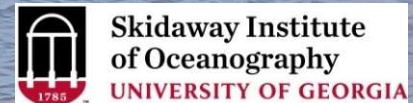


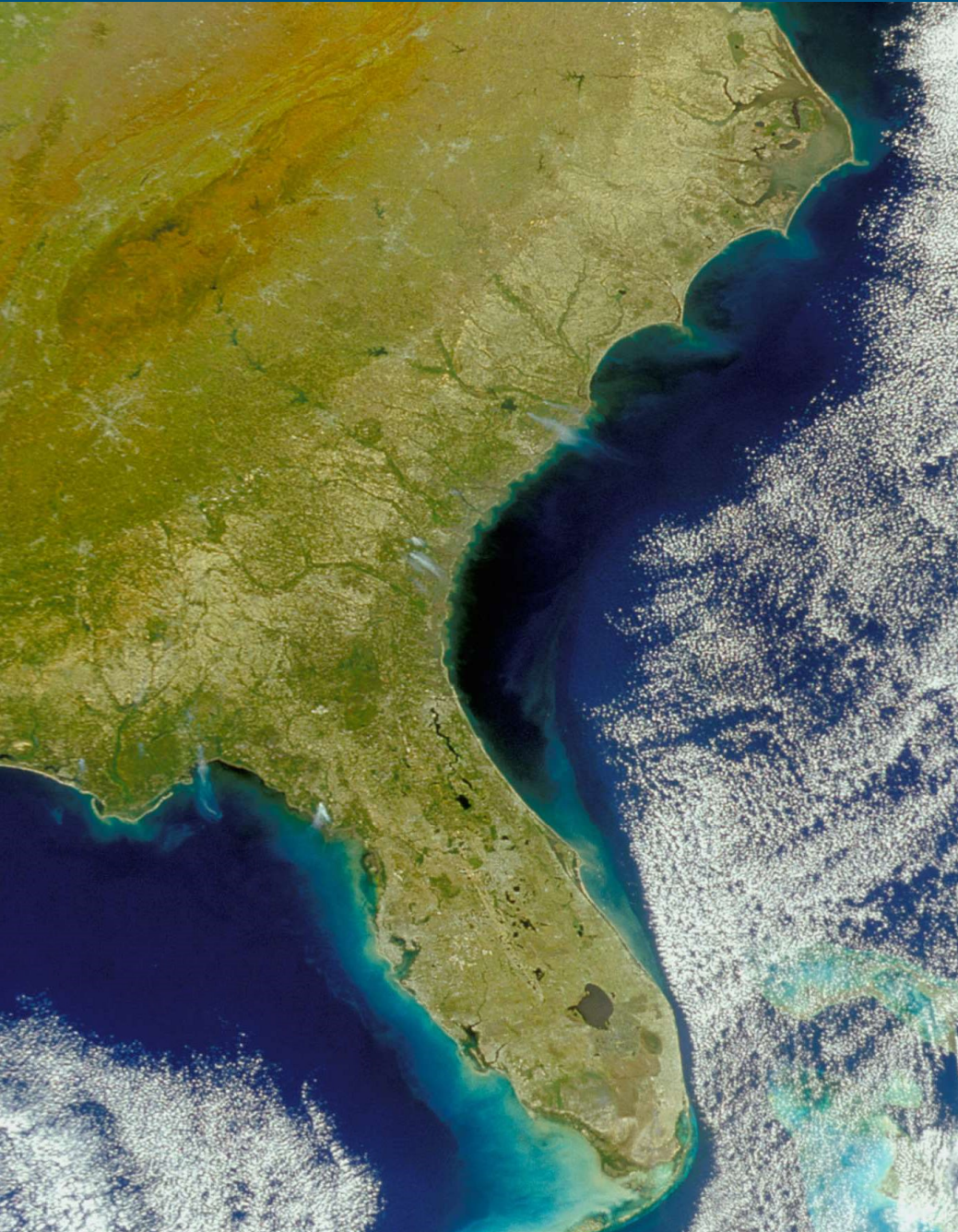
Sea level Rise, Climate Change, And One Community's Response

Clark Alexander
Alan Robertson



Sarah Cameron Sunde "36.5: A Durational Performance with the Sea"

Act 1



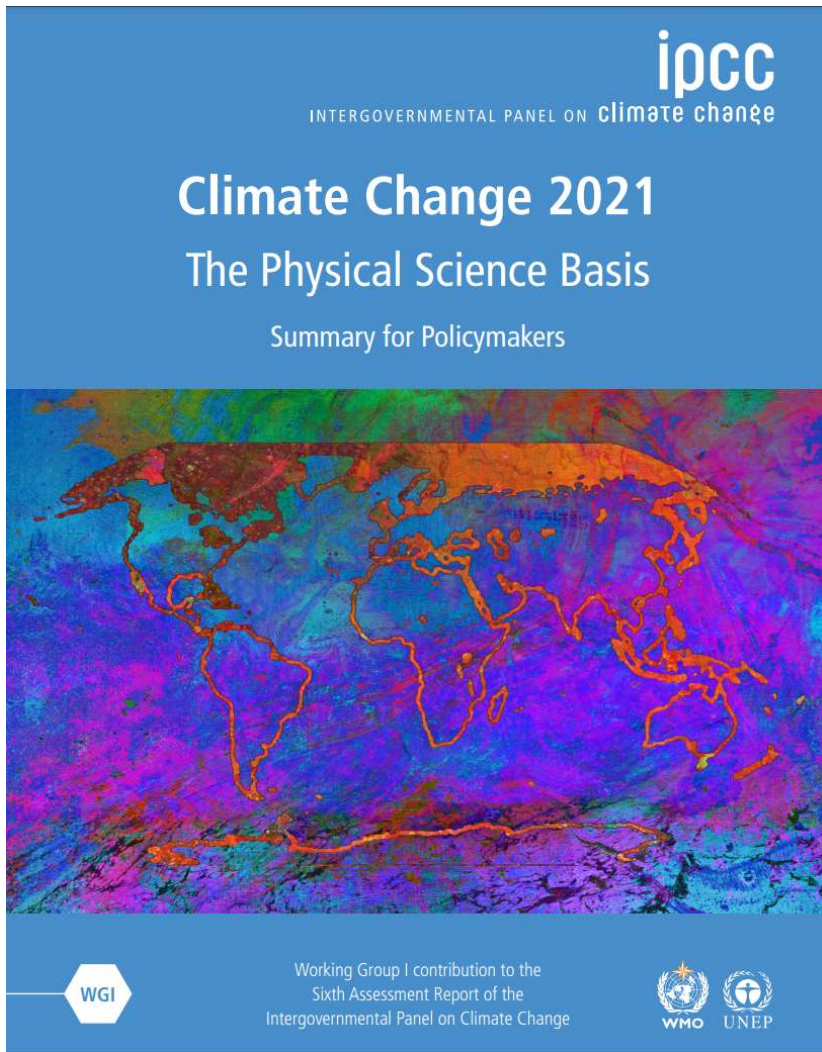
Natural Hazards for Coastal Regions

- Tropical cyclones (hurricanes)
- Extratropical storms (nor'easters)
- Localized strong wind
- Shoreline erosion
- Sea-level rise

Effects from a changing climate

- More extremes in weather
- Increased intensity of tropical cyclones globally
- Sea-level is rising in the ocean basins

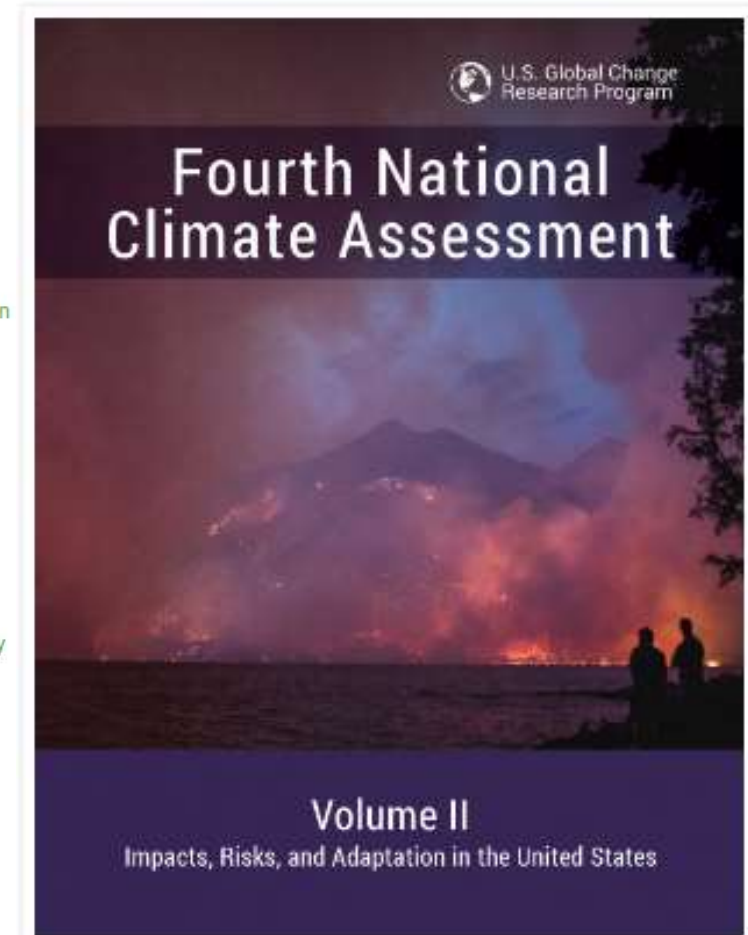
The Intergovernmental Panel on Climate Change (IPCC)



<https://www.ipcc.ch/report/ar6/>

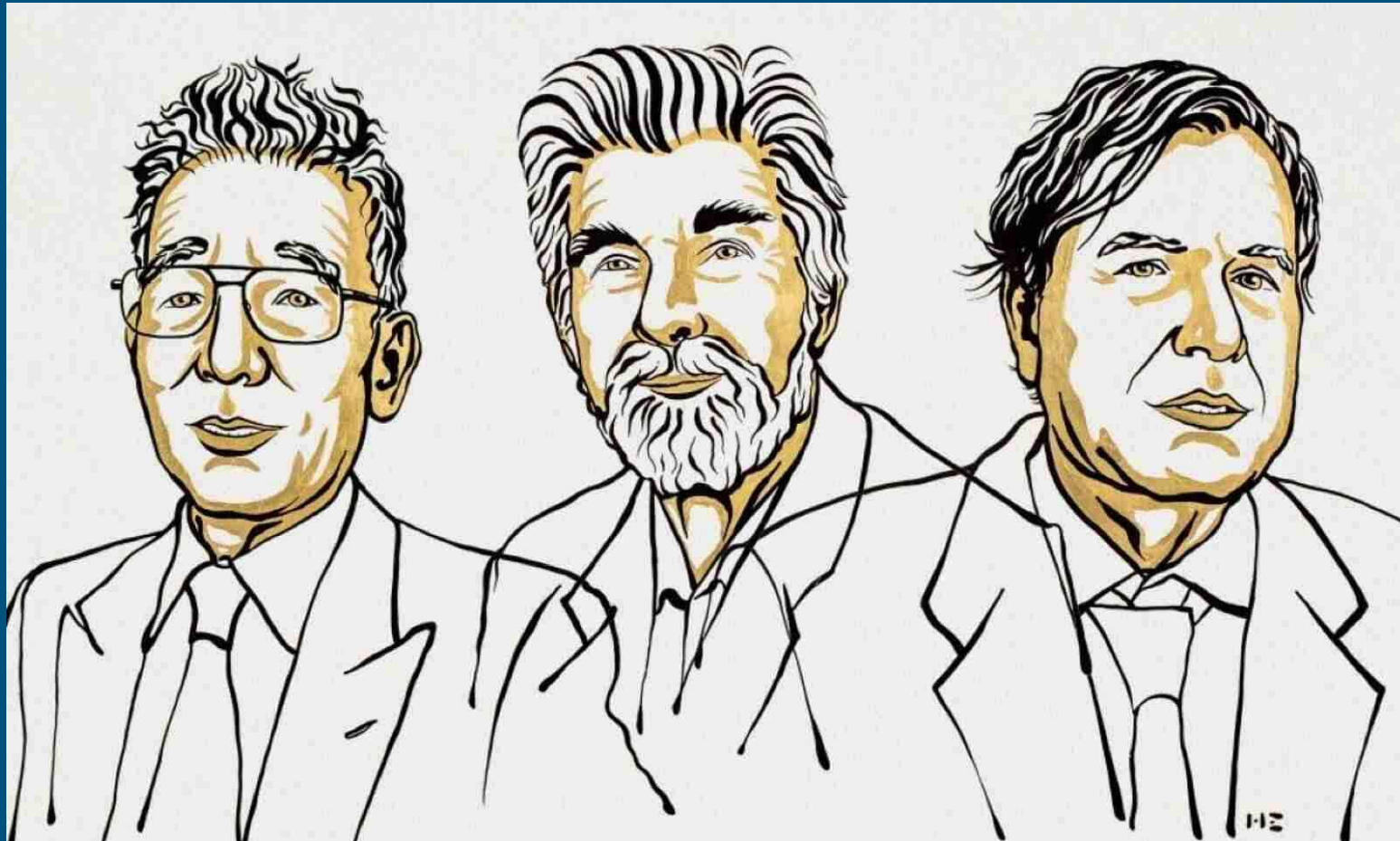
US National Climate Assessment

-  Department of Agriculture
-  Department of Commerce
-  Department of Defense
-  Department of Energy
-  Department of Health and Human Services
-  Department of the Interior
-  Department of State
-  Department of Transportation
-  Environmental Protection Agency
-  National Aeronautics & Space Administration
-  National Science Foundation
-  Smithsonian Institution
-  U.S. Agency for International Development

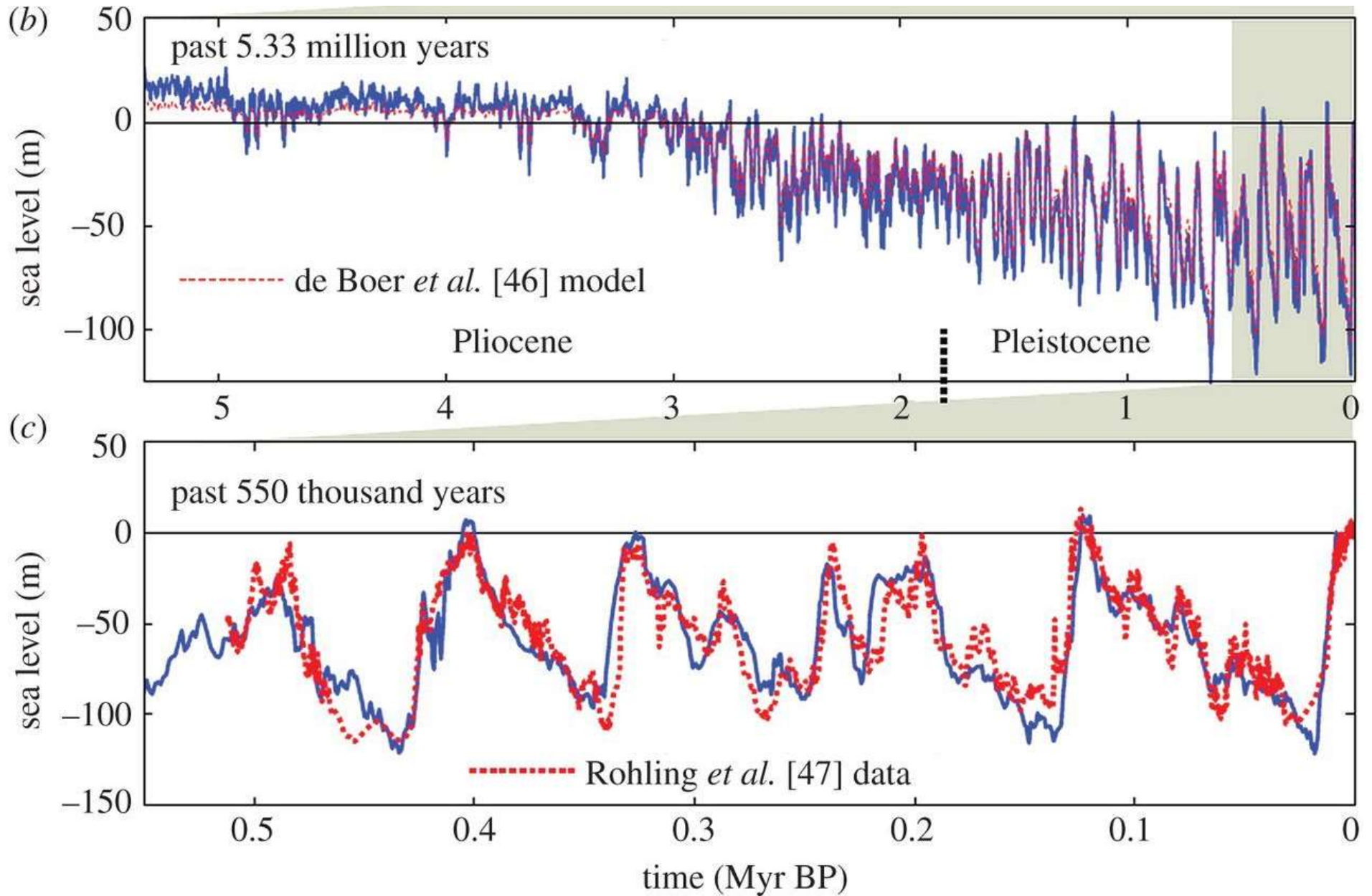


<https://science2017.globalchange.gov/>

This year's Nobel Prize in Physics is awarded to Syukuro Manabe, Klaus Hasselmann “for the **physical modelling of Earth's climate, quantifying variability and reliably predicting global warming**” and to Giorgio Parisi “for the discovery of the **interplay of disorder and fluctuations in physical systems** from atomic to planetary scales”.



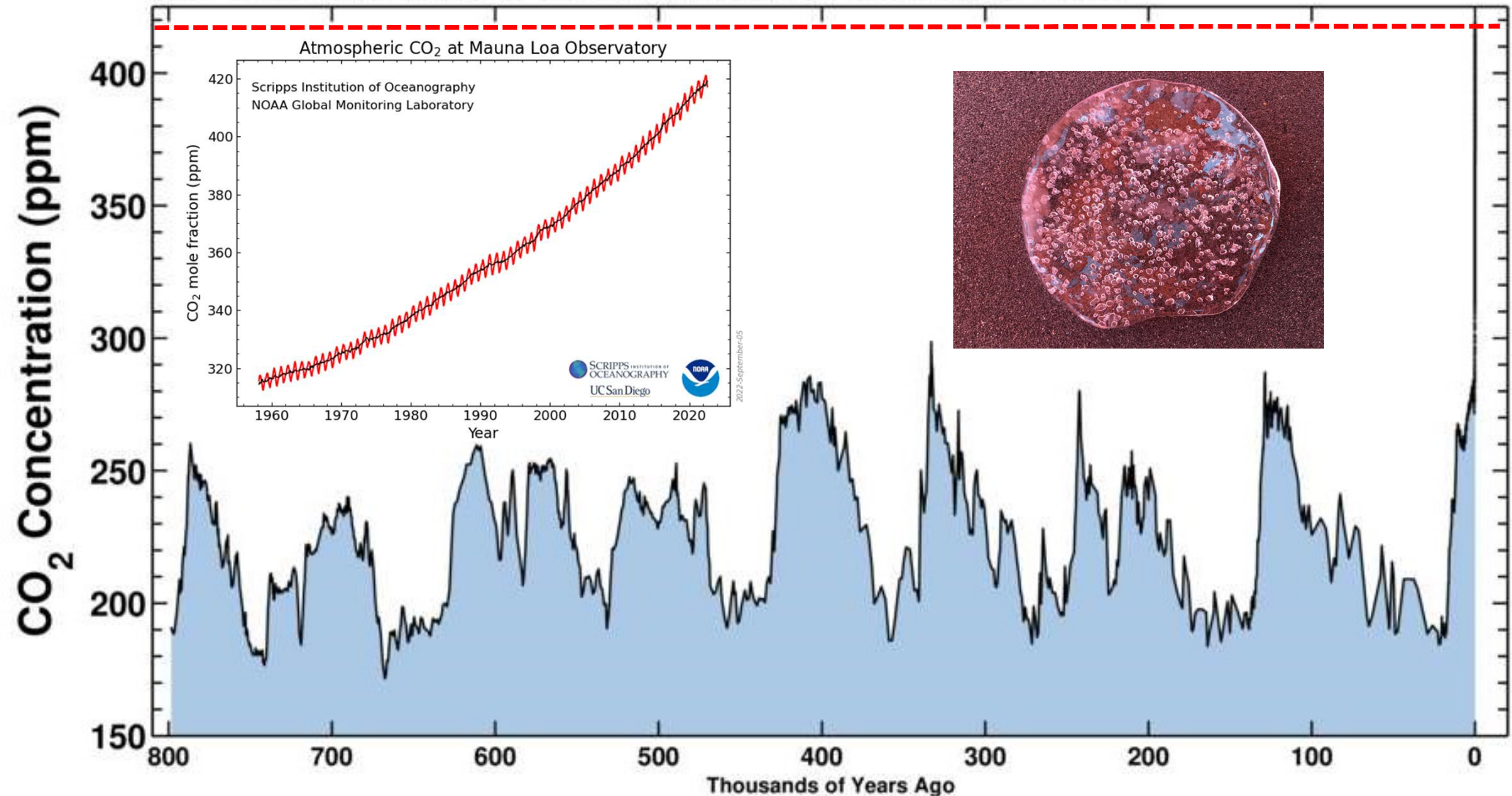
Sea Level History: The Long View



September 5, 2022

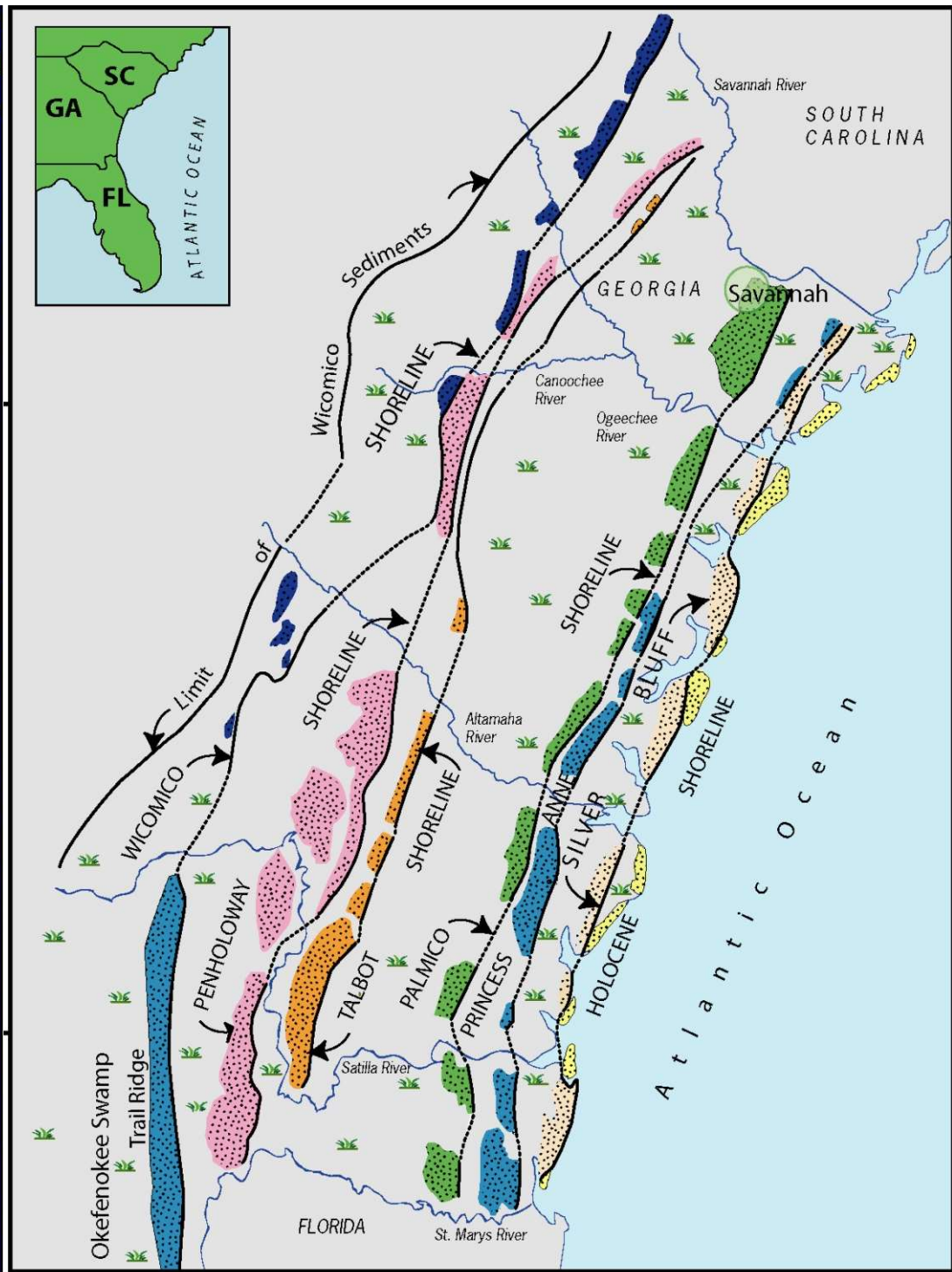
Today: 417 ppm

Ice-core data before 1958. Mauna Loa data after 1958.



Scripps Institute of Oceanography

<https://scripps.ucsd.edu/programs/keelingcurve/>

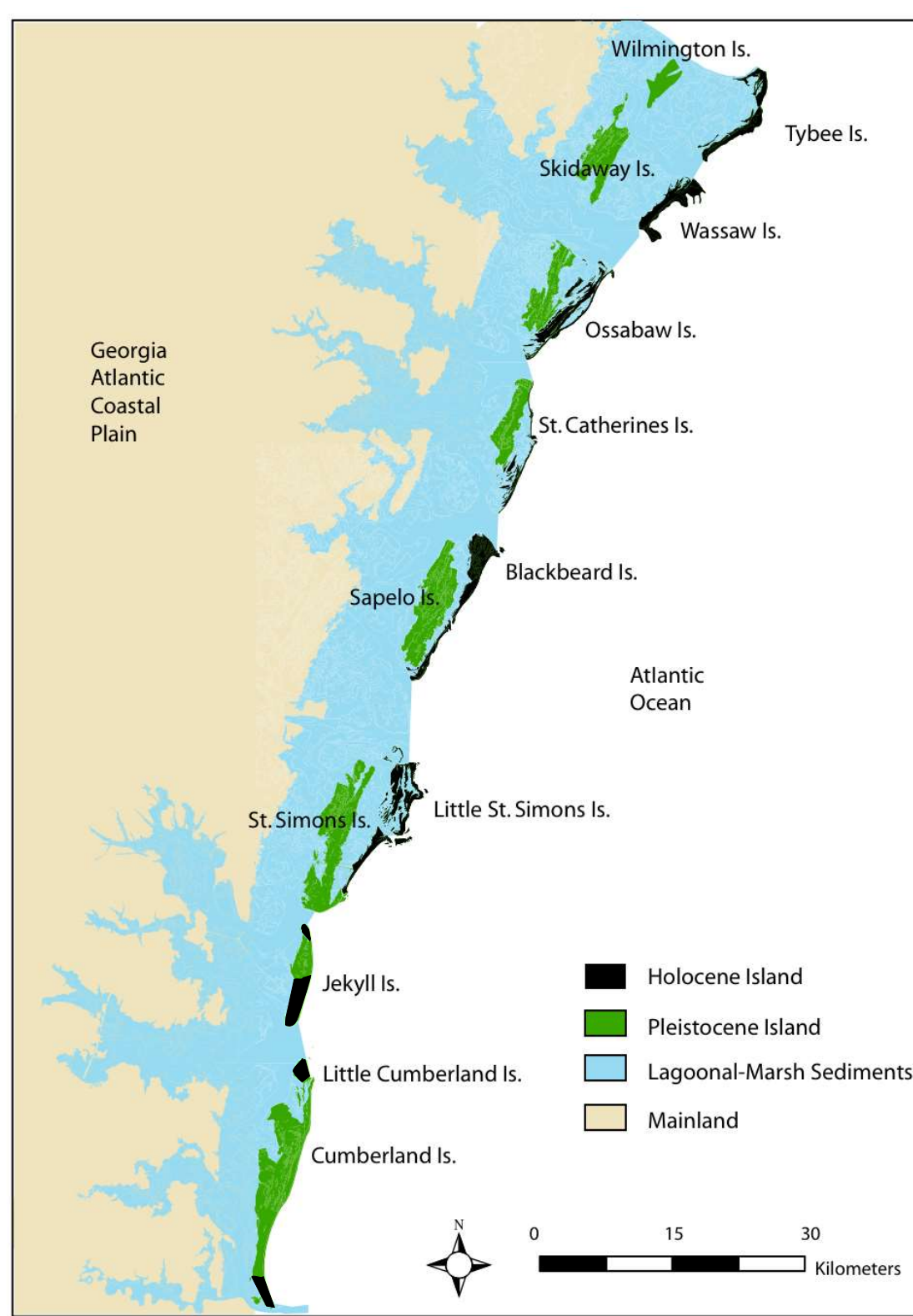


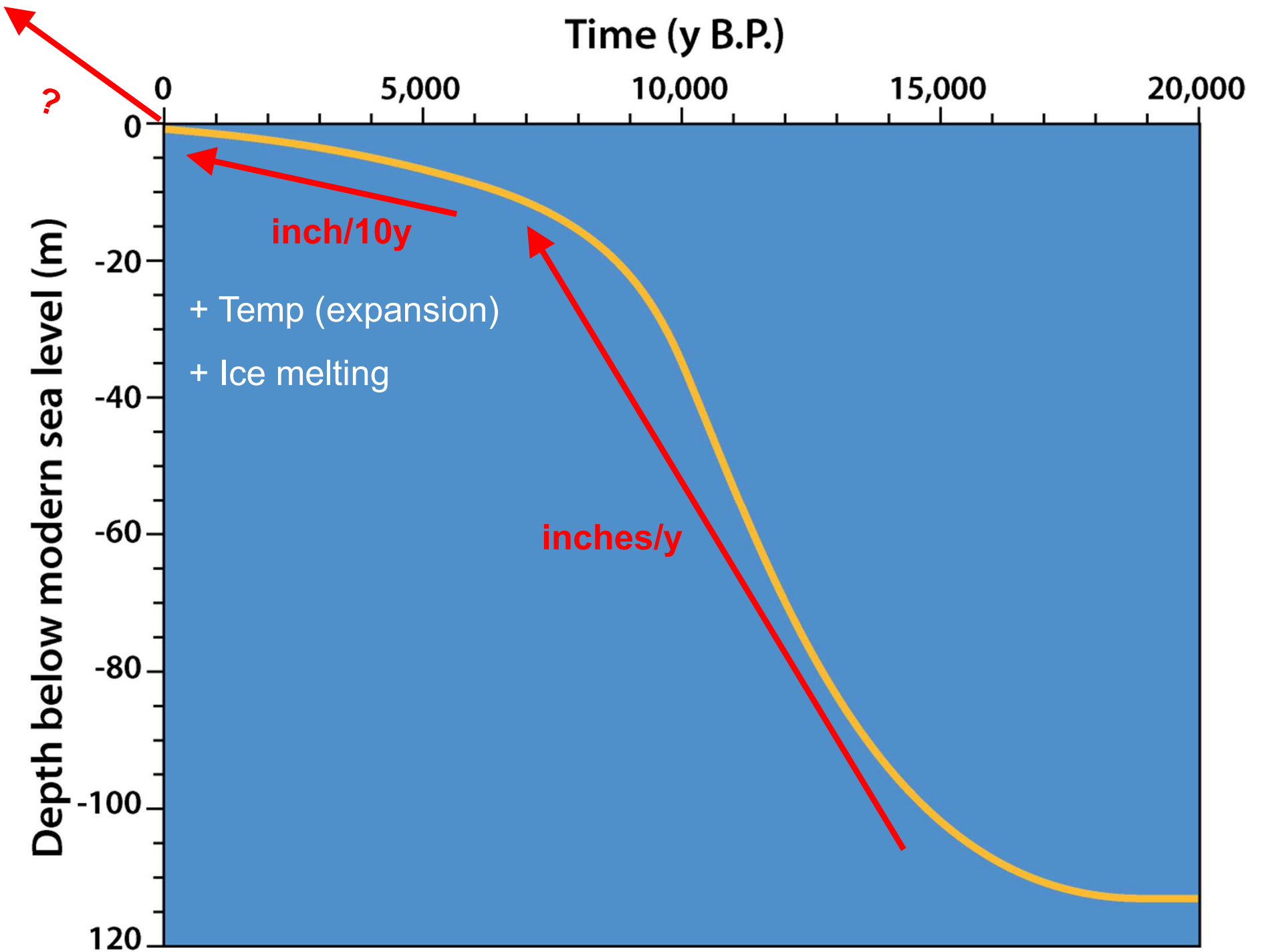
 Barrier Island Sediments

 Back Barrier Sediments

0 10 20 KILOMETERS

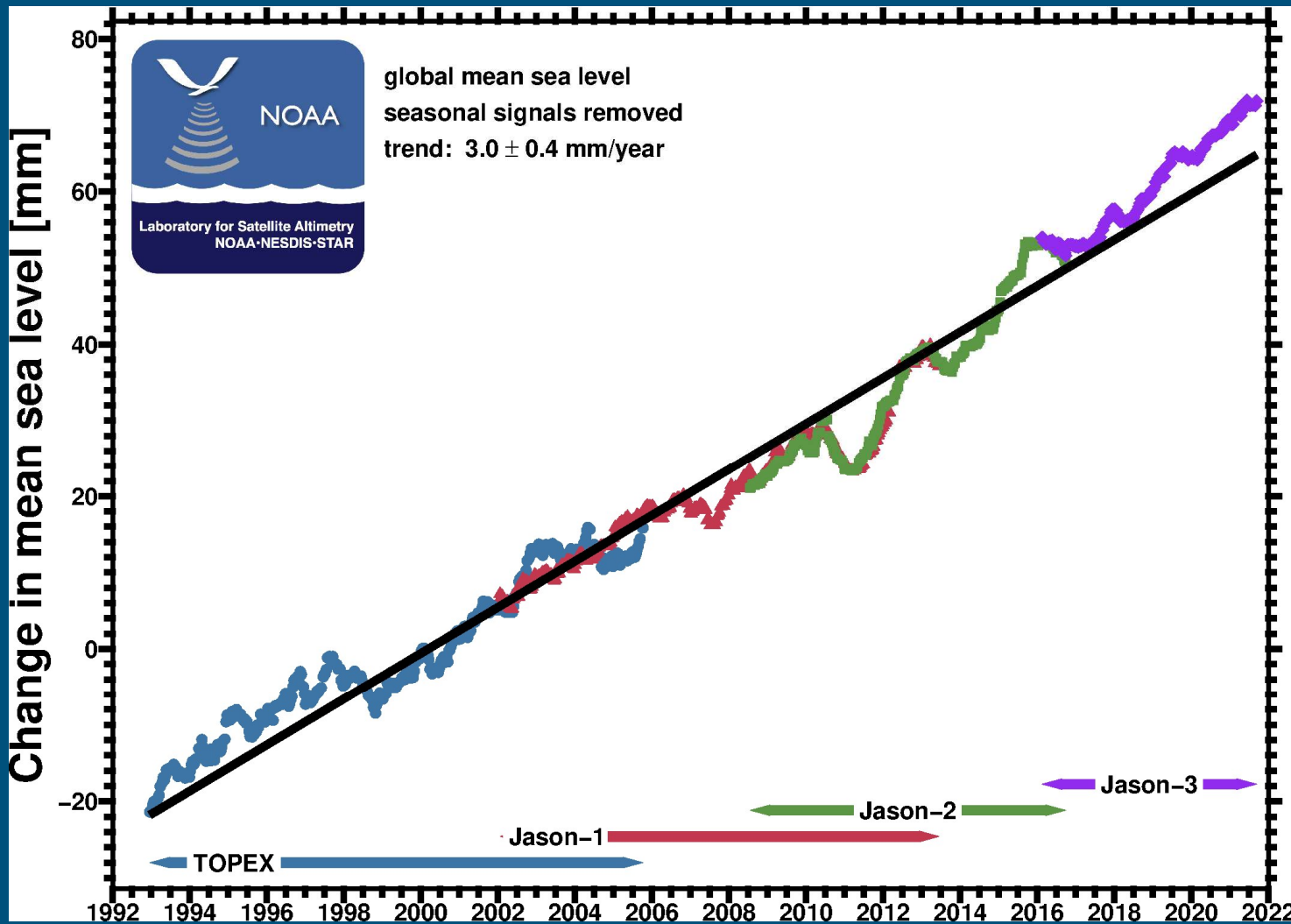
0 5 10 15 MILES





Absolute Sea Level Rise (1993-Present)

<https://www.star.nesdis.noaa.gov/sod/lisa/SeaLevelRise/>



Relative Rates of Sea Level Change

Local change = sum of global rise (+) and local factors (+/-)

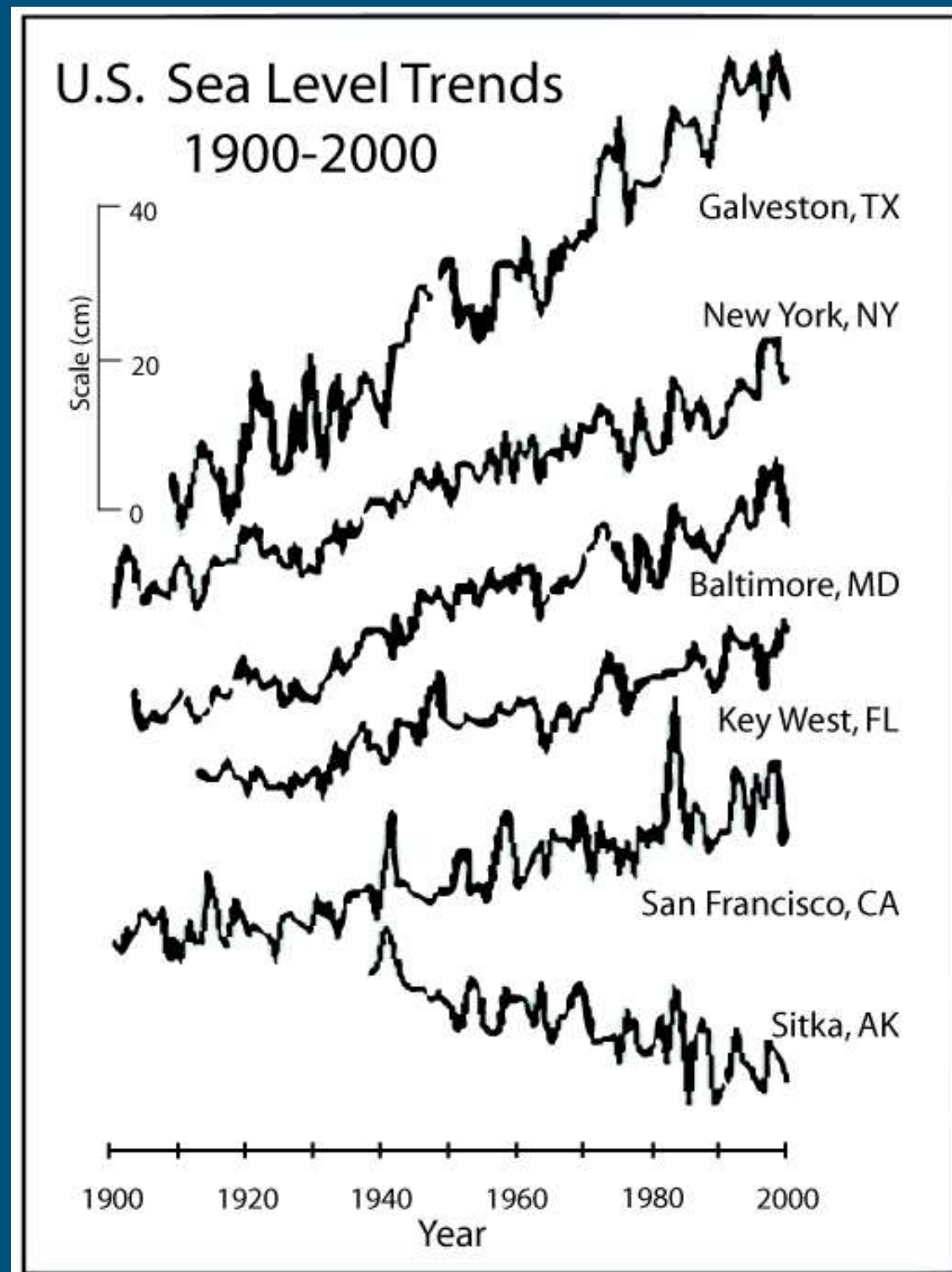
Local factors:

* Human activities

- groundwater use
- oil/gas extraction
- river channelization

* Geologic processes

- autocompaction
- active tectonics
- glacial rebound

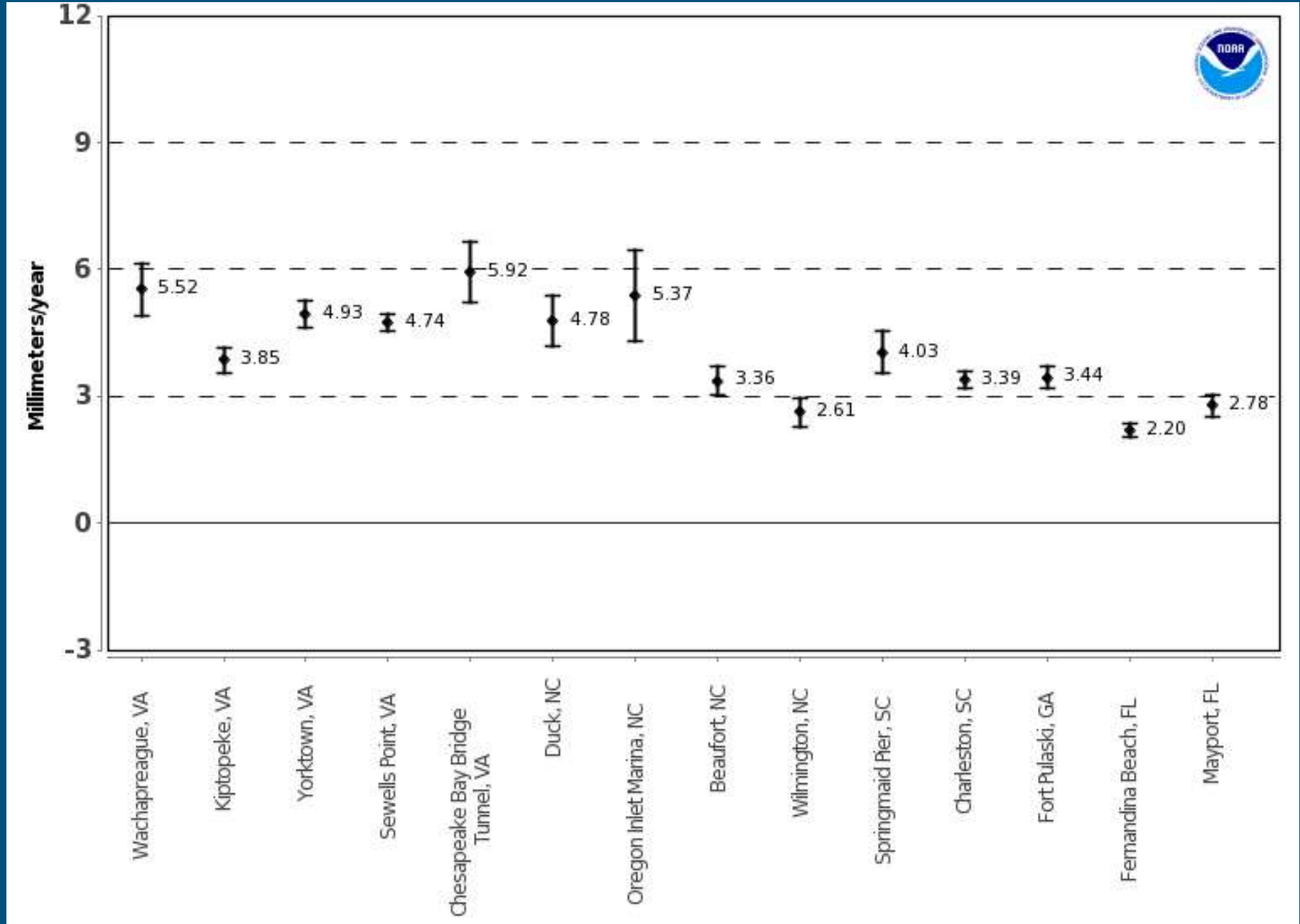


Sea Level Rise



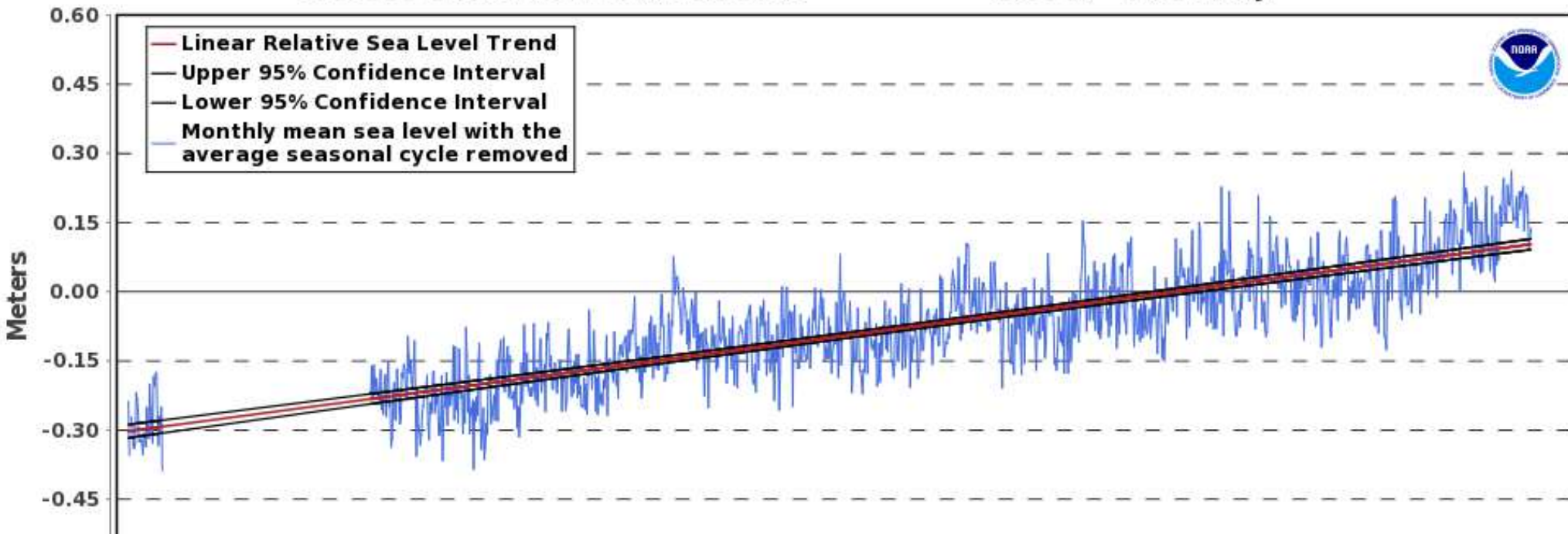
Measured at the coast with tide gauges – and from space with satellites!

Recent Sea Level Trends (NOAA)



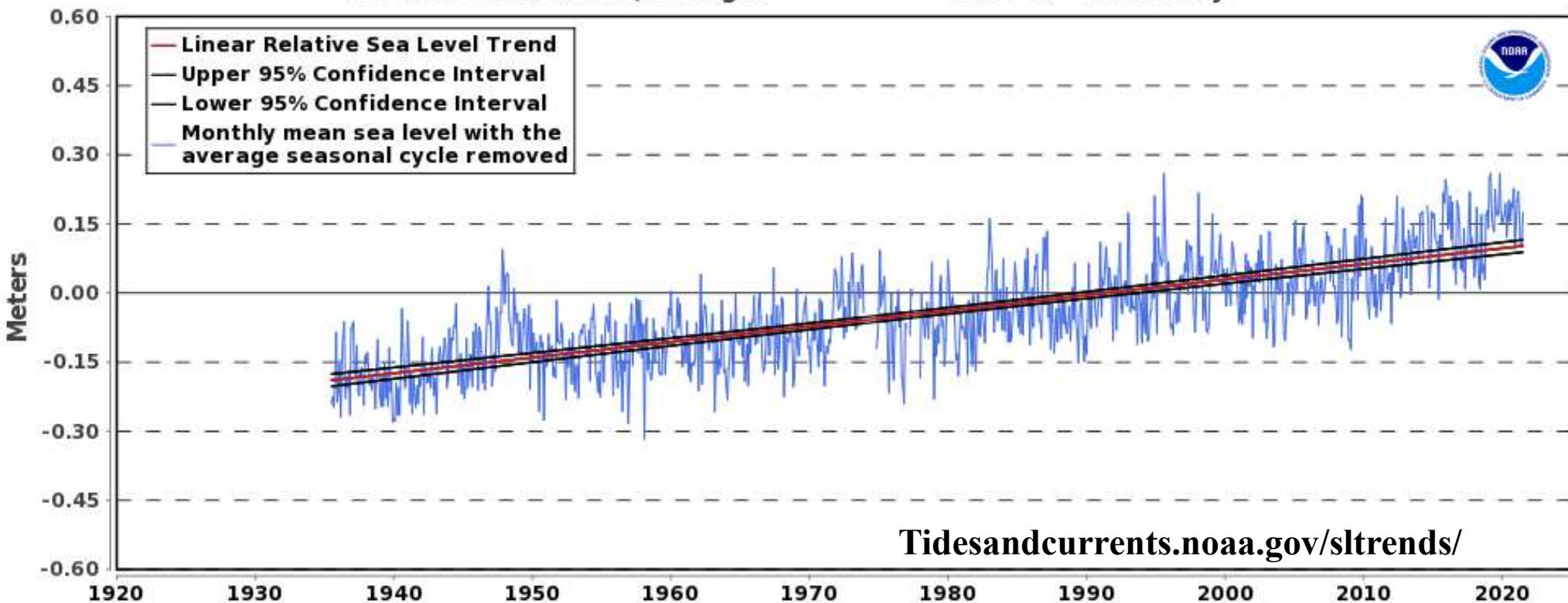
8665530 Charleston, South Carolina

3.36 +/- 0.19 mm/yr



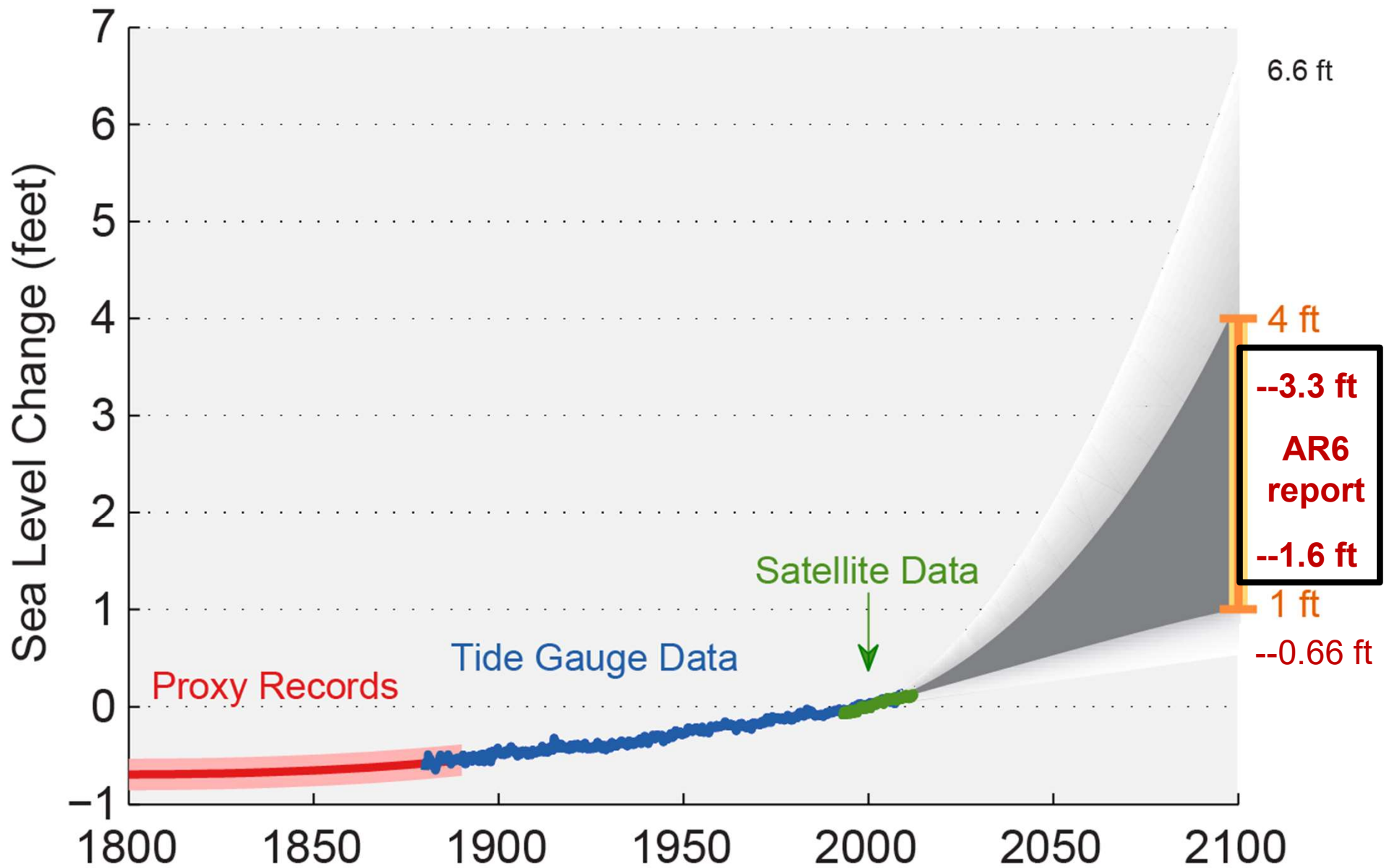
8670870 Fort Pulaski, Georgia

3.39 +/- 0.27 mm/yr



[Tidesandcurrents.noaa.gov/sltrends/](https://tidesandcurrents.noaa.gov/sltrends/)

Past and Projected Changes in Global Sea Level



Tools for Visualizing Coastal Change

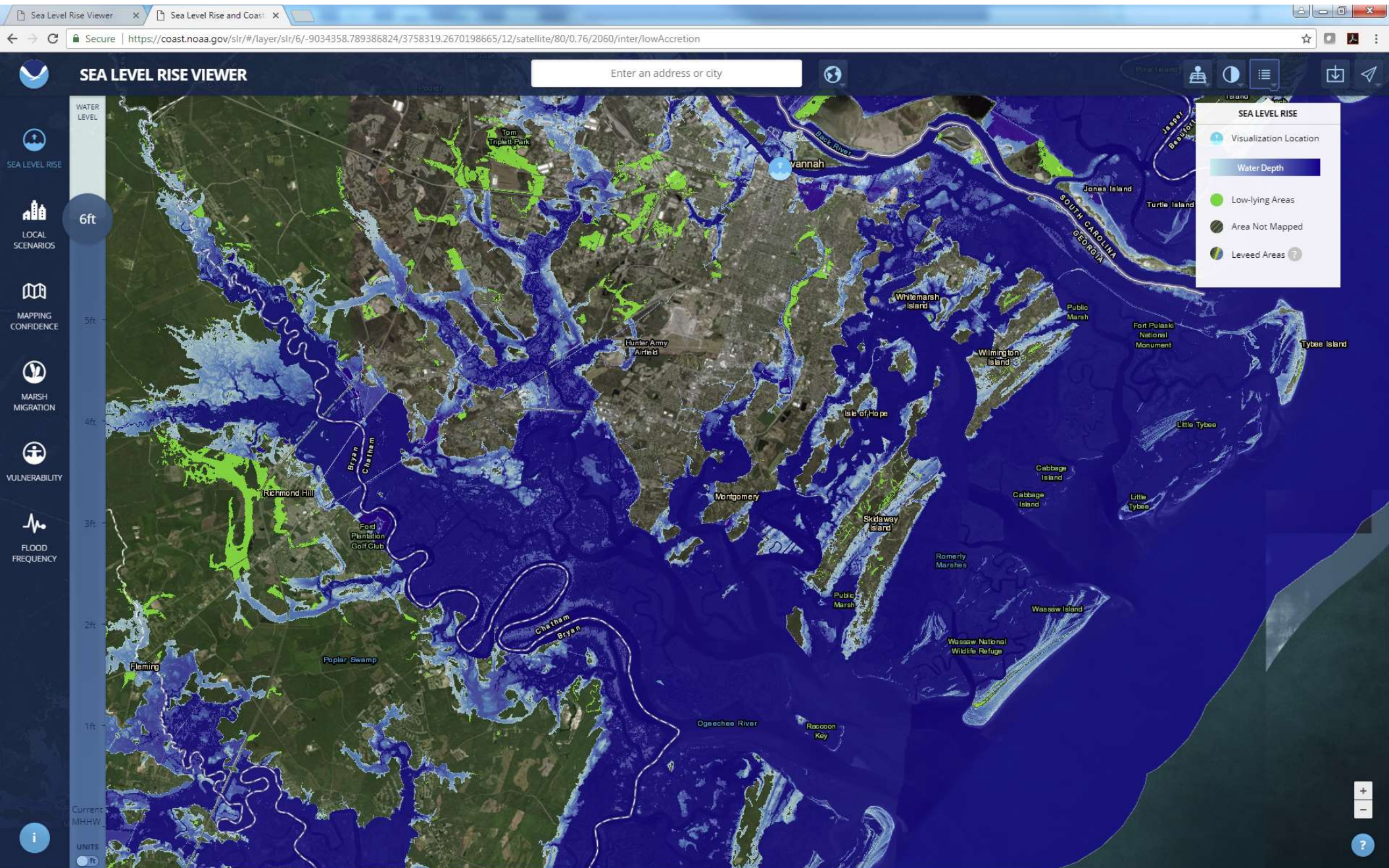


Georgia Coastal Hazards Portal
(gchp.skiio.uga.edu)

- sea level rise models
- flood and storm inundation zones
- shoreline erosion and accretion rates
- historic hurricane tracks
- historic shorelines
- storm hazard modeling

NOAA Digital Coast (<https://coast.noaa.gov/digitalcoast/tools/slr.html>)

Sea level rise – marsh migration – flood frequency



MHHW



Tybee Island

Little Tybee

3 feet



Tybee Island

Little Tybee

6 feet



Tybee Island

Little Tybee

Act 2



Skidaway Hamiltons

A non-partisan, civic-minded men's organization



How the City of Tybee Island is Responding

Alan Robertson, Principal, AWR Strategic Consulting
October 18, 2022







Six Years Ago...





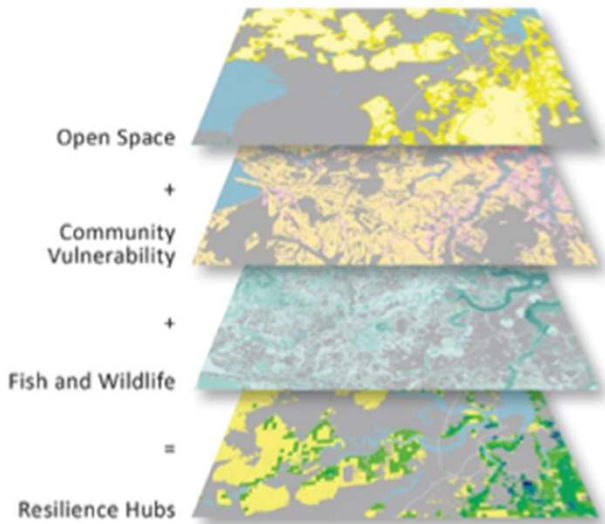


FEMA Lifting Houses



FEMA Stormwater Management Plan

Coastal Resilience Assessment of the Savannah River Watershed



*Left: Diagram of the overall approach of this assessment. Human community asset (HCA) vulnerability and fish and wildlife richness are assessed within all areas of public and private open space. Open space areas in proximity to HCAs with high vulnerability **and** high fish and wildlife richness are mapped as Resilience Hubs where efforts to preserve or increase resilience to threats are well-justified. From the set of all such Hubs, those scoring highest by these measures represent priority areas for undertaking resilience projects.*



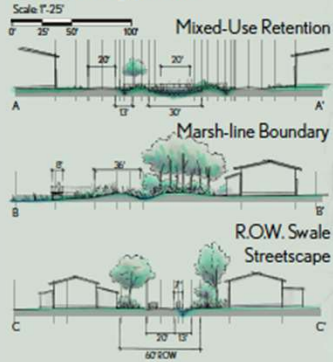
Tybee Island Back River Study

Marsh-line Inundation Park

Project Statement

This design seeks to mitigate the impact of sea level rise and unwanted flooding, two of Tybee Island's largest vulnerabilities. By utilizing green infrastructure and storm water management practices to develop a resilient framework for controlled inundation, a more flexible recovery strategy will help the community adapt to flood events and future sea level rise. Site scaled design examines the marsh ecosystem between Lewis Street and Miller Ave, but similar methods and strategies should be applied elsewhere on the island.

Section Typicals



Master Plan



Site Systems

Axon

Circulatory Structure

Elevated boardwalks create a 1.5 mile loop within the site, providing connectivity even during periods of peak inundation.

Green Infrastructure

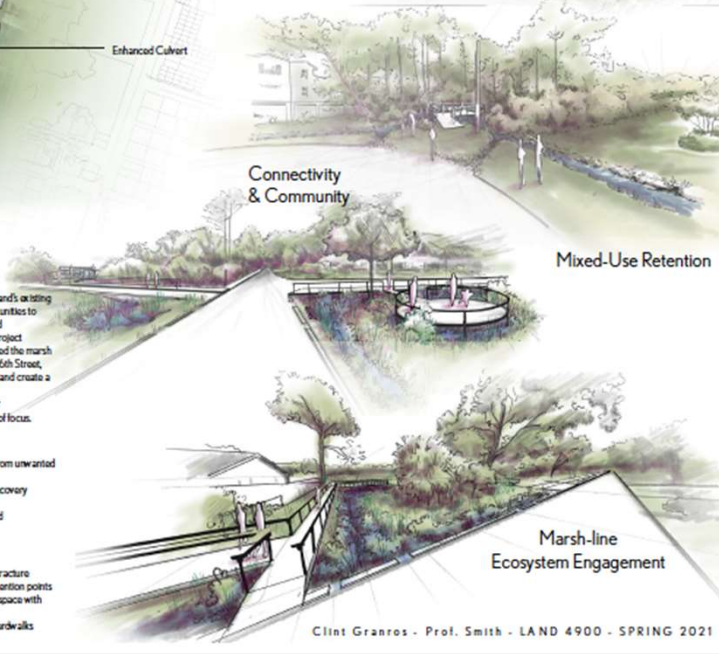
Acting as the boundary for planned inundation, the marshline levee provides a layer of protection for residential properties, minimally impacts existing tree canopy.

Planned Inundation

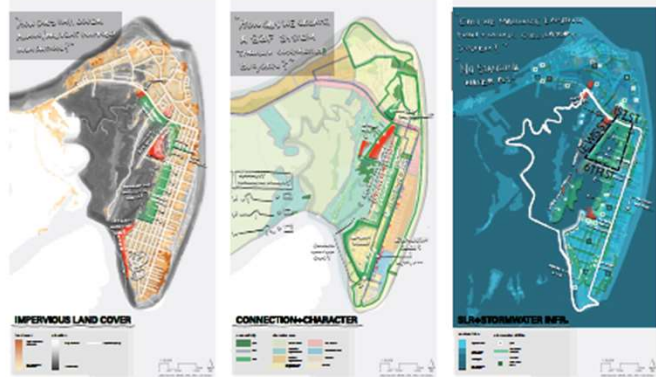
Mixed-Use swales and retention ponds create a matrix of stormwater management features throughout the vulnerable portions of the site. Retention ponds serve as "shock points" for the system, temporarily storing runoff to be discharged into lower elevation marshland. The combination of these protective measures helps mitigate the impact of flood events and promotes rapid community recovery.



Connectivity & Community



Existing Conditions: Inventory & Analysis

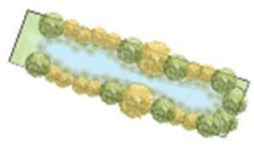


Site Context
Inventory and analysis of the Tybee Island's existing conditions revealed numerous opportunities to improve stormwater management and inundation recovery throughout the project boundary. Site scale design approached the marsh ecosystem between Lewis Street and 6th Street, seeking to reduce unwanted flooding and create a flexible inundation recovery system. Elevated housing is recommended for residential properties within this area of focus.

- Project Goals**
- Protect the residential community from unwanted inundation
 - Develop a more responsive flood recovery system
 - Improve pedestrian connectivity and engagement to marsh ecosystem
- Project Objectives**
- Develop R.O.W. Green/Blue Infrastructure
 - Connect Mixed-Use swales and retention points
 - Establish "Safe-to-fail" marsh greenspace with reinforced boundary
 - Engage marshline with elevated boardwalks

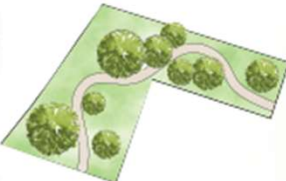


② Bioretention Pond



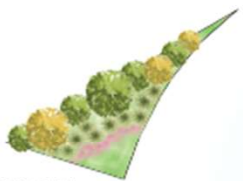
Scale: 1"=20'

③ Community Park



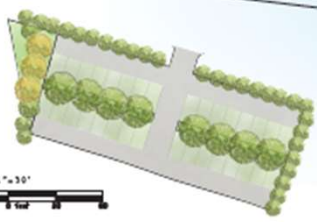
Scale: 1"=30'

④ Rain Garden



Scale: 1"=30'

⑤ Permeable Parking Lot

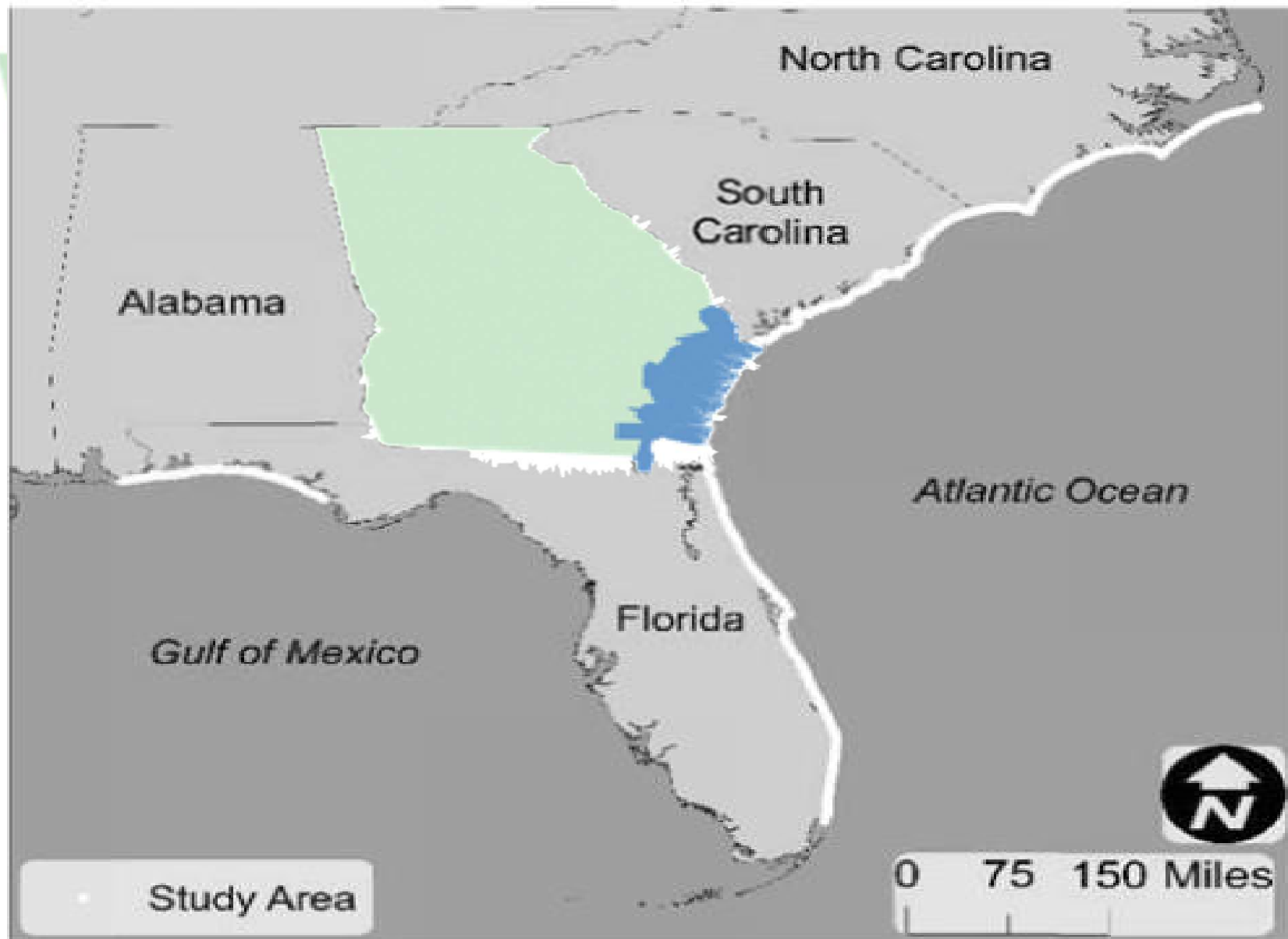


Scale: 1"=30'

SITE SCALE MASTER PLAN

- LEGEND
- Site Scale + Site Paths
 - Green
 - Proposed Street Infrastructure
 - Existing Paths
 - Proposed (Paved) Road
 - Existing Streets + Roadways



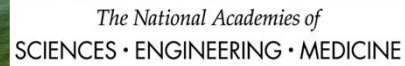




Georgia Department of
Community Affairs



asbpa
American Shore & Beach Preservation Association
Advocating for healthy coastlines



The National Academies of
SCIENCES • ENGINEERING • MEDICINE



**GEORGIA
SOUTHERN
UNIVERSITY**



**UNIVERSITY OF
GEORGIA**



Sea Grant
Georgia



**US Army Corps
of Engineers®**
Savannah District



NATIONAL FISH AND WILDLIFE FOUNDATION
NFWF



GEORGIA
DEPARTMENT OF NATURAL RESOURCES



**GEORGIA
COASTAL**
Management Program
est. 1998
Department of Natural Resources
COASTAL RESOURCES DIVISION



**Skidway Institute
of Oceanography**
UNIVERSITY OF GEORGIA

Where Tybee is going....

- ✓ Broader geographic scope
- ✓ Collaborate with broader network of partners
- ✓ Address the most vulnerable of our communities: What is the community's responsibility?
- ✓ Transportation, Health Care, Telecommunications, Power
- ✓ Financial Risk Management – plugging the holes in our resilience plan
- ✓ Political will to make hard decisions – public outreach, education, engagement

... Why Tybee matters

- ✓ A “canary in a cage” experiencing most all elements of resilience
- ✓ Island exacerbates issues – literally the “end of the road”
- ✓ Existing collaborations with a broad group of constituents
- ✓ Exploring risk management tools with global reinsurers
- ✓ Experience – assessment, plans, regulatory reviews and approvals, budgets, grant administration



Skidaway Hamiltons

A non-partisan, civic-minded men's organization



... addressing some of today's most important issues for building a strong, viable, and sustainable ... community.

Alan Robertson, Principal, AWR Strategic Consulting
October 18, 2022



Thanks for your attention!

