



Smart Sea Level Sensors

Chatham County

Dr. Kim Cobb

Director, Global Change Prog.
Georgia Power Chair
Earth & Atmospheric Sciences

Dr. Russell Clark

Senior Research Scientist
Computer Science

Nick Deffley

Director, Office of
Sustainability
City of Savannah

Randall Mathews
CEMA

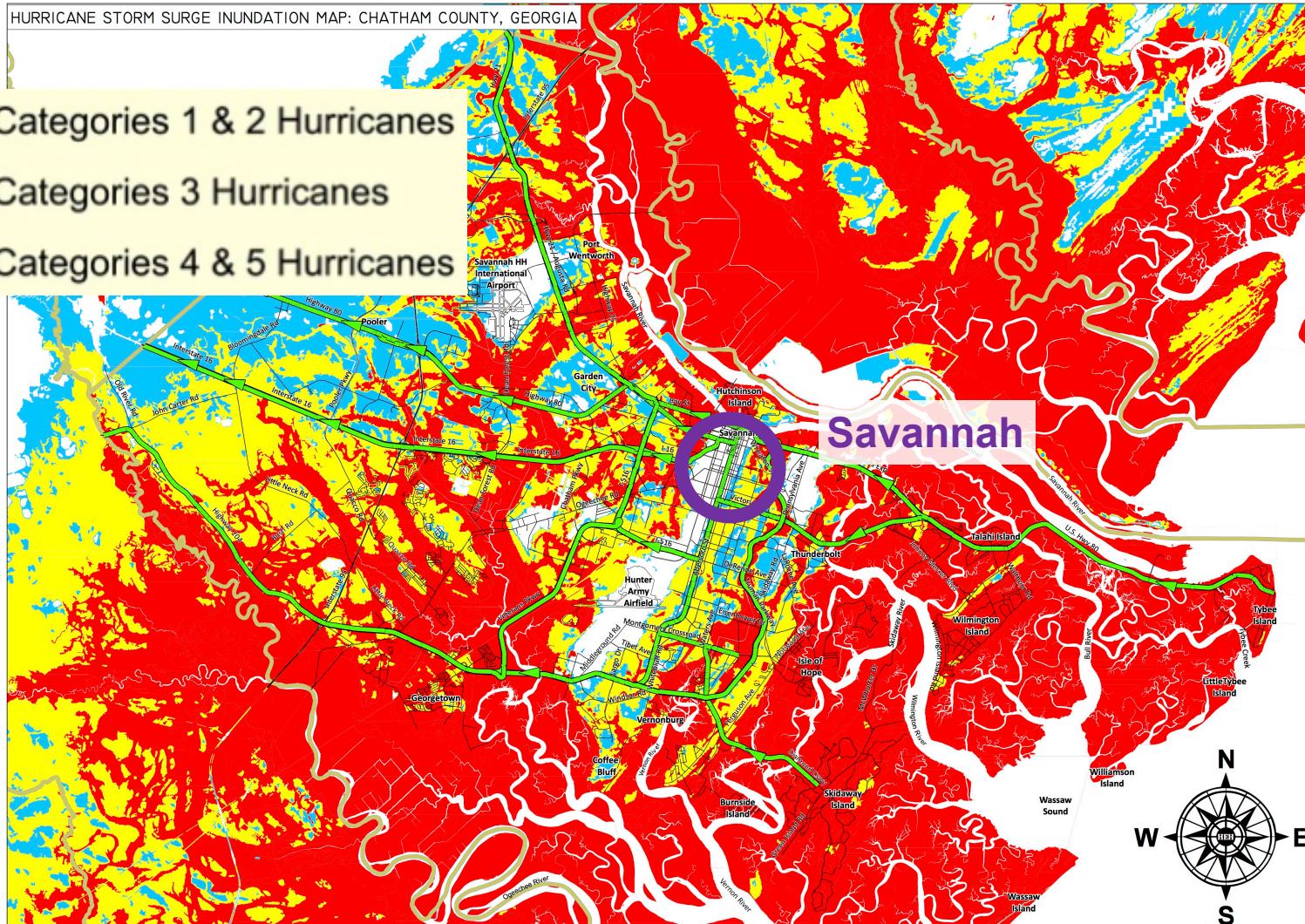
GEORGIA SMART
COMMUNITIES CHALLENGE



SAVANNAH
savannahga.gov

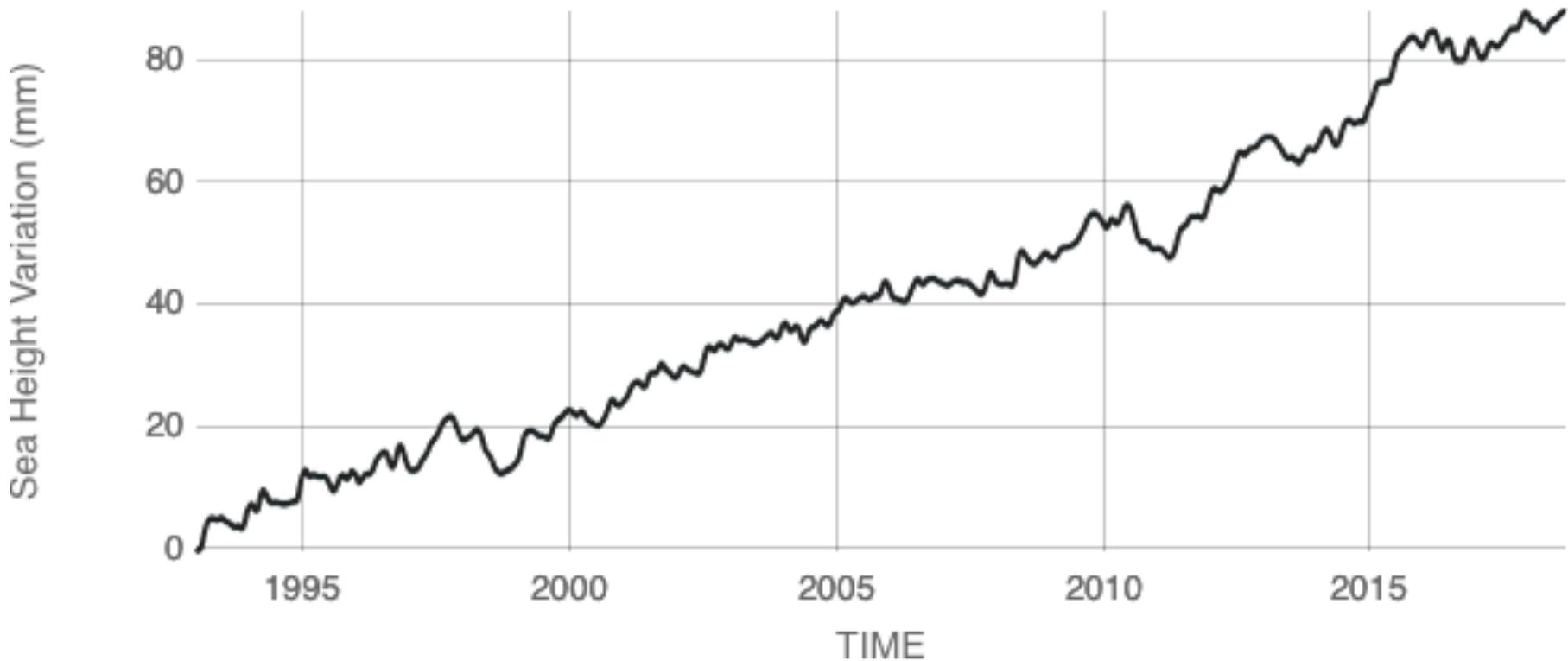


Coastal flooding – a current threat



<https://www.chathameergency.org/storm-surge-impact-by-category.php>

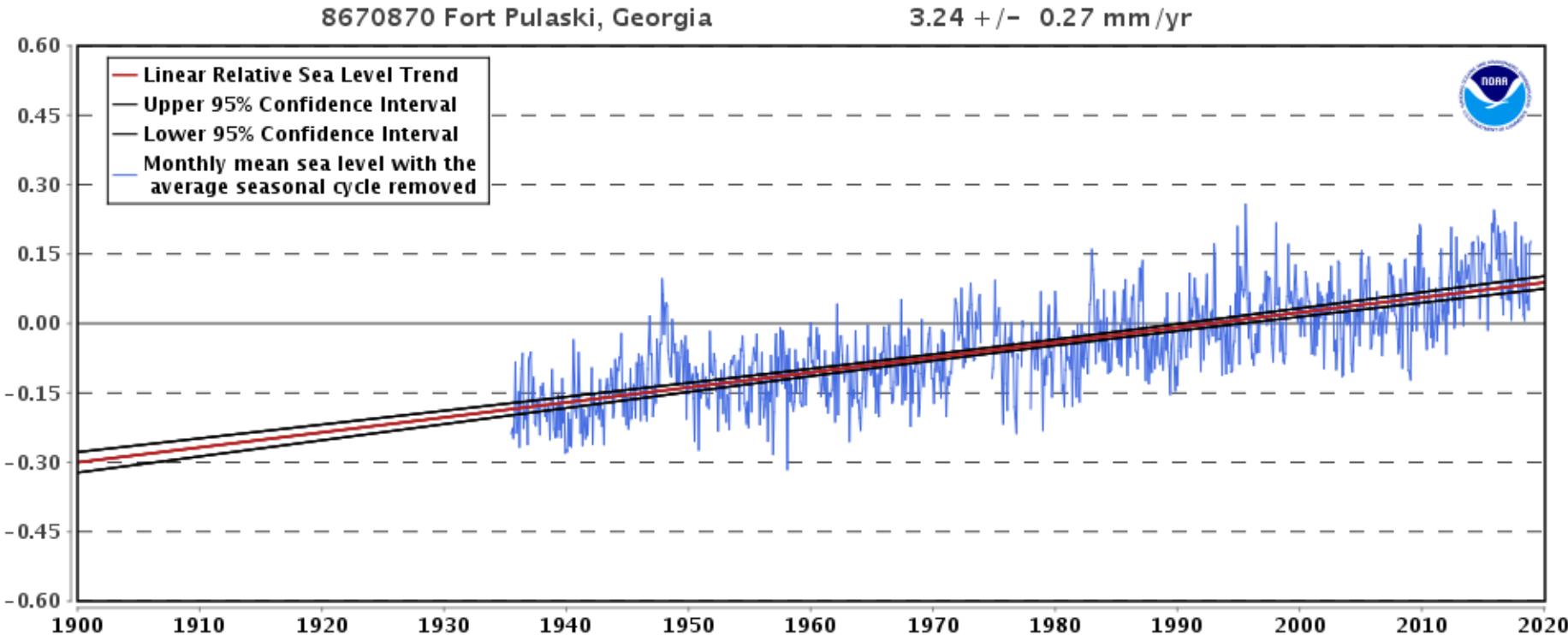
Sea level rise – a growing threat



Source: climate.nasa.gov

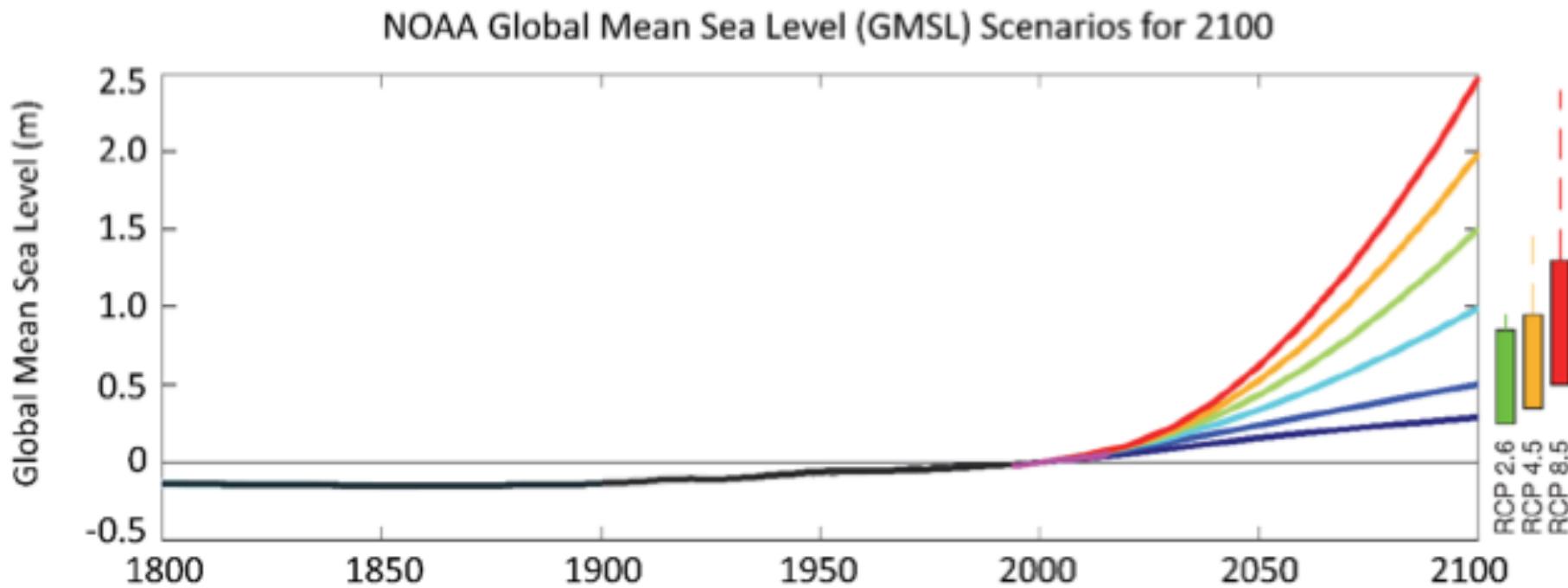
current rate of sea level rise = +3.2 mm/yr
→ in 100yrs, +320mm (or 12") minimum

Ft. Pulaski - Georgia's only NOAA tide gauge



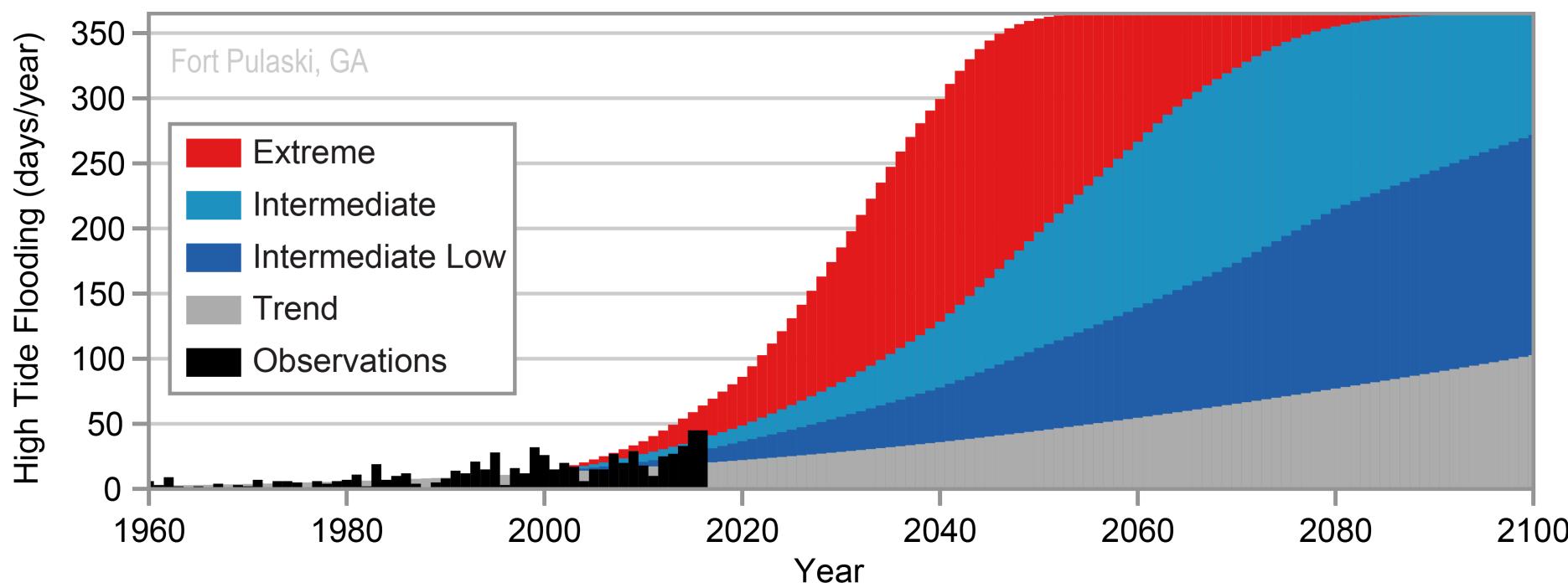
local sea level has risen by +10" in 85yrs

Global sea level rise scenarios



future sea level rise rates depend on:
1) our emissions pathway
2) response of the ice sheets to warming

Ft. Pulaski – flooding becoming more frequent



More extreme scenarios project
+1300mm (+51") of global sea level
rise by 2100.

Sweet et al., 2017

<https://nca2018.globalchange.gov/chapter/19/>

“Blue sky flooding”

Savannah,
Nov 24, 2018



photo by Russ Clark

<http://sealevelsensors.org>

SMART SEA LEVEL SENSORS

CHATHAM COUNTY, GA

Watch video



Dr. Kim Cobb

Dr. Russ Clark

Dr. Emanuele Di Lorenzo

Dr. David Frost

Lalith Polepeddi

Tim Cone (GT-Savannah)

Jayma Koval



Randall Mathews
David Anderson
Dennis Jones

SAVANNAH
savannahga.gov



Nick Deffley
Director, Sustainability
Tom McDonald
David Donnelly

Project goals

emergency planning & response

real-time data portal & toolkits

***short- and long-term risk assessment
and resilience planning***

develop & test educational resources

middle school & high school curricula

communication and building awareness

public events, installations, website

Project timeline



Stakeholder engagement:

workshops every 2-3 months (big event on May 16, 2019)
meetings, calls with the project team
newsletters
public events

Community engagement

e.g.

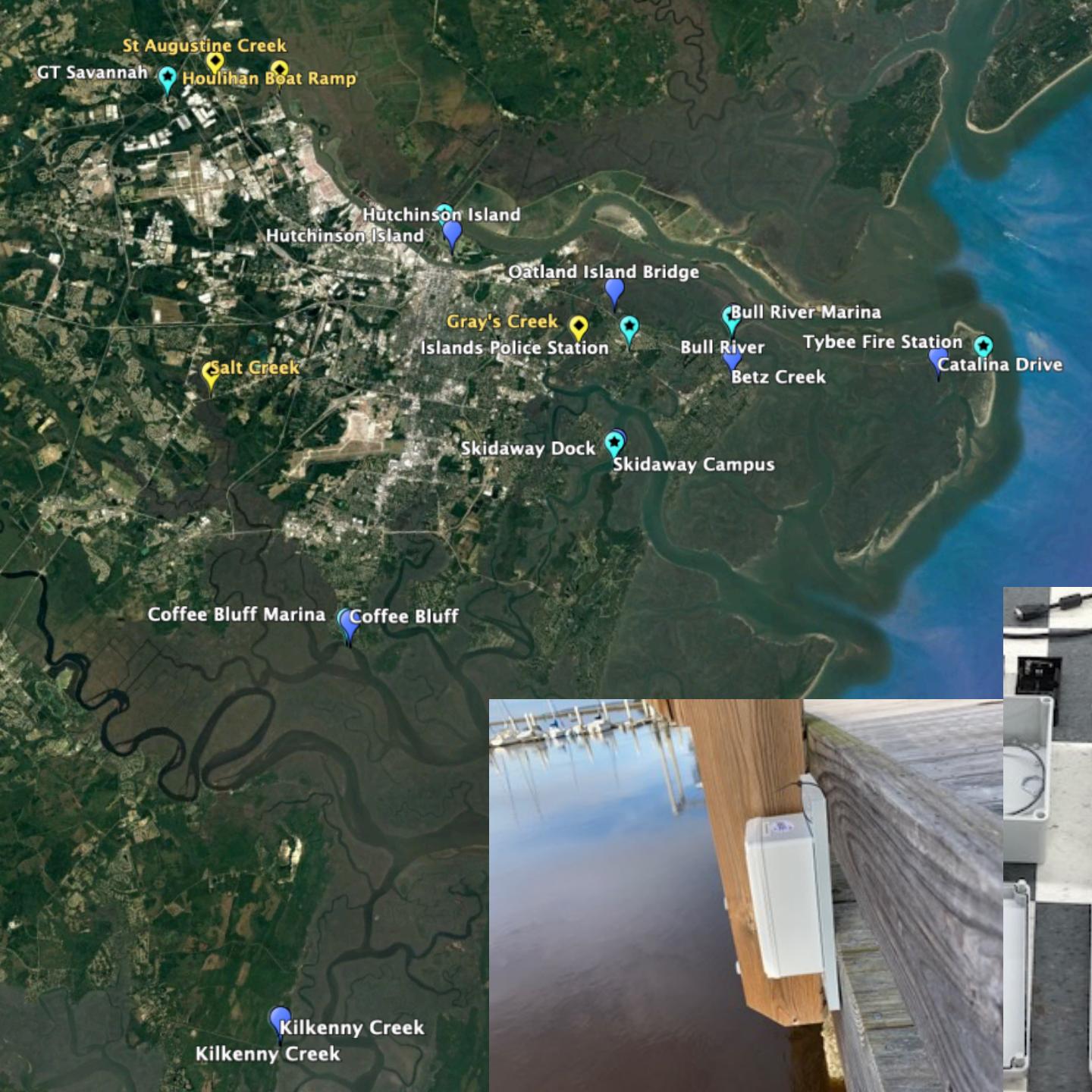
Brunswick workshop on sea level rise Jan 22, 200+ attendees



Sensor Placement Team Updates

Russ Clark





8+4 sensors
8 gateways
30 sensors in production

Still target:
100 sensors
by August



GDOT Approval!!!



GDOT Approval!!!

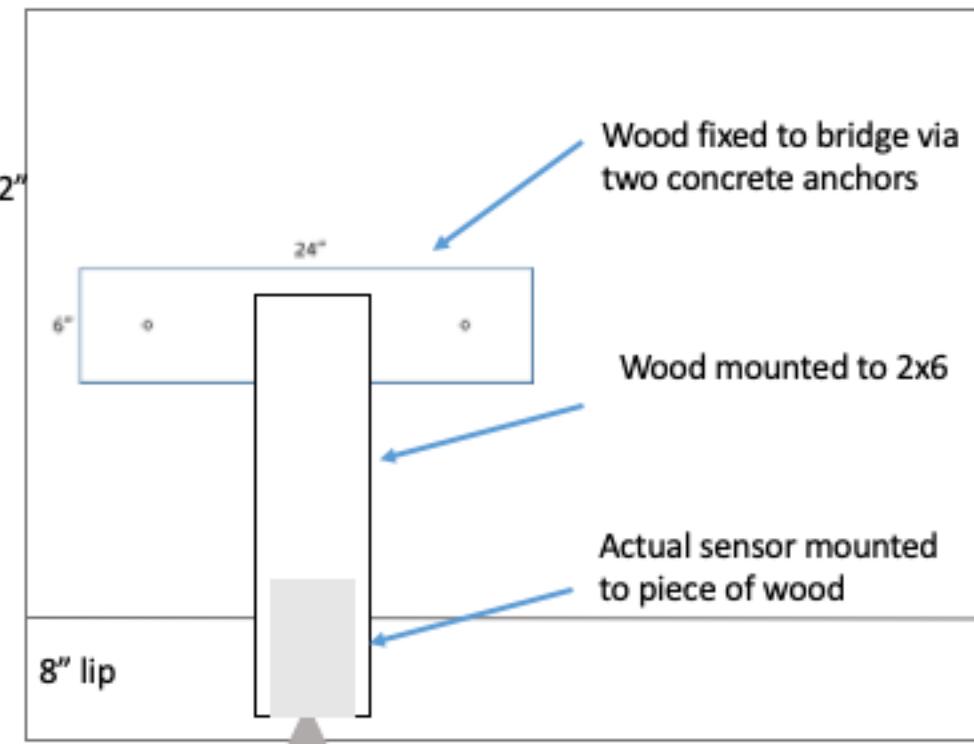


Pressure Treated Board Mounted to Bridge

Mounting methodology:

- Holes will be drilled approximately 18" above the lip
- Drill two holes in the bridge wall $\frac{3}{8}$ " diameter, 2" deep.
- Mount 2"x6"x24" pressure treated lumber to the bridge.
- Screw holes will be 16" apart, 4" from each end of the board.
- 5/16"x3" concrete anchors used to mount board to bridge wall
- All sensor equipment will be mounted to the board
- First hole will be approximately 77'4" measured from west to east on north side of bridge
- Second hole will be approximately 76' measured from west to east on north side of bridge

GDOT Approval!!!

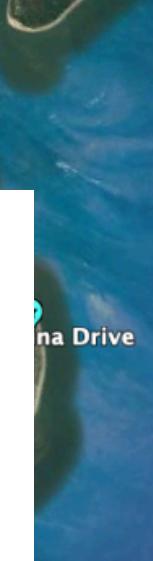




8 sensors
8 gateways

currently:
sea level, air temperature

planned:
seawater properties
air quality
inland flooding



goal: 100
sensors by
August

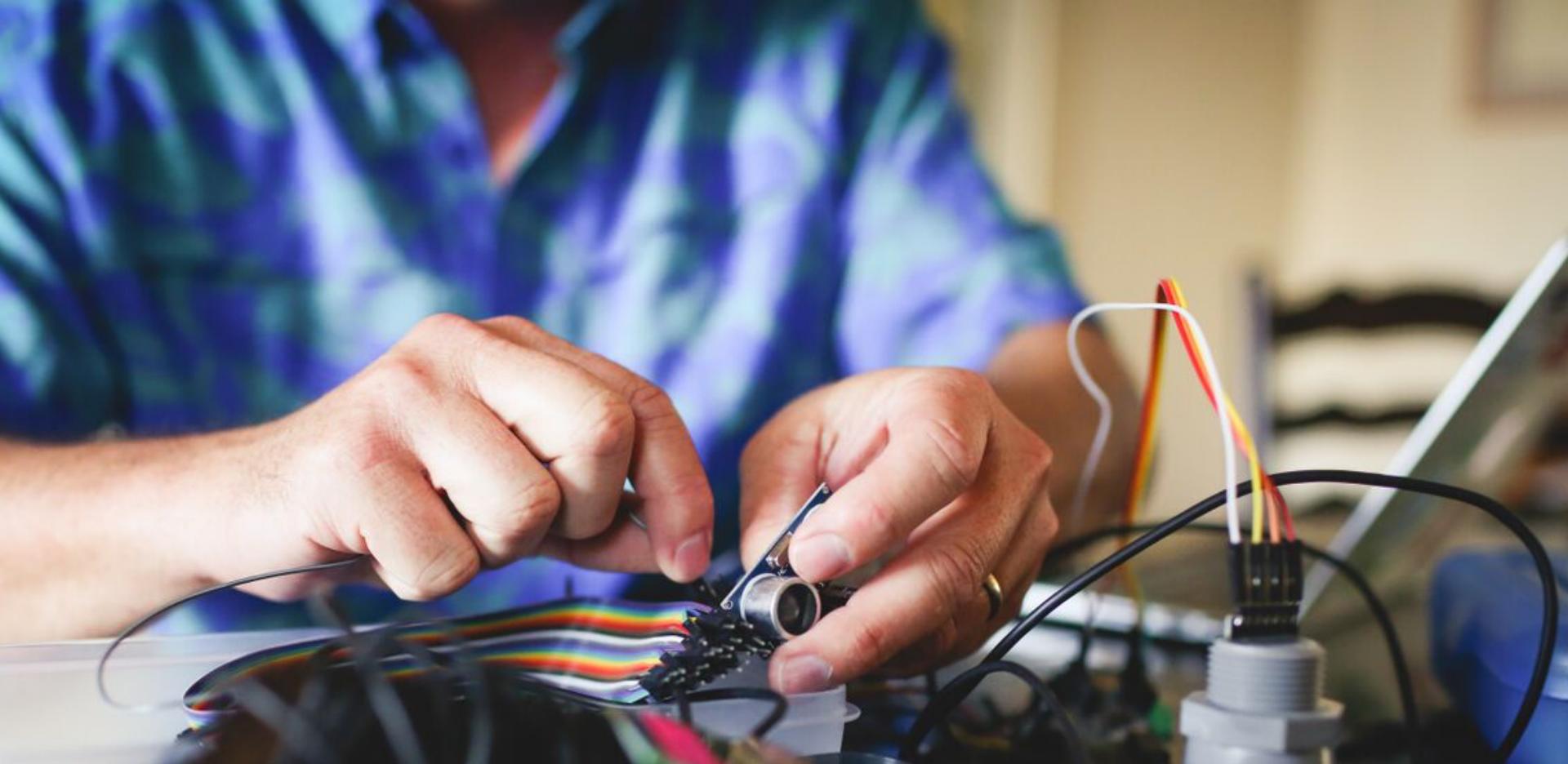




gateway device:

- roughly \$1,500
- 1 to 4 mile range
- can serve hundreds of sensors
- needs internet, power

goal:
provide backbone for
diverse IoT applications



benefits of GT-designed sensor:

- high precision (1mm)
- long battery life (3-5yrs)
- inexpensive (\$300)

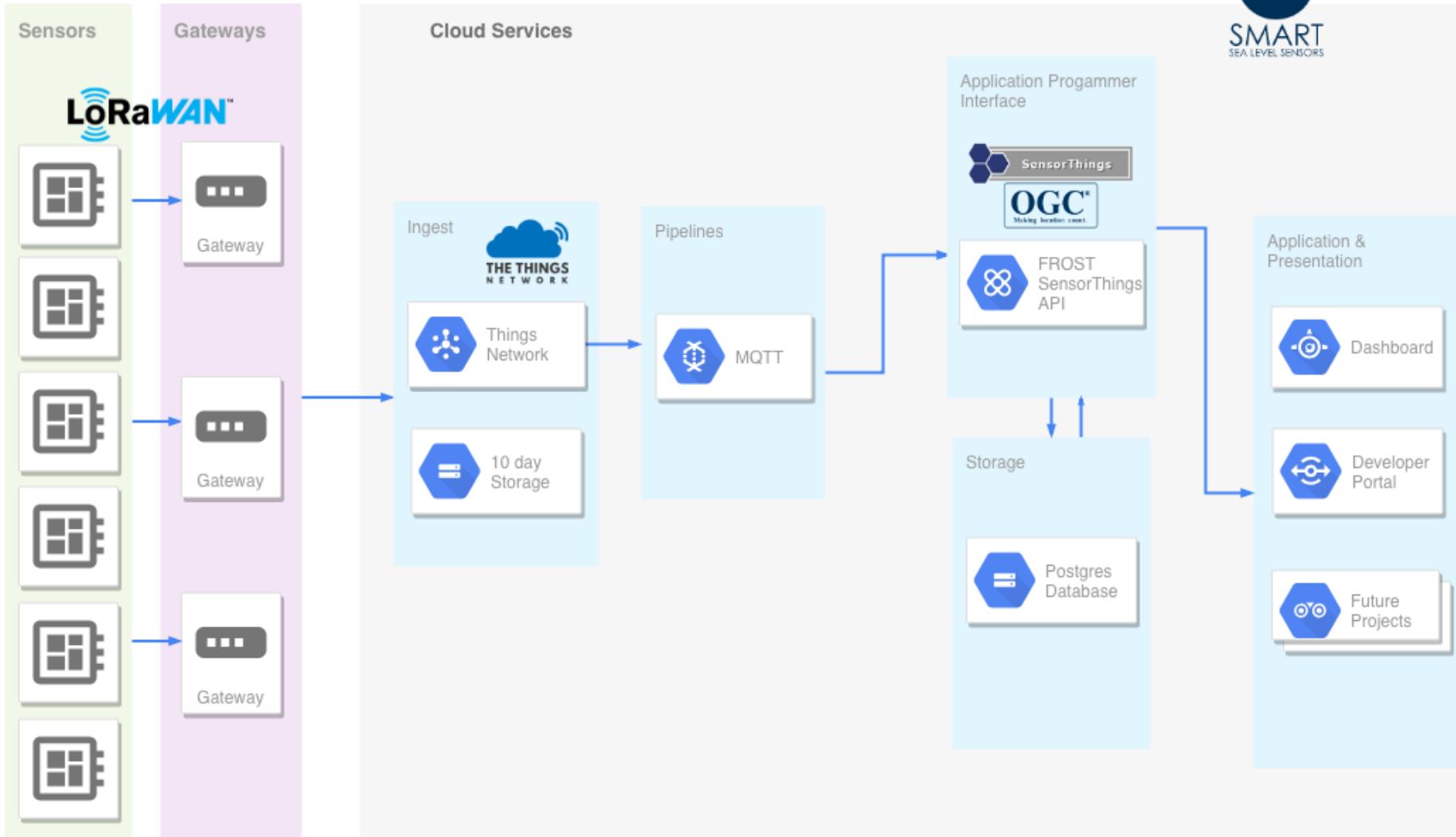
Sensor Assembly

Jenkins High School – 20 sensors to be assembled and tested
in February/March



API Development

Sea Level Sensors Application Architecture



API Development



Smart Sea Level Sensors API

An API for sea level sensors in Chatham County, GA

GET STARTED

Open access

Our network of sensors collect data on water level, air pressure, and air temperature, which is made available through the Smart Sea Level Sensors API.

Open standards

The Smart Sea Level Sensors API adheres to the OGC SensorThings API open standard, which provides a documented and expressive API to access sensor data.

API Development

Getting started

Getting started

Concepts

API reference

EDIT

Getting started

The Smart Sea Level Sensors API provides an easy way to retrieve measurements and metadata from sea level sensors deployed in Chatham County, GA. The API is built according to the OGC SensorThings API standard, which makes use of REST semantics and JSON encoding.

Quickstart

GET all sensors

```
$ curl 'https://api.sealevelsensors.org/v1.0/Things'
```

Example response

```
{
  "value": [
    {
      "name": "esp32-rfm95-scott-1",
      "description": "Skidaway Dock environmental sensors",
      "properties": {
        "sslsId": "esp32-rfm95-scott-1",
        "elevationNAVD88": "3.103"
      },
      "Datastreams@iot.navigationLink": "https://api.sealevelsensors.org/v1.0/Things(1)",
      "MultiDatastreams@iot.navigationLink": "https://api.sealevelsensors.org/v1.0/Things(1)/MultiDatastreams@iot.navigationLink",
      "Locations@iot.navigationLink": "https://api.sealevelsensors.org/v1.0/Things(1)/Locations@iot.navigationLink",
      "HistoricalLocations@iot.navigationLink": "https://api.sealevelsensors.org/v1.0/Things(1)/HistoricalLocations@iot.navigationLink",
      "@iot.id": 1,
      "@iot.selfLink": "https://api.sealevelsensors.org/v1.0/Things(1)"
    }
  ]
}
```

Dashboard Demonstration

BERA Dashboard

Map Settings

Search Go

Sensor Stations

Skidaway Dock environmental sensors	1 Stream
Hutchinson Island environmental sensors	1 Stream
Kilkenny Creek environmental sensors	3 Streams
Bull River Marina environmental sensors	3 Streams
Coffee Bluff Marina environmental sensors	3 Streams

The map displays the Savannah River and its tributaries, including the Skidaway River, Talmadge Creek, Bull River, and Kilkenny Creek. It shows the locations of various sensor stations, such as Skidaway Dock, Hutchinson Island, Kilkenny Creek, Bull River Marina, and Coffee Bluff Marina. The map also includes major roads like US 17, GA 25, GA 26, GA 21, and GA 204, along with state and local highways. The river network is shown in blue, with arrows indicating the direction of water flow. The map is overlaid with a grid, likely representing a digital elevation model or a specific monitoring grid.

Dashboard Demonstration

Coffee Bluff Marina environmental sensors

ID
7

Location Description
Coffee Bluff Marina

Properties

```
{  
  "sslsId": "gt-envsense-001",  
  "elevationNAVD88": "2.4",  
  "notes": "Installed on wooden dock of city park adjacent to the marir  
}
```

[API Link](#)



Leaflet | © OpenStreetMap contributors

Time Range

Sun Jan 20 2019 20:40:59 GMT-0500 to Sun Jan 27 2019 20:40:59 GMT-0500

Datastream of vertical distance measurements from the sensor to the surface of the water

[API Link](#)

1519 Observations



[Details](#)

[Download CSV](#)

Stat	Value
Last	2.237 m
Min	1.276 m
Max	4.473 m
Average	2.7695 m



Integrated Coastal Ocean Modeling and Forecasting

Emanuele Di Lorenz





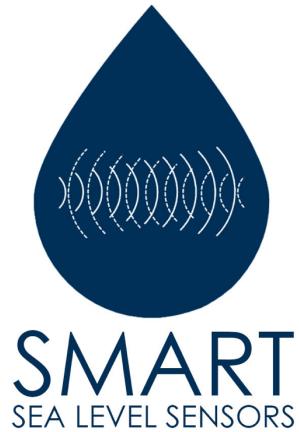
Integrated Coastal Ocean Modeling and Forecasting

Emanuele Di Lorenz



Sea Level Science Education for a Changing Climate

Jayma Koval &
Alex Robel



Week-long Phenomena Based Learning curriculum for 6th grade Earth Science

- **Topics covered:**
 - Science: Tides, sea level rise, coastal flooding, climate change
 - Math: Statistics and Probability
- **Leverages:**
 - Smart Sea Level Sensors Project- perfect intersection of science/technology/society
 - Authentic Smart Sea Level Sensors data for data visualization exercises & data analysis
 - Georgia Climate Stories videos
 - NASA-JPL activities on sea-level rise
- **Implementation:**
 - April-May 2019 at Oglethorpe Charter School, revisions summer 2019

Sensor Data applications and visualization

Lalith Polepeddi

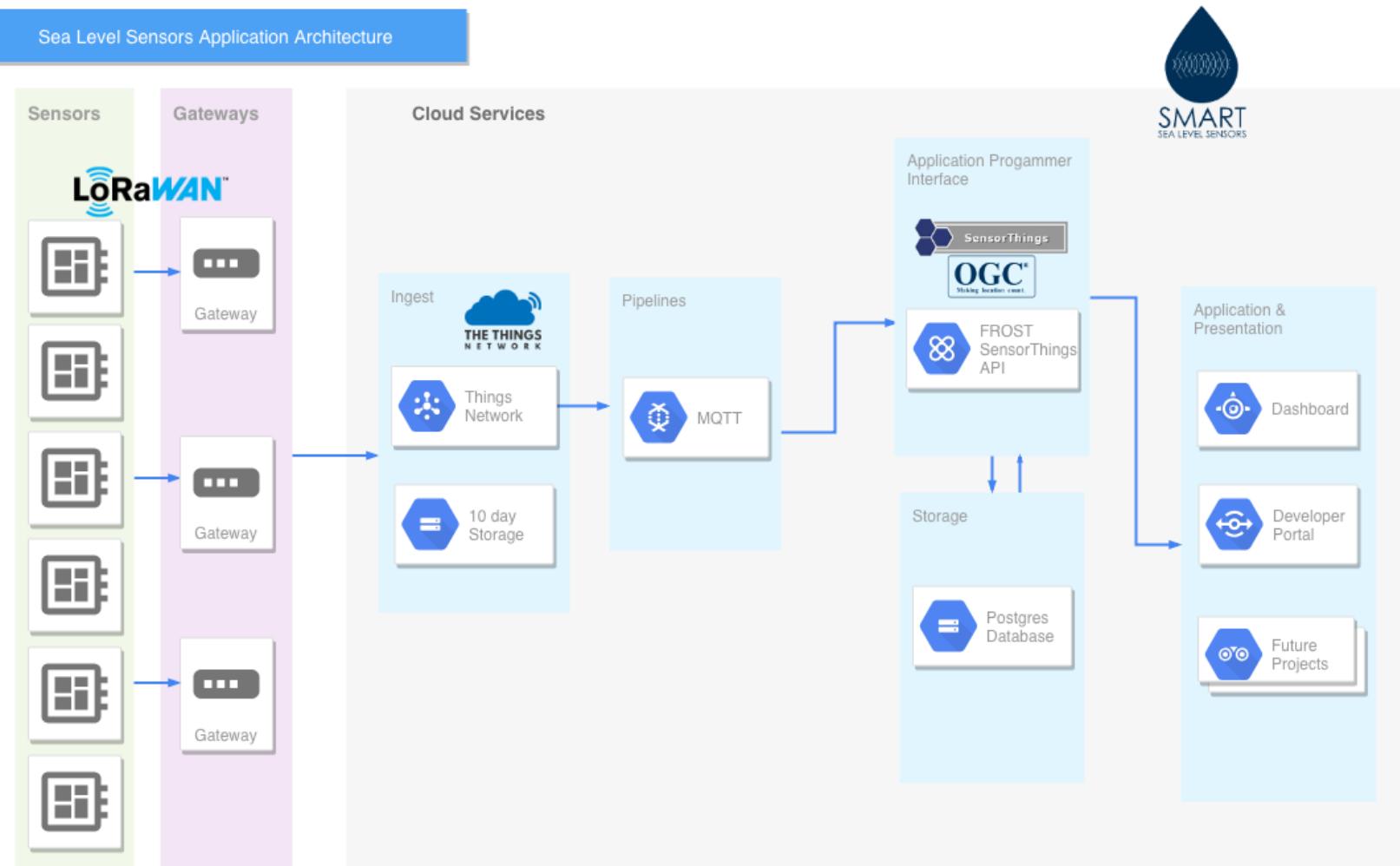


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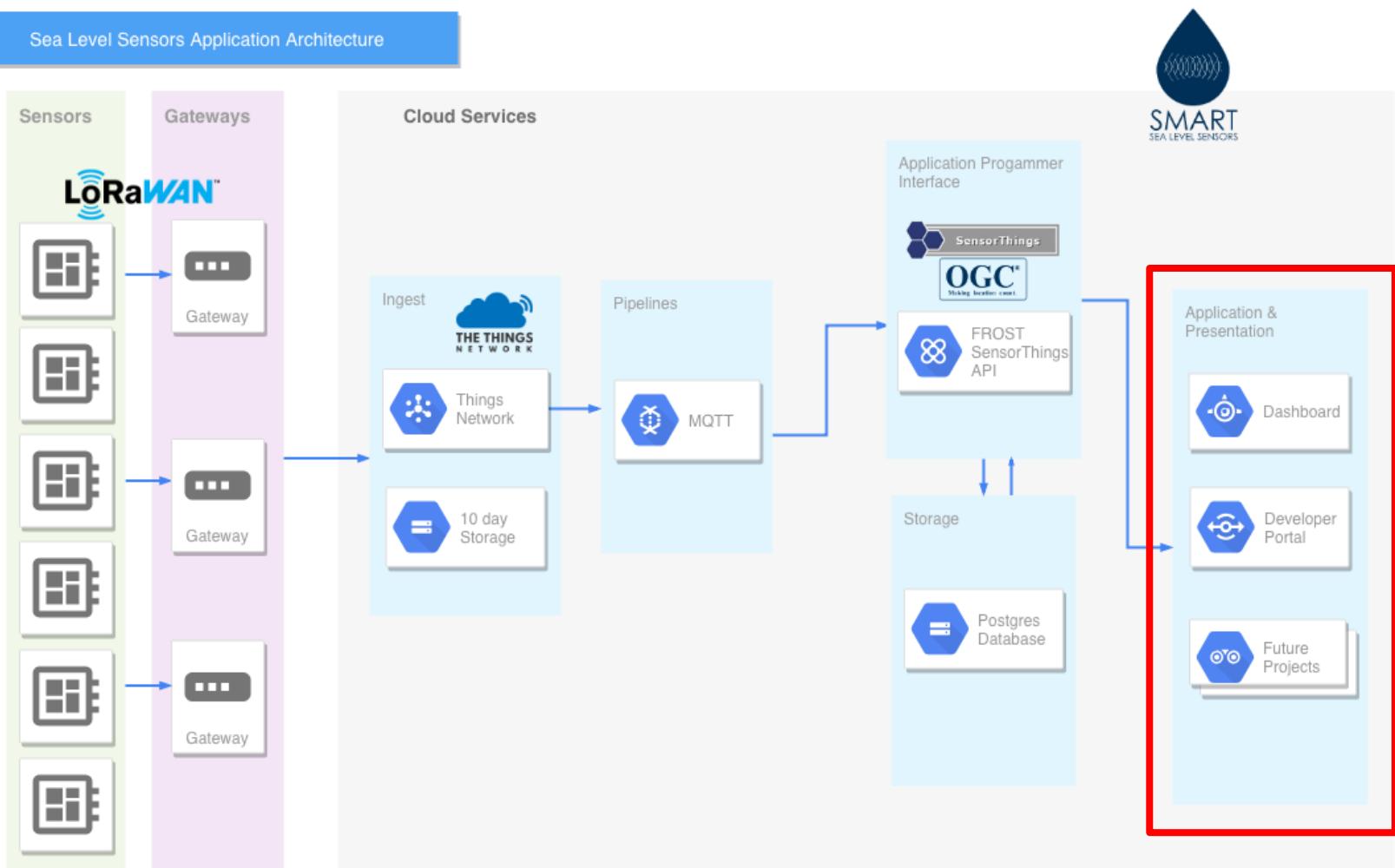


GEORGIA SMART
COMMUNITIES CHALLENGE

Sea Level Sensors Application Architecture



Sea Level Sensors Application Architecture



Interactive map that visualizes sensor data over time

Dashboard x +

https://www.sandraisawesome.com

Savannah

MAP LAYERS

- Sensors**
A description of this layer goes here
- Inundation**
A description of this layer goes here
- Predicted risk**
A description of this layer goes here

MAP LEGEND

- Color 1
- Color 2
- Color 3

SENSOR 832

Chart title 1

Time	Value
08:00	100
09:00	110
10:00	95
11:00	105
12:00	100
13:00	105
14:00	110
15:00	100
16:00	105
17:00	110
18:00	100
19:00	105
20:00	110
21:00	100
22:00	105
23:00	110
00:00	100
01:00	105
02:00	110
03:00	100
04:00	105
05:00	110
06:00	100
07:00	105
08:00	110

Chart title 2

Time	Value
08:00	100
09:00	110
10:00	95
11:00	105
12:00	100
13:00	105
14:00	110
15:00	100
16:00	105
17:00	110
18:00	100
19:00	105
20:00	110
21:00	100
22:00	105
23:00	110
00:00	100
01:00	105
02:00	110
03:00	100
04:00	105
05:00	110
06:00	100
07:00	105
08:00	110

Chart title 3

Time	Value
08:00	100
09:00	110
10:00	95
11:00	105
12:00	100
13:00	105
14:00	110
15:00	100
16:00	105
17:00	110
18:00	100
19:00	105
20:00	110
21:00	100
22:00	105
23:00	110
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04:00	105
05:00	110
06:00	100
07:00	105
08:00	110

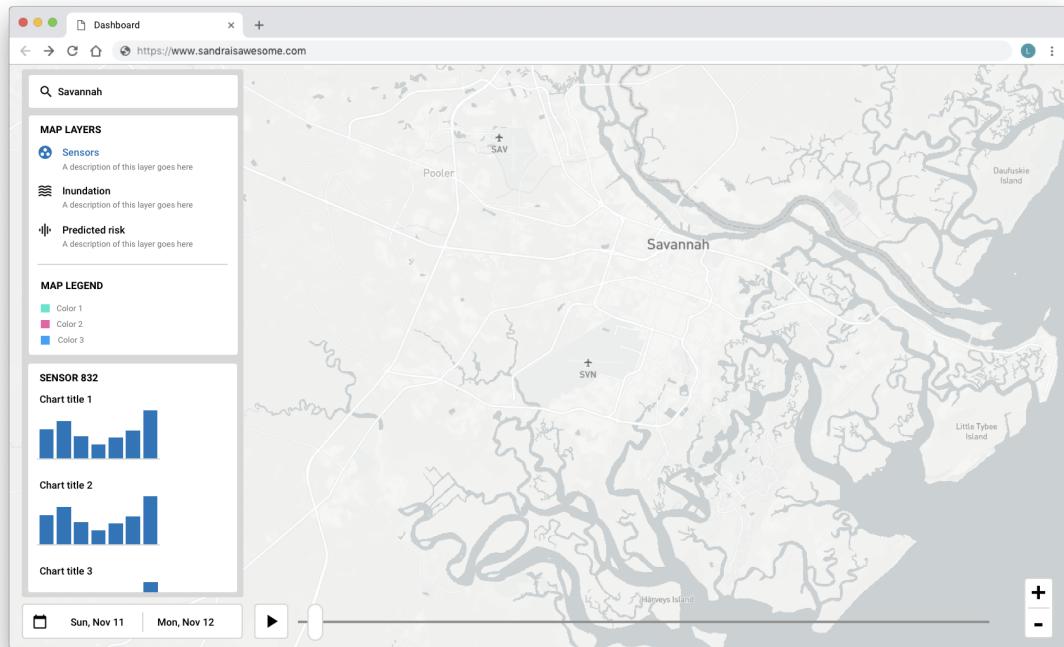
Sun, Nov 11 Mon, Nov 12

+

-

The map displays the city of Savannah, Georgia, along with surrounding areas like Pooler, Daufuskie Island, and Little Tybee Island. A legend indicates three sensor layers: Sensors (blue dots), Inundation (wavy lines), and Predicted risk (shaded areas). The sidebar contains three bar charts for Sensor 832, each with three data series: Color 1 (light blue), Color 2 (medium blue), and Color 3 (dark blue). The charts show data points for every hour from 08:00 to 08:00 the next day. Below the charts is a timeline showing 'Sun, Nov 11' and 'Mon, Nov 12' with navigation arrows. A zoom control is located in the bottom right corner.

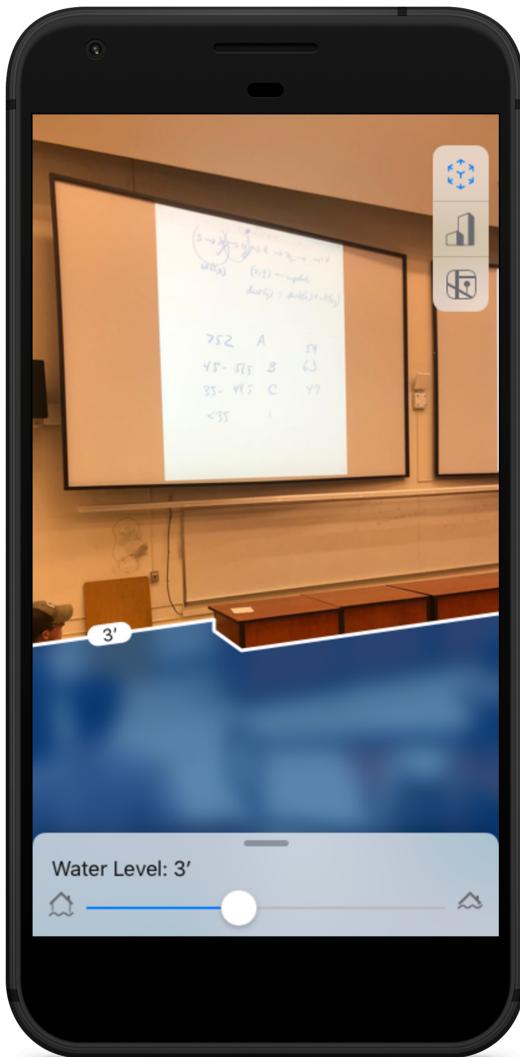
Interactive map that visualizes sensor data over time



Roadmap

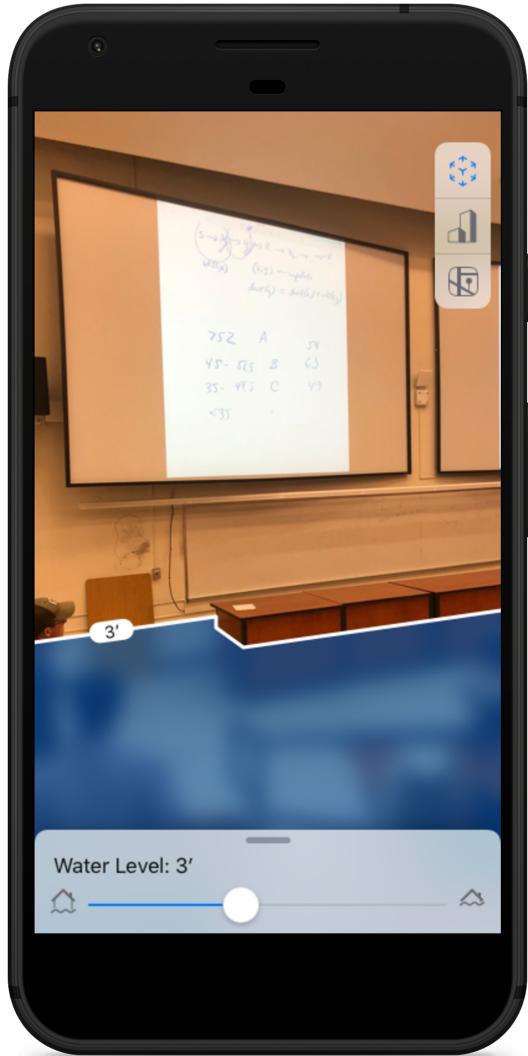
- Add sensor data layer
- Visualize sensor measurements in charts
- Play back sensor measurements over time
- Combine sensor measurements and altitude data to calculate inundation
- Enable other services to be added as layers

Mobile app that visualizes flood risk scenarios using augmented reality



[Demo](#)

Mobile app that visualizes flood risk scenarios using augmented reality



Roadmap

- Adjust AR water level
- View historical storms
- Change location
- View water level in aerial flyover mode

Help shape the future of these apps

Sign up at bit.ly/sensor-apps

Talk to us about other tools / apps that would be useful

Check out dev.sealevelsensors.org