ESLR Coastal Resilience MTAG 2022 Workshop Report

Report of Activities, methods, and results from the

ESLR 2021 Coastal Resilience: Living with Sea Level Rise in the Texas Coastal Bend

Management Transition Advisory Group (MTAG) Kickoff Meeting

December 8, 2022

Harte Research Institute for Gulf of Mexico Studies

Report Compiled by: Diana Del Angel and Kara Coffey

Edited by: Katya Wowk, Renee Collini, and James Gibeaut

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Workshop Summary

The Harte Research Institute for Gulf of Mexico Studies (HRI), Texas A&M University-Corpus Christi recently received funding from the National Oceanic and Atmospheric Administration to launch a project called "ESLR 2021 Coastal Resilience: Living with Sea Level Rise in the Texas Coastal Bend." The project, being led by HRI Endowed Chair for Coastal and Marine Geospatial Sciences Dr. James Gibeaut, will engage key stakeholders to improve and apply advanced modeling techniques to project how sea level rise (SLR) and natural infrastructure may impact coastal resiliency. The applied aspect of this work will be guided by a Management Transition Advisory Group (MTAG), which will provide researchers with key input and insights on modeling SLR scenarios to produce projections of future landscapes.

The MTAG Kickoff Meeting was held online on December 8, 2022. The goal of this meeting was to introduce the MTAG to the ESLR project. There were a total of 20 attendants including 10 members of the project team. Members of the MTAG represent various local and state organizations including Coastal Bend Council of Governments, Nueces Parks, Port of Corpus Christi, Coastal Bend Bays & Estuaries, Corpus Christi Metropolitan Planning Organization, Corpus Christi Convention & Visitors Bureau, Corpus Christi Regional Economic Development Corporation, Texas Sea Grant, Texas Water Development Board, Texas General Land Office and Texas Department of Transportation.

Dr. Katya Wowk opened the meeting and Dr. Gibeaut presented a brief project summary for Living with SLR in the Texas Coastal Bend. The project is a collaboration between three entities: Harte Research Institute (HRI), Louisiana State University (LSU) and The Water Institute of the Gulf (TWI). HRI has previously been involved with local modeling of the effects of SLR and LSU has previous modeling experience with wetland change models. Project goals include: 1.) improve and adapt Hydro-MEM (Hydrodynamic-Marsh Equilibrium Model) for the region, 2.) assess SLR vulnerability and efficiency of natural and nature-based features, and 3.) co-produce knowledge and products through collaboration with the MTAG.

Dr. Peter Bacopoulos gave a brief presentation of the Hydro-MEM scientific basis, inputs, application, and example output. The presentation was followed by a few questions. Next, Dr. Renee Collini presented Practical Considerations for SLR in 5 minutes or less. She compared SLR estimated from 2017 to 2022, showing that, overall, the high end has decreased but the low end has increased, thus narrowing the range of possible SLR. By 2050, it is expected that Corpus Christi will experience over 2ft of SLR compared to the year 2000. Following the presentation, the participants reviewed some results from the pre-workshop survey and had a discussion.

Workshop Objectives

- To introduce project goals, objectives, and timeline
- To define the role of the Management Transition Advisory Group (MTAG)
- To understand MTAG management/decision making needs relating to sea-level rise
- To introduce the ESLR modeling approaches

◊ ◊ ◊ ◊

Workshop Attendants

Meredith Dardedn, Visit CC

Peter Bacopoulos, LSU*

Kara Coffey, HRI-TAMUCC*

Diana Del Angel, HRI-TAMUCC*

Renee Collini, TWI*

Scott Cross, Nueces County Coastal Parks

James Gibeaut, HRI-TAMUCC*

Danielle Hale, Port of CC

Jin Ikeda, LSU*

Craig Casper, CC MPO

Chris Kees, LSU*

Emily Martinez, CBCOG

Debalina Sengupta, Texas Sea Grant

Brittney Sotelo, CC Regional EDC

Kristen Stanzel, CBBEP

Lihong Su, HRI-TAMUCC*

Mukesh Subedee, HRI-TAMUCC*

Evan Turner, TWDB

Tony Williams, TGLO TCRMP

Katya Wowk, HRI-TAMUCC*

*denotes affiliation with project team

Description of Meeting Activities and Content

This kickoff meeting was an hour long. To capture MTAG feedback before the meeting a pre-meeting survey was sent to the MTAG group (see Appendix C for results). The meeting components included introductions, project overview and a group discussion (Also see Appendix A. Workshop Agenda).

Welcome and Introductions

Dr. Katya Wowk welcomed the MTAG and ESLR team to the call. Dr. James Gibeaut, Lead-PI, led the introductions for the ESLR team. Following the team introductions, MTAG participants introduced themselves, name and affiliation. Dr. Wowk emphasized that at the in-person meeting planned for Spring 2023 ample time would be provided to better introduce group members and focus on relationship building.

Project Overview

Dr. Gibeaut presented a brief project summary for Living with SLR in the Texas Coastal Bend. The project is funded by NOAA's ESLR program, which has been active over 10 years. Project co-PI's at LSU, had been funded through the NOAA's ESLR program, bringing their expertise to this project. The project is a collaboration between three entities: HRI-TAMUCC, LSU, and TWI. HRI has previously been involved with local modeling of the effects of SLR for the GLO's TCRMP. Here the team has used SLAMM and ADCIRC models to assess the impacts of SLR. The project presented here will apply new modeling techniques, in particular the application of the Hydro-MEM, with the goal of improving SLR models for the area. The project is ongoing and expected to end August 31, 2024, but may be extended 1 year .

The project study extent covers the six coastal counties of the Coastal Bend. One goal is to improve and adapt the HydroMEM model for the region. This includes improvements to the bare-earth digital elevation models (DEMs) and updates to the HydroMEM, which is specific to spartina, to adjust to local vegetation, such as mangrove. Then, with these inputs, SLR vulnerability can be better assessed based on model results. Dr. Gibeaut explained that the MTAG input is important, particularly when designing and modeling the effects of potential solutions, such that solutions are based on priority decision-making needs, including where we might protect coastal habitat to mitigate or adapt to SLR. Potential questions include: Which areas do we prioritize for modeling the effects of potential solutions? What techniques should be employed? These questions will be addressed through co-producing knowledge with the MTAG for improved modeling and potential application in the region.

MTAG Role

Dr. Wowk spoke briefly to the MTAG about a charter. The charter will define MTAG roles and responsibilities, and will be crafted jointly between project leads and the MTAG. Dr. Wowk and Mrs. Coffey will be reaching out to the MTAG to organize individual calls to assess how the output of this project can best be incorporated into their work and programs.

Introduction to Hydro-MEM Modeling

Dr. Peter Bacopoulos gave a brief presentation of the Hydro-MEM scientific basis, inputs, application, and example output. Originally developed in the 70's by Dr. Jim Morris, the MEM model relates the surface elevation of the marsh surface to the water elevation (tidal frame) to determine how productive a marsh will be. Marsh production is measured as biomass, and through a series of mesocosm experiments (marsh organs deployed in the field) a marsh biomass curve (see slides for figure). There is not a marsh organ experiment for the coastal bend therefore the data will be determined from a collection of biomass curves based on a variety of locations. The HydroMEM uses ADCIRC for modeling water movement and to help determine the water level, which is the input to the MEM model to then estimate biomass density. Dr. Bacopoulos explained that the model will be adapted to the meteorology and ecology of the Texas Coastal Bend.

Planning for Sea Level Rise

Dr. Renee Collini kicked off this section with a short presentation titled, *Practical Considerations for SLR in 5 Min or Less*. She compared SLR estimated from 2017 to 2022; overall, the high end has decreased but the low end has increased, thus narrowing the range of possible SLR. By 2050, it is expected that Corpus Christi will experience over 2ft of SLR compared to the year 2000. Dr. Collini encouraged the workshop participants to visit the Application Guide online, which translate the science within the updated technical report and special considerations for planning using the range of projected SLR. Approaches to decision-making in the face of uncertainty are risk tolerance, scenario planning, and adaptation pathways.

Group Discussion

Following the presentation, the participants reviewed some results from the pre-workshop survey and had a discussion. One participant asked if the project would generate inundation frequencies. The research team suggested that the hydroperiod is an intermediate product of the marsh model, yet this does not include open coast areas. Further, Dr. Gibeaut clarified that sedimentary processes at the beach shoreline will not be modeled. Another participant asked if the soil type affects the MEM model output. The response from the research team stated that the inorganic component is modeled using suspended sediments. Lastly, a question was pointed at mangroves: Specifically, how will mangrove expansion be included in the model? The team responded that marsh productivity for mangrove is not yet available, and it is expected that mangroves will have a different curve than the spartina.

Action Items

- The ESLR team will send an email follow-up with resources and meeting summary.
- The MTAG team will be scheduling a Spring MTAG meeting.
- Follow-up will include individual meetings with MTAG members to engage in more in-depth discussion on survey responses.
- Complete and adopt an MTAG Charter, including roles and responsibilities.

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December 8, 2022
Harte Research Institute for Gulf of Mexico Studies
Management Transition Advisory Group (MTAG) Kickoff Meeting

Workshop Objectives:

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- To understand MTAG management/decision making needs relating to sea-level rise
- To introduce the ESLR modeling approaches

Meeting Agenda

Time	Item
12:50 pm	Meeting opens for technology check
1:00 pm	Welcome & Introductions
1:15 pm	MTAG Role
1:25 pm	Introduction to Hydro-MEM Modeling Component
1:40 pm	Planning for Sea Level Rise (Review MTAG survey results)
2:00pm	Adjourn

Meeting Information:

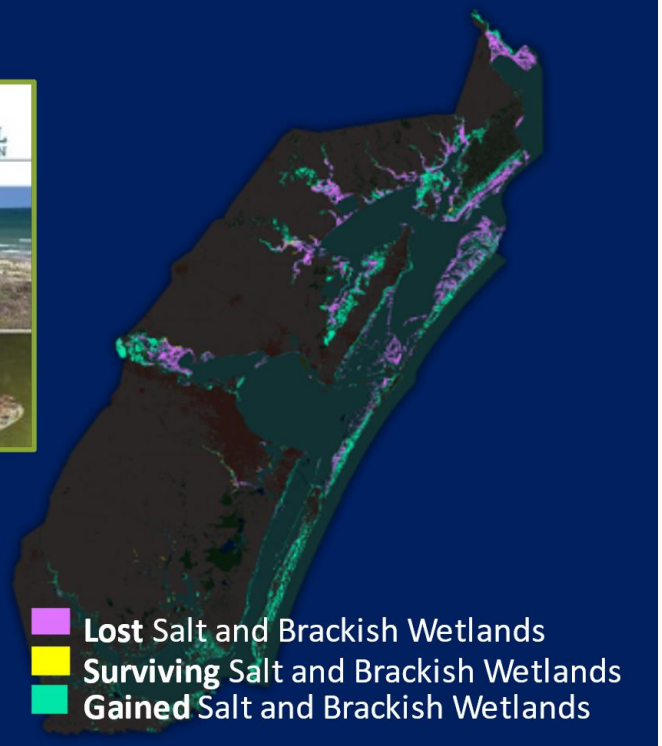
Click here to join the meeting

Meeting ID: 238 697 875 675
Passcode: vBXcNe

Or call in (audio only): +1 361-434-5376,,585489635# Phone Conference ID: 585 489 635#

Context

- The Texas General Land Office publishes the TCRMP which identifies coastal vulnerabilities and strategies to address them.
- HRI models the impacts of SLR and storm surge for the TCRMP using SLAMM and ADCIRC models.
- NOAA's Effects of SLR (ESLR) Program funds research for (1) describing coastal vulnerability, (2) determining benefits of Natural and Nature Based Features (NNBF), and (3) predict effects of SLR under varying management strategies.
- LSU developed and applied new SLR modeling techniques (Hydro -MEM) under the ESLR program.
- HRI, LSU, and MSU are partners on this newly funded ESLR project with the following goals:



NCCOS | NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

SCIENCE SERVING COASTAL COMMUNITIES

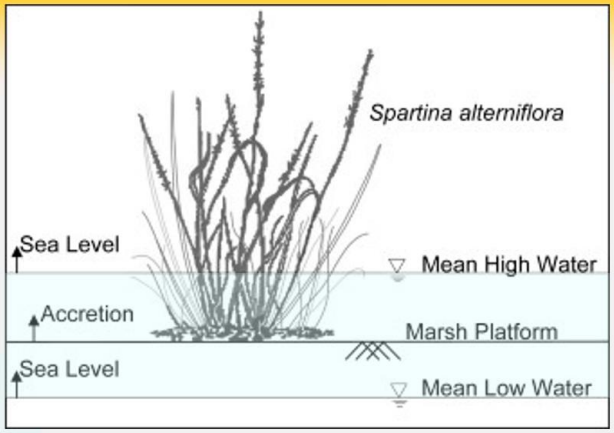
The Effects of Sea Level Rise (ESLR) Program

Goals

- Improve and adapt Hydro-MEM to the Texas Coastal Bend
  - Improve bare-Earth elevation model
  - Develop model mesh
  - Add wetland species
  - Validate Hydro-MEM
- Assess SLR vulnerabilities and NNBF efficacy using Hydro-MEM and SLAMM as appropriate
  - Model SLR effects with and without NNBF
- Form a collaborative MTAG and co-produce a knowledge base for modeling and assessing SLR resiliency in the region

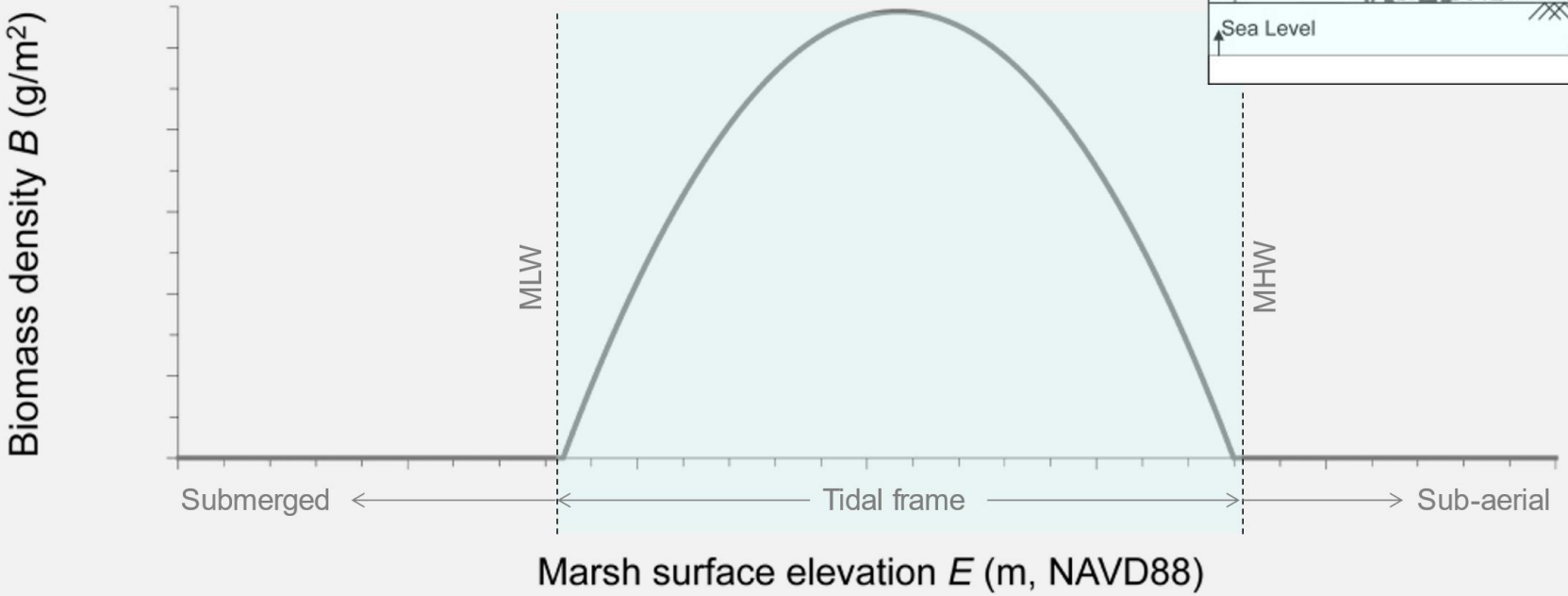
Hydro-MEM (ecological basis)

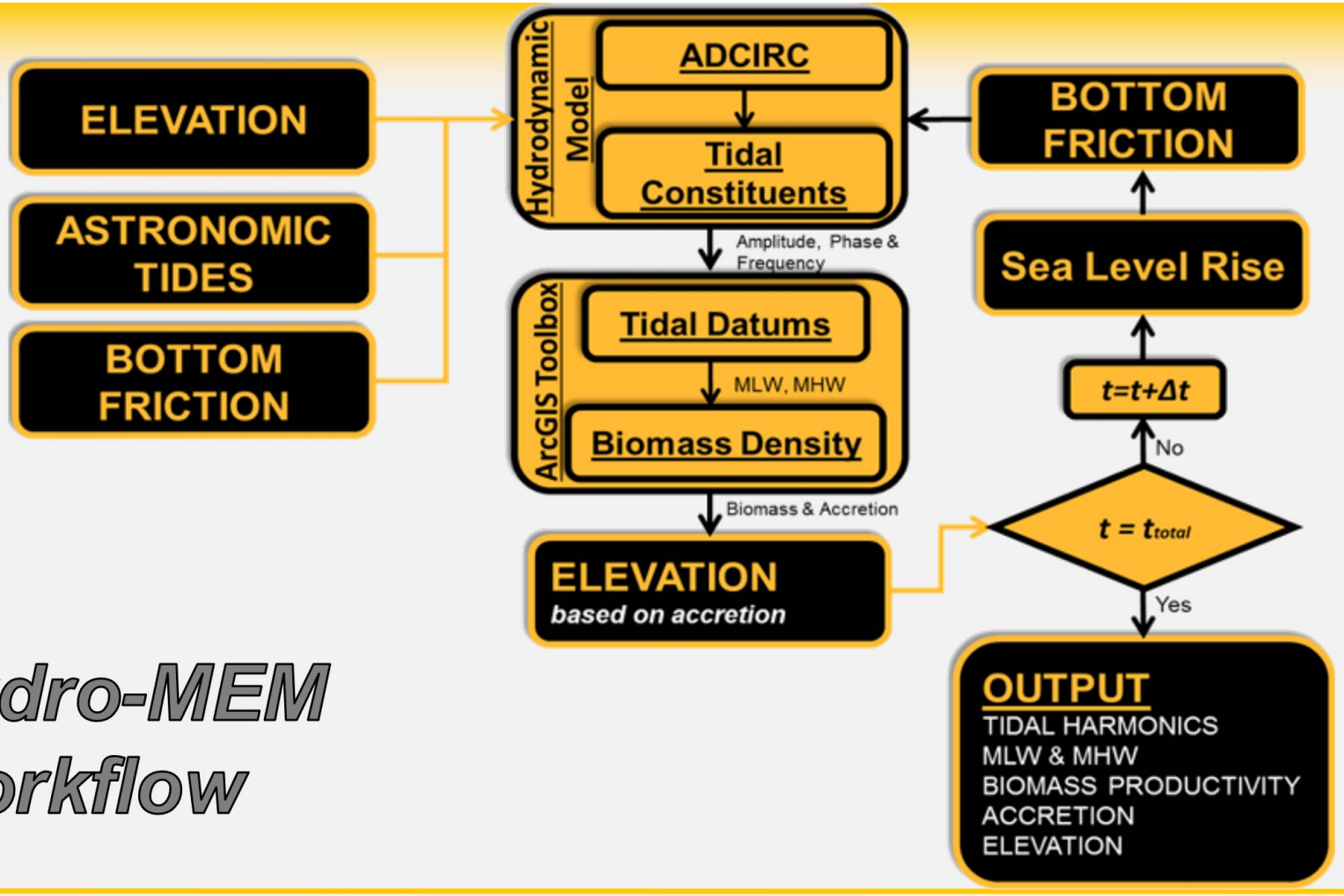
Hydrodynamic – Marsh Equilibrium Model



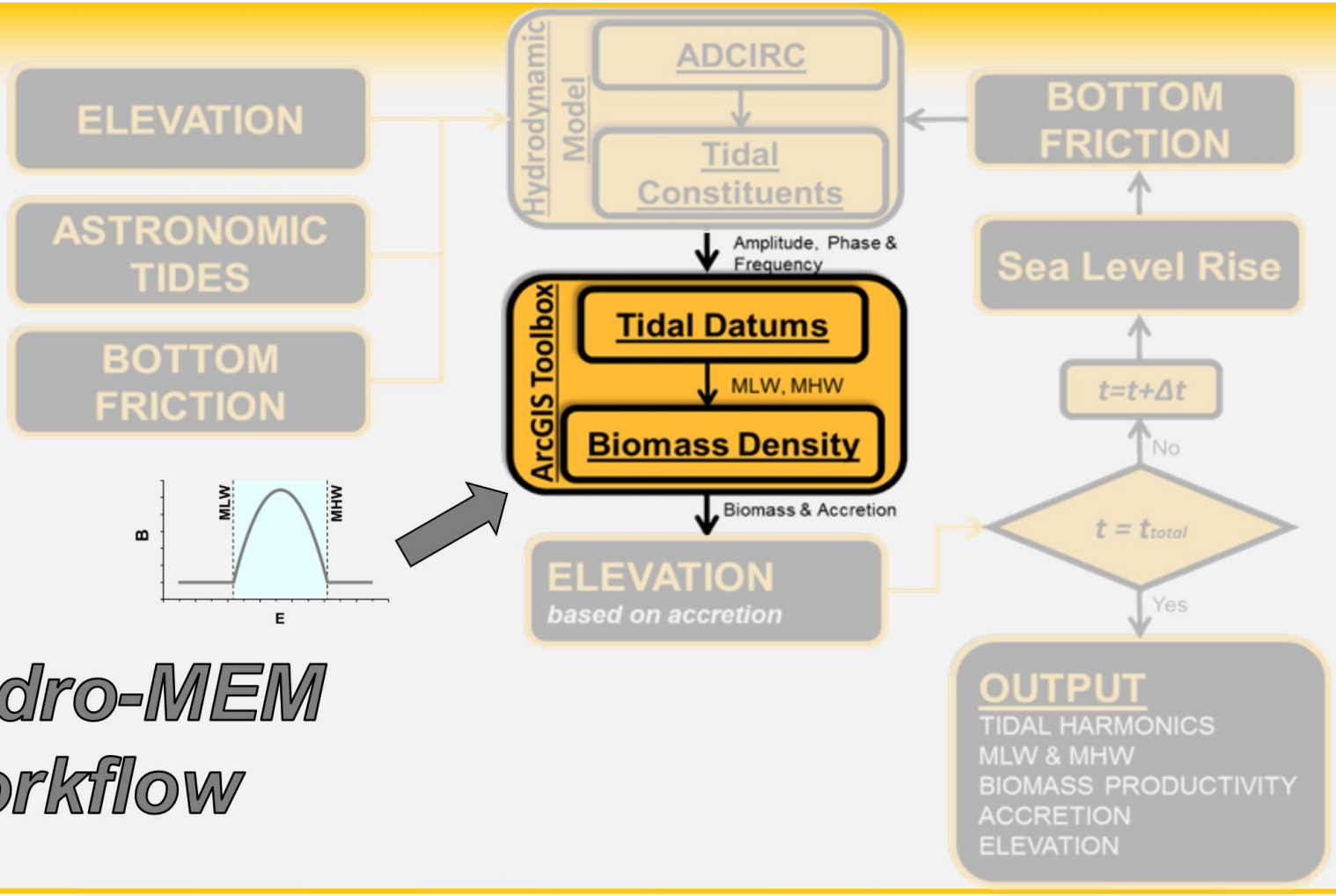
Marsh Equilibrium Model for *Spartina alterniflora* system

Marsh is productive if the surface elevation resides within the tidal frame (MLW < E < MHW)

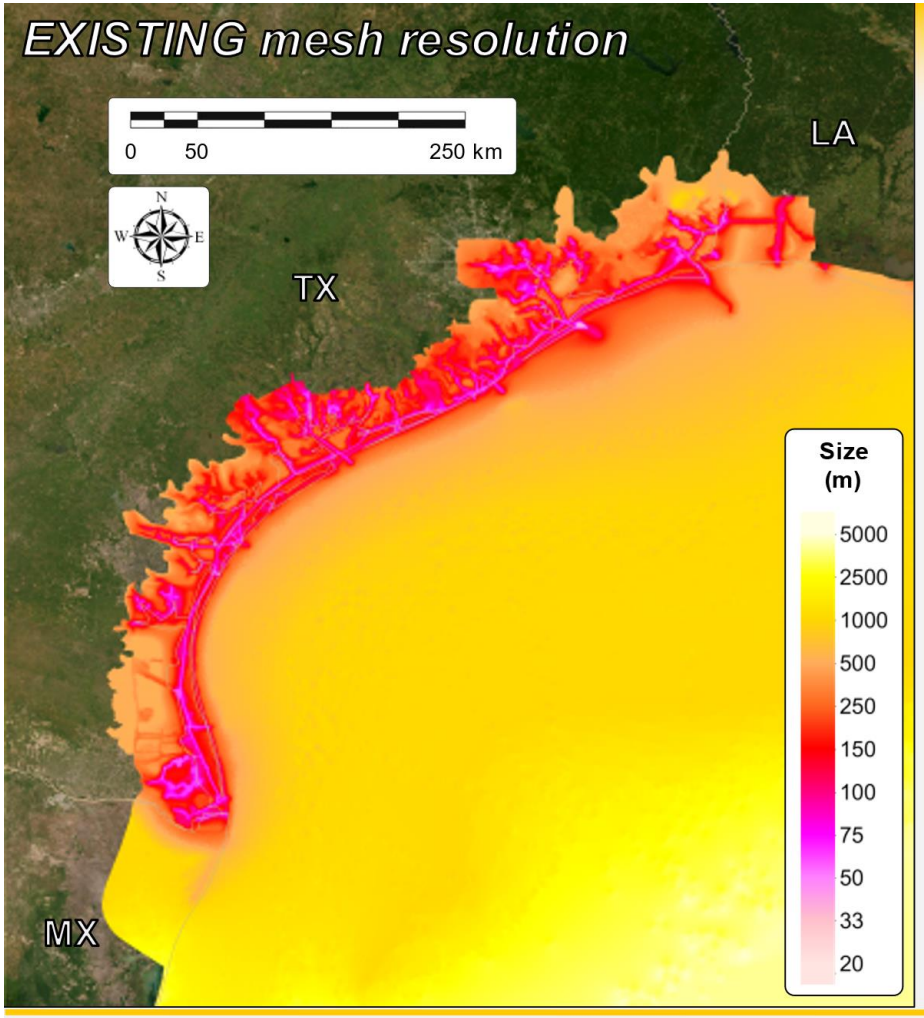


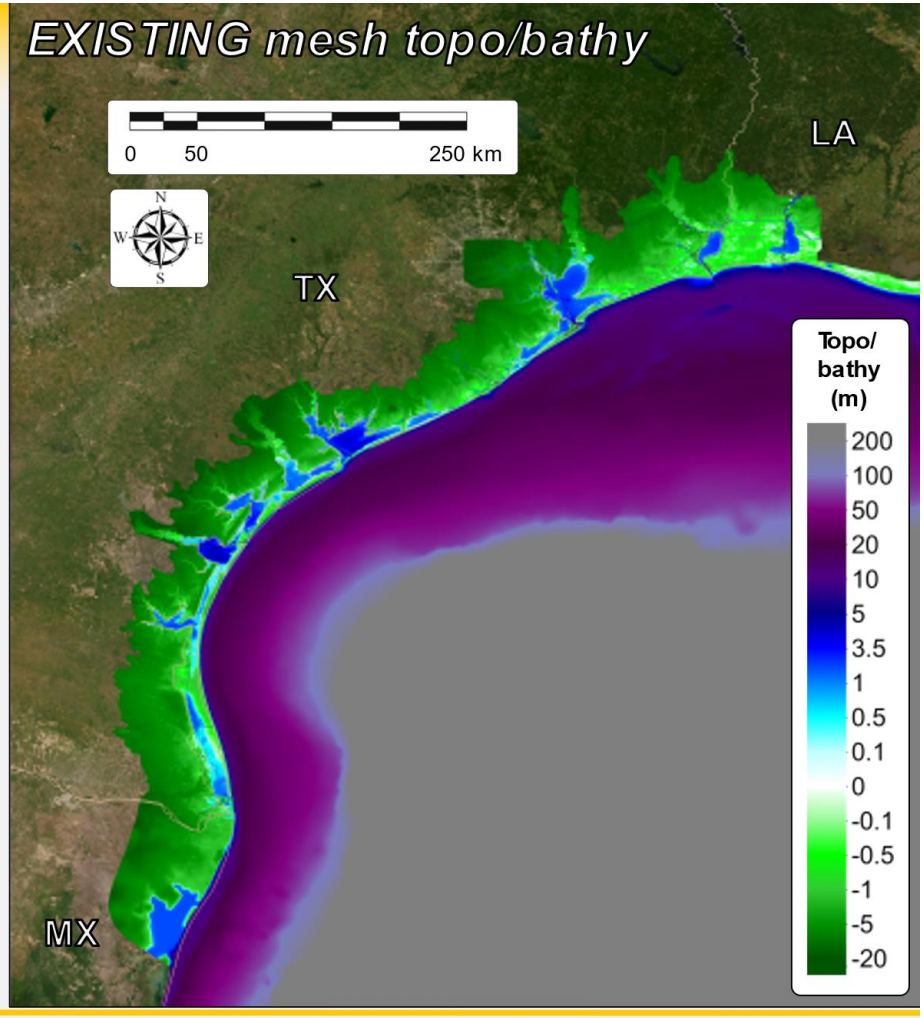


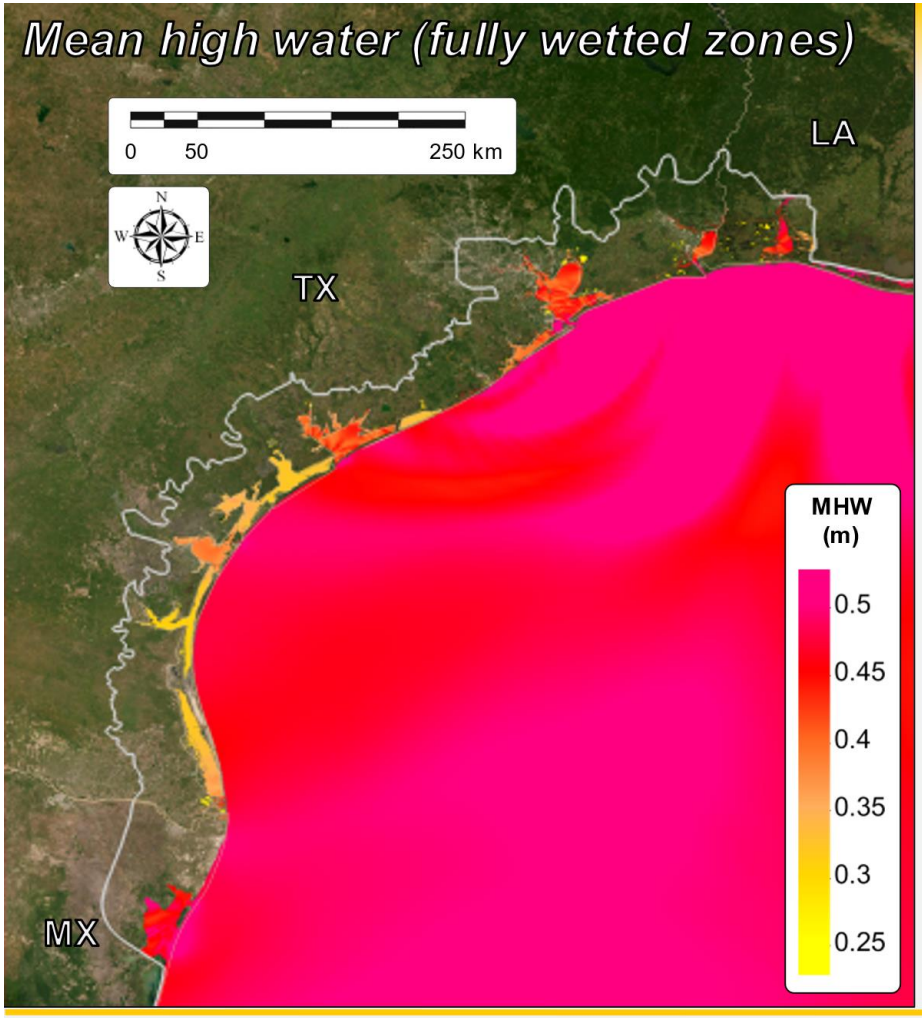
Hydro-MEM Workflow

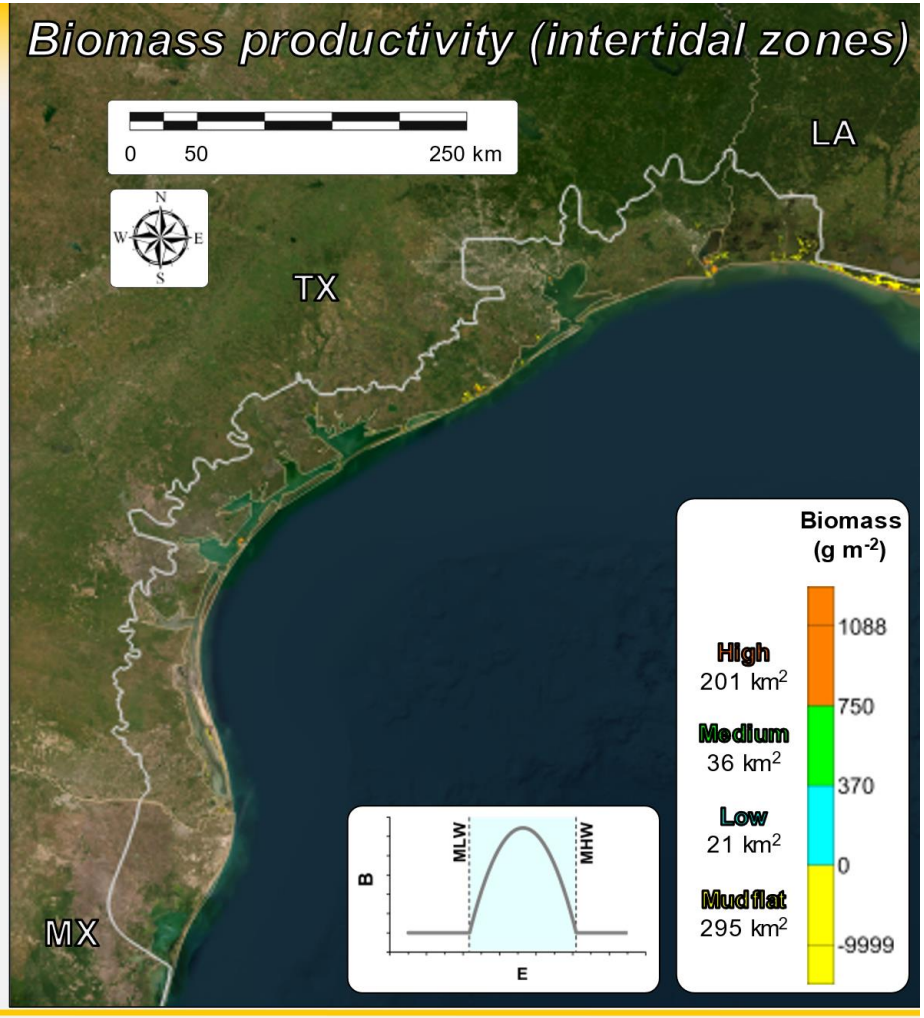


Hydro-MEM Workflow


EXISTING mesh resolution
0 50 250 km
N
W E
S
LA
TX
MX
Size (m)
5000
2500
1000
500
250
150
100
75
50
33
20

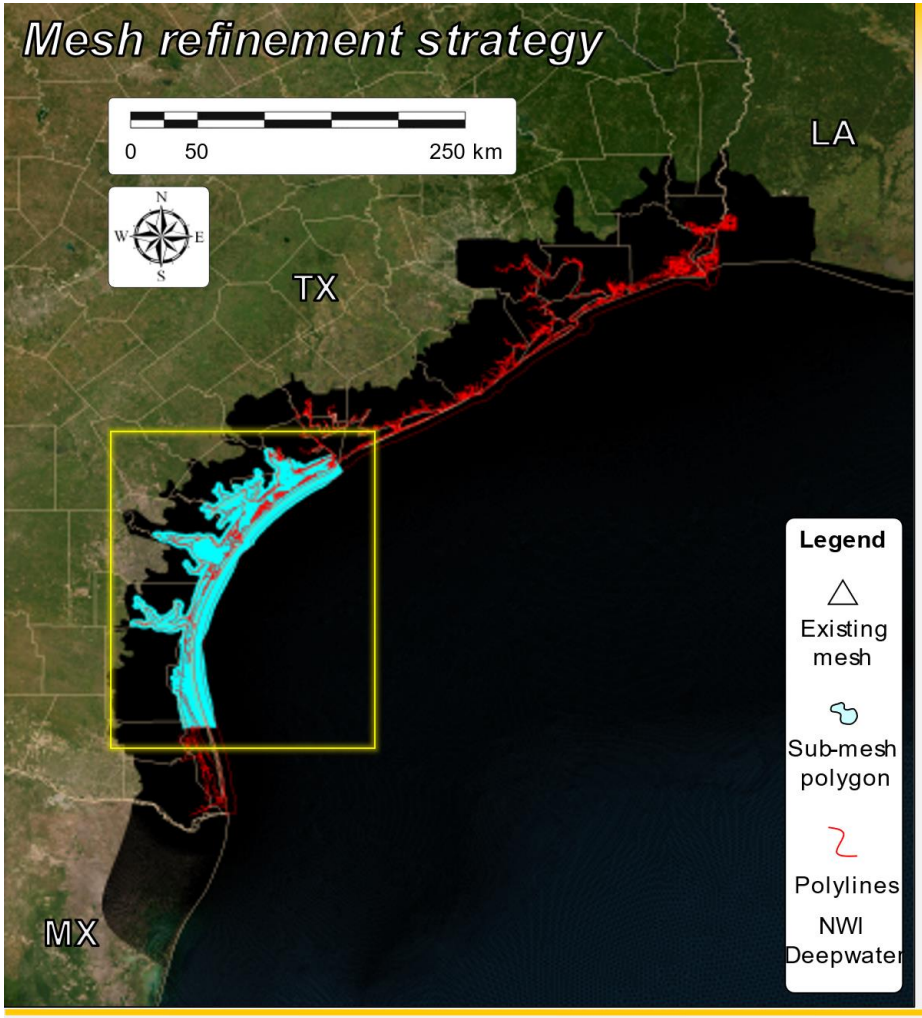

EXISTING mesh topo/bathy
0 50 250 km
N
W E
S
LA
TX
MX
Topo/ bathy (m)
200
100
50
20
10
5
3.5
1
0.5
0.1
0
-0.1
-0.5
-1
-5
-20

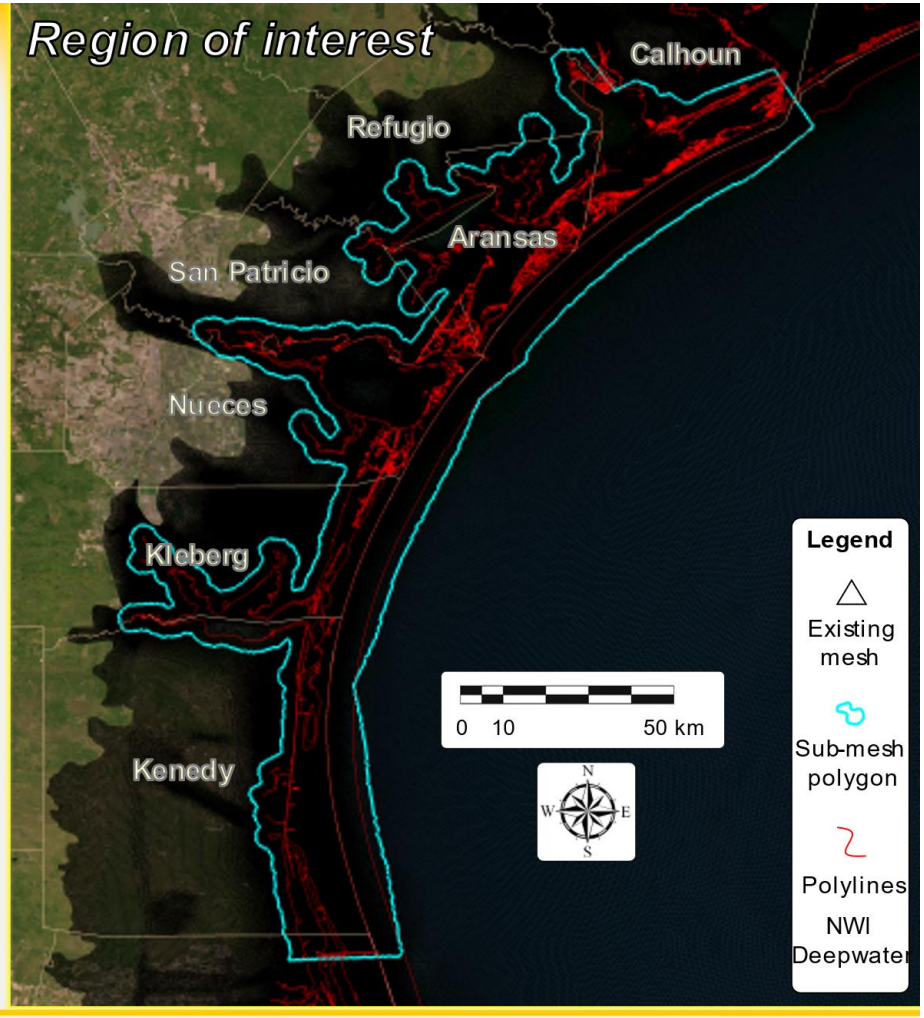

Mean high water (fully wetted zones)
0 50 250 km
N
W E
S
LA
TX
MX
MHW (m)
0.5
0.45
0.4
0.35
0.3
0.25

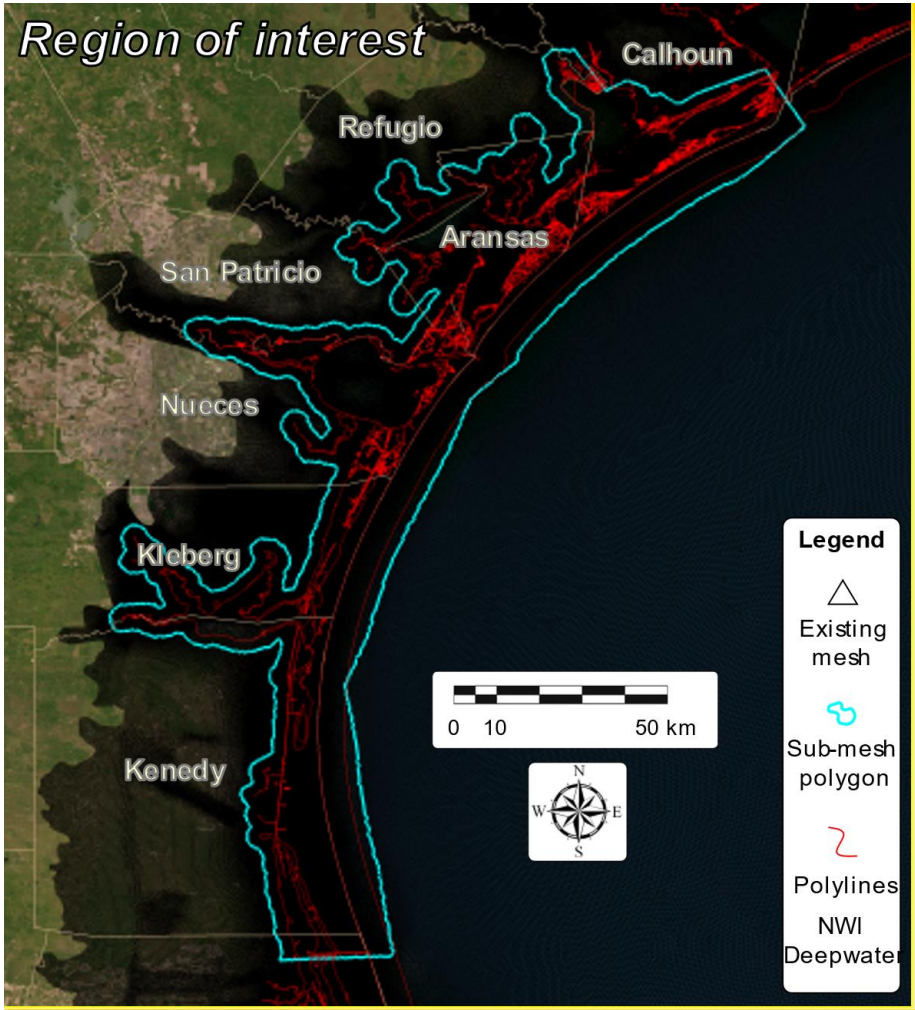

Biomass productivity (intertidal zones)
0 50 250 km
N
W E
S
LA
TX
MX
MLW
MHW
B
E
Biomass (g m-2)
High 201 km2
Medium 36 km2
Low 21 km2
Mud flat 295 km2
1088
750
370
0
-9999

Adapting Hydro-MEM to Texas Coastal Bend

- Mesh development/refinement
  - Current mesh resolution useful for storm surge modeling
  - New: Refine the mesh at the land-water interface for ecological modeling
- Tidal datums
  - Original method based on astronomic tides only
  - New: Adapted method based on astronomic tides + wind forcing
- Biomass curve
  - Original method based on site-specific observations (parabolic)
  - New: Adapted method based on regional marsh observations (exponential)


Mesh refinement strategy
0 50 250 km
LA
TX
MX
Legend
Existing mesh
Sub-mesh polygon
Polylines
NWI Deepwater


Region of interest
Calhoun
Refugio
Aransas
San Patricio
Nueces
Kleberg
Kenedy
0 10 50 km
Legend
Existing mesh
Sub-mesh polygon
Polylines
NWI Deepwater



Mesh refinement strategy

Sub-mesh polygon encompasses local refinement

- **Sub-mesh boundary is 3 km away from NWI polylines**
- **Ensures seamless connection with global mesh**

Redistribute polylines to DX

Transition away from $DX_{@polylines}$ via gradation: DX(x,y)

Mesh refinement only

- **If DX(x,y) > EXISTING(x,y), then DX(x,y) = EXISTING(x,y)**

Sub-mesh size relates with DX

Tabulated values are for the sub-mesh region

	Resolution (m)	Num nodes
Pre-existing	121 ± 59	523,231
Refined (DX 100 m)	159 ± 75	306,977
Refined (DX 30 m)	0 ± 0	0,000,000
Refined (DX 10 m)	0 ± 0	0,000,000

PRACTICAL CONSIDERATIONS FOR SEA LEVEL RISE

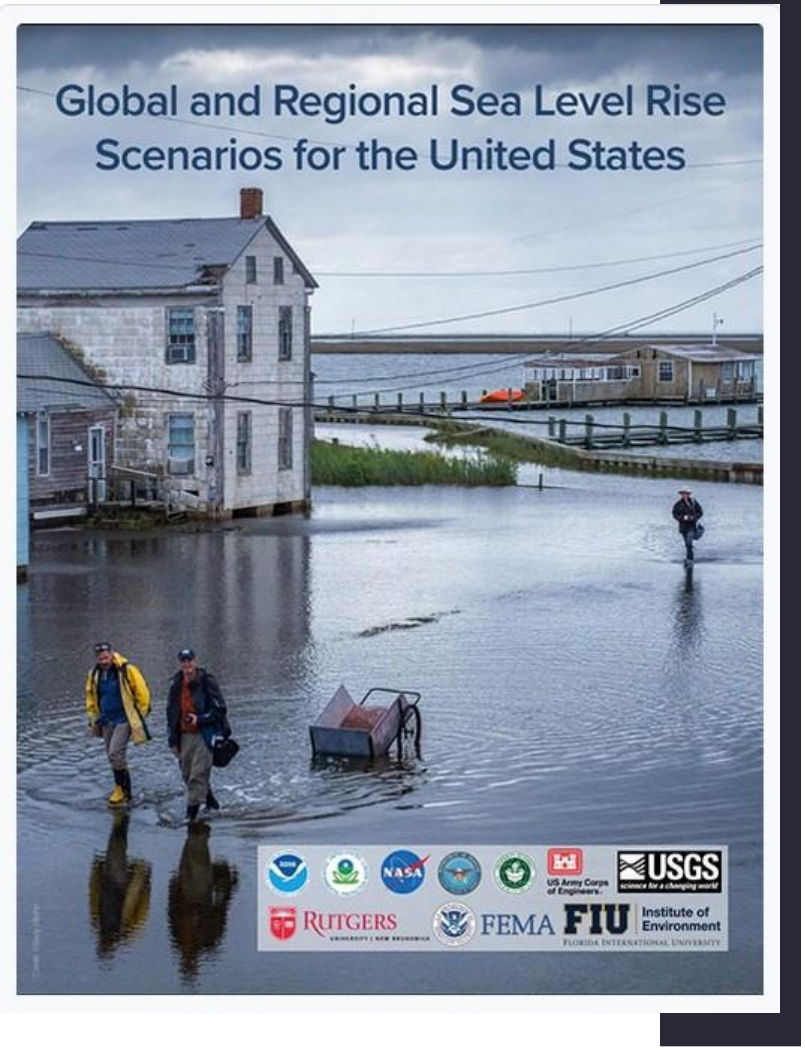
Management Transition Advisory Group (MTAG

In less than 5 minutes!

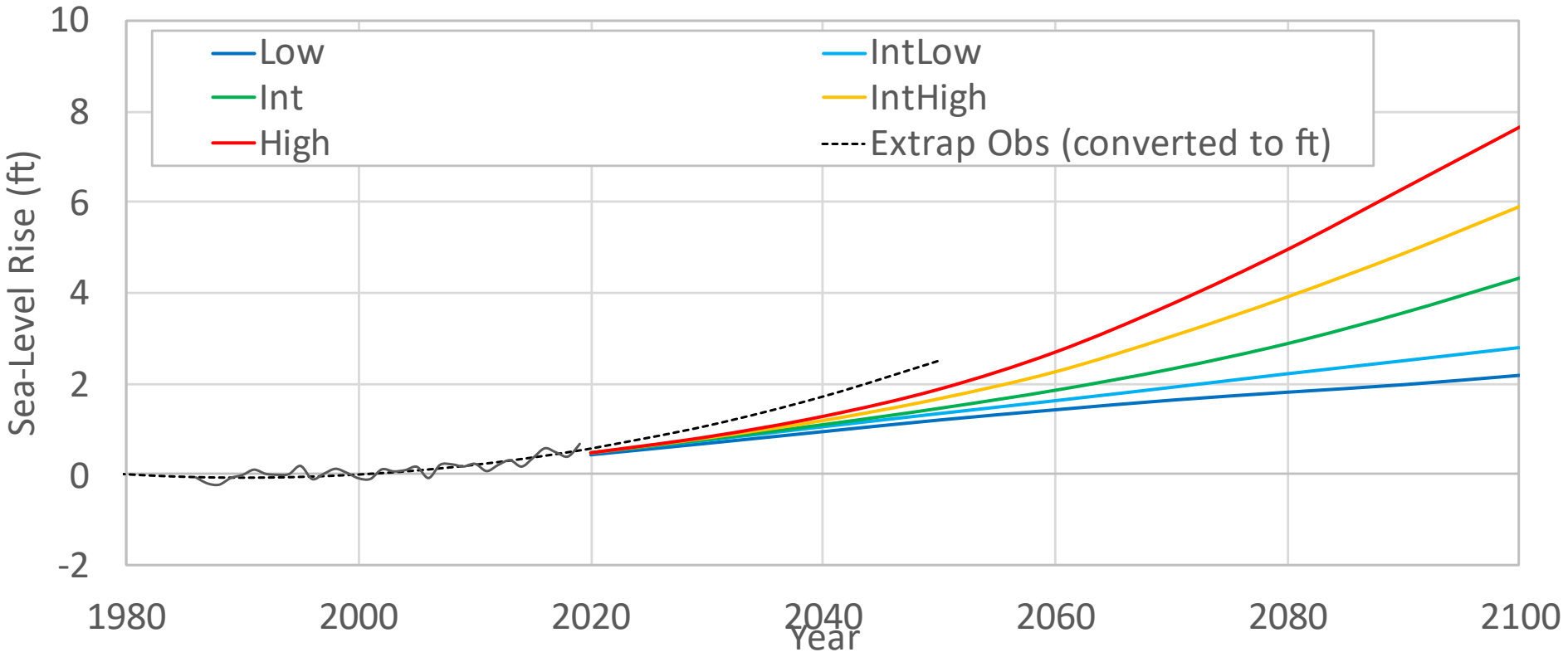
Renee Collini | December 8, 2022

2022 SLR Technical Report

- Updates to SLR Projections
- Extrapolated Tide Station Data
- Analysis of Changes in Extreme Water Levels

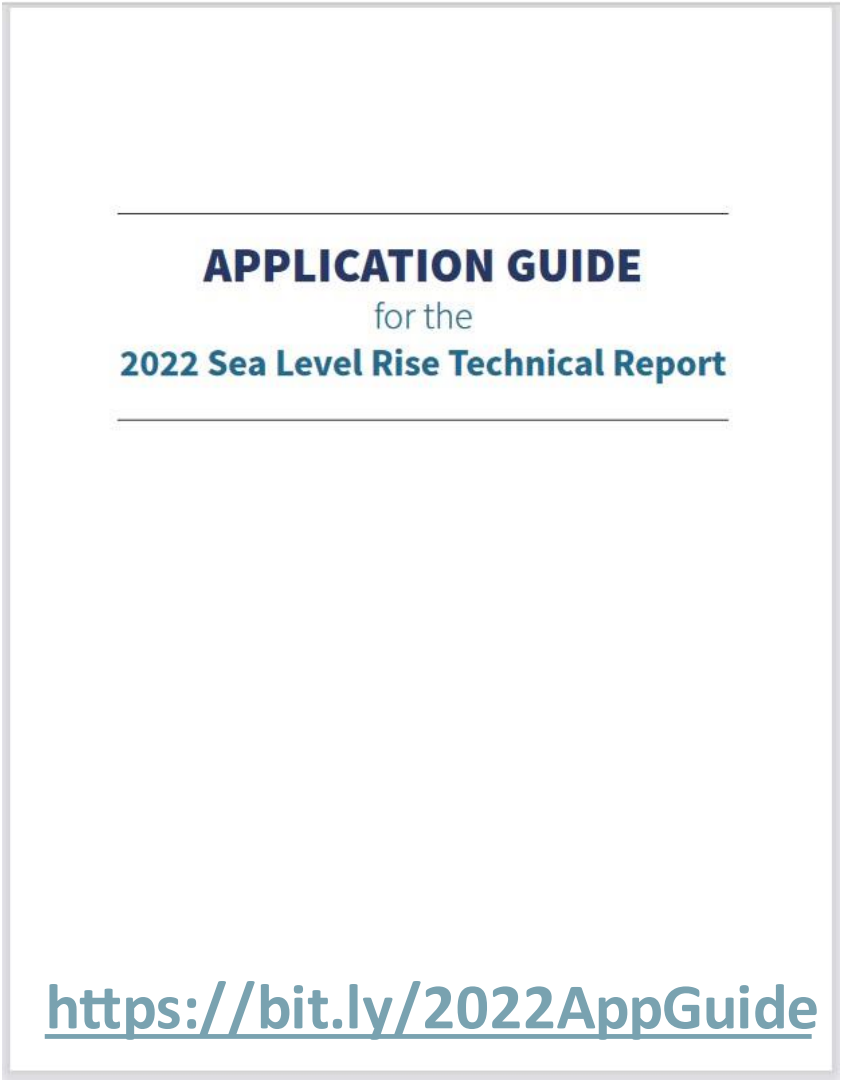


Sea-Level Rise in Corpus Christi



Application Guide for 2022 SLR Technical Report

- Describe tech report contents
- Discuss considerations when planning for sea level rise
- Review approaches addressing uncertainty in SLR planning
- Additional resources



https://bit.ly/2022AppGuide

Approaches for Addressing SLR Uncertainty

- Risk tolerance
- Scenario planning
- Adaptation pathway

Maybe time for questions??

Renee Collini r.collini@msstate.edu

Survey Report

ESLR 2021 Coastal Resilience: Living with Sea Level Rise in the Texas Coastal Bend

Management Transition Advisory Group (MTAG) Kickoff Meeting

Pre-Meeting Survey

December 8, 2022

Q2 - 1. Please state your name and the institution you represent

1. Please state your name and the institution you represent
Debalina Sengupta, Texas Sea Grant
Evan Turner, Texas Water Development Board
Danielle Hale - Port of Corpus Christi Authority
Matthew Mahoney Texas Department of Transportation
Craig Casper; Corpus Christi Metropolitan Planning Organization
Meredith Darden, Visit Corpus Christi

Q3 - 2. In a brief response, please let us know: "why do you care" about this issue, i.e., why did you agree to join this group?

2. In a brief response, please let us know: "why do you care" about this issue, i.e., why did you agree to join this group?
As Coastal Resilience Program director of Texas Sea Grant, coastal hazards and water issues are in our purview for the NOAA Sea Grant Program.
Critical for planning water needs of Texans for the future; directly relates to all of our collected observations and model data.
Want to ensure sound principles of emergency management are appropriately represented for the betterment of our community.
Because we need to develop a Regional Resiliency Plan for the transportation system and we should collaborate on development.
One of our strategic initiatives at Visit CC is to balance the need for growth with responsible and sustainable development.

Q4 - 3. Do you have a source of information you use to understand the anticipated rate or amount of sea level rise, and if so, what is it?

#	Answer	%	Count
4	Yes and that source is:	40.00%	2
5	I look at varied sources	40.00%	2
6	No	20.00%	1
	Total	100%	5

Q4 - 3. Do you have a source of information you use to understand the anticipated rate or amount of sea level rise, and if so, what is it?

Q4_4_TEXT - Yes and that source is:

Yes and that source is: - Text
MASGC Sea Grant Team
https://www.gfdl.noaa.gov/research_highlight/spear-the-next-generation-gfdl-modeling-system-for-seasonal-to-multidecadal-prediction-and-projection/

Q5 - 4. Do you use a specific rate of sea level rise in your planning efforts, and if so, what rate?

#	Answer	%	Count
1	I use a specific rate of SLR in planning efforts and that rate is:	0.00%	0
2	I use varied SLR rates in planning efforts	20.00%	1
3	I do not use SLR rates in planning efforts	80.00%	4
	Total	100%	5

Q6 - 5. What timelines are you concerned about with respect to sea level rise and/or flood risk?

5. What timelines are you concerned about with respect to sea level rise and/or flood risk?
we are seeing impacts already, so immediate response is required in some places.
near-term to long-term planning: all important factors
near term/daily for flood risk
2050 primarily, but also 2035.

Q7 - 6. Are there any particular locationsyou are concerned about with respect to sea level rise and/or flood risk? Please briefly describe.

6. Are there any particular locations you are concerned about with respect to sea level rise and/or flood risk? Please briefly describe.
Texas Coast
the entire coastline, changes to inflow gaging at the downstream most gage station to an estuary.
Roadways
Corpus Christi Metropolitan Planning Area (generally Nueces, San Patricio, and possibly part of Aransas Counties.

Q8 - If there is anything else you'd like to tell us about sea level rise or flood risk in the coastal bend, please do so here.

If there is anything else you'd like to tell us about sea level rise or flood risk in the coastal bend, please do so here.
Not at this time, looking forward to learning more, and provide inputs as necessary
High tides have an exceptional impact on flooding by blocking/backfilling outfalls
We will likely develop multiple scenarios for how much rise as part of the MPO resiliency plan. I have also been contemplating how to use this source in planning. https://hazards.fema.gov/nri/expected-annual-loss

Appendix D: Acronym List

Organizations and Agencies

CBCOG – Coastal Bend Council of Governments

CC Regional EDC – Corpus Christi Regional Economic Development Corporation

HRI – Harte Research Institute for Gulf of Mexico Studies

LSU – Louisiana State University

MSU – Mississippi State University

NOAA – National Oceanic and Atmospheric Administration

PLACE-SLR – Program for Local Adaptation to Climate Effects: Sea-Level Rise

TAMUCC – Texas A&M University – Corpus Christi

TGLO – Texas General Land Office

TWDB – Texas Water Development Board

CBBEP - Coastal Bend Bays and Estuaries

CC MPO - Corpus Christi Metropolitan Planning Organization

Other Acromyms

ADCIRC – ADvanced CIRCulation (hydrodynamic model)

DEM – Digital Elevation Model

ESLR – Effects of Sea Level Rise Program

MEM – Marsh Equilibrium Model

MTAG – Management Advisory Group

SLAMM – Sea Level Affecting Marshes Model

SLR – Sea level rise

TCRMP – Texas Coastal Resiliency Master Plan