clusters 1 and 2 form farther north than 3 and 4

Storms in clusters 1 and 3 form farther east than 2 and 4

Cluster 1 has pronounced northward track

Cluster 4 has pronounced westward track

Cluster 2 form almost exclusively in GoM

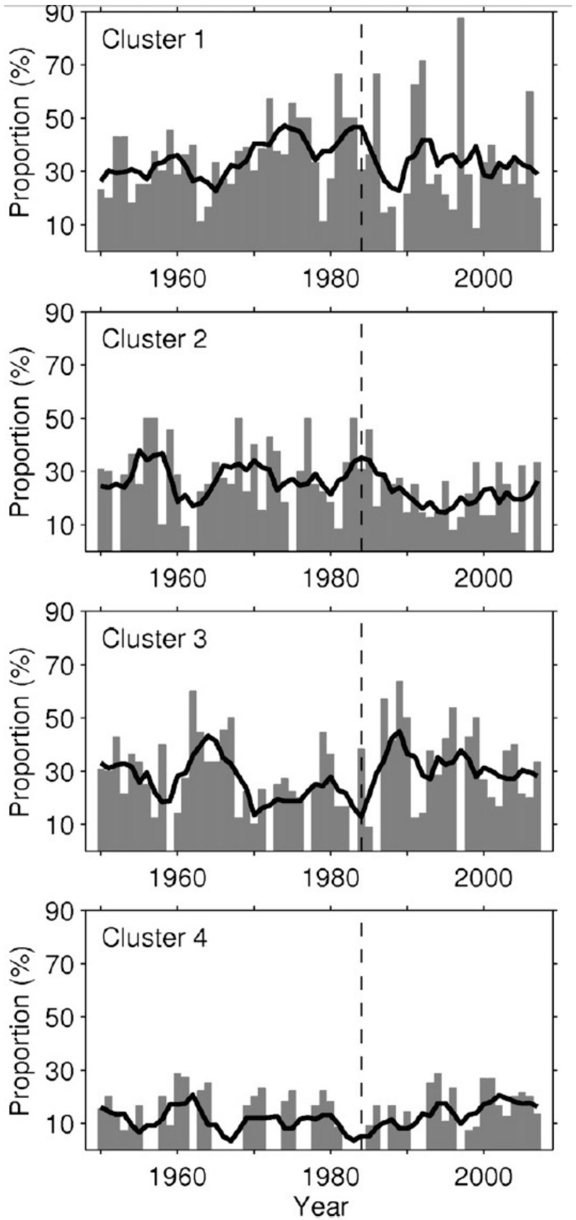


FIG. 5. As in Fig. 4 but for the percent contribution of each cluster to the total number of storms that year. Dashed lines identify the early- to mid-1980s shift toward proportionally more deep tropical systems.

Kossin et al. 2010

1. There is a clear regime shift beginning in early to mid-1980's
2. As the total annual rate of storms have increased in the Atlantic, post-1980 there is proportionately more cluster 3 and 4 storms compared to clusters 1 and 2.
3. That is more tropical only storms are increasing and baroclinically initiated or enhanced storms are decreasing post 1980.

4. This regime shift has occurred within the period of regular operational polar (July 1965) and geo-stationary (June 1977) orbiting satellite observations

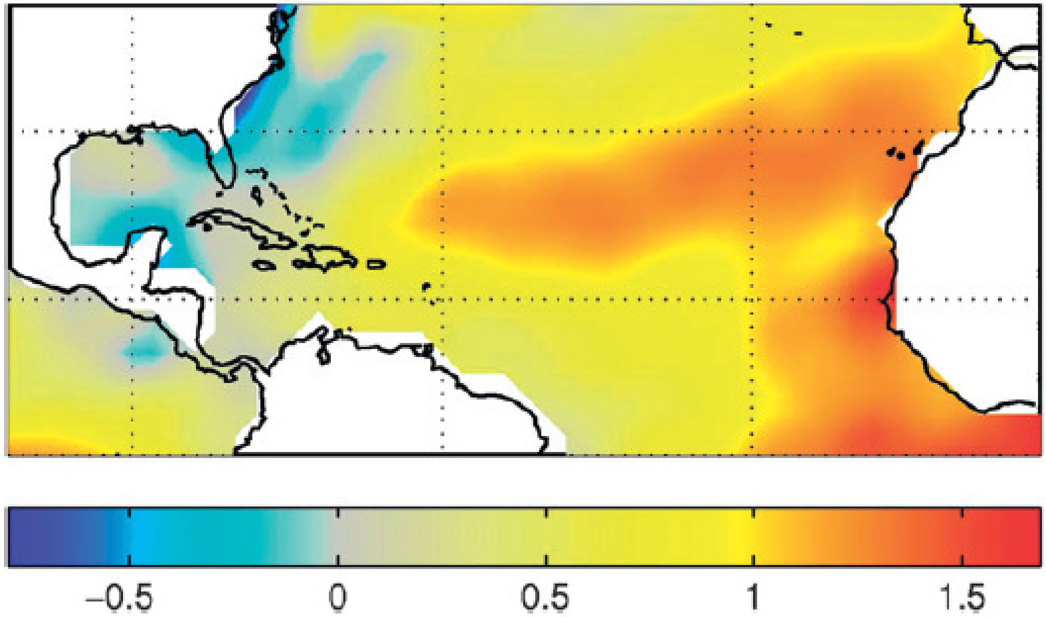


FIG. 7. Observed SST trends (°C century^{-1}) during the official North Atlantic hurricane season (June–November) for the period 1950–2007.

Kossin et al. 2010

1. Clusters 3 and 4 form over regions of positive SST trends
2. Cluster 2 genesis is colocated with region that is experiencing no upward SST trend (or a weak cooling SST trend)
3. The main genesis region of cluster 1 spans region of both warming and cooling SST trends and the overall trend is positive but significantly weaker than those found in clusters 3 and 4.

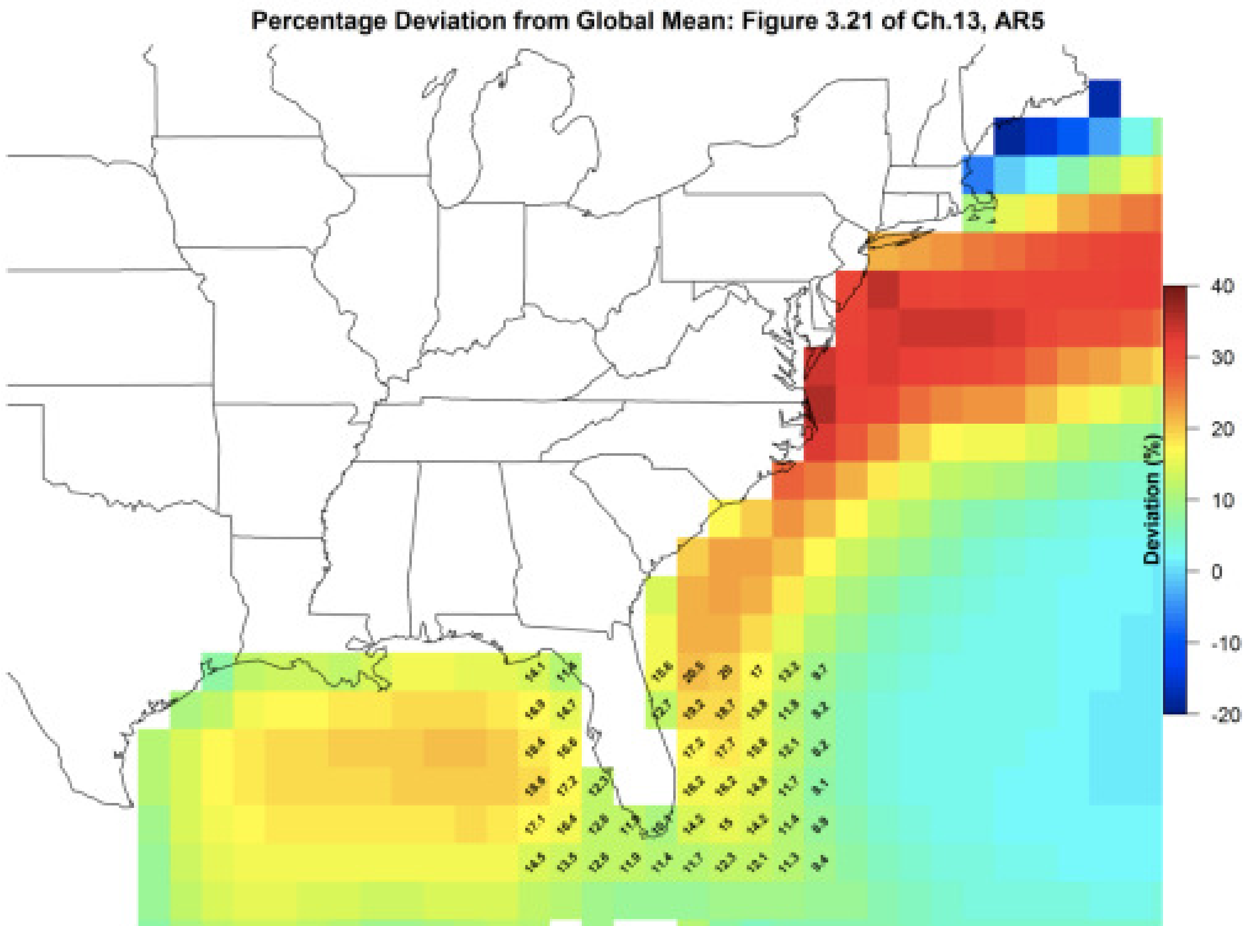


Figure B-1. Percentage of the deviation of the ensemble mean regional relative sea level change between 1986-2005 and 2081-2100 from the global mean value, based on Figure 13.21, IPCC (2013). The figure was computed for RCP4.5, but to first order is representative for all Representative Concentration Pathways (RCP). RCPs are the four greenhouse gas concentration trajectories adopted by the IPCC for its fifth Assessment Report (AR5).

From SECC 2015

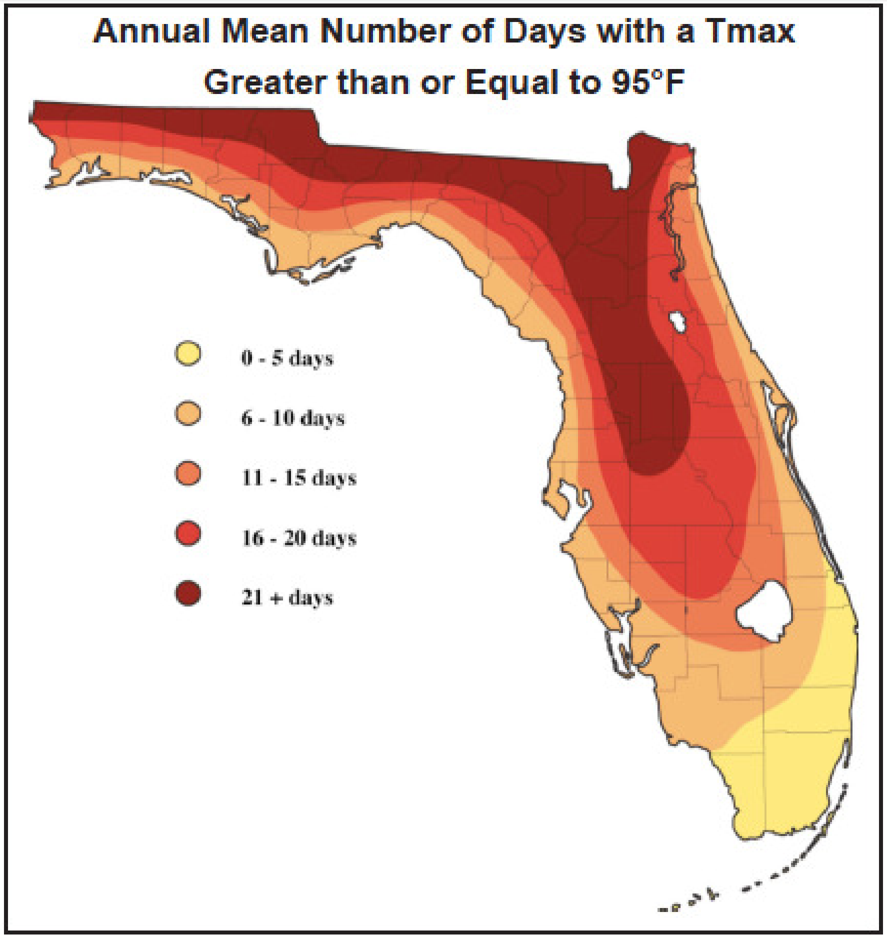


Figure 1. Annual mean number of days with a maximum temperature (Tmax) greater than or equal to 95°F (Source: The Florida State University Center for Ocean-Atmospheric Prediction Studies).

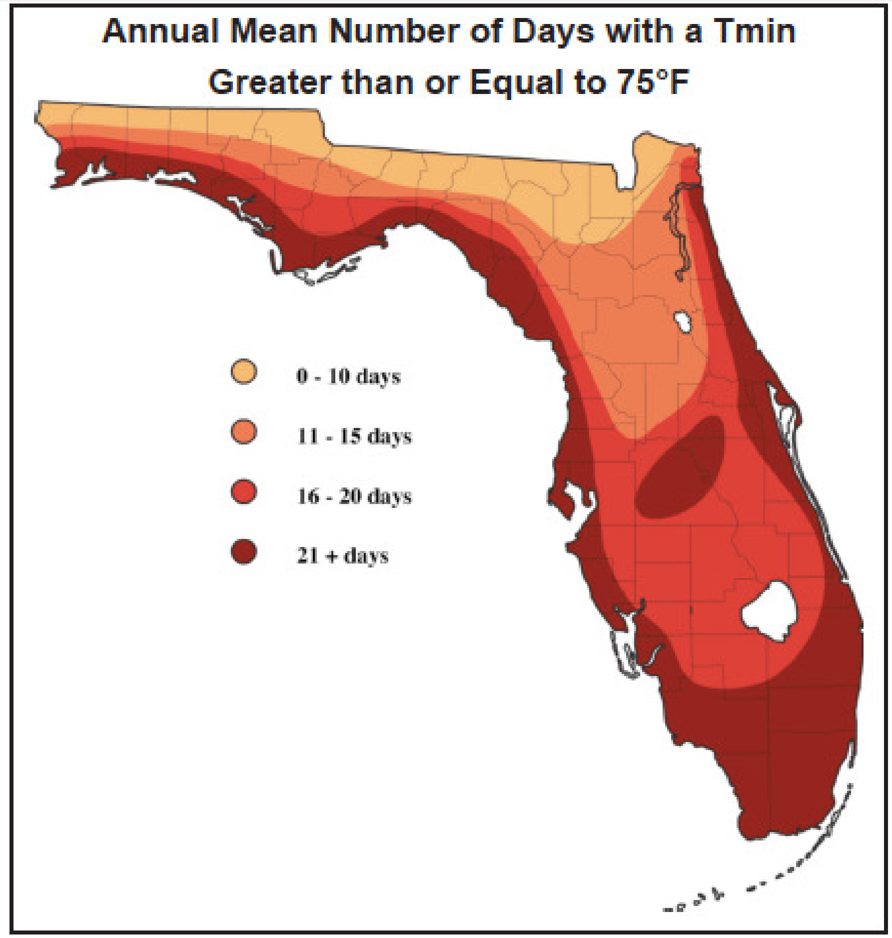


Figure 2. Annual mean number of days with a minimum temperatures (Tmin) greater than or equal to 75°F (Source: The Florida State University Center for Ocean-Atmospheric Prediction Studies).

Humidity impact on differences in Tmax and Tmin

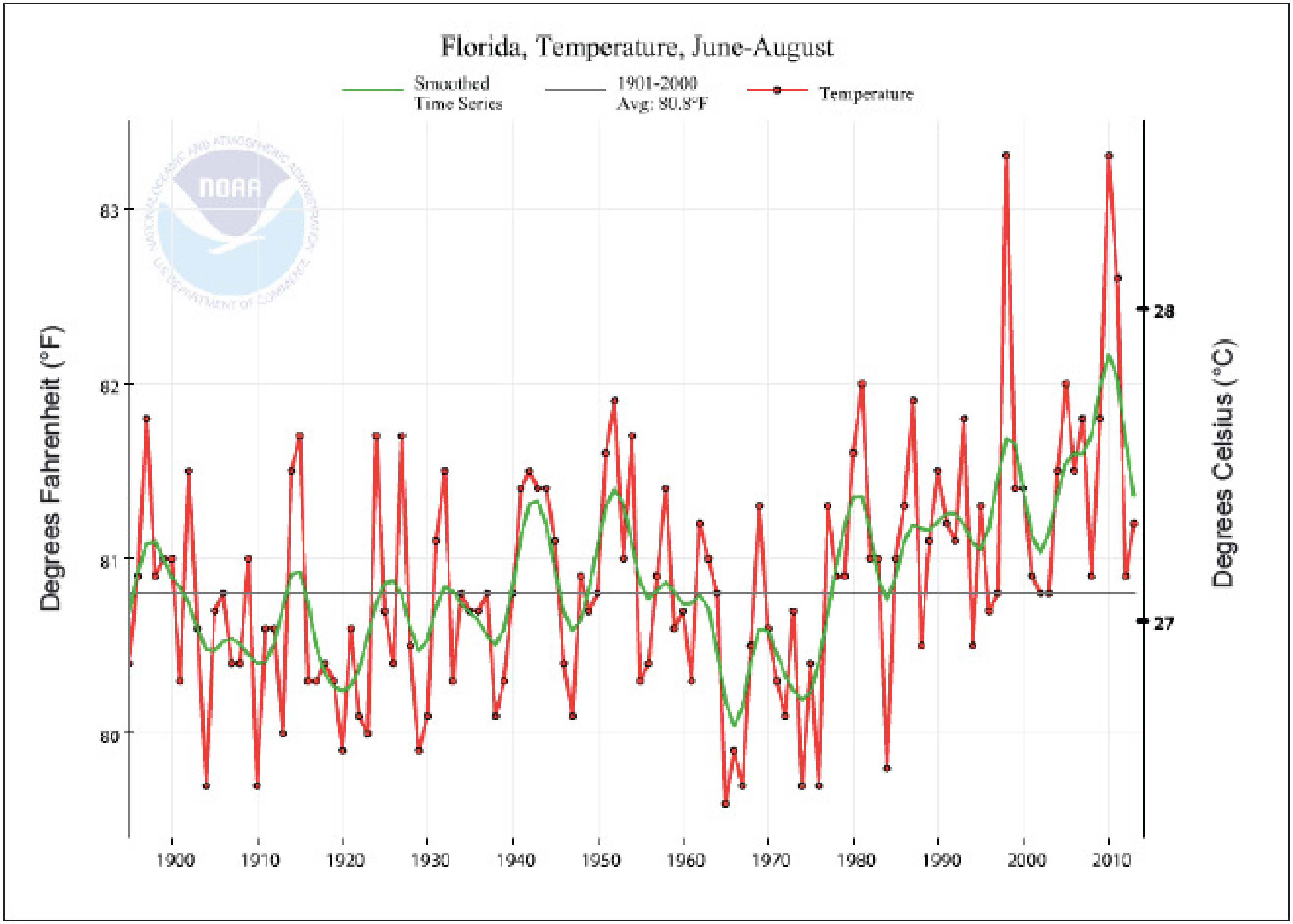
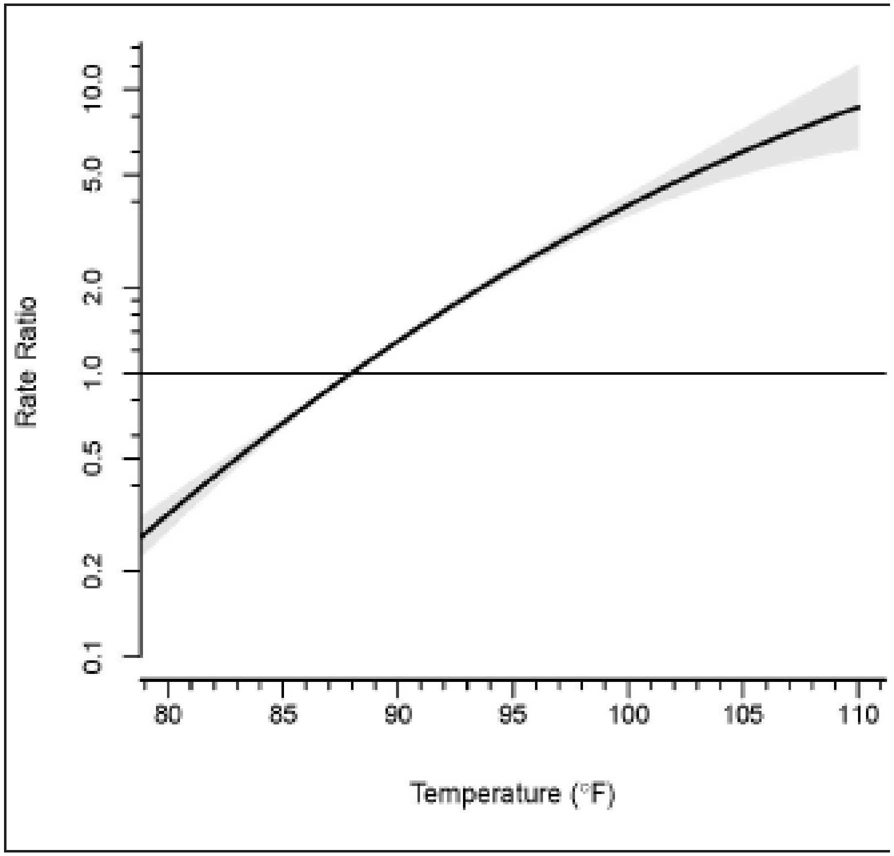


Figure 3. The average summer (June-August) temperature in degrees Fahrenheit and Celsius, Florida 1985-2012 (Source: National Climatic Data Center).



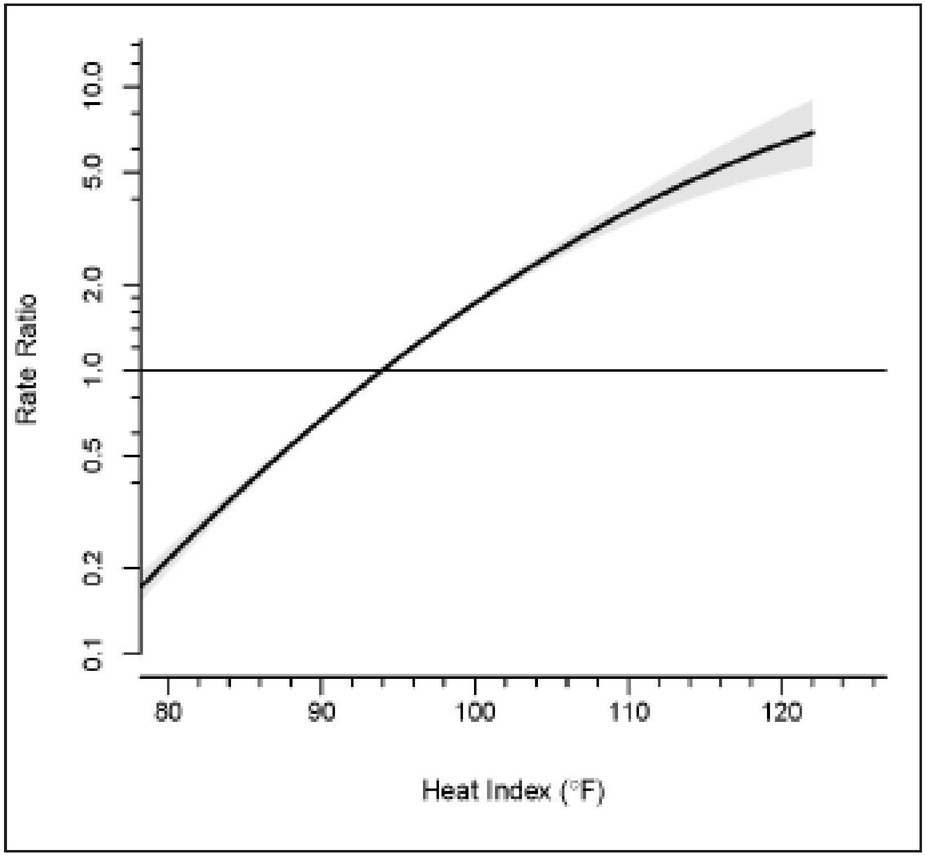


Figure 8. Associations between daily maximum temperature (°F) and heat-related illness, Florida, May-October, 2005-2012.

Figure 10. Associations between daily maximum heat index (°F) and heat-related illness, Florida, May-October, 2005-2012.

Conclusions

- In a changing and growing population the vulnerability to adverse weather and climate increases
- Growing coastal population exposes vulnerability to hurricane impact
- Growing inland senior population exposes vulnerability to heat stress related issues
- Same adverse weather of the past will have different impact in future
- Urban water suppliers have to plan
  - for sudden spikes in water demand for power generation
  - Reliable water supply in adverse conditions to sustain fragile population