Mapping and Visualizing SLR and Coastal Flooding Impacts

Doug Marcy
NOAA Coastal Services Center

Preparing for the Rising Tide:
Adapting to Climate Change in the Mid-Atlantic
December 10 , 2012

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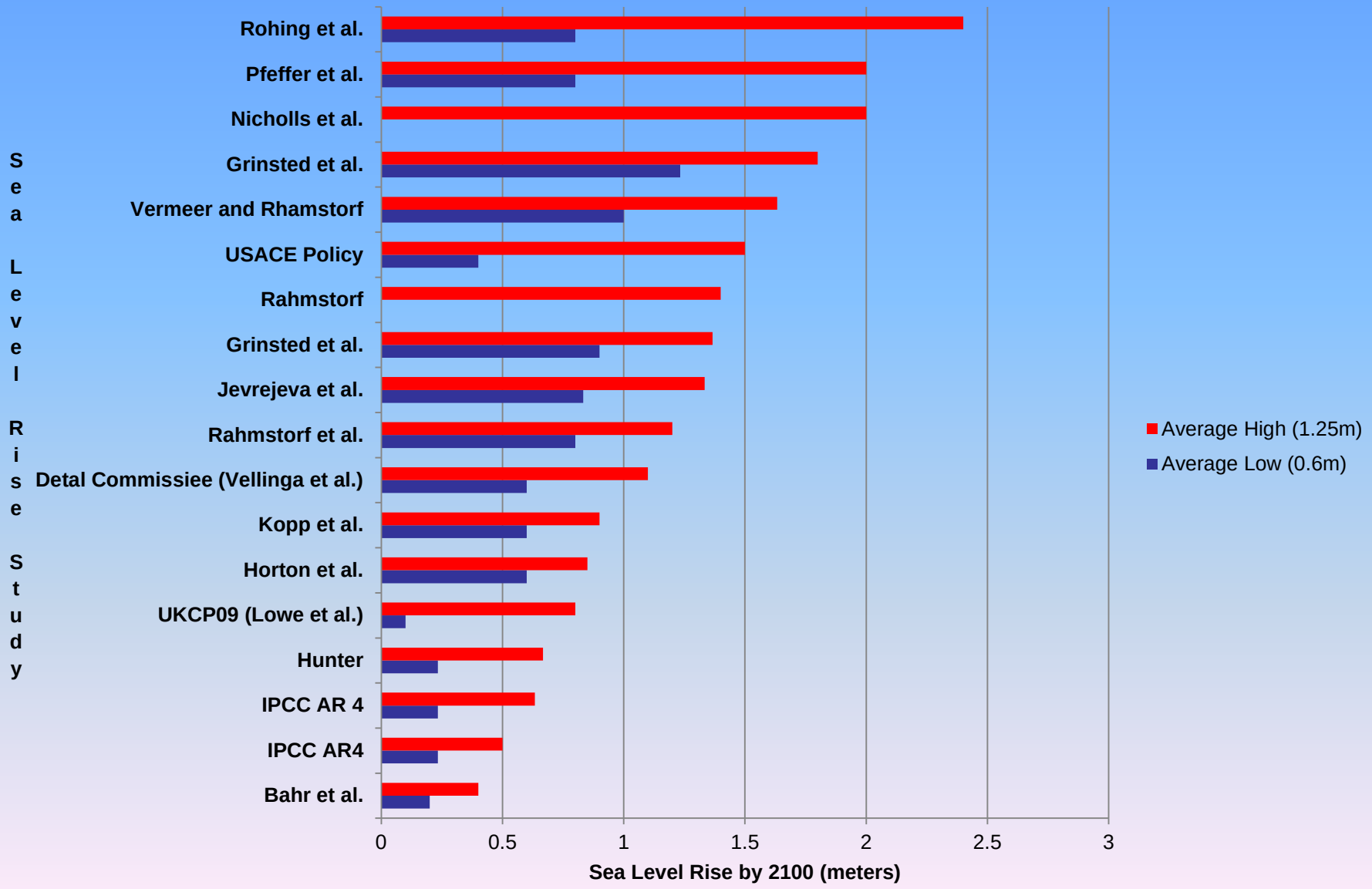
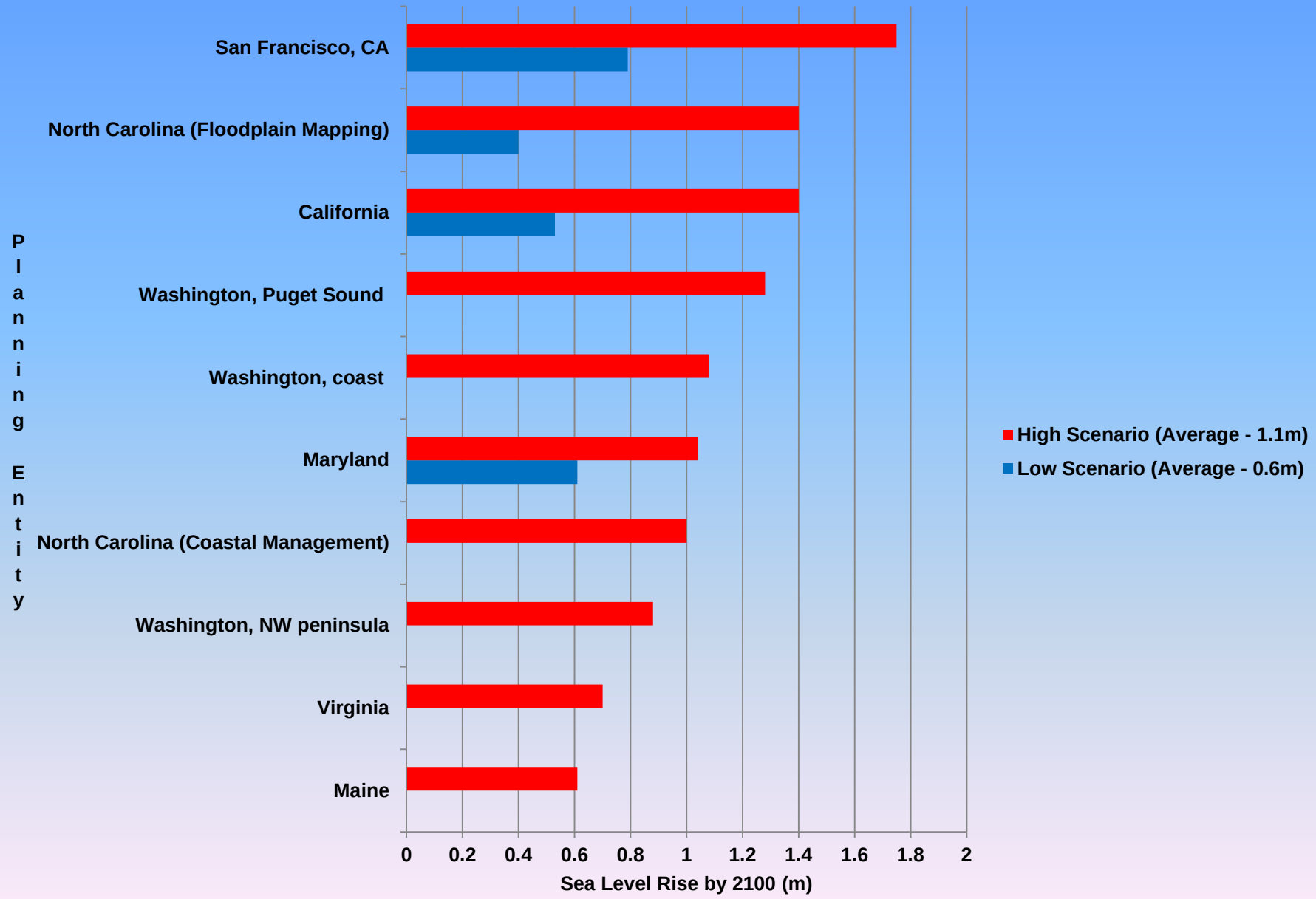
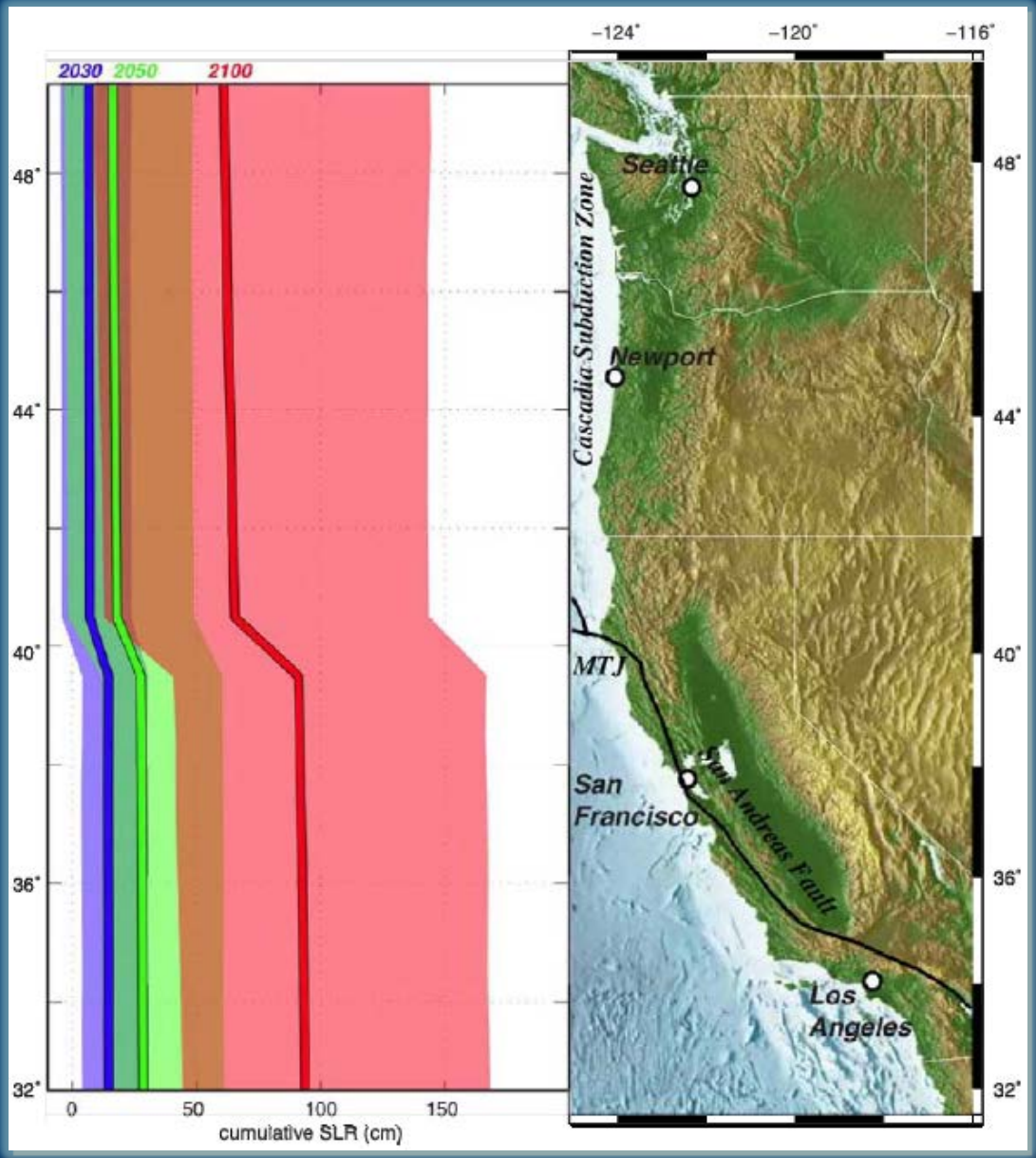
Sea Level Rise Projections
(based on various climate scenarios)



Planning for Sea Level Rise



Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future – NRC, 2012



Earthquakes could cause an instantaneous rise of 1m

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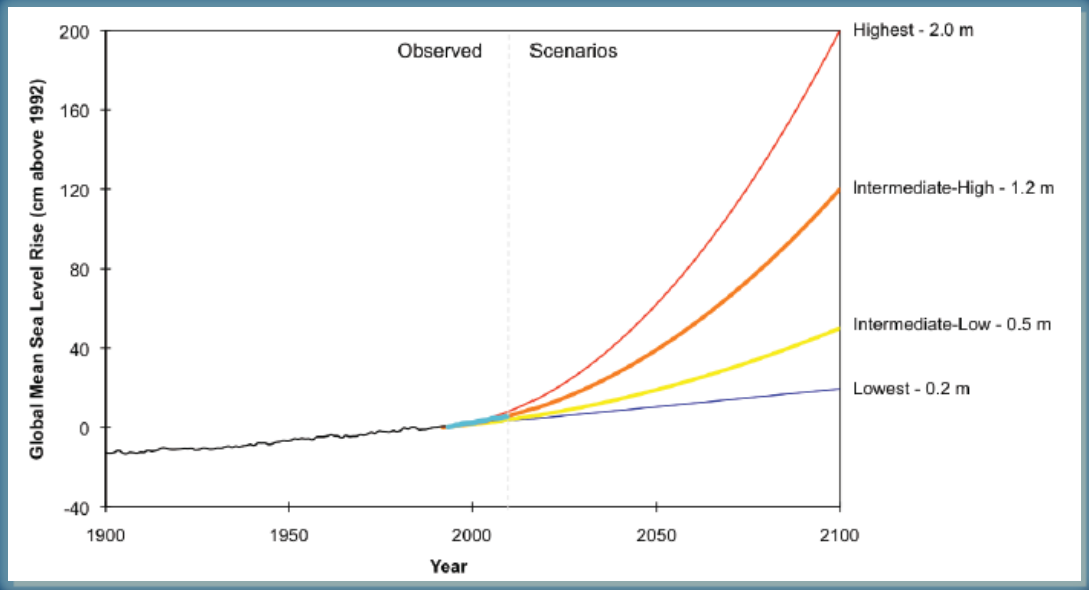
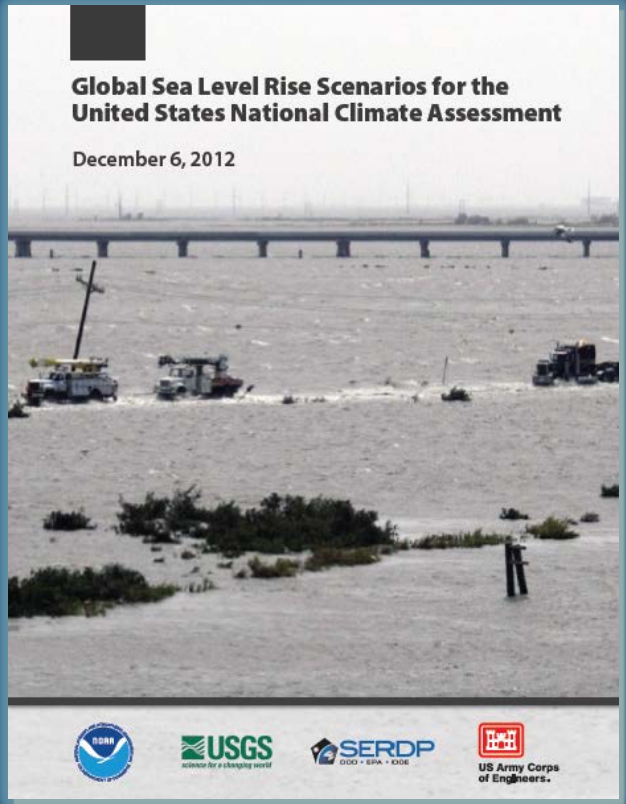
Global Sea Level Rise Scenarios for the United States National Climate Assessment

http://www.cpo.noaa.gov/reports/sealevel/





Scenario	SLR by 2100 (m)*	SLR by 2100 (ft)*
Highest	2.0	6.6
Intermediate-High	1.2	3.9
Intermediate-Low	0.5	1.6
Lowest	0.2	0.7

* Using mean sea level in 1992 as a starting point.

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State, Regional, and County Needs

- Assistance with collection of consistent, standardized elevation data and avoidance of duplication
- Federal agency guidance and justification for flood, tide, and storm elevations for coastal areas to use for creating inundation models
- Methods and standards for mapping coastal inundation
- Simple sea level rise (SLR) visualization tools that show high-risk areas with possible future flooding problems so that land acquisition and adaptation planning can start now

When It Comes to Flood Mapping or Sea Level Rise Projection, Elevation Data Is the Key . . .

- 2009 National Research Council report "Mapping the zone: Improving Flood Map Accuracy"

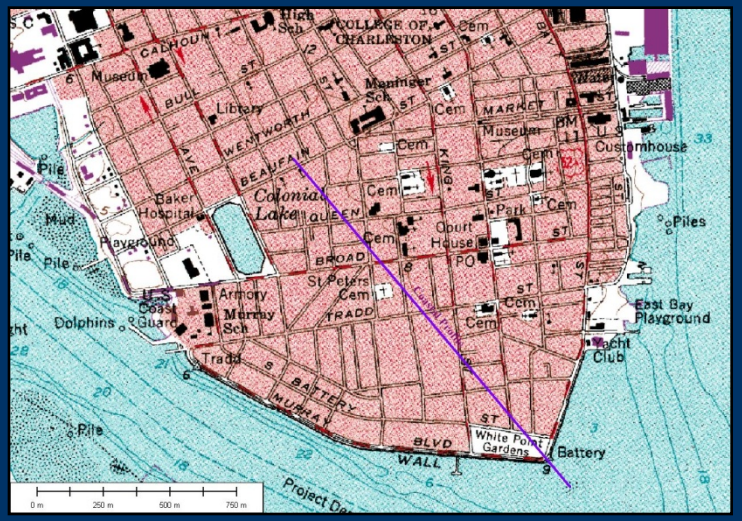
  Topographic/bathymetric data is the most important factor in determining the accuracy of flood maps

- Climate Change Science Program SAP 4.1, "Coastal Elevations and Sensitivity to Sea-Level Rise"

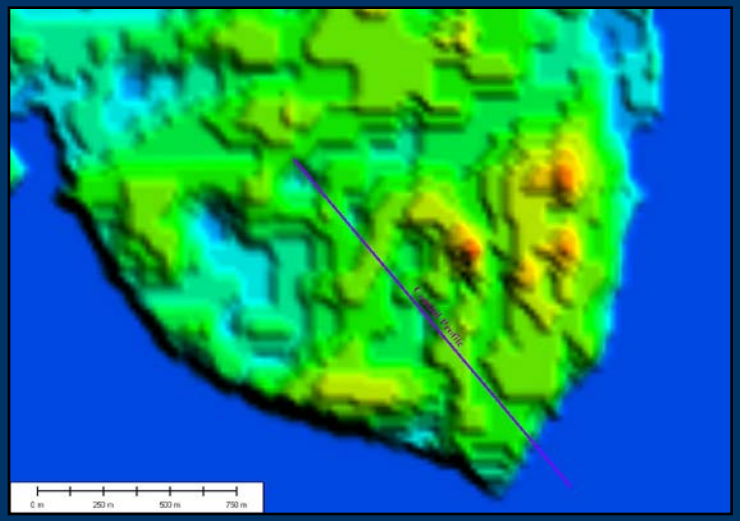
  Sea level rise mapping requires high-resolution elevation data (Current national datasets {30m DEMs} are not adequate)

Importance of Elevation Data

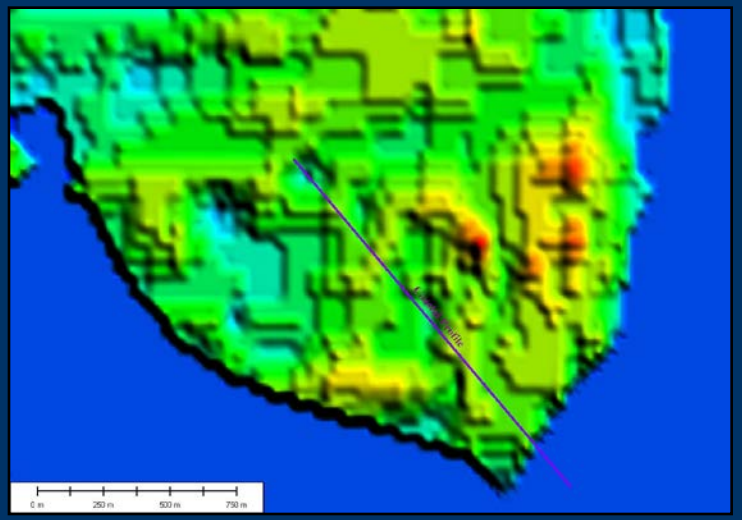
Profile in Charleston, South Carolina



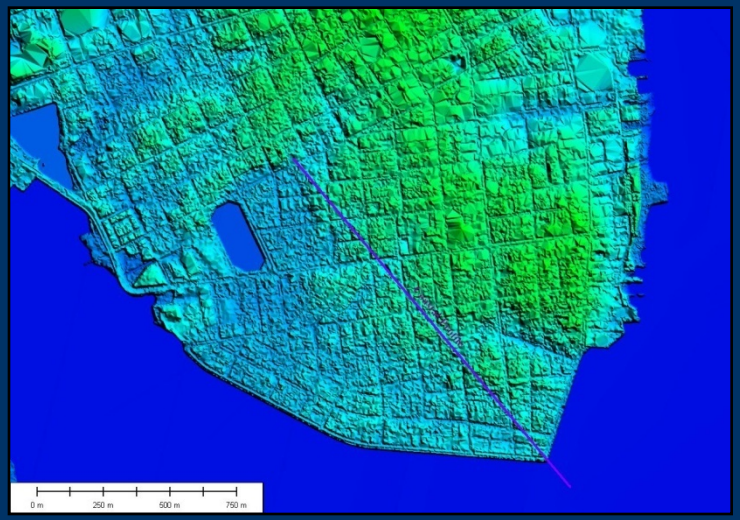
30-meter NED data (1 arc second)



10-meter NED data (1/3 arc second)

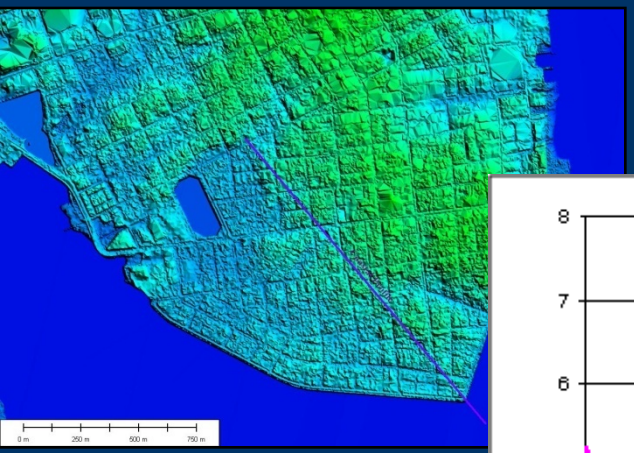


Lidar data

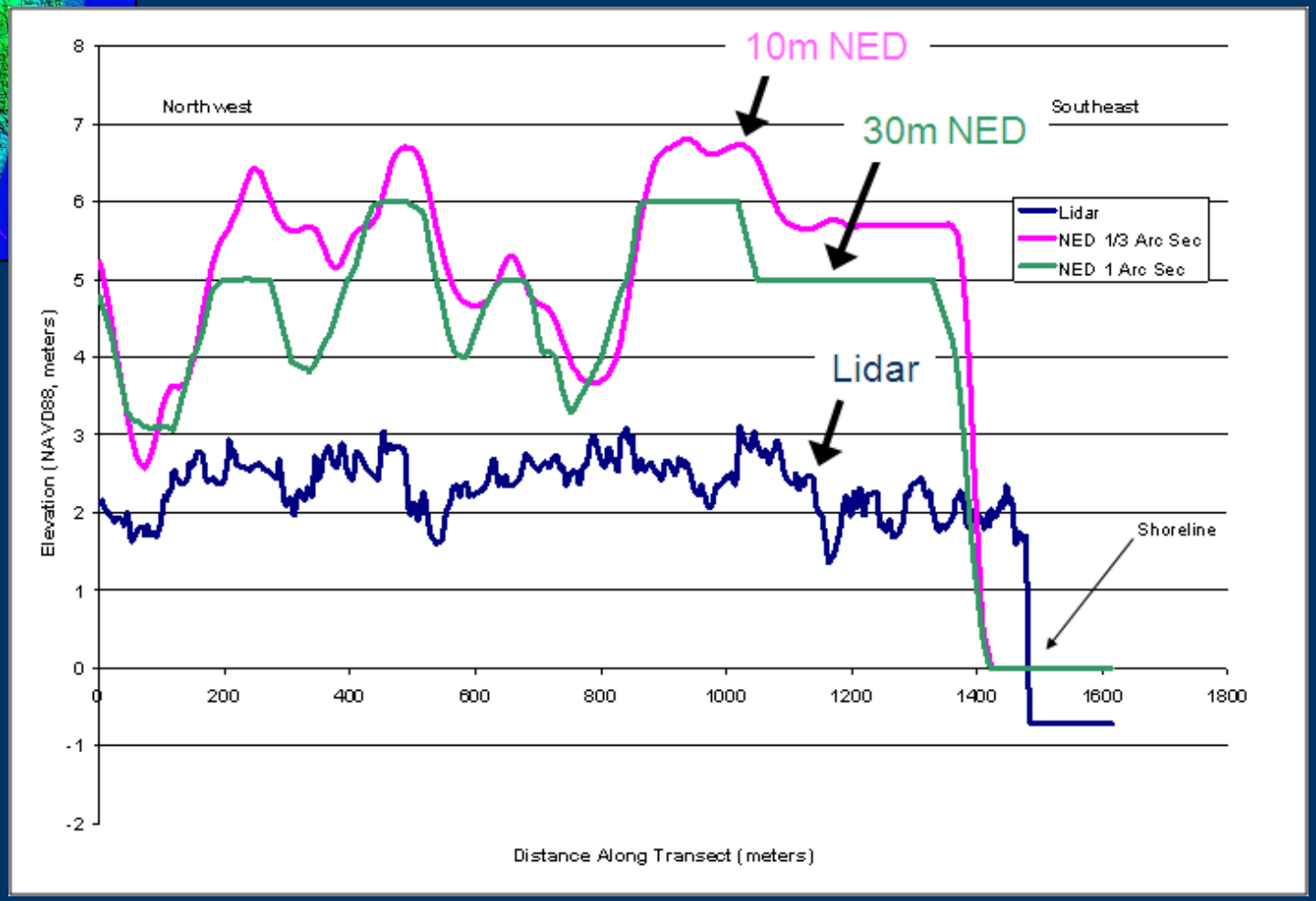


NED – *National Elevation Dataset*

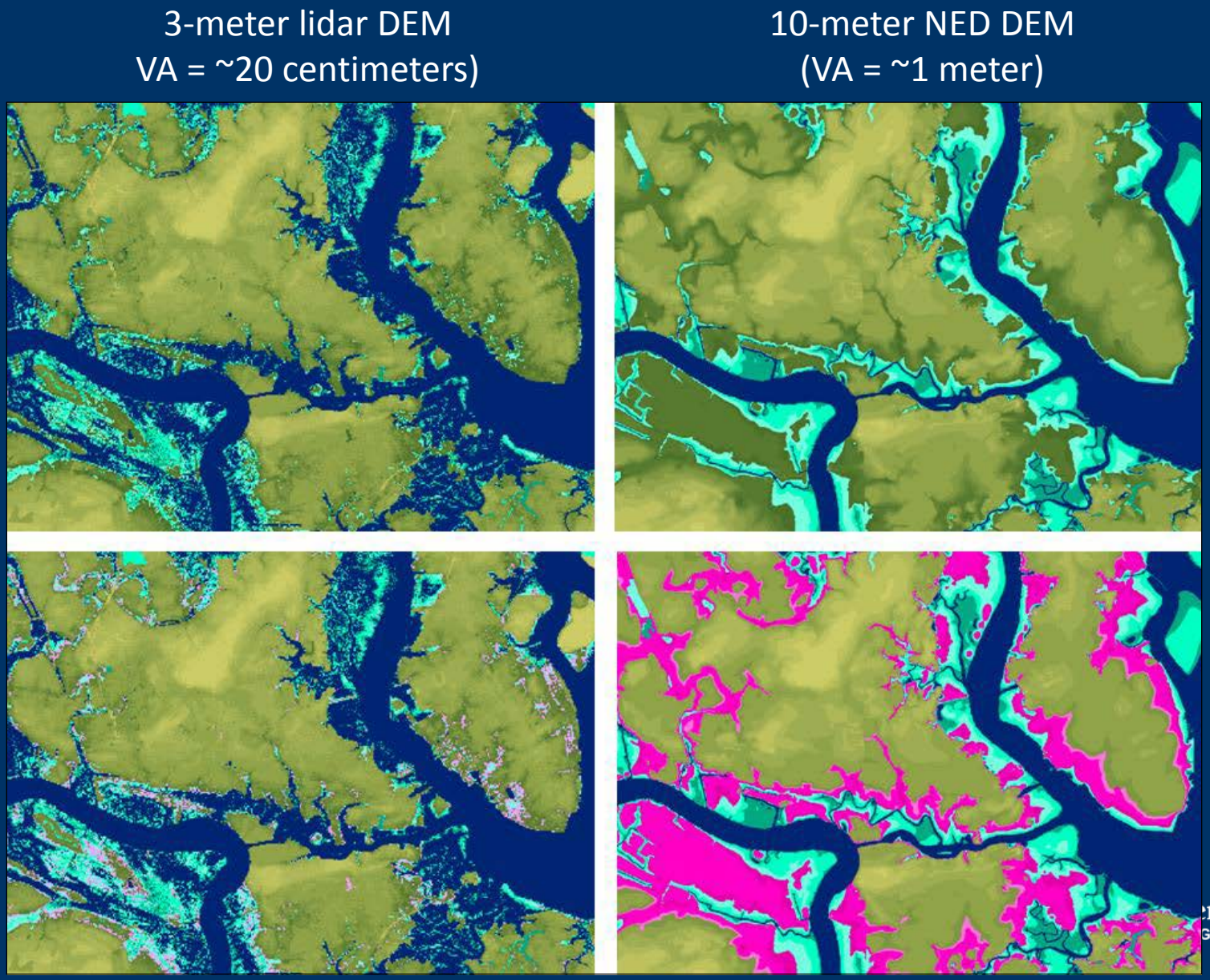
In Charleston, South Carolina
Vulnerable Areas Are Lower Than We Thought



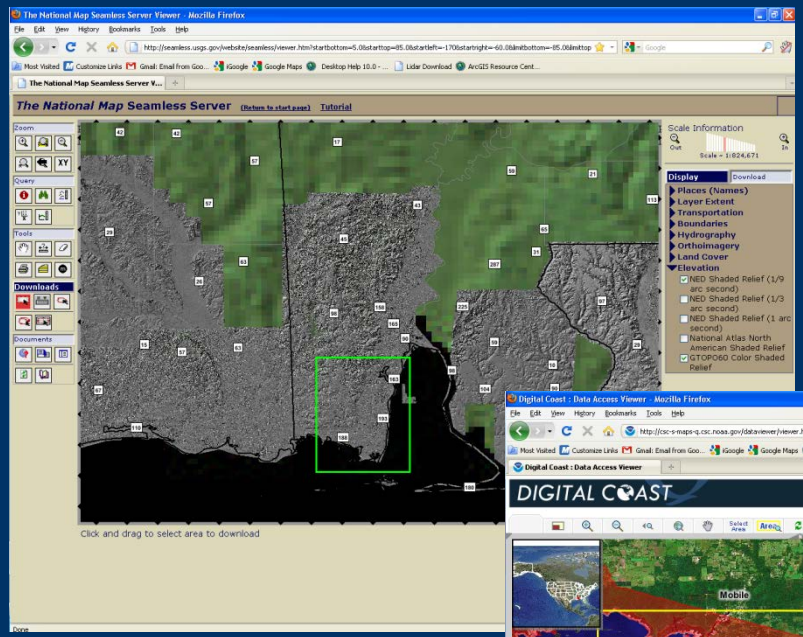
Up to 3 meters (10 feet) LOWER!!



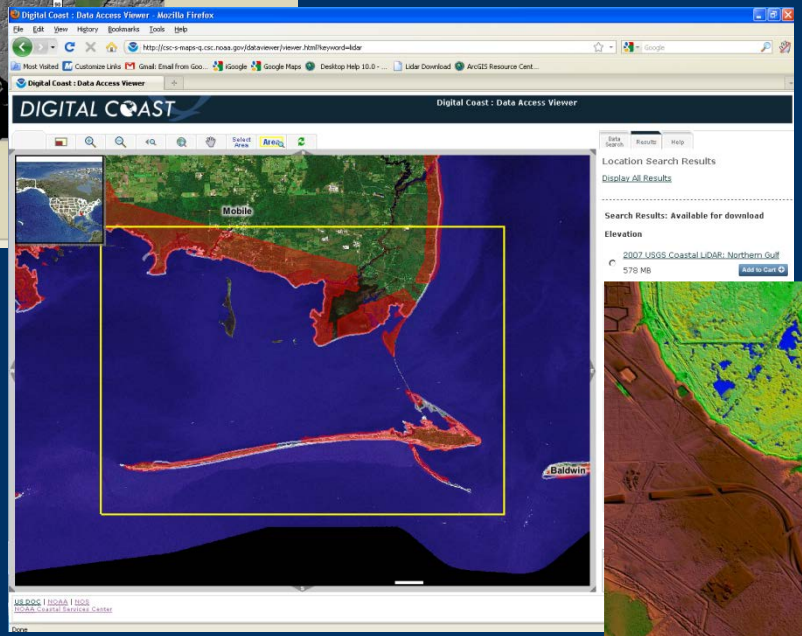
Digital Elevation Model (DEM) Accuracy and Mapping Results



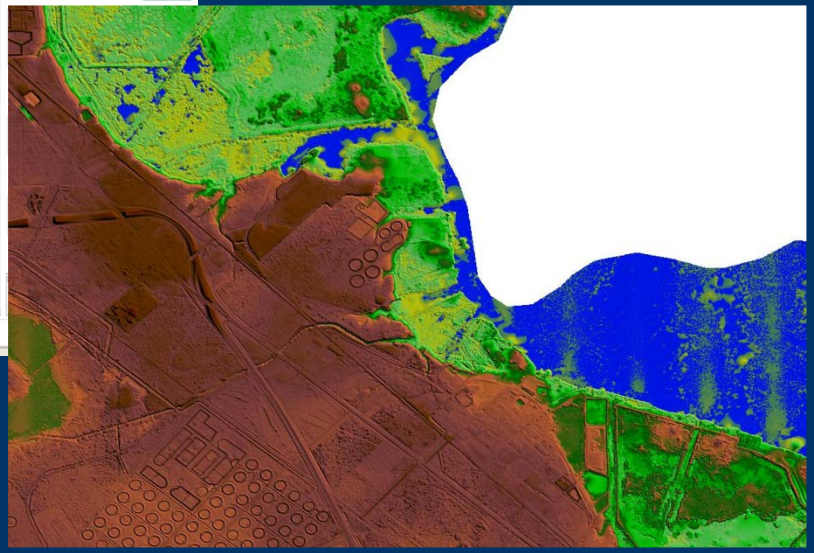
Build Best Terrain Available



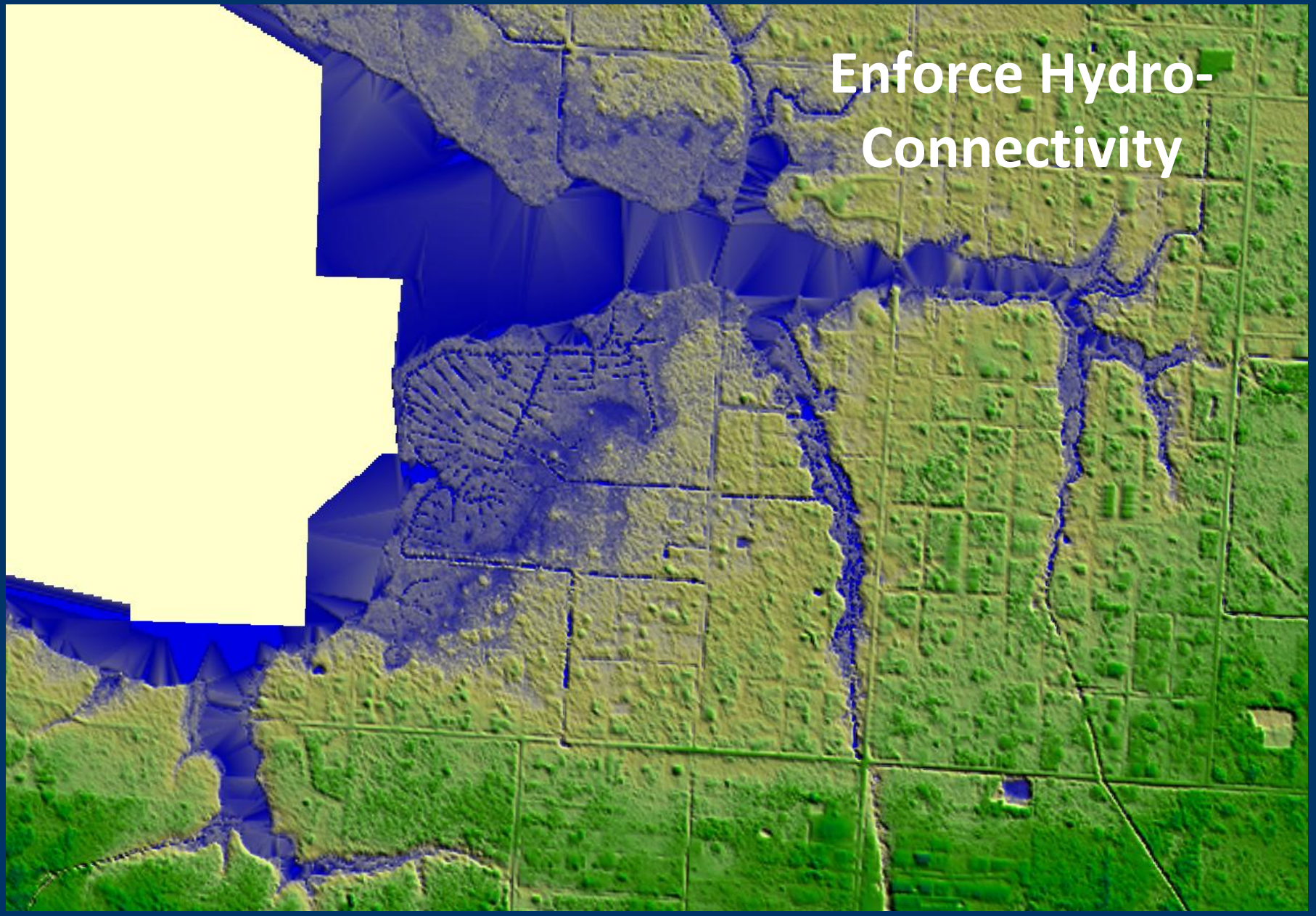
NED

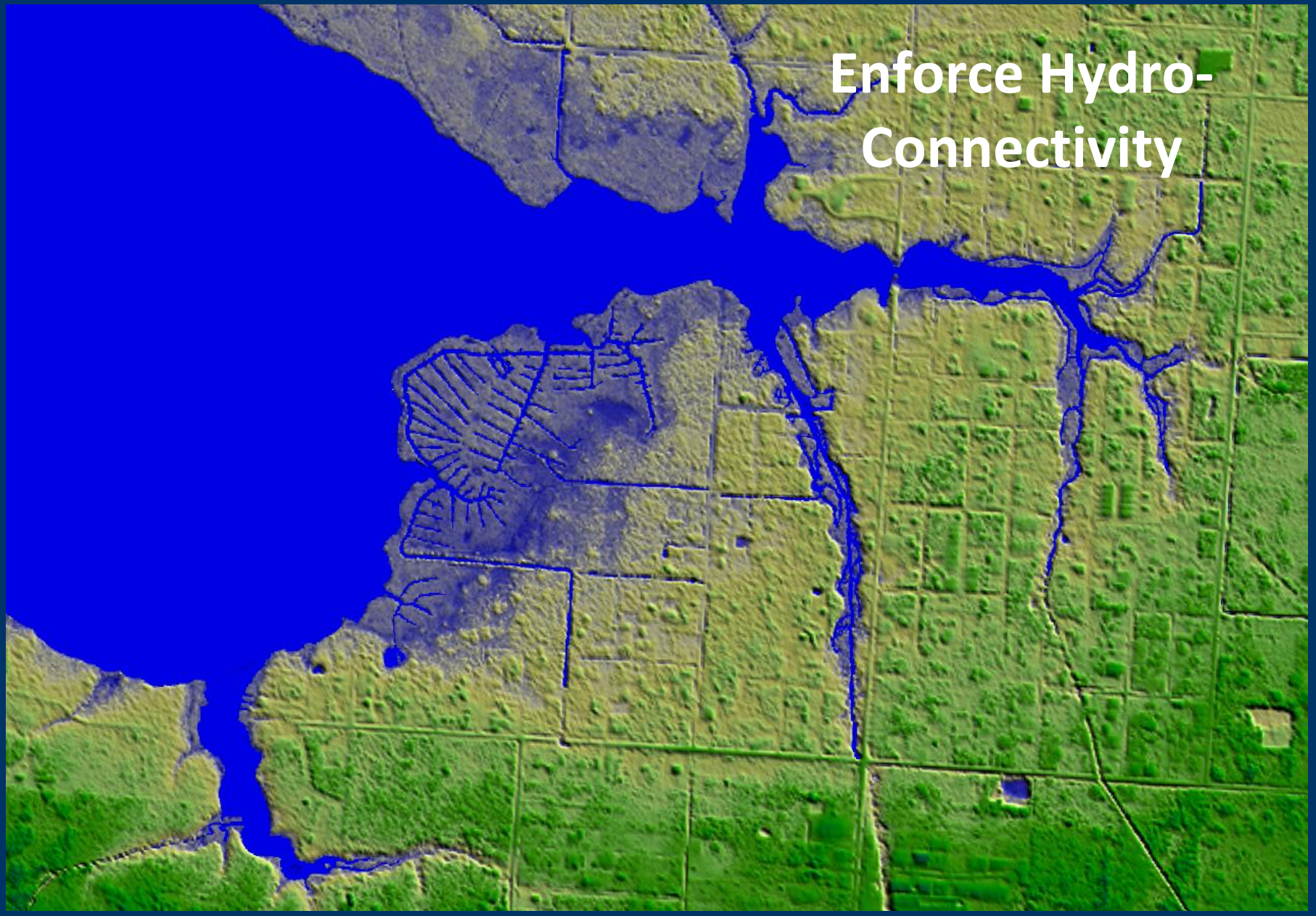


Digital Coast - JABLTCX

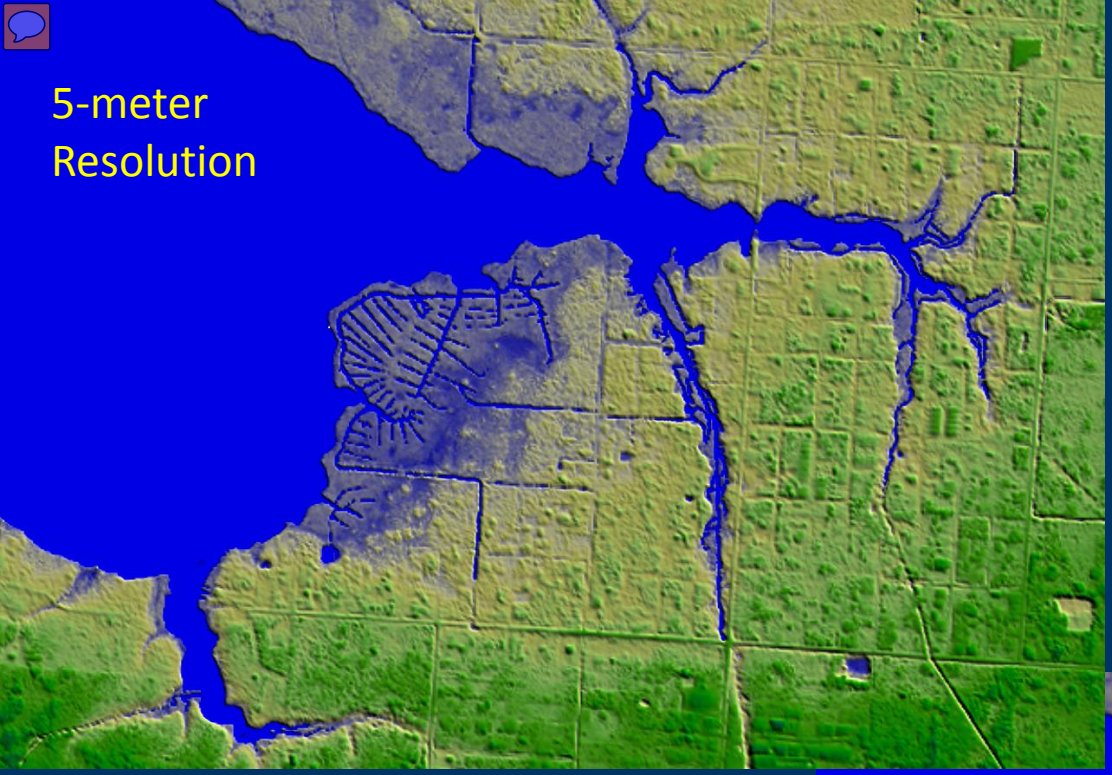


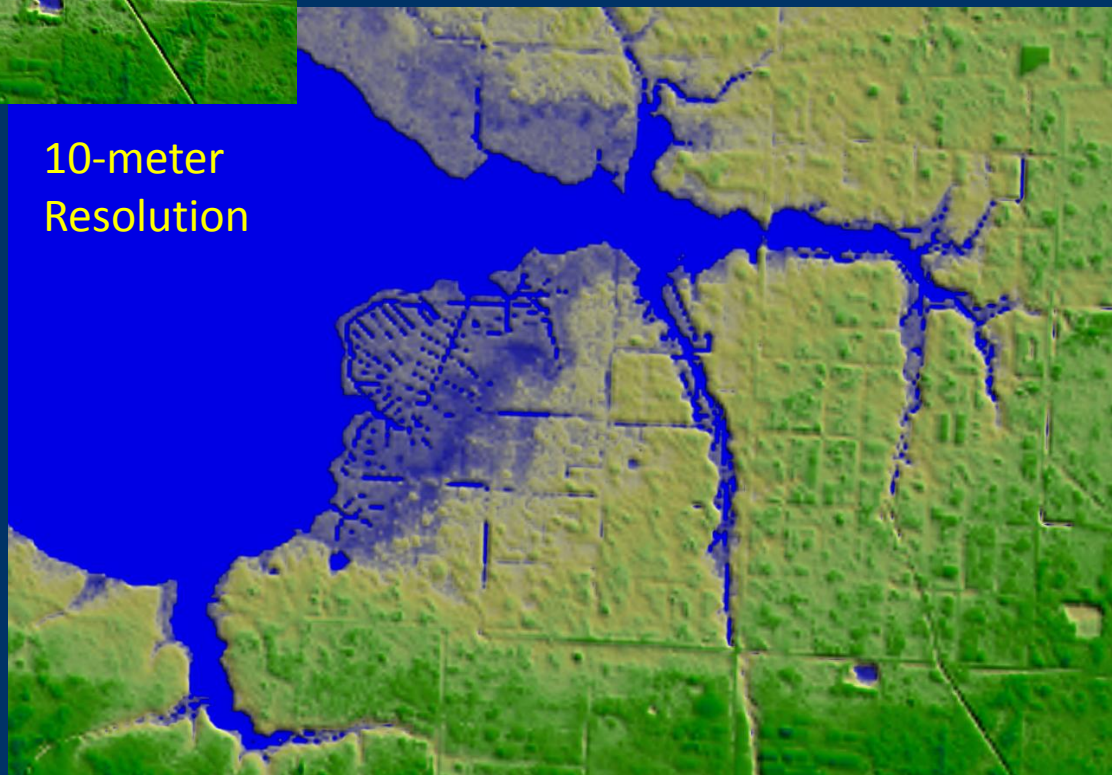
Raw Points/Breaklines


Enforce Hydro-
Connectivity


Enforce Hydro-
Connectivity

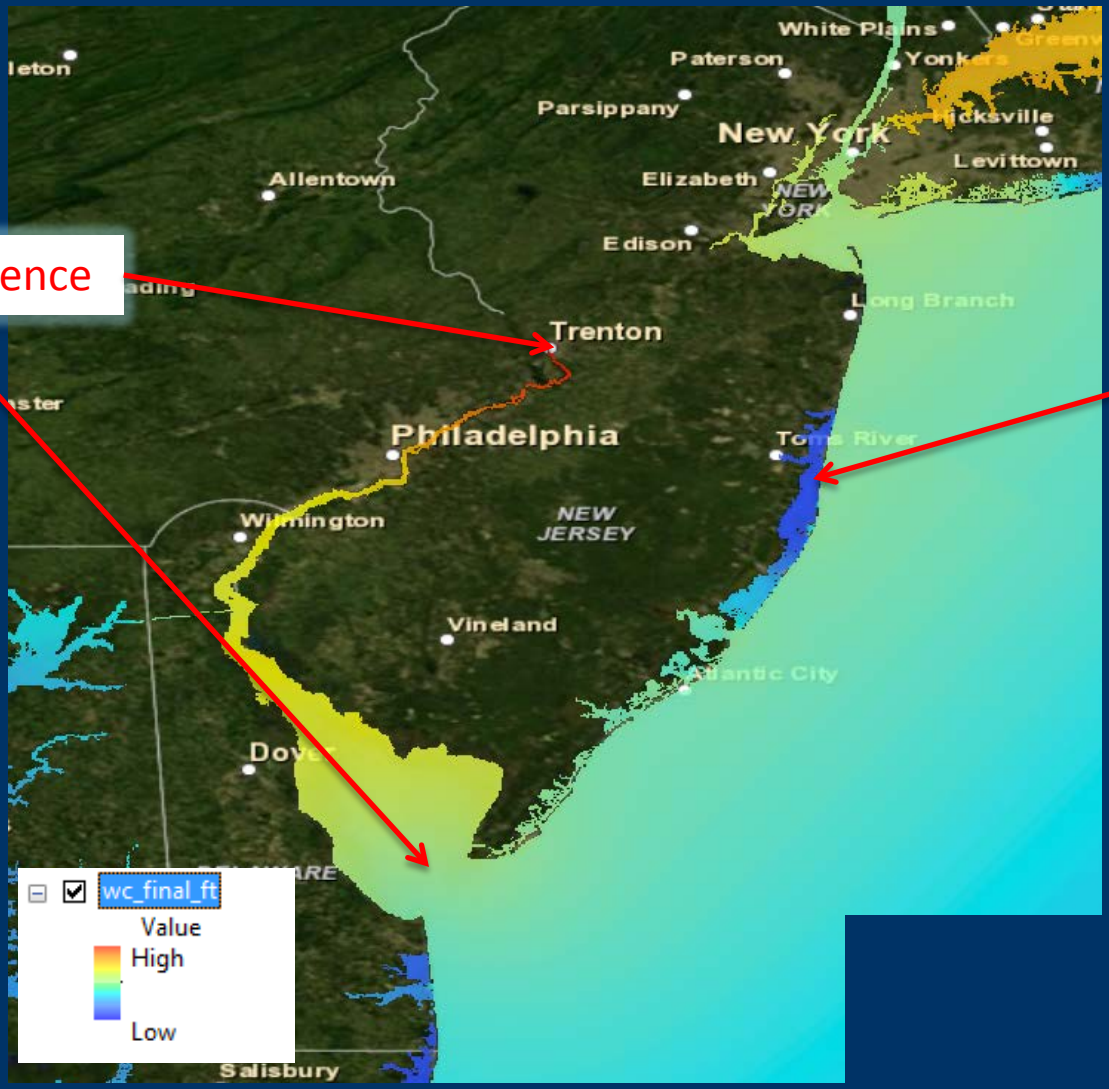
Resolution Requirements





The Ocean Is Not a Flat Surface

(especially in bays and estuaries)



~3 foot difference

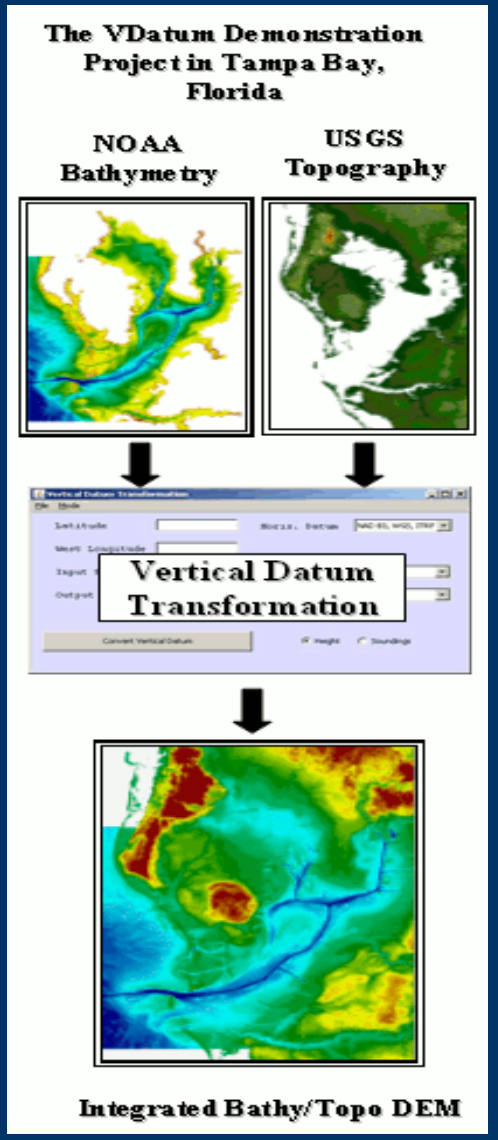
~2 foot difference

MHHW
Tidal Surface

Vertical Transformation

Using VDatum to convert between tidal, orthometric, and ellipsoidal datums

- Vertical Datum Transformation Tool
- Developed jointly by NOAA's Office of Coast Survey and the National Geodetic Survey
- Provides a method to accurately combine topographic (orthometric) and bathymetric (tidal) elevation data
- Application is limited to the region it was developed for

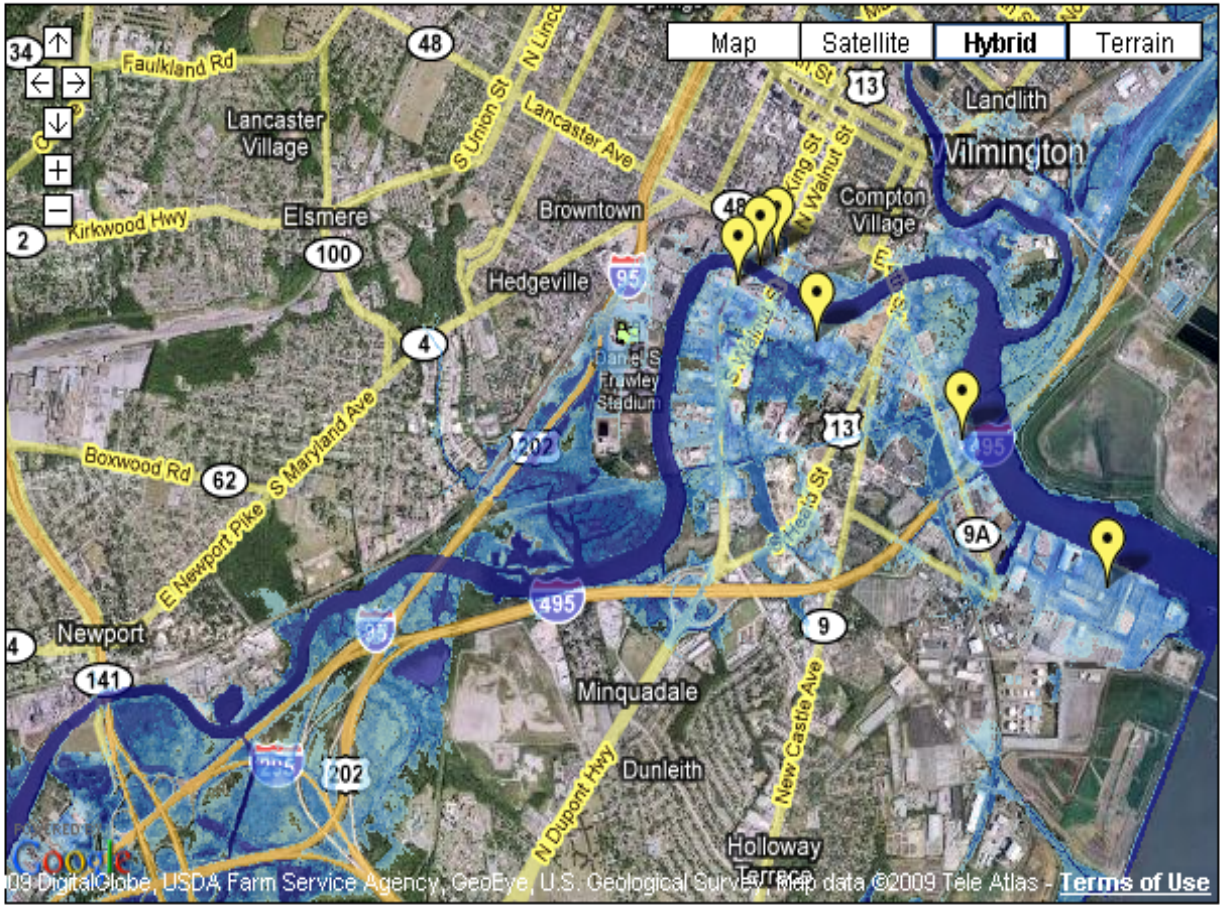


State, Regional, and County Needs

- Simple visualization tools
- Show potential impacts of SLR scenarios
- Show how everyday tidal flooding will become worse and more frequent

Building on local pilot studies and recommendations from communities of practice

Sea Level Rise Impacts for Wilmington, Delaware



Sea Level Rise: 4 ft

This map shows potential flooding, or inundation, caused by sea level rise. Use the slider bar to view the extent.

The map illustrates the scale of potential flooding, not the exact location, and does not account for erosion, subsidence, or future construction. Water levels are shown as they would appear during an average high tide (mean high water). Rising sea levels will cause daily high tides to reach farther inland.

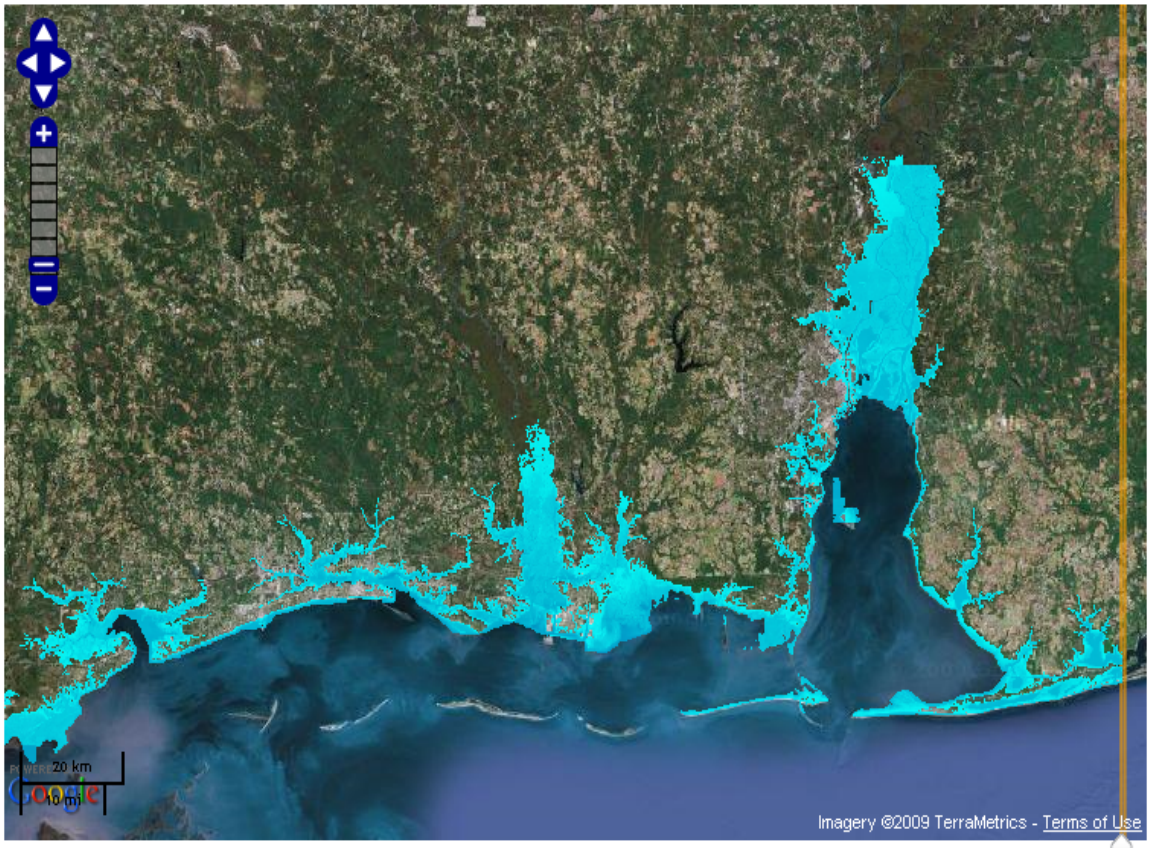
Places of interest vulnerable to sea level rise.

Note: Flood layers may take a moment to load.

View the **Flood Frequency Predictions**

This pilot project is a collaborative effort of NOAA, the U.S. Geological Survey, and the Delaware Department of Natural Resources.

Sea Level Rise Visualization for Alabama and Mississippi



The orange line marks the edge of the Sea Level Rise map. Move the slider to change the visible area.

Hold Shift and drag to zoom in to a particular area.

The map illustrates the scale of potential flooding, not the exact location, and does not account for erosion, subsidence, or future construction. Water levels are shown as they would appear during an average high tide. Rising sea levels will cause daily high tides to reach farther inland.

Background Layer
- ○ Maps
- ◉ Satellite
- ○ Satellite+Labels
- ○ Terrain

Overlay Layer
- ☐ Population

Population count in 2000
0 1000+

Transparency

Magnitude of Sea Level Rise
- ○ 1ft
- ○ 3ft
- ◉ 6ft

Water depth (ft)
0 25.194

Transparency

Select a scenario to view the extent of potential flooding, or inundation, caused by 1 foot, 3 foot, or 6 foot sea level rise on coastal Alabama and Mississippi.

Address Finder
Enter your address to locate it on the map.
Map It!

Addressing the Needs to Build a Better Tool

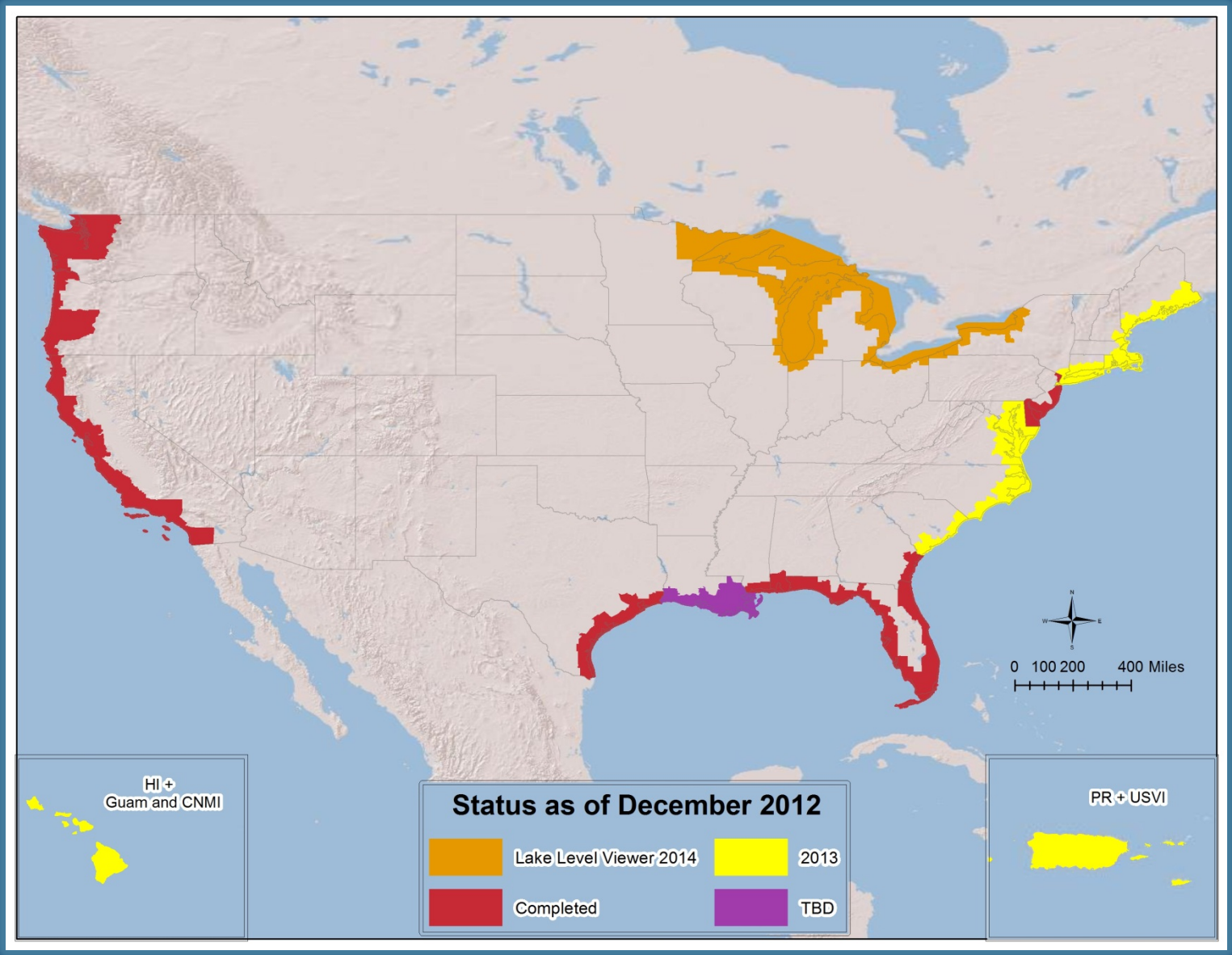
1. Sea Level Rise and Inundation Community Workshop "Executive Summary" (December 2009) ***www.csc.noaa.gov/publications/inundation-workshop.html***
    - Defining needed data and tools for adaptation planning
2. *Technical Considerations for Use of Geospatial Data in Sea Level Change Mapping and Assessment* (September 2010) ***www.csc.noaa.gov/publications/slc_tech.pdf***
    - Technical guidance for sea level change monitoring and mapping
3. *Coastal Sea-Level Change Societal Challenge Needs Assessment Report* (October 2011) – ***www.floods.org/ace-files/documentlibrary/committees/Coastal/NOAA_Coastal_Sea_Level_Change_Societal_Challenge_Needs_Assessment_Report.pdf***
    - Defining needed tools, education, and communication for decision-making

Sea Level Rise and Coastal Flooding Impacts Viewer

www.csc.noaa.gov/slr

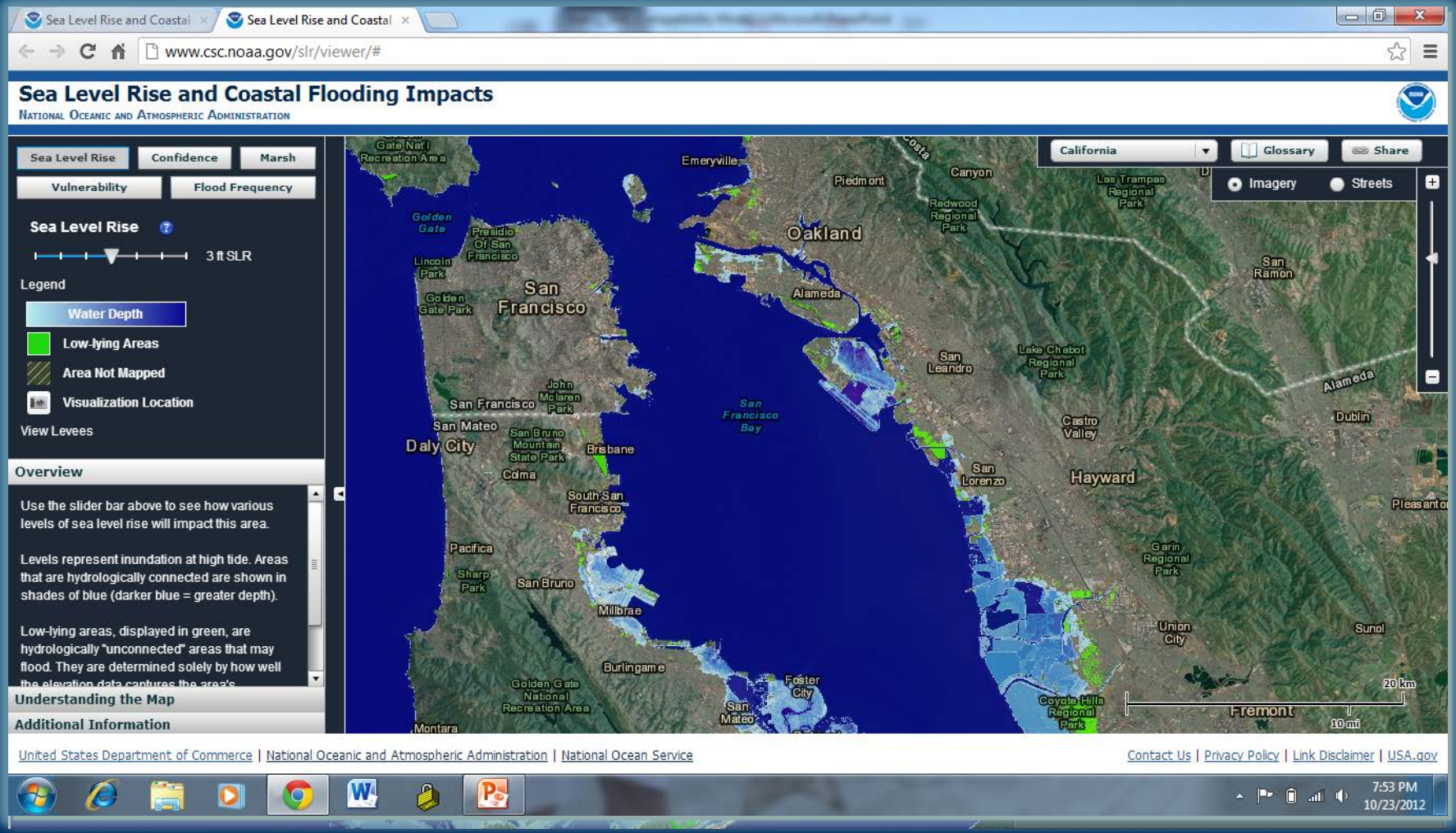
* Working with U.S. Geological Survey, Sea Grant, Gulf Coast Services Center, Digital Coast Partners, National Ocean Service's Center for Operational Oceanographic Products and Services (CO-OPS), Dewberry, University of South Carolina, Bureau of Labor Statistics.

Current Geographies



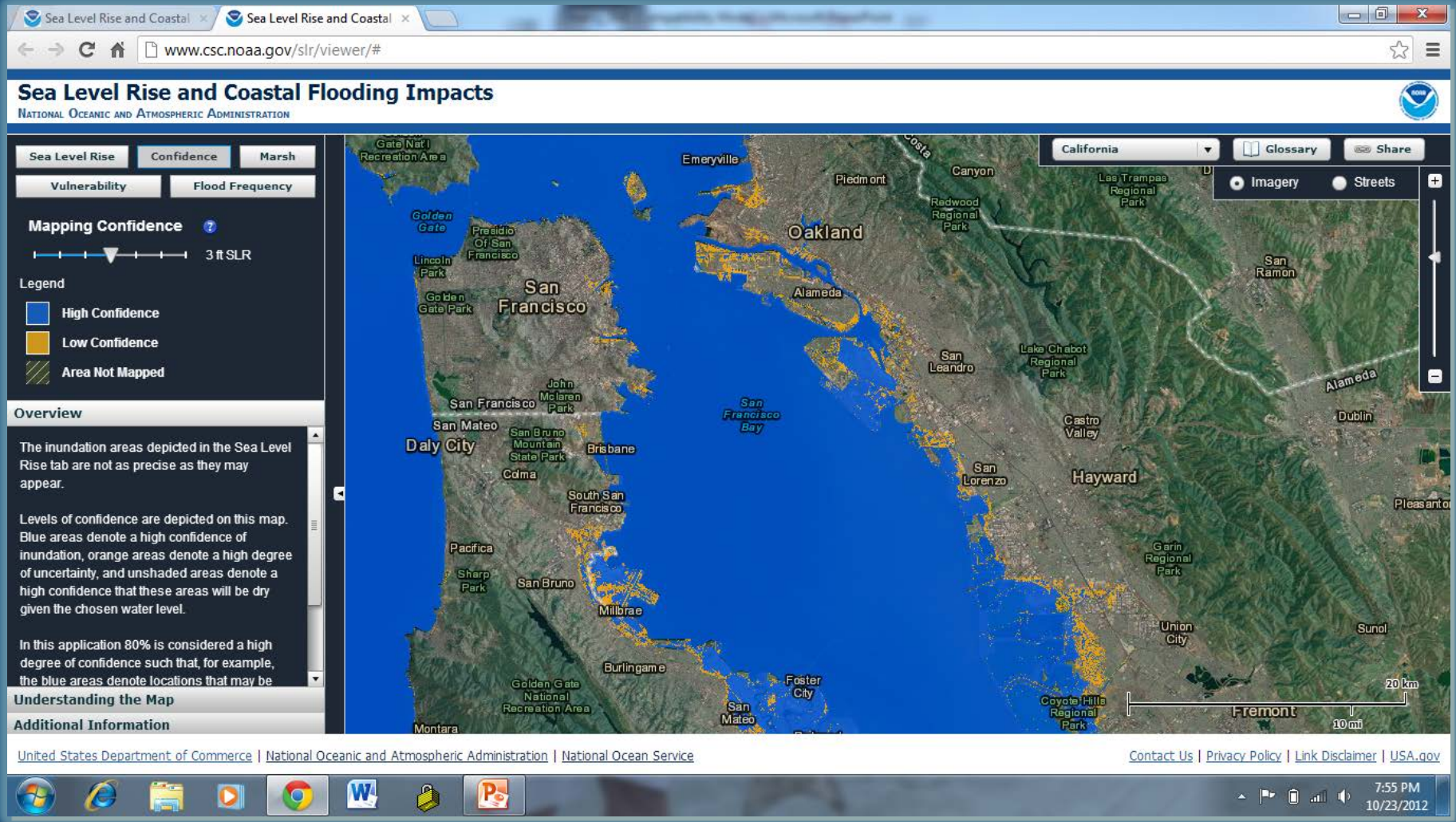
Impacts of Sea Level Rise

- Visualize impacts for mean higher high water (MHHW) 6-foot SLR scenarios overlaid on aerial imagery, street map, and terrain map. Photos of SLR on individual structures will illustrate site-specific impacts.



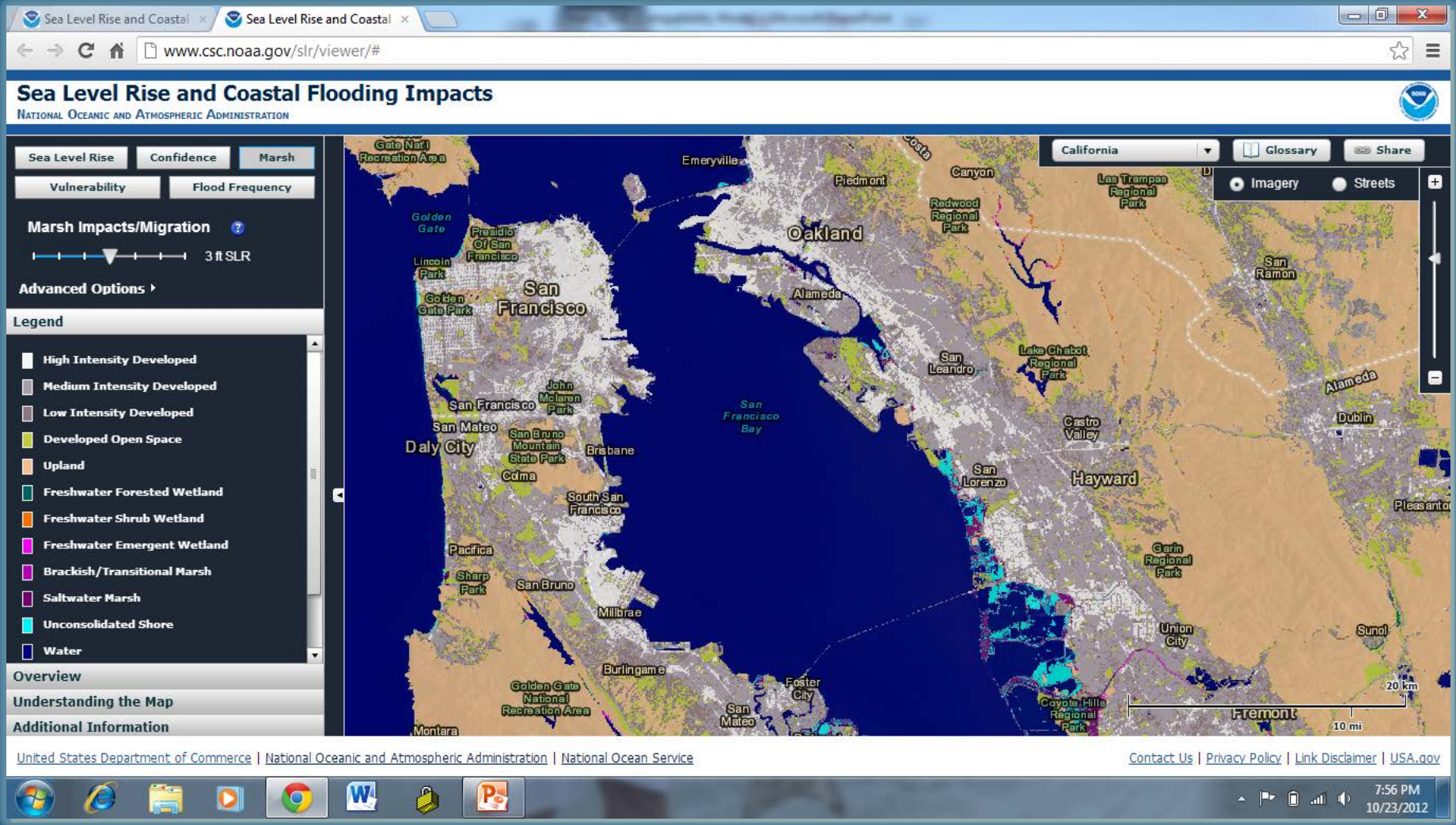
Communicate Mapping Confidence

- Visualize the mapping confidence of inundation area based on uncertainty of elevation data and MHHW tidal surface.



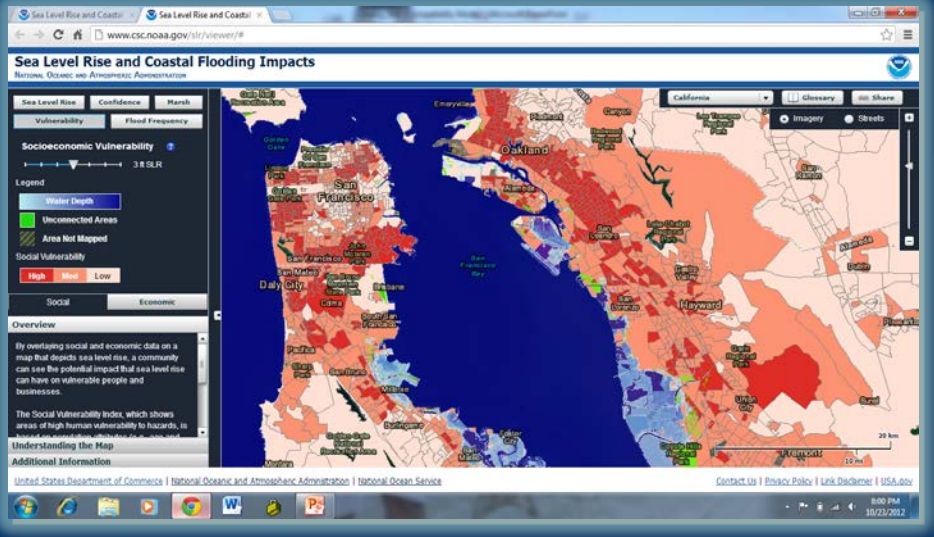
Visualize Marsh Impacts

- Visualize the impacts of SLR scenarios on marshes using Coastal Change Analysis Program (C-CAP) data.



Social and Economic Vulnerability

- Include Social Vulnerability Index (SOVI) from USC and data from Bureau of Labor Statistics (BLS) showing impacts on society and economy.



Social Vulnerability Index (Cutter)

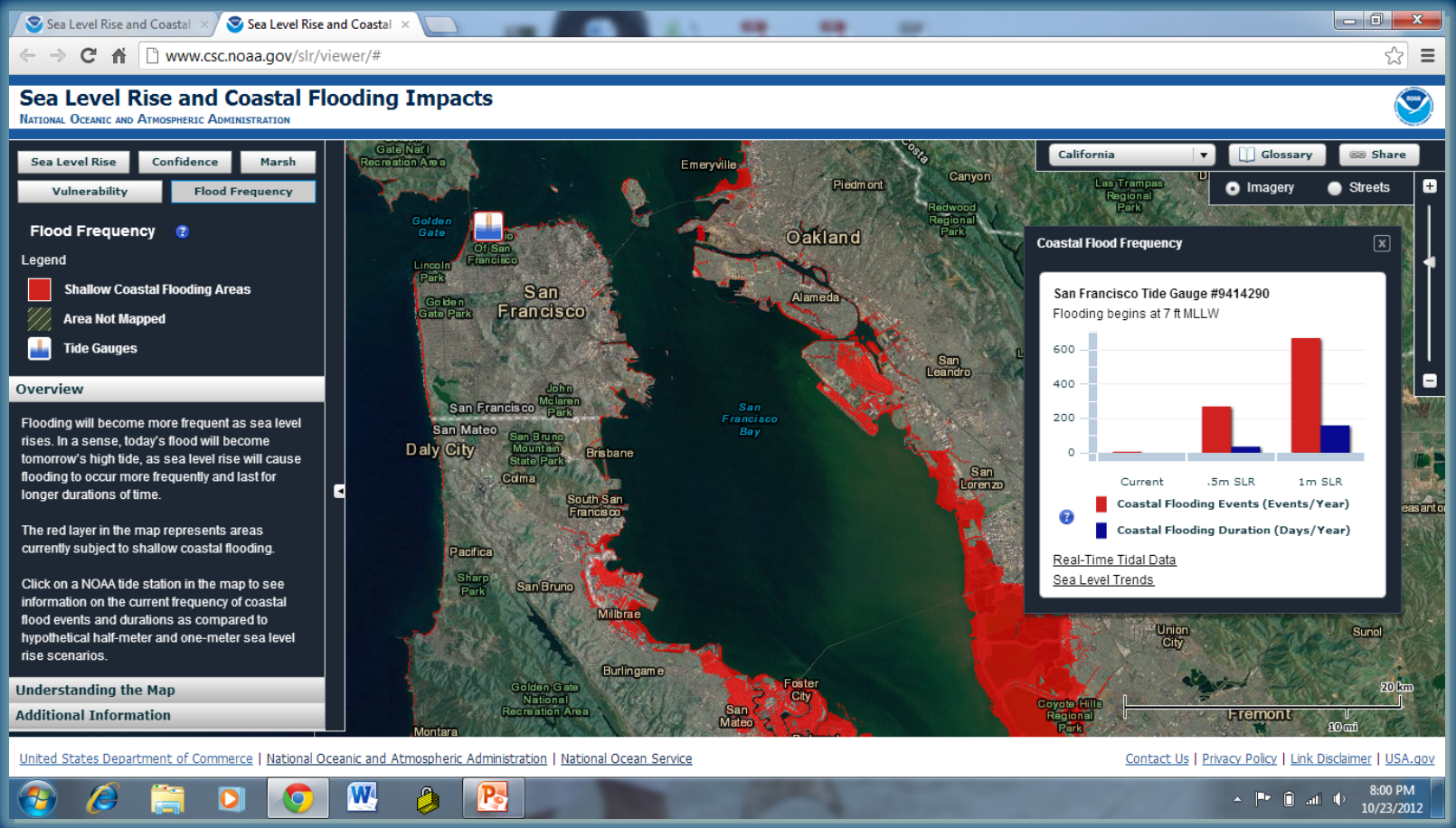
Bureau of Labor Statistics (Department of Labor)

- *Businesses*
- *Employees*
- *Wages*

Coastal Flood Frequency

- Communicate that today's flood is tomorrow's high tide. Use three years of observed water level data at National Ocean Service National Water Level Observation Network (NWLON) stations to show increased frequency of everyday flooding.

0.5m 270 times/30 days
1.0m 667 times/135 days

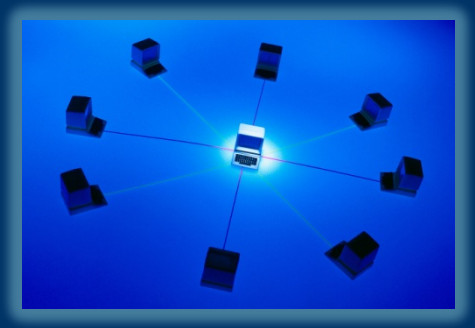


Future: Increase Geography and Regional Implementation

- Louisiana (on hold)
- NY, MD, VA
- Pacific
- Northeast
- Southeast
- Caribbean
- Great Lakes

- San Francisco Bay – Adapting to Rising Tides and OCOF
- California Coastal Conservancy
- New Jersey – Rutgers
- EPA Climate Ready Estuaries
- South Florida Climate Compact (Seven / 50)
- TNC and U. of Southern MS Gulf of Mexico Coastal Resilience Project
- EPA Point Source Outfalls
- National Park Service Coastal Parks Assessment
- U.S. Army Corps Projects Evaluation
- HI Sea Grant and U. of Hawaii School of Ocean and Earth Sci. (NOAA Coastal Storms Program)
- NCCOS N. Gulf Ecological Effects of SLR project

Data Distribution



Lots of Layers

- Conditioned DEMs
- SLR layers
- Marsh migration layers
- Uncertainty layers
- Shallow coastal flooding layer
- Social Vulnerability Index data
- Bureau of Labor Statistics data

Lots of Ways to Distribute

- Raster geodatabases via HTTP
- Representational State Transfer (REST) page
- Feature and Image services
- Enabling mash-up applications

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Available via NOAA Digital Coast

www.csc.noaa.gov/digitalcoast/

DIGITAL COAST
NOAA Coastal Services Center

Home | About | Data | Tools | Training | Approaches | In Action

Tools

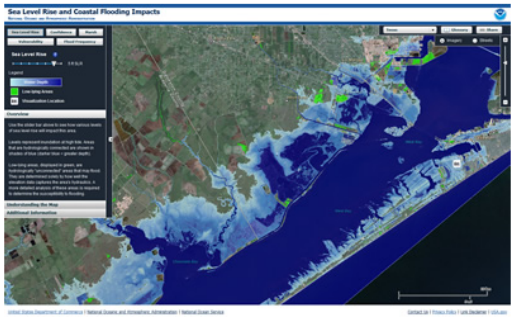
Sea Level Rise and Coastal Flooding Impacts Viewer

NOAA Coastal Services Center

Overview | Support | Get It Now

Overview

Being able to visualize potential impacts from sea level rise is a powerful teaching and planning tool, and the Sea Level Rise Viewer brings this capability to coastal communities. A slider bar is used to show how various levels of sea level rise will impact coastal communities. The initial project areas include Mississippi, Alabama, and parts of Texas and Florida, with additional coastal counties to be added in the near future. Visuals and the accompanying data and information cover sea level rise inundation, uncertainty, flood frequency, marsh impacts, and socioeconomics.



Launch Now

Features

- **Displays** potential future sea levels
- **Provides** simulations of sea level rise at local landmarks
- **Communicates** the spatial uncertainty of mapped sea levels
- **Models** potential marsh migration due to sea level rise
- **Overlays** social and economic data onto potential sea level rise
- **Examines** how tidal flooding will become more frequent with sea level rise

Acknowledgements

The NOAA Coastal Services Center would like to acknowledge those organizations that provided direct content used in this tool or feedback, ideas, and reviews over the course of the tool's development. Specifically the Center would like to acknowledge the following groups.

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Questions?

www.csc.noaa.gov/slr

doug.marcy@noaa.gov

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