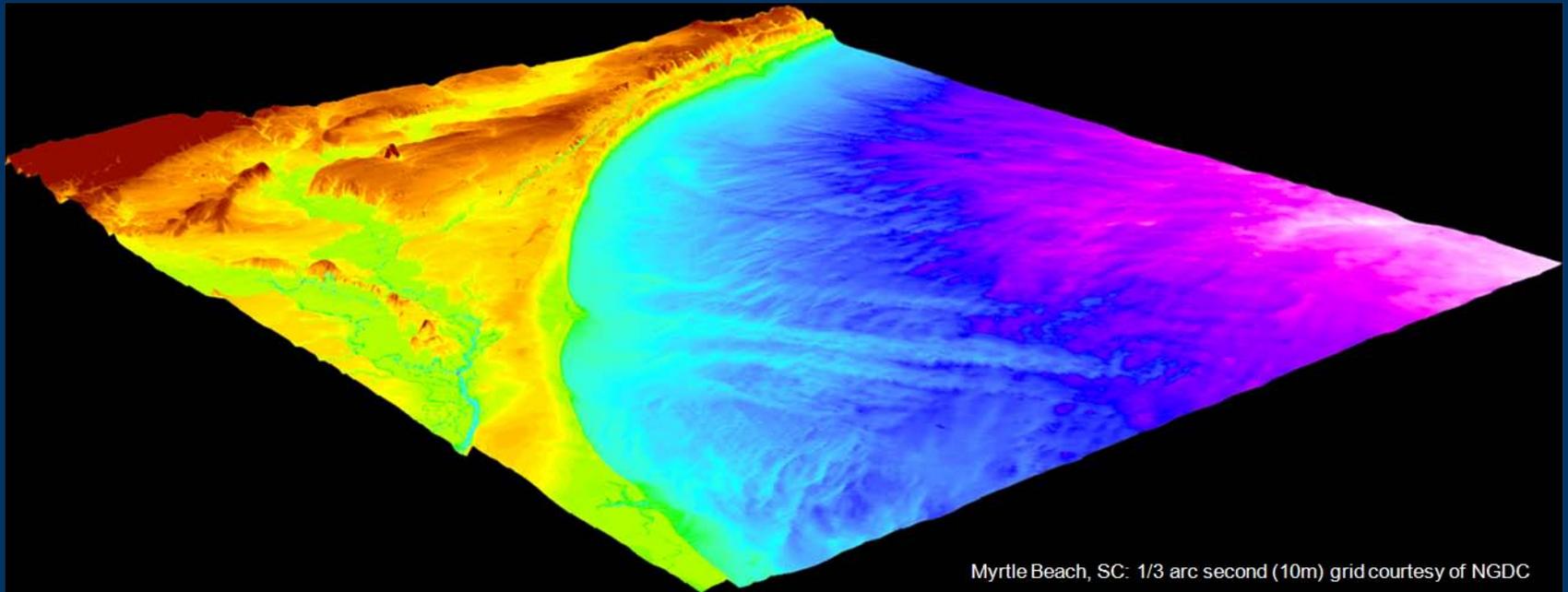


# Coastal Applications of High Resolution Elevation Data



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# Purpose

To highlight some of the common coastal applications of high resolution elevation data

## Coastal Applications

- Coastal inundation prediction
- Lake level drop impacts
- Coastal change visualization
- Shoreline delineation
- Habitat mapping



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# High Resolution Elevation Data: How to Define?

**For this presentation, high resolution elevation data:**

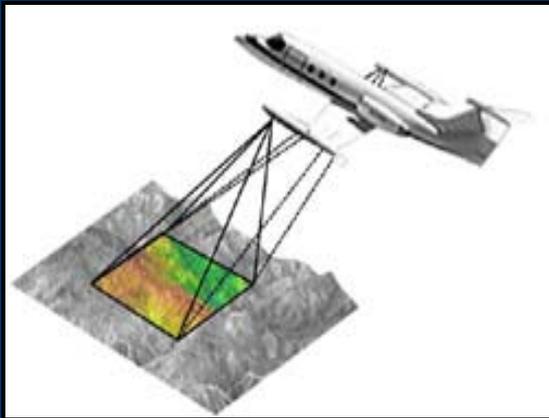
- Provide elevations of Earth's surface on land or under water
- Support a grid cell resolution of five meters (m) or less
- Meet a vertical accuracy of one meter or less RMSE (root mean square error)
- Meet a horizontal accuracy of five meters or less RMSE
- Are data that can be collected by aerial or bathymetric surveys



# Types of High Resolution Elevation Data

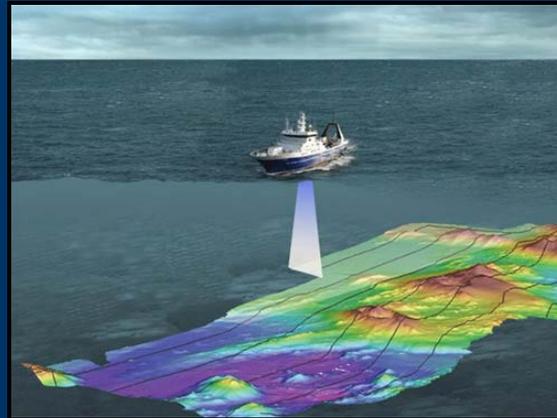
## Topographic

Land elevation



## Bathymetric

Seafloor elevation



## Topobathy

Combines topographic and bathymetric data to create a seamless model of the interface between land and water

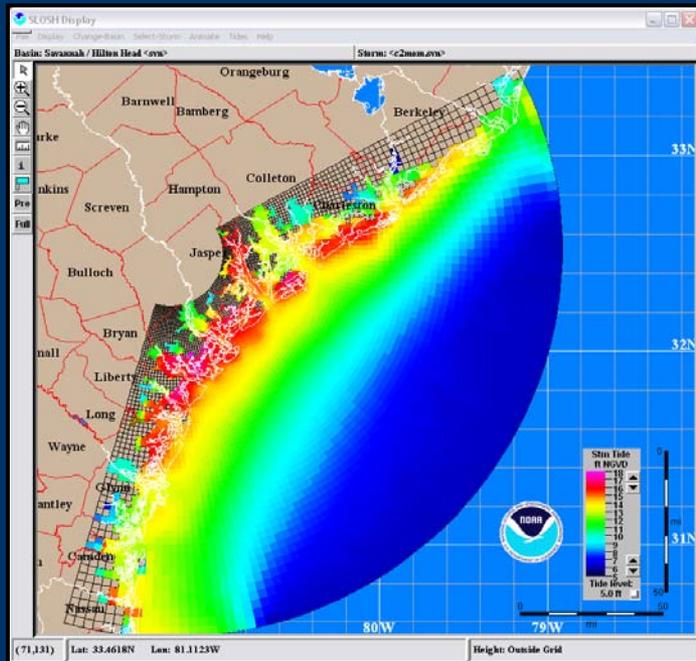


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# Coastal Inundation Prediction

The condition under which water covers normally dry land

- Caused by storm surges, tsunamis, inland flooding, high tides, sea level rise
- Can result in severe onshore impacts
- Predicting the extent of the inundation can aid in decision making



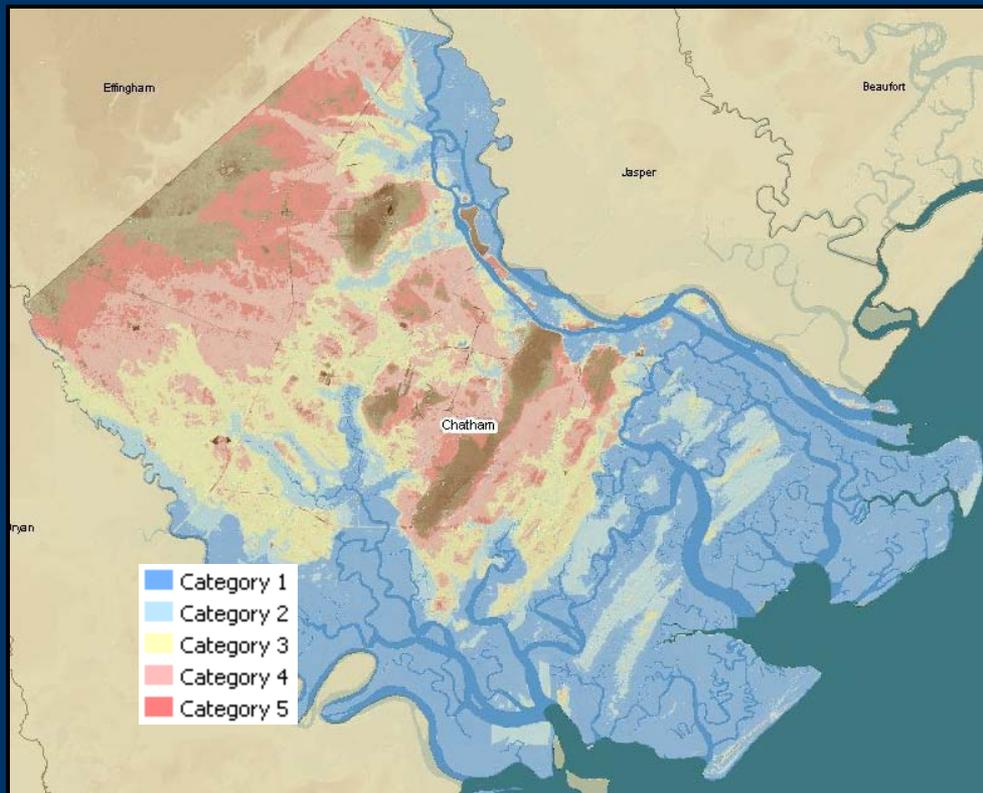
The SLOSH (Sea, Lake, and Overland Surges from Hurricanes) model and other inundation prediction models use topobathy data as a base of analysis.



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# Coastal Inundation Prediction

The SLOSH results can then be mapped onto a high resolution topographic surface (lidar) to create an inundation map that shows which areas are likely to be inundated by each storm category.

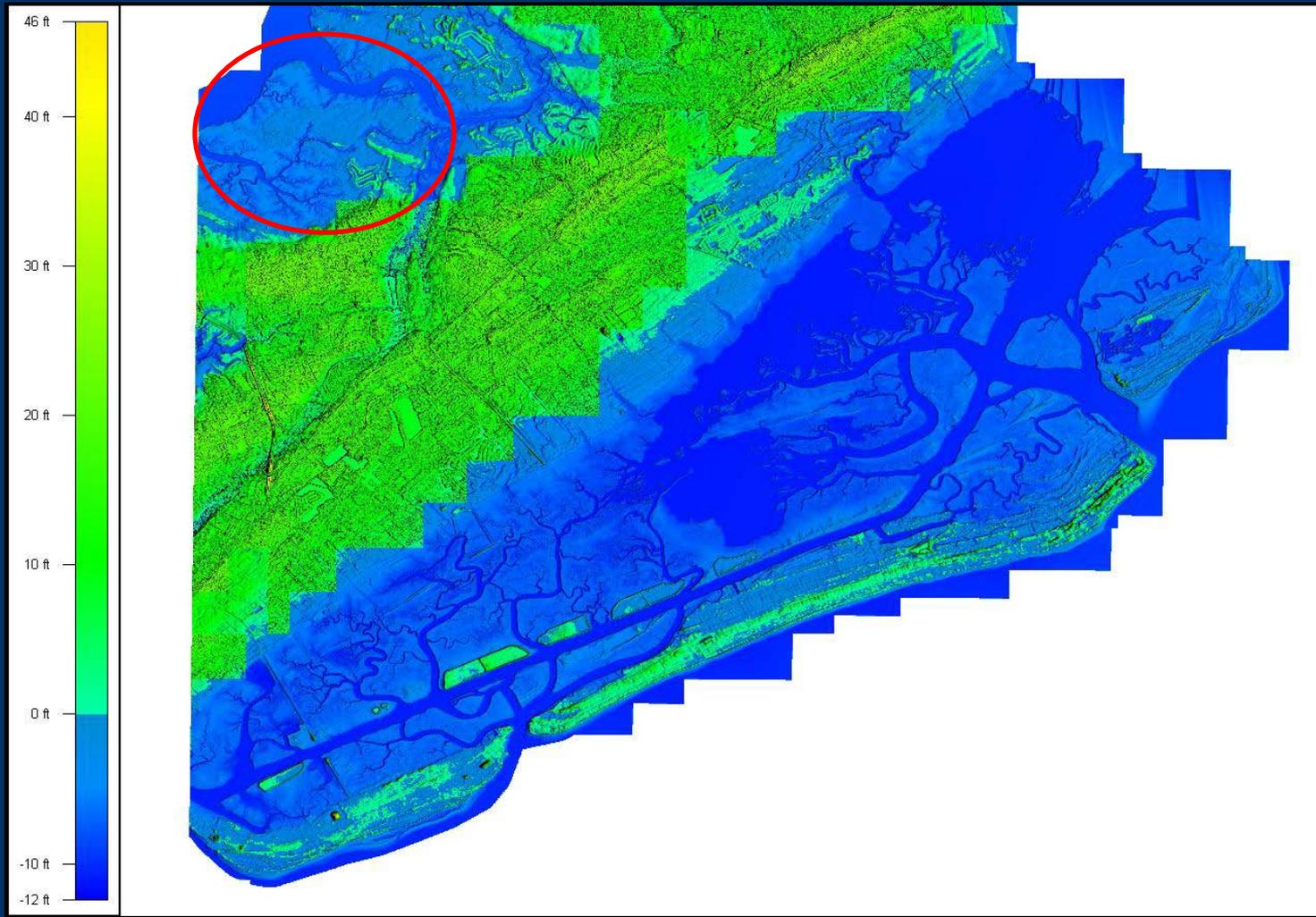


**Storm surge zones by  
hurricane category for  
Chatham County, Georgia**



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# Coastal Inundation Prediction

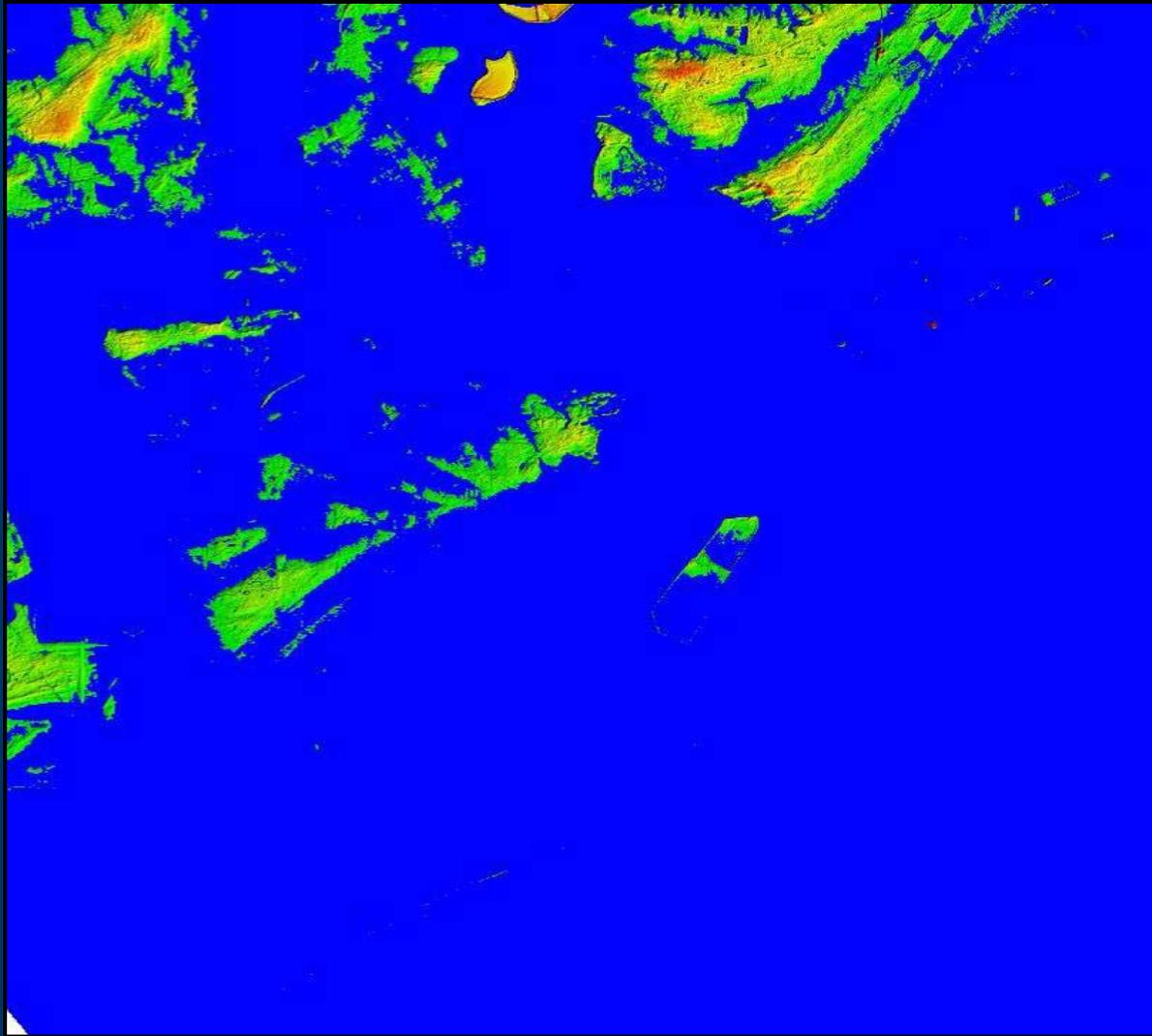


**SLOSH Run Category 1 Maximum of Maximums**  
**SLOSH Elevation on National Elevation Dataset**  
**SLOSH Elevation on lidar**



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# Coastal Inundation Prediction



**Mean sea level (MSL)**

**Mean high water  
(MHW)**

**MHW + 0.6 m (IPCC\*)**

**MHW + 0.8 m (IPCC)**

**Hurricane Hugo**

**Hugo + 0.8 m**



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# Coastal Inundation Prediction

## Shallow Coastal Flooding

High tides in Charleston, South Carolina, often cause shallow coastal flooding, which is defined by the National Weather Service as a tide of 7.0 feet or more.

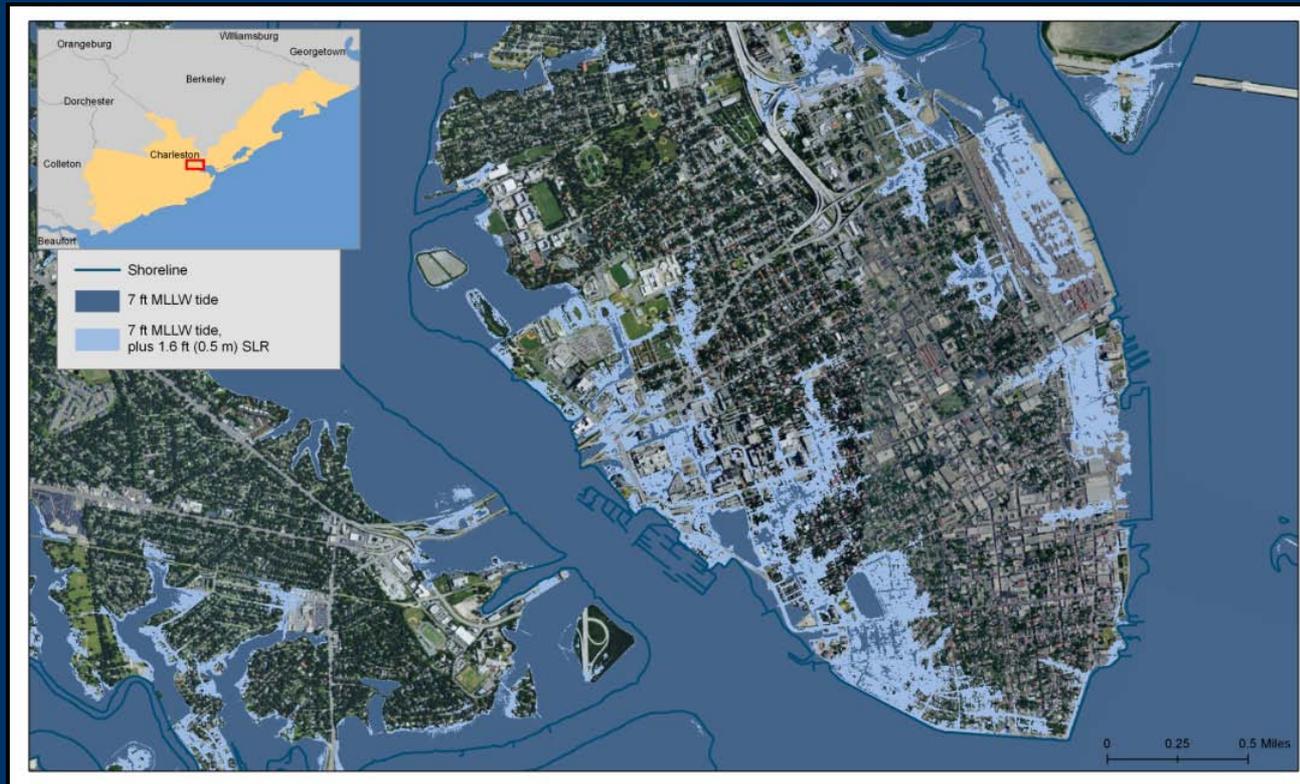


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# Coastal Inundation Prediction

## Shallow Coastal Flooding

Shallow coastal flooding inundation and sea level rise map



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# Lake Level Drop Impacts

## Lake Ontario

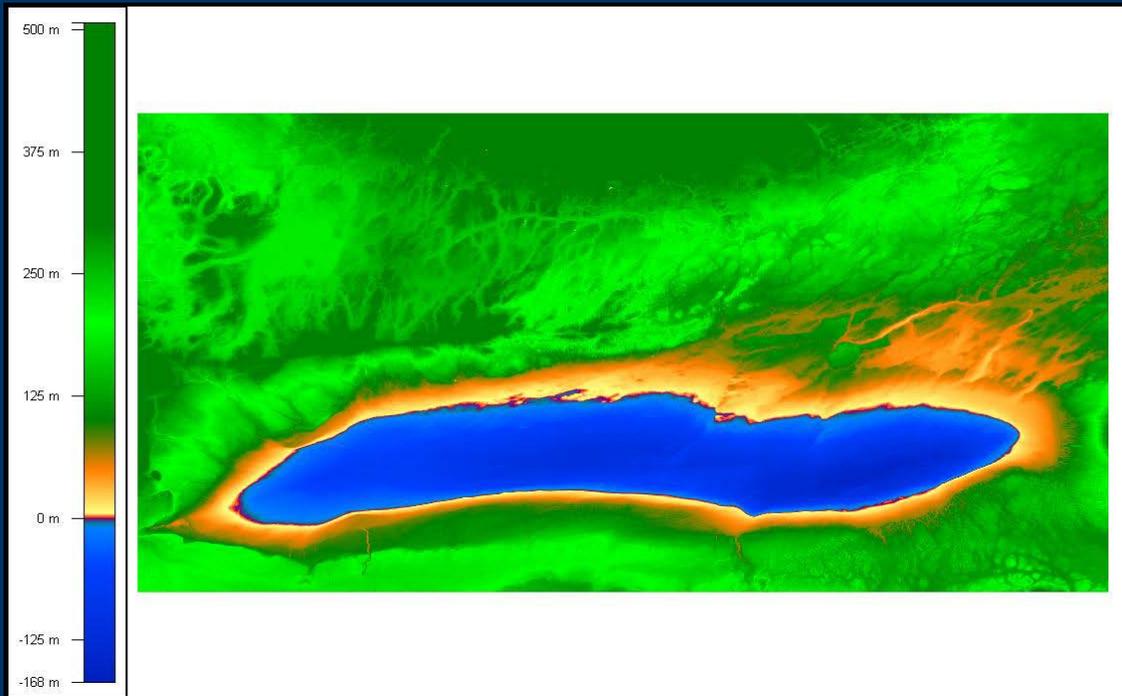
The Nature Conservancy is examining the impacts of lake level drop on coastal habitat migration and developing effective conservation and management strategies.



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# Lake Level Drop Impacts

## Topobathy Surface of Lake Ontario



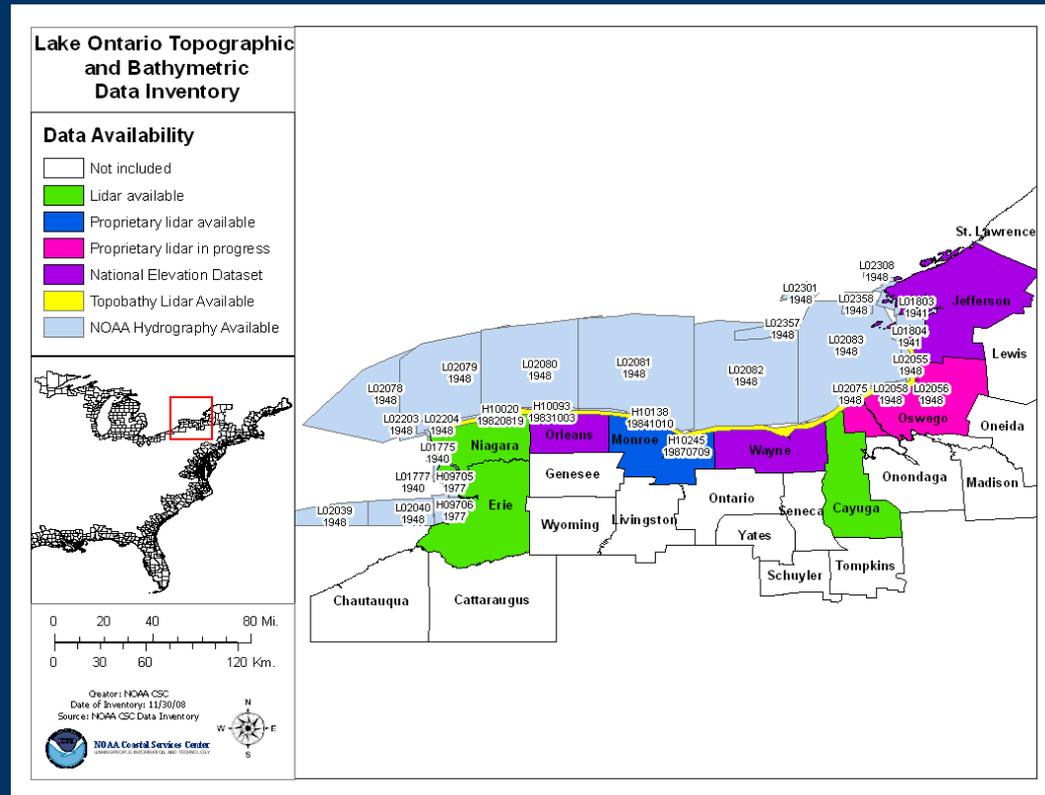
Created from  
gridded NOAA  
hydrographic survey  
data combined with  
U.S. Geological  
Survey topographic  
grids, ~90 m  
resolution



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# Lake Level Drop Impacts

Developing an inventory of available topo and bathy data sources to produce topobathy surfaces for areas of interest



# Lake Level Drop Impacts

From this USACE topobathy lidar, a new site-specific topobathy surface will be constructed for TNC's areas of interest



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# Coastal Change Visualization

Monitoring shoreline change allows coastal resource managers to keep the public informed, invest time and effort in at risk areas, prioritize habitat restoration, and model the success of potential protective measures.

**Pre-nourishment**

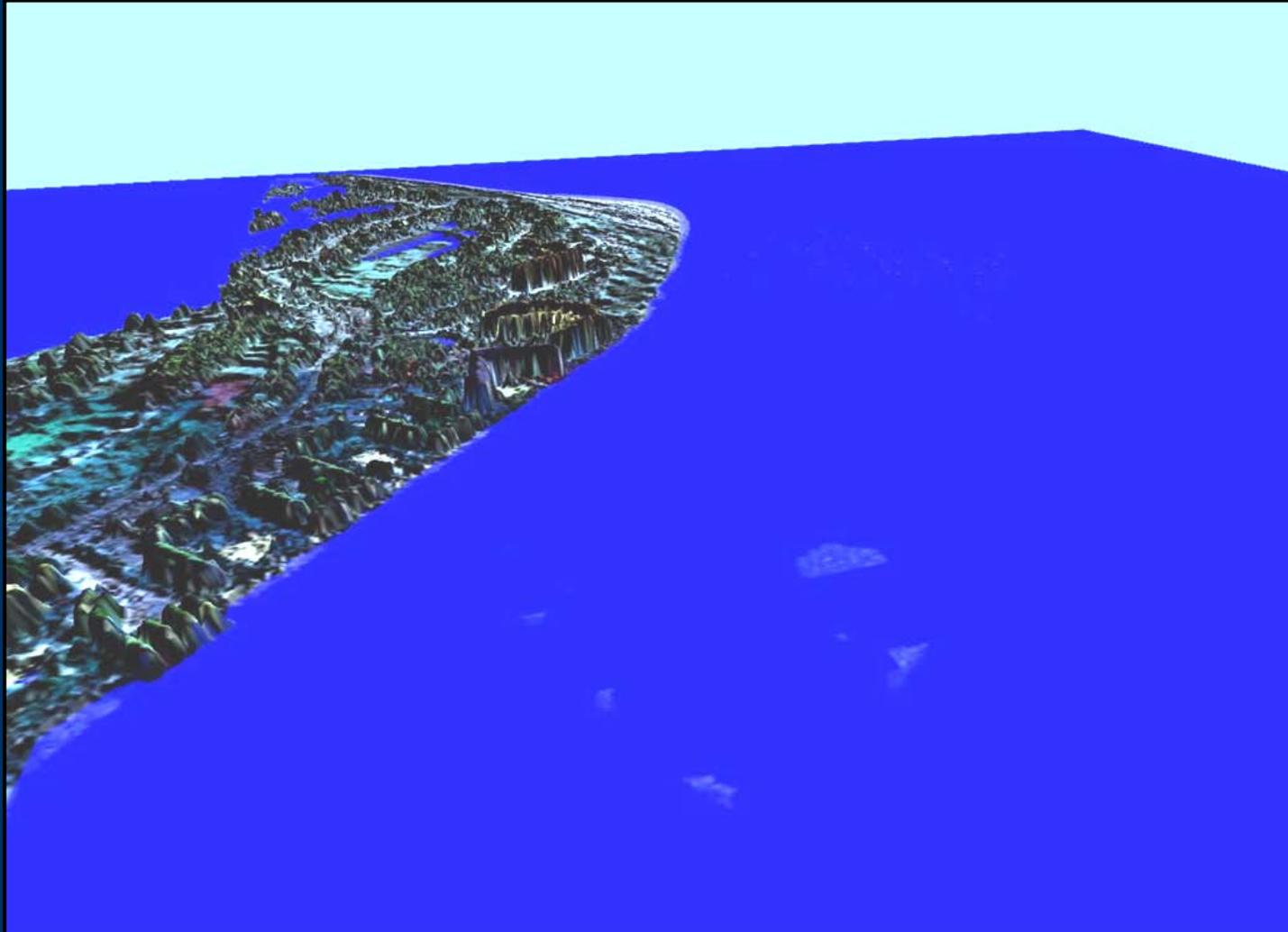


**Post -nourishment**



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# Coastal Change Visualization



1997

2000

2007

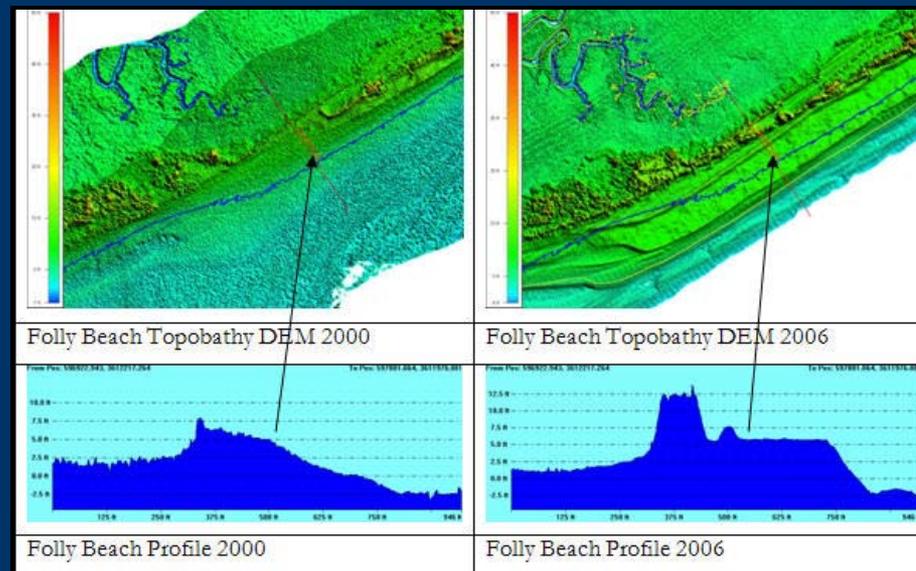
Isle of Palms – Wild Dunes



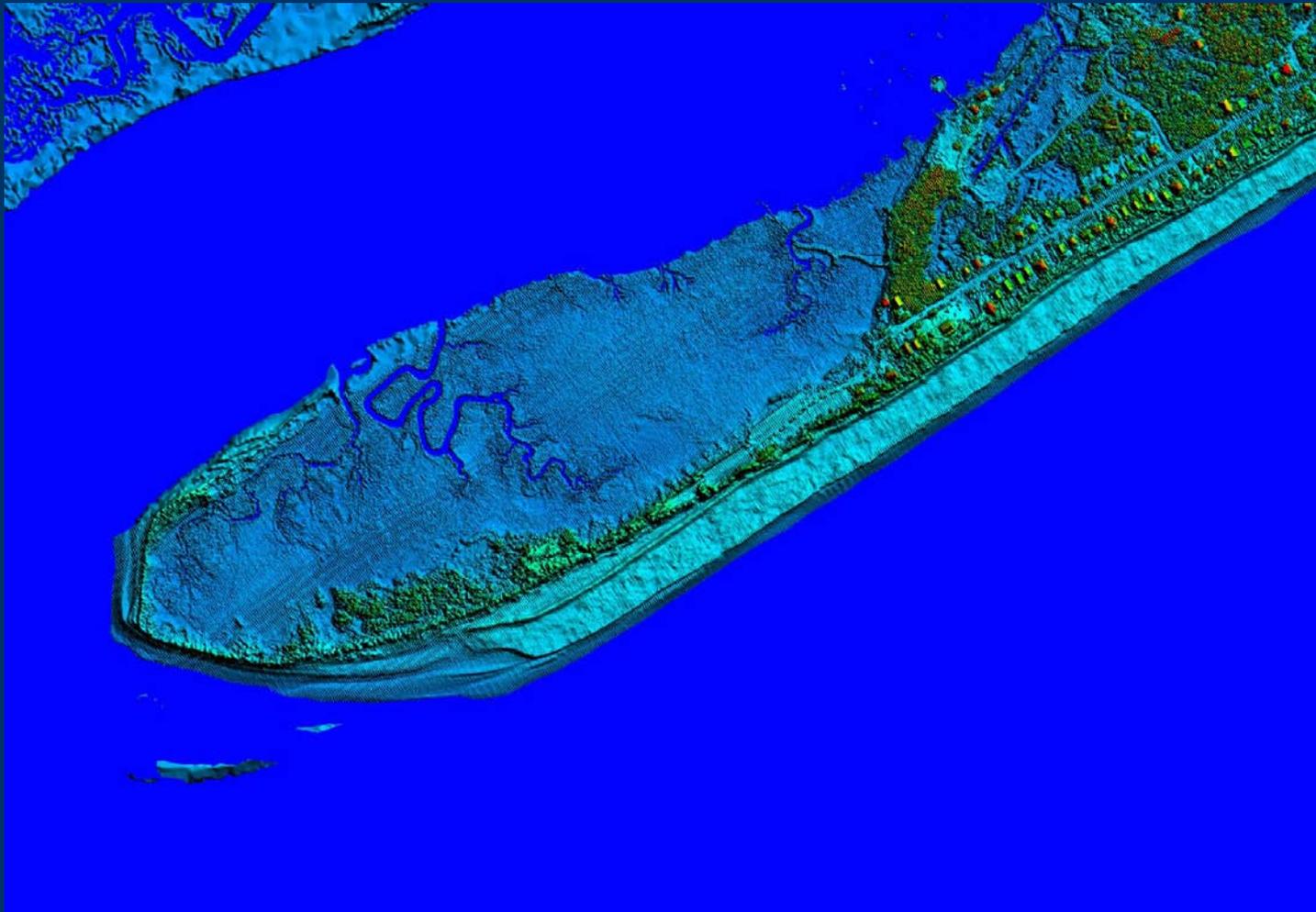
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# Coastal Change Visualization

High resolution topobathy data collected at different times allows for assessment of coastal change in beach volume and extent.



# Coastal Change Visualization



1997

2000

2007

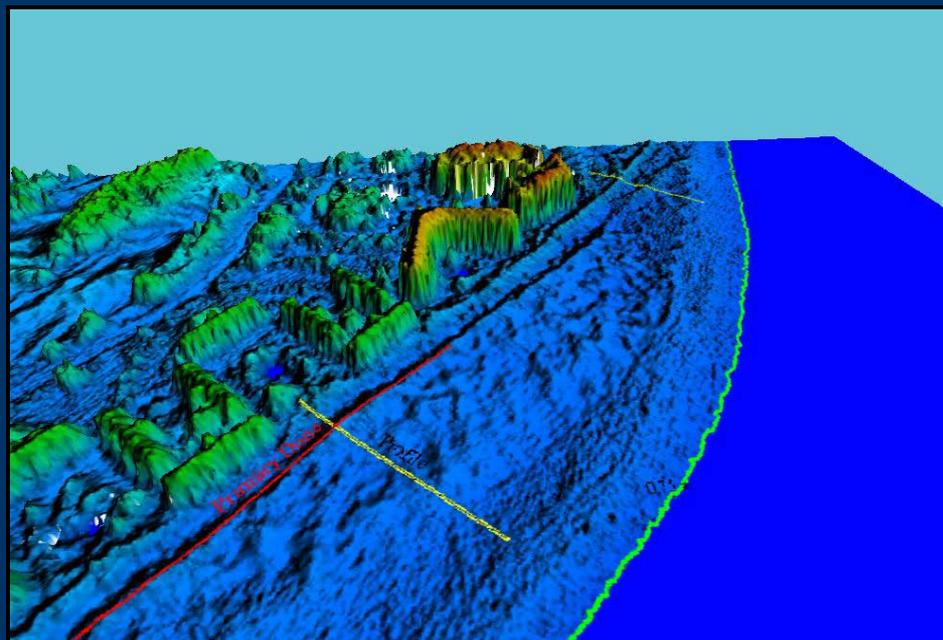
Folly Beach



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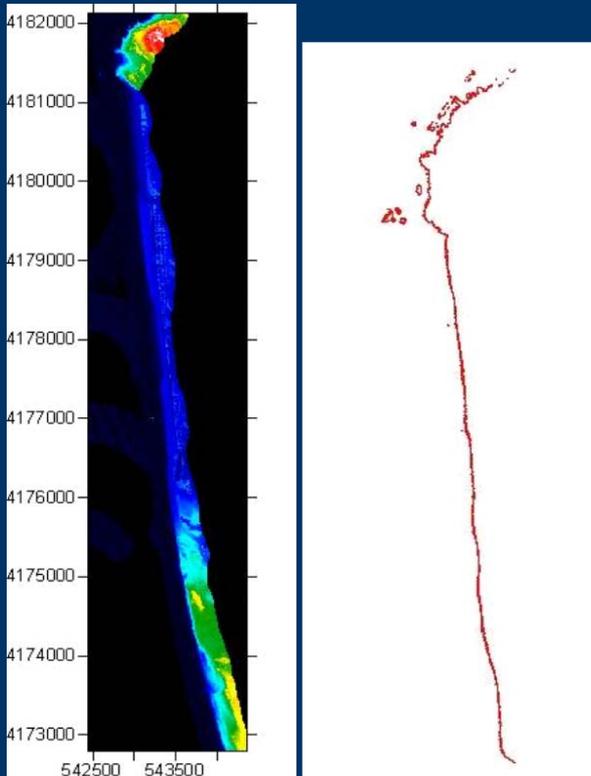
# Shoreline Delineation

A topobathy surface allows for a legally defensible, reproducible shoreline and reduces subjectivity



# Shoreline Delineation

NOAA is experimenting with using a topobathy surface created from lidar elevation data sets to delineate shoreline



## Advantages

- Provides a defined, measurable accuracy
- Provides ancillary data on shoreline aspects, slopes, and morphology
- Can be created economically under wider range of tidal stages

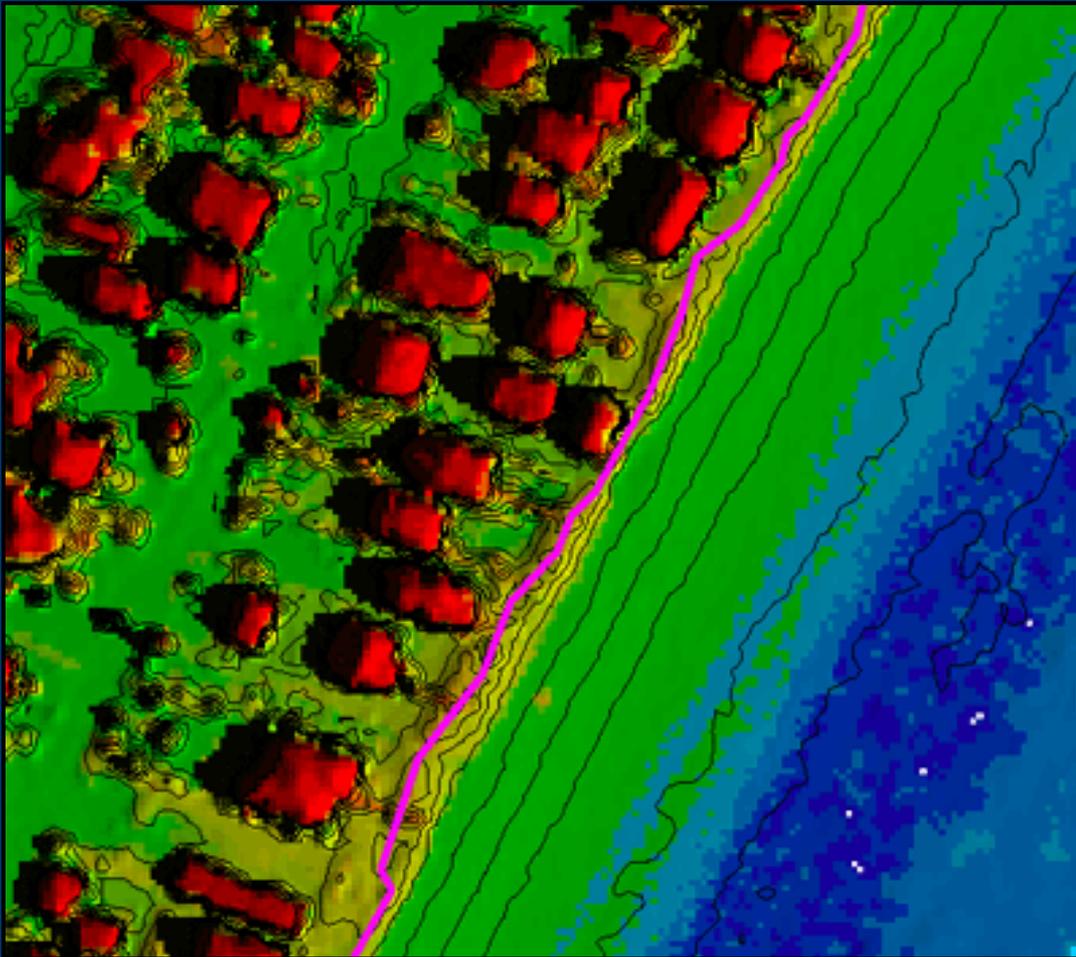
Shoreline derived from a topobathy surface near San Francisco, CA, 2008



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# Shoreline Delineation

## Setback Lines



South Carolina has used a topobathy surface to determine the crest of the primary dune.

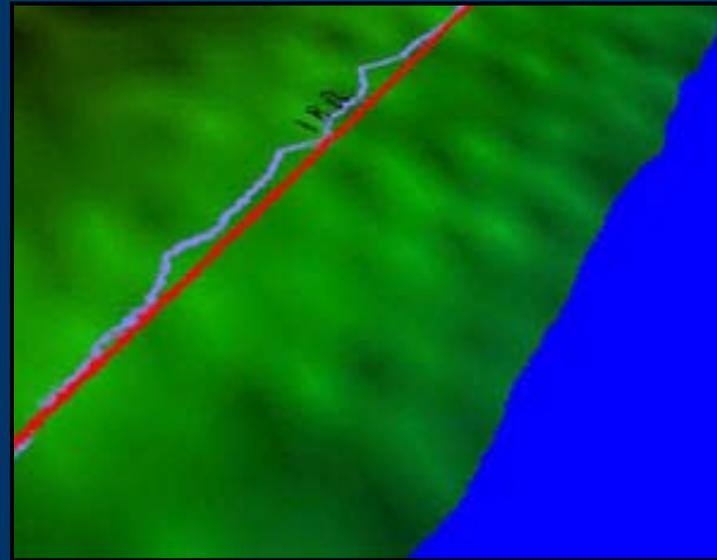
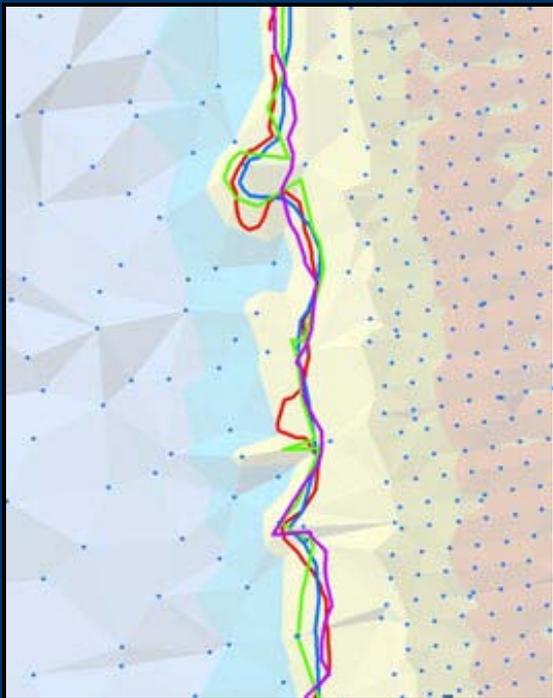


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# Shoreline Delineation

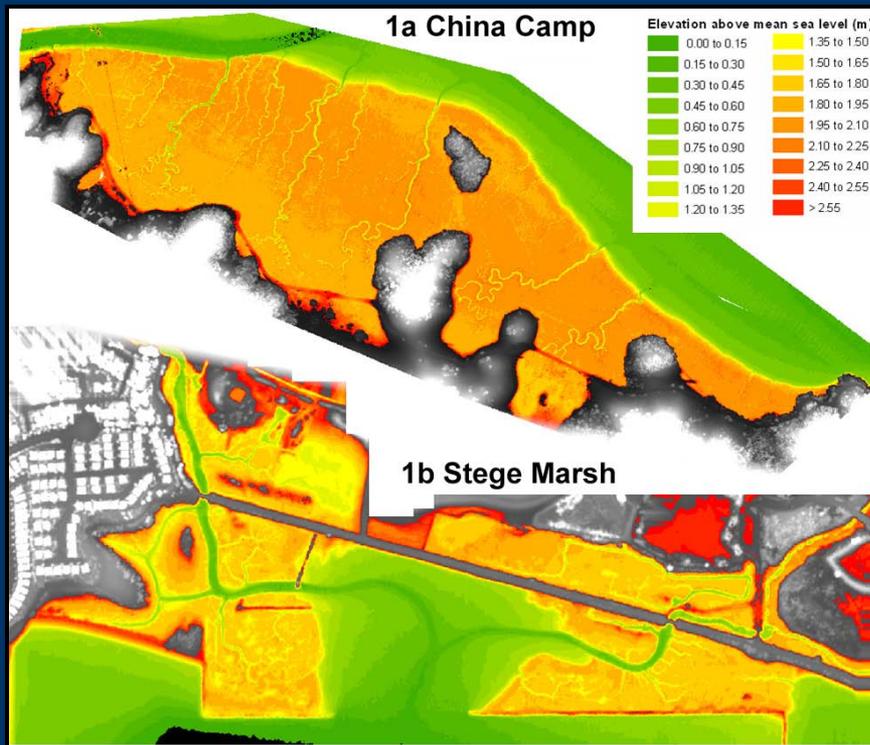
## Something to Consider

Using different methods to create the topobathy surface can introduce some bias and uncertainty.



# Habitat Mapping

High resolution elevation data, such as lidar, can produce a high level of detail for analyzing how natural and manmade threats such as sea level rise, drought, storm flooding, and development may affect a wetland.



## China Camp

Typical marsh elevation pattern

## Stege Marsh

Atypical marsh elevation pattern

Ustin, 2007



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# Conclusion

## High resolution elevation data

- Provides a solid base for coastal analysis
- Provides valuable information and visualization capability to researchers and coastal managers
- Can be used to predict inundation extents, visualize coastal change, establish a repeatable shoreline, and map habitats



# For More Information

## A Roadmap to a Seamless Topobathy Surface

### A series of products to help users create seamless coastal maps



The screenshot shows the NOAA Coastal Services Center website. The header includes the NOAA logo and the text 'NOAA Coastal Services Center NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION'. A search bar is visible on the right. The main content area features a navigation menu with links for Home, About, Data, Tools, Training, How-To Guides, Publications, Partnerships, and Technical Assistance. The page title is 'A Roadmap to a Seamless Topobathy Surface' with the subtitle 'Bringing together the resources to simplify coastal digital elevation models'. The text describes a topobathy digital elevation model (DEM) and lists three key points: 1. Available data resources, 2. Processes to generate high-resolution DEMs that minimize error, and 3. Examples of topobathy applications. A satellite-style map of a coastal area is shown. Below the map, there are sections for 'Data Inventory: Gulf of Mexico', 'Topographic and Bathymetric Data Considerations', and 'Topobathy Applications'. At the bottom, there are contact details for the NOAA Coastal Services Center and the USA.gov logo.

## Includes:

- Data inventory
- Topographic and Bathymetric Data Considerations
- Examples of coastal applications

[www.csc.noaa.gov/topobathy](http://www.csc.noaa.gov/topobathy)



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# Contact Information

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