# South Florida Water Management District

## RESILIENCY COORDINATION FORUM
## AGENDA

December 3, 2025
9:30 AM
District Headquarters, B-1 Auditorium
3301 Gun Club Road
West Palm Beach, FL 33406

FINAL

1. Welcome and Introduction - Carolina Maran, Ph.D., P.E., Division Director of Flood Control and Water Supply Planning, Chief of District Resiliency, SFWMD

2. Statewide Office of Resilience - Charles Jacoby, Ph.D., Strategic Program Director, The Florida Flood Hub for Applied Research and Innovation

3. District Resiliency Updates - Carolina Maran, Ph.D., P.E., Division Director of Flood Control and Water Supply Planning, Chief of District Resiliency, SFWMD

4. Polk County Comprehensive Vulnerability Assessment 200- and 500-Year Modeling and Visualization Project - Tabitha Biehl, Director of Parks and Natural Resources Division, Polk County; Jennifer Hecker, Executive Director, Coastal & Heartland National Estuary Partnership; and Adrian Santiago Tate, Chief Executive Officer and Co-Founder, HighTide

5. Statewide Coupled Atmosphere-Ocean Regional Climate Model - Vasu Misra, Ph.D., Professor of Meteorology, Florida State University

6. Break

7. Update on the Lower East Coast Water Supply Vulnerability Assessment - Peter Kwiatkowski, P.G., Resource Evaluation Section Administrator, SFWMD

8. C&SF Flood Resiliency Study Updates - Tim Gysan, P.E., Resilience Senior Project Manager, USACE; Eva Velez, P.E., Ecosystem Branch Chief, USACE; Jennifer Smith, Project Manager, USACE; and Carolina Maran, Ph.D., P.E., Division Director of Flood Control and Water Supply Planning, Chief of District Resiliency, SFWMD

9. Around the Table Updates from Local, State, and Tribal Partners

10. Public Comment

11. Closing Remarks - Carolina Maran, Ph.D., P.E., Division Director of Flood Control and Water Supply Planning, Chief of District Resiliency, SFWMD

12. Adjourn

Final Presentations:

**Agenda Item Background:**

03 Maran District Resiliency Updates
04 Biehl, Hecker, Tate Polk County CVA
05 Misra Statewide Coupled Atmosphere
07 Kwiatkowski LEC WS Vulnerability
11 Maran Closing Remarks

# District Resiliency Updates

## Resiliency Coordination Forum – December 3, 2025


**Carolina Maran, Ph.D., P.E.**

**Division Director, Flood Control and Water Supply Planning**

**Chief of District Resiliency**

**South Florida Water Management District**

# Flood Control /Resiliency Unit - Team Updates

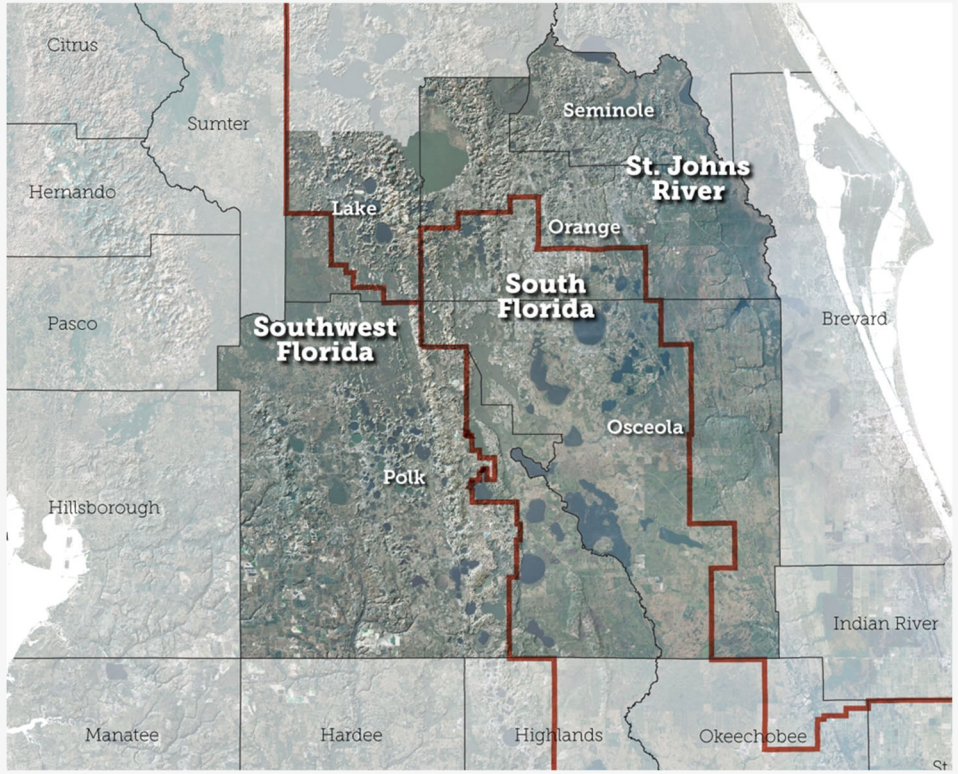
## This month we welcomed a new team member!

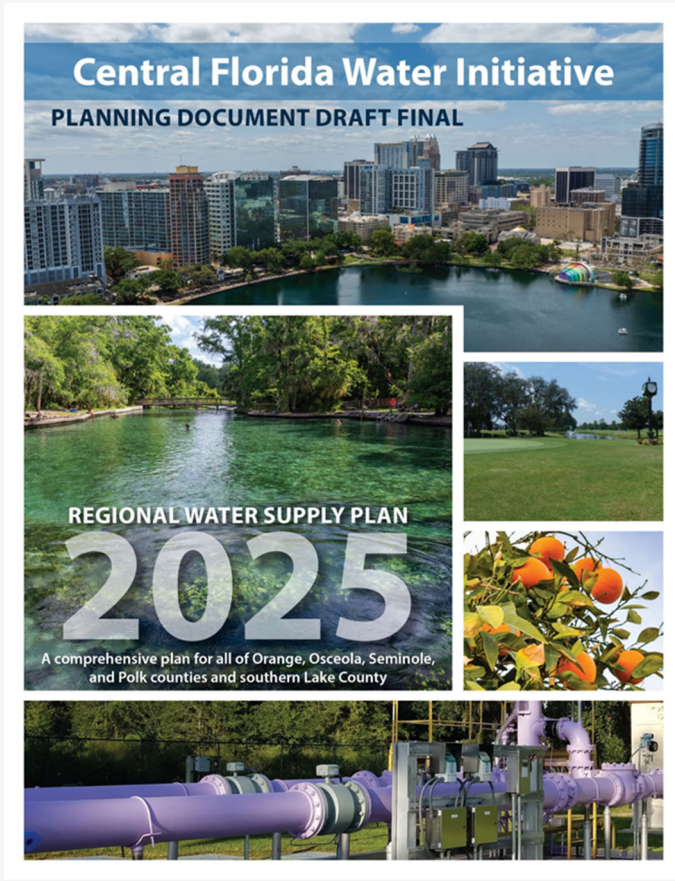
**Robert Wanvestraut**, MS. – Principal Project Manager, will be responsible for preparing federal, state, and other grant applications, as well as providing project management support for implementation projects. He will work closely with the Engineering and Construction, Permitting, and Real Estate teams, to ensure that recently awarded grant projects are implemented successfully and on schedule.

## We also have Tarana Solaiman appointed as the New Unit Lead!

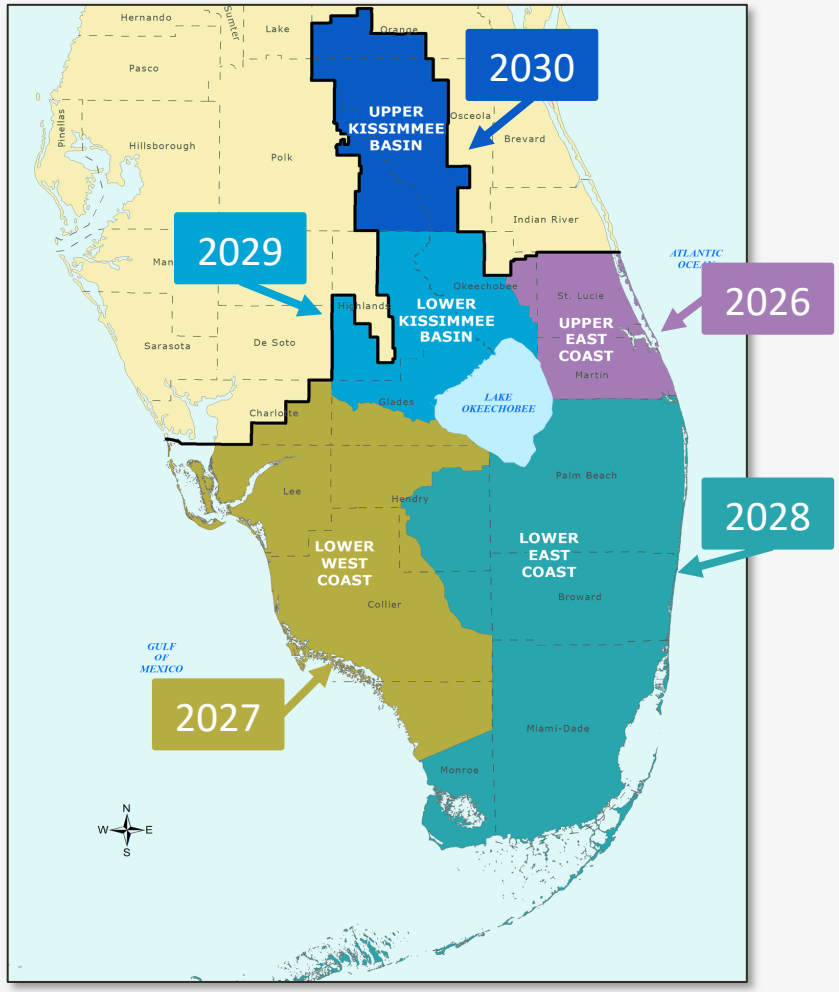
# 2025 CFWI Regional Water Supply Plan Approved at the November Governing Board Meeting

## CFWI Planning Area



# Water Supply Plans: Next Round of 5-year Updates




- 20-year planning period
- Demand estimates and projections
- Resource analyses
- Issue identification
- Evaluation of water source options
- Water resource development
- Responsibility of water management district
- Water supply development
- Responsibility of water users
- Environmental protective and restoration strategies
- Review/update prevention and recovery strategies for minimum flows and minimum water levels (MFLs)

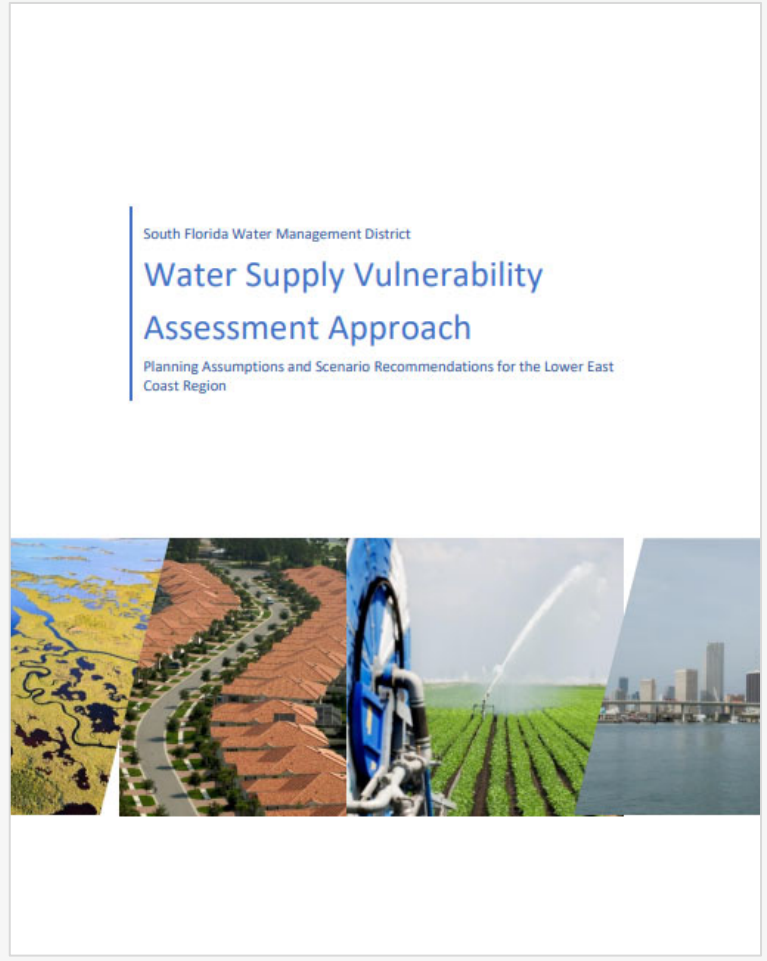
# Water Supply Vulnerability Assessment Update

## Modeling Effort

- Utilize the East Coast Surficial Model (ECSM) – Upper/Lower East Coast
- 50-year look ahead (2075) at growth
- Sea Level Rise Intermediate Curves and Future Climate Scenarios
- Characterize future potential impacts on water supply sources
- Future iterations will inform strategies and projects to build resiliency

## Current Status

- Model data inputs under development:
  - Drought rainfall, ET & temperature data - COMPLETE
  - Future land use - COMPLETE
  - Future population distribution per utility service area - COMPLETE
  - Public supply and irrigation well withdrawals – in progress
- Model runs anticipated in summer 2026



# Future Water and Climate Scenarios Workgroup

## Ongoing Efforts

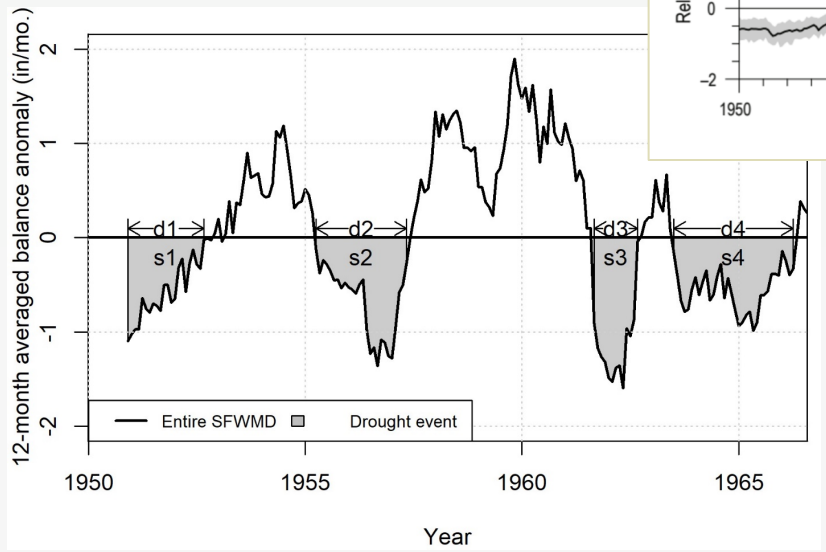
- **Drought** (deficit anomalies, supporting **WSVA**)
  - GCM scenarios selection / bias correction / spatial transformation
  - Technical Memorandum

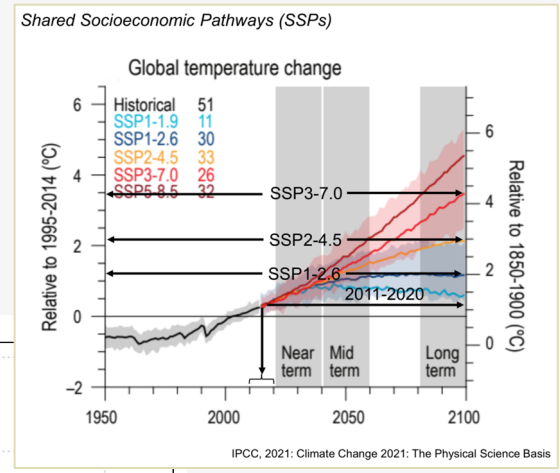
- **Statewide Coupled Ocean-Atmospheric Regional Model**
  - Baseline Reference Period – review and input
  - Simulations for Planning Horizons – review and input

## Upcoming and Planned Efforts

- Rainfall (long term planning)
- Multidecadal Variations (AMO)
- and more

Characterizing projected future droughts for south Florida (2056–2095) | Stochastic Environmental Research and Risk Assessment



# Water and Climate Resilience Metrics Update

## 2026 South Florida Environmental Report (SFER)

- **Chapter 2A:** Water Year 2025 Hydrology, Water Management, and Event Summaries
- **Chapter 2B:** Long-term Trends in Rainfall, Drought, High Tide Events at Coastal Structures, and Saltwater Intrusion

### Important Dates

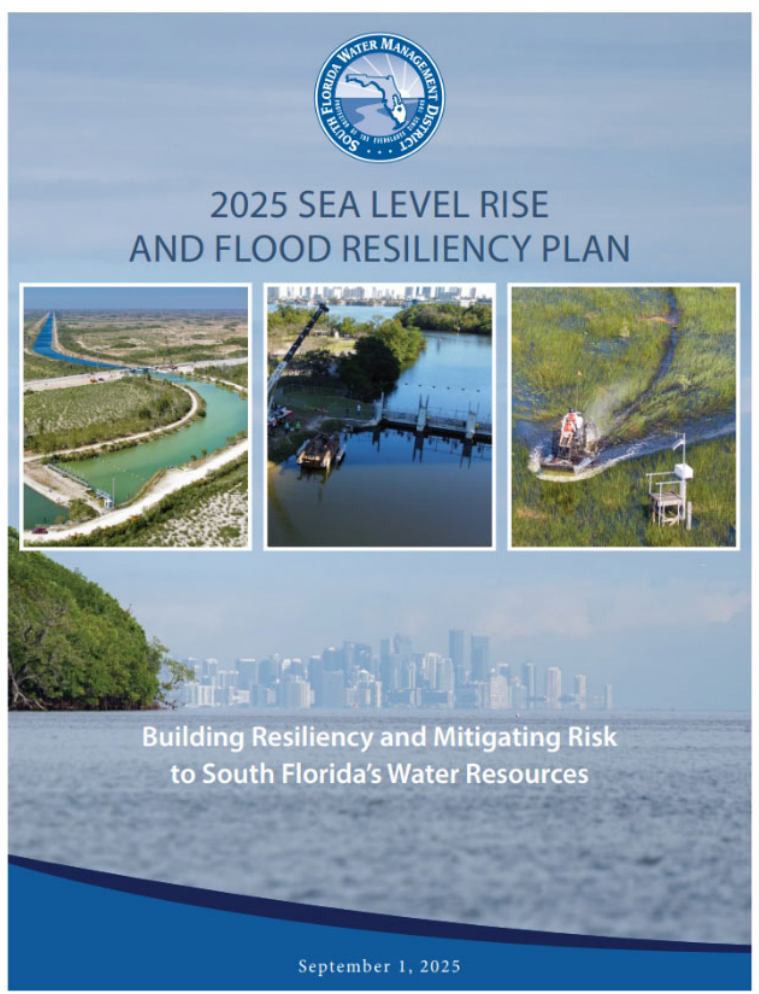
- November 21, 2025 – Public Review Period Ends
- December 5, 2025 – Author's Responses to Public Review Due
- March 1, 2026 – Publication Date
- March 11 and 12, 2026 – Open House

## 2027 Reporting

Planning for analyses is underway.

# 2026 Resiliency Project Ranking

- **2025 Sea Level Rise and Flood Resiliency Plan is published**
- **2026 Resiliency Project Updates is ongoing**
- **Efforts Underway**
  - Development of a dashboard tool that will host, consolidate, and make project data and progress tracking easily accessible.




SFWMD.gov/FloodResilienyPlan

2025 SFWMD Priority Resiliency Projects Map

# FPLOS Program Updates – Ongoing Studies

- St. Lucie/Martin Counties FPLOS Phase I & II Study
  - LOX Calibration and Validation is completed
  - St. Lucie Calibration and Validation is ongoing
- C-7 Basin (Miami-Dade County) FPLOS Phase II Study
  - Strategically Selected Plan (SSP) being finalized, along with Water Quality Assessment; Public Meeting in Spring 2026
- Western Basins (Hendry & Collier Counties) FPLOS Phase I Study
  - Model Calibration and Validation is completed
  - Level of Service for Current Conditions is ongoing
- Taylor Creek/Nubbin Slough FPLOS Phase I Study
  - Data Collection and Model Development is ongoing
- Targeted FPLOS Phase II Study at UKB, to support basis of design

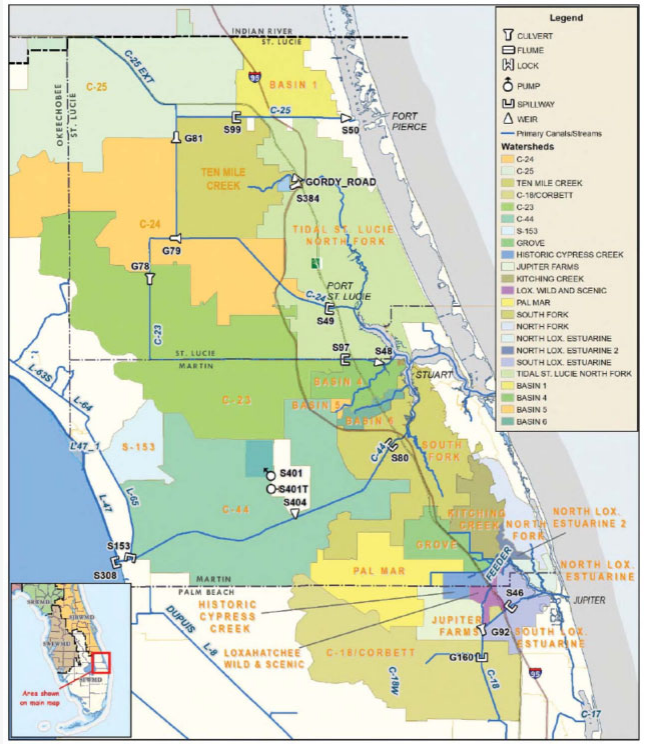


Figure 1: St Lucie/Indian River and Loxahatchee System FPLOS Study Areas

Phase I: Flood Vulnerability Assessment
Phase II Adaptation and Mitigation Planning

# Implementation Projects

- **FDEM/FEMA HMGP Grants Implementation:**
  - Environmental and Historic Preservation Deliverables submitted for **S-27, S-28, S-29 CS** Projects (Reach B)
  - Draft MOAs with key stakeholders ongoing
  - Planned Construction Start: Summer 2026
- **FDEP Resilient Florida Grants Implementation:**
  - 3 new grant award received for FY25-26
  - Periodic Site visits and quarterly reports
- **FDEP Innovative Tech Grant Implementation:**
  - WIPE OUT project, in collaboration with Miami-Dade County – design is complete
  - Governing Board approval received in November 2025 to initiate construction

# Implementation Projects (continued)

*Ongoing Coordination with project partners and key stakeholders*

## C-9 Basin / S-29 Structure

- Ongoing Meetings with MDC

## C-8 Basin / S-28 Structure:

- Commissioner's Meeting on C-8 Basin Project – October 7, 2025
- Additional Future Public Workshop in early 2026

## Other Projects:

- Additional Design and Real Estate Coordination efforts

# Resilient Florida Grants

Spent about 25% of grant funds, for all awarded planning and construction projects; representing about 35% of already executed grants

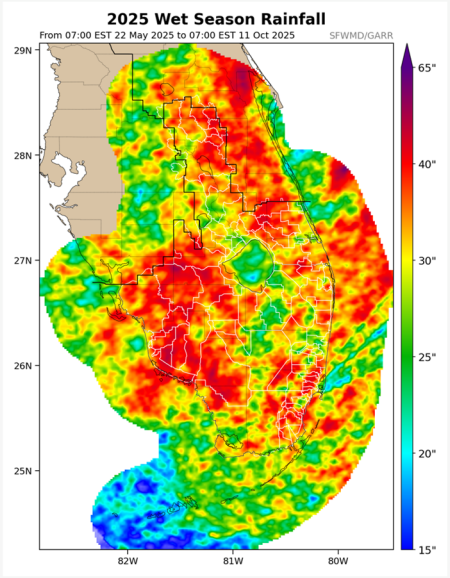
Working on invoicing and 37 contract amendments with vendors to comply with grant requirements

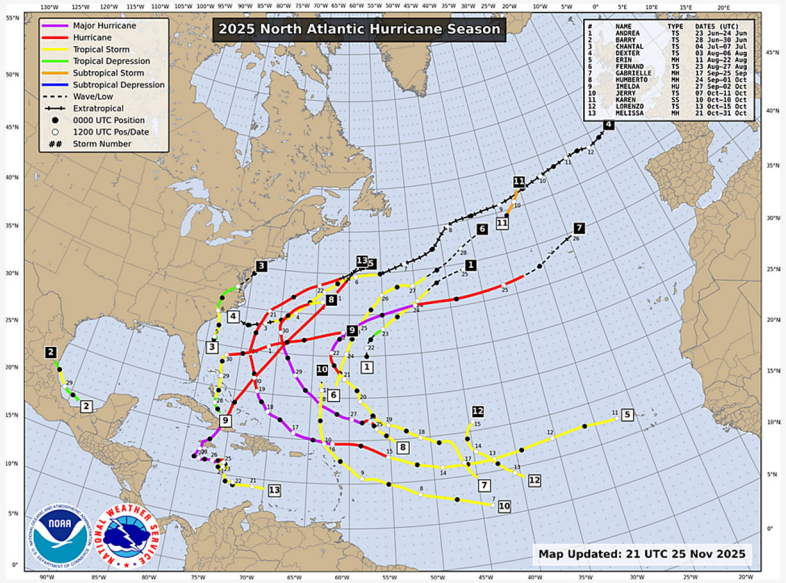
# 2025 Flood Documentation

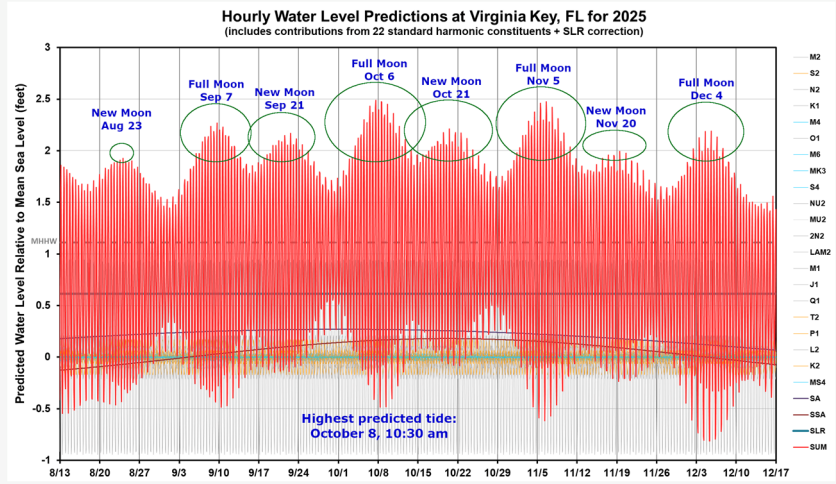
## *Update: Flood Observations Post-Processing Is Kicking Off!*

**We'll share findings as they become available – keep an eye out for updates.**

- **Wet Season:** May 22, 2025 - October 10, 2025
- **Hurricane Season:** June 1, 2025 - November 30, 2025
- **King Tide Season:** September 1, 2025 – December 7, 2025



# Call for Flood Data

## We welcome flood observations from recent events

- King Tides
- Heavy and extreme rainfall

sfwmd.gov/FloodingApp

Scan the QR Code

# Interagency Floodplain Management Services

## *"Flood Observations – Regional Coordination and Community Engagement"*

**Project Motivations:**

- Part of a multi-year, multi-phase Silver Jackets initiative.
- Completed flood model inventory in April 2025.
- Sister effort to the Community Guidebook to Flood Modeling project.

**Project Goals:**

- Define and document flood data collection processes.
- Map and identify existing tools for flood data acquisition.

**Project Deliverables:**

- Statewide Flood Data Collection Tool.
- Statewide Flood Data Repository.


***Current Partner Role: Help Identify currently available tools***

# C&SF Flood Resiliency Studies – Broward Basins (Section 203)

## Upcoming Public Meeting: Thursday, December 18, 2025

- Tentatively Selected Plan & Initial Design Plans
- Draft Integrated Feasibility Report and Environmental Evaluation Published and Open for Public Comments
- Parallel NEPA Environmental Assessment and Federal Consultation by USACE
- Ongoing Independent Reviews and USACE certifications

**PUBLIC MEETING: CENTRAL AND SOUTHERN FLORIDA (C&SF) FLOOD RESILIENCY STUDY– BROWARD BASINS**

**AGENDA**

December 18, 2025
10:00 AM
Broward County Government Center West
1st Floor MAP Meeting Area
1 North University Drive, Suite 1400A
Plantation, FL 33324

Zoom Registration Link:
https://broward-org.zoomgov.com/meeting/register/ivVA3eigS5uBevgf55JOgQ#/registration

1. Welcome and Opening Remarks – Broward County Representative (TBC); and Carolina Maran, Ph.D., P.E., Division Director of Flood Control and Water Supply Planning, Chief of District Resiliency, SFWMD
2. Tentatively Selected Plan (TSP) – Walter Wilcox, Bureau Chief, Water Resources Systems Modeling, SFWMD
3. Draft Integrated Feasibility Report and Environmental Evaluation – David Griffin, CFM, PWS, Resiliency Project Manager, SFWMD
4. Next Steps – David Griffin, CFM, PWS, Resiliency Project Manager, SFWMD
5. Public Comment
6. Closing Remarks – Carolina Maran, Ph.D., P.E., Division Director of Flood Control and Water Supply Planning, Chief of District Resiliency, SFWMD
7. Adjourn

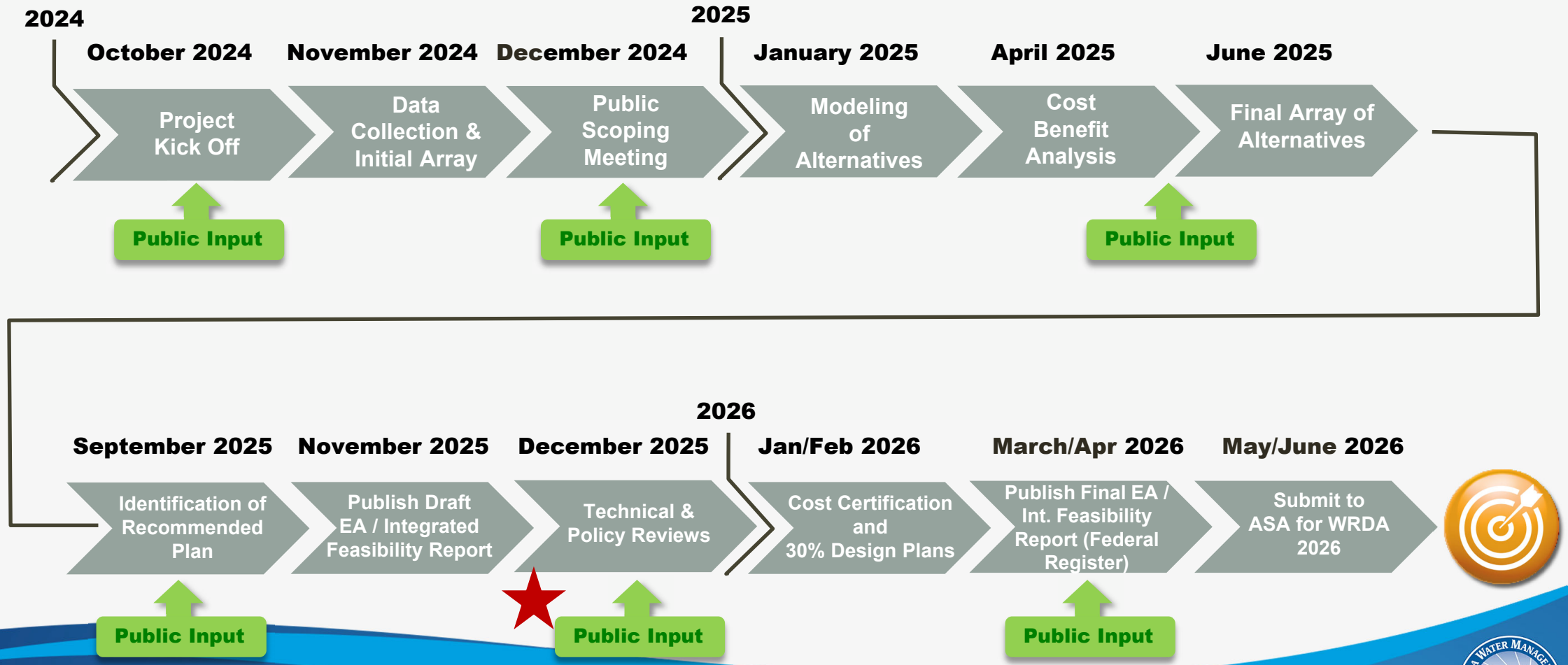
C&SF Flood Resiliency Study – Broward Basins Agenda of the South Florida Water Management District – December 18, 2025

Register Here

Visit www.sfwmd.gov/C&SF for more information.

# Project Schedule

Targeting June 2026 - Deliver Final Integrated Feasibility Report and Environmental Assessment (EA) to ASA Civil Works



# POLK COUNTY CVA ADDED 200 AND 500 YEAR MODELING AND VISUALIZATIONS PROJECT

*December 3, 2025 Resiliency Forum Presentation*


**Presenters:**

- **Tabitha Biehl, Parks and Natural Resources Director, Polk County**
- **Jennifer Hecker, Executive Director, Coastal & Heartland National Estuary Partnership**
- **Adrian Santiago Tate, CEO and Cofounder of HighTide**

POLK COUNTY

COASTAL & HEARTLAND NATIONAL ESTUARY PARTNERSHIP

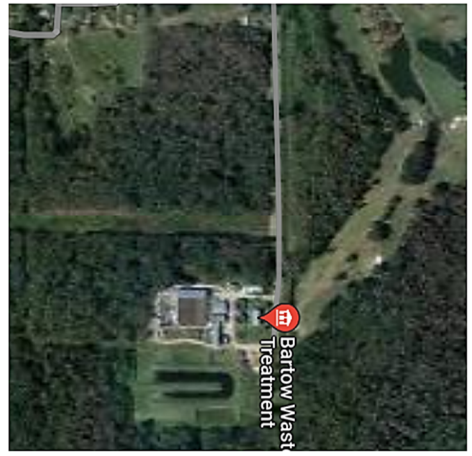
HighTide
Empowering Resilient Living ®

# Polk CVA Overview

- Polk County received Resiliency Florida state funding to do its baseline Comprehensive Vulnerability Assessment (CVA)
- Polk contracted the Central Florida Regional Planning Council (CFRPC) to do the baseline CVA
- CVA has been underway and is expected to be finished by 3/30/2026
- Polk Adaptation 200 and 500 Yr Analysis also underway and will be appendices to the CVA. This is the CHNEP-funded portion of the project that it has been working with the CFRPC, Hightide, and Halff Associates to do.

Example: Wauchula Wastewater Treatment Plant
2017 Google Earth

Example: Wauchula Wastewater Treatment Plant
Image Credit: Fox 35 - Sept. 29, 2022 (Hurricane Ian)




Before

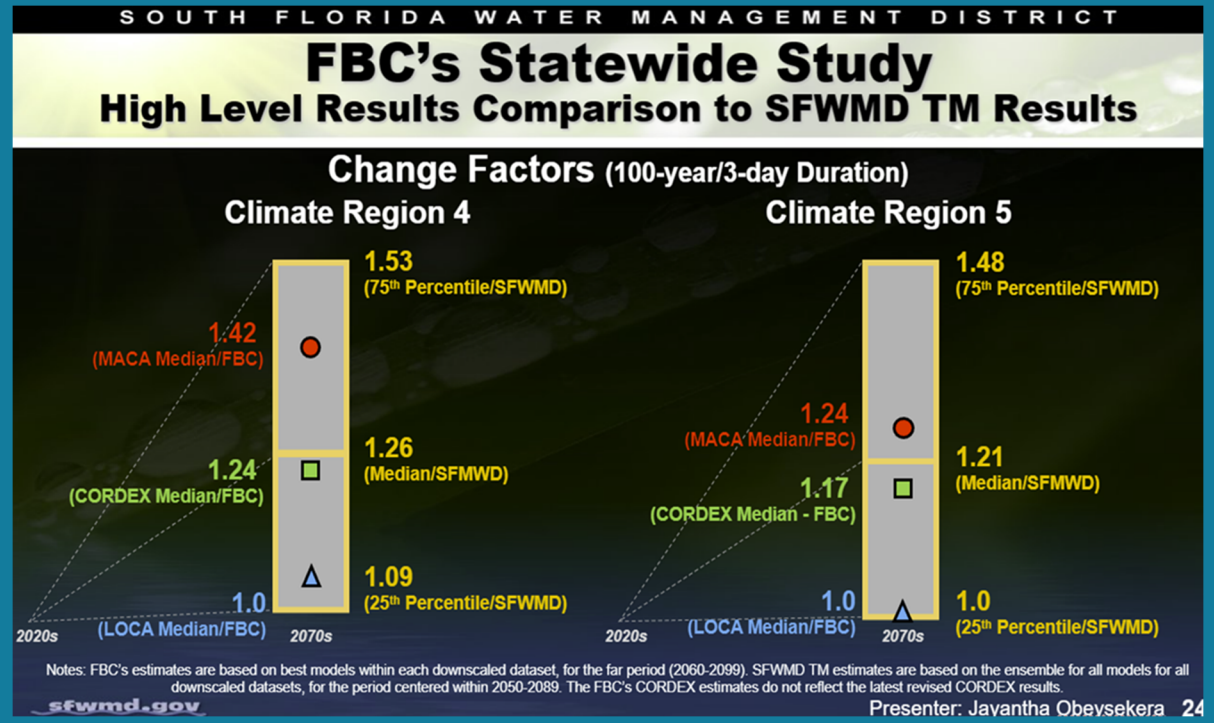
After

Bartow WWTP - POST HURRICANE IAN

# Polk CVA Data Collection and Rainfall Analysis

- **Acquired Background Data including**
  - ➢ **Critically / Regionally Significant Assets**
    - Transportation and Evacuation Routes
    - Critical Infrastructure
    - Critical Community and Emergency Facilities
    - Natural, Cultural, and Historical Resources
  - ➢ **Topographic Data**
    - Digital Elevation Model
    - 2018 FL LiDAR
  - ➢ **Flood Scenario-related Data**
    - Precipitation (NOAA Atlas 14 rainfall)
    - Land use
    - FEMA FIRMs
    - Soil Data
    - Building Outlines

- **Rainfall Analysis**
  - ➢ **Used change factors from FIU Florida Building Commission Study**
  - ➢ **CORDEX data is available statewide and CORDEX is the median range of the data**

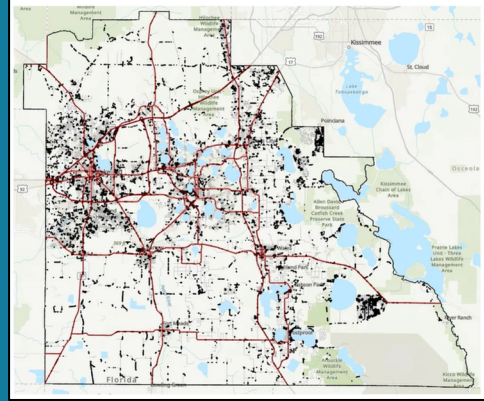


# Polk CVA Exposure Analysis

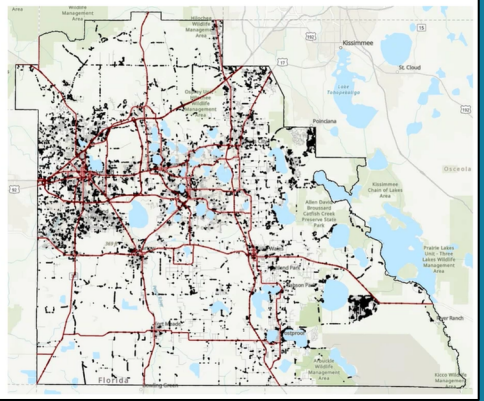
- Identification of depth of water caused by various flooding
- 2040 and 2070 year projections
- Includes data such as critical assets owned or maintained by the municipality/county
- Uses the most recent Digital Elevation Model data
- Yielded maps of impacted transportation and other critical assets

Impacted Transportation Network

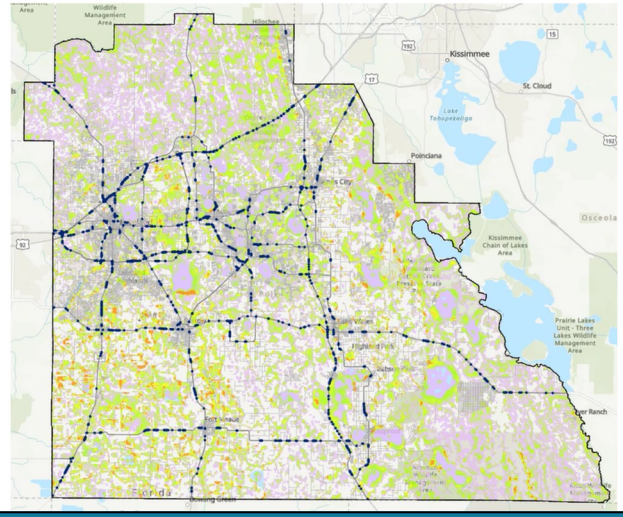
2040 Flow



2070 Flow



Impacted Transportation Evacuation Routes 2040



# Polk CVA Sensitivity Analysis

**Sensitivity was looking at degree of risk based on level of inundation, using Zonal Statistics and Percent Inundation by Area:**

## Zonal Statistics

- footprint of an asset was defined, and the minimum elevation came from the DEM
- finished structures were assumed slab-on-grade, and the finished floor elevation was the minimum DEM elevation plus one foot

## Percent Inundation by Area

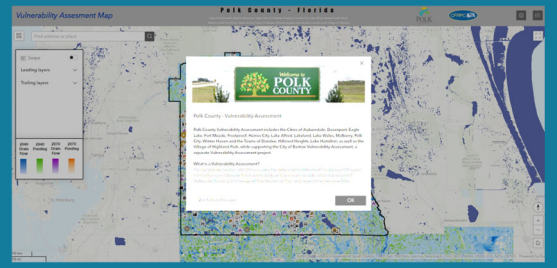
- total area and the total flooded area of an asset are compared to determine the amount of flooding impacting the asset.
- results are reported as percentage by area

| | Polk Evacuation Routes | 2040 - (Near) Inundation | | | 2070 - (Far) Inundation | | |
|---|---|---|---|---|---|---|---|
| FACILITY | Sum of Length | Count | Sum of Length | % | Count | Sum of Length | % |
| 1ST ST NE | 4,488.96 | 4 | 929.73 | 20.71% | 6 | 1016.02 | 22.63% |
| 5TH ST | 343.69 | 7 | 613.64 | 178.54% | 9 | 652.04 | 189.71% |
| AIRPORT ROAD | 1,059.40 | | | 0.00% | | | 0.00% |
| BROAD ST | 47,798.48 | | | 0.00% | | | 0.00% |
| COMBEE RD | 12,361.95 | 9 | 933.04 | 7.55% | 21 | 2203.60 | 17.83% |
| CR 559 | 17,262.28 | 62 | 5188.64 | 30.06% | 95 | 5366.03 | 31.09% |
| CYPRESS GARDENS BLVD | 17,507.78 | 92 | 4717.34 | 26.94% | 101 | 5242.93 | 29.95% |
| DUNDEE RD | 11,521.99 | 38 | 2725.65 | 23.66% | 37 | 2902.00 | 25.19% |
| E SEMINOLE AVE | 1,232.74 | | | 0.00% | | | 0.00% |
| E SR 60 | 75,583.18 | | | 0.00% | | | 0.00% |
| E US HWY 92 | 39,487.35 | | | 0.00% | | | 0.00% |
| EAGLE AVE | 1,422.55 | | | 0.00% | | | 0.00% |
| EAST AVE | 10,531.22 | | | 0.00% | | | 0.00% |
| EB OFF RMP TO SR-33 | 306.45 | 1 | 36.12 | 11.79% | 1 | 36.12 | 11.79% |
| EB ON RMP FR SR-33 | 177.03 | | | 0.00% | | | 0.00% |
| EB ON RMP FR SR-539 | 278.27 | | | 0.00% | | | 0.00% |
| EB ON RMP FR US-98 | 364.99 | 10 | 481.67 | 131.97% | 8 | 504.62 | 138.26% |
| HARDEN BLVD | 6,246.94 | 43 | 3543.55 | 56.72% | 51 | 4144.39 | 66.34% |
| I-4 | 103,488.94 | 479 | 38345.04 | 37.05% | 549 | 44444.29 | 42.95% |
| I-4 EB TO I-4 EB | 12,695.20 | 14 | 898.67 | 7.08% | 14 | 943.02 | 7.43% |
| I-4 EB OFF RMP | 606.46 | | | 0.00% | | | 0.00% |
| I-4 EB TO CR-532 SB | 456.69 | 7 | 271.23 | 59.39% | 6 | 430.39 | 94.24% |
| INTERSTATE 4 | 10,936.28 | 93 | 4462.58 | 40.81% | 99 | 4965.53 | 45.40% |
| KATHLEEN RD | 4,157.74 | 15 | 1017.51 | 24.47% | 27 | 1098.38 | 26.42% |
| LAKE SHIPP DR | 137.24 | | | 0.00% | | | 0.00% |
| LAKELAND HIGHLANDS | 2,201.80 | 60 | 2609.06 | 118.50% | 61 | 2932.36 | 133.18% |
| LAKELAND HILLS BLVD | 823.41 | 6 | 1614.81 | 196.11% | 7 | 1666.92 | 202.44% |
| LUCERNE PK RD | 18,747.26 | 36 | 5765.29 | 30.75% | 41 | 7214.92 | 38.49% |
| MAIN ST | 36,233.74 | 4 | 145.28 | 0.40% | 5 | 145.28 | 0.40% |
| MAIN ST S | 3,281.86 | 12 | 1623.81 | 49.48% | 9 | 1746.93 | 53.23% |
| MLK JR AVE | 2,948.84 | 23 | 967.89 | 32.82% | 24 | 1012.57 | 34.34% |
| Grand Total | 1,510,026.71 | 3798 | 308,767.10 | 20.45% | 4392 | 363,556.47 | 24.08% |

Notes: Routes were divided up to determine inundation which can increase the facility count.

★*To view Polk CVA data, use this QR code here* →

*:*




***This information then was used to do the Additional Flood Modeling that Jennifer and Adrian will cover next...***

# COASTAL & HEARTLAND NATIONAL ESTUARY PARTNERSHIP

- CHNEP is:
  - Funding for this Added Flood Modeling and Visualizations Project with IIJA fed. $$$
  - Providing project management support in:
    - participating in project meetings and reviewing deliverables to provide technical comment
    - disseminating project information to policymakers, general public, and other audiences

CHNEP is also planning to help with the implementation of County's Vulnerability Assessment and Adaptation Action Area Plans long-term.

# Additional Flood Modeling Overview

Prime: HighTide — Empowering Resilient Living

Sub: halff

- H&H HEC-RAS model developed by Halff Associates
- “Rain-on-mesh” simulates runoff and surface water interaction
- **Scenarios:**
  - 200-year, 24-hour event (0.5% Annual Chance)
  - 200-year, 24-hour event (0.5% Annual Chance) with saturated ground conditions
  - 500-year, 24-hour event (0.2% Annual Chance)
  - 500-year, 24-hour event (0.2% Annual Chance) with saturated ground conditions

# Flood Model Rainfall Amounts

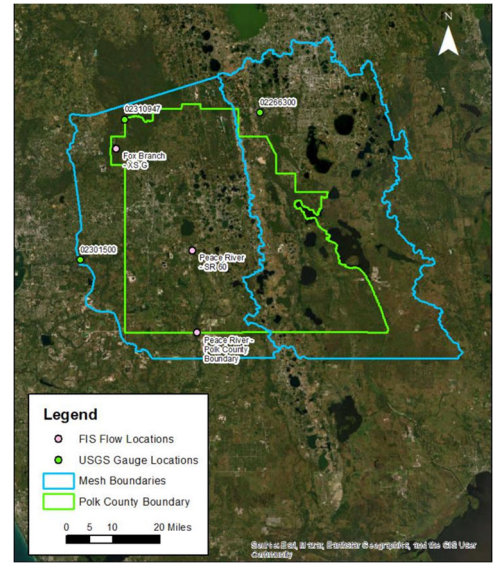
| Return Period (years) | AEP | Total Rainfall (in) | Rainfall w/ ARF (in) |
|---|---|---|---|
| 100 | 1% | 10.5 | 9.98 |
| 200 | 0.5% | 12.3 | 11.69 |
| 500 | 0.2% | 14.8 | 14.06 |

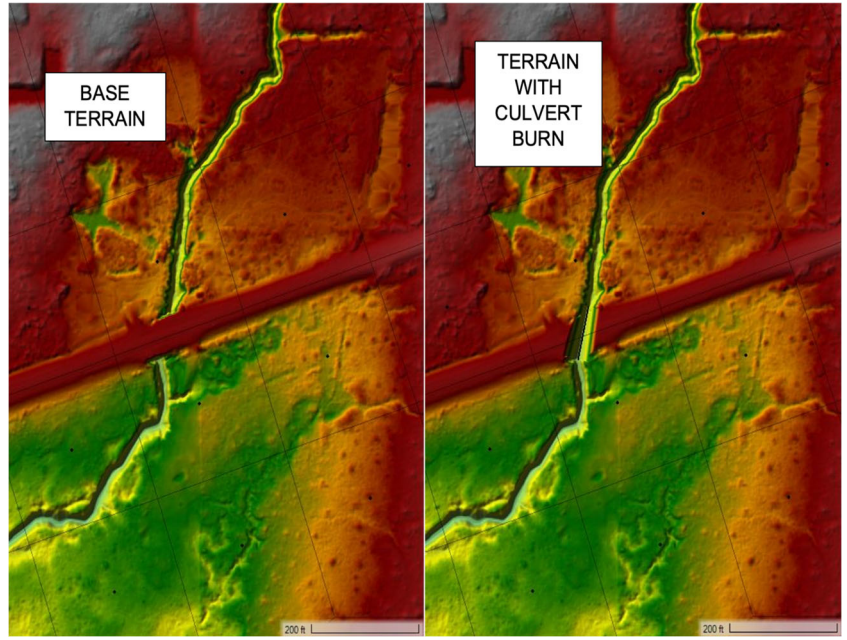
The table lists both the return period and its equivalent Annual Exceedance Probability (AEP) from NOAA Atlas 14 24-Hour Precipitation Data.

The Areal Reduction Factor (ARF) adjusts the total rainfall depth to represent the average rainfall expected across a larger watershed area rather than at a single point.

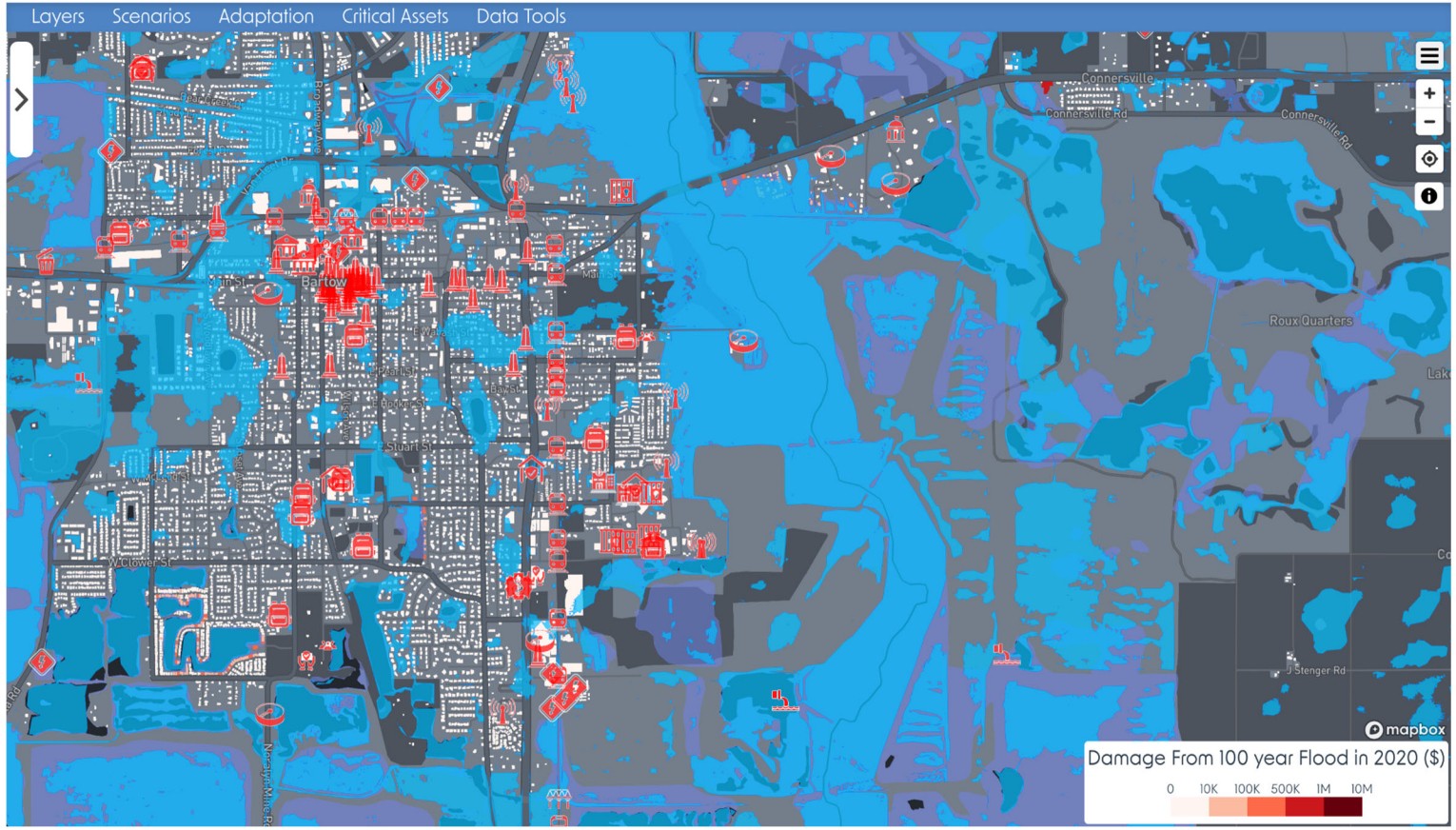
# Flood Model Validation

- Validation through observed flood behavior
- Compare the 100-year flood event with modeled event
- Compared to USGS NWIS and FEMA Flood Insurance Study (2016)
- Adjustments included manual clean-up of breaklines
- Addition of burn lines and terrain corrections



# Exposure Analysis Overview




PRO

# Exposure Summary by Class

200-year

| Asset Class Summary | | | |
|---|---|---|---|
| **Asset Class** | **Total Assets** | **Number of assets in 2025 exposed to a 200-year precipitation event (%)** | **Number of assets in 2025 exposed to a 200-year precipitation event with Saturated Ground Conditions (%)** |
| Critical Community and Emergency Facilities | 762 | 20 (2.6%) | 25 (3.3%) |
| Critical Infrastructure | 4,485 | 551 (12.3%) | 578 (12.9%) |
| Natural, Cultural, and Historical Resource | 6,594 | 382 (5.8%) | 413 (6.3%) |
| Transportation and Evacuation Routes | 609 | 134 (22.0%) | 141 (23.2%) |
| Total | 12,450 | 1,087 (8.7%) | 1,157 (9.3%) |

500-year

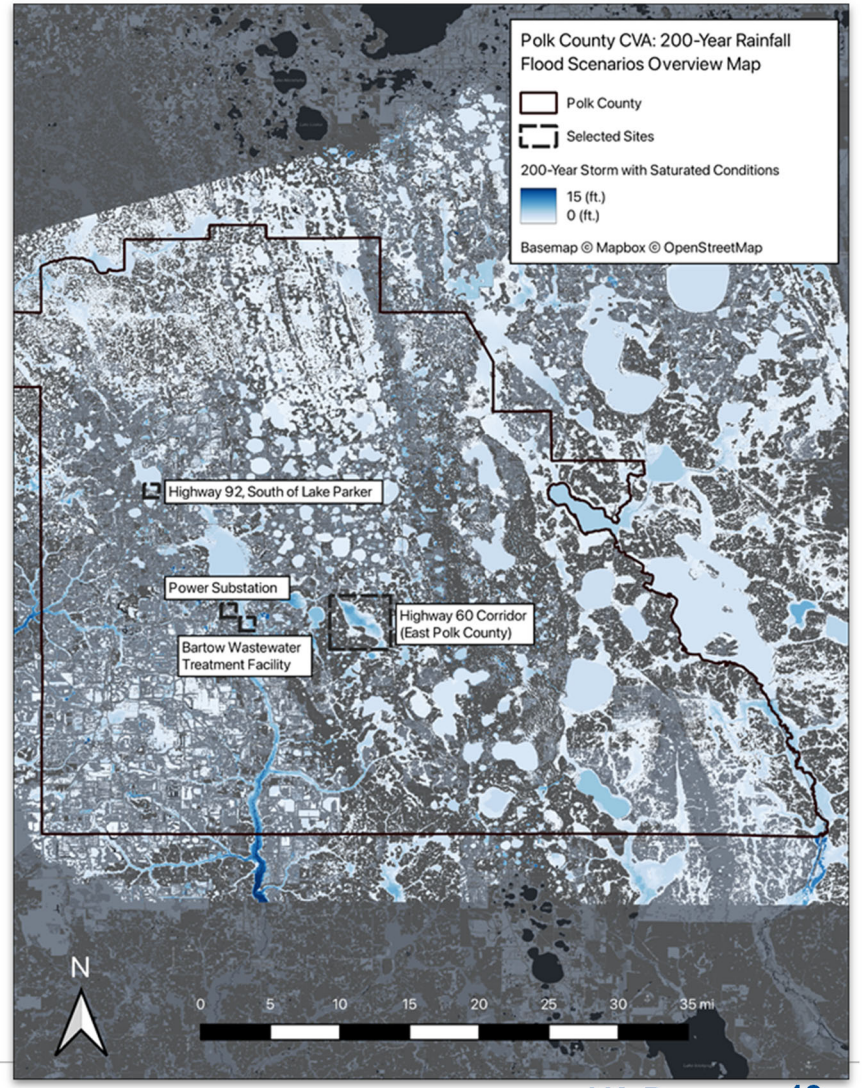
| Asset Class Summary | | | |
|---|---|---|---|
| **Asset Class** | **Total Assets** | **Number of assets in 2025 exposed to a 500-year precipitation event (%)** | **Number of assets in 2025 exposed to a 500-year precipitation event with Saturated Ground Conditions (%)** |
| Critical Community and Emergency Facilities | 762 | 26 (3.4%) | 32 (4.2%) |
| Critical Infrastructure | 4,485 | 618 (13.8%) | 660 (14.7%) |
| Natural, Cultural, and Historical Resource | 6,594 | 436 (6.6%) | 463 (7.0%) |
| Transportation and Evacuation Routes | 609 | 148 (24.3%) | 159 (26.1%) |
| Total | 12,450 | 1,228 (9.9%) | 1,314 (10.1%) |

# Site Selection Approach & Results

- Combined model data + stakeholder input
- **Criteria:**
  - Exposure to flooding
  - Asset priority class
  - Relevance and impact
  - Geographic representation

1) Bartow Wastewater Treatment Facility
2) Power Substation (North Bartow)
3) Highway 92 (South of Lake Parker, Lakeland)
4) Highway 60 Corridor (East Polk County)

**Overview map showing location of selected sites in Polk County. HighTide, 2025.**



# Visualization Approach

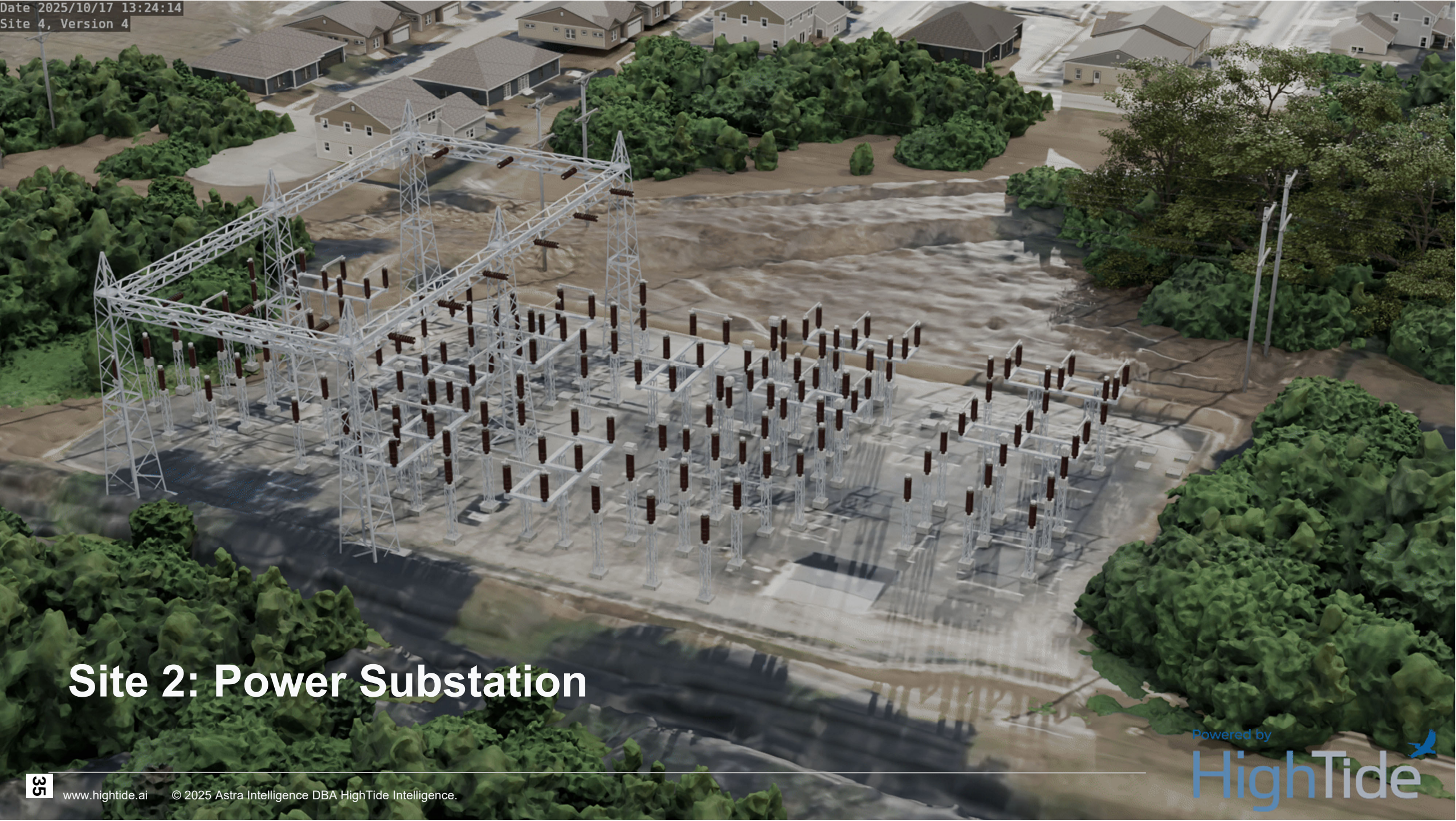
- Visualized using open-source software, Blender:
  - Imported DEM terrain
  - Added building and structure footprints
  - Overlapped with flood rasters
  - Added lighting and realistic water rendering
  - Python scripts automated scene generation


# Site 1: Bartow Wastewater Treatment Facility

Powered by HighTide


# Site 1: Bartow Wastewater Treatment Facility

Powered by HighTide




# Site 2: Power Substation

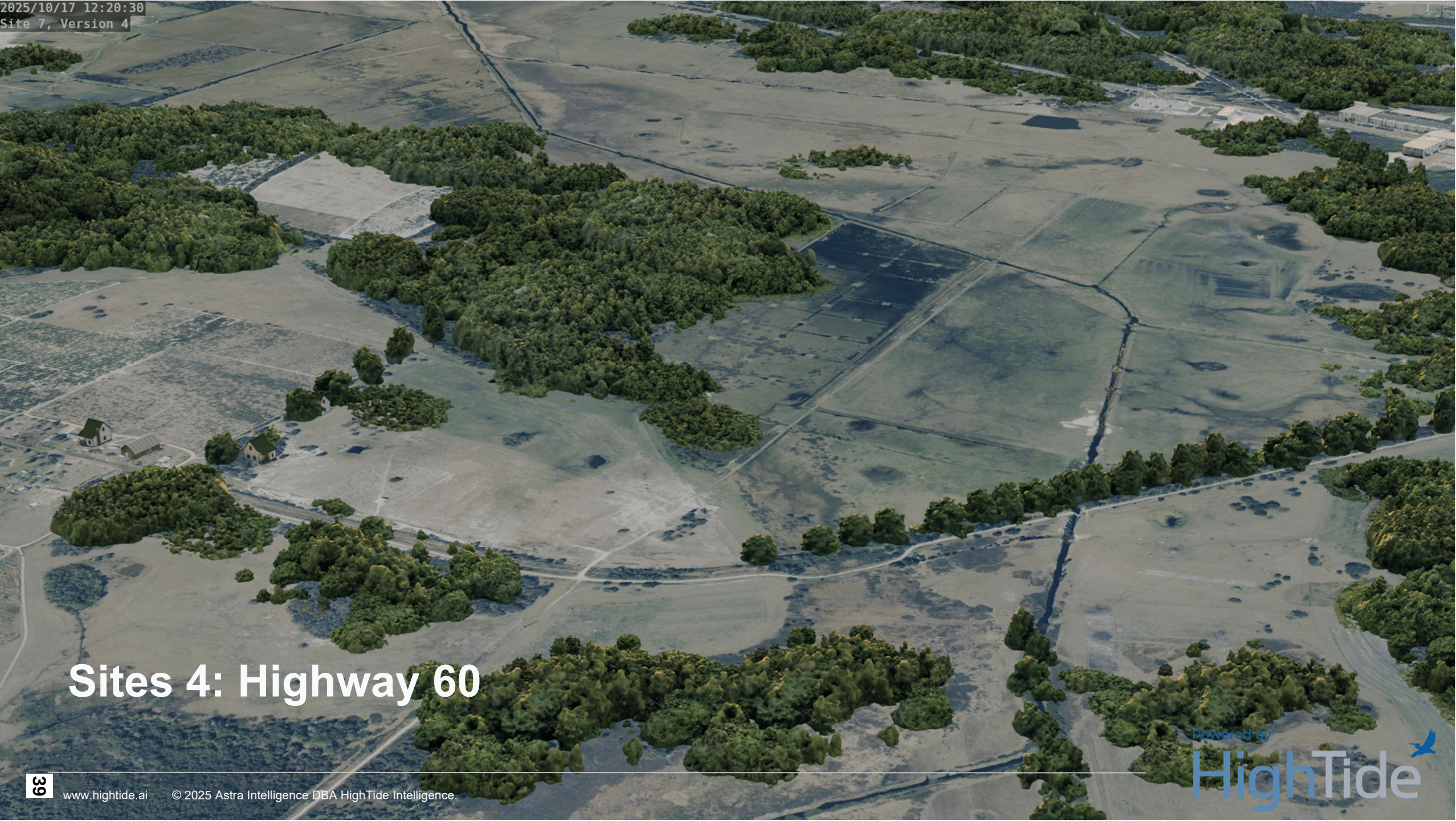
Powered by HighTide


# Site 2: Power Substation

Powered by HighTide


# Sites 3: Highway 92


# Sites 3: Highway 92




# Sites 4: Highway 60

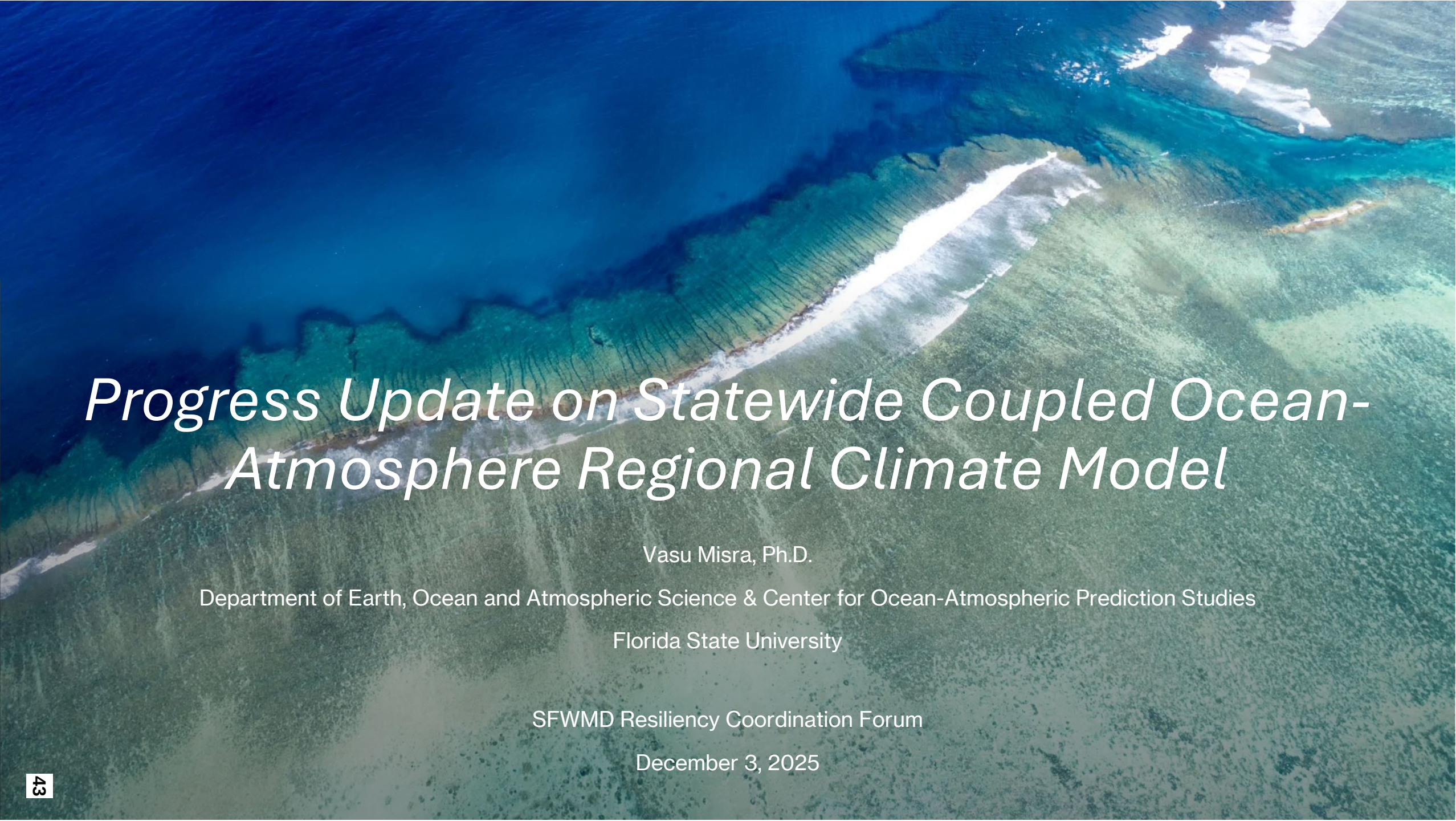

# Sites 4: Highway 60

# Comparative Summary:
# 200-Year vs. 500-Year Scenarios

- The 500-year rainfall event produces significantly **deeper and more widespread** flooding than the 200-year event
- Saturated soil conditions **amplify flood depths by 15–40%** across all sites
- **Impacts shift** from surface and parking areas to building-level flooding under the 500-year conditions

# Conclusions

- Extreme rainfall events are **increasing in frequency and intensity** across Polk County
- Saturated soil conditions **increase flood depths and duration**
- Critical infrastructure and transportation routes **show exposure under both 200- and 500-year events**
- Visualizations offer **a powerful communication tool** for public engagement and policy making
- Model results provide **a scientific foundation** for prioritizing resilience investments, including drainage improvements and asset hardening



# *Progress Update on Statewide Coupled Ocean-Atmosphere Regional Climate Model*

Vasu Misra, Ph.D.

Department of Earth, Ocean and Atmospheric Science & Center for Ocean-Atmospheric Prediction Studies

Florida State University

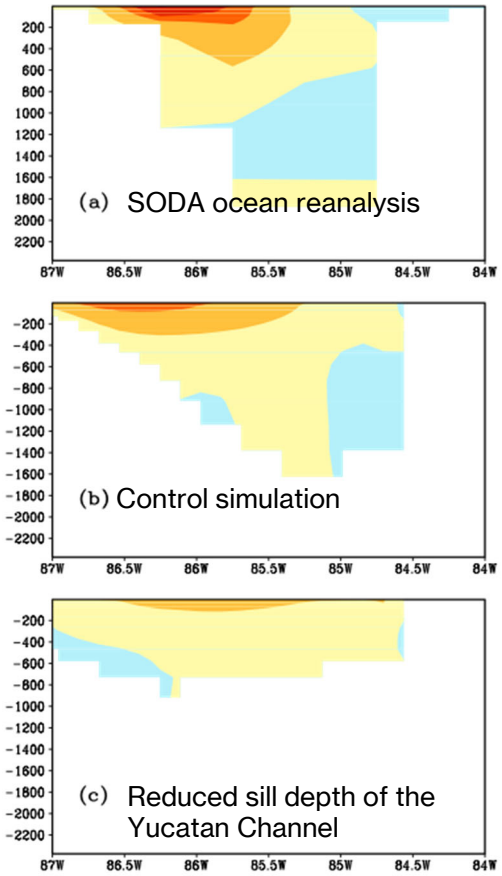
SFWMD Resiliency Coordination Forum

December 3, 2025

# Why is this project unique and grand?

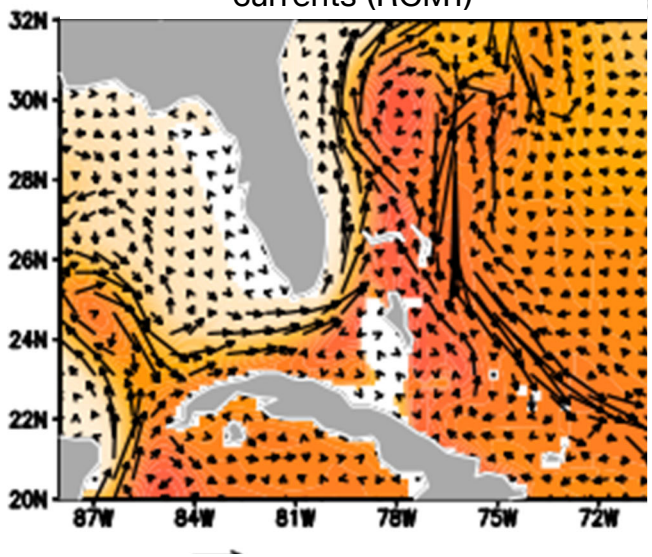
- Follows the upcoming release of change factors for rainfall from statistical downscaling
- Global models are inadequate to describe the regional climate of Florida owing to the unique geography of the state
- The hydroclimate of Florida is closely tied to the evolution and variability of the neighboring oceans
- Earlier attempts to dynamically downscale showed that it produced results contrary to global models
- We are able to justify the results giving a storyline of the produced climate
- It is grand as we are able to afford detailed modeling over a large domain which includes Floridan Aquifer in its entirety
- It is grand and unique because in many ways we are reaching unprecedented resolution to simulate the climate over Florida

# The Role of the Loop Current

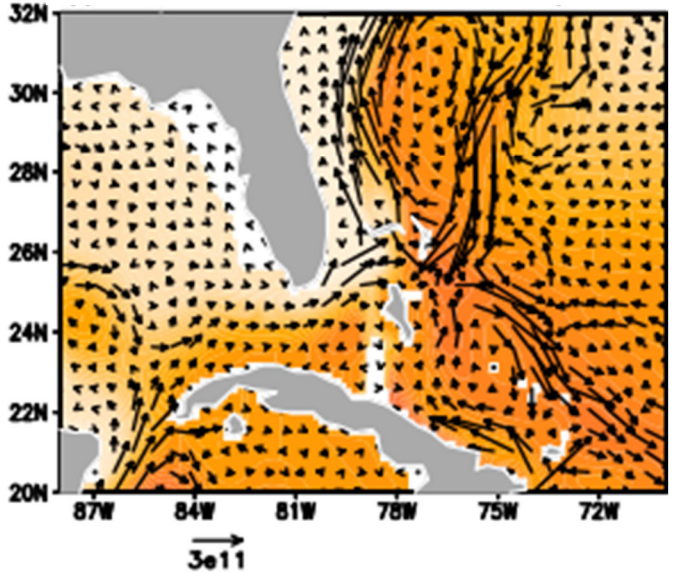



*Vertical cross section of the meridional flow ($ms^{-1}$) through the Yucatan Channel from a) SODA ocean reanalysis, b) CTL and c) EXP integrations.*

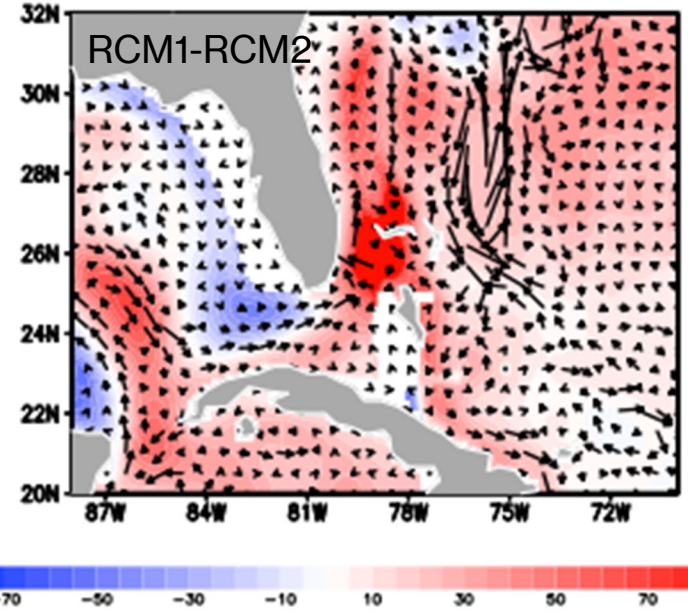
Model simulation with strong currents (RCM1)

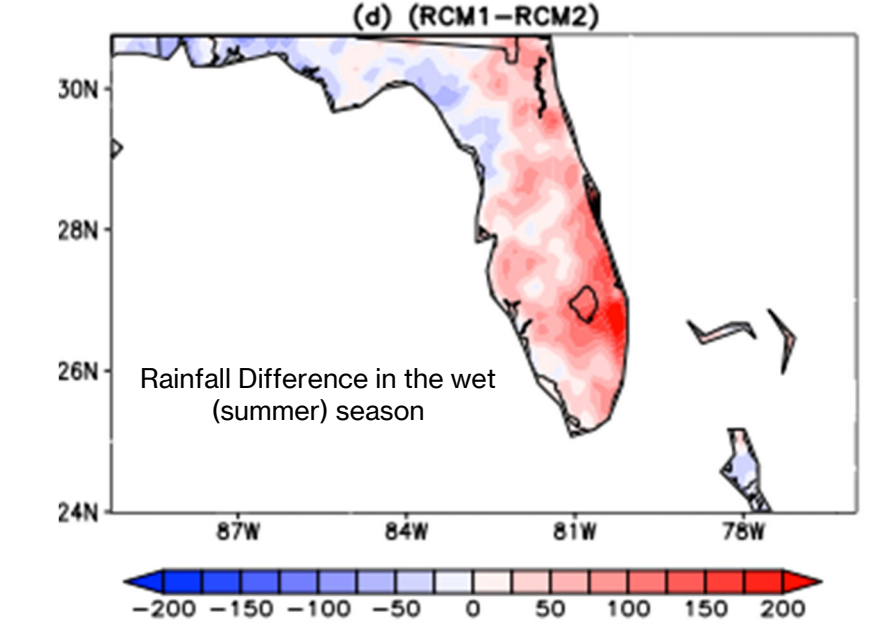


Model simulation with weak currents (RCM2)

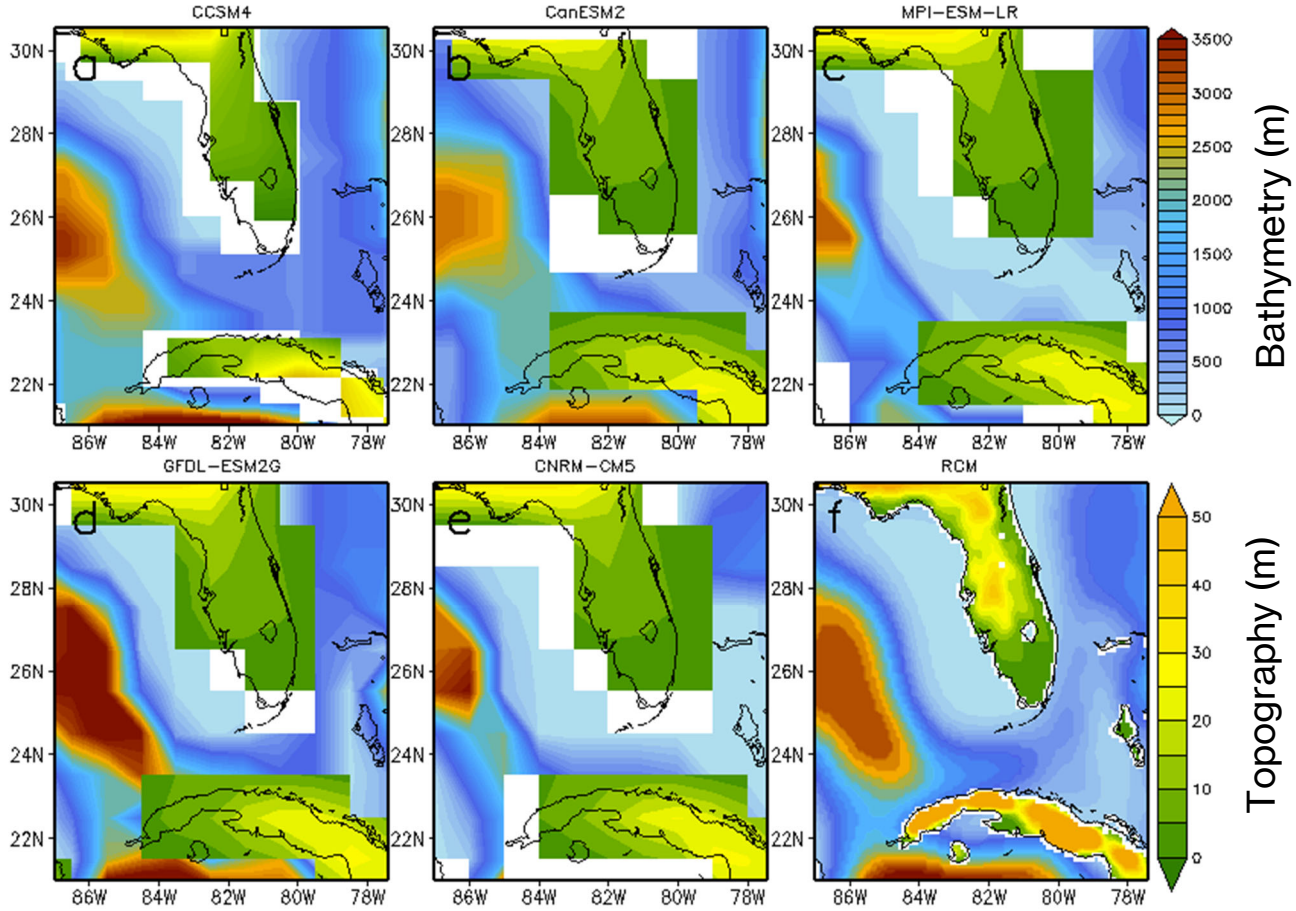


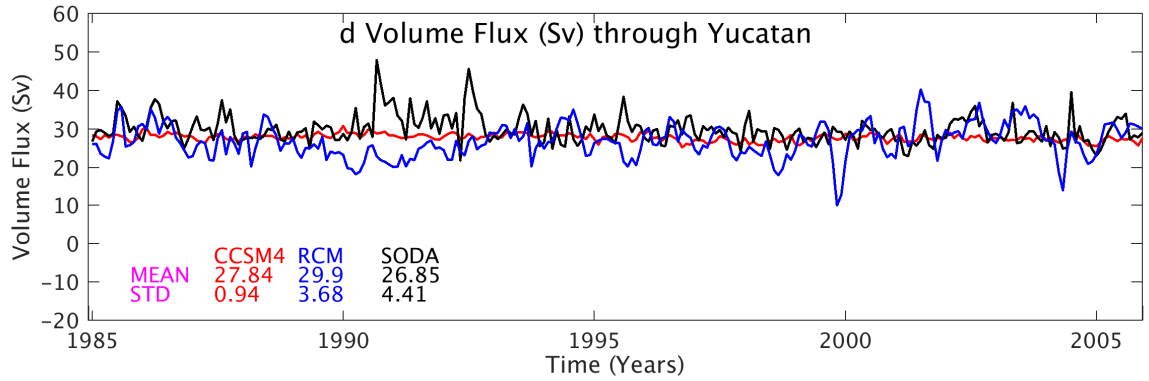

Heat content and heat transport

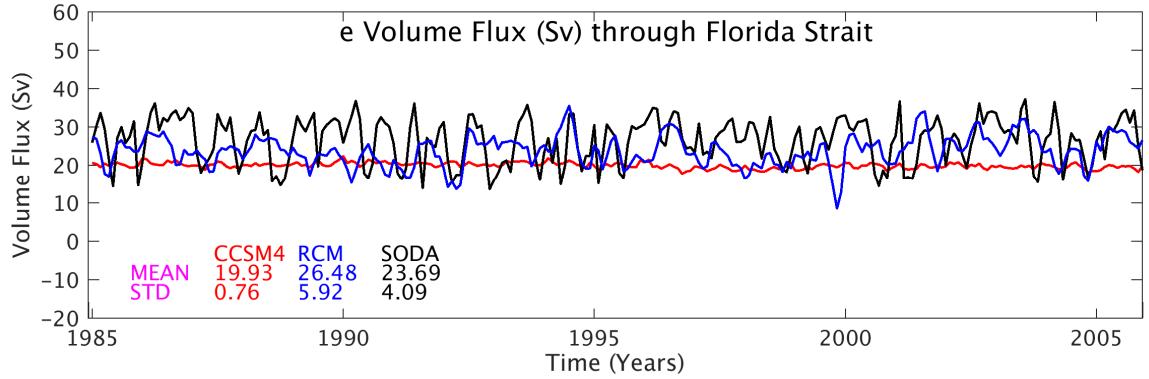


# Why CMIP models may not be the best fit for Florida?

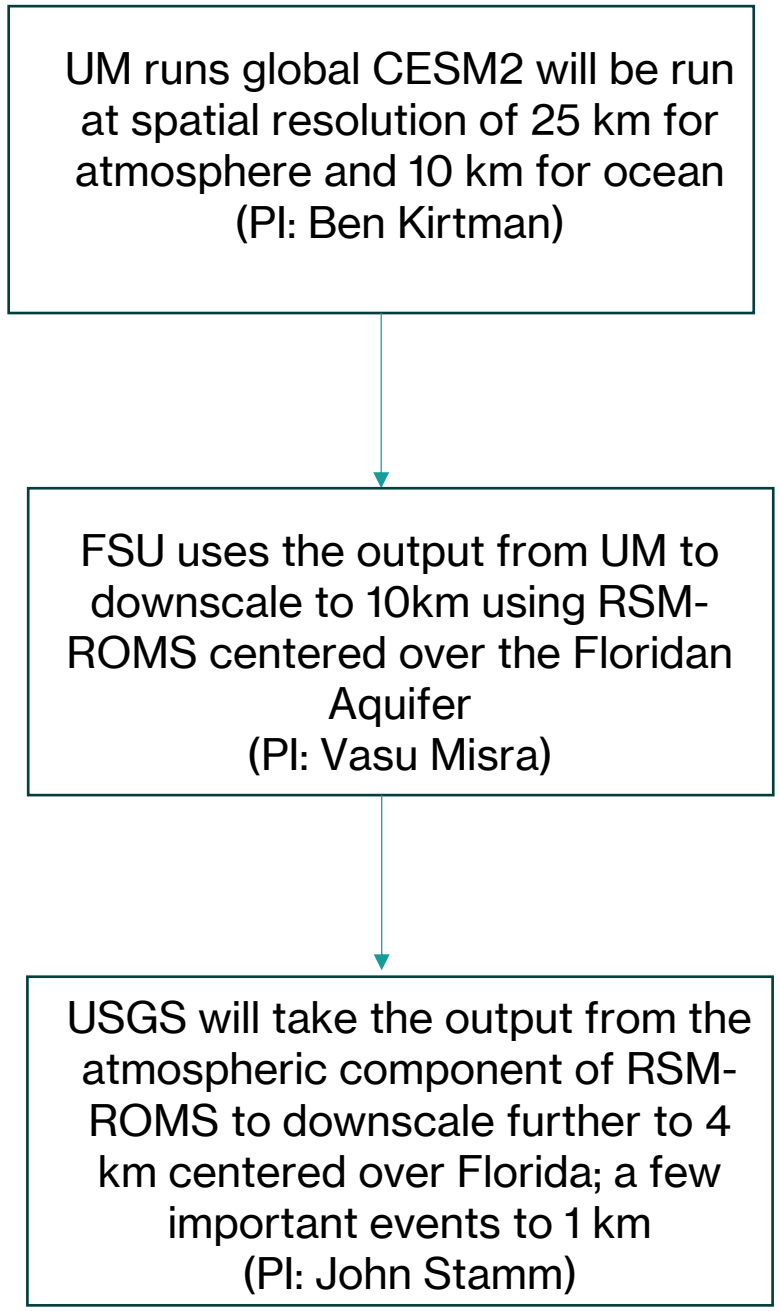



The ocean bathymetry (m) and terrestrial topography (m) of (a-e) five CMIP5 models and f) a coupled ocean-atmosphere RCM at 10km grid resolution with identical land-sea mask used in both atmosphere and ocean components.

# The Plan...

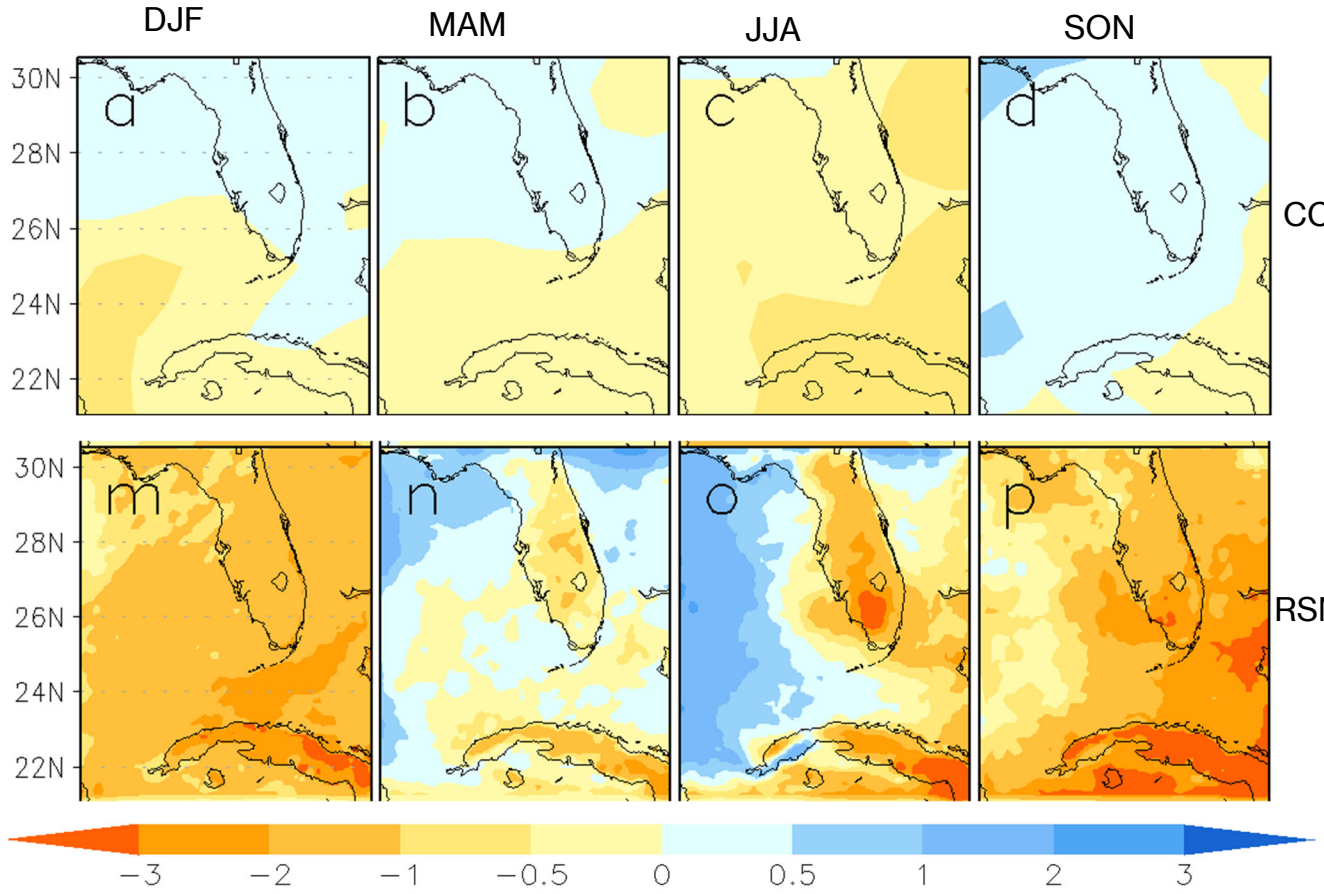



UM will share 150 years of their global model integration with FSU to downscale. These will include

- 50 years of historical integration, which will mark the reference period
- 50 years of a future climate depicting a 2˚C warming of the global mean temperature in reference to the historical climate
- 50 years of future climate depicting a 3˚C warming of the global mean temperature in reference to the historical climate

# How different is the projection of RSM-ROMS from CCSM4?

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




*Early attempt in 2015 showing how dynamic downscaling differs from global models*

Insignificant to moderate increase in rainfall

Much drier climate throughout the year in a future climate

# Updates

UM will run global CESM2 at spatial resolution of 25 km for atmosphere and 10 km for ocean

FSU uses the output from UM to downscale to 10km using RSM-ROMS centered over the Floridan Aquifer

USGS will take the output from the atmospheric component of RSM-ROMS to downscale further to 2km centered over Florida; a few important events at 1 km

JOURNAL OF APPLIED METEOROLOGY AND CLIMATOLOGY VOLUME 64
NOVEMBER 2025 MISRA AND JAYASANKAR 1585

**The Value of Dynamic Downscaling a CMIP6 Global Climate Model Simulation over the Floridan Aquifer**

VASUBANDHU MISRA[a,b] AND C. B. JAYASANKAR[b]

[a] *Department of Earth, Ocean and Atmospheric Science, Florida State University, Tallahassee, Florida*
[b] *Center for Ocean-Atmospheric Prediction Studies, Florida State University, Tallahassee, Florida*

(Manuscript received 10 March 2025, in final form 7 July 2025, accepted 18 August 2025)

CESM2 from CMIP6 1.25˚ x 0.95˚ for atmosphere and 1˚ for ocean model resolution

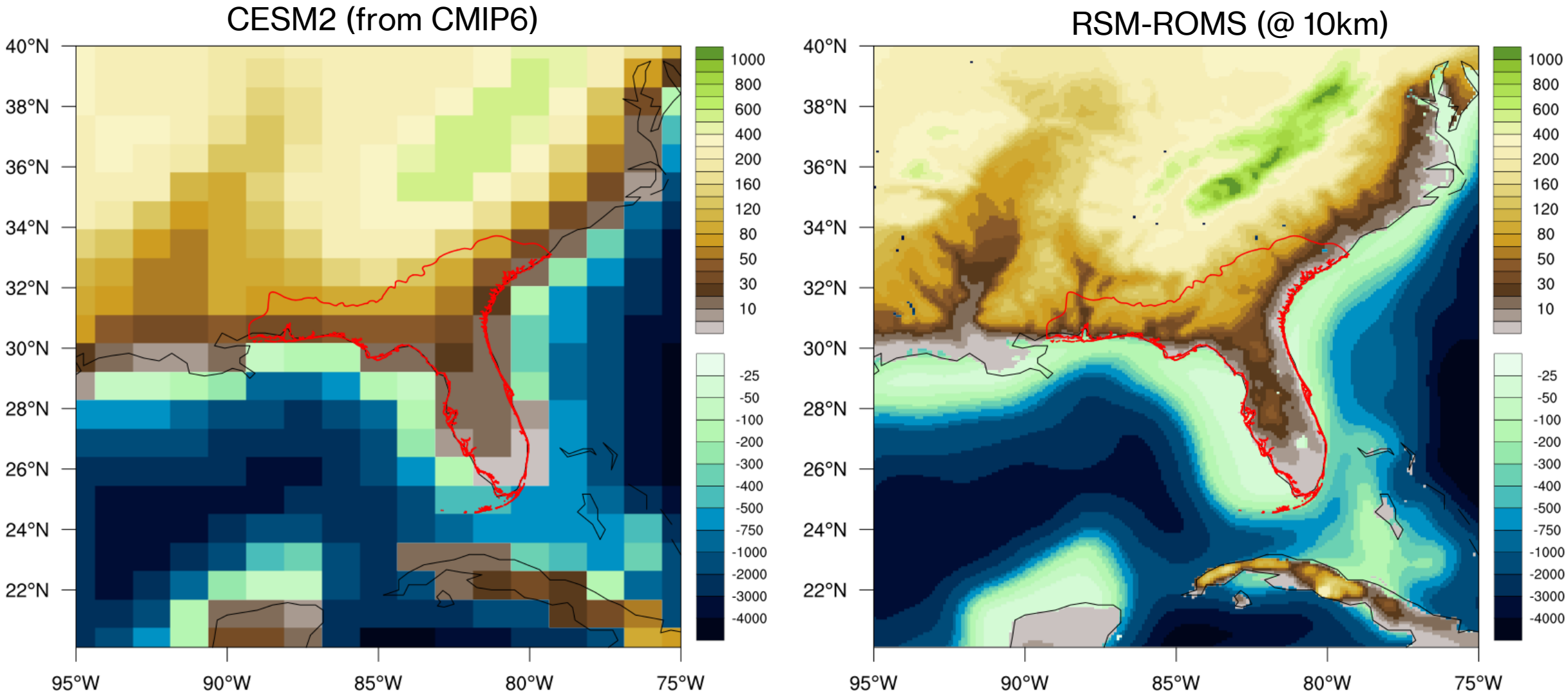
# Model Setup

- Global atmosphere component (CAM6) - 1.25° longitude x 0.95° latitude  (UM @ 25km)
- Global ocean component (POP2) - nominal 1° horizontal resolution (UM @ 10km)
- Historical run from CESM2: 1986 - 2014 (from CMIP6)
- Projected run from CESM2: 2071-2100 (from CMIP6; SSP585)

The regional climate model RSM-ROMS runs at 10 km grid spacing both for atmosphere (RSM) and ocean (ROMS) component

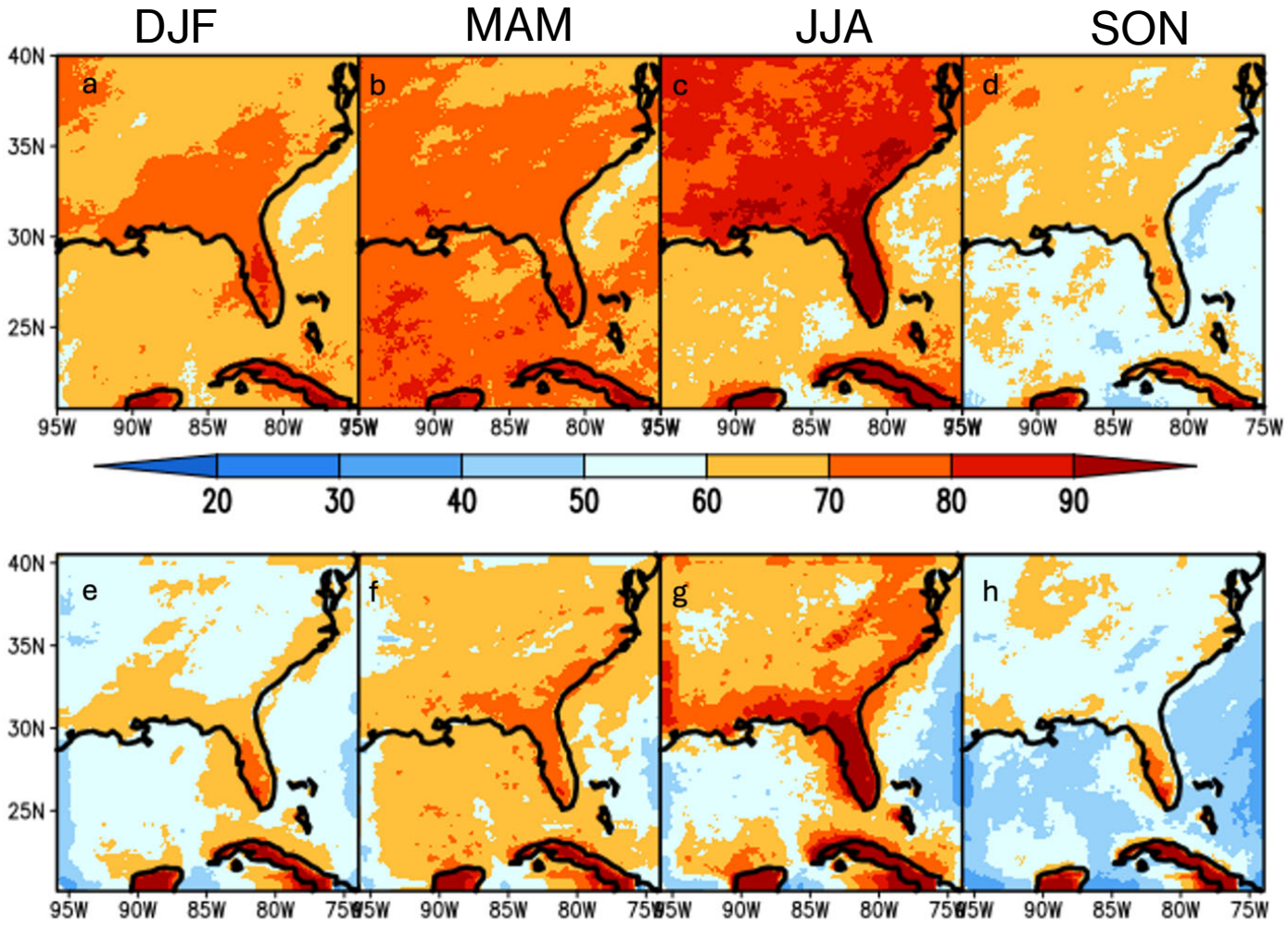
# What Makes This Approach Powerful

Contrast in the resolution of global and regional models



# The Prominence of Sea Breeze Thunderstorms

The percentage of daily precipitation variance explained by diurnal variation of precipitation




Observations

RSM-ROMS

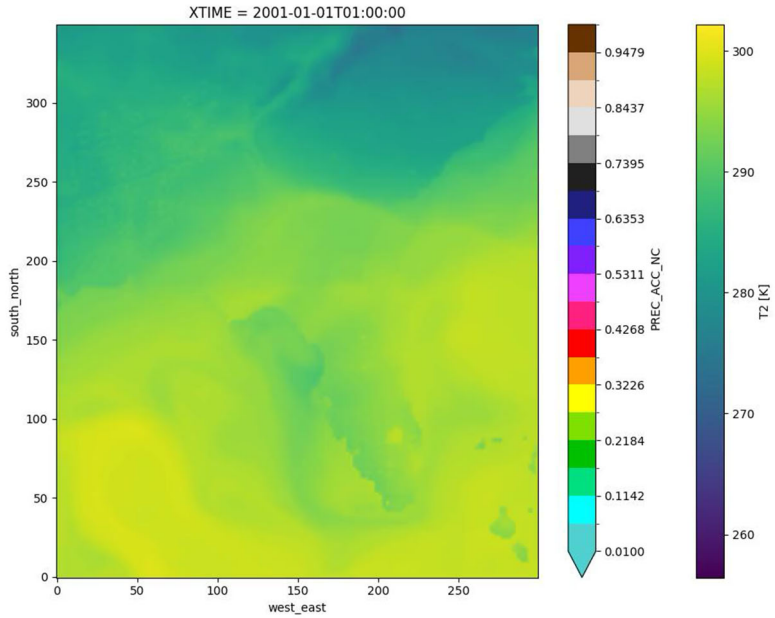
# Updates

UM runs global CESM2 will be run at spatial resolution of 25 km for atmosphere and 10 km for ocean

FSU uses the output from UM to downscale to 10km using RSM-ROMS centered over the Floridan Aquifer

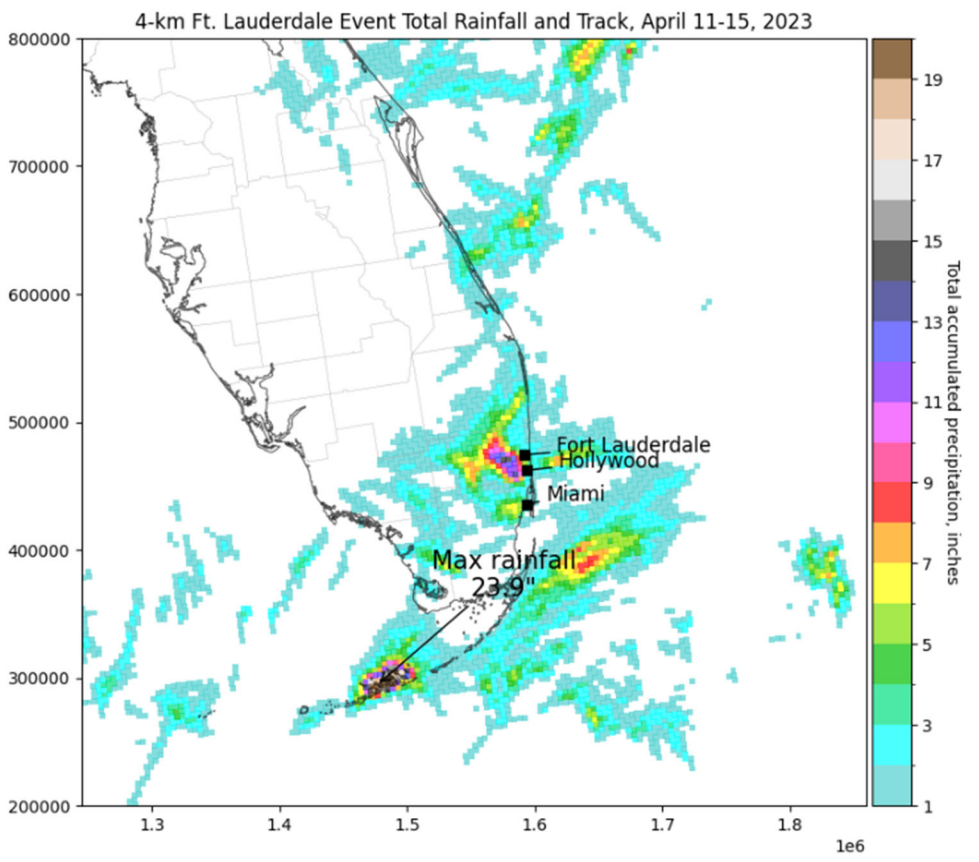
USGS will take the output from the atmospheric component of RSM-ROMS to downscale further to 2km centered over Florida; a few important events at 1 km

9 day animation of T2m and hourly precipitation

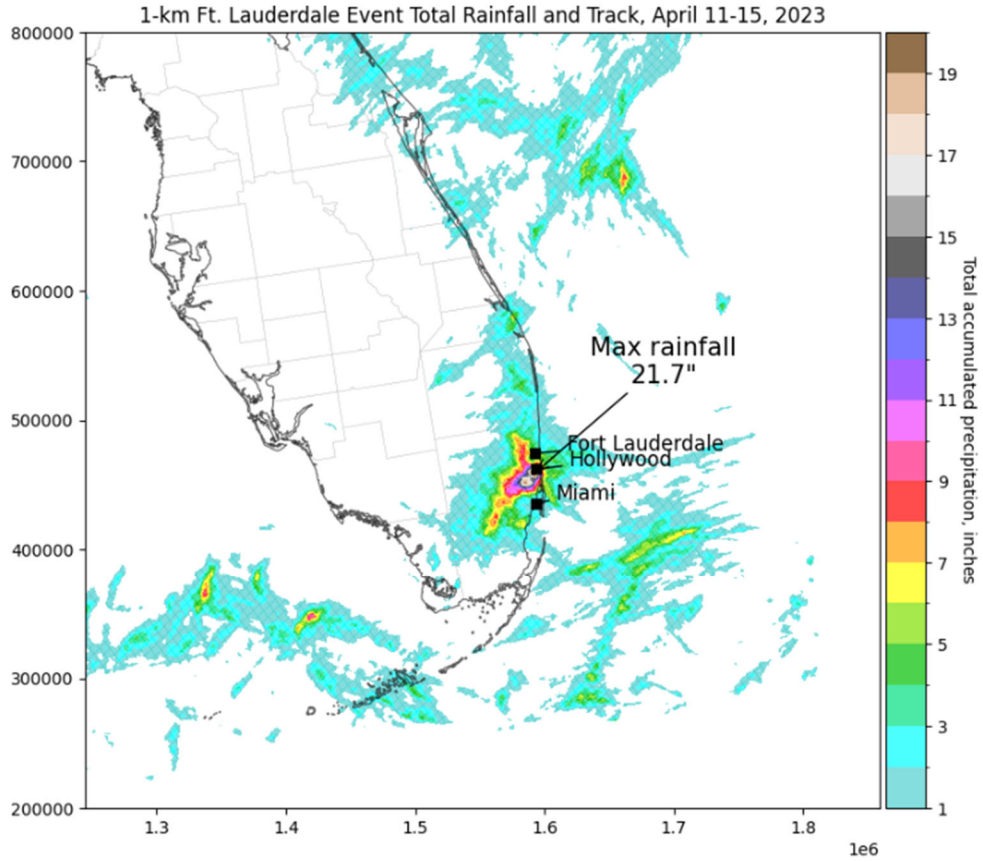


# The Ft. Lauderdale rain event of 2023

USGS WRF run @ 4 km




USGS WRF run @ 1km

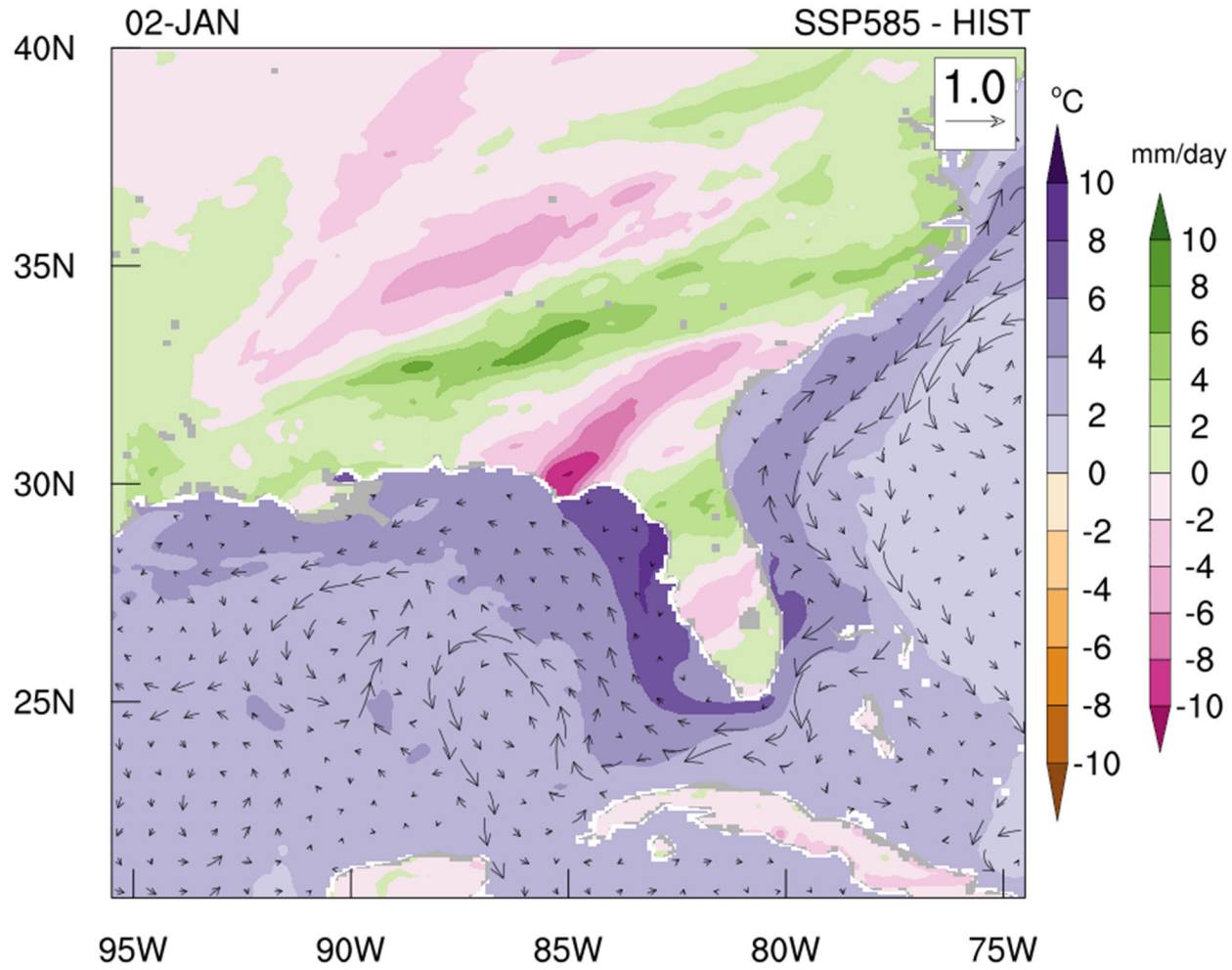


# Initial Conclusions

- The models are ready to be integrated.....
- The reference or the benchmark period of the current climate has been decided
- The output from RSM-ROMS to WRF has been tested
- The connection between CESM2 and RSM-ROMS has been vigorously tested.
- WRF runs at 4 and 1 km is producing reliable simulations of selected extreme events

**Animation of future (2071-2100)-historical (1986-2014) from RSM-ROMS @10km**

(Daily climatology of terrestrial precipitation and SST and surface ocean currents)

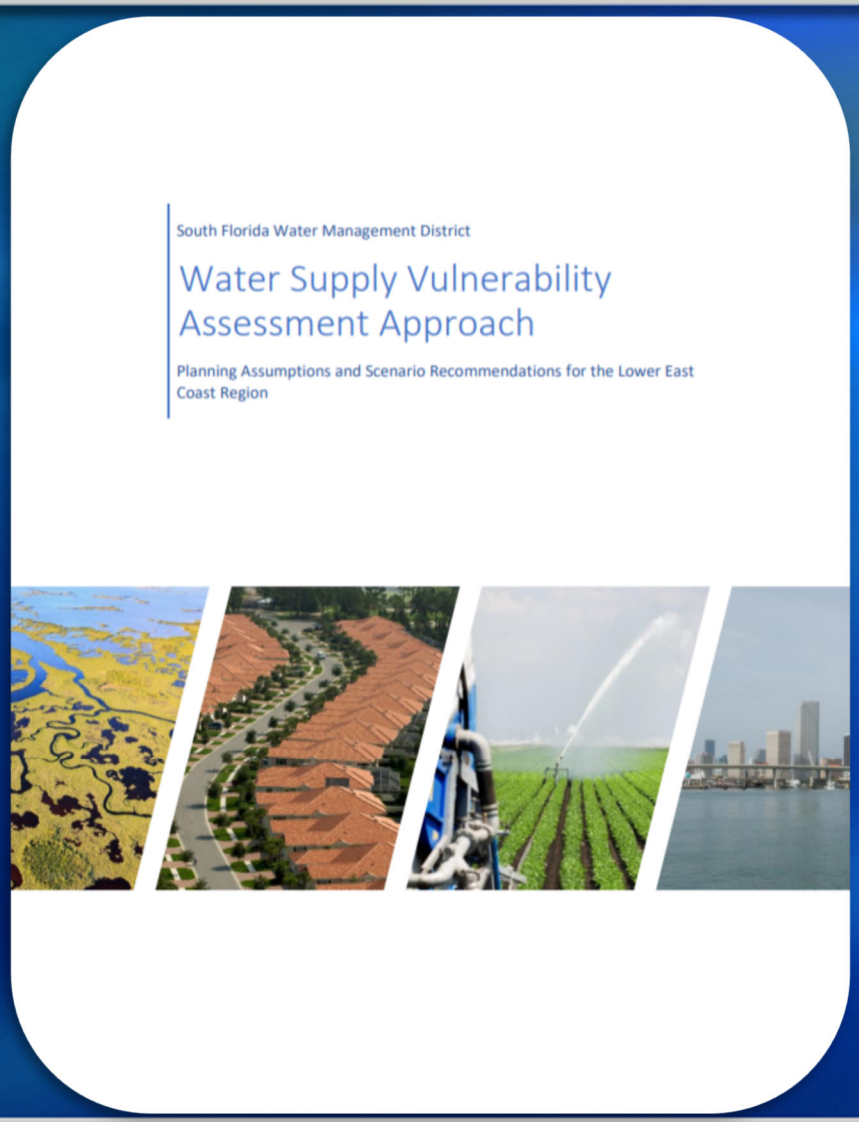


# Update on the Lower East Coast Water Supply Vulnerability Assessment

*Pete Kwiatkowski, P.G.*
*Section Administrator, Resource Evaluation*
*Water Supply Bureau*
*Flood Control and Water Supply Planning Division*

***Resiliency Coordination Forum***
*December 3, 2025*

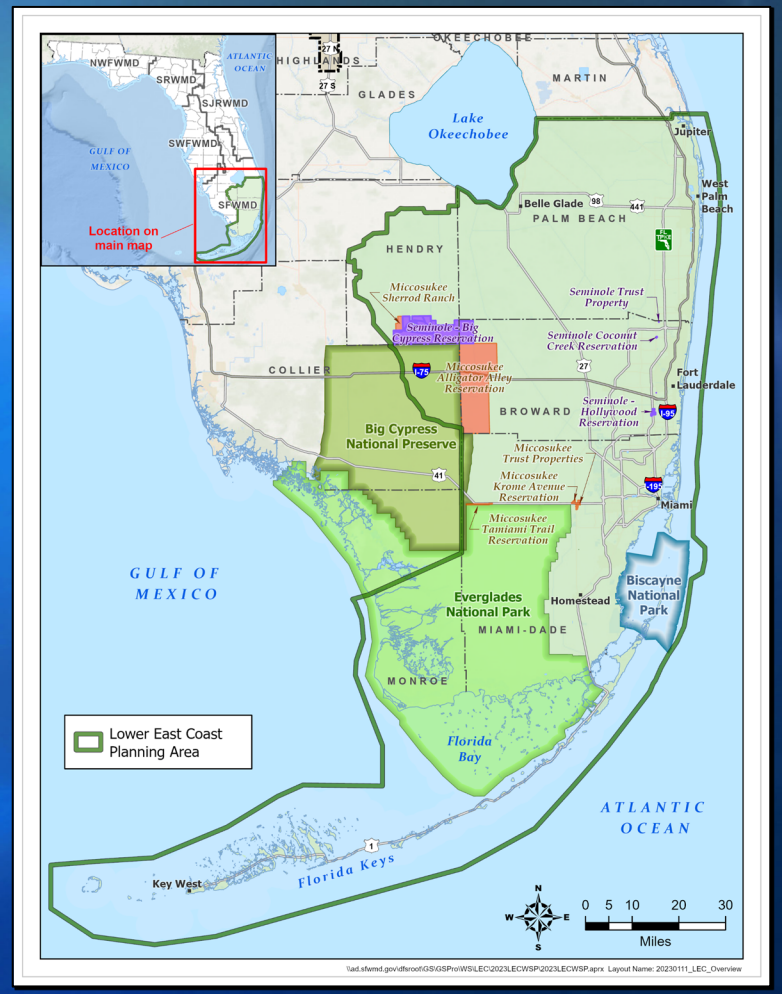
# LEC Water Supply Vulnerability Assessment



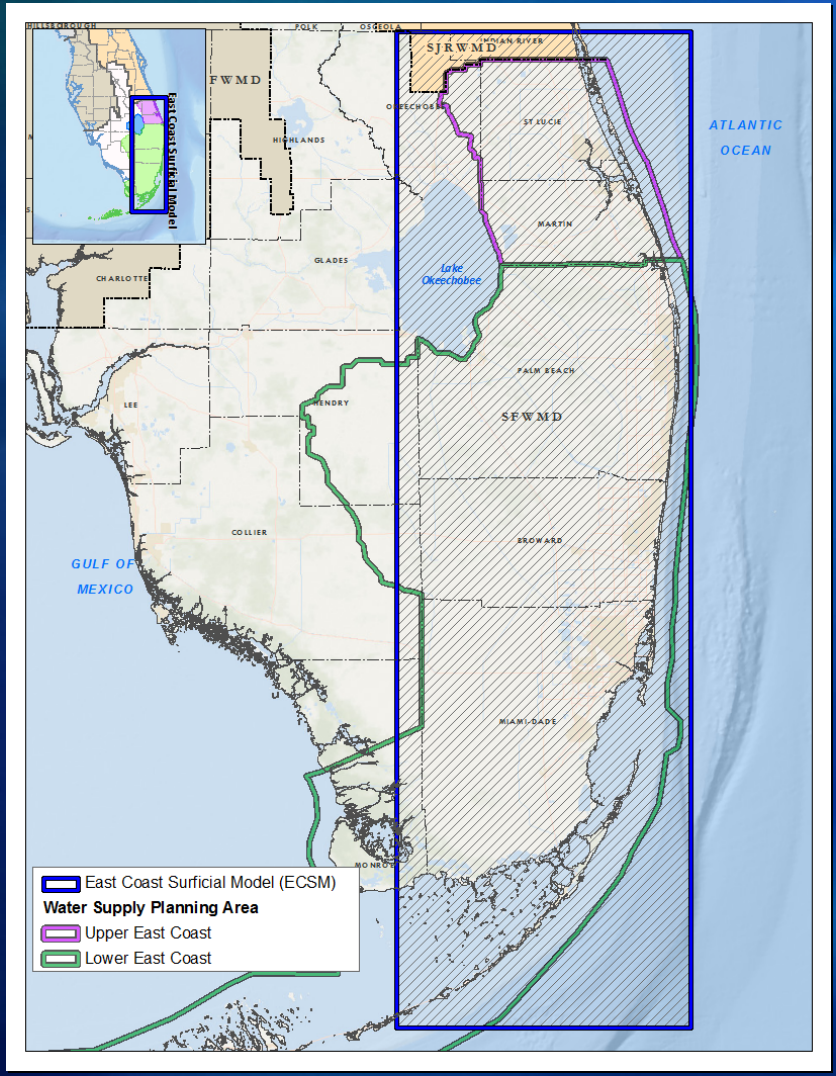

- Lower East Coast (LEC) has a population of 6.2 million people
- 50-year planning horizon
- Looking at increase in water supply demands, climate change and sea level rise
- Scenarios will use East Coast Surficial Model (ECSM), a density-dependent SEAWAT groundwater model

# Lower East Coast Planning Region

- Includes:
  - Palm Beach, Broward, Miami-Dade, part of Monroe County, and part of the eastern portions of Collier and Hendry counties
  - Seminole Tribe of Florida reservations and Miccosukee Tribe of Indians of Florida reservations
- Population:
  - 2021 6,222,707
- Major agricultural industry
- Significant environmental features



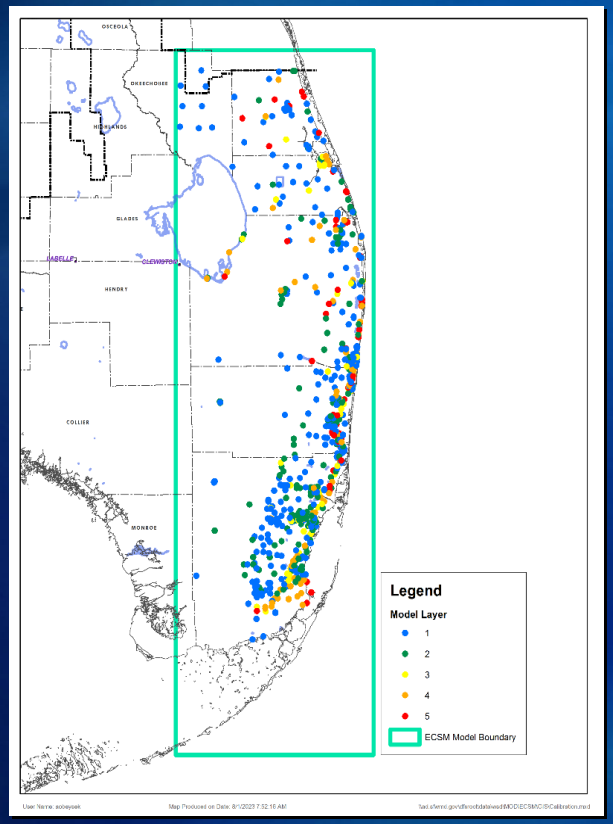
# East Coast Surficial Model



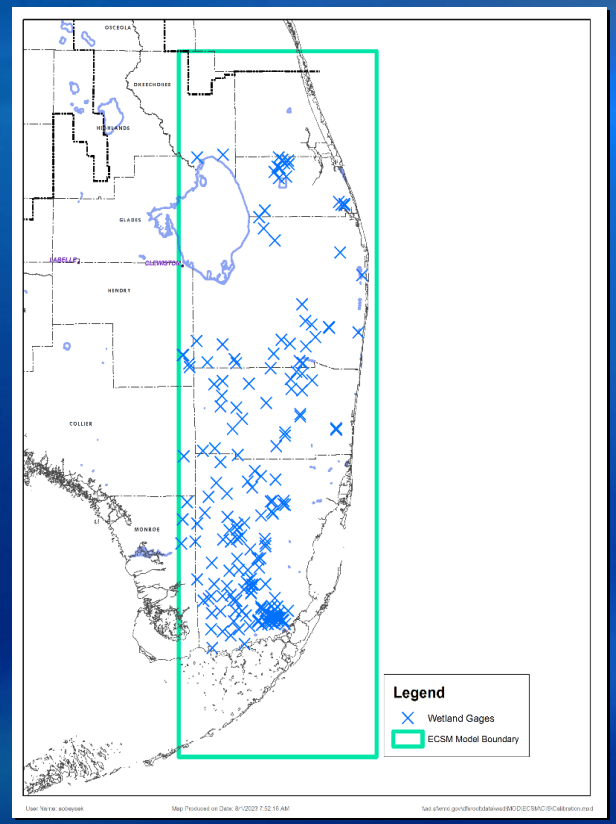

- SEAWAT (USGS Computer Code modified by SFWMD)
- Calibration Period of Record: 1985 – 2012, Verification Period of Record: 2013 – 2016
- Cell size: 1,000 ft x 1,000 ft
- 5 model layers that represent the Surficial Aquifer System, including the Biscayne Aquifer
- Calibrated to water levels (daily), water quality (Total Dissolved Solids [TDS]) mg/L (monthly), and structure flows (30-day rolling average)

# ECSM Calibration Locations

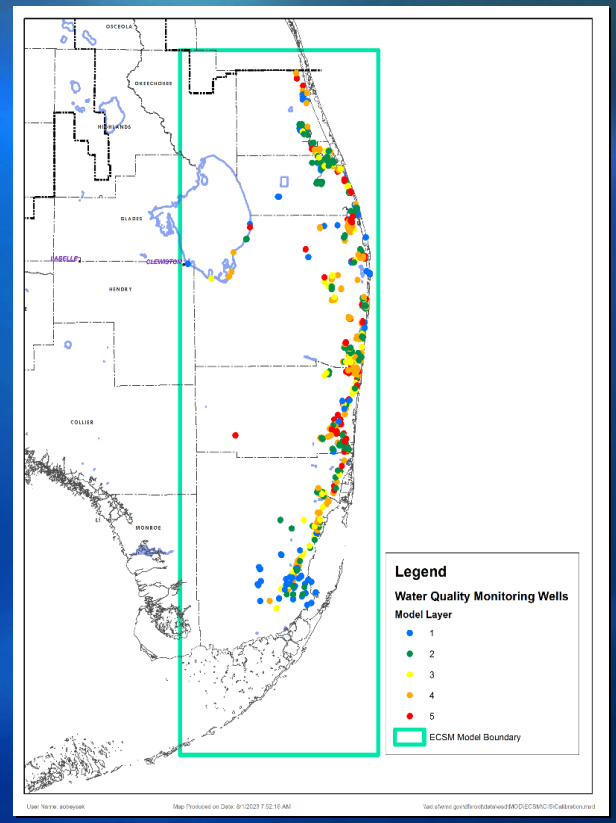
666 Groundwater Monitor Wells



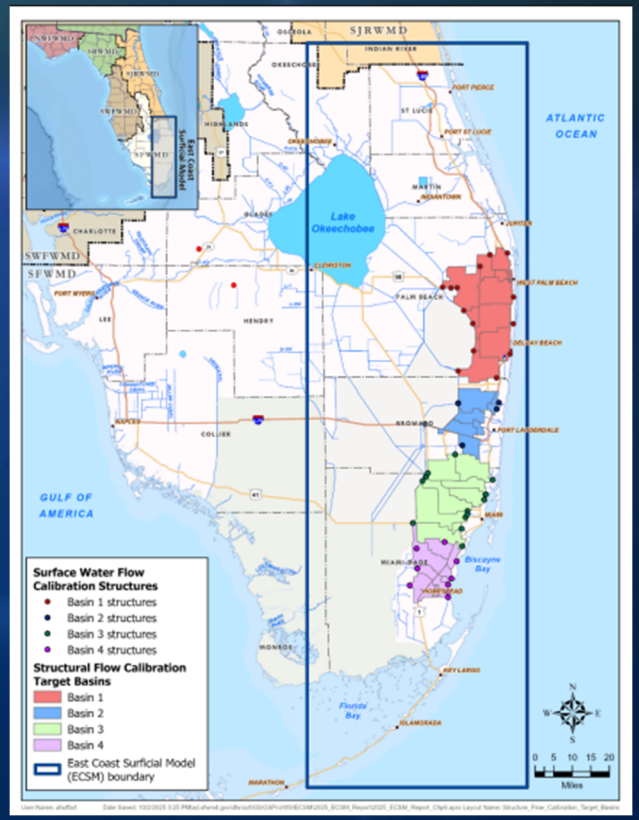

187 Wetland Gages




578 Water Quality Monitor Wells



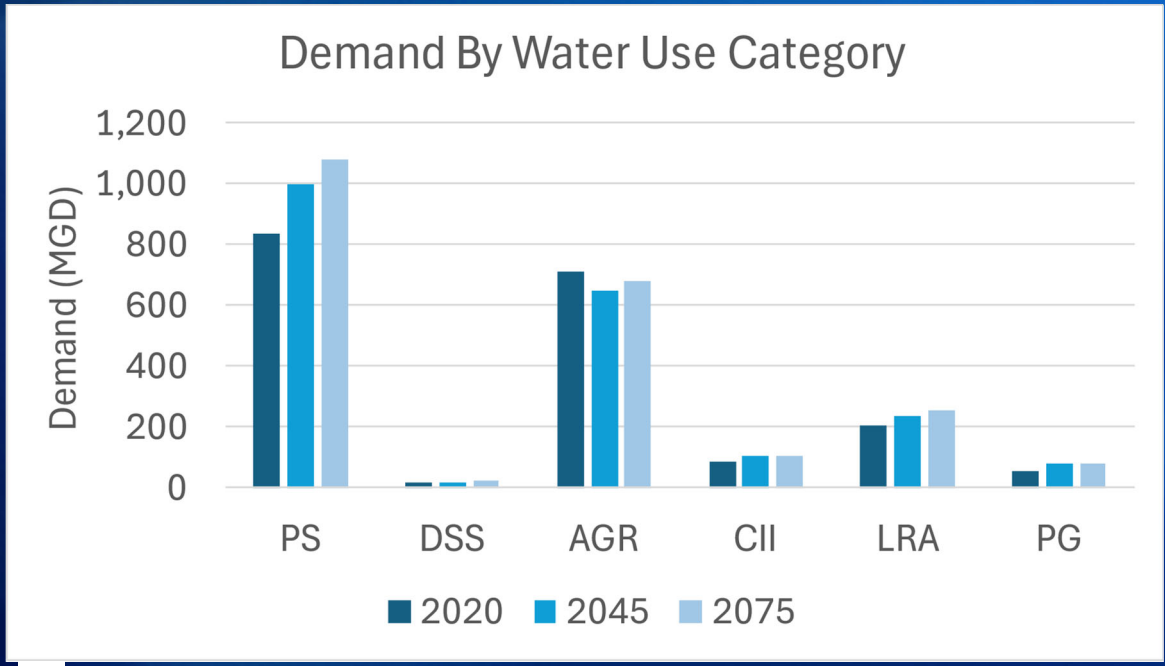

4 Joined Basins Surface Water



# Water Supply Planning Scenarios

| | |
|---|---|
| **PS** | Public Supply |
| **DSS** | Domestic Self-Supply |
| **AGR** | Agricultural |
| **CII** | Commercial/Industrial/Institutional |
| **LRA** | Landscape/Recreational |
| **PG** | Power Generation |

| Water Supply Plan (2045 Planning Horizon) | | |
|---|---|---|
| **Scenario** | **Growth Variable** | **Climate Variable** |
| **Base Condition (2020)** | Current Population | Current Climate |
| **Future Condition** | BEBR* Med 2045 | Current Climate |
| **Future Condition + SLR** | BEBR* Med 2045 | SLR1 |




| Water Supply Vulnerability Assessment (2075 Planning Horizon) | | |
|---|---|---|
| | **Growth Variable** | **Climate Variable** |
| **Base (2020)** | Current Population | Current Climate |
| **Scenario Runs** | BEBR Med 2075 | Current Climate |
| | BEBR Med 2075 | SLR1 |
| | BEBR Med 2075 | Warmer and Drier |
| | BEBR Med 2075 | Warmer, Drier, & SLR1 |
| | BEBR Med 2075 | Hot, Drier+, & SLR2 |



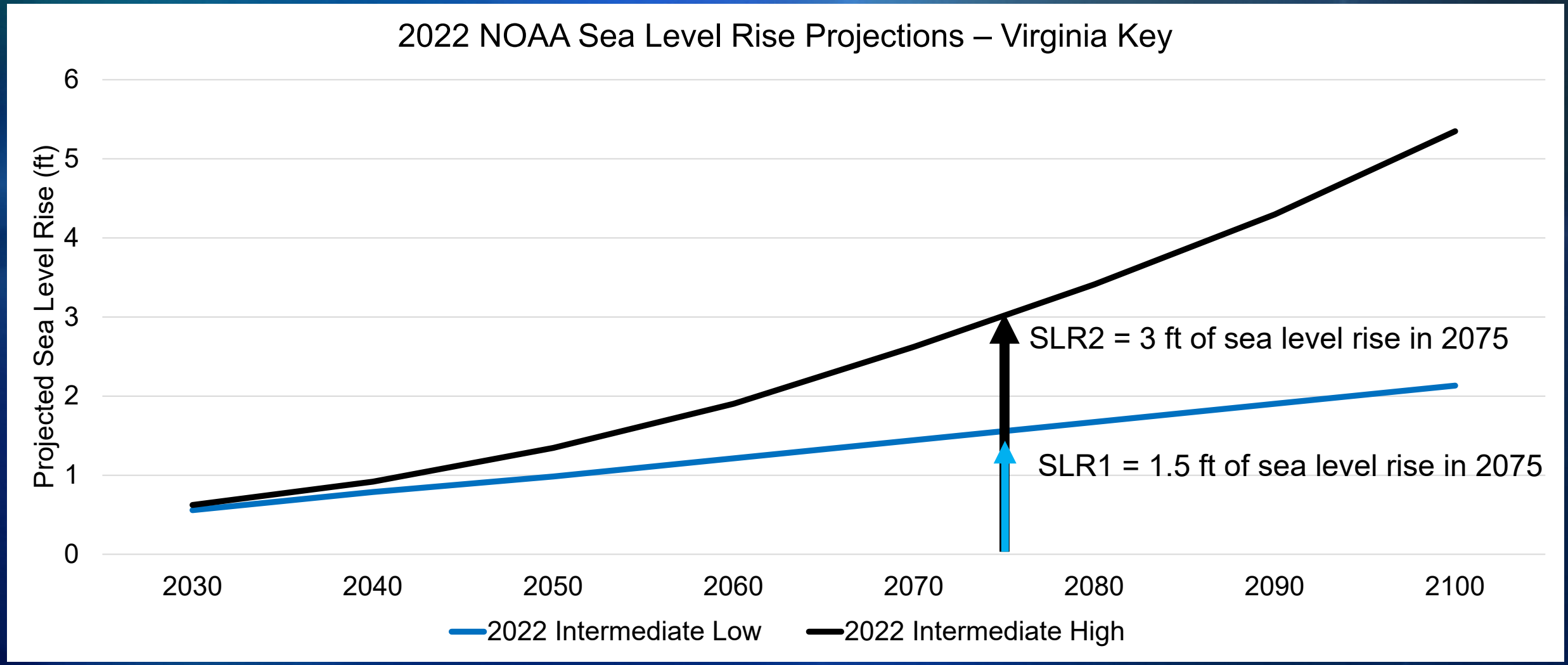
Presenter: Pete Kwiatkowski, P.G.

# 50-year Water Supply Demand Projections

| | |
|---|---|
| Public Supply | • Population = BEBR Med 2075<br>• Demand = Per Capita Use Rate for 50 years |
| Domestic Self-Supply | • Population = BEBR Med 2075<br>• Demand = Per Capita Use Rate for 50 years |
| Agricultural | • Projected agricultural acreages from FSAID12 - 2045 irrigated areas. AFSIRS will be utilized to determine irrigation demands. |
| Landscape/Recreational | • Water use demands will increase proportional to population |
| Commercial/Industrial/Institutional | • Scenario runs will utilize 2045 Water Supply Plan demands |
| Power Generation | • Scenario runs will utilize 2045 Water Supply Plan demands |

BEBR – U of FL Bureau of Economic & Business Research  FSAID – FL Statewide Agricultural Irrigation Demand  AFSIRS – Agricultural Field-Scale Irrigation Requirement Simulation

# Sea Levels in 2075



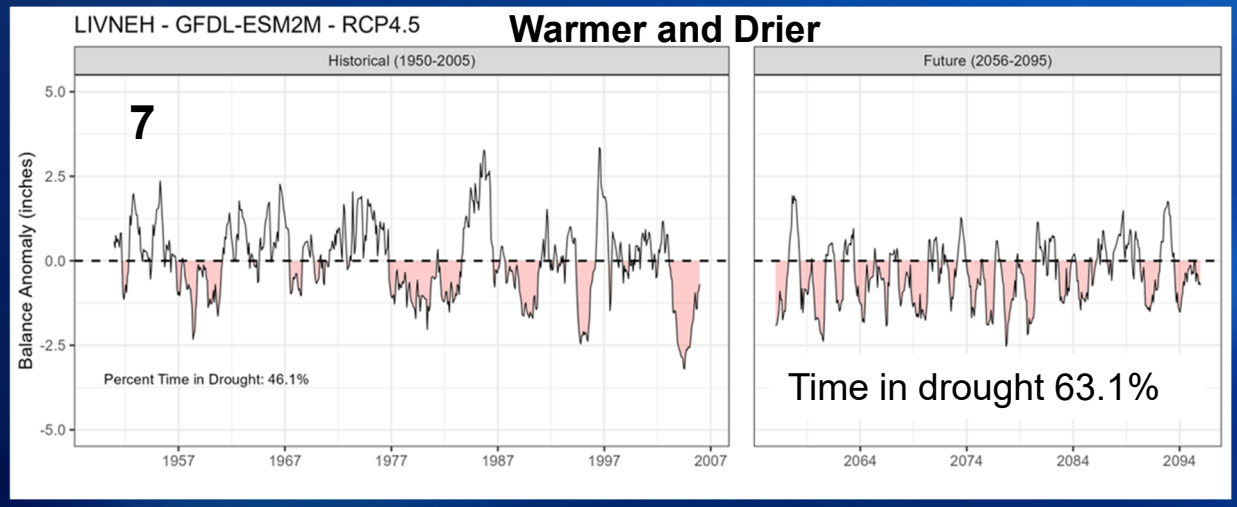
# Climate Conditions

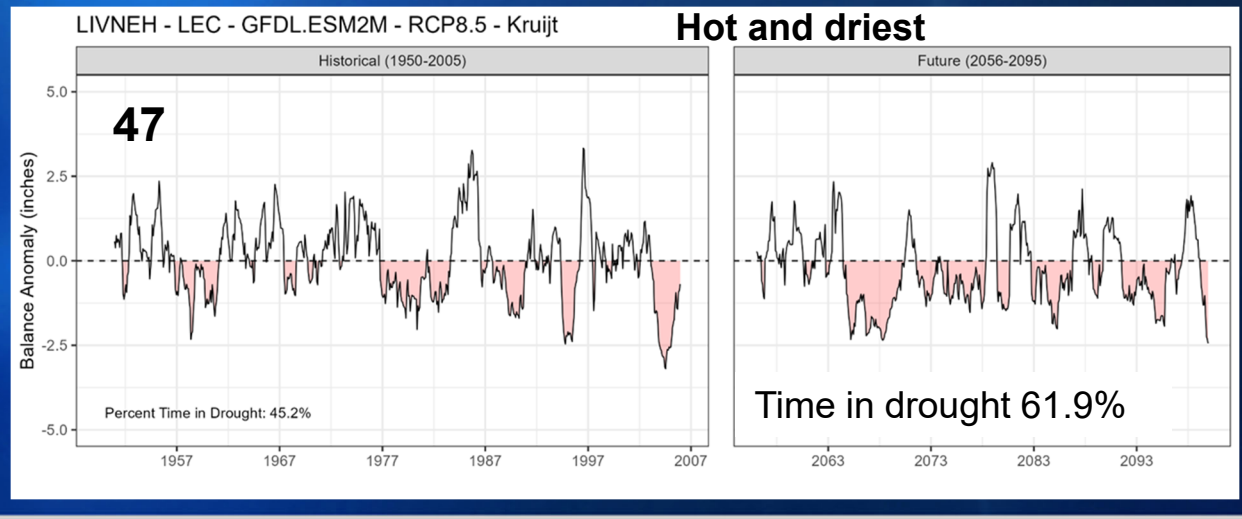
## Initial climate scenarios selected (subject to change)

| GCM ID* | mean dur | max dur | mean sev. | max sev. |
|---|---|---|---|---|
| 7 | 1 yr 4 mos | 2 yrs 10 mos | 1.6X | similar |
| 47 | 2 yrs 6 mos | 6 yrs 10 mos | 3X | 2.6X |
| LEC Region | 1 yr 4 mos | 6 yrs 7 mos | | |

### Wasserstein GCM screening

| Selected Global Climate Models (GCMs) | | | | Drought Duration (months) | | | | | Absolute Drought Severity (balance anomalies) | | | | | Average Annual (calendar year) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GCM ID* | MACA | GCM ID | RCP | % Total Dur | # Events | Mean | Min | Max | Mean | Min | Max | Percentiles | Change (%) | Temp Max Month °C | Percentile | Total Precip | Total RET |
| 7 | livneh | GFDL.ESM2M | RCP4.5 | 63 | 19 | 16 | 4 | 34 | 15.4 | 0.8 | 37.9 | 54 | 39 | 30.2 | 22% | 53 | 54 |
| 47 | livneh | GFDL.ESM2M | RCP8.5 | 62 | 10 | 30 | 4 | 72 | 30.1 | 1.8 | 105.5 | 62 | 43 | 30.8 | 65% | 53 | 53 |
| LEC Region Observed | | | | 53 | 22 | 16.3 | 3 | 69 | 9.7 | 0.1 | 40.6 | - | - | | | 53 | 54 |



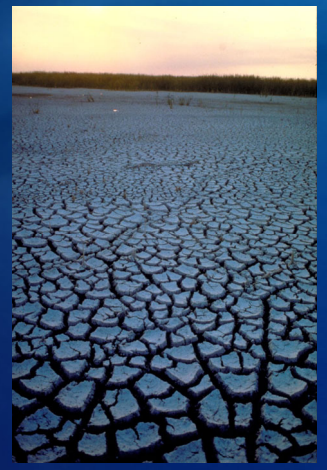








Presenter: Pete Kwiatkowski, P.G.

# WSVA - Climate Conditions



Future ET (potential increase)

Future Rainfall (potential decrease)

ET Recharge Program

Ground-water ET

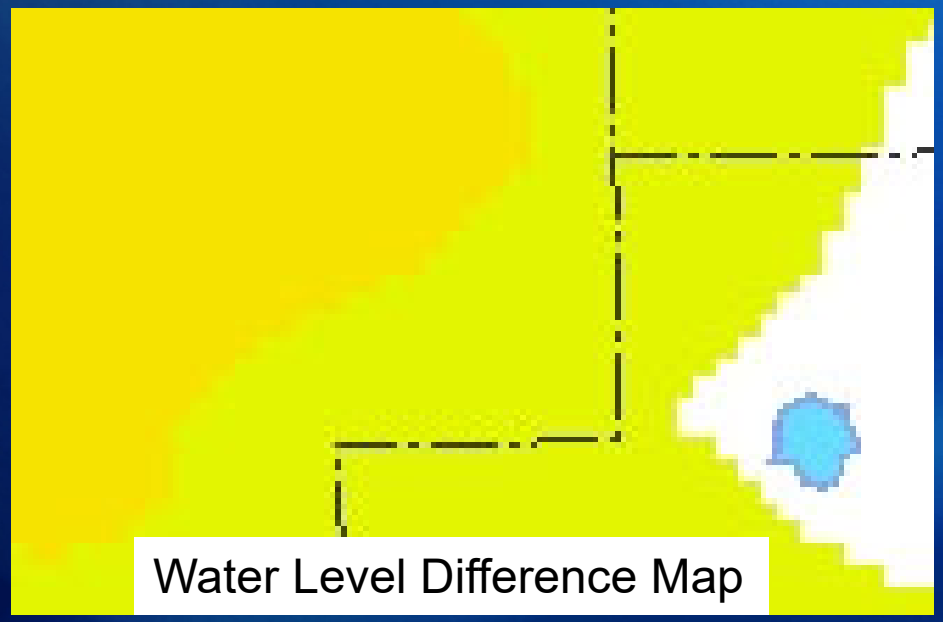
Recharge

SEAWAT

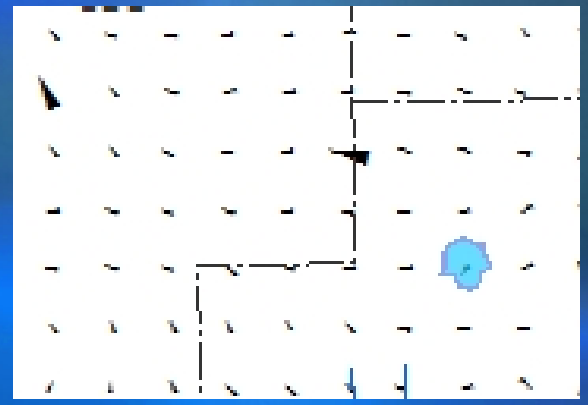
# Sample Model Analysis

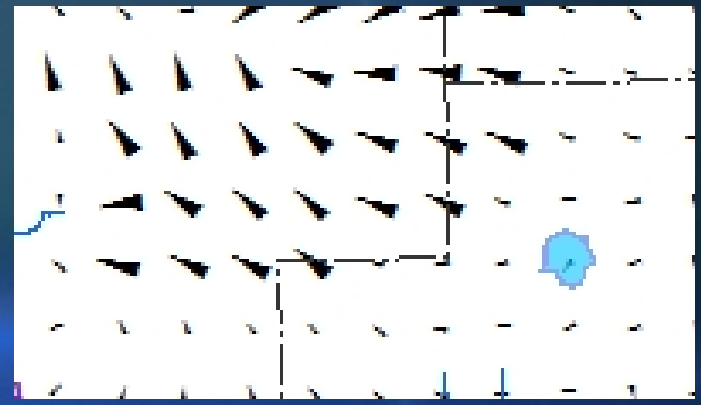
Differences between model scenarios are compared to each other

Future water levels – Current water levels = Water Level Difference Map



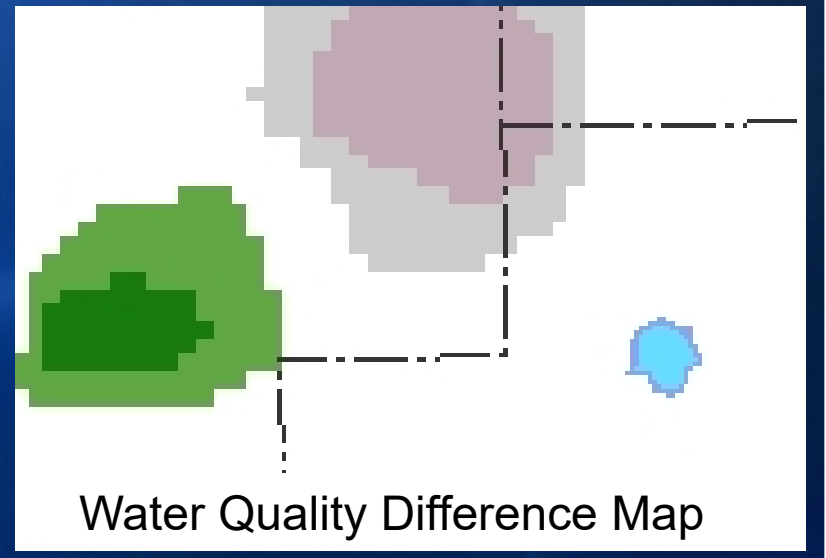
Water Level Difference Map





Flow vectors from different scenarios are compared to each other

Future water quality – Current water quality = Water Quality Difference Map



Water Quality Difference Map

# Project Status

- ECSM Calibration Complete
- For the LEC WSP runs
  - Developed 2045 future land use which incorporates future CERP projects, FSAID IX irrigated agricultural areas, and future LAN/REC acres
  - Completed demand sets for 2020 and 2045 for PS, CII, DSS, Power Gen
  - Completed ECSM crosswalk for canal stages in RSM-GL
  - Received tidal data for 2020 and 2045 with Sea Level Rise
  - 2020 demands and 2045 Projections are complete for LAN/REC
  - Upcoming work for December 2025:
    - Finalize calibration documentation
    - Complete Global Sensitivity Analysis using PEST++
    - Receive boundary conditions from RSM
    - Calculate return flow for 2020 and 2045 and run ET-Recharge program
    - Complete demand data sets for AGR and LAN/REC

# Project Status (cont'd)

- For WSVA
  - 2075 land use - complete
  - Population distribution and Public Supply / DSS projections – complete
  - Lan / Rec – projections complete
  - Well files – PS / DSS in process
  - Spring 2026
    - Complete climate transformations & RSM sensitivity runs
    - Calculate PS/DSS return flow, and run ET-Recharge program
    - Develop LAN/REC and AGR well files using ET-Recharge output
    - Incorporate 2075 tidal data
    - WSVA RSM runs - boundary conditions for ECSM runs
  - Summer 2026
    - ECSM WSVA runs

# Discussion

# 11. Closing Remarks

**Carolina Maran, Ph.D., P.E.**
**Division Director, Flood Control and Water Supply Planning**
**Chief of District Resiliency**
**South Florida Water Management District**

# Resiliency Coordination Forum

- **Provide feedback and share suggestions**
  - https://forms.office.com/g/MkZuHNhCPZ

- **Save the date for our 2026 meetings**
  - Wednesday, March 25, 2026
  - Wednesday, June 24, 2026
  - Wednesday, October 21, 2026

# Upcoming Events

- 17th Annual Southeast Florida Climate Leadership Summit
  - December 16-17, 2025
  - West Palm Beach, FL
- C&SF (Section 203) Flood Resiliency Study – Broward Basins Draft Feasibility Report
  - December 18, 2025
  - Fort Lauderdale, FL
- 10th Biennial University of Florida Water Institute Symposium
  - February 24-26, 2026
  - Gainesville, FL
- 2026 South Florida Environmental Report (SFER) Open House
  - March 11–12, 2026
  - West Palm Beach, FL

***Please share other relevant events during "Around the Table Updates"***

# 2026 UF Water Institute Symposium

## SFWMD Sessions: Wednesday, February 25, 2026

- **10:30 AM – Resiliency Planning Initiatives for Water Resources Management in South Florida**
  - *Rainfall Trends in South Florida*, Ali Alaa, SFWMD
  - *Flood Control Effectiveness Evaluations at South Florida Coastal Structures*, Tibebe Dessalegne, SFWMD
  - *Enhancing Regional Resilience Through Flood Occurrence Data Collection and Stakeholder Engagement*, Nicole Cortez, SFWMD
  - *Statewide Coupled Ocean-Atmosphere Regional Model*, Charles Jacoby, FFH
  - *Lower East Coast Water Supply Vulnerability Assessment*, Anushi Obeysekera, SFWMD
- **1:30 PM – Central and Southern Florida Project: Evolution, Collaboration, and Lessons Learned: Part I**
  - *Bringing Critical Flood Control Infrastructure Projects into Design and Construction*, Tarana Solaiman, SFWMD
  - *Talking Operations in the C&SF Project*, Jason Engle, USACE
  - *Comprehensive Everglades Restoration Plan: A Puzzle Piece of the Central and Southern Florida Project*, Bradley Foster, USACE
  - *Addressing Change Conditions with the Central and Southern Florida Flood Resiliency (Section 216) Study*, Gustavo Suarez, USACE
  - *Broward Basins C&SF Flood Resiliency Project (Section 203) Alternatives and Comprehensive Benefits*, Walter Wilcox, SFWMD
- **3:30 PM – Central and Southern Florida Project: Addressing New Challenges through Lasting Partnerships: Part II**
  - *Past, Present and Future wit the Central and Southern Florida Project*, John Mitnik, SFWMD
  - *Integration of Flood Risk Management Projects into Regional Resilience Efforts*, Tim Gysan, USACE
  - *C&SF Flood Resiliency (Section 203) Study for Broward Basins - Engineering Process*, Raymond Sciortino, Jacobs Engineering
  - *C7 Basin FPLOS Phase II Study Economic Assessment, Michael DelCharco*, Taylor Engineering
  - *Upper Kissimmee Basin Flood Direct and Indirect Benefits*, Francisco Pena, Galt Group

# September 16-19, 2025:
# Southwest Florida Resiliency Summit & Florida Resilience Conference