The climate change challenge

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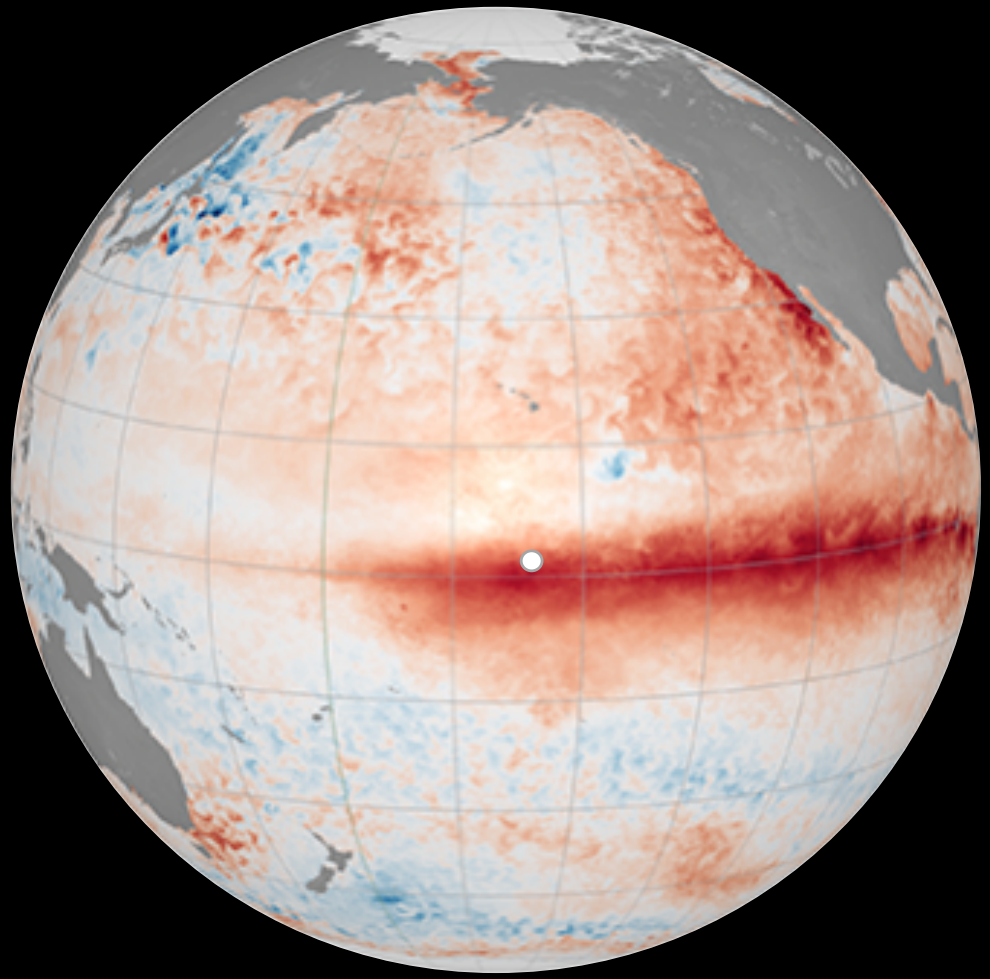
NSF

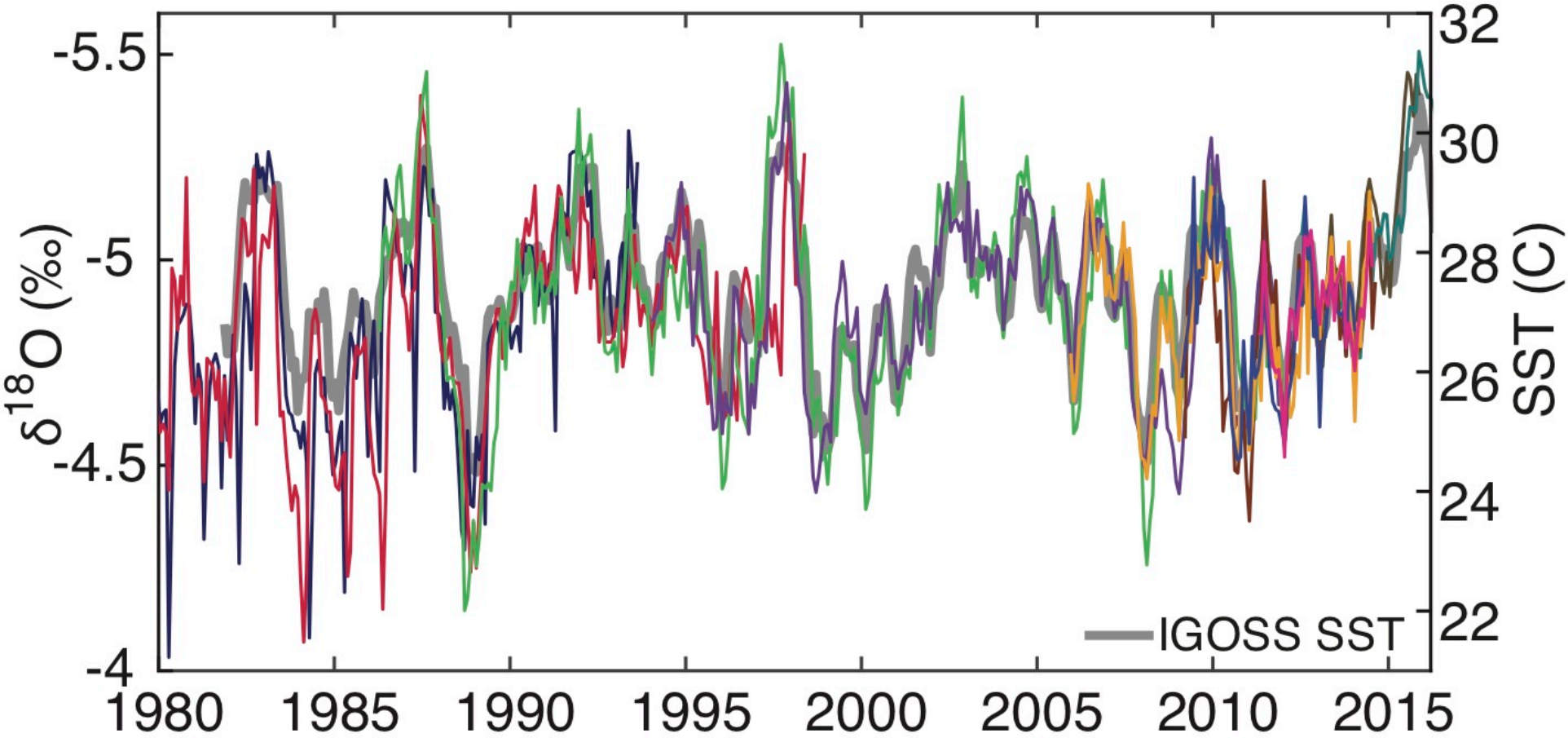
NOAA

1997
1998
2000
2003
2004
2005
2007
2010
2012
2013
2014
2015
2016



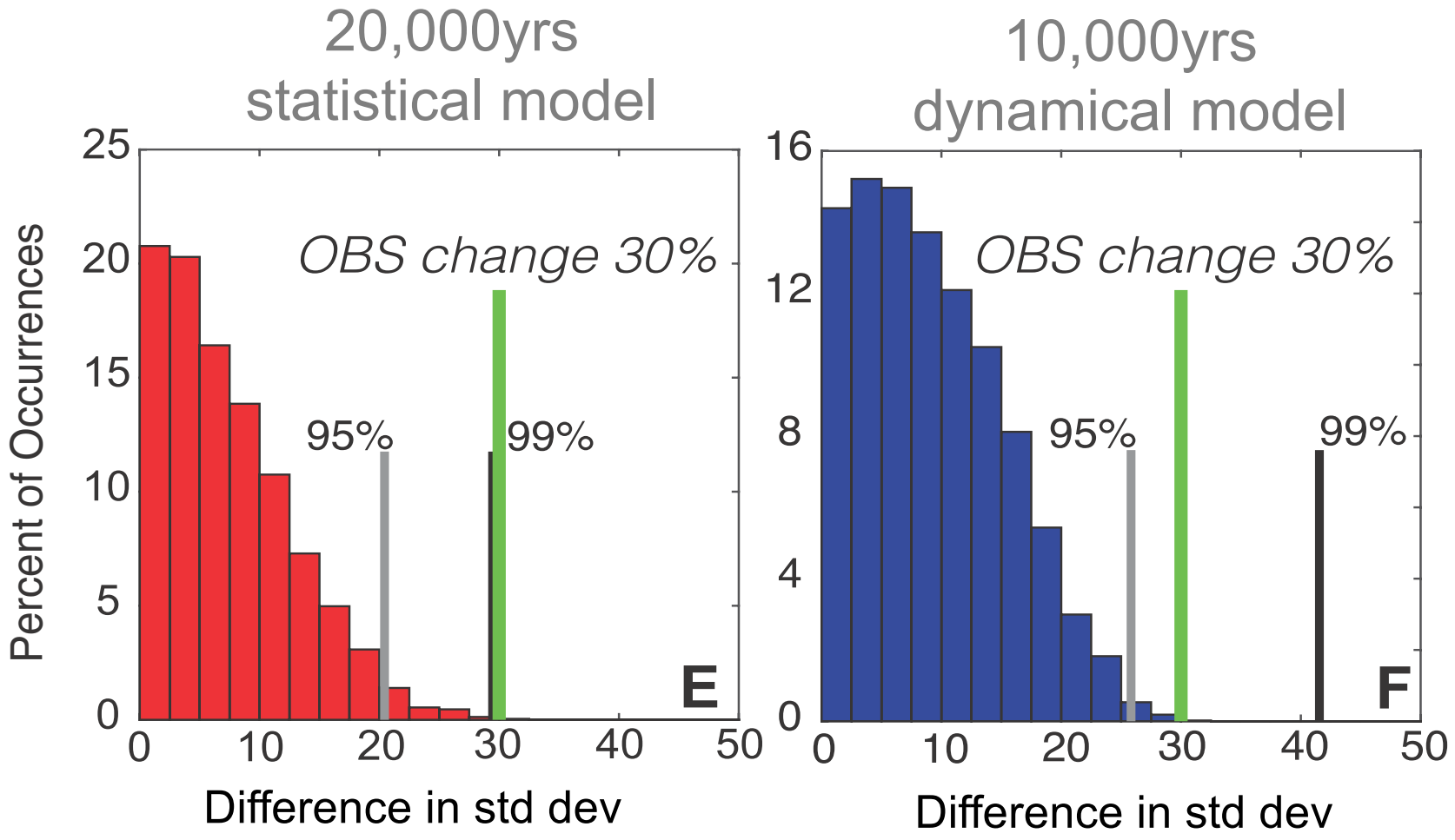
earth observatory

Coral oxygen isotopic records, an ideal ENSO proxy



Grothe et al., GRL, 2019

Interannual coral $\delta^{18}O$ is stronger in last 50yrs than in pre-industrial era



Grothe et al., 2019

Additional paleo-evidence for a recent strengthening of El Niño variability:

Li et al., 2013 → multi-proxy synthesis

McGregor et al., 2013 → multi-proxy synthesis

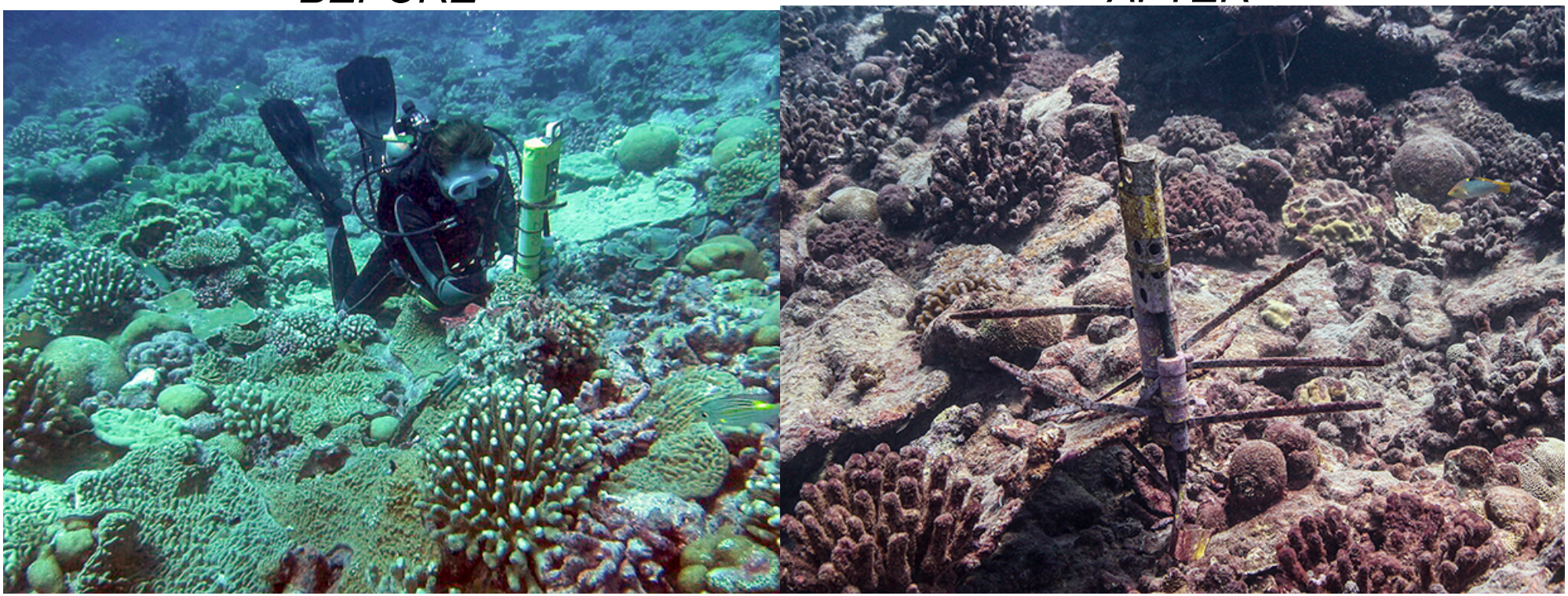
Liu et al., 2017 → Taiwan tree ring $\delta^{18}O$

Freund et al., 2019 → coral proxy synthesis

This time, it's personal.

BEFORE

AFTER

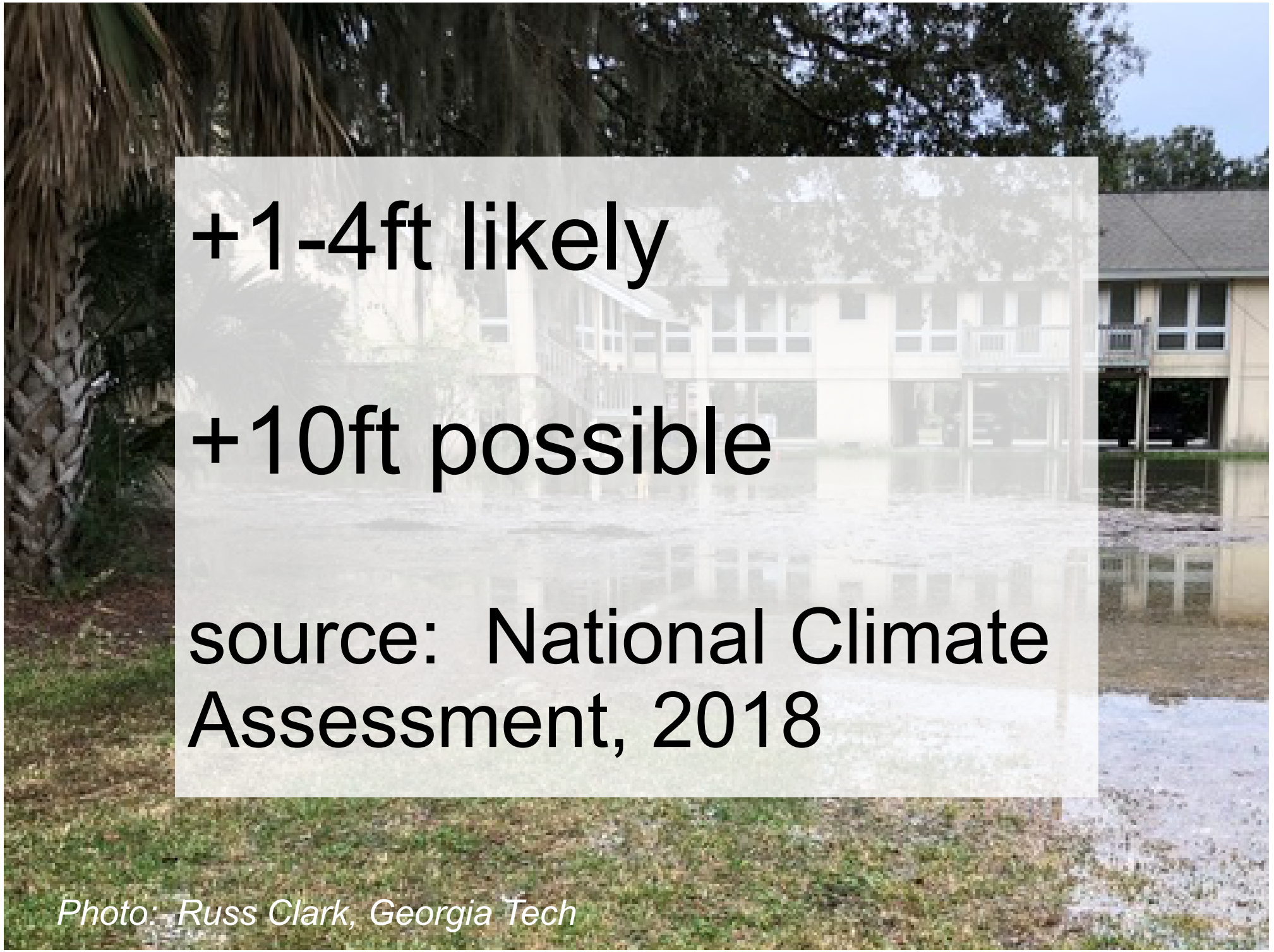


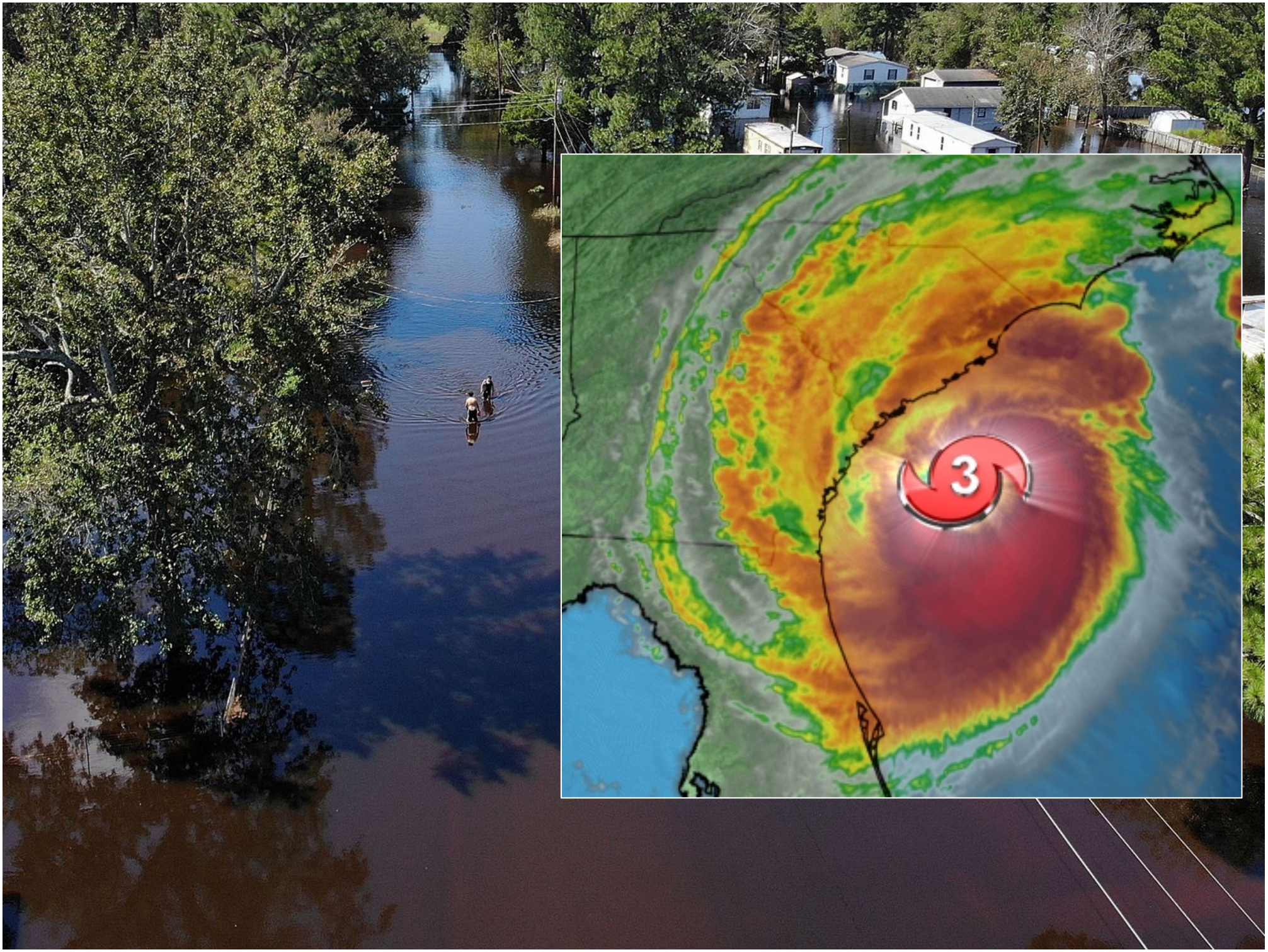
2015/16 El Niño brought 10 months of bleaching-level thermal stress → 85% of reef killed


October 27, 2019
photo: CA Dept Transportation, via the LA Times


Photo: Sean Compton, FOX5 Atlanta


“Blue sky flooding”
Photo: Russ Clark, Georgia Tech


+1-4ft likely
+10ft possible
source: National Climate Assessment, 2018
Photo: Russ Clark, Georgia Tech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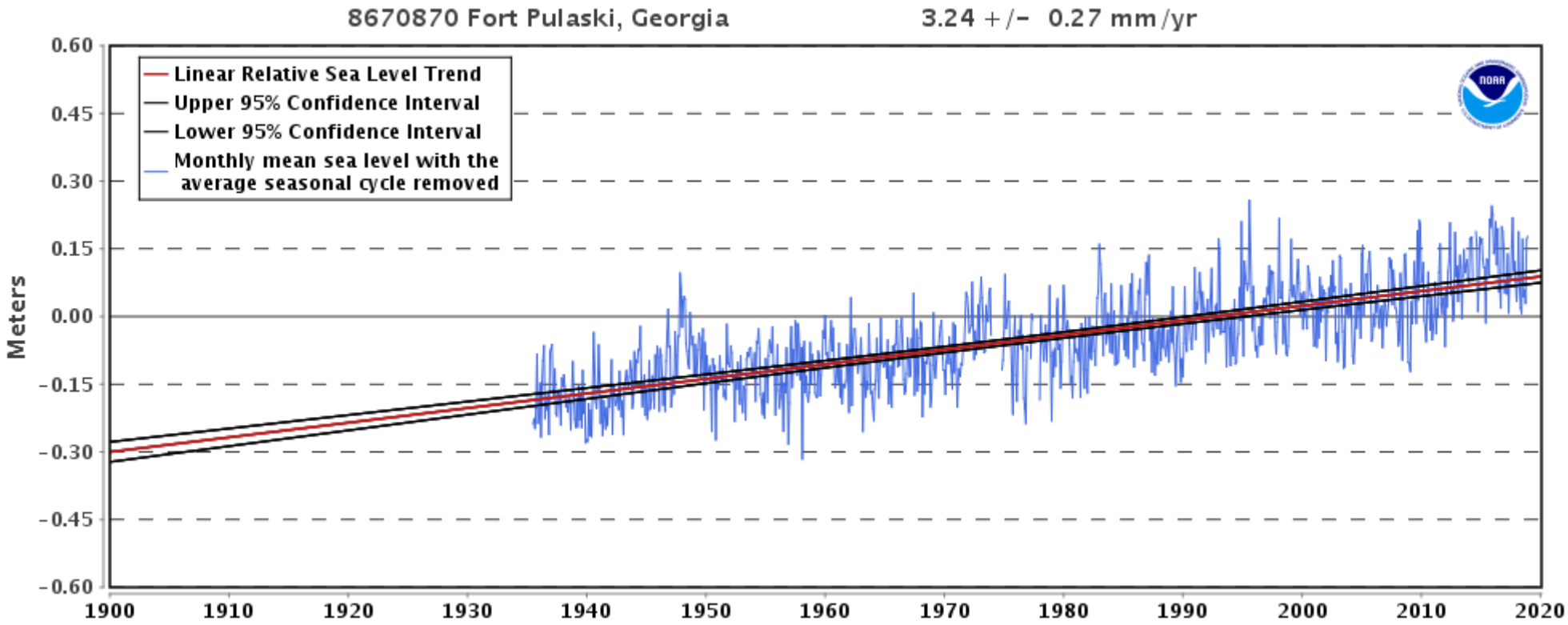
Ft. Pulaski - Georgia's only NOAA tide gauge



Georgia Tech

EMERGENCY MANAGEMENT CHATHAM COUNTY

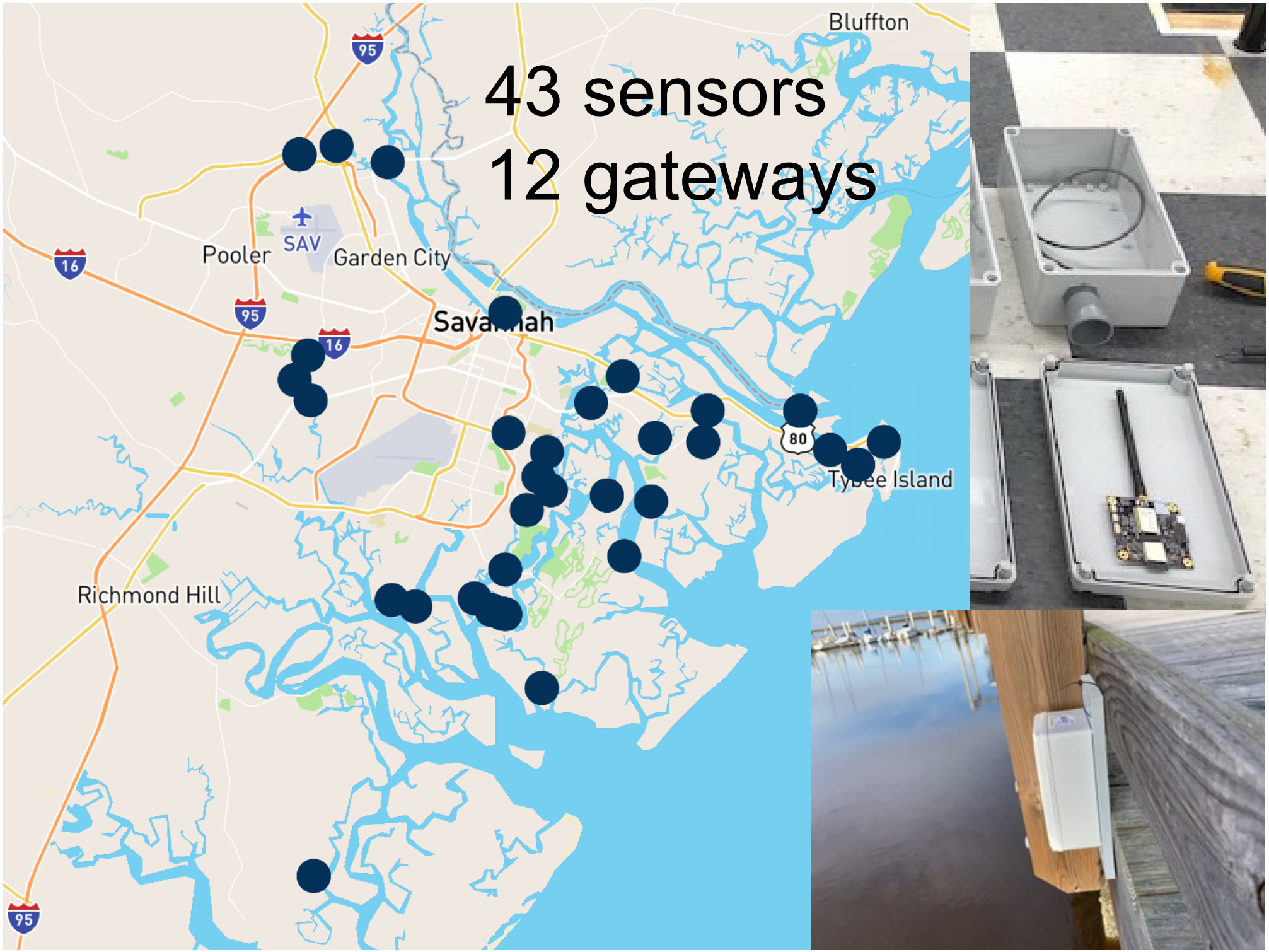
CHATHAM COUNTY 1777 GEORGIA

SAVANNAH savannahga.gov

http://sealevelsensors.org

real-time data
hyperlocal forecasts
resilience planning tools
education & awareness


GEORGIA CLIMATE PROJECT
100 MILES
NATIONAL WEATHER SERVICE
TYBEE ISLAND MARINE SCIENCE CENTER
SAVANNAH
savannahga.gov
EMERGENCY MANAGEMENT
CHATHAM COUNTY
SAVANNAH COLLEGE OF ART AND DESIGN
Georgia Tech
Sea Grant
Georgia
OCS
OGLETHORPE
ALMA MATER STUDIORUM
A.D. 1088
UNIVERSITY of HAWAI'I
MĀNOA
SAGIS
Savannah Area Geographic Information System
cmcc
SCHOOL OF ENGINEERING
HERSCHEL V. JENKINS
Skidaway Institute of Oceanography
UNIVERSITY OF GEORGIA
1785
the creative coast
Harambee House
Citizens for Environmental Justice
Communities of
COASTAL GEORGIA FOUNDATION
GEORGIA
DEPARTMENT OF NATURAL RESOURCES


43 sensors
12 gateways
Bluffton
Pooler
SAV
Garden City
Savannah
Tybee Island
Richmond Hill
95
16
80

gateway device:

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

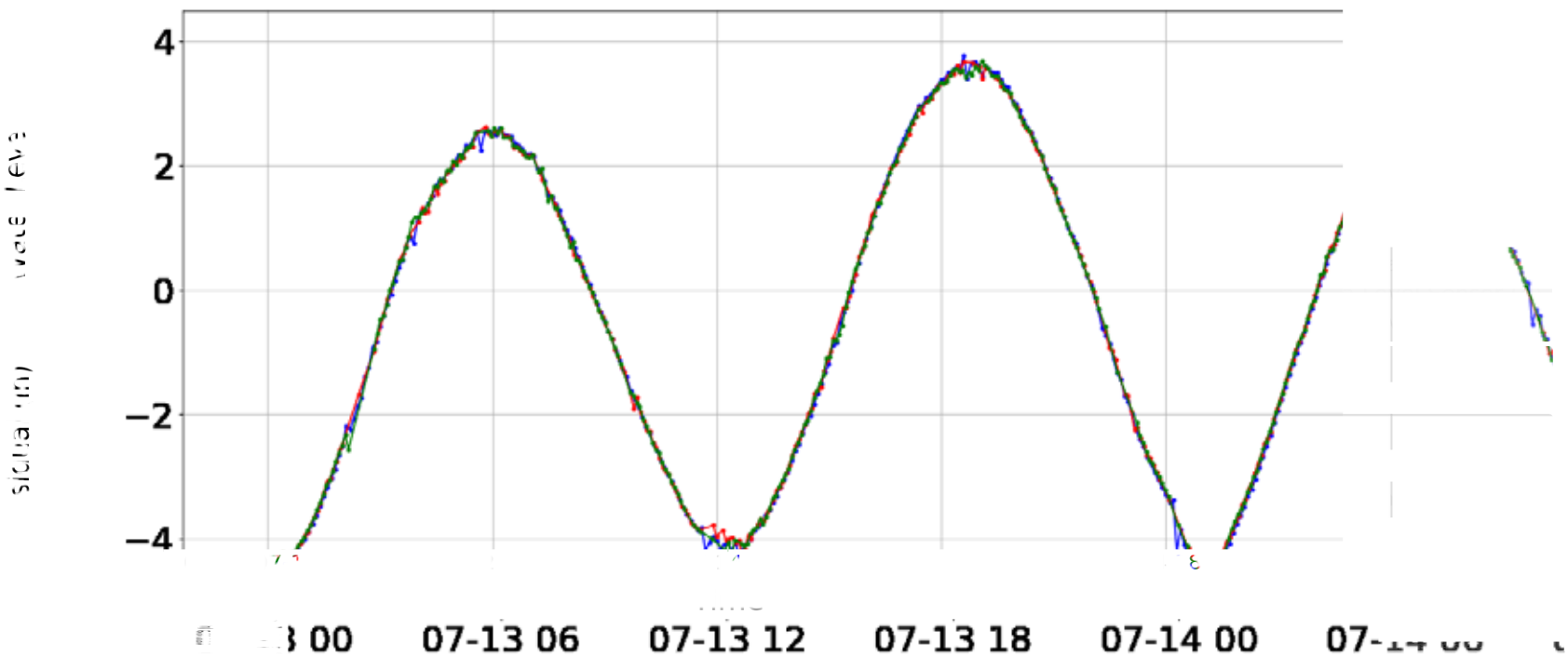
goal:

provide backbone for diverse IoT applications

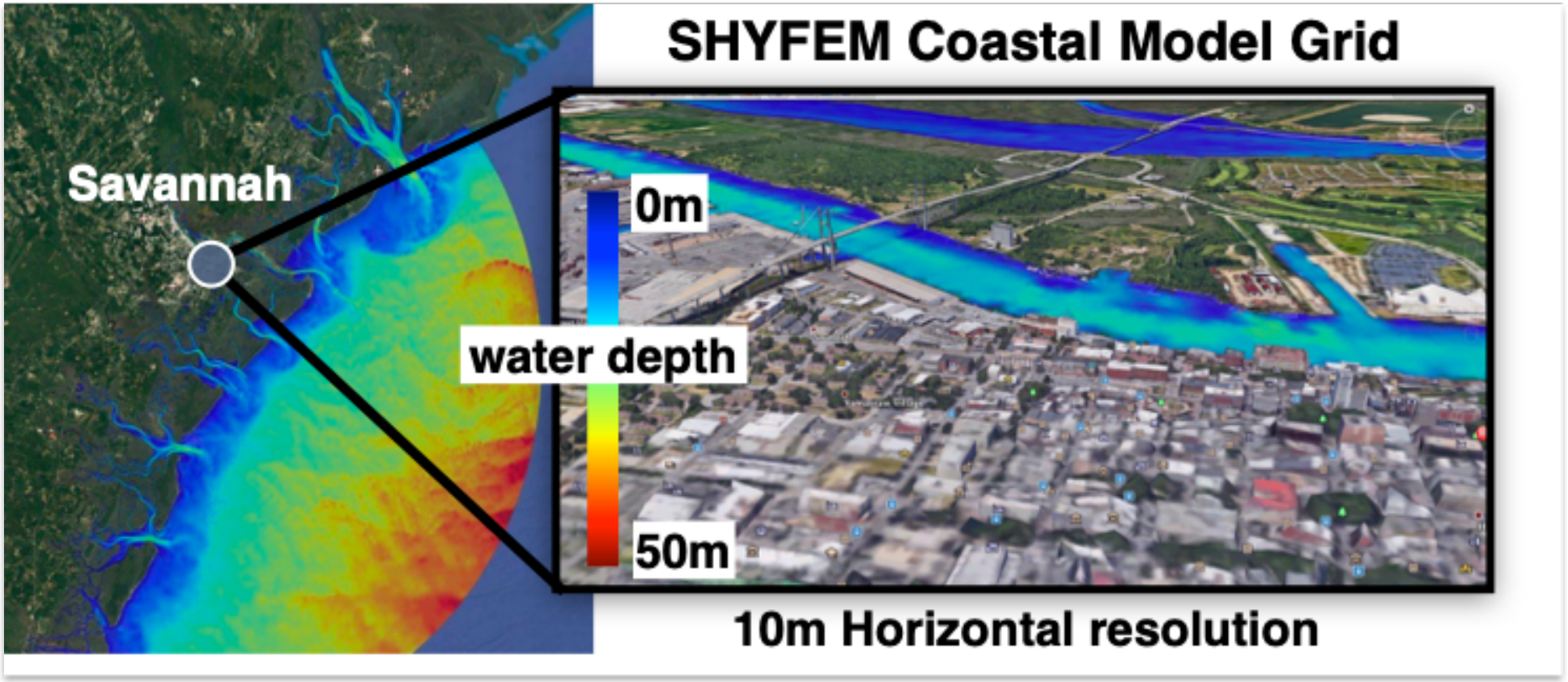
LoRa Alliance™
Wide Area Networks for IoT

THE THINGS NETWORK

Comparing two GT sensors with Ft. Pulaski NOAA gauge



- on average, accuracy is better than 0.7inches (1.7cm)
- maximum difference is 5inches, likely related to wave activity

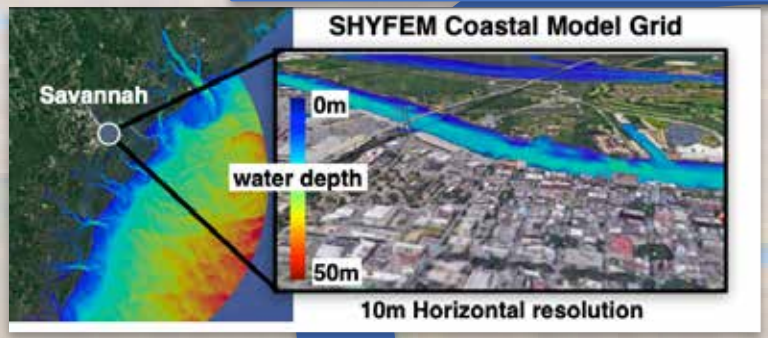


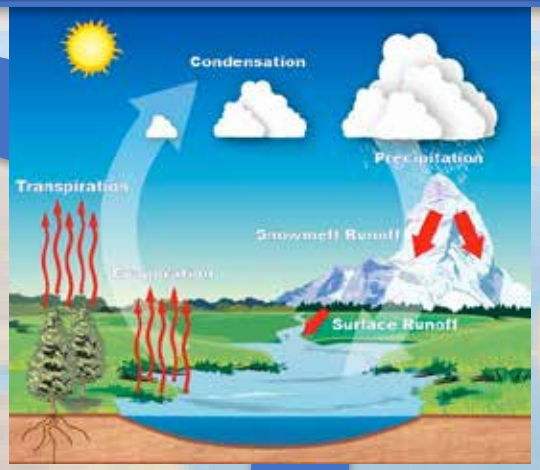
currently making 3-day forecasts
with high-resolution ocean model

Regional Earth System Model

Regional Atmosphere & Land Hydrology Model

Coastal Water and Ocean Model

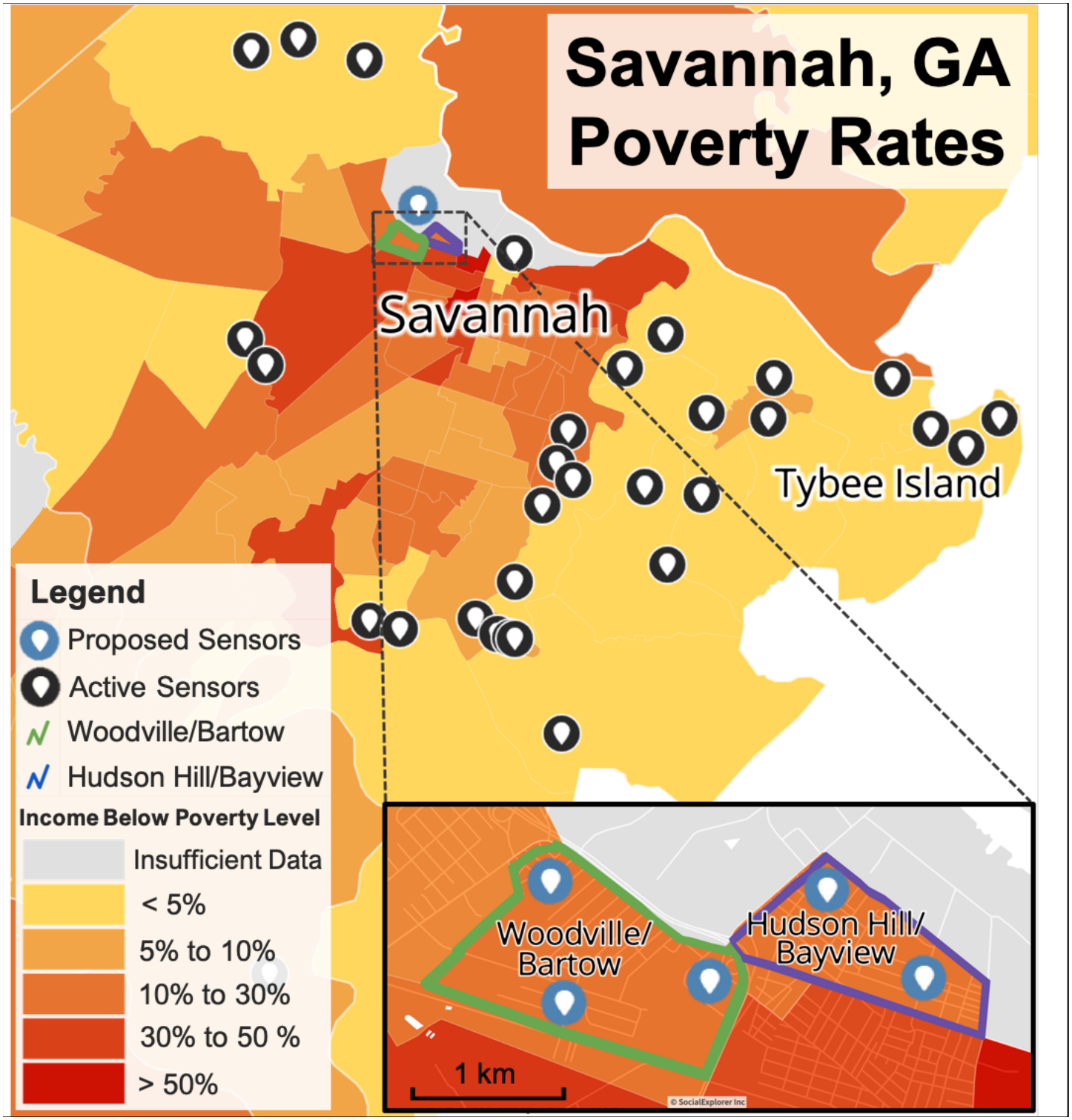




Urban Flooding Models with Infrastructure

towards 3-day, hyperlocal forecasts of coastal flooding

Di Lorenzo, Pinardi et al



IoT sensors for coastal flooding resilience in under-served communities of color

Jenkins High School Partnership

- assemble and test 30 sea level sensors
- redesigned sensor housing
- curriculum written by the students

School of Engineering
Herschel V. Jenkins

SMART
SEA LEVEL SENSORS

Science in Service to Solutions

Rewards are clear.

Hurdles are many.

Challenges and opportunities

- funding structures lacking
- transdisciplinary frameworks take time to take shape, mature
- science institutions present structural barriers (incentives, etc)
- how to train the next generation of translational science leaders?

You gotta be bad, you gotta be bold,
You gotta be wiser, you gotta be hard,
You gotta be tough, you gotta be stronger.

You gotta be cool, you gotta be calm,
You gotta stay together.

-- Des’ree

Model simulations of Hurricanes Matthew and Dorian reproduce observed flood levels to within 1ft