

# A brief update: Sea Level Rise and Climatic Trends

Jayantha Obeysekera, Chief Modeler

Palm Beach County Water Resources  
Task Force  
April 16, 2015

# Potential Climate Change & Sea Level Rise Impacts to SFWMD



## Climate Change Drivers

**Natural Cycles**  
Interannual  
(e.g. El Nino and La Nina) to  
Multi-decadal  
(e.g. AMO\*), and  
Glacial

**Human Induced**  
Land use changes  
Greenhouse gases



## Quartet of change: Stressors

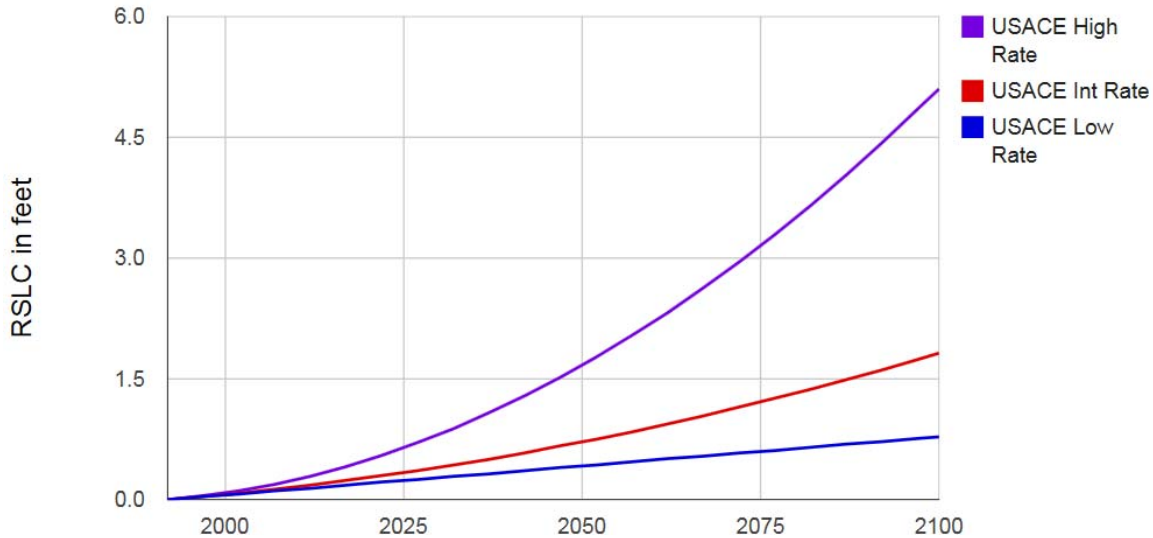
- **Rising Seas**
- **Temperature**
- **Rainfall, floods, and droughts**
- **Tropical Storms & Hurricanes**

## Water Management Impacts

- **Direct landscape impacts** (e.g. storm surge)
- **Water Supply** (e.g. droughts, saltwater intrusion)
- **Flood Control** (e.g. urban flooding, hurricanes)
- **Natural Systems** (e.g. ecosystem impacts, both coastal and interior)

\*Atlantic Multi-decadal Oscillation of temperature in the Atlantic Ocean

# USACE/SE Climate Compact Sea Level Projections



DEPARTMENT OF THE ARMY  
 U.S. Army Corps of Engineers  
 Washington, DC 20314-1000

ETL 1100-2-xx

CCWC-CE  
 CCWC-P  
 Technical Letter  
 No. 1100-2-xx

31 March 2014

EXPIRATION DATE (31 March 2019)  
 Global Changes

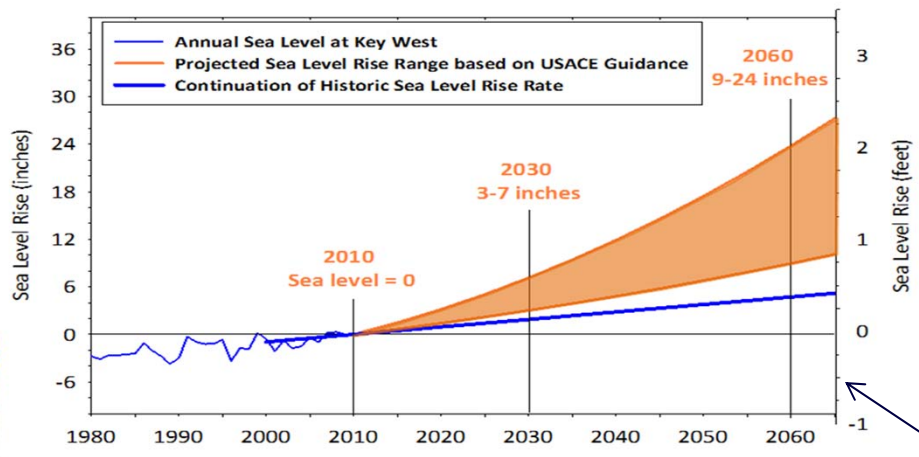
**PROCEDURES TO EVALUATE SEA LEVEL CHANGE:  
 IMPACTS, RESPONSES, AND ADAPTATION**

- Purpose:** This technical letter provides guidance for understanding the direct and indirect physical and ecological effects of projected future sea level change on USACE projects and systems of projects and considerations for adapting to those effects.
- Applicability:** This Engineer Technical Letter (ETL) applies to all USACE elements having Civil Works responsibilities.
- Distribution Statement:** Approved for public release, distribution is unlimited.
- References:** References are listed in Appendix A.
- Discussion:** USACE missions, operations, programs, and projects must be resilient to coastal climate change effects beginning with sea level change (SLC). This ETL addresses adaptation to changing sea levels for every USACE signal activity as far inland as the extent of estimated tidal influence. It includes a readily applicable method encompassing four USACE mission areas and also provides insight into on-site multipurpose projects. The information presented here is applicable to the full range of USACE projects and systems, from simple to complex, from small to very large, and over the full life cycle. This ETL integrates the recommended planning and engineering to understand and adapt to impacts of projected SLC through a hierarchy of decisions and review points that identify the level of analysis required as a function of project type, planning horizon, and potential consequences.

FOR THE COMMANDER:

*James C. Dalton*  
 JAMES C. DALTON, P.E., SES  
 Chief, Engineering and Construction Division  
 Directorate of Civil Works

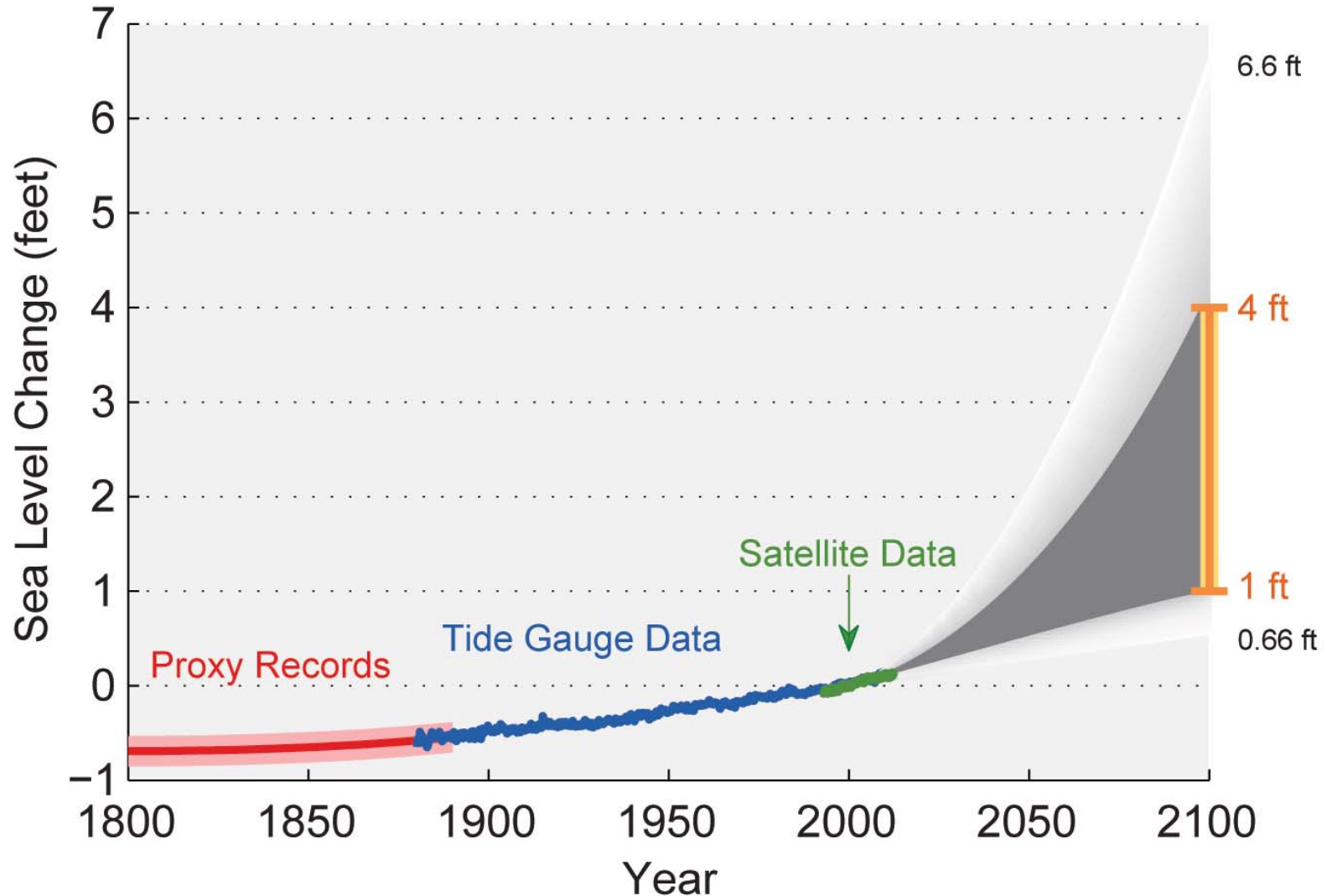
7 Appendixes:  
 As listed in the Table of Contents



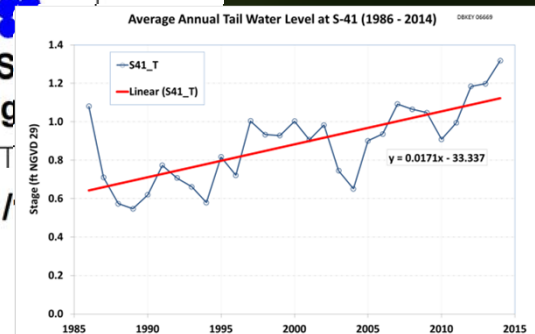
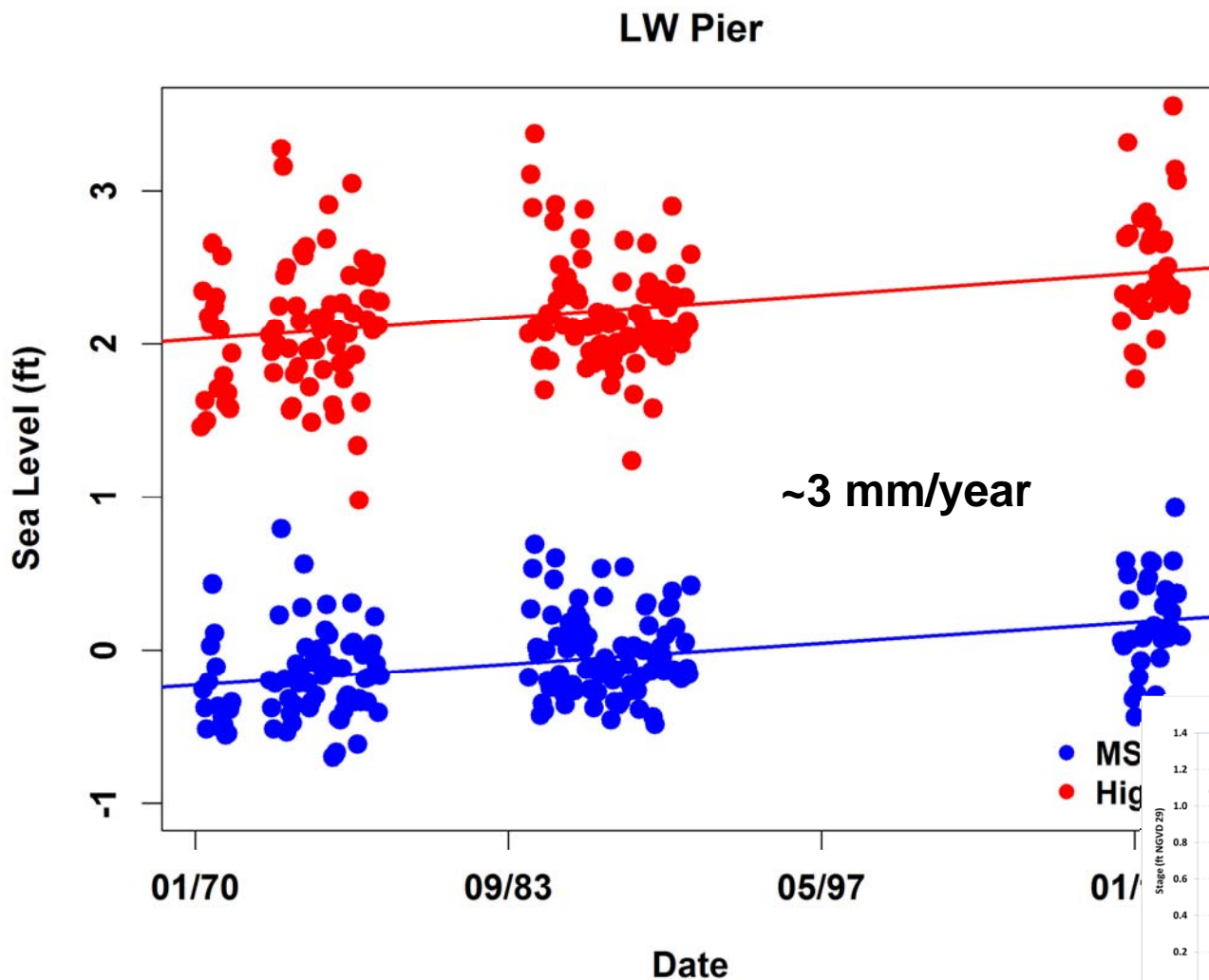
Update underway

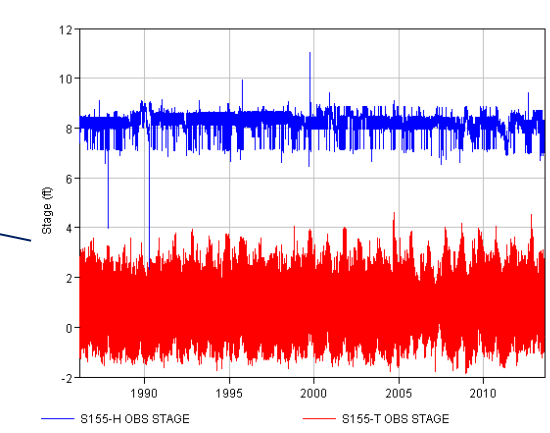
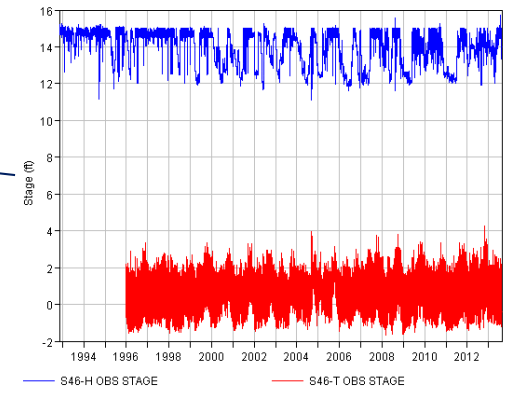
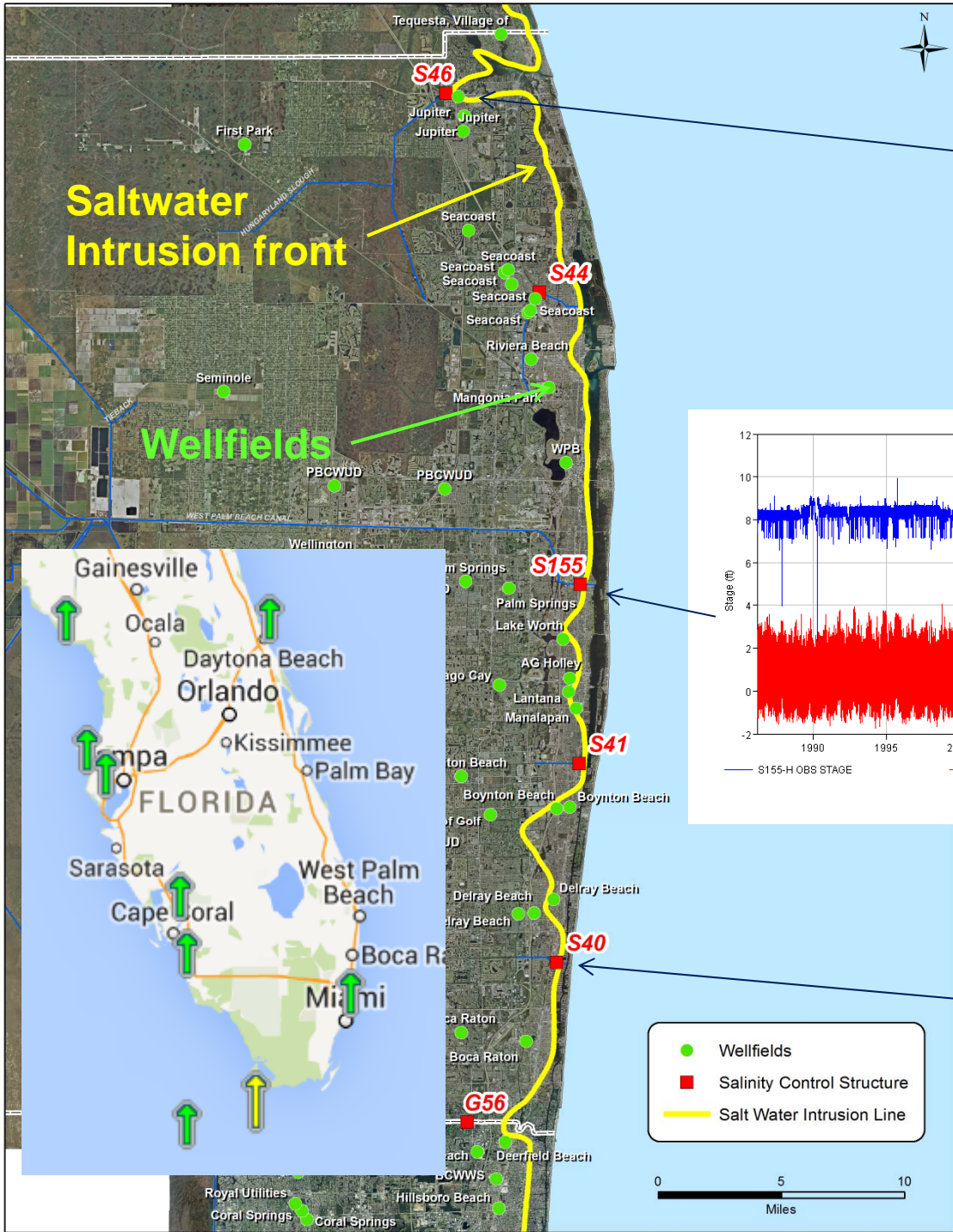
# National Climate Assessment (2014)

## Projoections

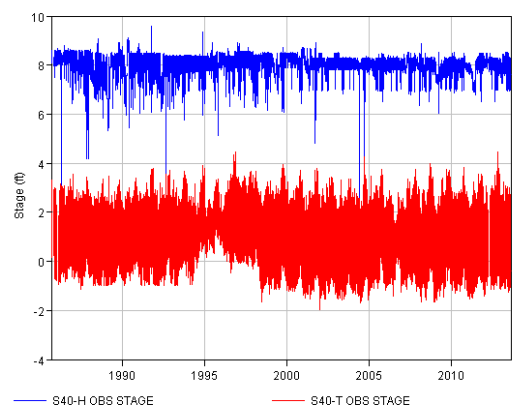


# Is sea level near the lagoon rising?

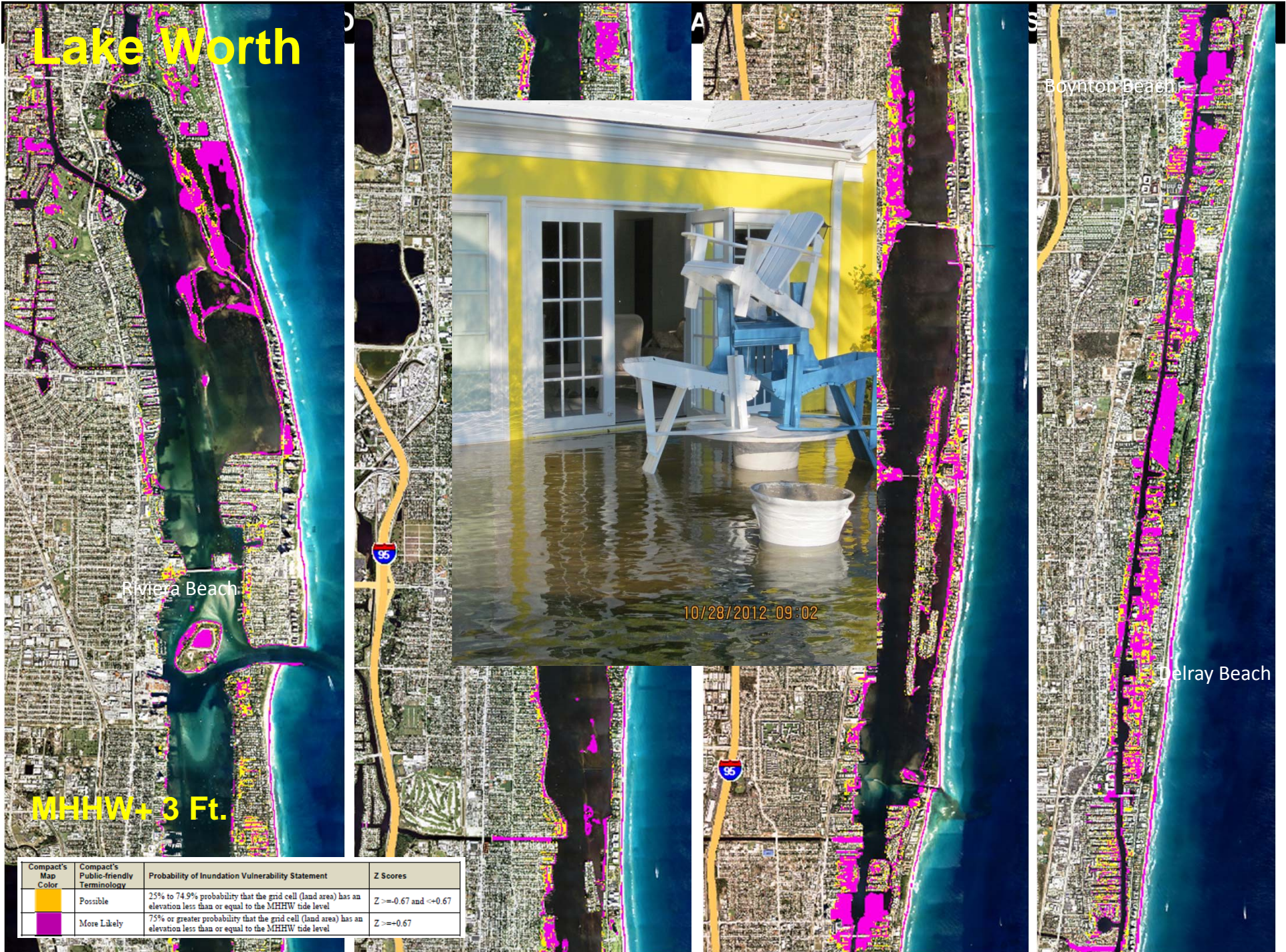




# Palm Beach County



# Lake Worth



**MHHW + 3 Ft.**

Compact's Map Color	Compact's Public-friendly Terminology	Probability of Inundation Vulnerability Statement	Z Scores
Yellow	Possible	25% to 74.9% probability that the grid cell (land area) has an elevation less than or equal to the MHHW tide level	$Z \geq -0.67$ and $Z < -0.67$
Purple	More Likely	75% or greater probability that the grid cell (land area) has an elevation less than or equal to the MHHW tide level	$Z \geq -0.67$

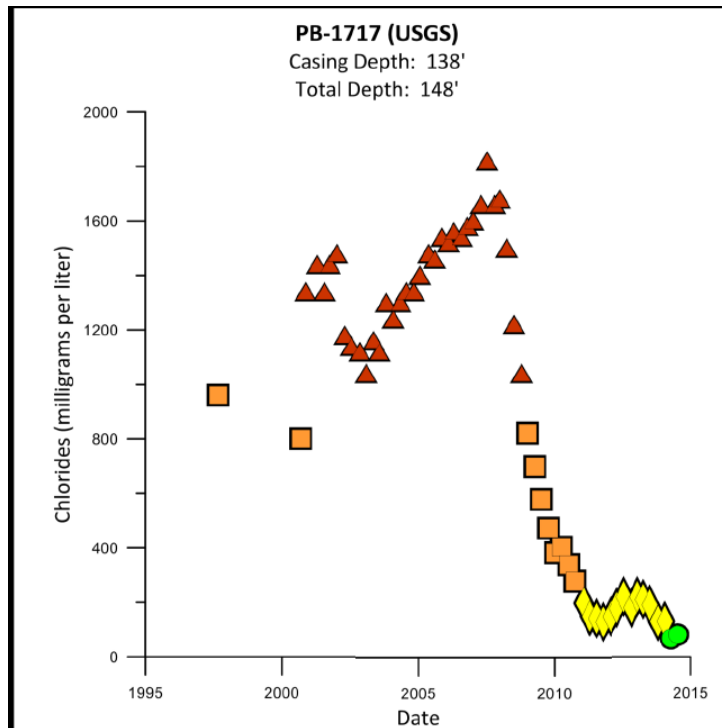
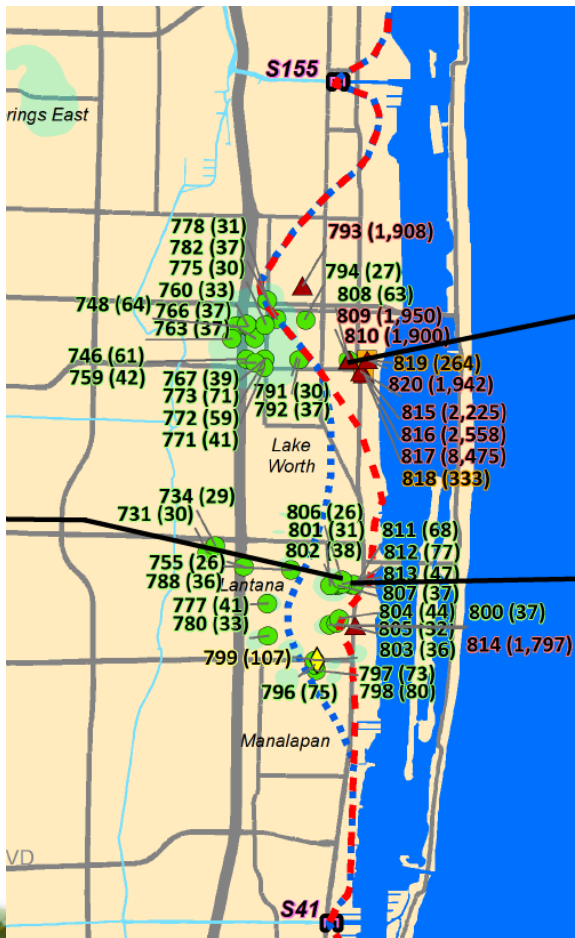
# Tidal Flooding

Credit: Joseph Park (SFWMD)  
Ocean Avenue, A1A



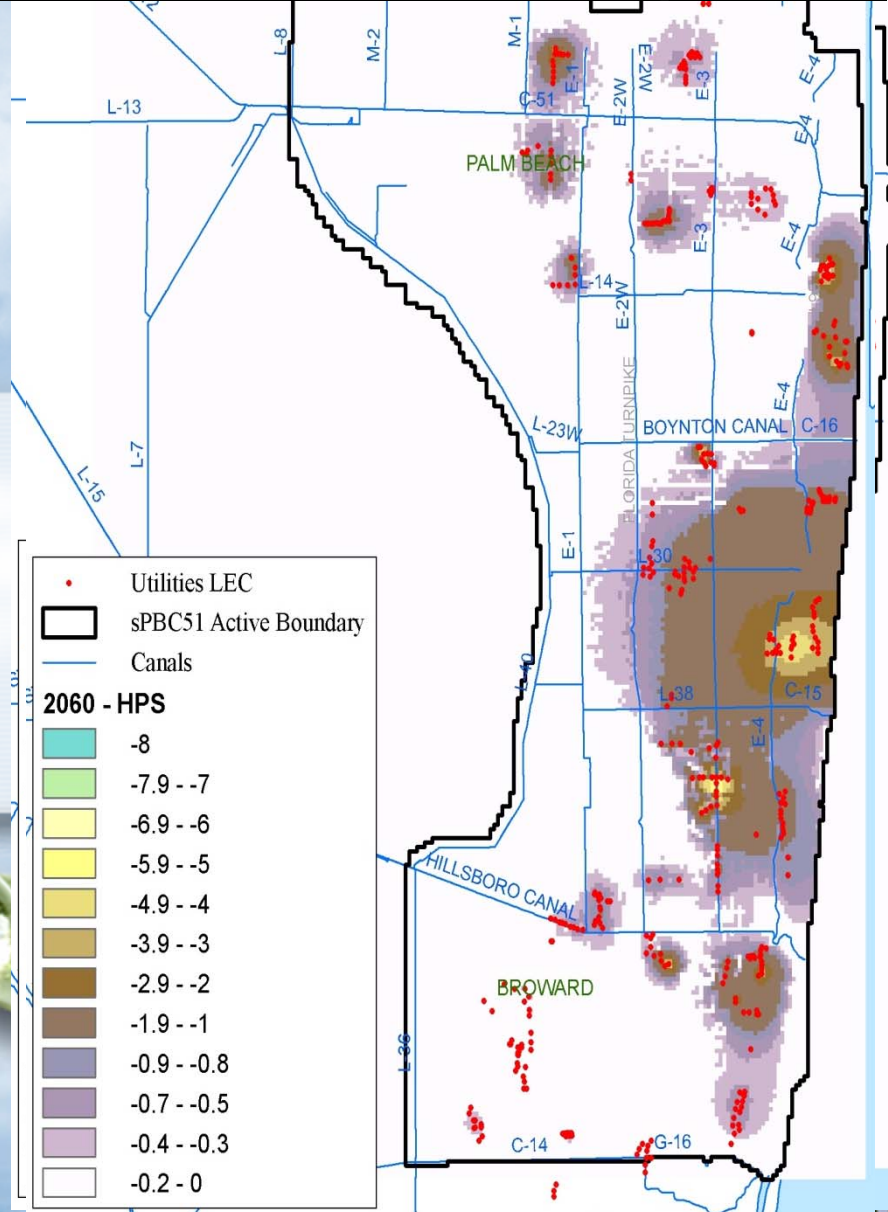
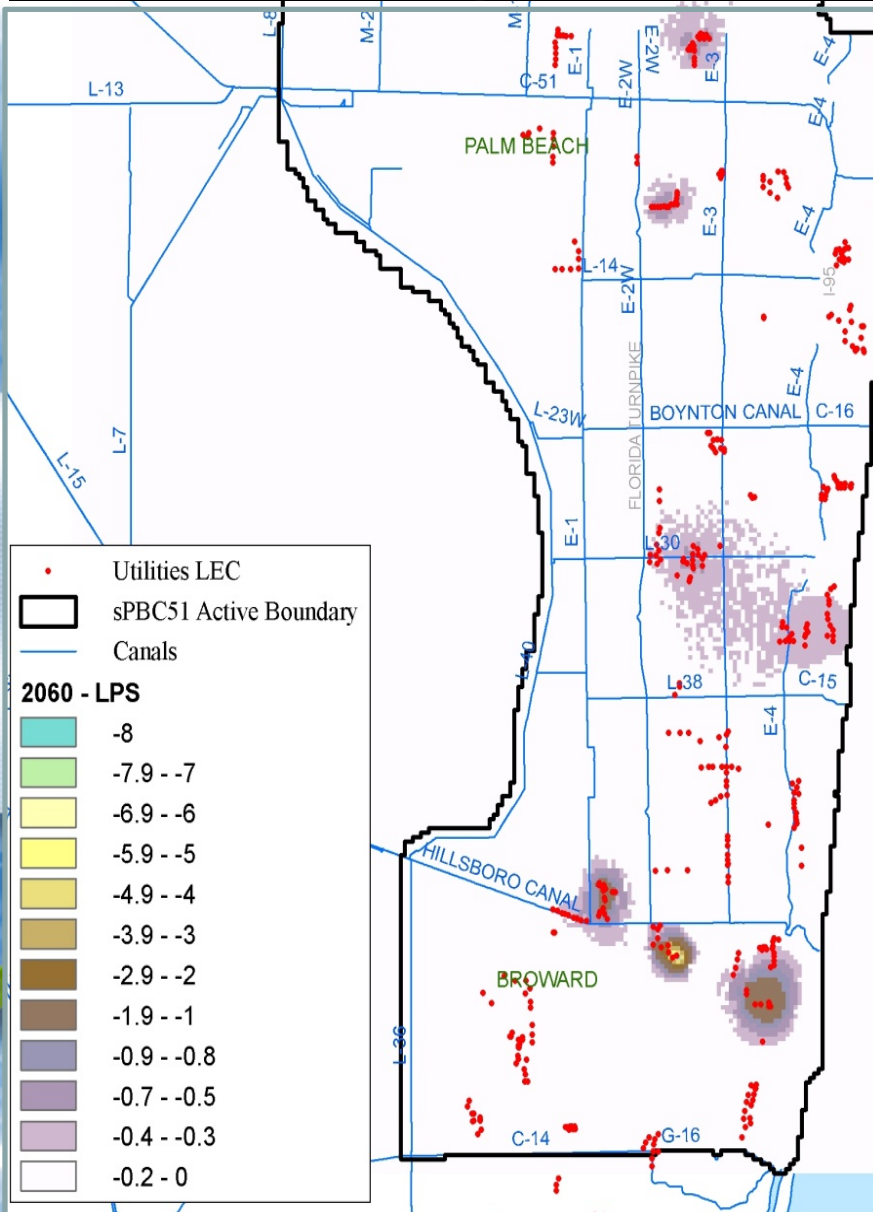


# Saltwater Intrusion Front: 2009 vs. 2014



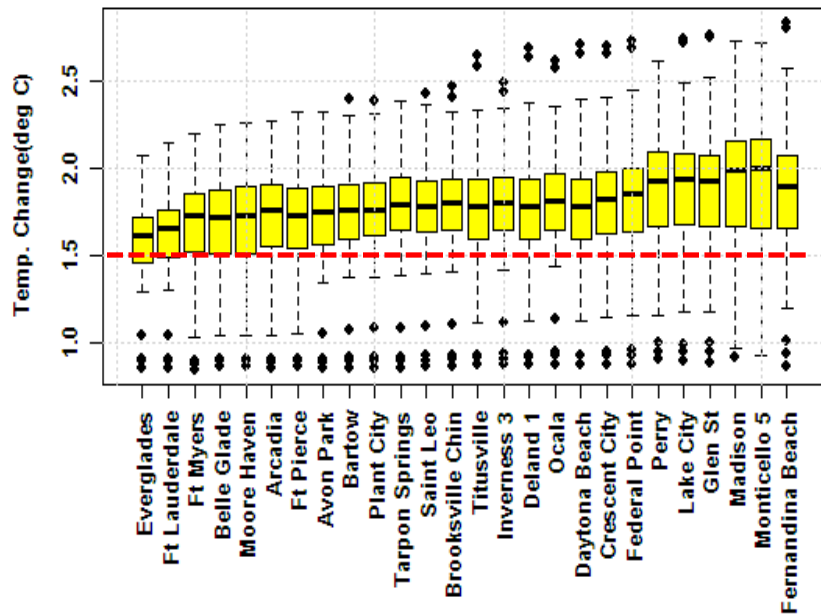
# Drawdown compared to BASE Option 1

# Option 2

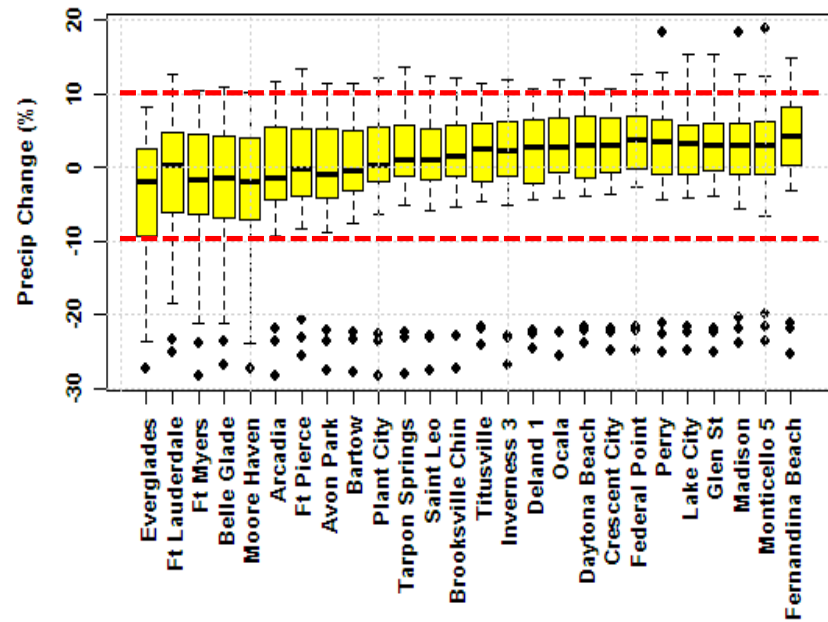


# Spatial Trends of Temperature & Rainfall

A2 Scenario

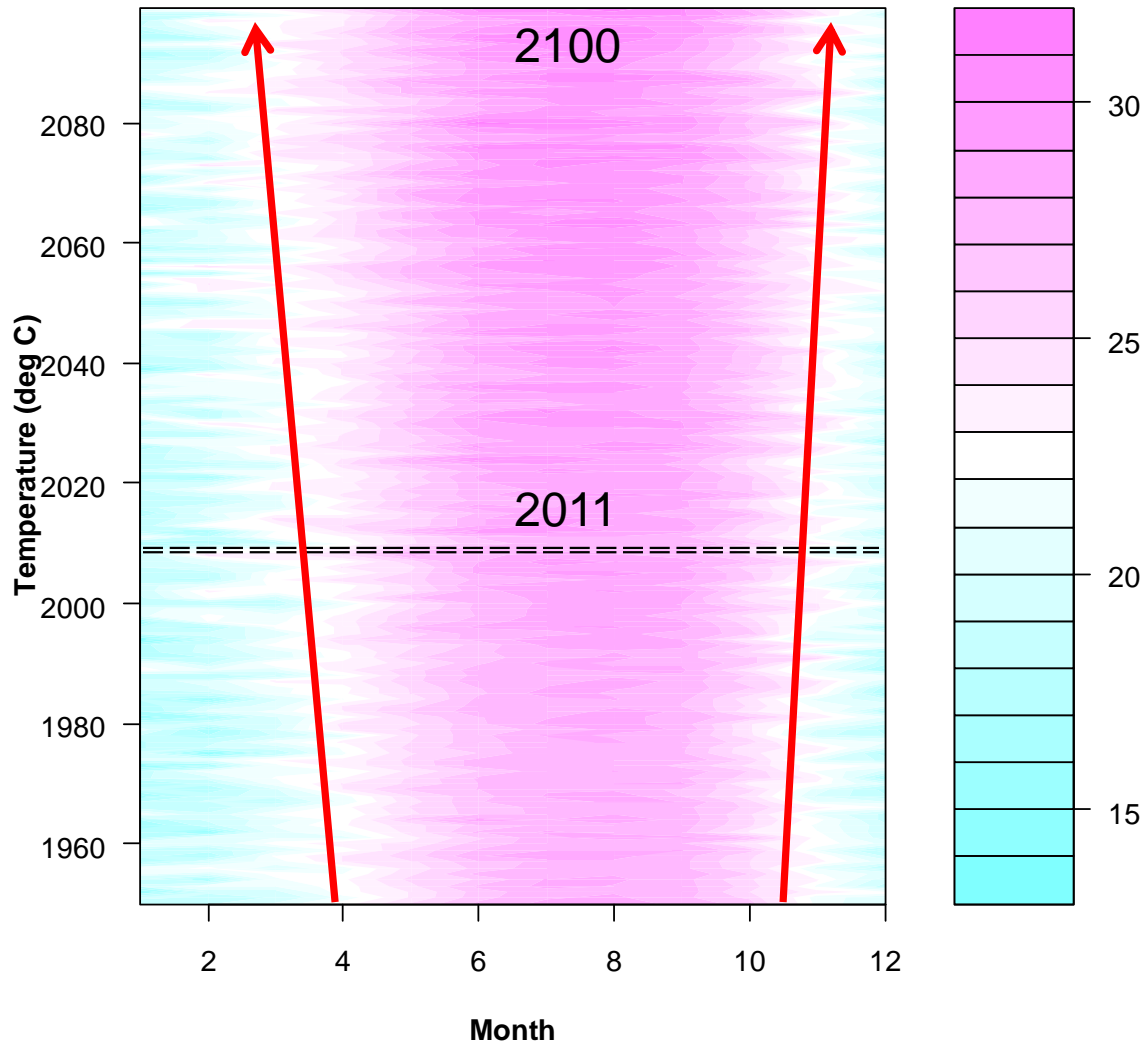


A2 Scenario



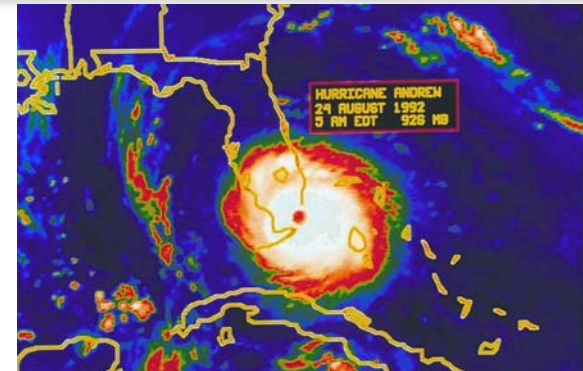
# Hotter and Longer Summer?

Everglades

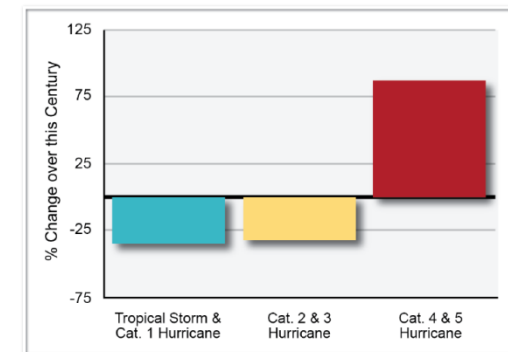


# Tropical Storms & Climate Change

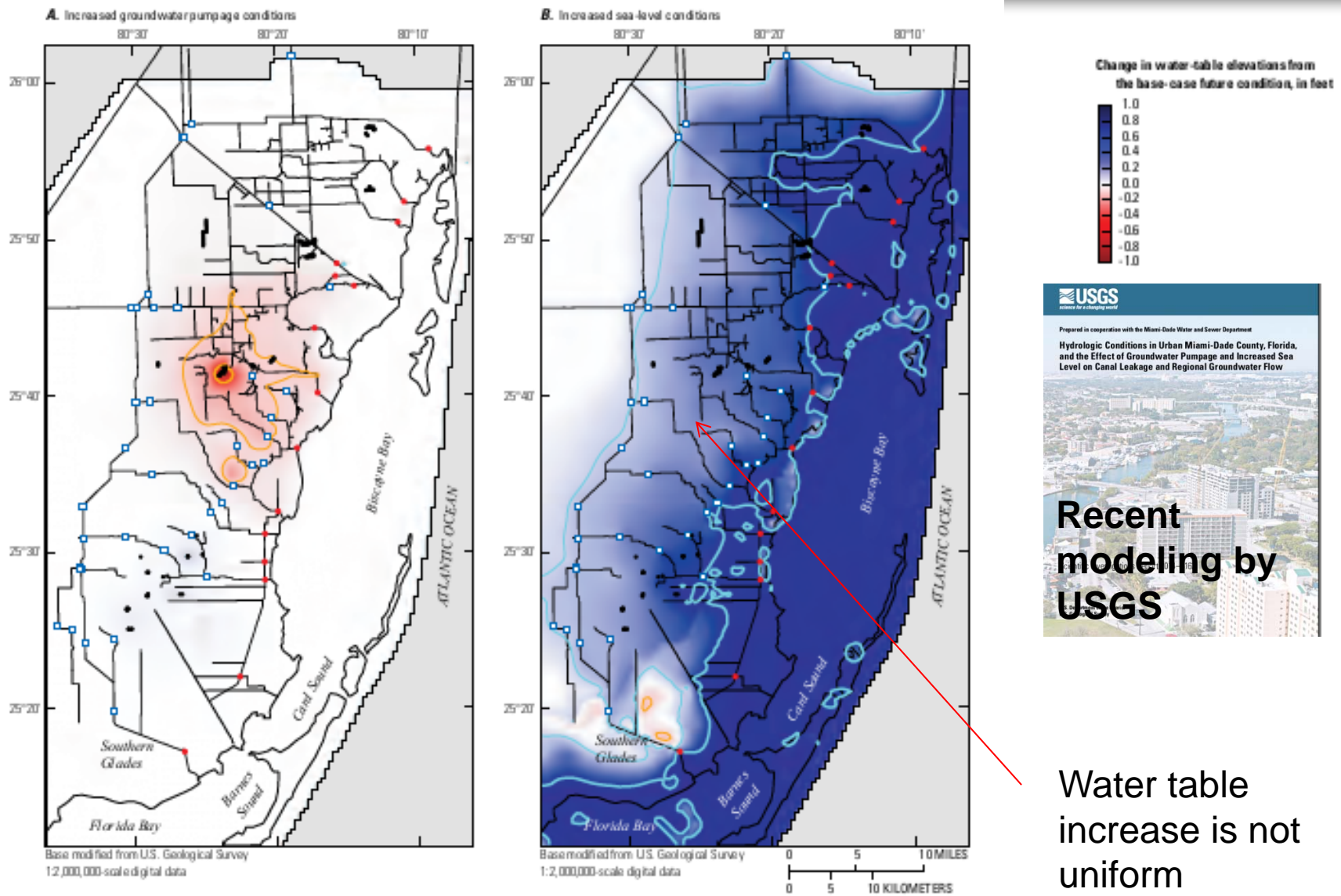
- Tropical cyclones to shift towards strong storms (2-11% intensity increase by 2100)
- Decrease in global frequency of tropical cyclones (6-34%)-**recent paper says this will increase!**
- Increase in the frequency of the most intense cyclones
- Increase in rainfall rate, 20% within 100 km of storm center



Projected Changes in Atlantic Hurricane Frequency by Category



# Change in Water Table: Pumping (decrease) & Sea Level Rise (increase)



# SOUTH FLORIDA WATER MANAGEMENT DISTRICT

## Historic Palm Beach Flooding January 9-10 2014



# Recent Global Mean Sea Level Projections

- Update to USACE guidance
- Sea Level Rise projections from IPCC Assessment Report V (AR5)
- NOAA scenario projections (NOAA 2012) developed for the most recent National Climate Assessment (NCA, 2014)
- National Research Council (NRC 2012) projections for West coast of the United States
- Sea Level Rise projections issued for state-level planning. These include the states of Maryland, Massachusetts, and New York
- Probabilistic Projections that have become available recently in the literature (Kopp et. al. 2014; Jevrejeva et al. 2014)





# For South Florida Sea Level Rise is a bigger concern in the near future

