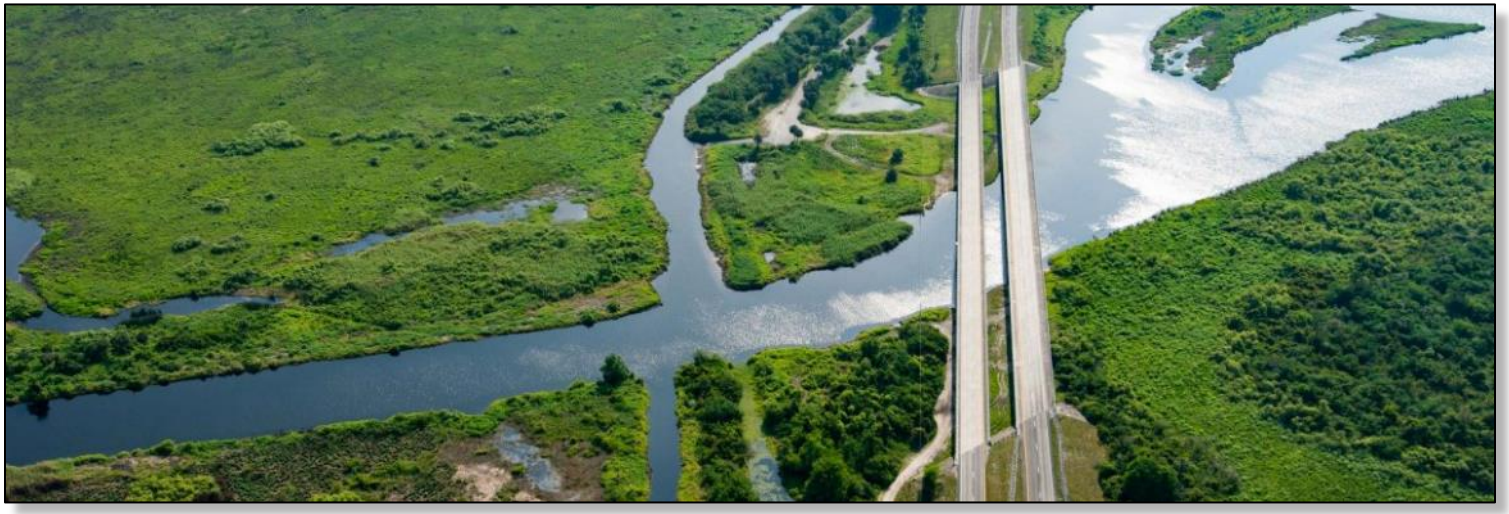


Flood Forecasting Resiliency Model of the Upper St. Johns River Basin

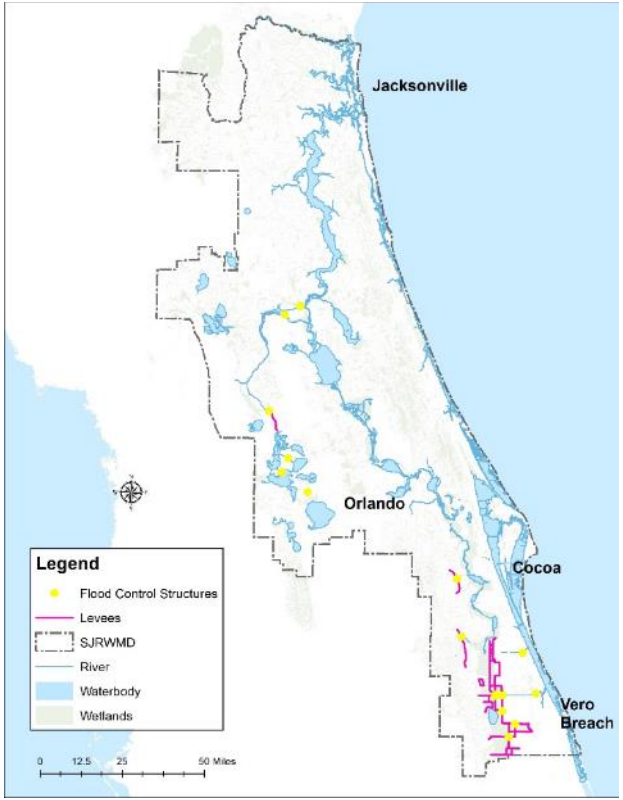
Pete Singhofen (SLT)/Yanbing Jia (SJRWMD)

St. Johns River Water Management District

STREAMLINE TECHNOLOGIES

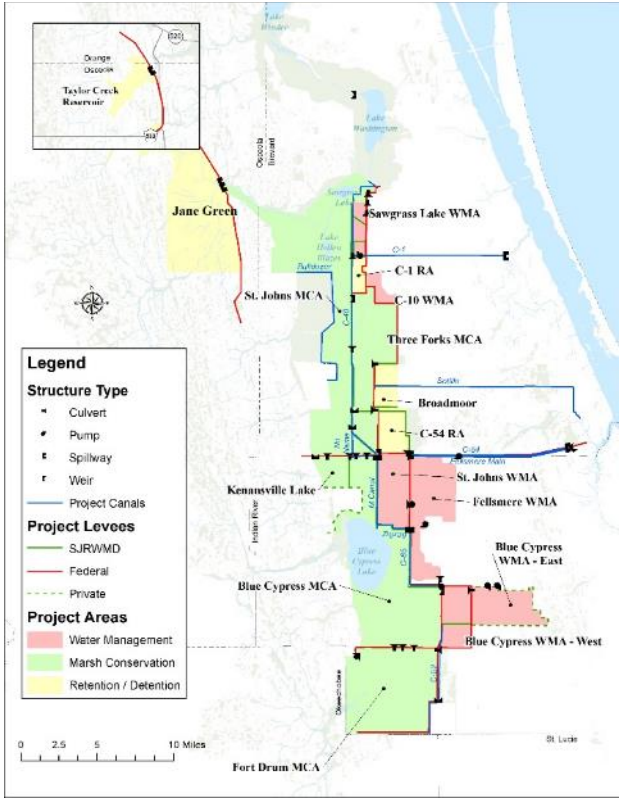
SJRWMD Flood Protection

- Provide flood protection to headwaters and downstream
- Operate and maintain federal and non-federal flood control projects
- Support other core missions



Upper St. Johns River Basin Project

- Project covers 160,000 acres and includes over 100 miles of levees and dozens of water control structures
- Multiple benefits including flood protection, water quality improvement, wetland enhancement, and reduction of freshwater discharge to Indian River Lagoon

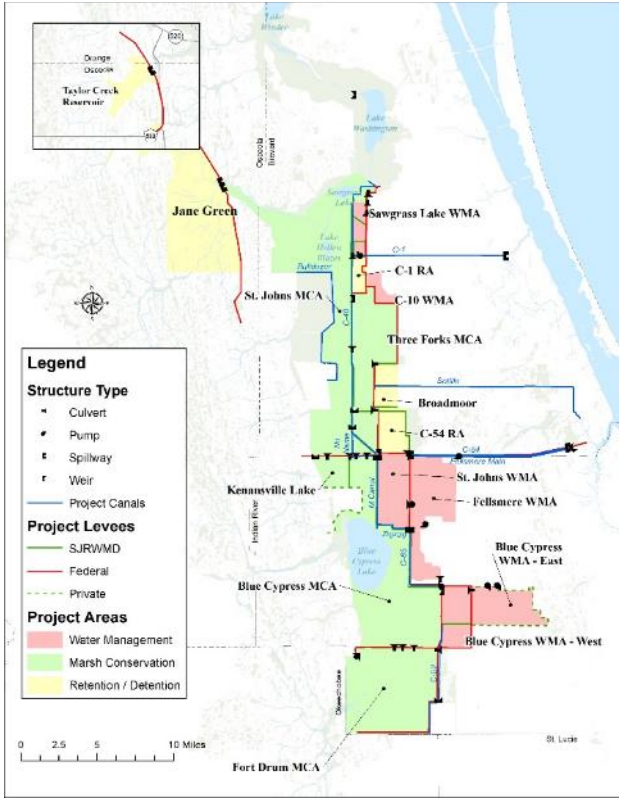


St. Johns River Water Management District

STREAMLINE TECHNOLOGIES

Project Functions

- Water Management Area
  - Stormwater storage
  - Water quality treatment
  - Agriculture irrigation
- Marsh Conservation Area
  - Stormwater storage
  - Wetland preservation
- Retention Area
  - Stormwater storage

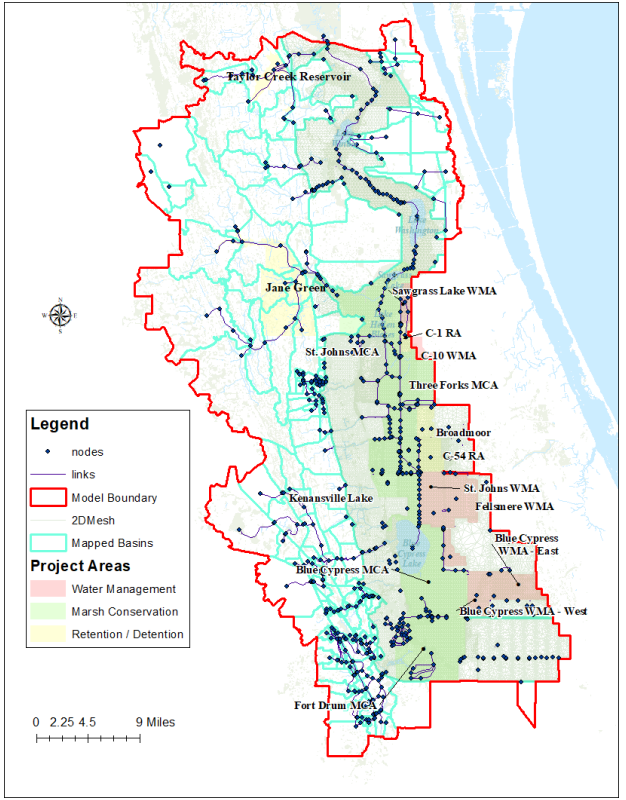


St. Johns River Water Management District

STREAMLINE TECHNOLOGIES

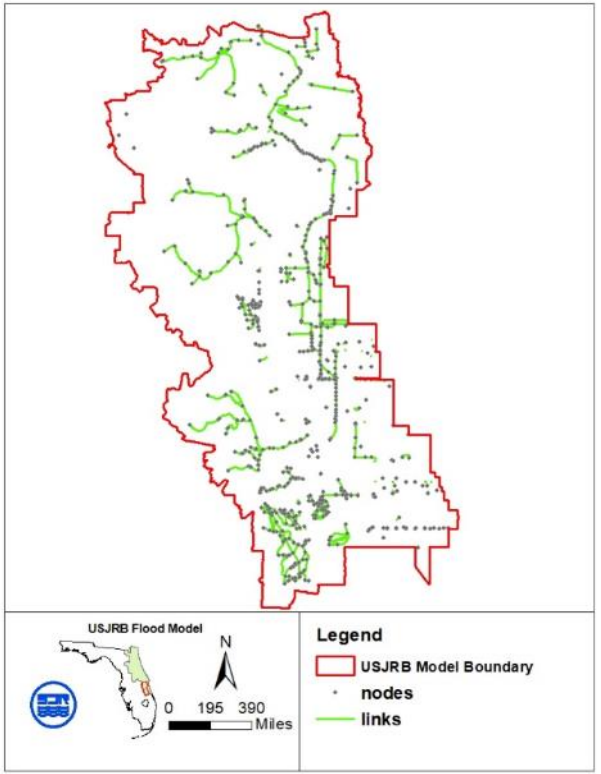
Flood Forecasting Resiliency Model

- Initially developed by Streamline Technologies, Inc.
- Updated by SJRWMD
  - Refinement of model grid and representation of structures and operations
  - Model domain extended to downstream areas
  - Additional calibration and validation



Model Development

- Combination of 1D and 2D Overland Flow
- 2D Surface Region
  - Land Cover / Land Use
  - Soil Type
  - Lidar-based DEM
  - Nexrad Rainfall
  - Control Volumes
  - Weir Features



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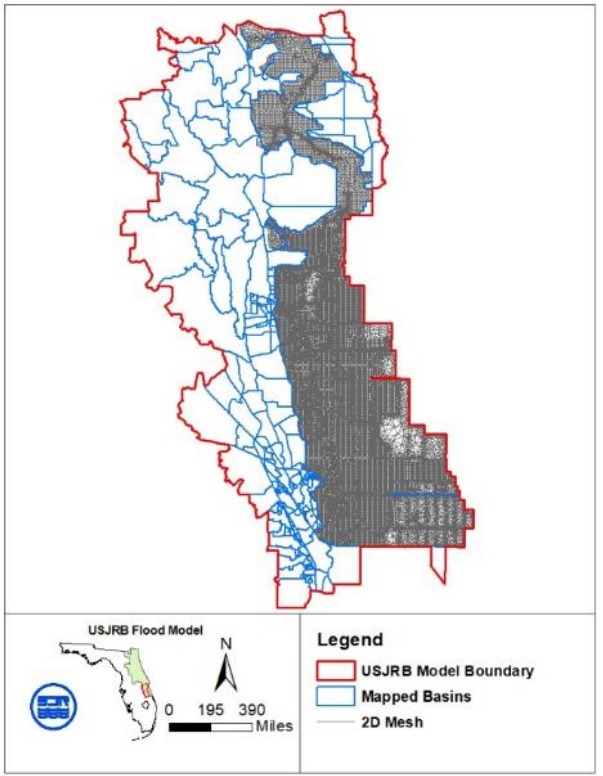

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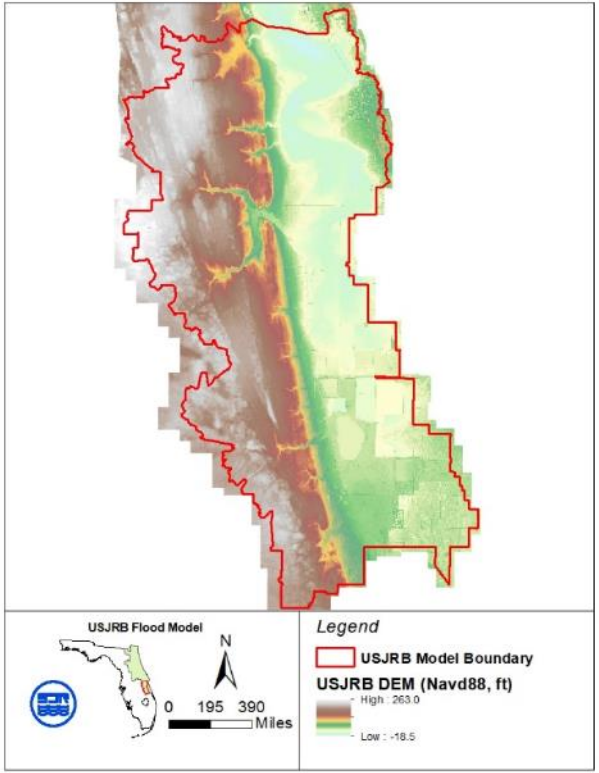
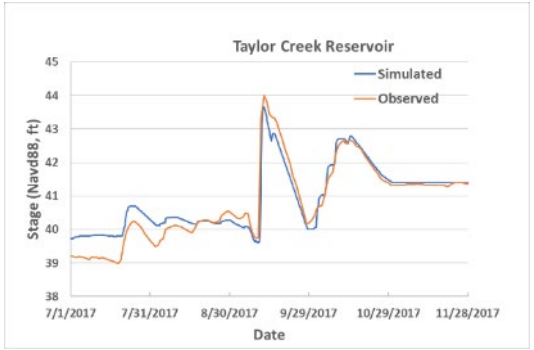
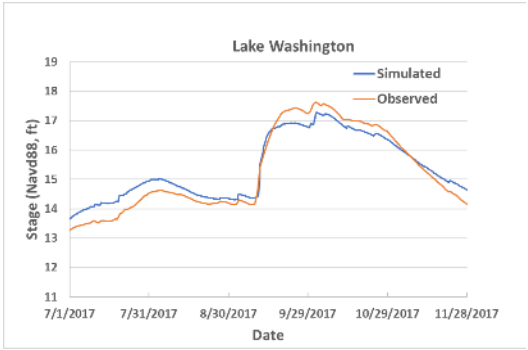
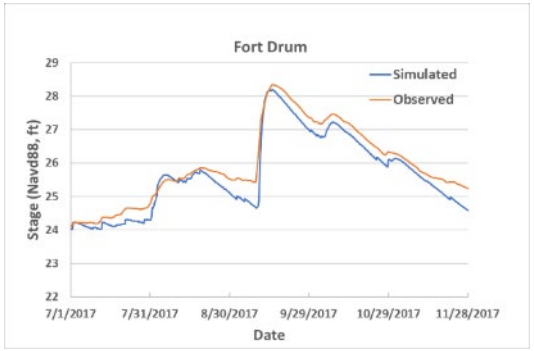
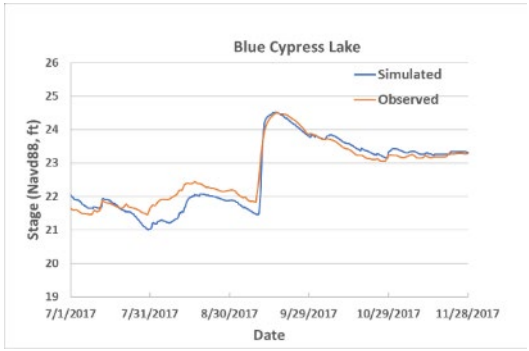


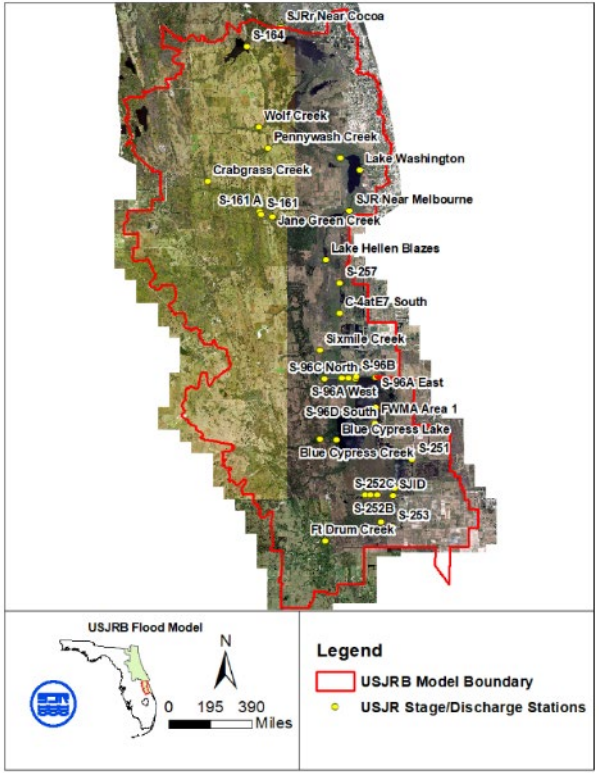
Model Calibration – Hurricane Irma 2017









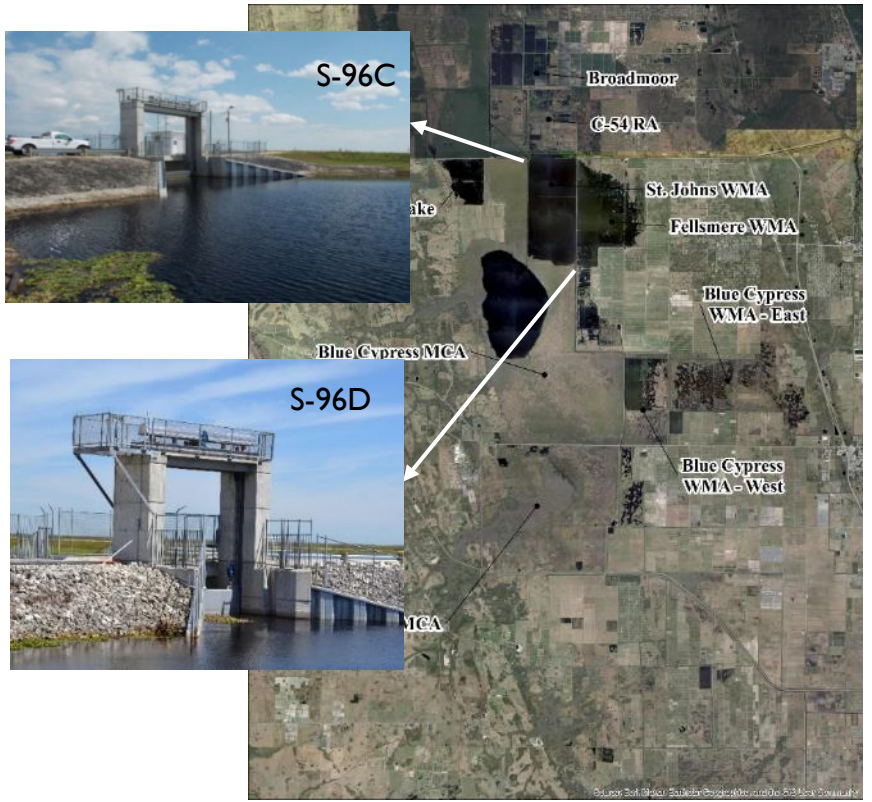


Peak Stage Comparison – Hurricane Irma

Station Name	Peak Stage (ft, NAVD88)		Difference (Model-Observation)	
	Observation	Model	Stage (ft)	Time (days)
Fort Drum	28.3	28.2	-0.1	0
Blue Cypress Lake	24.5	24.5	0.0	-1
Kenansville Lake	24.8	24.6	-0.2	0
Blue Cypress Water Management Area	24.6	24.5	-0.1	-2
St. Johns Water Management Area	21.8	21.3	+0.1	0
Fellsmere Water Management Aera	20.7	20.6	-0.1	-2
Mary A	20.3	19.8	-0.5	0
Three Folks Marsh Conservation Area	19.5	19.2	-0.3	-
Lake Hell'n Blazes	18.8	18.2	-0.6	-1
Lake Washington	17.6	17.2	-0.4	+3
Lake Washington Weir	17.3	17.2	-0.1	-1
Jane Green	34.5	34.3	-0.2	-1
Taylor Creek Reservoir	44.0	43.7	-0.3	0

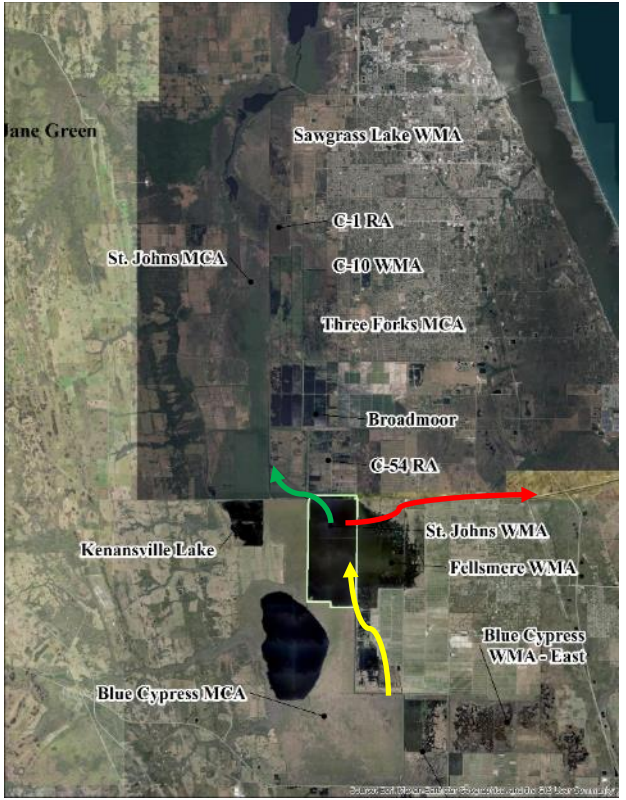
Local and Regional Flood Assessment

- System resiliency from rainfall and operation scenarios
- Flood mapping
- Conceptual design for flood control and water diversion projects



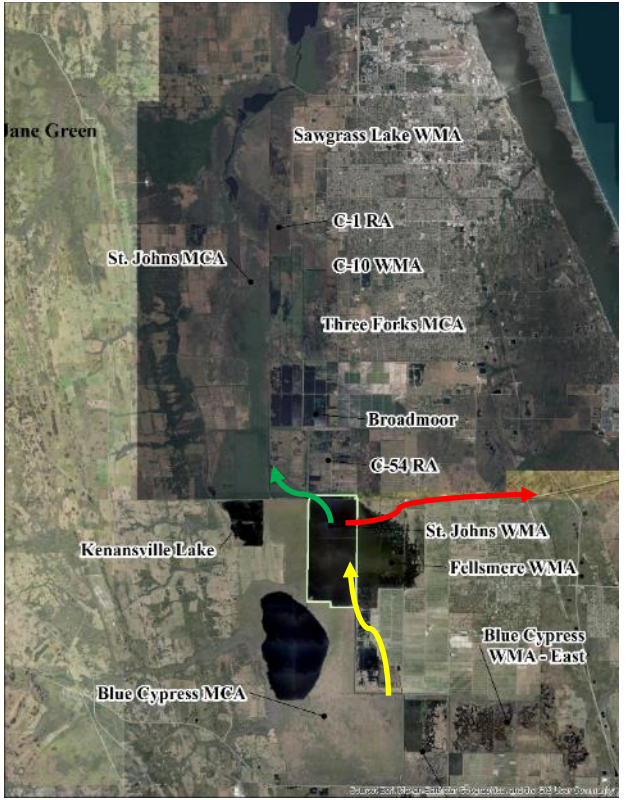
Structure Operations

- Optimize operations for flood mitigation
- Downstream flood protection



Environmental and Water Quality Analysis

- Release to Indian River Lagoon
- Oxidation of organic soils
- Predicted vegetation mapping



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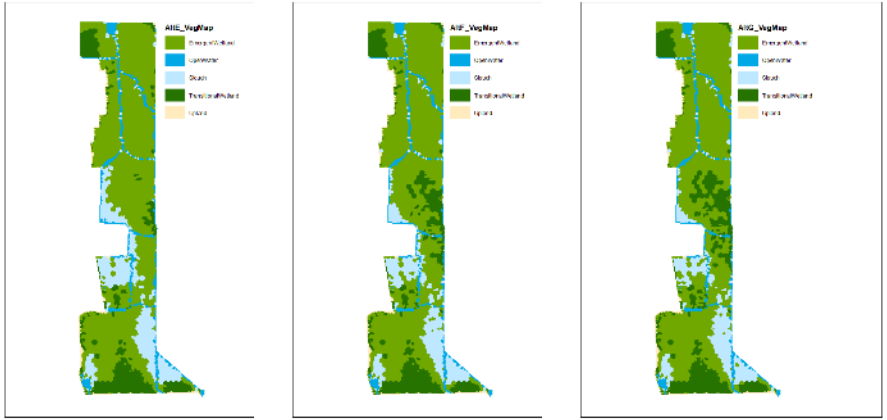
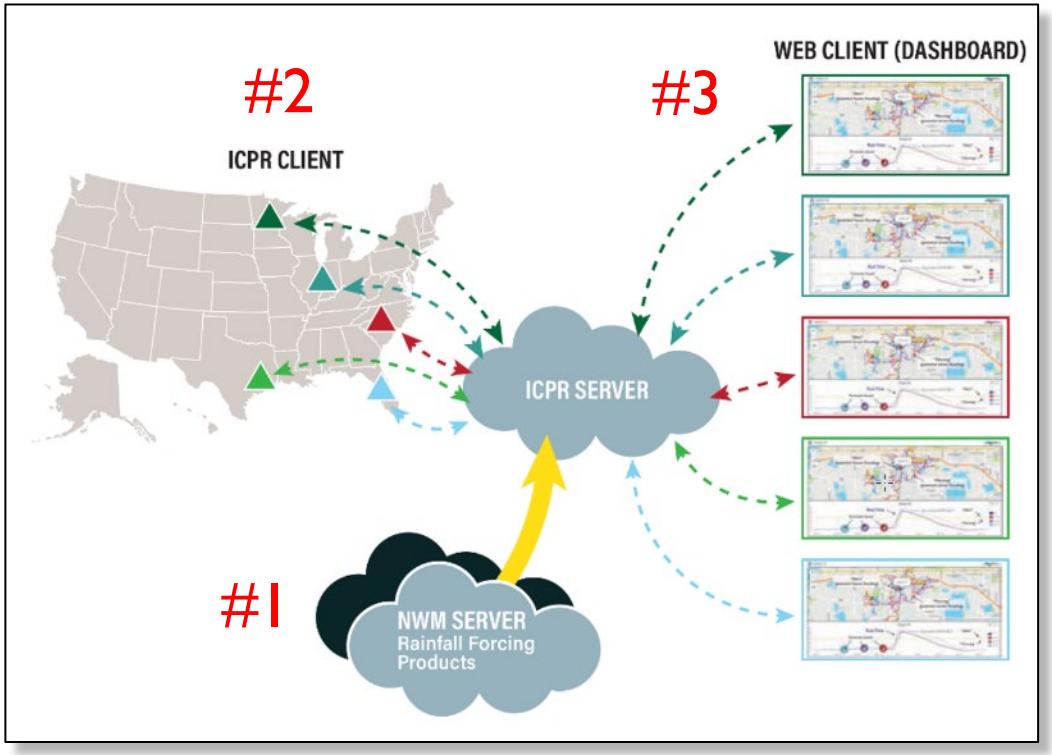


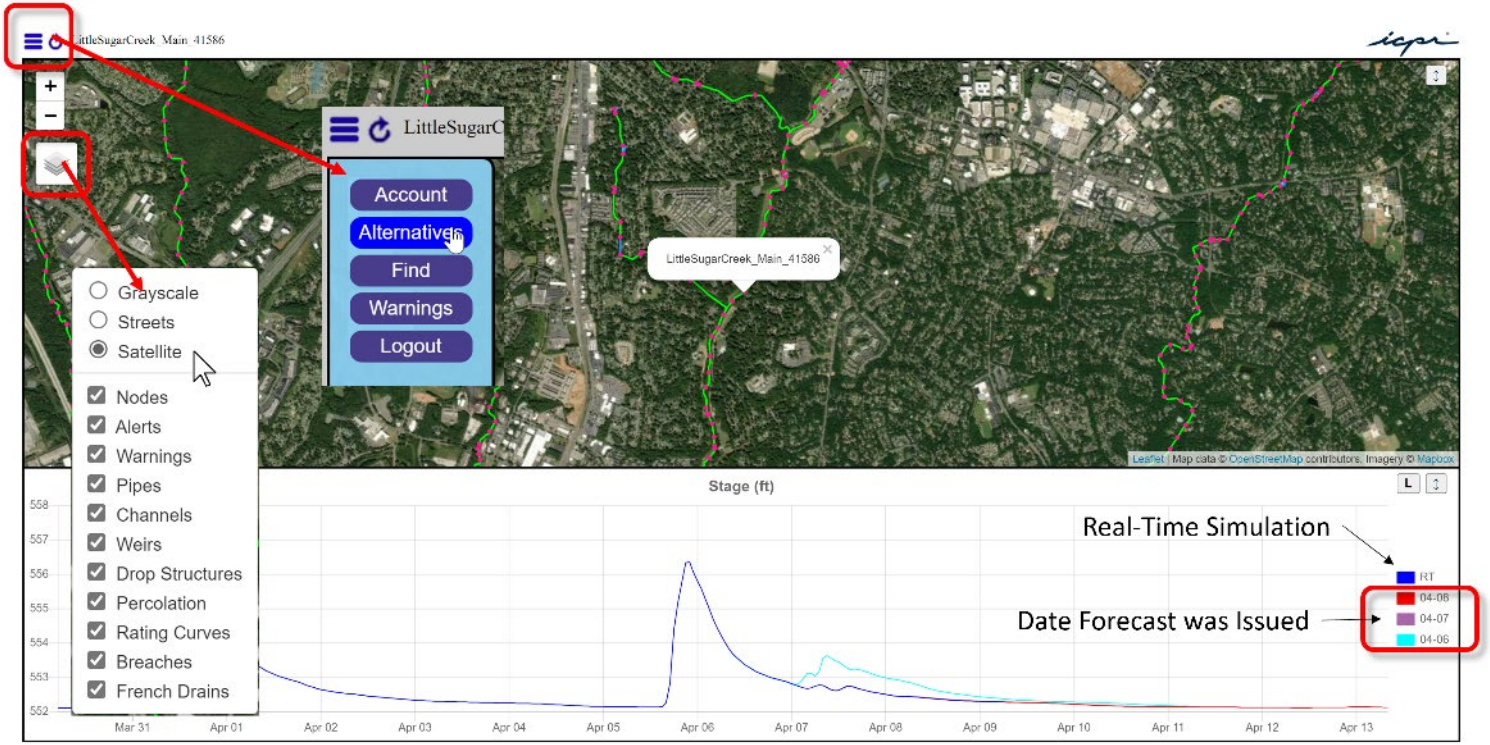
St. Johns River Water Management District STREAMLINE TECHNOLOGIES

Real-Time Flood Forecasting (RTFF)

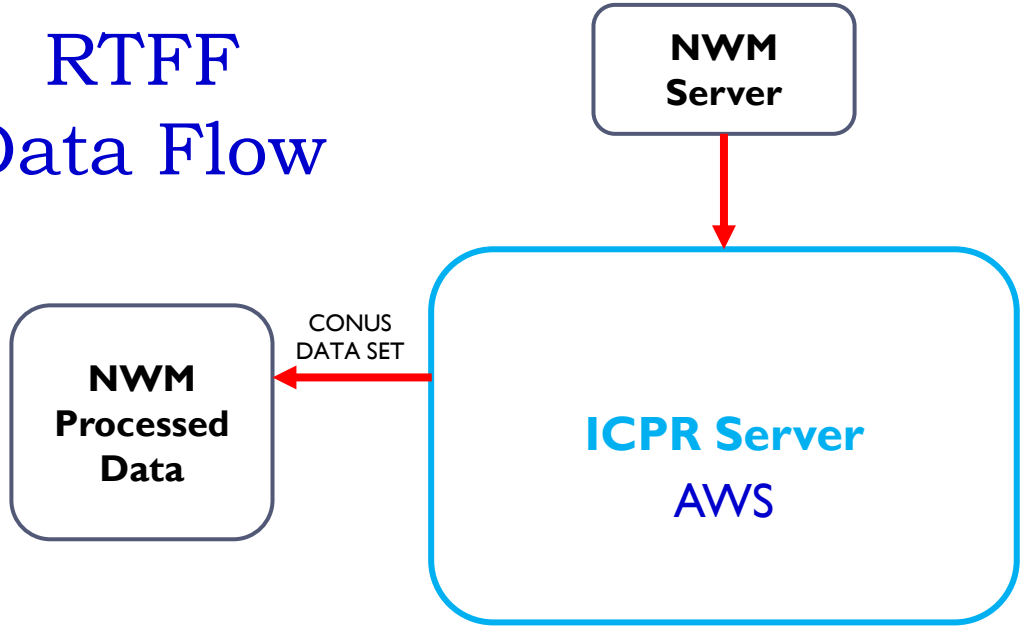
- Real-Time
  - ✓ updated hourly
- Short Range Forecast
  - ✓ 18-hr forecast
  - ✓ issued every hour
- Medium Range Forecast
  - ✓ 10-day forecast
  - ✓ issued every 6 hours



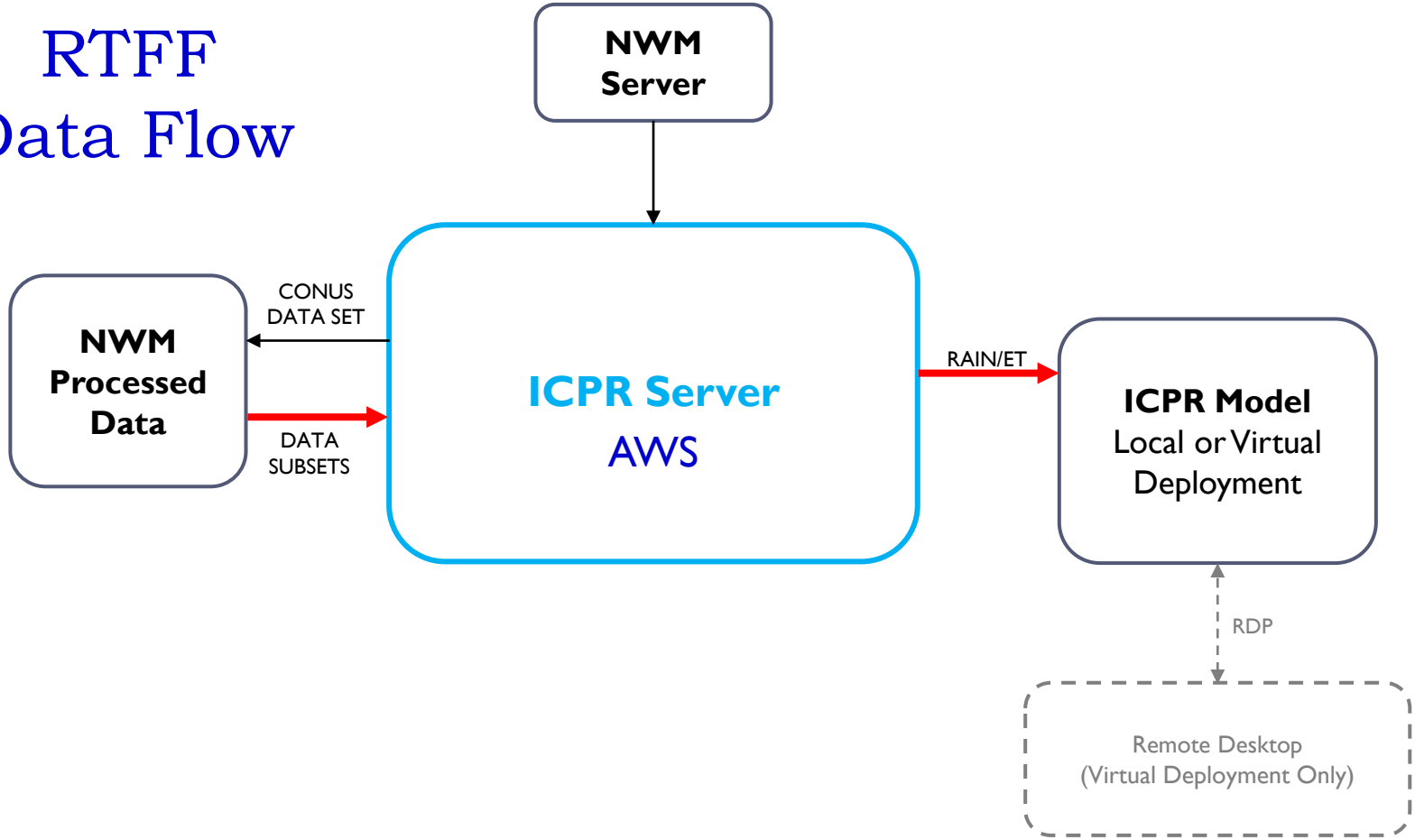
Real-Time Flood Forecasting (RTFF)



RTFF Data Flow



RTFF Data Flow



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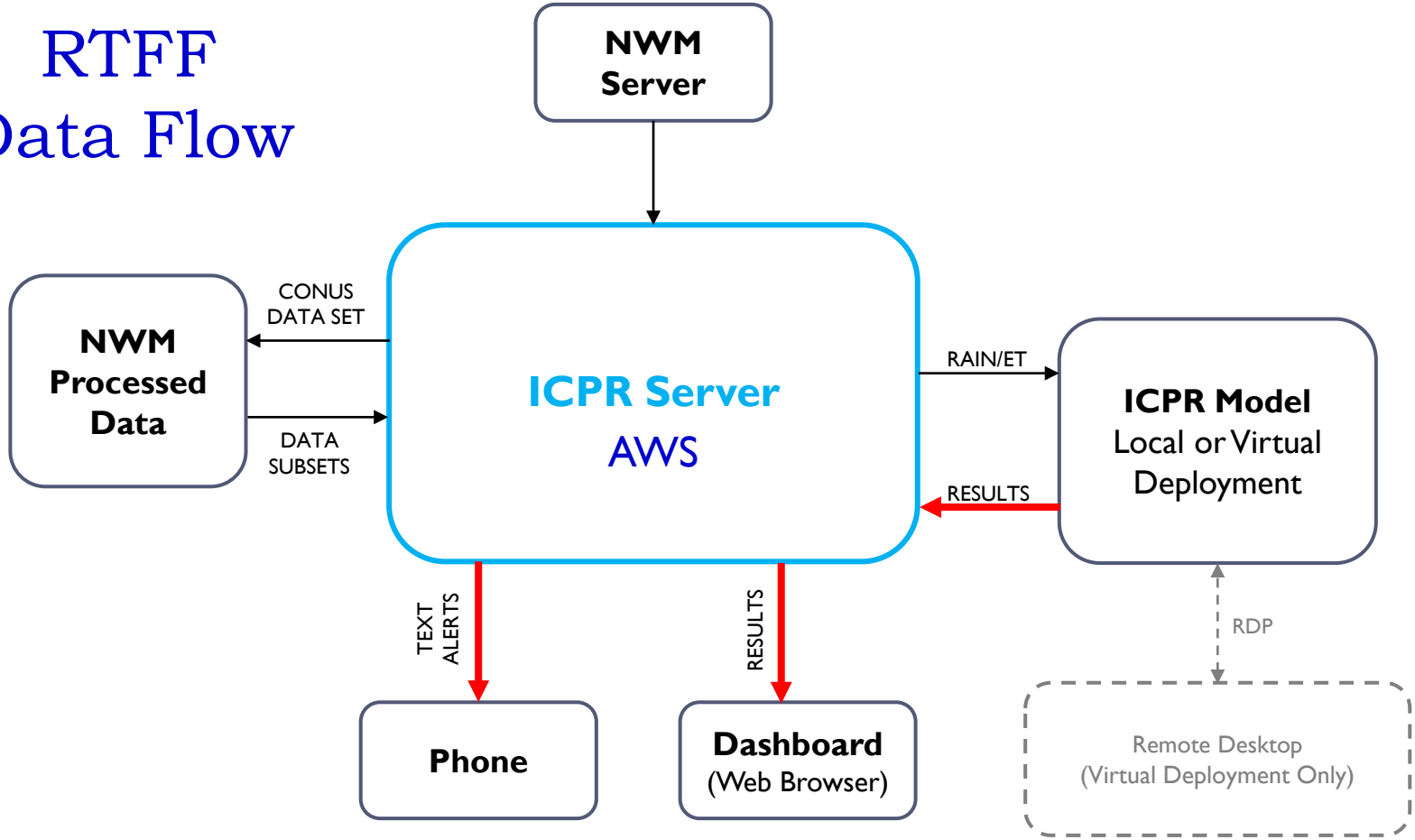

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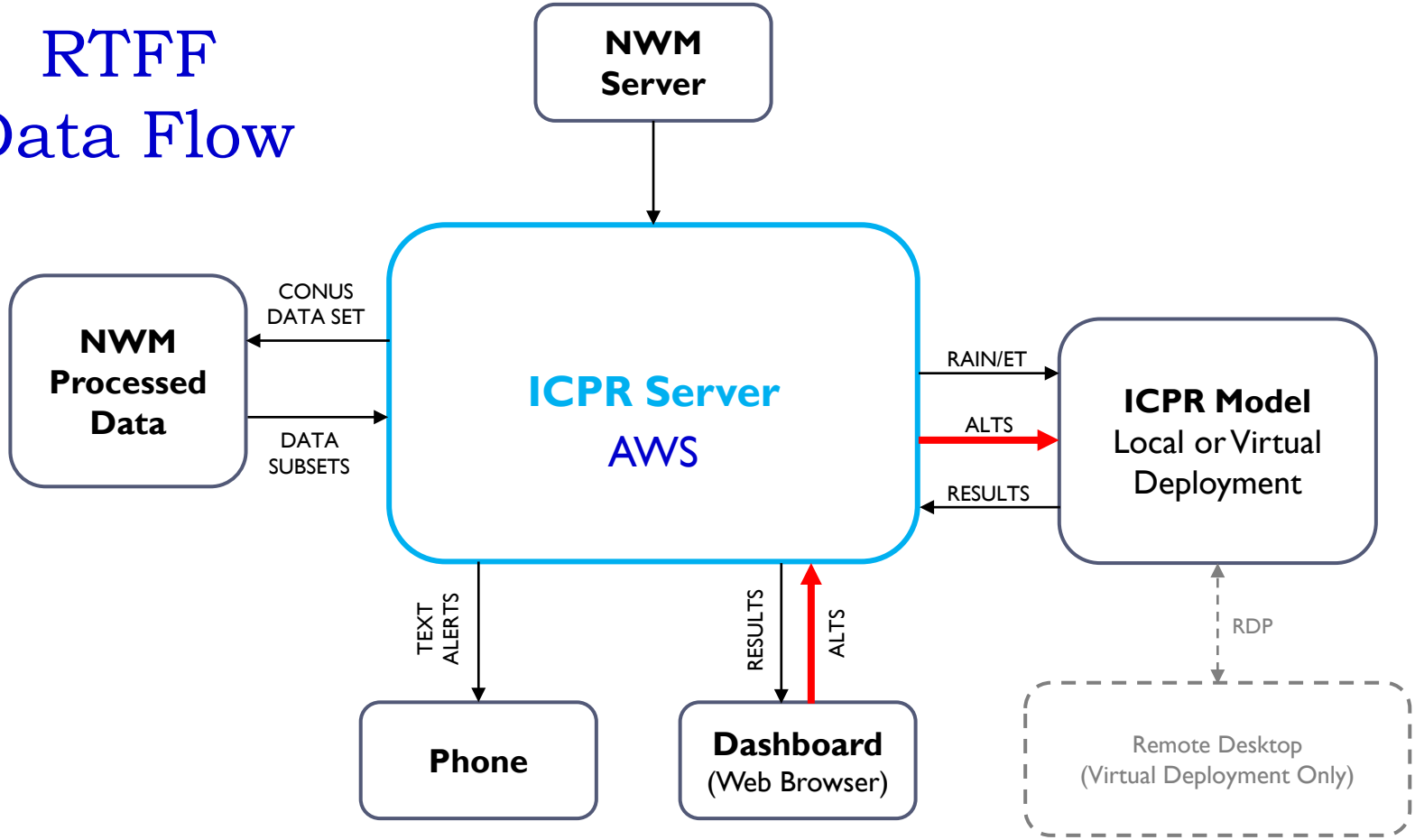

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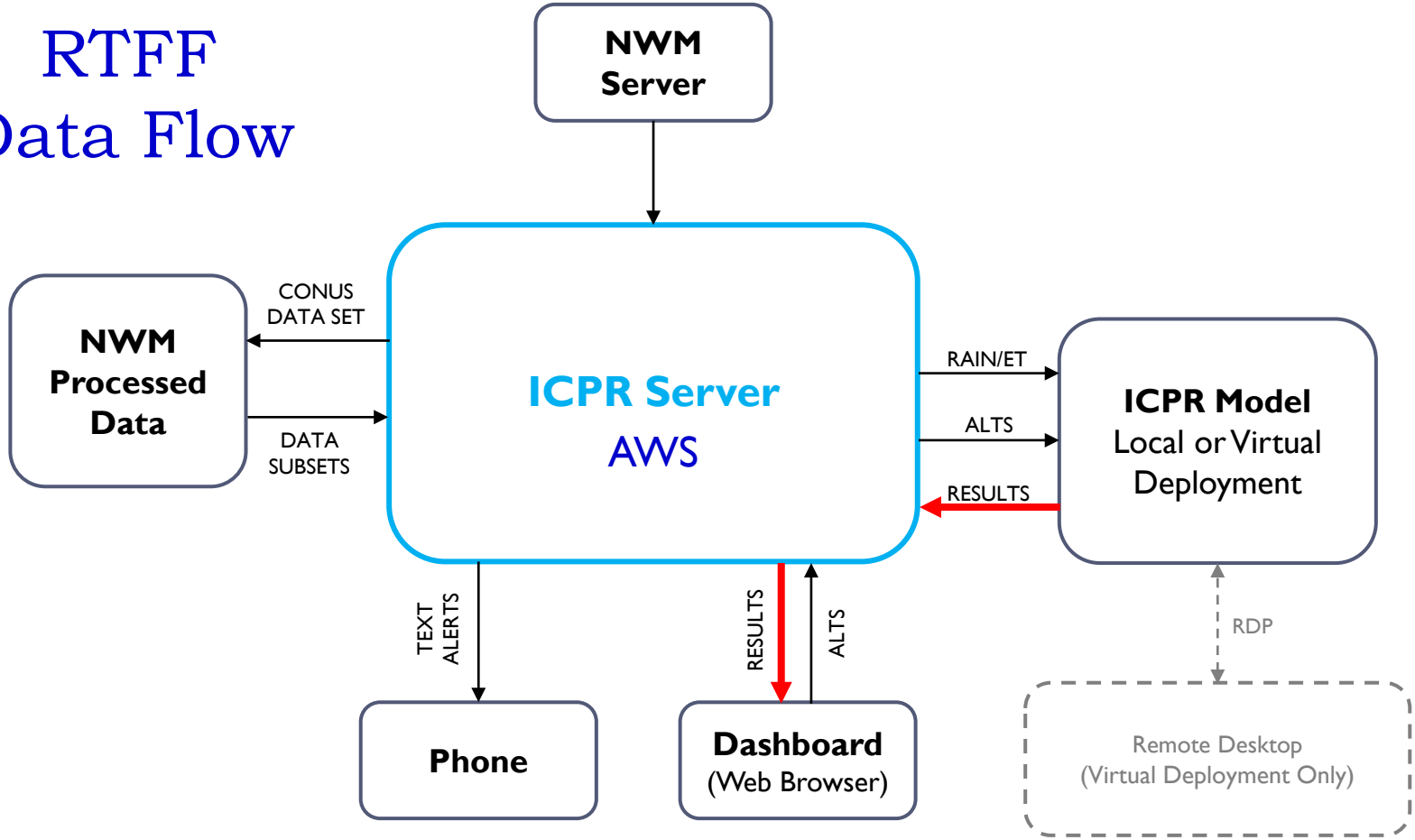
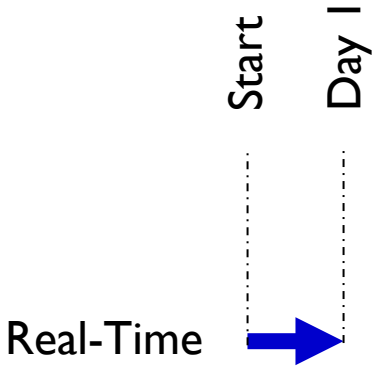


RTFF Deployment

Daily Medium Range Forecast Progression



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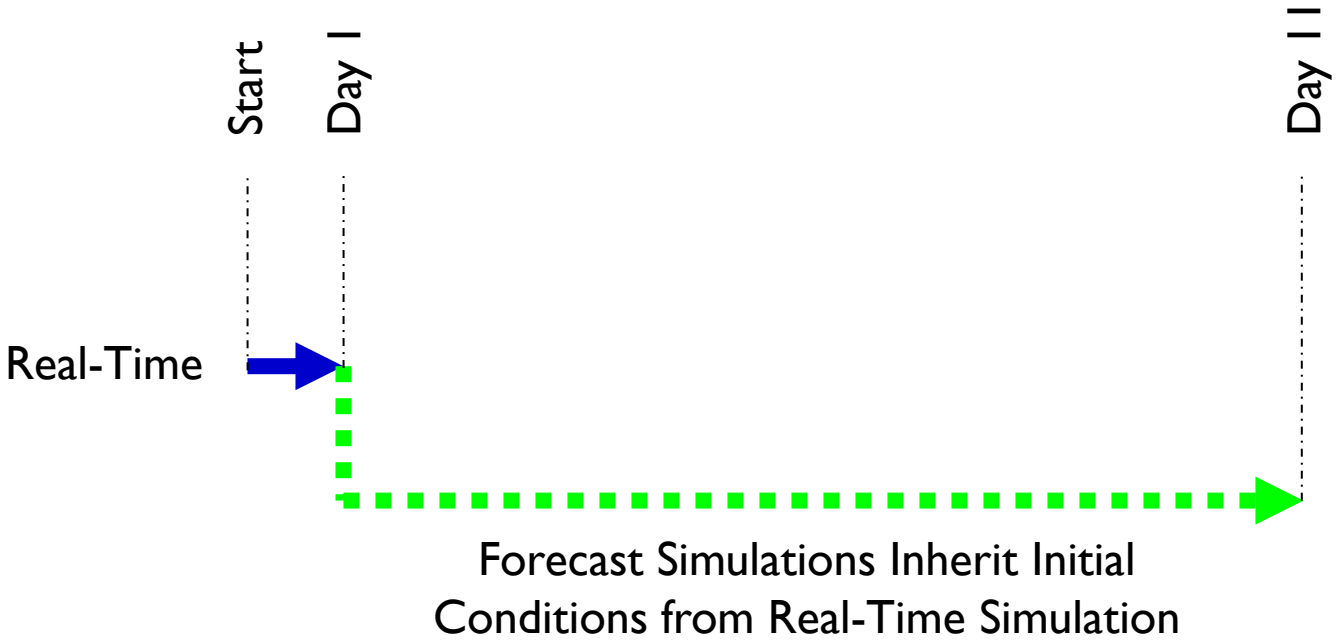

RTFF Deployment

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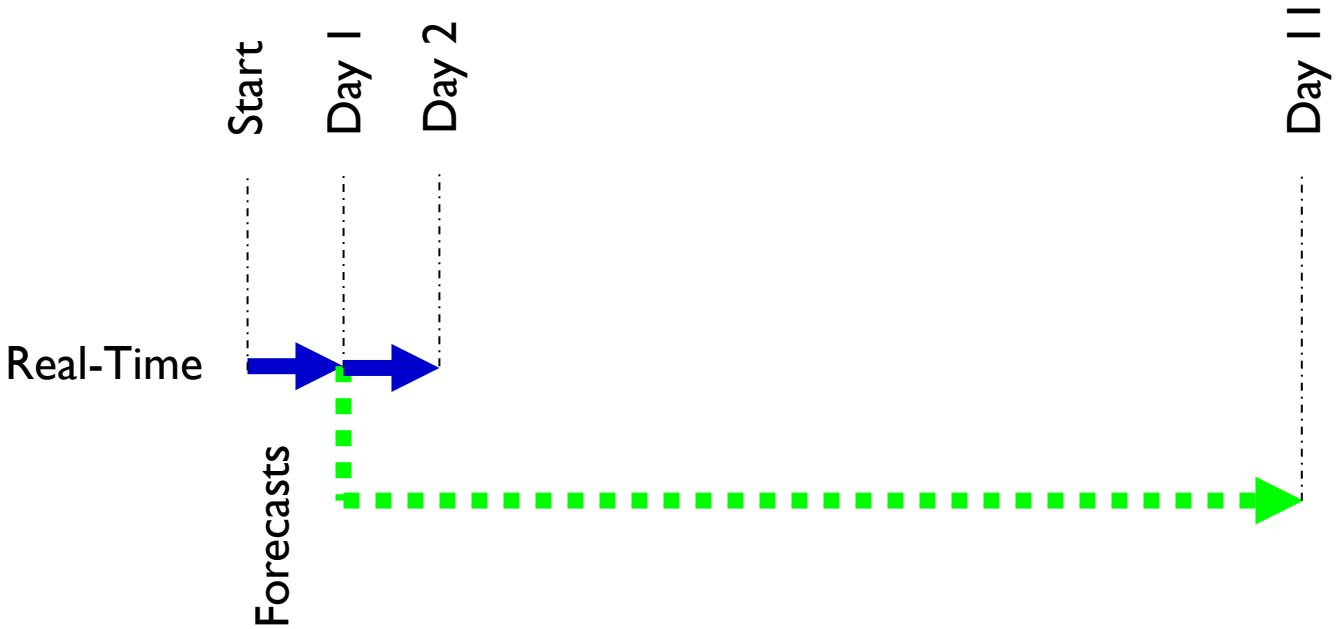

RTFF Deployment

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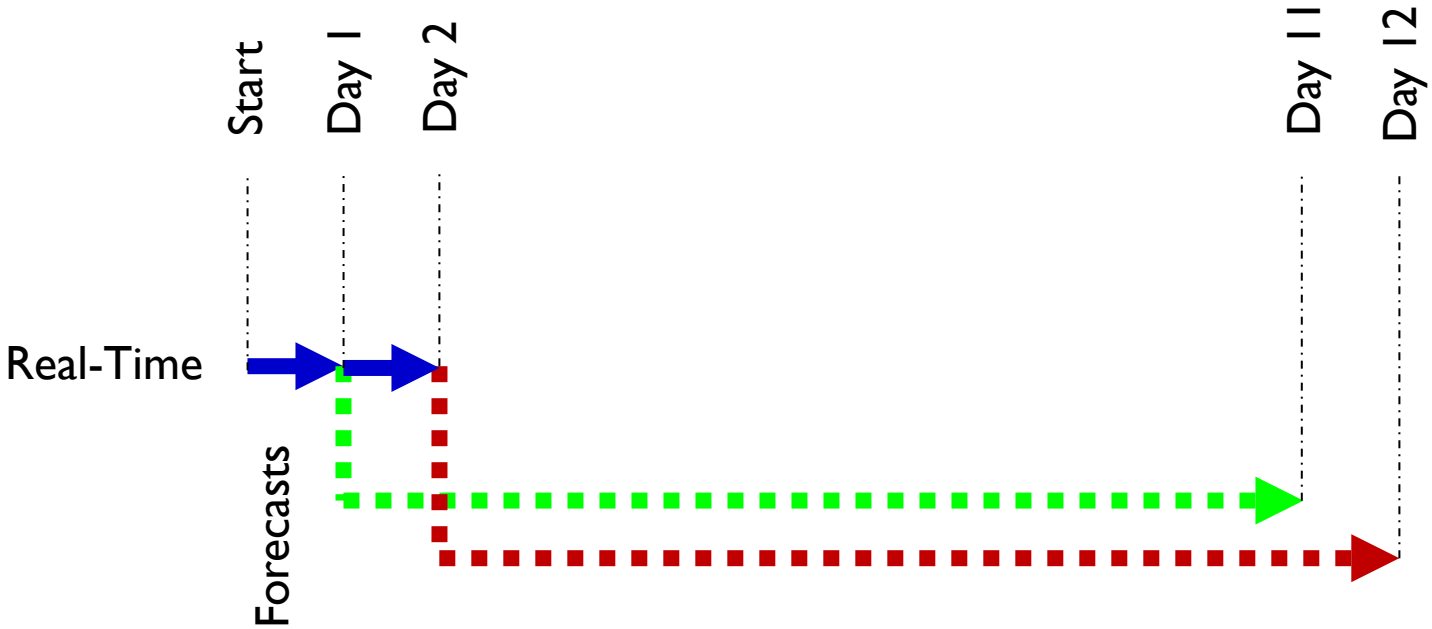
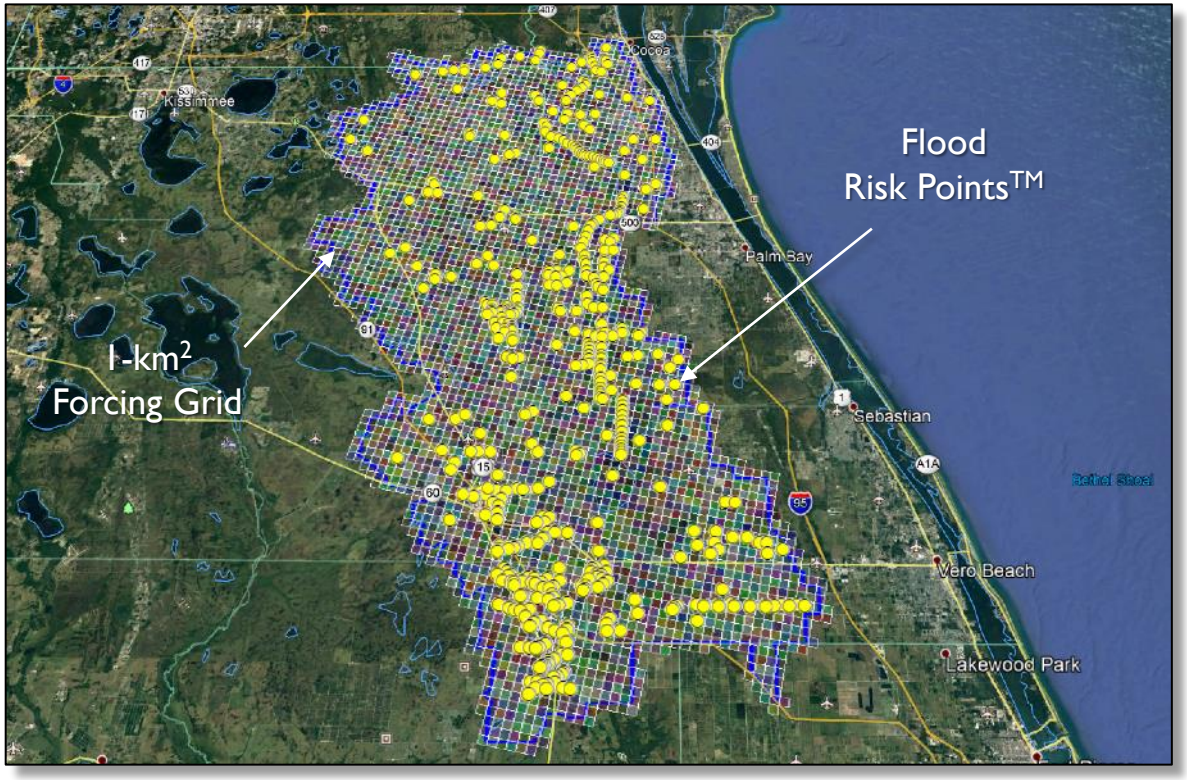
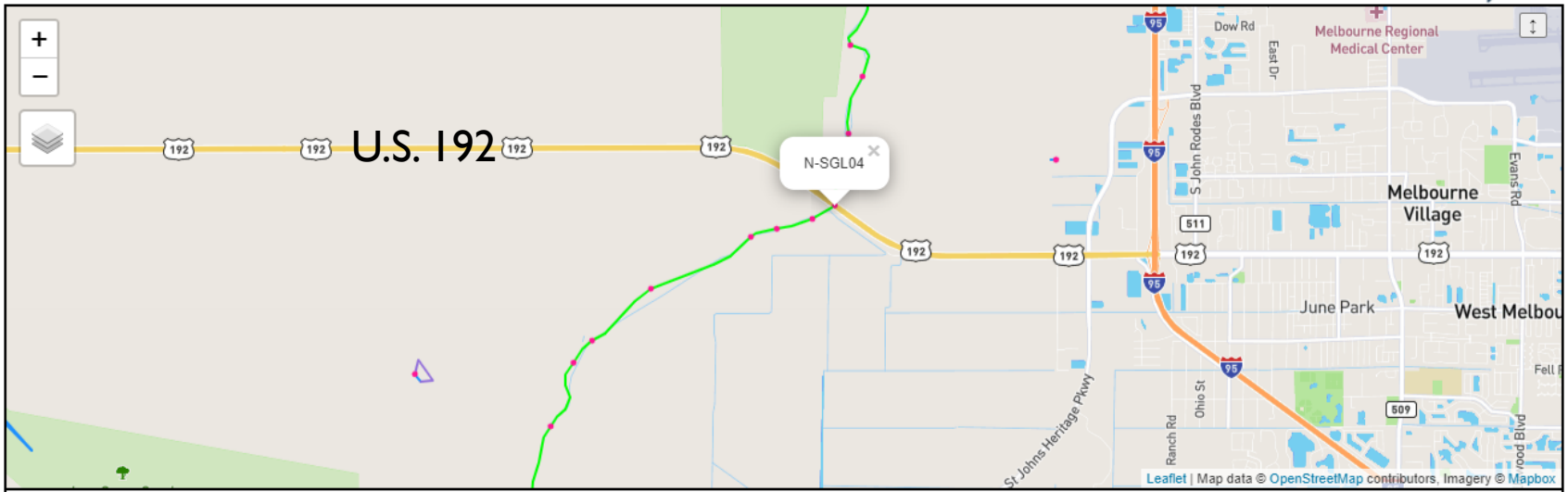


The USJRB RTFF System (Phase I)

- ✓ Model Domain: 1,333 mi^2
- ✓ 3,900 1-km^2 forcing grids
- ✓ Deployed for 2021 hurricane season




U.S. 192
N-SGL04
Melbourne Regional Medical Center
Melbourne Village
June Park
West Melbou
Dow Rd
East Dr
S John Rodes Blvd
Evans Rd
St Johns Heritage Pkwy
Ranch Rd
Ohio St
Leaflet | Map data © OpenStreetMap contributors, Imagery © Mapbox
Stage (ft)
T.S. Elsa
Real Time
FC: July 7
FC: July 5
FC: July 6
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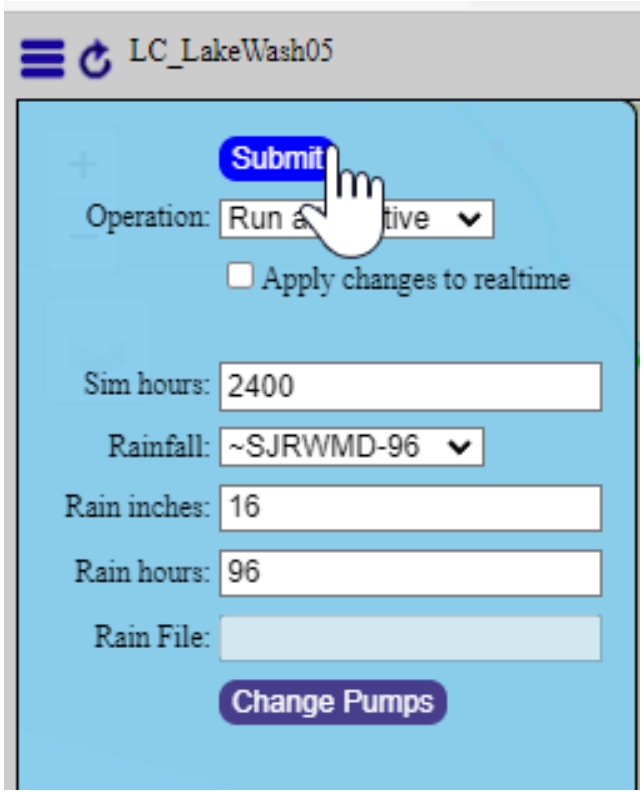
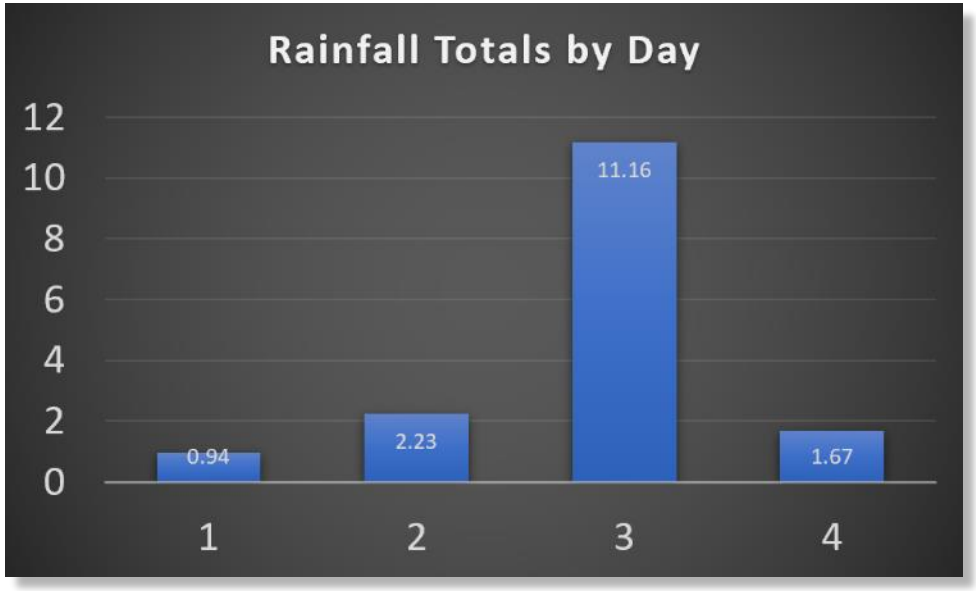
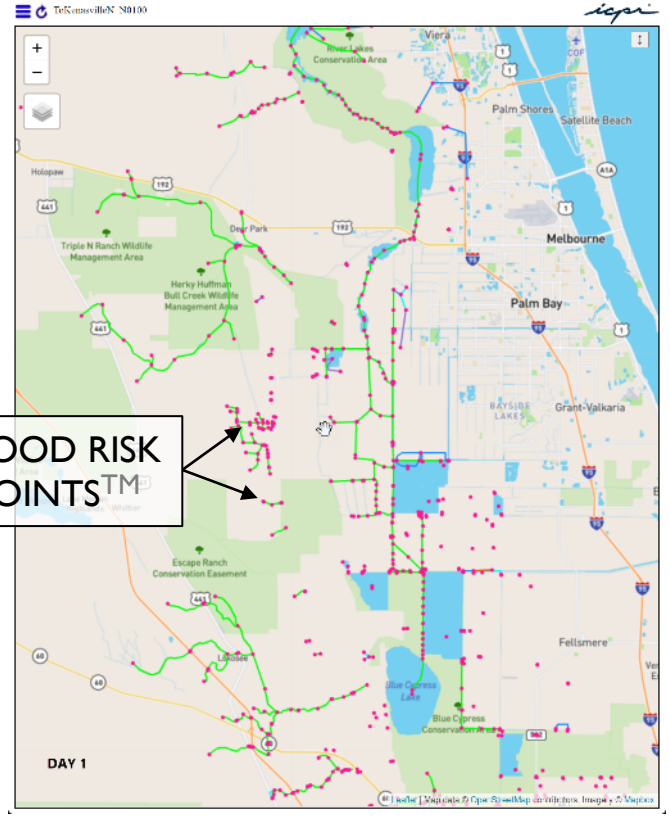
"WHAT IF" SCENARIOS TRIGGERED FROM THE DASHBOARD

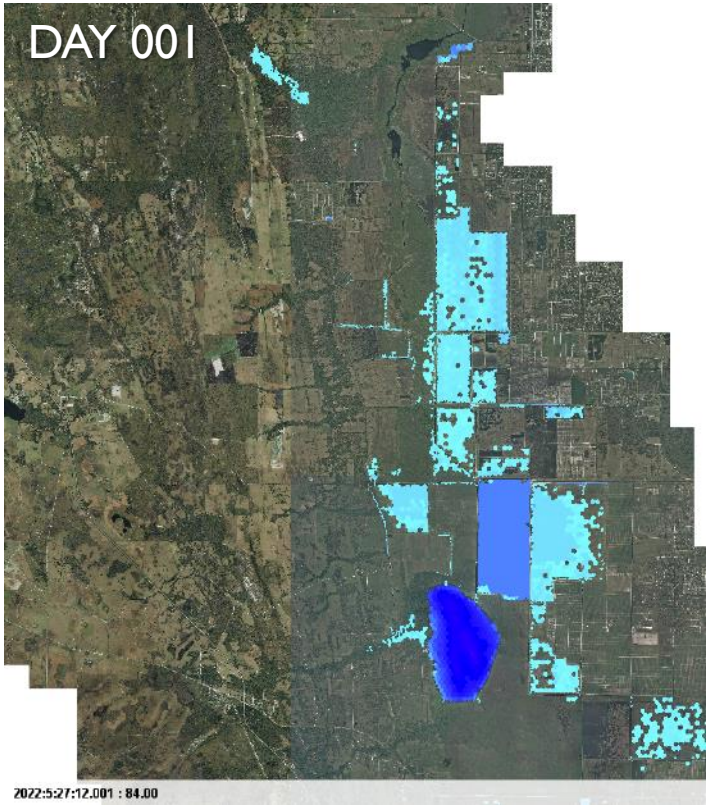




RTFF DASHBOARD



ICPR ANIMATION PANEL



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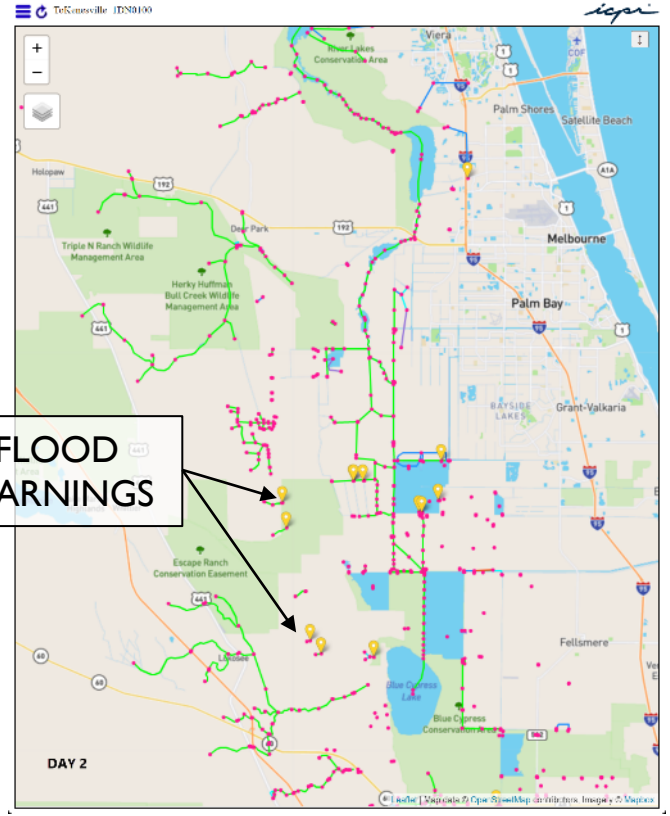

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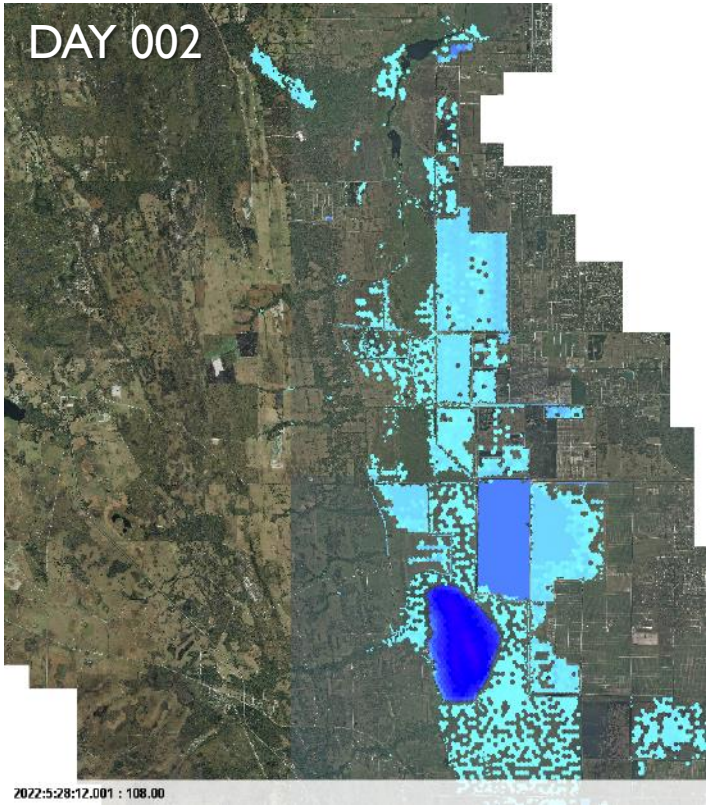
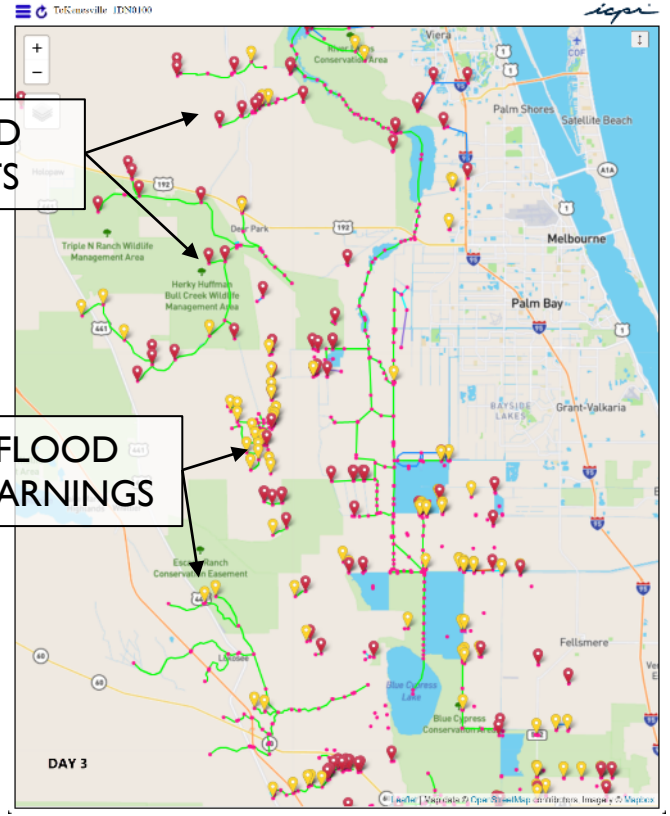


RTFF DASHBOARD

FLOOD ALERTS

FLOOD WARNINGS



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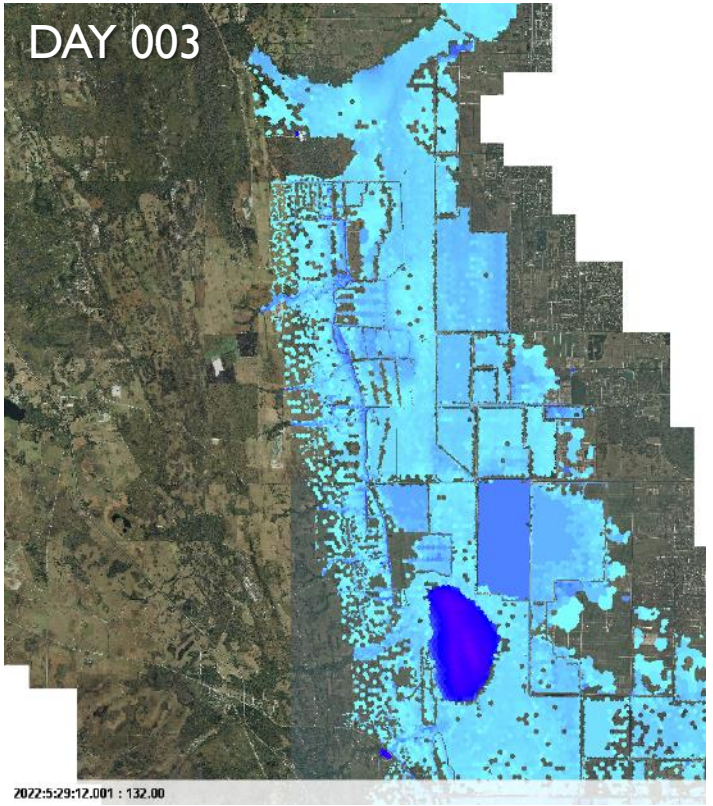
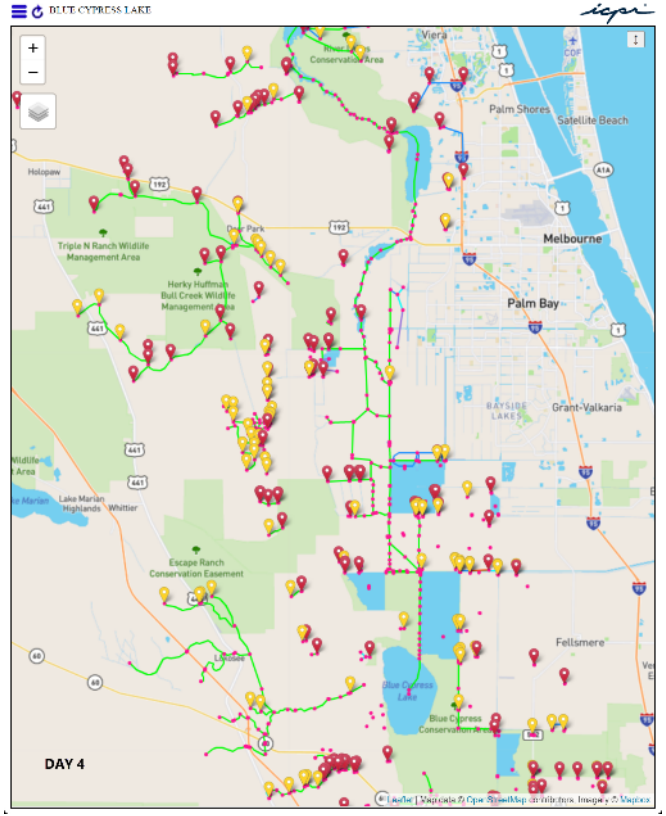


St. Johns River Water Management District

STREAMLINE TECHNOLOGIES

RTFF DASHBOARD



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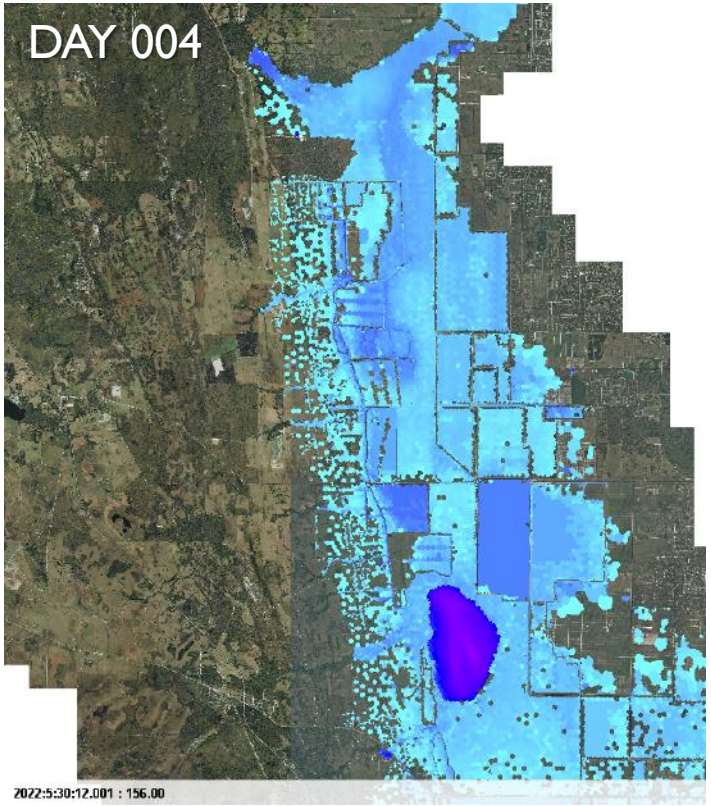

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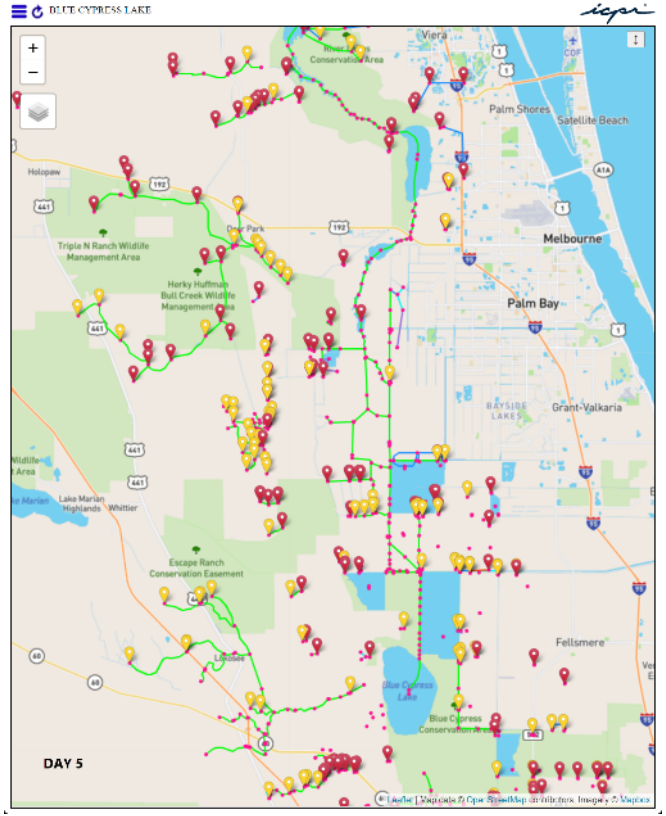

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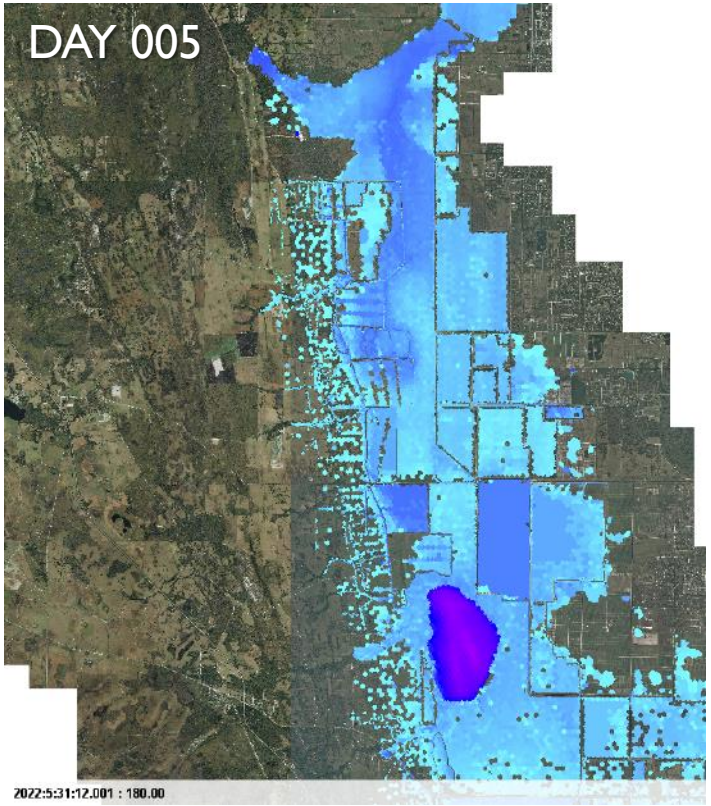

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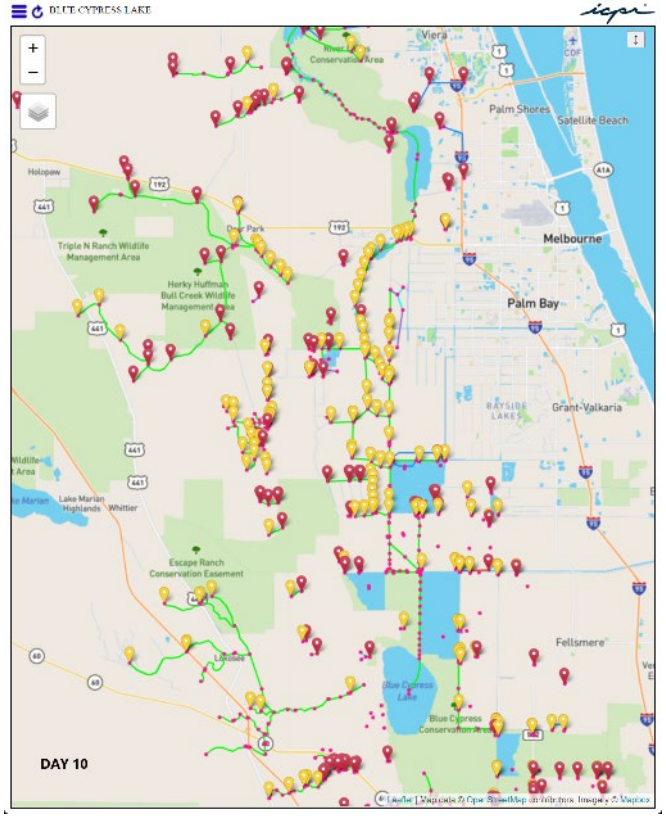

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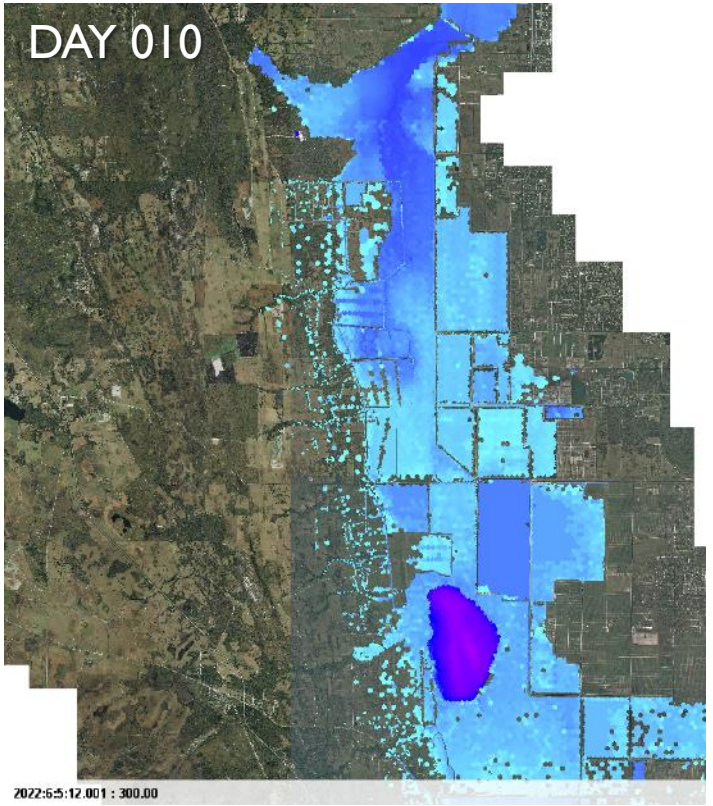

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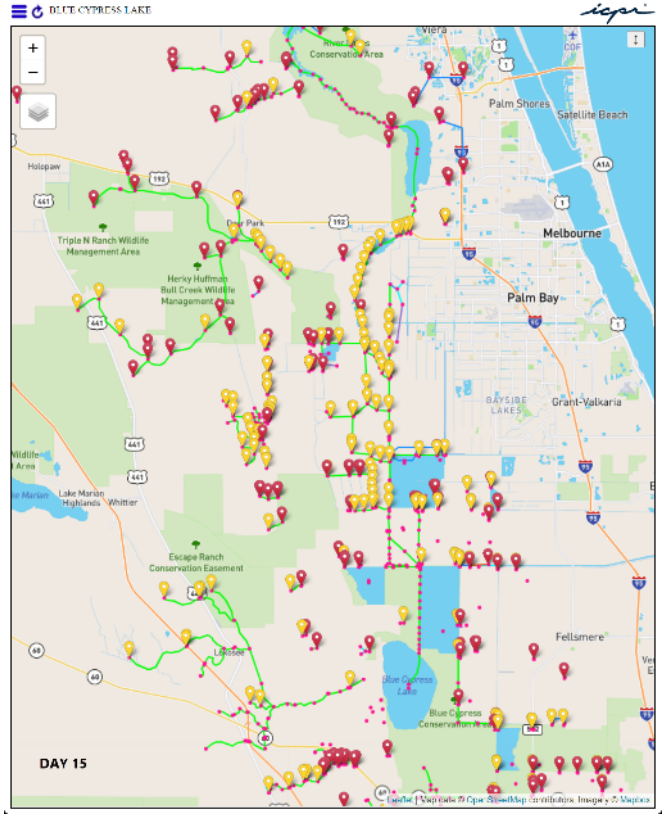
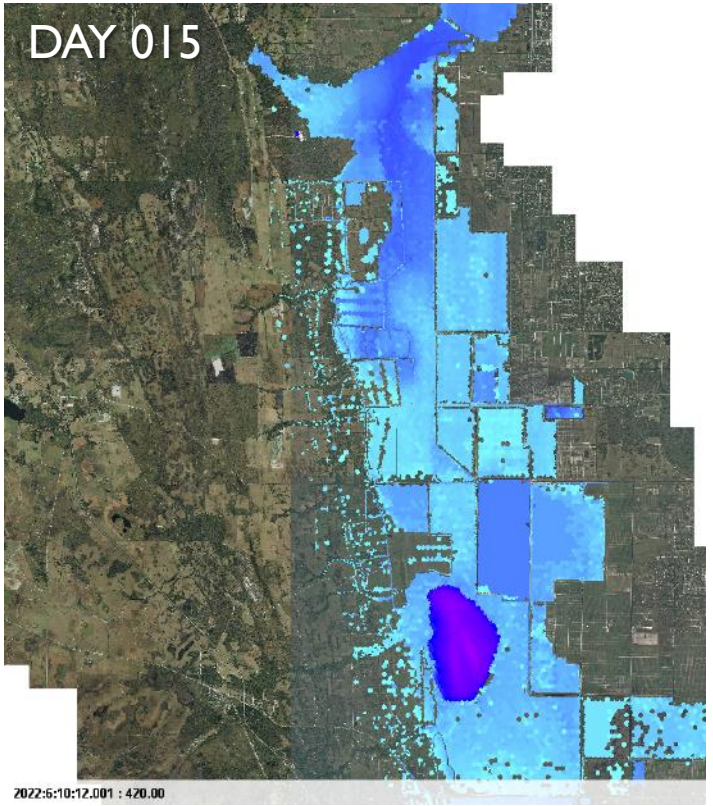


ICPR ANIMATION PANEL



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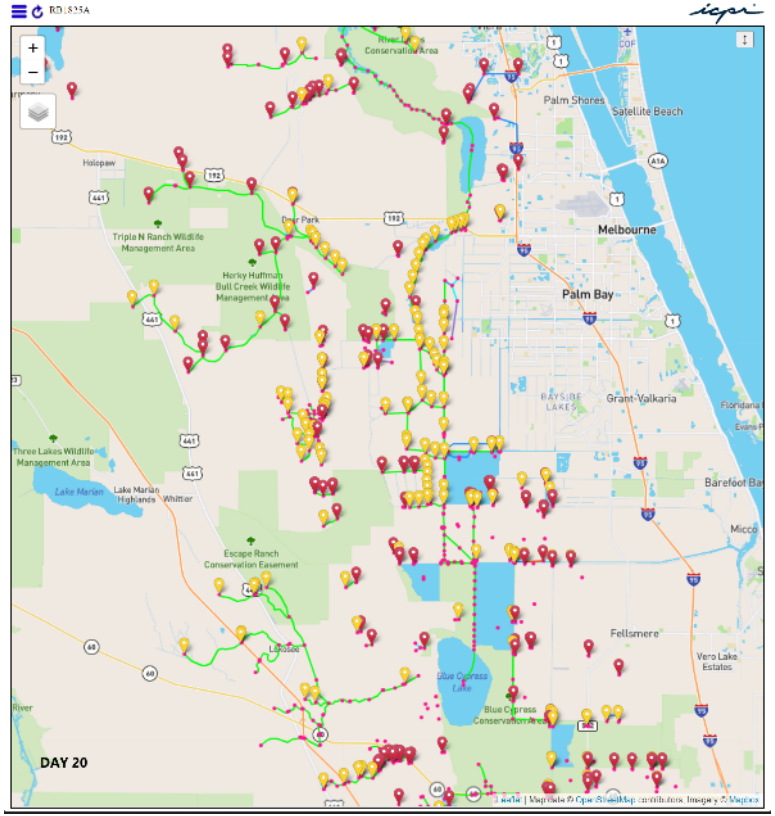

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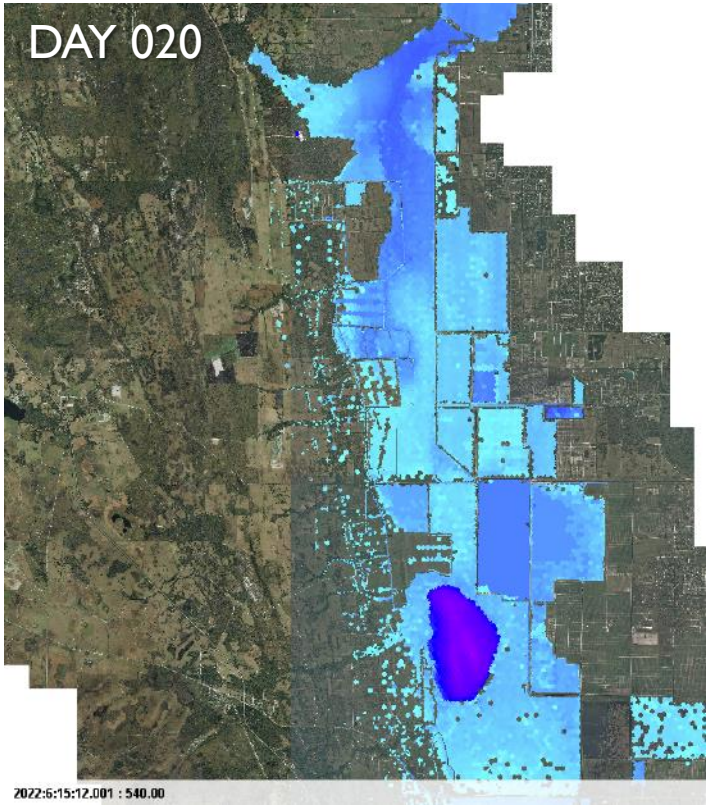
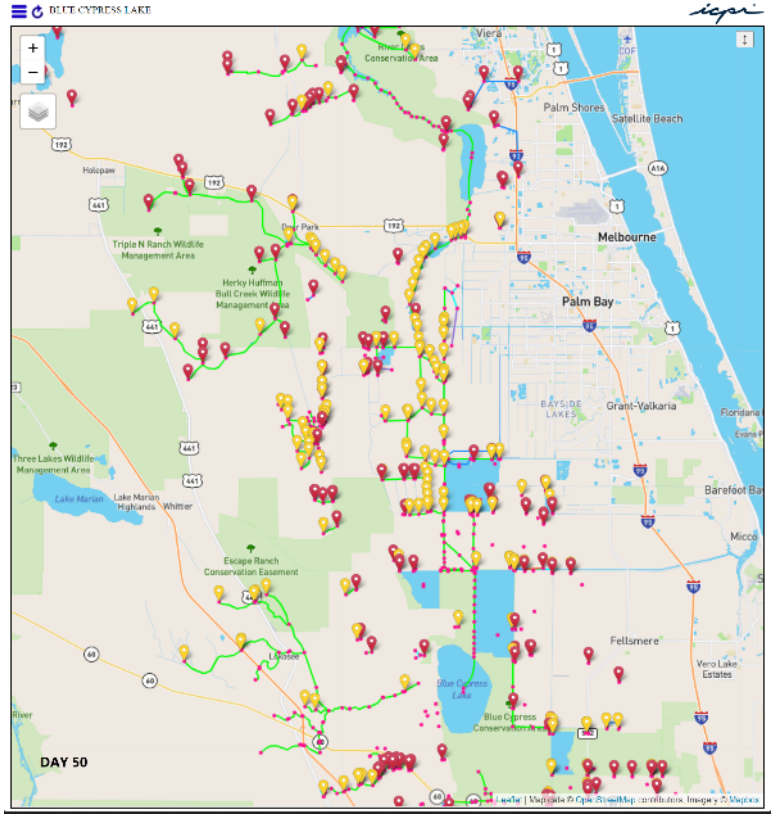


St. Johns River Water Management District

STREAMLINE TECHNOLOGIES

RTFF DASHBOARD



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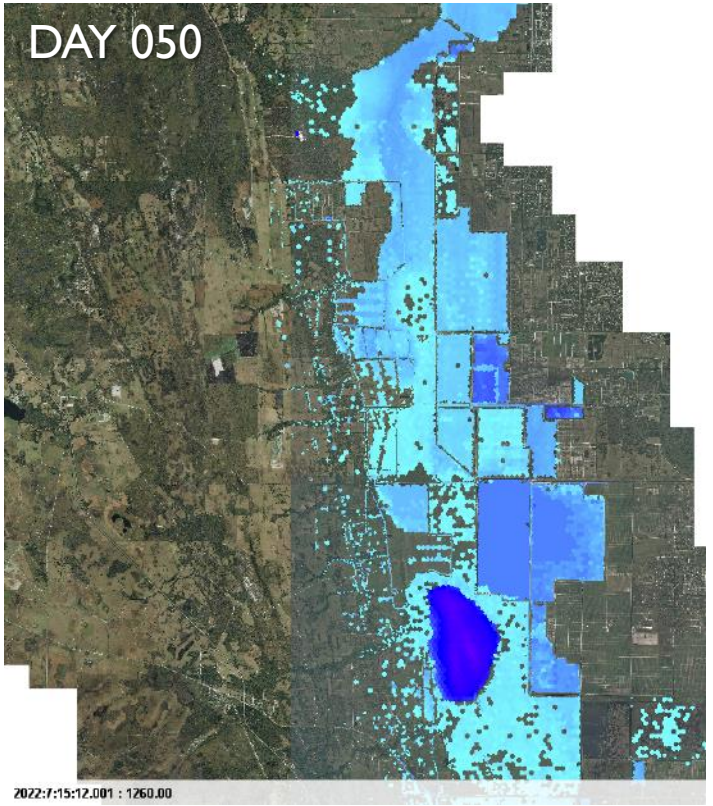
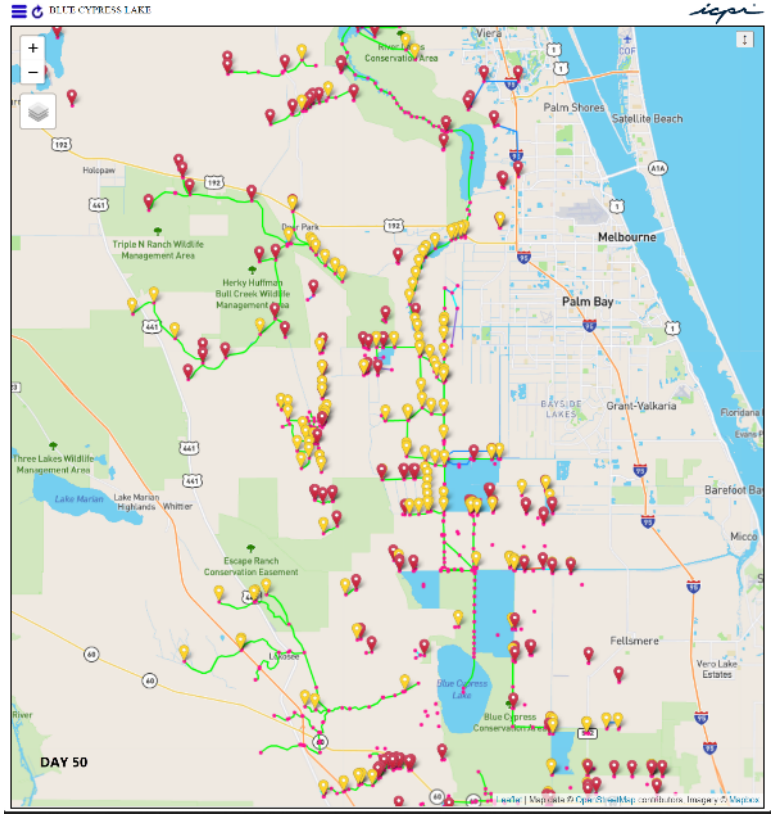


St. Johns River Water Management District

STREAMLINE TECHNOLOGIES

RTFF DASHBOARD



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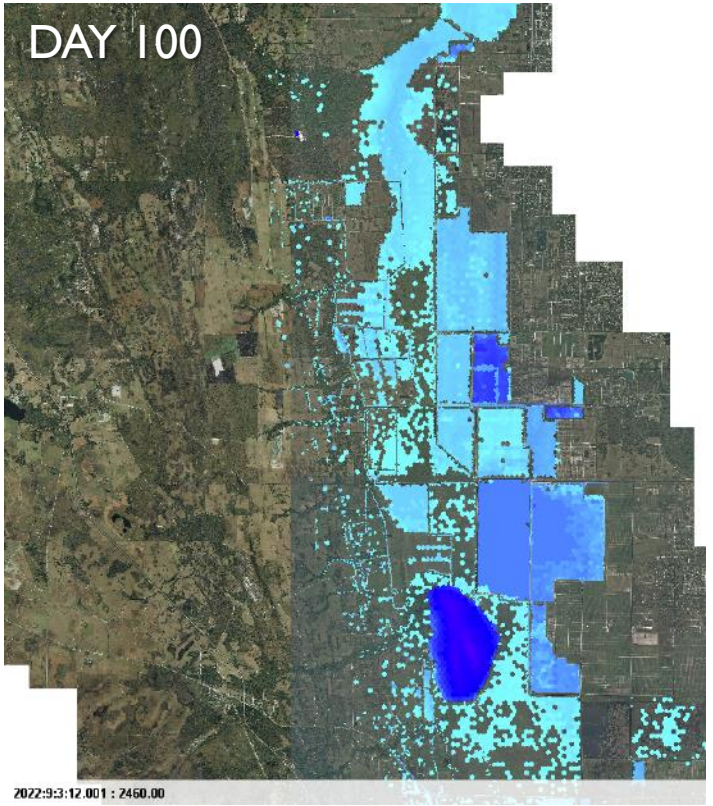
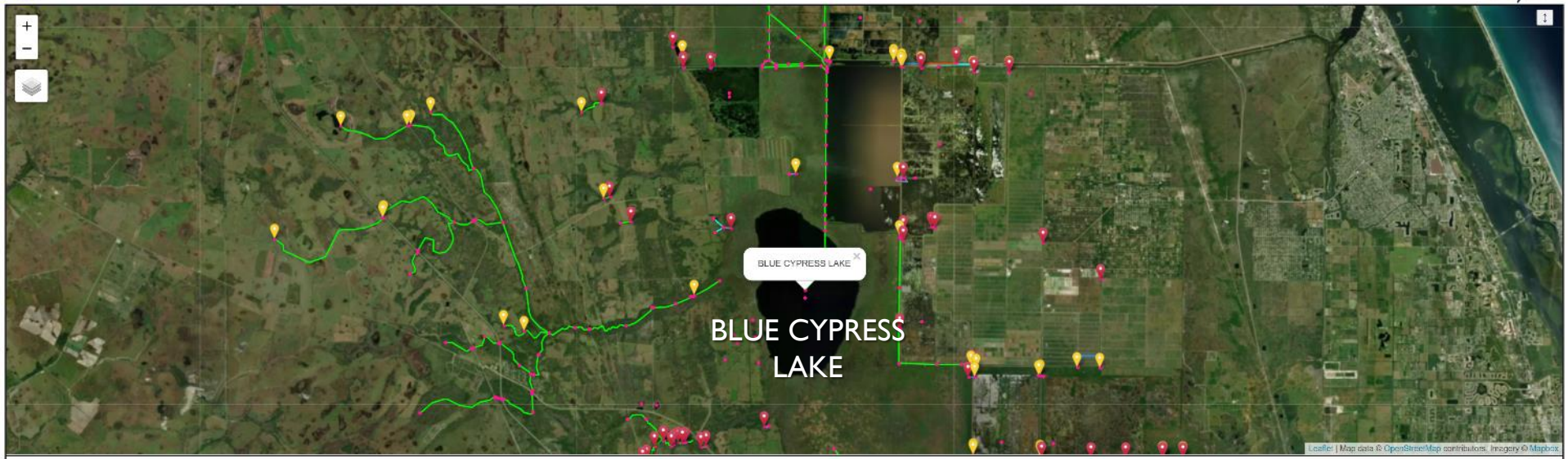
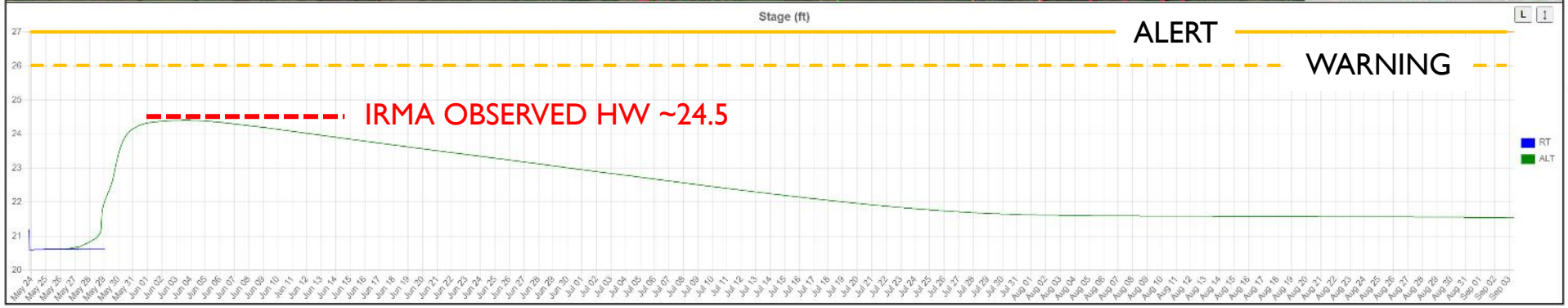
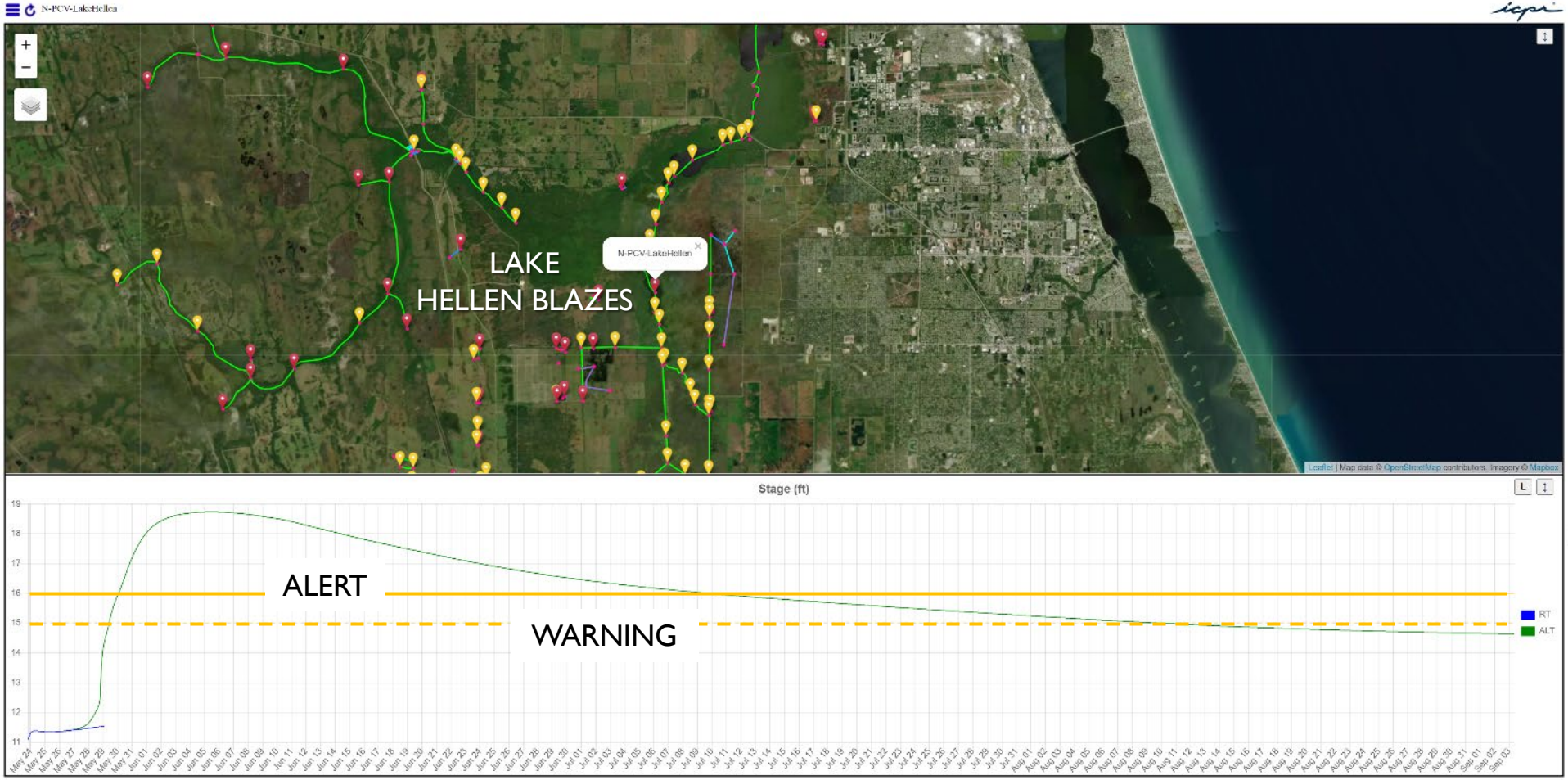


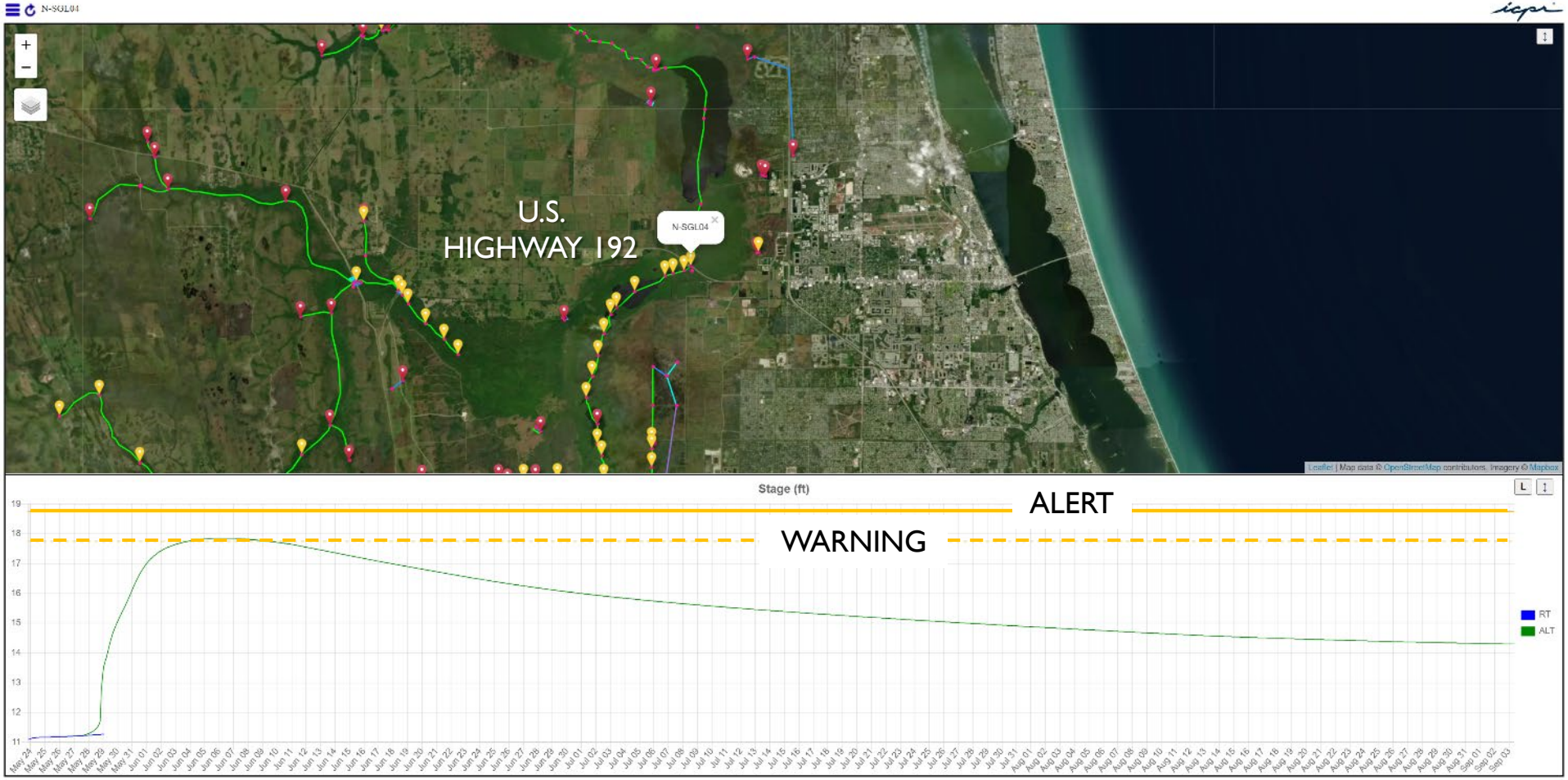
St. Johns River Water Management District

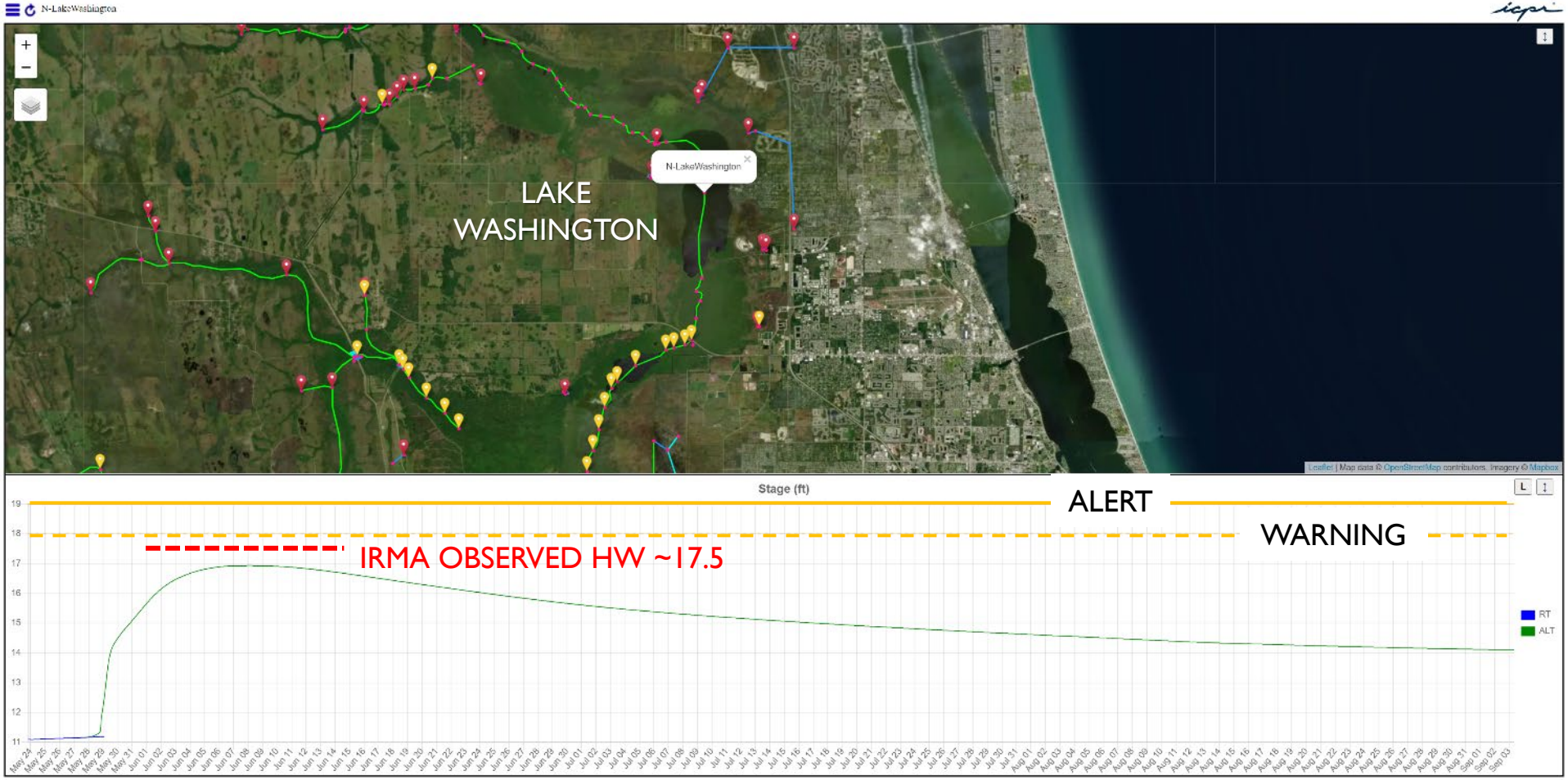
STREAMLINE TECHNOLOGIES


BLUE CYPRESS LAKE
BLUE CYPRESS LAKE


Stage (ft)
ALERT
WARNING
IRMA OBSERVED HW ~24.5
RT
ALT


N-PCV-LakeHellen
LAKE
HELLEN BLAZES
N-PCV-LakeHellen
Stage (ft)
ALERT
WARNING
RT
ALT

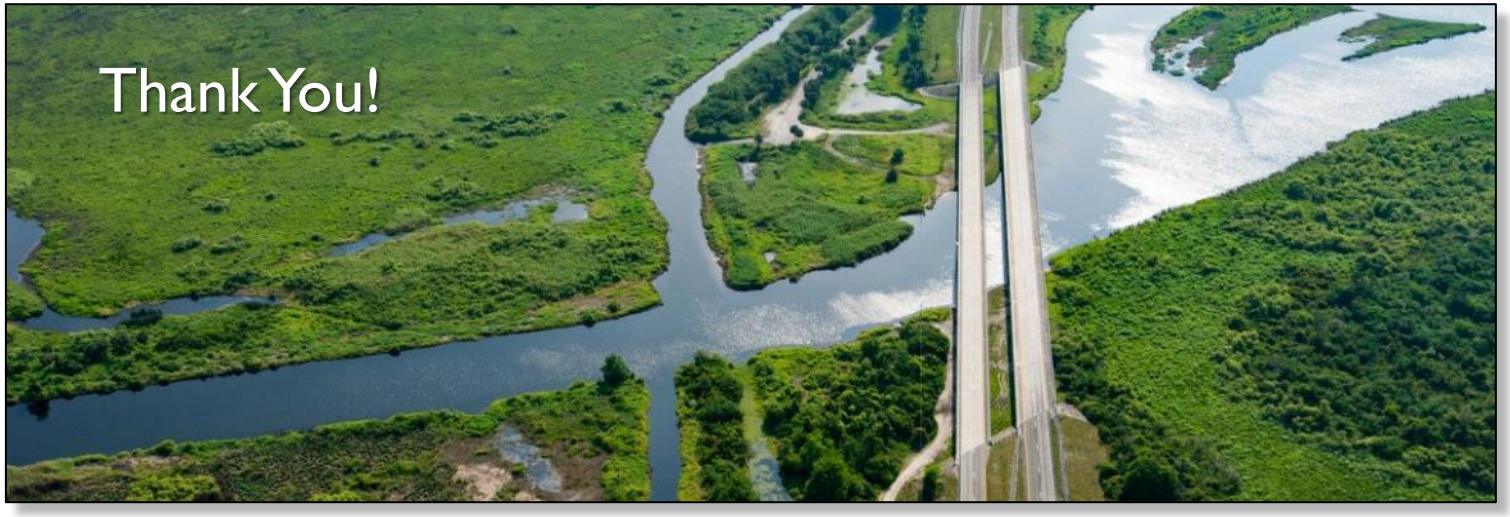

N-SGL04
U.S.
HIGHWAY 192
N-SGL04
Stage (ft)
ALERT
WARNING
RT
ALT


N-LakeWashington
LAKE
WASHINGTON
N-LakeWashington
Stage (ft)
ALERT
WARNING
IRMA OBSERVED HW ~17.5
RT
ALT

The USJRB RTFF System (Phase II)

- Incorporate observed water levels into the model
- Add ability to modify structure operations during simulations
- Acquire historical NWM data for hindcasting
- Automatically store forecast results
- Download results from dashboard

Flood Forecasting Resiliency Model of the Upper St. Johns River Basin



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Yanbing Jia: YJia@sjrwmd.com

STREAMLINE TECHNOLOGIES

St. Johns River Water Management District