Smart Sea Level Sensors in Chatham County

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Georgia Tech
CREATING THE NEXT

GEORGIA SMART

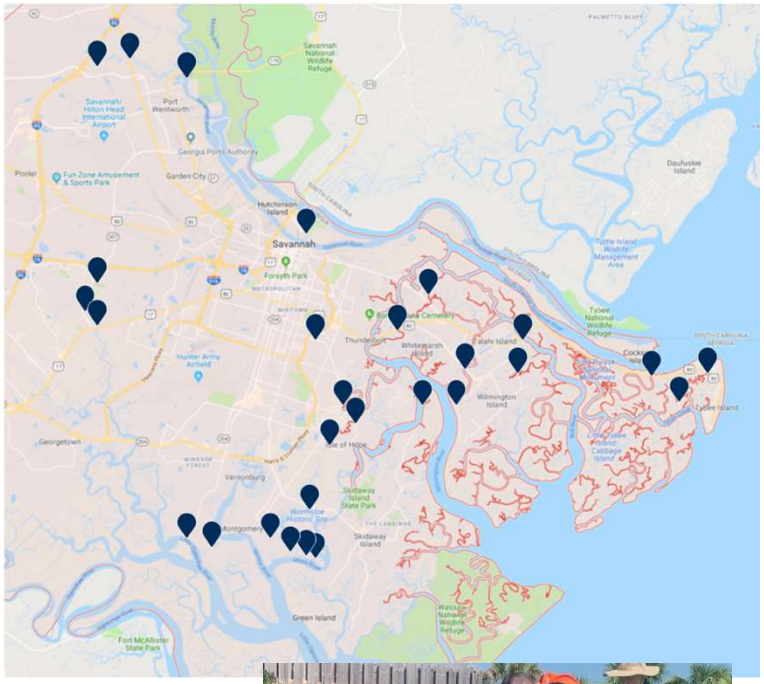
SMART
SEA LEVEL SENSORS

EMERGENCY MANAGEMENT
CHATHAM COUNTY

SAVANNAH
savannahga.gov

Overview

A high-density deployment of smart sea level sensors to provide hyper-local, real-time water level data across the community.

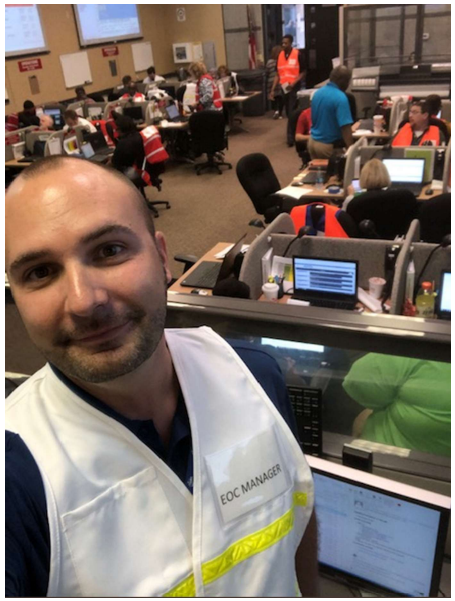


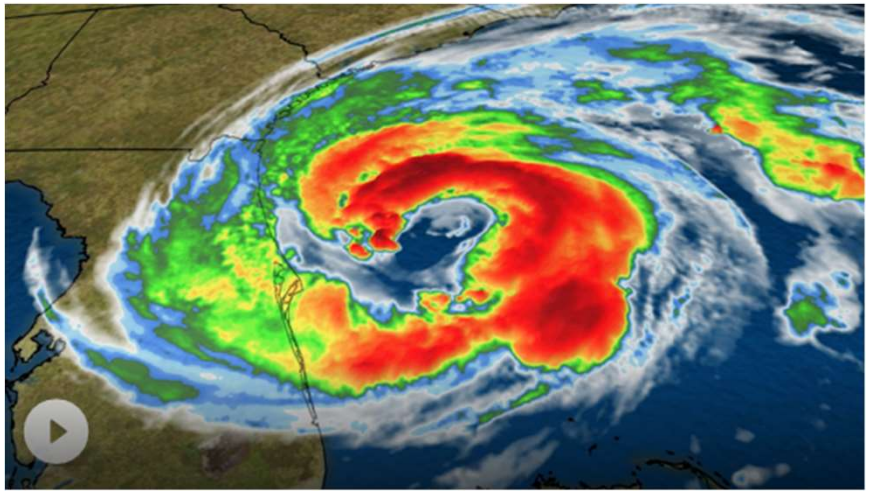
Goals:

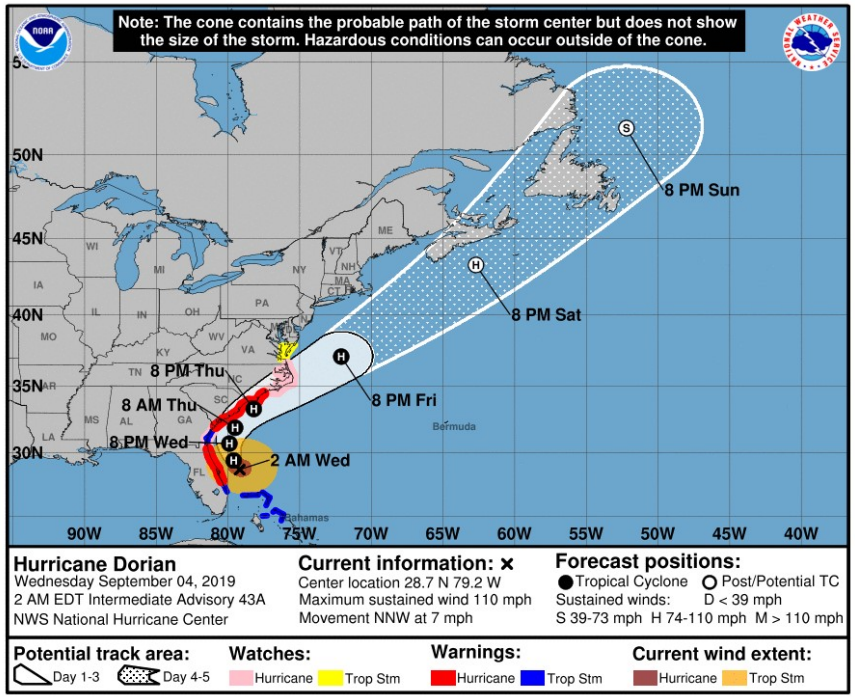
- ***emergency planning & response***
  real-time data portal & toolkits
- ***short- and long-term risk assessment and resilience planning***
- ***develop & test educational resources***
  middle & high school curricula
- ***communication and awareness***
  public events, installations, website

See more details at http://sealevelsensors.org

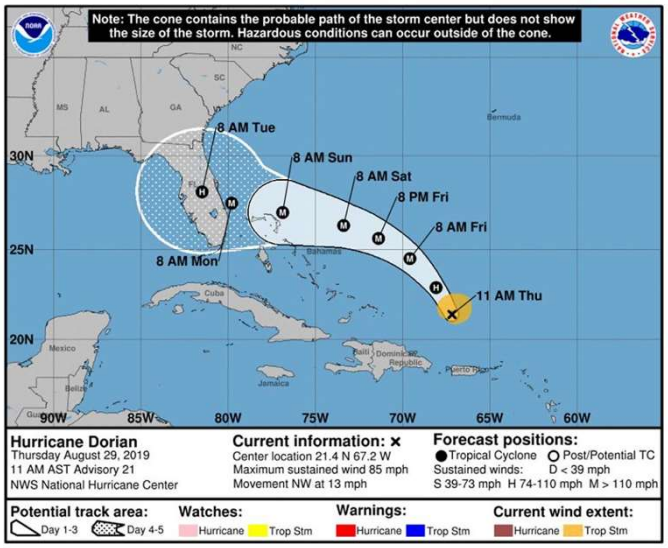
Busy Week

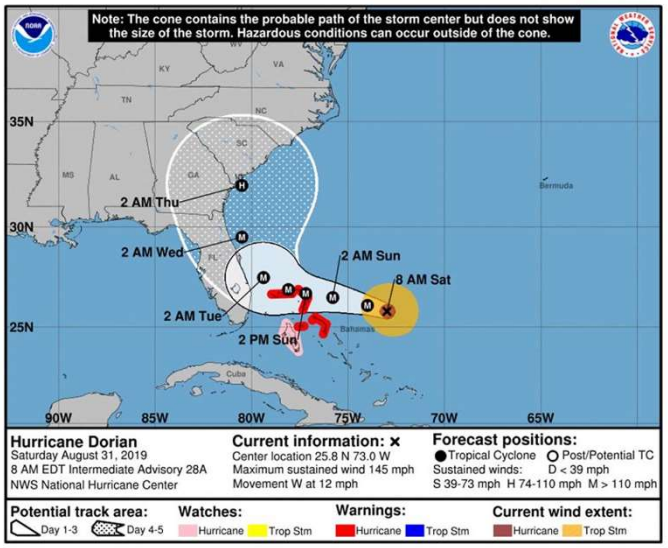

EOC MANAGER

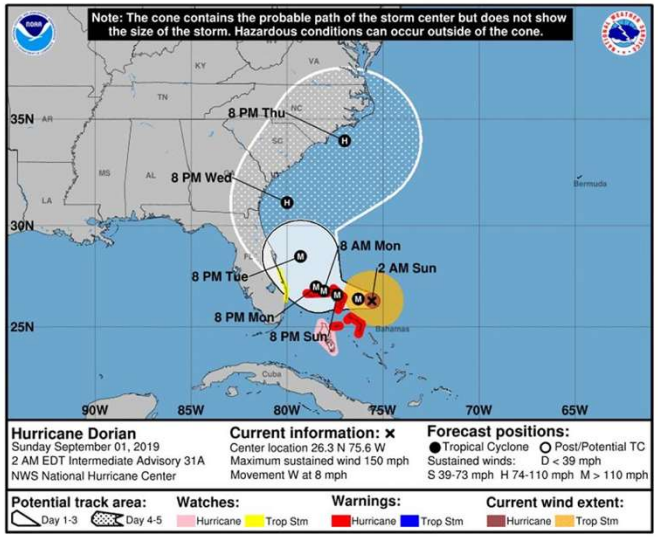


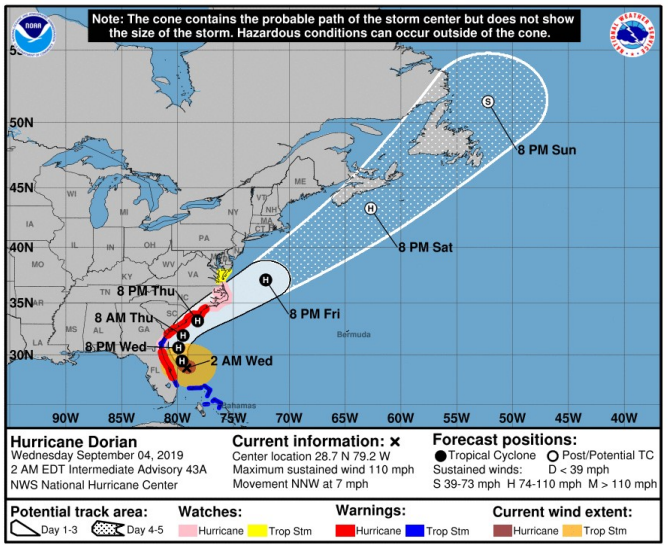

Note: The cone contains the probable path of the storm center but does not show the size of the storm. Hazardous conditions can occur outside of the cone.
50N
45N
40N
35N
30N
90W
85W
80W
75W
70W
65W
60W
55W
50W
45W
40W
8 PM Sun
8 PM Sat
8 PM Fri
8 PM Thu
8 AM Thu
8 PM Wed
2 AM Wed
Bermuda
Bahamas
Hurricane Dorian
Wednesday September 04, 2019
2 AM EDT Intermediate Advisory 43A
NWS National Hurricane Center
Current information: ×
Center location 28.7 N 79.2 W
Maximum sustained wind 110 mph
Movement NNW at 7 mph
Forecast positions:
Tropical Cyclone
Post/Potential TC
Sustained winds:
D < 39 mph
S 39-73 mph H 74-110 mph M > 110 mph
Potential track area:
Day 1-3
Day 4-5
Watches:
Hurricane
Trop Stm
Warnings:
Hurricane
Trop Stm
Current wind extent:
Hurricane
Trop Stm

A Week of Uncertainty









The project team

SAVANNAH
savannahga.gov

Nick Deffley
Office of Sustainability
Tom McDonald
David Donnelly

SAGIS
Savannah Area Geographic Information System

Lara Hall

SCHOOL OF ENGINEERING
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Dr. Alex Robel
Dr. Sally Ng
Dr. Iris Tien
Lalith Polepeddi
Jayma Koval
*Tim Cone**
Selena Perrin

**GT-Savannah*

EMERGENCY MANAGEMENT
CHATHAM COUNTY

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Leon Davenport
Dennis Jones
David Anderson

Harambee House
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Skidaway Institute of Oceanography
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Dr. Clark Alexander

OCS
OGLETHORPE CHARTER SCHOOL
1999

Rebecca Greenbush

GEORGIA CLIMATE PROJECT

100 MILES
PRESERVING GEORGIA'S COAST. FOREVER.

NATIONAL WEATHER SERVICE

TYBEE ISLAND MARINE SCIENCE CENTER

SAVANNAH COLLEGE OF ART AND DESIGN

SAVANNAH
savannahga.gov

EMERGENCY MANAGEMENT
CHATHAM COUNTY

Georgia Tech

Harambee House

UNIVERSITY of HAWAI'I
MĀNOA

Sea Grant
Georgia

SAGIS
Savannah Area Geographic Information System

Skidaway Institute of Oceanography
UNIVERSITY OF GEORGIA

SCHOOL OF ENGINEERING
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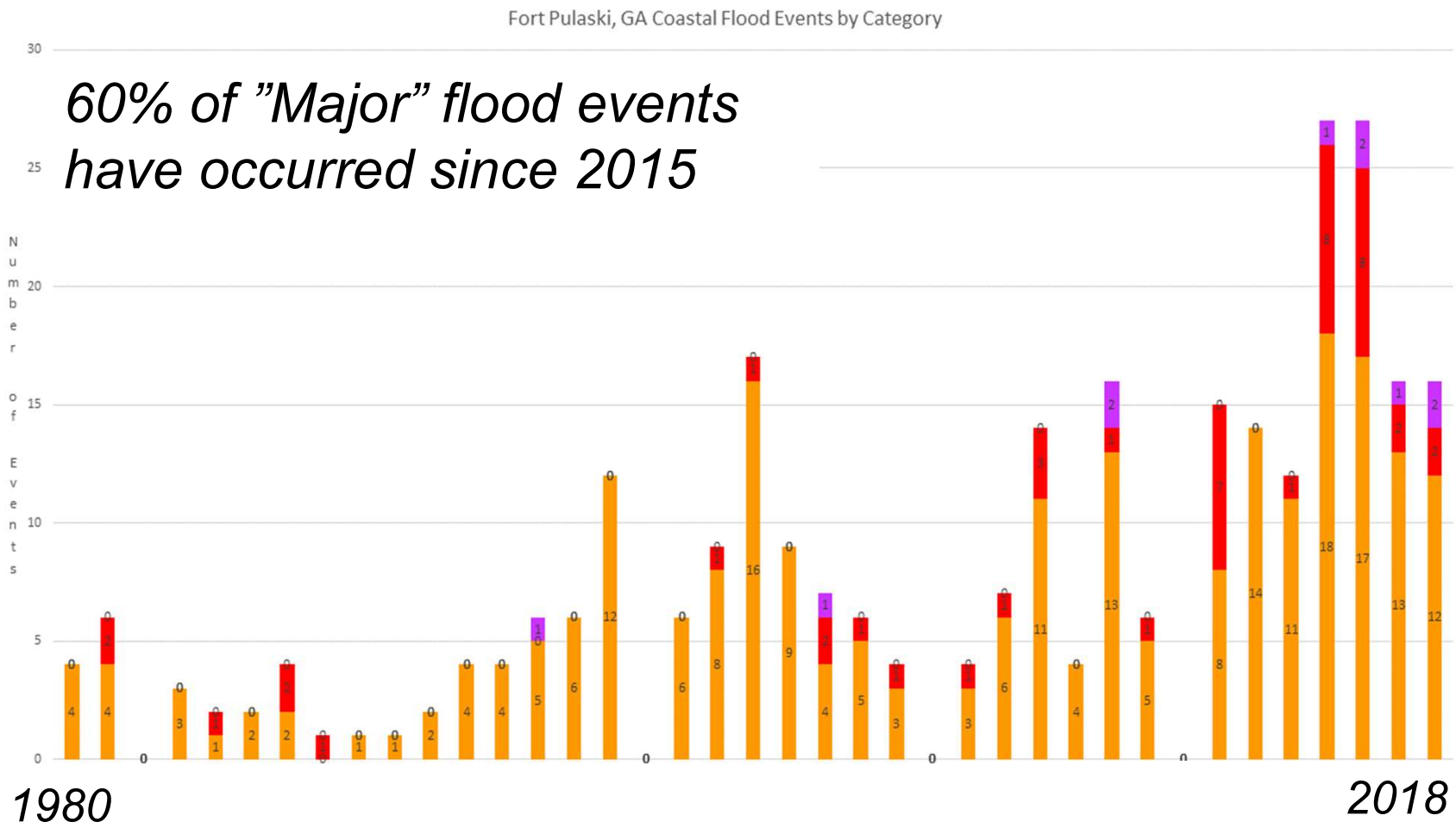
OCS
OGLETHORPE CHARTER SCHOOL
1999

the creative coast

Communities of
COASTAL GEORGIA FOUNDATION

GEORGIA
DEPARTMENT OF NATURAL RESOURCES

Sea level rise on the Georgia coast



flooding frequency and intensity rising

Source: NWS Charleston

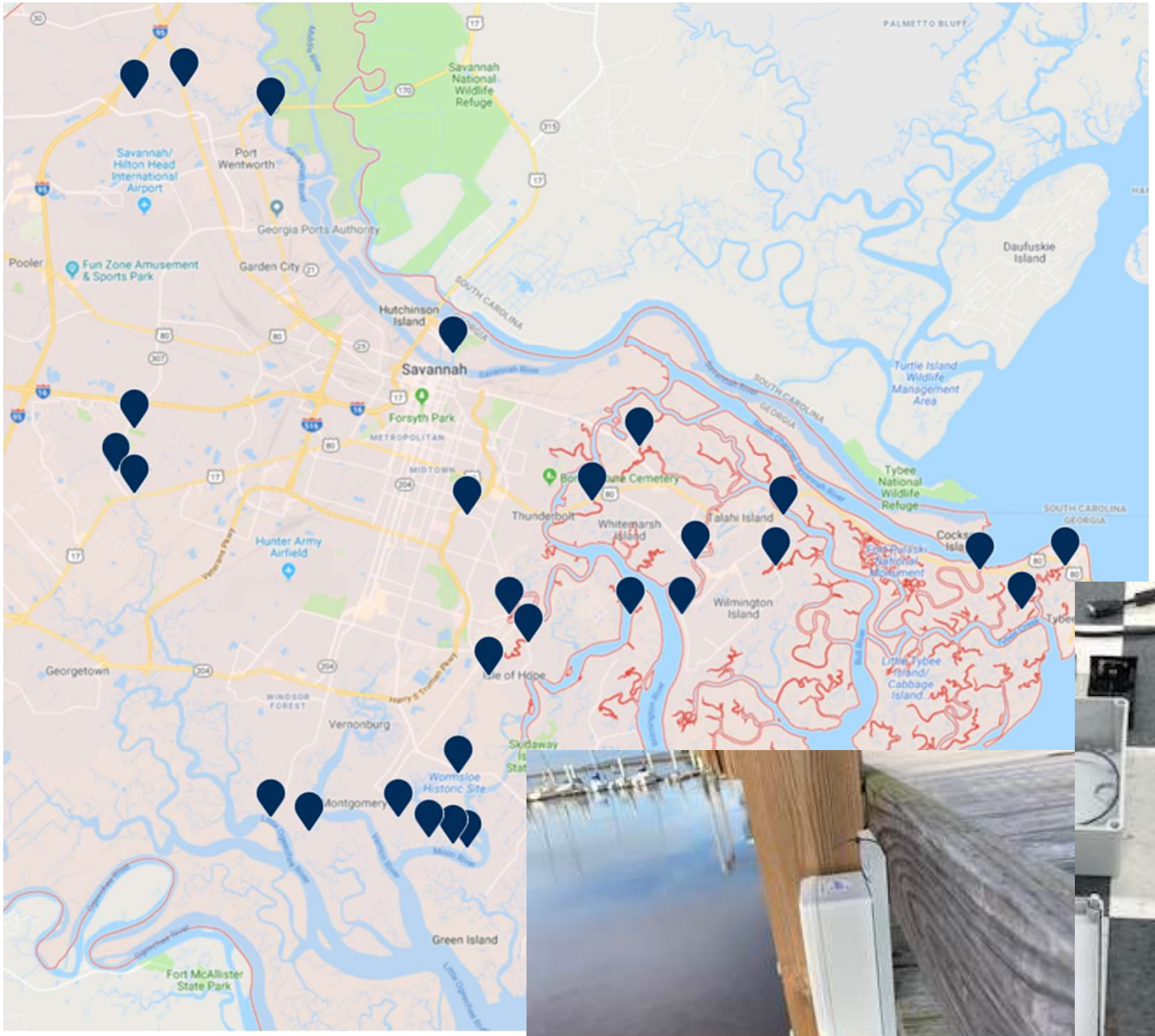
“Blue sky flooding”

Nov 24, 2018

Ultrasonic Range Sensors

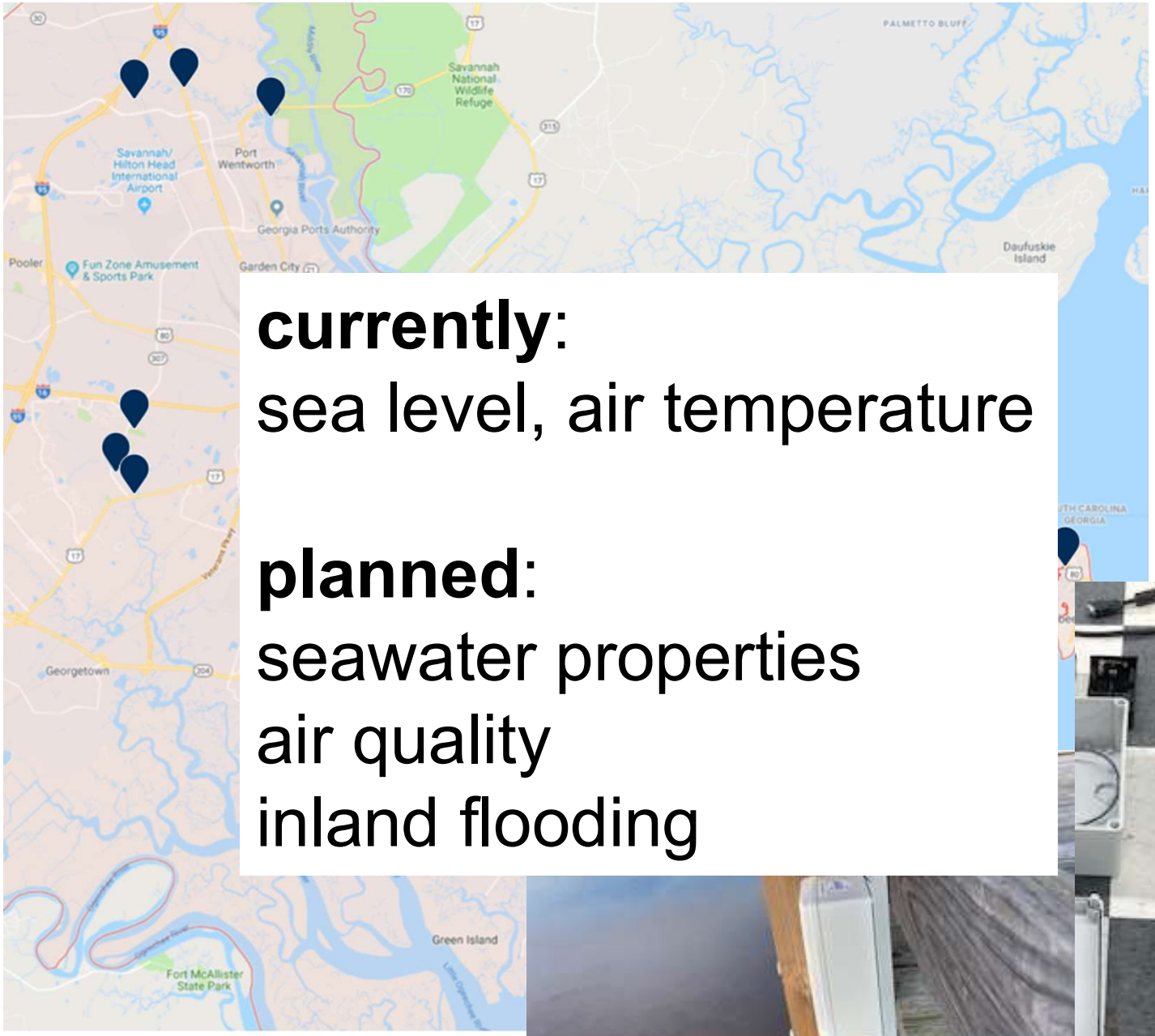
Deployed on bridges and docks across the county

Low installation and maintenance costs



37 sensors
14 gateways

<u>goal</u>: 50 sensors this year



currently:
sea level, air temperature

planned:
seawater properties
air quality
inland flooding

37 sensors
14 gateways

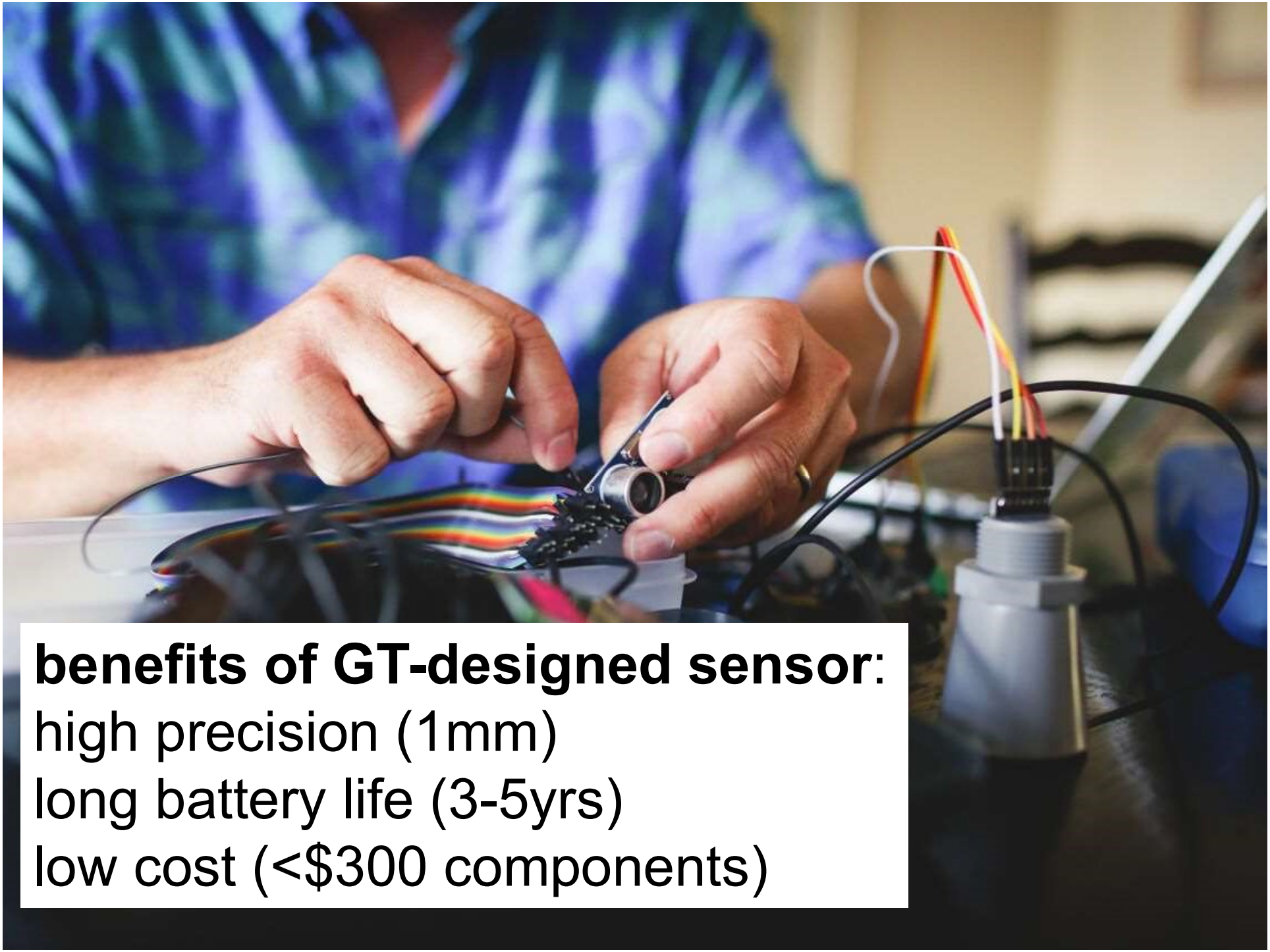
goal: 50 sensors this year

gateway device:
- 1 to 4 mile range
- can serve hundreds of sensors
- needs internet, power

goal:
provide backbone for diverse ‘internet of things’ applications

LoRa Alliance™
Wide Area Networks for IoT

THE THINGS NETWORK



benefits of GT-designed sensor:
high precision (1mm)
long battery life (3-5yrs)
low cost (<$300 components)

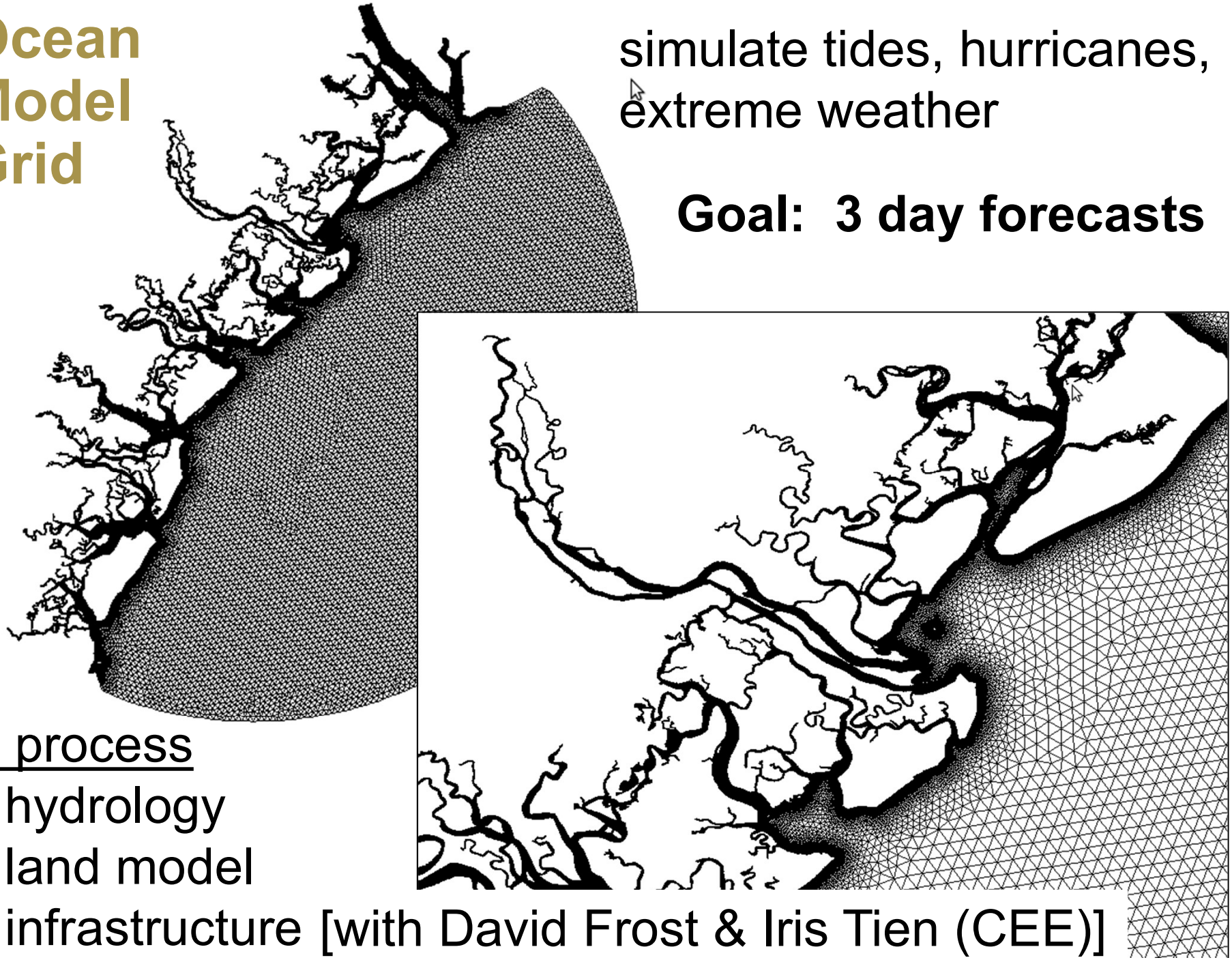
Lead:
Dr. Emanuele Di Lorenzo
Director, Ocean Science & Engineering
Earth & Atmospheric Sciences

FROM THE OPEN OCEAN TO THE URBAN SCALE: A MODELING SYSTEM FOR SAVANNAH CITY AND THE GEORGIA

Ocean Model Grid

simulate tides, hurricanes, extreme weather

Goal: 3 day forecasts

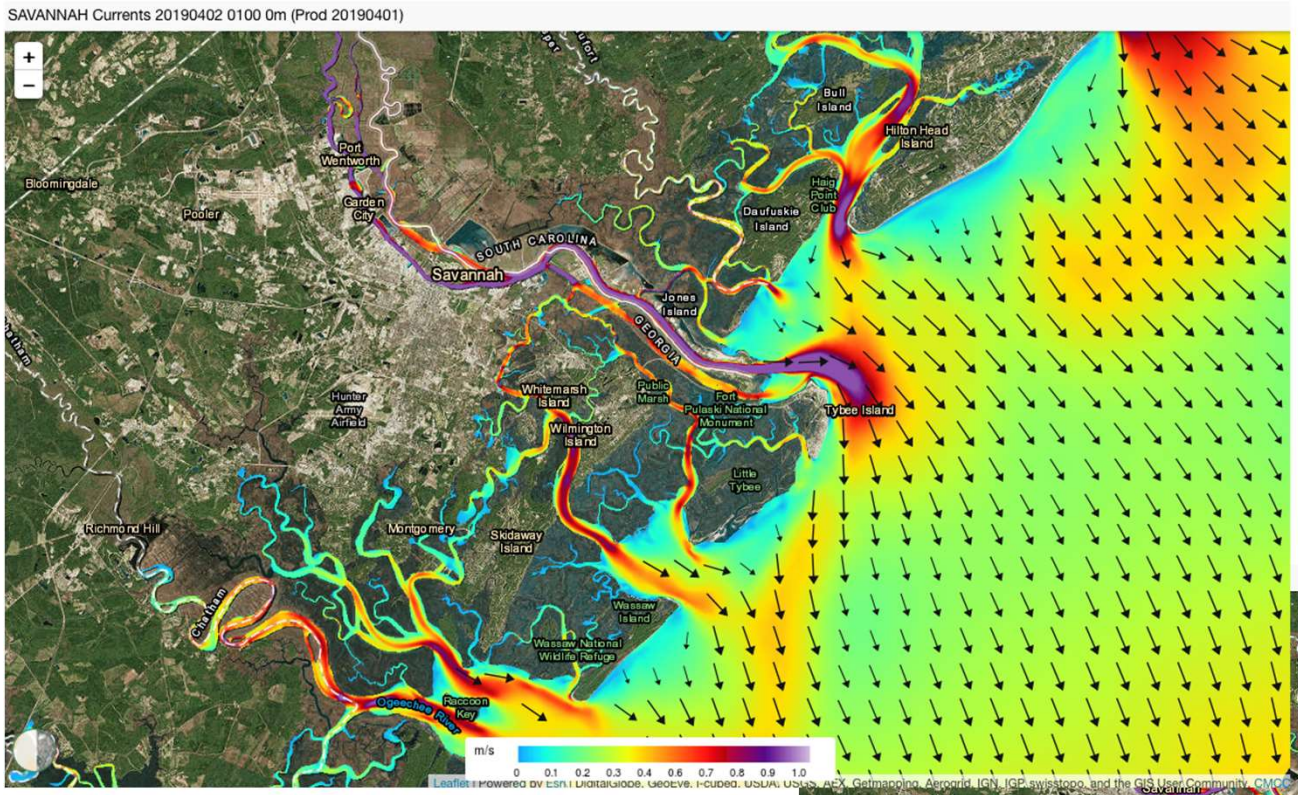


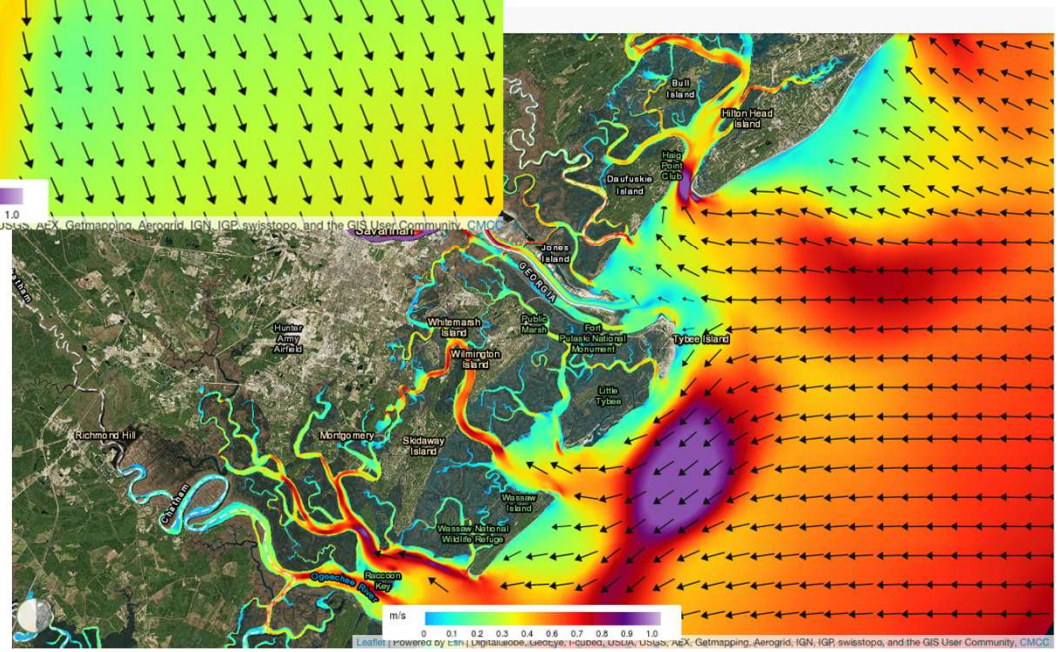
<u>in process</u>

+ hydrology
+ land model
+ infrastructure [with David Frost & Iris Tien (CEE)]

Model Visualizations

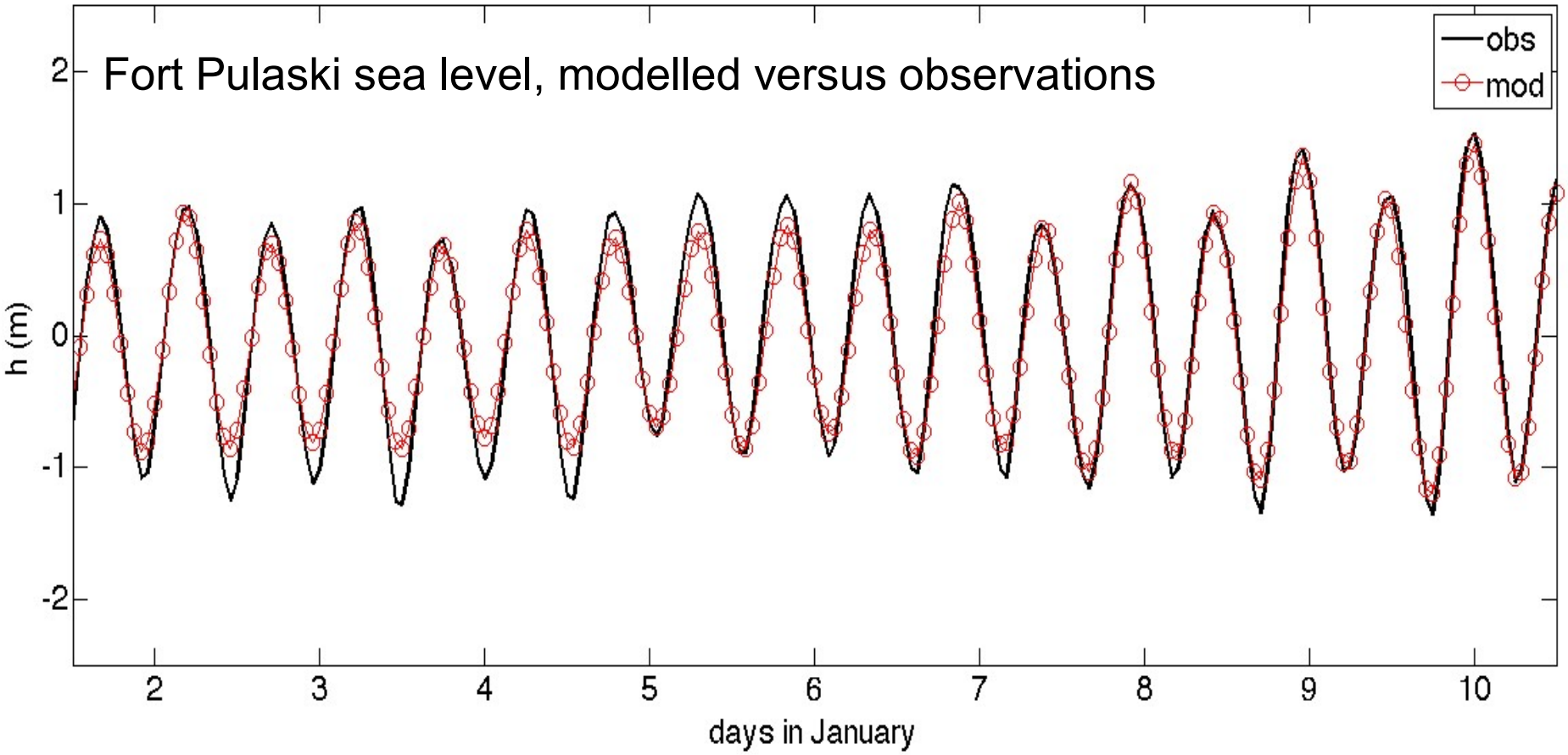
http://savannah.cmcc-opa.edu





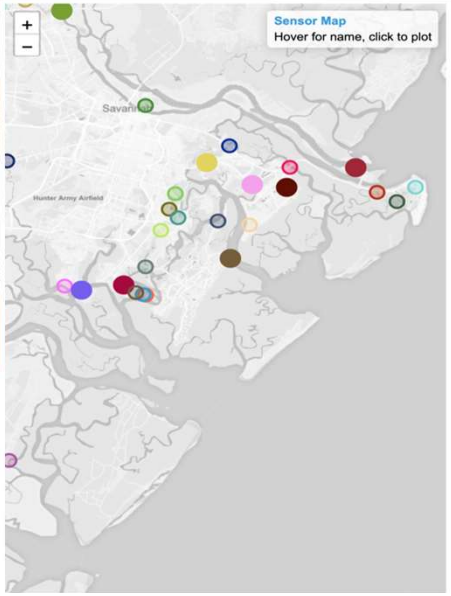
Sensor data vs. ocean model output

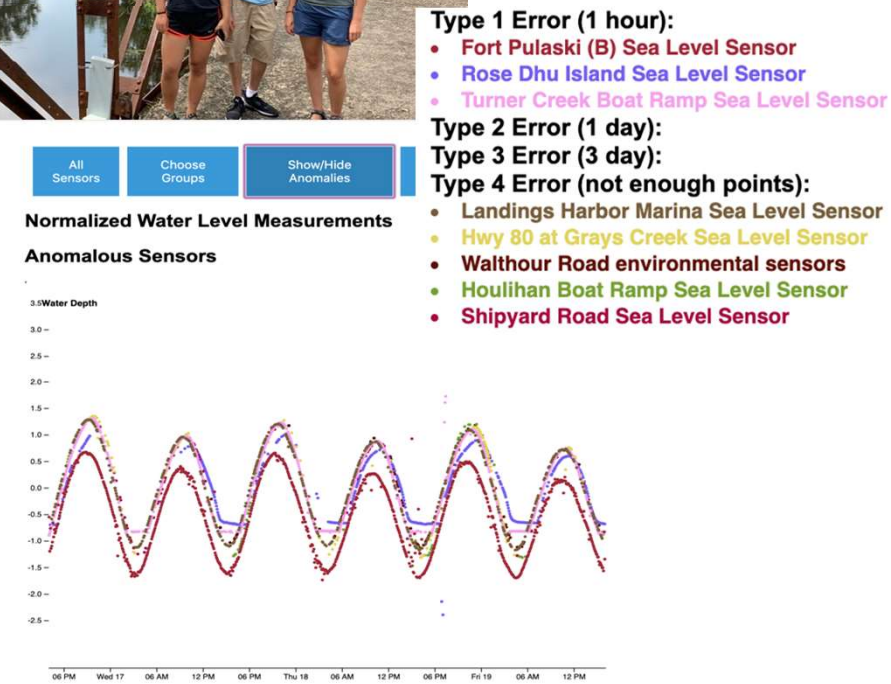
- quantify accuracy of model simulations of past and future flood events, inform uncertainties



Civic Data Science Team

Focused on identification and tracking of anomalies in the sensor data





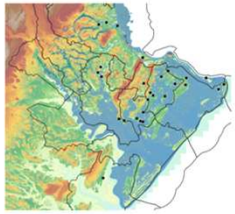
Chatham Emergency Management Agency (CEMA) Portal Team

Developing tools for emergency management users

Inundation Methodology

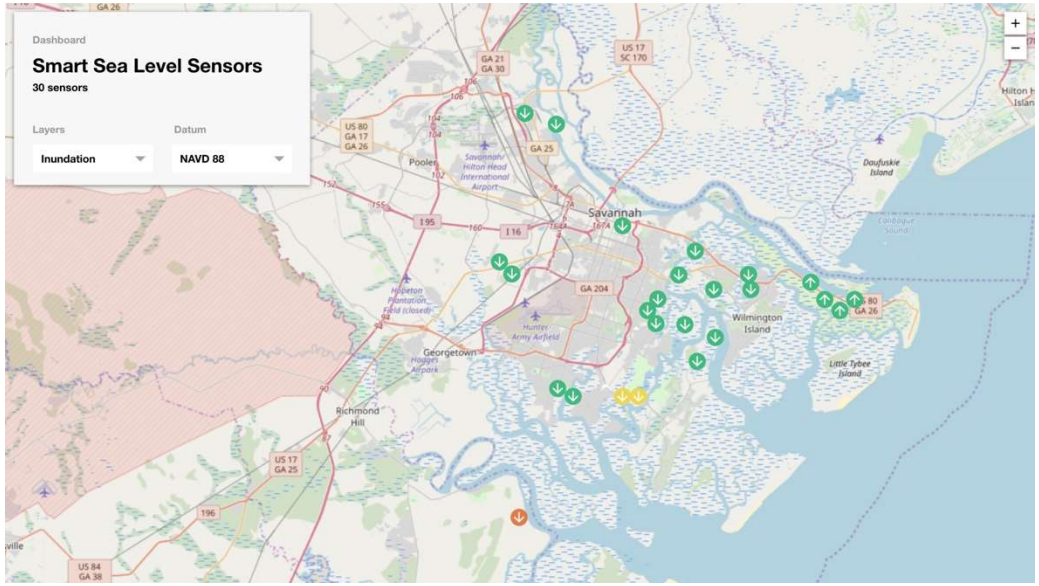
Data

- 1 ft (m) lidar-derived DEM (SAGIS)
  - possibly DSM to do bridge inundation?
- Hydrologic features (SAGIS)
- Sensor readings (API)
- HUC 12 boundaries? (USGS)



Methods

- Modified bathtub model vs. interpolation



Randall Mathews

Akhil Chavan

Jude Mwenda

Kait Morano

Lalith Polepeddi

CEMA Portal Team

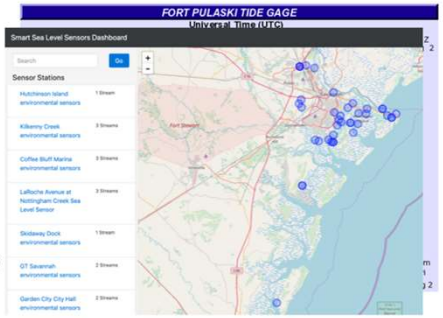
Worked with end-users to identify workflow and design appropriate tools

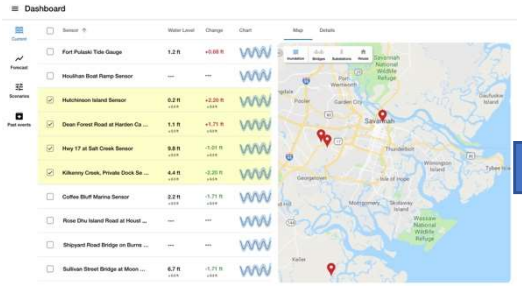
Before sensor data

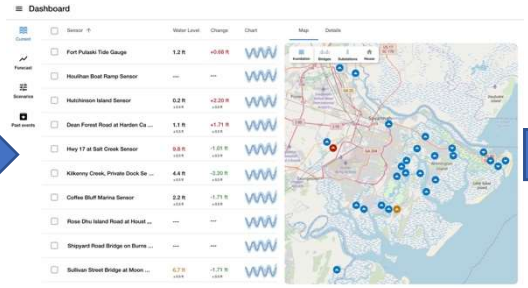
1. Receive an alert of a flooding event
2. Visit Fort Pulaski tide gauge chart
3. Check if water level has exceeded a threshold
4. If yes, dispatch 1-2 people to drive to known low lying areas
5. After the event, review which areas were affected and differences from the previous flooding event

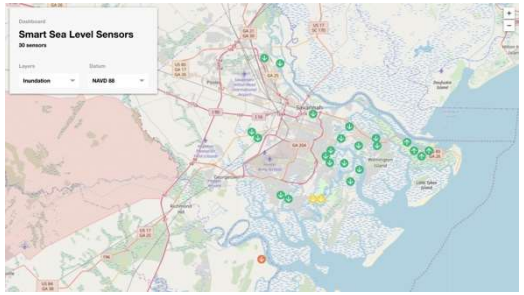
With sensor data

1. Receive an alert of a flooding event
2. Open one tab with Fort Pulaski tide gauge chart
   Open another tab with Sea Level Sensors dashboard
3. Compare differences between Fort Pulaski measurements and sensor measurements
4. Dispatch people to areas around specific sensors to see what's going on









Community engagement

TOP STORY

Ga. Governor Brian Kemp issues mandatory evacuation for multiple coastal counties

Evacuation Pace Slow Despite Mandatory Order

By GRANT BLANKENSHIP • 9 HOURS AGO

Share Tweet Email

By Tuesday, there wasn't enough traffic to push westbound cars into eastbound lanes on I-16 near Dublin.

GRANT BLANKENSHIP / GPB NEWS

Getting the message out can be difficult

Community Engagement Team


NEIGHBORHOOD DISASTER PLAN

TEMPLATE

Hudson Hill Community
[insert plan version number]
07/22/19

DRAFT

Nick Deffley
Director,
Office of Sustainability
City of Savannah

GT CEISMIC
Tim Cone
Jayma Koval

Kate Ferencsik
SMART Chatham County,
Community Engagement
Intern

Harambee House
Dr. Mildred McClain
Dawud Shabaka
Jaquez Harris
Alisha Saxena

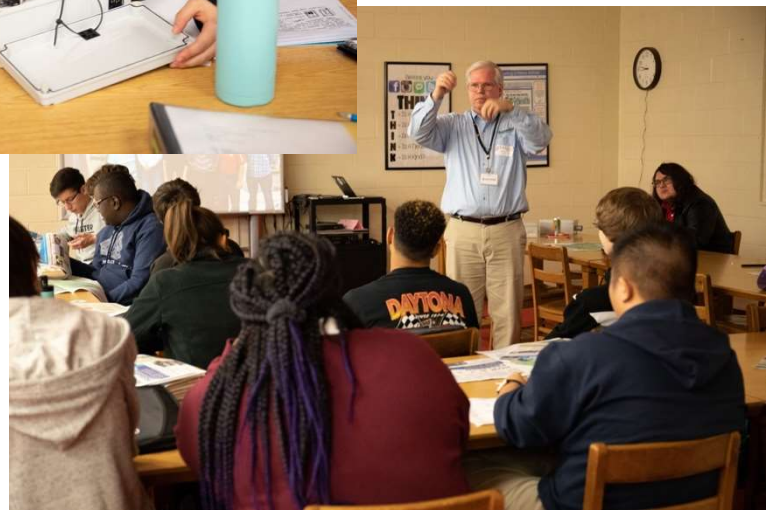
David Donnelly
City of Savannah, Director of
Emergency Management

Dr. Allen Hyde
Georgia Tech, Assistant
Professor of History and
Sociology

Educational Partnerships

Current

- Jenkins High School, School of Engineering
- Oglethorpe Charter Middle school



Planned

- Otis J. Brock Middle School
  - Curriculum
  - Sound, air quality sensors
- Woodville-Tompkins High School
  - Air quality sensors
  - Intersection sensors
  - Data analysis

Future Funding

Multiple proposals and funding opportunities pursued

- Georgia DNR Coastal Incentive Grant – awarded $80K
- NSF Award – Network Infrastructure Resilience – awarded $200K

NSF S&CC Proposal to be submitted this week

Lessons Learned

- **Technical challenges, limitations, improvements**
- **Major effort coordinating deployment on diverse infrastructure with many stakeholders**
- **Sensors are just the beginning, the data is not enough**
- **Community engagement takes time and local partnerships – one neighborhood at a time**

- ***An enthusiastic community response is inspiring!***