Future Extreme Rainfall Projections Workshop

April 27, 2022

Welcome

Moderator: Yvette Bonilla

Housekeeping

Q&A Session

If you're participating in person – please fill out Section 5 at the Technical Question / Public Comment Card and give to a meeting attendant

If you're participating via Zoom – use the Q&A function to submit a written question

Moderator: Yvette Bonilla

Housekeeping

Public Comments

If you're participating in person – please fill out Section 6 at the Technical Question / Public Comment Card and give to a meeting attendant

If you're participating via Zoom – use the Raise Hand feature

If you're participating via Phone:
*9 Raises Hand
*6 Mutes/Unmutes

Moderator: Yvette Bonilla

1. Opening Remarks

Drew Bartlett
Executive Director
South Florida Water Management District

1. Opening Remarks

Wesley Brooks, Ph.D.

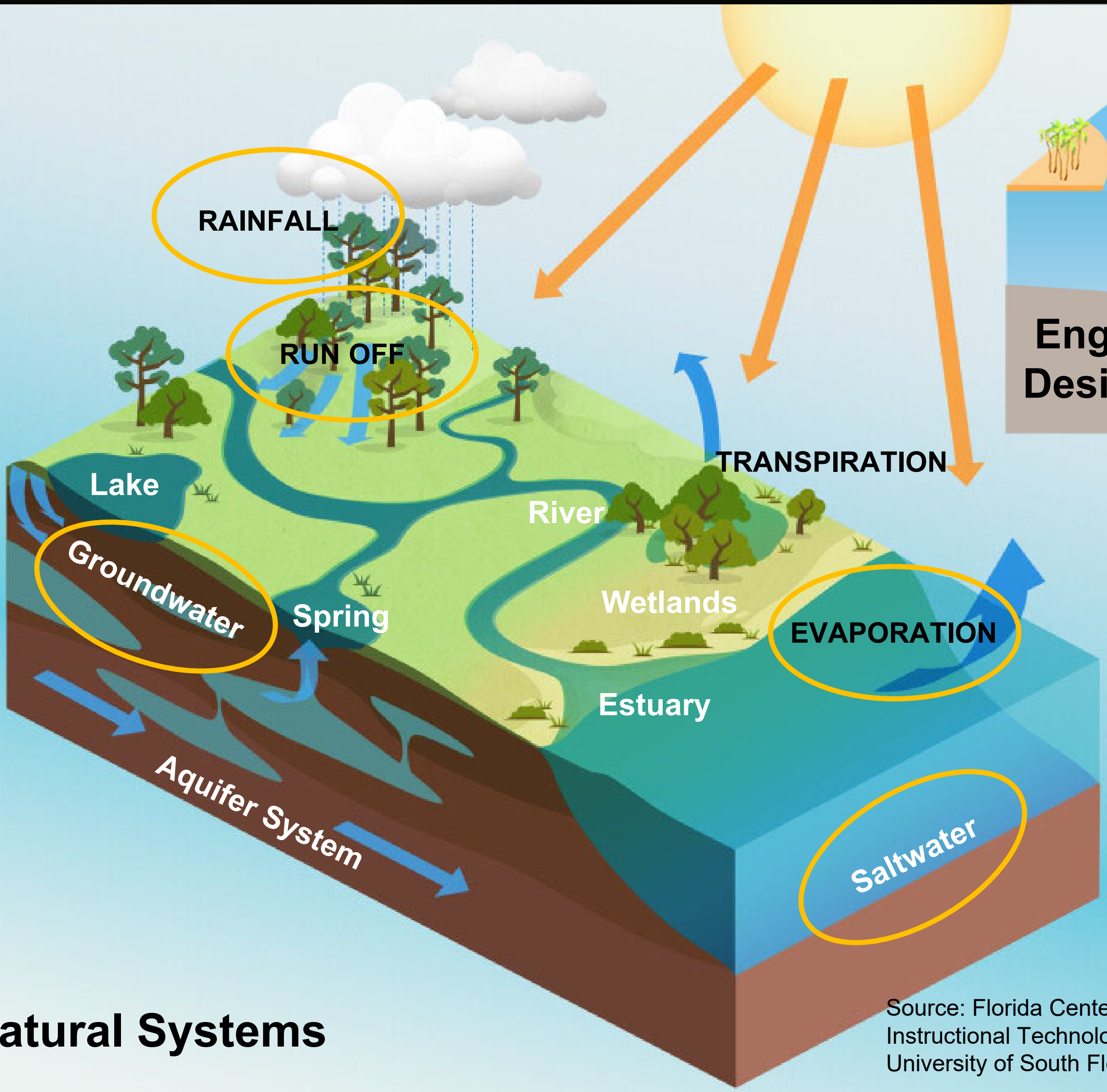
Chief Resilience Officer for the State of Florida

2. Resilient Florida Program and the Florida Flood Hub of Applied Research

Thomas K. Frazer, Ph.D.
Dean, College of Marine Science, University of South Florida
Director, Florida Flood Hub for Applied Research and Innovation

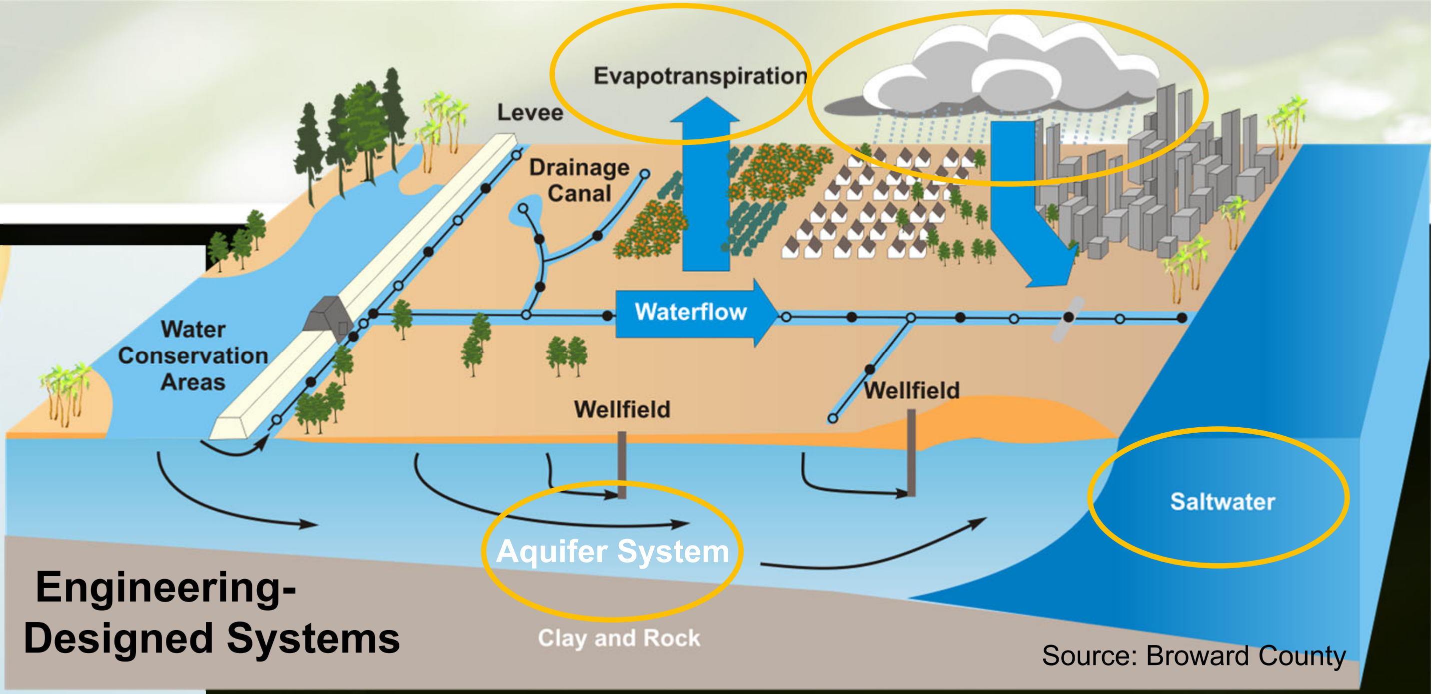
3. Extreme Rainfall Events as part of Flood Vulnerability Assessments

Carolina Maran, Ph.D., P.E.
District Resiliency Officer
South Florida Water Management District



Natural Systems

Source: Florida Center for Instructional Technology – University of South Florida

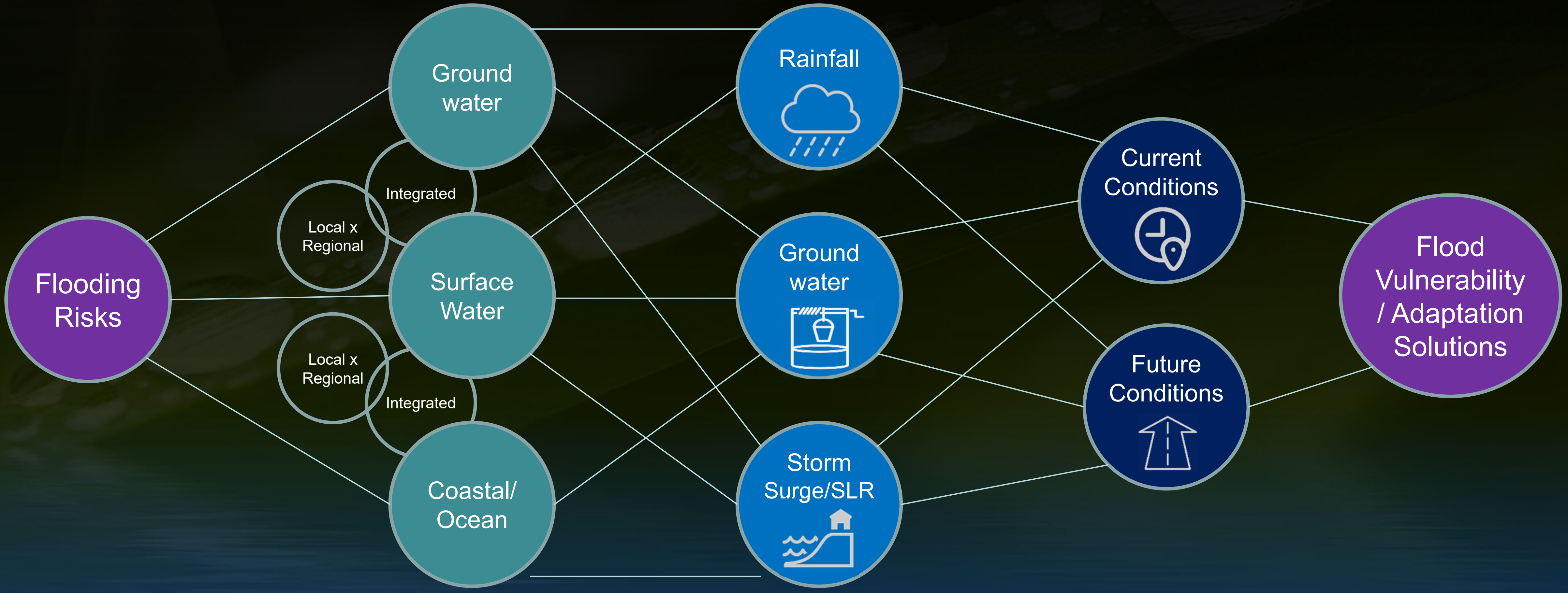


Engineering-Designed Systems

Source: Broward County

OUR WATER MANAGEMENT SYSTEM & CHANGING CONDITIONS

Assessing Flood Vulnerability and Adaptation Solutions

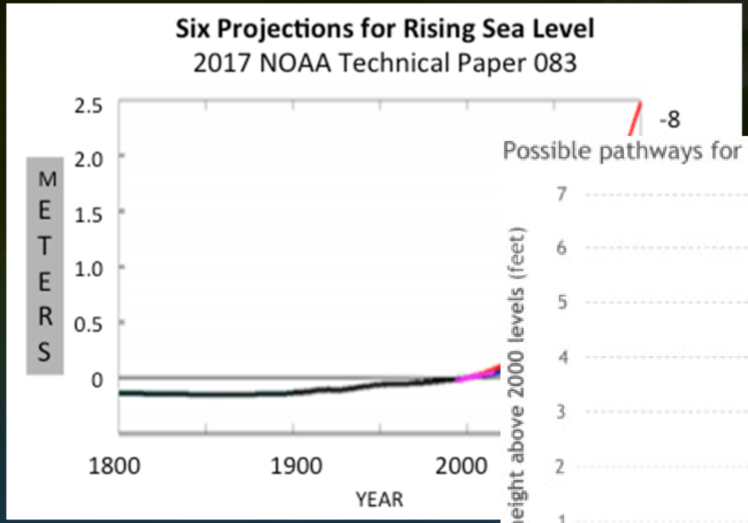


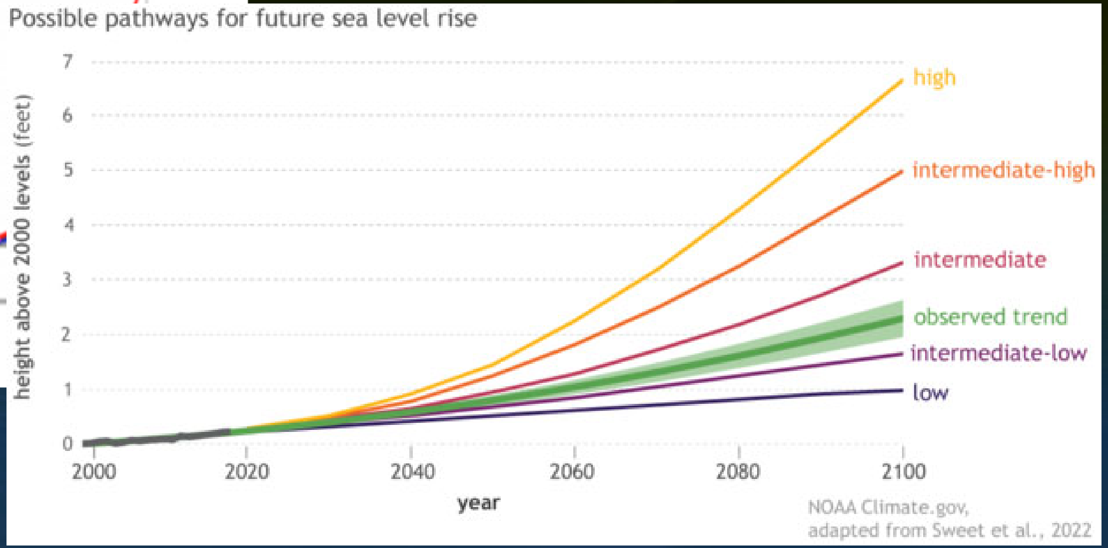
H&H Models/ Components **Drivers** **Scenarios**

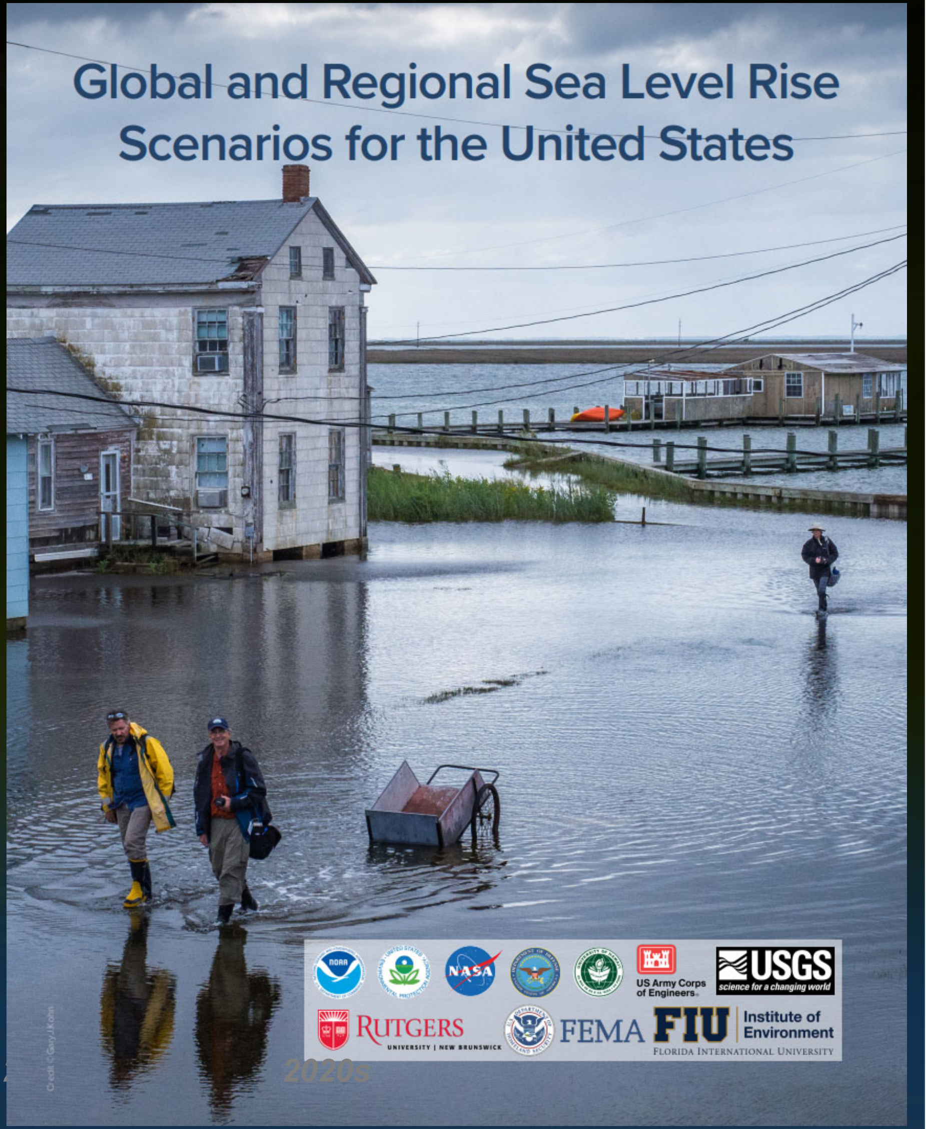
SLR Projections – Reducing Uncertainty

NOAA Curve/SLR (ft)	2017 (2040)	2022 (2040)	2017 (2060)	2022 (2060)	2017 (2080)	2022 (2080)
Intermediate Low	0.69	0.36	1.08	1.21	1.44	1.67
Intermediate	1.05	0.82	1.80	1.44	2.72	2.36
Intermediate High	1.41	0.92	2.56	1.87	4.10	3.38
High	1.77	1.02	3.38	2.30	5.61	4.46

Virginia Key Tidal Station

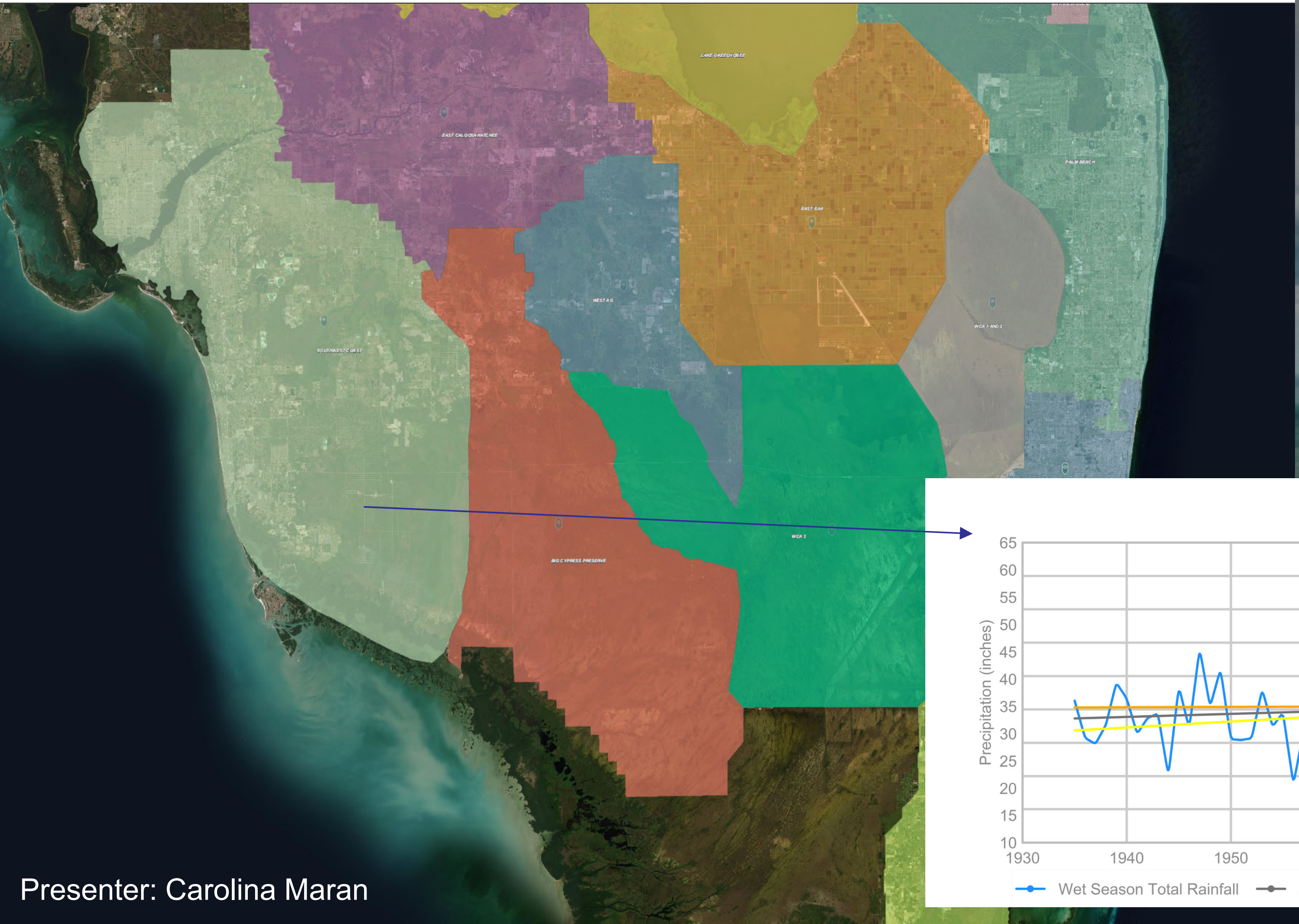


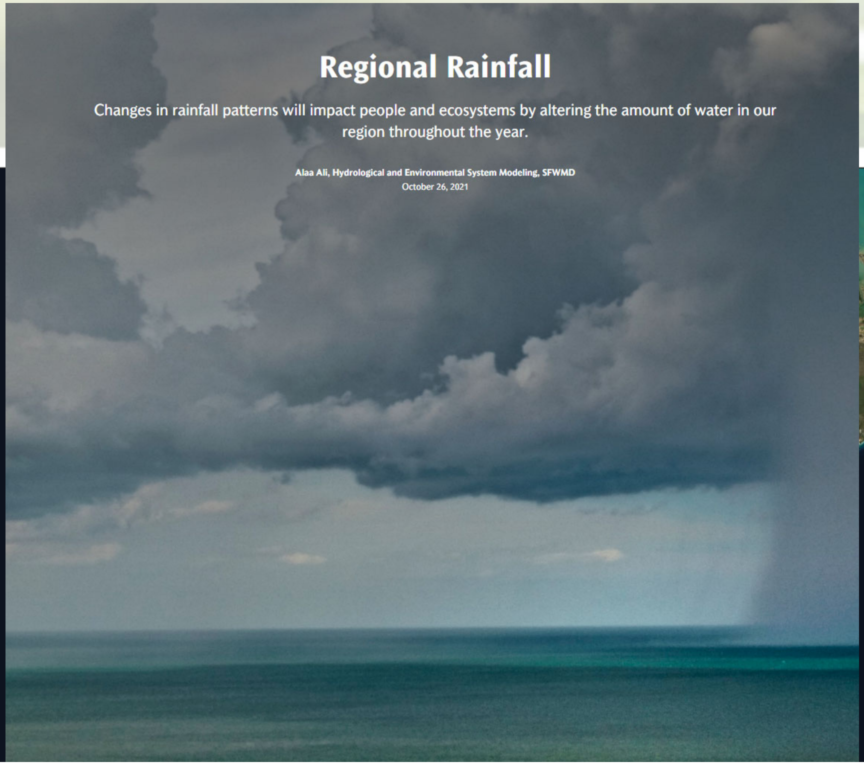


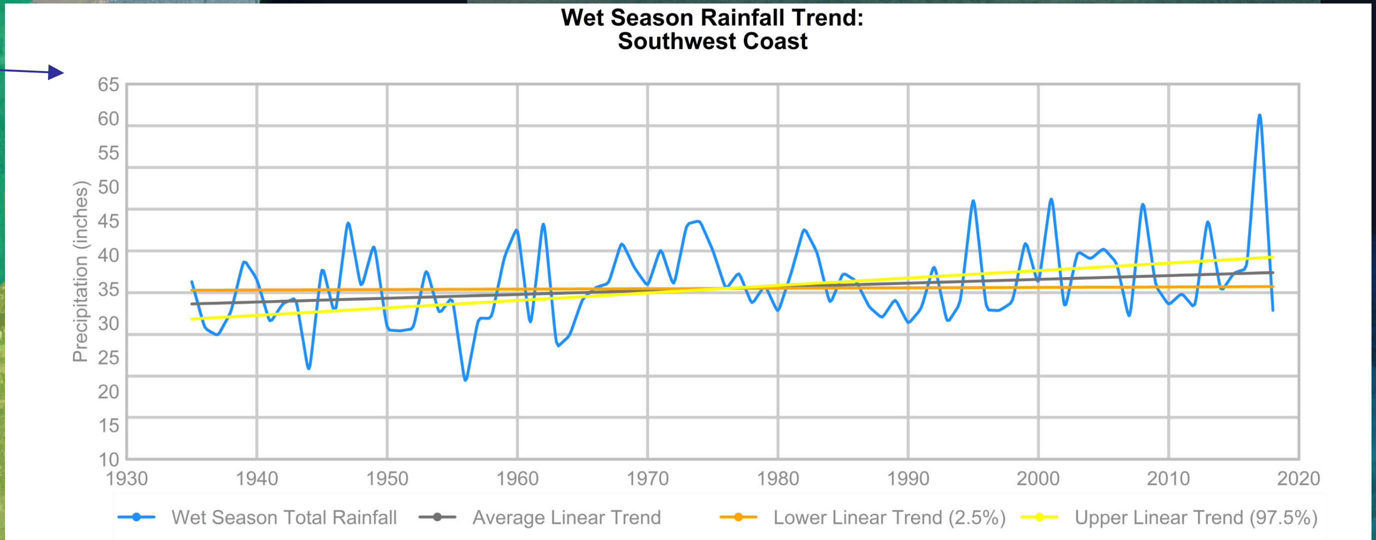


Presenter: Carolina Maran

Rainfall Observations







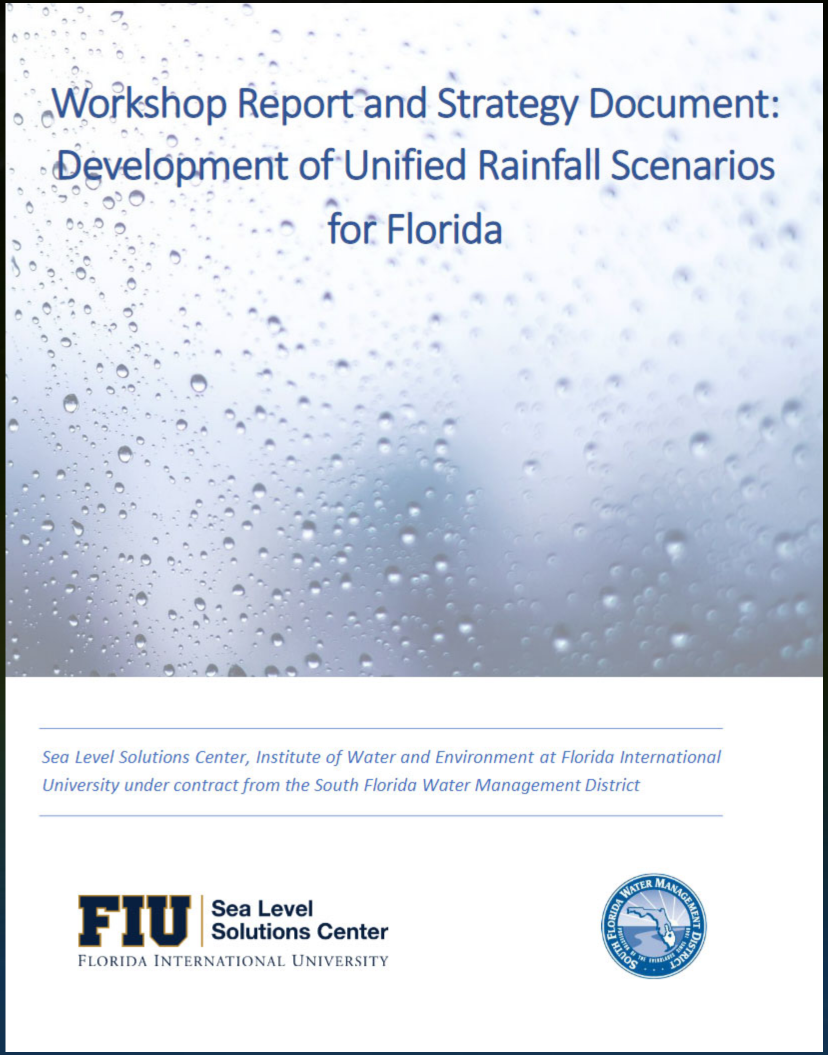
Presenter: Carolina Maran

Rainfall Projections

May 2019 Workshop FIU/SFWMD

Shorter-term strategy: rainfall estimates based on available global climate model downscaled datasets

Longer-term strategy: development of a Florida Regional Climate Model to capture particular conditions /mechanisms of rainfall occurrences in our State, including Tropical Storms and sea breeze contributions, among other important climatic processes.


Workshop Report and Strategy Document: Development of Unified Rainfall Scenarios for Florida

Sea Level Solutions Center, Institute of Water and Environment at Florida International University under contract from the South Florida Water Management District

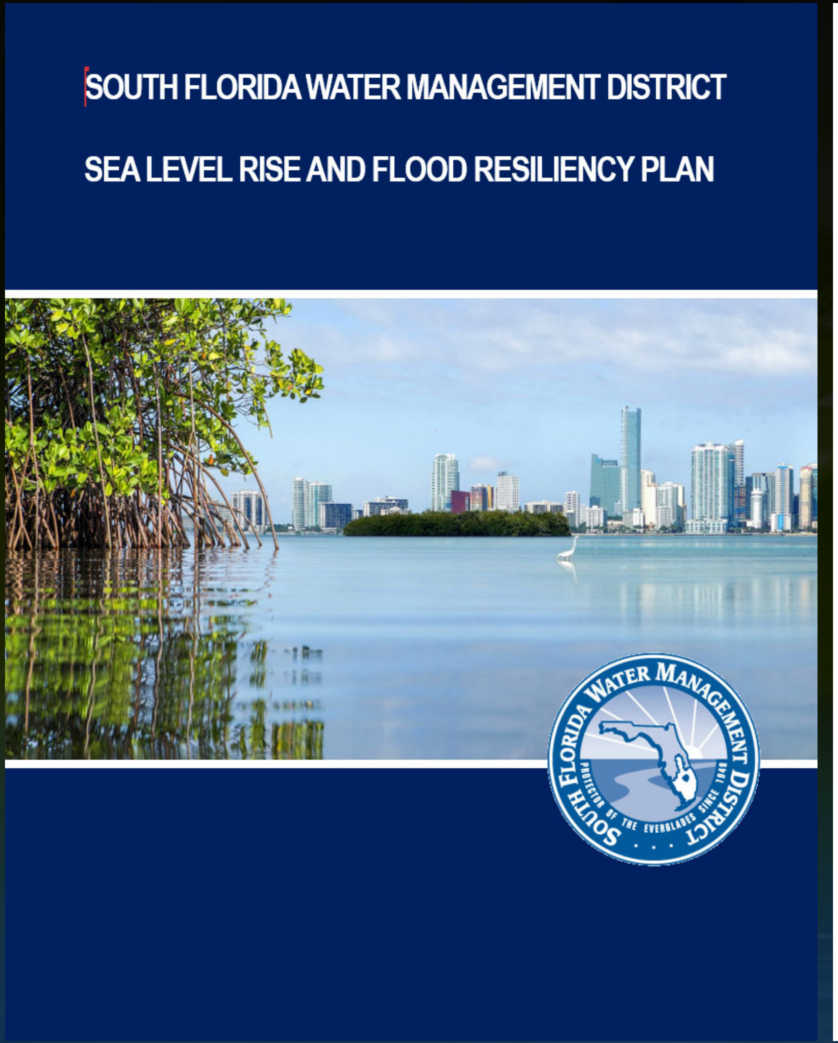
FIU Sea Level Solutions Center
Florida International University

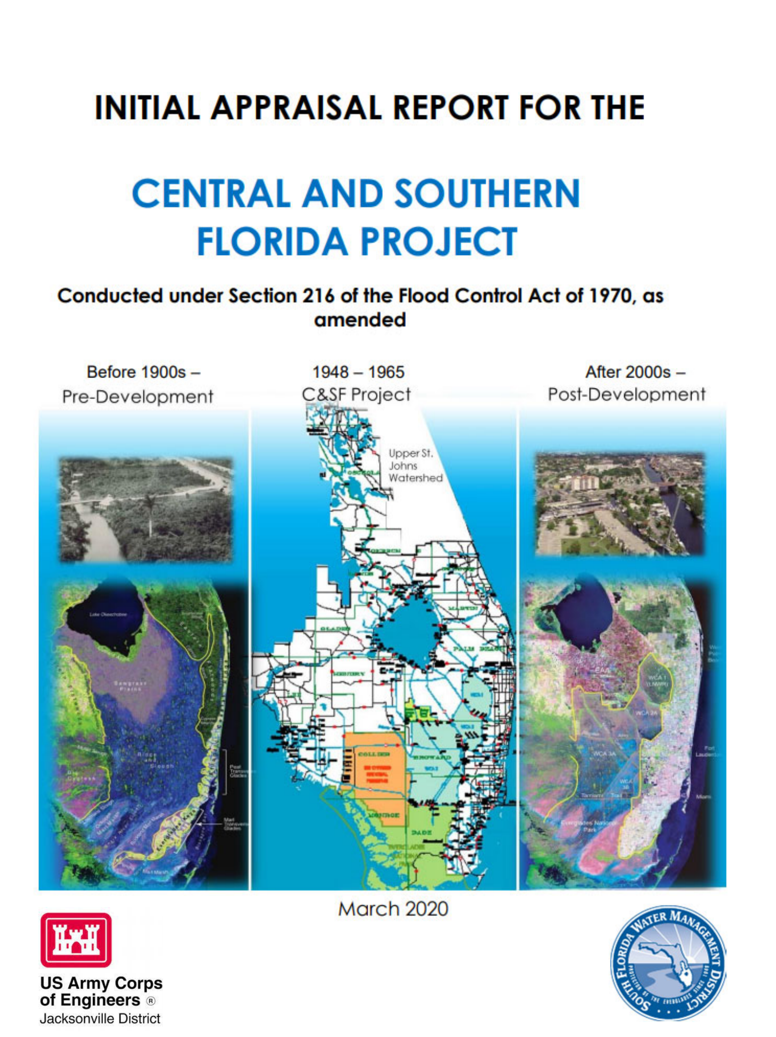
Presenter: Carolina Maran

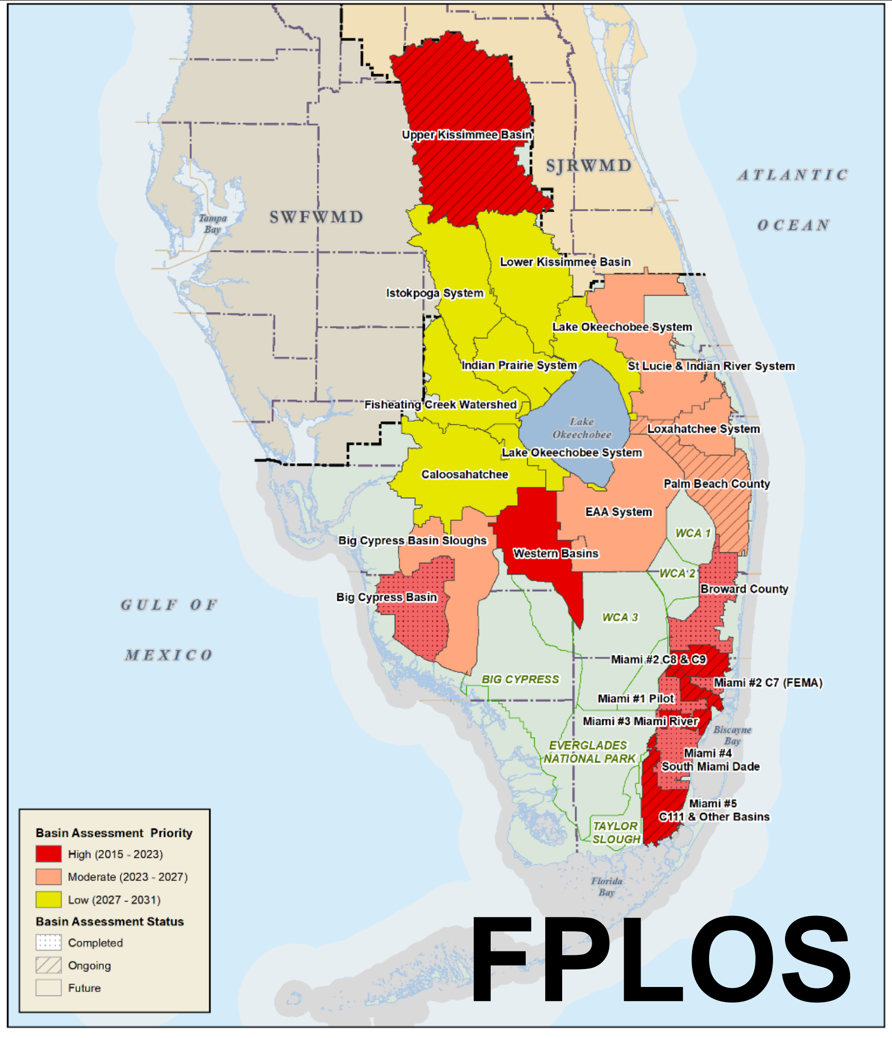
Review of Past and Recent Attempts (shorter-term strategy)

- Statistical Downscaling
  - Bias-Corrected, Spatially Downscaled (USBR-BCSD) — **SFWMD**
  - Bias-Corrected, Constructed Analogs (USBR-BCCA) — **SFWMD/Broward**
  - Locally Constructed Analogs (LOCA) — **SFWMD/Broward/FIU/USGS/FBC**
  - Multivariate Adaptive Constructed Analogs (MACA) — **USGS-FIU-SFWMD/FBC**
  - Self Organizing Maps (SOM) (FIU, Penn State) — **SFWMD**
  - Bias-Correction and Stochastic Analogs (UF) — **USGS-FIU-SFWMD**
- Dynamical Downscaling
  - NARCCAP (from NCAR)
  - Regional Spectral Model (RSM) (FSU) — **Broward**
  - NA-CORDEX — **Broward/USGS-FIU-SFWMD/FBC**
- Hybrid (Analog) Downscaling - Jupiter Int. WRF — **Broward/USGS-FIU-SFWMD**
- Raw GCMs — **Broward**

SFWMD's Future Rainfall Needs and Applications – Resiliency Planning







What information do we have today?

- Understanding future extreme rainfall conditions to aid planning practices and enhance flood vulnerability assessments
- This is about event simulation scenarios (design storms) and not for long term simulation / regional planning efforts
- This is not about average rainfall estimates or seasonality shifts into the future
- This is not about estimating drought conditions into the future
- This is not providing the necessary level of resolution that would be applicable to advance modernization of design criteria or to inform regulatory programs

4. Development of Projected Depth-Duration-Frequency Curves (2050–2089)

Michelle M. Irizarry-Ortiz, P.E., CC-P
Hydrologist, USGS Caribbean-Florida Water Science Center

5. Q&A Session

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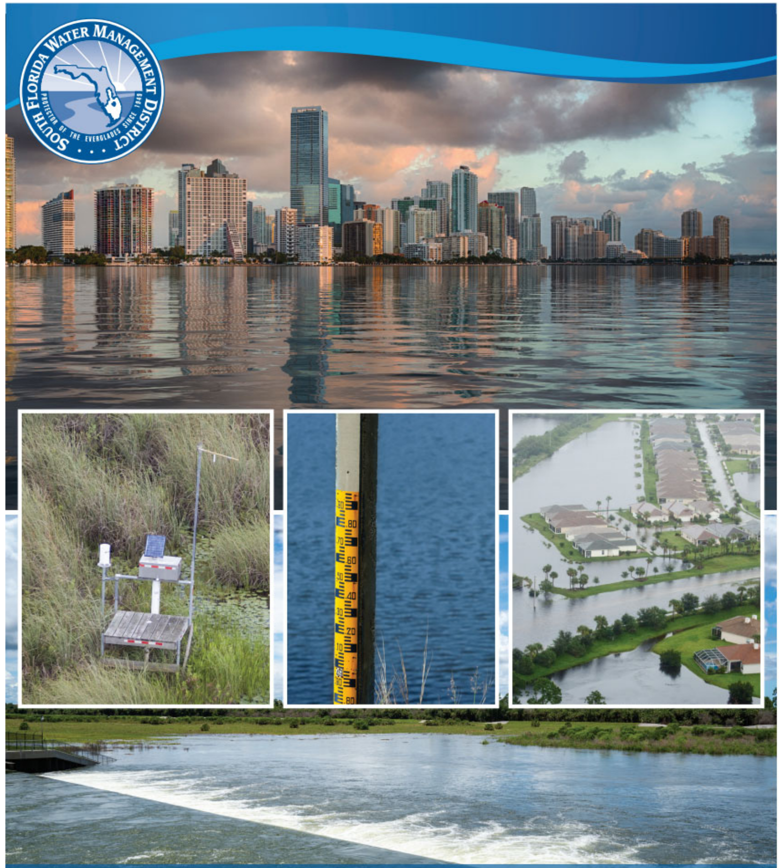
Moderator: Nicole Cortez

6. Adopting Future Rainfall Change Factors as part of SFWMD Resiliency Planning Efforts

TECHNICAL MEMORANDUM ON THE ADOPTION OF FUTURE EXTREME RAINFALL CHANGE FACTORS FOR FLOOD RESILIENCY PLANNING

Carolina Maran, Ph.D., P.E.
District Resiliency Officer
South Florida Water Management District

How to best adopt these results?

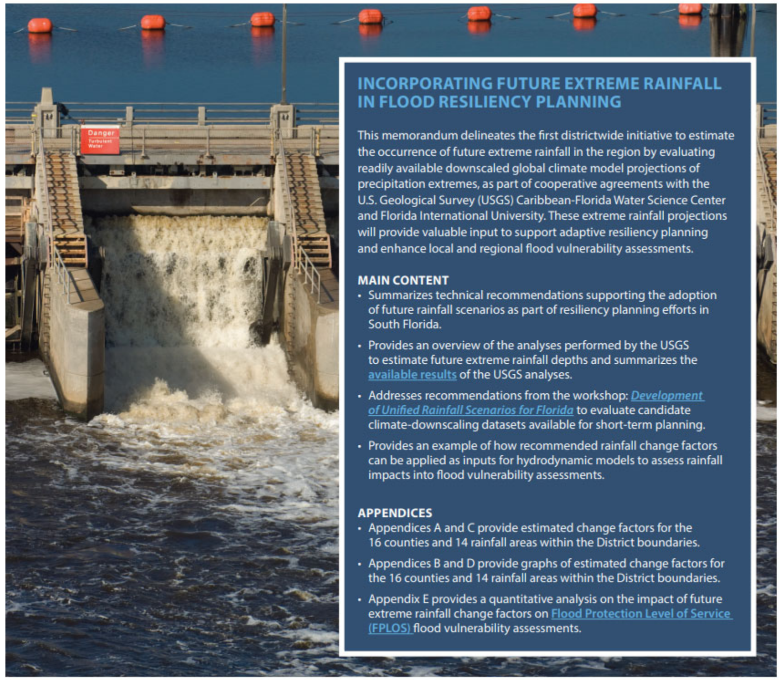


Technical Memorandum:

ADOPTION OF FUTURE EXTREME RAINFALL CHANGE FACTORS FOR FLOOD RESILIENCY PLANNING IN SOUTH FLORIDA

April 27, 2022

Technical Memorandum: Future Extreme Rainfall Change Factors For Flood Resiliency Planning In South Florida



INCORPORATING FUTURE EXTREME RAINFALL IN FLOOD RESILIENCY PLANNING

This memorandum delineates the first districtwide initiative to estimate the occurrence of future extreme rainfall in the region by evaluating readily available downscaled global climate model projections of precipitation extremes, as part of cooperative agreements with the U.S. Geological Survey (USGS) Caribbean-Florida Water Science Center and Florida International University. These extreme rainfall projections will provide valuable input to support adaptive resiliency planning and enhance local and regional flood vulnerability assessments.

MAIN CONTENT

- Summarizes technical recommendations supporting the adoption of future rainfall scenarios as part of resiliency planning efforts in South Florida.
- Provides an overview of the analyses performed by the USGS to estimate future extreme rainfall depths and summarizes the available results of the USGS analyses.
- Addresses recommendations from the workshop: *Development of Unified Rainfall Scenarios for Florida* to evaluate candidate climate-downscaling datasets available for short-term planning.
- Provides an example of how recommended rainfall change factors can be applied as inputs for hydrodynamic models to assess rainfall impacts into flood vulnerability assessments.

APPENDICES

- Appendices A and C provide estimated change factors for the 16 counties and 14 rainfall areas within the District boundaries.
- Appendices B and D provide graphs of estimated change factors for the 16 counties and 14 rainfall areas within the District boundaries.
- Appendix E provides a quantitative analysis on the impact of future extreme rainfall change factors on Flood Protection Level of Service (FPLOS) flood vulnerability assessments.

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Connect with us on Facebook, Twitter, Instagram, LinkedIn and YouTube.

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ACKNOWLEDGMENTS

This technical memorandum was made possible by the guidance, support, and contributions of a dedicated team of individuals at the South Florida Water Management District, United States Geological Survey, and United States Army Corps of Engineers. We would like to especially acknowledge the technical feedback provided by the United States Geological Survey Caribbean–Florida Water Science Center and Florida International University Sea Level Solutions Center, and express our appreciation to the Future Extreme Rainfall Projections Technical Workgroup members who assisted with the preparation of this memorandum as follows:

PROJECT TEAM

South Florida Water Management District

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Nicole Cortez	District Resiliency
Francisco Peña	District Resiliency
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Jenifer Barnes	Hydrology and Hydraulics Modeling
Hongying Zhao	Hydrology and Hydraulics
Akin Owosina	Hydrology and Hydraulics
Karin Smith	Water Supply Planning
Kristopher Esterson	Water Supply Planning
Sean Sculley	Applied Sciences
Brian Turcotte	Applied Sciences
Todd Kimberlain	Meteorological Operations

United States Army Corps of Engineers

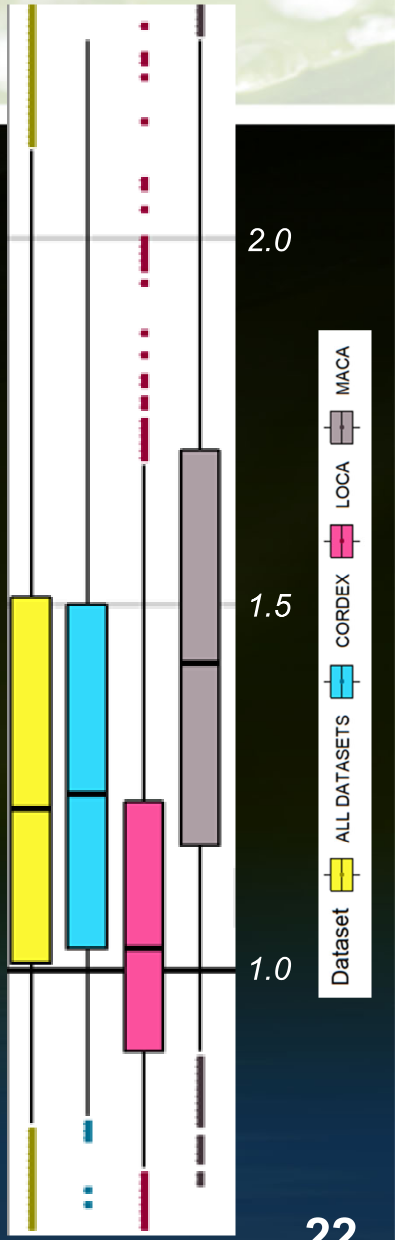
Ceyda Polatel	Jacksonville District
Drew Coman	Jacksonville District
Matt Fischer	Jacksonville District

Overall Observations & Findings

1. INCREASE IN FUTURE EXTREME RAINFALL: global climate models (GCMs) show consistent increases in the magnitude of future extreme rainfall occurrences for the 50-year future planning horizon represented by change factors larger than 1.0

2. RCP 4.5 AND RCP 8.5 EMISSIONS SCENARIOS: resulting change factors are slightly higher in RCP 8.5 than in RCP 4.5 for all downscaled datasets, and in both climate regions, and not statistically significant

3. INDIVIDUAL DOWNSCALED DATASETS: modeled and observed records for the historical period showed different degrees of agreement among the selected datasets and models, without any stand-out condition representing one single dataset that performs significantly better than others



100-year / 1-day Change Factors (All Models, both RCP 8.5 and 4.5) for Palm Beach AHED Rainfall Region. Boxes include 25-50-75th percentiles, whiskers include 5-95th percentile, points show a portion of the outliers (Illustrative Purposes).

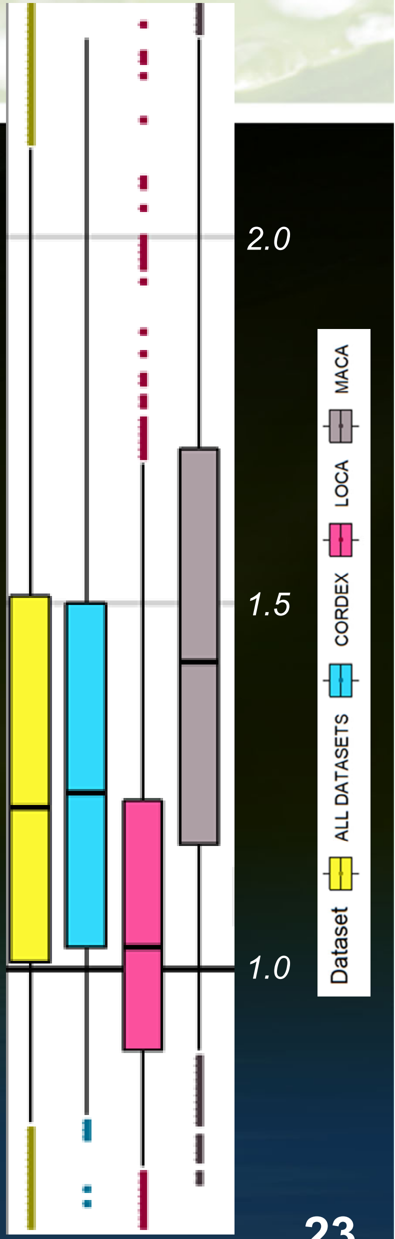
Overall Observations & Findings

4. ALL MODELS OR BEST MODELS: the comparison between a subset of best models versus all models showed different degrees of agreement. Best-models subset is biased towards the MACA results

5. RESULT RANGES: noticeable wide spread of derived change factors, potentially a result of the relatively coarse resolution, difference between statistical and dynamic downscaling approaches, biases in historically fitted DDF curves, and scenario and models spread

6. INDIVIDUAL RAINFALL STATIONS OR REGIONAL ANALYSES: There is noticeable variation between individual rainfall stations within rainfall areas.

100-year / 1-day Change Factors (All Models, both RCP 8.5 and 4.5) for Palm Beach AHED Rainfall Region. Boxes include 25-50-75th percentiles, whiskers include 5-95th percentile, points show a portion of the outliers (Illustrative Purposes).



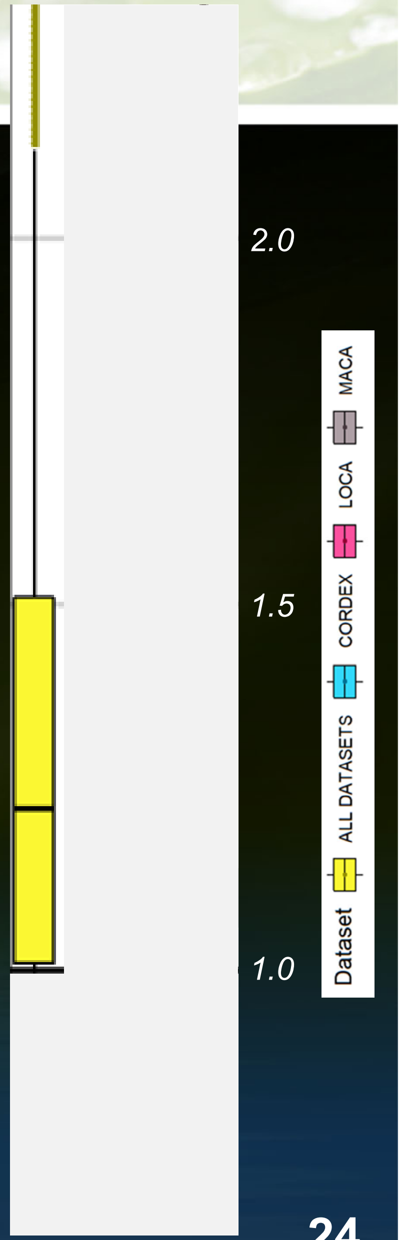
Overall Recommendations

1. INCREASING FUTURE EXTREME RAINFALL: change factors larger than 1.0 are to be adopted as part of scenario formulation

2. RCP 4.5 AND RCP 8.5 SCENARIOS: observed overlap in the results for RCP 4.5 and RCP 8.5, combined change factors are to be adopted as part of scenario formulation

3. ENSEMBLE ESTIMATES: model spread of all available results is to be adopted as part of scenario formulation, capturing upper and lower bounds of climate scenarios

100-year / 1-day Change Factors (All Models, both RCP 8.5 and 4.5) for Palm Beach AHED Rainfall Region. Boxes include 25-50-75th percentiles, whiskers include 5-95th percentile, points show a portion of the outliers (Illustrative Purposes).



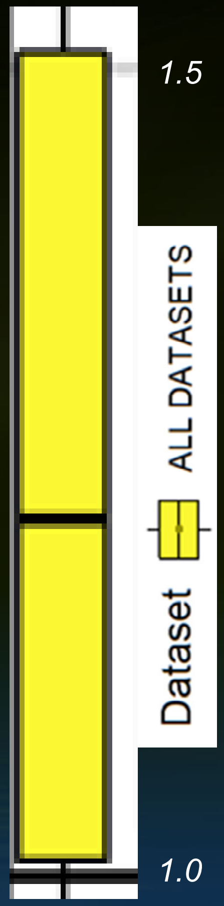
Overall Recommendations

4. ALL MODELS: ensemble estimates based on all the model results, instead of the subset of best models, are to be adopted as part of scenario formulation

5. 50% CONFIDENCE INTERVAL FOR MODEL SPREAD: 50% confidence interval is being adopted to represent model spread, by delineating a 25th to 75th percentile range, and to limit the scenario formulation process to the 50% confident / central tendency region around the median

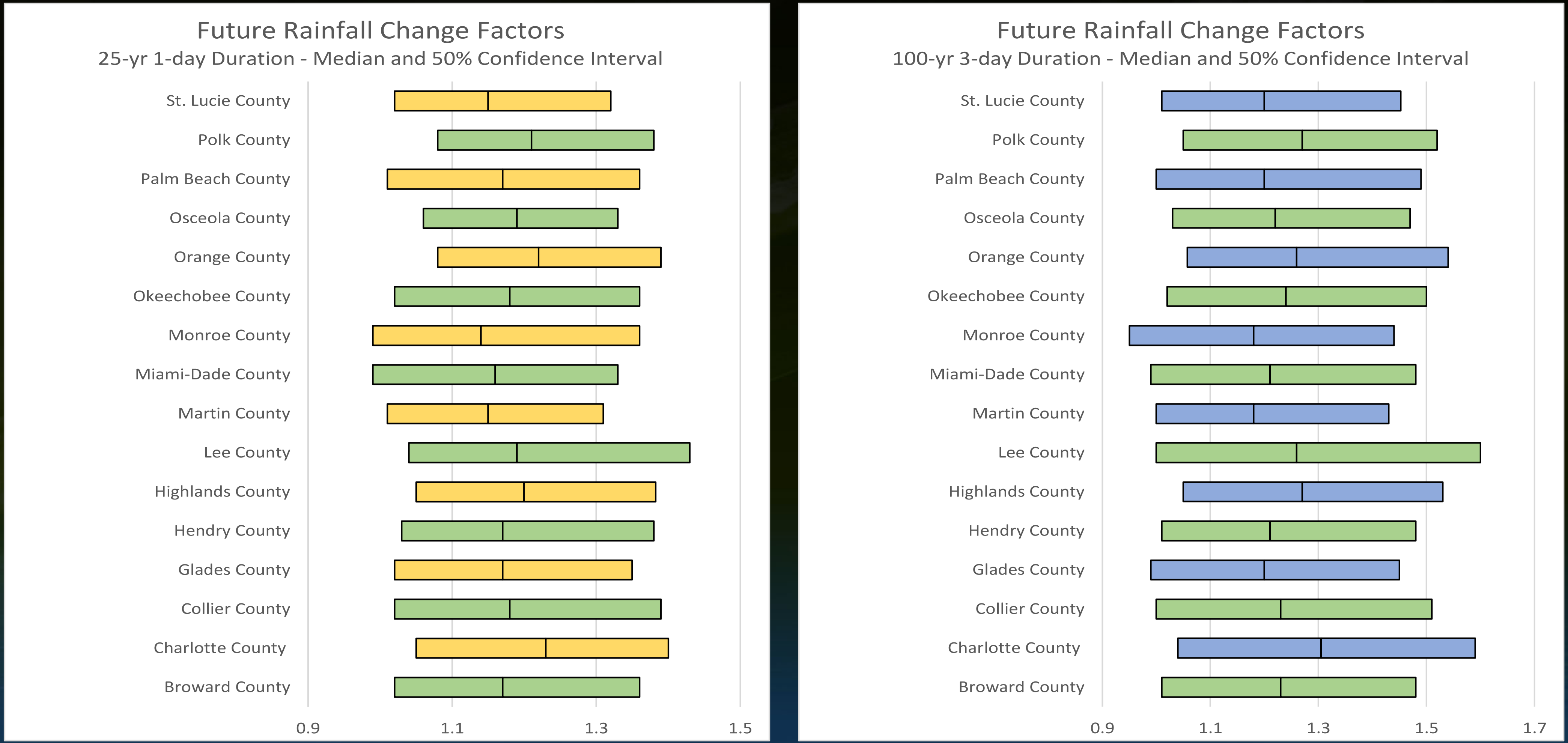
6. RESULTS BY REGION: median change factors across selected regions with respective spread are to be adopted as part of scenario formulation.

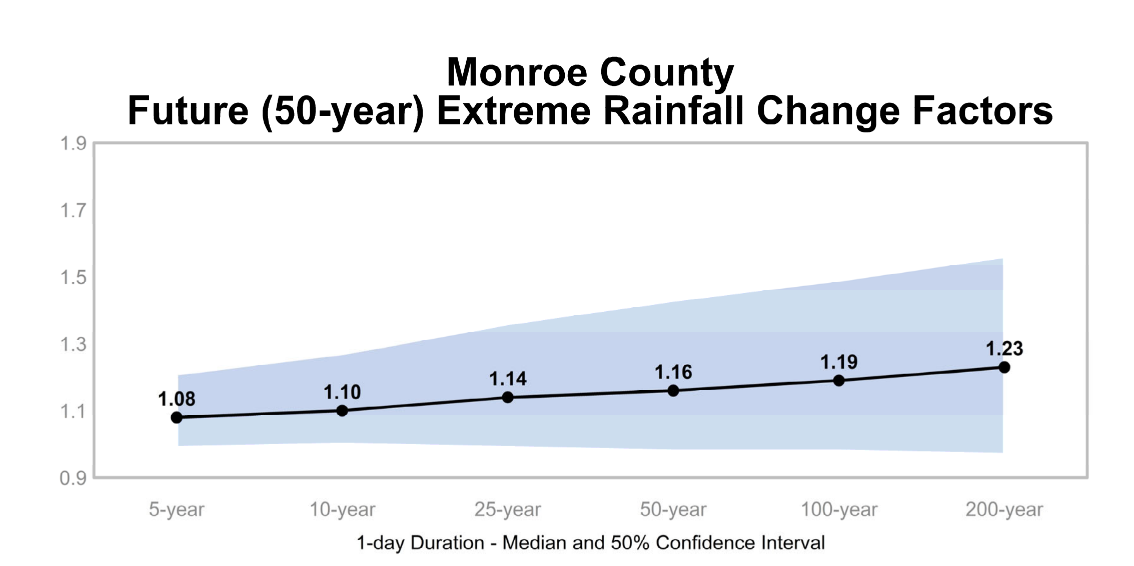
100-year / 1-day Change Factors (All Models, both RCP 8.5 and 4.5) for Palm Beach AHED Rainfall Region. Boxes include 25-50-75th percentiles, whiskers include 5-95th percentile, points show a portion of the outliers (Illustrative Purposes).

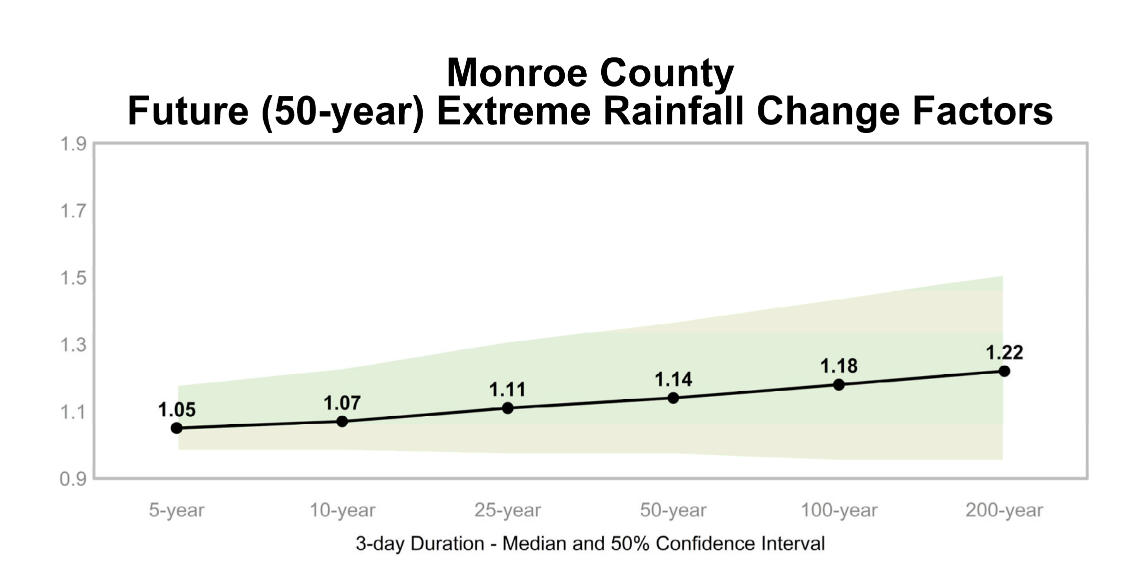


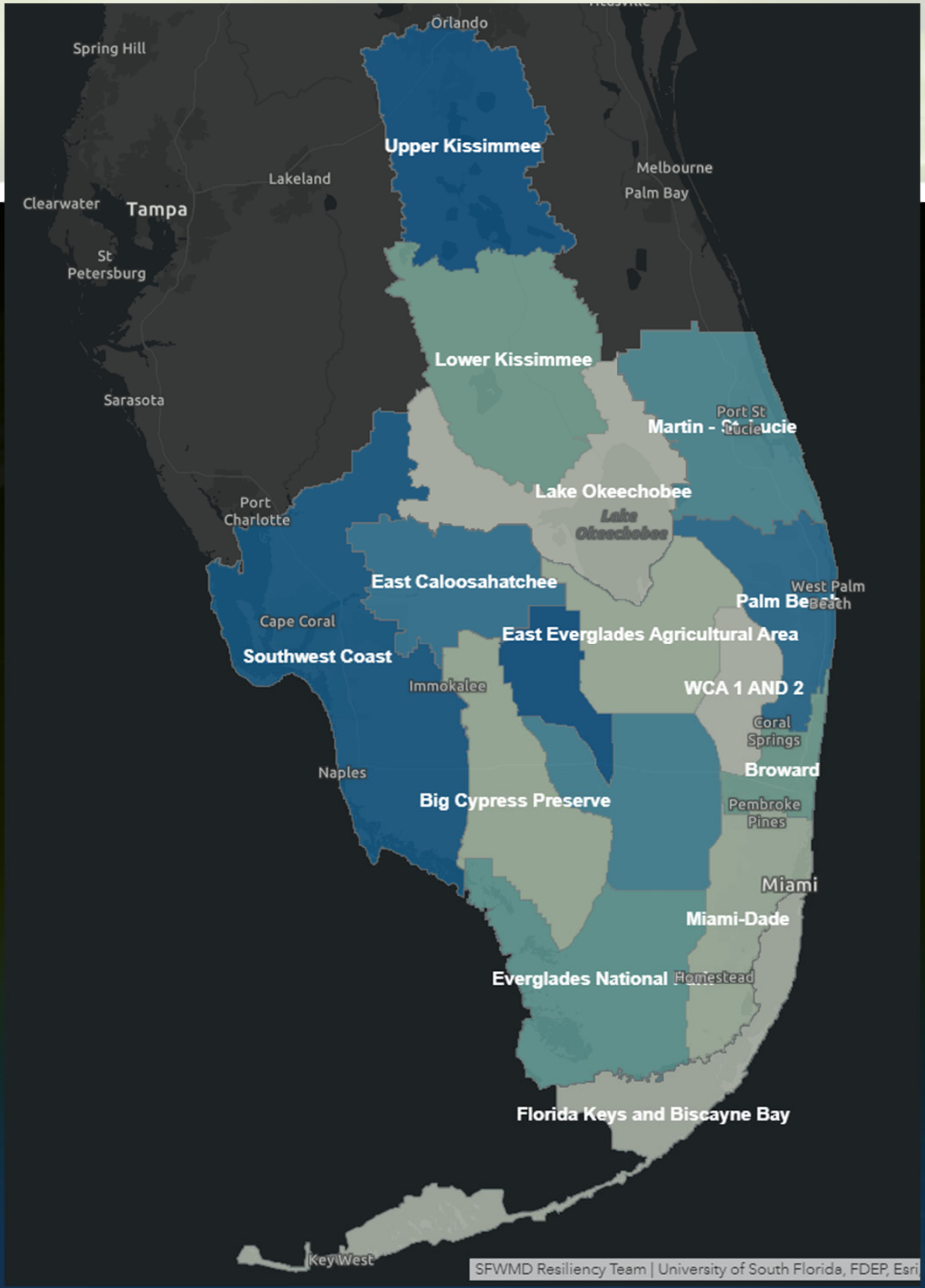
Counties Future Rainfall Change Factors

(median and 50% confidence interval, 100-year/3-day and 25-year/1-day)









Presenter: Carolina Maran

6a. Adopting Future Rainfall Change Factors as part of SFWMD Resiliency Planning Efforts

FLOOD PROTECTION LEVEL OF SERVICE PROGRAM
"adding rainfall to the mix"

Akintunde Owosina, P.E.
Chief, Hydrology and Hydraulics Bureau
South Florida Water Management District

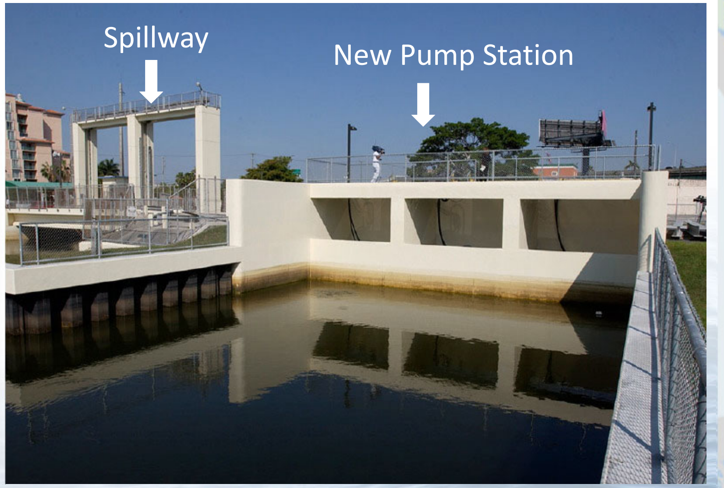
… The Manager's Question …

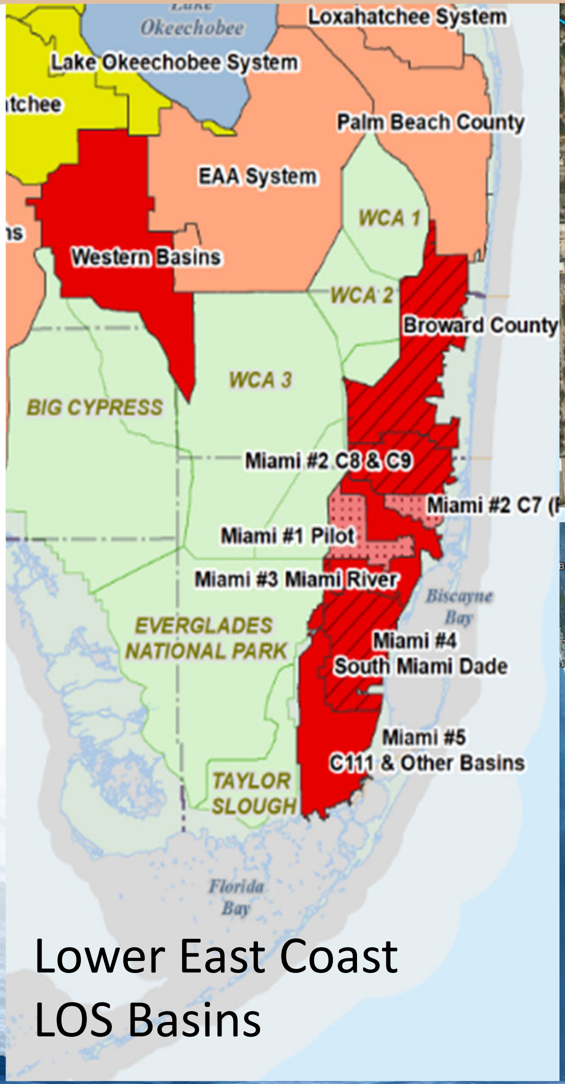
We have aging infrastructure approaching or past design end of life, in addition to changing conditions (land use, sea level rise, rainfall, groundwater levels)

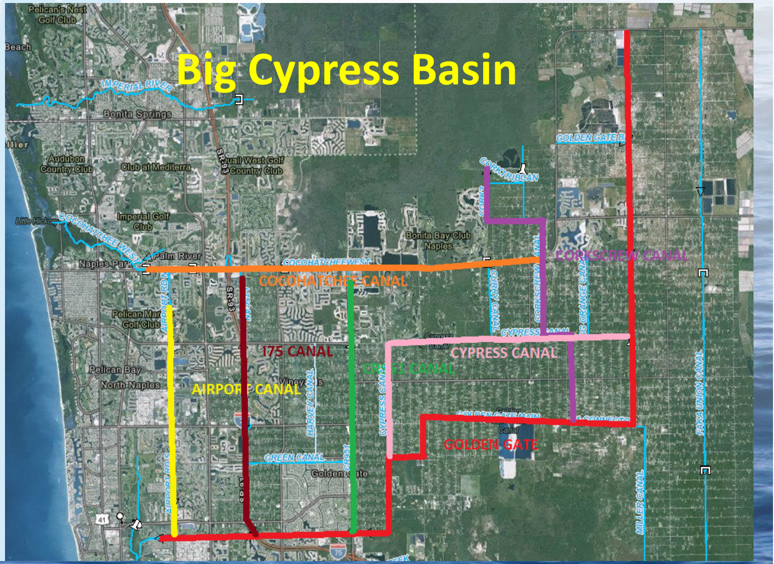
- Do I replace them?
- When do I replace them?
- What do I replace them with
- Where and how?
- What liability or risk am I exposed to – due to action or inaction
- Who pays for the fix
- What assurances do I have, considering associated uncertainties?

Flood Protection Response

- **Flood Protection Level of Service program:**
  - Assess flood protection performance of flood control infrastructure
  - Support decision making on prioritizing improvements and adaptation







Three Phases of the FPLOS Program

Phase 1
Assessment

- Focus on Flood Control Assets in Primary system
- Identify flood vulnerable assets and regions

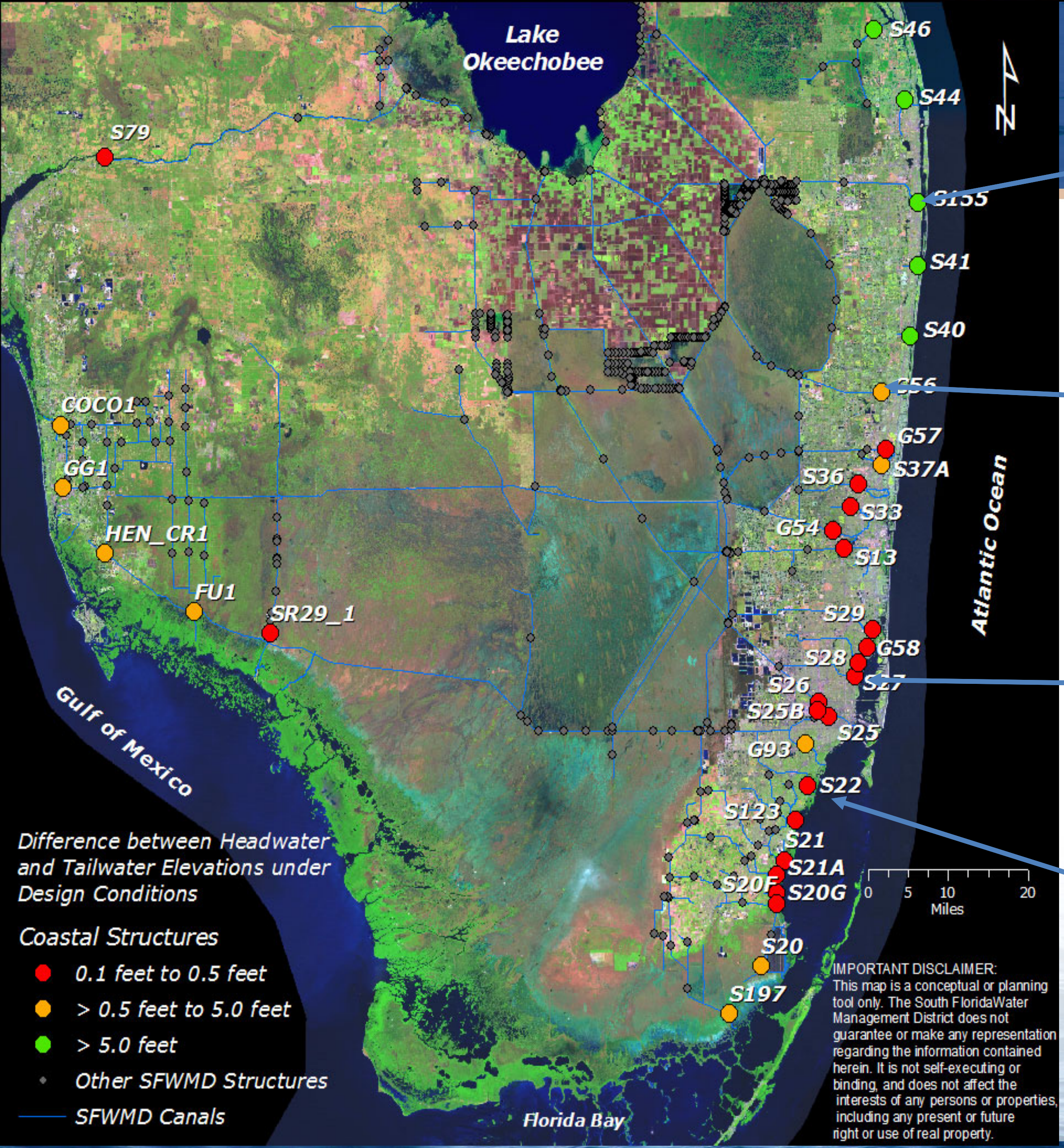
Phase 2
Mitigation and Adaptation Planning

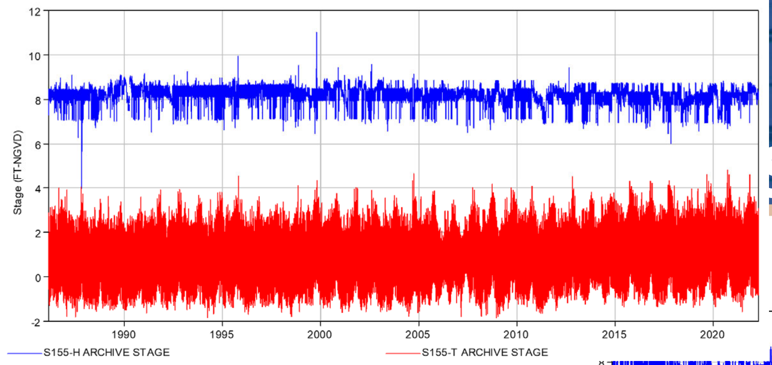
- Focus on Primary, Secondary and Tertiary systems
- Collaboratively identify projects, operations or regulations to meet flood control needs

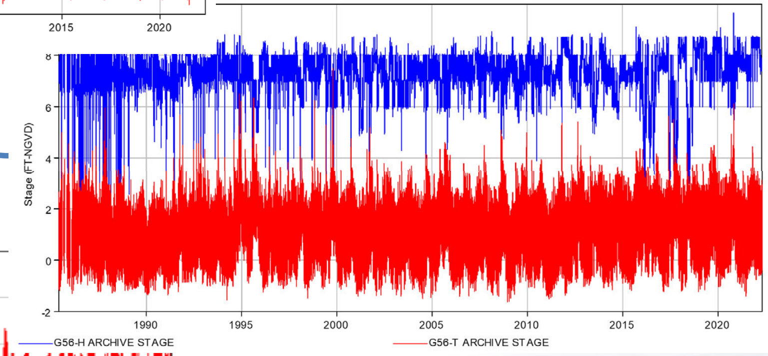
Phase 3
Implementation

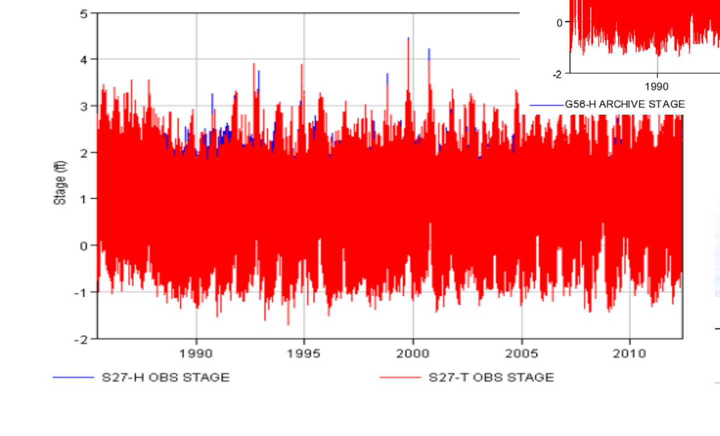
- Design, permit and build identified projects to achieve resilient flood protection goals, integrated into the Sea Level and Flood Resiliency Plan

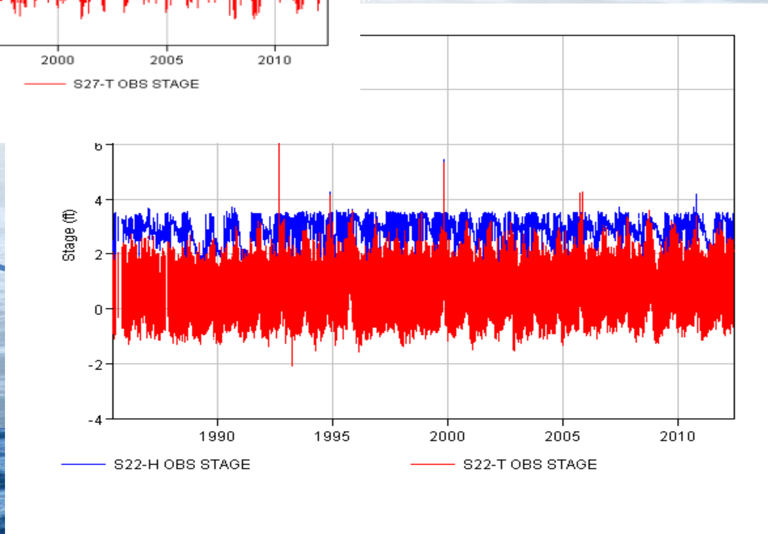
E…g and V…ssment



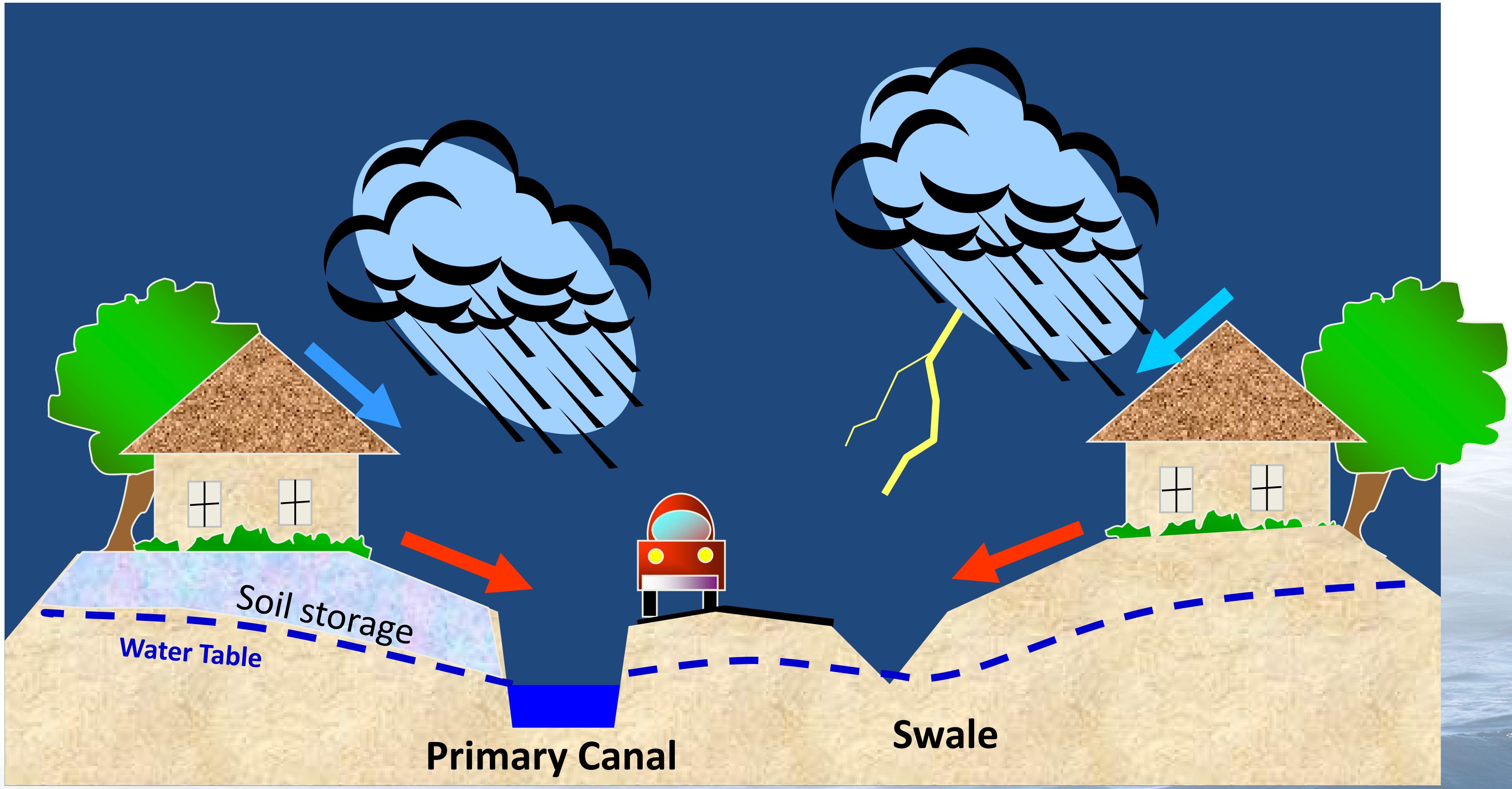




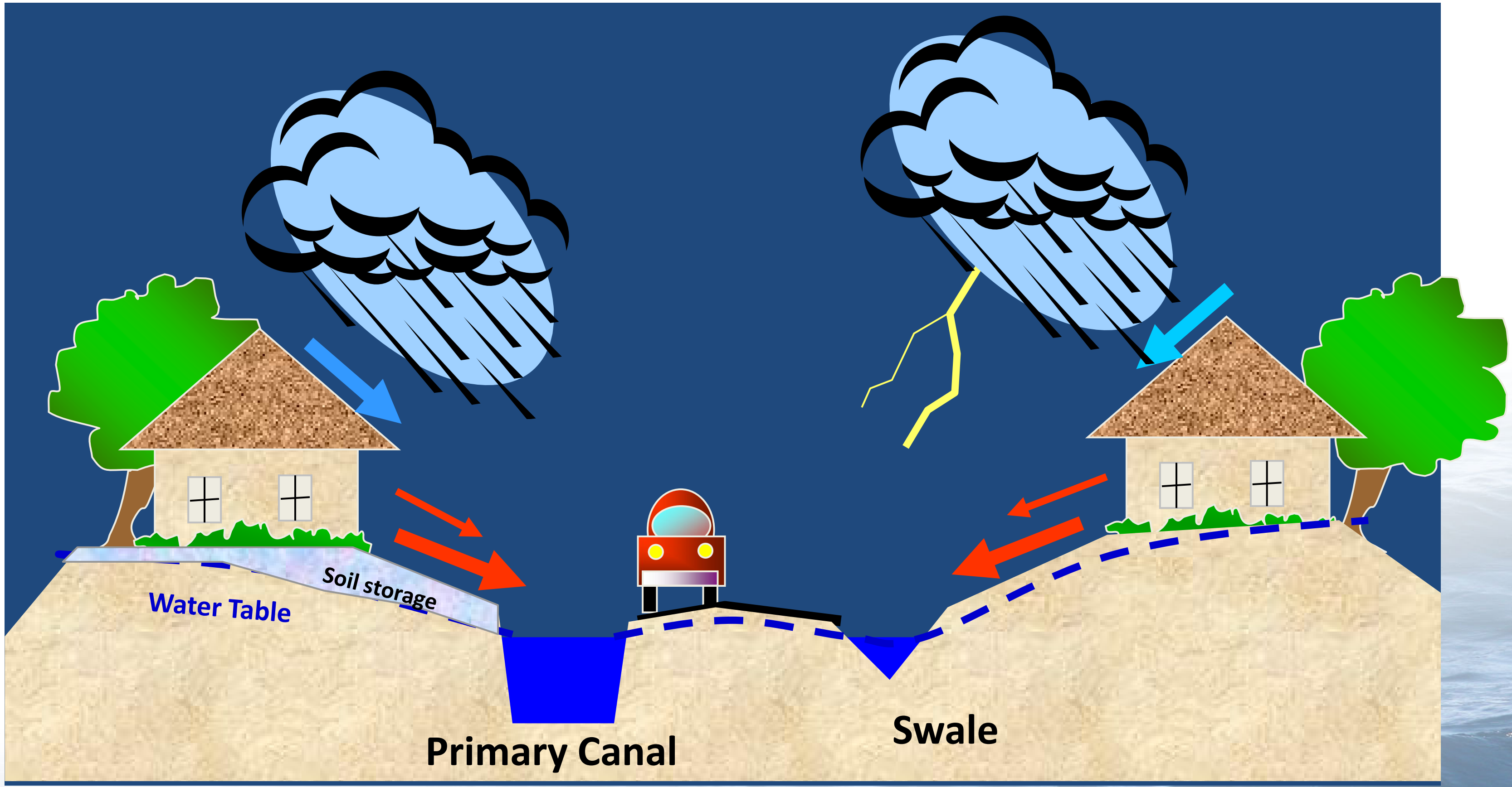




Flooding depends on the location of water table

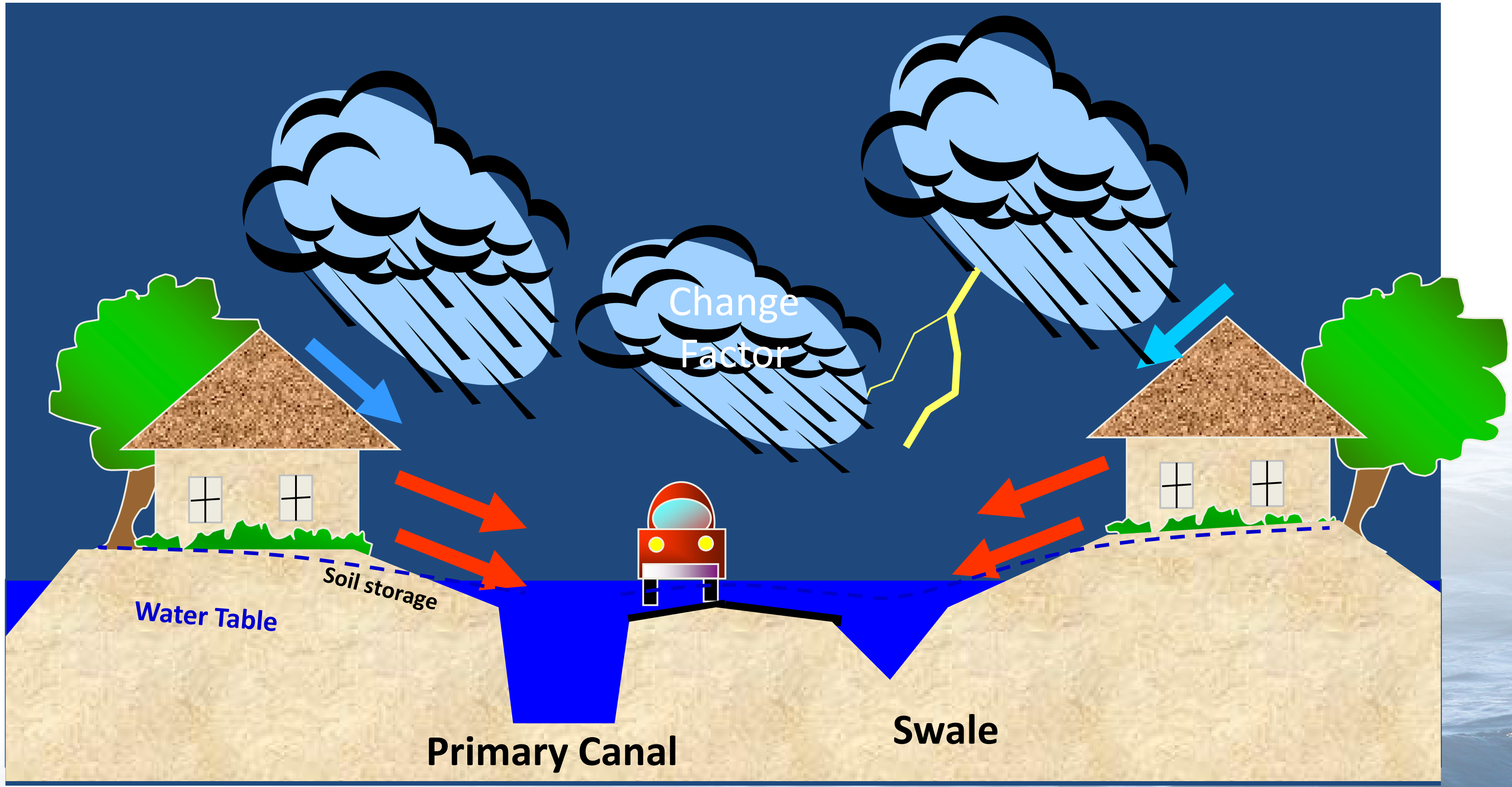


With Higher Water Table Due to Sea Level Rise



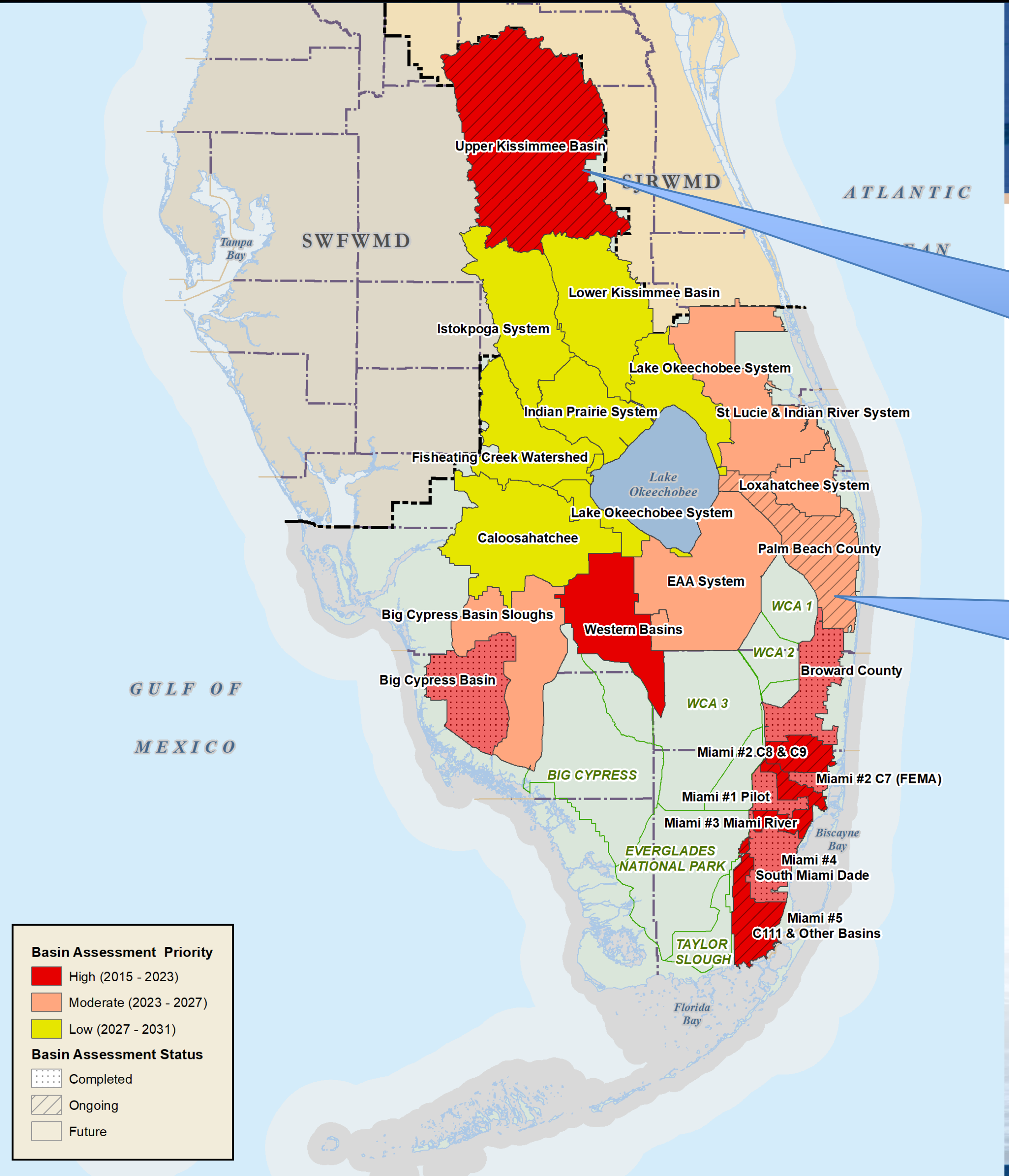
*A rise in water table will reduce soil storage and rapid runoff during storms

.. Then With Increase in Extreme Rainfall



*A rise in water table will reduce soil storage and rapid runoff during storms

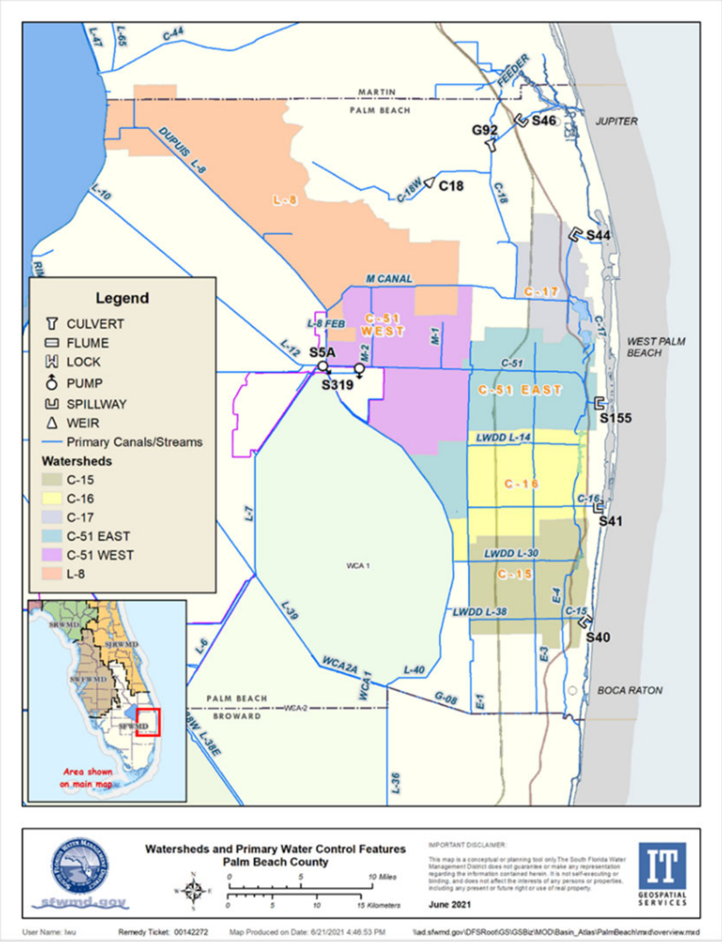
Two New Starts for FY2022



Upper Kissimmee Basin
- Land locked
- Significant development pressure
- Lake systems

Palm Beach County
- Coastal with large headwater tailwater difference
- Heavily managed
- Land use changes

Flood Protection Level Of Service for Eastern Palm Beach County Watersheds



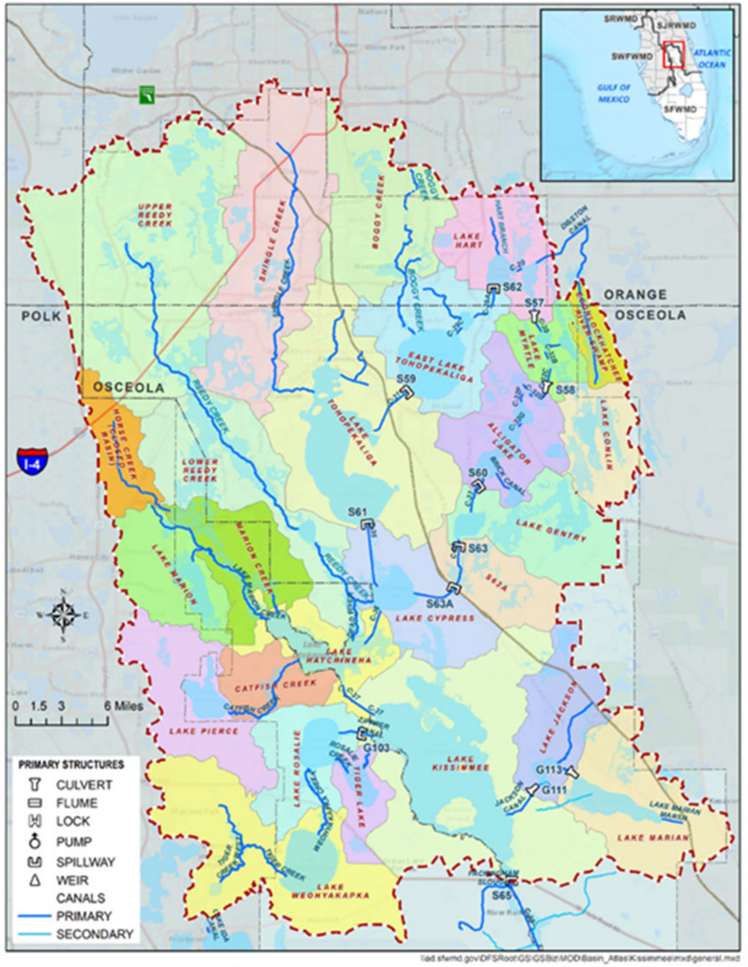
Started in April 2022

<u>Objectives</u>: to conduct a Flood Protection Level of Service analysis for seven watersheds in Palm Beach County: L-8, C-51 East, C-51 West, C-17, C-16, C-15 and W.P.B.

<u>Major Products:</u>

- Calibrated and validated hydrologic and hydraulic (H&H) model
- Assessment of current level of flood protection for existing infrastructure and for current sea level conditions.
- Assessment of future level of flood protection assuming current drainage infrastructure,
  - Future rainfall for different return Periods (Using change factor)
  - Three sea level rise scenario
  - Future land use and future groundwater
- Identify FPLOS deficiencies for different watersheds

Flood Protection Level Of Service for Upper Kissimmee Basin



Started in April 2022

Objectives: to conduct a Flood Protection Level of Service analysis for 26 watersheds in Upper Kissimmee Basin

Major Products:

- Calibrated and validated hydrologic and hydraulic (H&H) model
- Assessment of current level of flood protection for existing infrastructure
- Assessment of future level of flood protection assuming current drainage infrastructure,
  - Future rainfall for different return Periods (Using change factor)
  - Future land use and future groundwater level
- Identify FPLOS deficiencies for different watersheds

6b. Adopting Future Rainfall Change Factors as part of SFWMD Resiliency Planning Efforts

DATA APPLICATION: Sensitivity Tests at the C-8 And C-9 Basins, Using the Flood Protection Level of Service Integrated Hydrology and Hydraulics Modeling

Francisco Peña, Ph.D.
Resiliency Project Manager, SFWMD
Courtesy Post-Doc, Florida International University

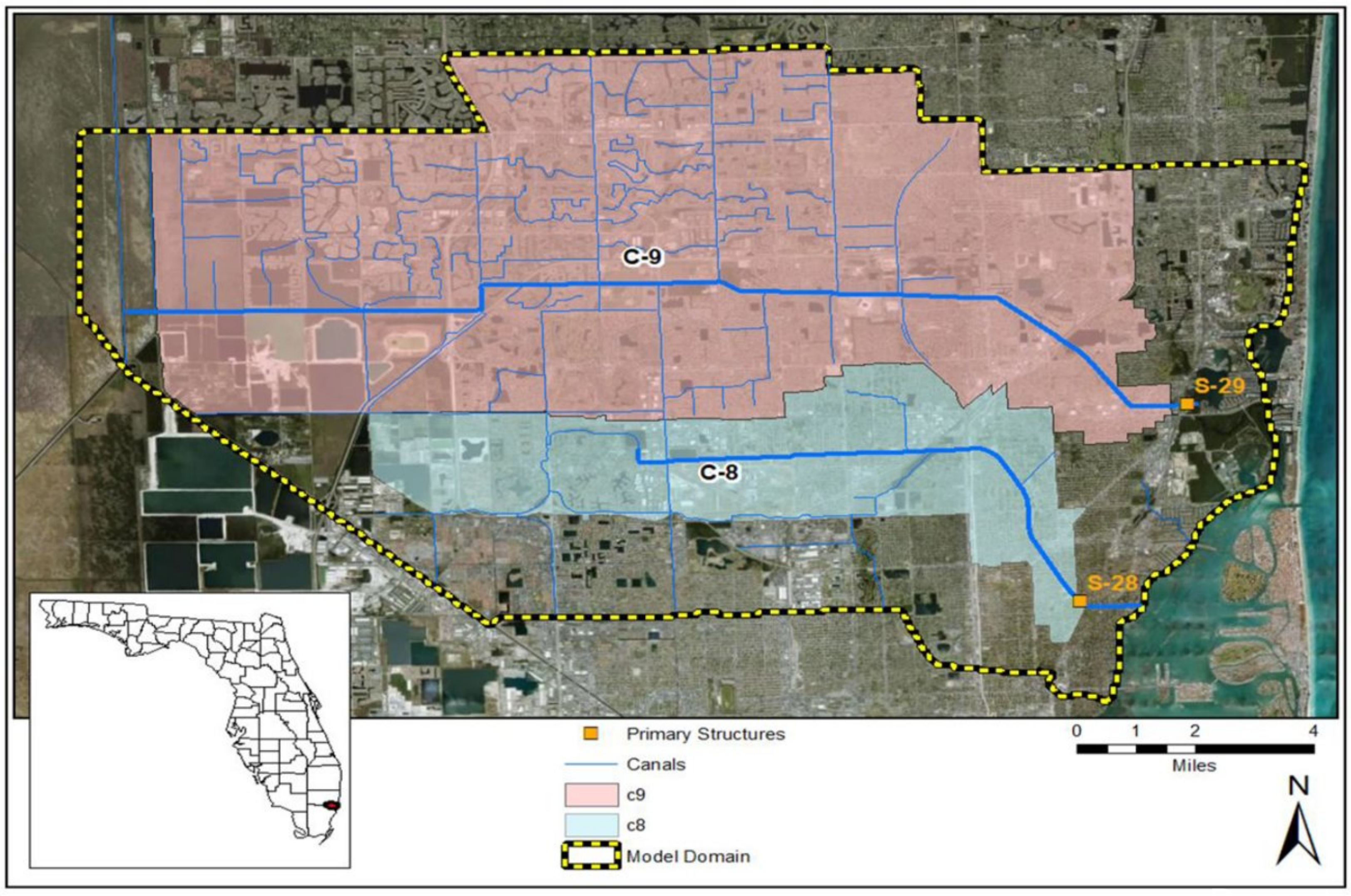
Sensitivity Analysis

- Overview:
  - Rainfall Change Factor Thresholds: 20%, 30%, 40%, 50%, and 75%
  - Assess the potential future rainfall impacts in northern Miami-Dade County (C-9 Basin) and southern Broward County (C-8 Basin), for a 3-day design events of 100-year recurrence frequency to evaluate current conditions (CC) and SLR with 1, 2, and 3-ft impacts

Rainfall Change Factor Threshold	Increases in Water Elevation (feet)		
	C-8 Profile (PM1)	C-9 Profile (PM1)	C-8 and C-9 Basins (PM5)
20%	≈ 0.1 - 0.25	≈ 0.1 – 0.2	≈ 0.2 – 0.3
30%	≈ 0.25 – 0.4	≈ 0.2 – 0.3	≈ 0.3 – 0.4
40%	≈ 0.4 – 0.55	≈ 0.3 – 0.4	≈ 0.4 – 0.5
50%	≈ 0.55 – 0.7	≈ 0.4 – 0.55	≈ 0.5 – 0.6
75%	≈ 0.7 – 1.0	≈ 0.55 – 0.8	≈ 0.6 – 1.0

Table 1: Relationship between rainfall change factors and increased flood depths for the C-8 profile, C-9 profile, and across both basins combined.

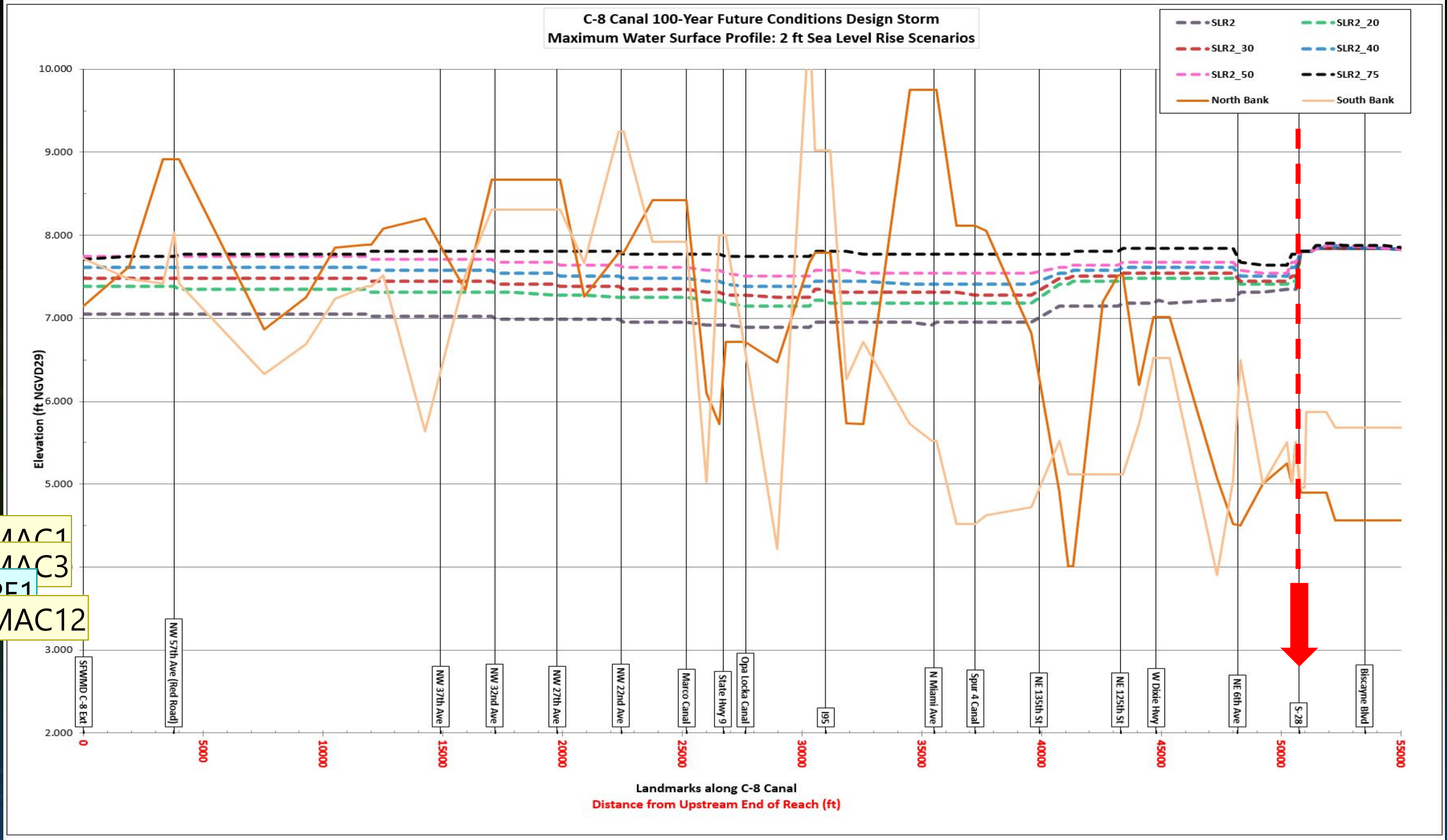
C-8 and C-9 Basin



PM1 – Maximum Stage in Primary Canals (C8 Canal)

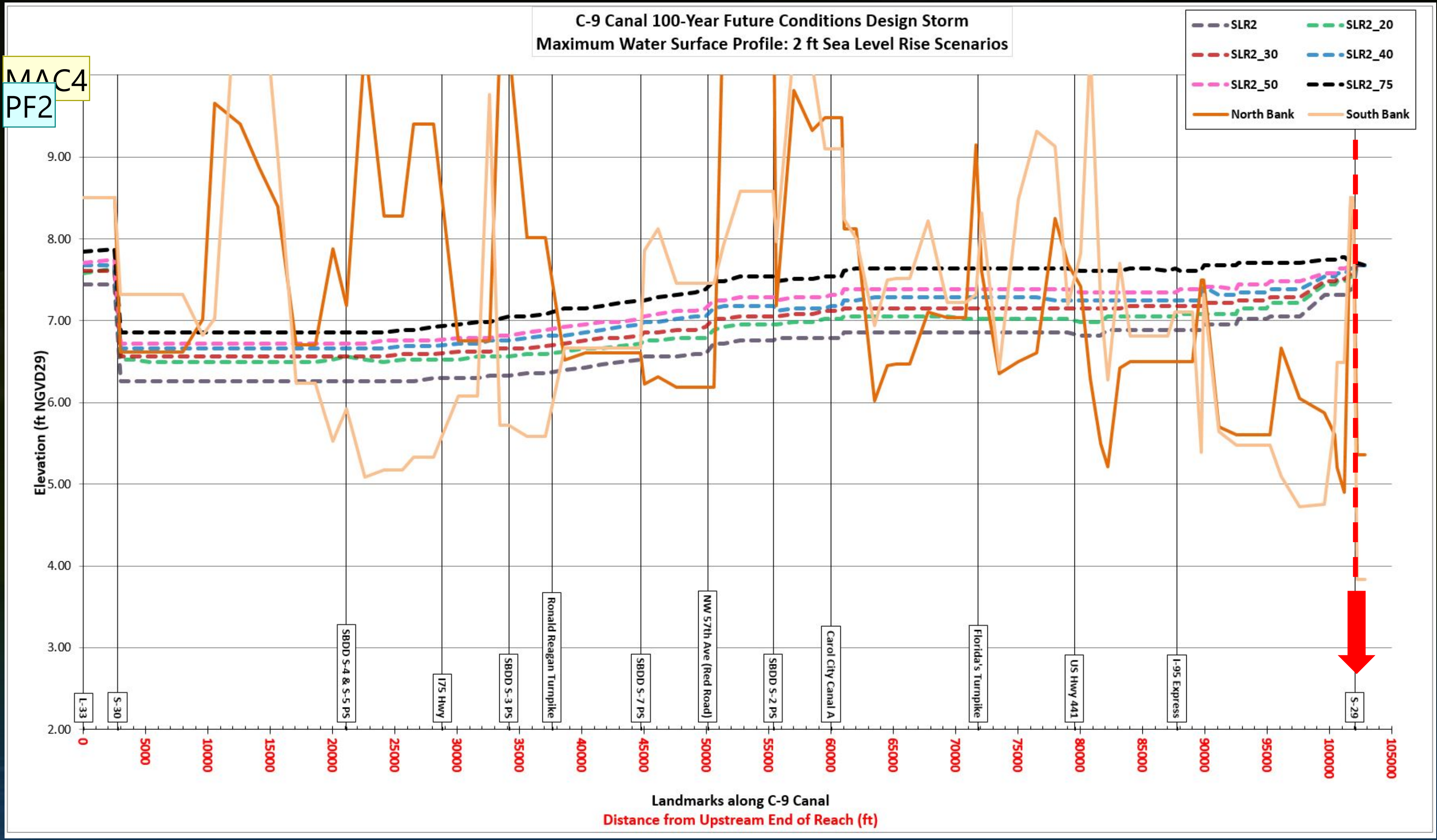
- Results:
  - Consistent increase pattern in peak stage profiles as result of rainfall increase
  - Downstream reach is limited to enforced simulated tidal boundary conditions at S-28 Structure (red arrow)
  - Coastal Structure operational limitations play a key role in allowing the tidal conditions to influence the canal levels upstream

MAC1
MAC3
PE1
MAC12



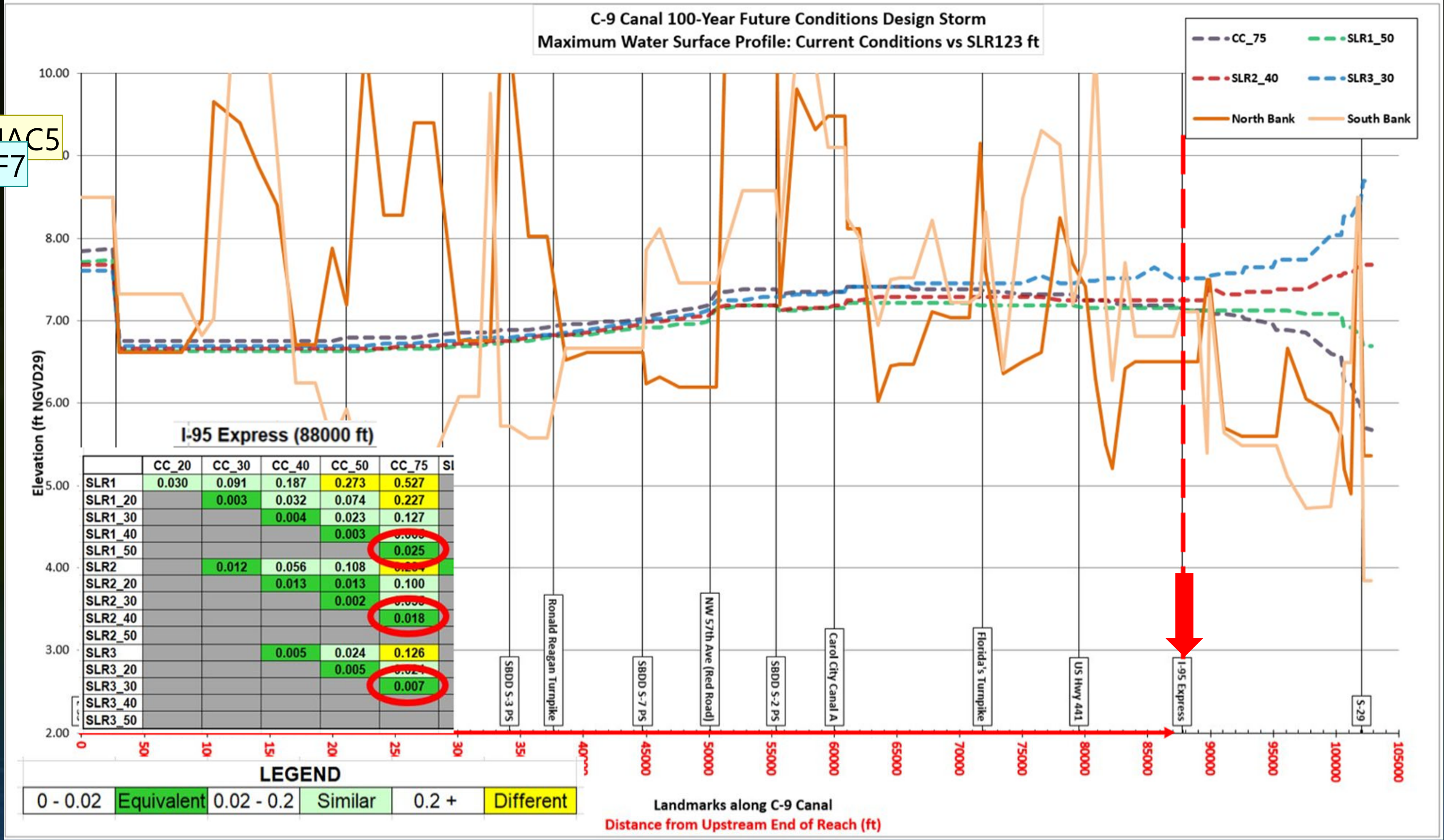
PM1 – Maximum Stage in Primary Canals (C9 Canal)

- Results:
  - Consistent increase pattern with C8 Canal:
    - 20%- 0.2 ft
    - 30%- 0.3 ft
    - 40%- 0.4 ft
    - 50%- 0.5 ft
    - 75%- 0.75 ft
  - Downstream reach is limited to enforced simulated tidal boundary conditions at S-29 Structure (red arrow)



PM1 – Maximum Stage in Primary Canals (C9 Canal)

- Results:
  - Root Mean Square Difference (RMSD) was selected to measure differences across the profile.
  - Different combinations of rainfall change factors and SLR can produce "similar" water surface elevation on "inland" portion of canal (red arrow)

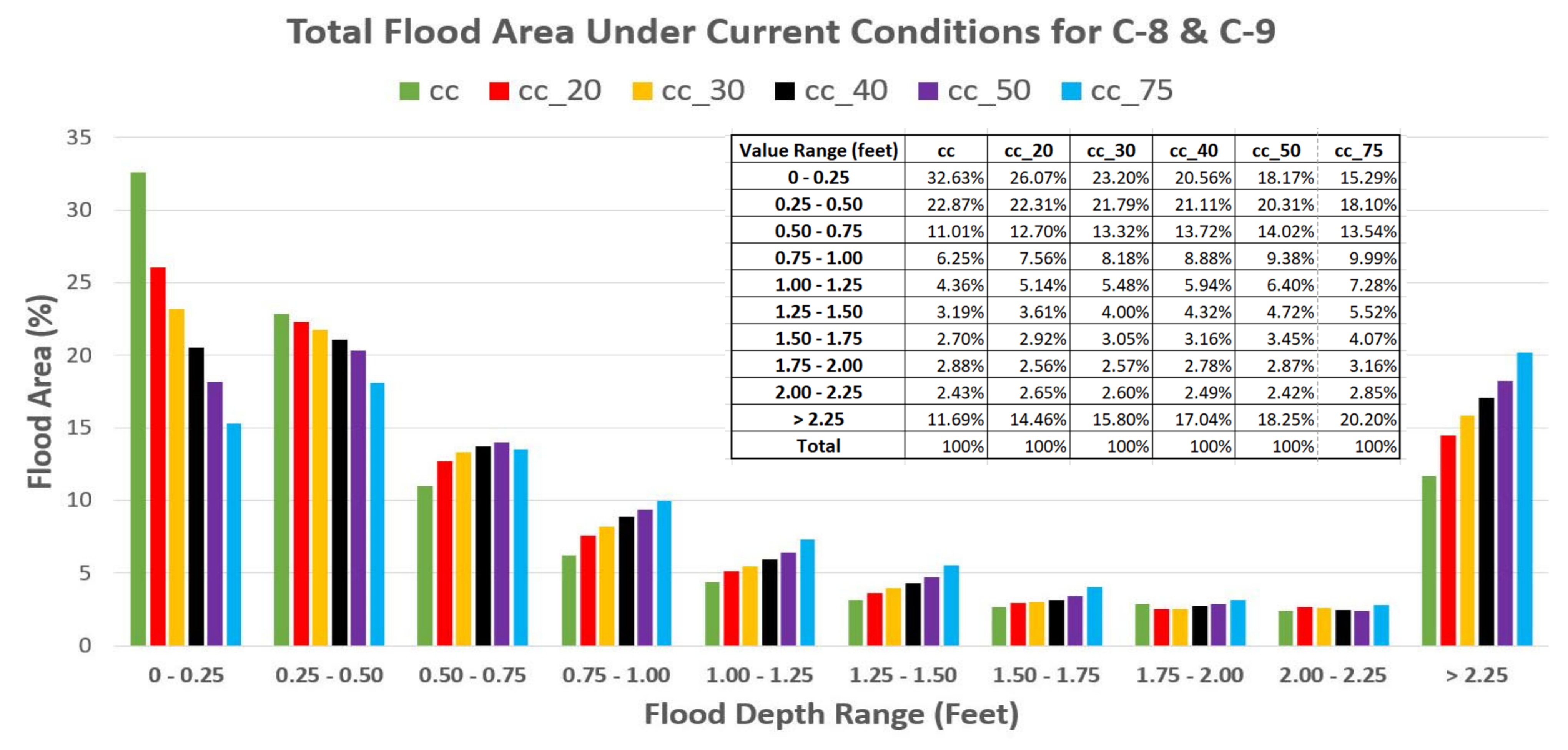


	CC_20	CC_30	CC_40	CC_50	CC_75
SLR1	0.030	0.091	0.187	0.273	0.527
SLR1_20		0.003	0.032	0.074	0.227
SLR1_30			0.004	0.023	0.127
SLR1_40				0.003	[illegible]
SLR1_50					0.025
SLR2		0.012	0.056	0.108	[illegible]
SLR2_20			0.013	0.013	0.100
SLR2_30				0.002	[illegible]
SLR2_40					0.018
SLR2_50					
SLR3			0.005	0.024	0.126
SLR3_20				0.005	[illegible]
SLR3_30					0.007
SLR3_40					
SLR3_50					

LEGEND

0 - 0.02	Equivalent	0.02 - 0.2	Similar	0.2 +	Different

PM5- Overland Flooding

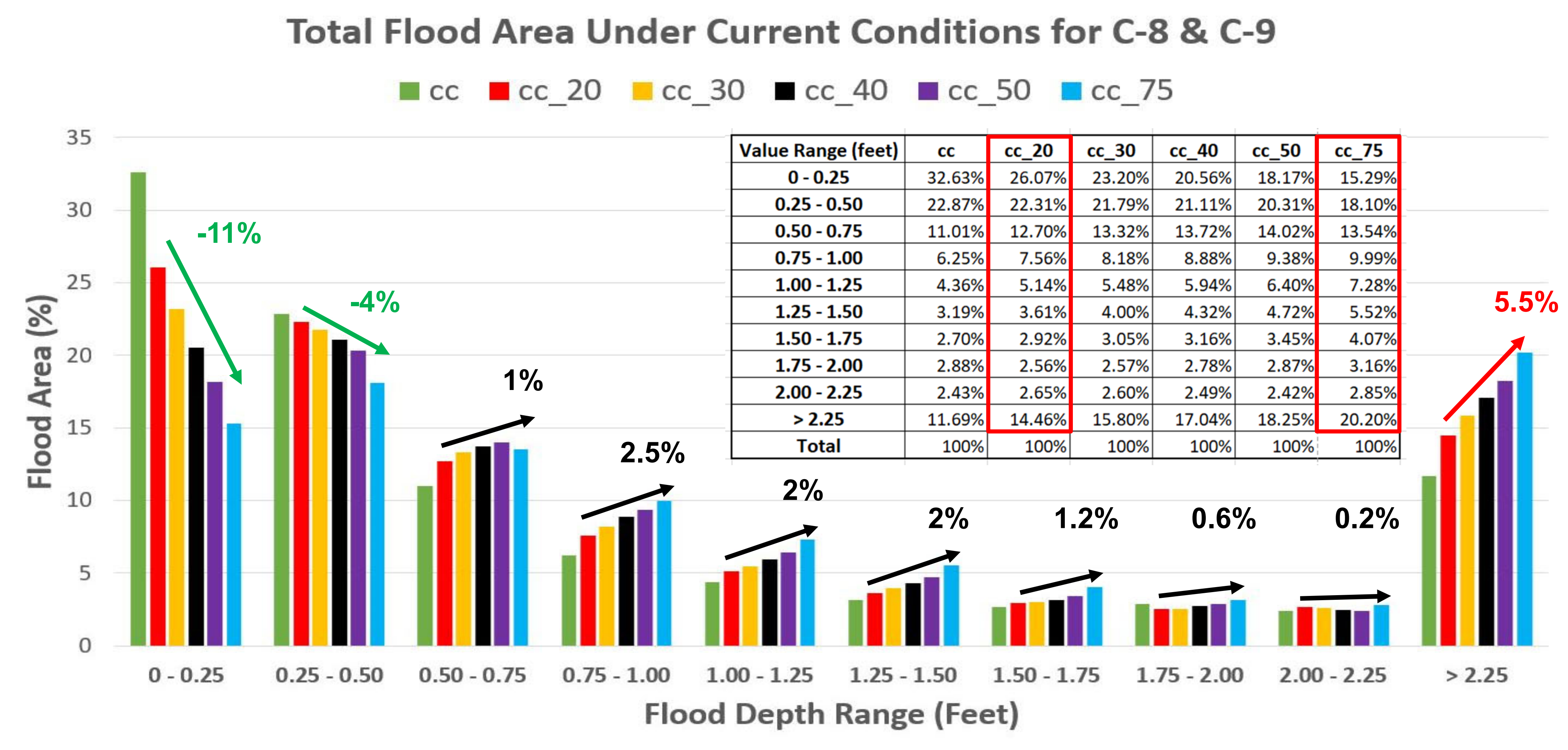


Value Range (feet)	cc	cc_20	cc_30	cc_40	cc_50	cc_75
0 - 0.25	32.63%	26.07%	23.20%	20.56%	18.17%	15.29%
0.25 - 0.50	22.87%	22.31%	21.79%	21.11%	20.31%	18.10%
0.50 - 0.75	11.01%	12.70%	13.32%	13.72%	14.02%	13.54%
0.75 - 1.00	6.25%	7.56%	8.18%	8.88%	9.38%	9.99%
1.00 - 1.25	4.36%	5.14%	5.48%	5.94%	6.40%	7.28%
1.25 - 1.50	3.19%	3.61%	4.00%	4.32%	4.72%	5.52%
1.50 - 1.75	2.70%	2.92%	3.05%	3.16%	3.45%	4.07%
1.75 - 2.00	2.88%	2.56%	2.57%	2.78%	2.87%	3.16%
2.00 - 2.25	2.43%	2.65%	2.60%	2.49%	2.42%	2.85%
> 2.25	11.69%	14.46%	15.80%	17.04%	18.25%	20.20%
Total	100%	100%	100%	100%	100%	100%

Figure 2: Overland inundation map for 100-year 72-hour design storm event for current conditions with a range of rainfall change factor thresholds

MAC7
PF6

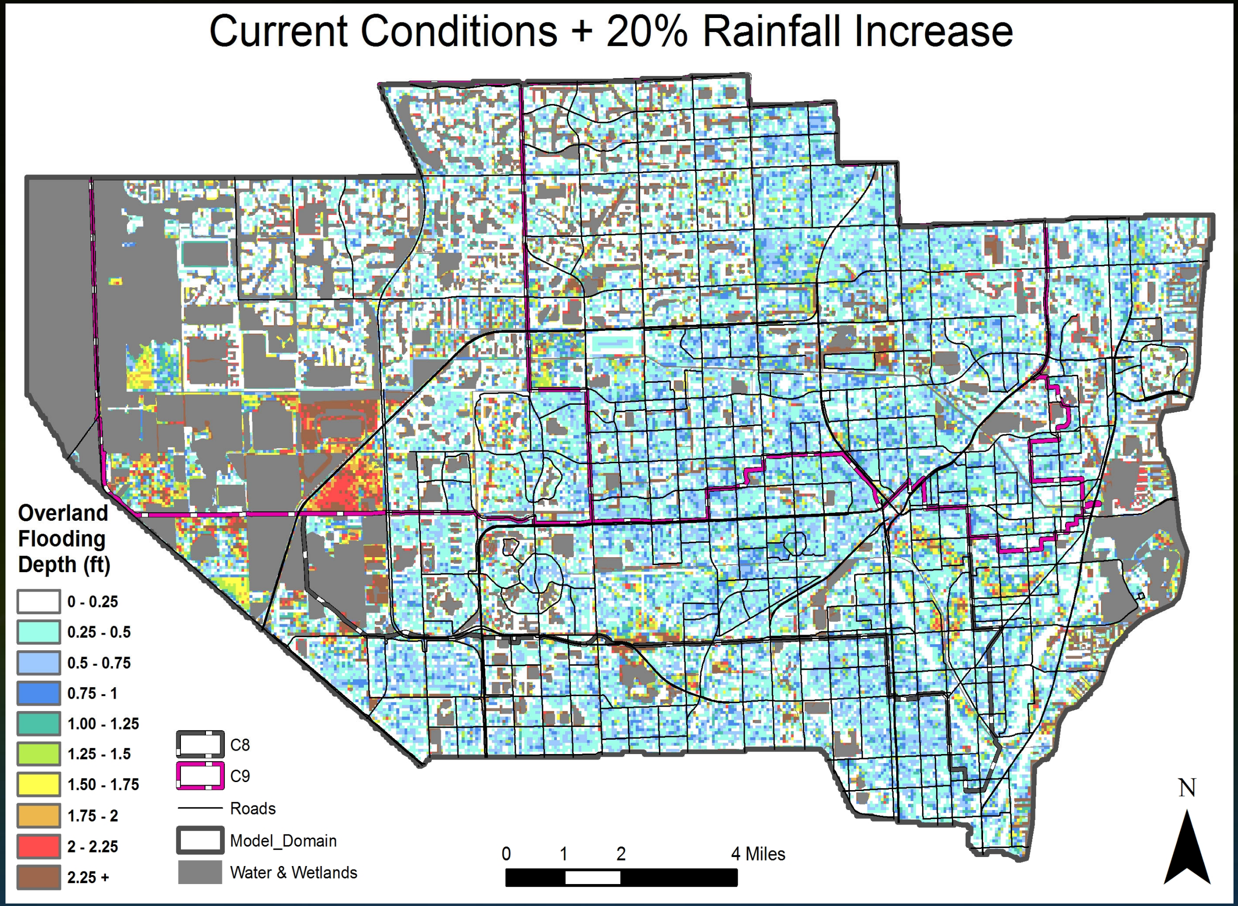
PM5- Overland Flooding



Value Range (feet)	cc	cc_20	cc_30	cc_40	cc_50	cc_75
0 - 0.25	32.63%	26.07%	23.20%	20.56%	18.17%	15.29%
0.25 - 0.50	22.87%	22.31%	21.79%	21.11%	20.31%	18.10%
0.50 - 0.75	11.01%	12.70%	13.32%	13.72%	14.02%	13.54%
0.75 - 1.00	6.25%	7.56%	8.18%	8.88%	9.38%	9.99%
1.00 - 1.25	4.36%	5.14%	5.48%	5.94%	6.40%	7.28%
1.25 - 1.50	3.19%	3.61%	4.00%	4.32%	4.72%	5.52%
1.50 - 1.75	2.70%	2.92%	3.05%	3.16%	3.45%	4.07%
1.75 - 2.00	2.88%	2.56%	2.57%	2.78%	2.87%	3.16%
2.00 - 2.25	2.43%	2.65%	2.60%	2.49%	2.42%	2.85%
> 2.25	11.69%	14.46%	15.80%	17.04%	18.25%	20.20%
Total	100%	100%	100%	100%	100%	100%

Figure 2: Overland inundation map for 100-year 72-hour design storm event for current conditions with a 20% and 75% rainfall change thresholds

PM5- Overland Flooding



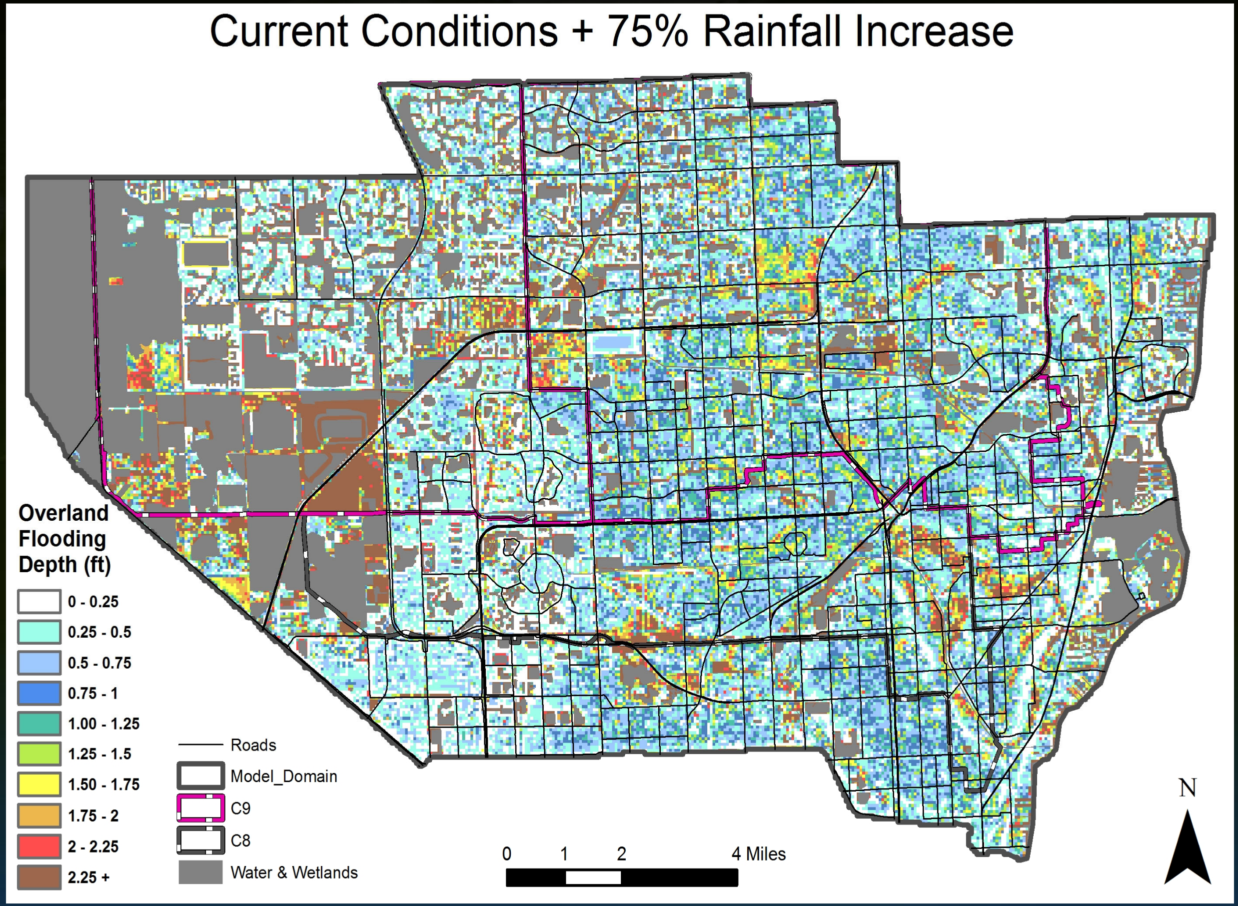


Figure 1: Overland inundation map for 100-year 72-hour current conditions for a 20% and 75% rainfall increase change factor

PM5- Overland Flooding

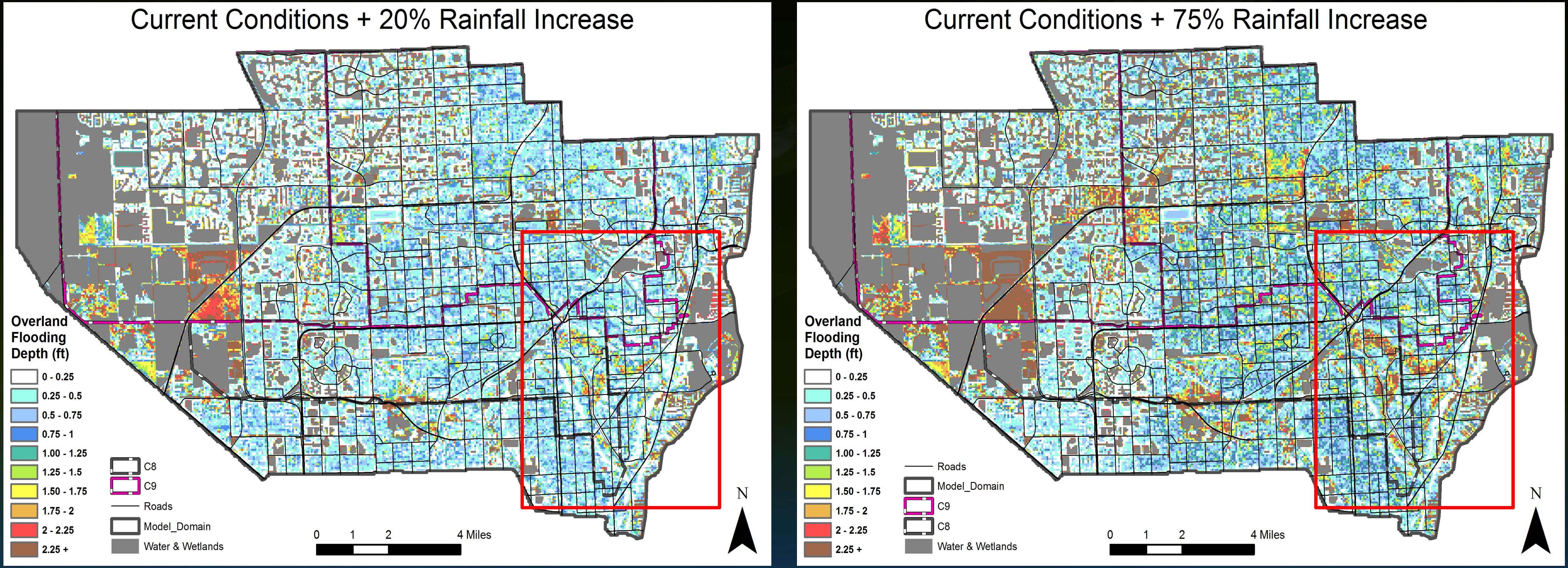


Figure 1: Overland inundation map for 100-year 72-hour current conditions for a 20% and 75% rainfall increase change factor

PM5- Overland Flooding

- Results:
  - Rainfall change factors increase overland flooding depths across both basins (0.25 ft to 1.0 ft)
  - Most vulnerable areas:
    - Locations subject to riverine flooding due to overbank flow
    - Low elevation, coastal and transition zones
  - Flood Depths:
    - Urban areas within 8 miles (1.0 ft to 1.50 ft)
    - Coastal zones (up to 2.25 ft)

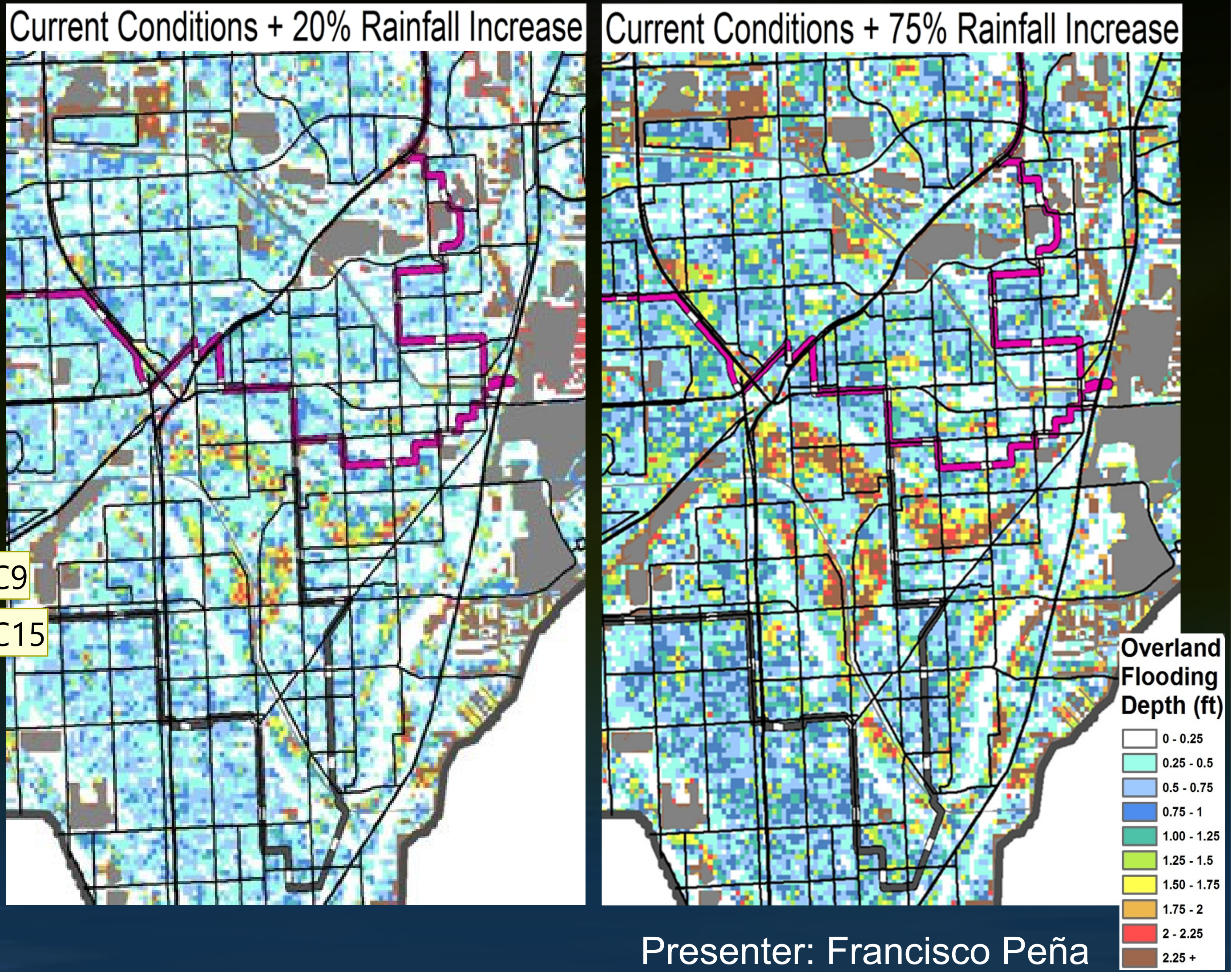
MAC9

MAC15

MAC10

MAC16

MAC14



Presenter: Francisco Peña

Lessons Learned

A- The basins mostly experience low to moderate flooding conditions, producing spread out inundation across both Basins

B- Transitions Zones across low elevation inland and coastal zones are highly vulnerable to compound flood hazards (rainfall + tides + water table)

C- It is possible to produce equivalent/similar outcomes of rainfall increase with SLR scenarios to assess inland flooding conditions*

D- Next Steps: Incorporate additional Performance Metrics and replicate effort in other basins

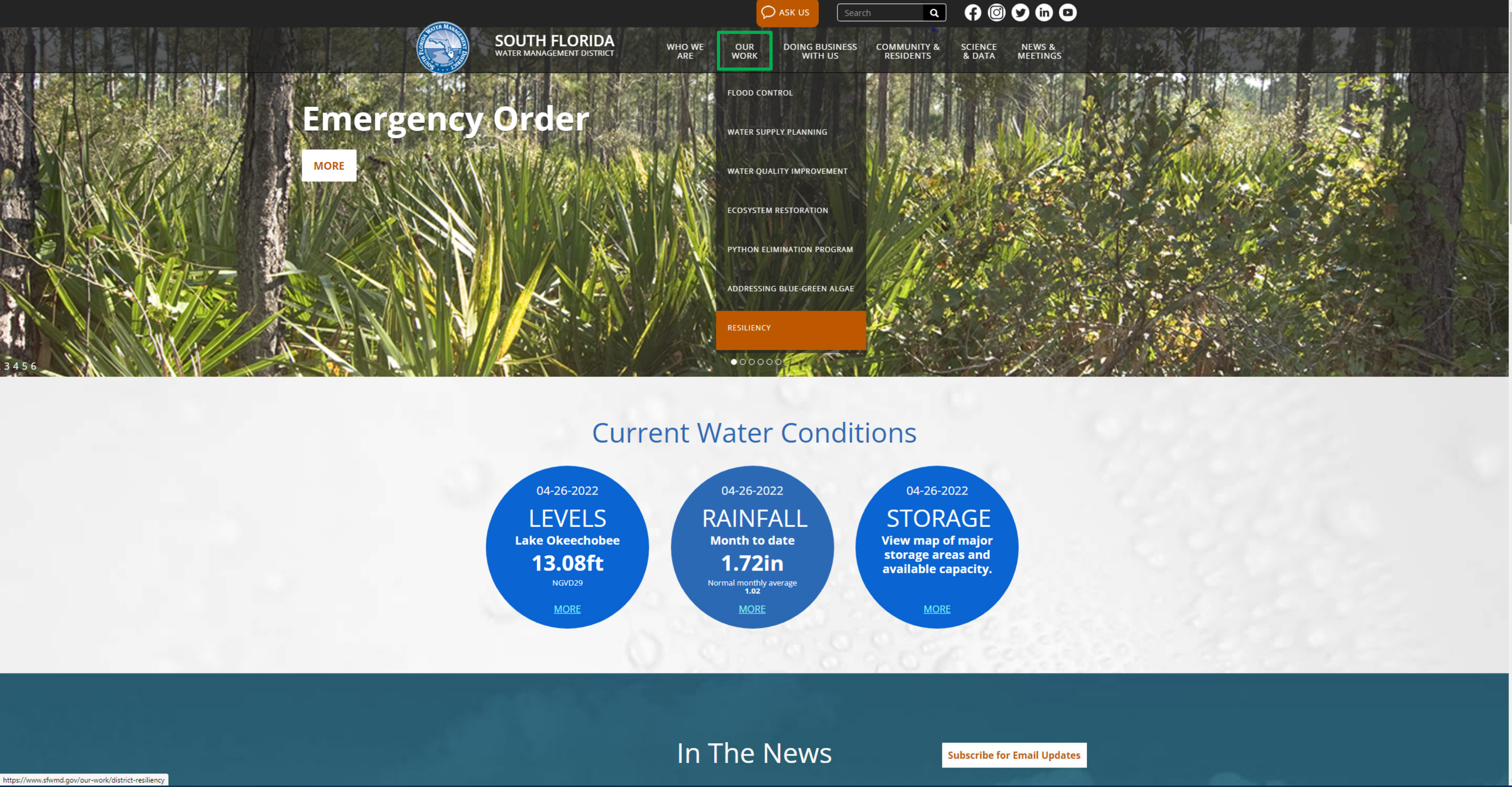
MAC11 MAC17

Rainfall Change Factor Threshold	Increases in Water Elevation (feet)		
	C-8 Profile (PM1)	C-9 Profile (PM1)	C-8 and C-9 Basins (PM5)
20%	≈ 0.1 - 0.25	≈ 0.1 – 0.2	≈ 0.2 – 0.3
30%	≈ 0.25 – 0.4	≈ 0.2 – 0.3	≈ 0.3 – 0.4
40%	≈ 0.4 – 0.55	≈ 0.3 – 0.4	≈ 0.4 – 0.5
50%	≈ 0.55 – 0.7	≈ 0.4 – 0.55	≈ 0.5 – 0.6
75%	≈ 0.7 – 1.0	≈ 0.55 – 0.8	≈ 0.6 – 1.0

6c. Adopting Future Rainfall Change Factors as part of SFWMD Resiliency Planning Efforts

DATA ACCESSIBILITY: Resilience Metrics Hub

Nicole A. Cortez
Resiliency Coordinator
South Florida Water Management District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WATER SUPPLY PLANNING
WATER QUALITY IMPROVEMENT
ECOSYSTEM RESTORATION
PYTHON ELIMINATION PROGRAM
ADDRESSING BLUE-GREEN ALGAE
RESILIENCY
Emergency Order
MORE
3 4 5 6
Current Water Conditions
04-26-2022
LEVELS
Lake Okeechobee
13.08ft
NGVD29
MORE
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Month to date
1.72in
Normal monthly average
1.02
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View map of major storage areas and available capacity.
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sfwmd.gov/resiliency

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SOUTH FLORIDA
WATER MANAGEMENT DISTRICT

WHO WE ARE | OUR WORK | DOING BUSINESS WITH US | COMMUNITY & RESIDENTS | SCIENCE & DATA | NEWS & MEETINGS

Home >> Our Work >> District Resiliency

- Flood Control
- Water Supply Planning
- Water Quality Improvement
- Ecosystem Restoration - By Region
- Ecosystem Restoration - Projects and Programs
- MFLs & Water Reservations, & RAAs
- Land Management
- Local Projects and Programs
- Addressing Blue-Green Algae
- Resiliency

District Resiliency

Ensuring the Region's Water Resources and Ecosystems Resiliency Now and in the Future

The South Florida Water Management District is strongly committed to addressing the impacts of climate change, including rising sea levels, changing rainfall and flood patterns, and as such, has named its first District Resiliency Officer, Carolina Maran, Ph.D., P.E. The current resiliency efforts focus on assessing how sea level rise and extreme events, including flood and drought events, happen under current and future climate conditions, and how they affect water resources management. The District is also making significant infrastructure adaptation investments that are needed to successfully implement its mission of safeguarding and restoring South Florida's water resources and ecosystems, protecting communities from flooding, and ensuring an adequate water supply for all of South Florida's needs. Working to ensure the region's water resources and ecosystems resiliency, now and in the future, is part of everything the District does.

Actions

- Resiliency and Flood Protection
- Resiliency and Water Supply
- Resiliency and Ecosystem Restoration

Metrics

The South Florida Water Management District is implementing **Water and Climate Resilience Metrics** to track and document trends in its relevant water and climate observed data. These efforts support the assessment of current and future climate condition scenarios, operational decisions, and District resiliency priorities.

Upcoming Workshop

The SFWMD Future Extreme Rainfall Projections Public Workshop will present the proposed adoption of future extreme rainfall projections by the SFWMD, developed in collaboration with the USGS Caribbean-Florida Water Science Center (CFWSC) and Florida International University. This effort builds on long-term observed rainfall data and available Global Climate Models downscaling datasets and constitutes a first step in developing future rainfall projections for South Florida. The adoption of future extreme rainfall scenarios supports the District's mission and resiliency priority efforts and will provide unified resources for partner agencies and local government in South Florida. This meeting is for technical experts and researchers, planners, water managers, and is open to the public.

Meeting Agenda
Zoom Registration Link

- Flood Control
- Water Supply Planning
- Water Quality Improvement
- Ecosystem Restoration - By Region
- Ecosystem Restoration - Projects and Programs
- MFLs & Water Reservations, & RAAs
- Land Management
- Local Projects and Programs
- Addressing Blue-Green Algae
- Resiliency

Water and Climate Resilience Metrics

As part of our ongoing resilience initiatives, the District developed a set of Water and Climate Resilience Metrics to track and document shifts and trends in District managed water and climate observed data. These efforts support the assessment of current and future climate condition scenarios, operational decisions, and District resiliency priorities. The District published the Water and Climate Resilience Metrics Final Report in December 2021.

The District's commitment to resilience includes informing stakeholders, the public, and partner agencies to support local resiliency strategies. Visit the Resilience Metrics Hub to learn more about the data driving the District's resiliency efforts.

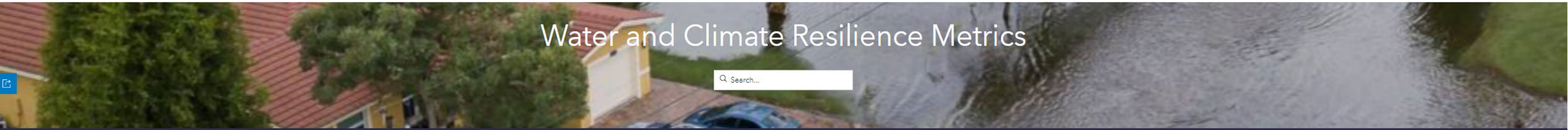
The first Water and Climate Resilience Metrics Public Workshop was hosted on January 22, 2021.

- Presentation
- Video

The second Water and Climate Resilience Metrics Public Workshop was hosted on December 17, 2021.

- Presentation
- Video
- Report

Resilience Metrics Hub



Water and Climate Resilience Metrics

Search...

The South Florida Water Management District is strongly committed to addressing the impacts of sea level rise and a changing climate. The District's resilience efforts support its mission of safeguarding and restoring South Florida's water resources and ecosystems, protecting communities from flooding, and ensuring we are able to meet South Florida's water needs while connecting with the public and stakeholders.

Objectives

As part of a series of District Resiliency initiatives to address changing conditions, the District is implementing a set of water and climate resilience metrics districtwide. These science-based metrics are being developed with the goal of tracking and documenting shifts and trends in District-managed water and climate observed data, supporting the assessment of current and future climate condition scenarios and related operational decisions, and informing District resiliency investment priorities. As part of the District's communication and public engagement priorities, this effort informs stakeholders, the general public, and partner agencies about the District's resilience efforts, while supporting local resiliency strategies. This Hub hosts the latest Water and Climate Resilience Metrics information and data analysis results, as well as related information that is relevant to the context of each metric discussion.

This page was designed as a living data hub and will be modified and updated as necessary. Check back frequently for updated data and resilience information.

Emerging Trends in Regional Resiliency

Regional Rainfall

Changes in rainfall patterns will impact people and ecosystems by altering the amount of water in our region throughout t...

Elevations at Coastal Structures and Sea Level Rise

Tailwater and headwater elevations at coastal structures represent how sea level rise affects stormwater discharge capacity in South...

Saltwater Intrusion in Coastal Aquifers

The inland migration of saltwater poses a threat to water supply and critical freshwater habitats.

Salinity in the Everglades

The salinization of previously freshwater systems poses threats to several factors.

Estuarine and Mangrove Inland Migration

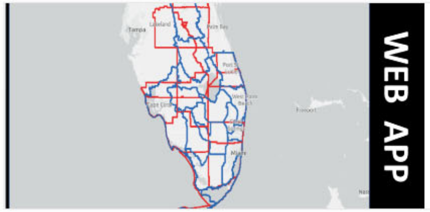
Trends in Estuarine Inland Migration provide insights to the impacts of sea level rise in coastal areas and the Everglades.

Soil Subsidence in South Florida

Maintaining soil elevations within coastal and intertidal habitats, as sea level changes, is an indicator of long-term stability of coastal.

Resilience Metrics Hub

Future Outlook in Regional Resiliency



Future Extreme Rainfall Change Factors for Flood Resiliency Planning in South Florida

This tool provides access to future extreme rainfall change factors for resiliency planning for the 16 counties and 14 rainfall areas within SFWMD boundaries, as well as the Everglades National Park rainfall area, and an additional combined rainfall area for the Florida Keys and Biscayne Bay.

SFWMD Data and Support

DBHYDRO insights

DBHydro Insights

DBHydro Insights

DBHYDRO is the South Florida Water Management District's corporate environmental database that stores hydrologic, meteorologic, hydrogeologic and water quality data.

Details | View

SFWMD GIS Open Data Hub

SFWMD GIS Hub

Our Open Data site is where our publicly available spatial datasets can be viewed and downloaded. Additional Web Apps and Story Maps are featured to explore and learn more about the data.

Details | View

SFWMD SFER 2021

SFWMD SFER 2021

As the South Florida Water Management District works to Achieve More Now For Florida's Environment, we are pleased to present the 2021 South Florida Environmental Report (SFER).

Details | View

Local Agencies' Information

Local Agencies are using their resources to help us understand the potential risks that come with Coastal Resiliency efforts.

BROWARD COUNTY FLORIDA

Broward County Resiliency Dashboard

Broward County continues to build resilience at a number of scales, internally for government operations, and county-wide through coordination with municipalities and regionally across Southeast Florida.

Details | Main Page

Miami-Dade County Sea Level Rise Strategy

Miami-Dade County faces an unprecedented challenge in the coming decades to adapt to climate change and sea level rise.

Details | Main Page

Palm Beach County Office of Resilience

The Office of Resilience (OOR) works to ensure that Palm Beach County remains a great place to live, work, and play while addressing physical, social, and economic challenges including climate change.

Details | Main Page

Resilience Metrics Hub

ncortez@sfwmd.gov_sfwmd

Future Extreme Rainfall Change Factors for Flood Resiliency Planning in South Florida

SFWMD Geospatial Services
South Florida Water Management District

Summary

This tool provides access to future extreme rainfall change factors for resiliency planning for the 16 counties and 14 rainfall areas within SFWMD boundaries, as well as the Everglades National Park rainfall area, and an additional combined rainfall area for the Florida Keys and Biscayne Bay.

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Web Experience

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Date Updated

April 18, 2022
Published Date

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Extreme Rainfall Change Factors for Resiliency Planning in South Florida

USGS Change Factors for SFWMD Areas

Area Type: - All -

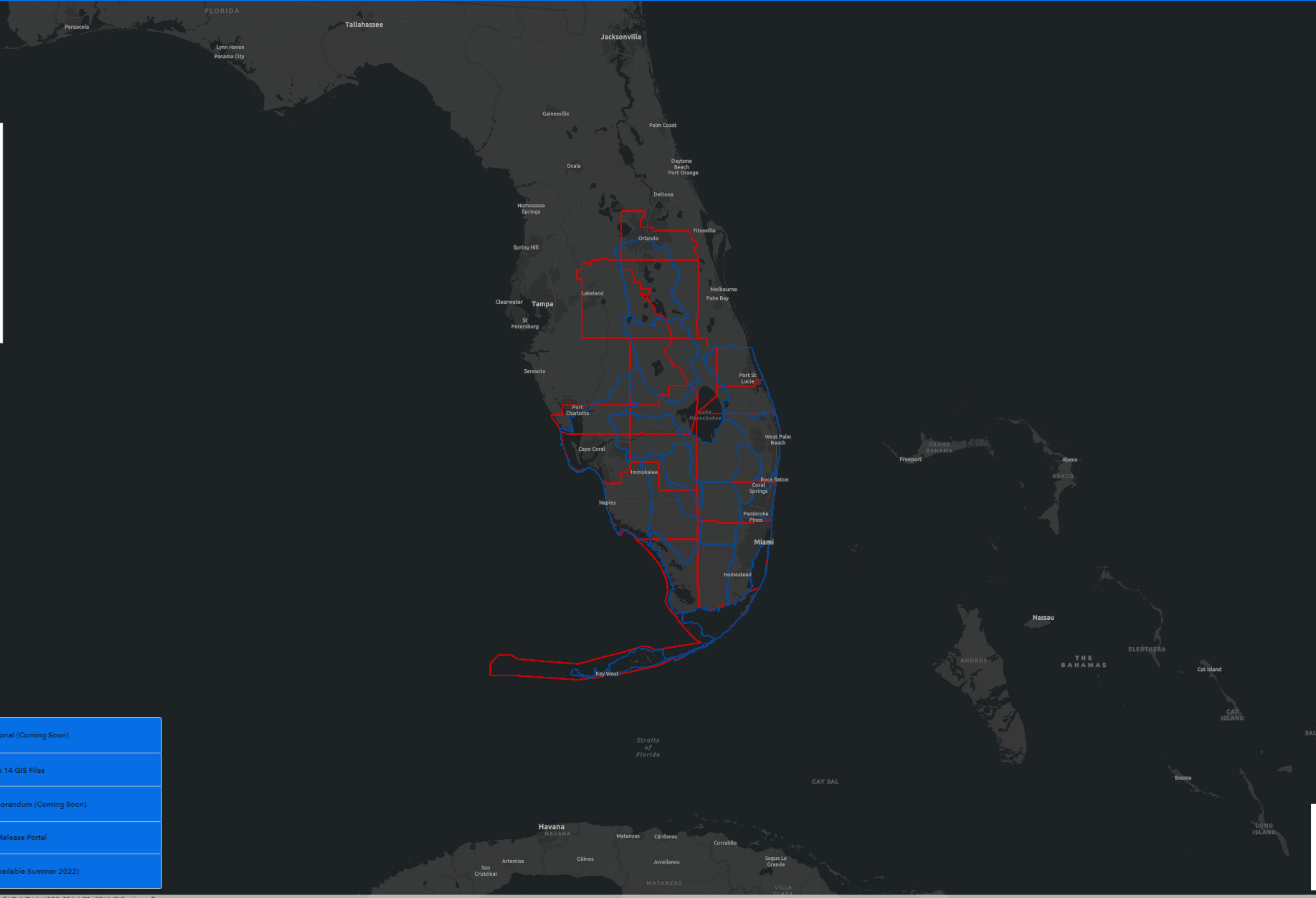
Area of Interest: - All -

Rainfall Duration (Days): - All -

Return Period (Years): - All -

Planning Horizon: 2050-2089

Apply | Clear



Collaborators: USGS, FIU Institute of Environment, FIU Sea Level Solutions Center

Change Factor Tutorial (Coming Soon)

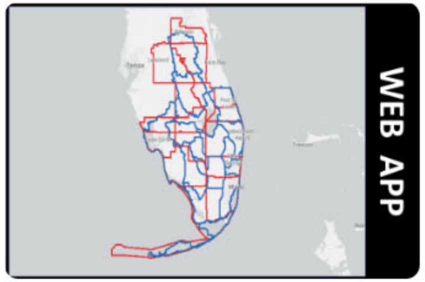
NOAA Atlas 14 GIS Files

SFWMD Technical Memorandum (Coming Soon)

USGS Data Release Portal

USGS Final Report (available Summer 2022)

https://sfwmd-district-resiliency-sfwmd.hub.arcgis.com



Future Extreme Rainfall Change Factors for Flood Resiliency Planning in South Florida

SFWMD Geospatial Services
South Florida Water Management District

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Tool Description

How to Use the Data

Original Data Source

Summary

This tool provides access to future extreme rainfall change factors for resiliency planning for the 16 counties and 14 rainfall areas within SFWMD boundaries, as well as the Everglades National Park rainfall area, and an additional combined rainfall area for the Florida Keys and Biscayne Bay.

The Future Extreme Rainfall Change Factors for Resiliency Planning in South information tool provides access to future extreme rainfall change factors by rainfall area and by county-level, estimated as part of cooperative agreements between South Florida Water Management District, U.S. Geological Survey Caribbean Florida Water Science Center and Florida International University.

The recommended change factors might be applied as inputs for hydrodynamic models to assess future conditions rainfall as part of local and regional flood vulnerability assessments. Project background and technical recommendations supporting the adoption of future rainfall scenarios as part of resiliency initiatives in the region are provided in the SFWMD's Technical Memorandum for the Adoption of Future Extreme Rainfall Change Factors for Flood Resiliency Planning in South Florida.

The estimated change factors available in this tool apply only to NOAA Atlas 14 precipitation frequency estimates to represent future extreme rainfall conditions in the period centered around 2070, based on historical period around 1966-2005. The 50th percent confidence interval represents the spread of change factors and median for each area, the range of uncertainty is outlined by the 25th and 75th percentile limits.

The data should not be applied to Atlas 14 values that have a different period than the available results (1966-2005) and to IDF curves not available from Atlas 14. These change factors do not represent changes in future rainfall average conditions, neither seasonality shifts, nor for estimating drought conditions into the future. Different change factors were estimated for each return frequency and duration to be applied as part of event simulations and are not representative of regional long-term simulations.

The comprehensive data products from the U.S. Geological Survey Caribbean-Florida Water Science Center are available on the USGS ScienceBase site via the citation: Irizarry-Ortiz, M.M., and Stamm, J.F., 2022, Change factors to derive projected future precipitation depth-duration-frequency (DDF) curves at 174 National Oceanic and Atmospheric Administration (NOAA) Atlas 14 stations in central and south Florida: U.S. Geological Survey data release, https://doi.org/10.5066/P935WRTG.

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Tags

resiliency rainfall

[Resilience Metrics Hub](#)

Future Extreme Rainfall Change Factors for Flood Resiliency Planning in South Florida

SFWMD Geospatial Services
South Florida Water Management District

Summary

This tool provides access to future extreme rainfall change factors for resiliency planning for the 16 counties and 14 rainfall areas within SFWMD boundaries, as well as the Everglades National Park rainfall area, and an additional combined rainfall area for the Florida Keys and Biscayne Bay.

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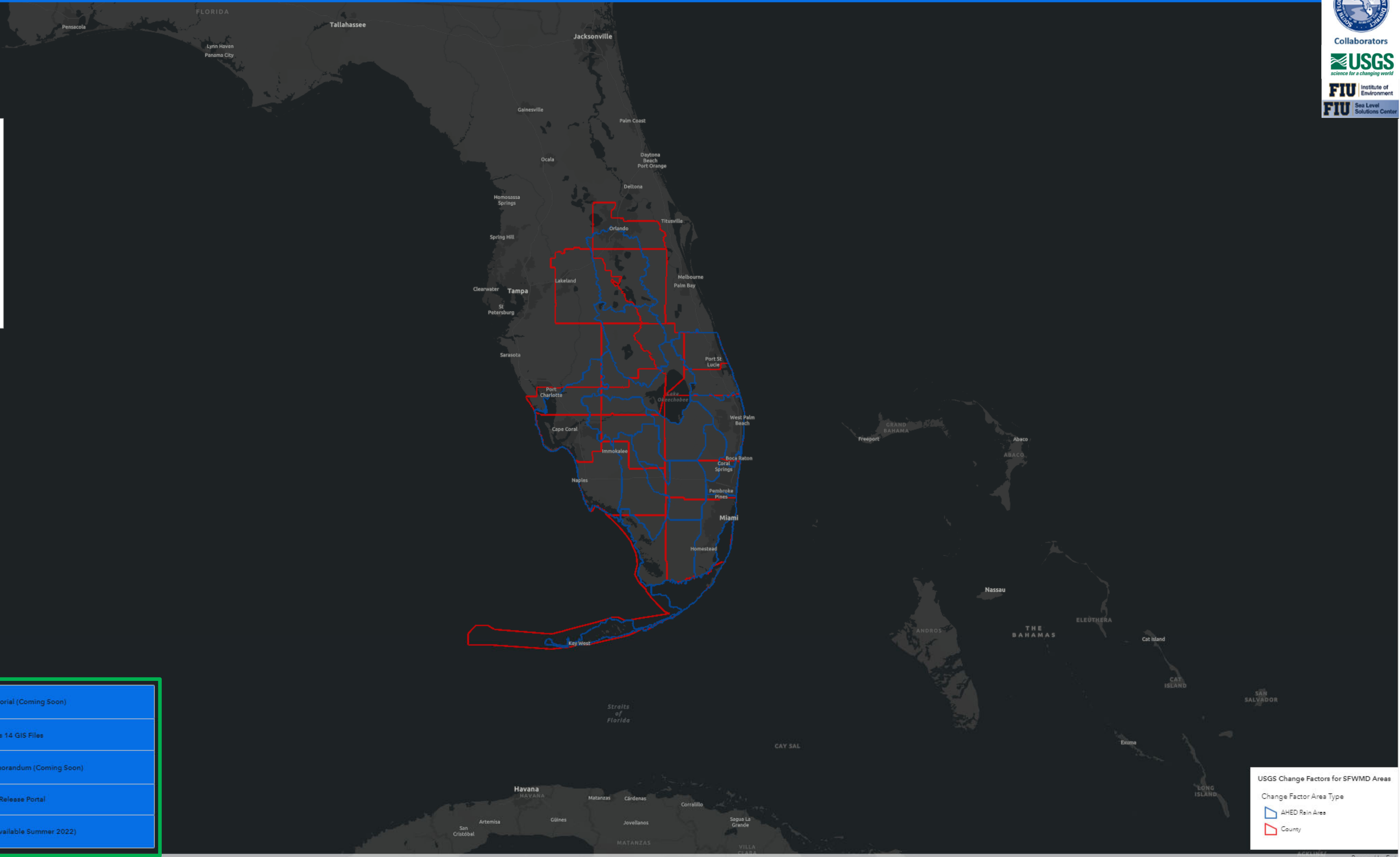
Extreme Rainfall Change Factors for Resiliency Planning in South Florida

Collaborators: USGS (science for a changing world); FIU Institute of Environment; FIU Sea Level Solutions Center

USGS Change Factors for SFWMD Areas

- Area Type: - All -
- Area of Interest: - All -
- Rainfall Duration (Days): - All -
- Return Period (Years): - All -
- Planning Horizon: 2050-2089

Apply | Clear



1. Change Factor Tutorial (Coming Soon)
2. NOAA Atlas 14 GIS Files
3. SFWMD Technical Memorandum (Coming Soon)
4. USGS Data Release Portal
5. USGS Final Report (available Summer 2022)

https://sfwmd-district-resiliency-sfwmd.hub.arcgis.com

Resilience Metrics Hub

ncortez@sfwmd.gov_sfwmd

Future Extreme Rainfall Change Factors for Flood Resiliency Planning in South Florida

SFWMD Geospatial Services
South Florida Water Management District

Summary

This tool provides access to future extreme rainfall change factors for resiliency planning for the 16 counties and 14 rainfall areas within SFWMD boundaries, as well as the Everglades National Park rainfall area, and an additional combined rainfall area for the Florida Keys and Biscayne Bay.

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Extreme Rainfall Change Factors for Resiliency Planning in South Florida

More Info

USGS Change Factors for SFWMD Areas

Area Type: - All -

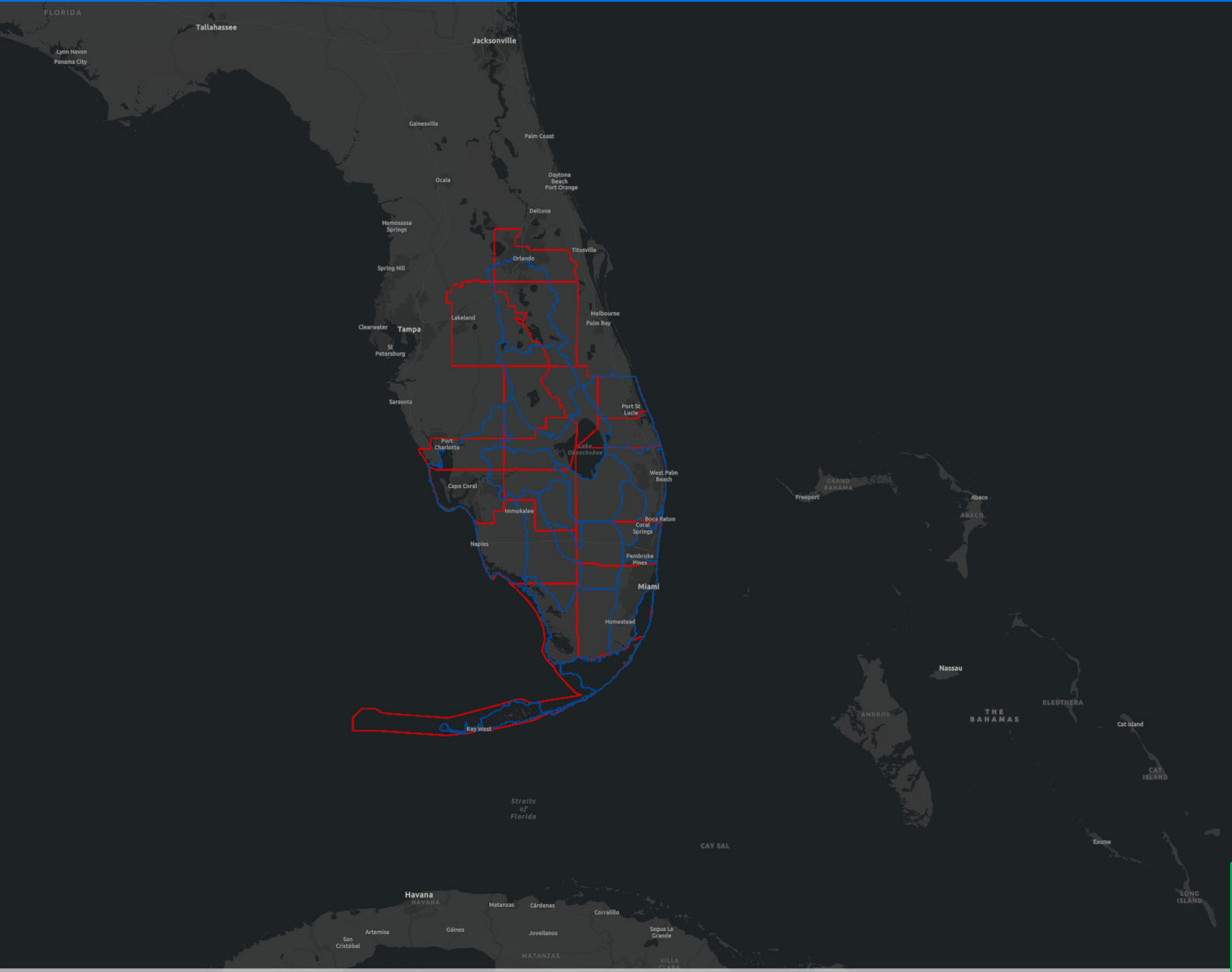
Area of Interest: - All -

Rainfall Duration (Days): - All -

Return Period (Years): - All -

Planning Horizon: 2050-2089

Apply | Clear



Collaborators

USGS

FIU Institute of Environment

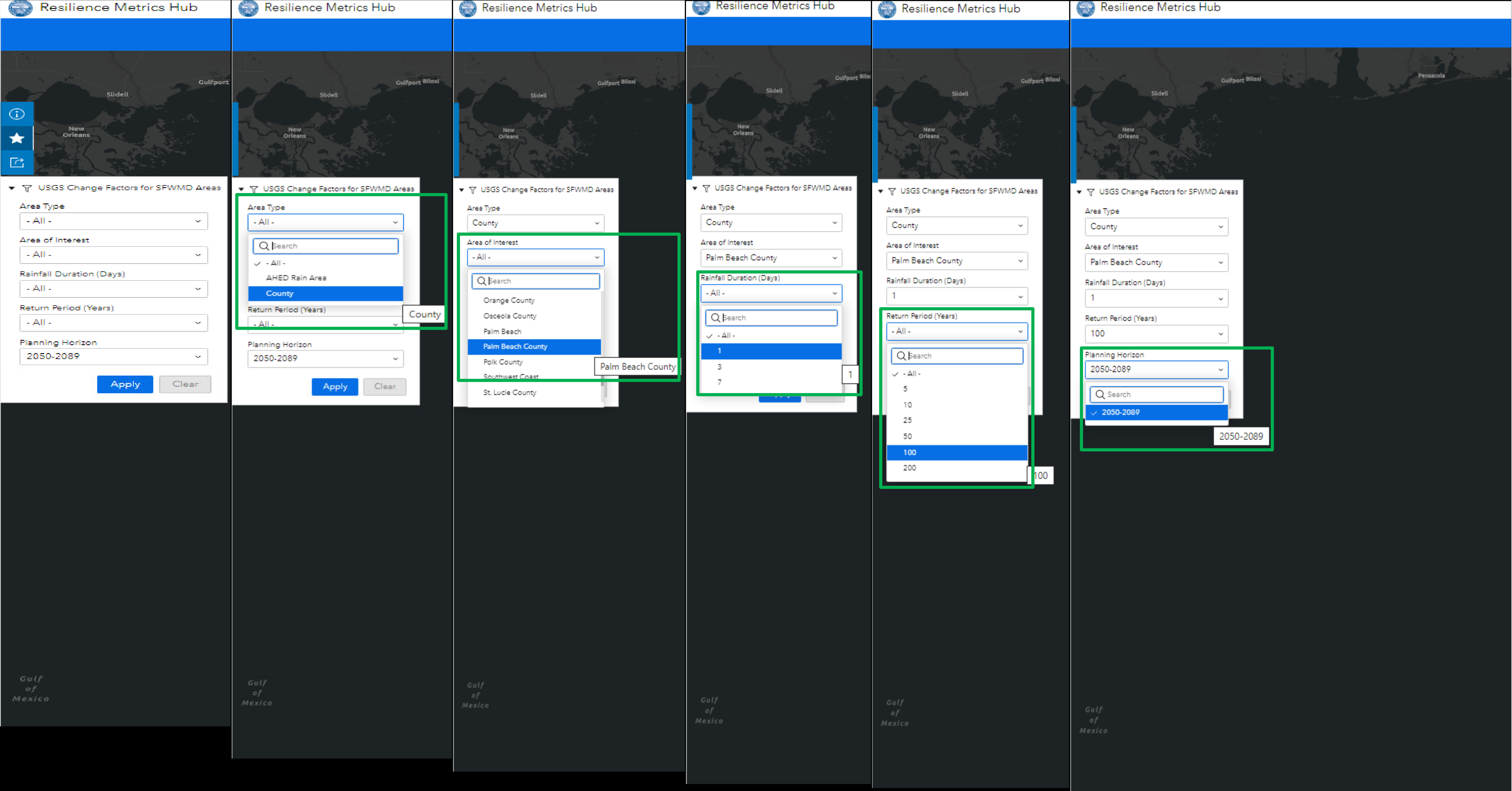
FIU Sea Level Solutions Center

- Change Factor Tutorial (Coming Soon)
- NOAA Atlas 14 GIS Files
- SFWMD Technical Memorandum (Coming Soon)
- USGS Data Release Portal
- USGS Final Report (available Summer 2022)

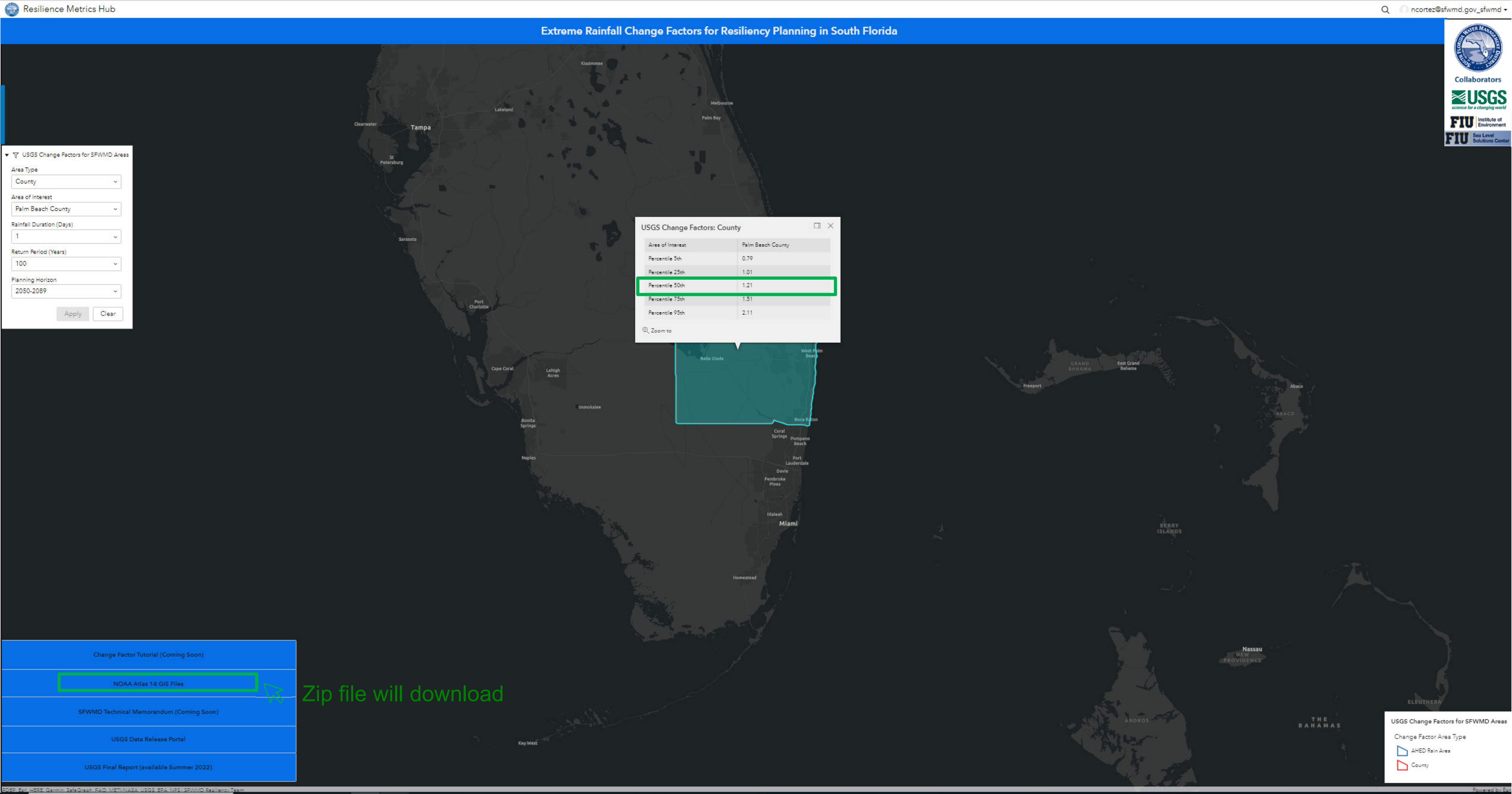
USGS Change Factors for SFWMD Areas

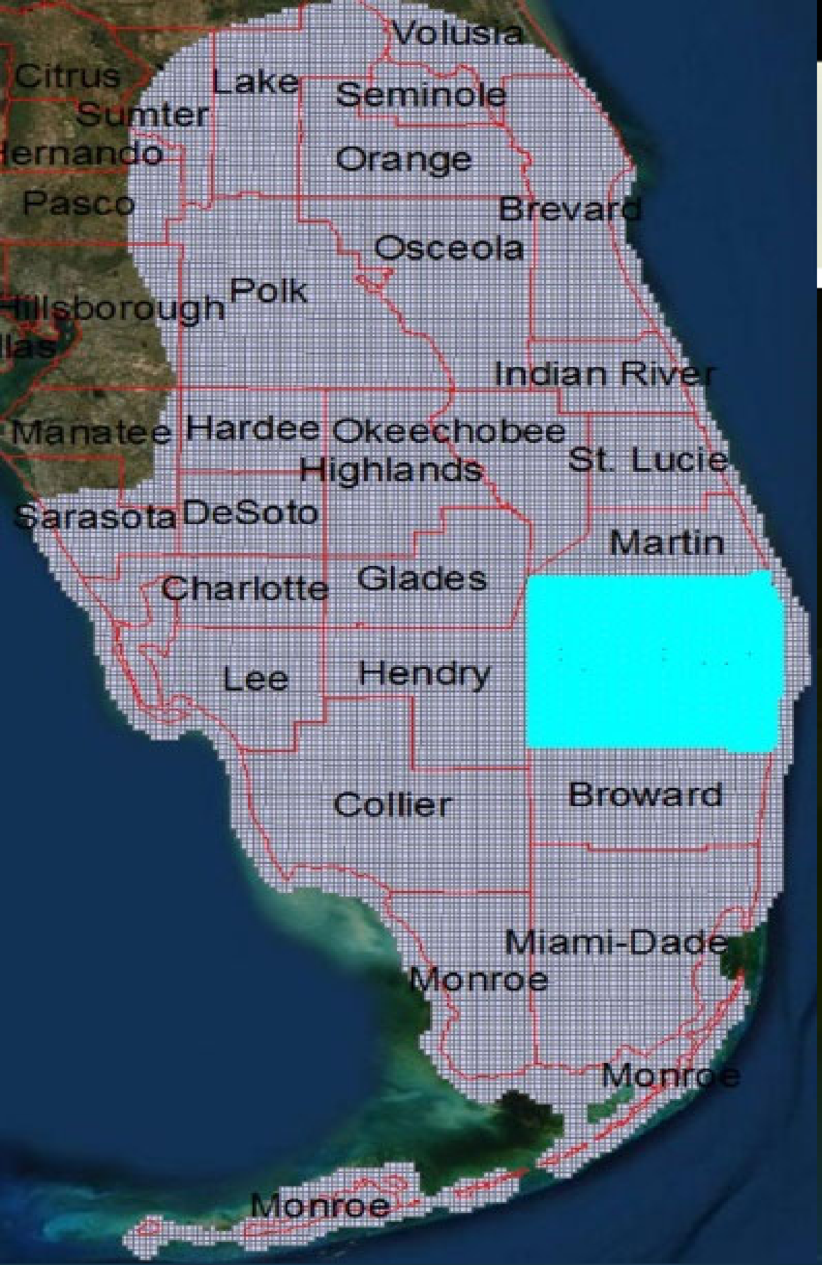
Change Factor Area Type

- AHED Rain Area
- County



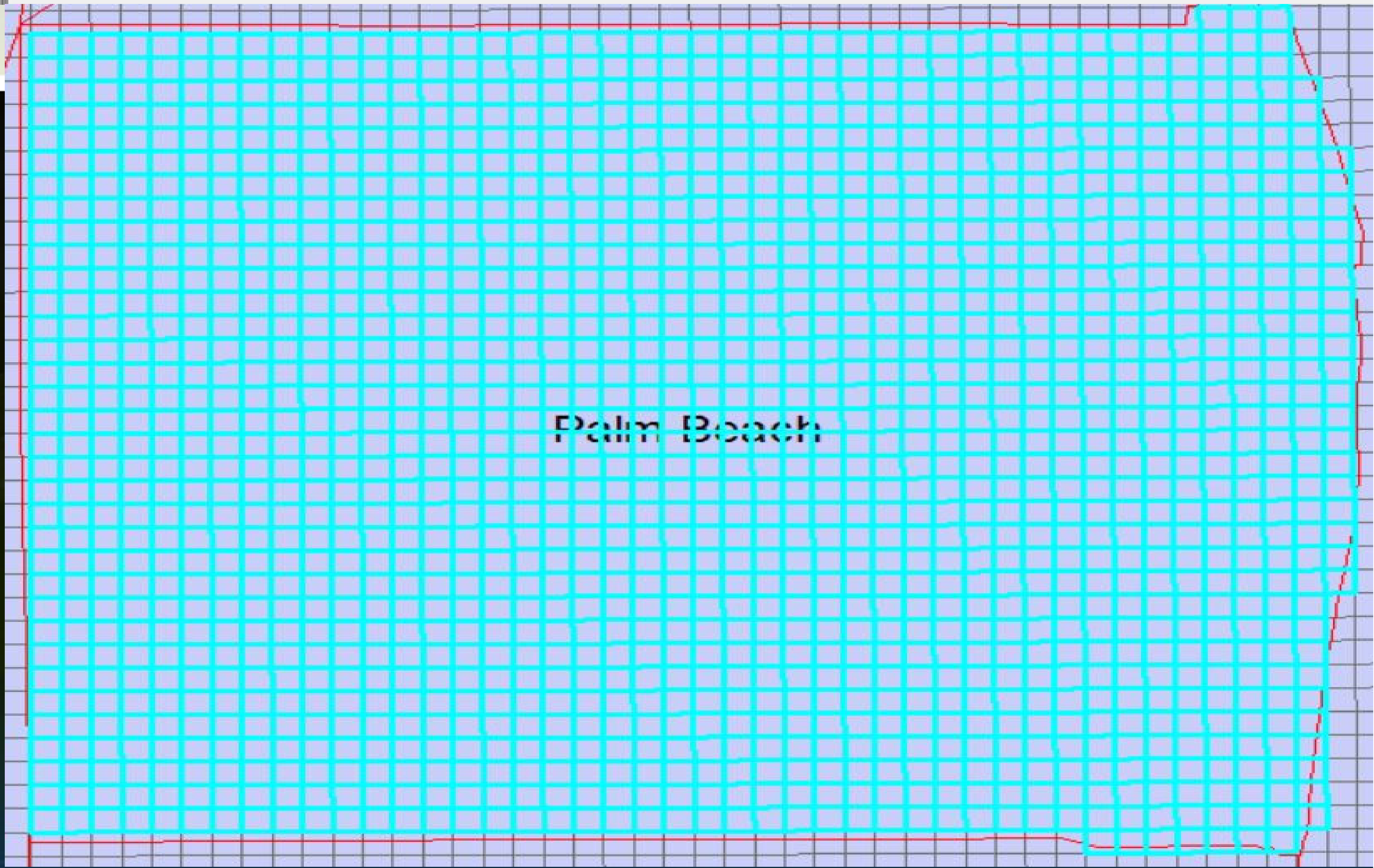
Resilience Metrics Hub
Gulfport
Biloxi
Pensacola
Slidell
New Orleans
USGS Change Factors for SFWMD Areas
Area Type
- All -
Area of Interest
Rainfall Duration (Days)
Return Period (Years)
Planning Horizon
2050-2089
Apply
Clear
Search
AHED Rain Area
County
Orange County
Osceola County
Palm Beach
Palm Beach County
Polk County
Southwest Coast
St. Lucie County
1
3
7
5
10
25
50
100
200
Gulf of Mexico

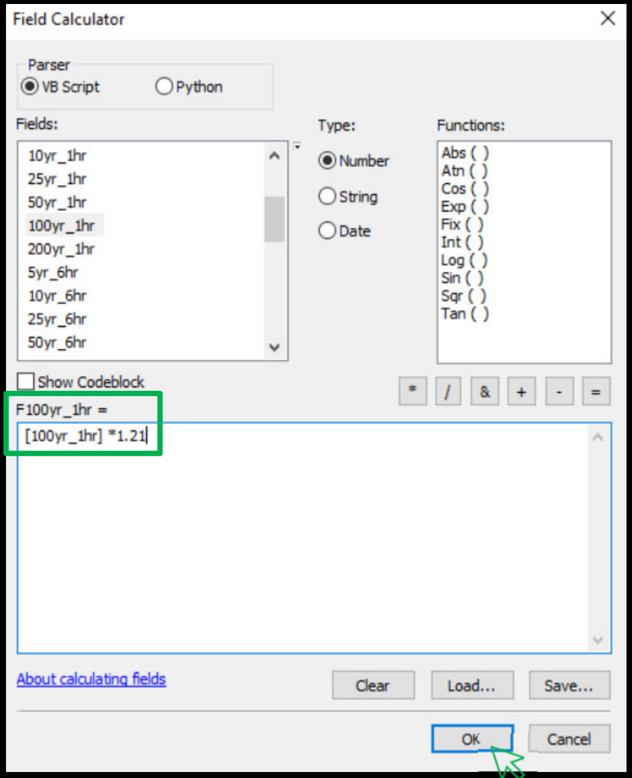

Resilience Metrics Hub
ncortez@sfwmd.gov_sfwmd
Extreme Rainfall Change Factors for Resiliency Planning in South Florida
Collaborators
USGS
FIU Institute of Environment
FIU Sea Level Solutions Center
USGS Change Factors for SFWMD Areas
Area Type
County
Area of Interest
Palm Beach County
Rainfall Duration (Days)
1
Return Period (Years)
100
Planning Horizon
2050-2089
Apply
Clear
USGS Change Factors: County
Area of Interest: Palm Beach County
Percentile 5th: 0.79
Percentile 25th: 1.01
Percentile 50th: 1.21
Percentile 75th: 1.51
Percentile 95th: 2.11
Zoom to
Change Factor Tutorial (Coming Soon)
NOAA Atlas 14 GIS Files
SFWMD Technical Memorandum (Coming Soon)
USGS Data Release Portal
USGS Final Report (available Summer 2022)
Zip file will download
USGS Change Factors for SFWMD Areas
Change Factor Area Type
AHED Rain Area
County
Tampa
Miami
Nassau
THE BAHAMAS



NOAA_Depths_on_NEXRAD_Grid

FID	Shape *	HYDROID	CENTROID_X	CENTROID_Y	5yr_1hr	10yr_1hr	25yr_1hr	50yr_1hr	100yr_1hr
17936	Polygon	10063477	935988.417	838424.463	2.927	3.3725	3.9905	4.47025	4.95275




Field Calculator
Parser
VB Script
Python
Fields:
10yr_1hr
25yr_1hr
50yr_1hr
100yr_1hr
200yr_1hr
5yr_6hr
10yr_6hr
25yr_6hr
50yr_6hr
Type:
Number
String
Date
Functions:
Abs ( )
Atn ( )
Cos ( )
Exp ( )
Fix ( )
Int ( )
Log ( )
Sin ( )
Sqr ( )
Tan ( )
Show Codeblock
F100yr_1hr =
[100yr_1hr] *1.21
About calculating fields
Clear
Load...
Save...
OK
Cancel


NOAA_Depths_on_NEXRAD_Grid
FID | Shape * | HYDROID | CENTROID_X | CENTROID_Y | 5yr_1hr | 10yr_1hr | 25yr_1hr | 50yr_1hr | 100yr_1hr | F100yr_1hr
17936 | Polygon | 10063477 | 935988.417 | 838424.463 | 2.927 | 3.3725 | 3.9905 | 4.47025 | 4.95275 | 5.993

7. Q&A Session

If you’re participating in person – please fill out Section 5 at the Technical Question / Public Comment Card and give to a meeting attendant

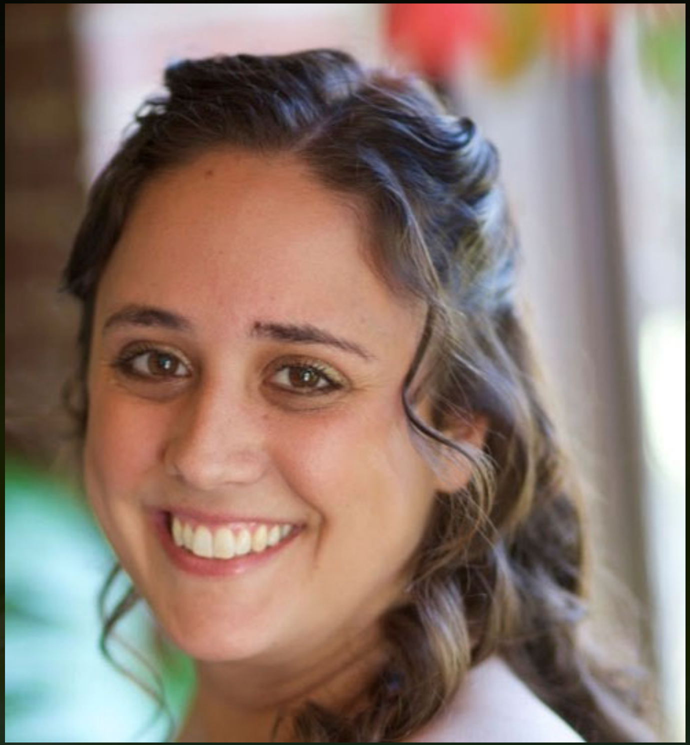
If you’re participating via Zoom – use the Q&A function to submit a written question

Moderator: Nicole Cortez

8. Break

Great Blue Herons
by Michelle Irizarry-Ortiz

9. Using Extreme Rainfall Projections to Plan for the Future – Featured Case Studies



Krista Romita Grocholski, Ph.D.
Physical Scientist,
RAND Corporation

Alan Cohn
Managing Director,
Integrated Water Management,
NYC Department of Environmental Protection

Jordan Fischbach, Ph.D.
Director of Planning and Policy Research,
The Water Institute of the Gulf

Moderator: Carolina Maran

9. Using Extreme Rainfall Projections to Plan for the Future – Featured Case Studies

FUTURE PROJECTED INTENSITY-DURATION-FREQUENCY (IDF) CURVES FOR THE CHESAPEAKE BAY WATERSHED AND VIRGINIA

Krista Romita Grocholski, Ph.D.
Physical Scientist,
RAND Corporation

9. Using Extreme Rainfall Projections to Plan for the Future – Featured Case Studies

DESIGNING AND IMPLEMENTING GREEN INFRASTRUCTURE PROJECT WITH CONSIDERATION OF FUTURE RAINFALL PROJECTIONS ADOPTED IN NEW YORK CITY

Alan Cohn

Managing Director, Integrated Water Management,
NYC Department of Environmental Protection

9. Using Extreme Rainfall Projections to Plan for the Future – Featured Case Studies

EVALUATING THE BENEFITS AND COSTS OF GREEN STORMWATER INFRASTRUCTURE IN PENNSYLVANIA'S NEGLEY RUN WATERSHED

Jordan Fischbach, Ph.D.
Director of Planning and Policy Research,
The Water Institute of the Gulf

Recording Breaking Rains in 2021

Tropical Storm Elsa: July 8-9

- Max 1-hr rainfall rate: 2.75 to 3 in/hr

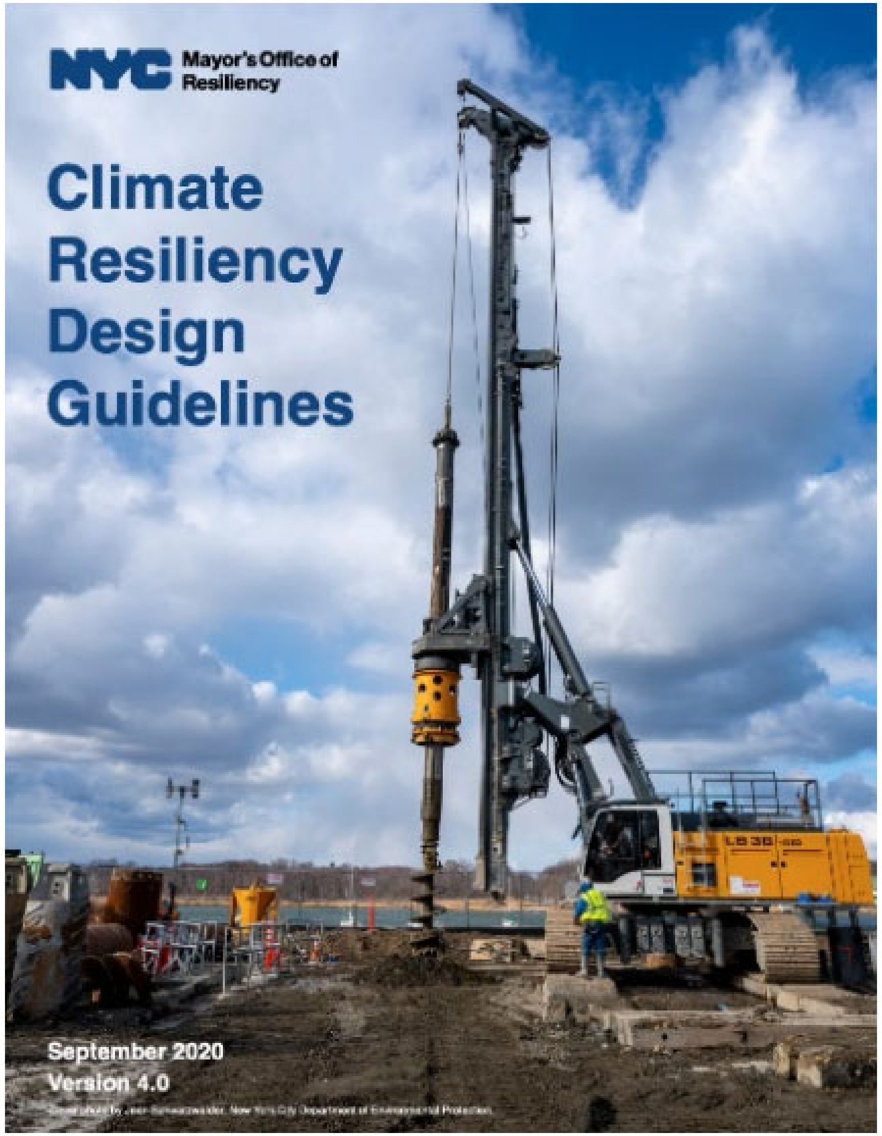
Tropical Storm Henri: August 21-23

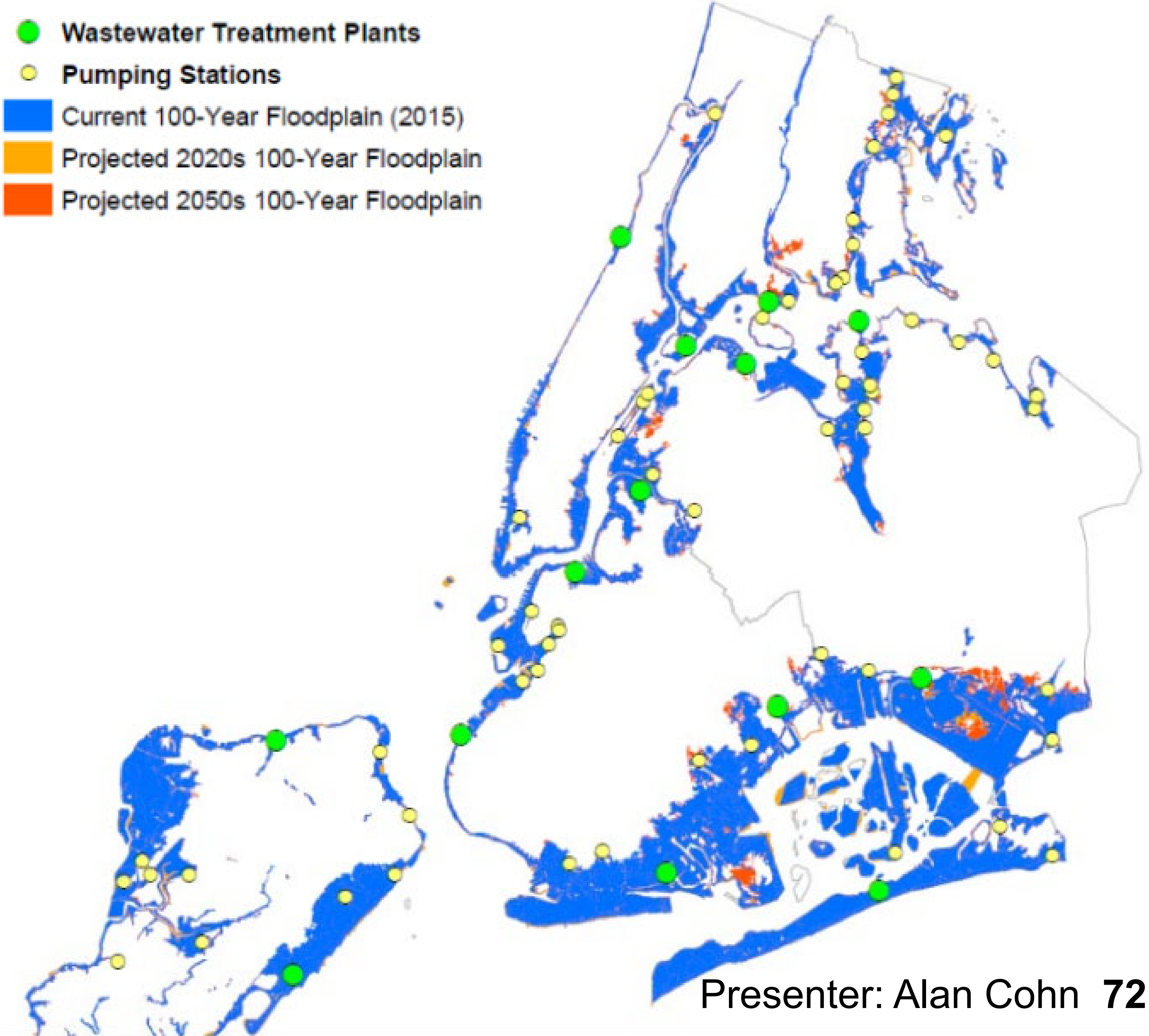
- Central Park reported 4.45 inches of rain on Aug. 21 alone, with 1.94 inches falling between 10 to 11pm.

Tropical Storm Ida: September 2

- The Central Park rain gauge set a new record for 1-hour rainfall with 3.15 inches (previously 1.94 in. from Tropical Storm Henri)

Critical equipment is being designed for climate change





Extreme rainfall risk is the latest to be made public

Sea level rise + coastal storms

Projections: Downscaled sea level rise projections available

Mapping: Future flood mapping under development; FEMA flood mapping well understood

Extreme Heat

Projections: Downscaled heat wave projections available

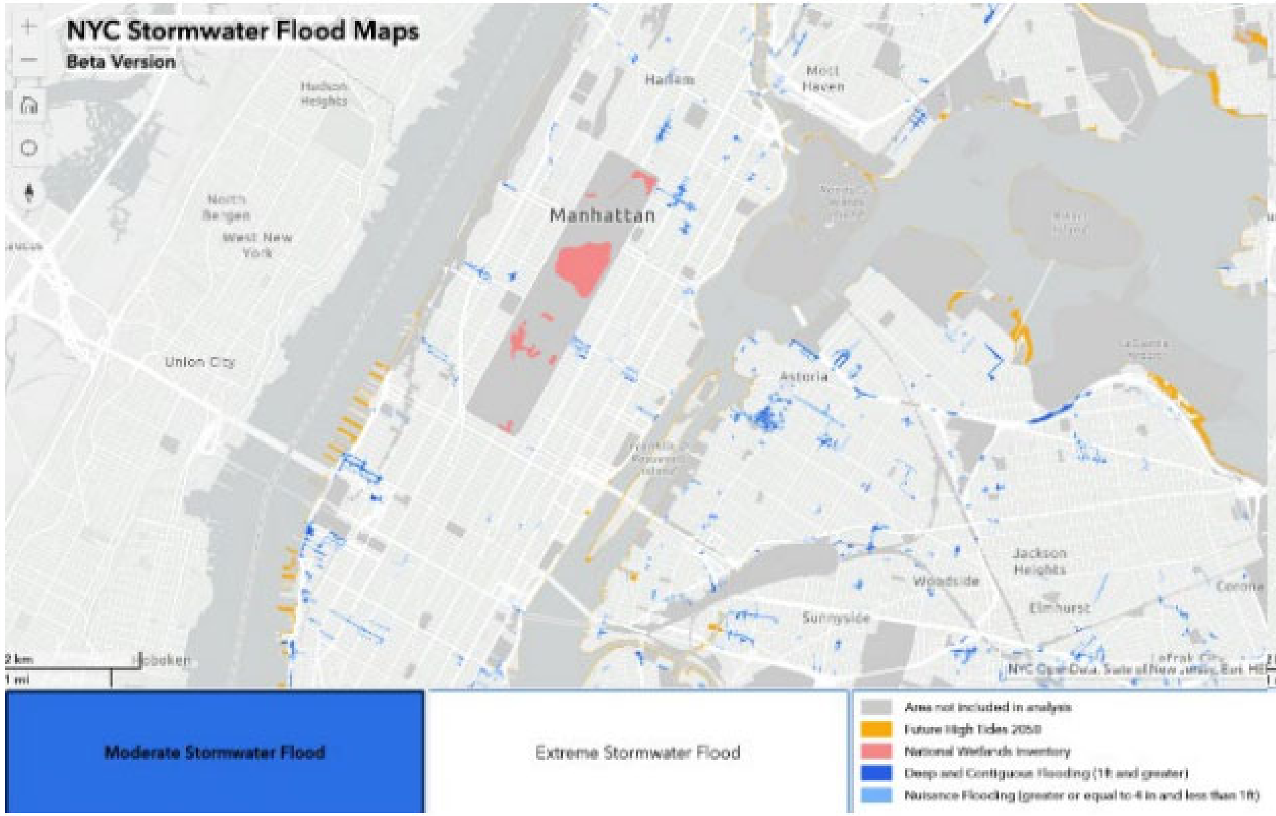
Mapping: Heat vulnerability index encourages prioritized mitigation

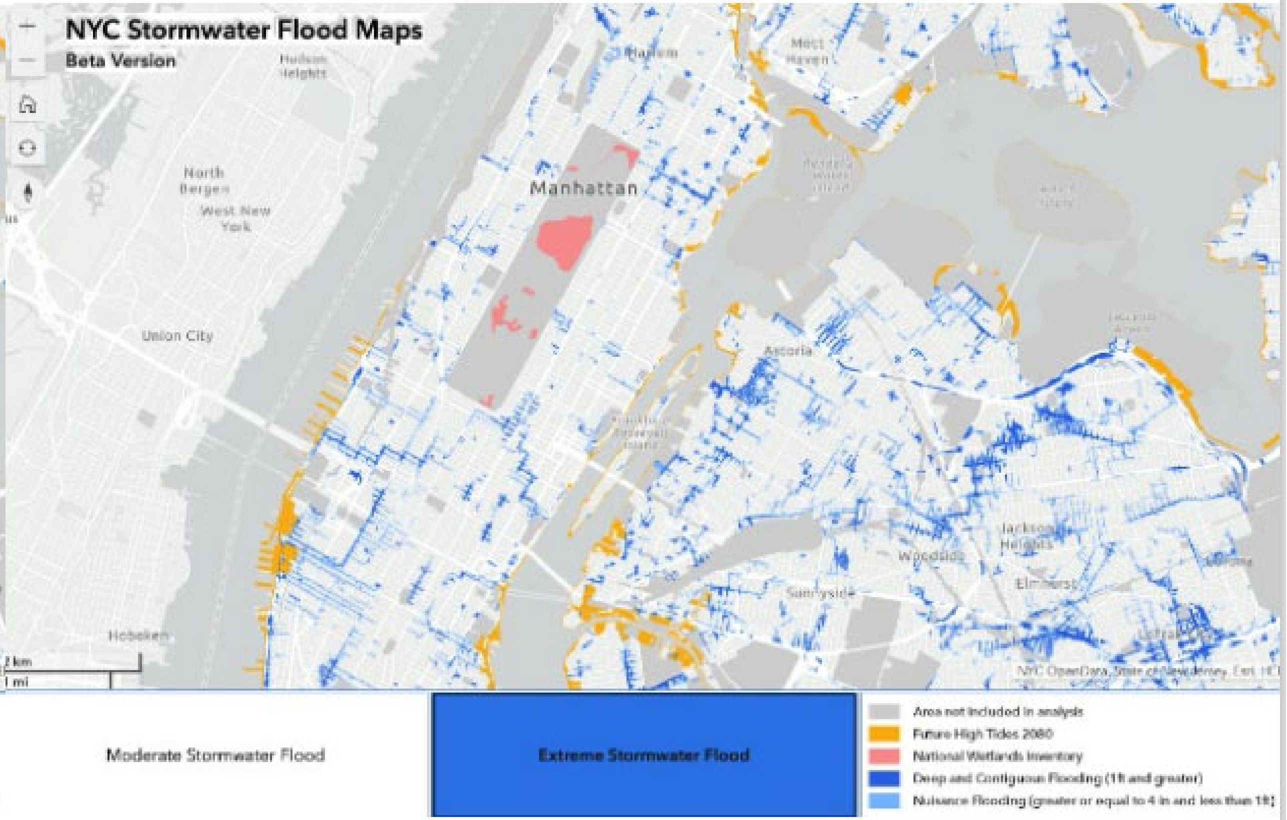
Extreme Rain

Projections: average increases available, rainfall intensity projections to be studied further

Mapping: maps of areas most vulnerable to flooding from extreme rain

NYC Stormwater Flood maps

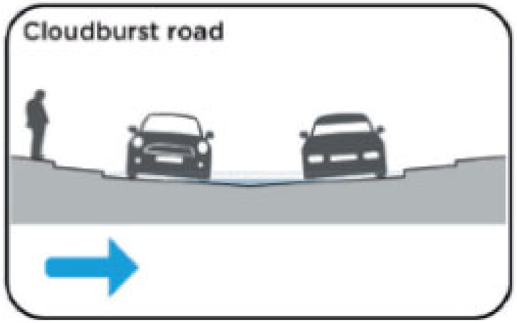




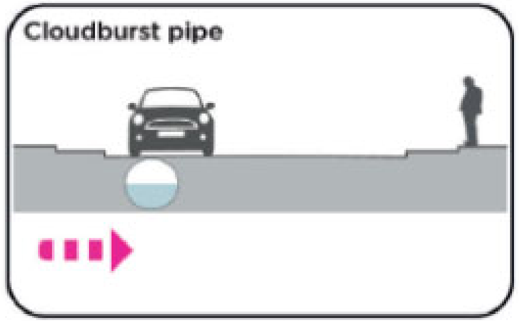
~2 inch/hr rain + 2.5 ft sea level rise (2050s high estimate)

~3.5 inch/hr rain + 4.8 ft sea level rise (2080s high estimate)

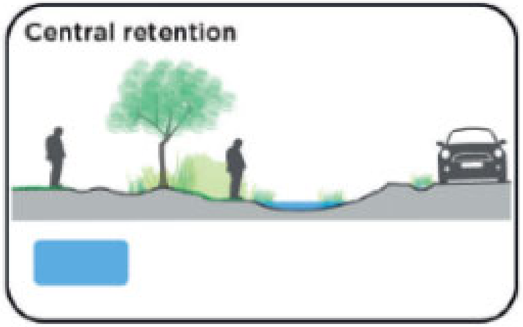
Applying the "cloudburst management" approach



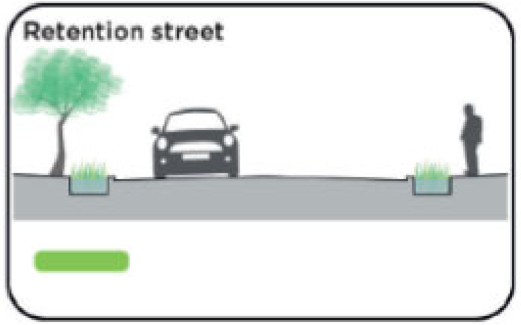
Used to convey water where the terrain is favourable



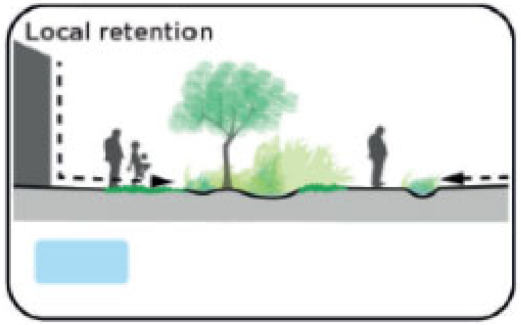
Used to convey water where the terrain does not permit BGI projects



Used to retain water in a larger area connected to other BGI projects



Used to retain water where the terrain is favourable



Used to retain water in larger areas from roofs and local surroundings

Using rainfall projections for cloudburst design

1-hour duration rainfall depths			
End of useful life	5-year design storm (in)	50-year design storm (in)	100-year design storm (in)
Baseline	1.61	2.57	2.87
Through to 2039	1.83	3.02	3.41
2040-2069	1.97	3.33	3.93
2070-2099	2.12	3.74	4.34

10-year
2.30

24-hour duration rainfall depths			
End of useful life	5-year design storm (in)	50-year design storm (in)	100-year design storm (in)
Baseline	4.70	7.83	8.79
Through to 2039	5.41	9.21	10.55
2040-2069	5.88	10.13	12.31
2070-2099	6.35	11.28	13.40

Pilot Project: South Jamaica Houses

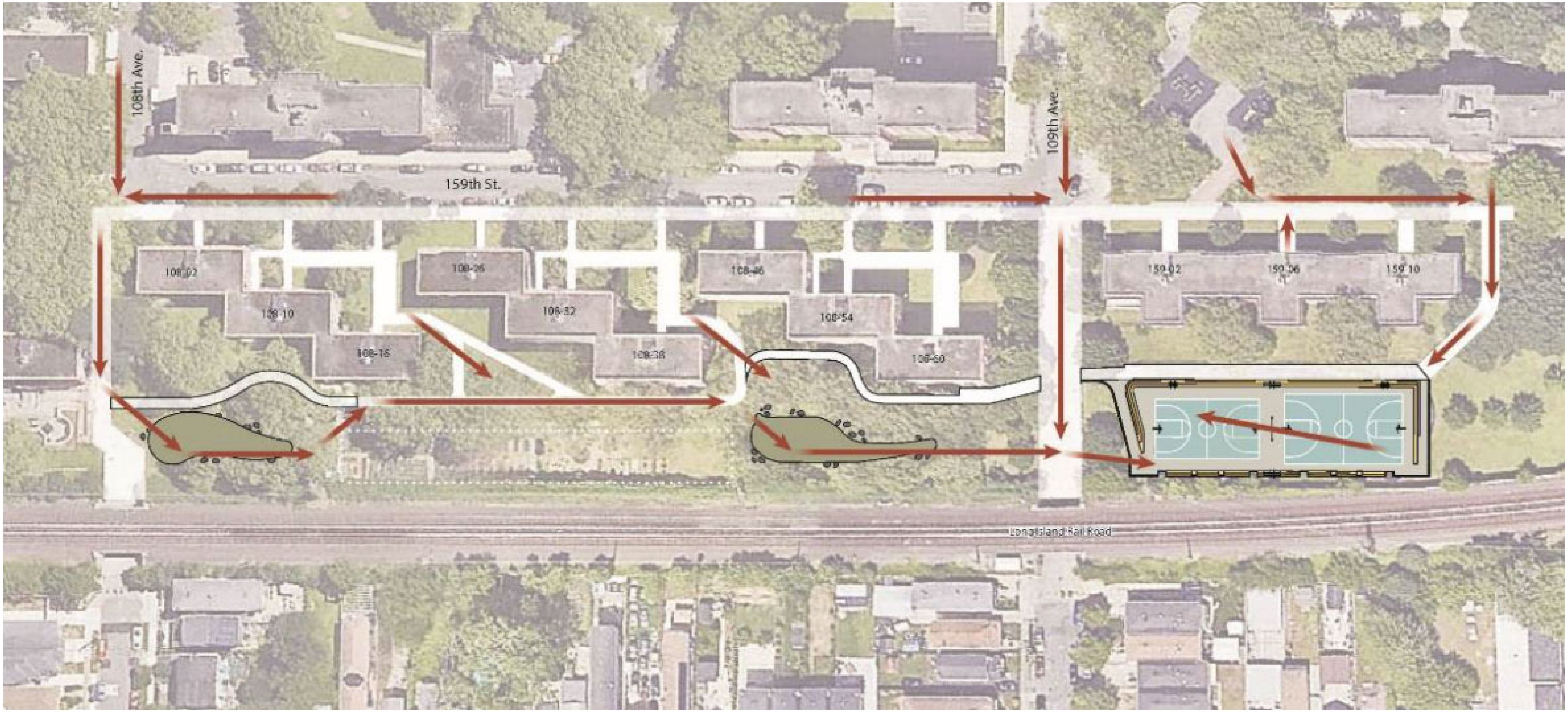
Features:
- Grassy areas and basketball court that infiltrate stormwater and fill up in heavier rain events
- Enhancement of walking paths, lighting, and benches near basketball courts

Design Criteria:
- 2.30” in an hour (10-Year Design Storm over a duration of 1 hour)
- Based on 2040-2069 projected 10-Year event

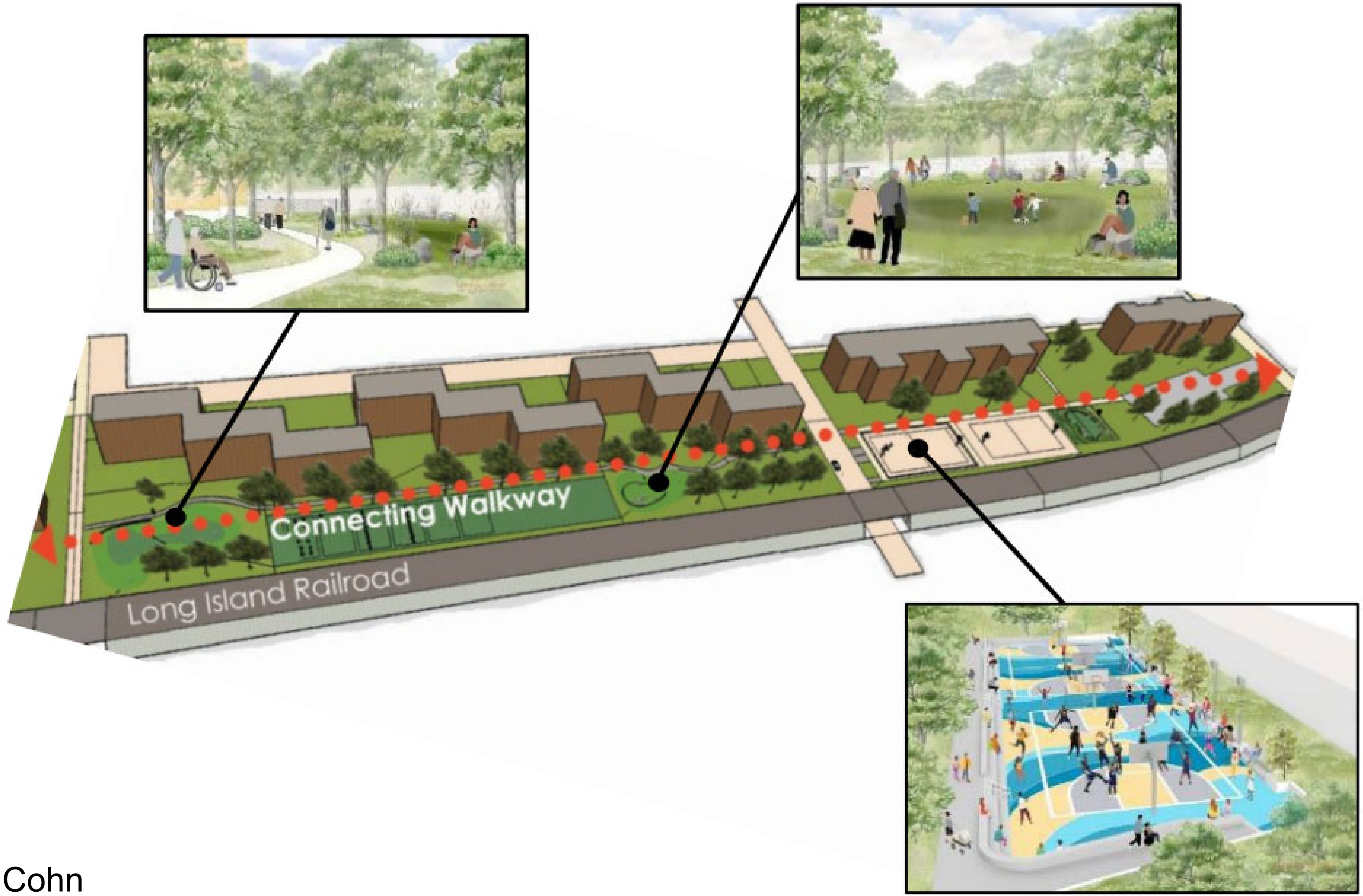
Capacity:
- Approximately 300,000 gallons (40,000 cf)

Status:
- 100% Design completed
- Construction anticipated in late 2023

Drainage pipes will be diverted from the sewer



South Jamaica Houses "Cloudburst" Pilot Project



Cloudburst Pilot Projects

Clinton Houses

Beach 67th Street

Legend

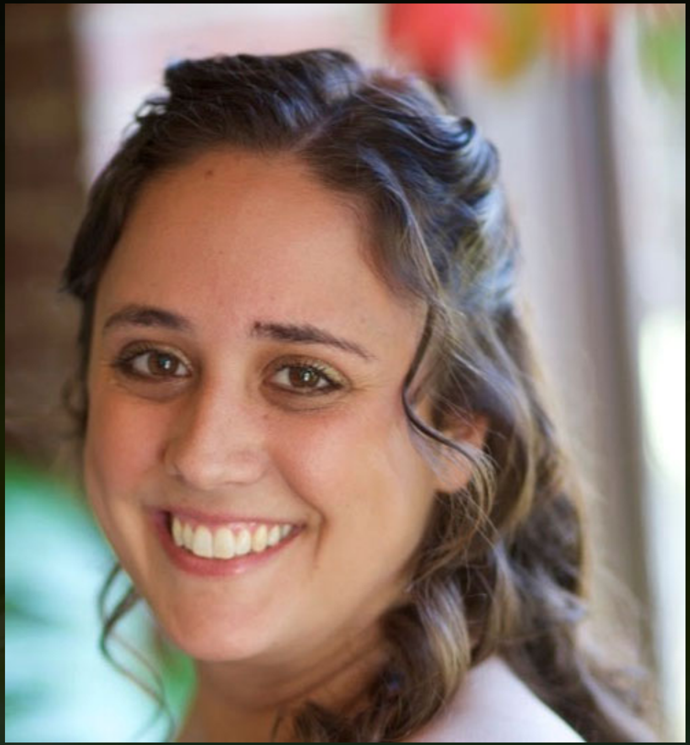
- In Design (green circle)
- Conceptual (blue triangle)

South Jamaica Houses

Sayres Ave. & St. Albans Park

St. Albans/ Addisleigh Park

9. Using Extreme Rainfall Projections to Plan for the Future – Featured Case Studies



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Alan Cohn
Managing Director,
Integrated Water Management,
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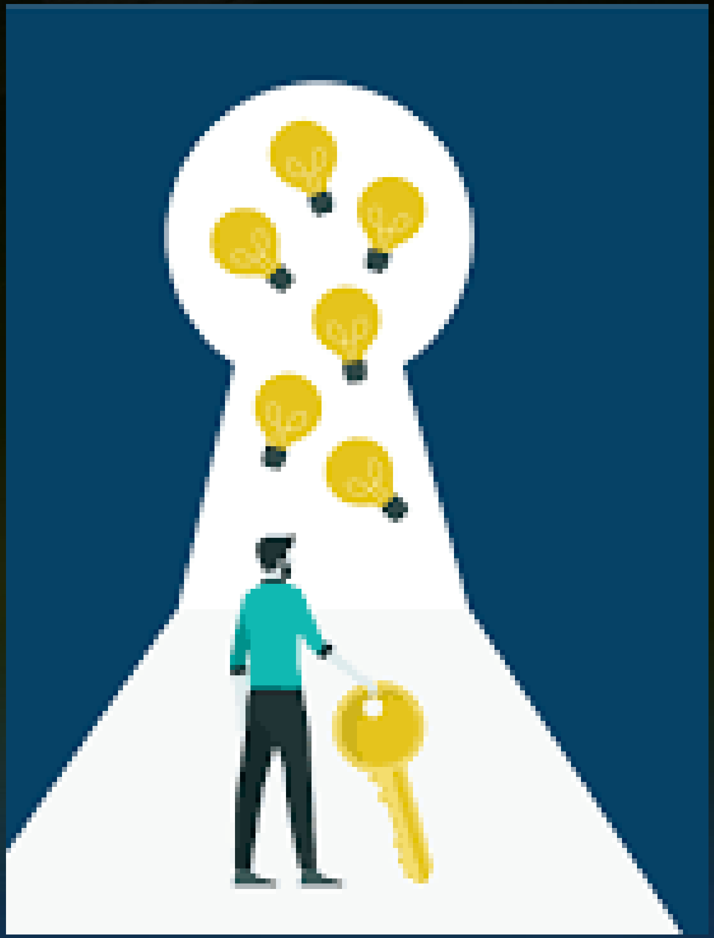
Jordan Fischbach, Ph.D.
Director of Planning and Policy Research,
The Water Institute of the Gulf

Moderator: Carolina Maran

Panel Discussion Takeaways

- Relevance of Determining Future Rainfall Estimates
- Comparable approaches adopted throughout the U.S.
- Incorporation of rainfall projections into design and regulation
- Uncertainty ranges and risk levels – decision making and communicating effectively
- Different ways of looking at the data and assuming uncertainty
- Other efforts going on in Florida, e.g. Planning Councils and Florida Building Commission



10. Development of Future Climate Scenarios for Regional Hydrologic Simulations in South Florida and Statewide Florida Building Commission Extreme Rainfall Results

Jayantha T. Obeysekera Ph.D., P.E.

Director & Research Professor

Sea Level Solutions Center, Institute of Environment

Florida International University

Development of Future Climate Scenarios for Regional Hydrologic Simulations in South Florida

Sponsor:

South Florida Water Management District

Project Managers: Jenifer Barnes, Walter Wilcox

Web: https://environment.fiu.edu | http://slsc.fiu.edu
Facebook: @FIUWater | **Twitter**: @FIUWater

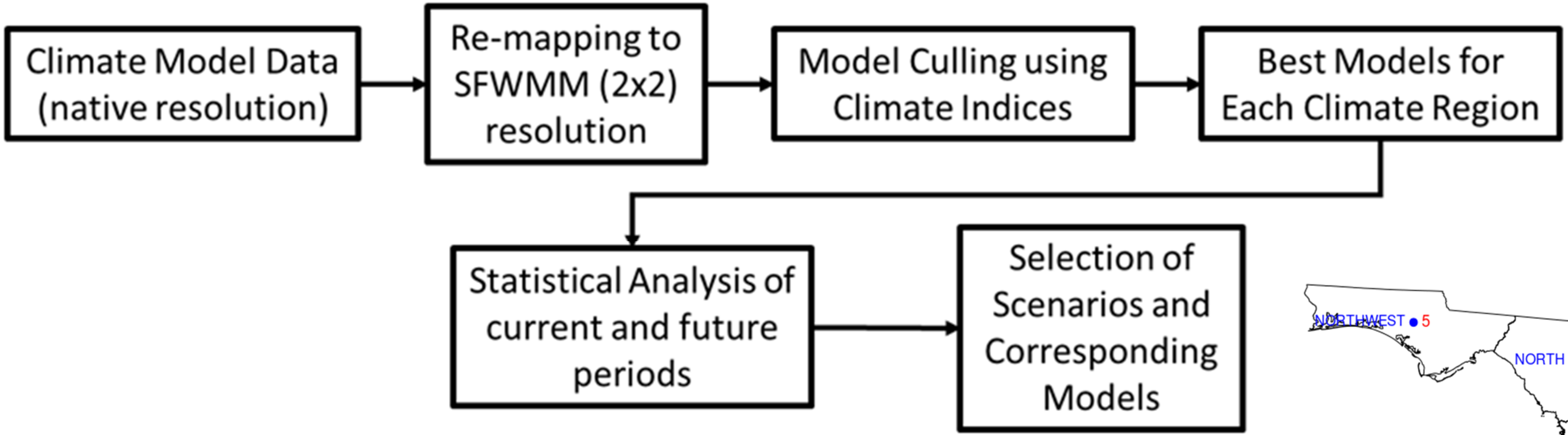
Presenter: Jayantha Obeysekera

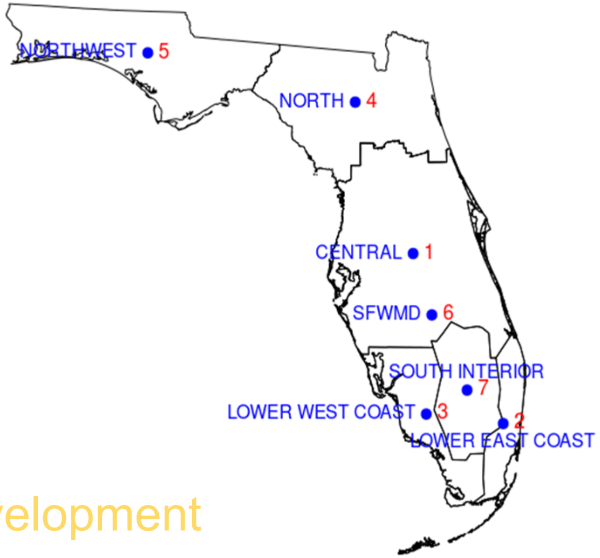
FIU Sea Level Solutions Center
Florida International University

FIU Institute of Environment
Florida International University

April 27, 2022

Scenario Development Approach





DRAFT RESULTS - The data presented here are under development and have not yet been reviewed and published.

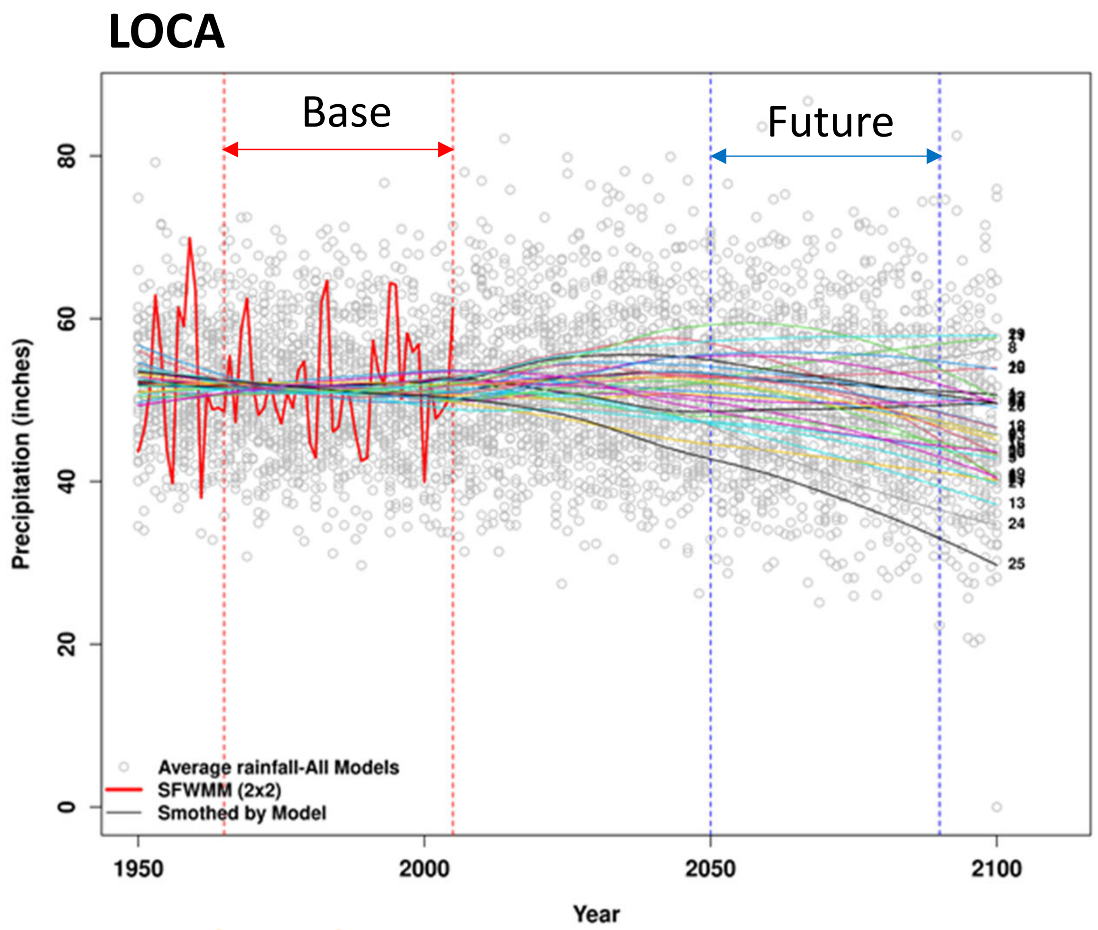
Model Culling: Metrics

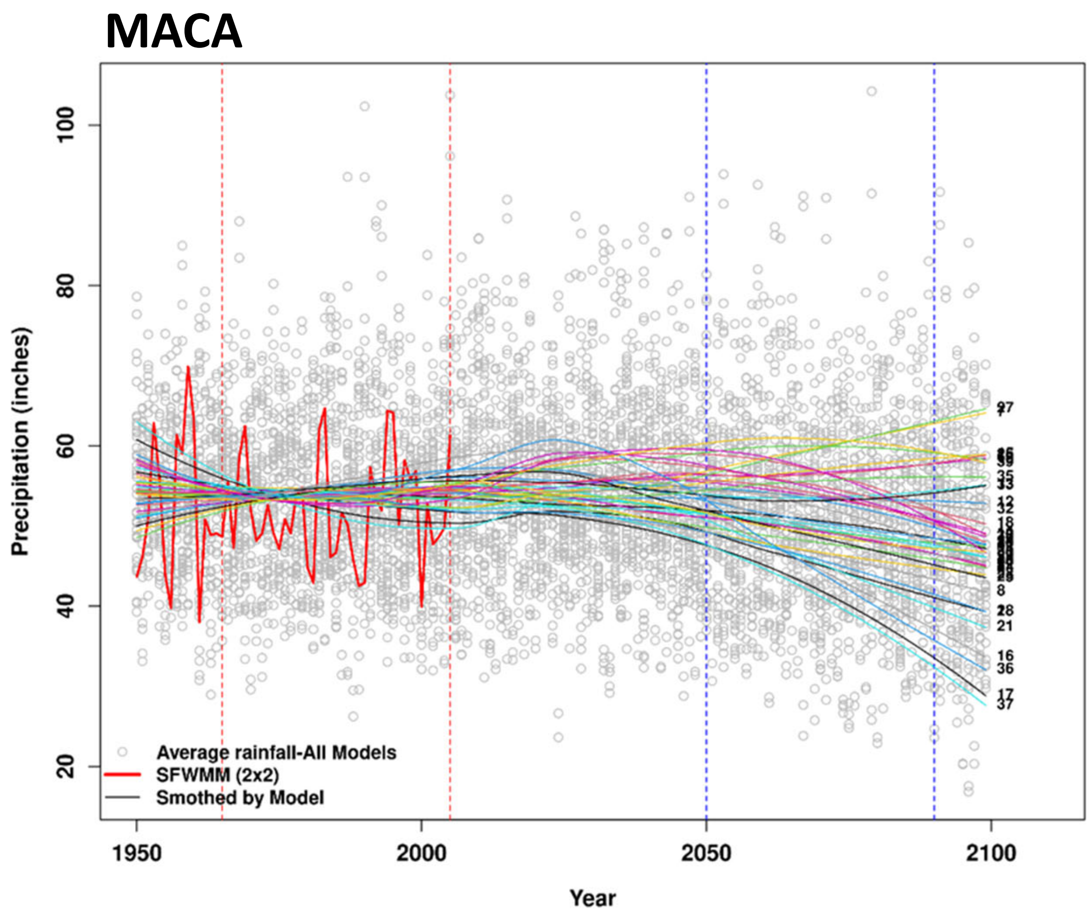
ID	Indicator Name	Definition	Units
PRCPTOT	Annual total precipitation	Annual total, days > 1mm	inches
PMMEAN	Seasonal Pattern	Mean monthly rainfall	inches
WSTART	Wet Season Start Date	Start of the Wet Season	days
R10mm	Heavy precipitation days	# of days with > 10mm	days
R20mm	Heavy precipitation days	# of days with > 20mm	days
SDII	Daily intensity index	Ratio Annual precipitation / #wet days	inches /day
CDD	Consecutive dry days	#max. consecutive days < 1 mm	days
CWD	Consecutive wet days	#max. consecutive days > 1 mm	days

ID	Indicator Name	Definition	Units
RX1day	Max 1-day precipitation amount	Annual maxima of 1-day precipitation	inches
R95p	Very wet days	Annual precip from days > 95%	inches
R99p	Extreme wet days	Annual precip from days > 99%	inches
RX3day	Max 3-day precipitation amount	Annual maxima of 3-day precipitation	inches
RX5day	Max 5-day precipitation amount	Annual maxima of 5-day precipitation	inches
RX7day	Max 7-day precipitation amount	Annual maxima of 7-day precipitation	inches
RX10day	Max 10-day precipitation amount	Annual maxima of 10-day precipitation	inches

DRAFT RESULTS – These data are under development and have not yet been reviewed and published.

Total Precipitation (Entire SFWMD Region)



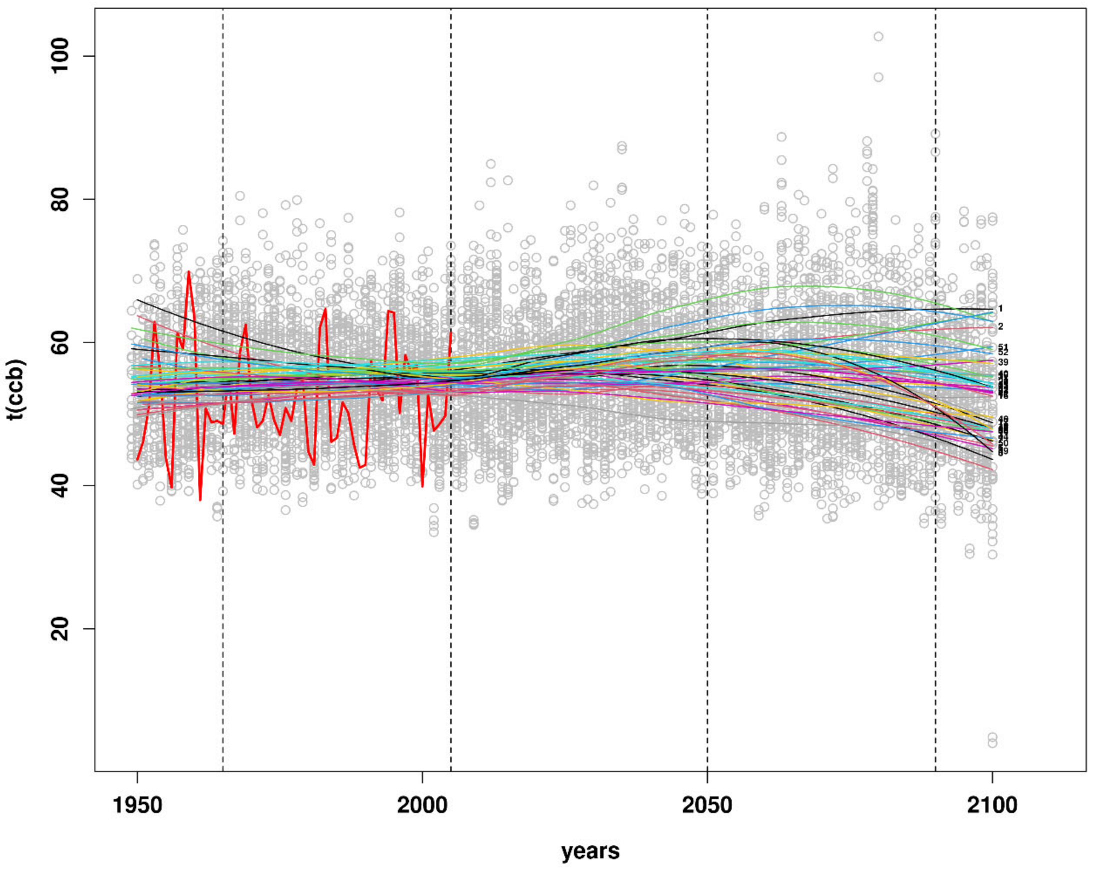


DRAFT RESULTS – These data are under development and have not yet been reviewed and published.

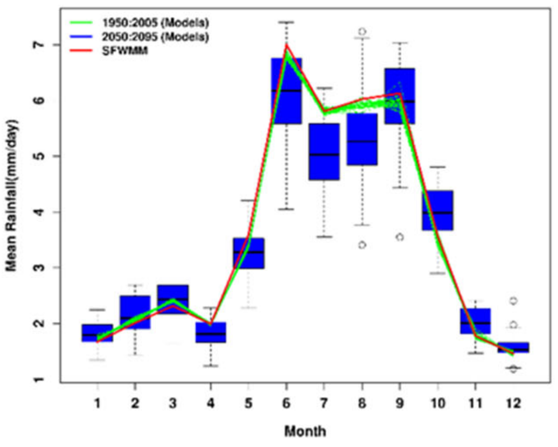
Presenter: Jayantha Obeysekera

CORDEX and Seasonality

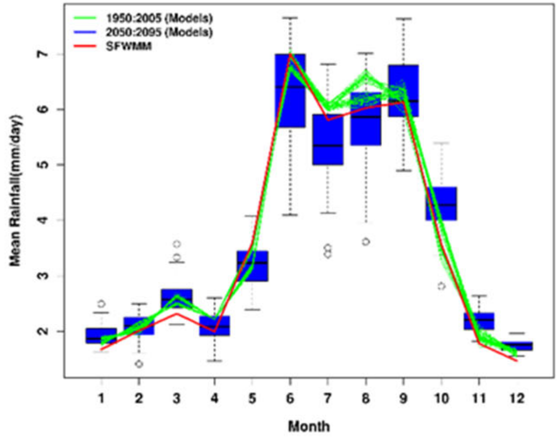
CORDEX



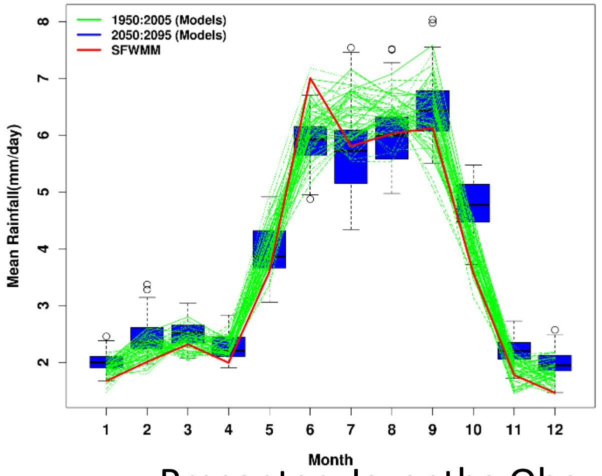
LOCA



MACA



CORDEX



DRAFT RESULTS – These data are under development and have not yet been reviewed and published.

Scenarios by Dataset

LOCA

Scenario	Model #	Percentile	Average Rainfall (inches)	Model Name
1	24	5%	41.36	pr_MIROC-ESM_r1i1p1_rcp85_2006-2100
2	5	25%	46.44	pr_CCSM4_r6i1p1_rcp85_2006-2100
3	4	50%	50.18	pr_CanESM2_r1i1p1_rcp85_2006-2100
4	20	75%	52.14	pr_HadGEM2-CC_r1i1p1_rcp85_2006-2100
5	29	95%	56.97	pr_MRI-CGCM3_r1i1p1_rcp85_2006-2100

MACA

Scenario	Model #	Percentile	Average Rainfall (inches)	Model Name
1	21	5%	42.97	macav2metdata_pr_bcc-csm1-1_r1i1p1_rcp85
2	25	25%	48.45	macav2metdata_pr_CCSM4_r6i1p1_rcp85
3	24	50%	52.58	macav2metdata_pr_CanESM2_r1i1p1_rcp85
4	18	75%	54.17	macav2livneh_pr_MIROC5_r1i1p1_rcp85
5	39	95%	60.28	macav2metdata_pr_MRI-CGCM3_r1i1p1_rcp85

CORDEX

Scenario	Model #	Percentile	Average Rainfall (inches)	Model Name
1	32	5%	49.10	HadGEM2-ES.RegCM4.day.NAM-22i.mbcn-gridMET
2	18	25%	51.91	GEMatm-Can.CRCM5-UQAM.day.NAM-44i.mbcn-gridMET
3	14	50%	55.82	EC-EARTH.RCA4.day.NAM-44i.mbcn-gridMET
4	21	75%	57.86	GEMatm-MPI.CRCM5-UQAM.day.NAM-44i.mbcn-Daymet
5	51	95%	62.80	MPI-ESM-MR.CRCM5-UQAM.day.NAM-22i.mbcn-Daymet

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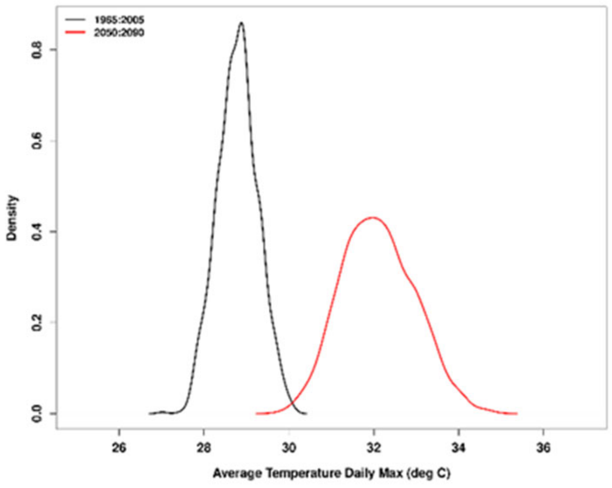
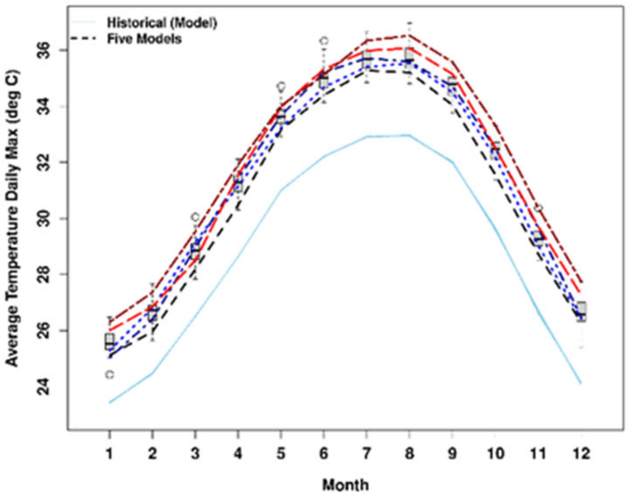
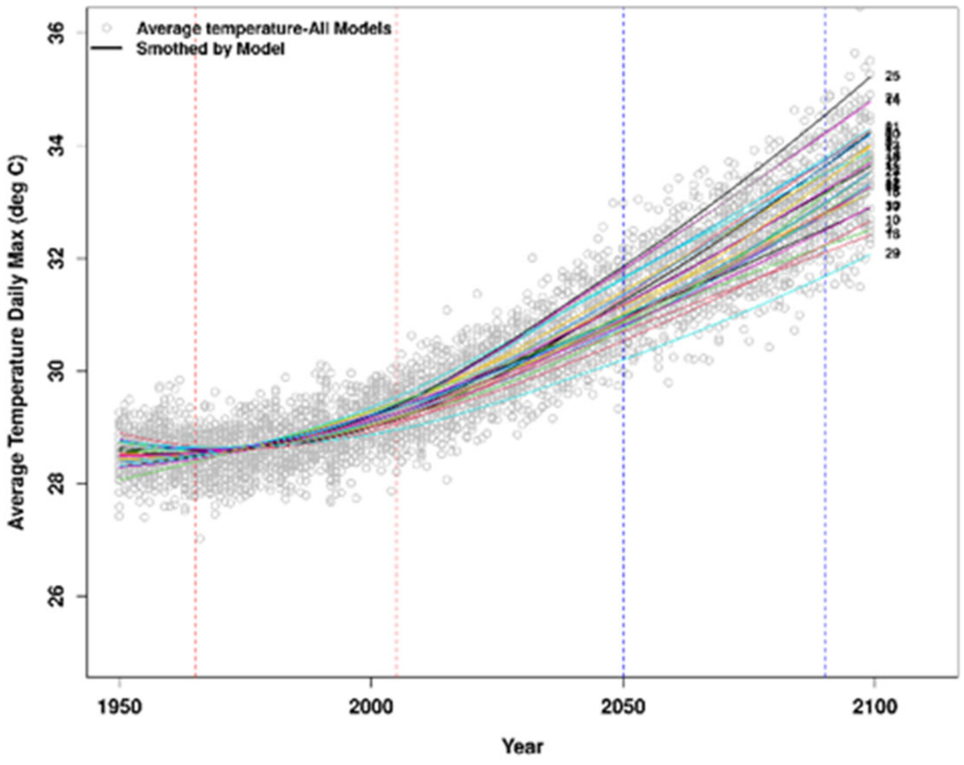
Evapotranspiration







Scenario	Model #		Percentile	Average Temperature (deg C)	Model Name
1	10		5%	31.4	tasmax_CNRM-CM5_r1i1p1_rcp85
2	6		25%	31.8	tasmax_CESM1-BGC_r1i1p1_rcp85
3	15		50%	32.0	tasmax_GFDL-ESM2G_r1i1p1_rcp85
4	20		75%	32.5	tasmax_HadGEM2-CC_r1i1p1_rcp85
5	14		95%	33.0	tasmax_GFDL-CM3_r1i1p1_rcp85

DRAFT RESULTS – These data are under development and have not yet been reviewed and published.

Statewide Florida Building Commission Extreme Rainfall Results

Sponsor:

Florida Building Commission

Hurricane Research Advisory Committee

Web: https://environment.fiu.edu | http://slsc.fiu.edu
Facebook: @FIUWater | **Twitter**: @FIUWater

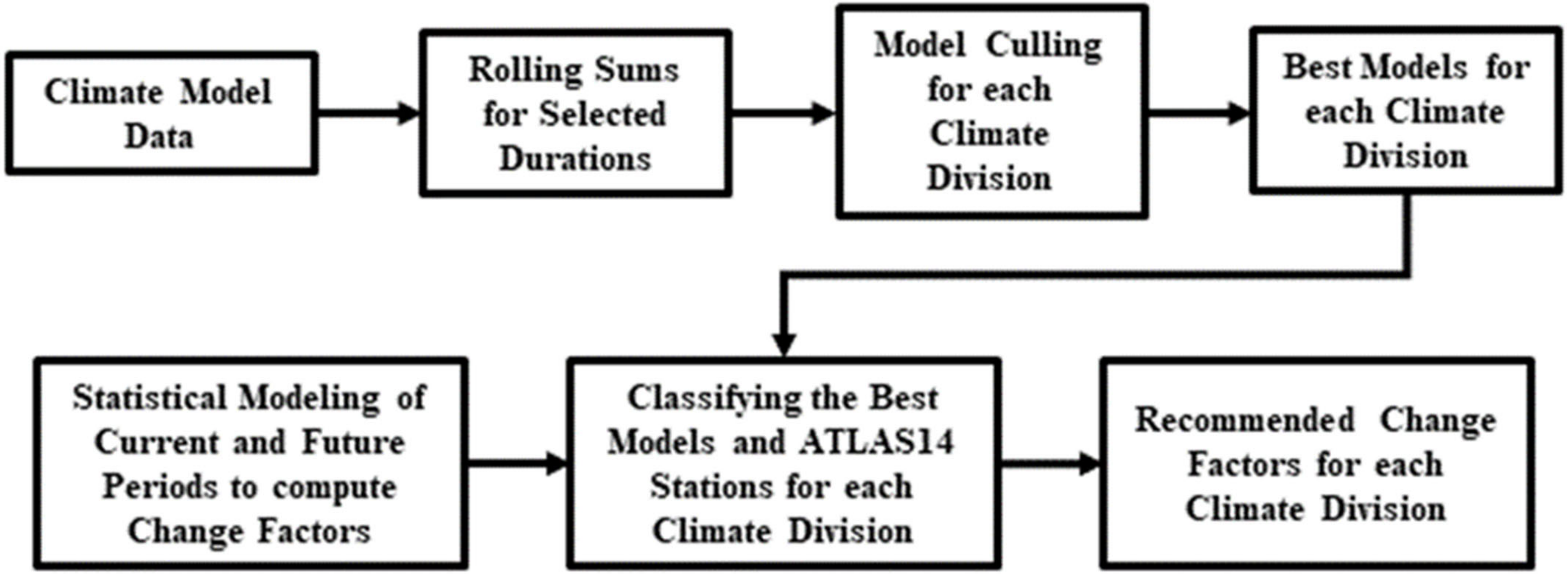
Presenter: Jayantha Obeysekera

FIU Sea Level Solutions Center
Florida International University

FIU Institute of Environment
Florida International University

April 27, 2022

Methodology

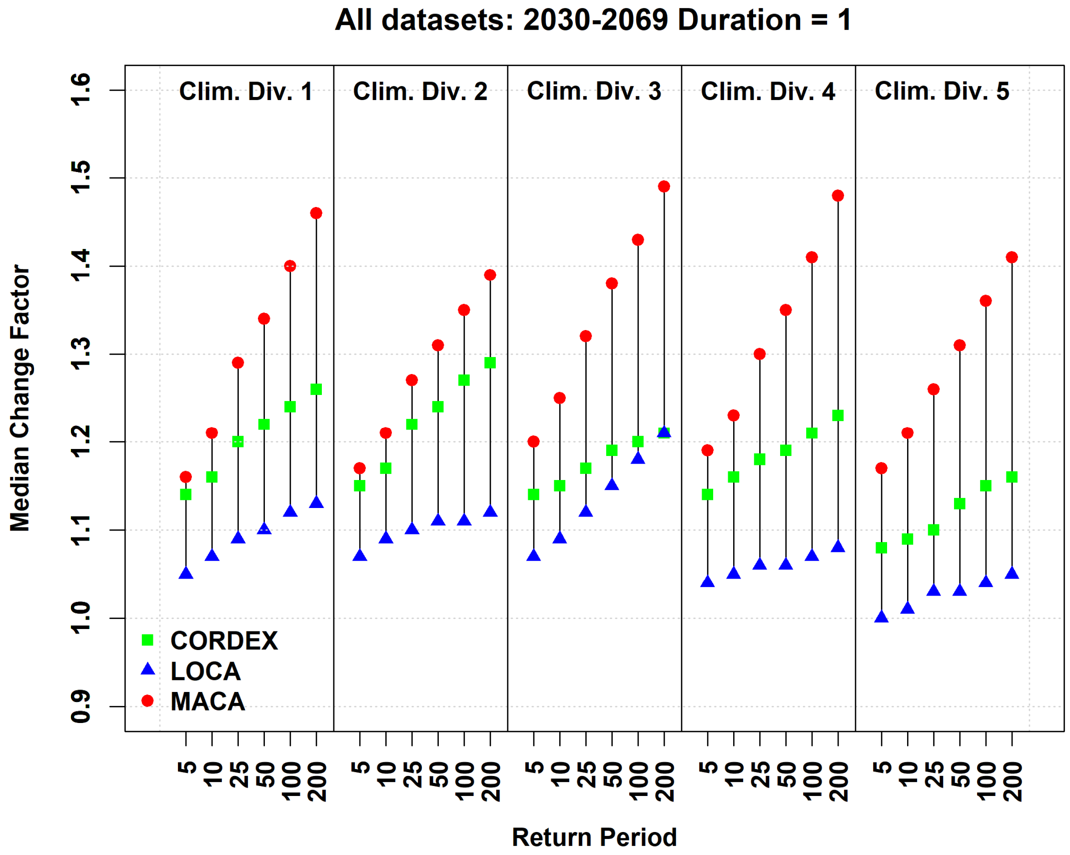


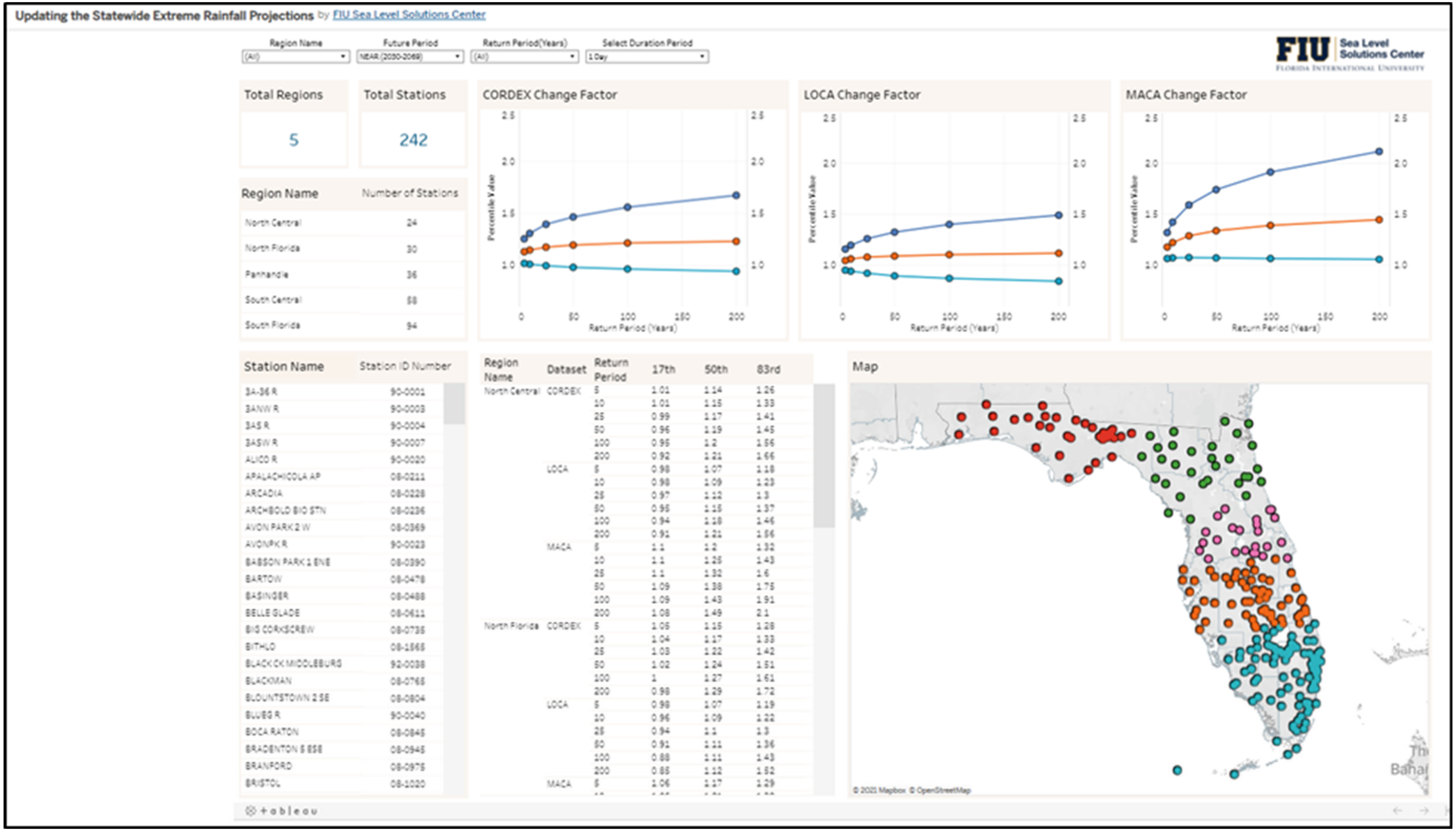
- Same Climate Model Datasets, Statistical Methods used in the USGS/SFWMD/FIU research on South Florida
- Alternative presentation of results for aggregated climate divisions for the entire state

Metrics of Evaluation

Name	Name	Definition	Units
PRCPTOT	Annual total wet days	Annual total, days > 1mm	inches
R10mm	Heavy precipitation days	# of days with > 10mm	days
R20mm	Heavy precipitation days	# of days with > 20mm	days
SDII	Daily intensity index	Ratio Annual / #wet days	inches
CDD	Consecutive dry days	#max. consecutive days < 1 mm	days
CWD	Consecutive wet days	#max. consecutive days > 1 mm	days
RX1day	Max 1-day precip amount	Annual maxima of 1-day precip	inches
R95p	Very wet days	Annual precip from days > 95% %	Inches
R99p	Extreme wet days	Annual precip from days > 99% %	Inches
RX3day	Max 1-day precip amount	Annual maxima of 3-day precip	inches
RX5day	Max 1-day precip amount	Annual maxima of 5-day precip	inches
RX7day	Max 1-day precip amount	Annual maxima of 7-day precip	inches
RX10day	Max 1-day precip amount	Annual maxima of 10-day precip	inches

Median Change Factor (NEAR Term)



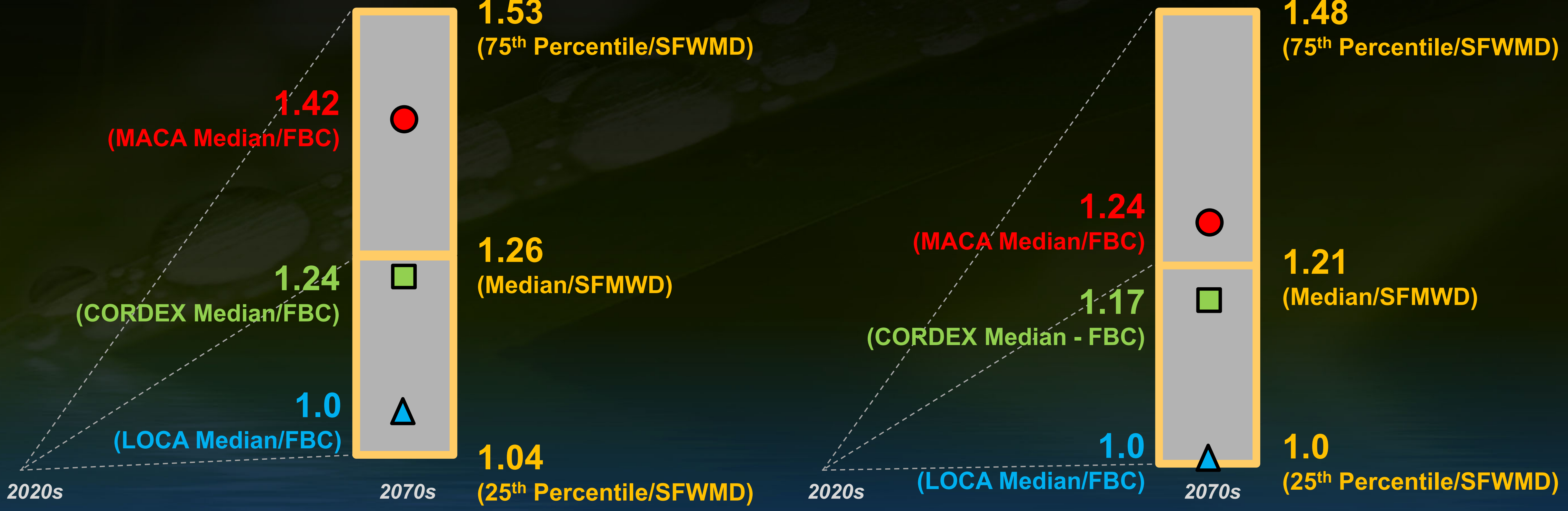

Updating the Statewide Extreme Rainfall Projections by FIU Sea Level Solutions Center
Region Name
Future Period
Return Period(Years)
Select Duration Period
FIU Sea Level Solutions Center
Florida International University
Total Regions
5
Total Stations
242
CORDEX Change Factor
LOCA Change Factor
MACA Change Factor
Percentile Value
Return Period (Years)
Region Name
Number of Stations
North Central 24
North Florida 30
Panhandle 36
South Central 58
South Florida 94
Station Name
Station ID Number
Region Name
Dataset
Return Period
17th
50th
83rd
Map
© 2021 Mapbox © OpenStreetMap
+ a b l e a u

FBC's Statewide Study

High Level Results Comparison to SFWMD TM Results

Change Factors (100-year/3-day Duration)

Climate Region 4 | Climate Region 5



Notes: FBC's estimates are based on best models within each downscaled dataset, for the far period (2060-2099). SFWMD TM estimates are based on the ensemble for all models for all downscaled datasets, for the period centered within 2050-2089. The FBC's CORDEX estimates do not reflect the latest revised CORDEX results.

11. Next Steps – Statewide Regional Climate Projections

Adam Blalock
Deputy Secretary for Ecosystems Restoration
Florida Department of Environmental Protection

11. Next Steps – Statewide Regional Climate Projections

Regional climate model data for historical and projected climate using 10-km regional coupled ocean-atmosphere model and 2-km Weather Research and Forecasting Model, derived from state-of-the-art climate models centered over Florida and its watersheds/aquifers, that can reproduce rainfall drivers in Florida and more accurately represent future rainfall totals, seasonal, average, extreme dry and extreme wet.

- Support for Section 380.093 F.S. Resilient Florida's Statewide Flood Vulnerability Assessment
- Accessible statewide regional climate projections web portal and local governments engagement
- Scientist-Stakeholder Workgroup Recommendations Report
- Future rainfall depth duration frequency curves and other estimated data summaries

Statewide Regional Climate Projections

Project Highlights:

- develop a high-resolution coupled ocean-atmosphere model
- produce comprehensive analysis of extremes and estimates of climate projection with reduced uncertainty
- involve stakeholders, so outcomes are actionable and fully utilized
- support effective, adaptive, and resilient operational, infrastructural decisions
- allow for informed planning for adaptation/mitigation measures at local and regional levels, integrated to coastal risk strategies (sea level rise driven)

Presenter: Adam Blalock

UF Water Institute UNIVERSITY of FLORIDA

FLORIDA Water & Climate Alliance

FIU Sea Level Solutions Center FLORIDA INTERNATIONAL UNIVERSITY

USGS science for a changing world

U.S. Department of Energy | Office of Science HYPERFACETS A Framework for Improving Analysis and Modeling of Earth System and Intersectoral Dynamics at Regional Scales

JUPITER

UNIVERSITY OF MIAMI ROSENSTIEL SCHOOL of MARINE & ATMOSPHERIC SCIENCE

FLORIDA STATE UNIVERSITY 1851

CLIMsystems Decision making in a climate changed world

PEACE RIVER MANASOTA REGIONAL WATER SUPPLY AUTHORITY

BROWARD COUNTY FLORIDA

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT SJR

TAMPA BAY WATER Supplying Water To The Region

USF UNIVERSITY OF SOUTH FLORIDA

11. Next Steps – Statewide Regional Climate Projections

Tirusew Asefa, Ph.D., Ph.D., P.E., D.WRE, F.ASCE
Chair, Florida Water and Climate Alliance
System Decision Support Manager, Tampa Bay Water

12. Q&A Session

If you're participating in person – please fill out Section 5 at the Technical Question / Public Comment Card and give to a meeting attendant

If you're participating via Zoom – use the Q&A function to submit a written question

13. Public Comments

If you're participating in person – please fill out Section 6 at the Technical Question / Public Comment Card

If you're participating via Zoom – use the Raise Hand feature

If you're participating via Phone –
*9 Raises Hand
*6 Mutes/Unmutes

Moderator: Nicole Cortez

14. Closing Remarks

Carolina Maran, Ph.D., P.E.
District Resiliency Officer
South Florida Water Management District

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- Sign-up for our updates by visiting https://www.sfwmd.gov/news-events and following these steps:
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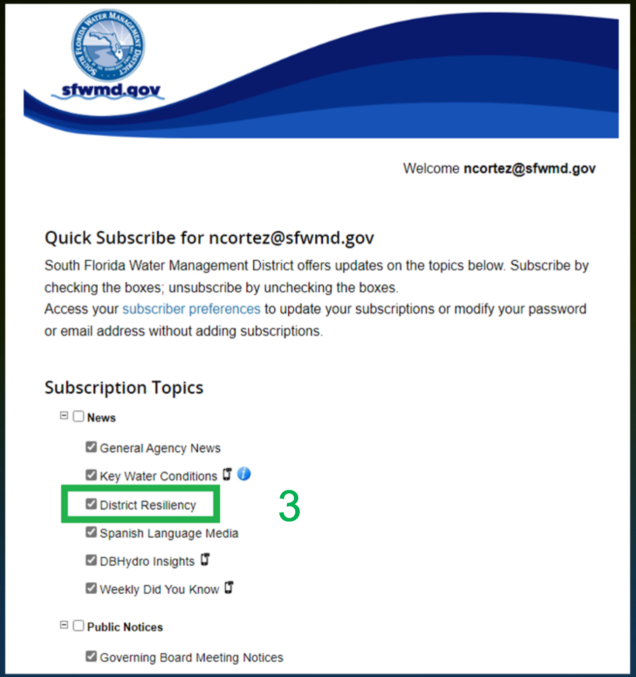

Photo by Miami DDA