

Causes and Impacts of Local / Relative Sea Level Rise on GA and SC

Doug Marcy

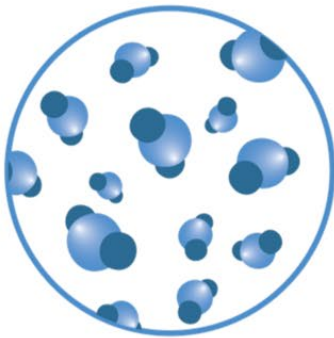
NOAA Office for Coastal Management



OFFICE FOR COASTAL MANAGEMENT
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Intergovernmental Panel on Climate Change Sixth Assessment Report

CO₂
concentration



Highest

in at least

2 million years

Sea level
rise



Fastest rates

in at least

3000 years

Arctic sea ice
area



Lowest level

in at least

1000 years

Glaciers
retreat

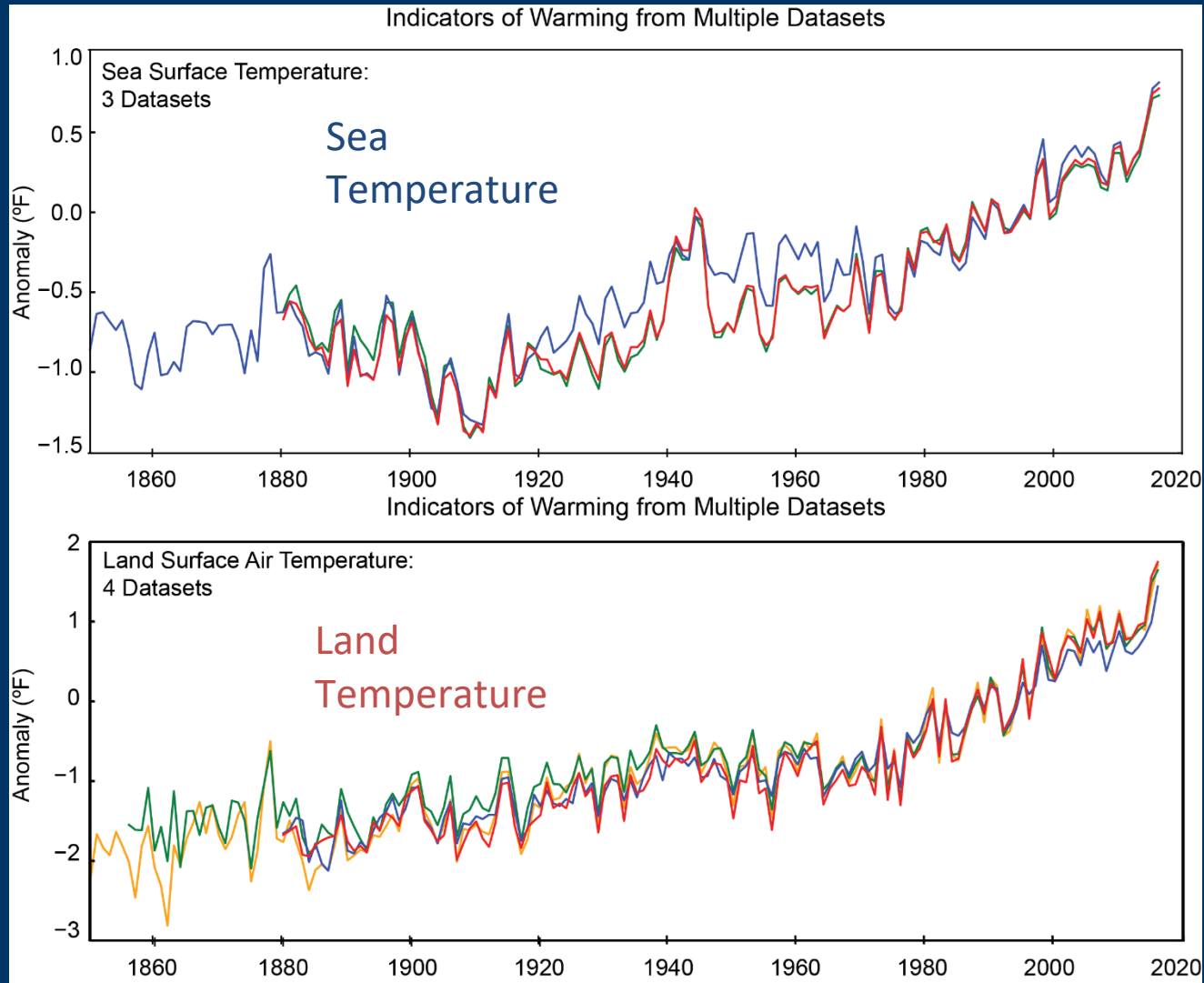


Unprecedented

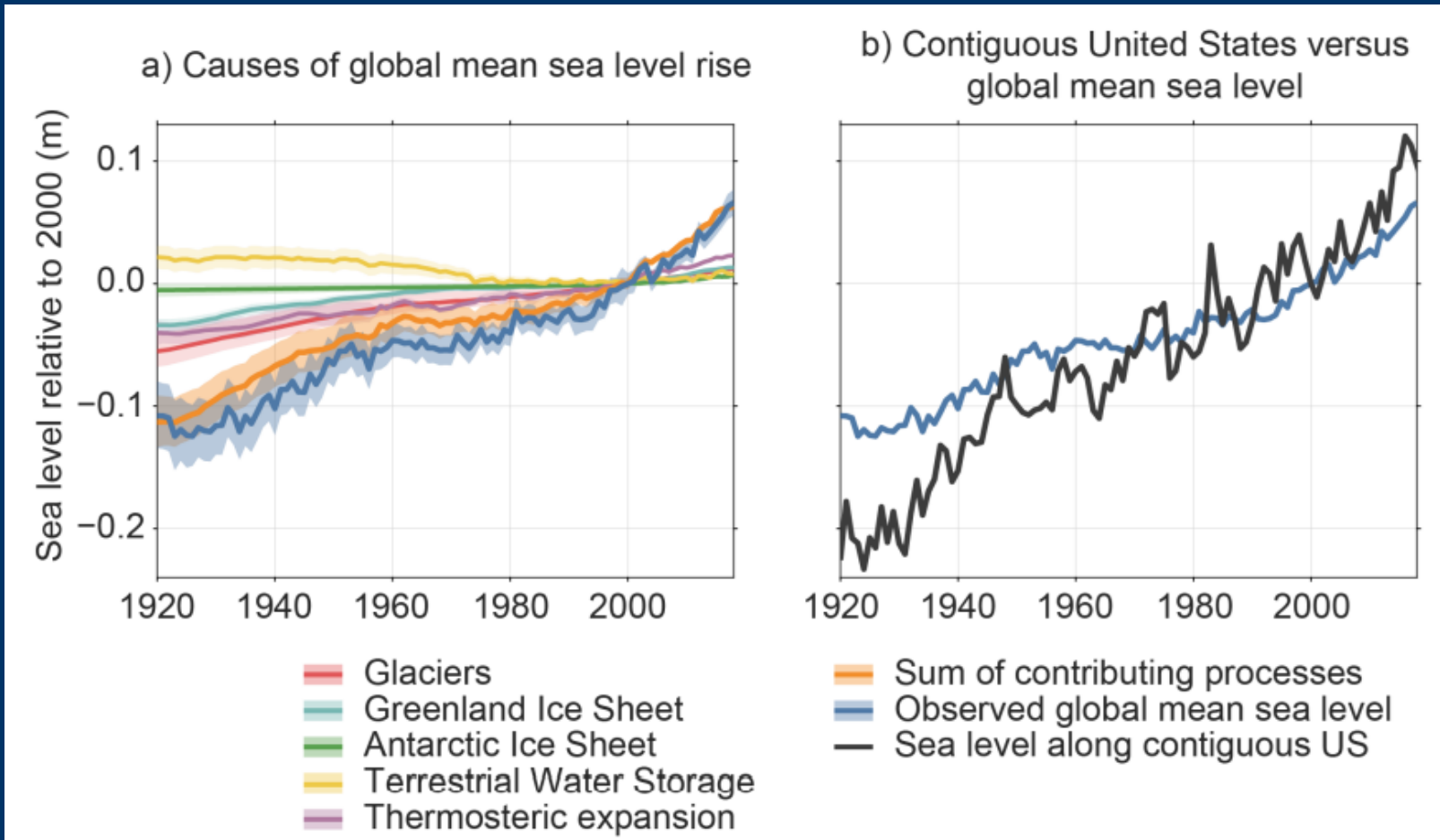
in at least

2000 years

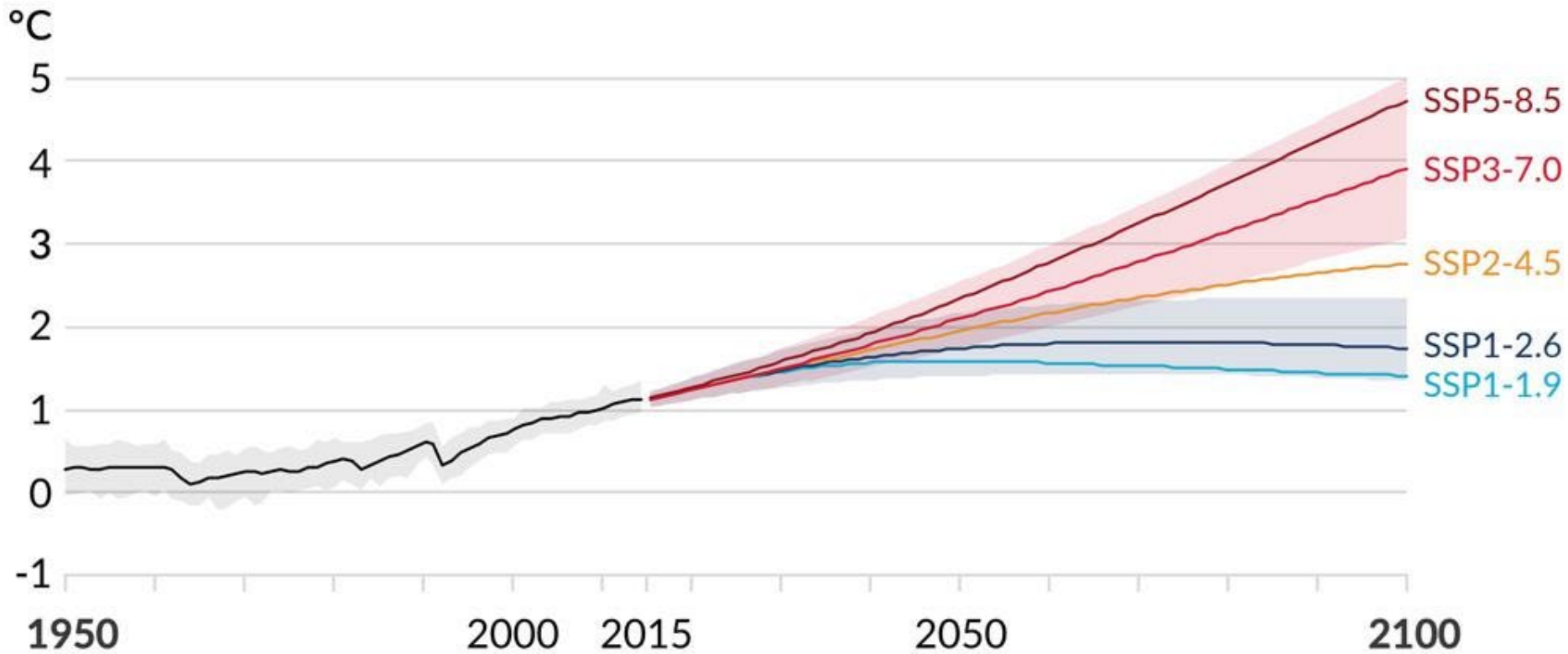
Historical Land and Sea Temperature



Historical Sea Level Rise



Future Temperature

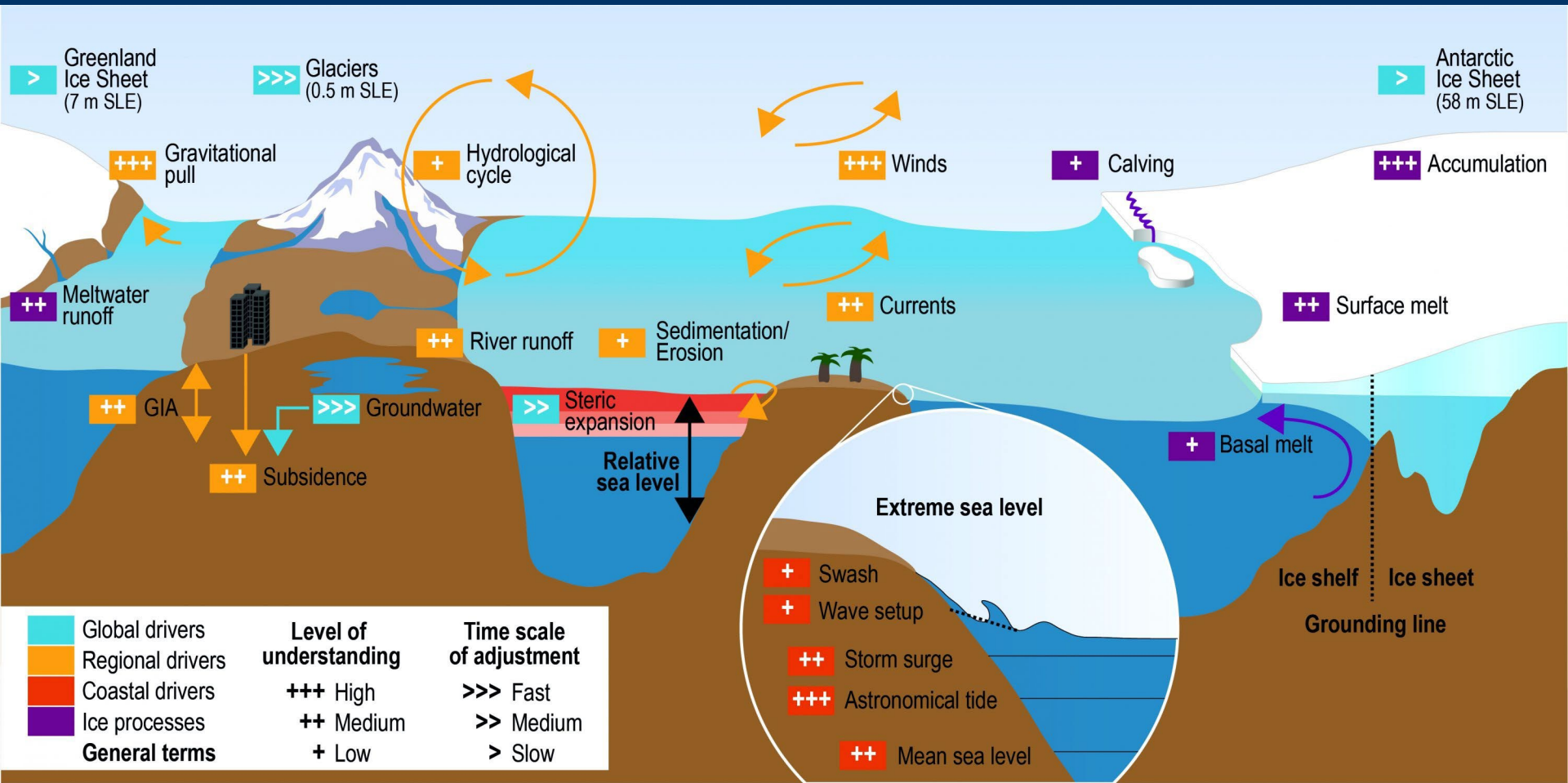


From IPCC AR6

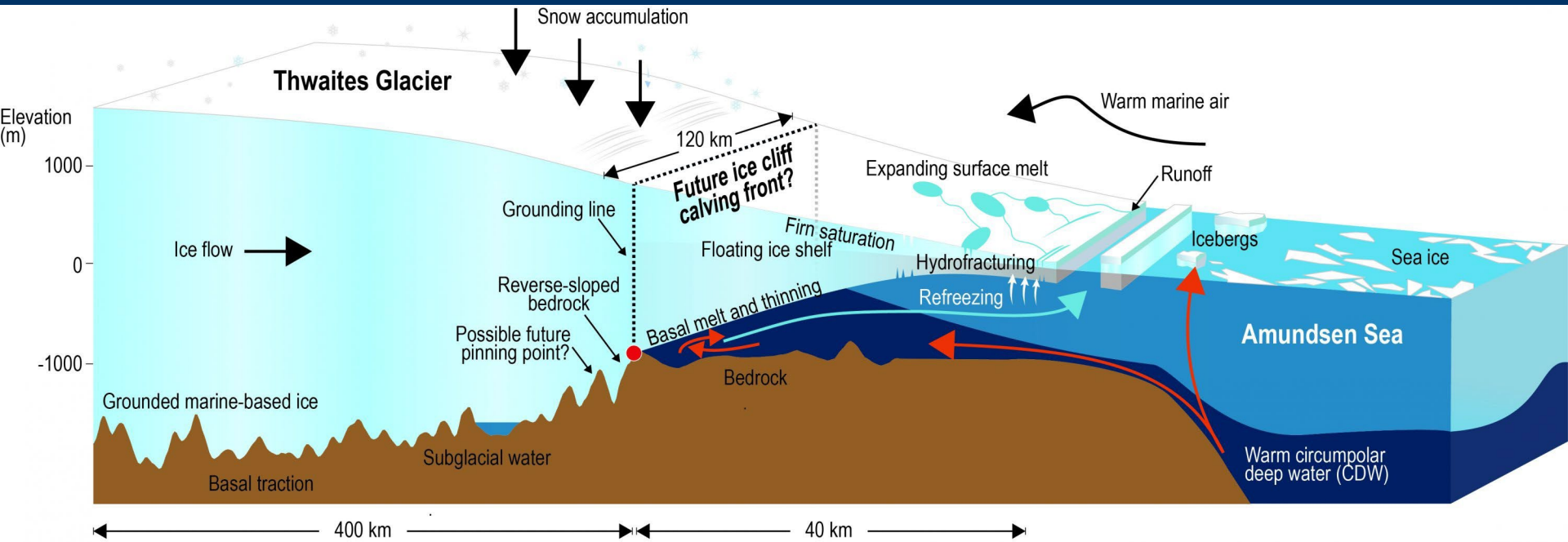


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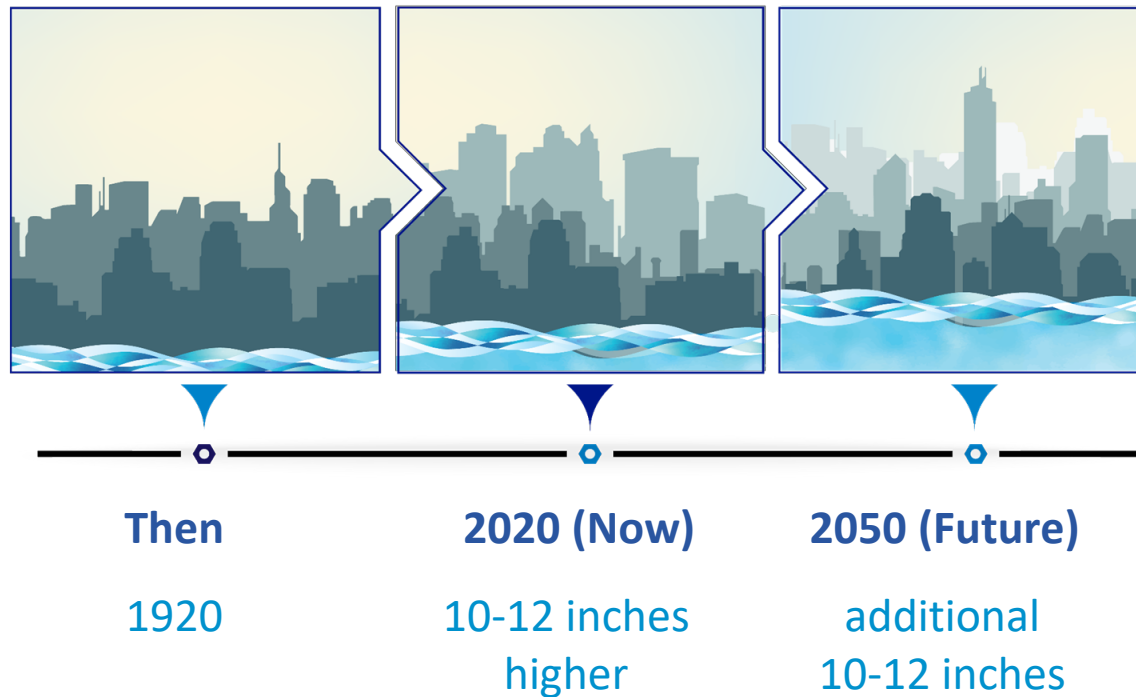
Sea Level Change



Greatest source of uncertainty?



National Sea Level Rise



- Projections vary by location.
- 10-12 inch rise in last 100 years; same amount of rise projected in next 30 years.
- Results: profound shift in coastal flooding over next 30 years.
- Results: damaging floods projected 10+ times as often.

DETAILS

2022 Sea Level Rise Technical Report

- Federal Interagency Sea Level Rise and Coastal Flood Hazard Scenarios and Tools Task Force
- Most up-to-date sea level rise projections available
- Key input for 5th National Climate Assessment
- Data informs sea level rise adaptation plans at all scales



FEMA



US Army Corps
of Engineers®



2022 Sea Level Rise Technical Report

KEY TAKEAWAYS

- U.S. Coast: average 10-12 inches sea level rise in next 30 years.
 - Equals change seen over past 100 years.
 - Rates will be lower or higher in different regions.
- Results: More extreme tides and damaging storm surges.
- Results: Profound shift in coastal flooding over next 30 years. By 2050, “moderate” (typically damaging) flooding likely to occur 10+ times more often.



2022 Sea Level Rise Technical Report

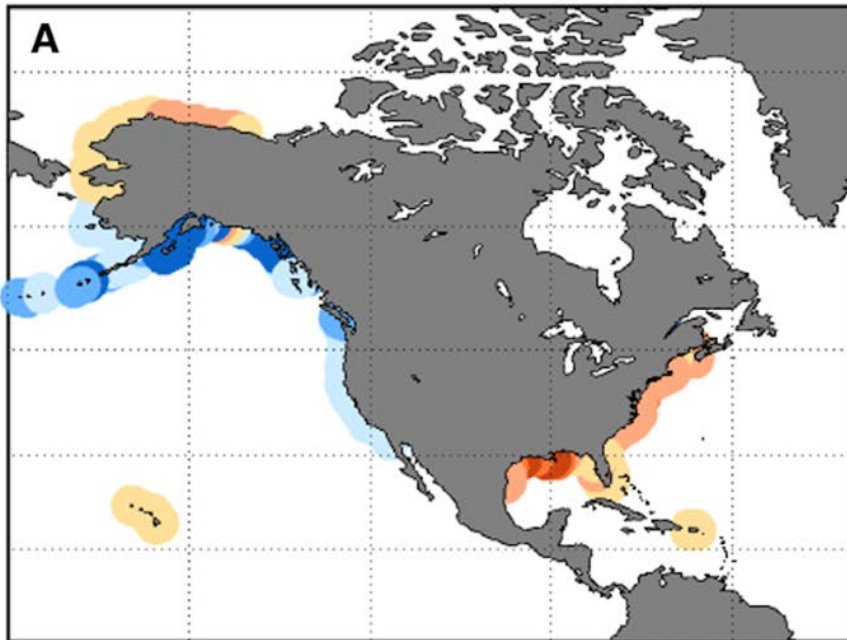
KEY TAKEAWAYS

- Emissions Matter: Likely at least two additional feet by 2100 due to current emissions alone. Rising emissions could cause a sea level spike upwards of 7 feet by 2100.
- Greater certainty than previous projections for the next 30 years.
- Uncertainty increases after 2050, and is highly dependent on future emissions.
- Continued observations will enhance future predictions.

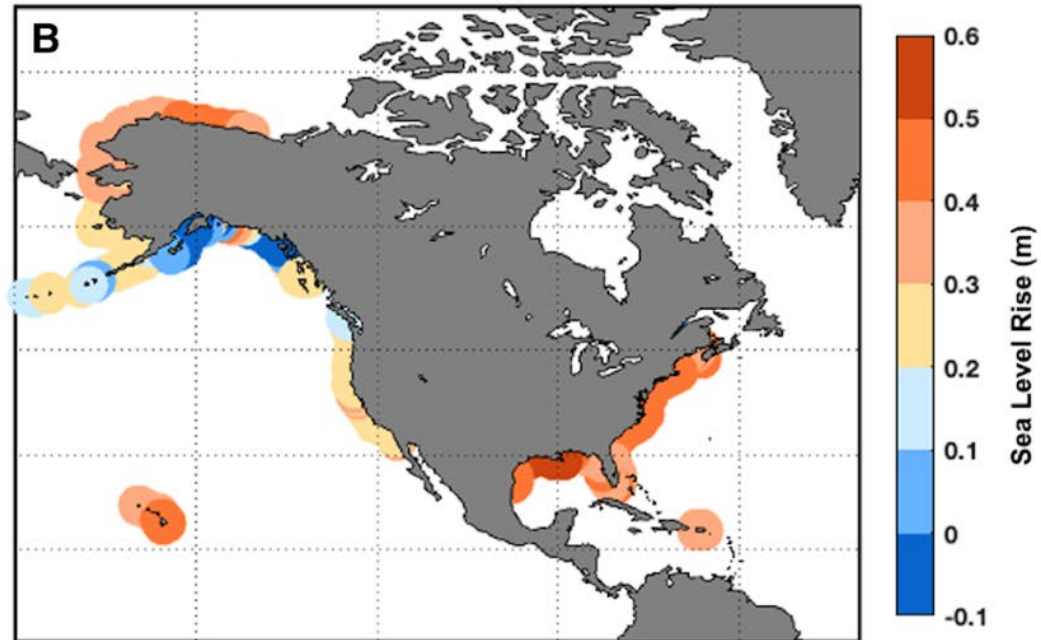


Near-Term Sea Level Change (2020-2050)

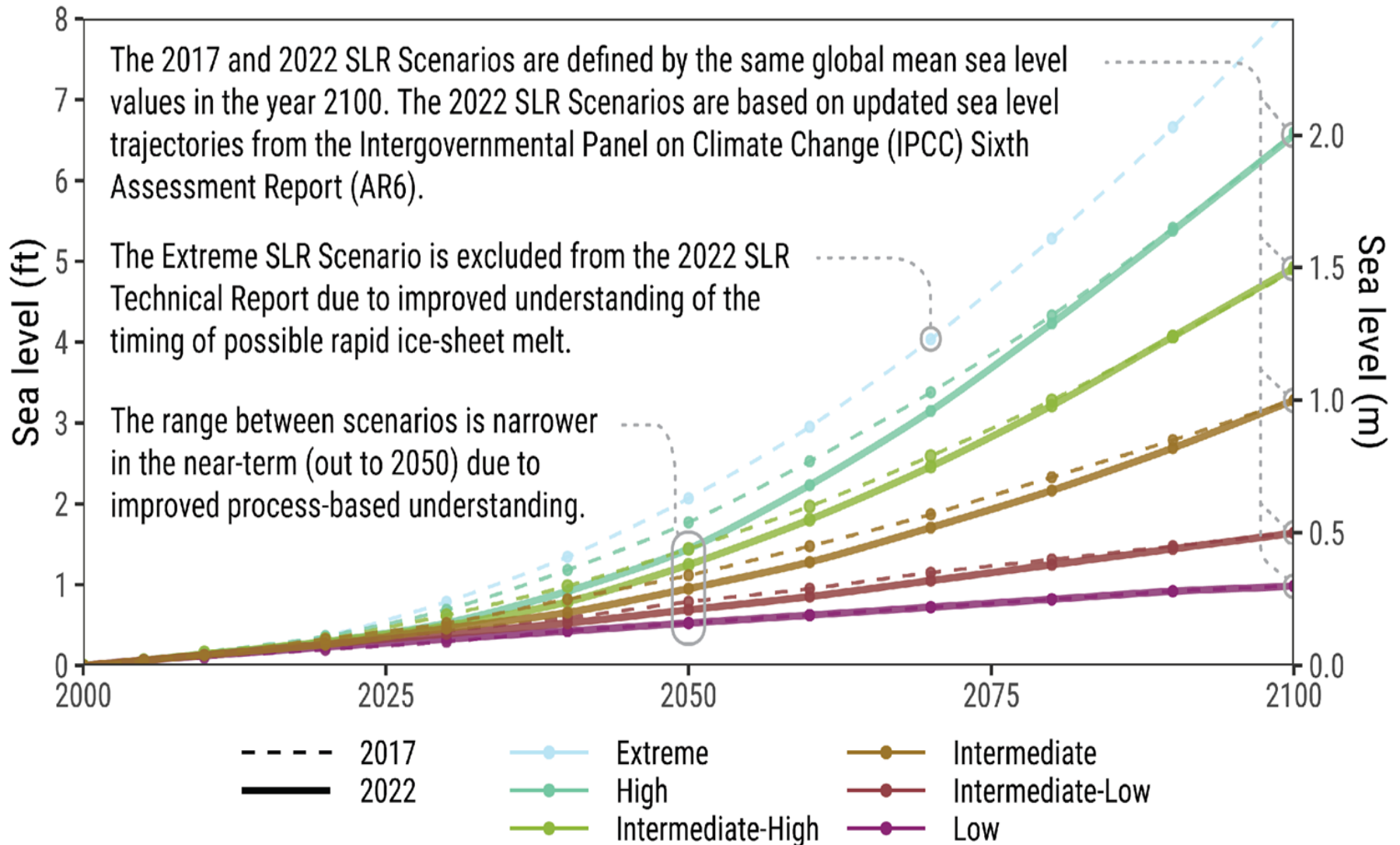
Intermediate Low (0.5m) (2050)



Intermediate High (1.5m) (2050)



What has changed from 2017?

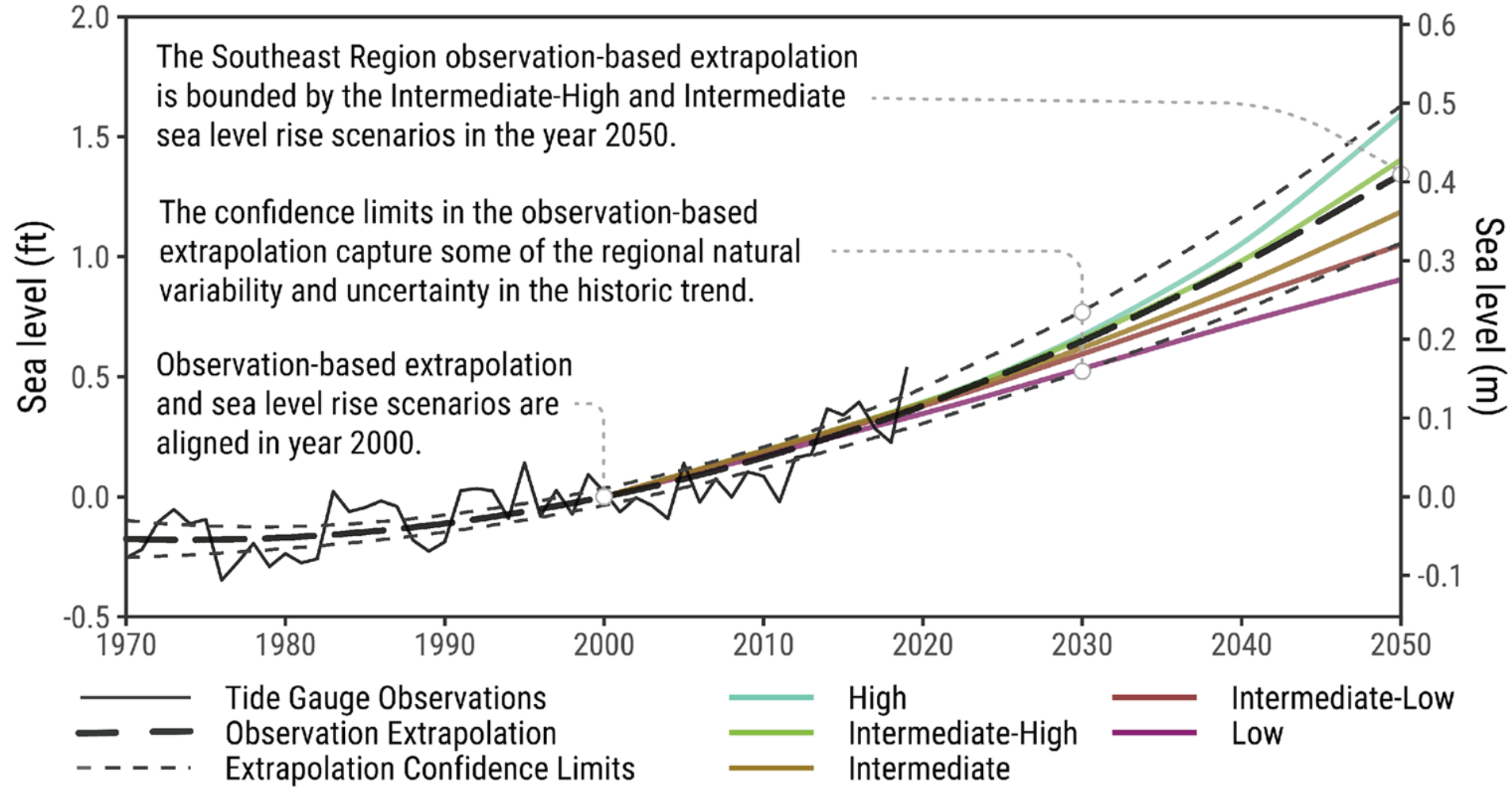


South Carolina and Georgia

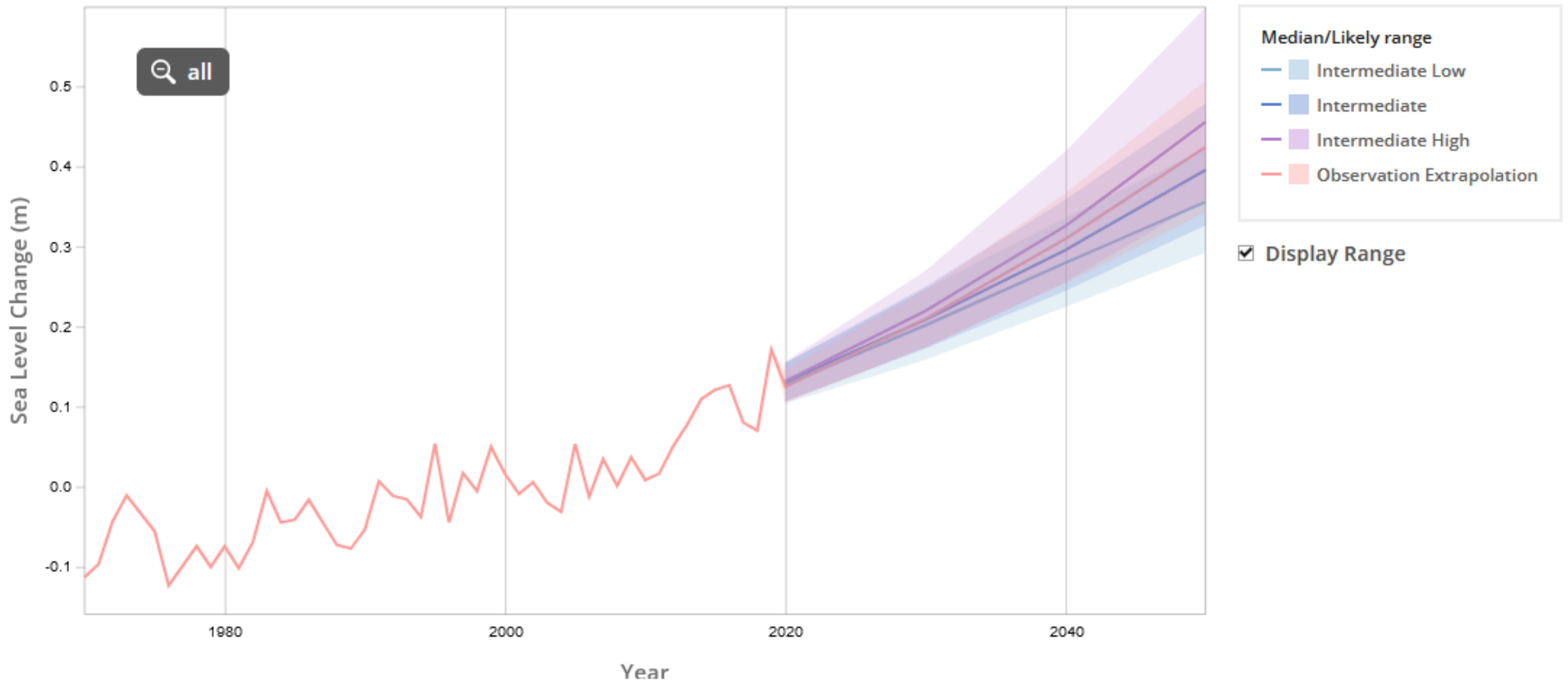
Tide Gauge	2017 Intermediate-low 2080	2022 Intermediate-low 2080	2017 Intermediate-high 2080	2022 Intermediate-high 2080
Fort Pulaski, GA	1.64 feet	1.90 feet	4.36 feet	3.51 feet
Charleston, SC	1.61 feet	1.87 feet	4.33 feet	3.48 feet



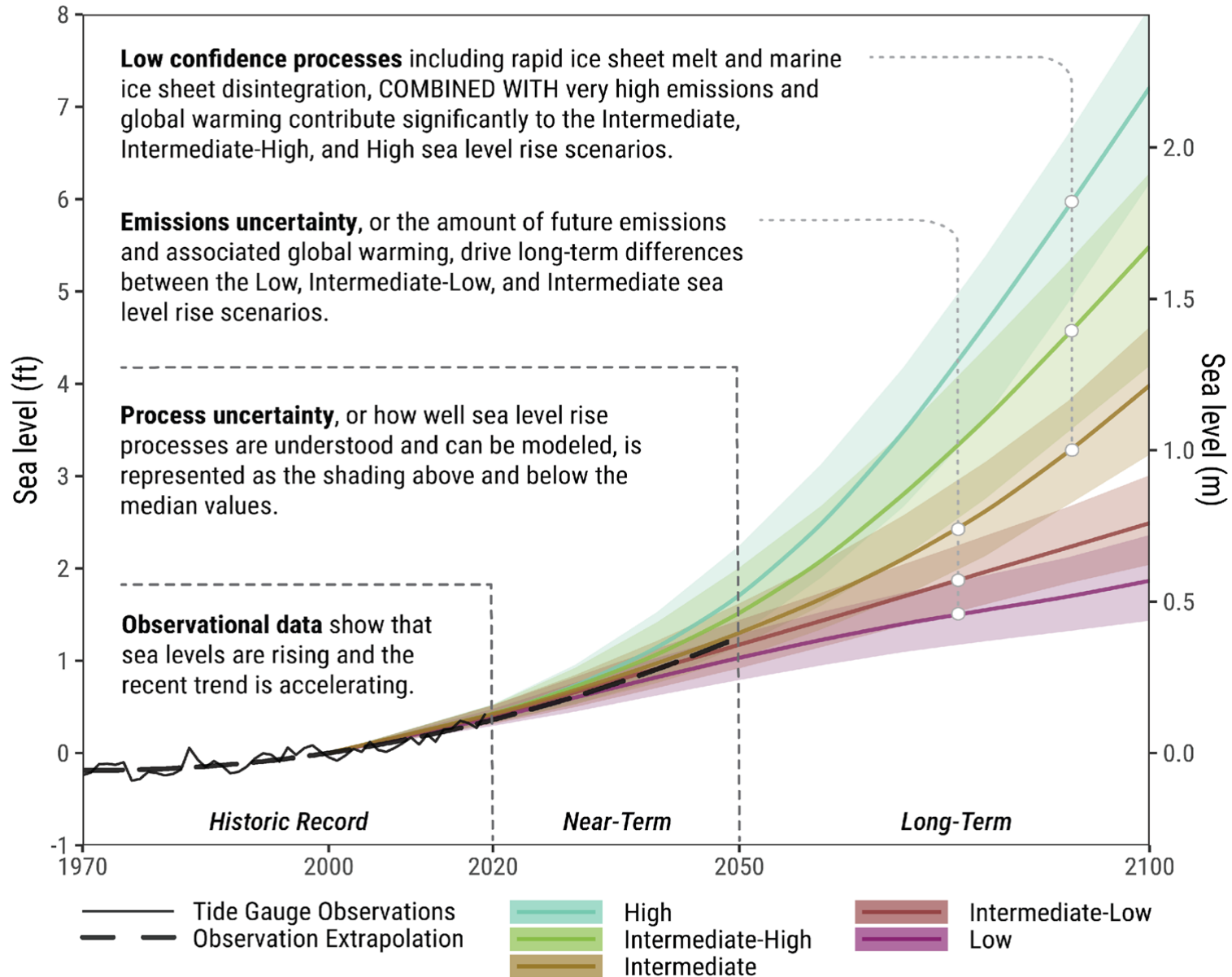
What else is new?



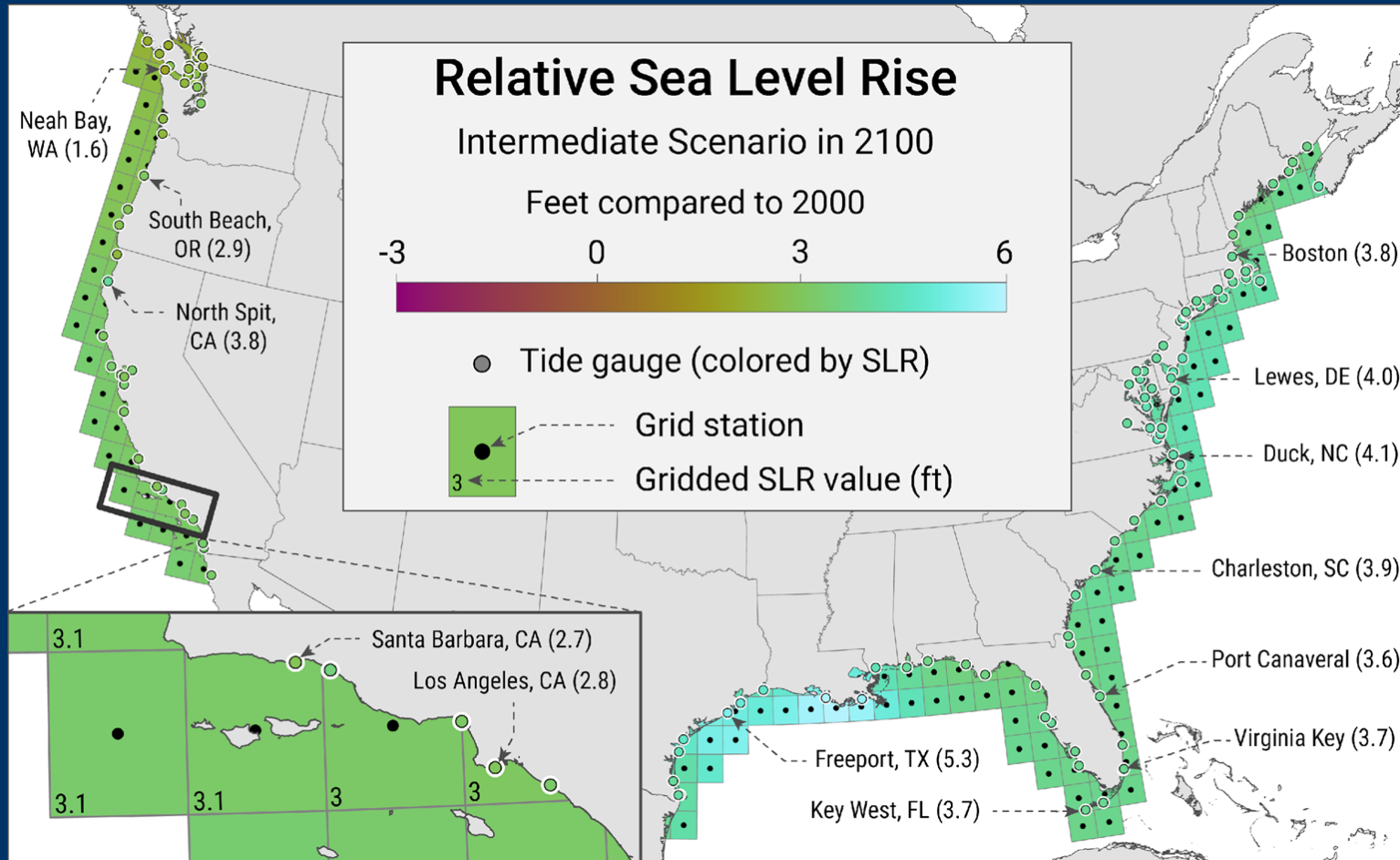
Fort Pulaski, GA: Extrapolated Observation



How confident are we?



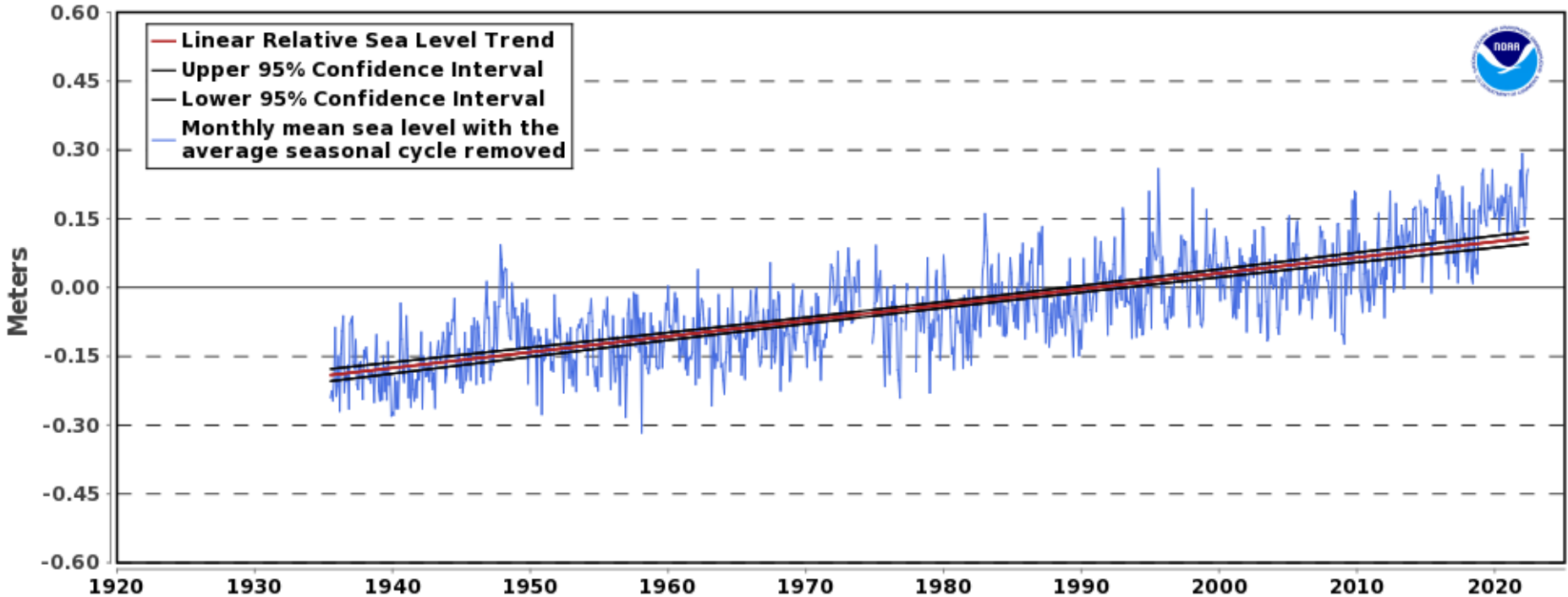
Gridded Sea Level Rise Data (with Tide Gauges Overlaid)



Local Sea Level Rise

8670870 Fort Pulaski, Georgia

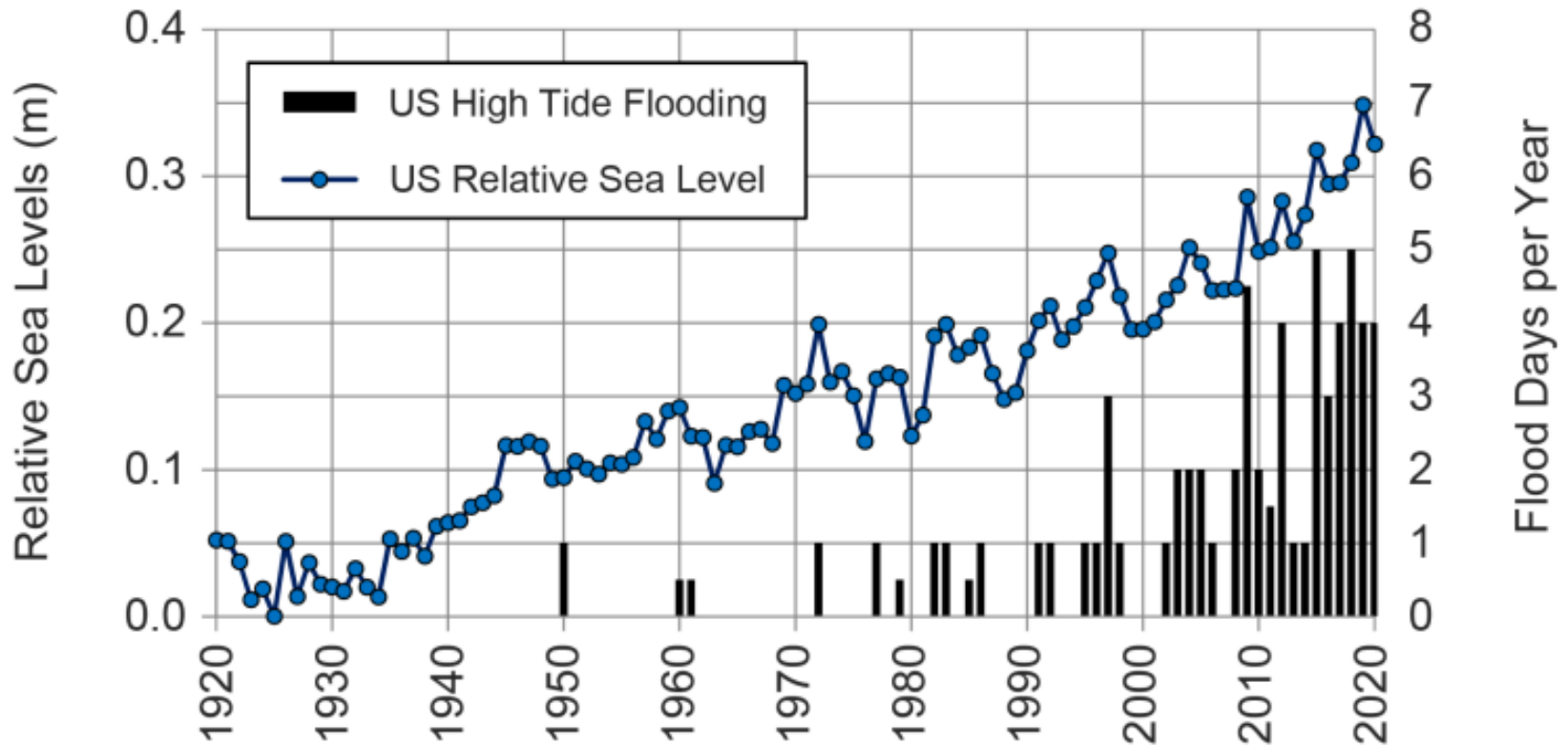
3.44 +/- 0.26 mm/yr



1.13 feet in 100 years



Increase in High Tide Flooding Events



High Tide Flooding Averages



Then (2000)

2 days

Now (2020)

4 days – twice
as frequent as in
2000

Future (2050)

25 to 75 days – up to
19 times as frequent
as in 2020

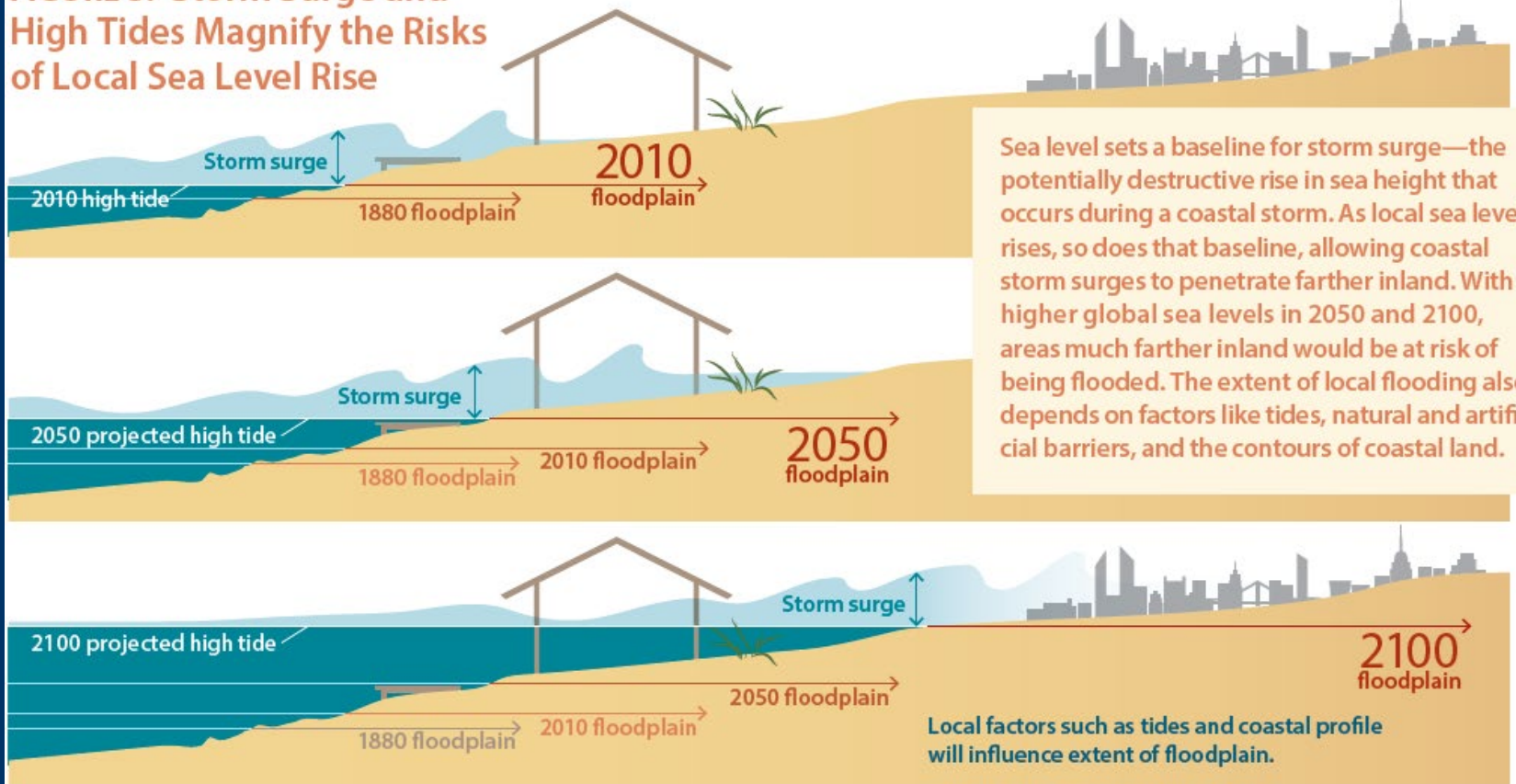
- Some regions have 400 - 1,100% increase in frequency.
- Acceleration is seen at 80% of East and Gulf Coast locations.
- By 2050, minor high tide flooding is normal occurrence at most locations.

Physical Factors Directly Contributing to Coastal Flood Exposure

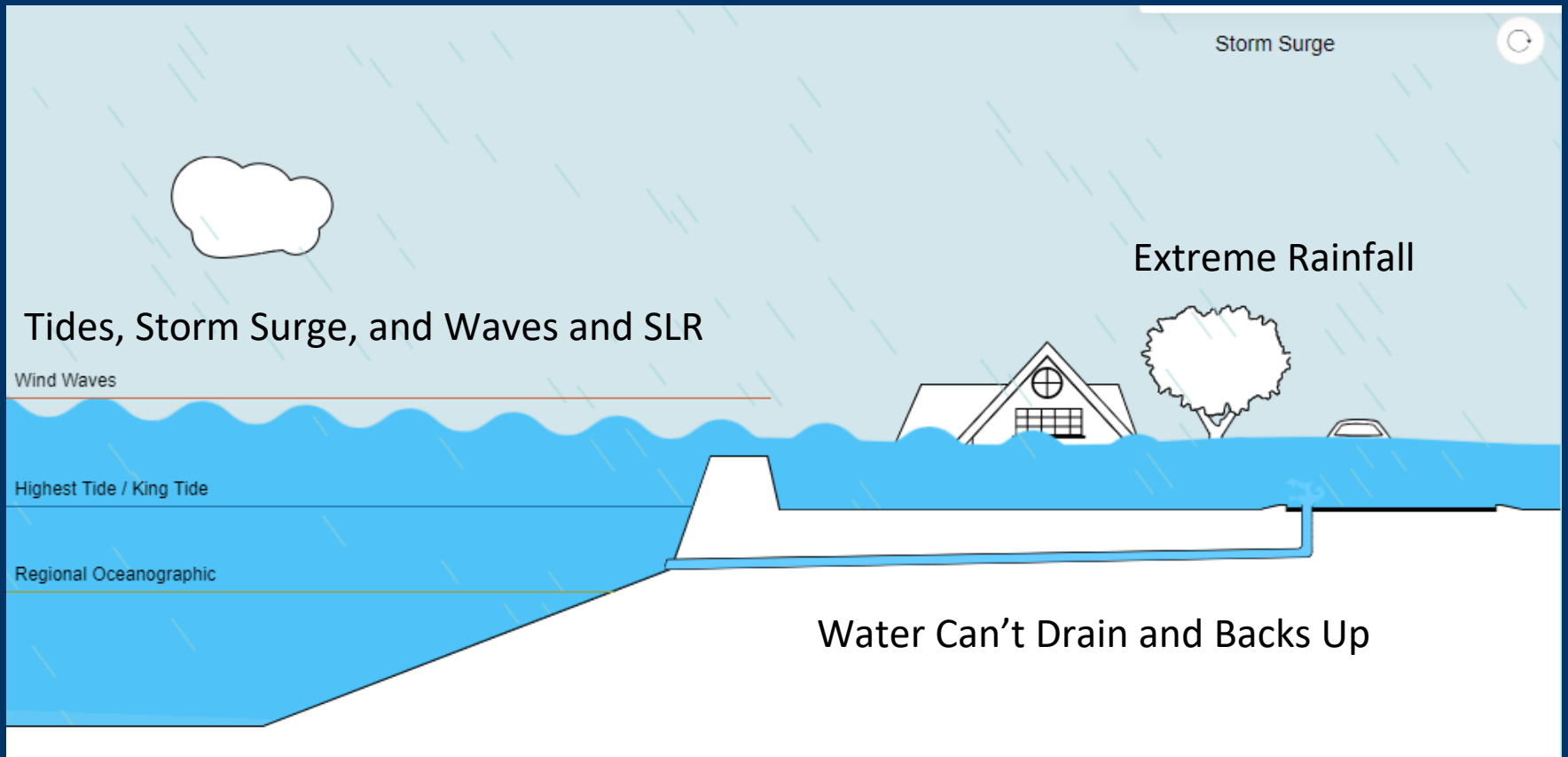


SLR Will Make Future Storms Worse

FIGURE 3: Storm Surge and High Tides Magnify the Risks of Local Sea Level Rise



Combined Flooding



Implications for Local Planning

MIXED NEWS

- Narrower range of possible scenarios until 2050, so more certainty
- Rate of sea level rise has accelerated over the last few decades
- More time to plan for the highest levels than previously projected (though unabated emission levels could change this)
- The tidal flooding regime shift predicted over the next 30 years means planning can't wait



ADVICE FOR COMMUNITIES

Consider Risk Tolerance, Type of Asset

- Some use higher scenarios because they are risk averse and know building a little higher buys extra protection from compound flooding (e.g. storm surge, heavy precipitation events)
- Cost is a factor. Elevating a building an extra foot is different than elevating a major road an extra foot.
- For natural infrastructure, the narrower range of possible scenarios helps avoid the “over building” that impacts ecosystem benefits



Application Guide for the 2022 Sea Level Rise Technical Report

oceanservice.noaa.gov/slr/report-guide

Contents

Building A Knowledge Base

- Scenario uncertainty and implications
- Observations vs projections
- Extreme water levels and flood frequencies
- Datums, baselines, and epochs

Planning Frameworks

- Risk tolerance
- Scenario planning
- Adaptation pathways

Community Examples

Additional Information Resources

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Coastal Inundation Topic

Science Report: 2022 Sea Level Rise Technical Report

Data: Extreme Water Levels

Interactive Website: Adapting Stormwater Management for Coastal Floods

Our nation's coasts are increasingly at risk from rising seas, changing water levels in the Great Lakes, and more frequent and intense storms. These changes are forcing communities to plan for and adapt to coastal flooding using time scales associated with both weather (hourly, daily, and weekly) and climate (seasonally, annually, by decade, and beyond).

Communities can benefit from the resources provided below as they work to increase community resilience.



Get Started

Access the most current information about climate change, its impacts, and future flooding.

Access Key Data

Use these data to develop a comprehensive understanding of your community's water levels.

Visualize the Information

"Seeing" potential flooding impacts is an important step in understanding risks and vulnerabilities and where communities can improve their resilience.

Communicate the Issue

Increase your skills when it comes to communicating with your stakeholders.

Take Action

Find resources to help fund research and other resilience implementation plans.

Training: Coastal Inundation Mapping Training

Historic and Projected Climate Data: Climate Explorer

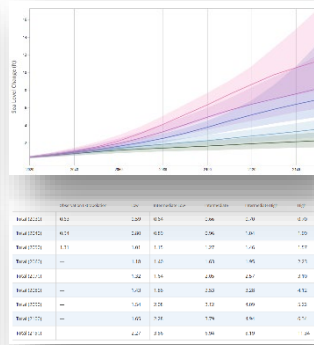
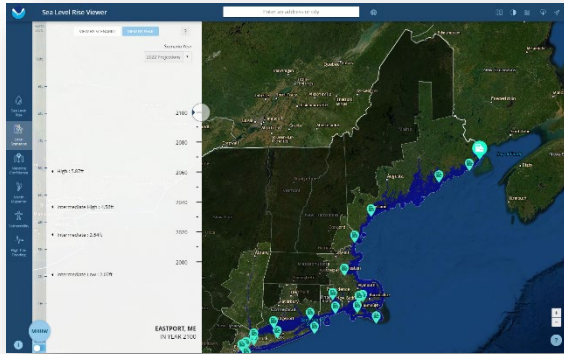
NEW Publication: Application Guide for the 2022 Sea Level Rise Technical Report

Tools: Sea Level Rise Viewer and Great Lakes Lake Level Viewer

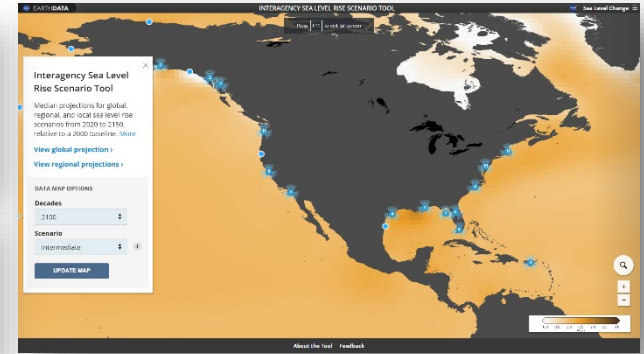
coast.noaa.gov/digitalcoast/topics/coastal-inundation.html



NOAA Sea Level Rise Viewer



NASA Sea Level Rise Scenario Tool



NOAA Stormwater Tool

Adapting Stormwater Management for Coastal Floods

Communities can use this website to determine how the flooding of today and tomorrow can affect their stormwater systems, and generate reports that can be used to:

- Display local information about the current and future flooding impacts
- Inform planning efforts

1. Learn more about coastal flooding and sea level rise.
2. Calculate current and future coastal flood frequency and impacts.
3. Determine if, when, and how your stormwater system will be impacted.
4. Learn different ways to mitigate flooding risks.

UNDERSTAND **ASSESS** **ANALYZE** **TAKE ACTION**

NOAA Sea Level Rise Snapshot

Sea Level Rise

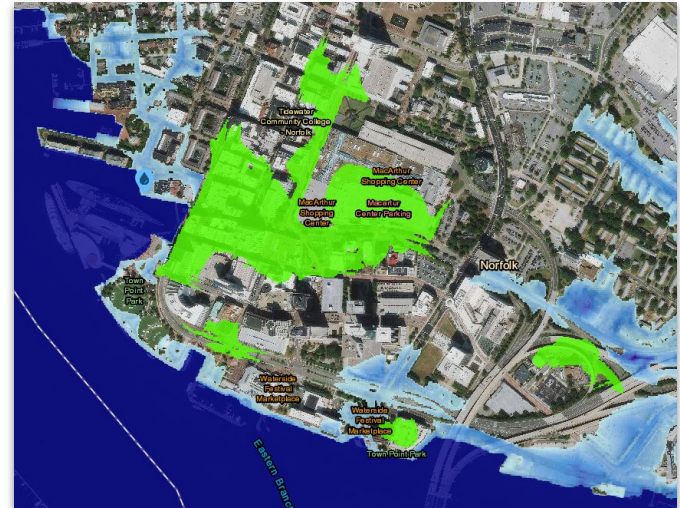
Visualize sea level rise exposure with this snapshot. Consider incorporating this data into all community planning strategies. In many communities, rising sea levels are already increasing the impacts of high tide flooding and storm surge events.

PRINT VIEW

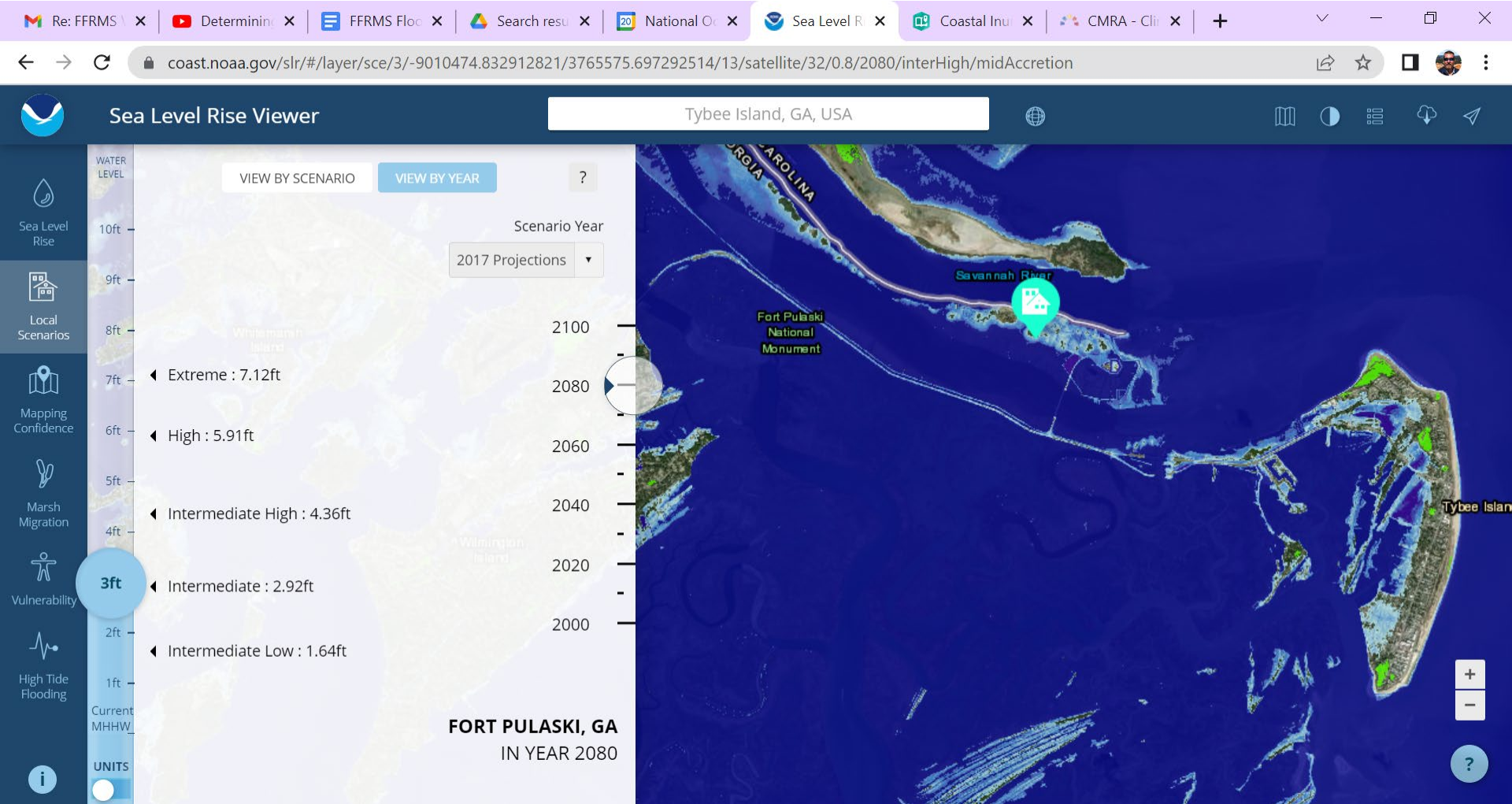


Sea Level Rise Viewer

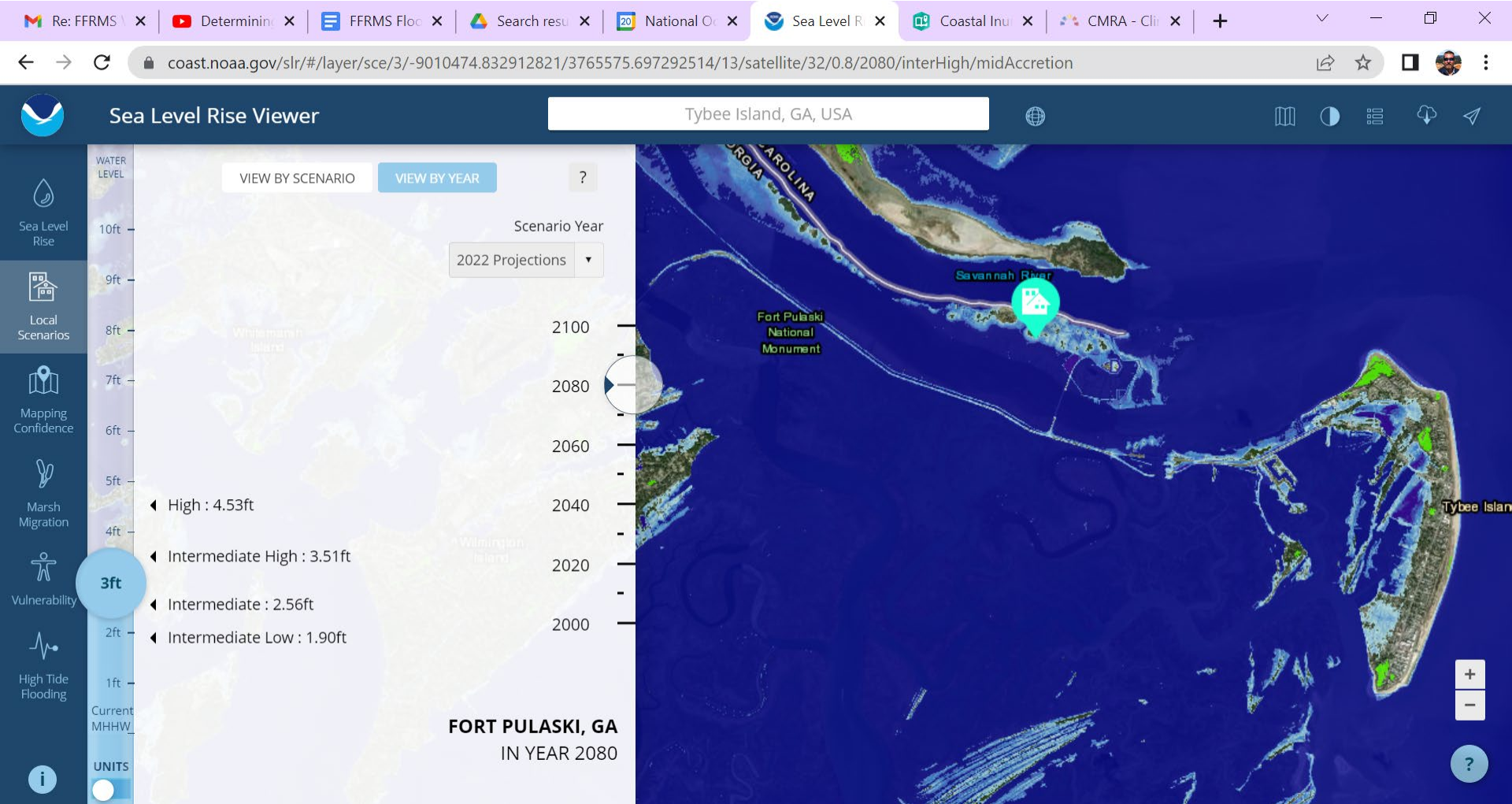
- Screening-level
- Nationally consistent
- Based on Lidar DEMs and VDatum Tidal Models
- All data can be downloaded
- Updates:
 - 3m resolution
 - Additional zoom level
 - 35 new visualization sites
 - 2017 and 2022 SLR Projections



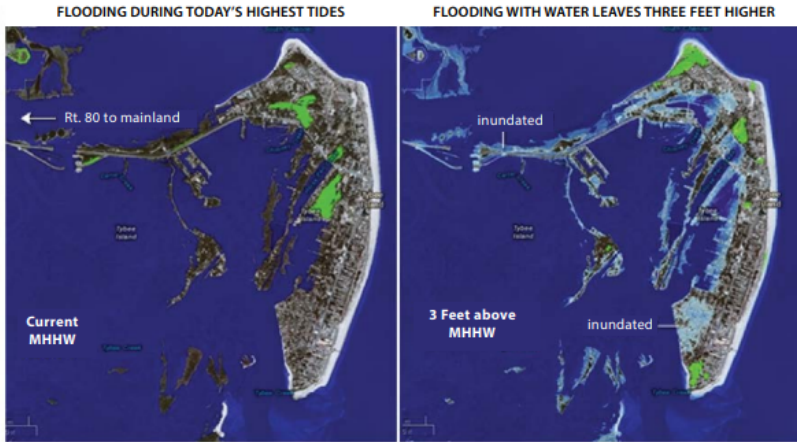
Sea Level Rise Viewer 2017



Sea Level Rise Viewer 2022



Sea Level Rise Viewer used for planning



- Tybee Island SLR Adaptation Plan
- NJ Floodmapper / NJ Adapt
- Climate Central Surging Seas (DEMs)
- NHC – storm surge modeling/mapping
- TNC climate resilience tool
- Others

FIGURE 3.1. SEA-LEVEL RISE AND COASTAL FLOODING IMPACTS VIEWER MAPS OF TYBEE ISLAND TODAY (LEFT) AND WITH THREE FEET OF SEA-LEVEL RISE (RIGHT).™

different models and scenarios. Particular effort was made to identify local assets at risk from sea-level rise in future projections and communicate hazards on the map. The project team employed a variety of visualization techniques to achieve this objective. For example, the Sea-level Rise Viewer (https://coast.noaa.gov/digitalcoast/tools/slr), launched by the National Oceanic and Atmospheric Administration's Coastal Management, allows website visitors to visualize sea-level rise in locations around the country. It uses a modified version of the Sea-level Rise Viewer, taking into account elevation, tidal variability, and inundation under different sea-level rise scenarios. The viewer displays Tybee Island with three-feet of sea-level rise (Figure 3.1), illustrating vulnerability in a way that was concrete, relatable, and actionable.

Identifying Vulnerabilities

A second series of town hall meetings, held in Atlantic Beach, NC, and citizens to identify local assets at-risk from sea-level rise, and choose the rates of sea-level rise to be used in the viewer. Utilizing a modified version of the Vulnerability Assessment and Planning Scenarios (VCAPS) facilitation process, the project team

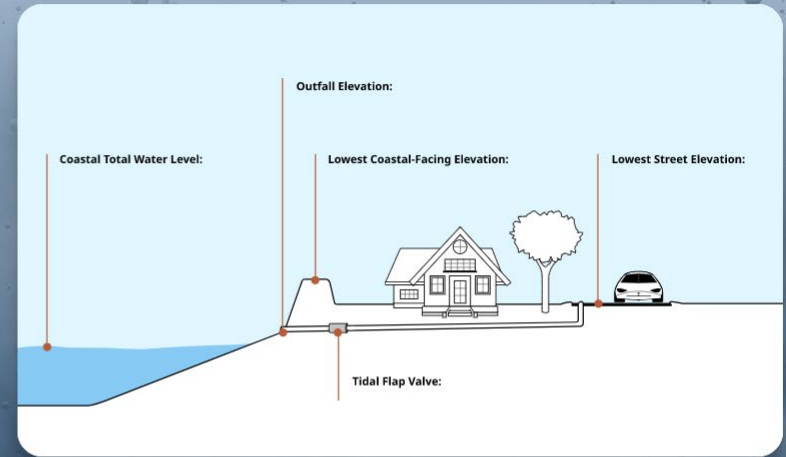
35 NOAA. 2015. Frequent Questions: Digital Coast Sea Level Rise and Coastal Flood Impacts Viewer. <https://coast.noaa.gov/digitalcoast/tools/slr/>. Accessed January 5, 2016.
39 Overmire, E. 2014. On Georgia seashores, visualizing sea level rise to set climate case studies. <http://www.governor.com/newsroom/visualizing-sea-level-rise-set-climate-case-studies>



Adapting Stormwater Management for Coastal Floods

Communities can use this website to determine how the flooding of today and tomorrow can affect their stormwater systems, and generate reports that can be used to:

- Display local information about the current and future flooding impacts
- Inform planning efforts



1 Learn more about coastal flooding and sea level rise.

UNDERSTAND



2 Calculate current and future coastal flood frequency and impacts.

ASSESS



3 Determine if, when, and how your stormwater system will be impacted.

ANALYZE



4 Learn different ways to mitigate flooding issues.

TAKE ACTION



Re: i think this is most re: X NOAA_CoastalInundationW... Calculator Tool SON and X National Oceanic and At... My Drive - Google Drive X FY23 Planning Schedule X NOAA Office for Coastal X Adapting Stormwater M... Assess Flood Risks X

https://coast.noaa.gov/stormwater-floods/assess/

NOAA

Charleston, SC 3ft (MHHW) Assessment

Specify Your Coastal Flood Threshold

Now that you've selected a location marker:

- Use the map to zoom in to your location.
- Drag the slider to see the potential impact of rising water levels. Any of the levels could be a critical threshold – the point at which impacts start to occur.
- After identifying your **coastal flooding threshold**, set it using the slider or enter it manually. Units are feet above mean higher high water (MHHW).

For reference, the 100-year (or 1% annual chance) water level at **Charleston, SC** is **4.27 ft**, which represents a major coastal flooding event for your area.

3 | ft of water level rise.

Feet Meters

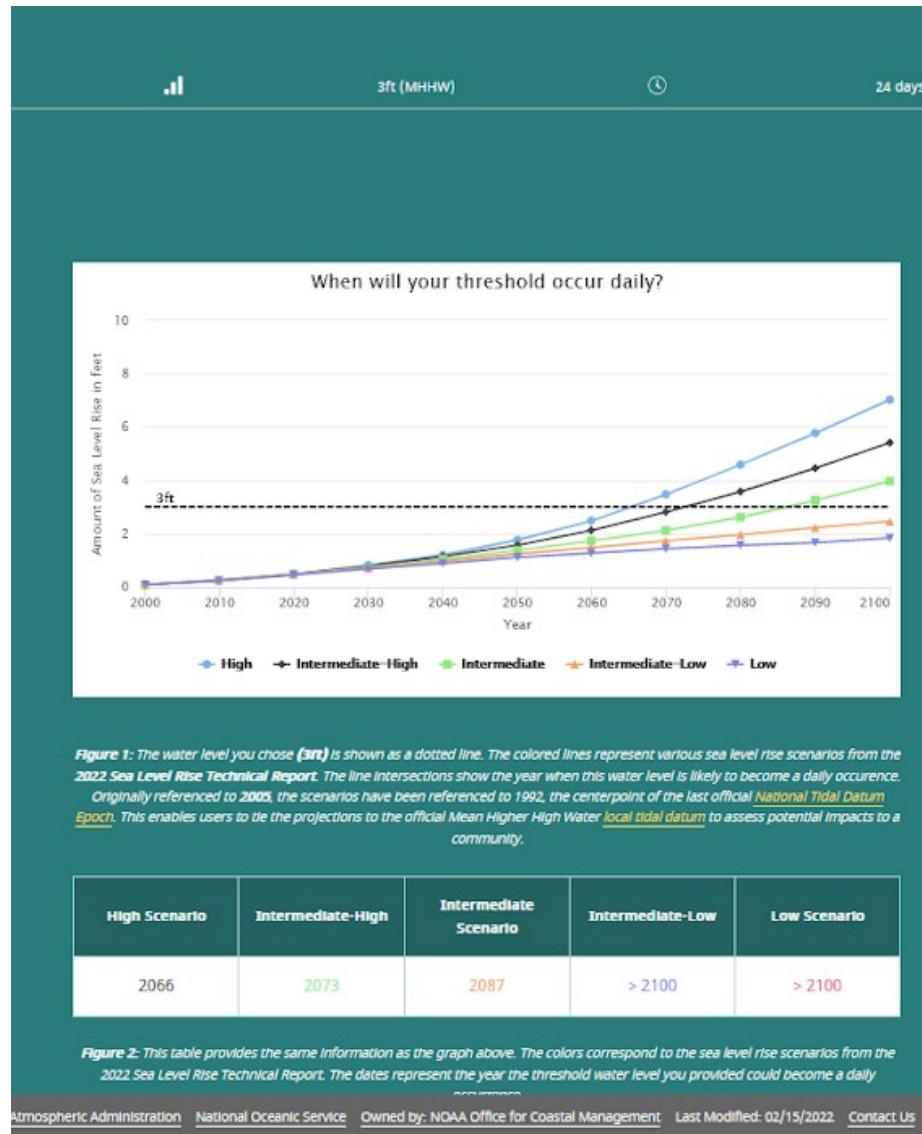
Note: The map is disabled when using the Advanced View

[Know Your Threshold?](#) [Next](#)

If you know your exact threshold, use the Advanced View for more options.

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On Screen and Printable PDF



Coastal Flood Exposure Mapper

coast.noaa.gov/digitalcoast/tools/flood-exposure

The screenshot displays the Coastal Flood Exposure Mapper interface. At the top, the browser address bar shows the URL coast.noaa.gov/floodexposure/#-9015934,3757393,11z. The main map area shows a coastal region of Savannah, GA, USA, with a color-coded hazard composite overlay. The legend, titled "Coastal Flood Hazard Composite", lists 11 hazard zones, ranging from 1 (lightest yellow) to 11 (darkest red). The map shows a concentration of 10 and 11 hazard zones along the coast and in the city center. The interface includes a search bar with "Savannah, GA, USA" entered, a "CREATE My Map" section, and a "HAZARD LAYERS" panel with controls for "Coastal Flood Hazard Composite", "High Tide Flooding", "FEMA Flood Zones", "Tsunami", "Storm Surge", and "Sea Level Rise". A "SAVE MAP" button is visible in the "SOCIAL" section. The bottom of the page features a footer with "Powered By ESRI 00.0000, 00.0000 5 mi" and navigation links for "Contact Us", "Privacy Policy", "Disclaimer", and "USA.gov".

Office for Coastal Management



Coastal Flood Exposure Mapper

coast.noaa.gov/digitalcoast/tools/flood-exposure

zoom - doug.marcy x My Drive - Google | x Calculator Tool SOI x National Oceanic a x Coastal Flood Expo x Coastal Flood Expo x +

coast.noaa.gov/floodexposure/#-9008163,3768731,12z

SEARCH Savannah, GA, USA

CREATE **My Map**

ACTIVE LAYERS SAVED MAPS 0

HAZARD LAYERS

- Coastal Flood Hazard Composite ⓘ ⏪
- High Tide Flooding ⓘ ⏪
- FEMA Flood Zones ⓘ ⏪
- Tsunami ⓘ ⏪
- Storm Surge ⓘ ⏪
- Sea Level Rise ⓘ ⏪

SOCIETAL **SAVE MAP**

NUMBER OF HAZARDS 9

HAZARD ZONES

- FEMA Zones (% annual chance): A zone (1%) & 0.2%
- High Tide Flooding
- Sea Level Rise (Above MHHW): 1 ft & 2 ft & 3 ft
- Storm Surge (by Hurricane Category): 1 & 2 & 3

Highway 80 E Jimmy Mercer Blvd Walhour Rd Tybee Island

LEGEND BASEMAPS

Powered By ESRI 31.9730, -80.8186 2 mi

United States Departme... National Oceanic and At... National Ocean Service Website owner: Office fo... Last Modified: 08/12/2022 Contact Us Privacy Policy Disclaimer USA.gov

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Questions?

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