

Contextualizing Sea Level Rise in our Modern World

A discussion on the key takeaways from the National Oceanic and Atmospheric Administration 2022 Sea Level Rise Technical Report & how these findings relate to the dredging community.

Presented by:
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About the Speaker



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Bachelor of Science in Coastal Environmental Science
Louisiana State University; 2020

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Louisiana State University; 2022

Student member of WEDA since 2019 and current WEDA Fellow

Research Interests: geochemical analyses, sea level & coastal resiliency, computer programming

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Webinar Overview

Part I - NOAA Technical Sea Level Report

What is the significance of sea level rise?

4 key takeaways from the NOAA report

1. The next 30 years
2. Flood damage
3. Emissions
4. Continued tracking

How do these findings relate to the dredging community?

Part II - Meet the Fellow!

Discussion about the WEDA fellowship

2022 Sea Level Rise Technical Report

Updated projections available through 2150 for all U.S. coastal waters.



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Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along U.S. Coastlines

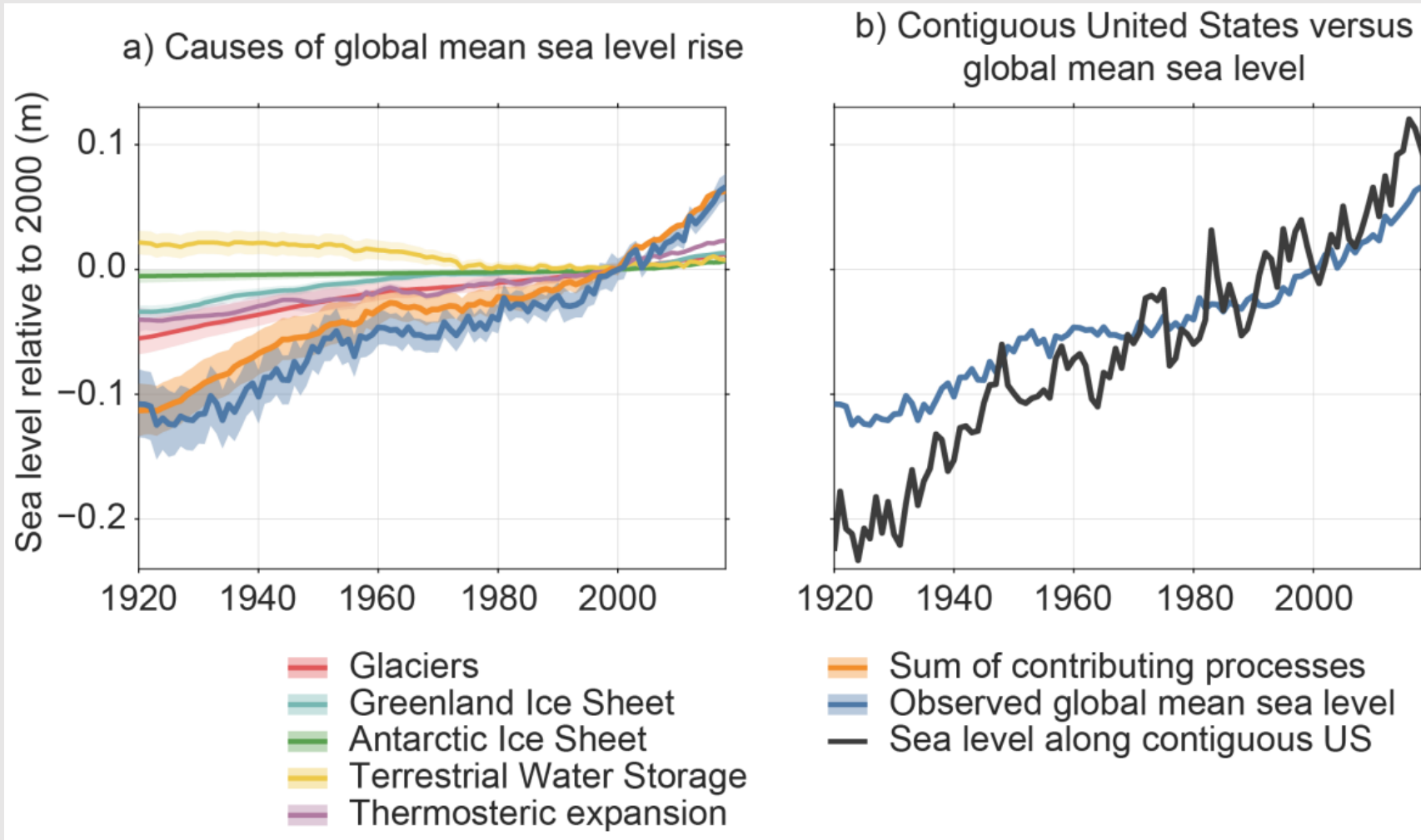
Sweet, W.V., B.D. Hamlington, R.E. Kopp, C.P. Weaver, P.L. Barnard, D. Bekaert, W. Brooks, M. Craghan, G. Dusek, T. Frederikse, G. Garner, A.S. Genz, J.P. Krasting, E. Larour, D. Marcy, J.J. Marra, J. Obeysekera, M. Osler, M. Pendleton, D. Roman, L. Schmied, W. Veatch, K.D. White, and C. Zuzak, 2022: Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along U.S. Coastlines. NOAA Technical Report NOS 01. National Oceanic and Atmospheric Administration, National Ocean Service, Silver Spring, MD, 111 pp.

Sweet et al., 2022

“Although the intent of this report is not to provide authoritative guidance or design specifications for a specific project, it is intended to help inform federal agencies, state and local governments, and stakeholders in coastal communities about current and future sea level rise to help contextualize its effects for decision-making purposes.”

–Executive Summary, Sweet et al., 2022

Base Knowledge & Important Terms



Eustatic Sea Level (**ESL**)

Relative Sea Level (**RSL**)

Figure from Sweet et al., 2022.

Why should we care
about sea level?

GLOBALLY

- Over 600 million people around the world live in coastal areas that are less than ten meters above sea level (400 million of these within 2 meters)
- More than 1 trillion dollars of infrastructure is within one meter of sea level.

UNITED STATES

- Over 40 million people live on the coasts and more people are moving to the coast each year.
- More than 100 billion dollars of infrastructure is within one meter of sea level.



LOUISIANA

- 2 million people live in coastal areas
- Home to the world's largest port system
- Hosts 20% of US waterborne commerce
- Home to over 25% of US commercial fisheries
- If highway 1 closed, over \$7,000,000,000 would be lost

Rising Sea Levels Threaten to Swallow Entire Resort Town in Brazil

By Precious Smith Feb 14, 2022 09:54 AM EST



The Brazilian resort town of Atafona has become an area of concern as rising sea levels threaten to swallow the entire town.

Warming will drive catastrophic storm surges and poles

25 SEP 2019 • BY PAUL VOOSEN

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By David Shukman
Science editor

14 February 2020



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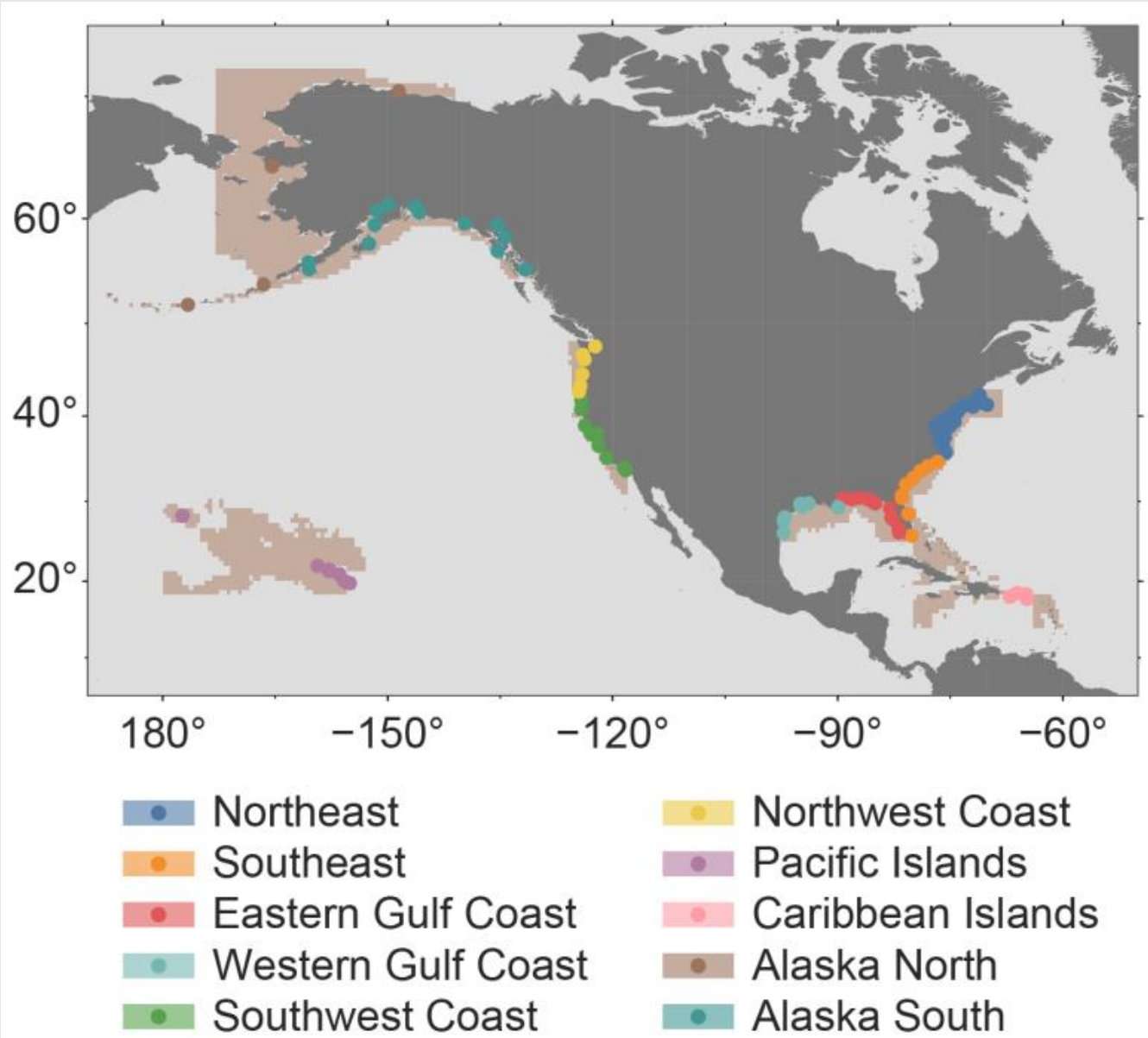


NEWS / WORLD NEWS / REST OF WORLD NEWS / New Zealand Sea Level Rising More Quickly Than Forecast: Data

New Zealand sea level rising more quickly than forecast: Data

AFP / May 2, 2022, 09:07 IST





Methods for Computing SLR Projections:

1. Data from tide gauges are combined to create a RSL timeseries that is monthly resolved.
2. Using regression analysis, certain modes of climate variability are removed (i.e., El Nino Southern Oscillation, Pacific Decadal Oscillation, and North Atlantic Oscillation).
3. Rates and accelerations are determined from 1970 to present and uncertainty due to natural variability and serially correlated variability is accounted for.
4. Rates, accelerations, and uncertainties are used to determine an ensemble of 5000 extrapolations extending to 2050. The baseline is 2000 (i.e., SLR = 0 is set to the MHHW datum average SL in the year 2000).

Figure from Sweet et al., 2022.

Regional Sea Level Linear Rates of Rise

1993 - 2020

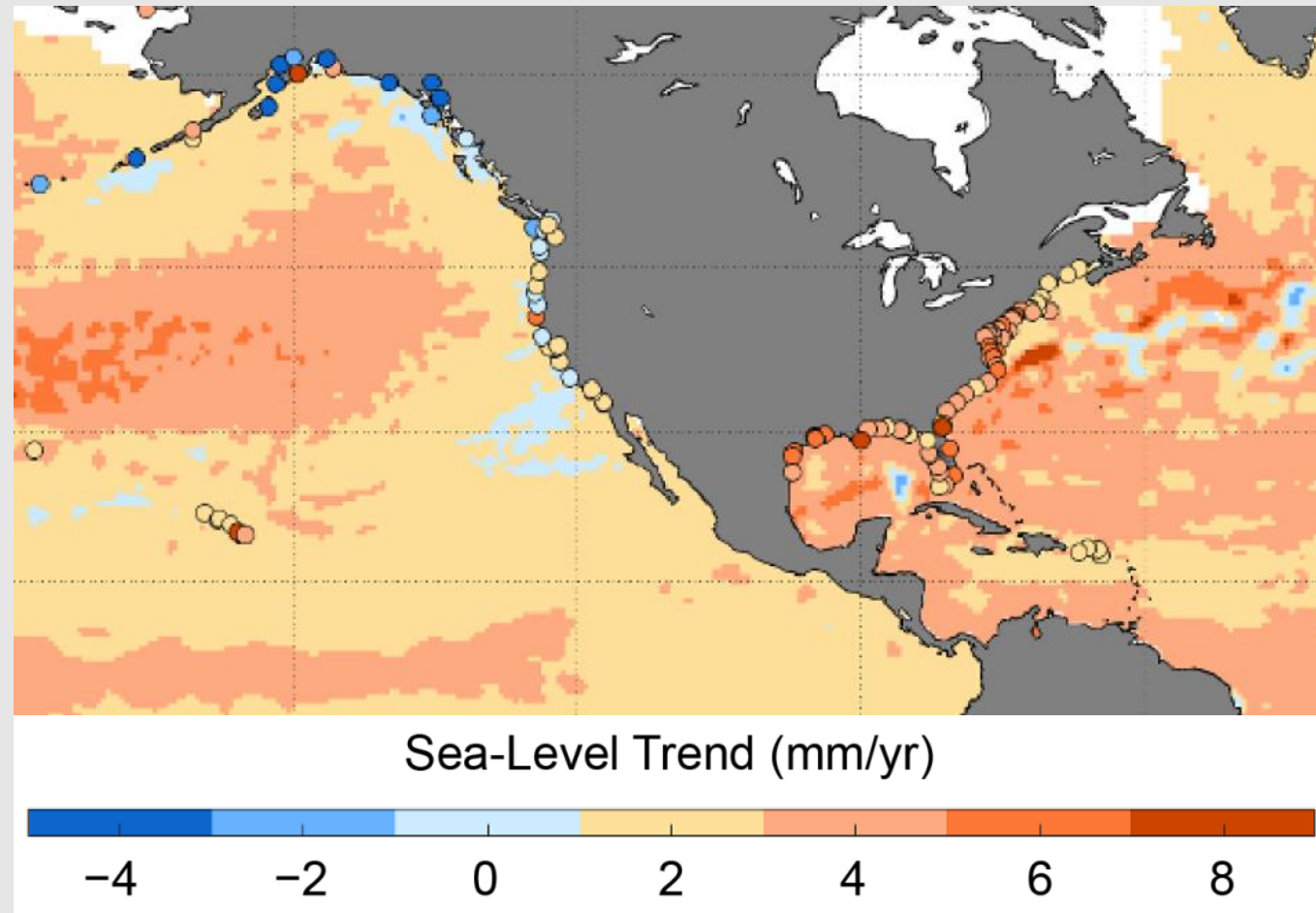
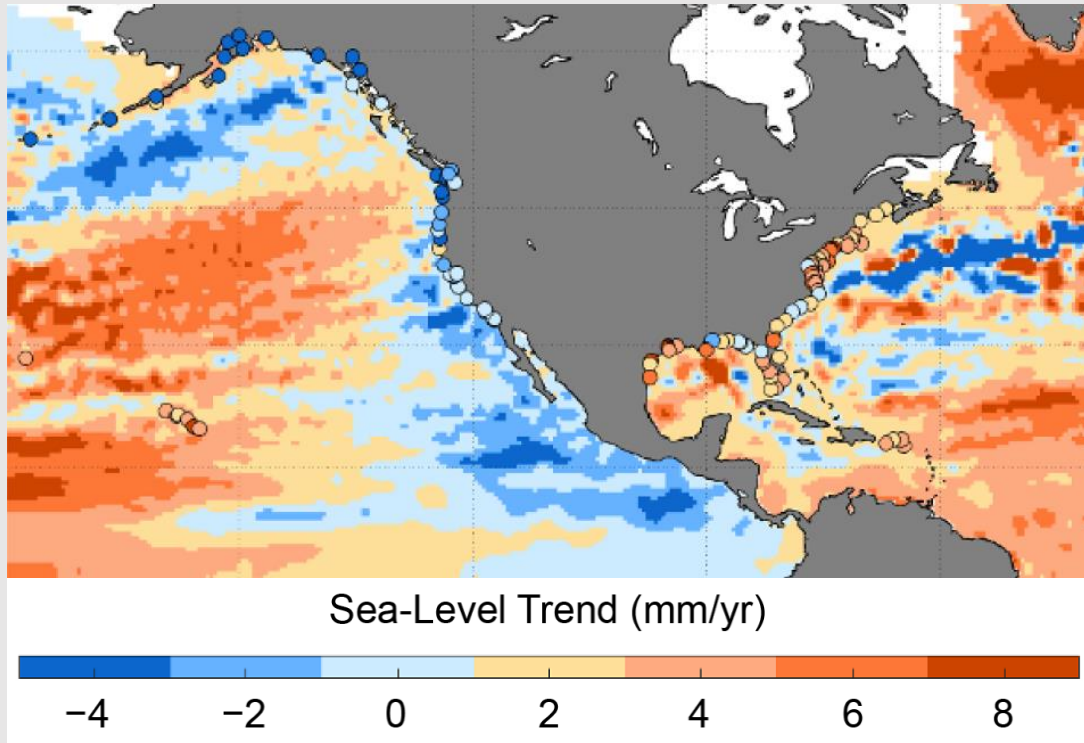


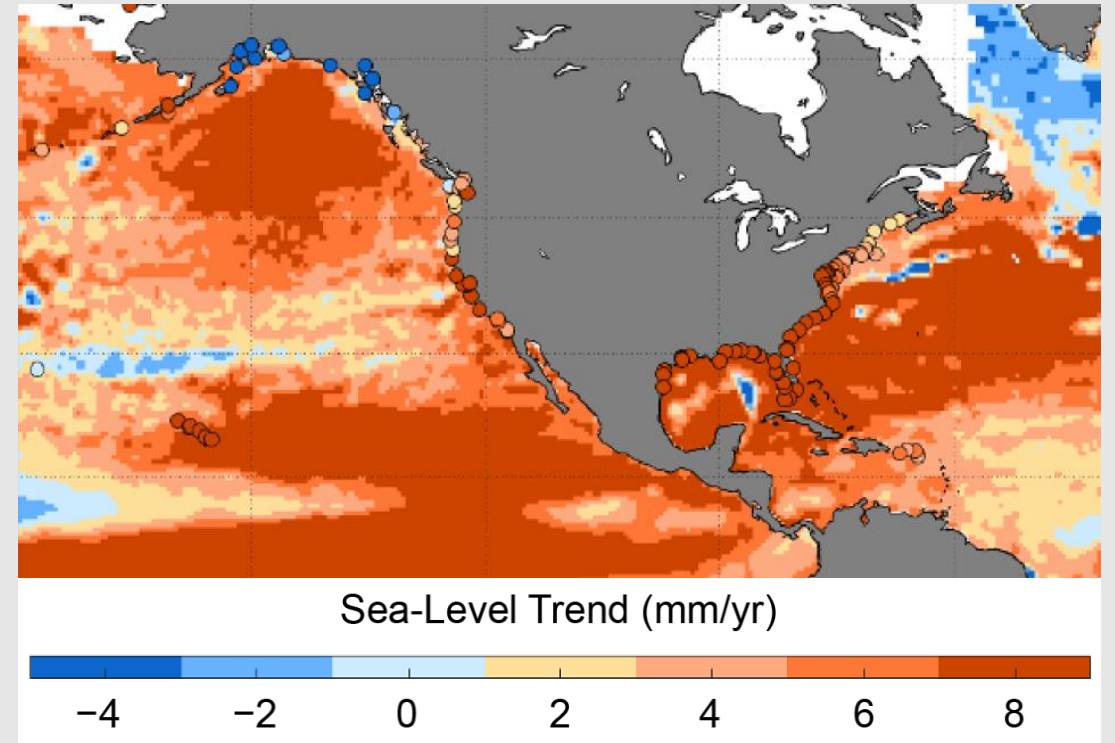
Figure from Sweet et al., 2022.

Regional Sea Level Linear Rates of Rise

1993 - 2006



2007 - 2020



Figures from Sweet et al., 2022.

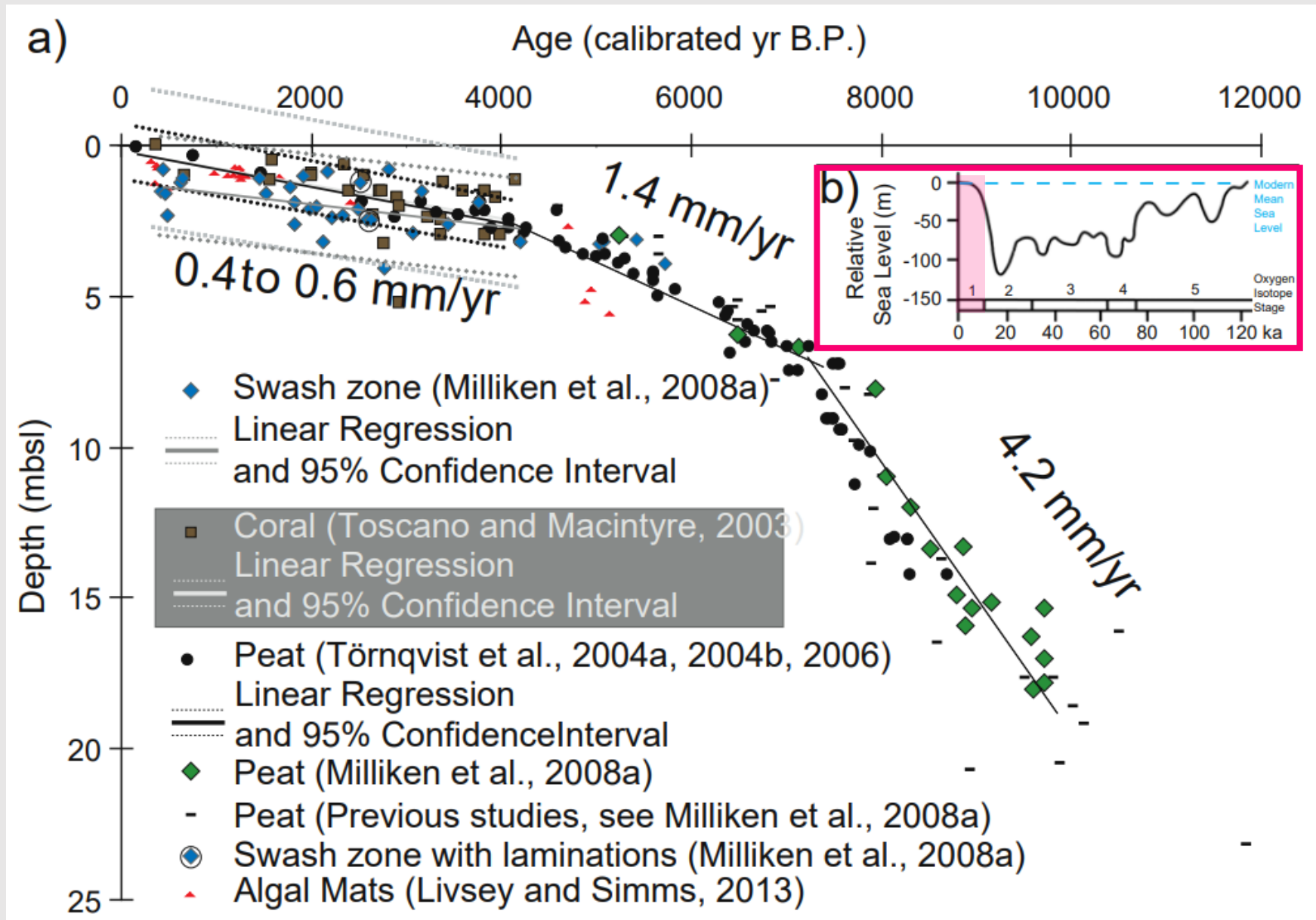


Figure from Anderson et al., 2013. *Marine Geology*.

An aerial photograph of a harbor. In the foreground, several small, colorful boats (blue, white, and orange) are docked at a stone pier. The water is a deep green color. In the background, a building with a red and white striped awning is visible on the shore. The sky is clear and blue.

Key Takeaway #1: The Next 30 Years

"Sea level along the U.S. coastline is projected to rise, on average, 10 - 12 inches (0.25 - 0.30 meters) in the next 30 years (2020 - 2050), which will be as much as the rise measured over the last 100 years (1920 - 2020). Sea level rise will vary regionally along U.S. coasts because of changes in both land and ocean height."

-Key Takeaway #1, Sweet et al., 2022

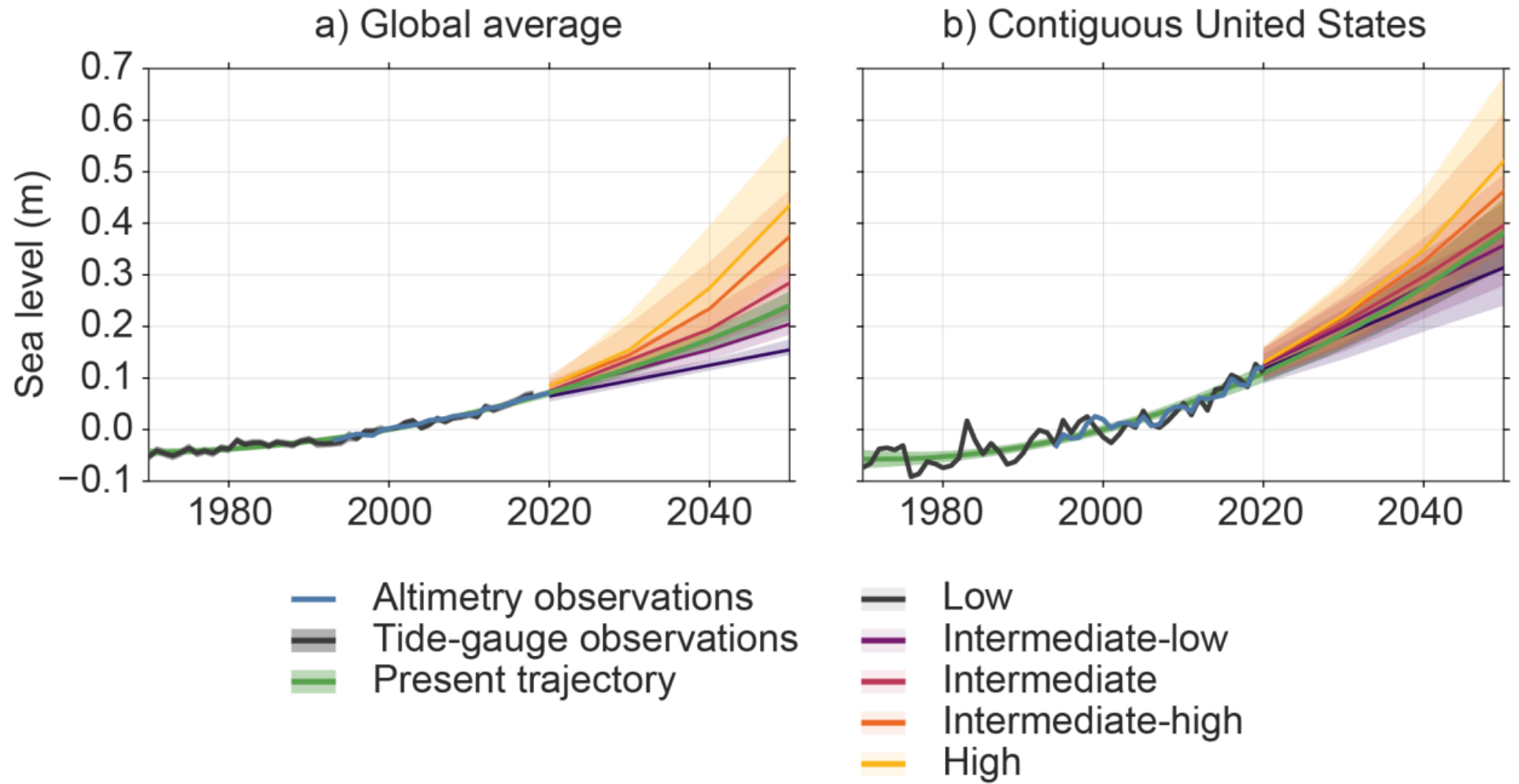


Figure from Sweet et al., 2022.

Coastline at Present

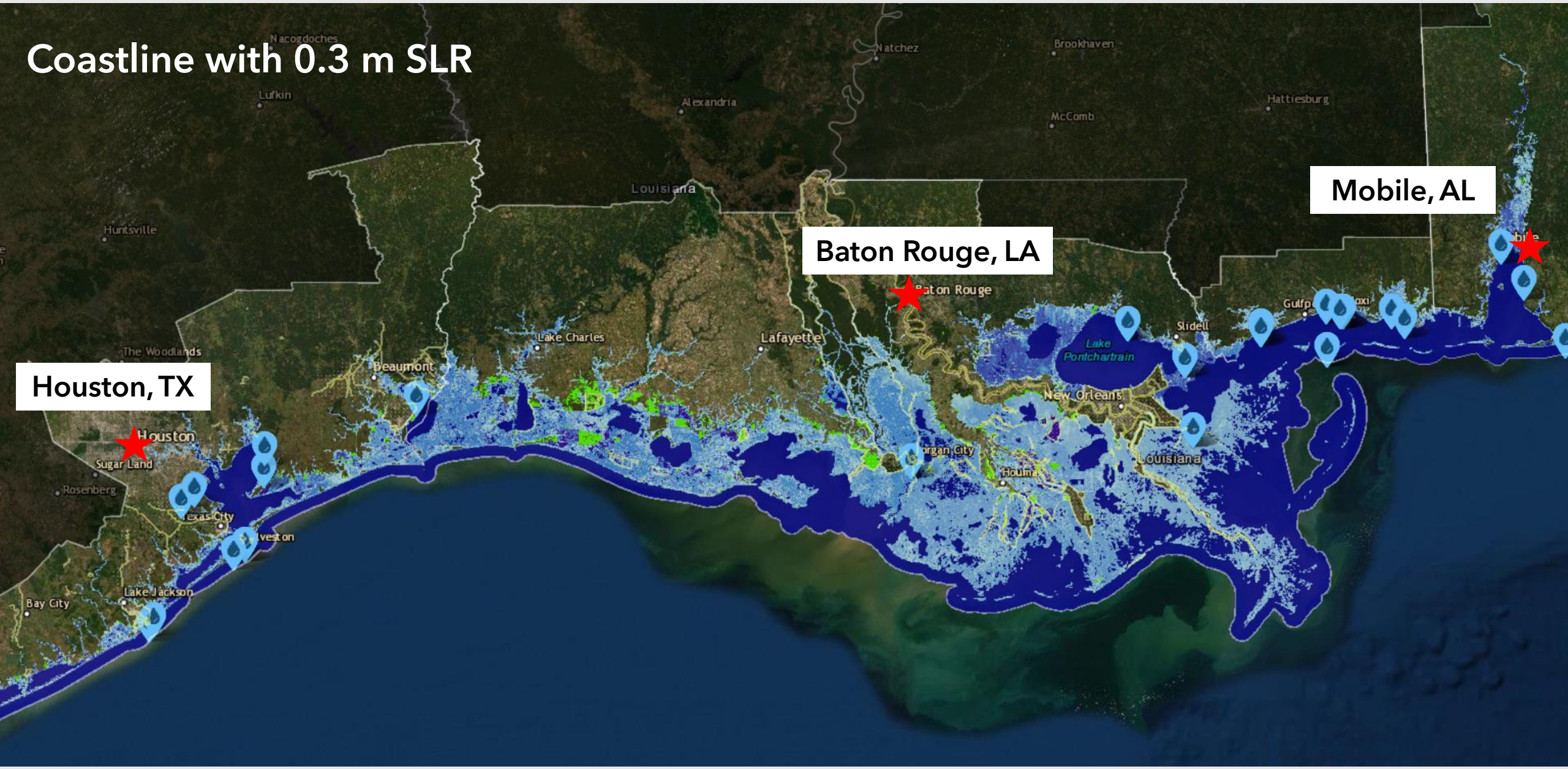


Houston, TX

Baton Rouge, LA

Mobile, AL

Coastline with 0.3 m SLR



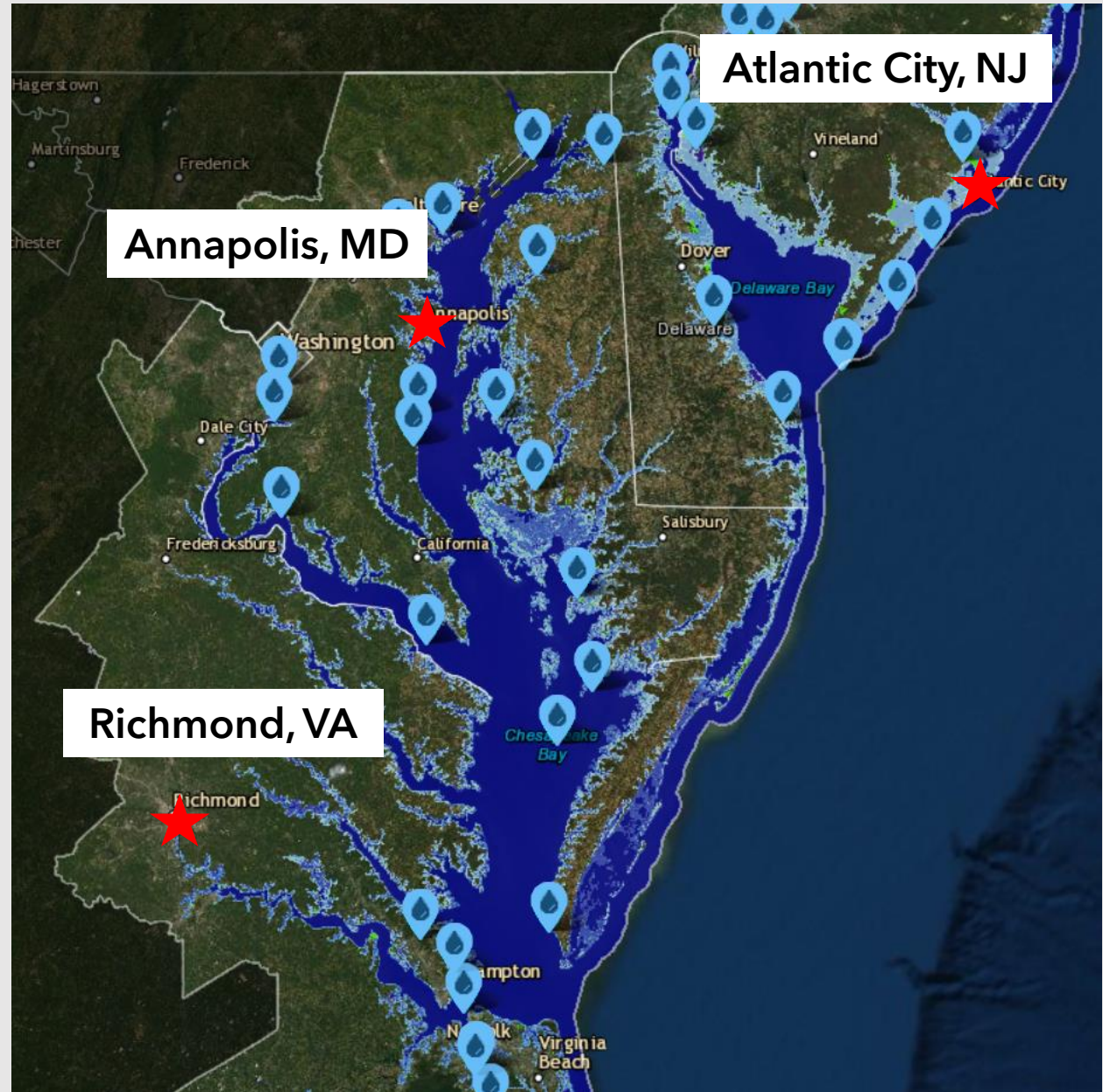
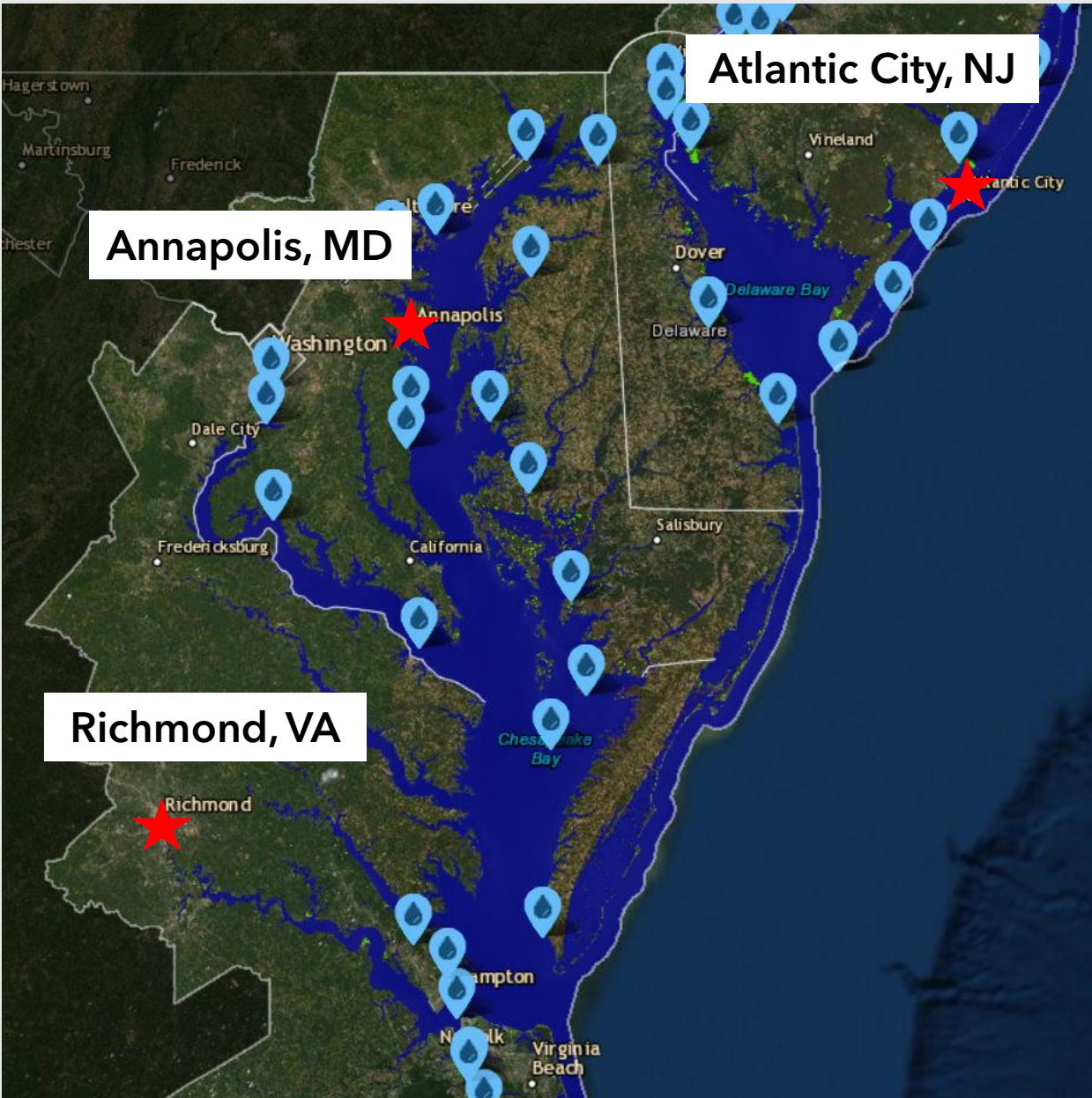
Houston, TX

Baton Rouge, LA

Mobile, AL

Present Coastline

Coastline with 0.3 m SLR



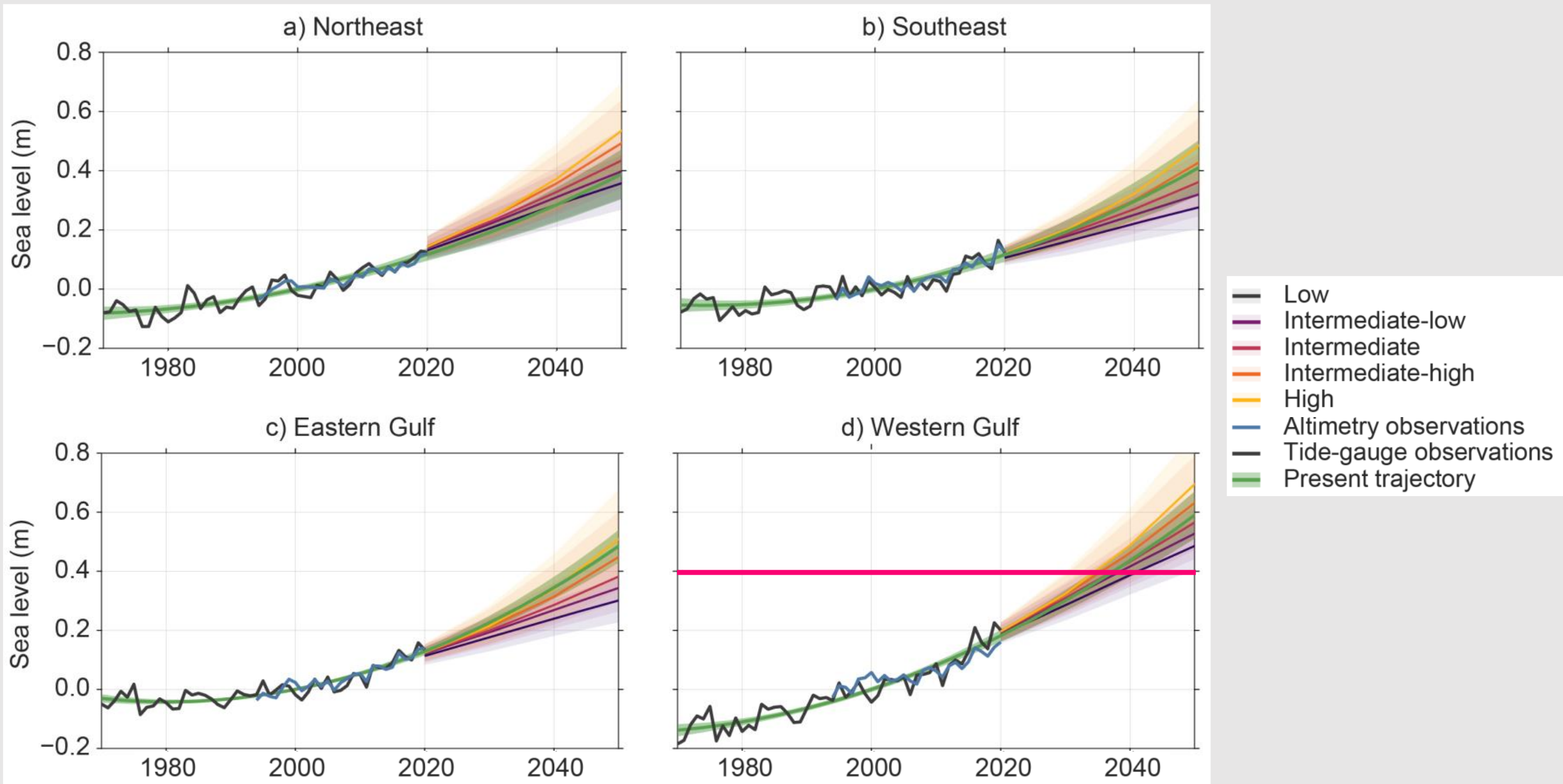


Figure from Sweet et al., 2022.

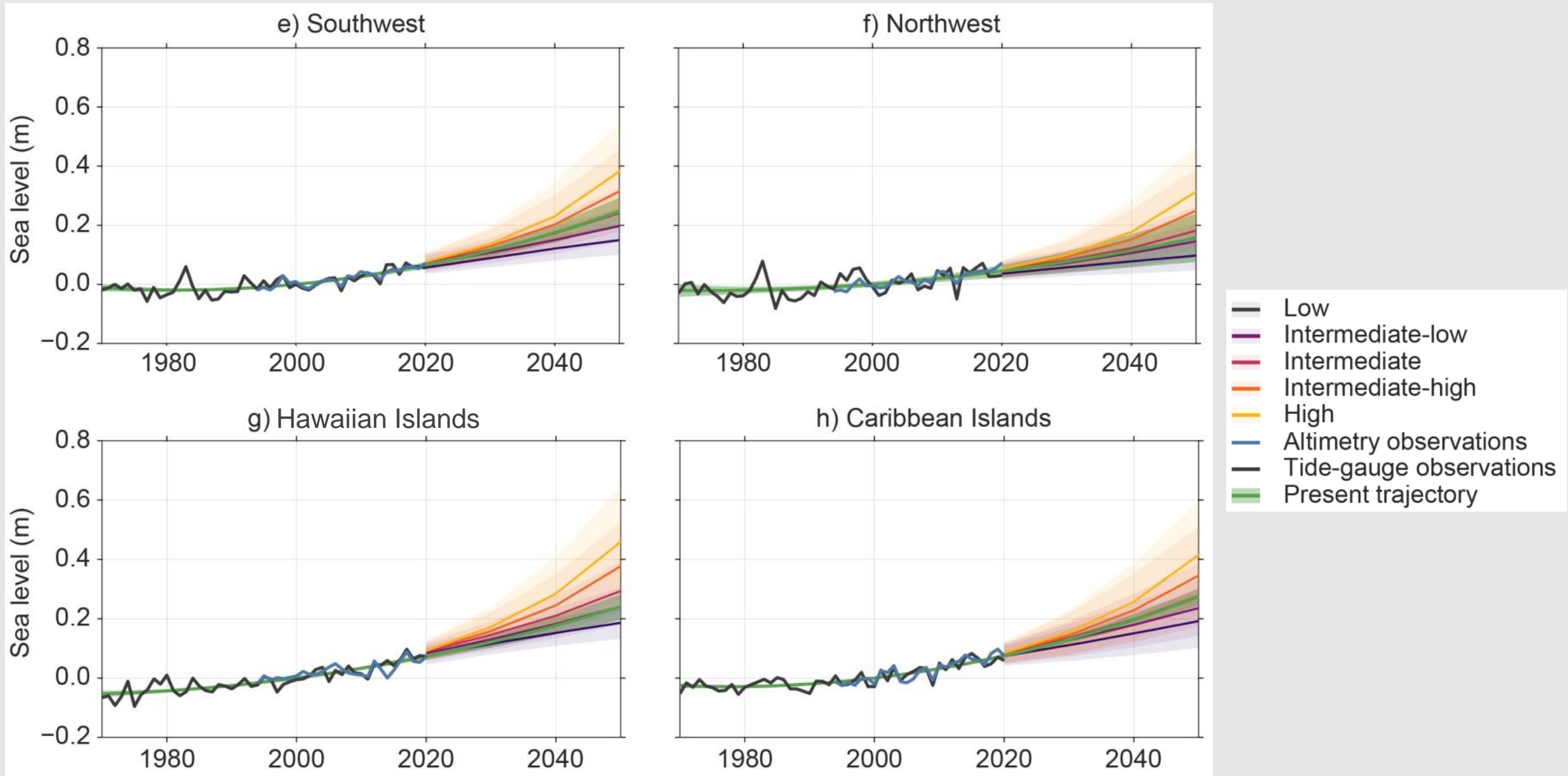


Figure from Sweet et al., 2022.

An aerial photograph of a coastal area showing extensive flooding of rice terraces. The water is a deep blue, reflecting the sky, and the terraces are separated by dark, narrow paths. The background is a dense forest of palm trees and other tropical vegetation.

Key Takeaway #2: More Damaging Flooding

“Sea level rise will create a profound shift in coastal flooding over the next 30 years by causing tide and storm surge heights to increase and reach further inland. By 2050, “moderate” (typically damaging) flooding is expected to occur, on average, more than 10 times as often as it does today and can be intensified by local factors.”

–Key Takeaway #2, Sweet et al., 2022

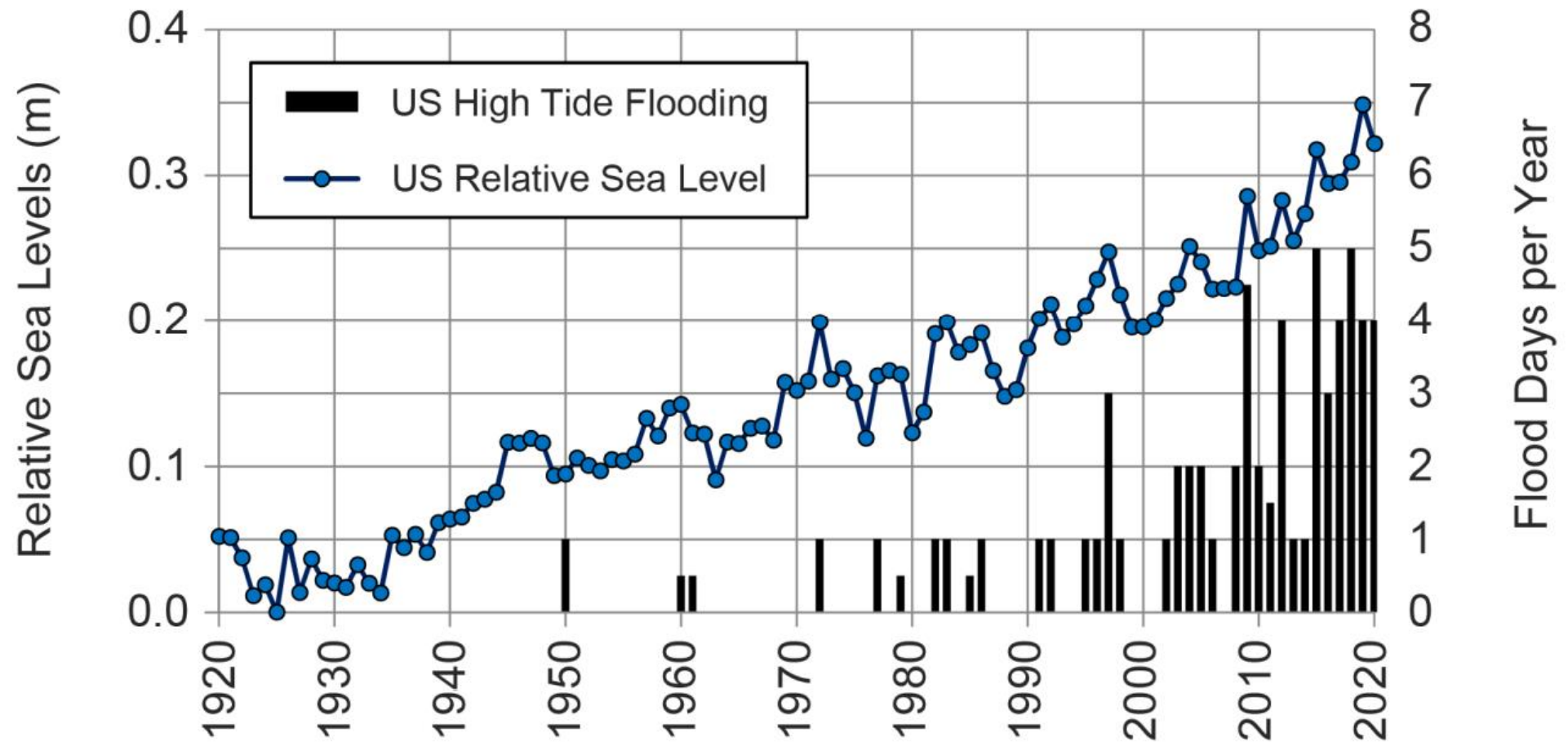


Figure from Sweet et al., 2022.

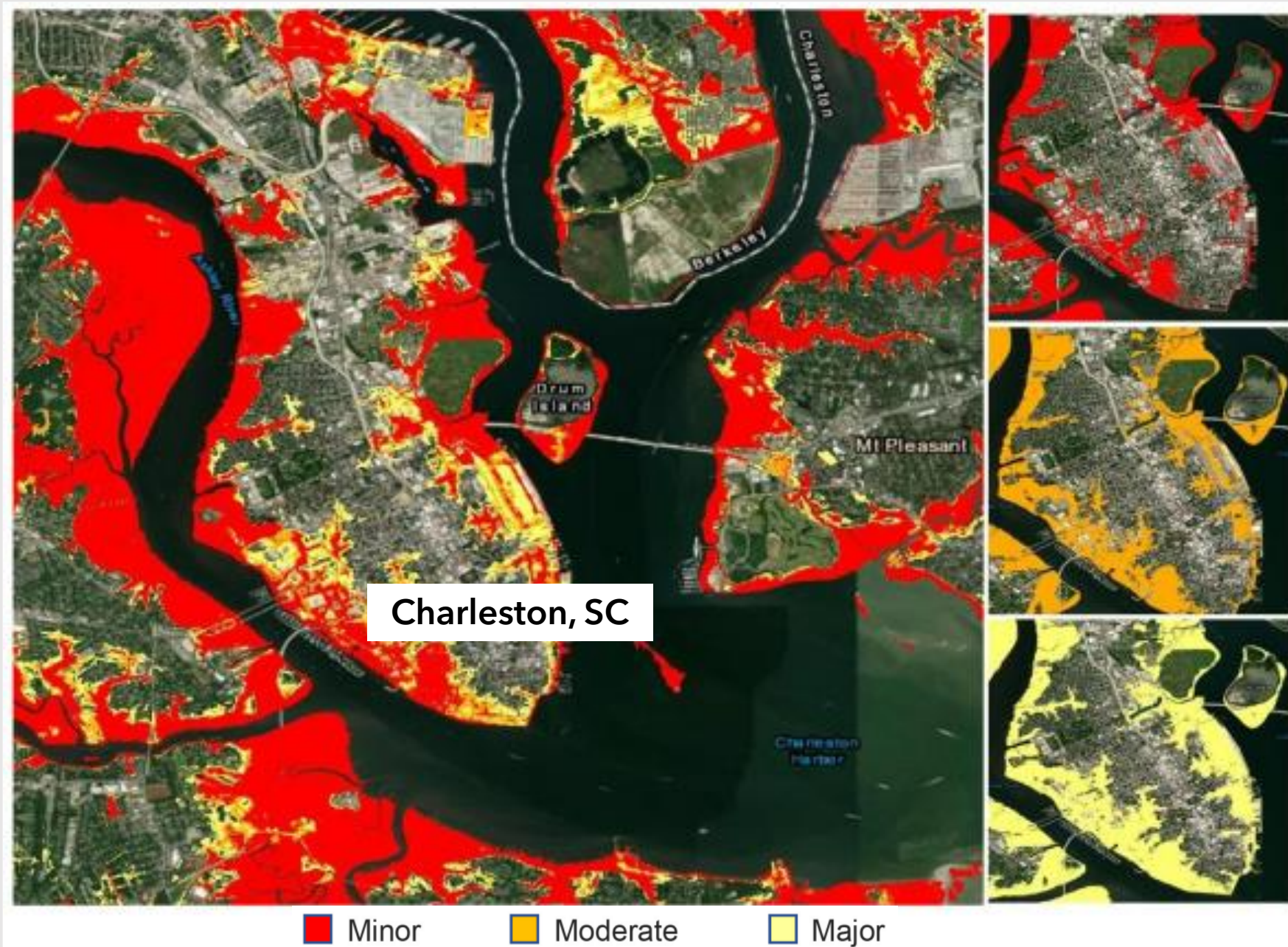
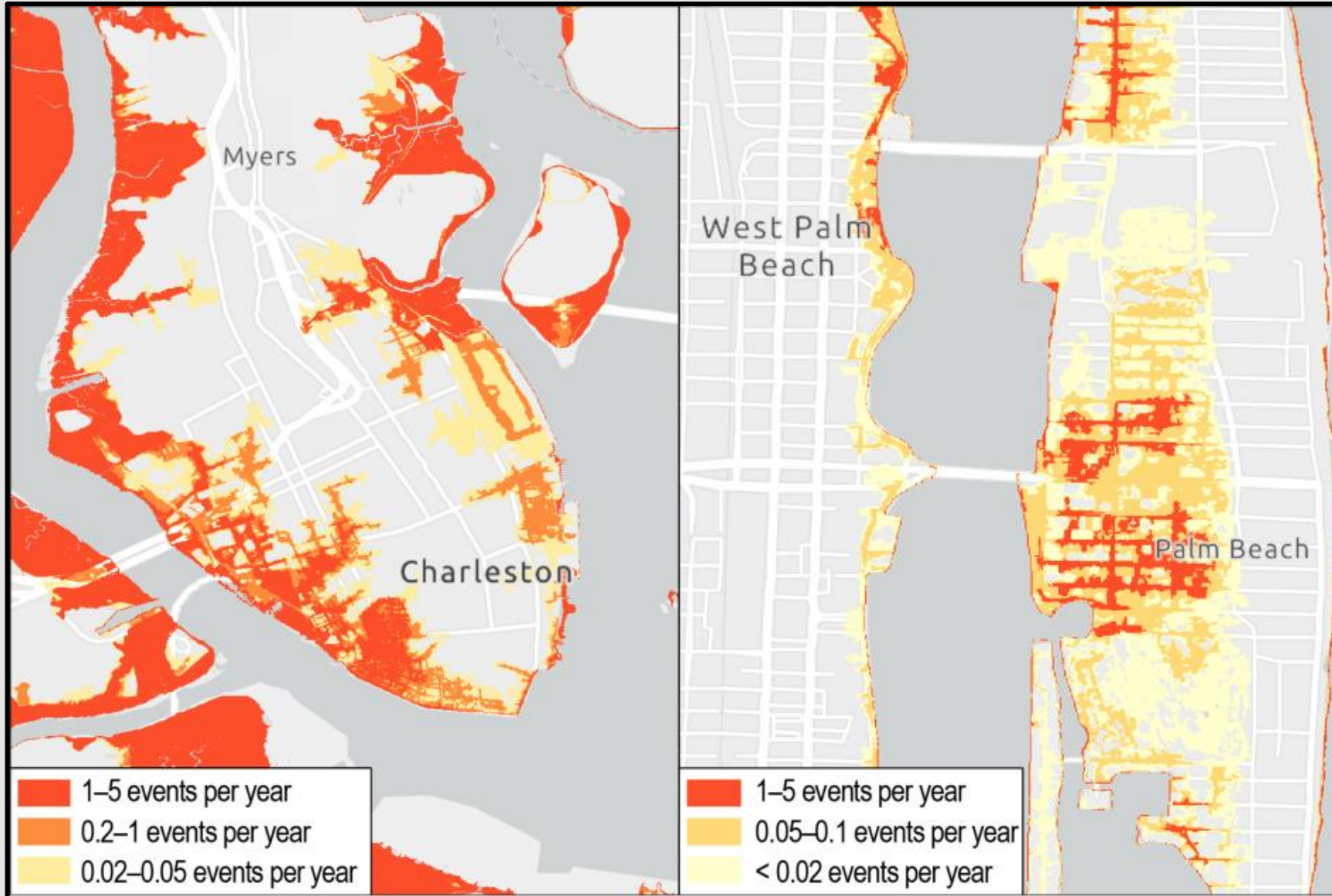


Figure from Sweet et al., 2022.



Figure from Sweet et al., 2022.



Major (destructive) flood events are expected to occur up to five times more frequently in 2050 compared to today

Local factors may exacerbate flood risk (i.e., river discharge, precipitation, coastal erosion, etc.)

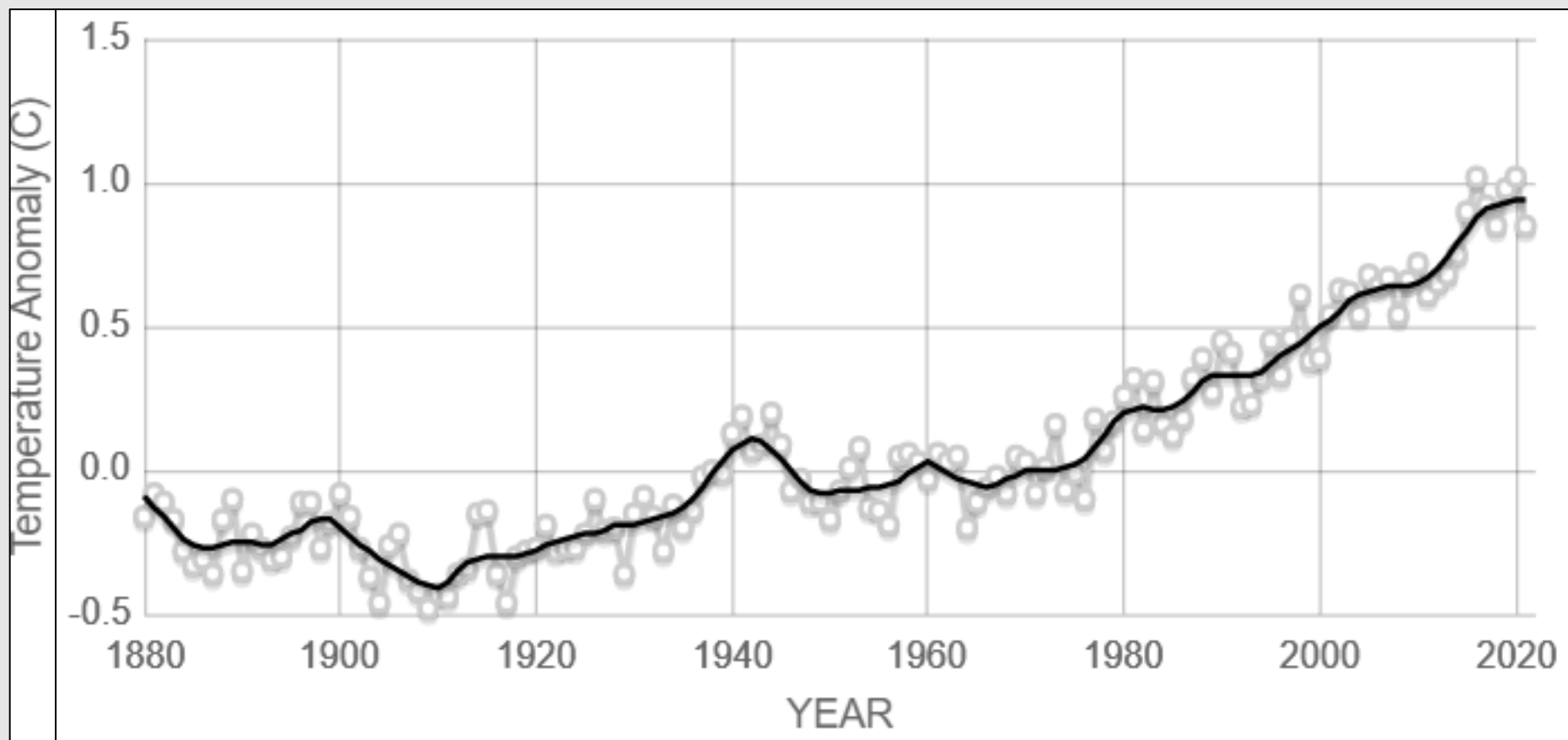
Figure from Sweet et al., 2022.

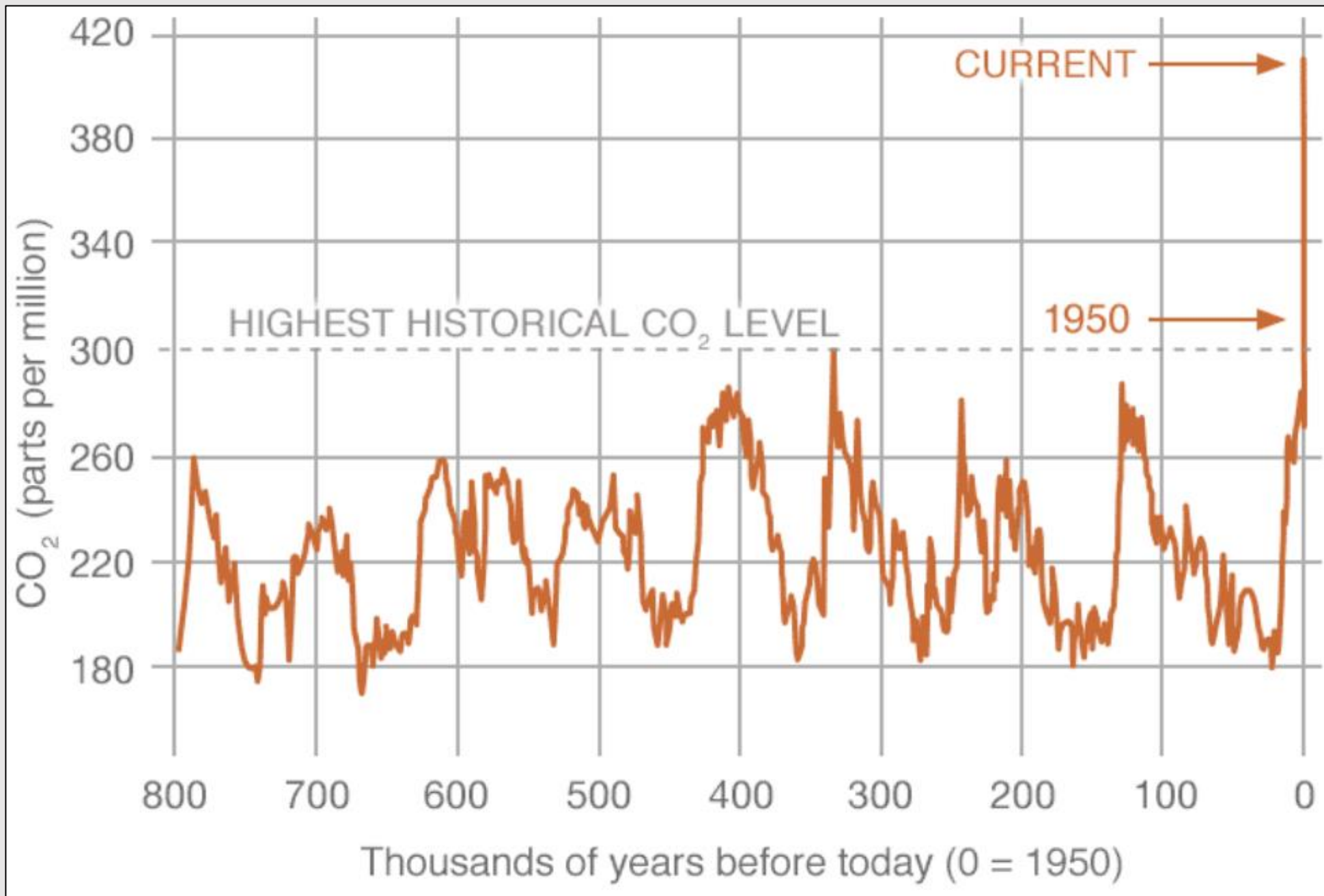


Key Takeaway #3: Emissions Matter

"Higher global temperatures increase the chances of higher sea level by the end of the century and beyond. The scenario projections of relative sea level along the contiguous U.S. (CONUS) coastline are about 0.6-2.2 m in 2100 and 0.8-3.9 m in 2150 (relative to sea level in 2000); these ranges are driven by uncertainty in future emissions pathways and the response of the underlying physical processes."

–Key Takeaway #3, Sweet et al., 2022





1. Global temperatures have been continually warming and the earth's average temperature is currently the highest it's been for the past over 2000 years.
2. 90% of this warming has occurred in the ocean. The year 2021 is the hottest on the instrumental record.
3. Natural and human activities contribute to increased emissions.
4. Current rates of sea level rise are unprecedented and may be explained in part by increased carbon emissions.

Key Takeaway #4: Continual Tracking

“Continuously tracking how and why sea level is changing is an important part of informing plans for adaptation. Our ability to monitor and understand the individual factors that contribute to sea level rise allows us to track sea level changes in a way that has never before been possible (e.g., using satellites to track global ocean levels and ice sheet thickness). Ongoing and expanded monitoring will be critical as sea levels continue to rise.”

–Key Takeaway #4, Sweet et al., 2022

What does this mean for
the dredging community?

Pros and Cons

Dredging creates a strong economy and clean environment!

1. Maintaining ports and channels for safe navigation
2. Manages flood and erosion risks with coastal infrastructure
3. Managing ecological adaptations in wetland environments
4. Increasing terrestrial water storage capacity to mitigate increases in precipitation
5. Regulating sedimentation and managing contaminated soils, which might impact agriculture or urbanization





Detroit District 

@detroitdistrict



[#USACE](#) contractor The King Company completed dredging Holland Harbor in west Michigan last week. The dredge material is being used as beach nourishment to replenish beaches after erosion during recent high water levels on Lake Michigan. [#BuildingStrong](#)



9:02 AM · May 23, 2022 · Twitter Web App

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Citations

Anderson, J.B., et al., 2013: Variable response of coastal environments of the northwestern Gulf of Mexico to sea-level rise and climate change: Implications for future change, *Marine Geology*, <http://dx.doi.org/10.1016/j.margeo.2013.12.008>.

Sweet, W.V., B.D. Hamlington, R.E. Kopp, C.P. Weaver, P.L. Barnard, D. Bekaert, W. Brooks, M. Craghan, G. Dusek, T. Frederikse, G. Garner, A.S. Genz, J.P. Krasting, E. Larour, D. Marcy, J.J. Marra, J. Obeysekera, M. Osler, M. Pendleton, D. Roman, L. Schmied, W. Veatch, K.D. White, and C. Zuzak, 2022: Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along U.S. Coastlines. NOAA Technical Report NOS 01. National Oceanic and Atmospheric Administration, National Ocean Service, Silver Spring, MD, 111 pp.

Q&A
