Smart Sea Level Sensors

Chatham County

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Georgia Tech
CREATING THE NEXT

SMART
SEA LEVEL SENSORS

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CHATHAM COUNTY

GEORGIA SMART
COMMUNITIES CHALLENGE

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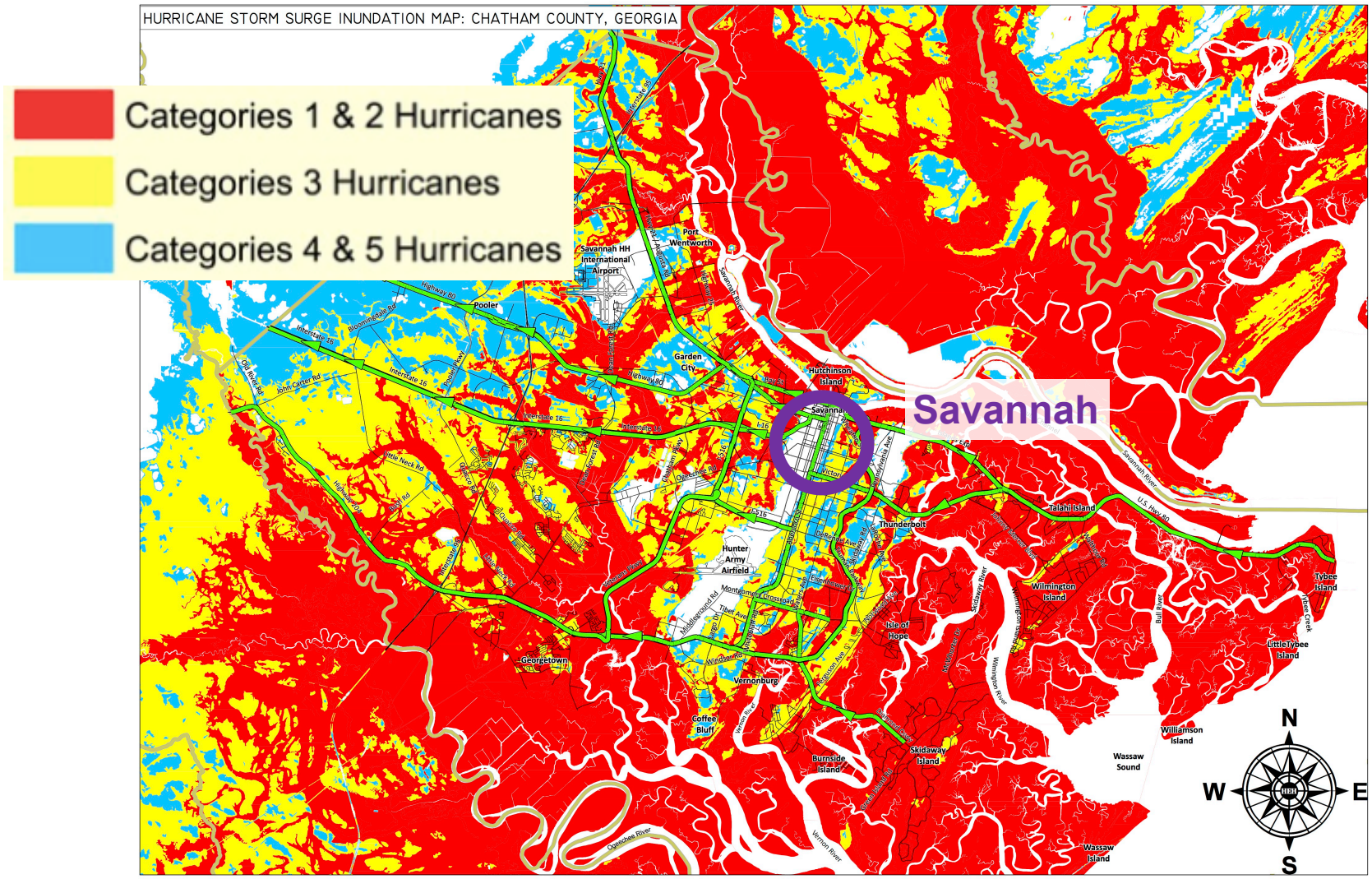
savannahga.gov

Coastal flooding – a current threat



https://www.chathamemergency.org/storm-surge-impact-by-category.php

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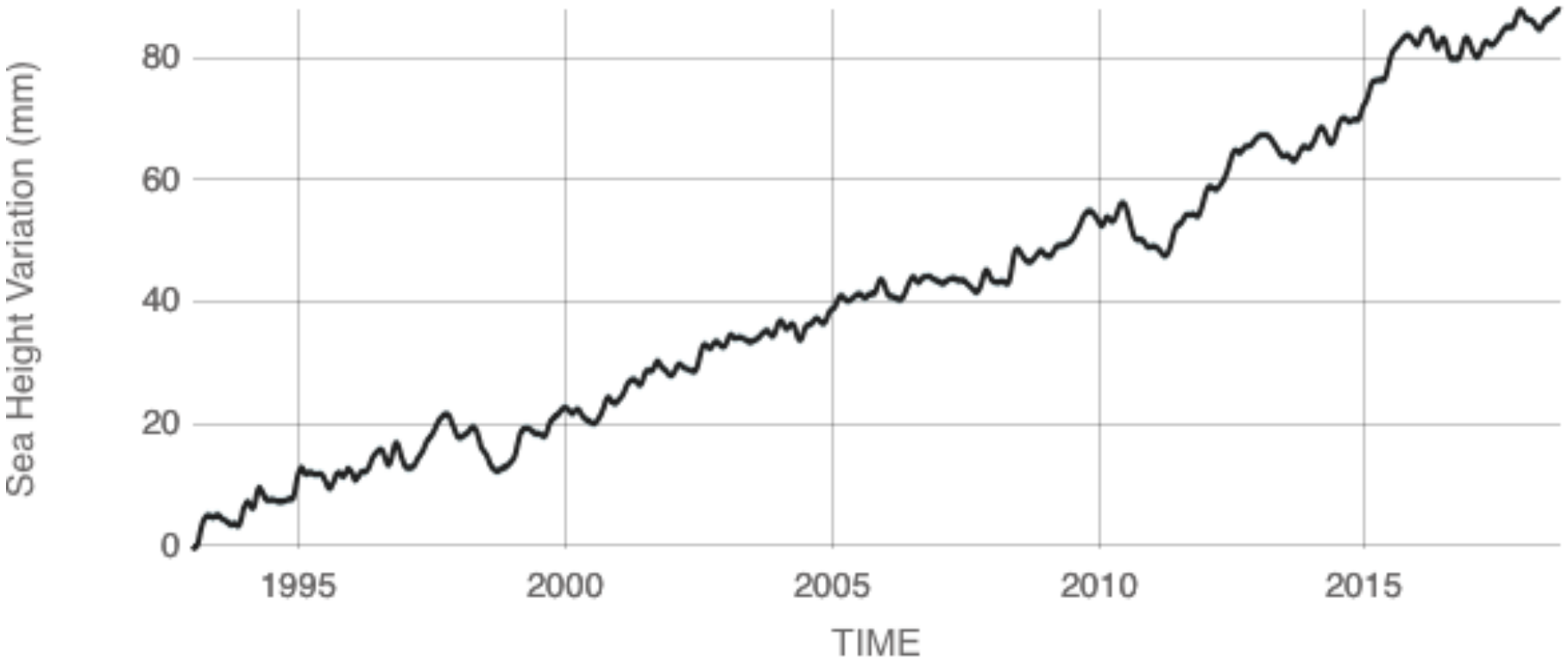
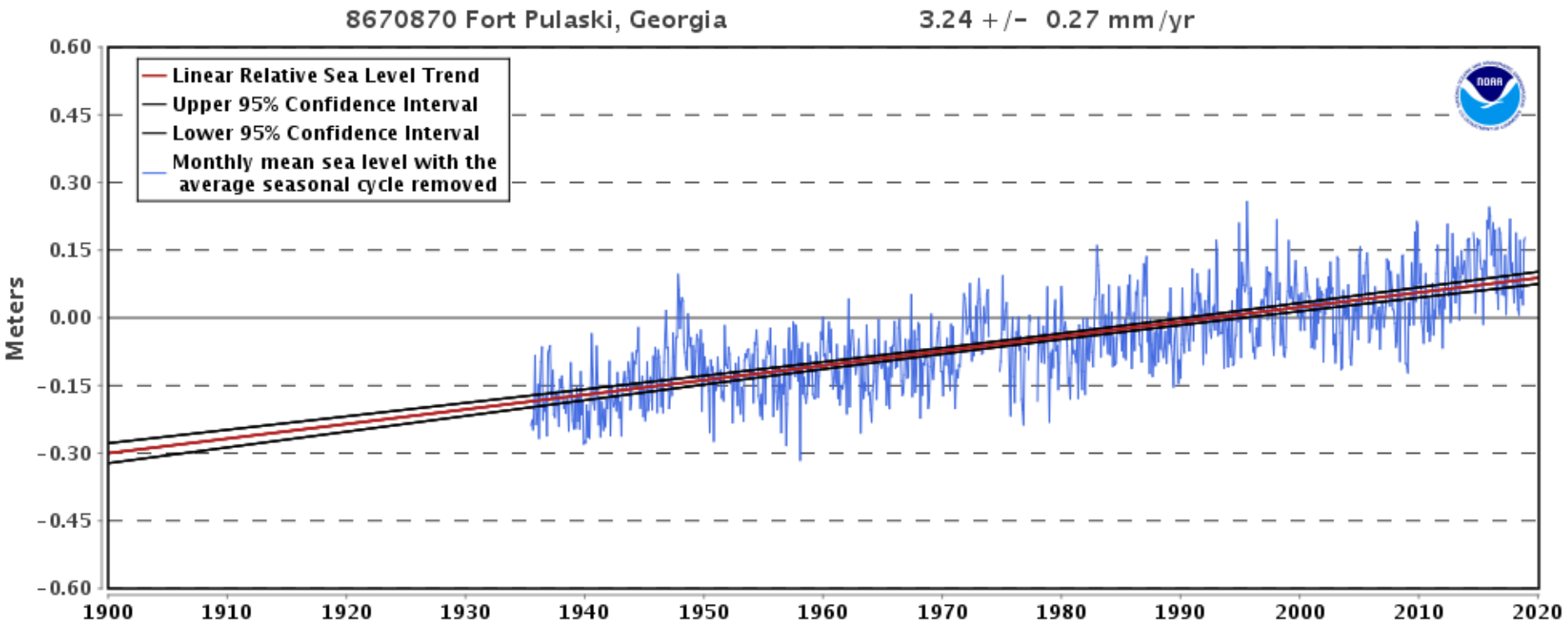
Sea level rise – a growing threat



Source: climate.nasa.gov

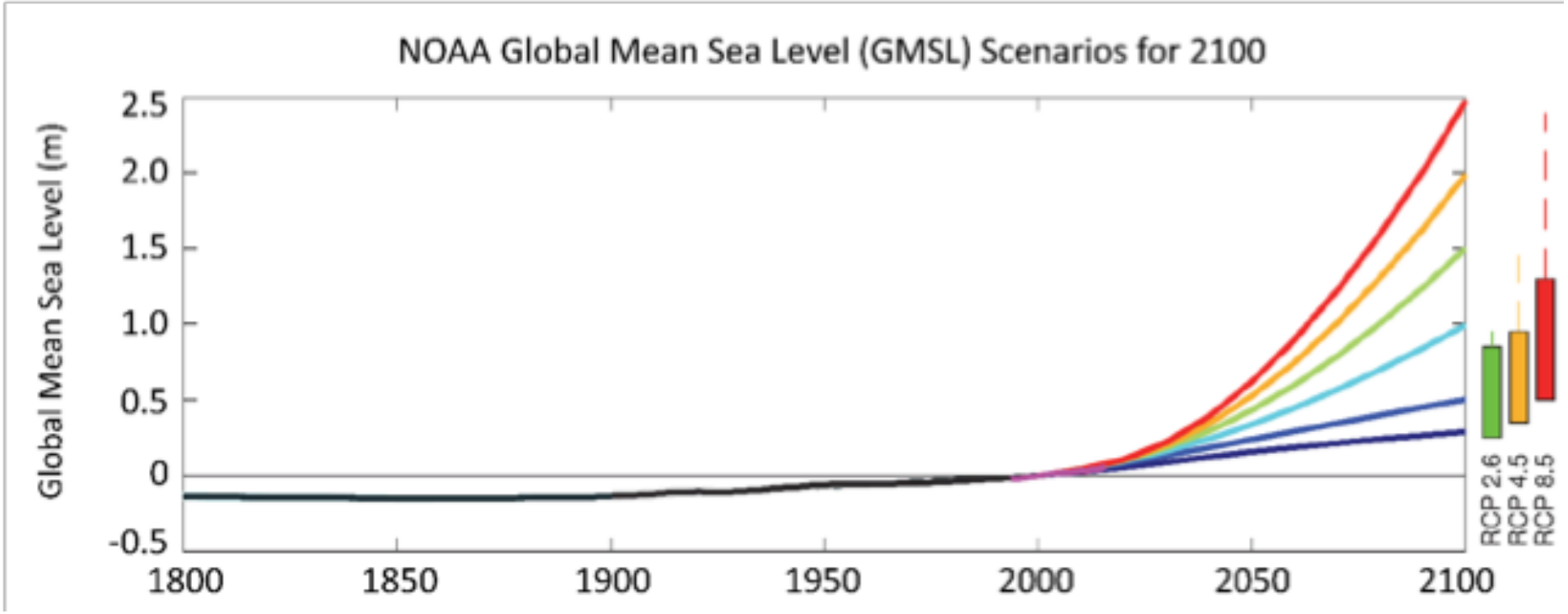
current rate of sea level rise = +3.2 mm/yr
→ in 100yrs, +320mm (or 12”) minimum

Ft. Pulaski - Georgia's only NOAA tide gauge



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

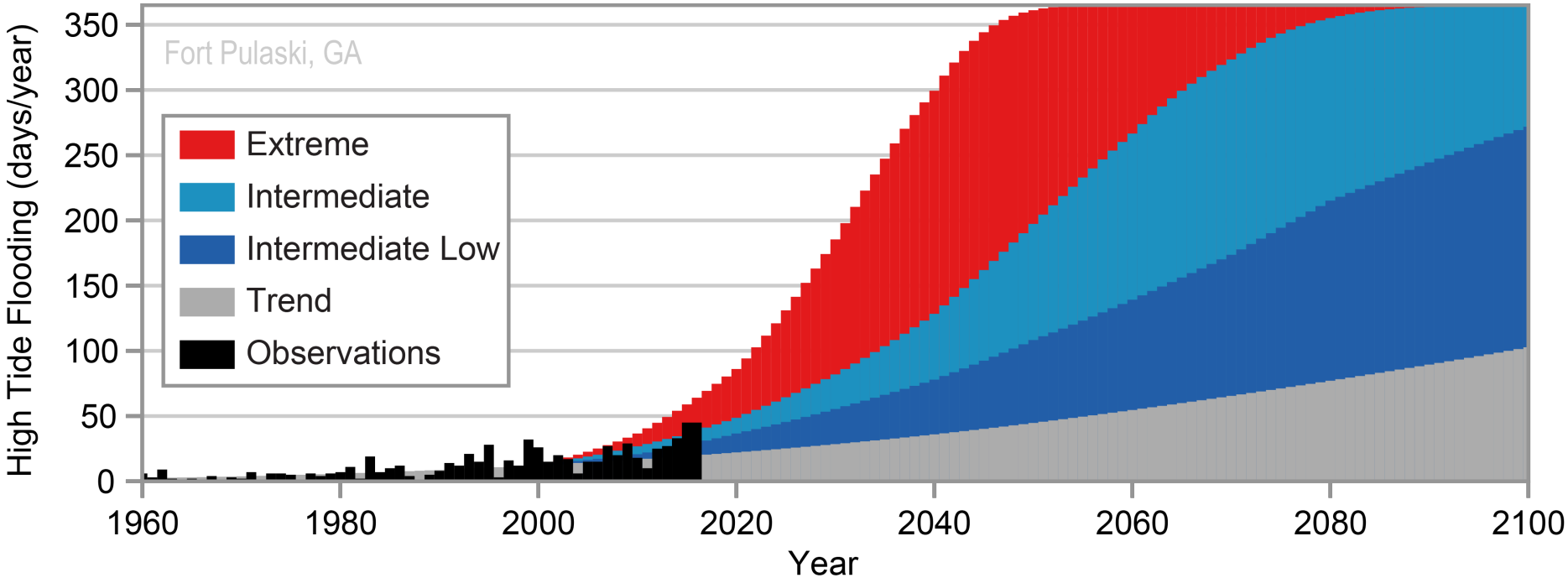
Global sea level rise scenarios



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

Sweet et al., 2017
https://nca2018.globalchange.gov/chapter/19/

Ft. Pulaski – flooding becoming more frequent



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

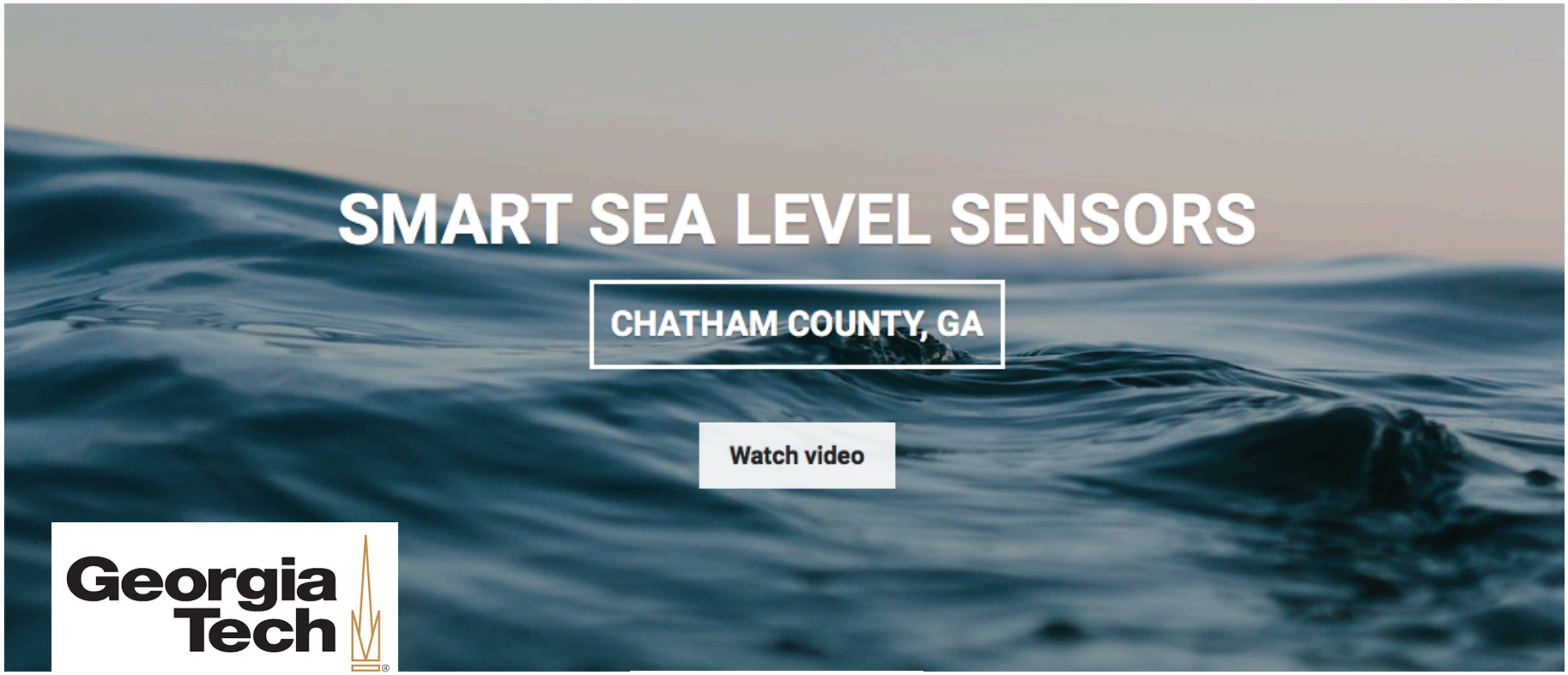
Sweet et al., 2017
https://nca2018.globalchange.gov/chapter/19/

“Blue sky flooding”

Savannah,
Nov 24, 2018

photo by Russ Clark

http://sealevelsensors.org



Georgia Tech

Dr. Kim Cobb
Dr. Russ Clark
Dr. Emanuele Di Lorenzo
Dr. David Frost
Lalith Polepeddi
Tim Cone (GT-Savannah)
Jayma Koval

EMERGENCY MANAGEMENT CHATHAM COUNTY

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

<u>Stakeholder engagement</u>:
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

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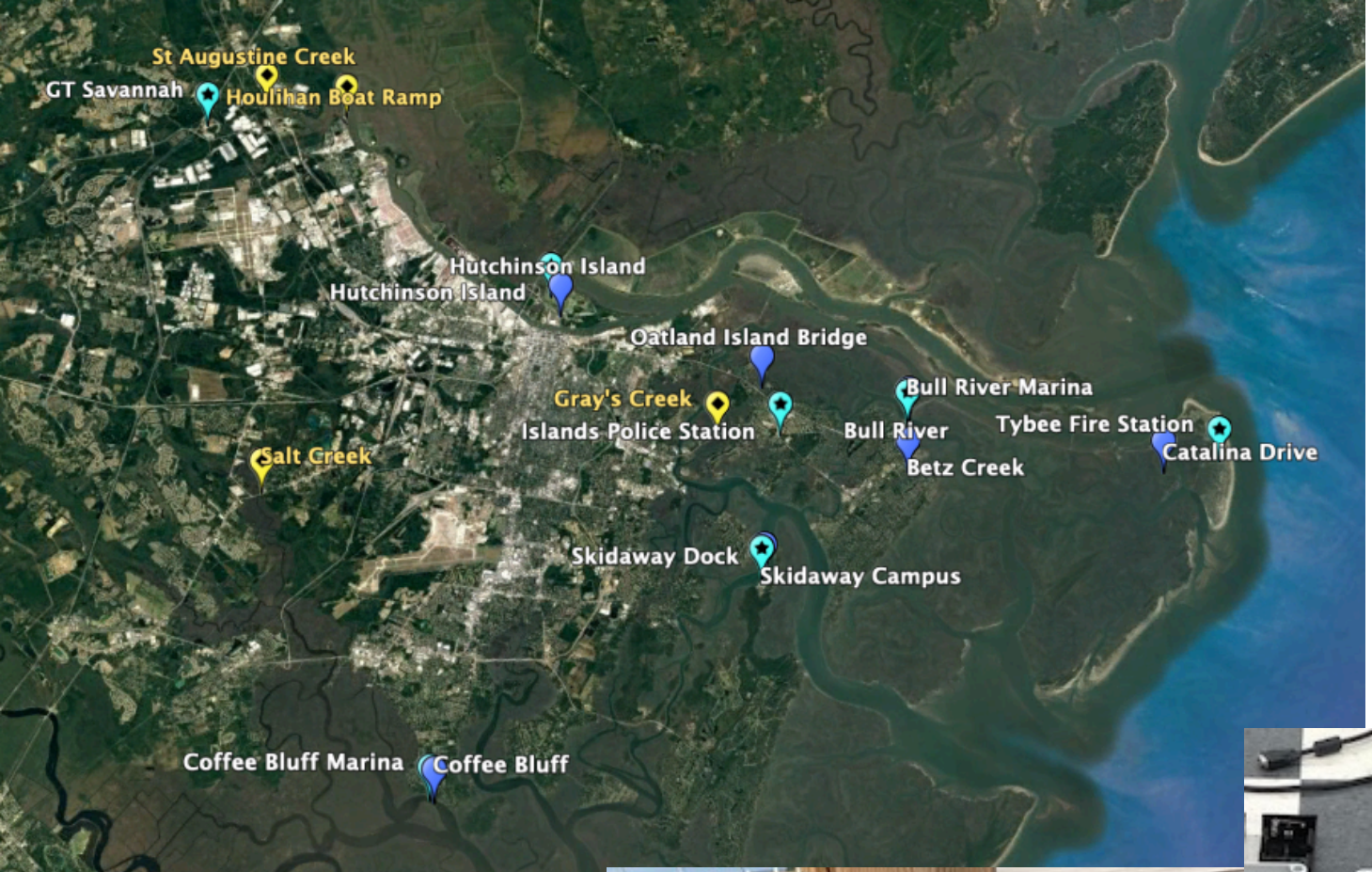

8+4 sensors
8 gateways
30 sensors in production

<u>Still target</u>:
100 sensors by August

GDOT Approval!!!

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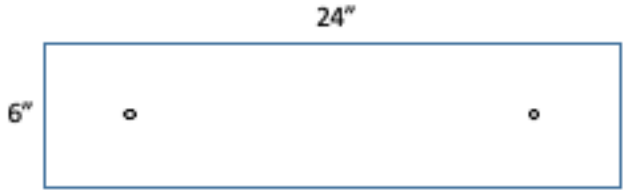


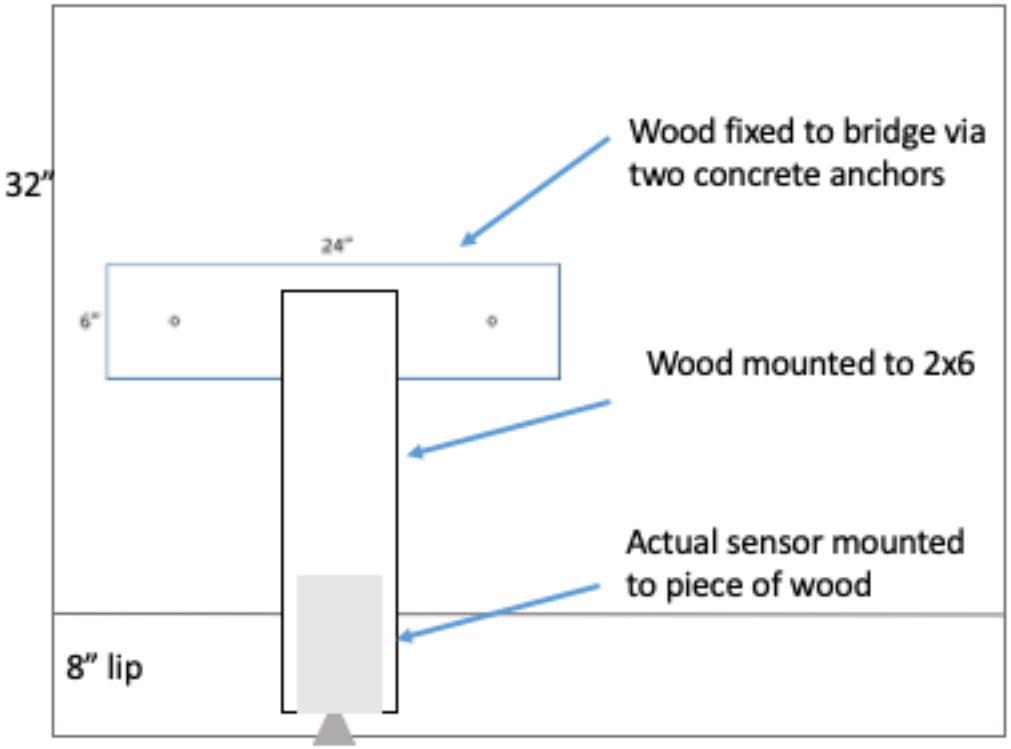
Pressure Treated Board Mounted to Bridge

Mounting methodology:

- Holes will be drilled approximately 18" above the lip
- Drill two holes in the bridge wall ¾" 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 boarc

- 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!!!



Production model of sensor

currently:
sea level, air temperature

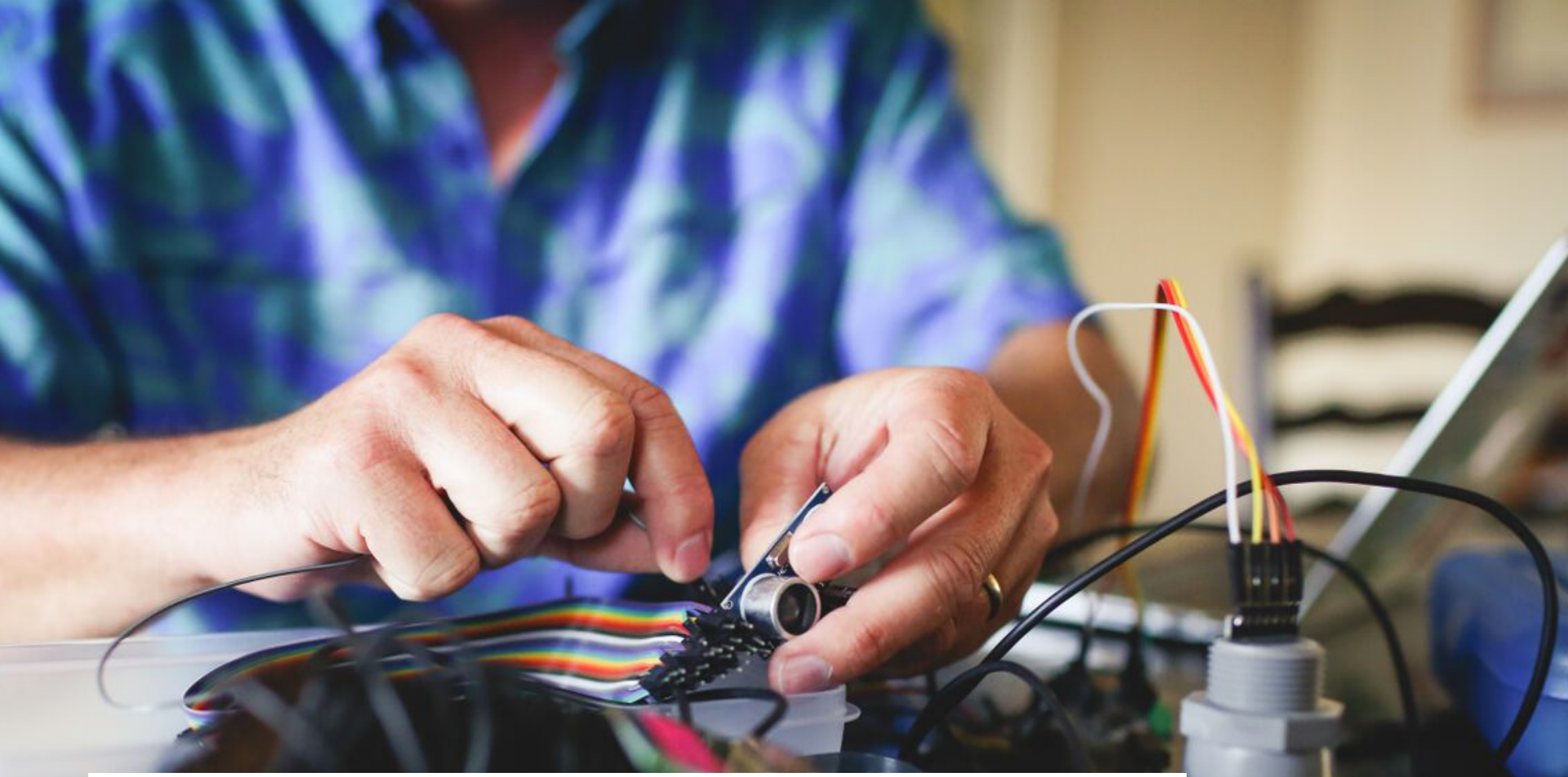
planned:
seawater properties
air quality
inland flooding

8 sensors
8 gateways

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

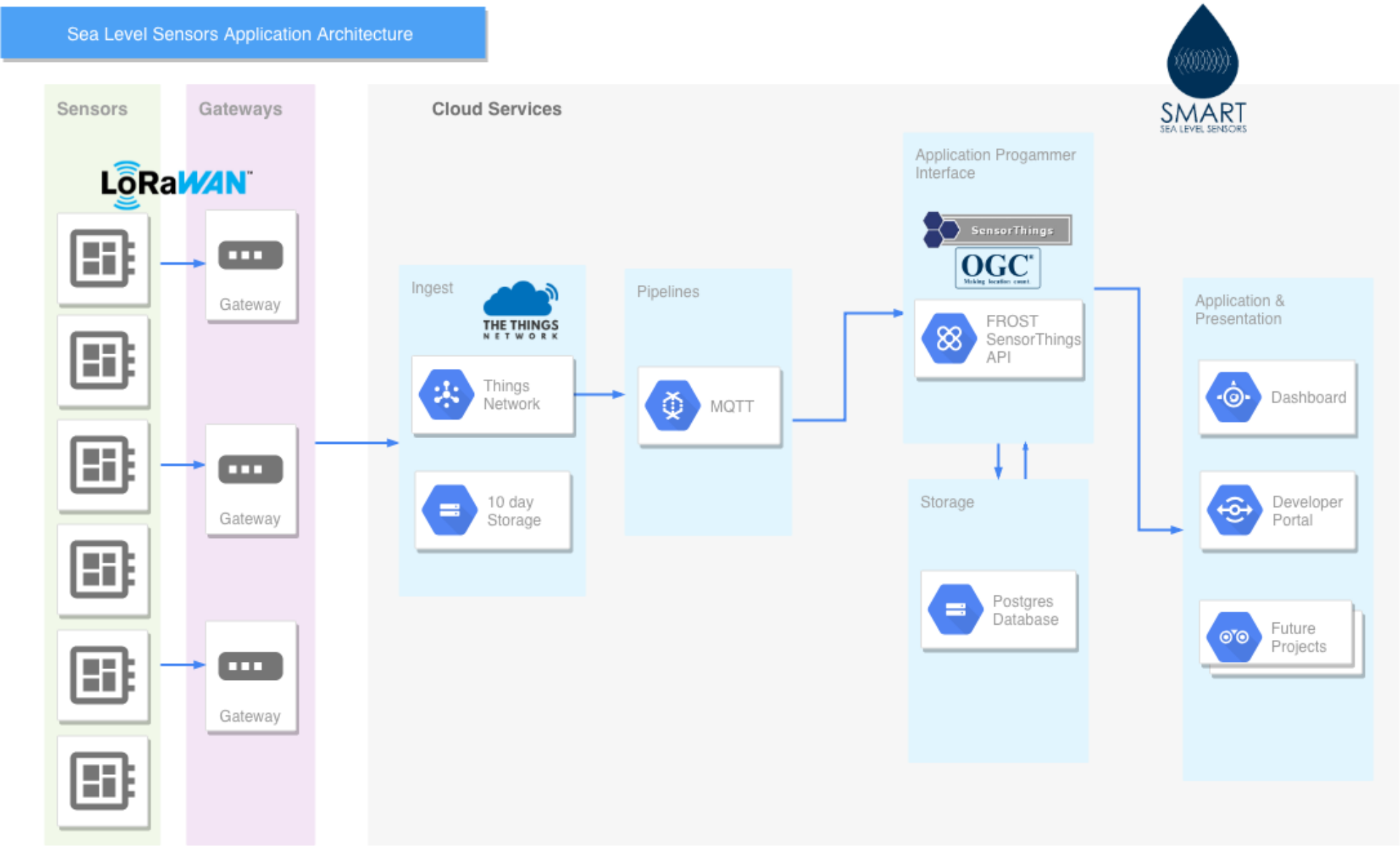


benefits of GT-designed sensor:
high precision (1mm)
long battery life (3-5yrs)
inexpensive ($300)

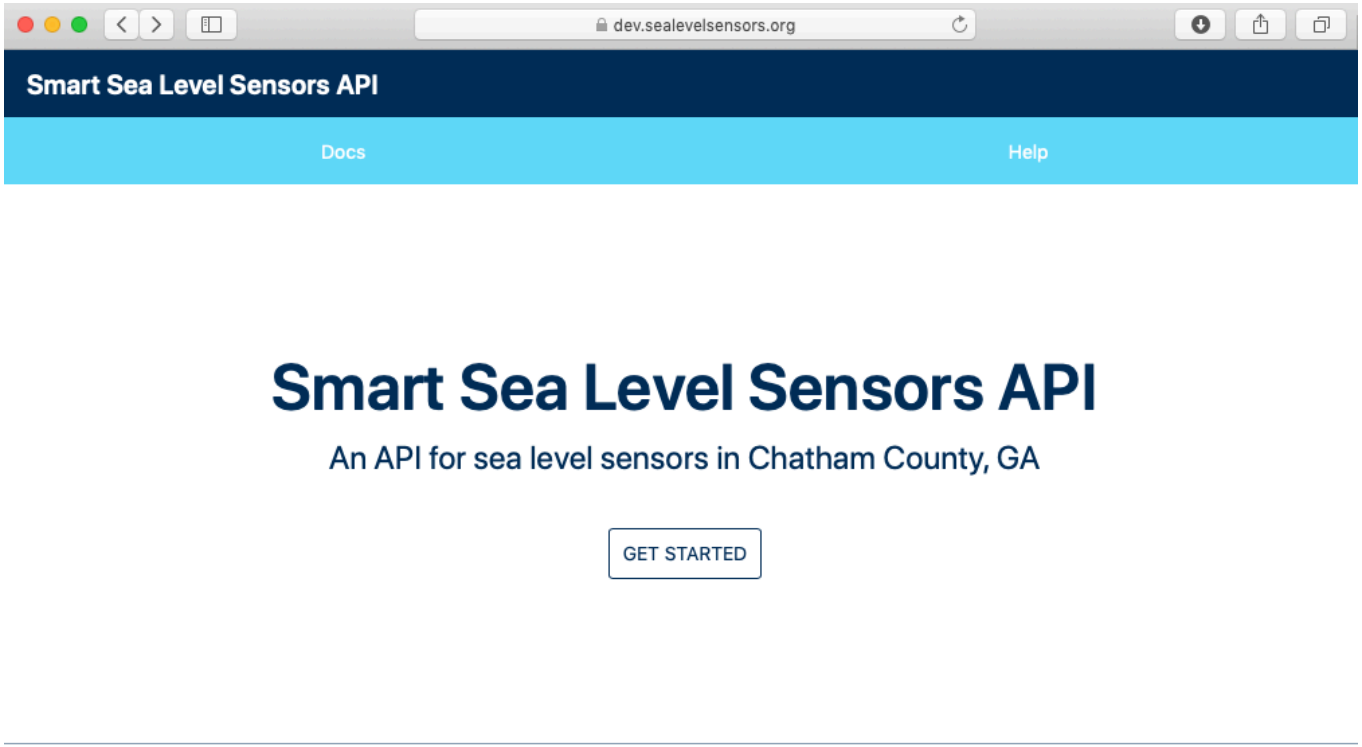
Sensor Assembly

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

API Development



API Development



API Development

Getting started

EDIT

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

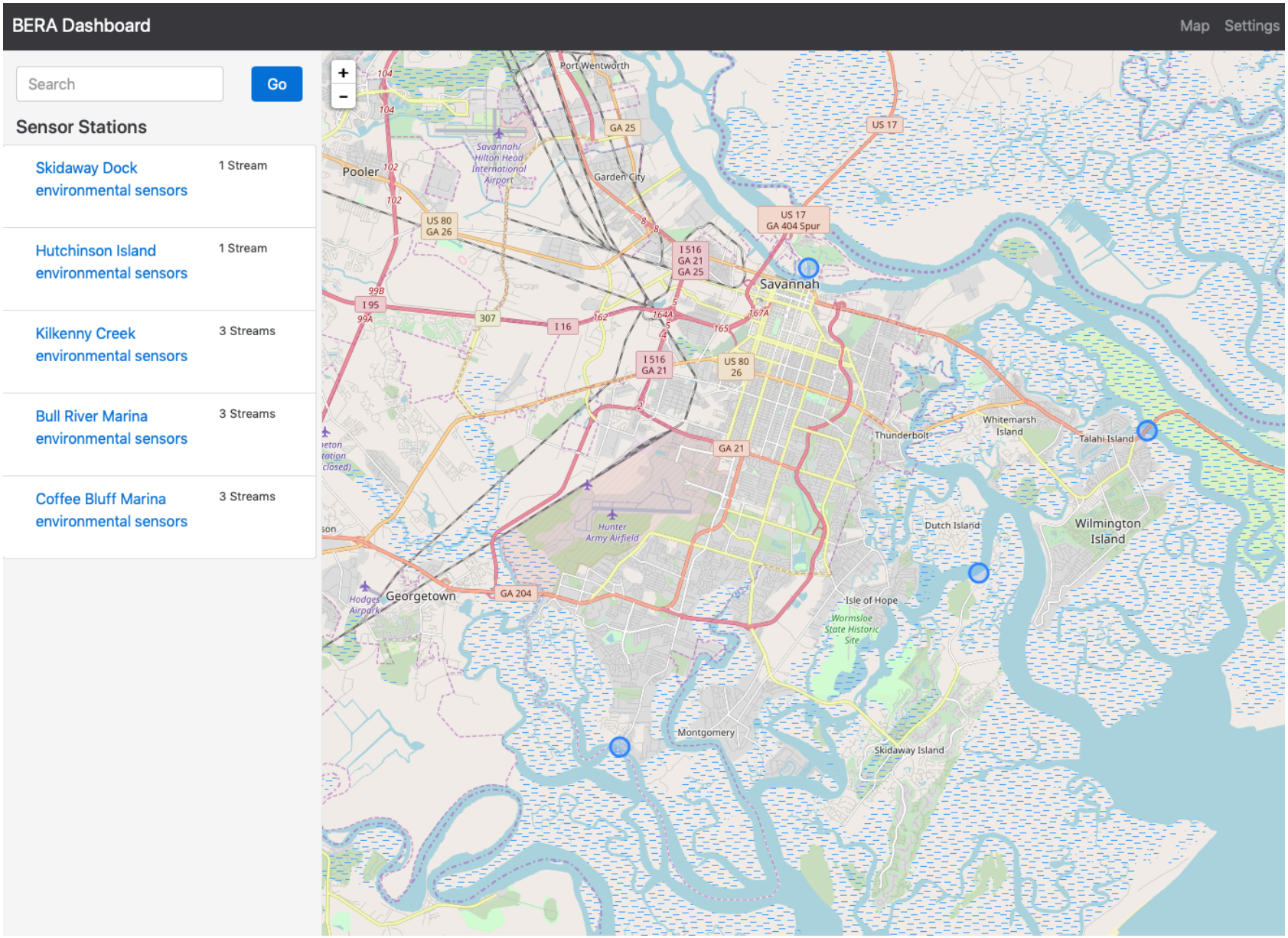
`GET` all sensors

```
$ 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/Thi
      "Locations@iot.navigationLink": "https://api.sealevelsensors.org/v1.0/Things(1)/
      "HistoricalLocations@iot.navigationLink": "https://api.sealevelsensors.org/v1.0/
      "@iot.id": 1,
      "@iot.selfLink": "https://api.sealevelsensors.org/v1.0/Things(1)"
    },
```

Dashboard Demonstration



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
}
```

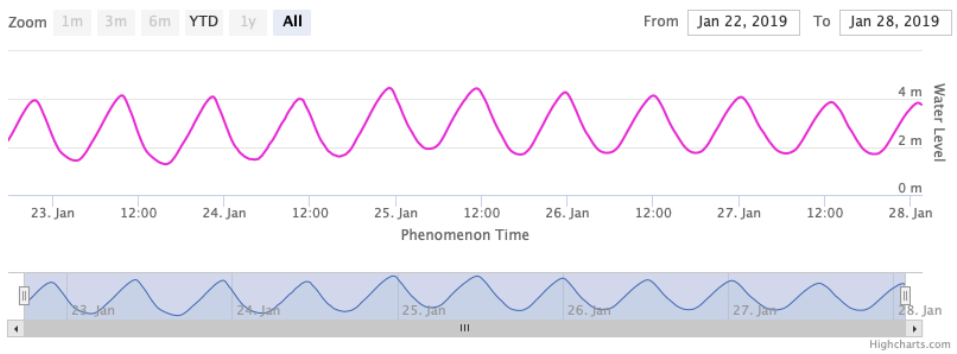

API Link

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



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

Details Download CSV

Integrated Coastal Ocean Modeling and Forecasting

Emanuele Di Lorenz

Georgia Tech

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Sea Level Science Education for a Changing Climate

Jayma Koval &
Alex Robel

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

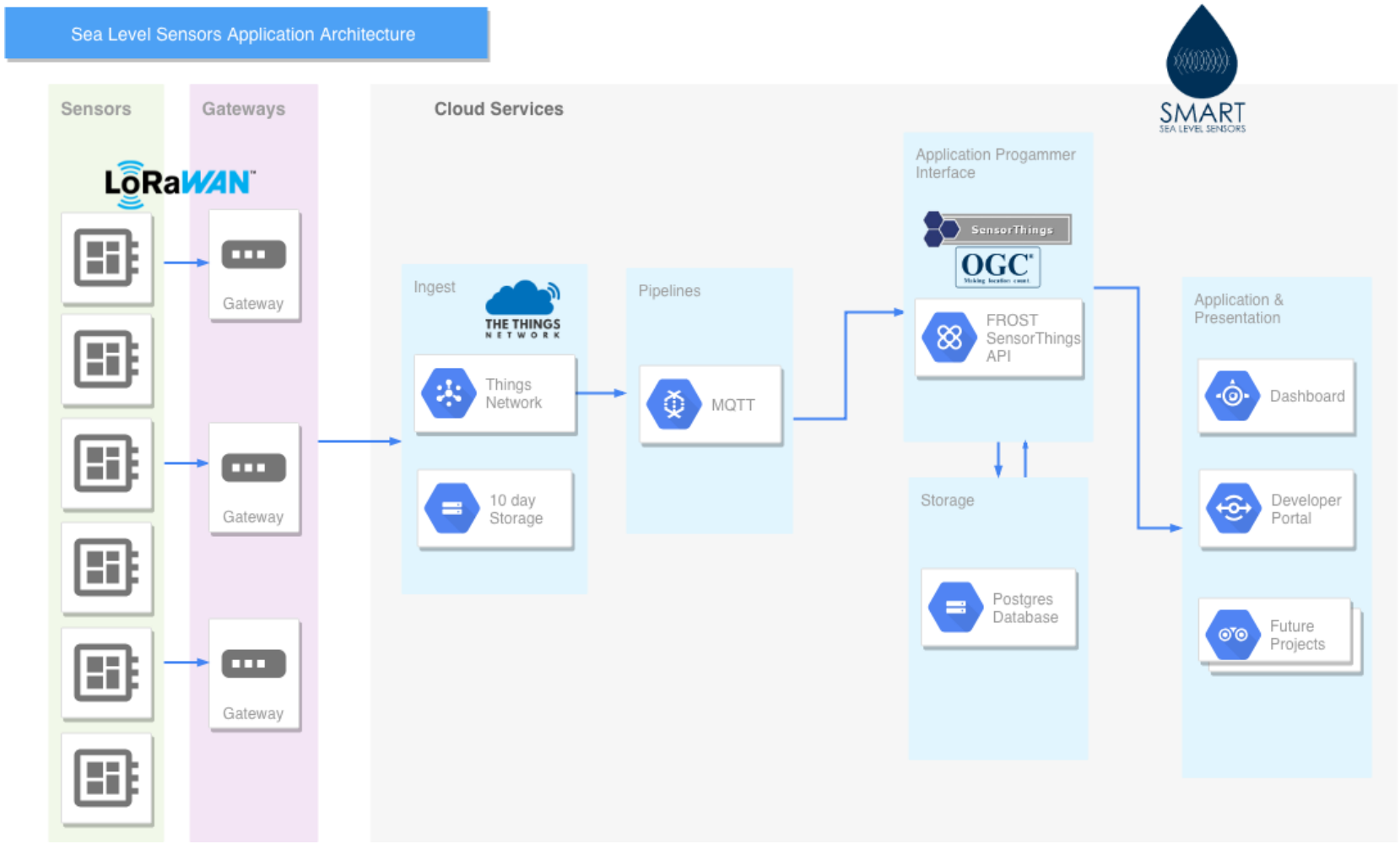
- **Topics covered:**
  - Science: Tides, sea level rise, coastal flooding, climate change
  - Math: Statistics and Probability

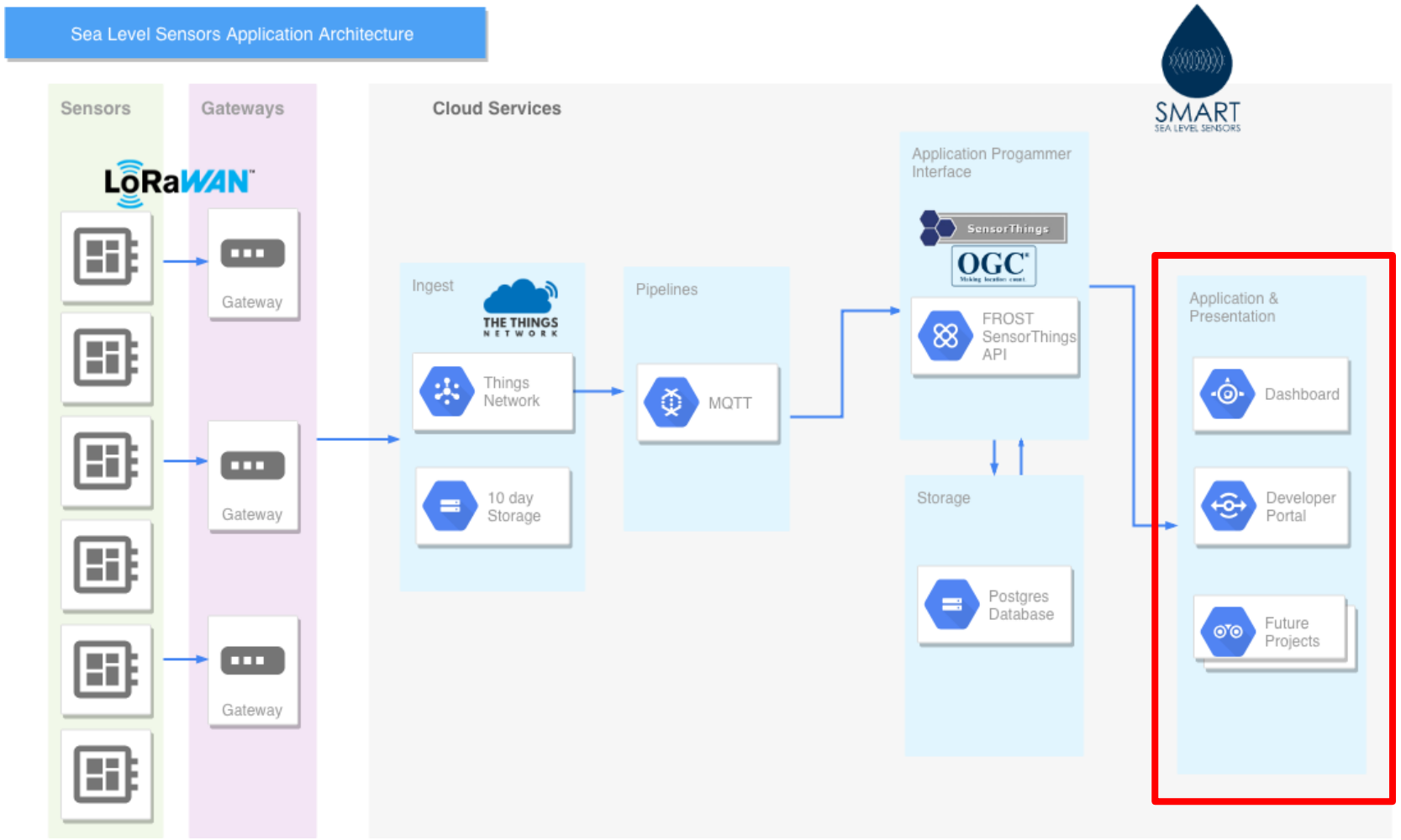
- **Leverages:**
  - Smart Sea Level Sensors Project- perfect intersection of science/ technology/society
  - Authentic Smart Sea Level Sensors data for data visualization exercises & data analysis
  - Georgia Climate Stories videos
  - NASA-JPL activities on sea-level rise

- **Implementation:**
  - April-May 2019 at Oglethorpe Charter School, revisions summer 2019

Sensor Data applications and visualization

Lalith Polepeddi


Sea Level Sensors Application Architecture
Sensors
Gateways
Cloud Services
SMART
SEA LEVEL SENSORS
LoRaWAN
Gateway
Gateway
Gateway
Ingest
THE THINGS NETWORK
Things Network
10 day Storage
Pipelines
MQTT
Application Progammer Interface
SensorThings
OGC
FROST SensorThings API
Storage
Postgres Database
Application & Presentation
Dashboard
Developer Portal
Future Projects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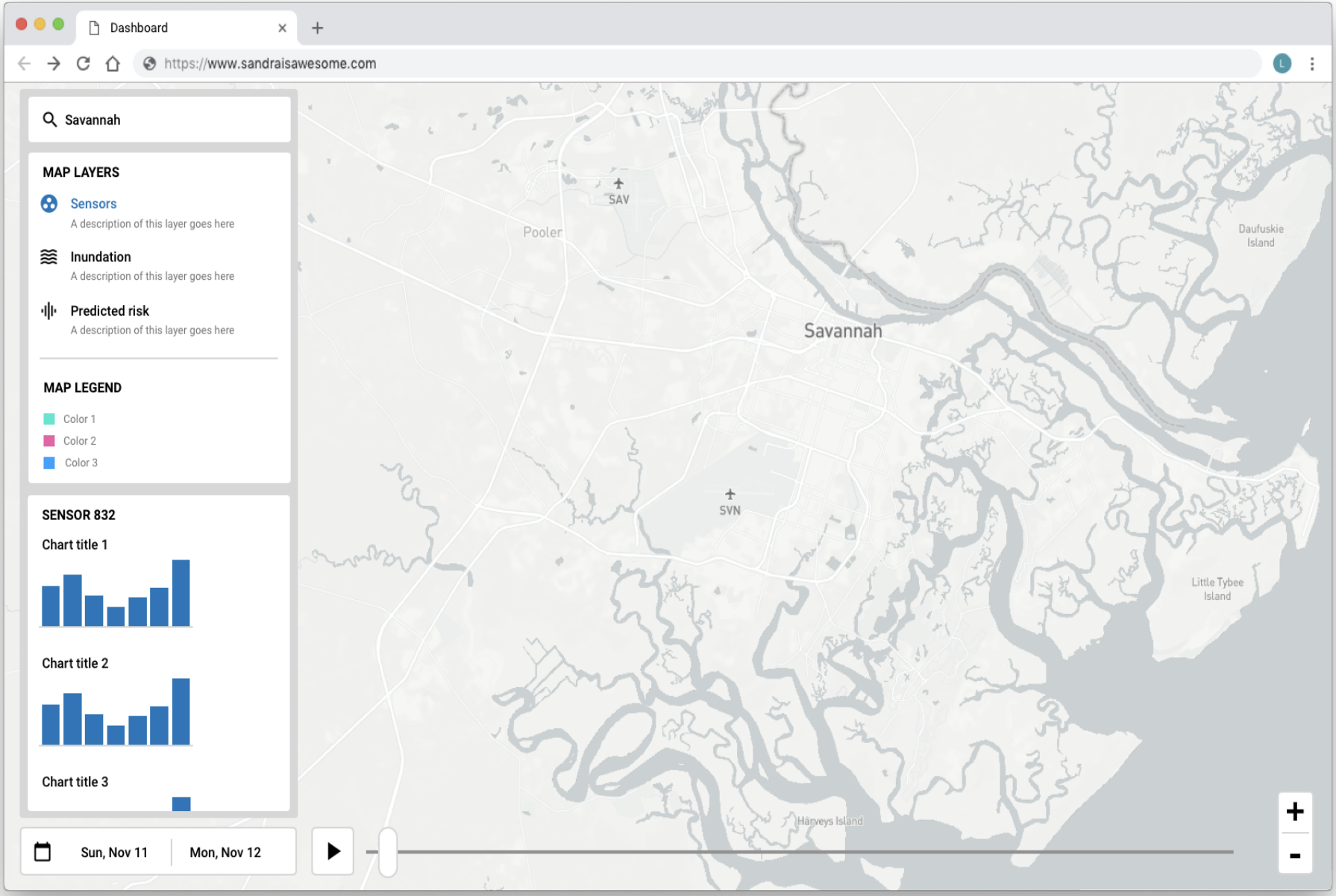
Interactive map that visualizes sensor data over time



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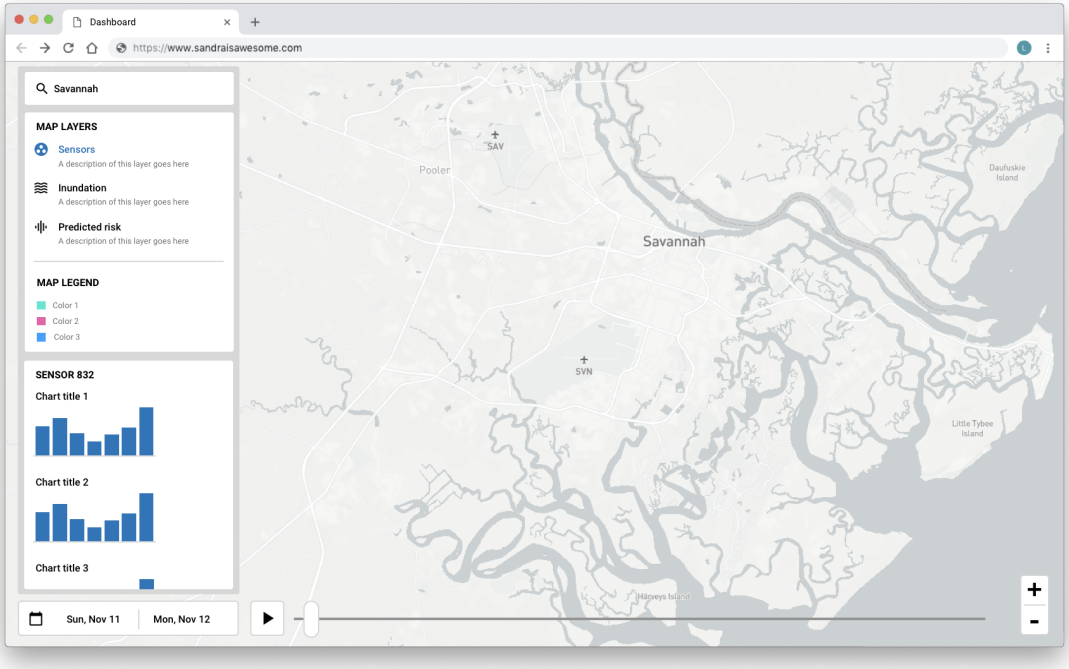
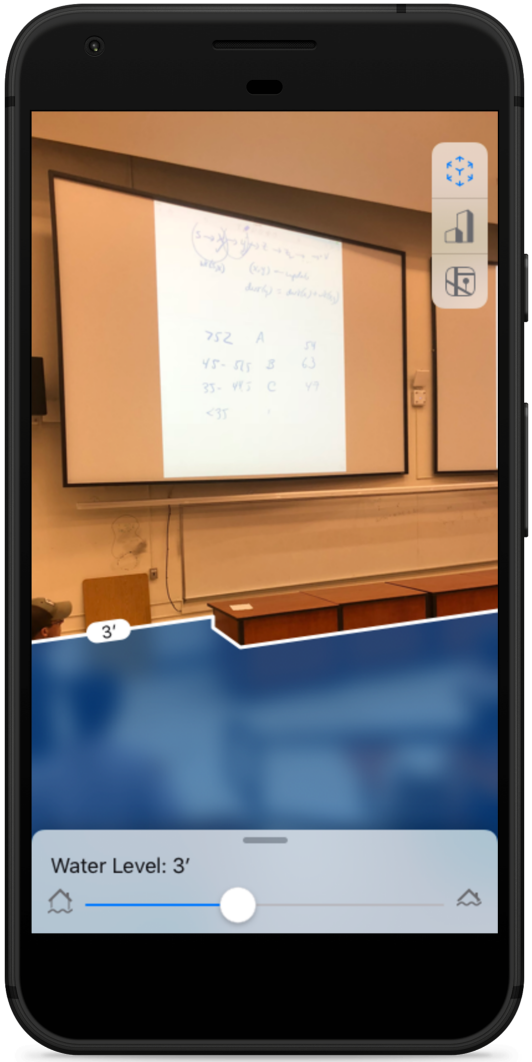


Roadmap

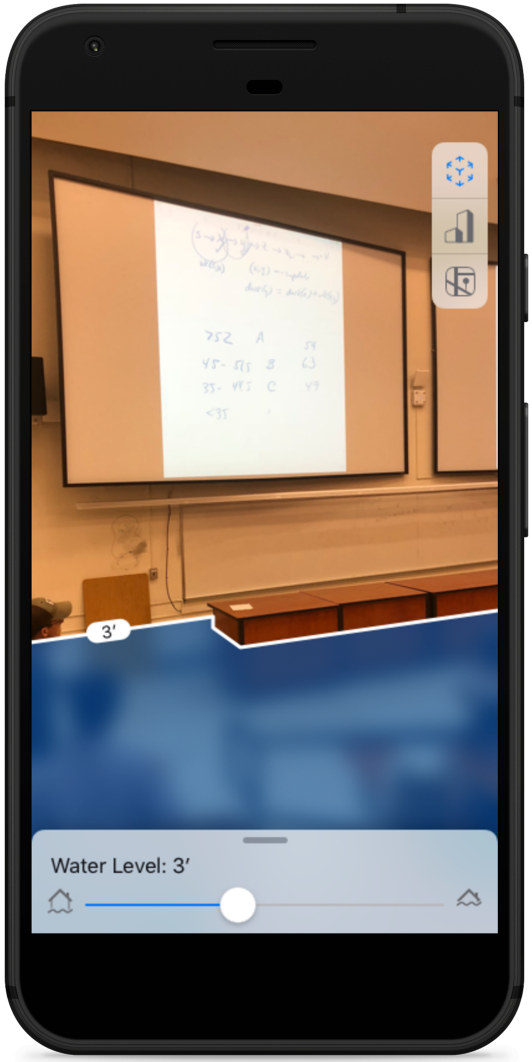
- Add sensor data layer
- Visualize sensor measurements in charts
- Play back sensor measurements over time
- Combine sensor measurements and altitude data to calculate inundation
- Enable other services to be added as layers

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