Making Sense of Sea-Level Rise in Planning

APA AL|MS Annual Conference● October 16, 2019

NORTHERN GULF OF MEXICO

Ground Rules

- Please silence phone
- Be respectful of all positions/questions
- ELMO (enough lets move on)
- Marina

- PARTICIPATION

Introductions

- www.slido.com
- Code: #APASLR

sarpc

Gulf Coast Prairie
Landscape Conservation Cooperative

HARTE
RESEARCH INSTITUTE
FOR GULF OF MEXICO STUDIES

EMERALD COAST
REGIONAL COUNCIL

Weeks Bay
Reserve

Climate and Resilience
COMMUNITY OF PRACTICE

NATIONAL PARK SERVICE

SOUTHEAST
Climate Adaptation Science Center

Dauphin Island Sea Lab
Alabama

The Nature Conservancy

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

Apalachicola
National Estuarine
Research Reserve

UF | IFAS Extension
UNIVERSITY of FLORIDA

UNIVERSITY OF CENTRAL FLORIDA
1963

Sea Grant
Mississippi-Alabama

USA

APALACHEE REGIONAL PLANNING COUNCIL

MISSISSIPPI
DEPARTMENT OF MARINE RESOURCES
ENHANCE · PROTECT · CONSERVE

Gulf Islands
NATIONAL SEASHORE

Sea Grant
Texas • Louisiana • Florida
Mississippi-Alabama

SENTINEL SITE COOPERATIVE

NORTHERN GULF
OF MEXICO

MAKING SEA-LEVEL RISE
SCIENCE MORE ACCESSIBLE

GCOOS
GULF OF MEXICO
COASTAL OCEAN
OBSERVING SYSTEM

Grand Bay
National Estuarine
Research Reserve

COASTAL PROTECTION AND RESTORATION AUTHORITY
CPRA

COMMISSION AND NATURAL RESOURCES
ALABAMA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

USGS
science for a changing world

NOAA

STATE

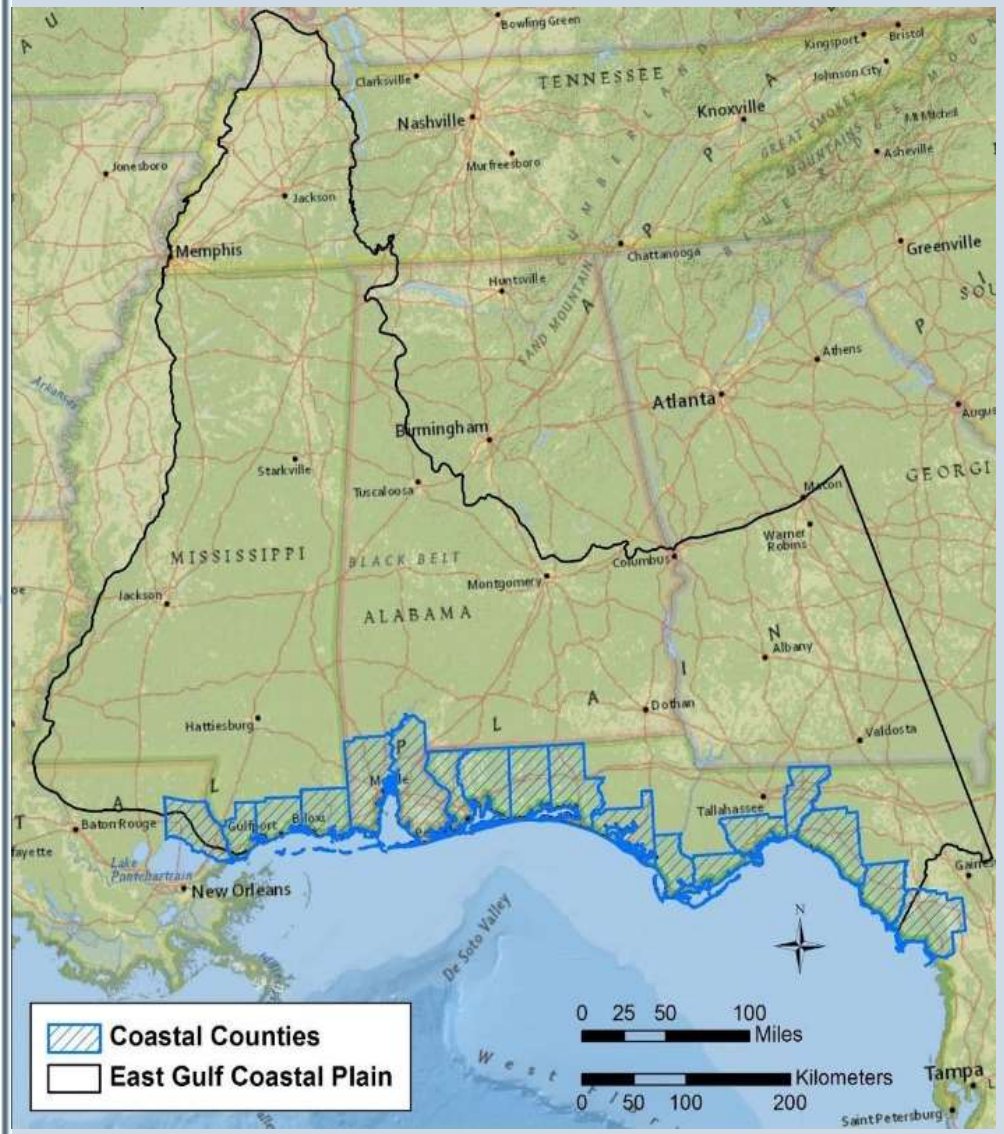
FEMA

GCPO

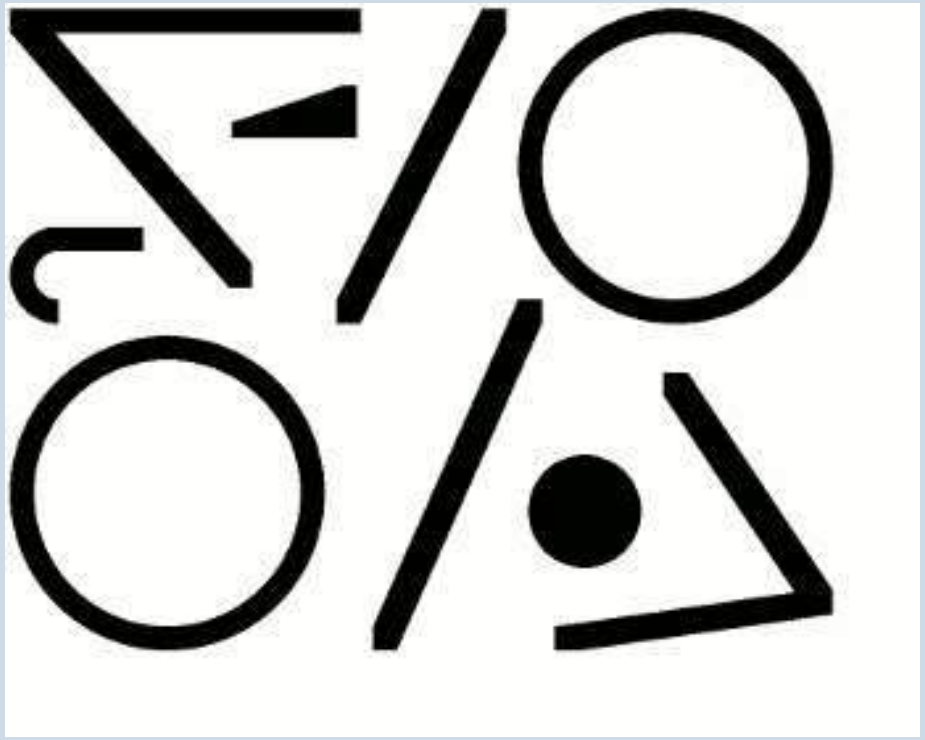
BARUCH INSTITUTE
UNIVERSITY OF SOUTH CAROLINA

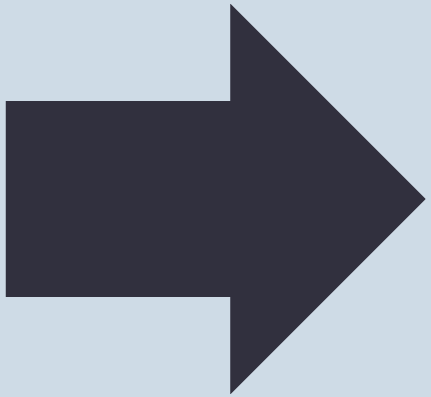
NGI
Northern Gulf Institute

GULF OF MEXICO ALLIANCE



The Goal

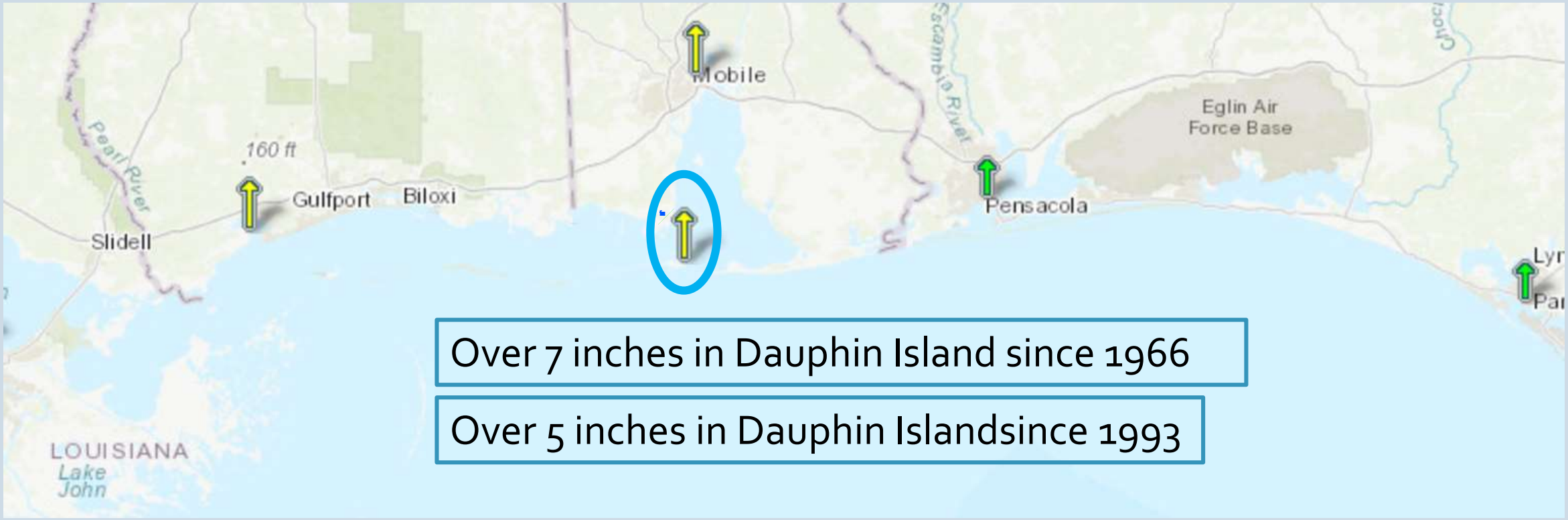




What IS sea-level rise?

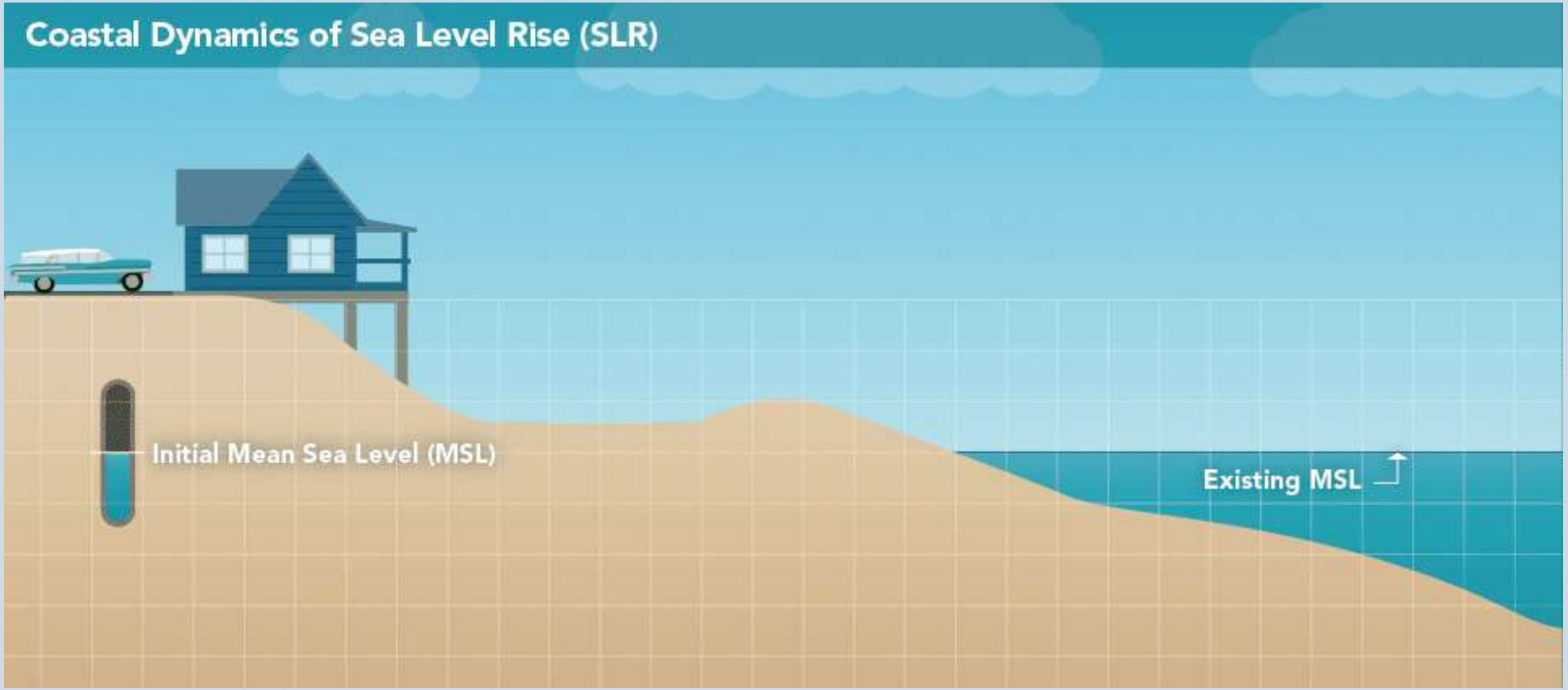
How do we know?

How do we know?



https://tidesandcurrents.noaa.gov/sltrends/

Small Rise Causes Big Changes



AGU Journal *Earth's Future* Special Issue on Gulf Sea Level Rise

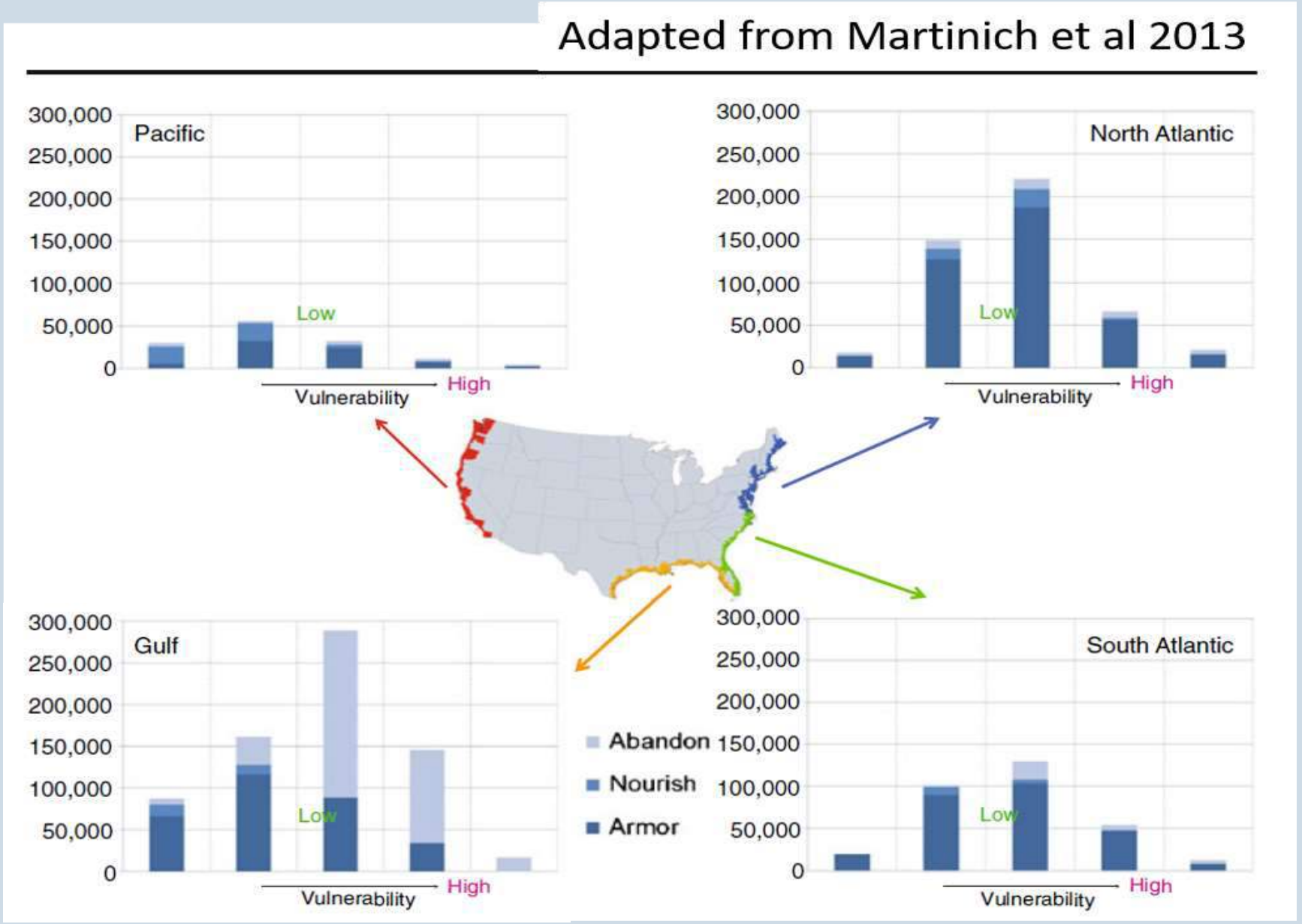
Small Rise Causes Big Changes

AGU Journal *Earth's Future* Special Issue on Gulf Sea Level Rise

Makes existing hazards worse

- Storm surge
- Nuisance flooding
- Erosion
- Salt-water intrusion
- Storm water management

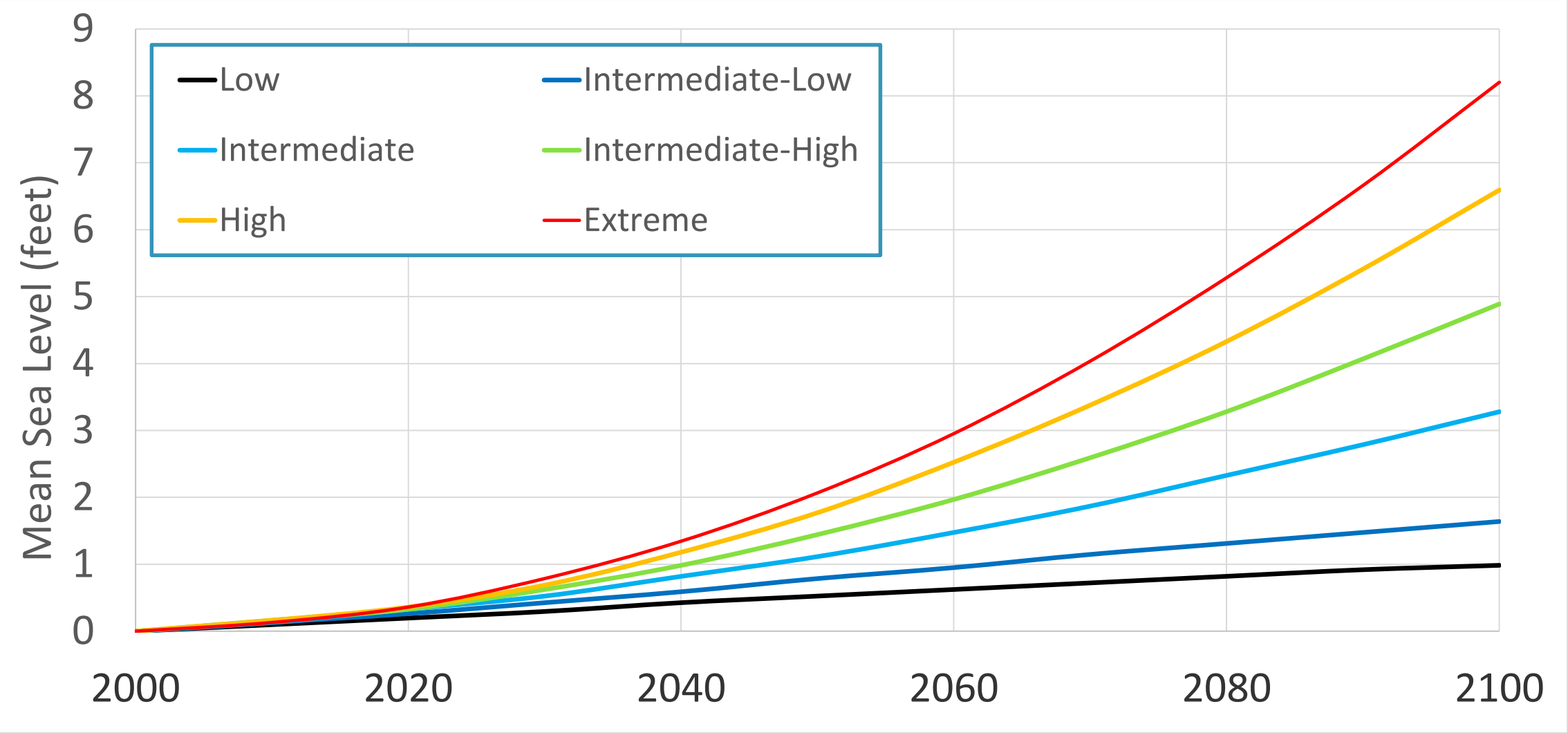
Effects of SLR on Communities



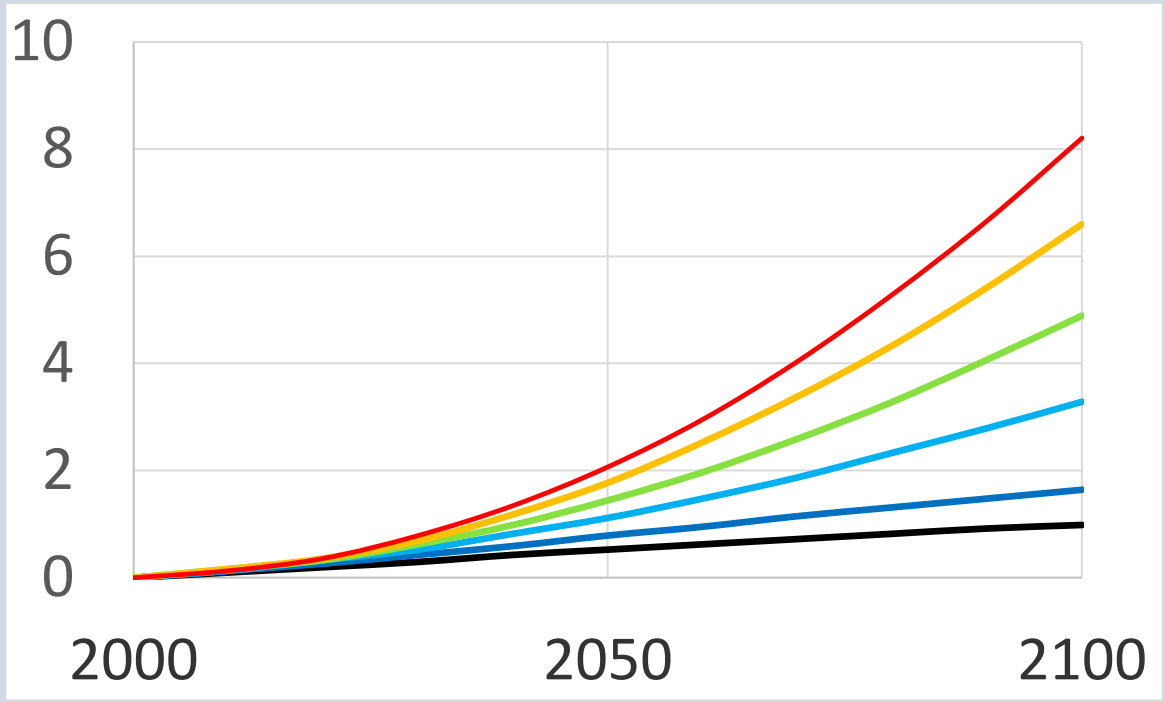
Why do we have sea-level rise scenarios?

Also – what are scenarios?

Global Scenarios - 2017



Why such a large range?



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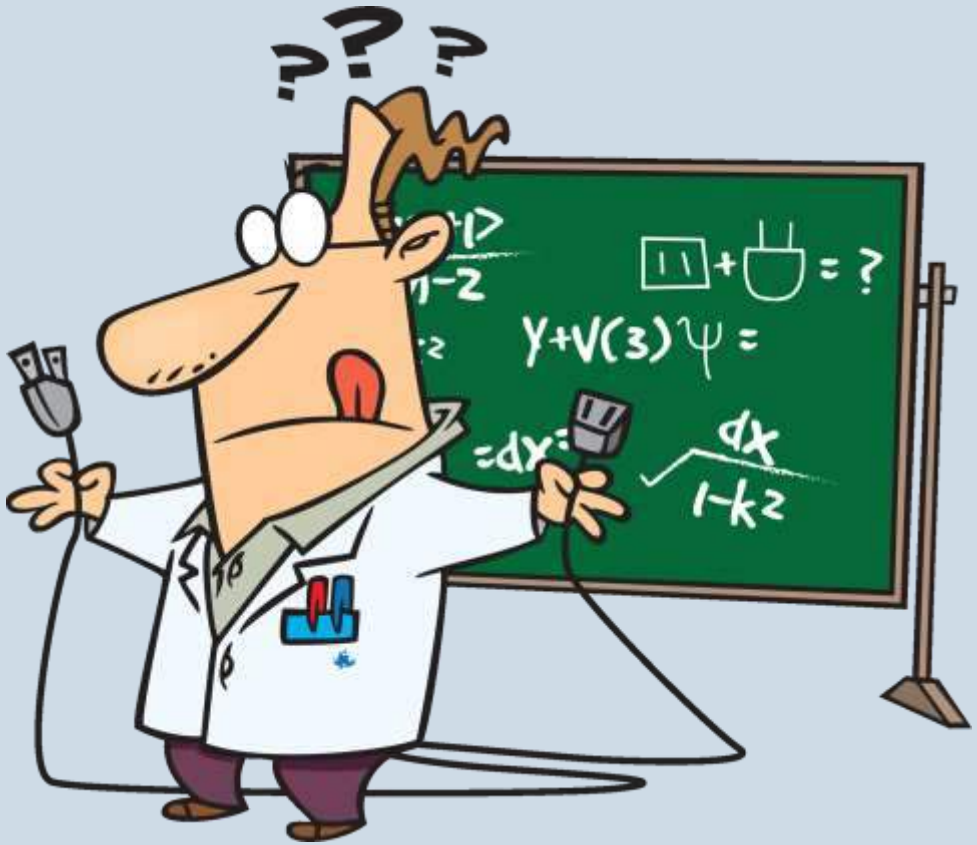


Three major reason

Big companies' climate chang
are 'unambitious', say analys

U.S. NEWS

US companies act on climate despite Trump: Survey

- Companies are still among the most ambitious in setting targets to combat
ump's plans to quit the Paris

a 2017 "A list" of 159 companies
g climate change and protecting

Ireland secures 'fair deal' on carbon emissions under EU pact

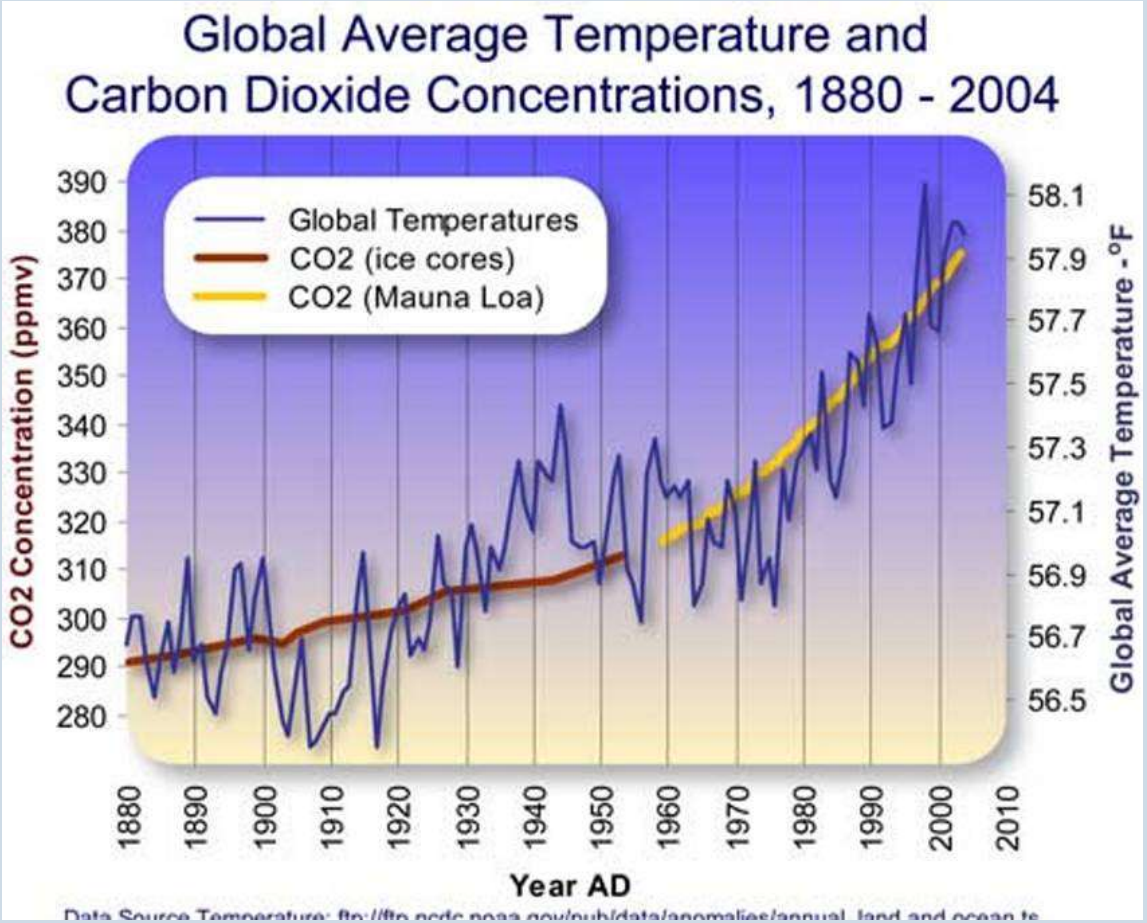
Implementing the Paris Agreement in the Pacific

by 2% in 2012-15

PTI | Oct 25, 2017, 02.23 PM IST

1 – We do not know how much carbon will be in the atmosphere.

Three major reasons for scenarios

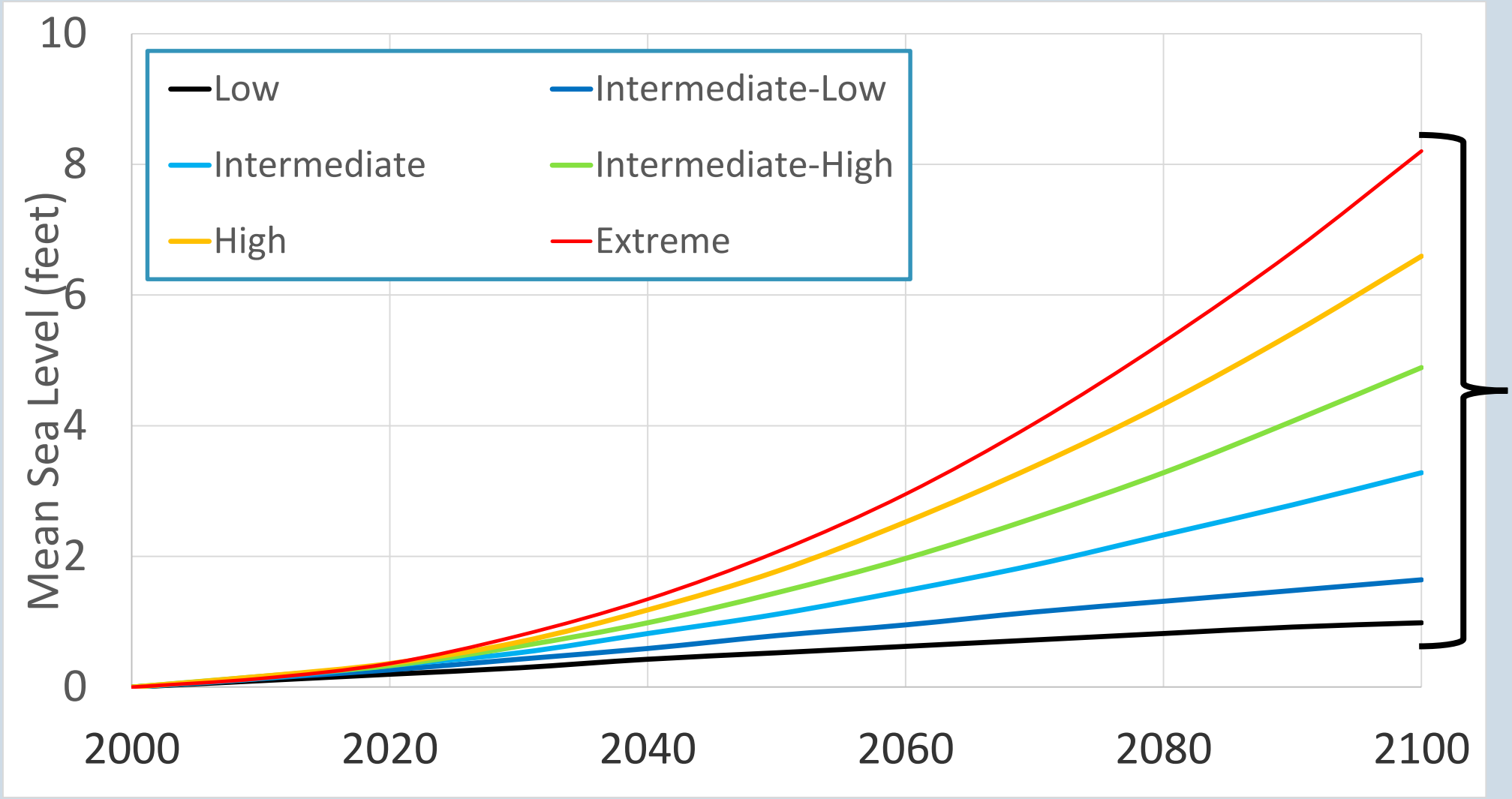


2 – Natural variability

Three major reasons for scenarios

3 – Still studying the ice sheet melt – the science to watch!

Global Scenarios - 2017



Range of scientifically possible scenarios

How to narrow down scenarios?

Step 1 - Understanding probabilities

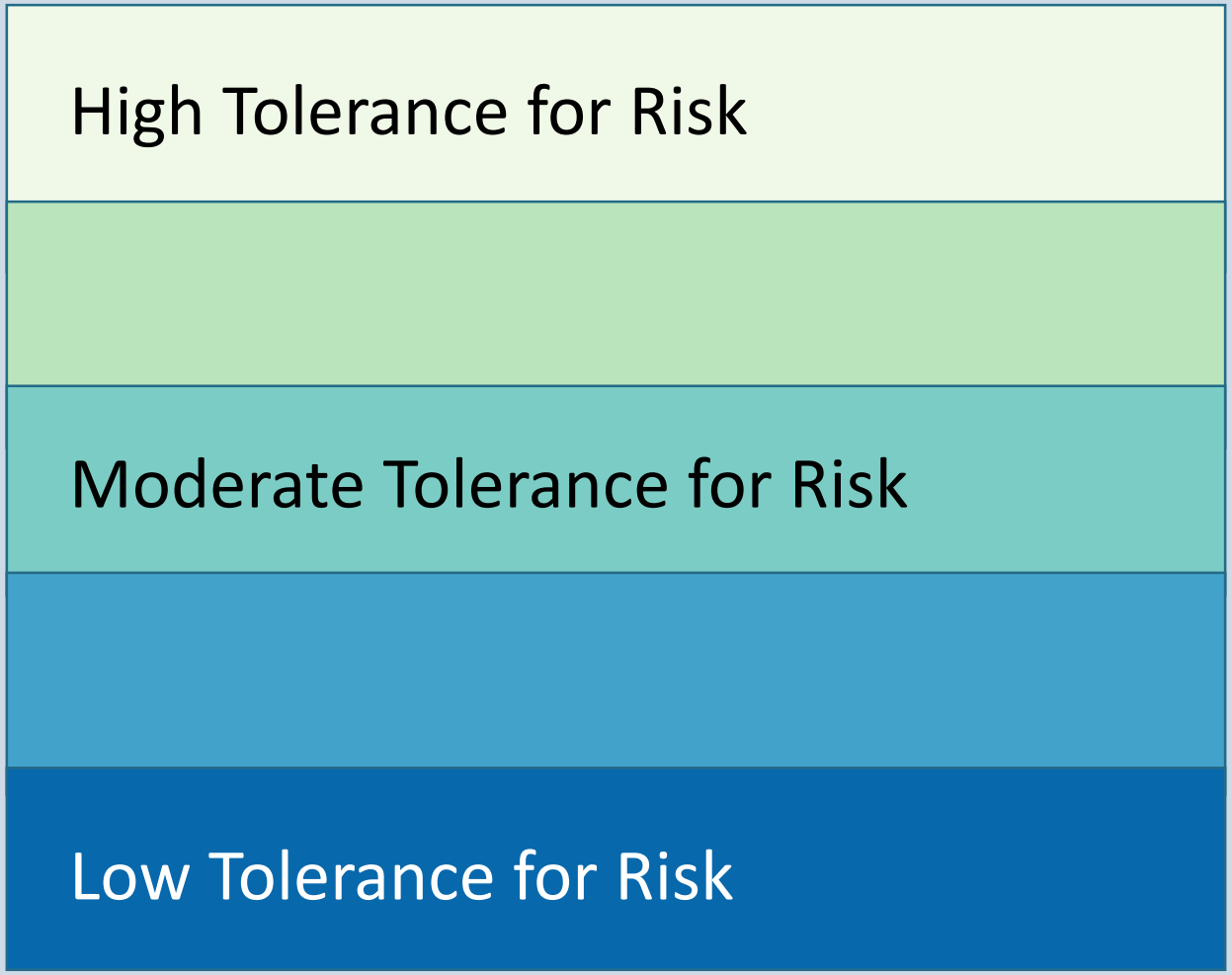
Likelihood of scenarios

Global Sea Level Rise Scenario	RCP2.6 dramatic reduction of carbon emissions	RCP4.5 modest reduction in carbon emissions	RCP8.5 no change in carbon emissions
Low	94%	98%	100%
Intermediate-low	49%	73%	96%
Intermediate	2%	3%	17%
Intermediate-high	0.4%	0.5%	1.3%
High	0.1%	0.1%	0.3%
Extreme	0.05%	0.05%	0.1%

How to narrow down scenarios?

Step Two - Identify your risk tolerance

What is your flood risk tolerance?



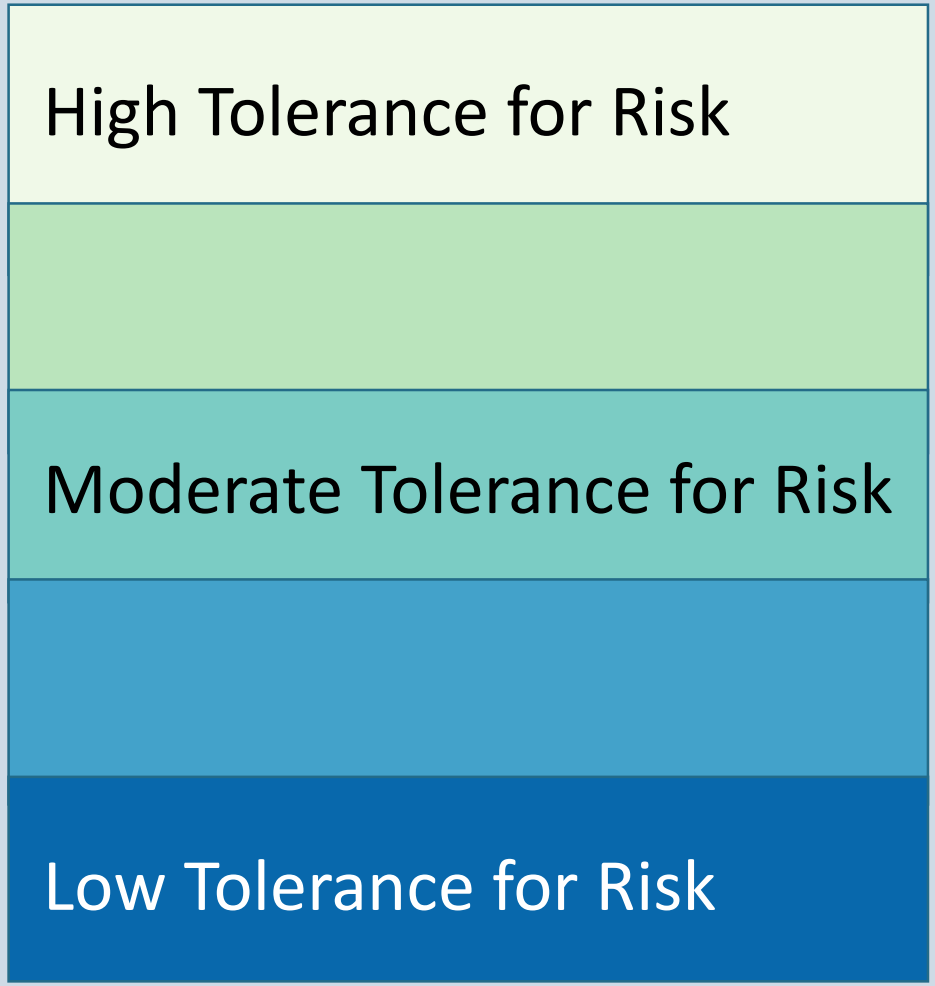
Minor Impact

Moderate Impact

Major Impact

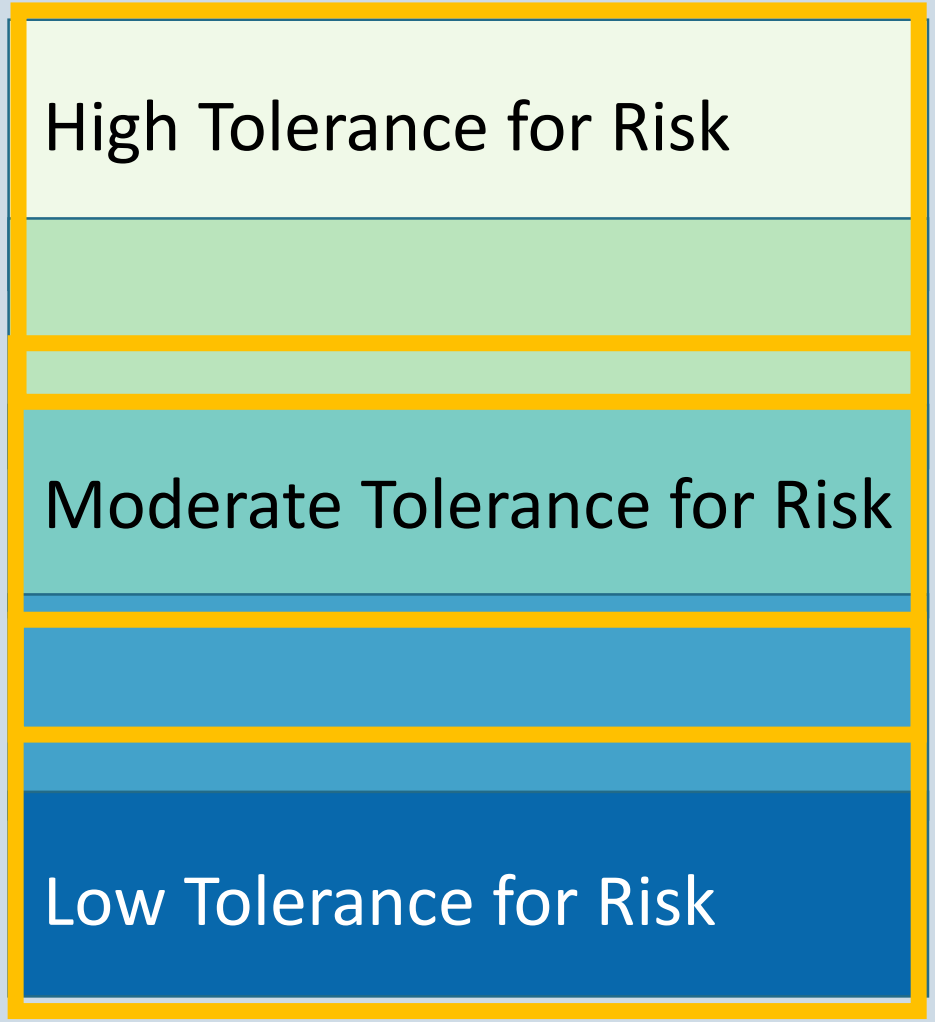
Thinking about your risk tolerance

- Scale dependent
- Location dependent
- Cost/value
- Function
  - Critical service?
  - Number of people impacted
- Length of Time



Risk Tolerance Examples

- Hospital
  - High Expense
  - Critical function
  - Long-term
- Buying A Home
  - Moderate Expense
  - Critical function – to who?
  - Mid-term (30 years)
- Shed
  - Minor Expense
  - Not critical
  - Short-term



How to narrow scenarios?

Step 3 - Linking flood risk tolerance and probabilities

Linking risk tolerance & likelihood

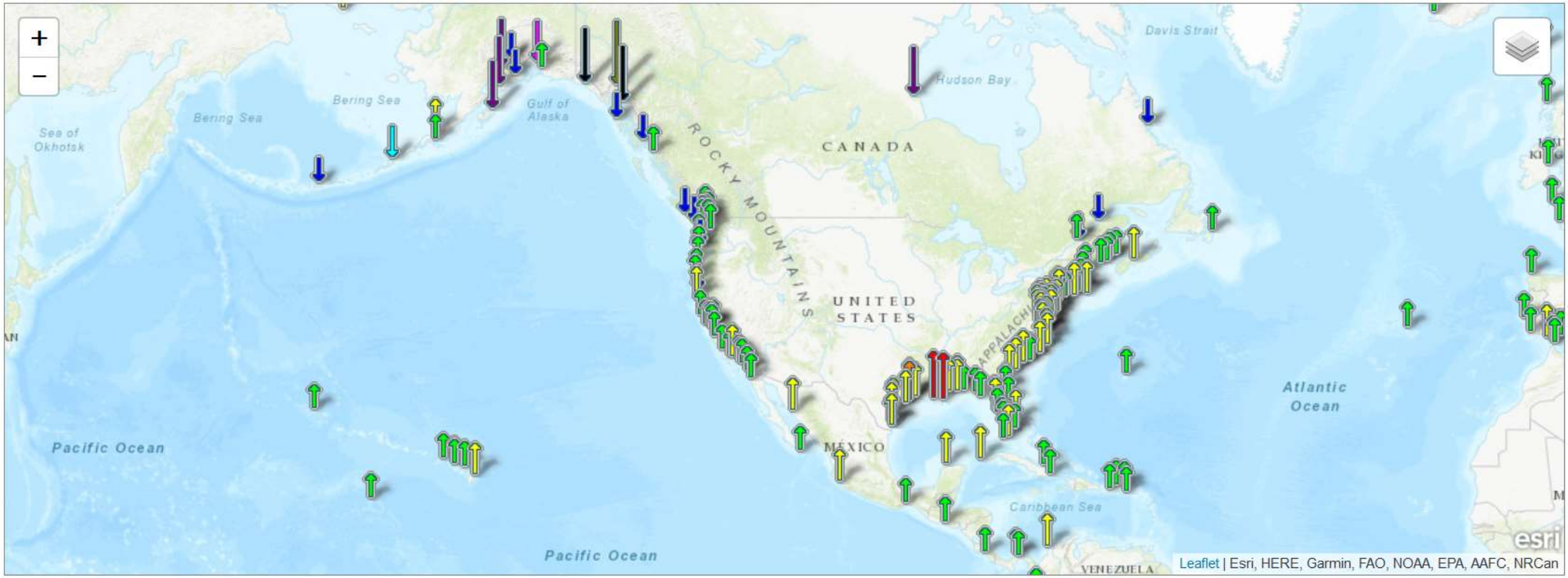
Sea level rise scenario	Likelihood
Low	100%
Intermediate-low	96%
Intermediate	17%
Intermediate-high	1.3%
High	0.3%
Extreme	0.1%

Low chance of happening, but would have a big impact

Which set of scenarios?

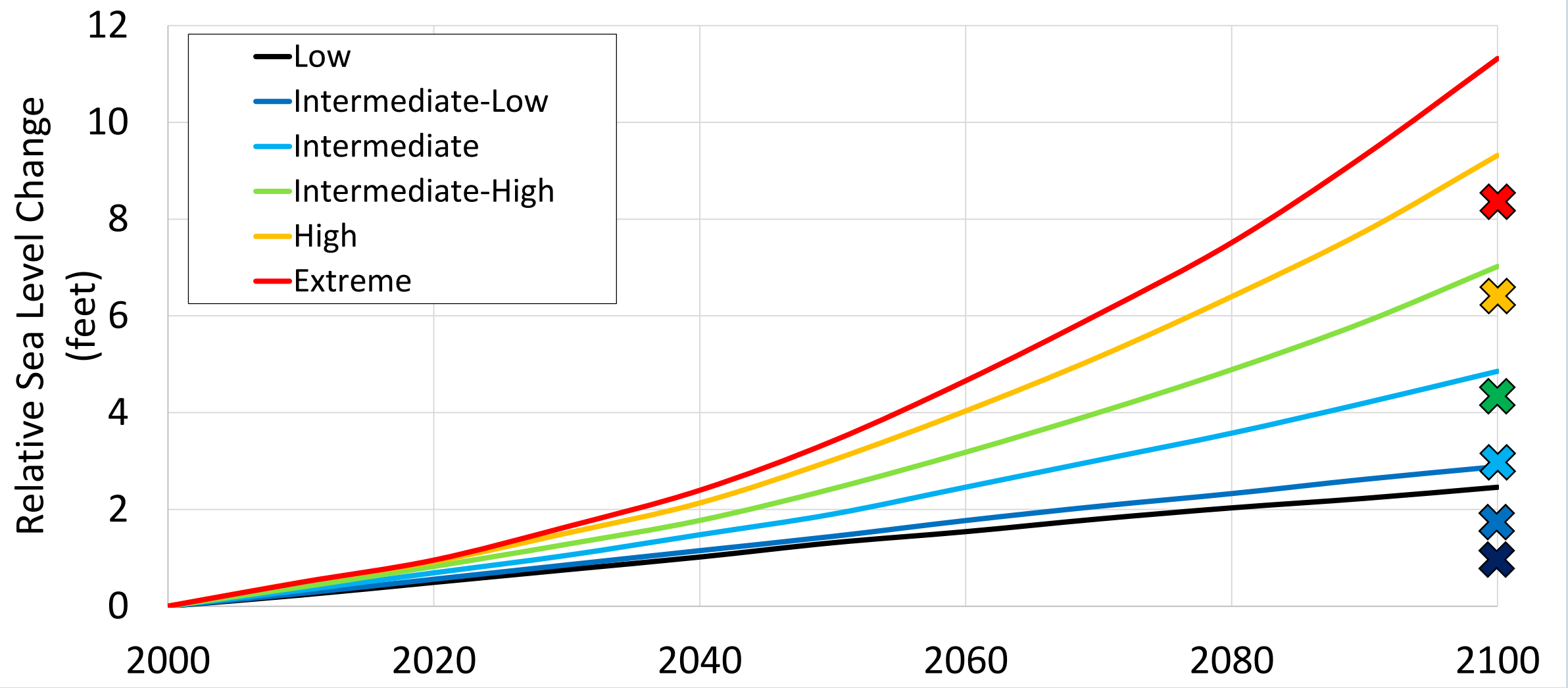
Local and regional data

Relative Sea Level Rise



The map above illustrates regional trends in sea level, with arrows representing the direction and magnitude of change. Click on an arrow to access additional information about that station.

Dauphin Island Scenarios



Putting it all together

Looking at data, time frame, risk, and probability together.

Hospital in a Coastal County

Risk tolerance?

- Low

Scenario?

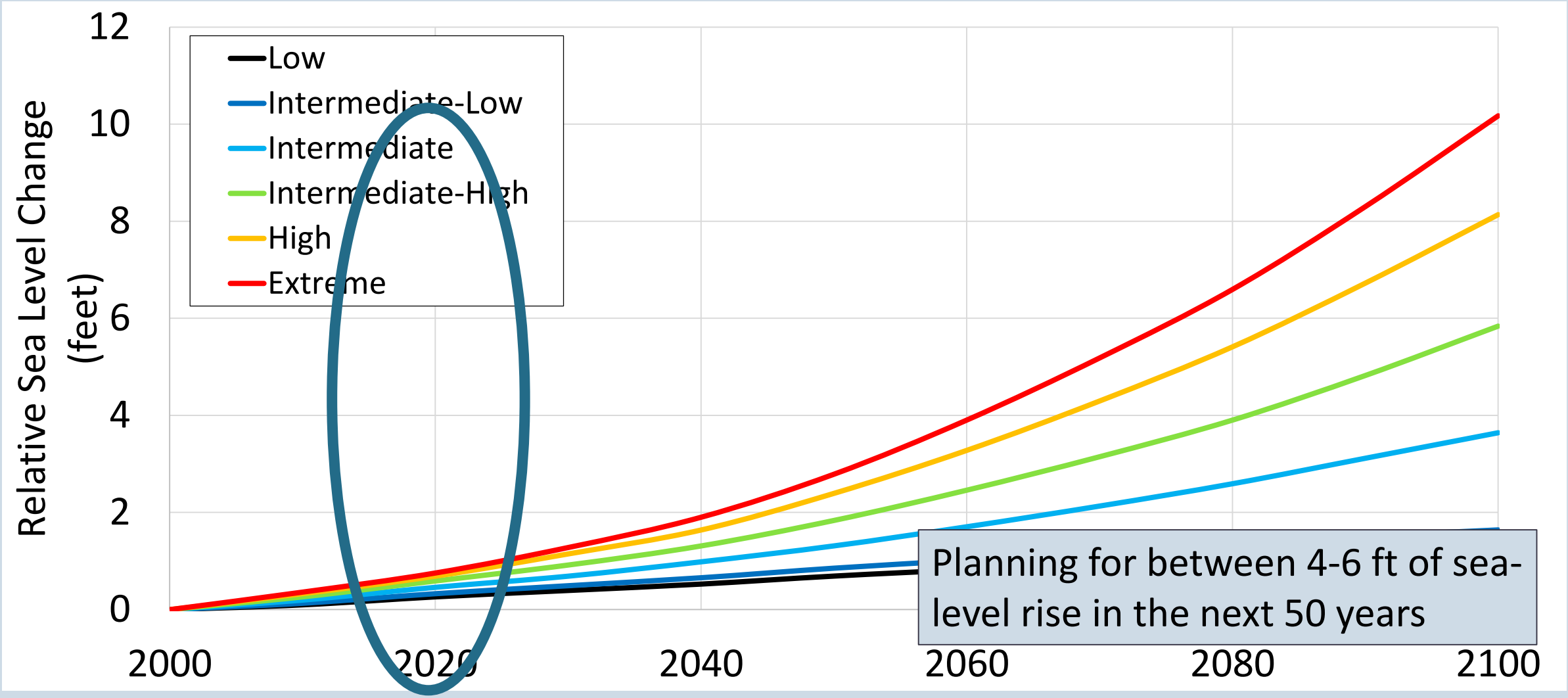
- High or Extreme

High Tolerance for Risk

Sea level rise scenario	Likelihood
Low	100%
Intermediate-low	96%
Intermediate	17%
Intermediate-high	1.3%
High	0.3%
Extreme	0.1%

Low Tolerance for Risk

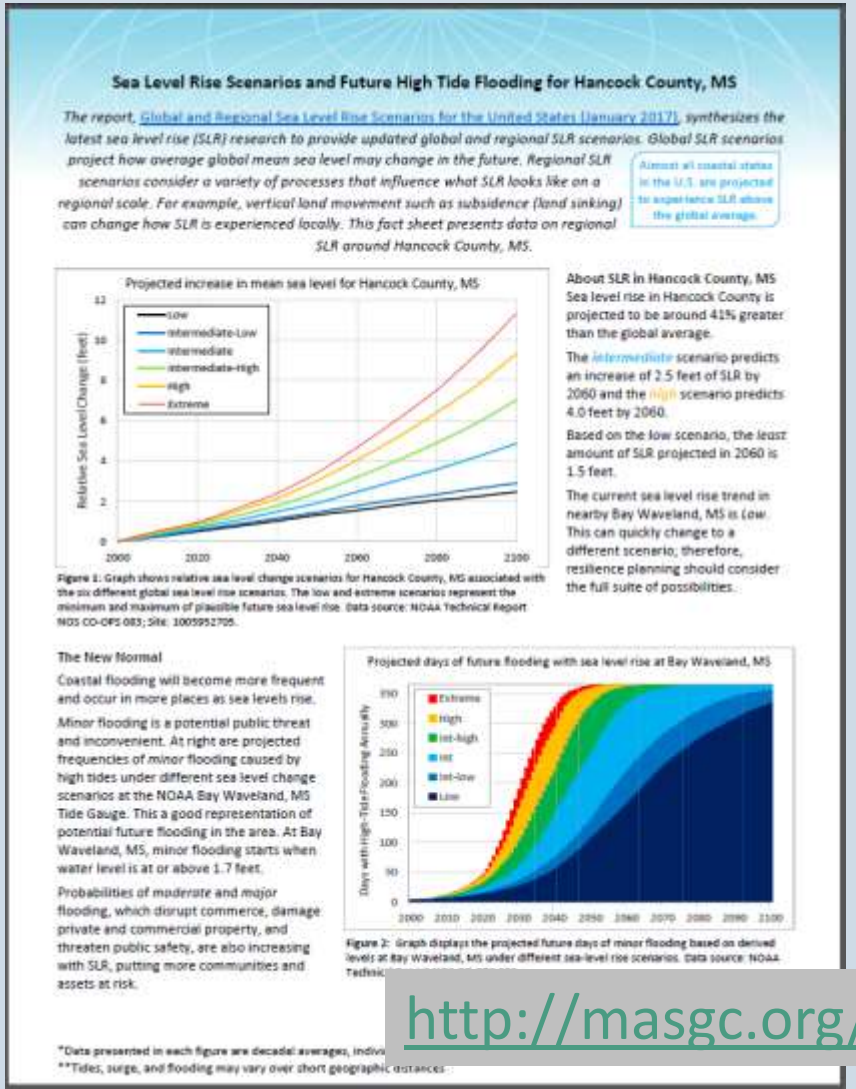
Hospital in Coastal County



Next Steps

AKA – What to do with your scenarios

First Step – use locally-relevant projections



Sea Level Rise Scenarios and Future High Tide Flooding for Hancock County, MS

The report, Global and Regional Sea Level Rise Scenarios for the United States (January 2017), synthesizes the latest sea level rise (SLR) research to provide updated global and regional SLR scenarios. Global SLR scenarios project how average global mean sea level may change in the future. Regional SLR scenarios consider a variety of processes that influence what SLR looks like on a regional scale. For example, vertical land movement such as subsidence (land sinking) can change how SLR is experienced locally. This fact sheet presents data on regional SLR around Hancock County, MS.

Almost all coastal states in the U.S. are projected to experience SLR above the global average.

Projected increase in mean sea level for Hancock County, MS

Figure 1: Graph shows relative sea level change scenarios for Hancock County, MS associated with the six different global sea level rise scenarios. The low and extreme scenarios represent the minimum and maximum of plausible future sea level rise. Data source: NOAA Technical Report NOS CO-OPS 083; Site: 1005952705.

About SLR in Hancock County, MS

Sea level rise in Hancock County is projected to be around 41% greater than the global average.

The intermediate scenario predicts an increase of 2.5 feet of SLR by 2060 and the high scenario predicts 4.0 feet by 2060.

Based on the low scenario, the least amount of SLR projected in 2060 is 1.5 feet.

The current sea level rise trend in nearby Bay Waveland, MS is Low. This can quickly change to a different scenario; therefore, resilience planning should consider the full suite of possibilities.

The New Normal

Coastal flooding will become more frequent and occur in more places as sea levels rise.

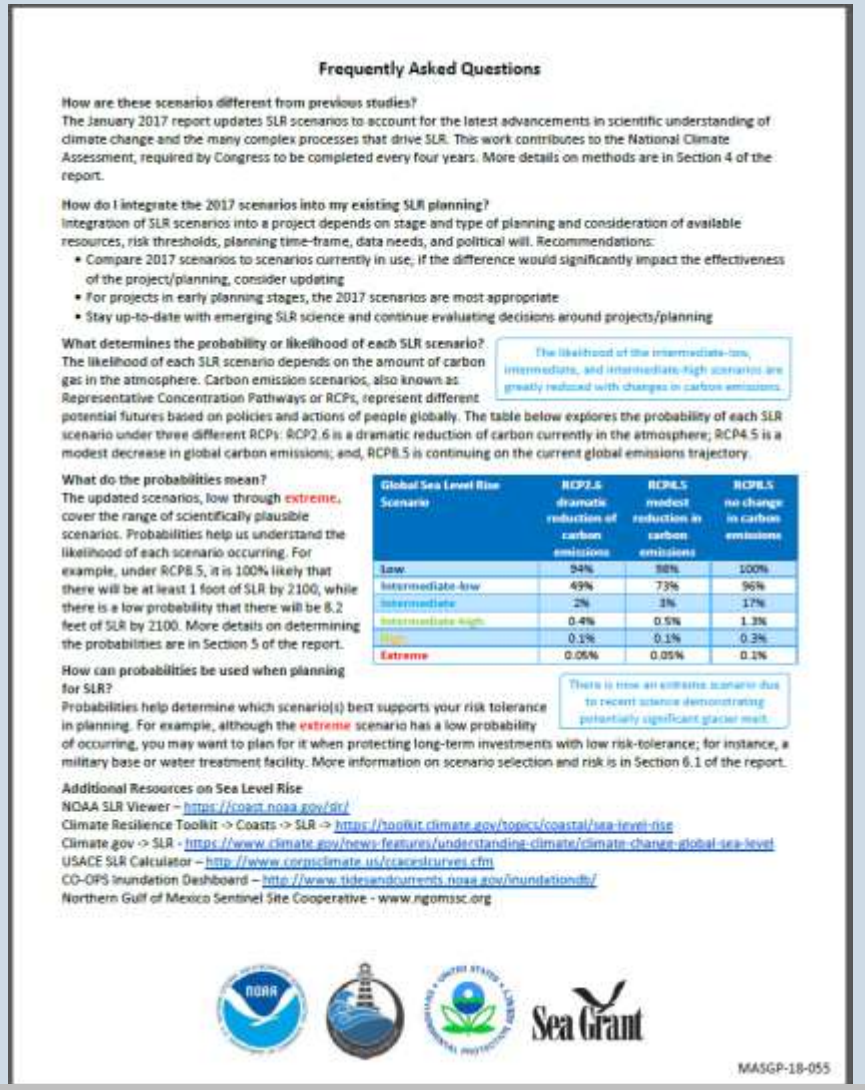
Minor flooding is a potential public threat and inconvenient. At right are projected frequencies of *minor* flooding caused by high tides under different sea level change scenarios at the NOAA Bay Waveland, MS Tide Gauge. This a good representation of potential future flooding in the area. At Bay Waveland, MS, minor flooding starts when water level is at or above 1.7 feet.

Probabilities of *moderate* and *major* flooding, which disrupt commerce, damage private and commercial property, and threaten public safety, are also increasing with SLR, putting more communities and assets at risk.

Projected days of future flooding with sea level rise at Bay Waveland, MS

Figure 2: Graph displays the projected future days of minor flooding based on derived levels at Bay Waveland, MS under different sea-level rise scenarios. Data source: NOAA Technic

*Data presented in each figure are decadal averages, indivi
**Tides, surge, and flooding may vary over short geographic distances



Frequently Asked Questions

How are these scenarios different from previous studies?
The January 2017 report updates SLR scenarios to account for the latest advancements in scientific understanding of climate change and the many complex processes that drive SLR. This work contributes to the National Climate Assessment, required by Congress to be completed every four years. More details on methods are in Section 4 of the report.

How do I integrate the 2017 scenarios into my existing SLR planning?
Integration of SLR scenarios into a project depends on stage and type of planning and consideration of available resources, risk thresholds, planning time-frame, data needs, and political will. Recommendations:

- Compare 2017 scenarios to scenarios currently in use; if the difference would significantly impact the effectiveness of the project/planning, consider updating
- For projects in early planning stages, the 2017 scenarios are most appropriate
- Stay up-to-date with emerging SLR science and continue evaluating decisions around projects/planning

What determines the probability or likelihood of each SLR scenario?
The likelihood of each SLR scenario depends on the amount of carbon gas in the atmosphere. Carbon emission scenarios, also known as Representative Concentration Pathways or RCPs, represent different potential futures based on policies and actions of people globally. The table below explores the probability of each SLR scenario under three different RCPs: RCP2.6 is a dramatic reduction of carbon currently in the atmosphere; RCP4.5 is a modest decrease in global carbon emissions; and, RCP8.5 is continuing on the current global emissions trajectory.

The likelihood of the intermediate-low, intermediate, and intermediate-high scenarios are greatly reduced with changes in carbon emissions.

What do the probabilities mean?
The updated scenarios, low through extreme, cover the range of scientifically plausible scenarios. Probabilities help us understand the likelihood of each scenario occurring. For example, under RCP8.5, it is 100% likely that there will be at least 1 foot of SLR by 2100, while there is a low probability that there will be 8.2 feet of SLR by 2100. More details on determining the probabilities are in Section 5 of the report.

Global Sea Level Rise Scenario	RCP2.6 dramatic reduction of carbon emissions	RCP4.5 modest reduction in carbon emissions	RCP8.5 no change in carbon emissions
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Extreme	0.05%	0.05%	0.1%

How can probabilities be used when planning for SLR?
Probabilities help determine which scenario(s) best supports your risk tolerance in planning. For example, although the extreme scenario has a low probability of occurring, you may want to plan for it when protecting long-term investments with low risk-tolerance; for instance, a military base or water treatment facility. More information on scenario selection and risk is in Section 6.1 of the report.

There is now an extreme scenario due to recent science demonstrating potentially significant glacier melt.

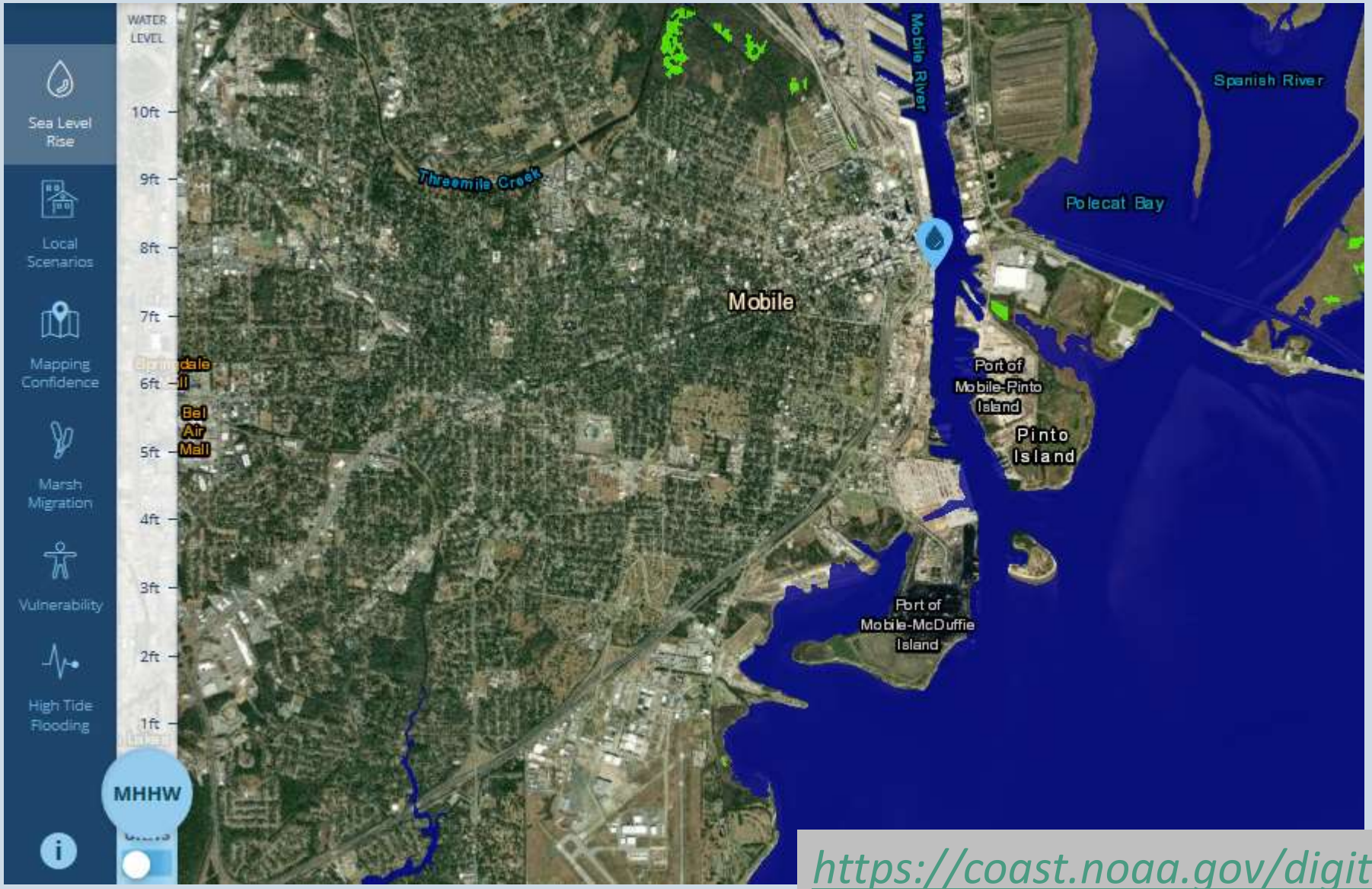
Additional Resources on Sea Level Rise
NOAA SLR Viewer – https://coast.noaa.gov/slr/
Climate Resilience Toolkit -> Coasts -> SLR -> https://toolkit.climate.gov/topics/coastal/sea-level-rise
Climate.gov -> SLR - https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level
USACE SLR Calculator – http://www.corpsclimate.us/ccaceslcurves.cfm
CO-OPS Inundation Dashboard – http://www.tidesandcurrents.noaa.gov/inundationdb/
Northern Gulf of Mexico Sentinel Site Cooperative - www.ngomssc.org

Sea Grant

MASGP-18-055

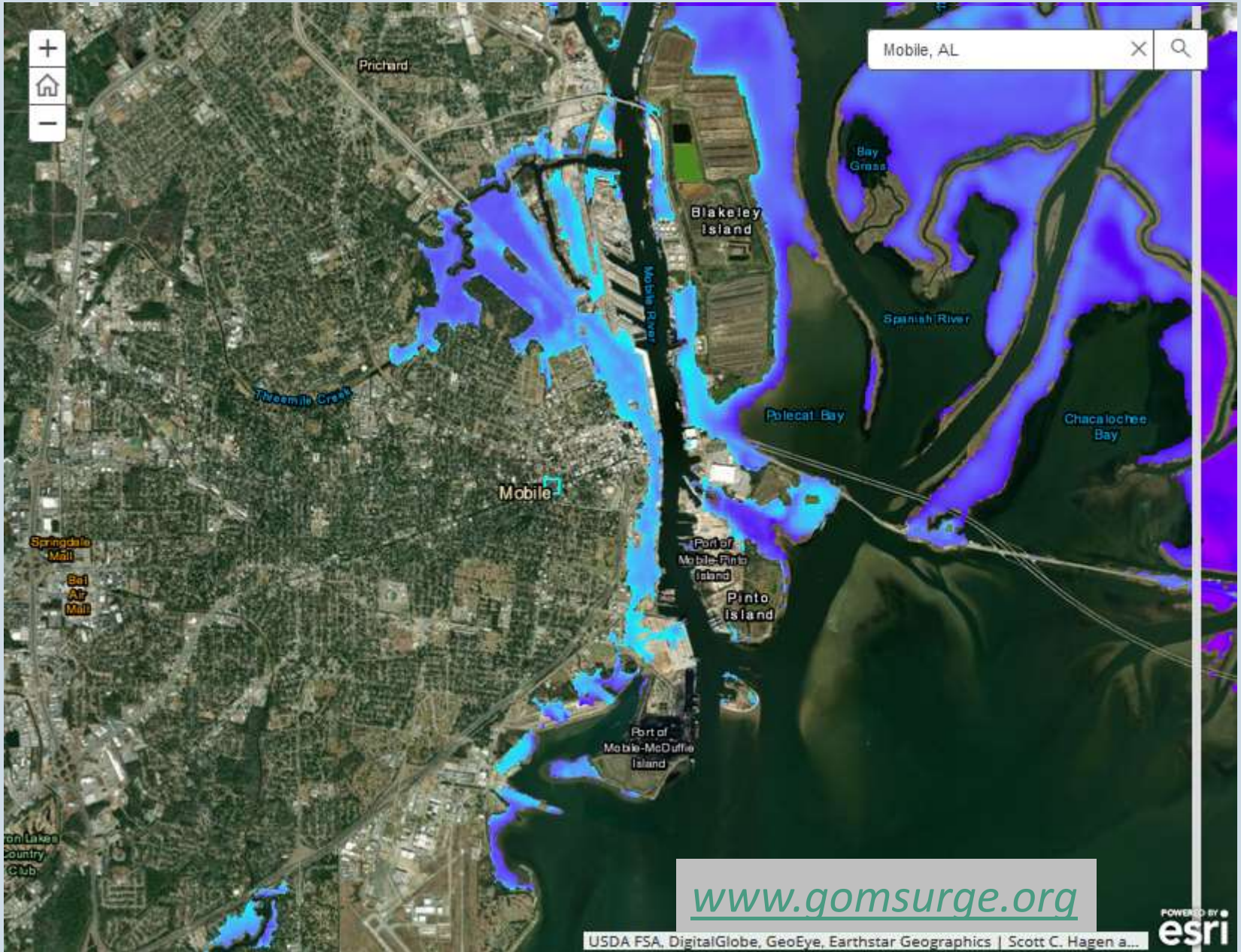
http://masgc.org/northern-gulf-of-mexico-sentinel-site-co/two-pager

Translate your scenario – new high tide



https://coast.noaa.gov/digitalcoast/tools/slr

Translate your scenario – future storm surge



Recap

- Sea-level rise is already impacting our coast
- Scenario probabilities = planning power
- Risk-based planning is a useful approach to integrating sea-level rise scenarios
- Scenario selection is step one of integrating sea-level rise
- Use that information to understand impacts

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Questions???

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Sea Grant Mississippi-Alabama