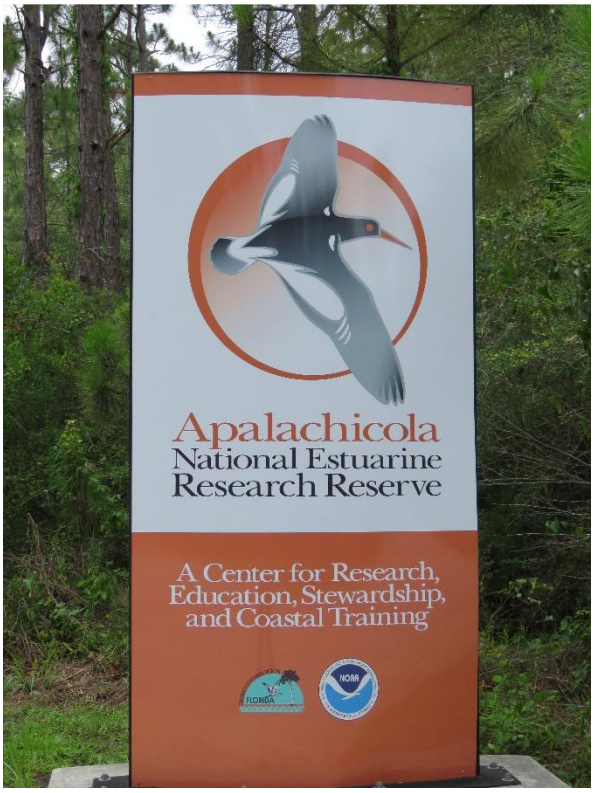
NGOM+N2E2 MTAG 2017 Workshop Report



Report of activities, methods, and results from the

NGOM+N2E2 MTAG Workshop

June 28, 2017

Apalachicola National Estuarine Research Reserve

108 Island Dr., Eastpoint, FL 32328

Complied by: Renee Collini

Edited by: Denise DeLorme and Scott C. Hagen

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Apalachicola National Estuarine Research Reserve

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Workshop Summary

The NGOM+N2E2 team is leveraging almost a decade of transdisciplinary science and relationship building with coastal decision-makers to develop actionable data products in support of natural resource management in the face of sea-level rise. Progress made during the Ecological Effects of Sea Level Rise in the Northern Gulf of Mexico (EESLR-NGOM) project has generated a paradigm shift in how coastal vulnerability to sea-level rise can be assessed. Further refinement and expansion of the Coastal Dynamics of Sea Level Rise (CDSLR) and Hydro-MEM modeling capabilities and approaches from the EESLR-NGOM efforts will enable coastal decision-makers to consider how coastal processes interact with natural and nature based features (NNBFs) to reduce potential vulnerability.

The Management Transition Advisory Group (MTAG) and the project team for the NGOM+N2E2 project met face-to-face for the first time on June 28, 2017 for an opportunity to exchange knowledge, expertise, needs, and perspectives between researchers and key stakeholders. All members of the MTAG, a group that represents natural resource managers, restoration specialists, and extension and outreach professionals from across the northern Gulf of Mexico (MS, AL, nw FL), were invited. Certain local stakeholders (e.g. local regional planning council, local RESTORE project coordinator for DEP, local water management district, etc.) were also invited to offer further information specifically about the Apalachicola and Big Bend regions of northwest Florida. A majority of the NGOM+N2E2 project team was present including social scientists, biogeochemical researchers and modelers, and economists.

The workshop participants gained background knowledge on the NGOM+N2E2 project goals, objectives, and methodologies, and provided input on multiple aspects of the project. The issues on which participants contributed direct guidance included local socioeconomic data sources, marsh sampling points of interest and opportunities, perceptions and impressions of nuisance flooding and NNBFs, locations and occurrences of nuisance flooding, and potential NNBFs for evaluation. The management needs discussed in order to help the researchers refine the scope of the project were: trade-offs between comparisons of multiple NNBFs vs multiple SLR scenarios, scenario timesteps, life span of NNBF projects, astronomic and meteorological conditions of interest, and type and number of storms to be considered. The participants were engaged through multiple techniques and approaches to encourage feedback. These mechanisms included traditional PowerPoint presentations of pertinent background information and research methods with time for question and answer; open dialogue sessions; a variety of print, digital, and online mapping exercises; focus groups; facilitated discussion; and an icebreaker activity.

The workshop resulted in positive outcomes for the participants and researchers and further strengthened the productive relationship between Gulf stakeholders and scientists. The participants are now familiar with the NGOM+N2E2 project goals, objectives, and planned outputs and better understand the science behind the models. At the same time, the NGOM+N2E2 researchers now better understand management needs and considerations for the northern Gulf of Mexico region. Results from the workshop evaluation surveys show that participants thought that the workshop was a positive experience that was a good use of their time, increased their knowledge, and provided information to be applied to their future work.

Workshop Objectives

- To understand the NGOM+N2E2 project goals, objectives, and timeline
- To become familiar with the concepts and methods being used in the NGOM+N2E2 modeling
- To solicit input on marsh sampling locations and preliminary Economic Impacts Assessment (EIA) and Ecosystem Services Valuation (ESV) results from Apalachicola
- To understand the modeling capabilities and constraints and how that relates to NNBF selection
- To understand the management needs of the MTAG and how that relates to NNBF abilities
- To identify potential NNBFs for evaluation

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Workshop Attendees

Karim Alizad, LSU*
Len Balthis, NOAA NOS*
Pearce Barrett, FL DEP
Joseph Bauer, FL DEP
Matt Bilskie, LSU*
Renee Collini, NGOM SSC*
Ginny Crothers, NOAA NCCOS*
Joe Crozier, Apalachee RPC
Mark Curenton, Franklin County
Diana Del Angel, TAMU CC*
Denise DeLorme, LSU*
Rebecca Domangue, Apalachicola NERR
Anita Grove, Apalachicola NERR
Scott Hagen, LSU*
Marian Hanisko, NOAA OCM
Jenna Harper, Apalachicola NERR
David Kidwell, NOAA NCCOS*
Katie Konchar, FL FWCC
Jess Kuonen, MASGC*
Trevor Meckley, NOAA EESLR*
Stephen Medeiros, UCF*
Davina Passeri, USGS*
Jonathan Pitchford, Grand Bay NERR
Katie Price, Northwest Florida WMD
Rhonda Price, MS DMR
George Ramseur, MS DMR
Mike Shelton, Weeks Bay NERR
Sonia Stephens, UCF*
Lily Swanbrow Becker, FL FWCC
Will Underwood, AL DCNR
Dan Van-Nostrand, NOAA NMFS
Kim Wren, Apalachicola NERR
David Yoskowitz, TAMU CC*

*denotes affiliation with project team

Description of Workshop Activities and Content

Welcome, Introductions, Ice Breaker

Participants used an online geoform (electronic form with an interactive map) to identify points of interest nearby and their perception of SLR vulnerability of the location. Then the facilitator, Ms. Renee Collini, added storm surge layers over a variety of SLR scenarios (Fig 1). As individuals' points of interest were inundated, they were asked to state their name, organization, and why that particular location was important to them. The icebreaker introduced participants to the types of data layers they would be learning about and gave participants a chance to learn about the area and each other in a non-traditional way.

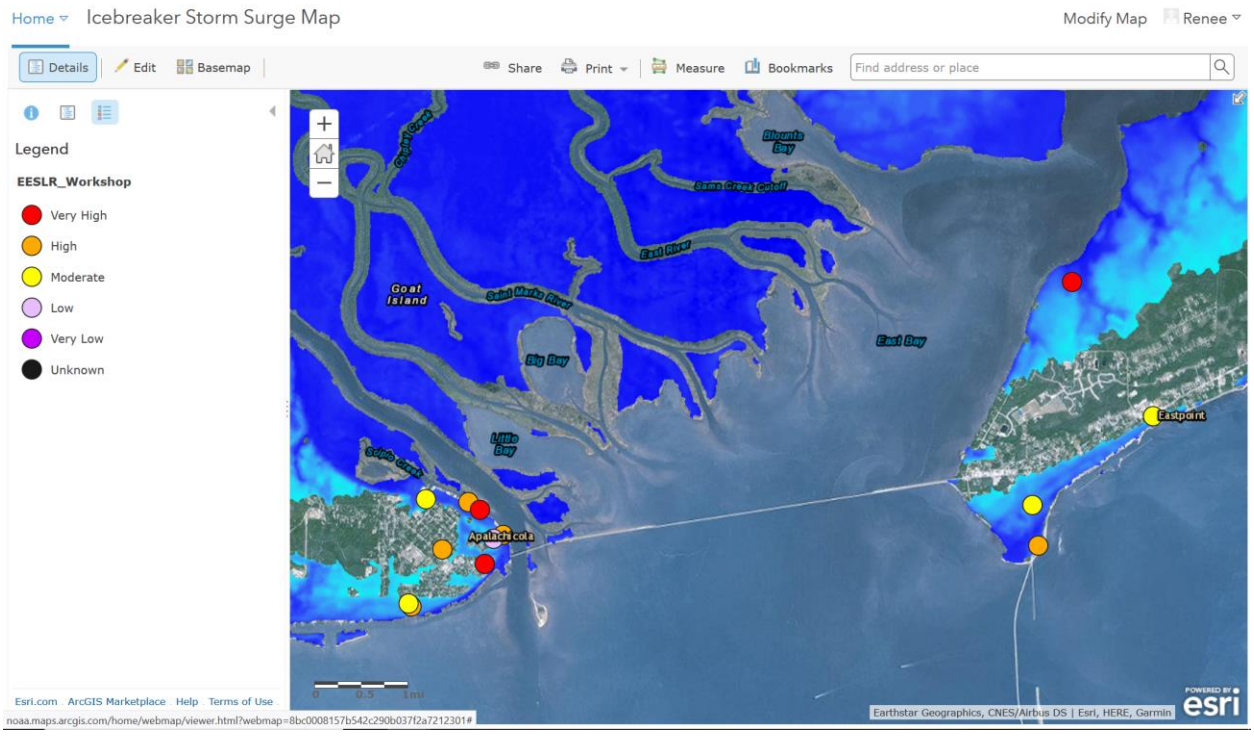

Figure 1 Screen shot of dashboard results displaying participants' points of interest and future storm surge under 2.0 m of SLR.

Project Overview

Dr. Scott Hagen, Lead-PI on the project, introduced the other PIs, collaborators, and NOAA Ecological Effects of Sea Level Rise (EESLR) Program Managers on the project (Fig 2). Scott presented information on the recent paradigm shift that enables assessment of coastal dynamics to understand sea-level rise at the coastal land margin. From there, the new project and its new acronym, **NGOM+N2E2,** was explained and discussed. The overall project goal is to provide information to decision-makers on the effectiveness of natural and nature-based features' (NNBFs) ability to mitigate storm surge and nuisance flooding as sea level rises. The primary objectives were specified as were the Year 1 milestones. See presentation in Appendix B for details.

During the Q/A session, Scott was asked if the NGOM+N2E2 project would incorporate the recently released SLR scenarios by Sweet et al. Scott clarified that it would be a topic for the MTAG and NGOM+N2E2 project team to discuss on a future webinar. There was also a query about the model starting date as the previous project (EESLR-NGOM) was 2000. Additionally, there was some discussion about a more current starting date, potentially 2020 or 2025. Again, it was stated that this is a topic to be considered by the MTAG and the project team on a future webinar.

Figure 2 Dr. Scott Hagen giving background on the NGOM+N2E2 project at the June 2017 MTAG workshop.

Scientific Methods Overview – Storm Surge & Nuisance Flooding

Dr. Matt Bilskie gave a brief overview of the storm surge model that will be utilized in the NGOM+N2E2 project. This included details on the model elevations and the ADCIRC mesh, model validation, the cumulative efforts of the EESLR-NGOM project and how they are built into the modeling approach, and potential outputs. Additionally, Matt spoke about specific applications for NGOM+N2E2 such as examining NNBFs and nuisance flooding. See presentation in Appendix B for details.

There was substantial interest and discussion during the Q/A session. Initially, questions focused on clarification of contributing storms to the modeling efforts and of data sources on the digital elevation model (DEM). Questions then centered on understanding the LULC data, specifically on the rate of development across the modeling domain, resolution of the LULC data, and resulting population change. These data layers are from the USGS and the shifts are related to expectations based on various carbon emissions scenarios. Further information about the data layers can be found here: https://landcover-modeling.cr.usgs.gov.

Scientific Methods Overview – Economic Impacts Assessment

Dr. David Yoskowitz provided background and an example of the Economic Impacts Assessment (EIA) that will be applied in the NGOM+N2E2 project. This included inputs and assumptions of the HAZUS model, the various user levels of HAZUS (from minimal data requirements to expert adjustment of analysis parameters and advanced capabilities), and an example of HAZUS application in Franklin County using the biogeophysical modeling inputs from storms surge work. Utilizing the Franklin County example, David demonstrated the various economic impacts integrated into HAZUS. See presentation in Appendix B for details.

During the Q/A session, there was interest in the projected EIA considering future build out, not just existing structures. David clarified that they currently do not have project build out data. However, if they were able to obtain data on projected development, they could include it in the model. This transitioned into an open discussion in which David and his graduate student, Ms. Diana Del Angel, solicited suggestions on the best sources for finding local socioeconomic data. Participants

recommended various agencies and individuals from across the northern Gulf. A complete list of the 14 total suggestions was captured and appears in Appendix C.

Scientific Methods Overview – Projecting Coastal Change

Dr. Davina Passeri presented information on the modeling that will consider coastal dune and shoreline change under sea-level rise for the NGOM+N2E2 project. This included background on types of shoreline change, model development under EESLR-NGOM, capabilities that can be utilized in the NGOM+N2E2 effort, and examples of application of this modeling approach on barrier islands in the modeling domain. See attached presentation for details. Specific capabilities include large-scale assessments of morphologic changes using PCOI and follow-up high resolution analysis in areas of interest using XBeach. See presentation in Appendix B for details.

Scientific Methods Overview – Marsh Field Sampling

Dr. Stephen Medeiros provided an overview of the marsh sampling and field experiments that will be conducted in NGOM+N2E2 and how those data will be applied to modeling efforts. Field work will capture the topography of the marsh platform, above and below ground biomass, and soil density. Stephen explained that these data will enable adjustment of LiDAR elevation data, which is critical for an accurate elevation "starting point" for the models. See presentation in Appendix B for details.

Participants were then invited to provide input on the planned sampling locations by identifying three types of considerations: areas of interest, areas of potential collaborations, and areas of recommended sampling. In addition, participants were asked to share any other thoughts or considerations regarding sampling in the area. This activity enabled Stephen to develop additional local knowledge about the planned sampling area and increase opportunities for leveraging resources and building relationships with regional stakeholders. Nine total considerations were suggested across all three types. A complete list of the nine suggestions was captured and appears in Appendix C.

Selecting NNBFs – Setting the Stage

Dr. Trevor Meckley opened the second half of the day by ensuring that participants were utilizing similar definitions and categorizations of NNBFs. This included an overview of the sliding scale of green to grey infrastructure, defining NNBFs and the types of NNBFS, and discussing the frequent overlapping of types of projects. Trevor encouraged participants to not become overly concerned with precisely where their projects are on the continuum of green to grey or type of NNBF. See presentation in Appendix B for details.

Focus Groups

Two concurrent focus groups were conducted by Dr. Denise DeLorme and Dr. Sonia Stephens: one with the core MTAG members and the other with Apalachicola stakeholders. The general purpose of the focus groups was to gain insight into stakeholders' perceptions, experiences, and information needs regarding nuisance flooding and NNBFs. Results from this qualitative social science research method provided the project team with a better understanding of what information is considered most critical for evaluating and making decisions between NNBFs and NNBFs and other project options and why.

Additionally, the focus groups helped the team better understand stakeholder impressions and management needs regarding nuisance flooding and nuisance flooding mitigation. (Please see Appendix D for the Focus Group Executive Summary)

Figure 3 Participant from the workshop completing the nuisance flooding identification exercise.

Nuisance Flooding Identification Exercise

Participants were asked to individually identify areas of nuisance flooding on printed maps and to complete a corresponding worksheet requesting descriptions of extent, timing, and impacts of the flooding; conditions that lead to nuisance flooding; and any additional information they felt was pertinent (Fig 3). This exercise resulted in over 70 identified examples of nuisance flooding, along with six additional points of contact for possible further information.

Selecting NNBFs – Considerations of Model Limitations

Matt Bilskie spoke briefly about the limitations of the modeling capabilities to be considered. The major points included the mesh resolution, limited number of NNBFs that can be run due to computational considerations, and spatial extent. Additionally, Matt mentioned that there will be some limitations regarding nuisance flooding; however, as that modeling capability is being further developed, the project team is not yet sure what those types of limitations will be exactly.

Generally, the modeling limitation considerations were clear. There was only one participant follow-up inquiry. During the presentation, Matt mentioned that the minimum length of an NNBF needs to be about 60 feet long. This does not mean that long, skinny NNBFs (e.g., breakwaters) could not be included but they might be stretched a bit for the modeling mesh to capture them. Davina added that by utilizing the type of modeling she had described earlier for beaches and dunes (XBeach), the project team has the capabilities to describe shoreline evolution at a finer resolution (3 m) for select areas of interest.

Selecting NNBFs – MTAG Needs

Participants interacted in a facilitated discussion about their own management needs and potential model outputs. Six major topics were discussed among the project team and the workshop participants. This conversation was informed and robust and stemmed from the presentations, actions, and focus groups that had occurred earlier in the day.

Figure 4 Workshop participants discussing their management needs around NNBFs and SLR.

Topic 1: Balancing the need for multiple NNBFs vs a variety of scenarios/conditions. Resolving this tradeoff was challenging for the stakeholders. They expressed desire for several types of NNBFs to facilitate actions such as permitting, demonstration of project benefits (planned and existing), and comprehensive restoration planning. It may be more productive to readdress this topic after the MTAG has been presented with some summary information of the NNBF identification activity.

Topic 2: Timeline. Participants quickly focused on 25 and 50 years into the future so projections will coincide with NNBF project life spans. There was also interest in including future projections of populations/demographics if those data were available.

Topic 3: Number of SLR Scenarios. Generally, conversation focused on not needing six scenarios, but only a few that are representative of the range of expectations. A suggested action was to follow up during the next virtual meeting to have an in-depth discussion of scenarios.

Topic 4: Astronomic & Meteorological Conditions (This discussion was devoted to understanding what kind of astronomic and/or meteorological conditions the MTAG has interest in seeing and/or what conditions cause nuisance flooding.). There were diverse drivers, frequency, and intensity of nuisance flooding across the three states within the modeling domain. These conditions ranged from the Apalachicola region which currently does not have much tidal flooding to Mississippi which experiences intense stormwater and tidal flooding.

Topic 5: Storms (This discussion was focused on understanding what kind of storms would be most useful for the MTAG.). Discussion started with size of storms with general agreement among participants that both smaller, high-frequency storms and larger, less-frequent storms are important to capture. Tradeoffs of using historic storms vs synthetic storms were also considered, as well as examining benefits of NNBFs outside of the direct path of the storm.

Topic 6: Other Thoughts. The MTAG does have concerns about the impact of rainfall events and believes that the increasing frequency of rainfall events has been more pressing than storm surge. However, they are especially interested in how much worse this situation will be when coupled with SLR.

A detailed summary of the discussion can be found in Appendix C.

Selecting NNBFs – Selection Activity

Participants divided into five preassigned subgroups based on geography (three northwest Florida groups, one coastal Alabama group, one coastal Mississippi group) and identified existing, ongoing, or planned NNBFs using an online geoform (Fig 5). Documented information about each NNBF included a brief description, type, dimensions, anticipated design life, estimated cost, status (completed, planned, etc.), and location. A total of thirty-three NNBF suggestions were entered across all five groups. Participants

Figure 5 Participants working together to enter NNBFs using an online entry form.

reviewed the suggested NNBFs and viewed some of the information collected (Fig 6).

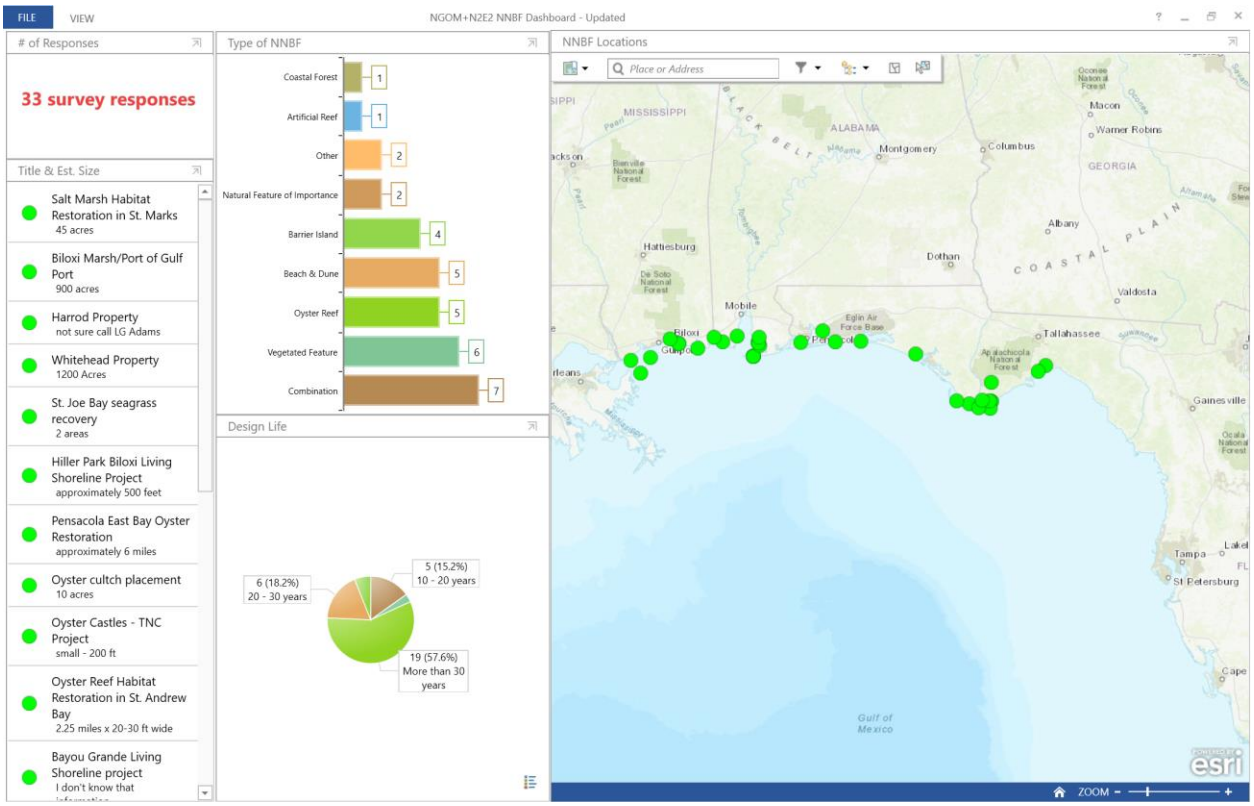

Figure 6 Screenshot of the online dashboard for easy review of participant-suggested NNBFs.

Wrap-up

Renee thanked the participants for their time and valuable input and encouraged everyone to immediately complete the printed workshop evaluation survey that was provided in the information packets distributed to participants at the beginning of the workshop. A copy of the evaluation survey instrument is provided in Appendix A.

Workshop Evaluation Survey Results

Total Participants: 18 *Total Responses:* 14

Summary of Responses

The printed workshop evaluation survey was provided to all participants at the beginning of the workshop and collected immediately at the end of the workshop. The survey was comprised of both closed-ended and open-ended question formats and was only distributed to MTAG participants, not to any of the project team members. The evaluation survey is included in Appendix A on page 28.

Participants agreed that the workshop was a productive use of time, increased their understanding of the project, increased their knowledge of NNBFs, and had sufficient opportunities to provide input. Workshop content, format, and length, presenters, opportunities to interact and ask questions, and overall experience were all scored very positively. Additionally, while participants provided a moderate score on increased knowledge of EIA and ESV, 92% feel more comfortable with EIA and ESV after the workshop. Open-ended responses also provided insight into what participants found most useful (learning about the project and models, networking, and the focus groups) and additional questions that participants had around the timeline, specific target audiences, ESV, end-products, and confidence estimates.

NGOM+N2E2 MTAG Workshop

June 28, 2017

Apalachicola National Estuarine Research Reserve

108 Island Dr., Eastpoint, FL 32328

Agenda

Meeting Objectives

- To understand the NGOM+N2E2 project goals, objectives, and timeline
- To become familiar with the concepts and methods being used in the NGOM+N2E2 modeling
- To solicit input on marsh sampling locations, nuisance flooding, and preliminary Economic Impacts Assessment (EIA) and Ecosystem Services Valuation (ESV) results from Apalachicola
- To understand the modeling capabilities and constraints and how that relates to NNBF selection
- To understand the management needs of the MTAG and how that relates to NNBF abilities
- To identify potential NNBFs for evaluation

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8:00 am	**Breakfast and Check-In**
8:30 am	**Welcome, Objectives, and Introductions** *Who's Flooding First?* Ice breaker activity
9:30 am	**Project Overview** *Speaker*: Scott Hagen, PhD, LSU Center for Coastal Resiliency
9:45 am	**Scientific Methods Overview** *Speakers* Matt Bilskie, PhD, LSU Center for Coastal Resiliency David Yoskowitz, PhD, Harte Research Institute
10:30 am	**Break**

10:40 am	**Scientific Methods Overview cont.** *Speakers* Davina Passeri, PhD, U.S. Geological Survey Stephen Medeiros, PhD, PE, University of Central Florida *Activity:* Mapping and identification of areas of interest for marsh sampling
11:30 am	**Lunch** Lunch will be provided on site.
12:15 pm	**Selecting NNBFs – Setting the stage** *Speakers* Trevor Meckley, PhD, NOAA NCCOS Ecological Effects of Sea Level Rise Program *Activity:* Focus Groups
1:50 pm	**Break**
2:00 pm	**Nuisance Flooding Identification Exercise**
2:20 pm	**Selecting NNBFs – Considerations** *Speakers:* Panel of NGOM+N2E2 Science Team *Activities* • Facilitated discussion about considerations of model limitations related to NNBF selection. • Facilitated discussion about considerations of participants' needs for NNBF evaluation.
3:40 pm	**Selecting NNBFs – Selection Activity** *Activities* • Interactive session identifying and describing potential NNBFs • Facilitated discussion of any additional considerations or activities
4:20 pm	**Wrap-up** *Activity:* Workshop evaluation survey
4:30	**Adjourn**
5:30	**Happy Hour -** Oyster City Brewing Company, 17 Ave D, Apalachicola, FL 32320

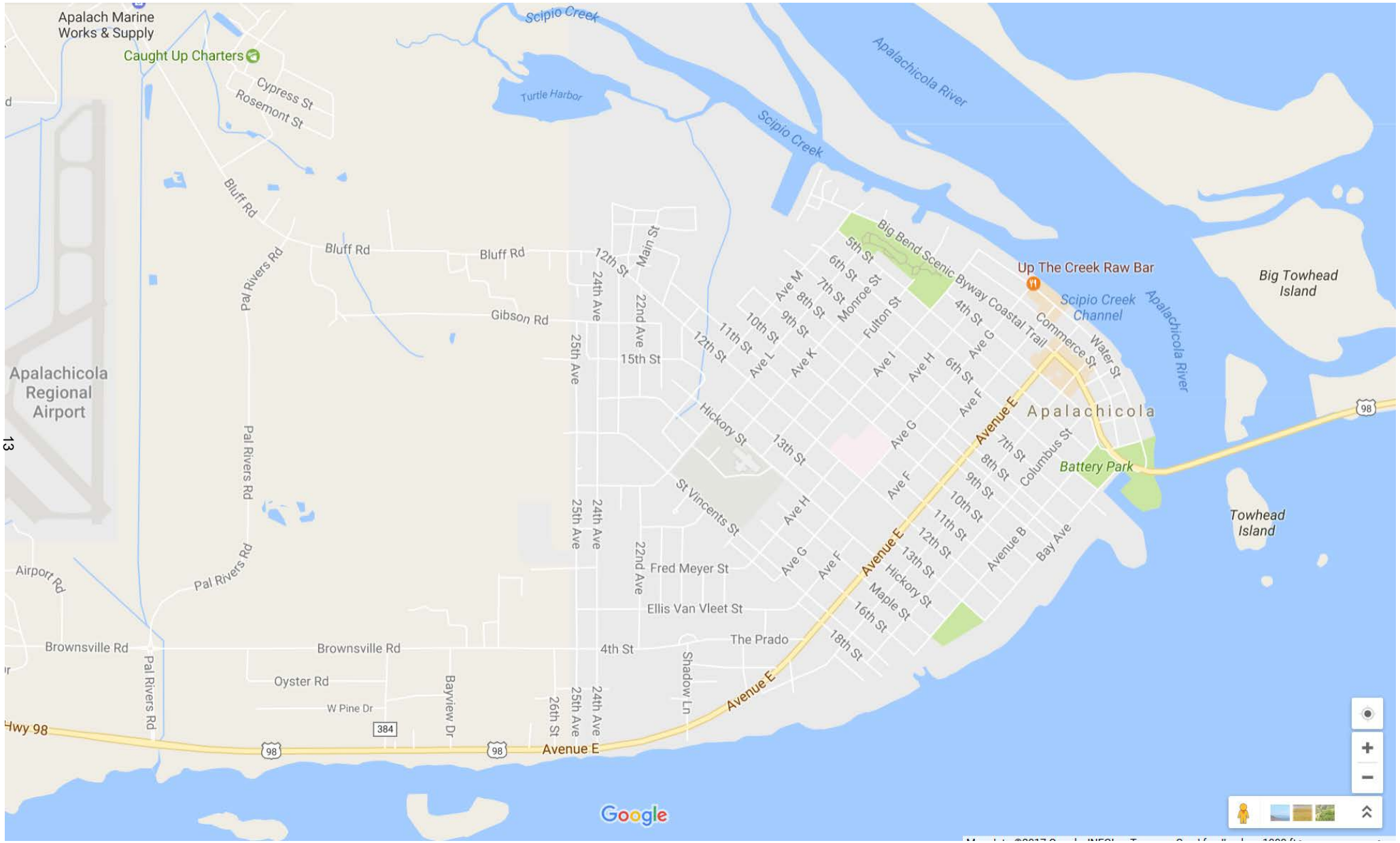
NGOM+N2E2 MTAG Workshop

June 28, 2017
Apalachicola National Estuarine Research Reserve
108 Island Dr., Eastpoint, FL 32328

Nuisance Flooding Identification Exercise

Instructions: For this exercise, please identify on each of the following maps the locations where you know of or have experienced nuisance flooding. We are particularly interested in recent, persistent minor flooding in the past 10 to 20 years. In the space below each map, please provide additional descriptive information about characteristics of the nuisance flooding identified in that area. If you do not have information pertaining to nuisance flooding for a particular map, simply leave that space blank. Also, if you have a recommendation of someone we should contact for more information regarding nuisance flooding in a certain area, please provide their name, organization, and contact information. Thank you for your valuable input!

Name and Affiliation: _____



Location A – Apalachicola, Florida

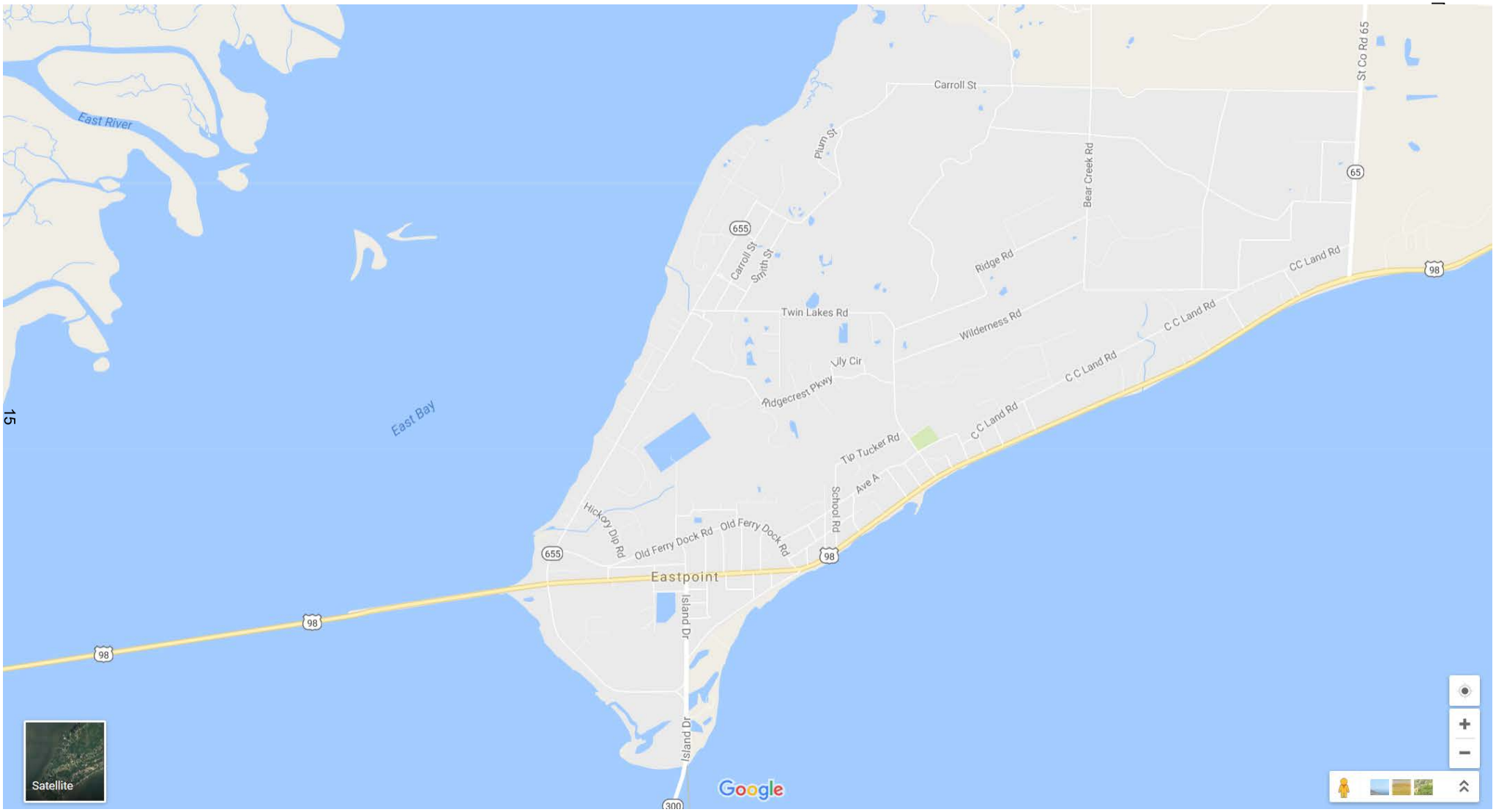
Location A – Apalachicola, Florida

Please identify and describe the nuisance flood(s) that you marked on the map above with a red pen, including frequency of occurrence, intensity, dates, and duration as best you can recall.

What were the impacts of this (these) nuisance flood(s)? Impacts include, but are not limited to, social, economic, ecological, personal, work, community, etc.

Are there specific conditions that you think generally lead to nuisance flooding in this area? For example, certain astronomic tides (Spring tides or "King Tides") or astronomic tides combined with meteorological events (e.g., onshore winds, high river discharge, etc.).

Is there anything else that we need to know about nuisance flooding in this (these) location(s)?



Location B – Eastpoint, Florida

Location B – Eastpoint, Florida

Please identify and describe the nuisance flood(s) that you marked on the map above with a red pen, including frequency of occurrence, intensity, dates, and duration as best you can recall.

What were the impacts of this (these) nuisance flood(s)? Impacts include, but are not limited to, social, economic, ecological, personal, work, community, etc.

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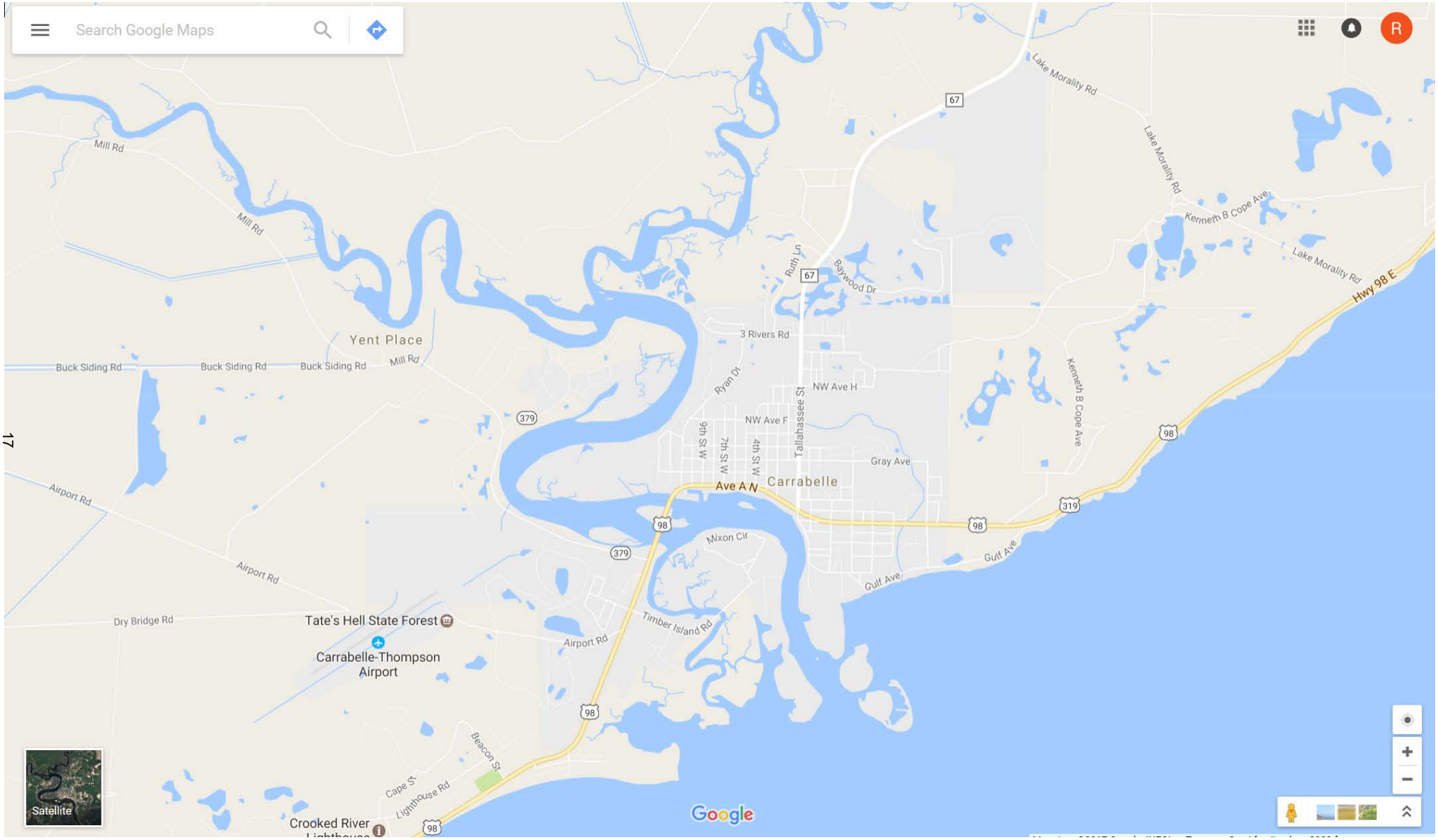
Is there anything else that we need to know about nuisance flooding in this (these) location(s)?



Location C – Carabelle, Florida

Location C – Carabelle, Florida

Please identify and describe the nuisance flood(s) that you marked on the map above with a red pen, including frequency of occurrence, intensity, dates, and duration as best you can recall.

What were the impacts of this (these) nuisance flood(s)? Impacts include, but are not limited to, social, economic, ecological, personal, work, community, etc.

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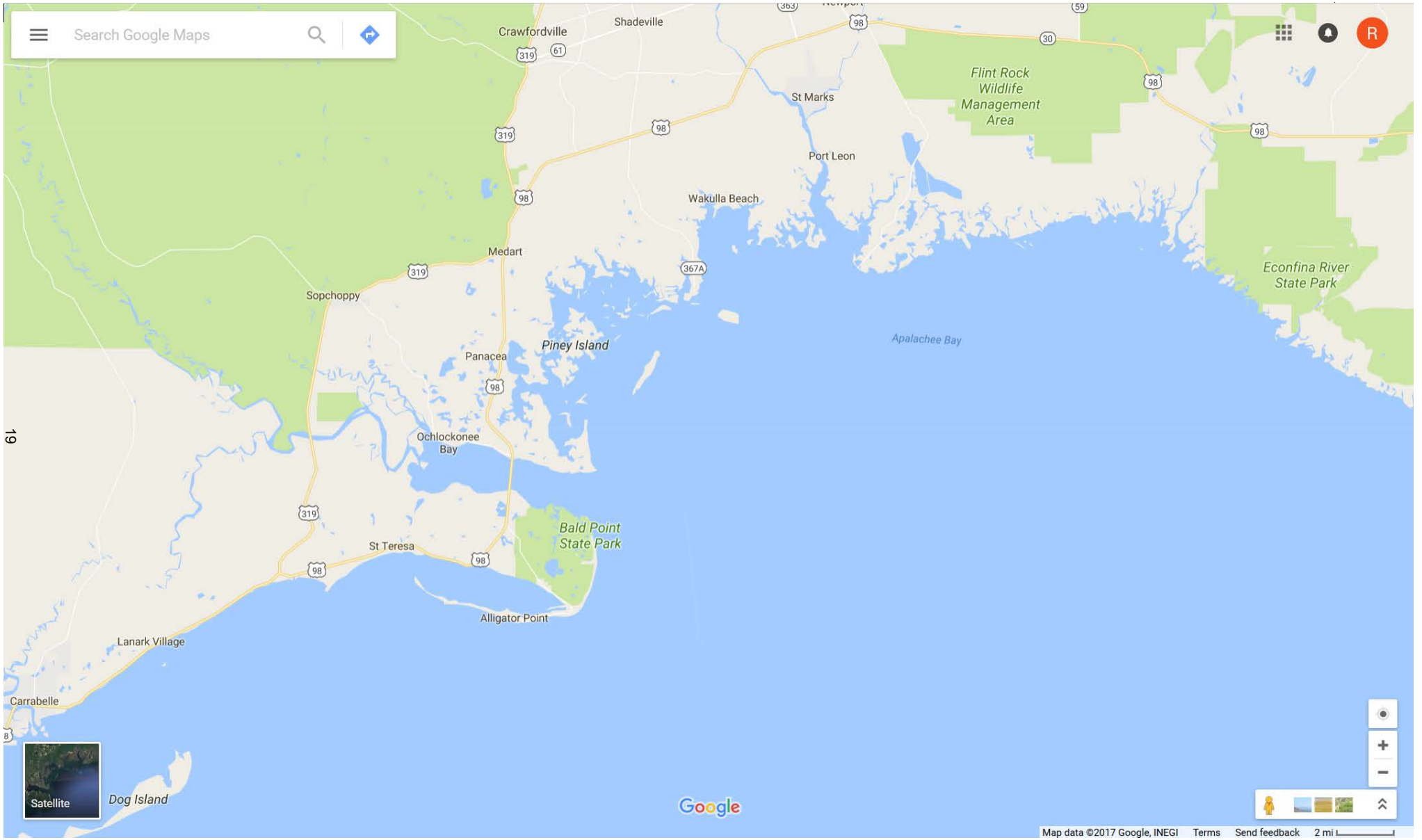
Is there anything else that we need to know about nuisance flooding in this (these) location(s)?



Location D – Apalachee Bay, Florida

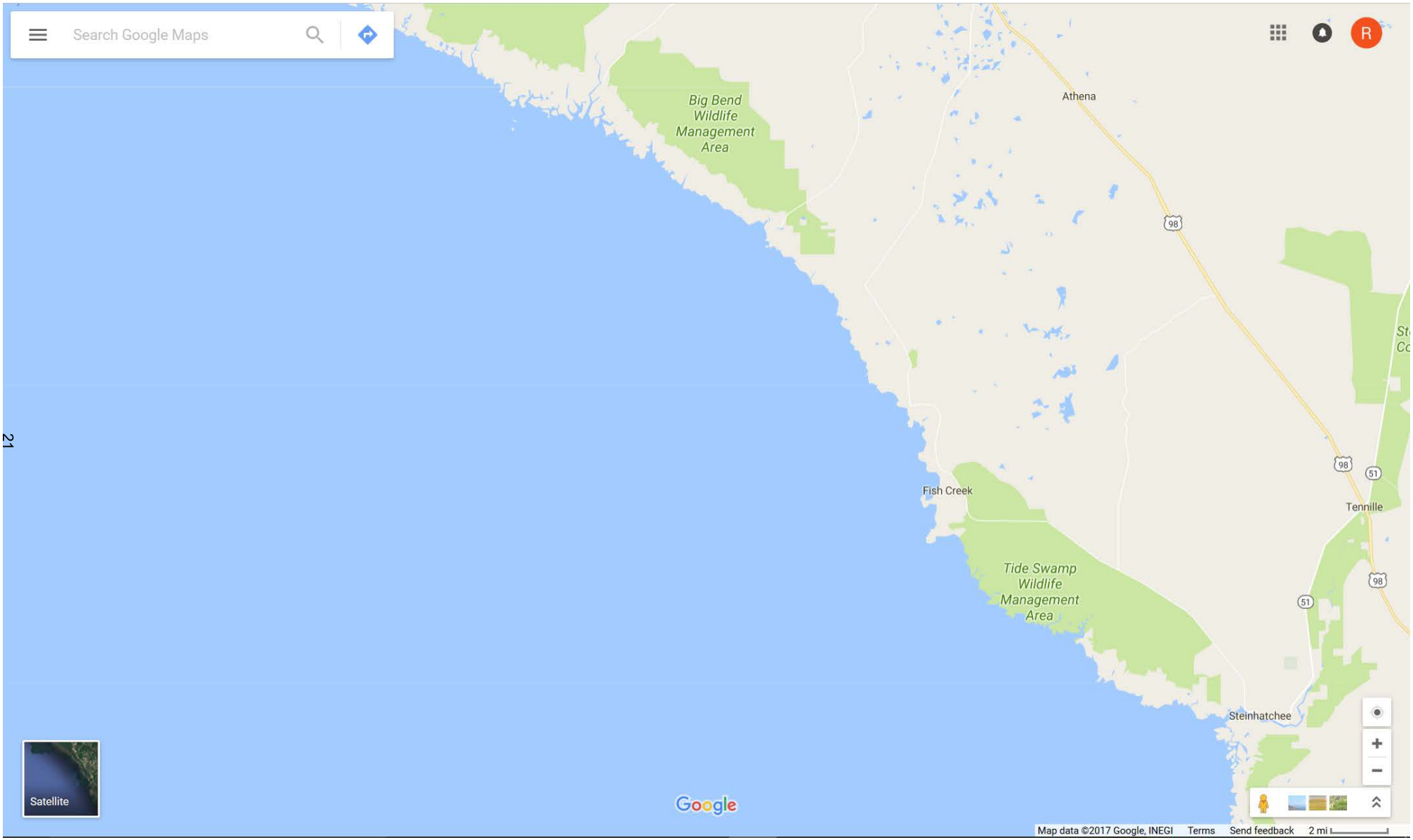
Location D – Apalachee Bay, Florida

Please identify and describe the nuisance flood(s) that you marked on the map above with a red pen, including frequency of occurrence, intensity, dates, and duration as best you can recall.

What were the impacts of this (these) nuisance flood(s)? Impacts include, but are not limited to, social, economic, ecological, personal, work, community, etc.

Are there specific conditions that you think generally lead to nuisance flooding in this area? For example, certain astronomic tides (Spring tides or "King Tides") or astronomic tides combined with meteorological events (e.g., onshore winds, high river discharge, etc.).

Is there anything else that we need to know about nuisance flooding in this (these) location(s)?



Location E – Big Bend, Florida

Location E – Big Bend Area

Please identify and describe the nuisance flood(s) that you marked on the map above with a red pen, including frequency of occurrence, intensity, dates, and duration as best you can recall.

What were the impacts of this (these) nuisance flood(s)? Impacts include, but are not limited to, social, economic, ecological, personal, work, community, etc.

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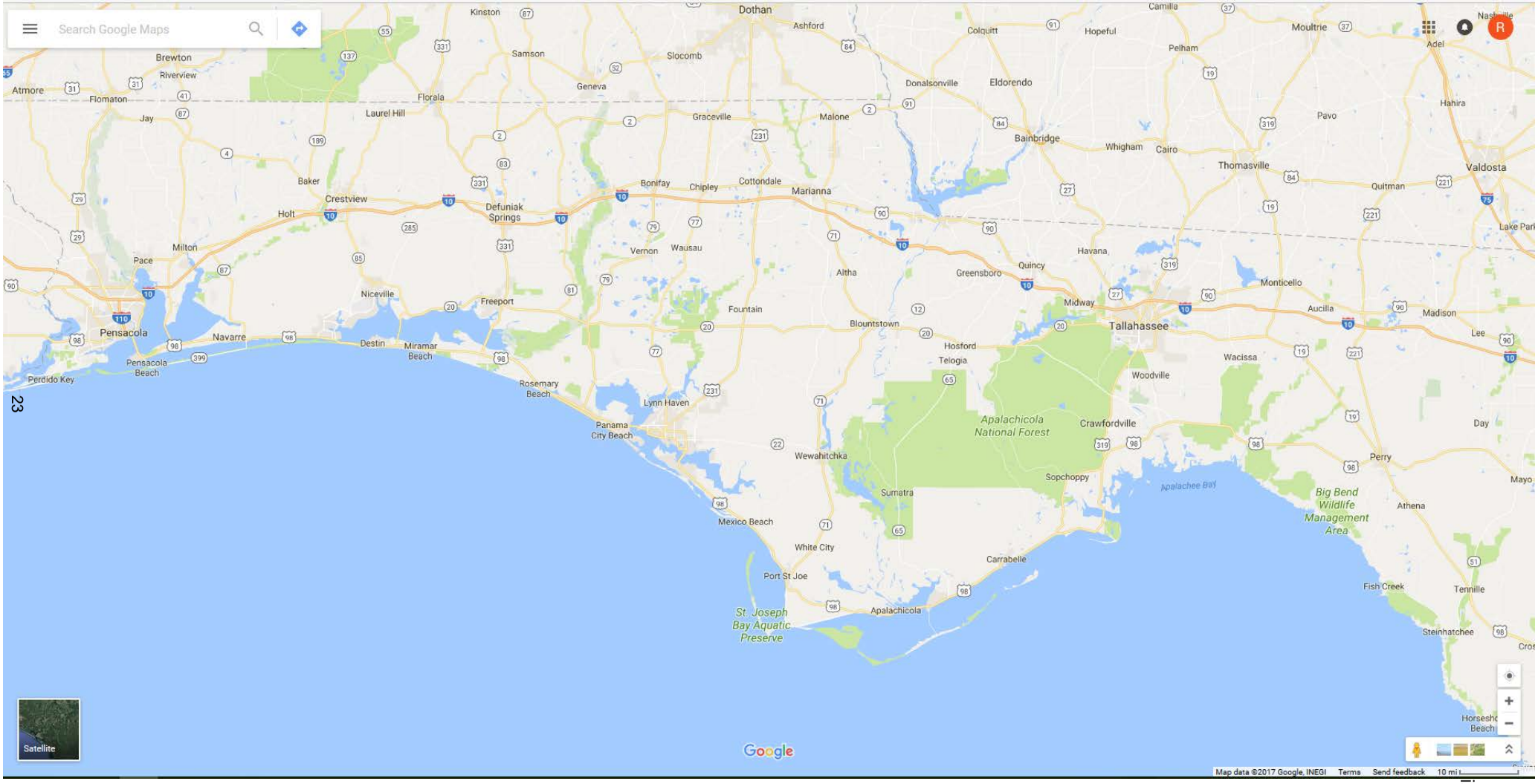
Is there anything else that we need to know about nuisance flooding in this (these) location(s)?



Location F – Northwest Florida

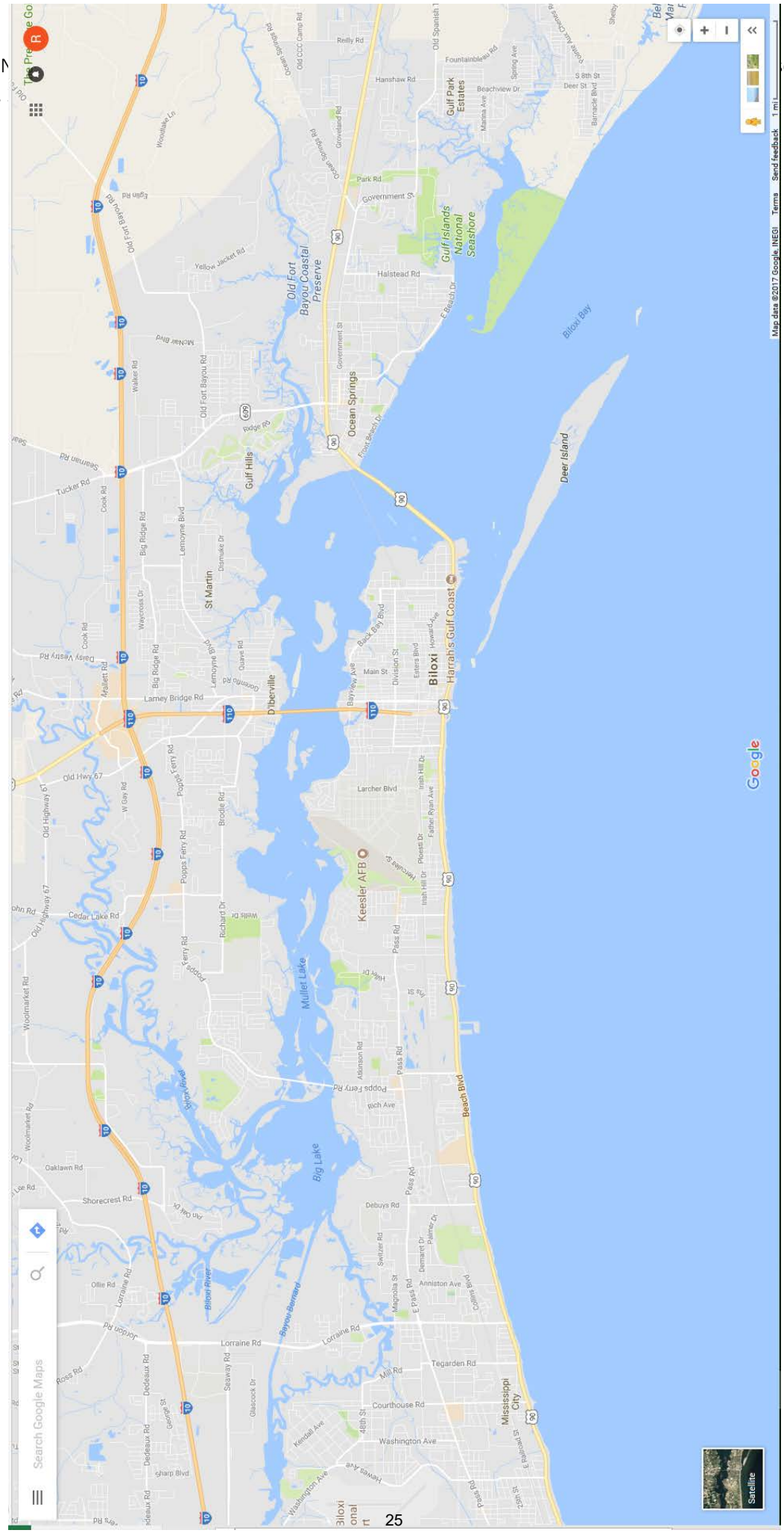
Location F – Northwest Florida

Please identify and describe the nuisance flood(s) that you marked on the map above with a red pen, including frequency of occurrence, intensity, dates, and duration as best you can recall.

What were the impacts of this (these) nuisance flood(s)? Impacts include, but are not limited to, social, economic, ecological, personal, work, community, etc.

Are there specific conditions that you think generally lead to nuisance flooding in this area? For example, certain astronomic tides (Spring tides or “King Tides”) or astronomic tides combined with meteorological events (e.g., onshore winds, high river discharge, etc.).

Is there anything else that we need to know about nuisance flooding in this (these) location(s)?



Location G – Biloxi, Mississippi

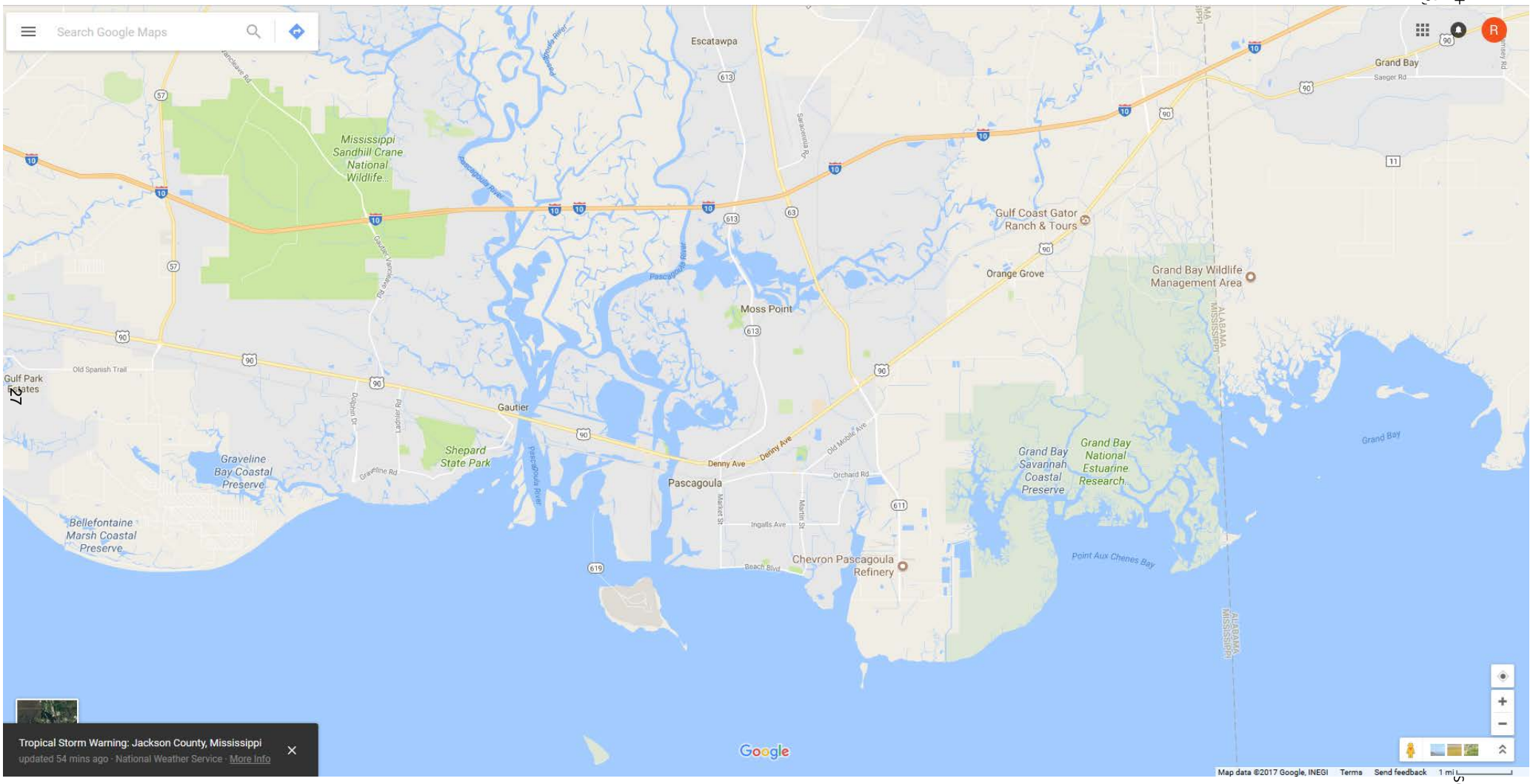
Location G – Biloxi, Mississippi

Please identify and describe the nuisance flood(s) that you marked on the map above with a red pen, including frequency of occurrence, intensity, dates, and duration as best you can recall.

What were the impacts of this (these) nuisance flood(s)? Impacts include, but are not limited to, social, economic, ecological, personal, work, community, etc.

Are there specific conditions that you think generally lead to nuisance flooding in this area? For example, certain astronomic tides (Spring tides or "King Tides") or astronomic tides combined with meteorological events (e.g., onshore winds, high river discharge, etc.).

Is there anything else that we need to know about nuisance flooding in this (these) location(s)?



Location H – Pascagoula, Mississippi

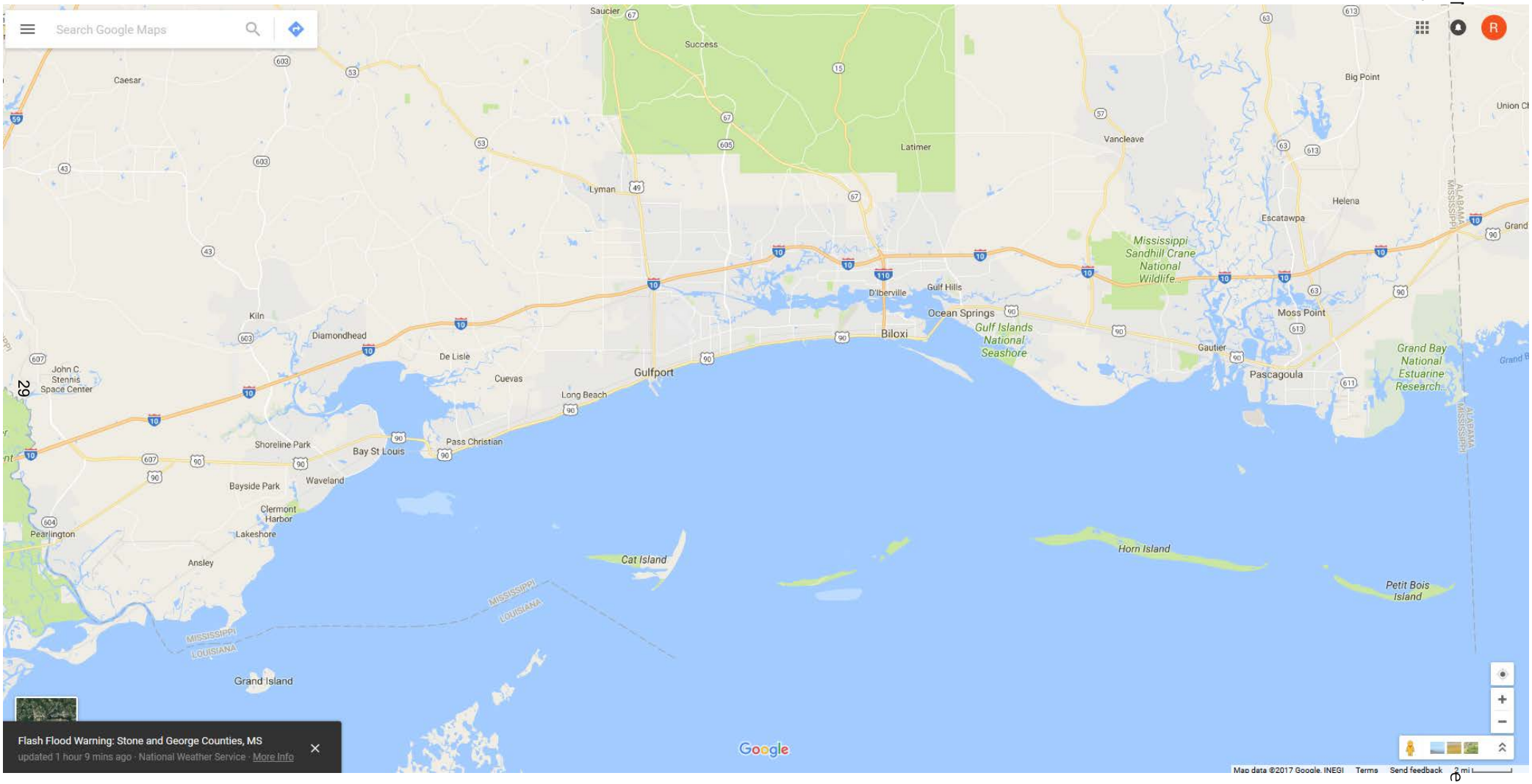
Location H – Pascagoula, Mississippi

Please identify and describe the nuisance flood(s) that you marked on the map above with a red pen, including frequency of occurrence, intensity, dates, and duration as best you can recall.

What were the impacts of this (these) nuisance flood(s)? Impacts include, but are not limited to, social, economic, ecological, personal, work, community, etc.

Are there specific conditions that you think generally lead to nuisance flooding in this area? For example, certain astronomic tides (Spring tides or "King Tides") or astronomic tides combined with meteorological events (e.g., onshore winds, high river discharge, etc.).

Is there anything else that we need to know about nuisance flooding in this (these) location(s)?



Location I – Mississippi Coast

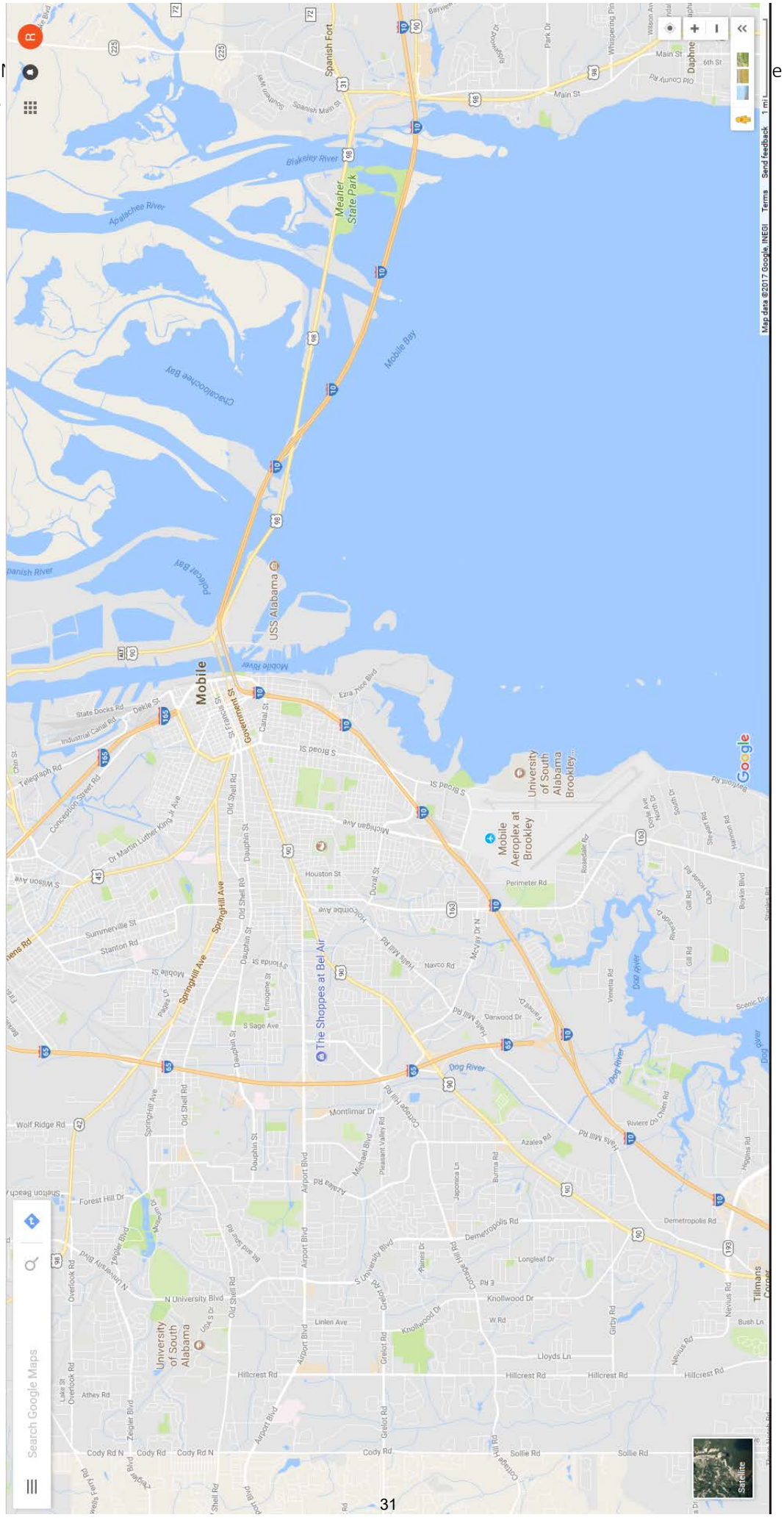
Location I – Mississippi Coast

Please identify and describe the nuisance flood(s) that you marked on the map above with a red pen, including frequency of occurrence, intensity, dates, and duration as best you can recall.

What were the impacts of this (these) nuisance flood(s)? Impacts include, but are not limited to, social, economic, ecological, personal, work, community, etc.

Are there specific conditions that you think generally lead to nuisance flooding in this area? For example, certain astronomic tides (Spring tides or "King Tides") or astronomic tides combined with meteorological events (e.g., onshore winds, high river discharge, etc.).

Is there anything else that we need to know about nuisance flooding in this (these) location(s)?



Location J – Mobile, Alabama

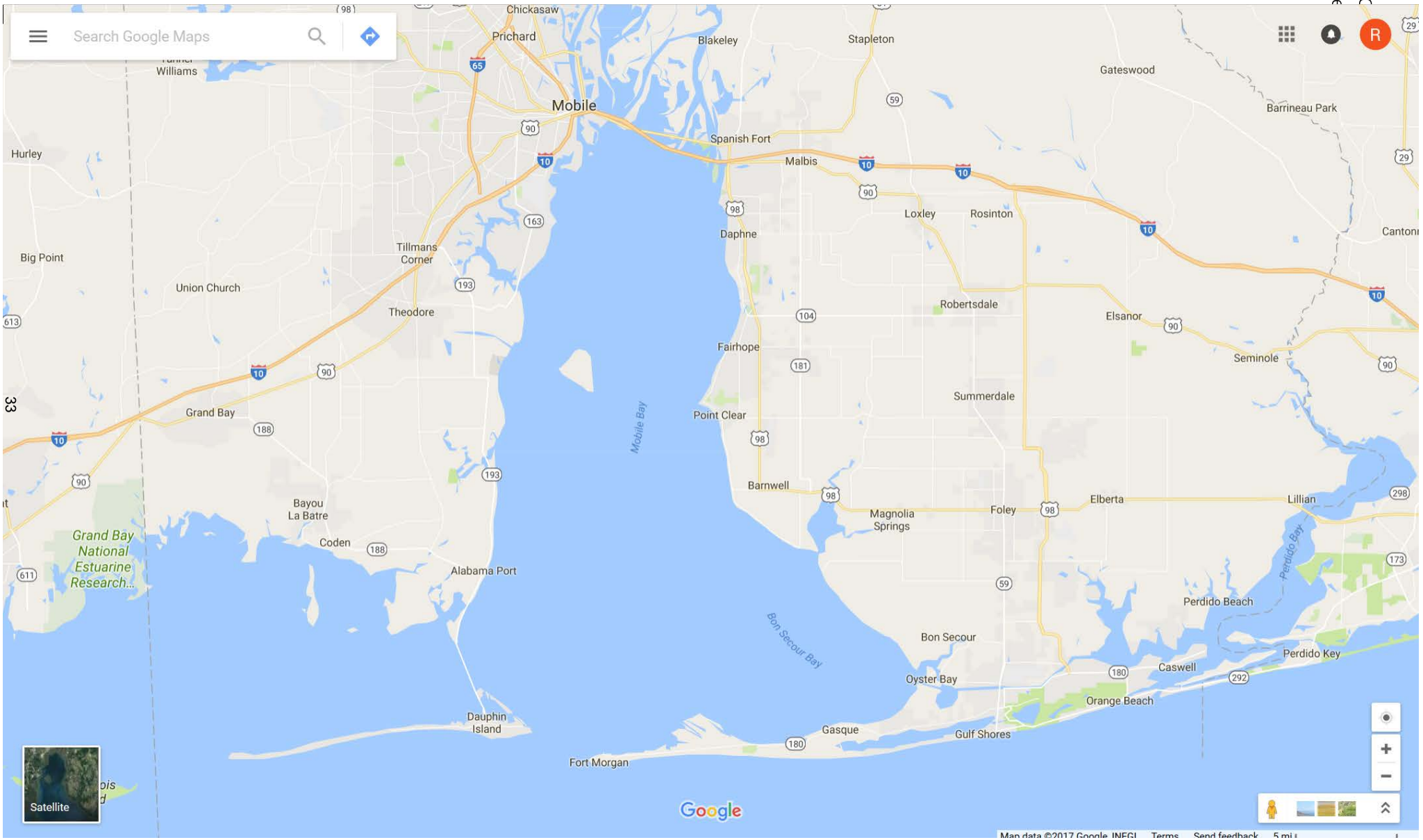
Location J – Mobile, Alabama

Please identify and describe the nuisance flood(s) that you marked on the map above with a red pen, including frequency of occurrence, intensity, dates, and duration as best you can recall.

What were the impacts of this (these) nuisance flood(s)? Impacts include, but are not limited to, social, economic, ecological, personal, work, community, etc.

Are there specific conditions that you think generally lead to nuisance flooding in this area? For example, certain astronomic tides (Spring tides or "King Tides") or astronomic tides combined with meteorological events (e.g., onshore winds, high river discharge, etc.).

Is there anything else that we need to know about nuisance flooding in this (these) location(s)?



Location K – Coastal Alabama

Location K – Coastal Alabama

Please identify and describe the nuisance flood(s) that you marked on the map above with a red pen, including frequency of occurrence, intensity, dates, and duration as best you can recall.

What were the impacts of this (these) nuisance flood(s)? Impacts include, but are not limited to, social, economic, ecological, personal, work, community, etc.

Are there specific conditions that you think generally lead to nuisance flooding in this area? For example, certain astronomic tides (Spring tides or "King Tides") or astronomic tides combined with meteorological events (e.g., onshore winds, high river discharge, etc.).

Is there anything else that we need to know about nuisance flooding in this (these) location(s)?

Thank you for your participation!!!

NGOM+N2E2 Natural and Nature-Based Feature (NNBF) Survey

Please submit your NNBF project/idea below. We are looking for actual projects, either already completed, being implemented, or planned, to include in the evaluation. In addition, we are interested in natural systems (i.e., an existing marsh complex) to evaluate ecosystem services and where future mitigation may be necessary.

1. Please provide a brief title for your NNBF.
    a. 50 characters or less.
    b. Some examples might be: NERR living shoreline, marsh near primary school, etc.

2. Please provide a general description of your NNBF.
    a. A brief description of the NNBF project type and why it is needed.
    b. Please identify type of vegetation involved with the project (e.g. SAV, salt marsh, wetland, maritime forest/shrub).

3. Which of the following categories best characterizes your NNBF? Select one only.
    - **Beach & Dune:** the dune is the mount, hill or ridge of sand behind the part of the beach affected by tides. A number of beach and dune feature characteristics impact nuisance flooding and storm surge attenuation capacity. Important characteristics influencing storm surge include height, width, slope, sediment grain size and supply, dune height, dune crest, dune width, and vegetation characteristics.
    - **Vegetated Feature:** low elevation regions with emergent and submergent vegetation with a range of salinity and hydraulic tolerances comprise this feature type but include a number of habitats including coastal wetlands, marshes, and SAV, etc. Important characteristics include elevation, plant type, plant density, and spatial extent of the feature.
    - **Coastal Forest:** a coastal woody vegetated feature that includes pine savannah and cypress swamps and occurring at higher elevation than beach and dune, but still within the reach of salt spray. Similar to vegetated features, important characteristics to know include forest elevation, forest dimensions, vegetation height and density, and sediment composition.
    - **Artificial Reef:** a reef structure that would not be primarily constructed of oyster shell. The reef could be fully or partially submerged. Important coastal protection characteristics include reef width, elevation, and roughness.
    - **Oyster Reef**: a reef structure primarily constructed of oyster shell. Reef width, elevation, and roughness, are key aspects that will mitigate storm surge.
    - **Barrier Island:** a long narrow offshore deposit of sand and sediment running parallel to the coast. Important characteristics include elevation, length, width, land cover, breaching potential and proximity to shore.
    - **Combination (i.e., Living Shorelines/Hybrid):** this category is a catchall when a combination of features is utilized. It ranges from a collection of natural features to including some hardened features such as rock sills that create semi-natural conditions **(Living Shorelines),** and continues on to a continuum of more hardened features **(Hybrid Natural/Gray Infrastructure).** We won't list every term that different groups may use; instead please describe the NNBF in Question #2 and indicate what term you use to describe it. See individual natural features to think about the characteristics of importance.
    - **Natural Feature of Importance:** an existing natural system or feature of importance or concern with no anticipated action being taken. For example, this would be an area (i.e., marsh) you are aware of that provides a beneficial service landward and is at risk of being lost/impacted by SLR.
    - **Don't Know or Other:** feel free to use this answer option if you're not sure or your project type doesn't fall within one of these categories, but first check with a facilitator -- they may be able to provide clarity.

4. Describe the following actions that associate with the implementation of your NNBF? Select only one, if more than one is needed - select the first one you will need to complete for this activity.
    - **Conservation Acquisition:** preserving land through purchase or easement.
    - **Restoration:** an activity focused on returning a site to its original or preferred state.
    - **New Build/Construction:** creating habitat or structures where none existed before.
    - **Maintenance:** routine actions. Some examples would include routine beach re-nourishment.
    - **Other, None, or Don't Know:** Please explain in more detail in question #2.

5. What are the approximate dimensions for your NNBF?
    - Provide approximate dimensions (i.e. length and width) along with units of measure.
    - Or a general description / approximation of the project size.

6. What is the estimated design life of your NNBF?
    - How long would you expect the project to remain in-tact and effective.
    - Select one only.

7. What is the estimated cost of your NNBF?
    - if you are far enough along in your planning process, please provide an estimated cost.
    - Cost ranges are acceptable here, too.

8. When is your NNBF estimated to begin?
    - It has already been completed.
    - It is currently under construction.
    - It will begin in the next two years.
    - It will begin if and when funding is obtained.
    - It has not been proposed.
    - Don't know.

9. Where is the general location of the project?
    - Using the map, place a point in the approximate location of the NNBF project identified above.

Participant Evaluation Survey of *NGOM+N2E2* Workshop 1:
Apalachicola, Florida National Estuarine Research Reserve June 28, 2017

Instructions: The following questions ask about your workshop experience today. Please reflect on your experience and mark the choice closest to your opinion for each of the items below or write in the information requested. Your constructive feedback is very important in helping us plan and improve future NGOM+N2E2 workshops and related research products. This survey should take less than 10 minutes to complete and all individual responses will be anonymous.

(1) Please indicate how much you agree or disagree with the following statements on a scale of 1 to 5 where 1 means "Strongly disagree" and 5 means "Strongly agree." If you are not sure or don't know, please mark DK for "Don't know."

	Strongly disagree				Strongly agree	
This workshop was a good use of my time.	1	2	3	4	5	DK
This workshop increased my understanding about the NGOM+N2E2 project.	1	2	3	4	5	DK
This workshop increased my knowledge about natural and nature based features (NNBFs).	1	2	3	4	5	DK
This workshop increased my knowledge about NGOM+N2E2's modeling capabilities and constraints.	1	2	3	4	5	DK
This workshop increased my knowledge about methods for economic impacts assessments (EIA).	1	2	3	4	5	DK
This workshop increased my knowledge about methods for ecosystem services valuation (ESV).	1	2	3	4	5	DK
I was provided with opportunities to provide input about the project, MTAG, and methodology.	1	2	3	4	5	DK
I learned something that I will apply in my work, either now or in the future.	1	2	3	4	5	DK

(2) Please rate your satisfaction with each of the following dimensions of this workshop on a scale of 1 to 5 where 1 means "Extremely dissatisfied" and 5 means "Extremely satisfied." If you are not sure or don't know about a particular dimension, please mark DK for "Don't know."

	Extremely dissatisfied				Extremely satisfied	
Workshop content	1	2	3	4	5	DK
Workshop format	1	2	3	4	5	DK
Workshop time length	1	2	3	4	5	DK

	Extremely dissatisfied				Extremely satisfied	
Communication skills of presenters	1	2	3	4	5	DK
Opportunities to interact	1	2	3	4	5	DK
Opportunities to communicate my resource management needs	1	2	3	4	5	DK
Opportunities to give input	1	2	3	4	5	DK
Opportunities to ask questions	1	2	3	4	5	DK
Overall workshop experience	1	2	3	4	5	DK

(2a) If you answered 1 or 2 on any of the above, please explain how we can improve or what specifically left you dissatisfied.

(3) What aspect of this workshop was <u>most useful</u> to you? Please explain.

(4) What aspect of this workshop was <u>least useful</u> to you? Please explain.

(5) What questions, if any, do you have as a result of participating in this workshop?

(6) What else related to the NGOM+N2E2 project would you like to learn, if anything?

(7) What recommendations, if any, do you have for future NGOM+N2E2 workshops?

(8) Did you attend any of the previous EESLR-NGOM project Management Committee annual workshops?

Yes ____ No ____ Don't know ____

(9) Did you participate in the NGOM+N2E2 virtual meeting in April of this year?

Yes ____ No ____ Don't know ____

(10) Are you more comfortable with methods of EIA/ESV after this workshop and the additional distributed materials?

Yes ____ No ____ Don't know ____

(11) Please provide any other comments regarding the workshop or the project that you would like to share.

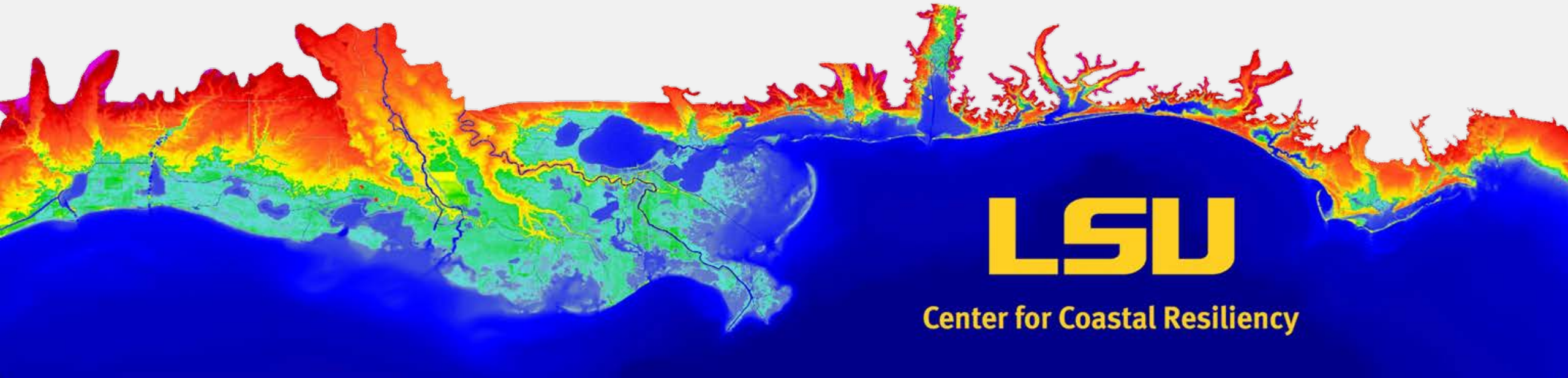
(12) Please list and provide contact information (phone number, email address) for any individuals, groups, or organizations who you think would benefit from participating in future NGOM+N2E2 workshops and/or webinars. Also, please indicate if they should be specifically considered for participation on the NGOM+N2E2 Management Transition Advisory Group (MTAG).

Thank you!

*Acknowledgement: Adapted from evaluation surveys of EESLR-NGOM and GOMA project workshops in partnership with Apalachicola, Grand Bay, and Weeks Bay NERRs; Louisiana Sea Grant workshops; and the "Best Practices for Interviews" training evaluation survey at the 2016 Social Coast Forum.

Dynamic sea level rise assessments of the ability of natural and nature-based features to mitigate surge and nuisance flooding

Scott C. Hagen
Director, LSU Center for Coastal Resiliency (shagen@lsu.edu)
Professor, Civil & Environmental Engineering / Center for Computation & Technology



Co-PIs & Science Collaborators

MTAG PI: Renee Collini, Dauphin Island Sea Lab / NGOM SSC

Co-PIs: Denise E. DeLorme, Louisiana State University

Stephen C. Medeiros, University of Central Florida

James T. Morris, University of South Carolina

David Yoskowitz, Texas A&M University-Corpus Christi

Science Collaborators: Karim Alizad, LSU

Matthew Bilskie, LSU

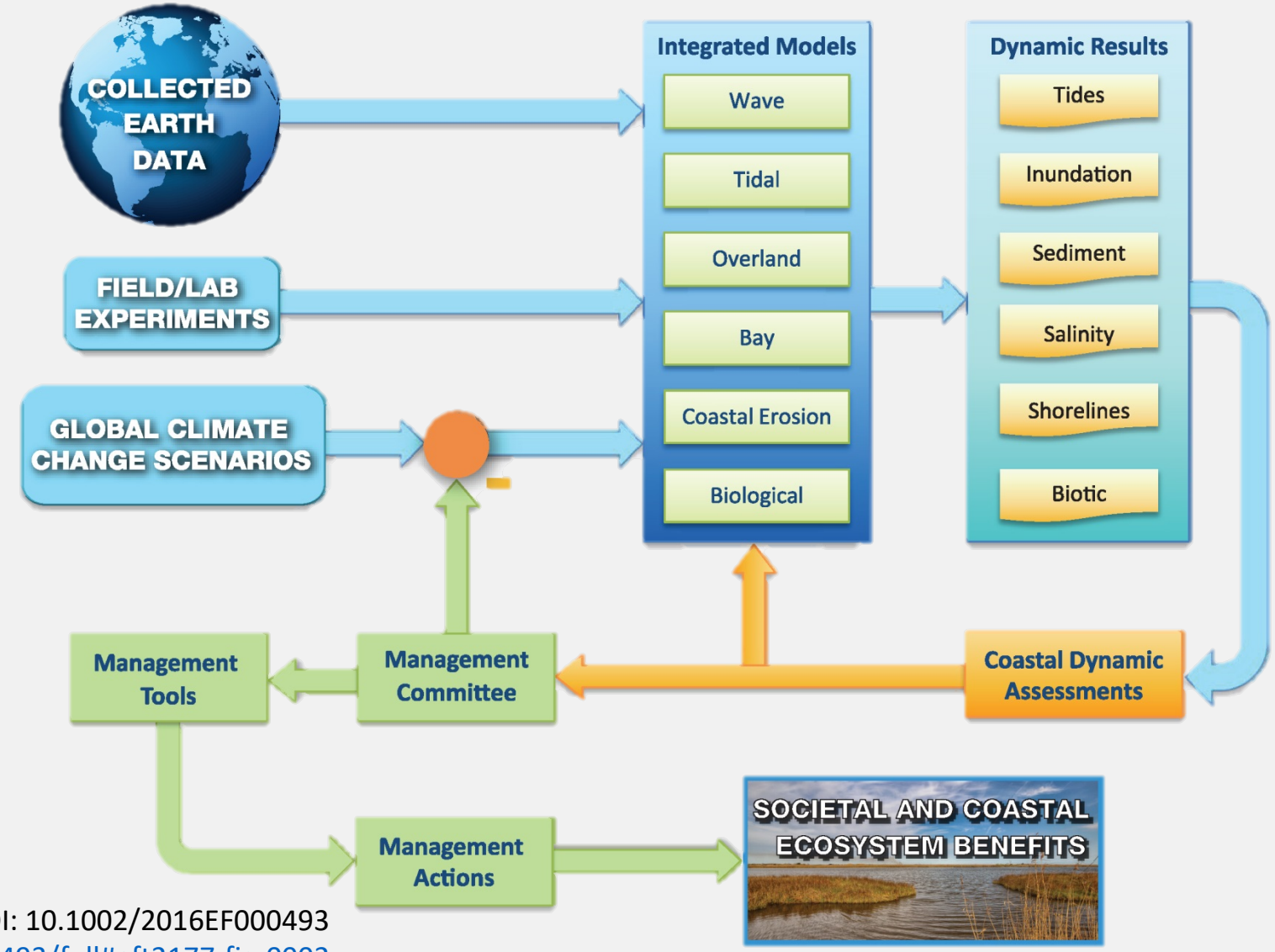
Christine Buckel, NOAA

Davina Passeri, USGS

Nathaniel Plant, USGS

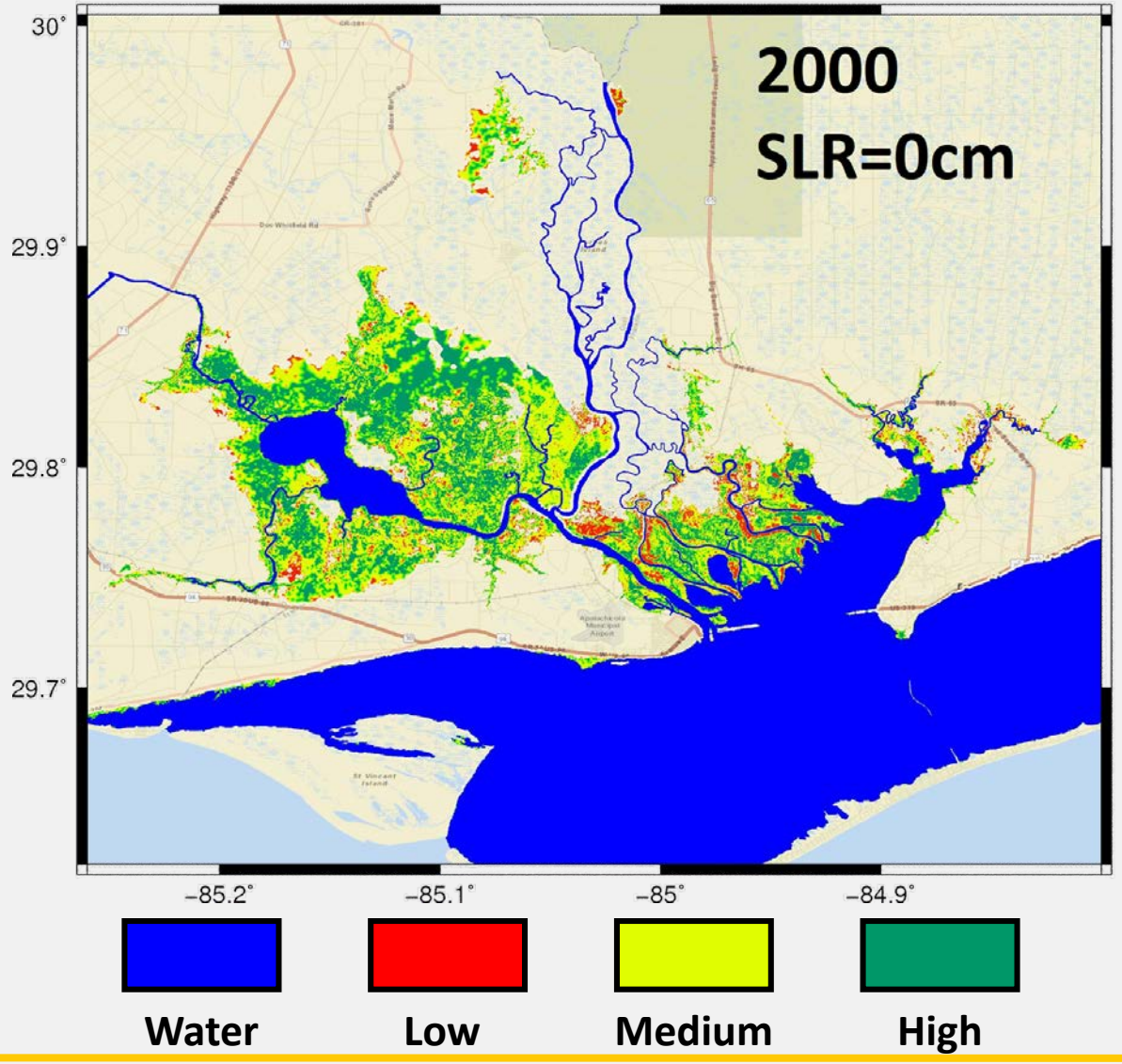
A Process Diagram for the Coastal Dynamics of Sea Level Rise

We have contributed to a shift in the paradigm of how climate change in general and sea level rise in particular is assessed at the coastal land margin. With a system of systems approach we can evaluate the coastal dynamics of sea level rise.



Earth's Future Volume 5, Issue 1, pages 2-9, 20 JAN 2017 DOI: 10.1002/2016EF000493
http://onlinelibrary.wiley.com/doi/10.1002/2016EF000493/full#eft2177-fig-0002

Apalachicola salt marsh under a high SLR



Defining the acronym

- 2010 – 2017 :

  EESLR-NGOM:

  Ecological Effects of Sea Level Rise in the Northern Gulf of Mexico

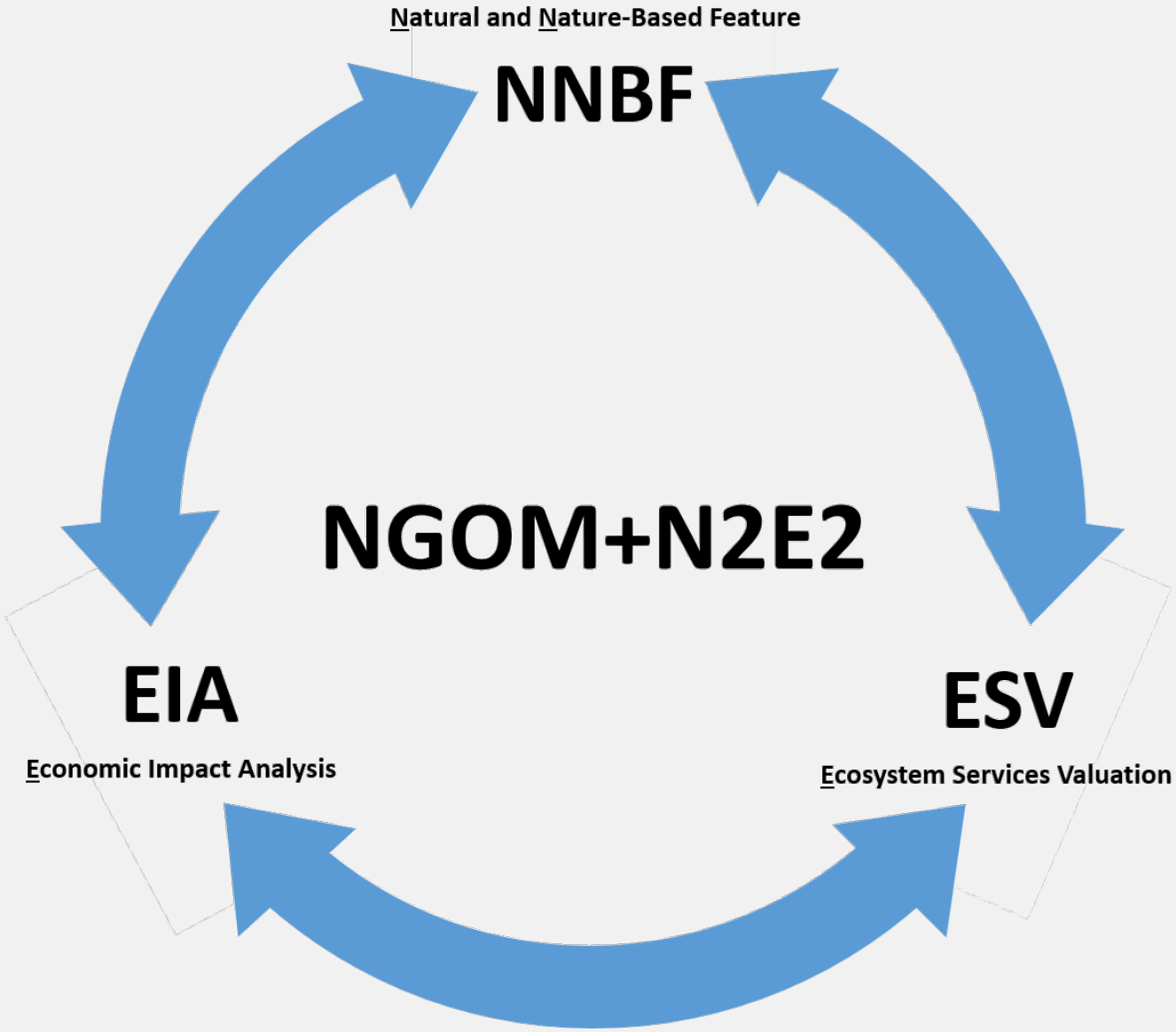
- 2017+ : **EESLR-NGOM ⟹ NGOM+**

  Natural and **N**ature-Based Features ⟹ **N2**

  Economic Impact Analysis / **E**cosystem Services Valuation ⟹ **E2**

  ⟹ **NGOM+N2E2**

NGOM+N2E2 System



NGOM+N2E2 Objectives

The objectives for this transdisciplinary project are to:

1) Refine, enhance, and extend the coupled dynamic, bio-geo-physical models of coastal morphology, tide, marsh, and surge;

2) Advance the paradigm shift for sea level rise assessments by linking economic impact analysis and ecosystem services valuation directly to these coastal dynamics of SLR;

3) Establish and engage a Management Transition Advisory Group (MTAG) throughout the entire project process;

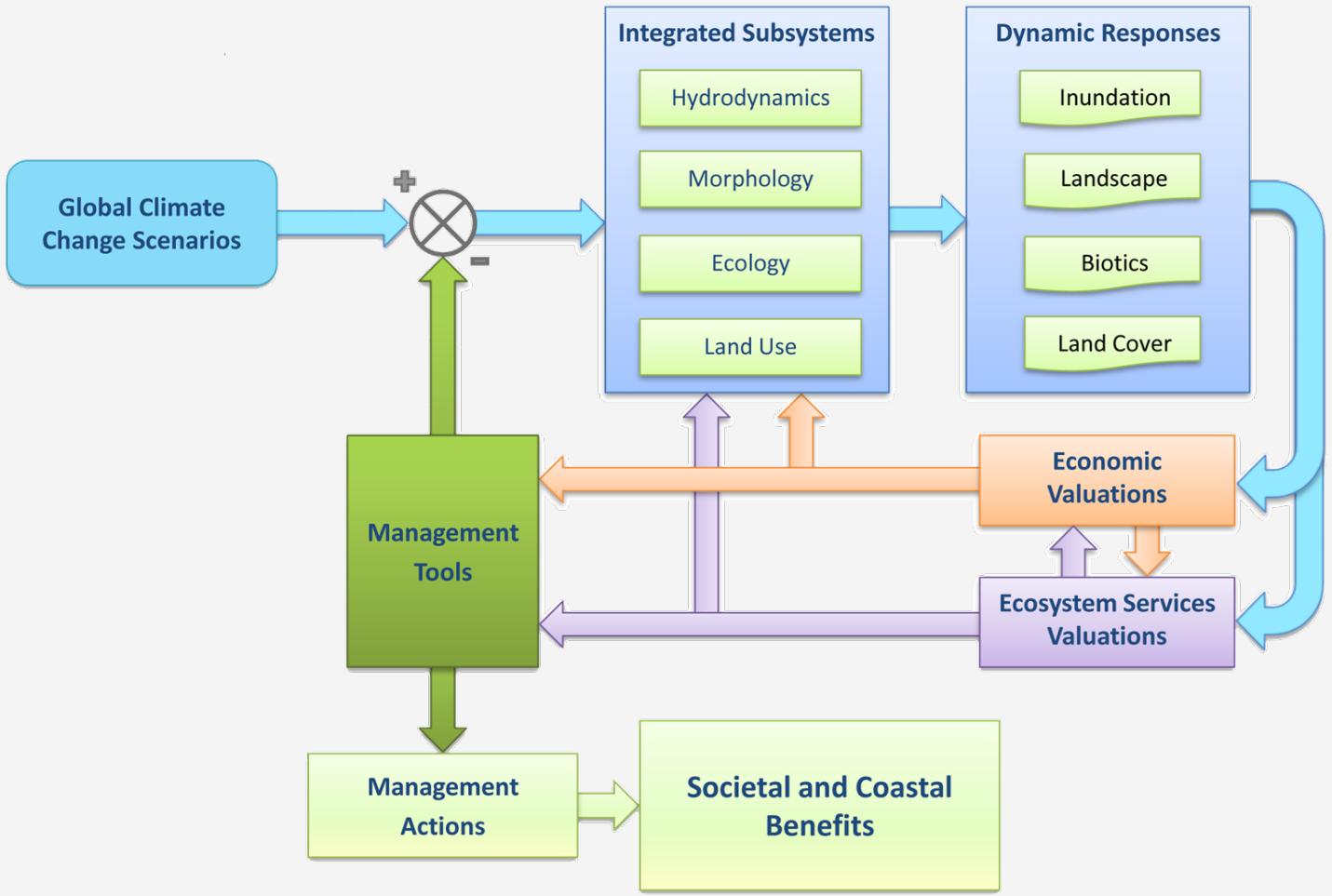
4) Deliver our results via a flexible, multi-platform mechanism that allows for region-wide or place-based assessment of NNBFs.

NGOM+N2E2 Year 1 Milestones

- Nuisance flooding assessment for Apalachicola
- Economic impact analysis and ecosystem services valuation for SLR scenarios without NNBFs
- Identification of NNBF options for the Apalachicola and Apalachee regions

A Process Diagram for the NGOM+N2E2 System

We will continue to shift the paradigm of how climate change in general and sea level rise in particular is assessed at the coastal land margin. With our system of systems approach we can evaluate more aspects of the coastal dynamics of sea level rise.

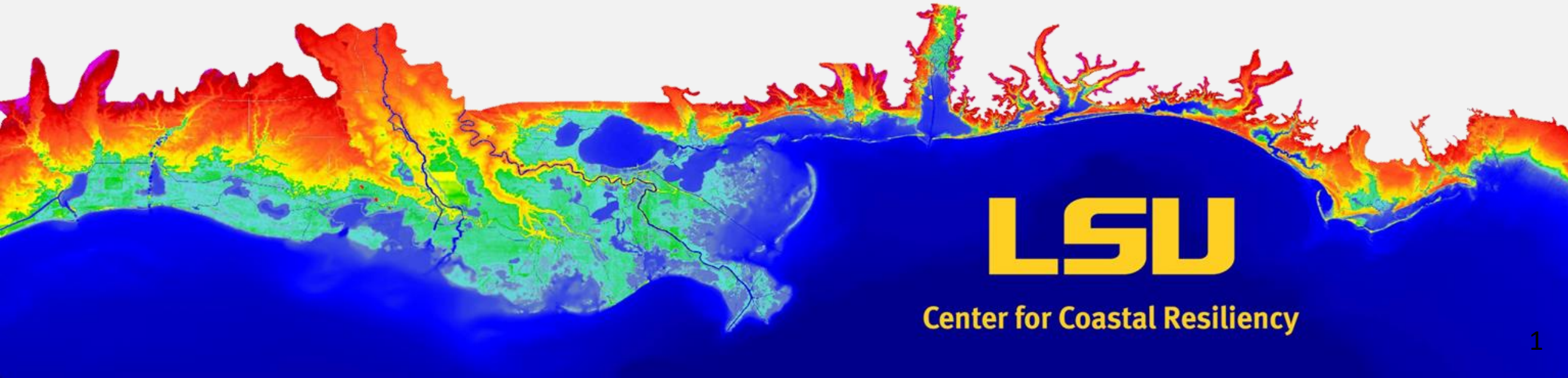


"*Systems Approaches for Coastal Hazard Assessment and Resilience*."
in S. Cutter (Ed): Oxford Research Encyclopedia: Natural Hazard Science.
http://naturalhazardscience.oxfordre.com/browse?t0=ORE_NHS:REFNHS063

NGOM+N2E2:
Tide and Storm Surge Modeling Overview

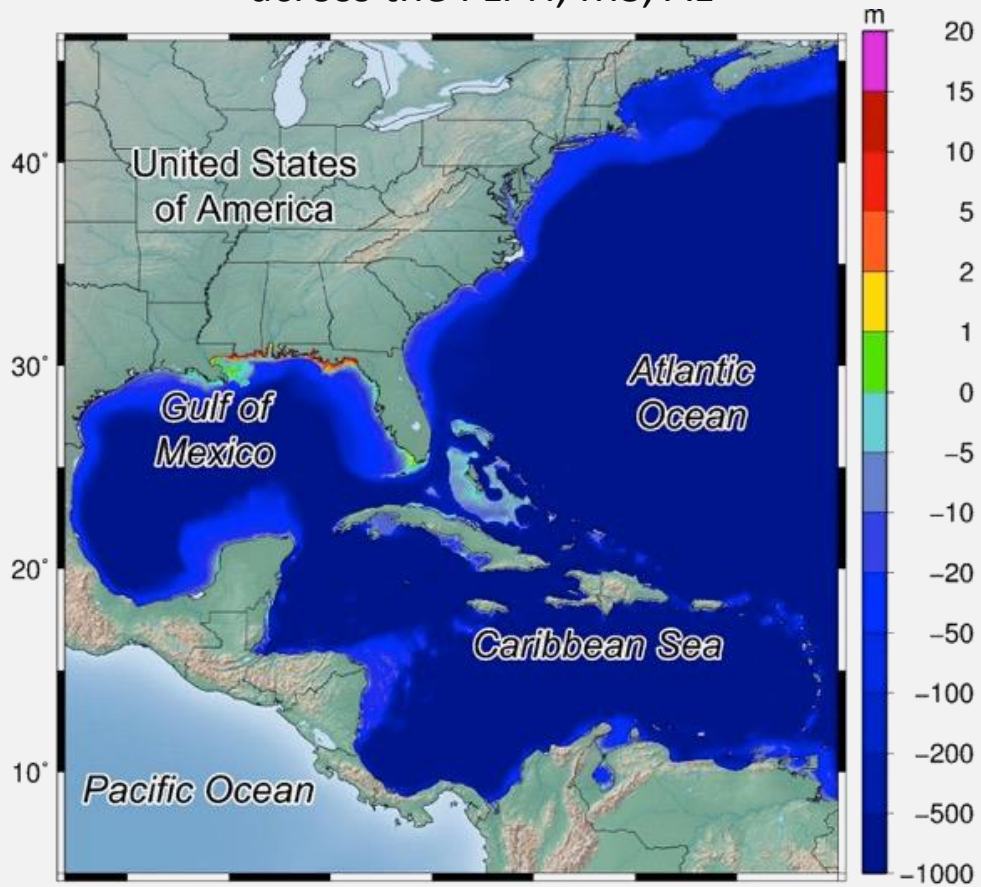
Matthew V. Bilskie

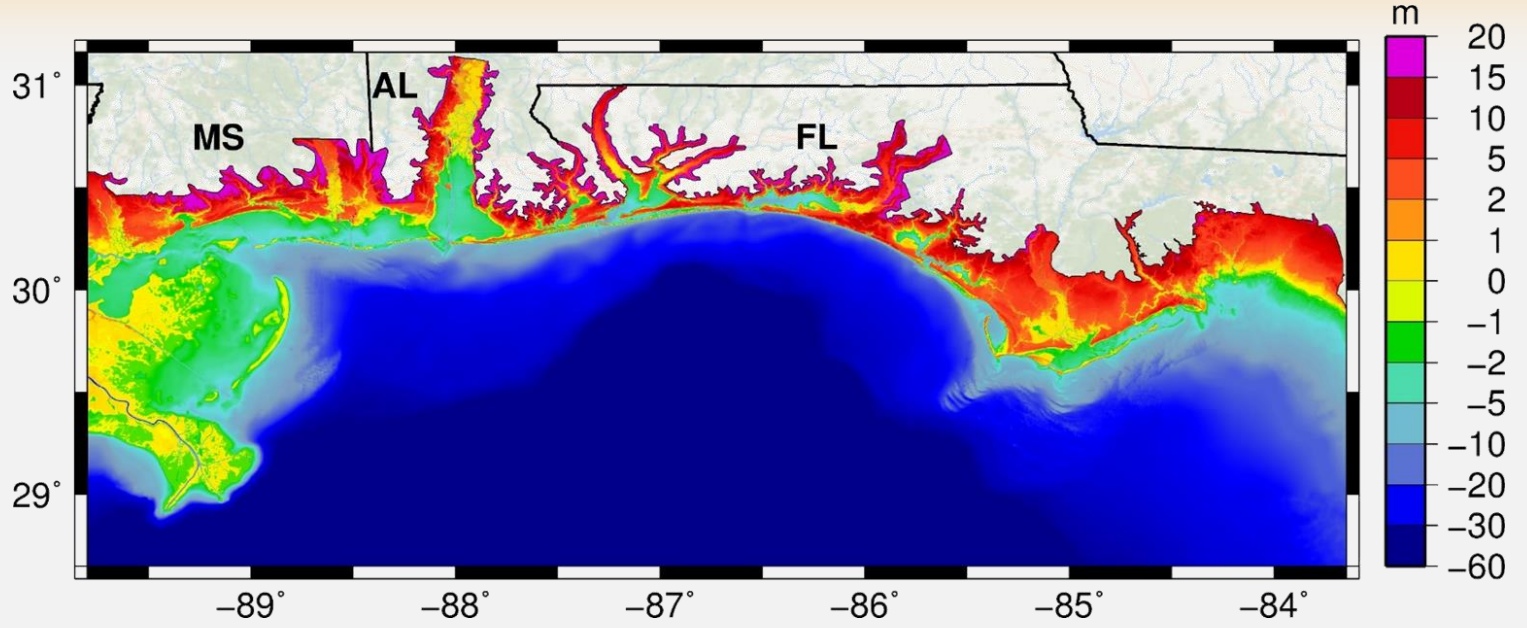
Center for Coastal Resiliency, Louisiana State University

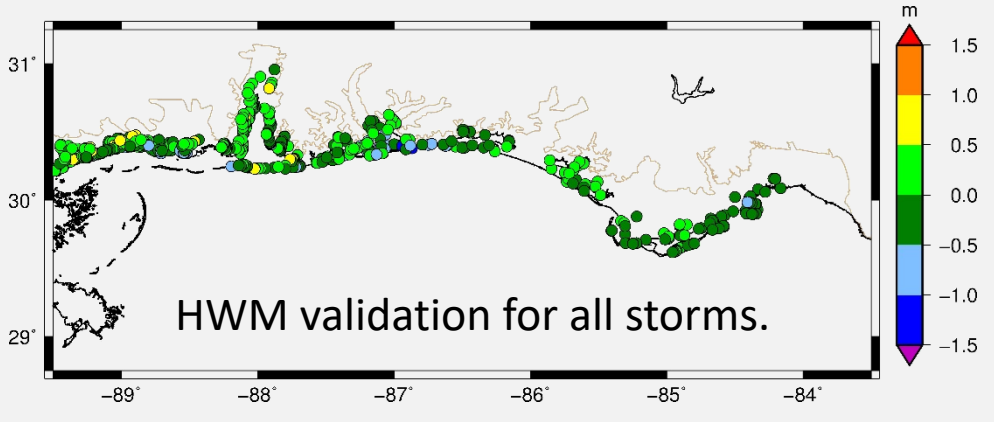


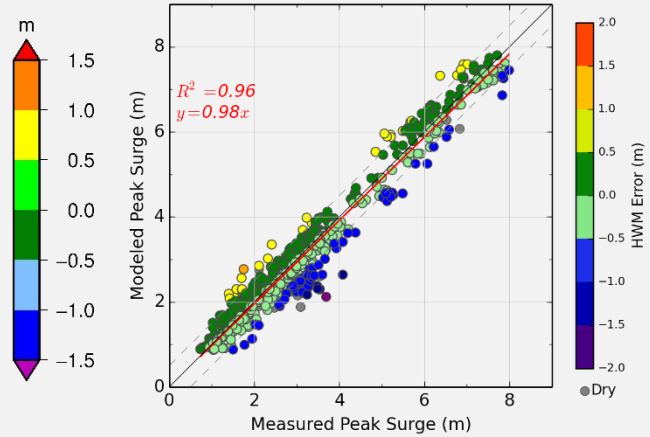
NGOM3 Storm Surge Model

5.5 million compute nodes / 10.9 million elements
~20,000 km^2 of floodplain (4.9 million acres)
across the FLPH, MS, AL





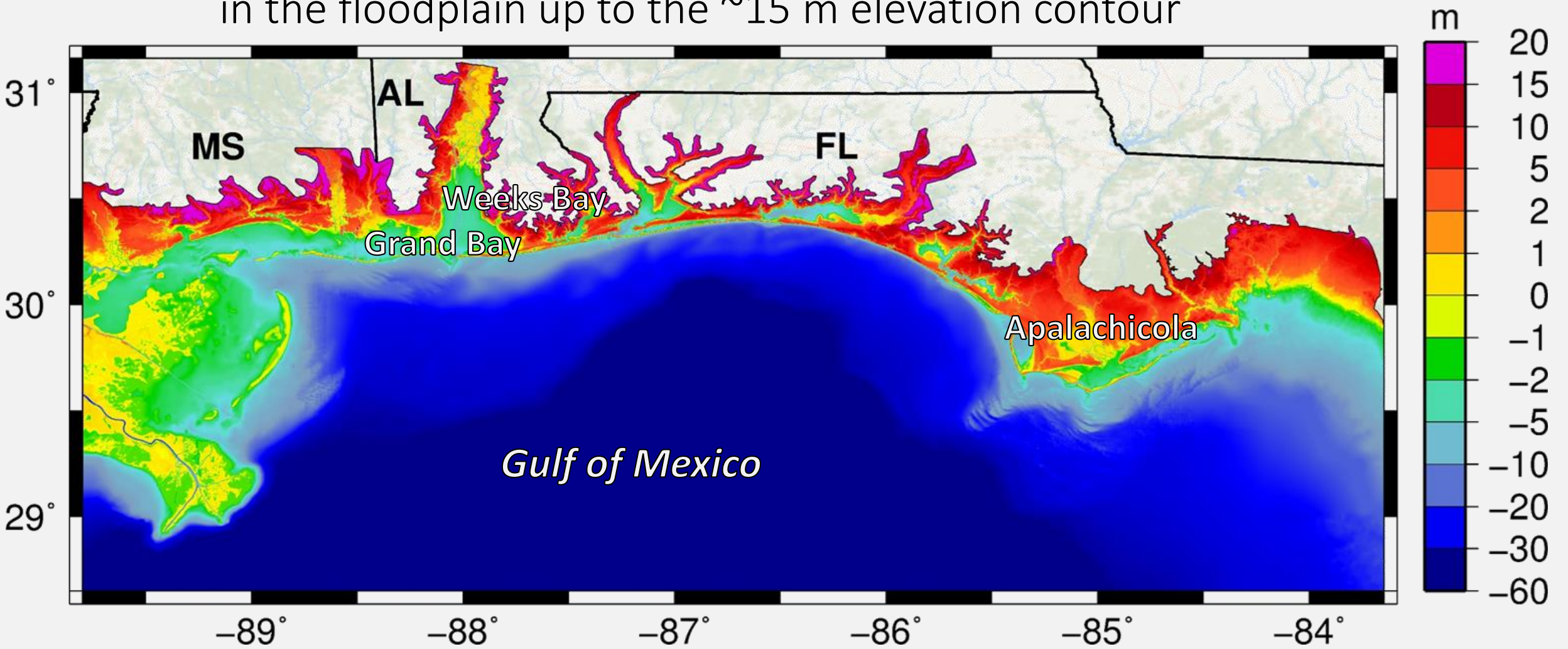




M.V. Bilskie, et al. (2016) Data and numerical analysis of astronomic tides, wind-waves, and hurricane storm surge along the northern Gulf of Mexico, *Journal of Geophysical Research: Oceans*, 121(5), 3625-3658, http://dx.doi.org/10.1002/2015JC011400

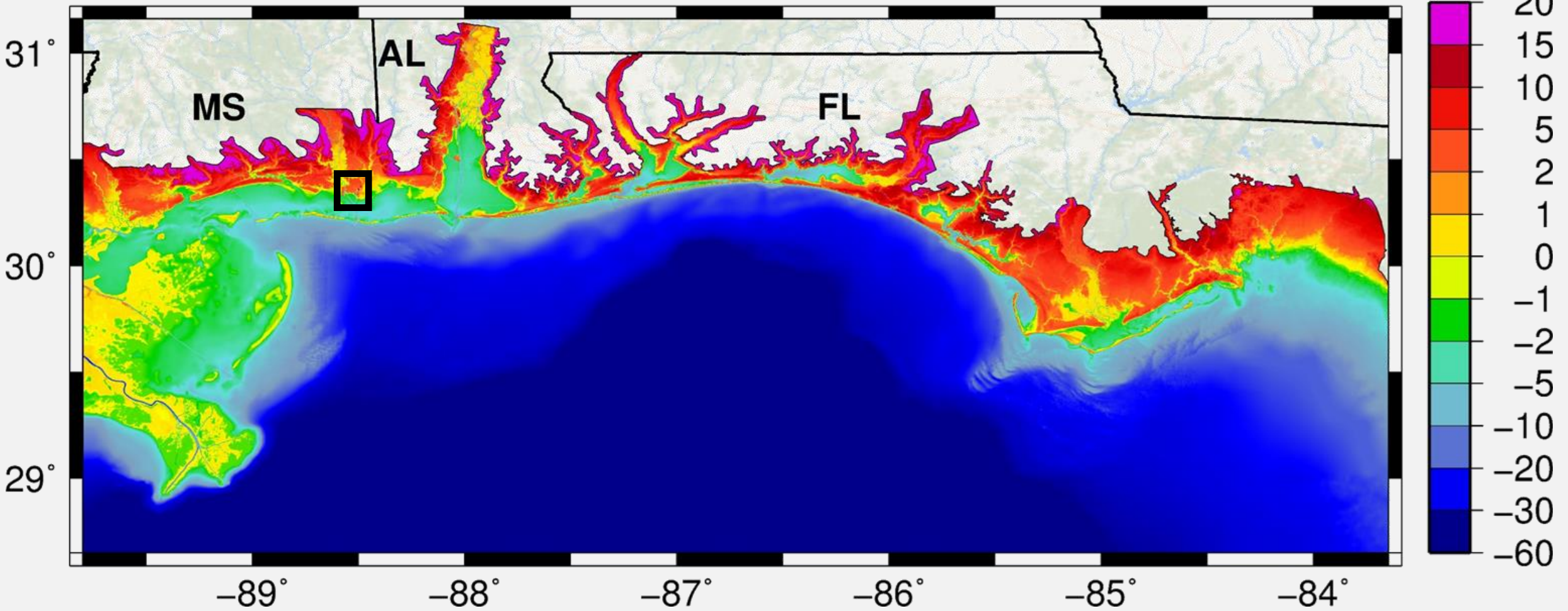
Model Elevations

5.5 million nodes with mesh resolution ranging from 20-200 m in the floodplain up to the ~15 m elevation contour



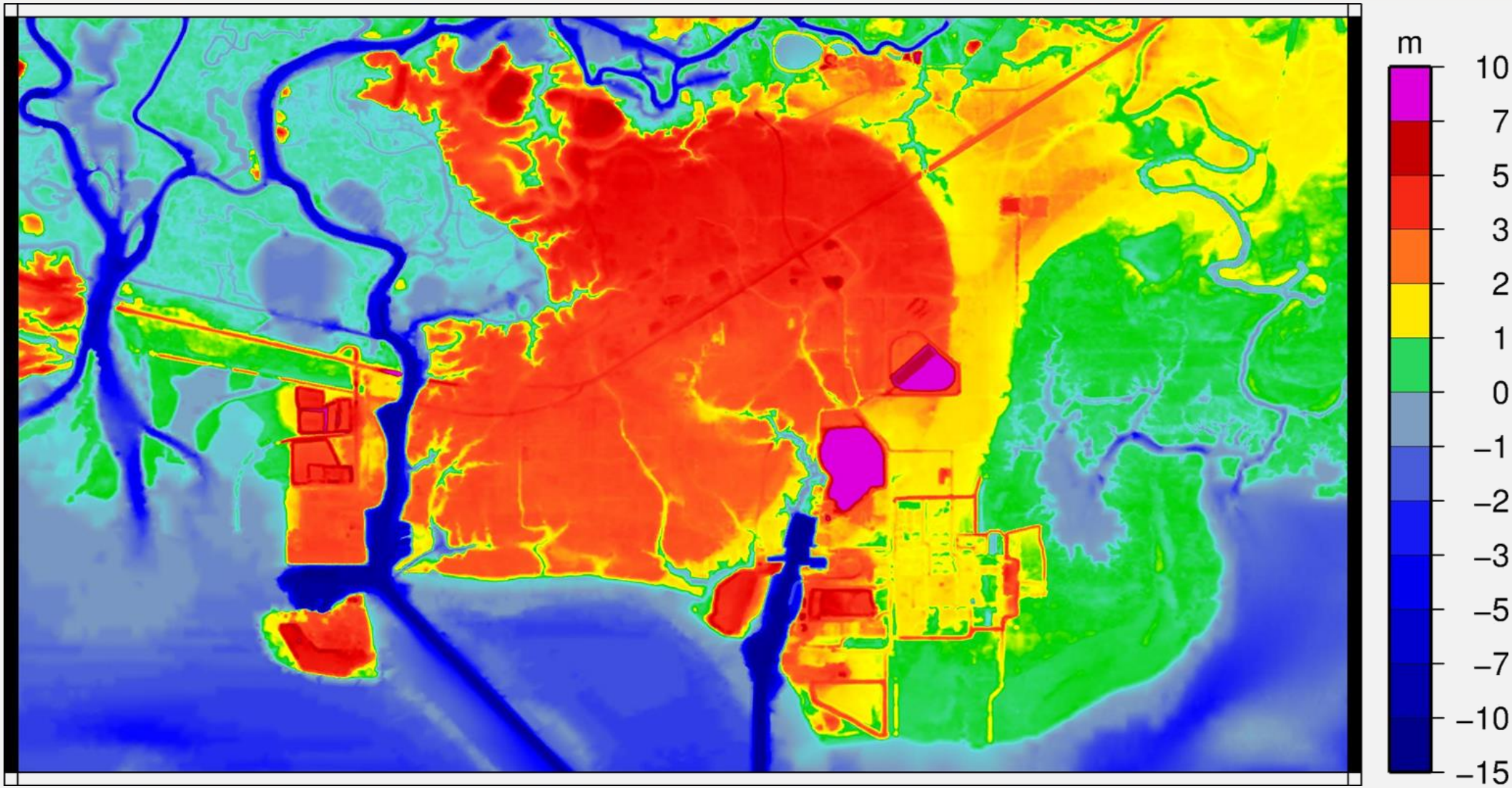
Model Elevations

5.5 million nodes with mesh resolution ranging from 20-200 m in the floodplain up to the ~15 m elevation contour



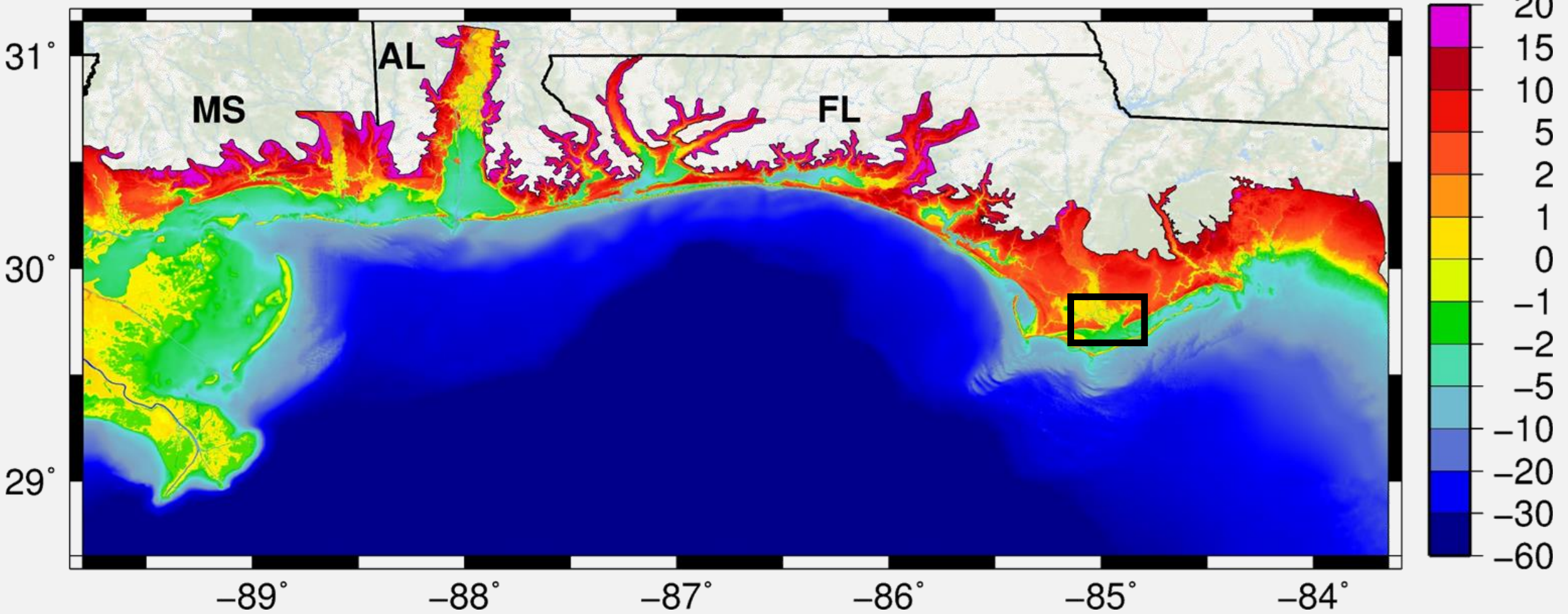
Pascagoula, MS

Pascagoula, MS | Model Elevations

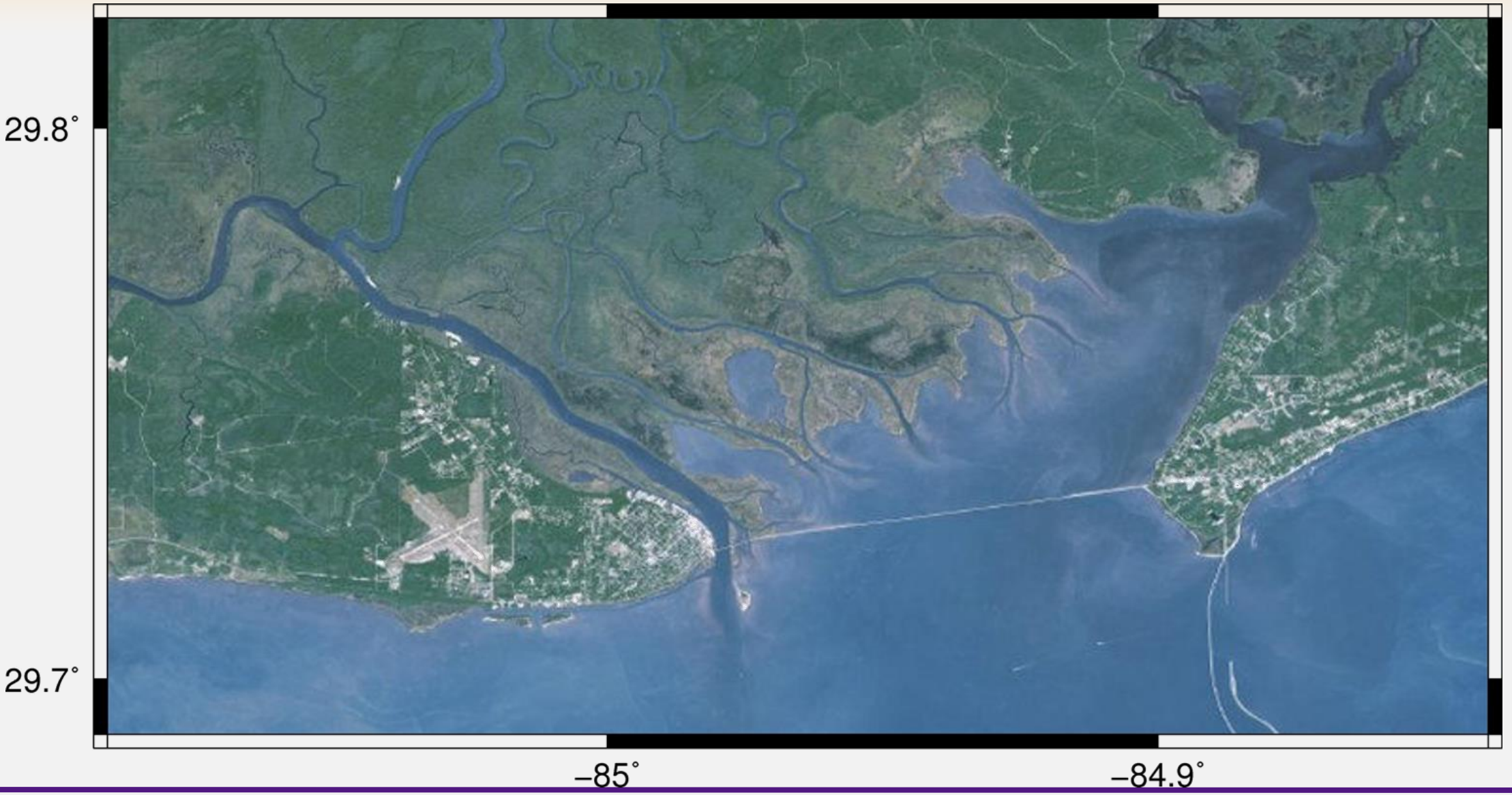


Model Elevations

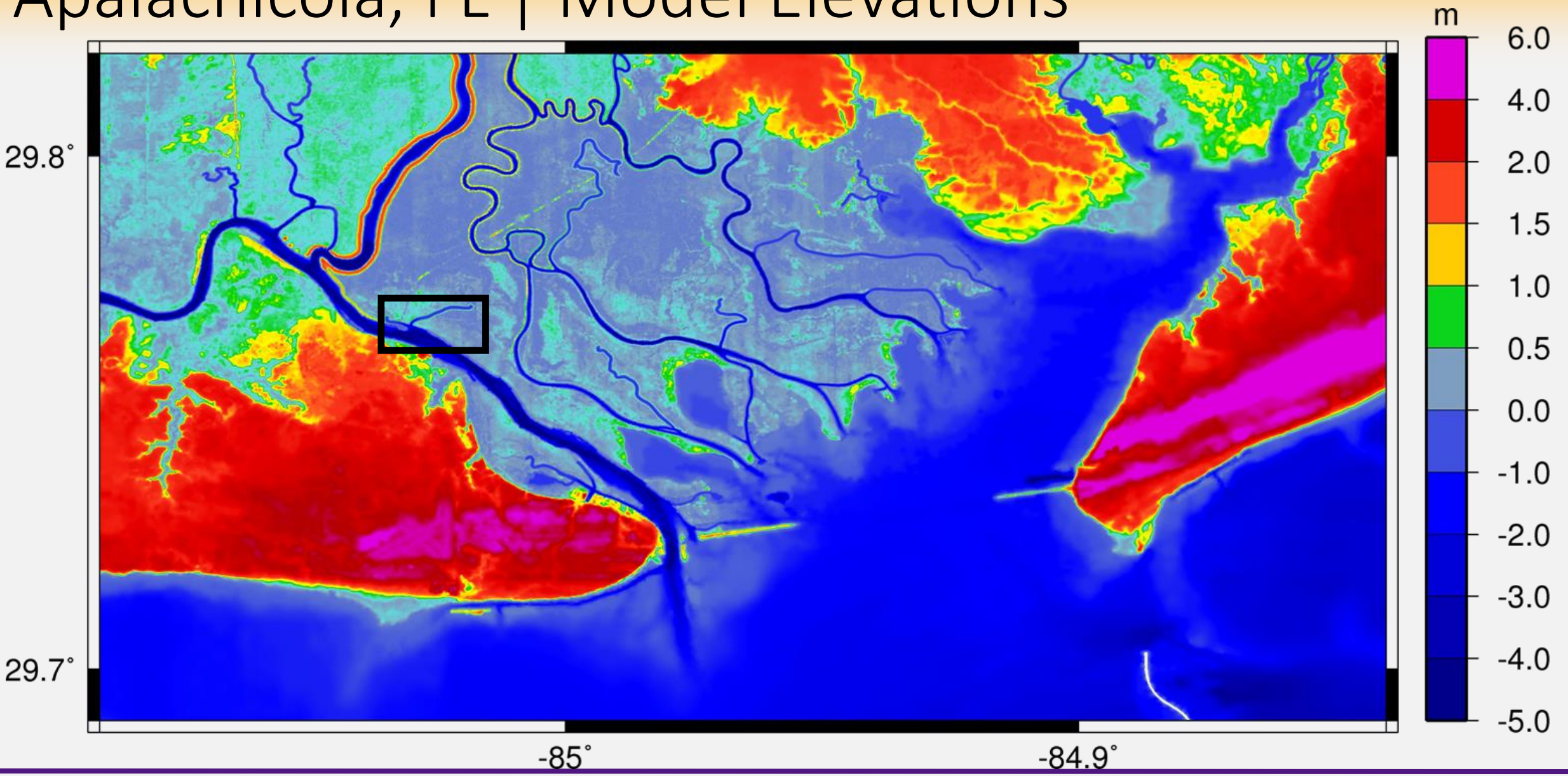
5.5 million nodes with mesh resolution ranging from 20-200 m in the floodplain up to the ~15 m elevation contour



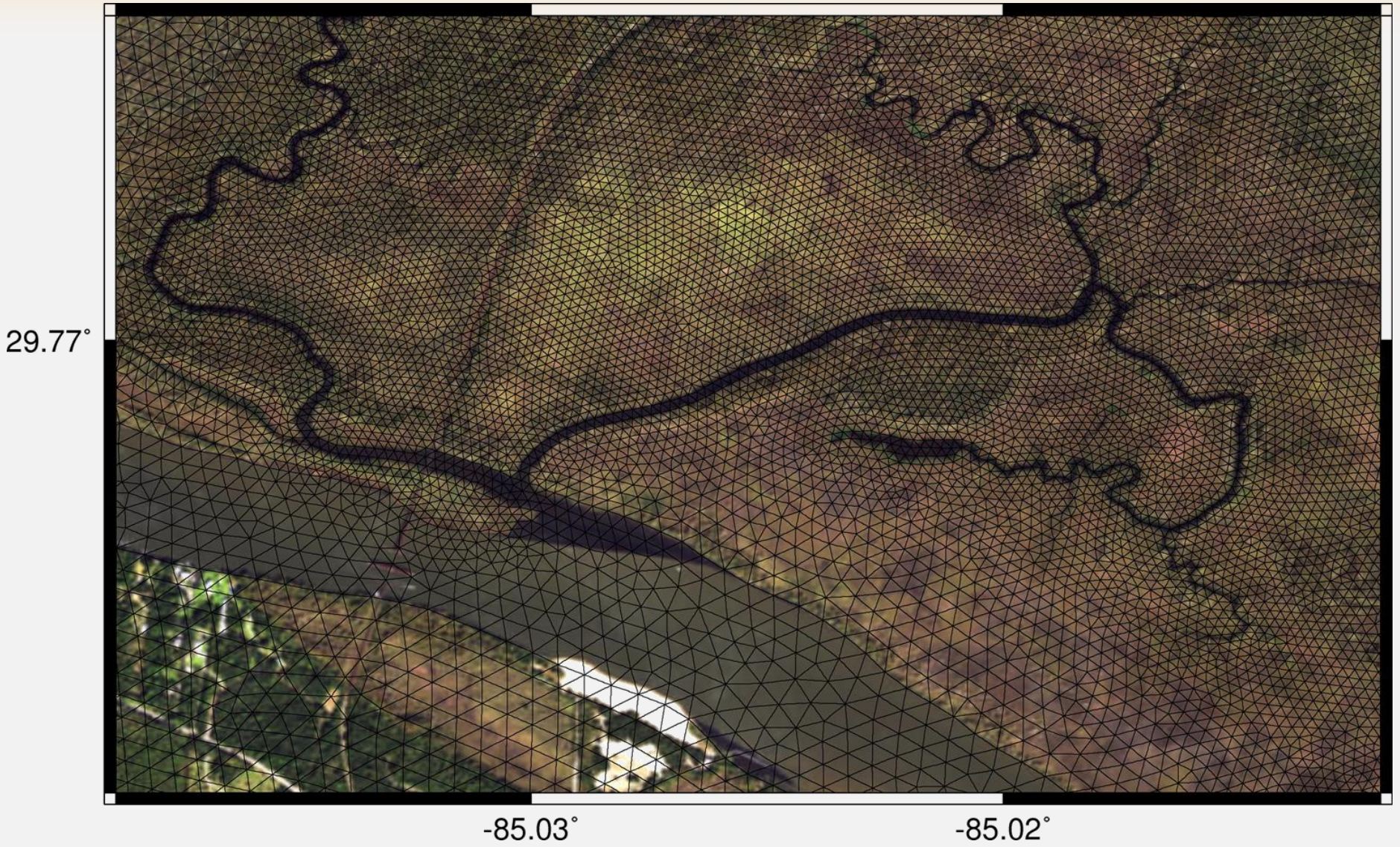
Apalachicola, FL



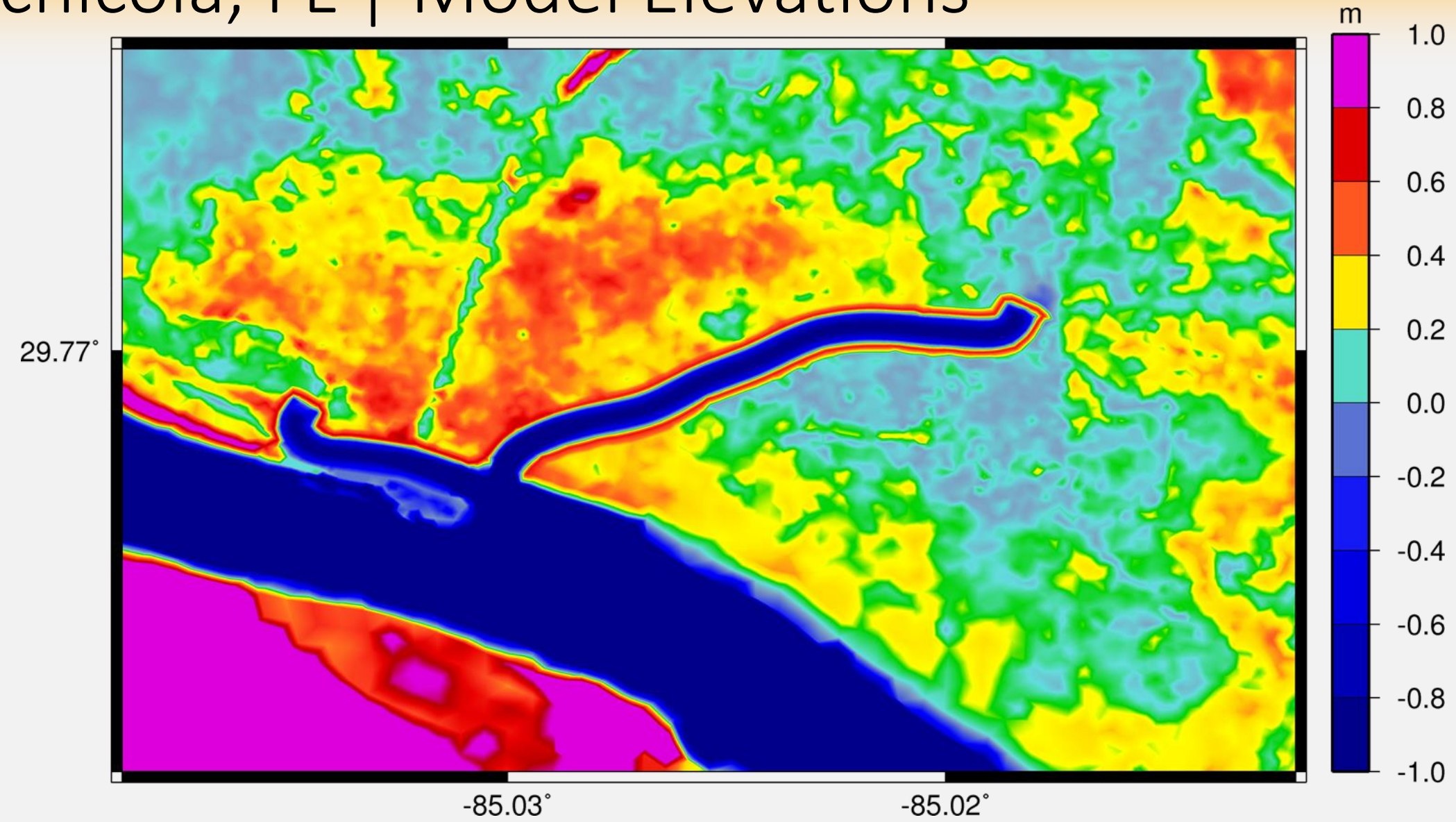
Apalachicola, FL | Model Elevations



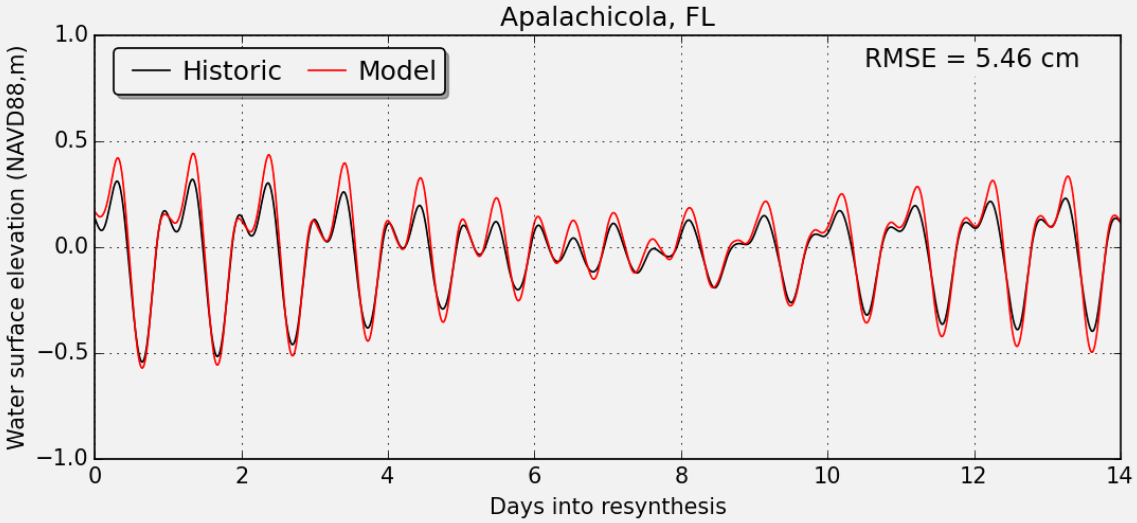
Apalachicola, FL | ADCIRC Mesh

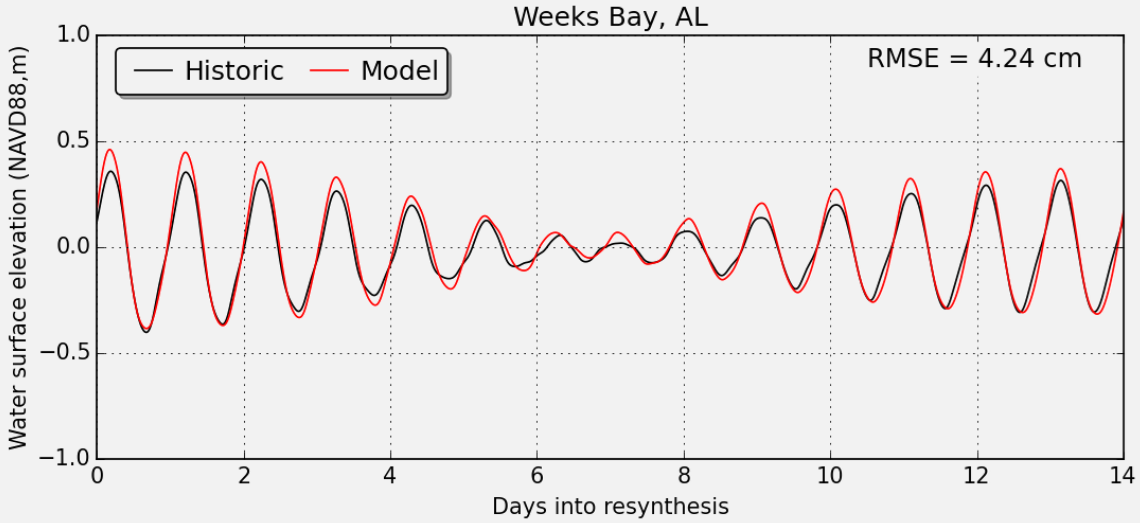


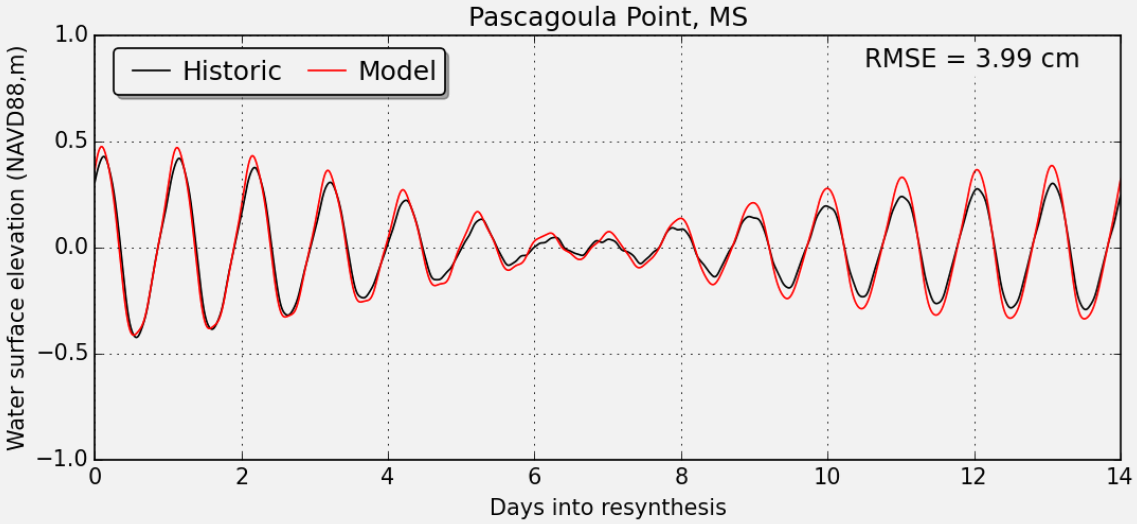
Apalachicola, FL | Model Elevations

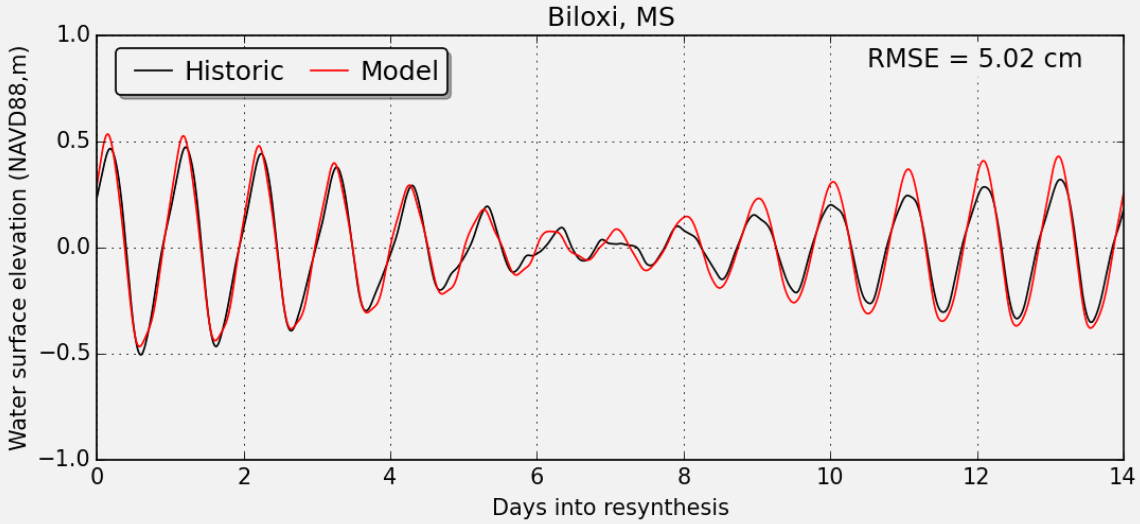


Model Validation | Astronomic Tides

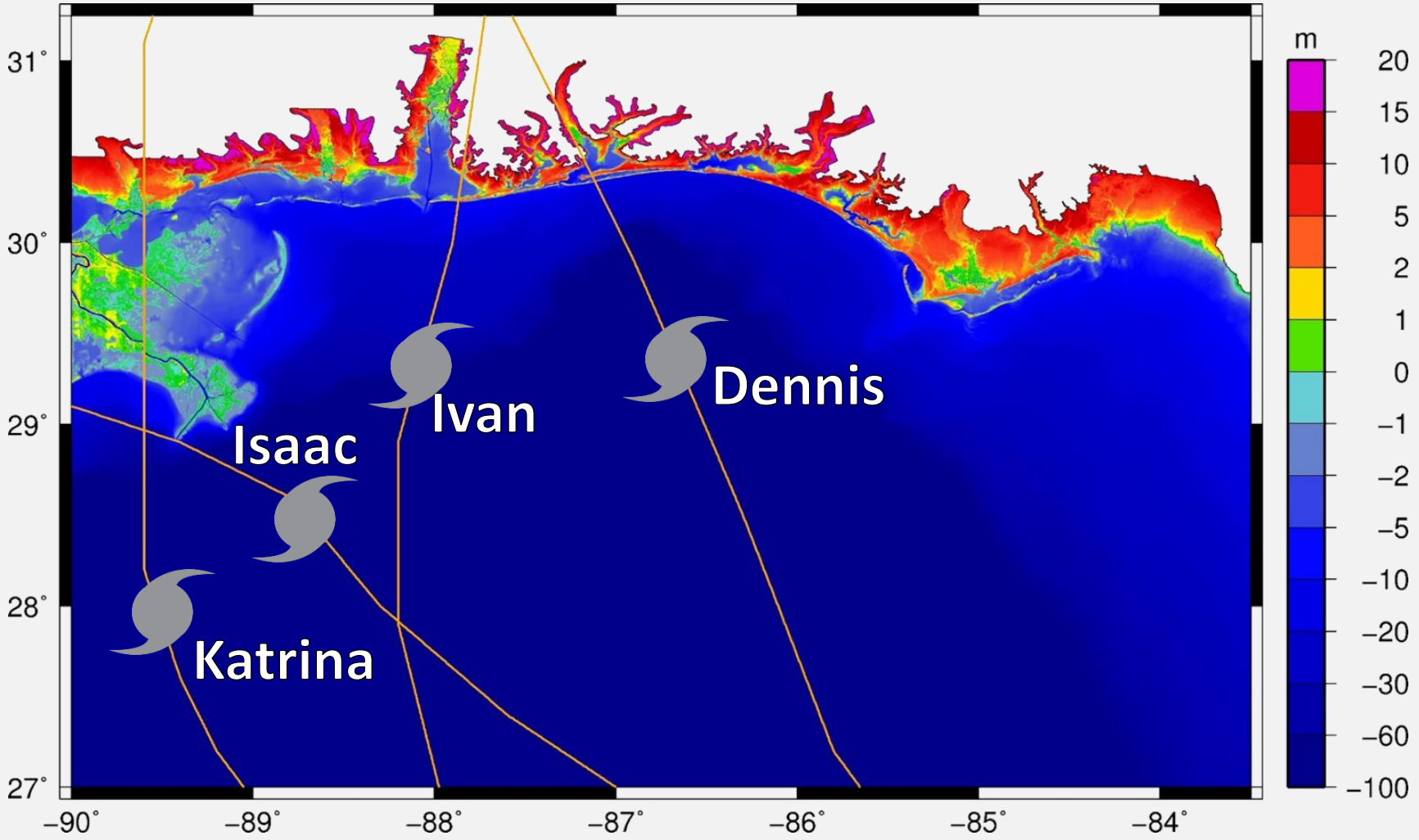




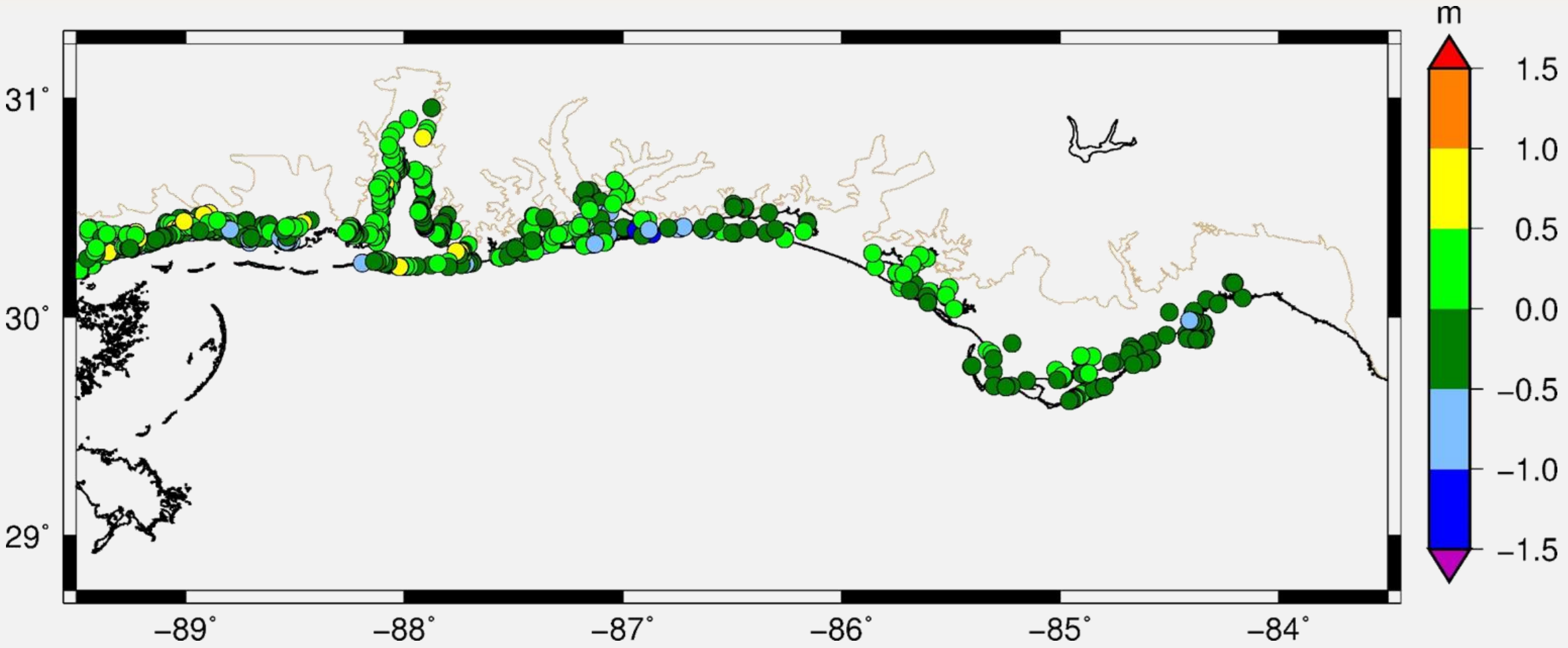




Model Validation | Hurricane Storm Surge

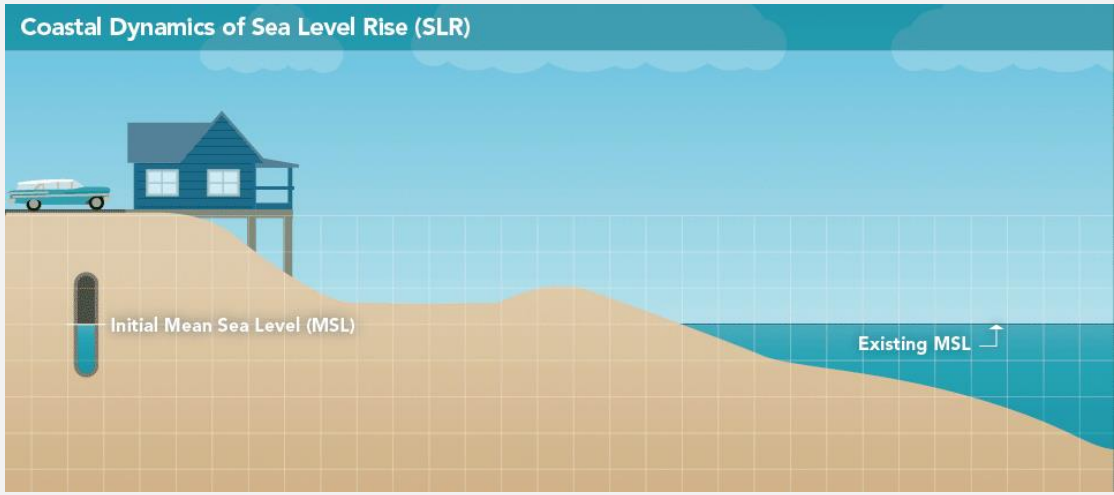


Model Validation | Hurricane Storm Surge HWM



EESLR-NGOM: What we did

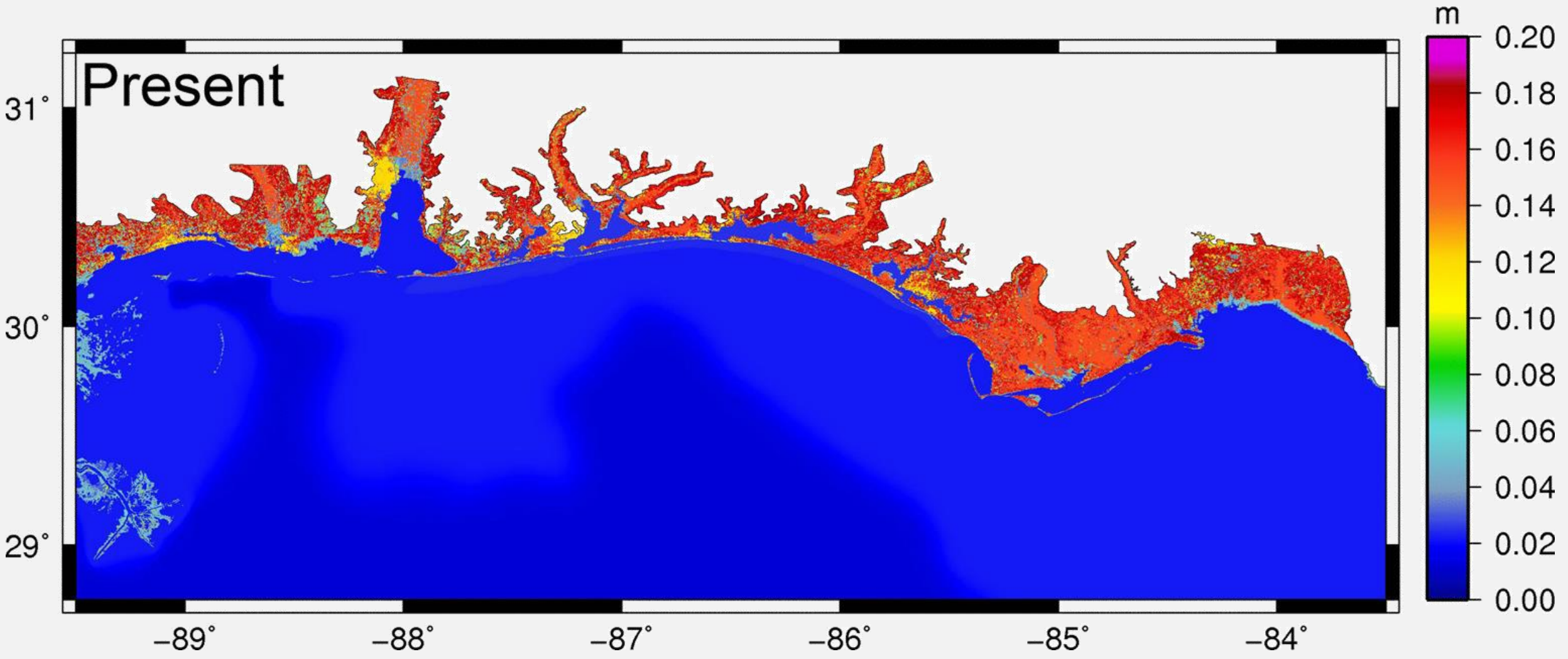
- Established the coastal dynamics of SLR.
- Interdisplinary effort (Kidwell et al.)…
  - Astronomic Tidal Analysis (Passeri et al.)
  - Biomass productivity / migration (Alizad et al.)
  - Adjusted marsh elevation (Medeiros et al.)
  - Shoreline and dune height change (Plant et al.)
  - Land Use Land Cover (USGS / Bilskie et al.)
  - Transdisciplinary Research Outcomes (DeLorme et al.)
- Storm surge model that reflects changes to the coastal landscape.



Passeri et al., 2015, Earth's Future

[Earth's Future Special Section, (2016) Integrated Field Analysis & Modeling of the Coastal Dynamics of Sea Level Rise in the Northern Gulf of Mexico]

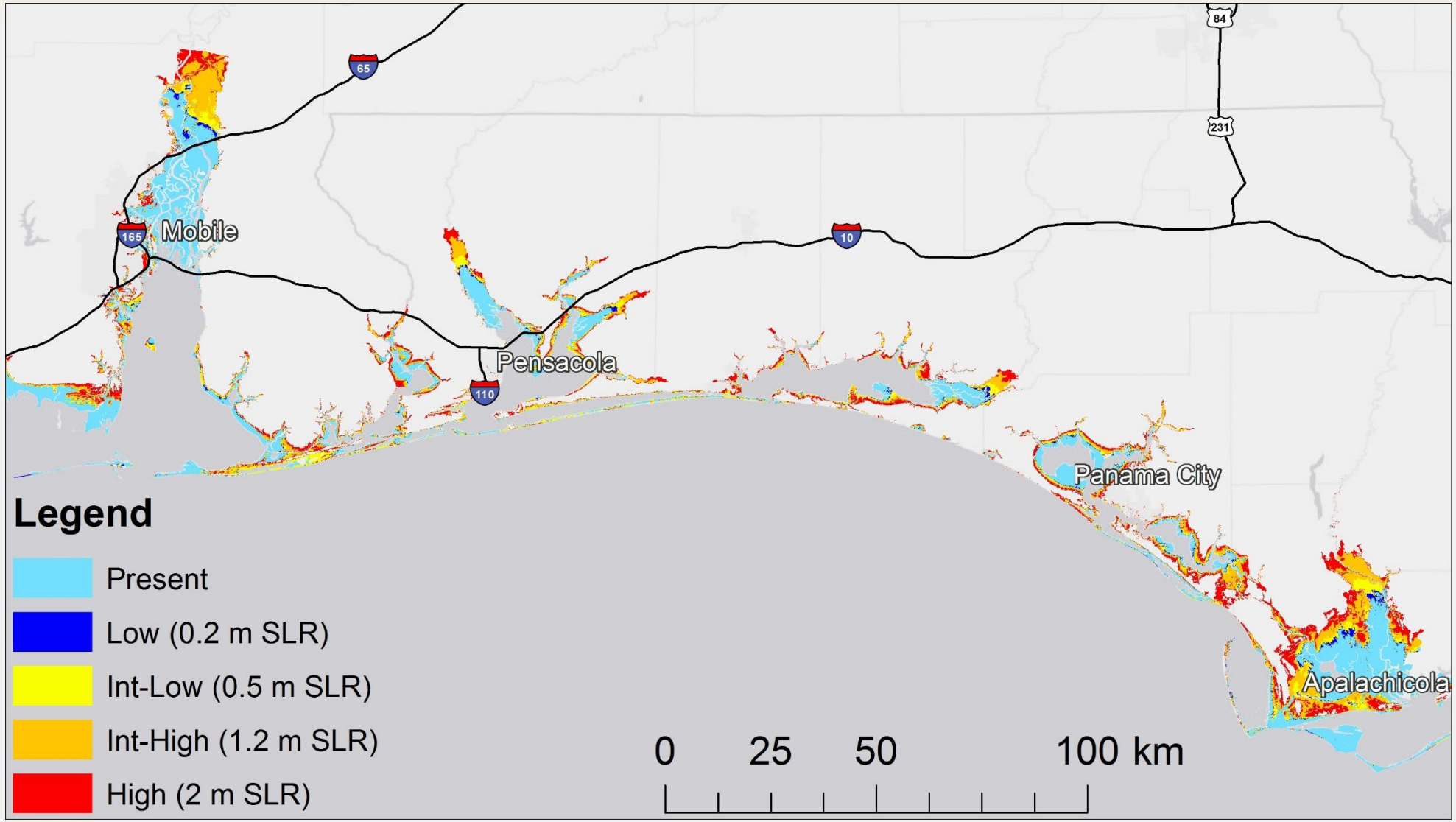
Bottom Friction via Manning's *n*



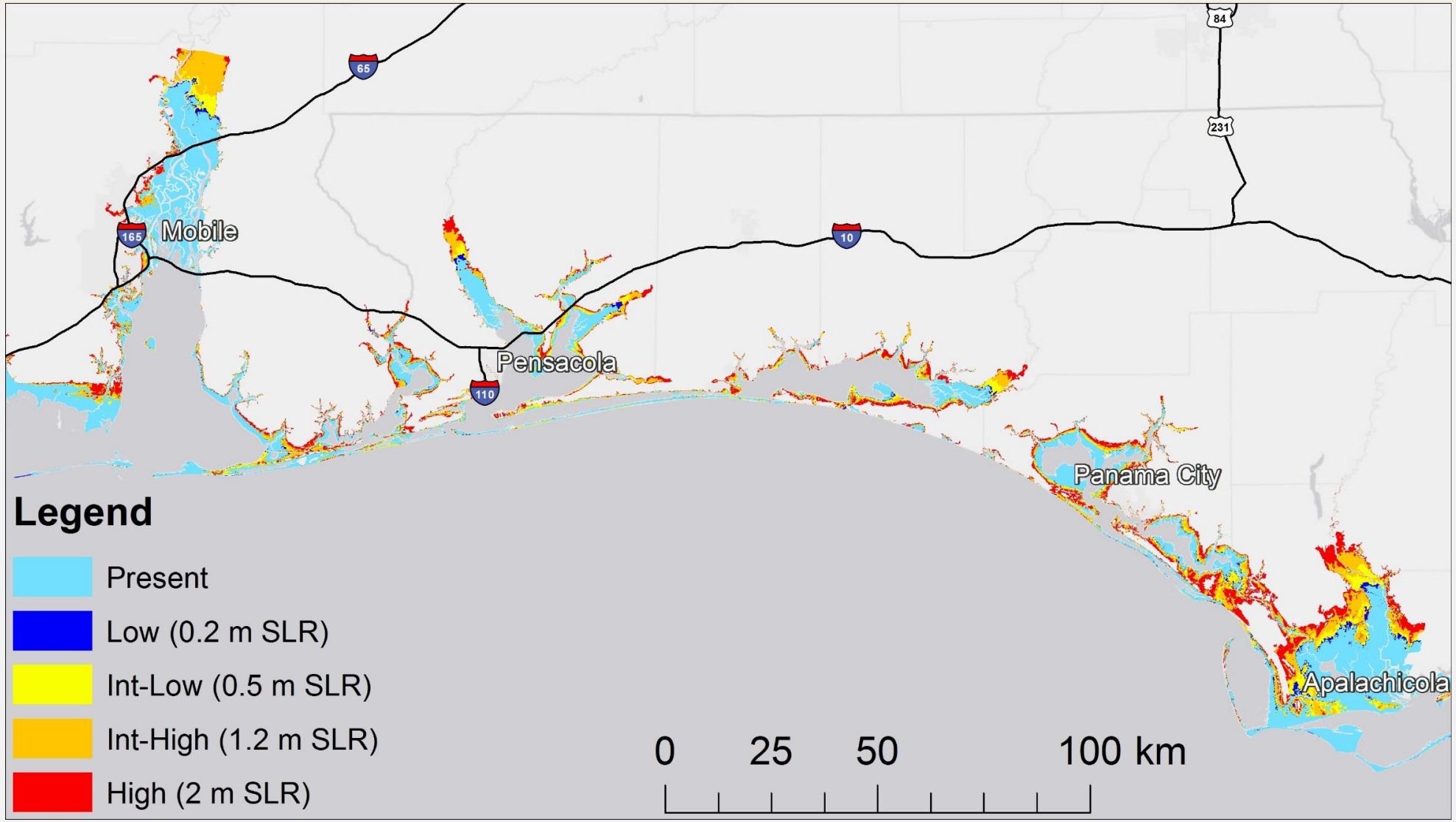
EESLR-NGOM Storm Surge Model Outputs

- Low, Intermediate-Low, Intermediate-High, High sea level rise
  - Peak storm surge (Hurricanes Agnes, Elena, Kate, Opal, Earl, Georges, Ivan, Dennis, Katrina, and Isaac).
  - Maximum of Maximums (MOM) of the 10 above storms.
  - 100-year and 500-year return period stillwater elevation

100-year Return Period Stillwater Inundation



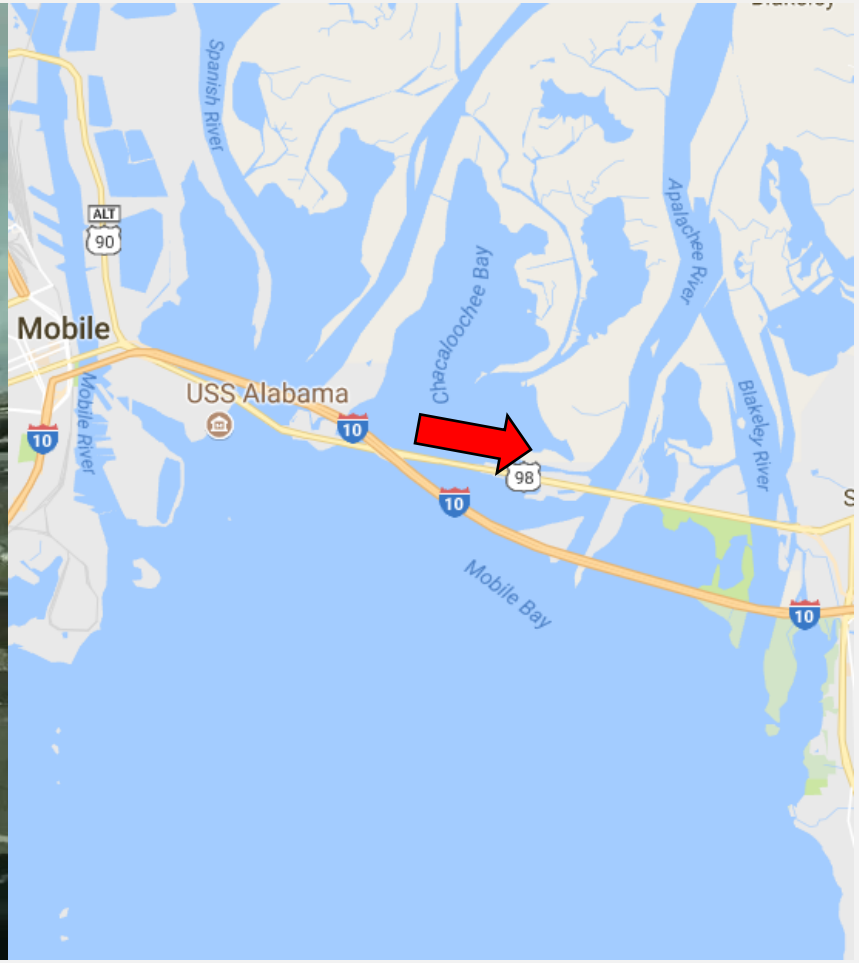
500-year Return Period Stillwater Inundation



NGOM+N2E2: What we can do

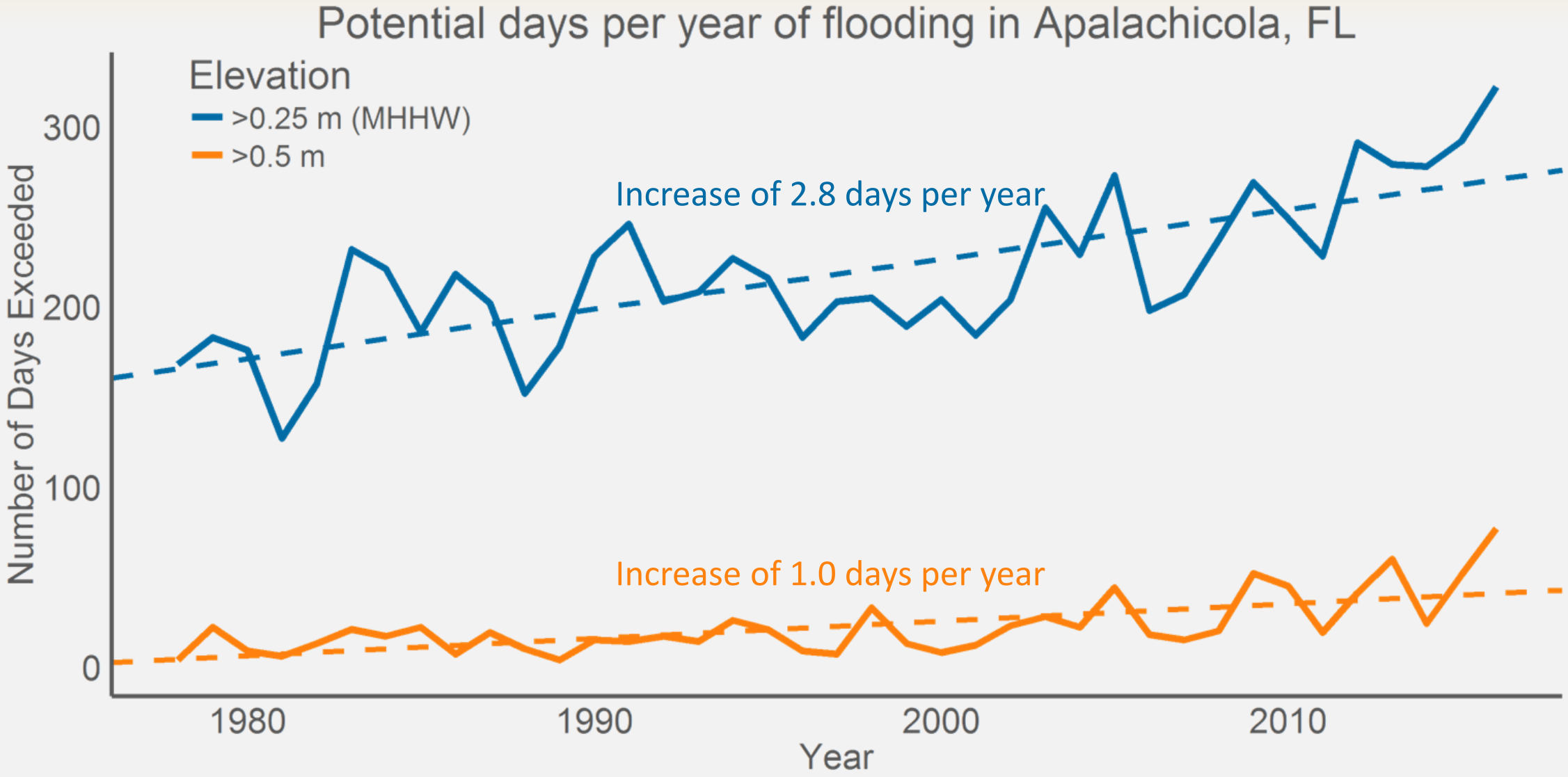
- Continue to advance the coastal dynamics of sea level rise.
  - Examine Natural and Nature-Based Features.
  - Economics of storm surge inundation.
- Modeling of low return period (more frequent / less intense) events:
  - Tropical cyclones
  - Nuisance flooding

Nuisance Flooding | Mobile Bay on May 23

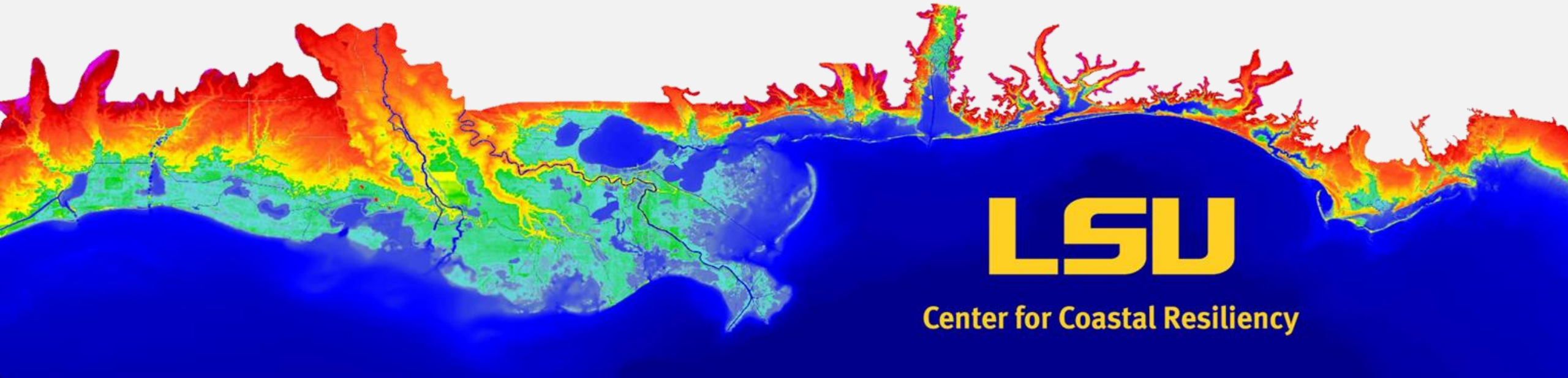


Video Courtesy of the City of Mobile via Twitter

Potential for Nuisance Flooding



Questions



Understanding Flood Economic Impact Assessment in NGOM+N2E2

David W. Yoskowitz
Diana Del Angel
Harte Research Institute
Texas A&M University-Corpus Christi

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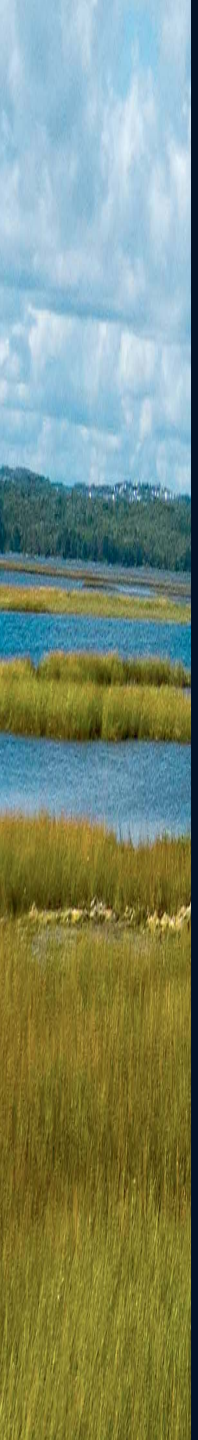


The overarching objective of this work is to demonstrate the benefits of natural and nature based features by:

1. Illustrating the enhanced value of ecosystem services from NNBF including reducing storm surge and nuisance flooding, and

2. Estimating the change in traditional economic impact by incorporating NNBF.

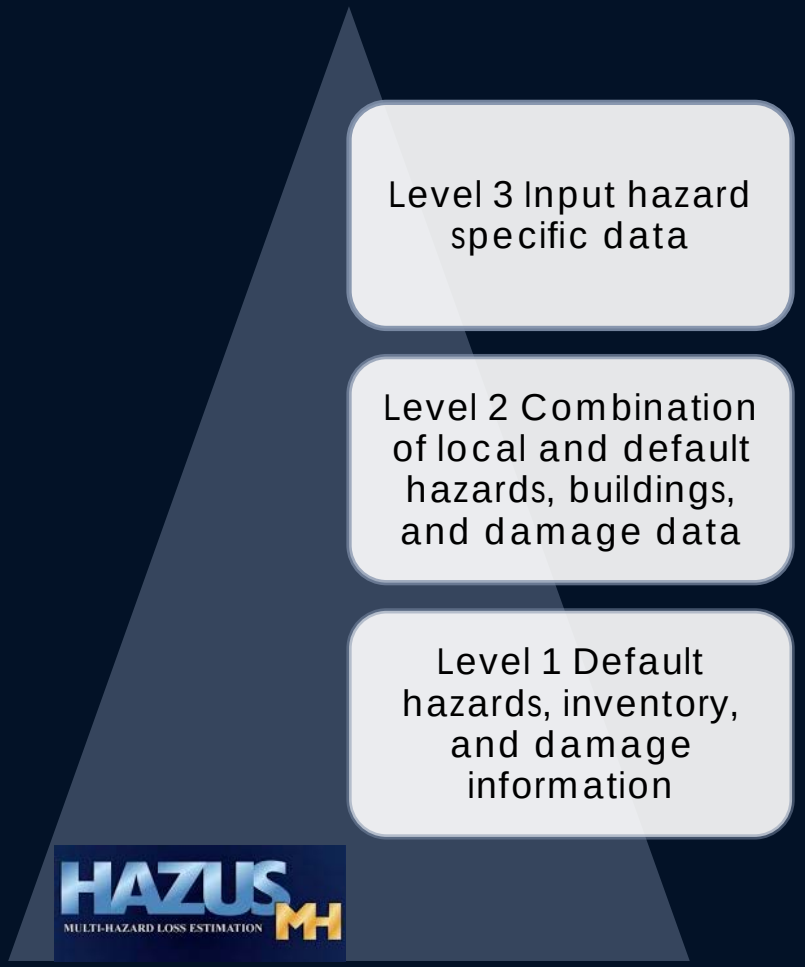
How do we do it?

HAZUS

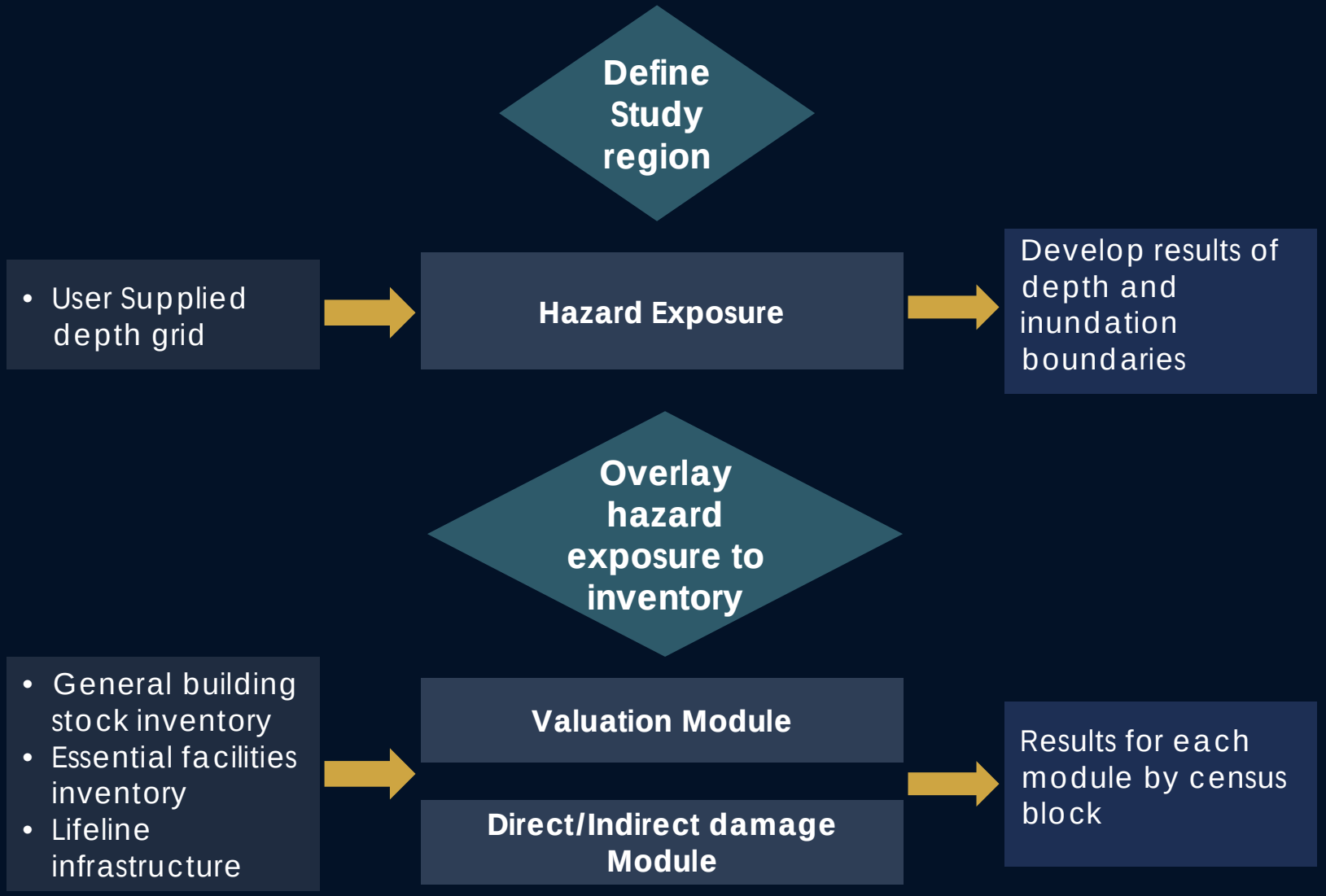
- Developed by the Federal Emergency Management Agency (FEMA) to map and display hazard.
- Allows users to estimate damage and economic losses buildings and infrastructure, as well as the impacts of natural disasters on populations.
- Model results can be enhanced with user-supplied data and models.

HAZUS User Levels

- **Level 1** requires minimal user interface and data
- **Level 2** requires user-supplied data for more detailed analyses
  - Incorporates site-specific flood hazard data
  - Detailed building data
- **Level 3** expert adjustment of analysis parameters and use of advanced HAZUS capabilities



Flood Model Methodology



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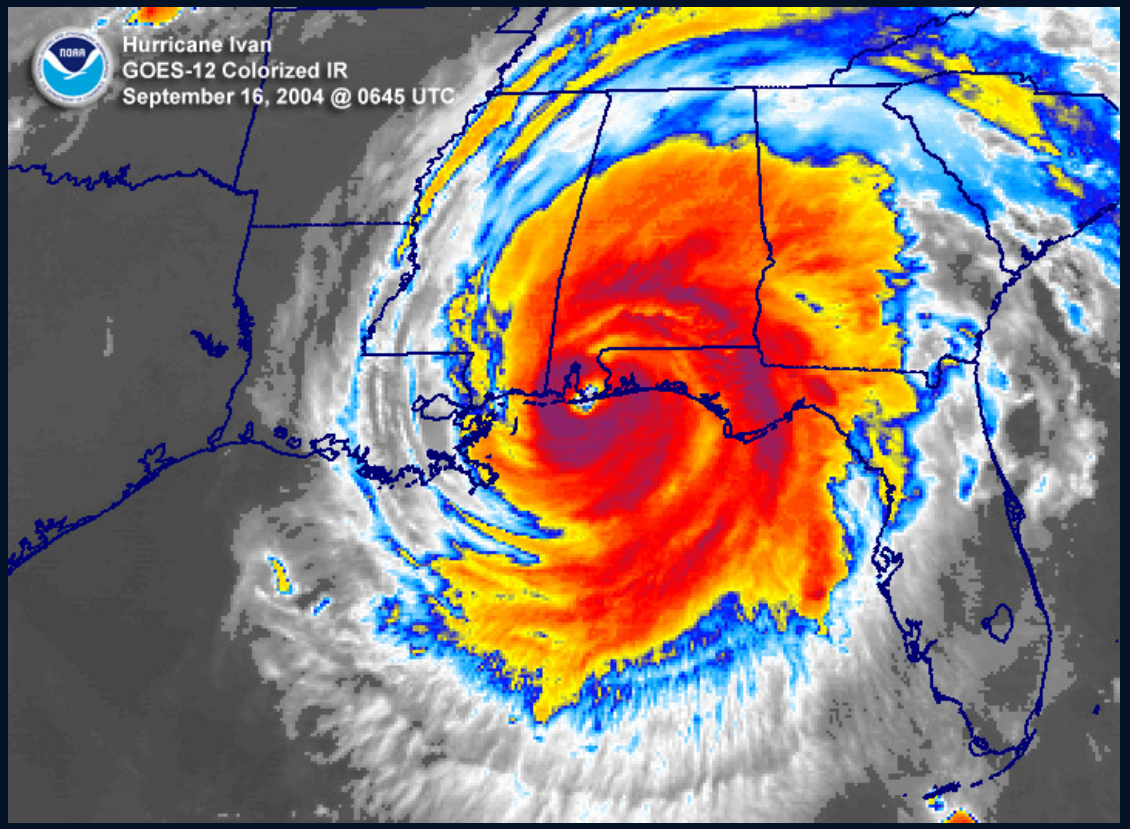
Example Scenario: Hurricane Ivan

- Landed September 16, 2004, West of Gulf Shores, AL
- Surge heights 10-15 ft

- Total US Damage estimate $14.2 B.
- Caused extensive overwash and erosion.



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Flood Model Methodology

Define Study region

- User Supplied depth grid

→ **Hazard Exposure** →

Develop results of depth and inundation boundaries

Overlay hazard exposure to inventory

- General building stock inventory
- Essential facilities inventory
- Lifeline infrastructure

→ **Valuation Module**

Direct/Indirect damage Module

→ Results for each module by census block

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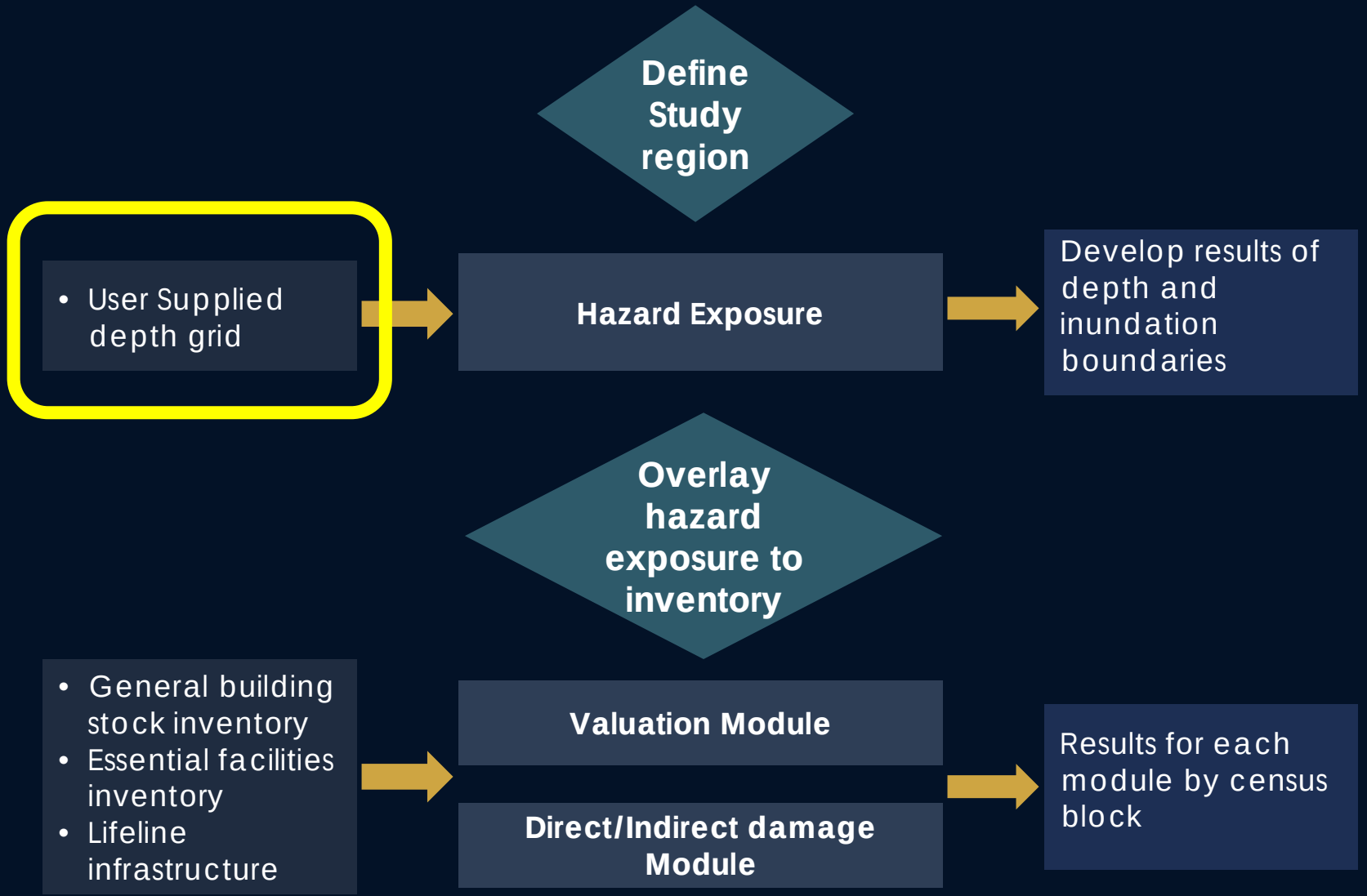
Region details (Franklin County)

- 541 sq mi
- 2,141 census blocks
- >4,000 households
- Population 11,549 people (2010 Census bureau data)
- Estimated 8,423 building in the region with replacement value of 1,726 M dollars (2010)
- ~91.73% of buildings are residential housing

Flood Model Methodology



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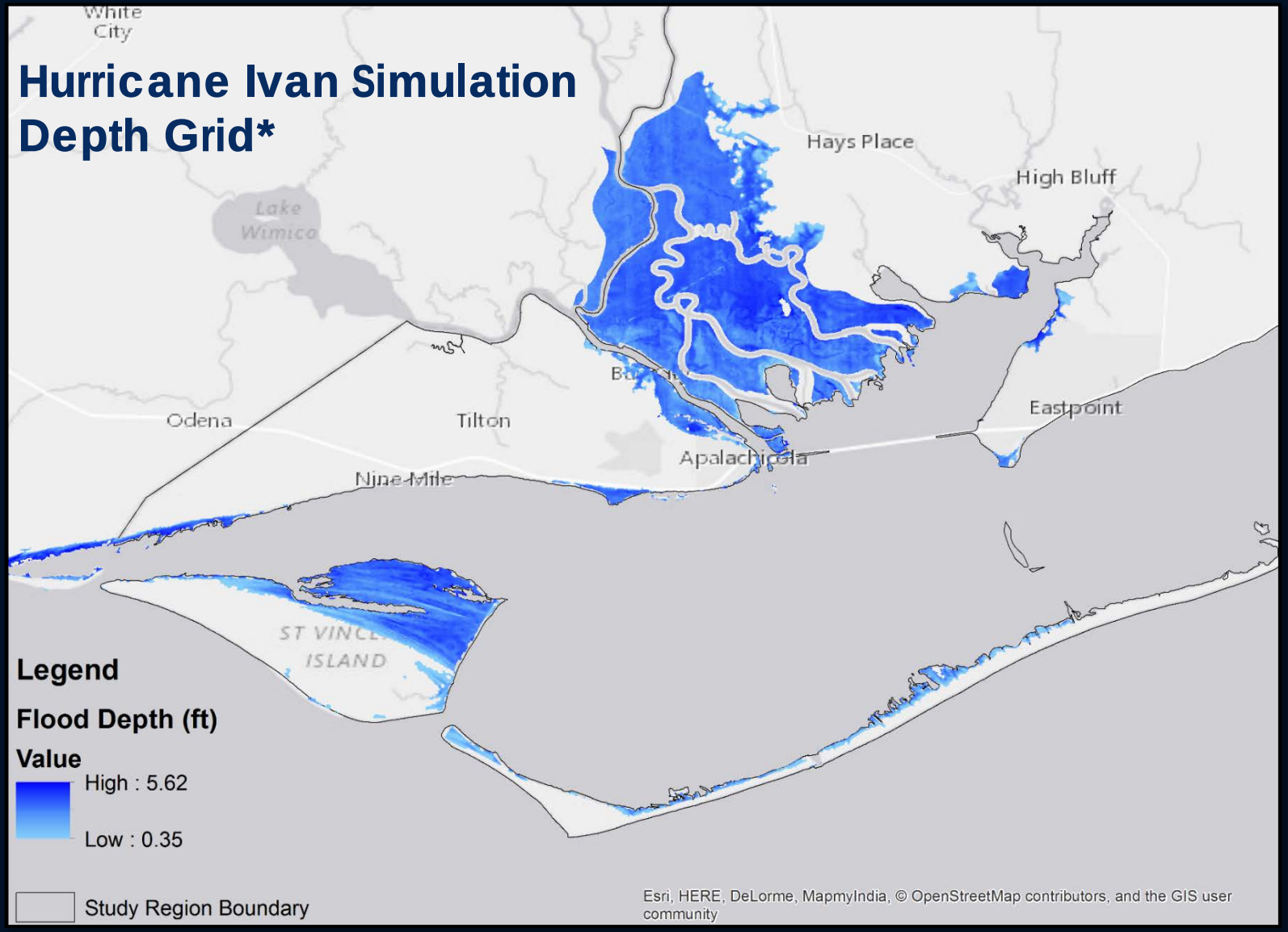
Hurricane Ivan Simulation Depth Grid*



*Maximum inundation depth above ground

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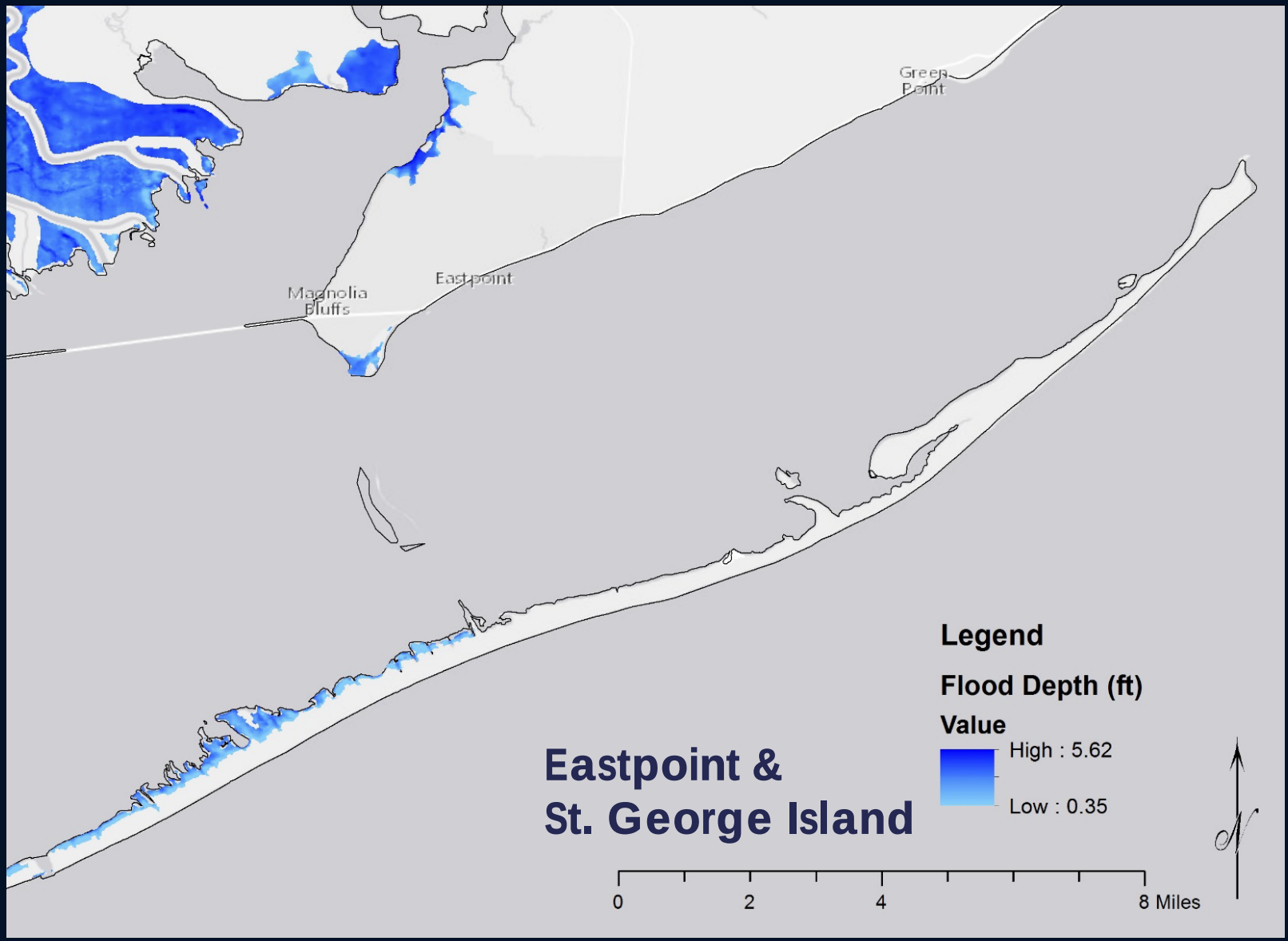

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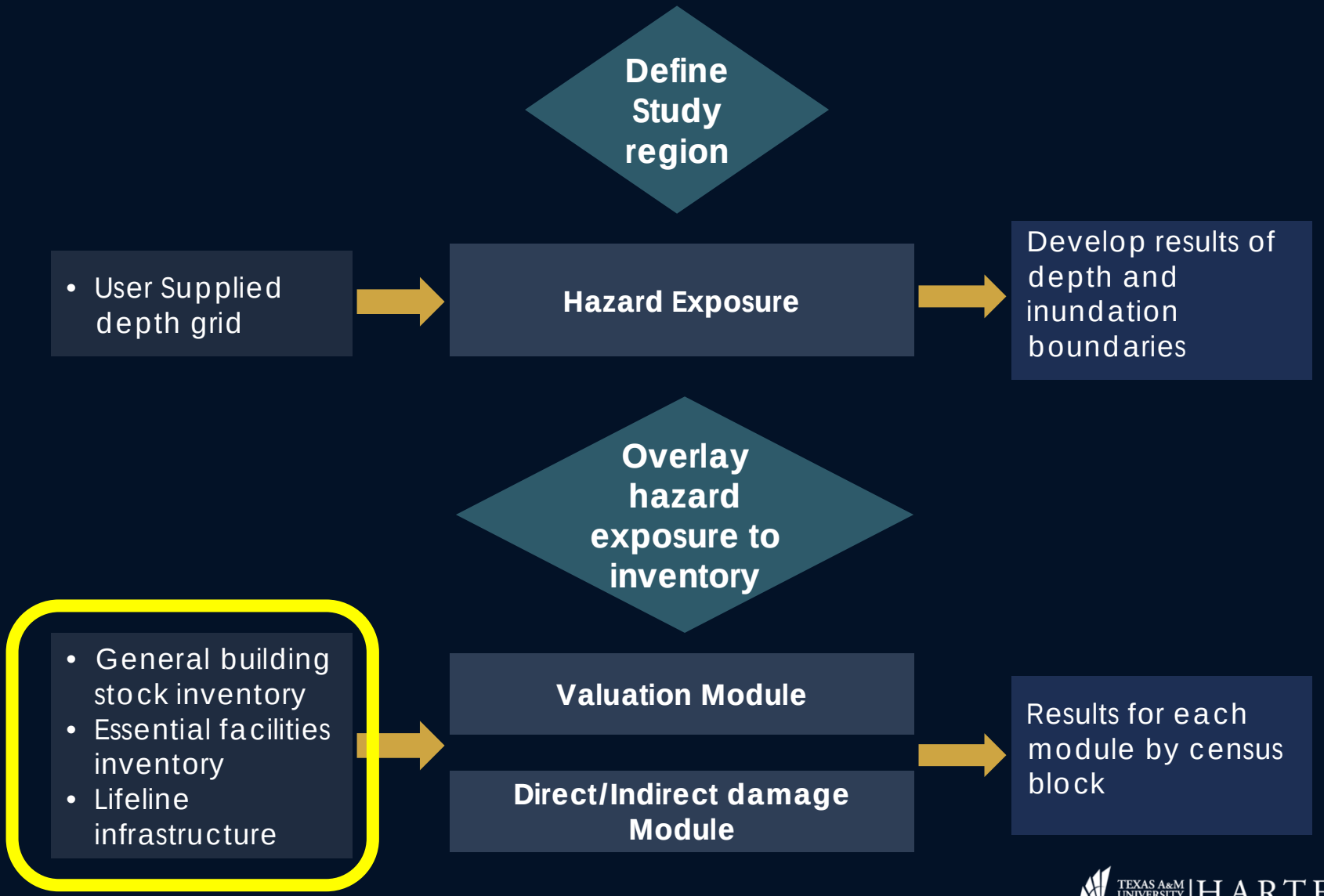
Flood Model Methodology



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HAZUS Inventory

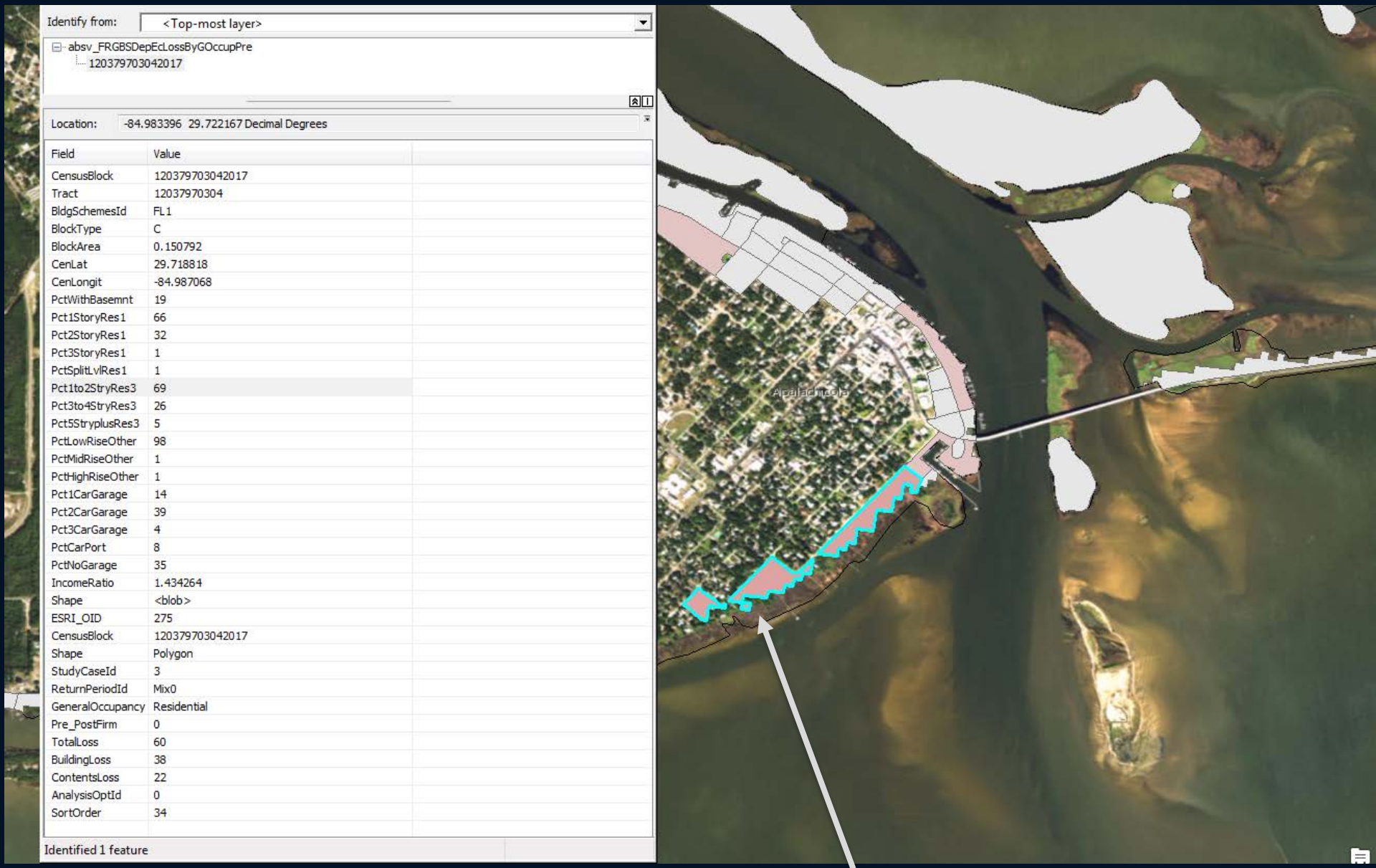
- General Building Stock (GBS)
- Essential Facilities
- High Potential Loss Facilities *
- Transportation Systems
- Lifeline Utility Systems
- Hazardous Materials *
- Agricultural Products*
- Vehicles data
- Demographics

*not available in this example

General Building Stock

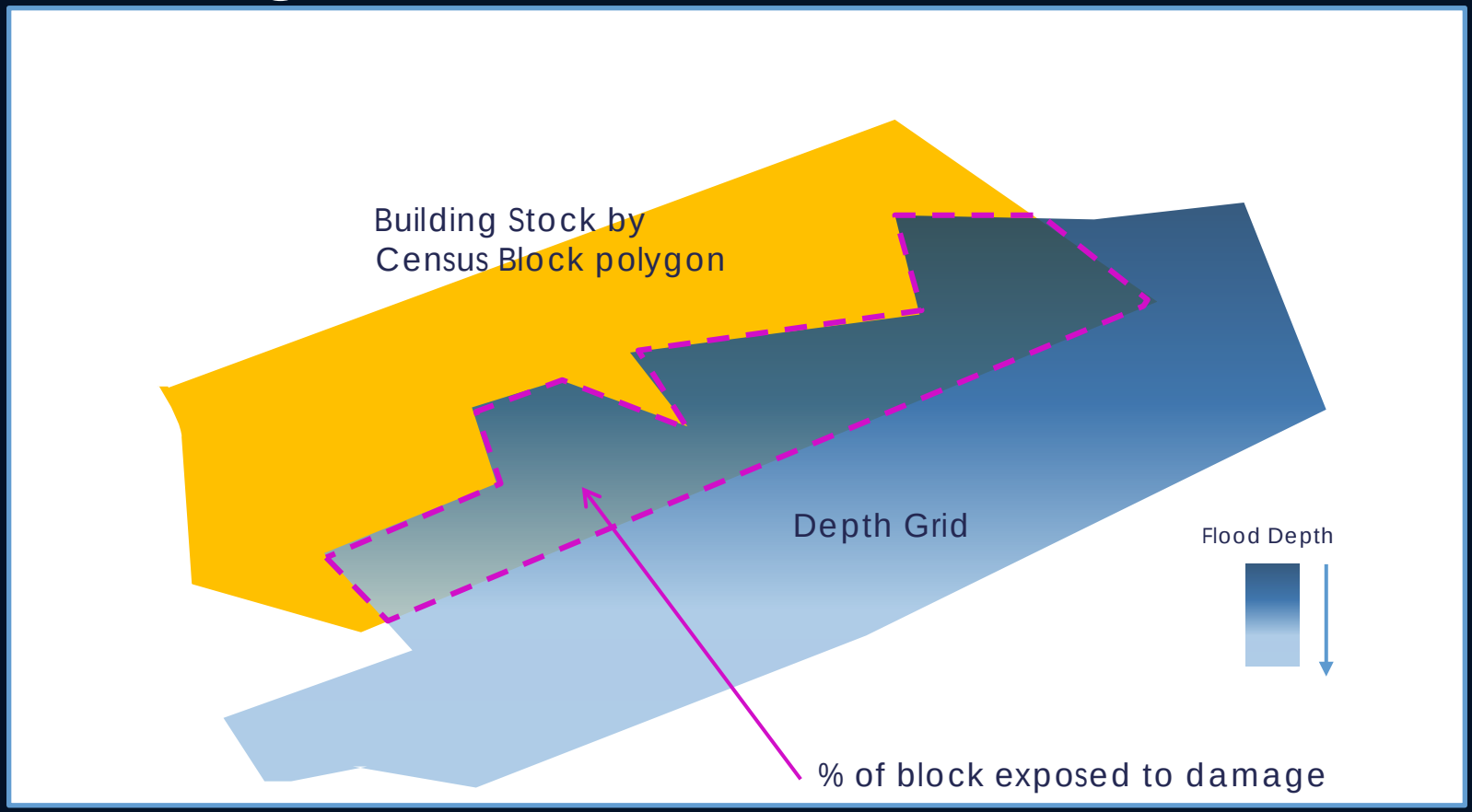
GBS was developed from the following information:

- Census population and housing (Bureau of Housing)
- Business Population Report aggregated by Std Industrial Classification and census block (Dun & Bradstreet)
- Housing Characteristics, Residential Energy Consumption & Commercial Buildings (Department of Energy)



General Building Stock is Summarized by census block

Damage Estimation



- Damage is estimated in percent and weighed by the area of inundation at a given depth.
- The entire composition of the GBS is assumed to be evenly distributed within the census block.

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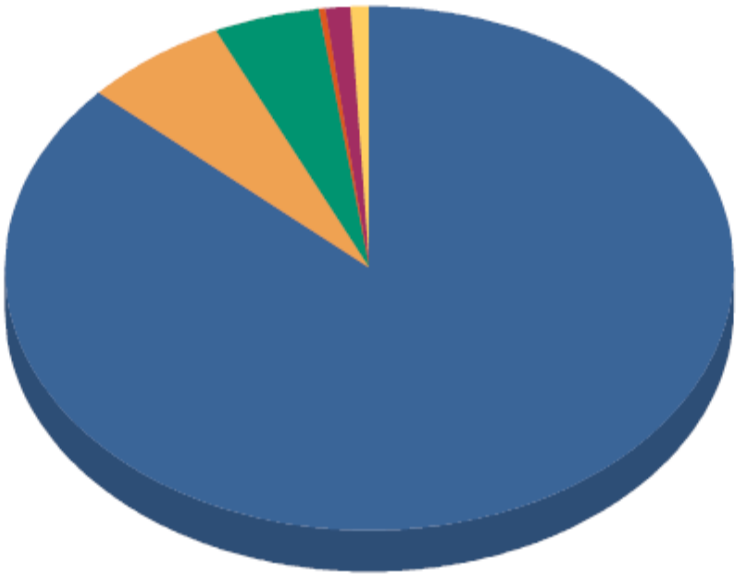
Building Exposure

Building Exposure by Occupancy for the Scenario ($1,000's)



Residential	$287,007
Commercial	$21,502
Industrial	$15,198
Agricultural	$974
Religion	$4,182
Government	$2,358
Education	$112
Total:	$331,333

*Scenario (Flood depth grid extent)

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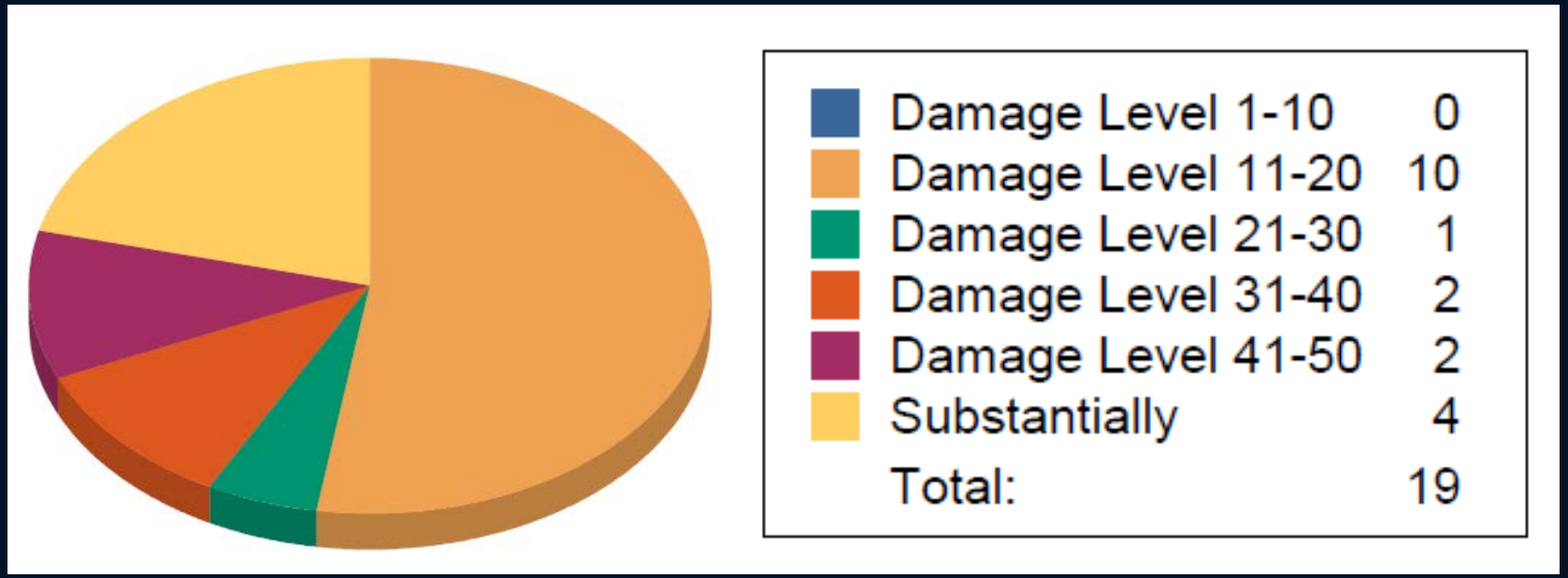
Count of building damage by level (%)



Building types:
Masonry (14), Wood (2), Manufactured housing (3)

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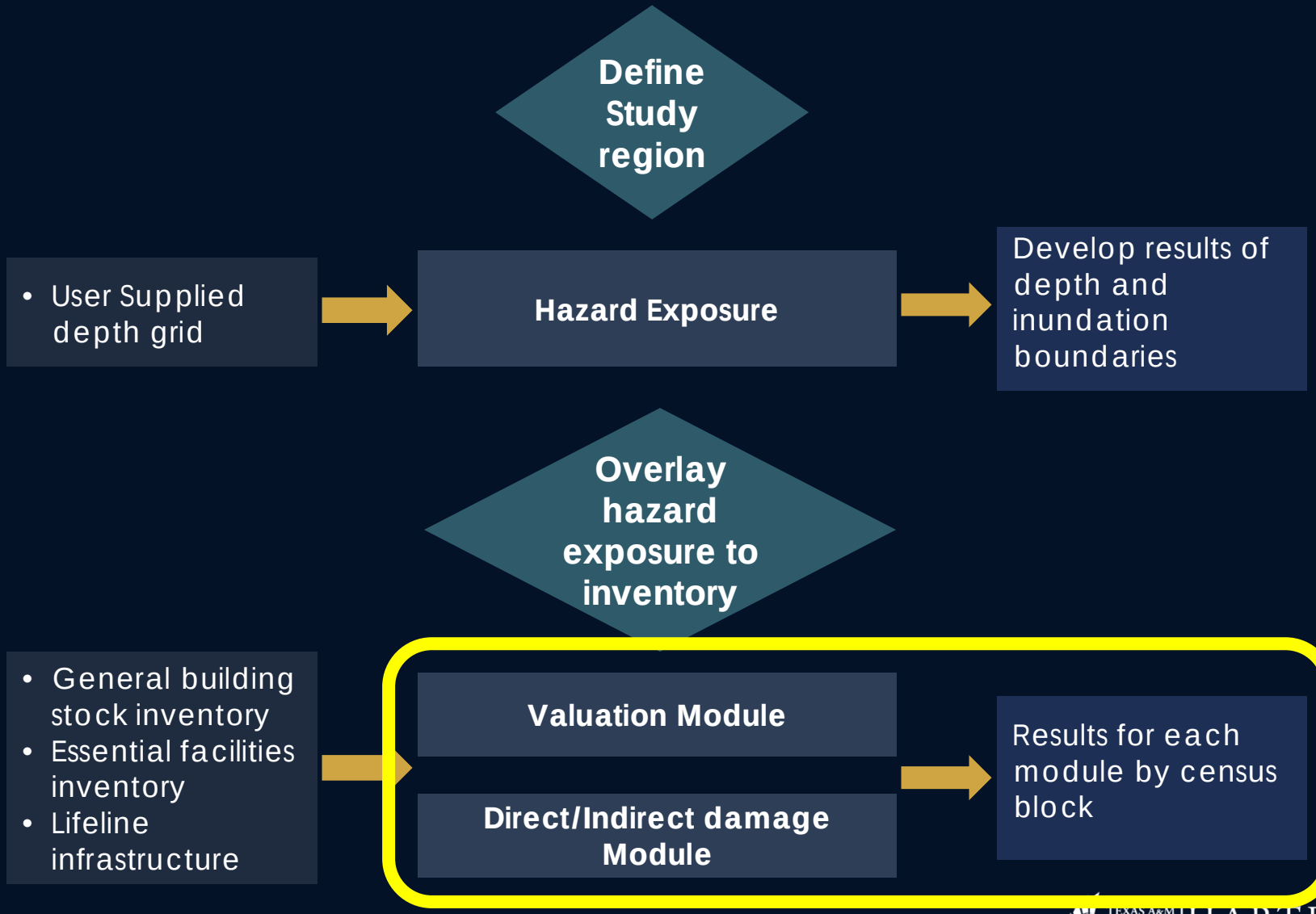
Flood Model Methodology



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Related economic losses estimates ($M)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	3.99	0.24	0.56	0.08	4.87
	Content	2.4	0.82	1.88	0.46	5.55
	Inventory	0	0.03	0.34	0.02	0.39
	Subtotal	6.39	1.08	2.778	0.56	10.81
Business Interruption						
	Income	0	0	0	0	0
	Relocation	0.01	0	0	0	0.01
	Rental Income	0	0	0	0	0
	Wage	0	0.01	0	0.01	0.01
	Subtotal	0.01	0.01	0	0.01	0.03
	Total	**6.41**	**1.09**	**2.78**	**0.57**	**10.85**

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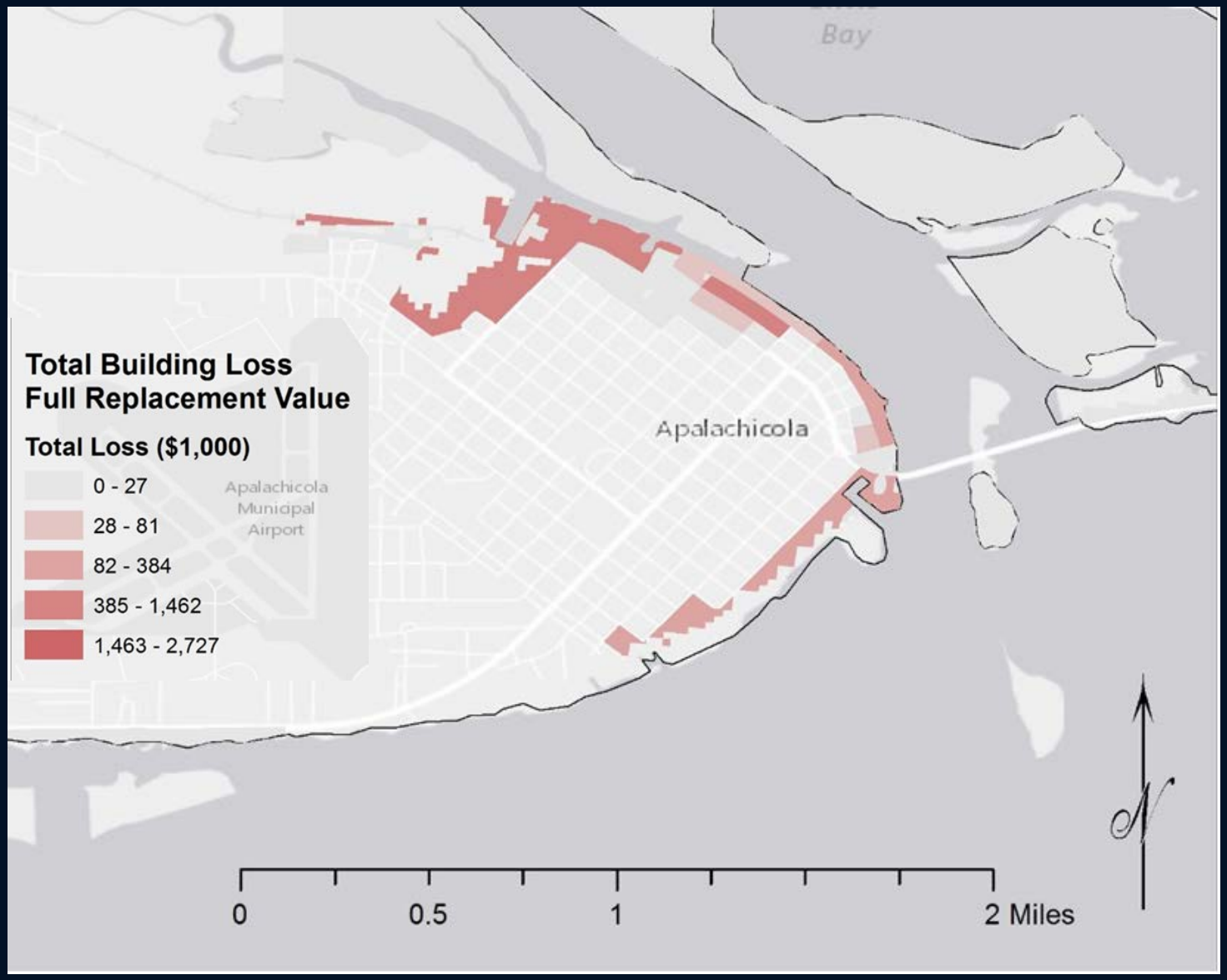

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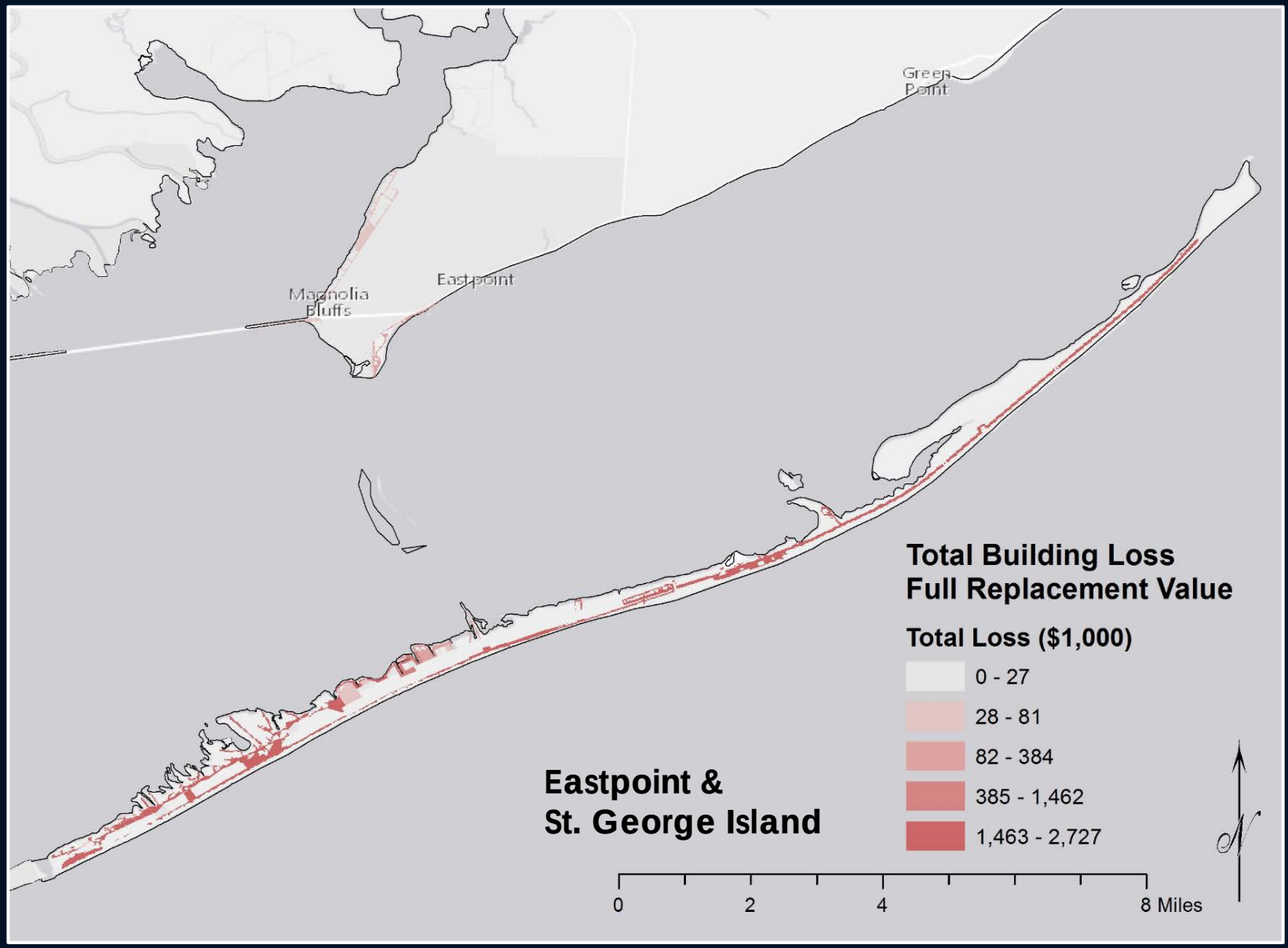

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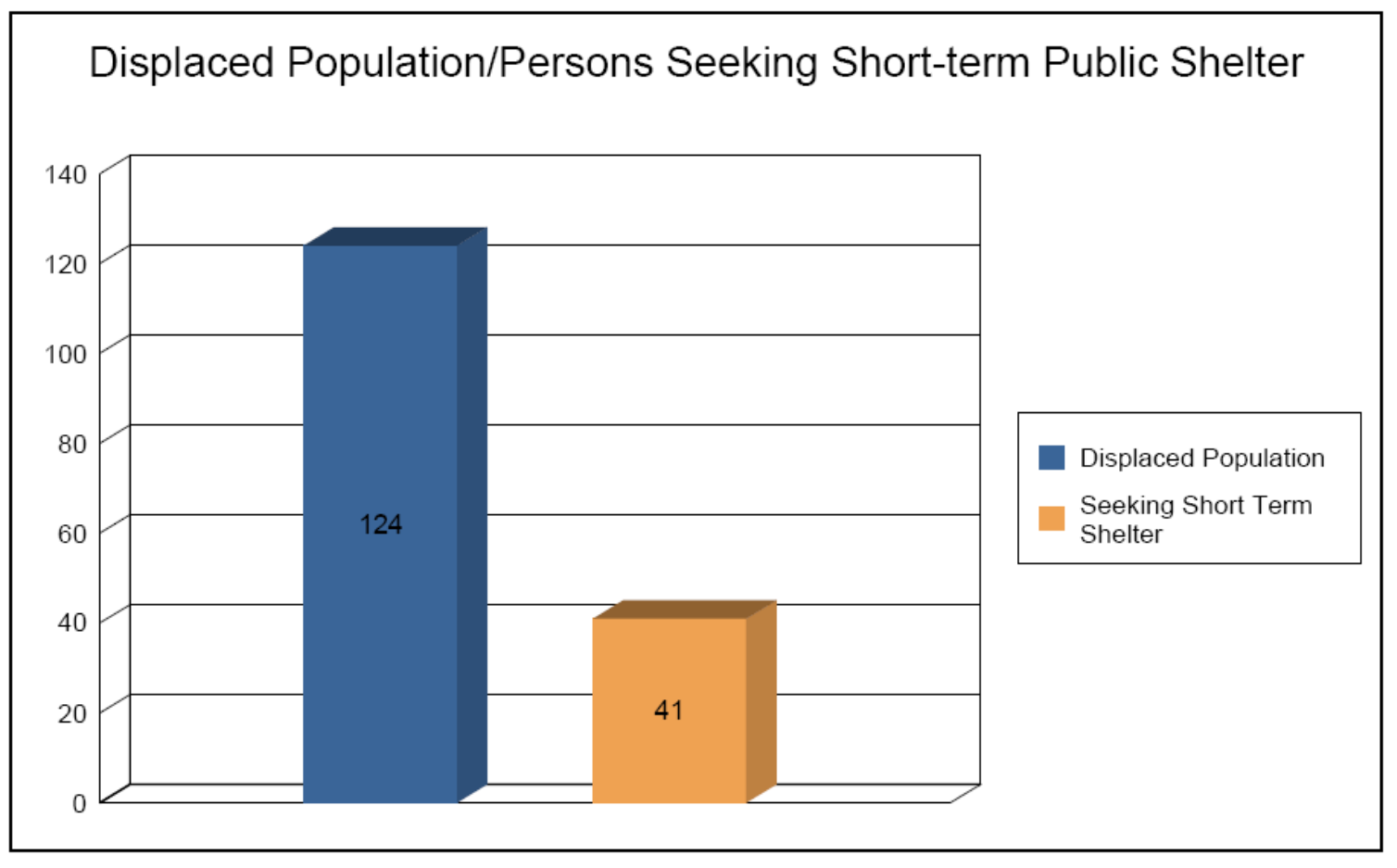
People



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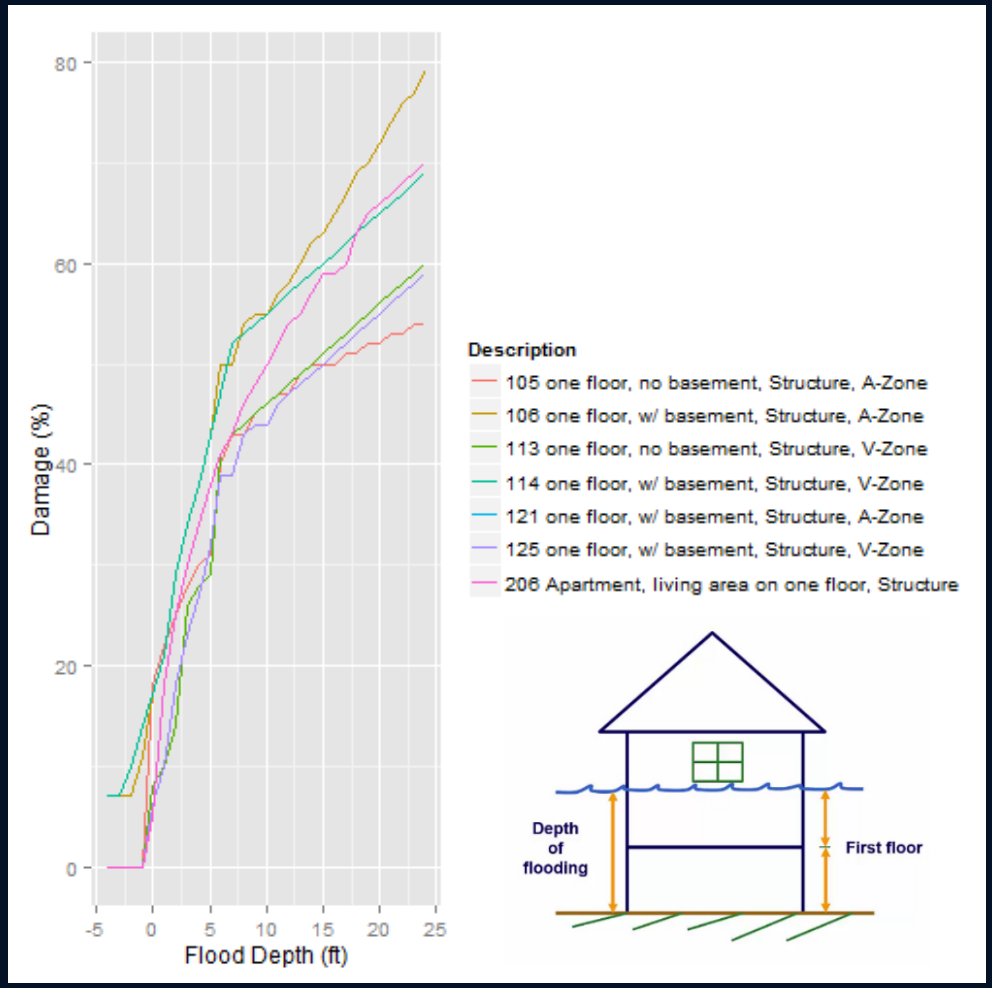
Takeaways

- HAZUS is powerful tool for calculating impact of flooding events (storm surge and nuisance)
- We have provided an example that is better than the default settings (depth grid).
- We can do much better with local datasets that describe the building stock in greater detail.

Questions?

Loss estimation

Damage estimates are estimated using a library of depth damage functions- they assigned based on characteristics of buildings



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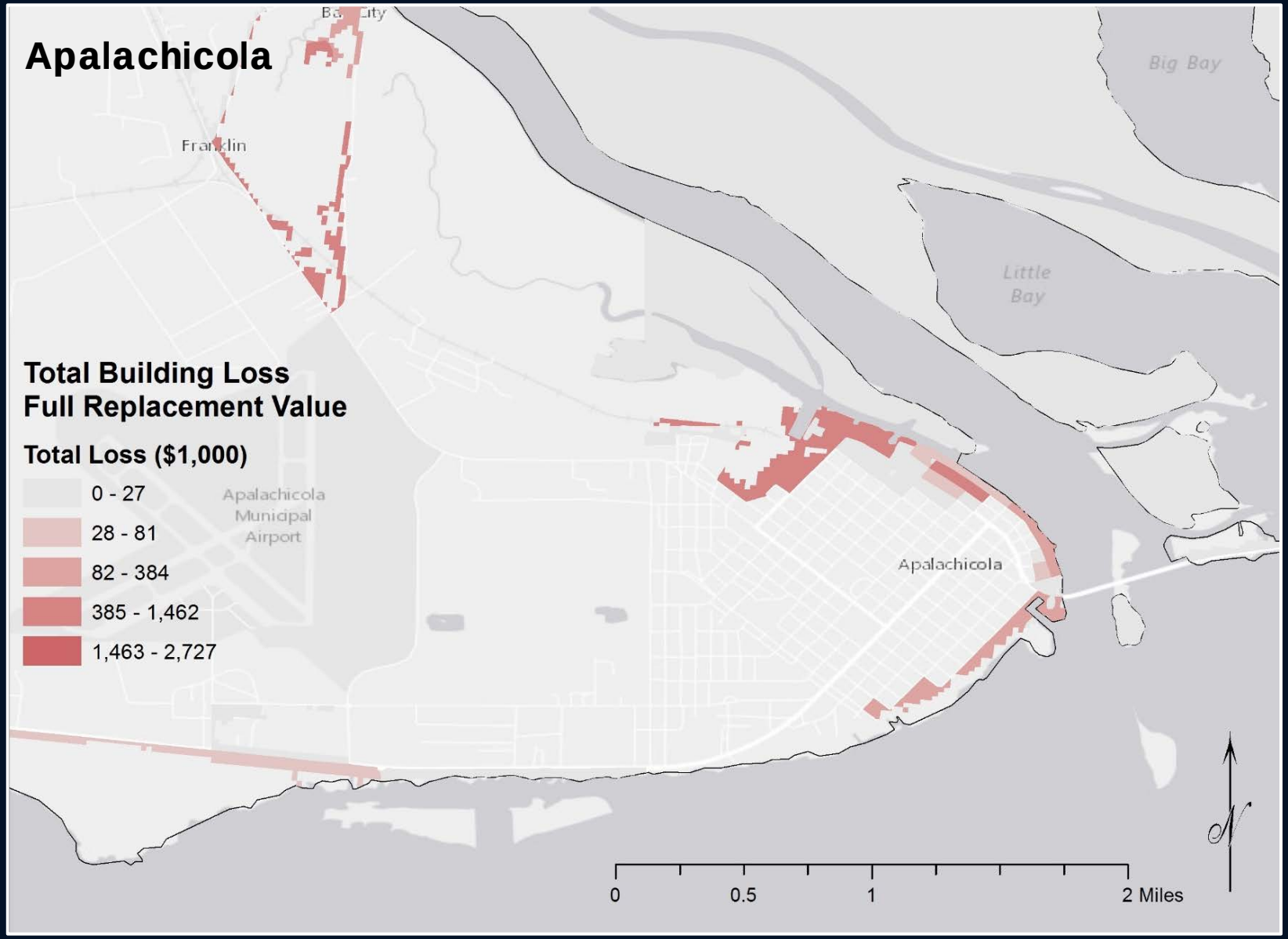

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Depreciated direct economic losses for buildings ($M)

Capital Stock Losses		
Building Loss	Content Loss	Total Loss
$2.7	$2.8	$5.5

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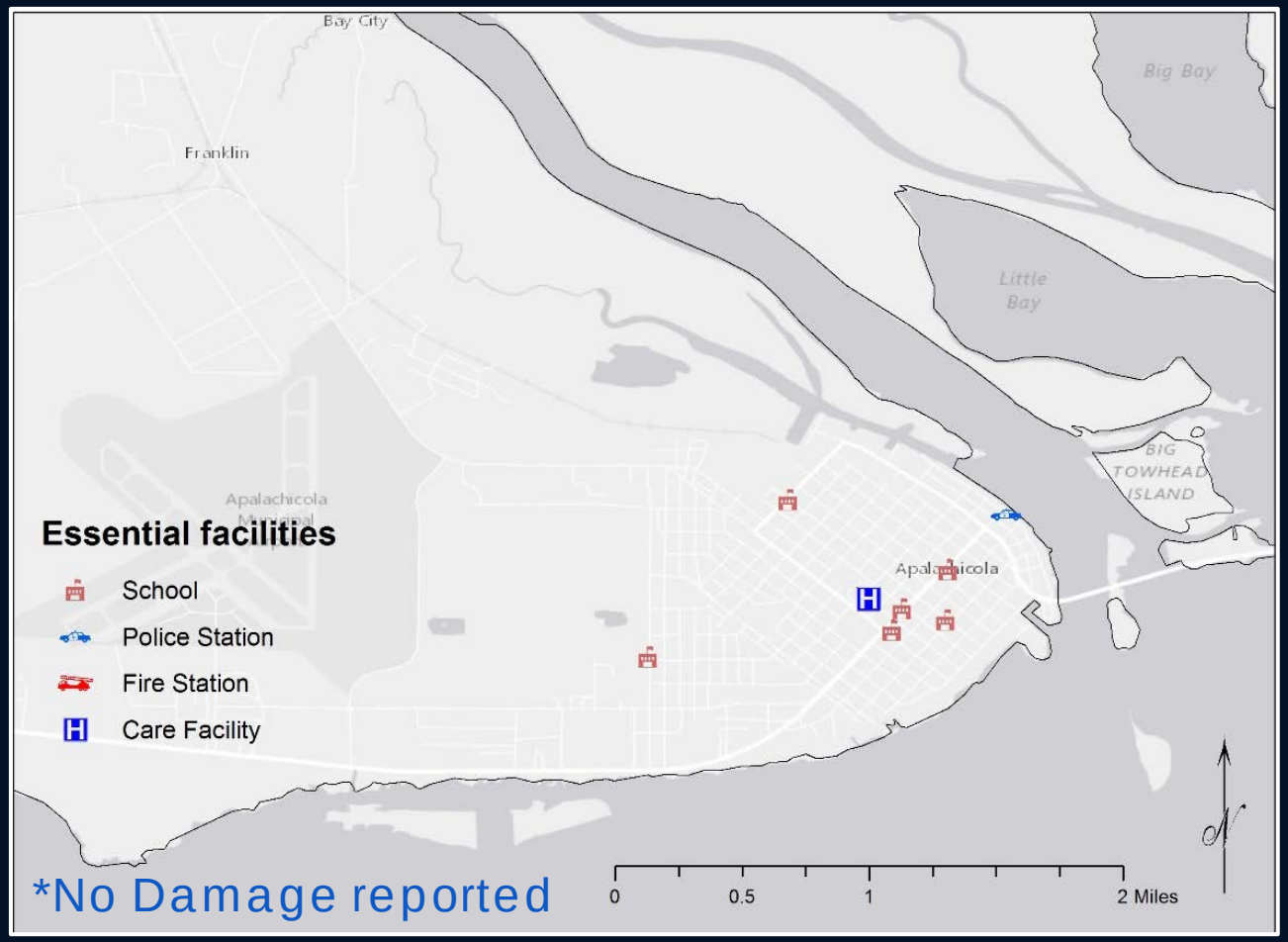
Essential Facilities



Similar to this report: User defined facilities-user provided table of structures . Damage functions based on occupancy code or user defined.

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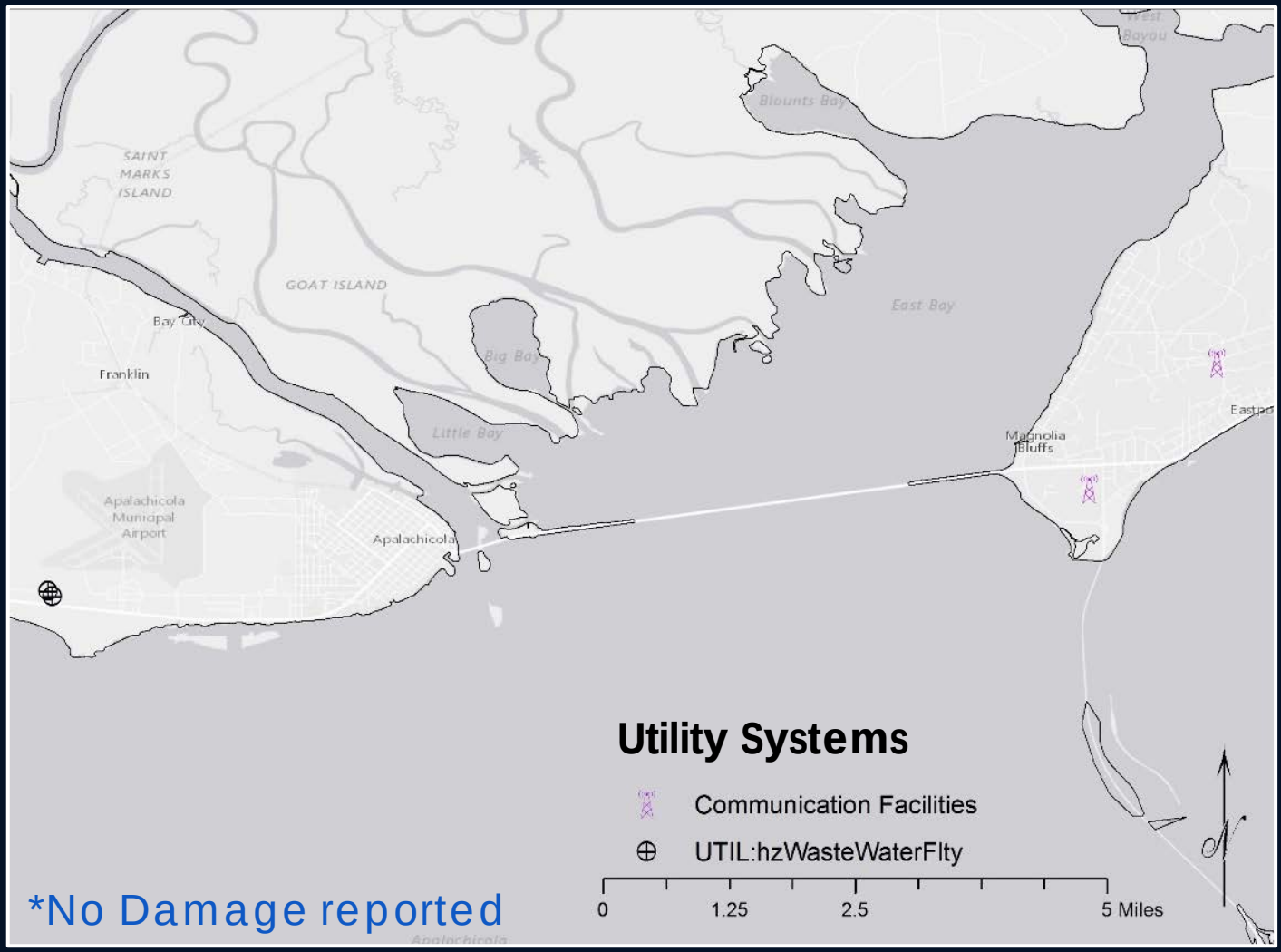
Exposure of Utility Systems



*No Damage reported

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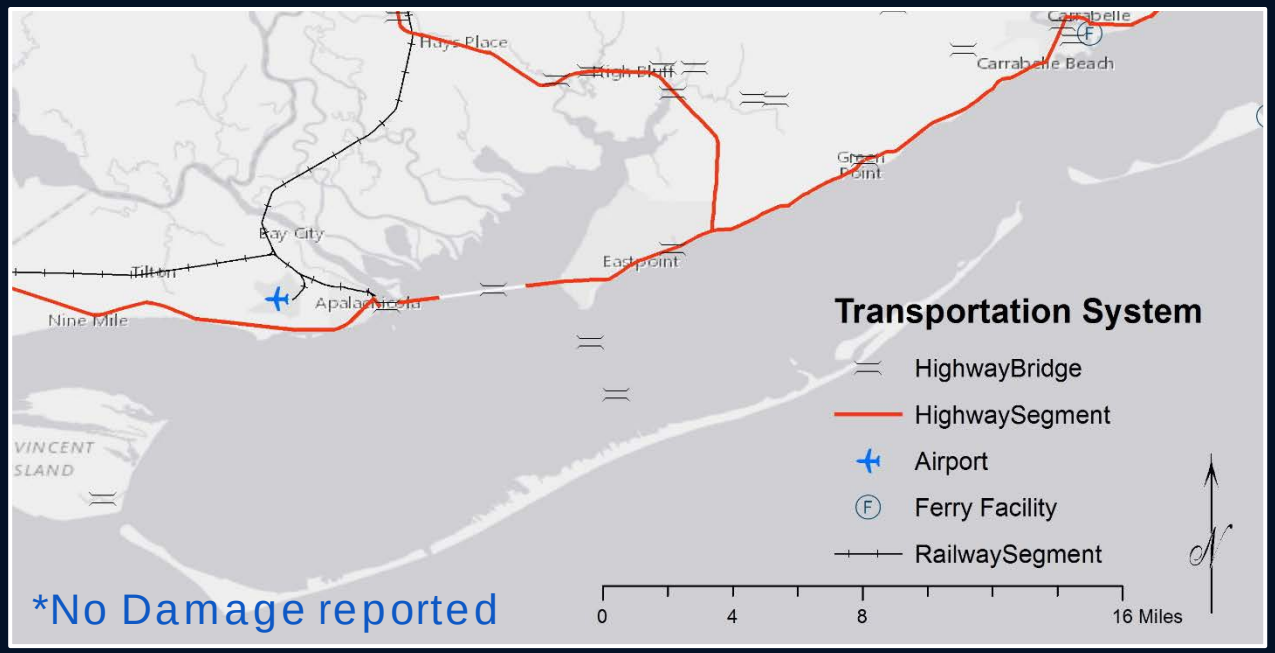
Transportation System Exposure ($M)



Transportation Systems (Franklin County)								
	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airports	Total
Segments	667	47	0	0	0	0	114	828
Bridges	178	0	0	0	0	0	0	178
Tunnels	0	0	0	0	0	0	0	0
Facilities	0	0	0	0	0	3	11	14
Total	845	47	0	0	0	3	125	1,020

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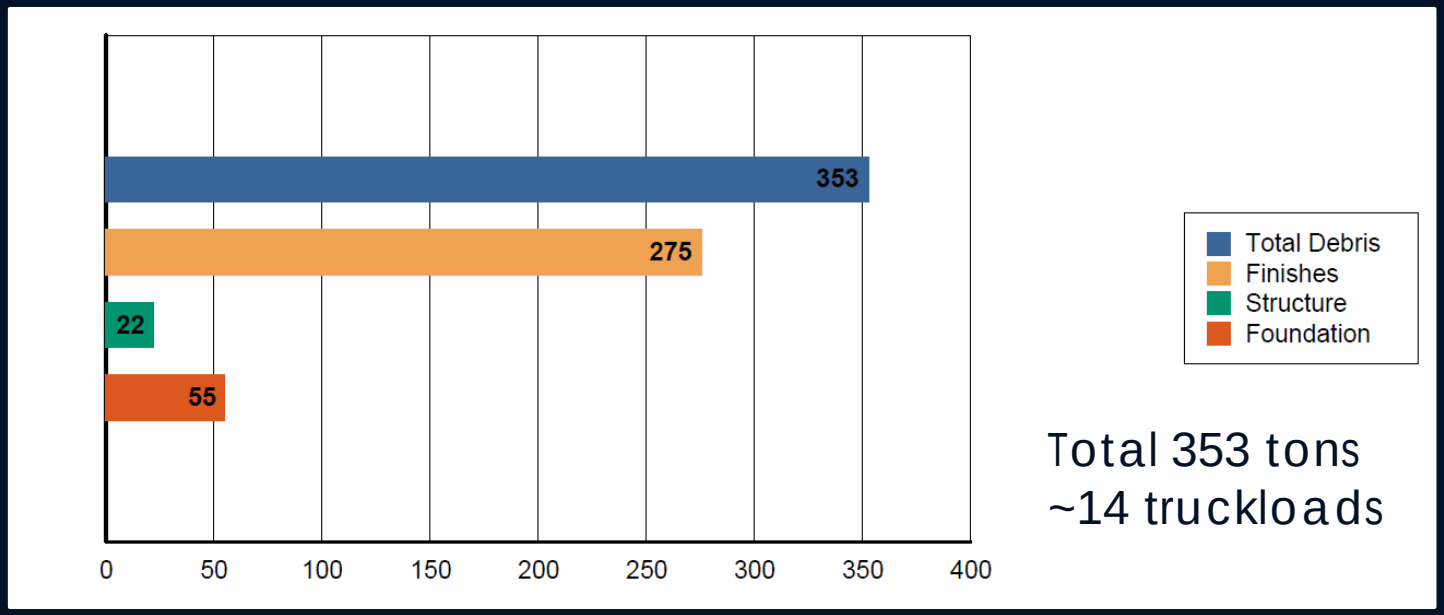
Direct Economic Losses for Vehicles

	Day	Night
Car	$1,218,212	$1,478,072
Light Truck	$335,119	$390,879
Heavy Truck	$42,025	$46,315
Total	$1,595,356	$1,915,266

- Vehicle inventory is developed using standard traffic models for planning and is based on census block area by specific occupancy.
- Valuation based on average new and used vehicle.

Debris Breakdown (tons)



- Debris can include flood-damaged building finished and structural components, and does not address vegetation or sediment materials.
- Estimated using depth of flooding, building square footage, foundation type
- Model does not account for flood borne debris impacts

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Indirect Economic Losses Module

- Inputs include:
  - Current employment level
  - Income level
  - Composition of economy
  - % rebuilding
  - Unemployment rate
  - Outside aid
  - Interest rate
  - Stimulus
  - Property tax rate
  - Sales tax rate
  - Tourism loss and restoration
  - Among others…

* Data can be supplemented using IMPLAN Input-Output methodology

Output covered today

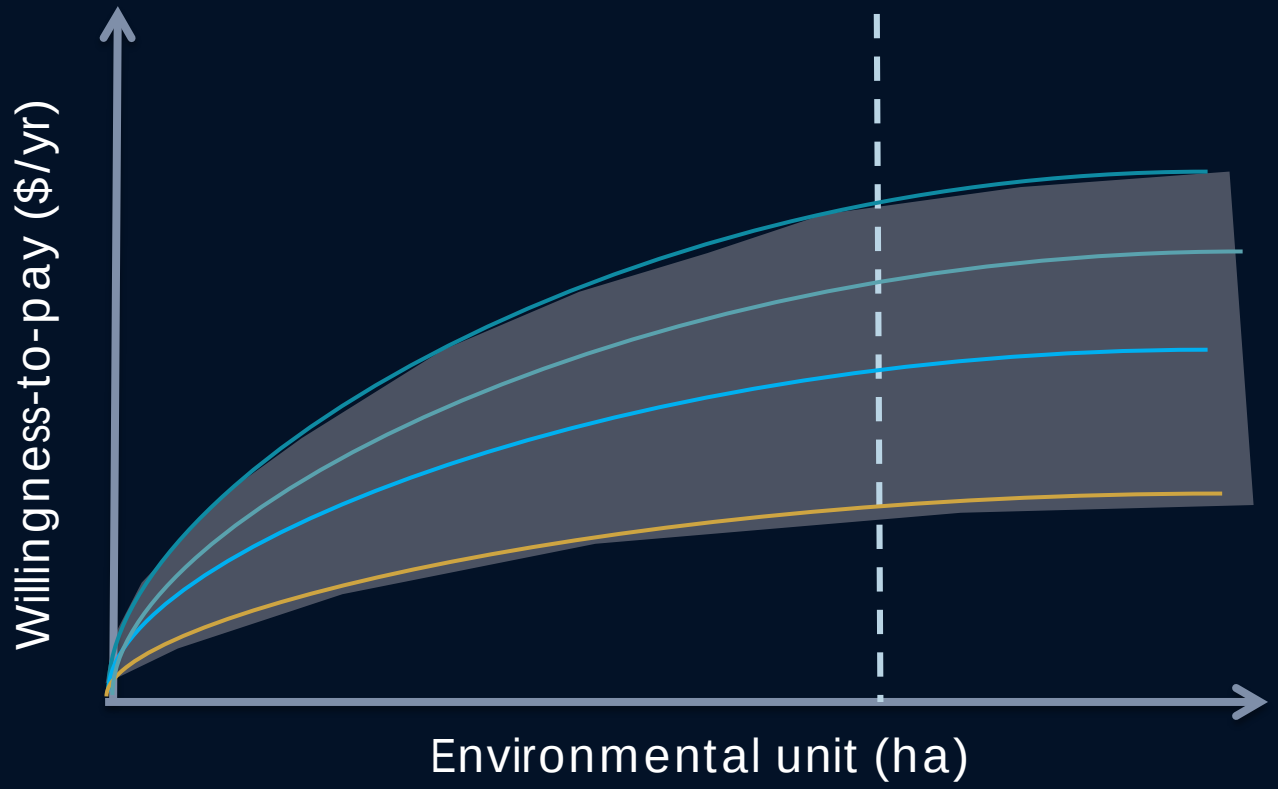
- Building exposure and building related losses
- Essential facilities exposure
- Transportation systems exposure
- Lifeline utility systems exposure
- Vehicle losses
- Direct economic and social Losses
- Indirect economic losses

Not Covered:

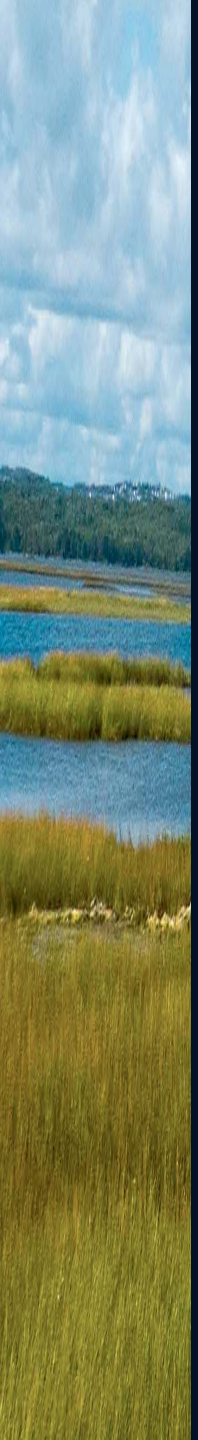
- High Potential Loss Facilities
- Hazardous Materials
- Agricultural Products

Using Value Transfer for estimation of ecosystem service values

Meta-regression Analysis Value Function Transfer



Benefit transfers assumes that there is an underlying meta-valuation function that links the value of the resource or activity to the characteristics cross space and time.



Galveston Sea Level Rise Example (Yoskowitz et al. 2016)

$$ln(y_i) = a + b_s X_s + b_w X_w + b_E X_E + u_i$$

Study characteristics:
- Valuation method
- Year of study
- Type of value

Socio-economic characteristics:
- Population density
- Income per capita
- % Female
- % Population with bachelor's degree

Habitat characteristics:
- Type
- Area
- Region
- Ecosystem Services

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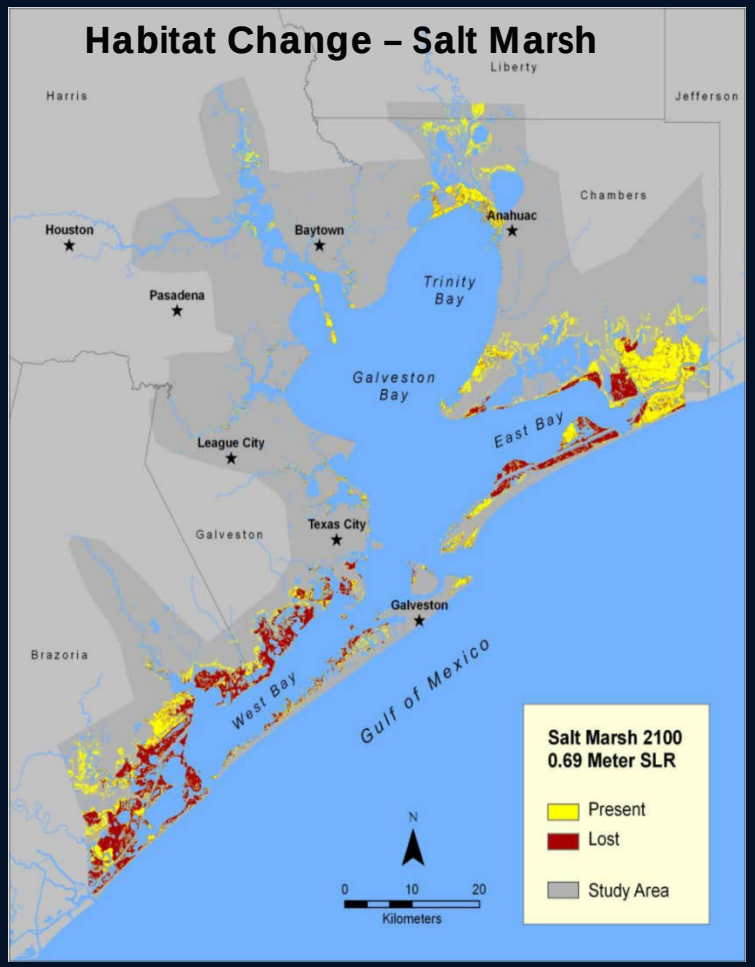
Match changes in habitat with the value of the ES



Bio-physical model output

Table 3. Explanatory variables[ab]

Variable	Coefficient	*P* value
Constant	2.319[c]	0.045
Marsh	–0.422[d]	0.053
Region code	–0.189[d]	0.069
(ln) Area	–0.390[b]	0.000
(ln) Income per capita	0.844[b]	0.000
Trend by units	–0.010	0.363
Coastal type	–0.181	0.340
Disturbance regulation	0.235	0.323
Waste regulation	0.081	0.774
Recreation	–0.604[c]	0.012
Aesthetics	–0.761[d]	0.082

[a]Ordinary least squares results: $R^2 = 0.604$; adjusted $R^2 = 0.556$; $N = 93$.
[b]Statistical significance at 1% level.
[c]Statistical significance at 5% level.
[d]Statistical significance at 10% level.

Valuation model output

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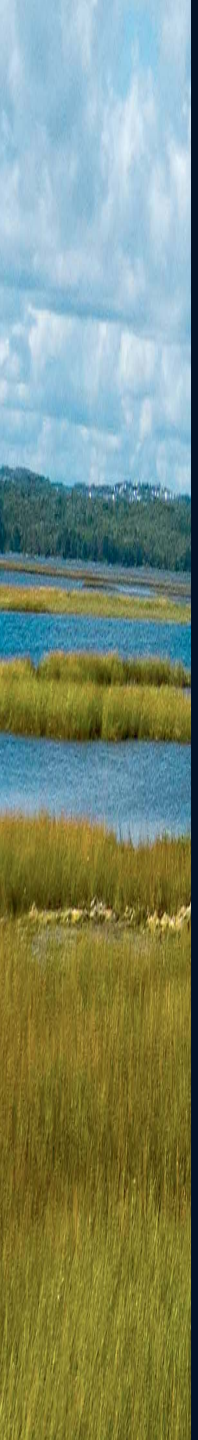

Value of ecosystem services provided by salt marsh in Galveston Bay under the A1Bmax sea level rise scenario (0.69m). All monetary values are in 2008 U.S. $

Salt marsh	Initial condition Total value in 2008 US$/y	2050 Total value in 2008 US$/y	Value differential from initial condition to 2050	Discounted value differential from initial condition to 2050	2100 Total value in 2008 US$/y	Value differential from 2050 to 2100	Value differential from initial condition to 2100	Discounted value differential from initial condition to 2100
Disturbance Regulation	79 974 534	77 044 671	–2 929 863	–846 611	74 223 275	–2 821 396	–5 751 259	–1 661 879
Waste regulation	56 104 939	54 049 537	–2 055 402	–593 927	52 070 229	–1 979 308	–4 034 710	–1 165 867
Recreation	11 576 100	11 152 010	–424 090	–122 545	10 743 621	–408 390	–832 479	–240 552
Aesthetics	8 066 123	7 770 621	–295 502	–85 388	7 486 059	–284 562	–580 064	–167 615
Total	155 721 697	150 016 840	–5 704 857	–1 648 471	144 523 184	–5 493 656	–11 198 513	–3 235 914

[a]The losses in total values are due to a decrease in areal extent; as marshes are lost and become scarcer, the per-hectare values increase but the total values decrease; discount rate = 3%.
[b]Intergovernmental Panel on Climate Change scenario; 0.69 m.

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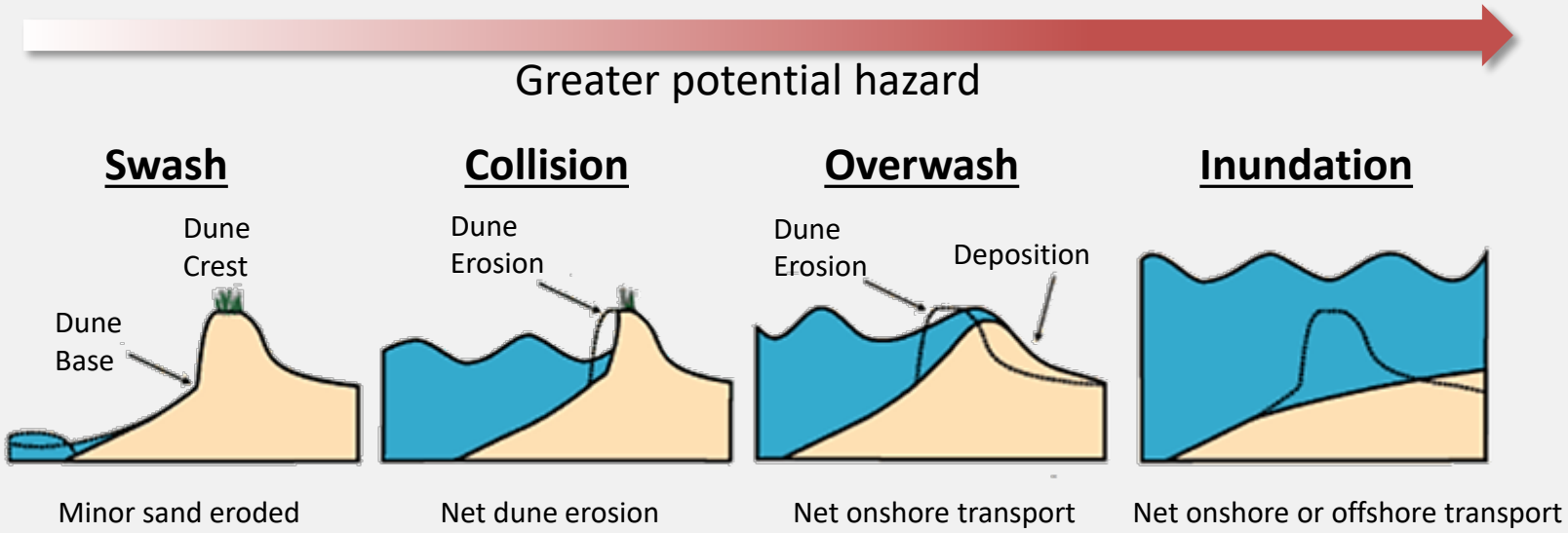
NGOM+N2E2:
Projecting Coastal Evolution under Rising Seas

Davina L. Passeri and Nathaniel G. Plant

U.S. Geological Survey

St. Petersburg Coastal and Marine Science Center

Short-term Coastal Change

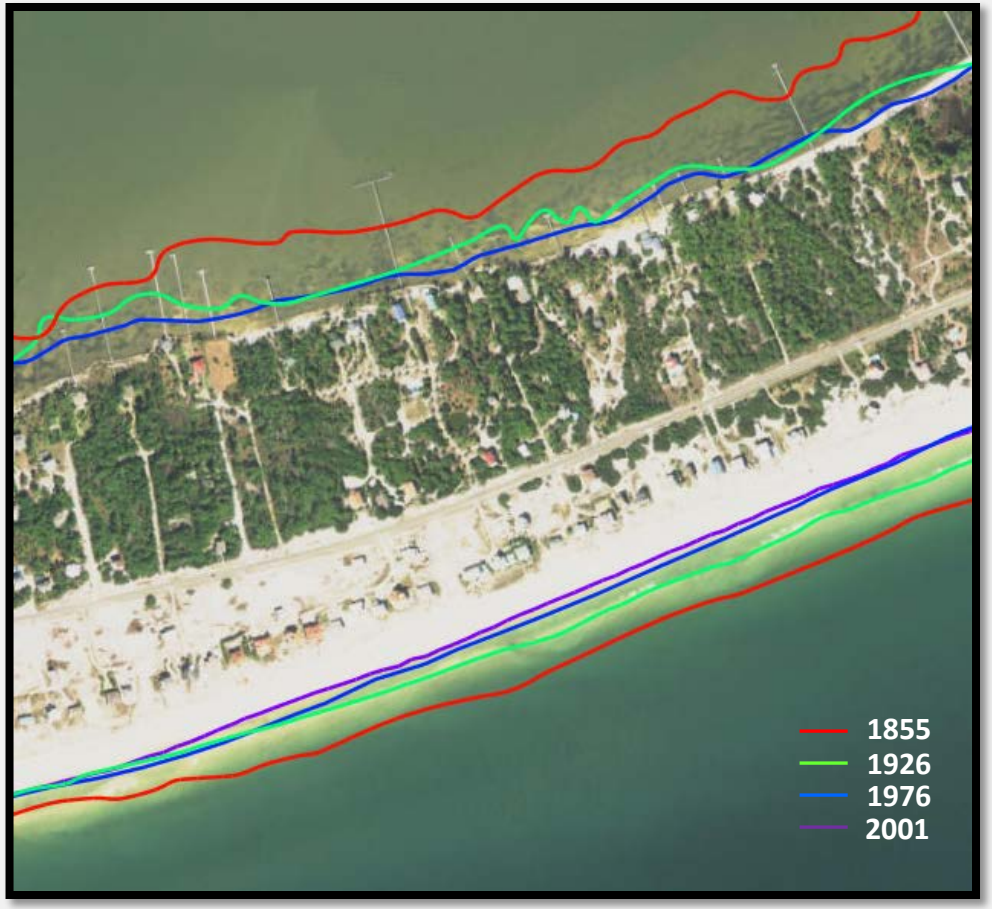


- Storms can alter the coast over hours and days
- Dunes are first line of defense against storm-induced water levels
  - Tides + storm surge + wave runup
- As water levels exceed dune heights, sand is transported
- Post-storm dune recovery occurs over years

Long-term Coastal Change

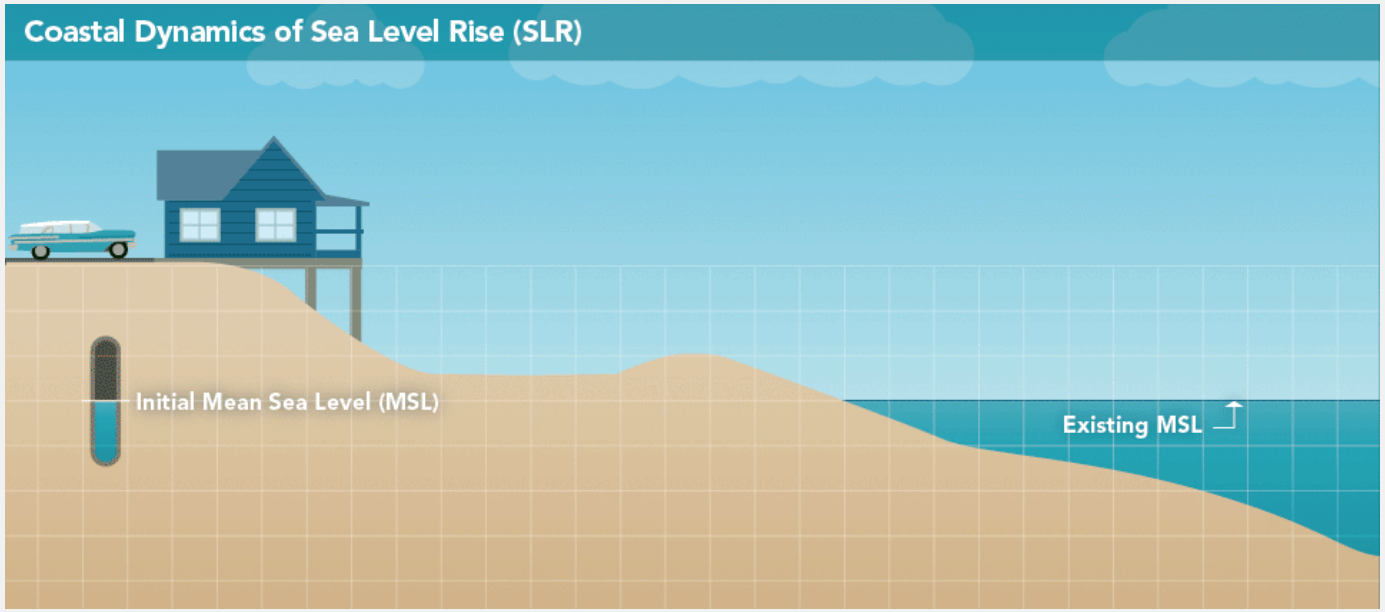
- Results from the combination of:
  - Storms
  - Changes in sediment supply
  - Anthropogenic alterations
  - Sea level rise
- Dynamic changes
  - Not just inundation
  - Gradual shoreline erosion

St. George Island Historic Shoreline Positions



EESLR-NGOM: What we did

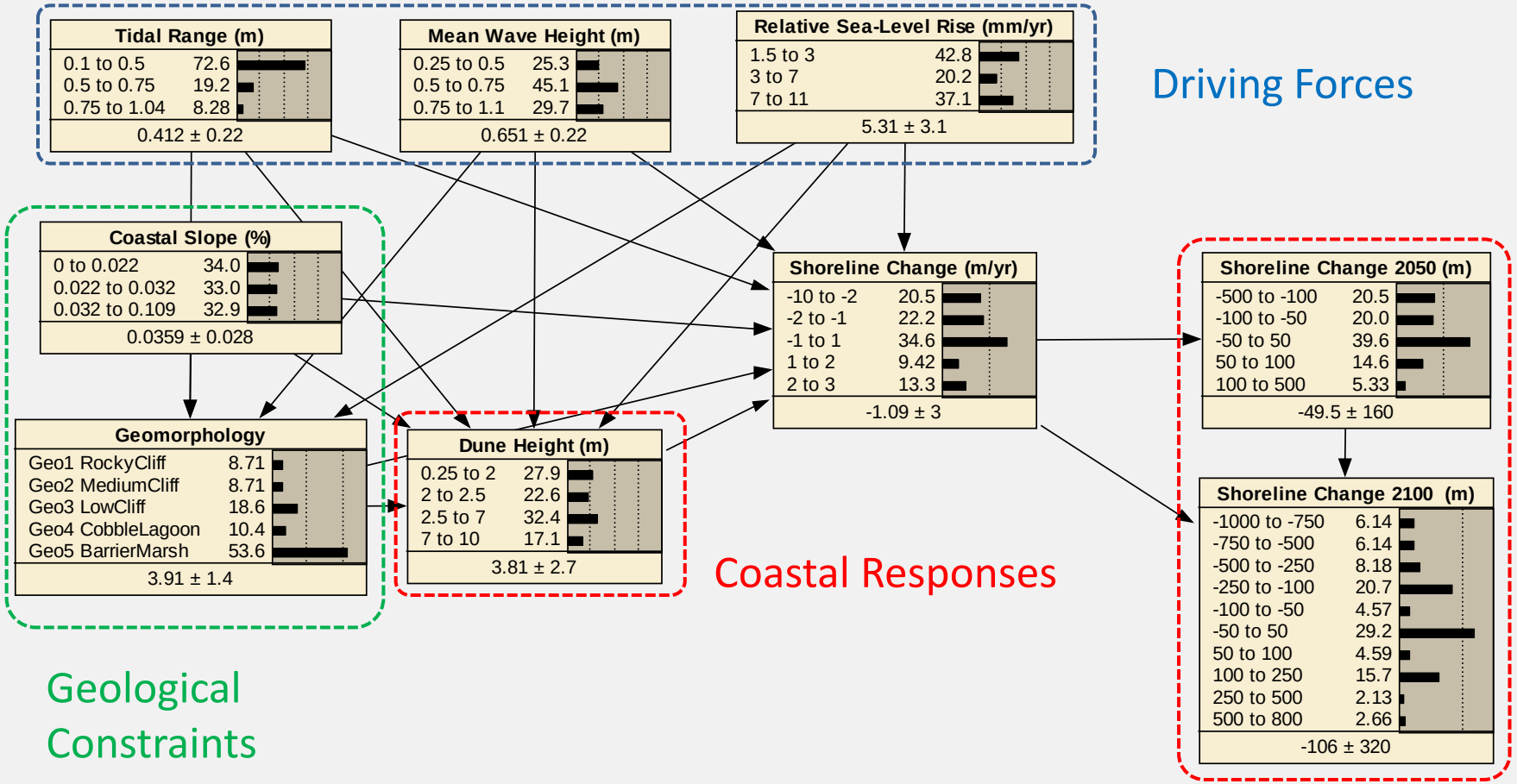
- Established the coastal dynamics of SLR
  - Coasts are not static
  - Future assessments should account for long-term changes in coastal morphology



Passeri et al. (2015) Earth's Future

EESLR-NGOM: Probabilistic Modeling

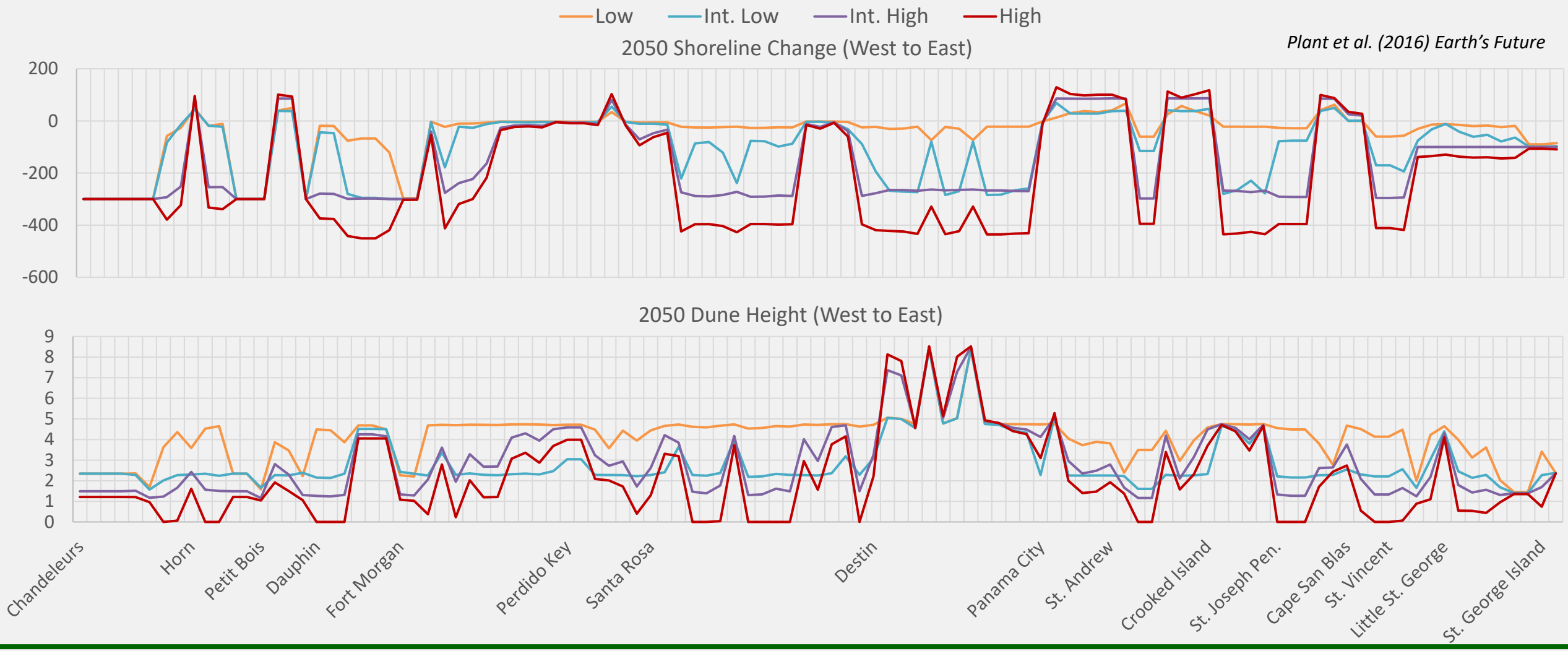
Bayesian Network



- Defines relationships between coastal variables
- Output: probabilistic projections of shoreline change and dune heights under SLR
- Benefit: can be applied across a large-domain with low computational expense

Plant et al. (2016) Earth's Future

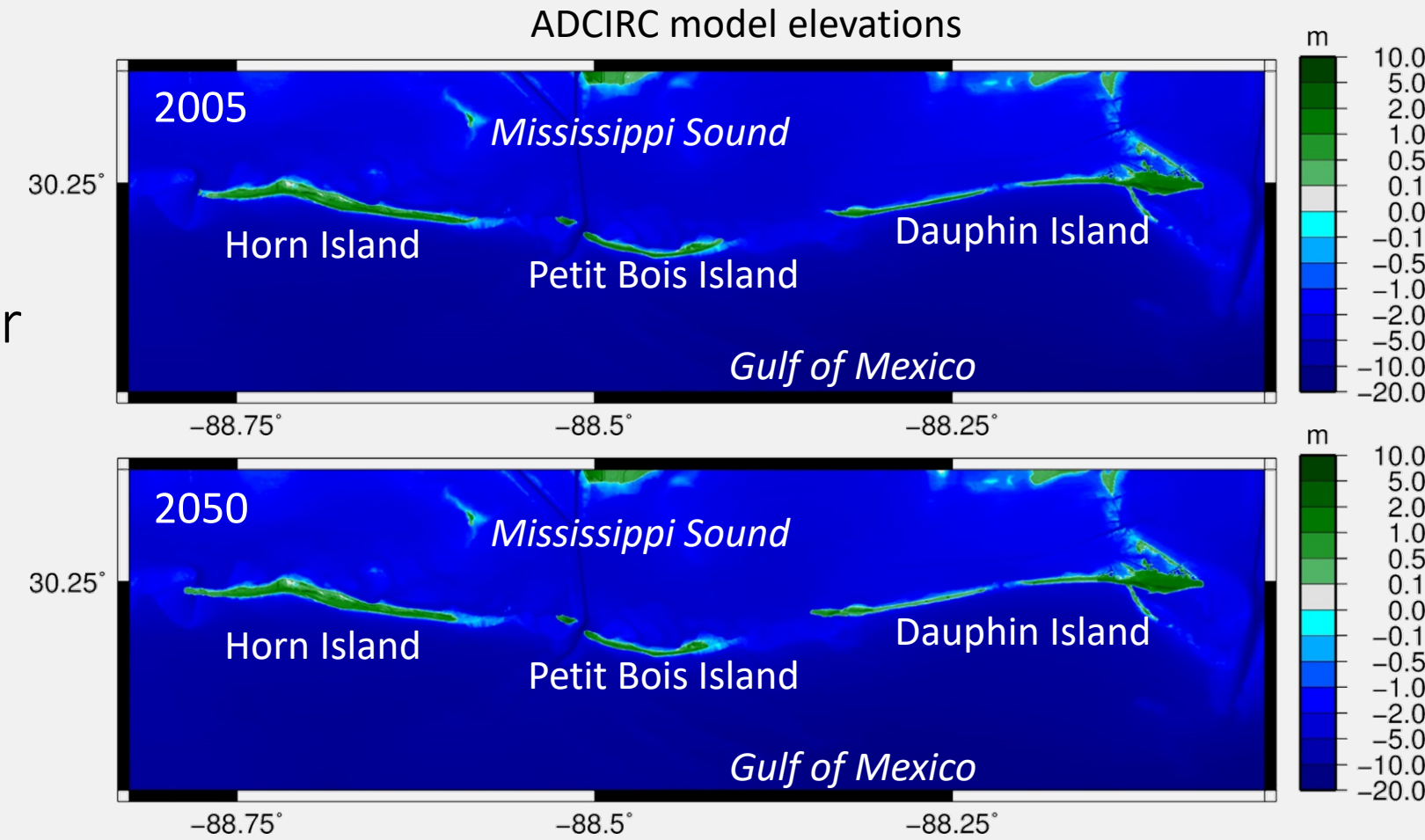
EESLR-NGOM: Projections of Shorelines and Dunes



Plant et al. (2016) Earth's Future

EESLR-NGOM: Scenarios for Hydrodynamic Assessments

- Implemented projected shoreline change and dune heights into the hydrodynamic model for each future scenario
  - Astronomic tides
  - Storm surge



Passeri et al. (2015) Continental Shelf Research; Passeri et al. (2016) Earth's Future; Bilskie et al. (2016) Earth's Future

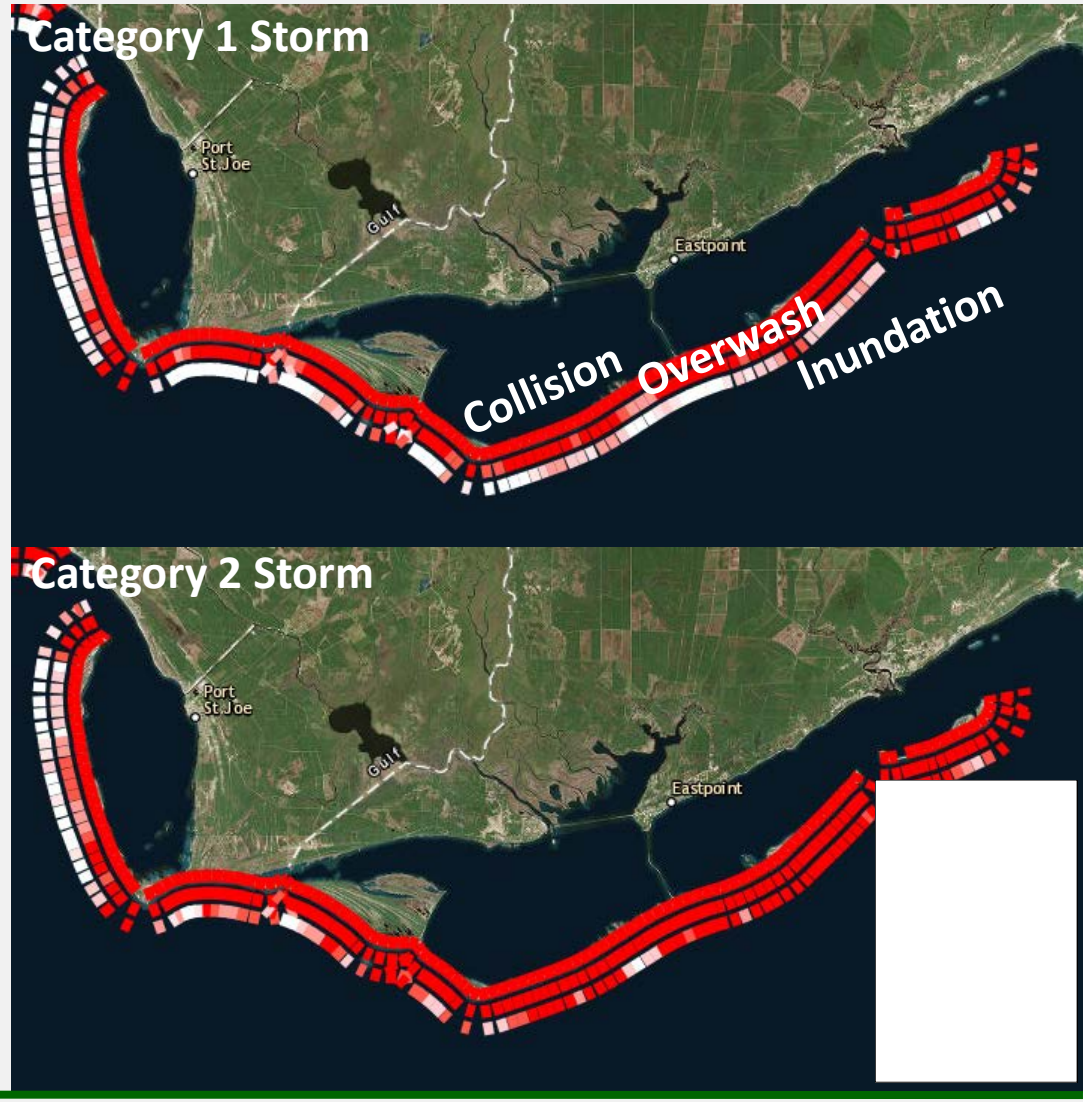
NGOM+N2E2: What we can do

- Continue to advance the coastal dynamics of SLR
- More detailed morphologic modeling of coastal change
  - Storms
  - Nuisance flooding
- Evaluations of NNBFs

Photo source: Climate Central

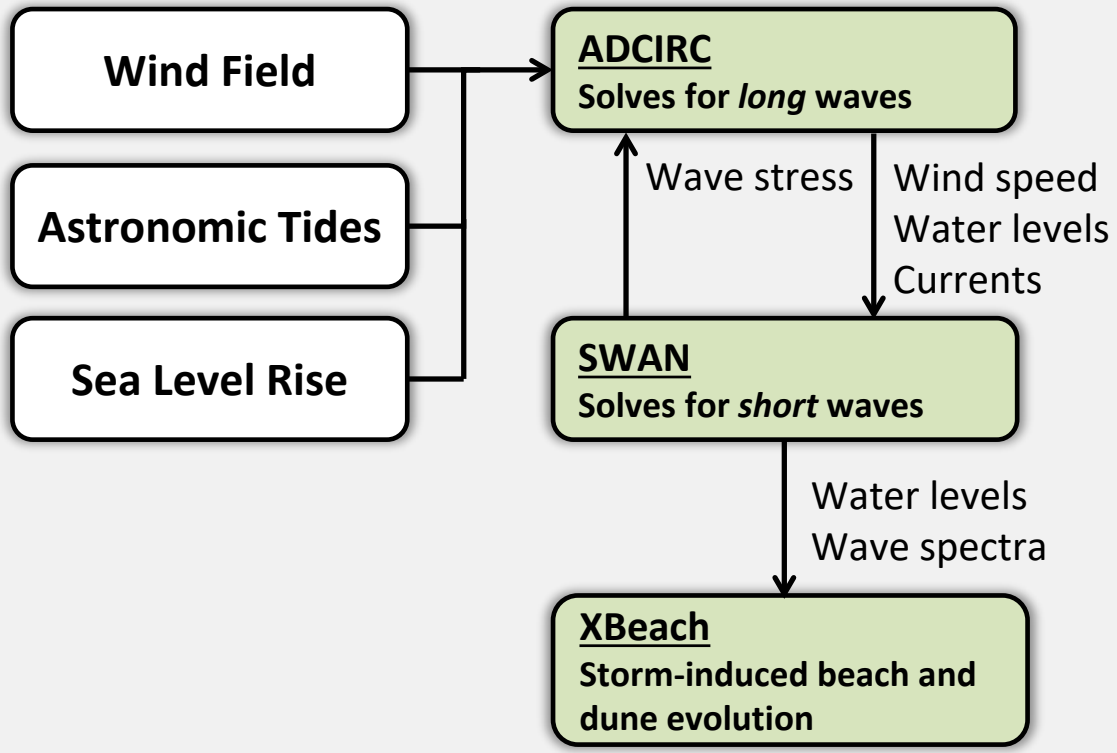
NGOM+N2E2: Probability of Coastal Change

- Probability of collision, overwash and inundation (PCOI)
  - Based on dune elevations and total water levels during events
- Large-scale assessment
- Individual storms and nuisance flooding scenarios
  - Identifies vulnerable areas for more detailed modeling and evaluations of NNBFs

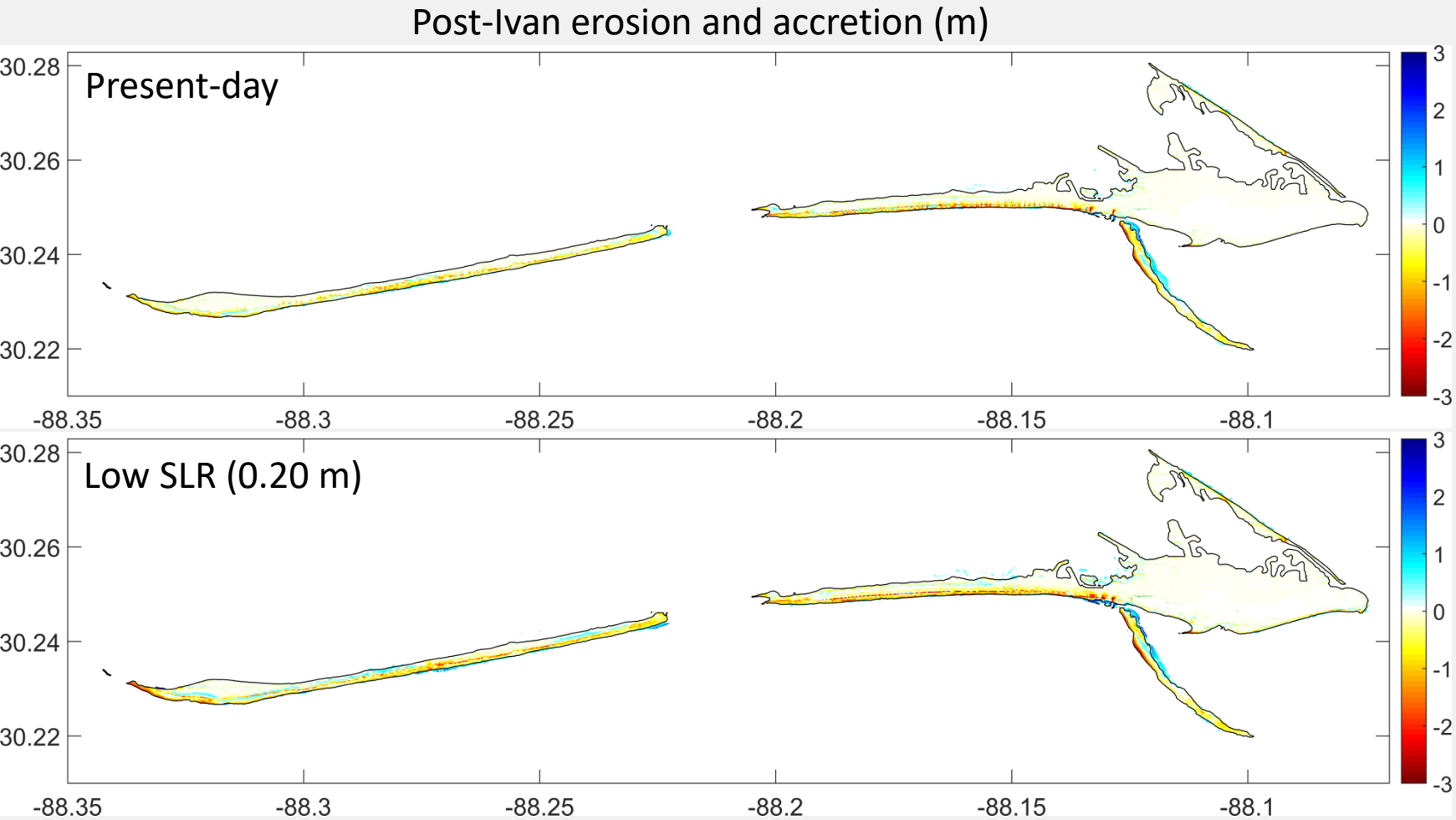


NGOM+N2E2: XBeach Modeling

- Numerical modeling of storm-driven barrier island morphology
  - Using coupled hydrodynamic and morphodynamic models
- Limitations
  - Computationally expensive
  - Only valid for beaches (not marshes)



Dauphin Island response to storms + SLR



- 87% of island inundated
- Average dune erosion -0.51 m
- 51% of dunes in overwash
- Net loss in island volume 5.1%

- 97% of island inundated
- Average dune erosion -0.92 m
- 68% of dunes in overwash
- Net loss in island volume 8.0%

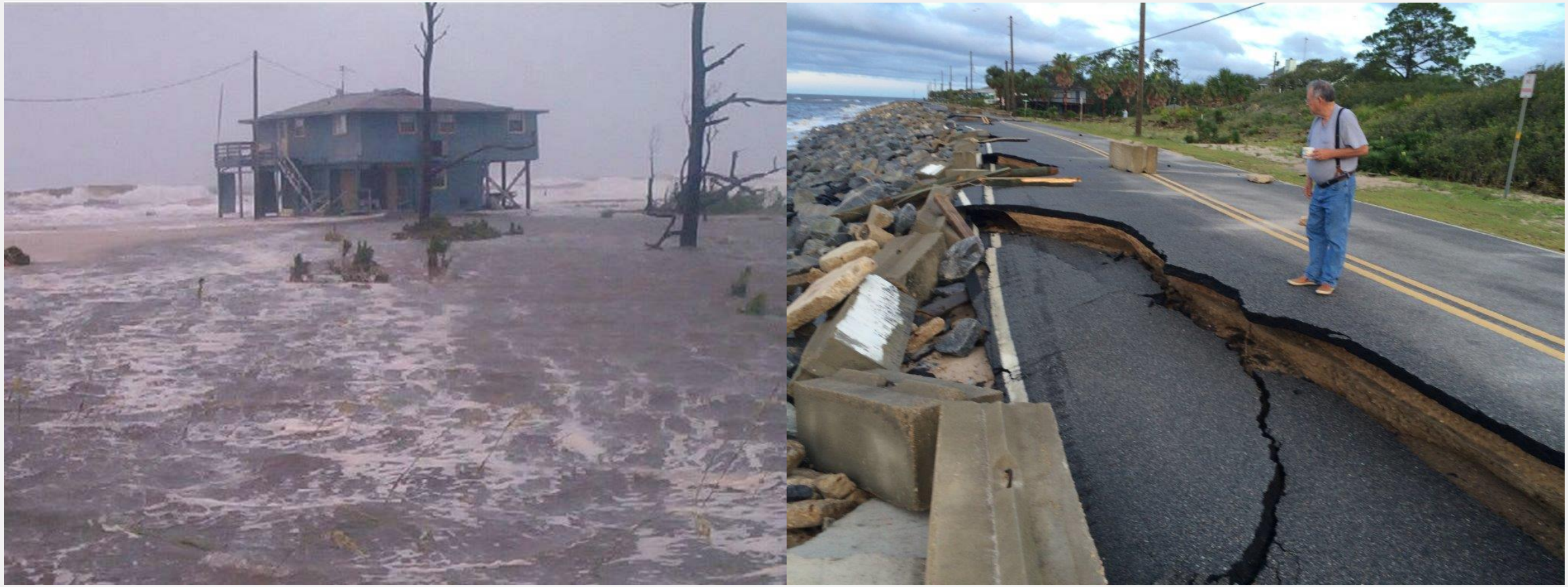
St. George Island response to storms + SLR + NNBF

- Select locations from PCOI assessments
  - Individual storms
  - Nuisance flooding
  - SLR scenarios
- Evaluate NNBFs to mitigate flooding/erosion
  - Beach nourishment
  - Dune rebuilding
  - Combination

Summary

- PCOI assessments along Gulf shorelines
  - Probability of coastal change (collision, overwash, inundation)
  - Identifies areas vulnerable to erosion during storms/nuisance flooding
- XBeach modeling of St. George Island
  - Can quantify inundation and erosion during storms/nuisance flooding
  - Evaluate the effectiveness of NNBFs

Questions?



Damage from Hurricane Hermine (2016) at Alligator Point near Apalachicola, FL.
Photo credit: Allan Feifer and Lois Swoboda

NGOM-N2E2
Field Data Collection

Stephen C. Medeiros, PhD, PE

Lecturer

University of Central Florida

Civil, Environmental & Construction Engineering

Stephen.Medeiros@ucf.edu

UCF

Field Data Collection (Scoped)

- Topography of Marsh Platform
- Above ground biomass density
- Soil Cores (with depth segmentation)
  - Below ground biomass bensity
  - Soil density

RTK-GPS Topography

Field Biomass Density

Lab Biomass Density

Field Soil Cores

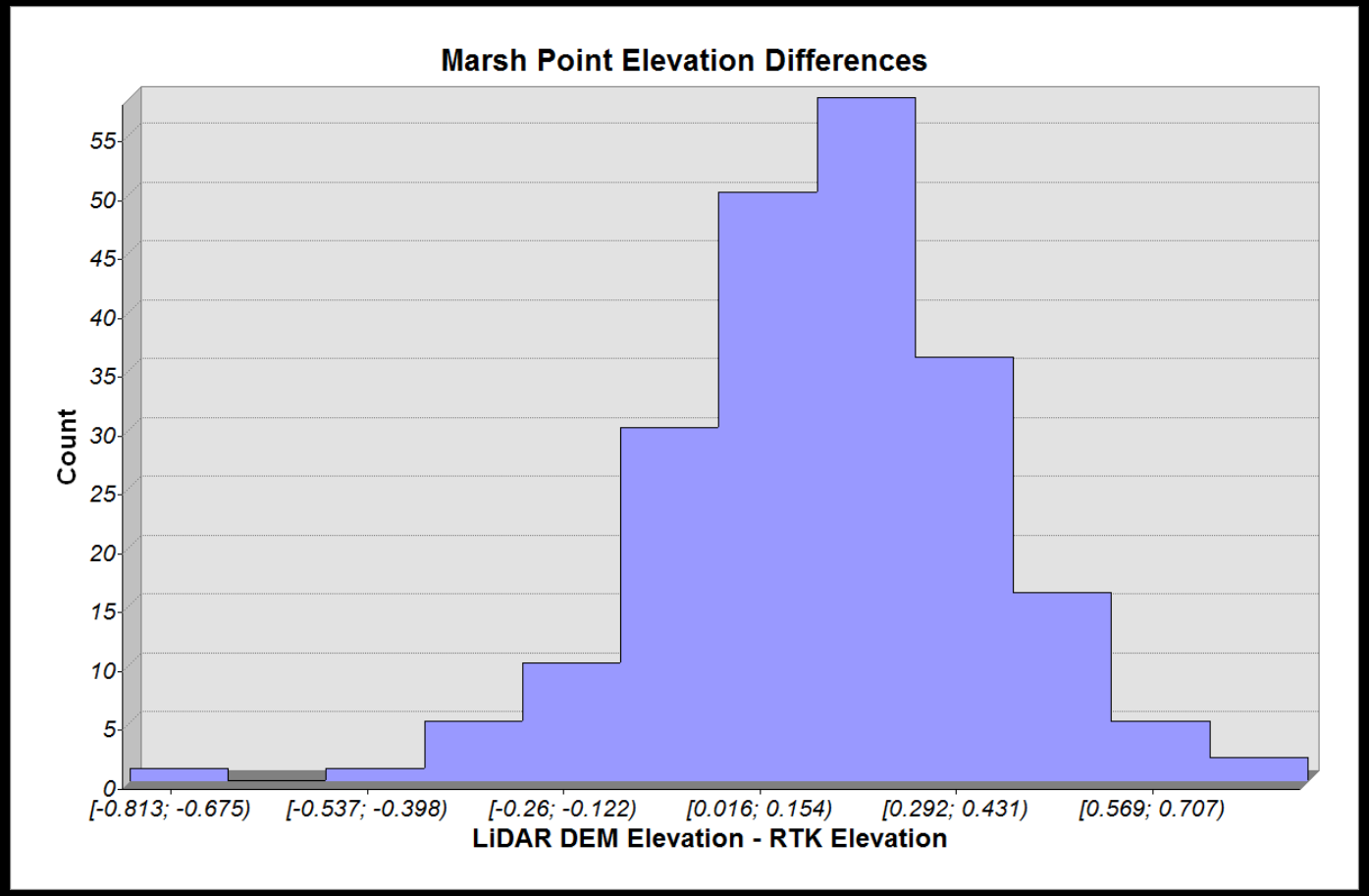
Gulf of Mexico

Motivation

N
0 40 80 160 240
Meters
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

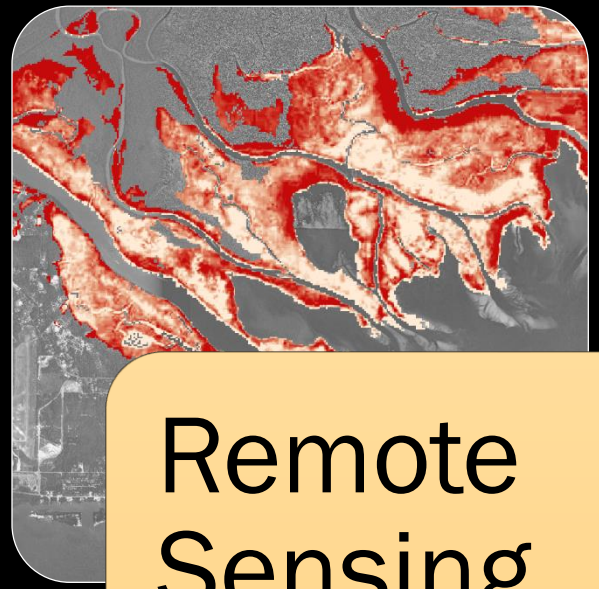
N
0 40 80 160 240
Meters
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Motivation



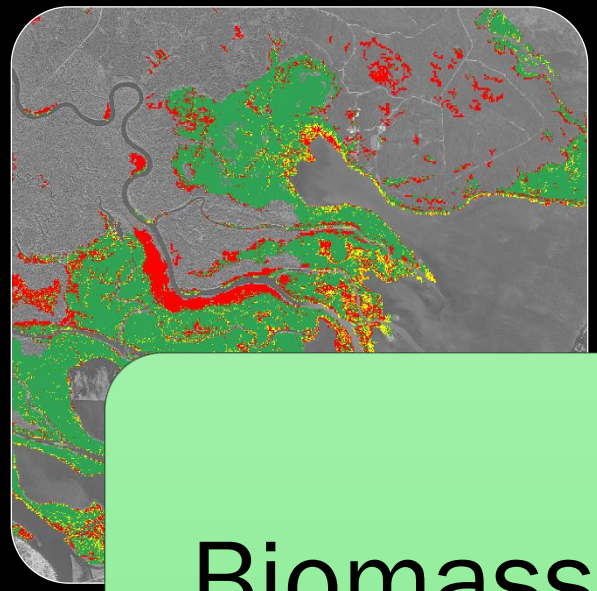
Mean Error = +26 cm

Motivation



Remote Sensing

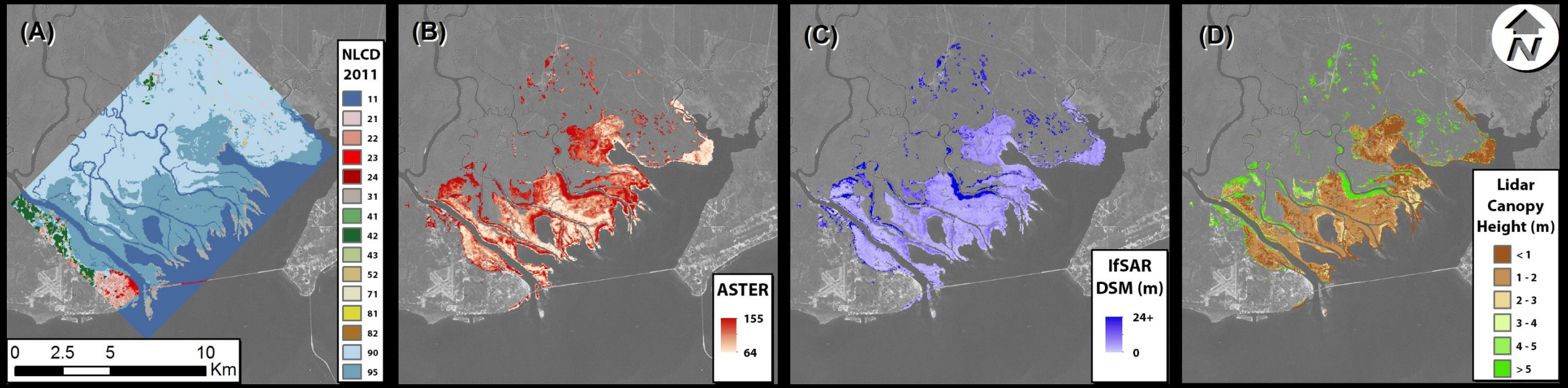
- Active
- Passive



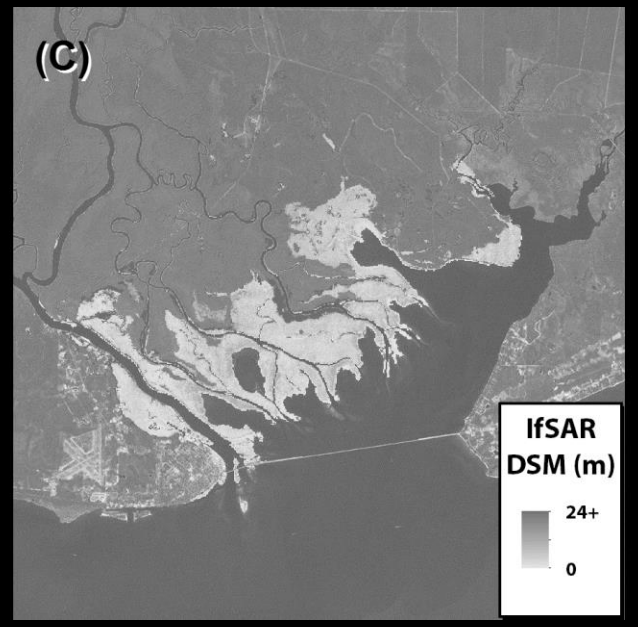
Biomass Density

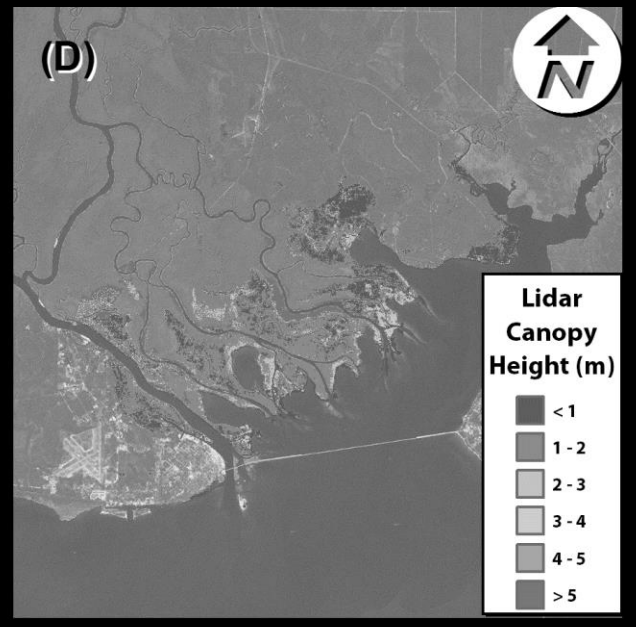
Lidar DEM Error

Remote Sensing Biomass Density

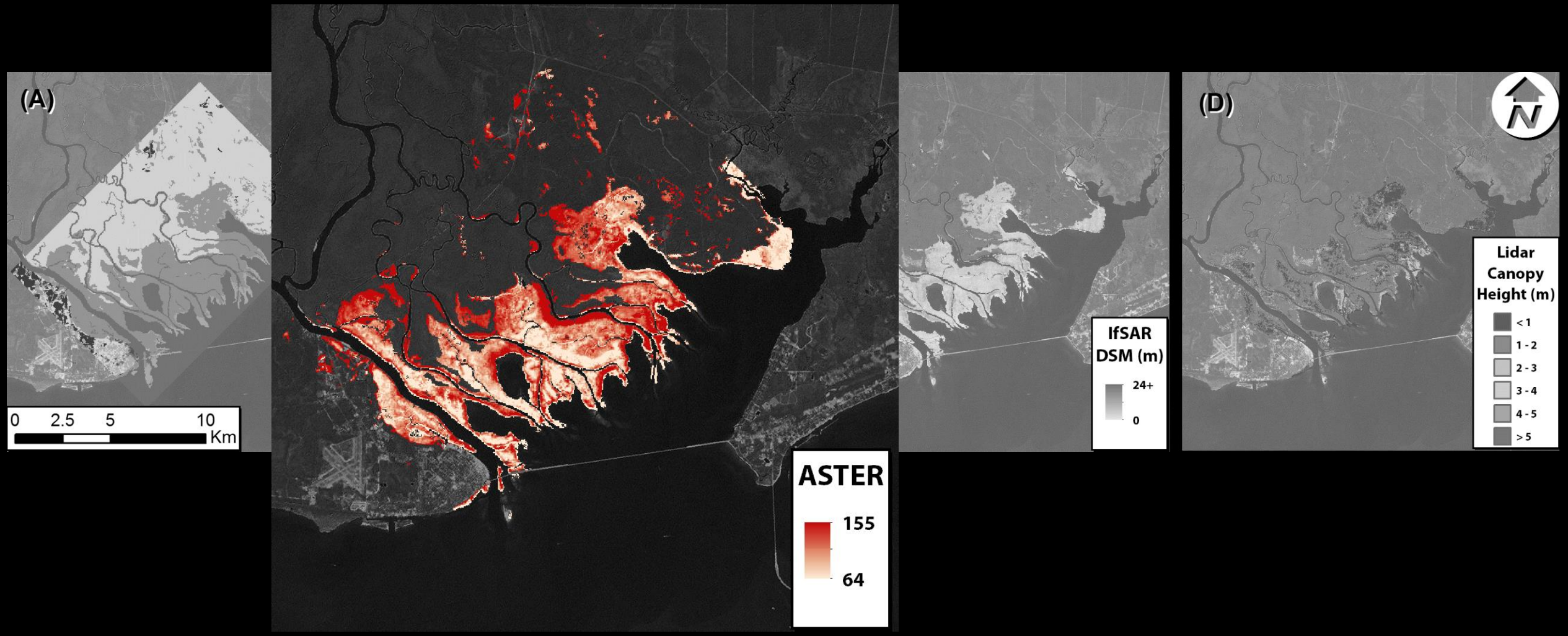


Remote Sensing Biomass Density

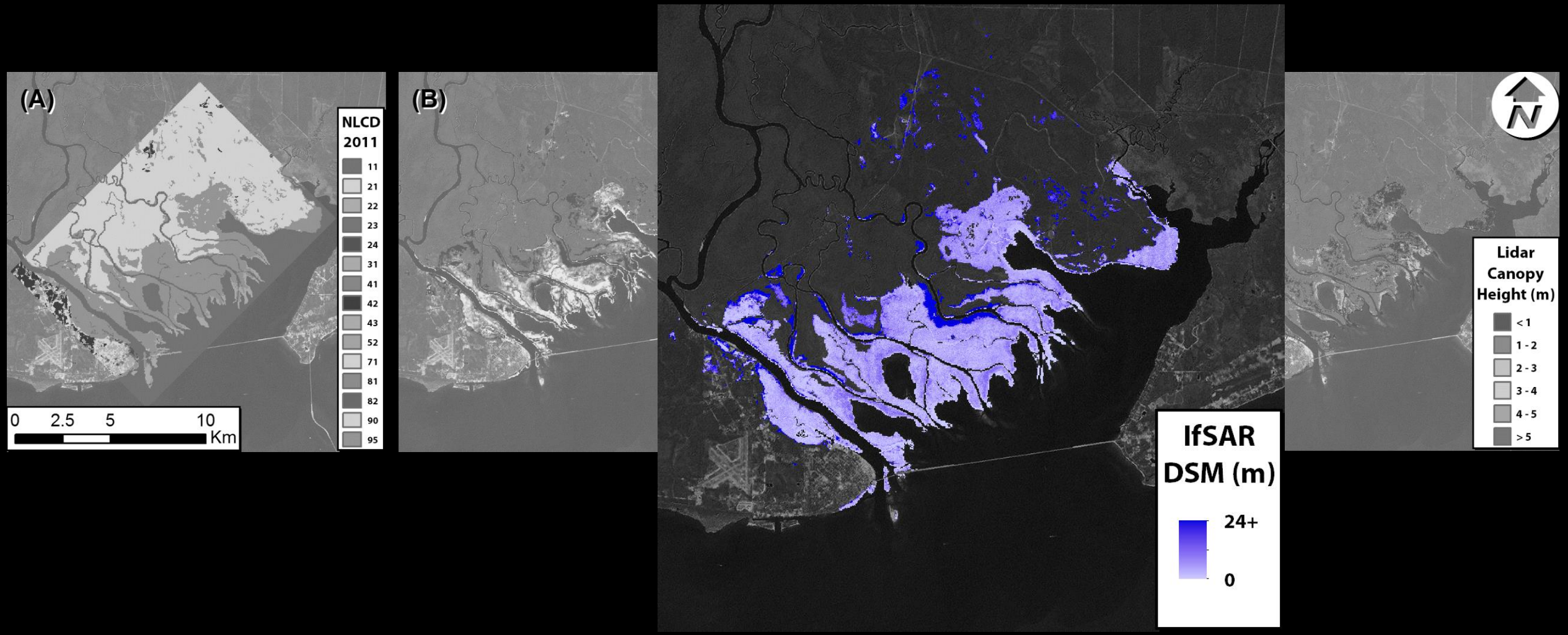




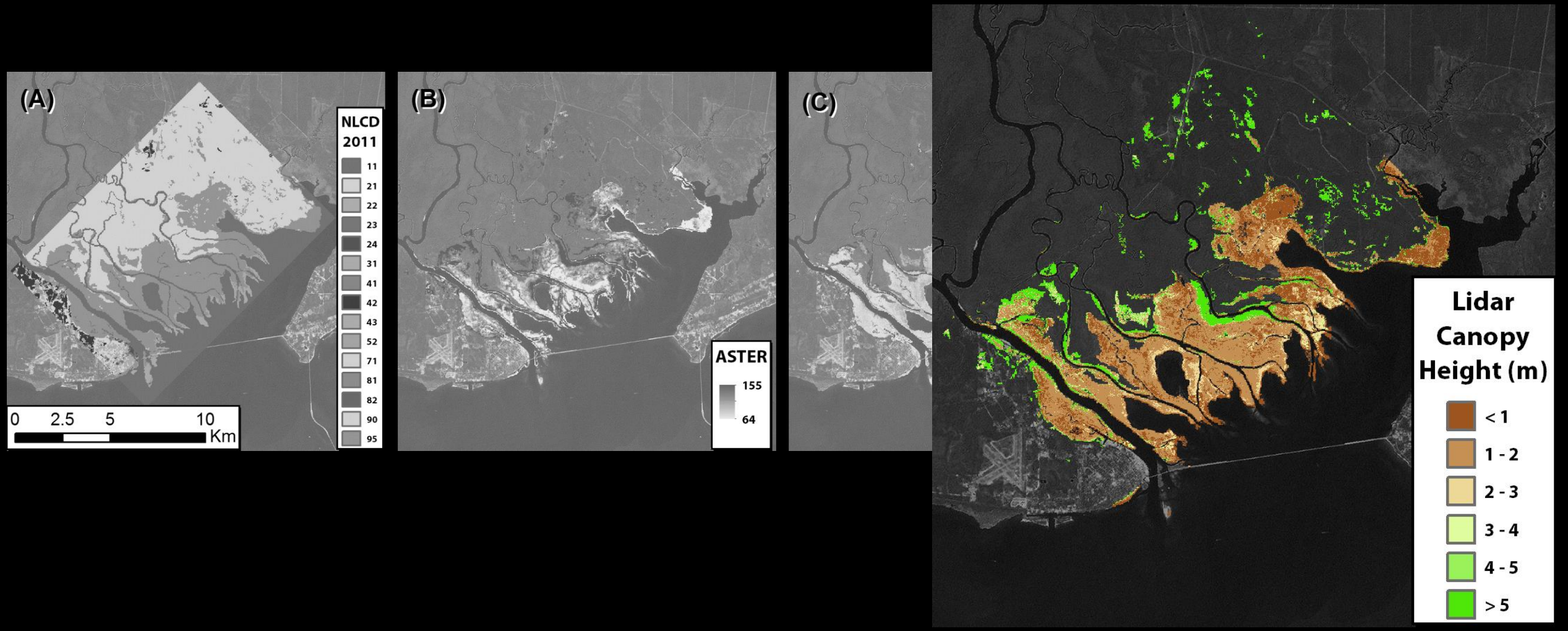
Remote Sensing Biomass Density



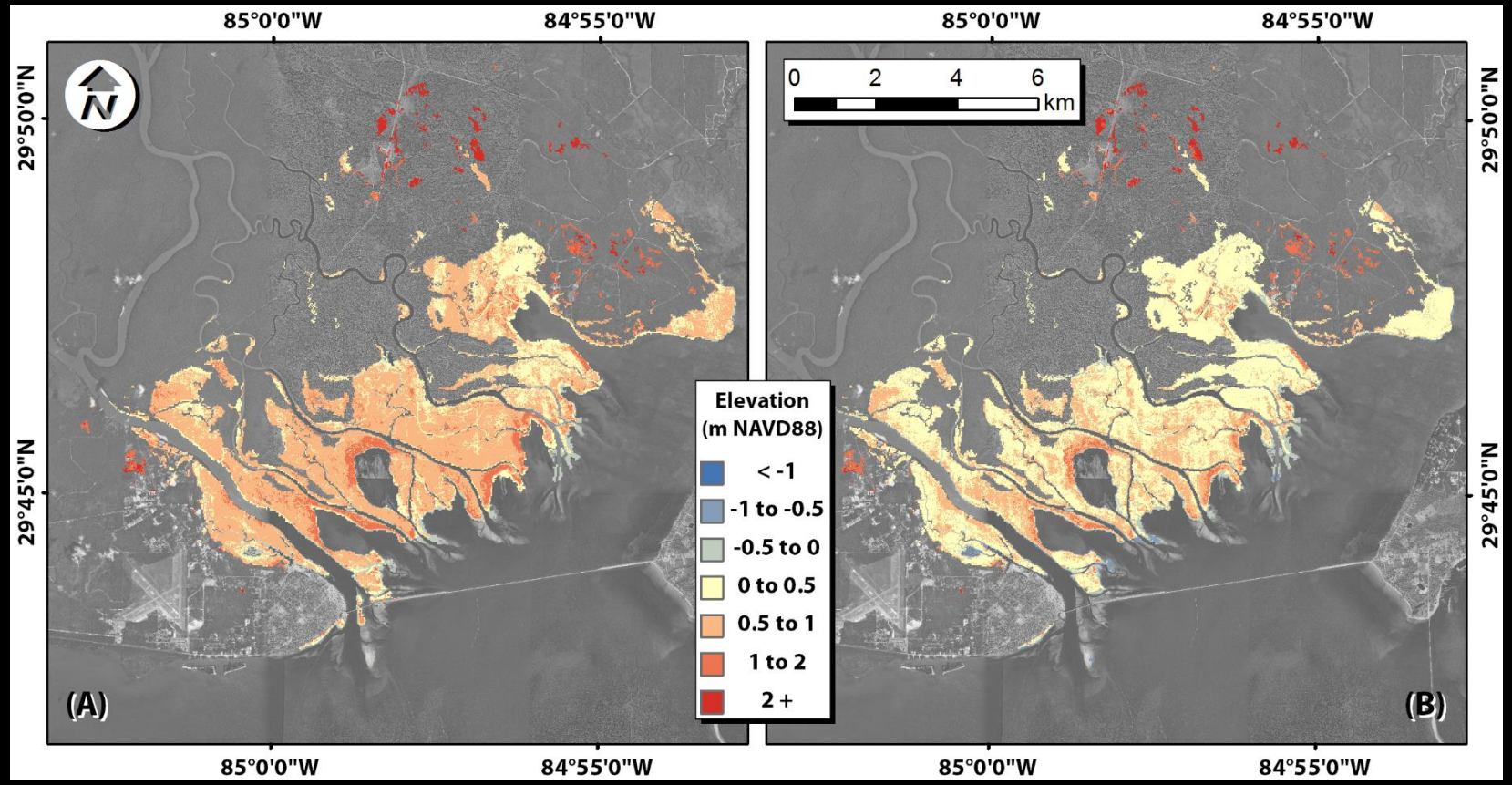
Remote Sensing Biomass Density



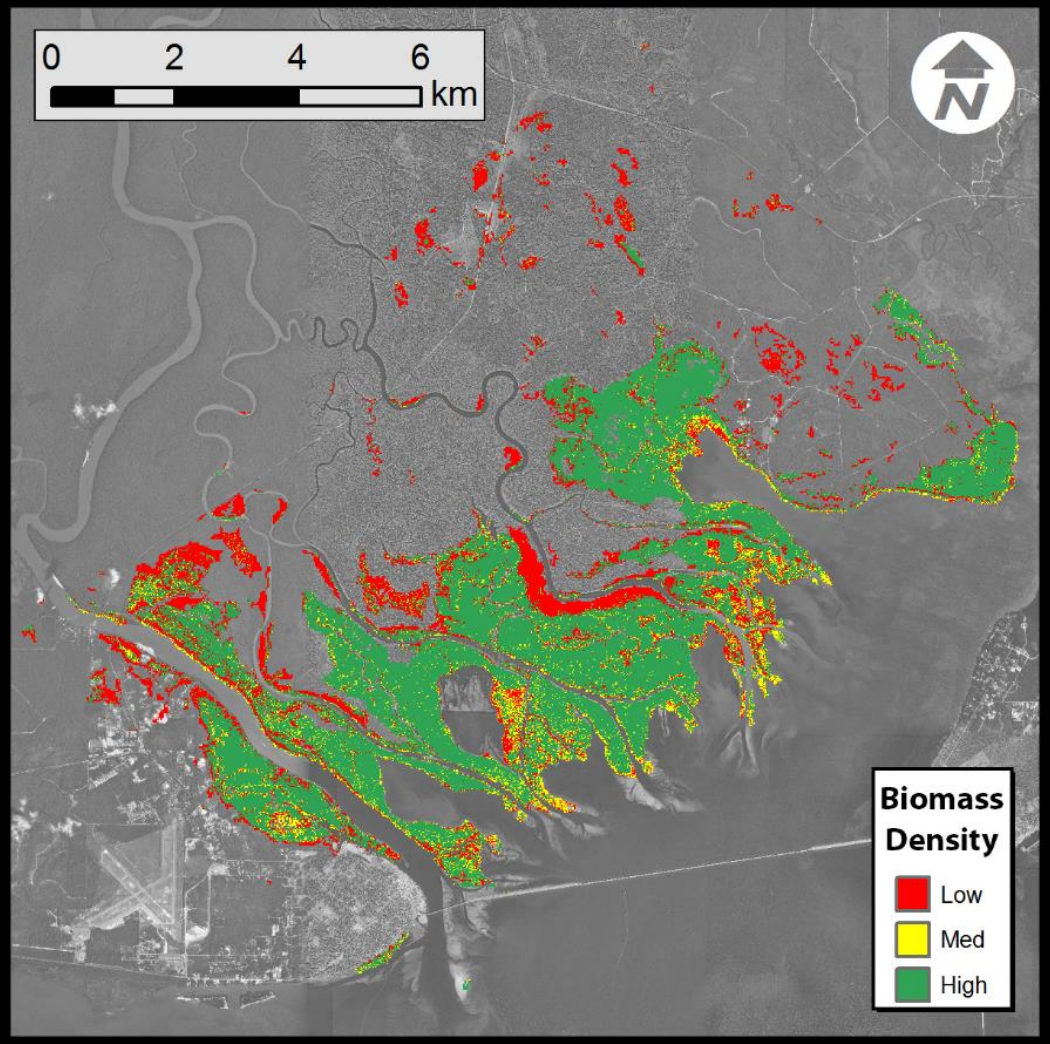
Remote Sensing Biomass Density



Adjusted DEM

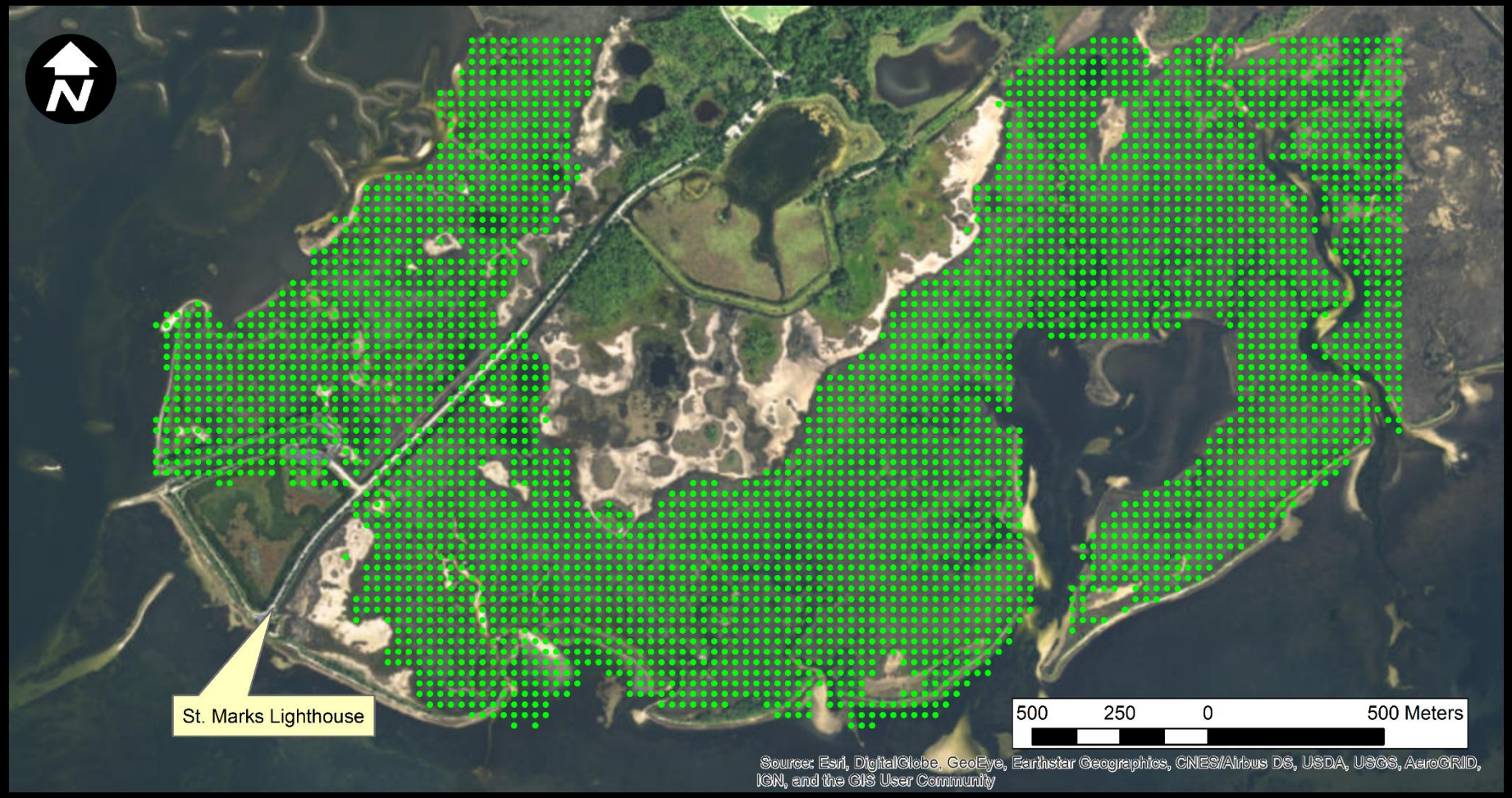


Current Biomass – Initialize HydroMEM



Apalachee Bay – St. Marks Lighthouse

Apalachee Bay – St. Marks Lighthouse



Apalachee Bay – St. Marks Lighthouse

Apalachee Bay – St. Marks Lighthouse

Acknowledgements

Selecting NNBF Project Scenarios for Model Consideration

Trevor Meckley

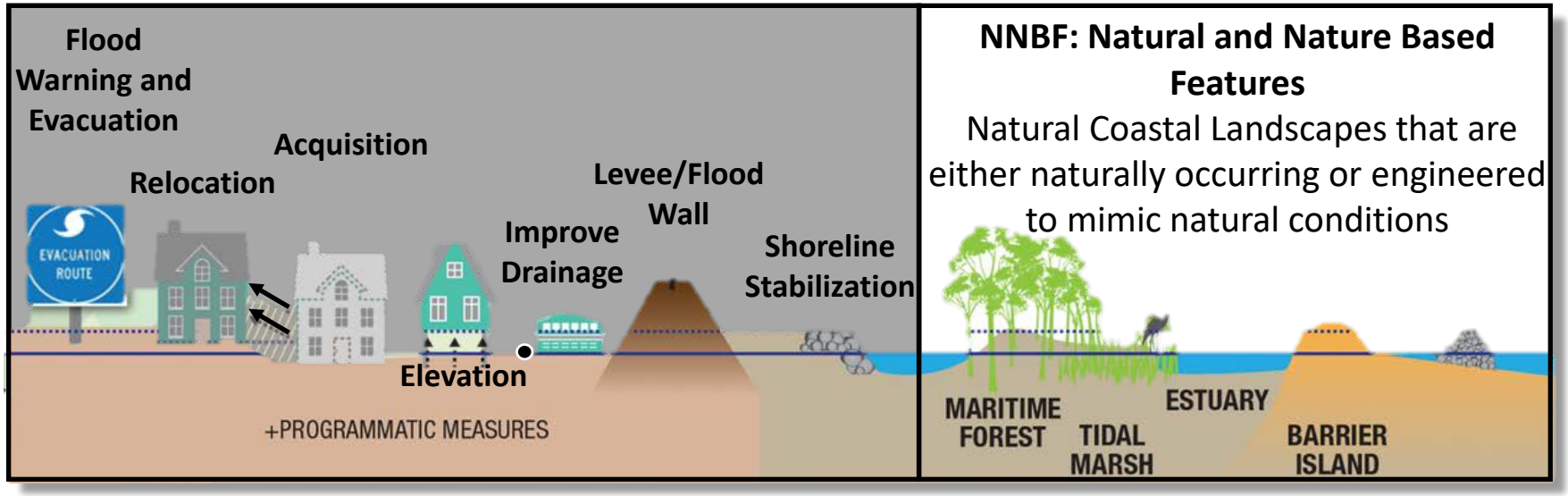
NNBF Scenarios for Discussion

- Define and discuss types of features (NNBF)

- Review the continuums that sometimes confuse NNBF discussions

https://ewn.el.erdc.dren.mil/workshops/2016March_NNBF/Electronic%20Library/5%20ERDC%20-%20NNBF%20Brochure.pdf#view=fit

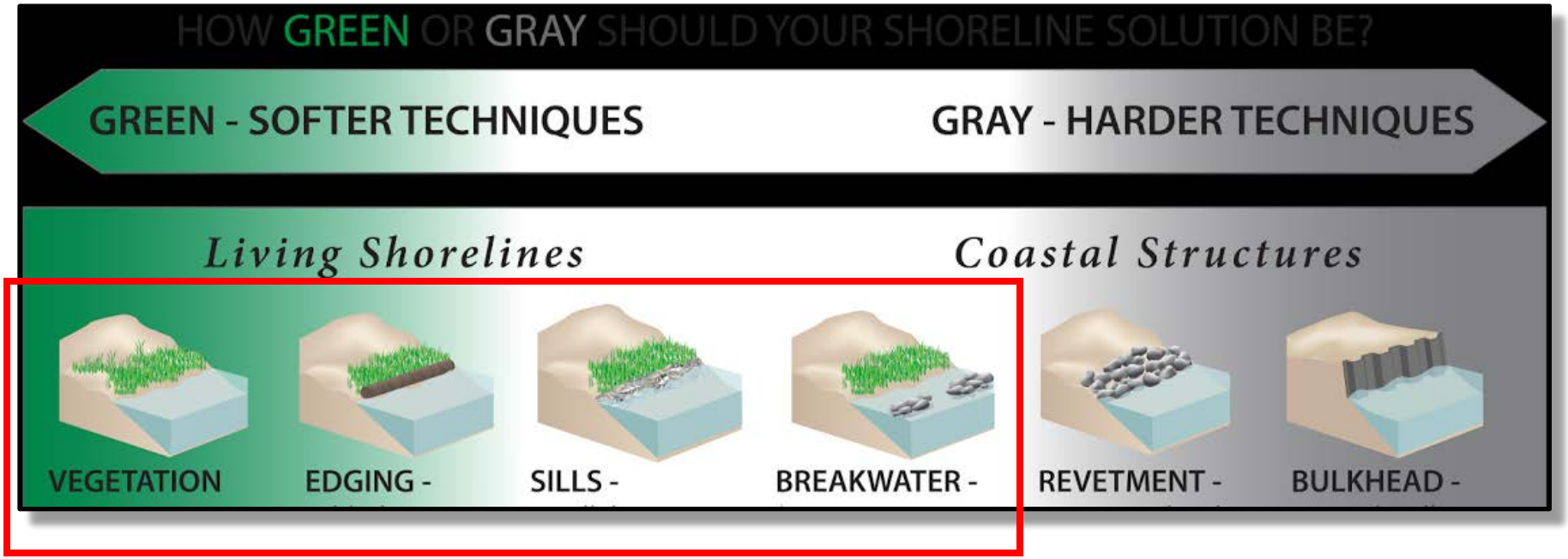
NNBF Protect via Natural Processes



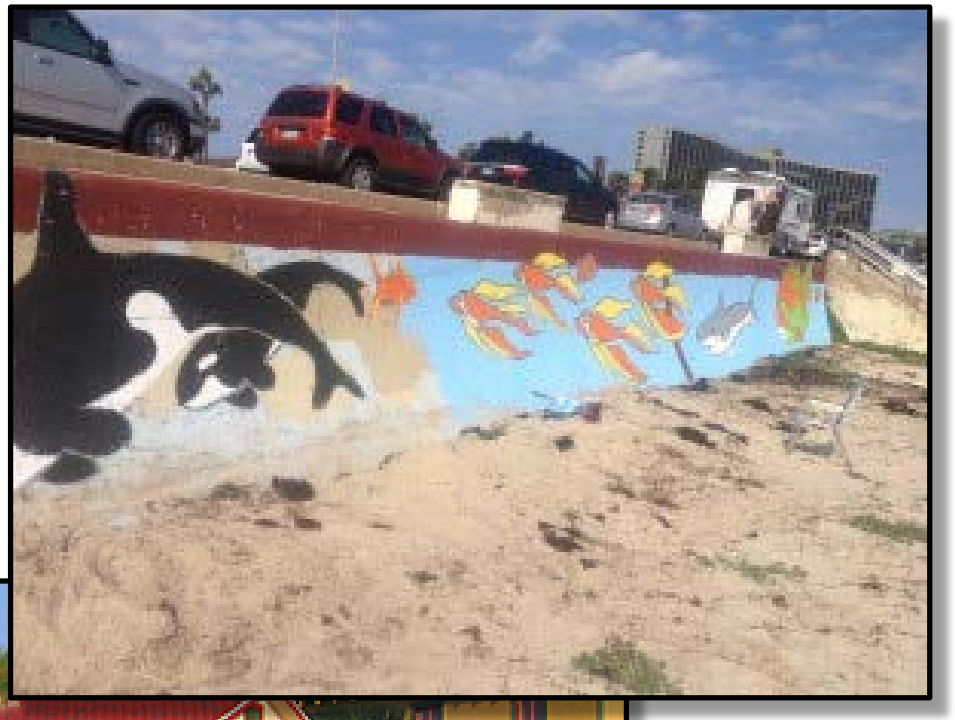
Natural features are comparatively "long-standing" in terms of age and created through the action of physical, biological and chemical processes over time

Nature-based features are created by human design, engineering and construction to mimic natural features and are designed to provide similar, if not identical, services

A Continuum of Green to Gray



These may be nature inspired but they are not NNBF's…



Types of NNBF Features

Beach and Dune	**Vegetated Feature**	**Oyster Reef** / **Artificial Reef**	**Barrier Island**	**Coastal Forest**
Benefits/Processes Breaking of offshore waves Attenuation of wave energy Slow inland water transfer	**Benefits/Processes** Breaking of offshore waves Attenuation of wave energy Slow inland water transfer Increased infiltration	**Benefits/Processes** Breaking of offshore waves Attenuation of wave energy Slow inland water transfer	**Benefits/Processes** Wave attenuation and/or dissipation Sediment stabilization	**Benefits/Processes** Wave attenuation and/or dissipation Shoreline erosion stabilization Soil retention **(i.e., Cypress Swamp/Pine Savanna)**

http://www.nad.usace.army.mil/Portals/40/docs/NACCS/NNBF%20FINAL.pdf

Combination Features

- Living Shorelines
- Hybrid natural/gray infrastructure
- Consider Landscape level designs containing multiple features but provide feature level detail

http://publicradioeast.org/post/noaa-grant-funds-living-shoreline-projects-along-nc-coast , credit North Carolina Coastal Federation

What are your NNBF steps?

- Is the land owned?
  - Acquisition (conservation)?
- Is the desired feature there?

Note feature of importance

Nothing/Protect Maintenance Restoration New Build

Beach and Dune Nourishment

Thin Layer Sediment Depositions

Deploying Bagged Shell

http://seagrant.gso.uri.edu/elevating-drowning-salt-marshes/

http://seagrant.gso.uri.edu/cashing-in-on-offshore-sand-deposits/risg_2017_coastalstate_lecture_28feb2017/

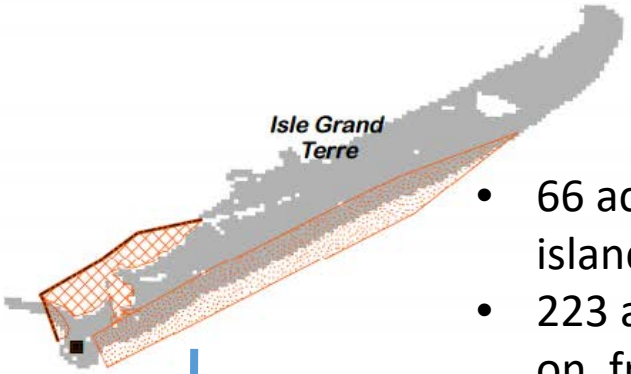
http://www.habitat.noaa.gov/highlights/oysterrestorationcreatesjobs.html

We are looking for projects that consider existing features and created features, don't let continuums throw you off.

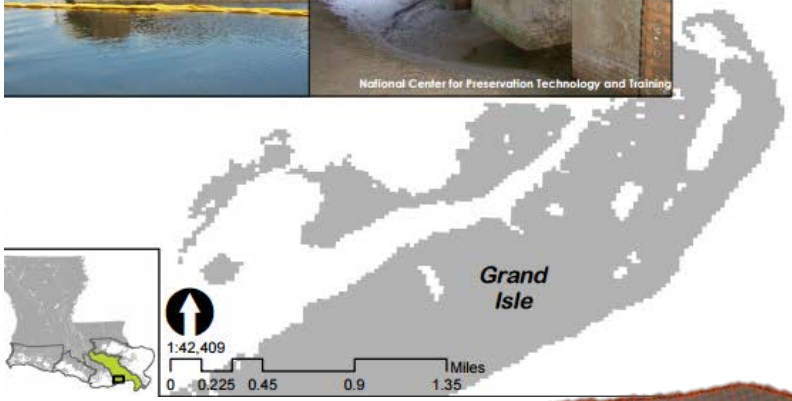
- We want to hear about your projects, keep in mind we will need detail about each feature if the project combines many
- There are a number of project continuums that make NNBF's a little confusing…
  - Natural-Nature based Continuum – how human created is it?
  - Green-Gray Continuum – how naturally occurring is it?
  - Complexity Continuum – how many feature are combined in the project

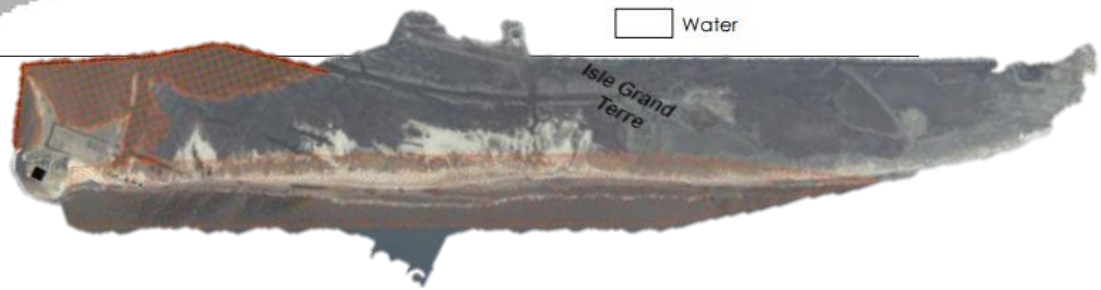
NNBF Questions?

West Grand Terre Beach Nourishment and Stabilization



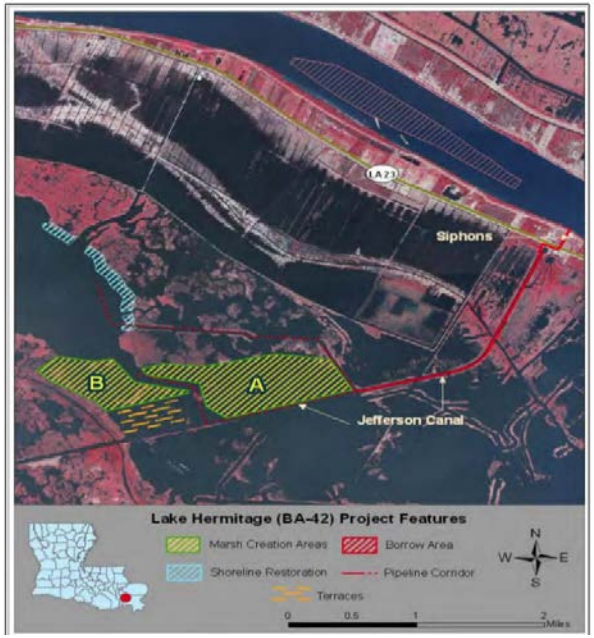
- 66 acres marsh on back of island via rock revetment
- 223 acres of nourishment on front of island at 2 m height (Southside)



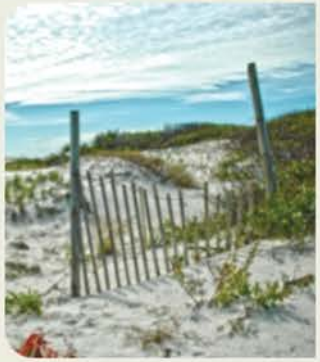


Think of project options, here are some examples as *starting points*....

- Project 1-Lake Hermitage Marsh Creation – NRDA Early Restoration Project



Need to know NNBF design factors

				
Dunes and Beaches	**Vegetated Features (e.g., Marshes)**	**Oyster and Coral Reefs**	**Barrier Islands**	**Maritime Forests/Shrub Communities**
Performance Factors Berm height and width Beach slope Sediment grain size and supply Dune height, crest, and width Presence of vegetation	**Performance Factors** Marsh, wetland, or SAV elevation and continuity Vegetation type and density Spatial extent	**Performance Factors** Reef width, elevation, and roughness	**Performance Factors** Island elevation, length, and width Land cover Breach susceptibility Proximity to mainland shore	**Performance Factors** Vegetation height and density Forest dimension Sediment composition Platform elevation

General coastal risk reduction performance factors include: Storm surge and wave height/period, and water levels

Need to know NNBF design factors at individual feature level

Performance Factors Berm height and width Beach slope Sediment grain size and supply Dune height, crest, and width Presence of vegetation	**Performance Factors** Marsh, wetland, or SAV elevation and continuity Vegetation type and density Spatial extent	**Performance Factors** Reef width, elevation, and roughness	**Performance Factors** Island elevation, length, and width Land cover Breach susceptibility Proximity to mainland shore	**Performance Factors** Vegetation height and density Forest dimension Sediment composition Platform elevation

General coastal risk reduction performance factors include: Storm surge and wave height/period, and water levels

http://www.nad.usace.army.mil/Portals/40/docs/NACCS/NNBF%20FINAL.pdf

Detailed Participant Feedback

NGOM+N2E2 MTAG Workshop
June 28, 2017
Apalachicola National Estuarine Research Reserve
108 Island Dr., Eastpoint, FL 32328

The following notes present feedback from portions of the workshop that required participant input except for the Focus Groups, which can be found in Appendix D.

DISCUSSION NOTES – Scientific Methods Overview, Dr. David Yoskowitz

Recommendations for who might have additional data for the HAZUS modeling.

- Mississippi
  - Jackson County (robust appraisal w/GIS affiliated information)
  - Gulf Regional Planning Council
    - Elaine Wilkinson (228-864-1167; contactus@grpc.com)
- Alabama
  - Baldwin County – web page
  - Mobile and Baldwin Counties have annual appraisals of property values (Mike Shelton)
  - City of Mobile – Map for Mobile efforts on city website
  - South Alabama Regional Planning Council
    - Diane Burnett (251-706-4621; dburnett@sarpc.org) has conducted comprehensive plans for communities that could not do it for themselves.
- Florida
  - Apalachicola
    - Contact Mark Curenton (Franklin County) & Pam Brownell (Emergency Management; 850-653-8977x100; em3frank@fairpoint.net)
  - Franklin County
    - Mark Curenton (Franklin County) & Joe Crozier (Apalachee Regional Planning Council)
  - Bay County
    - Future planning efforts have been conducted – get contacts from Anita Grove (ANERR)
  - Escambia County
    - Flood risk and insurance work, probably has some additional information that would help – Contact Marilyn Montgomery (The Wharton School University of Pennsylvania; mmontgo@wharton.upenn.edu)
    - Coastal Vulnerability Assessment: Escambia County, Florida, Florida Department of Economic Opportunity (July 23, 2016)
  - Gulf County
    - Kim Wren (ANERR)

DISCUSSION NOTES – Scientific Methods Overview, Stephen Medeiros, PhD, PE

Additional information on marsh field sampling in the St. Marks region.

Dots were added to a projected map; the colors of the dots in the photos below correspond to different topical areas:

- *Green – Areas of interest*
- *Pink – Recommended sampling*
- *Yellow – Potential areas of collaboration*

Notes on the recommendations; the numbers correspond to the dots in the photos below:

1 – St. Marks sampling (pink) added by Stephen

32 – Alligator point (yellow)

51/53 – Ocklocknee (yellow) – construction

16 – Big Bend Wildlife Management Area (green) – collaborate and area of interest with Florida Fish and Wildlife Conservation Commission. Recommended by Katie Konchar.

31 – Big Bend Aquatic Preserves (yellow) – Tim Jones (Manager Big Bend Aquatic Preserves; 352-228-6028; timothy.w.jones@dep.state.fl.us) is working all down the coast line including regular sampling. Suggested by Kim Wren.

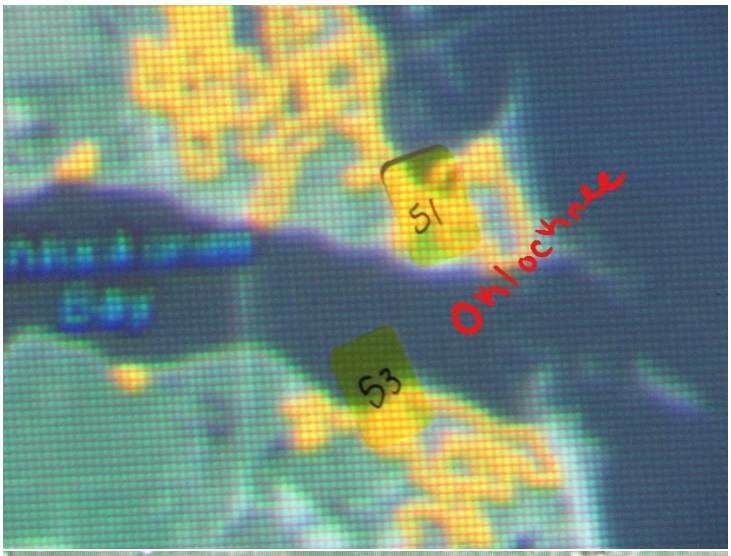
52 – St. Teresa (yellow)

32 – Alligator Point Road (green) DWH money being invested in a road/bridge. Possibly beach renourishment

Shell Point – RTK (Bilskie Collaboration)

George Ramseur (UAV work – Mississippi)

Annotated Photos



DISCUSSION NOTES – Nuisance Flooding Identification Exercise

A worksheet exercise where participants identified areas of nuisance flooding, timing/duration of nuisance flooding, and impacts from nuisance flooding. Over 70 examples and six additional points of contact were identified. Contact MTAG PI Renee Collini (rcollini@disl.edu) for further details.

DISCUSSION NOTES – Selecting NNBFs-Considerations, Understanding Model Limitations

There was a short presentation by Dr. Bilskie that seemed to be generally well understood by the participants. There was some follow up discuss to clarify the 60 ft x 60 ft minimum for projects: smaller projects can be included, but they might have to be stretched. Dr. Passeri further clarified that there is the ability to look at shoreline erosion on smaller scales utilizing the capabilities discussed earlier (XBeach modeling).

DISCUSSION NOTES – Selecting NNBFs-Considerations, Understanding MTAG Needs

Balancing the need for multiple NNBFs vs a variety of scenarios/conditions

The initial discussion had a very "chicken or egg" feel; when asked what was preferred, more NNBFs with less scenarios or more scenarios on fewer NNBFs, the stakeholders seemed to have a difficult time determining what be most valuable. With further discussion, it became clear that this might need to be a balancing act of assessing what NNBFs are available for evaluation and reviewing different attributes (type, value, region, etc.).

It was pointed out that the needs might differ across the region, for example in Apalachicola, these evaluations might facilitate permitting, while in Mississippi, this could inform their comprehensive restoration planning. Discussion also touched on utilizing success stories or positive analysis from one region (Apalachicola), for communication and planning in another (Mississippi). Furthering this vein of discussion, stakeholders expressed interest in not only looking at specific areas, but also holistically at the region.

There was also general interest in learning more about EIA and ESV in other states and using that to guide NNBF selection by focusing on the most valuable NNBFs.

Discussion on the topic closed with thoughts that while some analysis could be more applied, there would also be value in some of the analysis being more theoretical, such as what is needed in the Mississippi area.

Summary: This was a difficult topic for the stakeholders to settle on. They would like a variety of types of NNBFs to facilitate addressing actions such as permitting, demonstration of project benefits (planned and existing), and comprehensive restoration planning. This topic might be better to readdress after the MTAG has been presented with some summary information of the NNBF identification activity.

Timeline

Discussion quickly started off with 25 and 50 years and suggested time frames. There was no strong interest to go beyond 50 years; the typical interest in the impacts of a project are immediate (3 – 5

years) and long-term (25 – 50 years). There was also a discussion around the concept that many things are designed for 10 – 25 years, but often are in operation for much longer, e.g. out to 50 years.

It was made clear that the idea is to understand what happens in the future if the NNBFs are maintained, not if they will be sustained; though, some insight could be provided into marsh NNBFs due to Hydro-MEM capabilities.

The discussion then turned to integrating future projections of a regions population/demographics and expressed interest in seeing that happen if those data were available.

Number of Scenarios

EESLR-NGOM had many scenarios with longer projections. There was discussion around the concept of not needing as many scenarios if the differences were not great. It was agreed that having the worst-case scenario is important. Suggestions were made to have a low, high, and intermediate depending on the differences between the scenarios.

Other topics briefly touched on were:

- If there is a need for differing scenarios between each area, and
- The lack of a smooth curve between 25 and 50 years and consideration of utilizing a step function when considering 5 to 10-year differences

Suggested action item: Follow up virtual meeting with the MTAG and Project Team to discuss scenarios. D. Kidwell suggested evaluating Sweet et al 2017 for a quick look at projected differences in SLR across the NGOM and between scenarios to inform the MTAG for the discussion.

Astronomic & Meteorological Conditions

This section was devoted to understanding what kind of astronomic and/or meteorological conditions the MTAG has interest in seeing and/or what conditions cause nuisance flooding.

Apalachicola: Currently, there do not seem to be very pressing impacts in the Apalachicola area – those that occur with tidal flooding are short-lived and on the edges – stormwater seems to have more of an impact. There was an acknowledgement that there are tidal issues further up the river where they have a narrower floodplain and that on certain low-lying roads high winds (+30 mph) causes flooding. The Apalach stakeholders recognized that while right now tidal nuisance flooding is not an issue, that it will be in the future. There was discussion that the results of this work will help communicate the risk of future conditions.

Alabama: In Alabama, they primarily have a tidal-water problem, wind is only an issue when it is exacerbating the water problem by pushing more water onshore.

Mississippi: They get both the stormwater flooding and the tidal flooding. These forces work on opposite sides of the region leading to more frequent and intense flooding. It is important for them to understand how current nuisance flooding will be exacerbated and how NNBFs can reduce the flooding.

Storms

This discussion was focused on understanding what kind of storms would be most useful for the MTAG.

Initially, discussion focused on the size of the storm. There was general acknowledgement that it is hard to motivate people to act on a lower category storm, but they are more frequent. It was suggested that perhaps we look at both ends of the spectrum (e.g. Cat 1 and 5). An additional suggestion was to not focus on the individual storms, but at specific surge levels.

Discussion was next focused on historical vs synthetic storms. Items discussed included: the importance of landfall location; benefits of historical storms for the completeness of the wind field which captures activity outside of the central pressure; and, the tradeoffs with historical storms when it comes to communication – they can be very impactful in some areas, but mean much less in other parts of the region. It was pointed out that even if the research starts with synthetic storms, when it is time to communicate results we can use comparative language such as "Katrina-like storm".

Other topics discussed included the potential benefits of NNBFs when there is not a direct hit and consideration of design life/scale of the NNBF(s) being evaluated. The MTAG seemed interested in capturing the ability of NNBFs to reduce surge on the "edges" of storms. This also led to the acknowledgement that while some NNBFs are designed for protection from larger events (e.g. barrier islands), many of the NNBFs they are working on (e.g. oyster reefs, living shorelines, etc.) are designed to be over-washed in large surge; however, they may have an impact on flooding from non-direct hits.

Time was also spent discussing the current efforts along the coast to being planning for 500-year storms and the difficulty communicating the potential impacts of these storms which is leading to low motivation for action. Hurricanes can be powerful motivators for change (e.g. Andrew revolutionizing building codes); however, the nomenclature can be confusing. MTAG members pointed out that it is important for elected officials and community members to understand and communicate about the impacts of these storms and that the results from this project could be helpful. It was suggested that as data products are developed to keep these nomenclature issues in mind.

Other Thoughts

The MTAG does have concerns about the impact of rainfall events and stated that the increasing frequency of rainfall events have been more pressing than storm surge; however, they are interested in how much worse this will be when coupled with sea-level rise.

DISCUSSION NOTES – Selecting NNBFs-Selection Activity

The participants were split into 5 groups; 3 of Apalachicola region stakeholders, 1 of Mississippi stakeholders, 1 of Alabama stakeholders. The groups used the online geoform designed by NCCOS to identify NNBFs in their respective regions. These included already implemented and planned projects across a variety of NNBF types.

Detailed results can be found here:
https://drive.google.com/file/d/1nLgMsXuW0EhdXPfLHflT1TVbFO7x1ZoU/view?usp=sharing

Northern Gulf of Mexico Natural and Nature-Based Features with Ecosystem Services Valuation and Economic Impact Analysis (NGOM+N2E2)
First Annual Focus Groups Report Executive Summary
FINAL 3.16.18
Denise E. DeLorme and Sonia H. Stephens

Purpose and Procedures

We conducted two 60-minute focus groups, each with nine participants (one group with Management Transition Advisory Group (MTAG) members and one with Apalachicola stakeholders) at NGOM+N2E2's first annual workshop at the Apalachicola National Estuarine Research Reserve in Florida. The purpose was to: (1) gain insight into stakeholders' views, experiences, and information needs regarding nuisance flooding under present conditions and with sea level rise (SLR); (2) obtain input on natural and nature-based feature (NNBF) mitigation options and NNBF-related perceptions, data needs, and evaluation recommendations; (3) gather suggestions for future engagement and outreach activities; (4) capture feedback on the NGOM+N2E2 project process and products (models and tools); and (5) collect comparative data for longitudinal analysis. Each group started with an introduction and explanation of objectives and procedures. The moderators (Dr. Denise DeLorme, Dr. Sonia Stephens) asked open-ended questions using the same flexible, collaboratively-developed interview guide. Groups were audio-recorded and had an assistant taking notes. Data analysis involved a qualitative interpretive approach to identify patterns and themes.

Key Findings

The key findings of the focus groups are summarized into the following nine topic areas.

1. Nuisance Flooding Perceptions and Experiences

Participants had a general understanding of nuisance flooding. They identified characteristics and impacts of nuisance flooding and differentiated it from more serious flooding from major storms (e.g., *"Flooding that…isn't threatening to life or property but…causes problems…for example, at my house if you have a lot of rain, my backyard floods…it doesn't cause any monetary damage but…it's a nuisance…it stays flooded for a day or two depending on the rain but then goes away."*).

- All indicated personally experiencing nuisance flooding, with several sharing recent reports.
- Nuisance flooding was described as happening suddenly and potentially resulting in puddles on property, travel inconveniences, safety concerns, and minor work disruptions.

There were various perceived causes of nuisance flooding, including substantial rain and high tides, but especially development and infrastructure issues. Direct mentions of SLR were not frequent, but this factor appeared to be on some participants' minds in the context of their comments.

- Nuisance flooding was perceived to be more widespread and more regular than in the past. Development was considered a key cause (i.e., more people building in vulnerable areas, more impervious surfaces and poorly-planned storm water drainage). The groups indicated nuisance flooding was common and expected in their areas and they had adapted to it.

Various impacts of nuisance flooding were mentioned. Current impacts (e.g., on backyards, roads, daily activities) did not seem to be a major concern, but participants had some concerns with long-term potential harms to not just humans but also the environment and its association with climate change.

- Human impact concerns included public health (e.g., contaminated water, mosquitos, dangerous wildlife encounters) and community disruption (e.g., media attention, increased phone calls).
- Ecosystem impact concerns included erosion, saturated soil, and increased water salinity.

2. Awareness and Views on Flooding Mitigation Options

Participants were aware of an array of flooding mitigation options and discussed pros and cons.

- Building structures higher and building better drainage systems were mentioned, but quickly followed with recognition of cost considerations and short-term limitations.
- Participants thought careful, long-term community planning was necessary for better decisions about building more sustainable infrastructure and appropriate locations for development (e.g., "*Maybe we need to think a little bit more realistically about where we're building and where we're developing…there may just be some places that are not good options."*).
- Educating property owners about adding more permeable surfaces and adopting related eco-friendly practices (e.g., building swales, rain gardens) was also advocated.

3. Decision Making Factors for Mitigation Options

The focus groups discussed multiple factors they thought were important for decision making about mitigation options for nuisance flooding, which included: (1) locations of flooding, (2) frequency, severity, duration, and contributing factors for flooding, (3) topographic information of area (soil percolation rates, drainage capabilities), (4) surrounding properties that may be vulnerable, and (5) cost. There was no consensus on relative importance of these factors.

4. Awareness of NNBF Projects

Participants were aware of a number of existing or planned NNBF projects in the region (living shorelines projects of various sizes), some of which they were directly involved with. From the perspective of the focus groups, the scale of NNBF projects is a key consideration for modeling, and there seemed to be particular interest in those that are smaller-scale.

5. Perceptions of NNBFs

The focus groups discussed both perceived benefits and drawbacks of using NNBFs. Major benefits included sustainability and ecosystem services. Major drawbacks included questionable functionality and public perceptions (e.g., *"we're kind of engineering it by the seat of our pants because we don't really know exactly what the outcome is going to be"*).

6. Considerations for NNBF

Decision-making about NNBFs was considered complex. Participants discussed various types of information needed for decision-making about NNBFs. Ecological information needed included: (1) characteristics of species that would be used in a given NNBF, (2) ecosystem service functions of a particular NNBF, (3) costs of establishing and maintaining NNBF, and comparative costs of flooding impacts both with and without NNBF, (4) project time frame, (5) scientific data on relative effectiveness and design life of different NNBFs, and (6) long-term understanding of the system and geographic area. Social considerations included: (1) project permitting procedures, (2) stakeholder support, (3) unintended consequences (e.g., conflicts of interest among neighboring property owners), and (4) current use of the area. Due to complexity of NNBF projects, the focus groups emphasized there is not one piece of information most essential for decision-making that can be applied uniformly. A unique combination of crucial information is needed on a case-by-case basis.

7. Recommendations for Evaluating NNBFs

On the topic of evaluating the performance of NNBFs, the focus groups discussed what criteria they thought should be used as well as how these criteria should be measured. Participants thought it

would depend on the project goal but should involve multiple metrics. Specific criteria mentioned as important included: (1) degree of wave energy reduction, (2) shoreline erosion reduction, (3) soil accretion, (4), production of natural habitat, and (5) resilience to regular tidal ebb and flow as well as extreme events. Regarding how to evaluate NNBFs, participants thought the process should: (1) be objective and (2) include long-term monitoring during normal as well as extreme events. There was some recognition that implementing NNBFs is often an experimental learning process requiring trial and error before eventual success.

8. NGOM+N2E2 Project Feedback

Overall reactions to NGOM+N2E2 were positive. Participants seemed confident NGOM+N2E2 would have high scientific research rigor for development and refinement of decision-support tools for nuisance flooding mitigation options in general, and types of NNBFs in particular. Participants thought the definitions and examples of nuisance flooding and NNBFs provided in the workshop presentations aligned with their conceptualizations and experiences. One major piece of advice was to be transparent about uncertainties in the modeling being developed, as it was anticipated users would be comparing a number of different models from different sources. Two recommendations were to: (1) extend examples of NNBFs to a wider variety of habitats (e.g., fresh water streams, floodplains), and (2) include native vegetation, seagrass beds, and oyster reefs as natural features. A number of questions about NGOM+N2E2 were also raised, including: (1) project time frame (2) ability of models to be predictive (3) probability of impacts of certain storms influencing economic evaluation, (4) project's end result and application, and (5) if project could inform smaller projects.

9. Outreach and Engagement Suggestions

For future NGOM+N2E2 outreach and engagement, the focus groups identified a variety of stakeholders/target audiences including: (1) planners, (2) floodplain managers, (3) emergency managers, (4) local elected officials, (5) city councils, (6) water management districts, (7) citizens' groups (e.g., watershed groups), (8) homeowners' associations, (9) property appraisers, and (10) adjacent waterfront property owners. They also offered suggestions for NGOM+N2E2 messages. Message content and format suggestions included: (1) providing stakeholders with adaptation alternatives and (2) educating stakeholders about types and benefits of natural shorelines. Message delivery methods included: (1) MTAG members, (2) Internet, (3) webinars, (4) workshops at community centers, (5) training existing trainers, and (6) local partnerships (e.g., land trusts, NGOs). Participants thought future MTAG communication and interaction should continue to involve multiple venues including virtual meetings, email, and in-person meetings rotating at different NERRs. As some challenges with attending in-person meetings were mentioned (limited time and travel budgets), continuing to use various technologies as part of engagement is recommended.

Conclusion and Recommendations

The initial focus groups were successful in engaging the MTAG and other stakeholders and contributing valuable local knowledge to assist NGOM+N2E2's scientific research and planned products and guide the next steps toward realizing transdisciplinary research outcomes. Participants seemed to learn and benefit from sharing their viewpoints and experiences, were pleased to be involved in NGOM+N2E2, and were comfortable with and enjoyed this component of the project. Focus groups will continue to be implemented in future NGOM+N2E2 in-person workshops. We recommend that the NGOM+N2E2 team consider this input carefully in preparing the path forward to achieve optimal utility and effective distribution of the NNBF-related scientific research findings and decision-support tools throughout the Northern Gulf of Mexico.

Appendix E – Acronym List

Organizations and Agencies

AL DCNR – Alabama Department of Conservation and Natural Resources

FL DEP – Florida Department of Environmental Protection

FL FWCC – Florida Fish and Wildlife Conservation Commission

LSU – Louisiana State University

MASGC – Mississippi Alabama Sea Grant Consortium

MS DMR – Mississippi Department of Marine Resources

NERR – National Estuarine Research Reserve

NGOM SSC – Northern Gulf of Mexico Sentinel Site Cooperative

NOAA NCCOS – National Oceanic and Atmospheric Agency National Centers for Coastal Ocean Science

NOAA NMFS – National Oceanic and Atmospheric Agency National Marine Fisheries Service

NOAA NOS – National Oceanic and Atmospheric Agency National Ocean Service

NOAA OCM – National Oceanic and Atmospheric Agency Office for Coastal Management

OSU – Oregon State University

RPC – Regional Planning Council

TAMU CC – Texas A&M University Corpus Christi

UCF – University of Central Florida

USGS – United States Geological Survey

WMD – Water Management District

Other Acronyms

DEM – Digital Elevation Model

EESLR – Ecological Effects of Sea Level Rise

EESLR-NGOM – Ecological Effects of Sea Level Rise in the Northern Gulf of Mexico project

HAZUS – Hazards US a FEMA model to assess the economic impacts of natural disasters

LULC – Land Use Land Change

MTAG – Management Transition Advisory Group

NGOM – Northern Gulf of Mexico

NGOM+N2E2 – Current project title based on key features of the project (**N**atural and **N**ature Based Features, **E**cosystem Services Valuation, **E**conomic Impacts Assessment)

NNBF – Natural and Nature Based Feature

PCOI – A model that does large-scale assessments of morphologic changes

SLR – Sea Level Rise

XBeach – A model that does high resolution analysis of morphologic changes