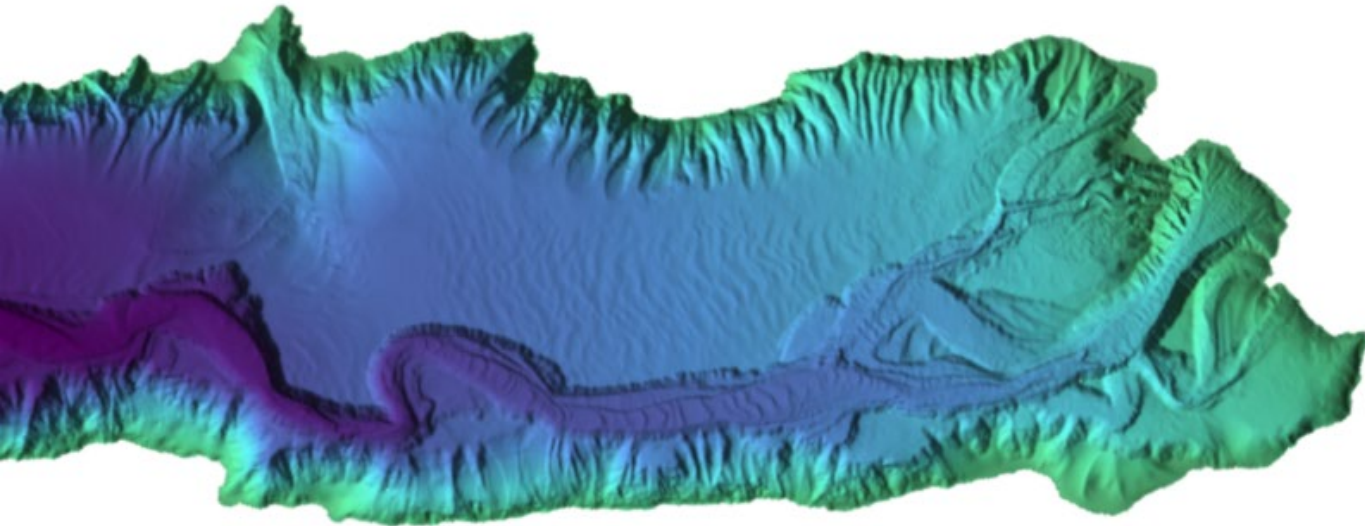


# The National Bathymetric Source



Katrina Wyllie  
NOAA HSRP  
March 3, 2021



# National Policies

- Presidential Executive Order 13840  
Ocean Policy to Advance the Economic, Security, and Environmental Interests of the United States
- Geospatial Data Act of 2018  
National Spatial Data Infrastructure
- Foundations for Evidence-Based Policymaking Act of 2017  
Title II – Open Government Data Act
- Hydrographic surveying is a critical system of record for National Ocean Service

**OUR WORLD OCEAN provides**

**THE AIR WE BREATHE**  
—> **>50%** The ocean produces over half of the world's oxygen and stores 50 times more carbon dioxide than our atmosphere.

**CLIMATE REGULATION**  
**70%** Covering 70% of the Earth's surface, the ocean transports heat from the equator to the poles, regulating our climate and weather patterns.

**TRANSPORTATION**  
**76%** Percent of all U.S. trade involving some form of marine transportation.

**RECREATION**  
From fishing to boating to kayaking and whale watching, the ocean provides us with so many unique activities.

**ECONOMY**  
**\$282 billion** Amount the U.S. ocean economy produces in goods and services. Ocean-dependent businesses employ almost 3 million people.

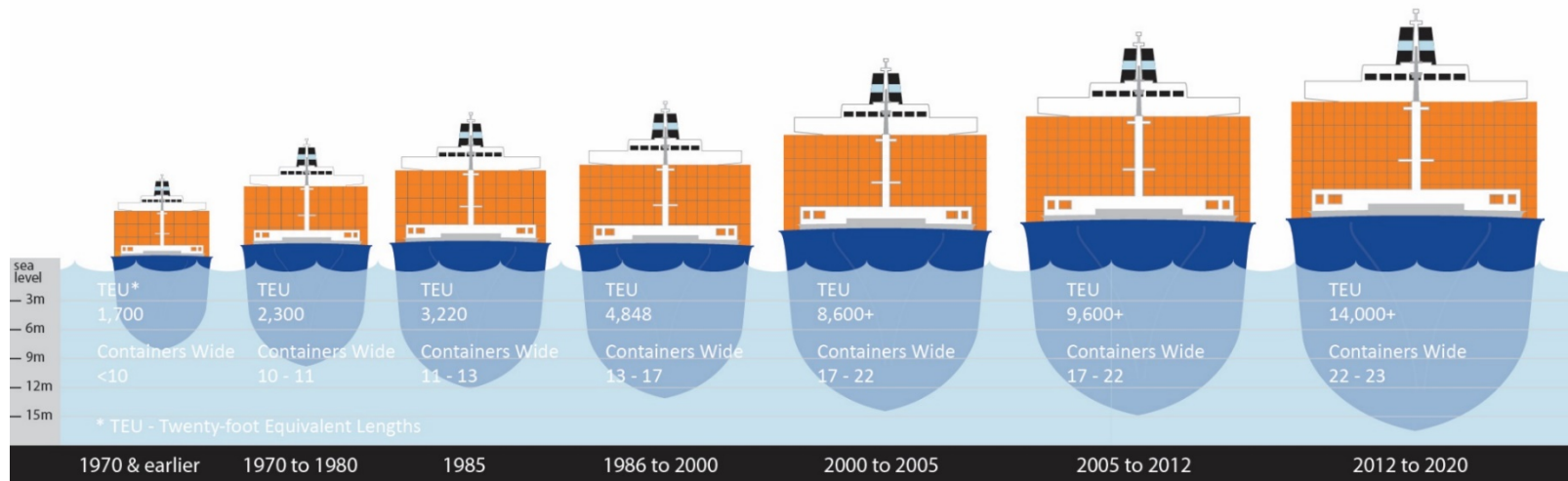
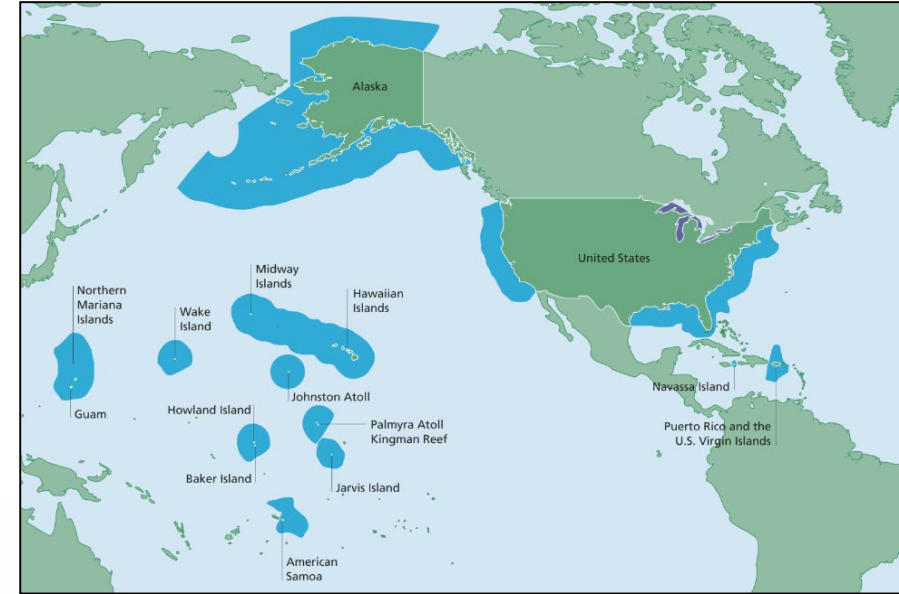
**FOOD**  
The ocean provides much more than just seafood. Ingredients from the sea are found in surprising foods such as peanut butter and soy milk.

**MEDICINE**  
Many medicinal products come from the ocean, including ingredients that help fight cancer, arthritis, Alzheimer's disease, and heart disease.



# Coast Survey Mandates

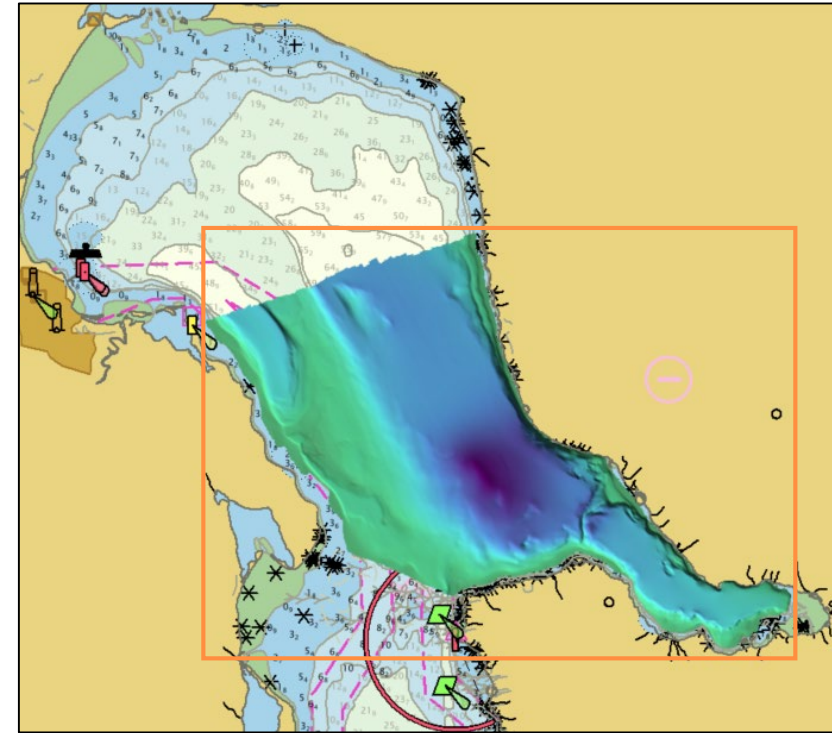
- Coast and Geodetic Survey Act of 1947
- Hydrographic Service Improvement Acts of 1998/2002/2008/2012
- Title 33 of Code of Federal Regulations
- Ocean and Coastal Mapping Integration Act (2009)
- International Convention for the Safety of Life at Sea (SOLAS)



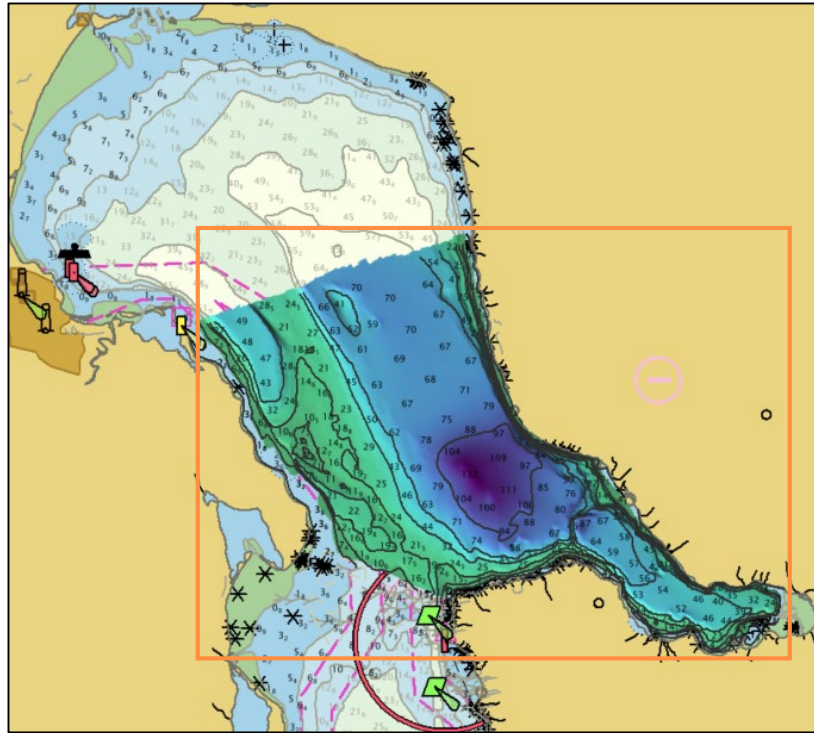
**1.3 billion** metric tons of cargo valued at **\$1.8 trillion** comes in and out of U.S. ports every year.



# Traditional Coast Survey Process



Source Survey



Cartography

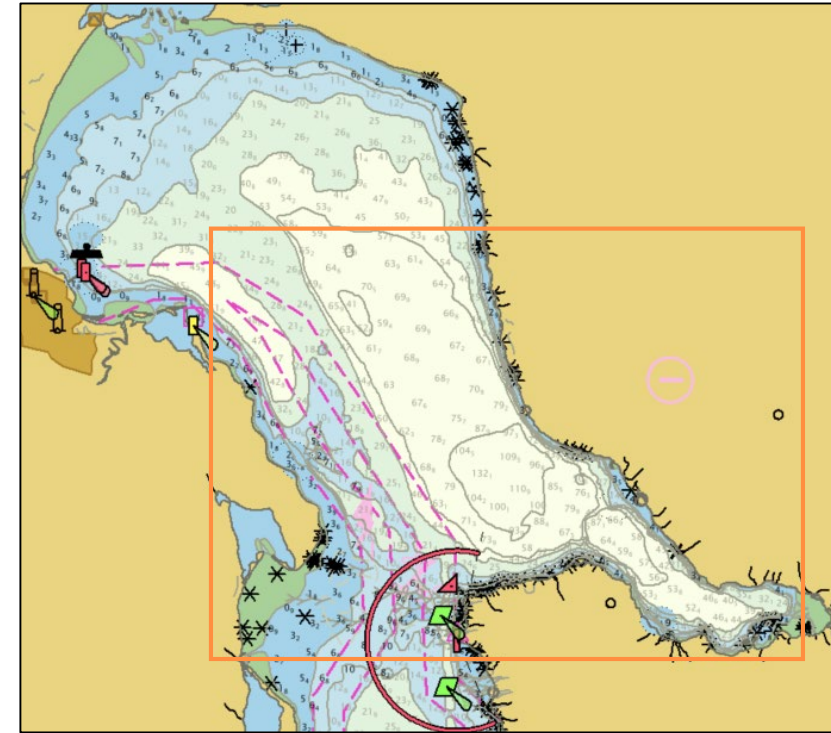
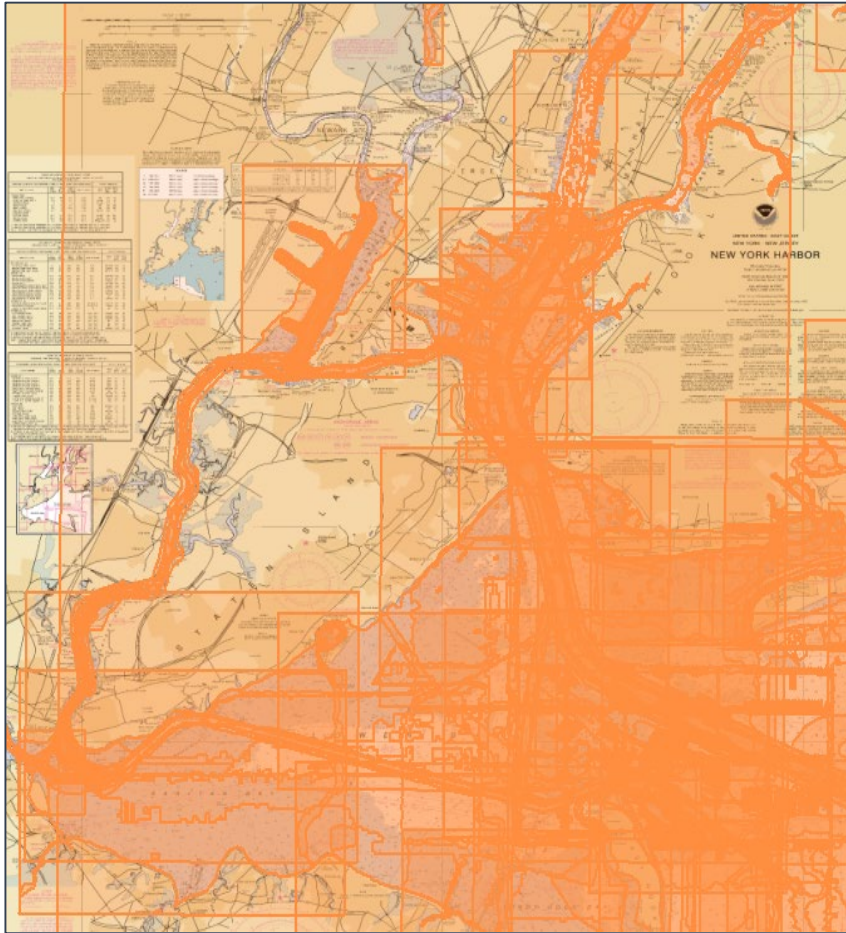


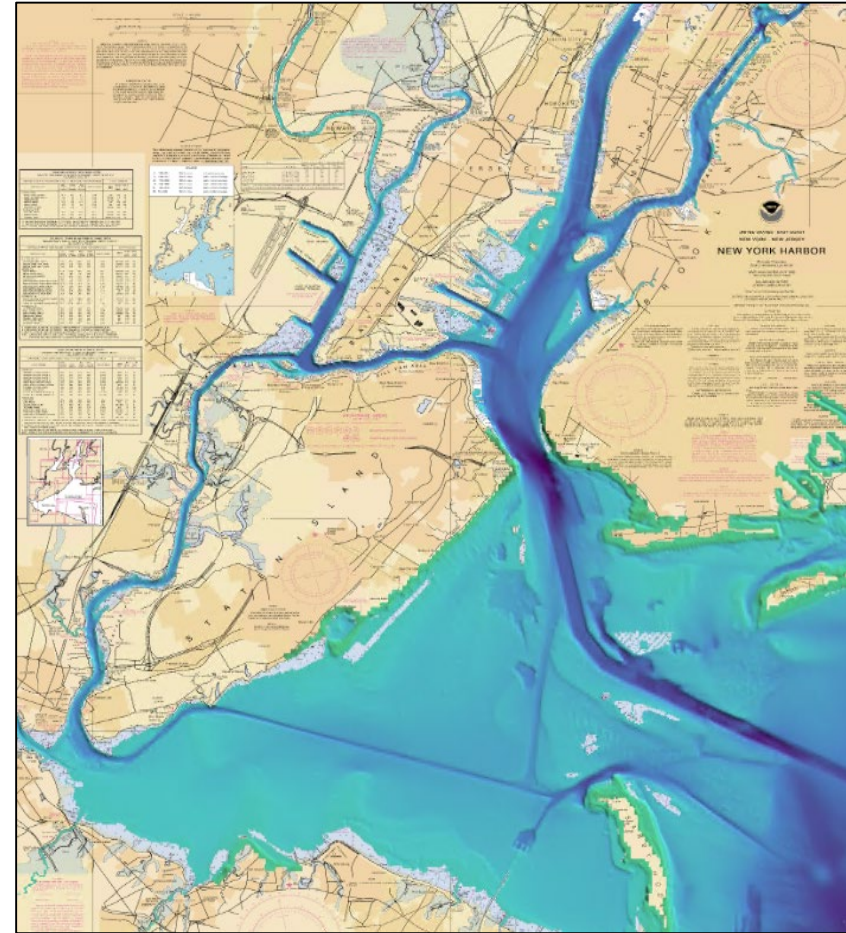
Chart Production



# Reimagining Navigation



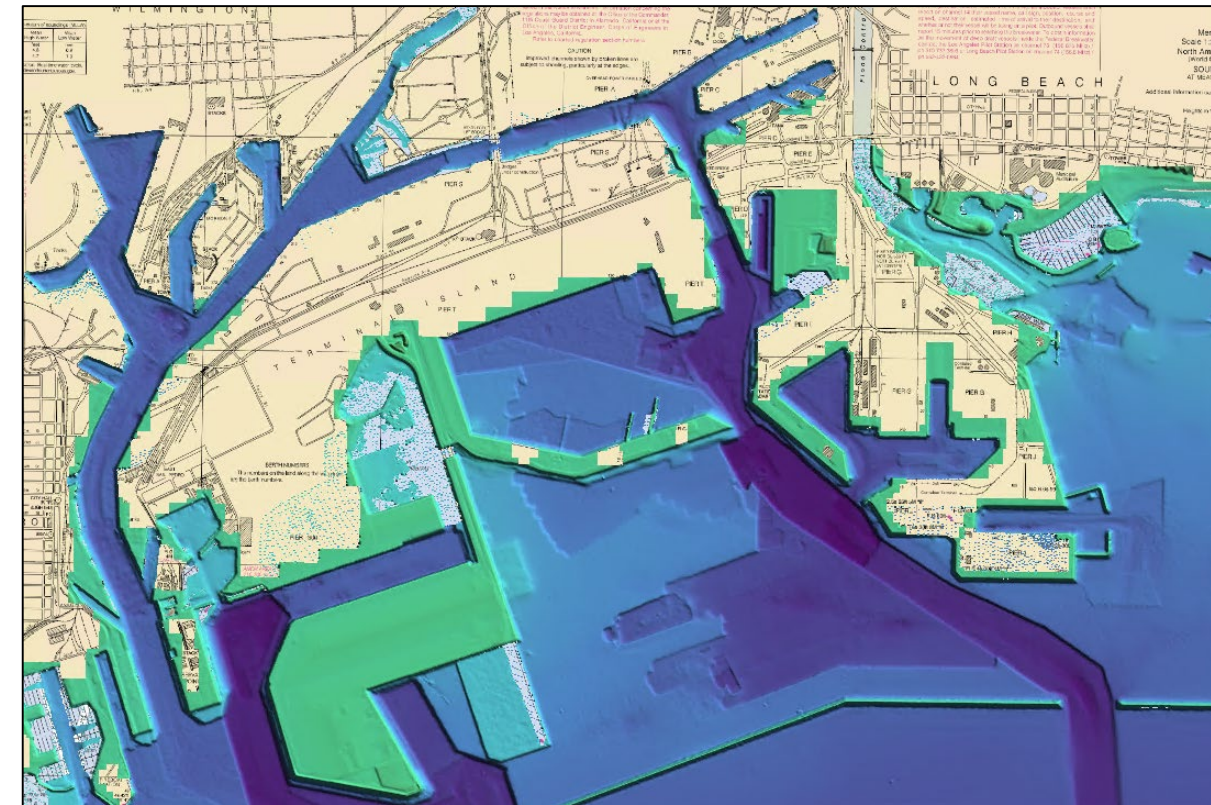
Disparate Sources



Compiled Bathymetry



# Reimagining Navigation



# National Bathymetry Metrics

## 1. Depth

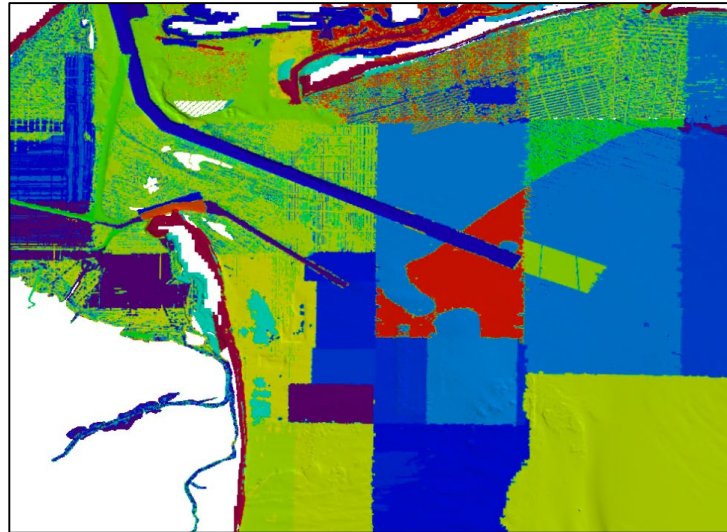
- Datum
- Units

## 2. Quality

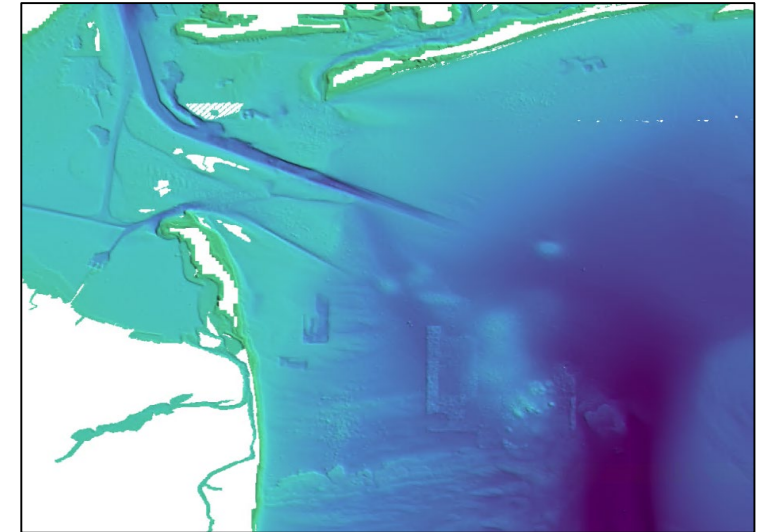
- Coverage
- Uncertainty
- Feature Detection

## 3. Origin

- Source information
- License



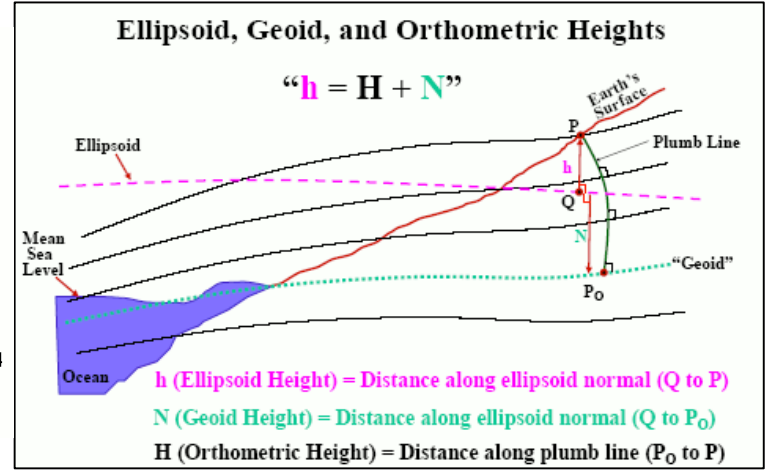
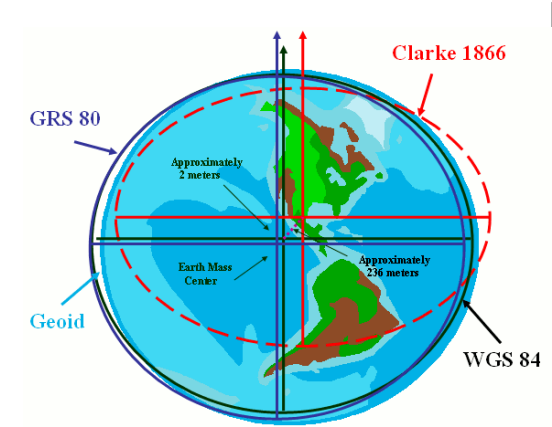
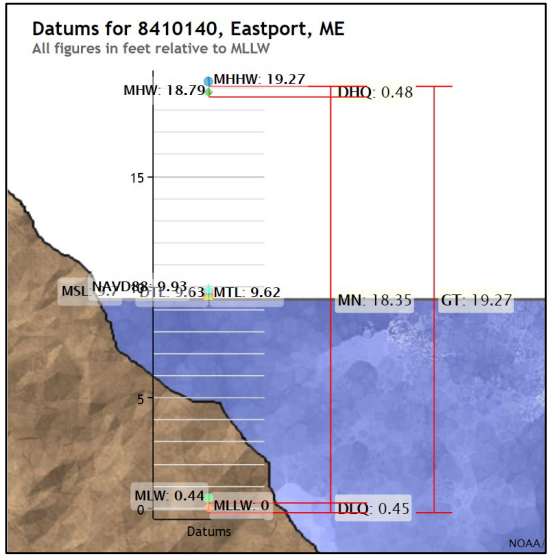
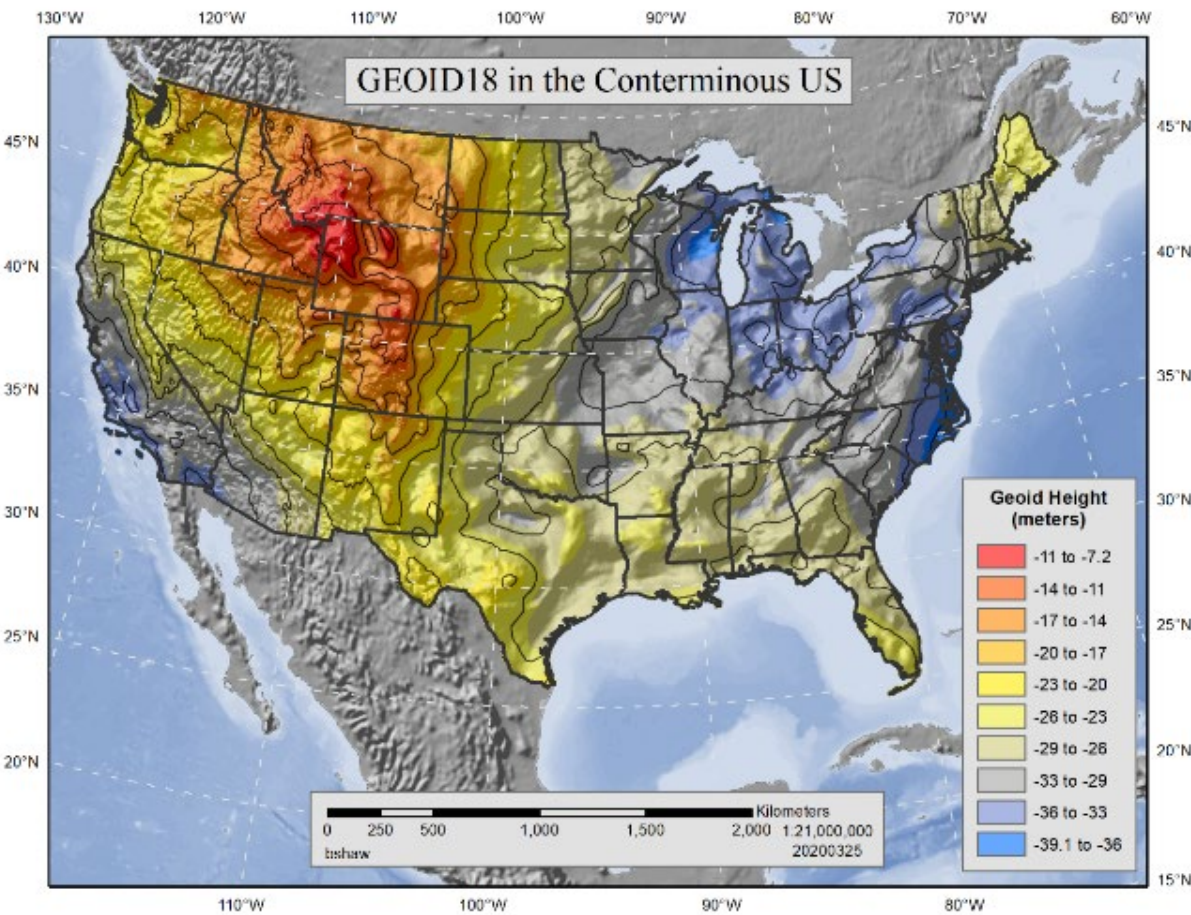
Contributing Sources



Compiled Bathymetry



# National Bathymetry Metrics

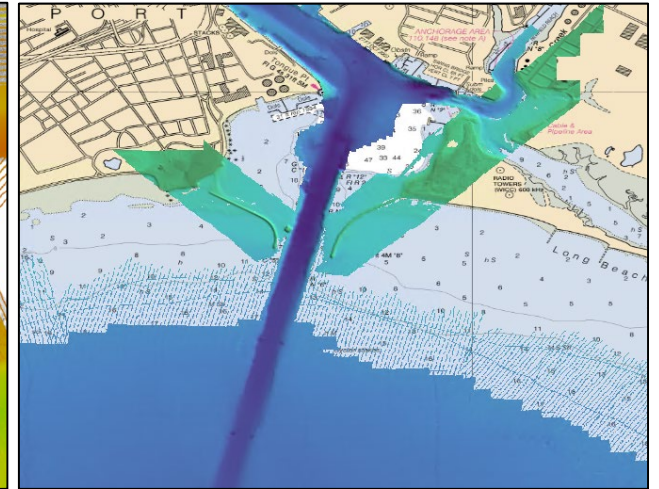
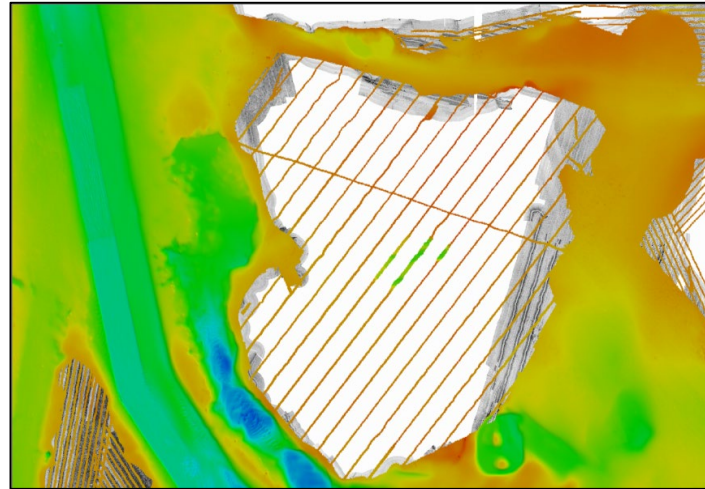
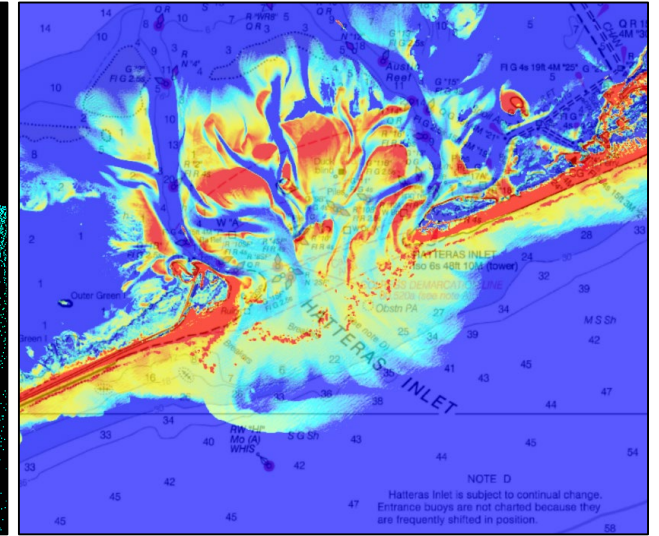
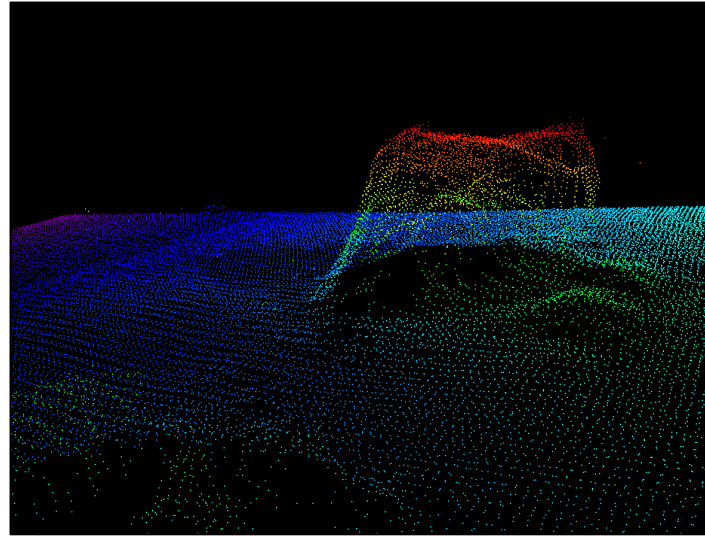




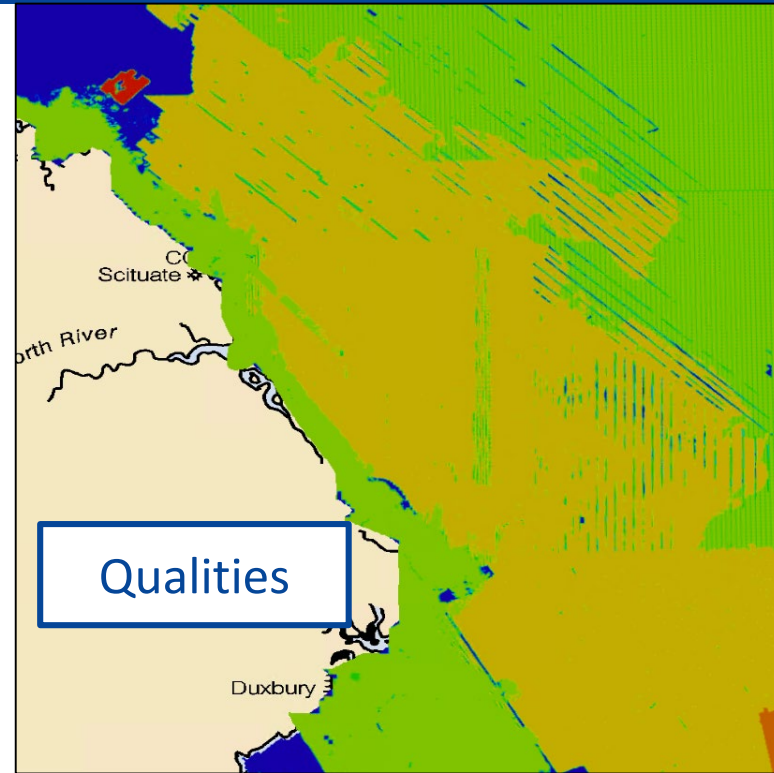
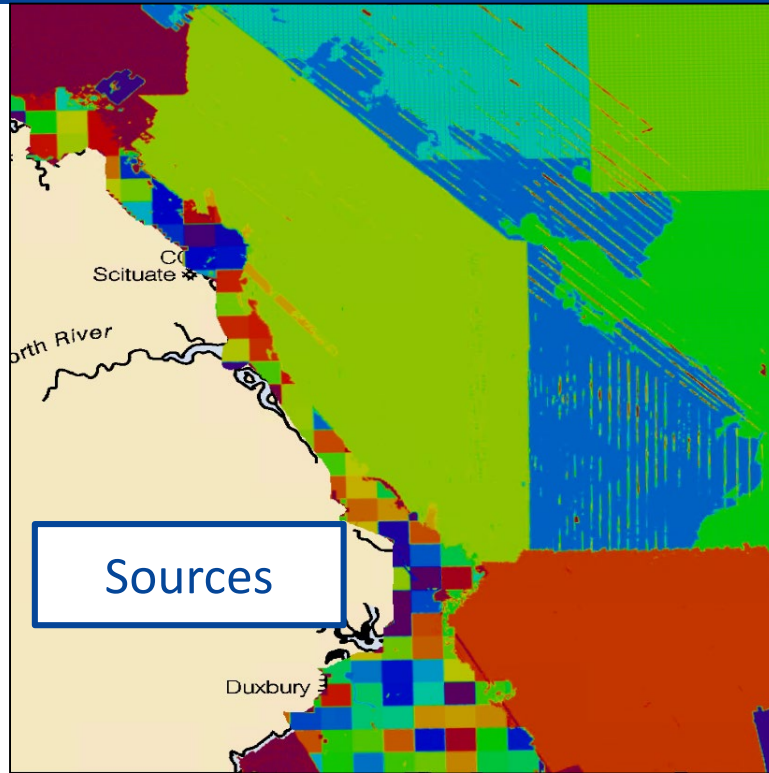
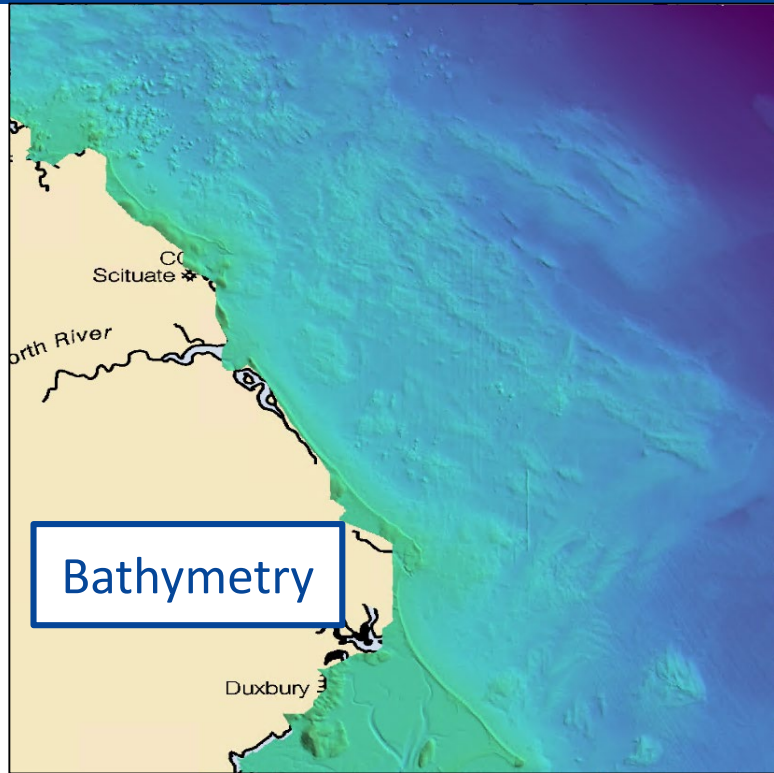
# National Bathymetry Metrics

## Quality of Bathymetry

- Vertical Uncertainty
- Horizontal Uncertainty
- Survey Date Range
- Full Coverage Achieved
  - Bathymetry Coverage
- Features Detected
  - Least Depth Measured
  - Size of Features Detected
- Temporal Variation



# National Bathymetry Metrics

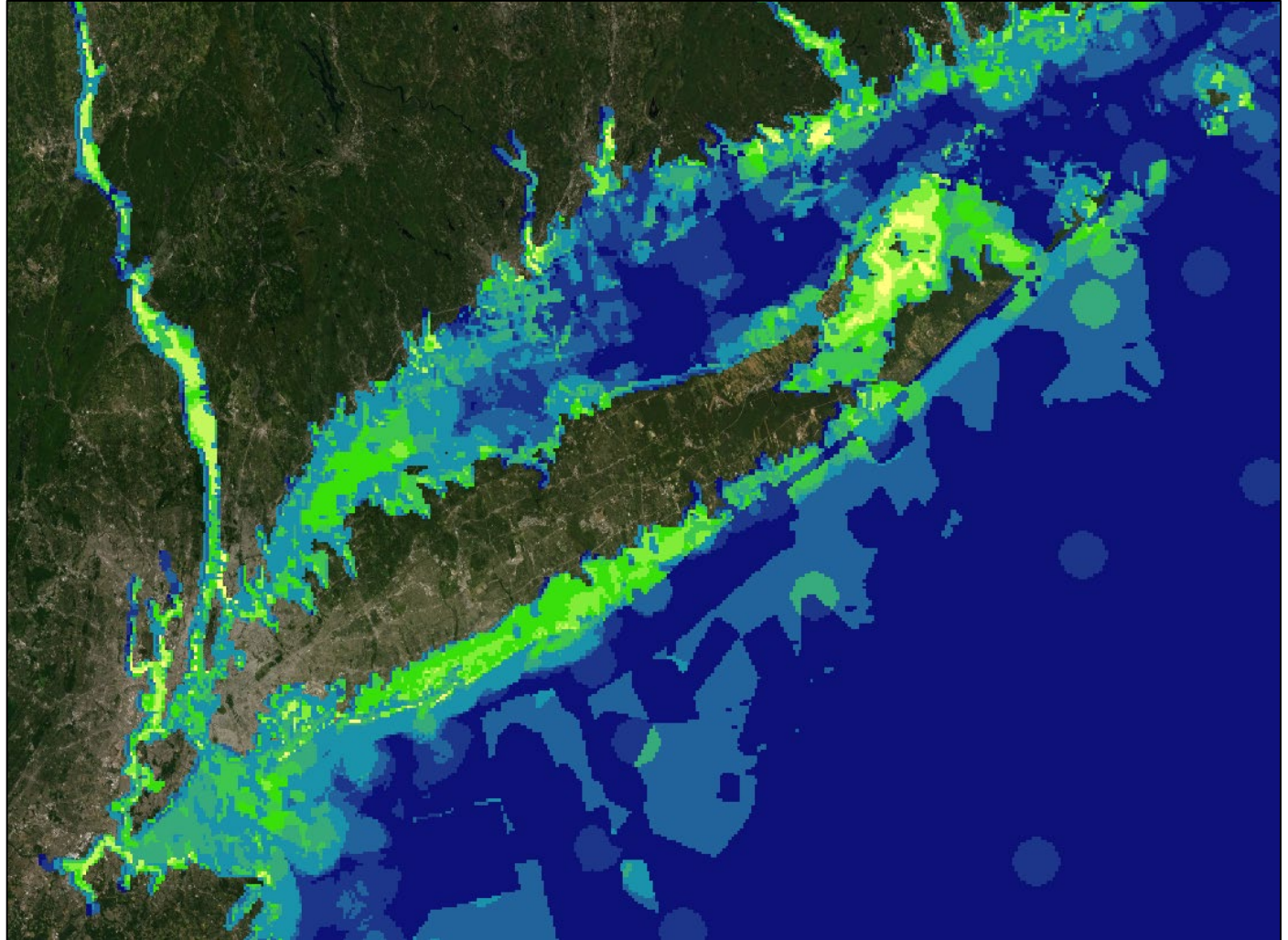
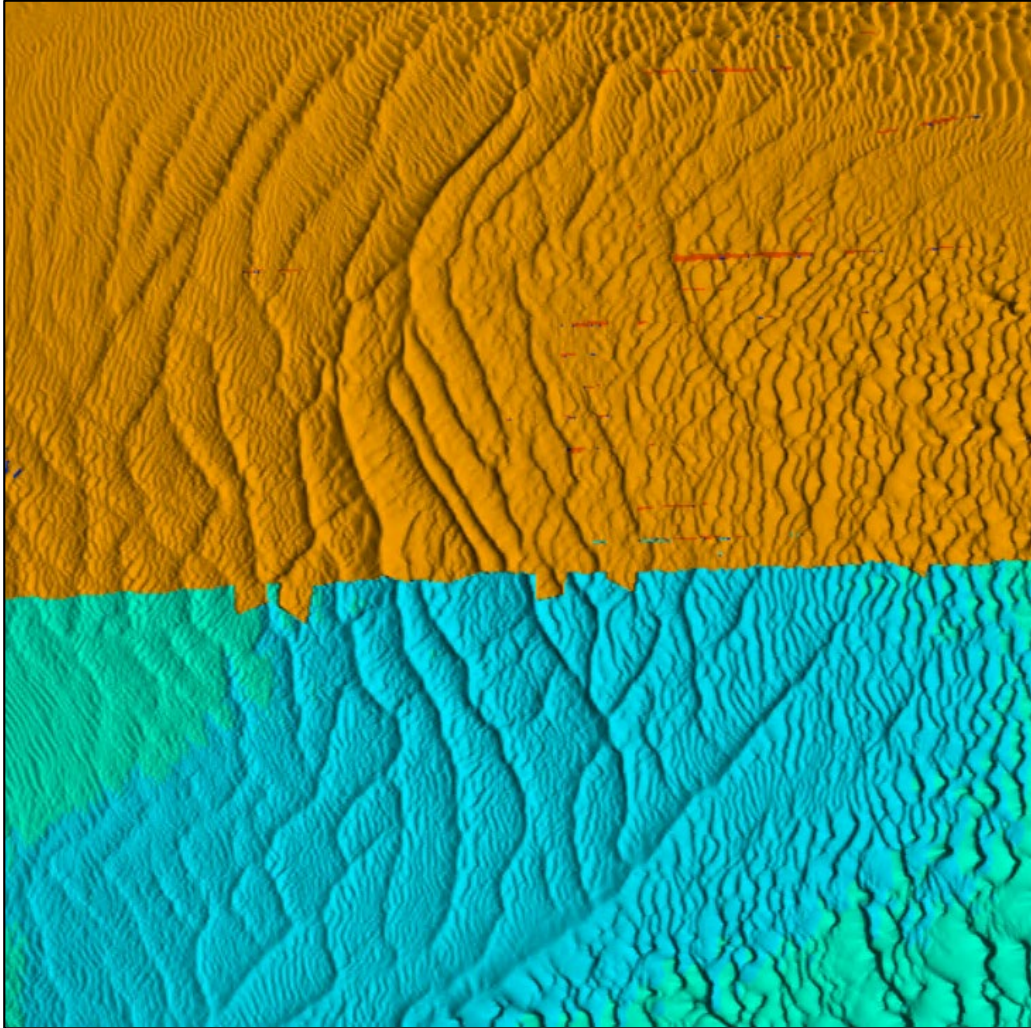


NBS\_US4MA1GD\_20201019\_0\_generalized\_p.source\_information.tiff

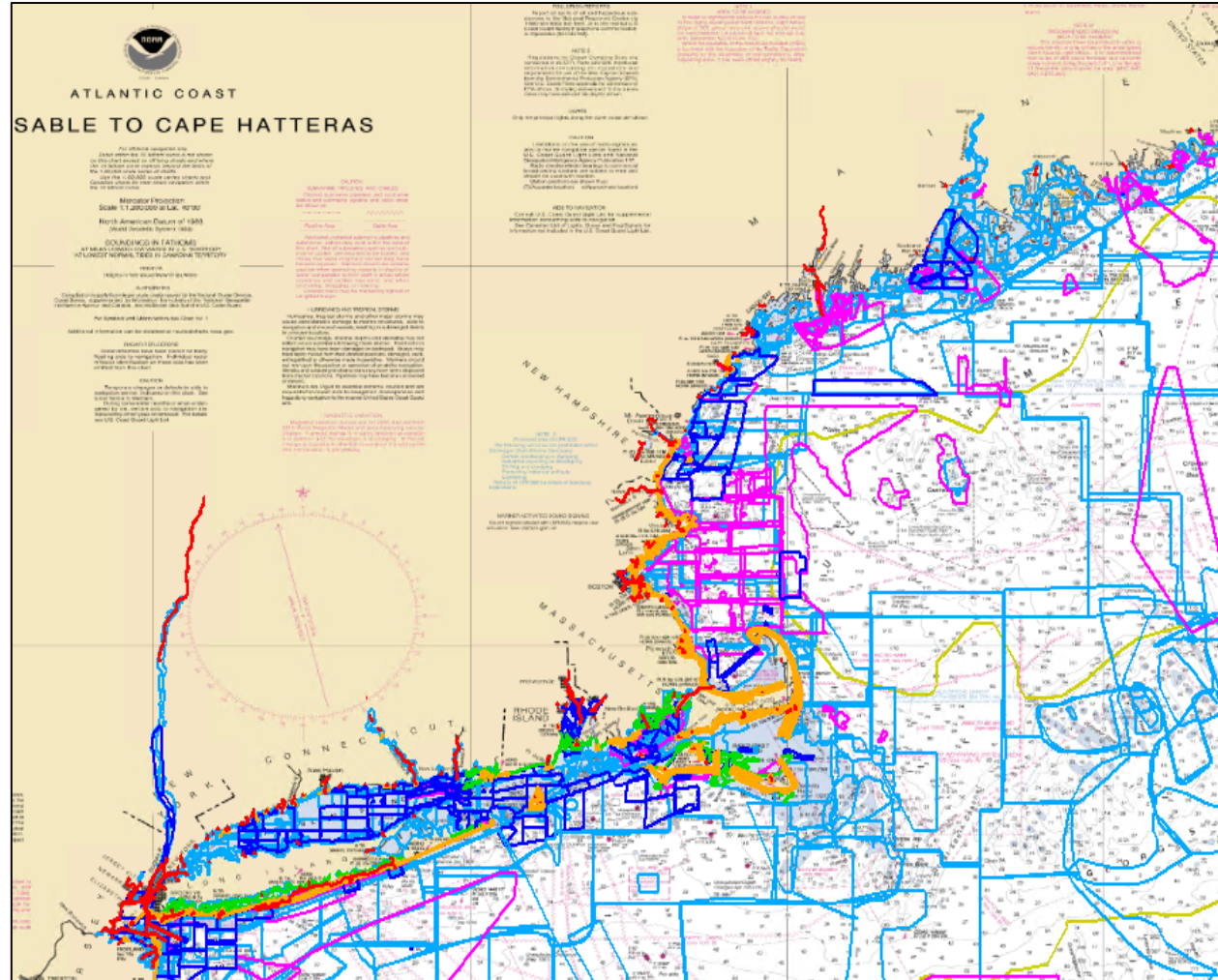
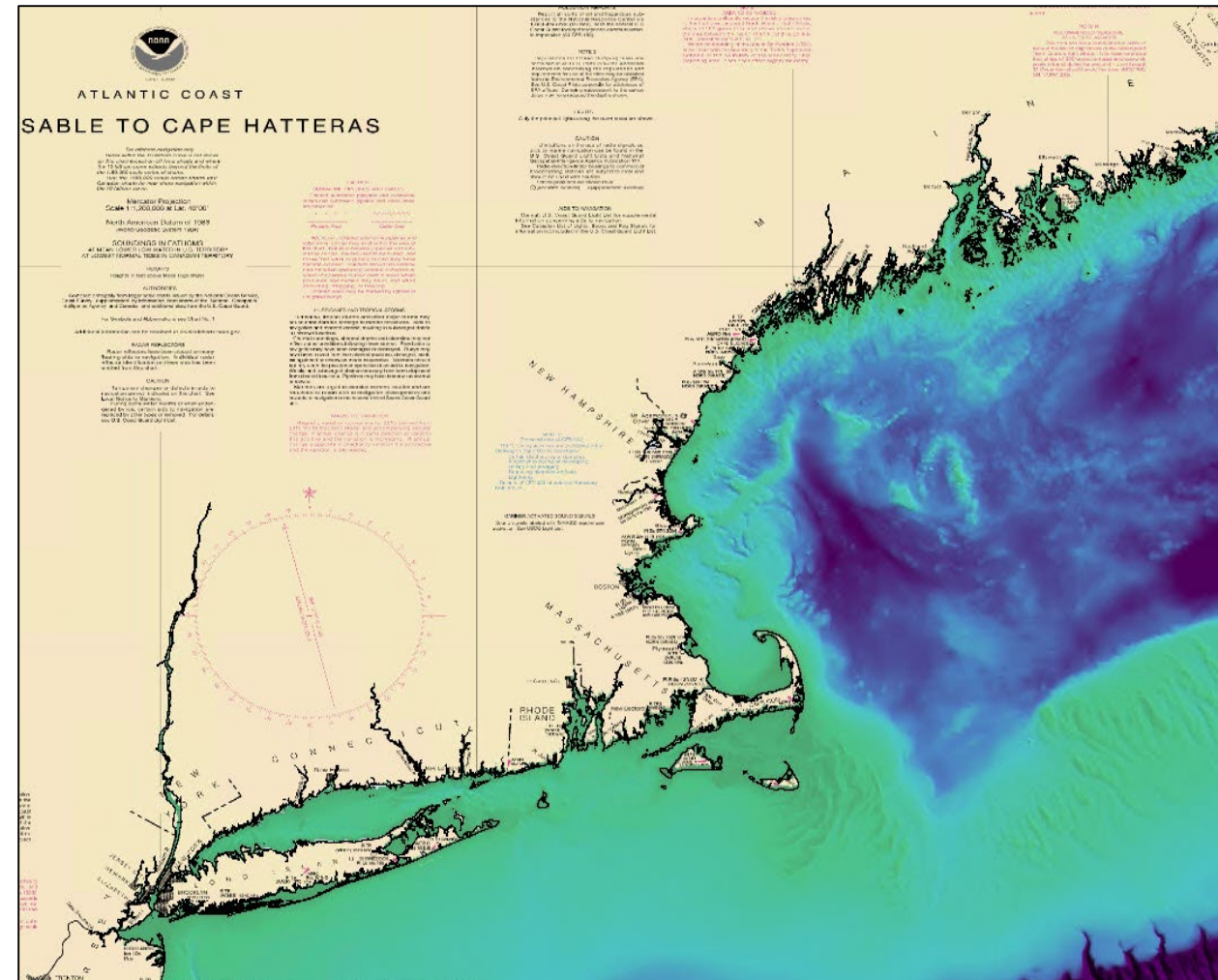
feature_size	full_coverage	bathy_coverage	horizontal_uncert_fixed	horizontal_uncert_var	License_Name	License_URL	Source_Survey_ID	Source_Institution	survey_date_start	survey_date_end
1000000	1	1	5	0.05	cc0-1.0	<a href="https://creativecommons.org/public">https://creativecommons.org/public</a>	2018_ncmp_ma_19tcg5774_bareearth_1mgrid.csar	DOD/USACE/JALBTCX -- Joint Airborne Lidar Bathymetry Technic	2018-05-09	2018-08-27
1000000	1	1	5	0.05	cc0-1.0	<a href="https://creativecommons.org/public">https://creativecommons.org/public</a>	2018_ncmp_ma_19tcg6851_bareearth_1mgrid.csar	DOD/USACE/JALBTCX -- Joint Airborne Lidar Bathymetry Technic	2018-05-09	2018-08-27
1000000	1	1	5	0.05	cc0-1.0	<a href="https://creativecommons.org/public">https://creativecommons.org/public</a>	2018_ncmp_ma_19tcg5868_bareearth_1mgrid.csar	DOD/USACE/JALBTCX -- Joint Airborne Lidar Bathymetry Technic	2018-05-09	2018-08-27
1.5	1	1	5	0.05	cc0-1.0	<a href="https://creativecommons.org/public">https://creativecommons.org/public</a>	f00545_mb_75cm_mllw_1of1.bag	DOC/NOAA/NOS/OCS -- Office of Coast Survey	2007-06-13	2007-09-14
4	1	1	5	0.05	cc0-1.0	<a href="https://creativecommons.org/public">https://creativecommons.org/public</a>	h11636_mb_2m_mllw_1of1.bag	DOC/NOAA/NOS/OCS -- Office of Coast Survey	2007-06-25	2007-07-13
1000000	1	1	5	0.05	cc0-1.0	<a href="https://creativecommons.org/public">https://creativecommons.org/public</a>	2018_ncmp_ma_19tcg6360_bareearth_1mgrid.csar	DOD/USACE/JALBTCX -- Joint Airborne Lidar Bathymetry Technic	2018-05-09	2018-08-27
1000000	1	1	5	0.05	cc0-1.0	<a href="https://creativecommons.org/public">https://creativecommons.org/public</a>	ma_32_gre_20191212_cs_098_full.csar	DOD/USACE -- US Army Corps of Engineers New England District	2019-12-12	2019-12-12
1000000	1	1	5	0.05	cc0-1.0	<a href="https://creativecommons.org/public">https://creativecommons.org/public</a>	2018_ncmp_ma_19tcg6361_bareearth_1mgrid.csar	DOD/USACE/JALBTCX -- Joint Airborne Lidar Bathymetry Technic	2018-05-09	2018-08-27
1000000	1	1	5	0.05	cc0-1.0	<a href="https://creativecommons.org/public">https://creativecommons.org/public</a>	ma_33_dux_20160128_ad_20_full.csar	DOD/USACE -- US Army Corps of Engineers New England District	2016-01-28	2016-01-28



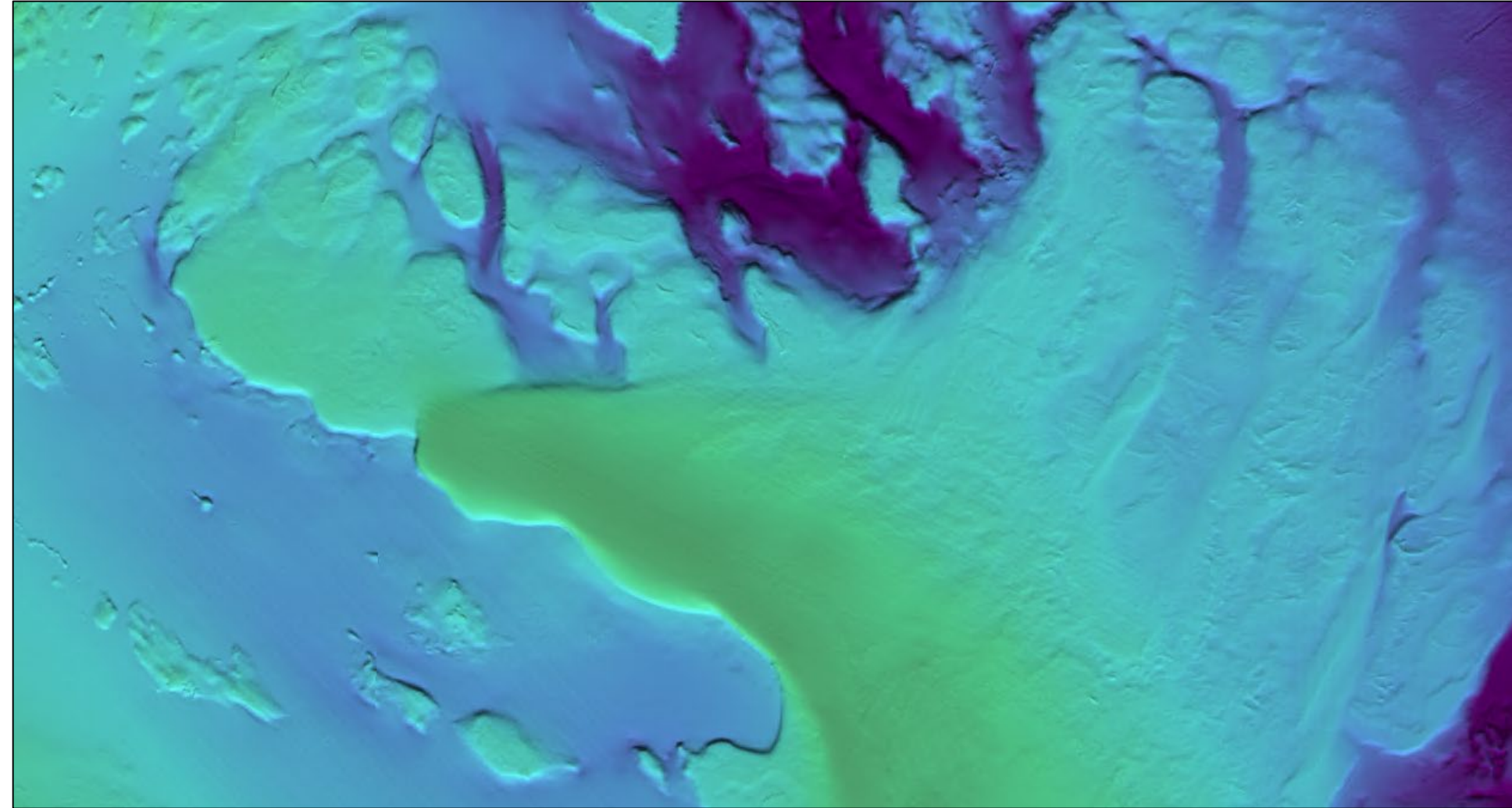
# National Bathymetry Metrics



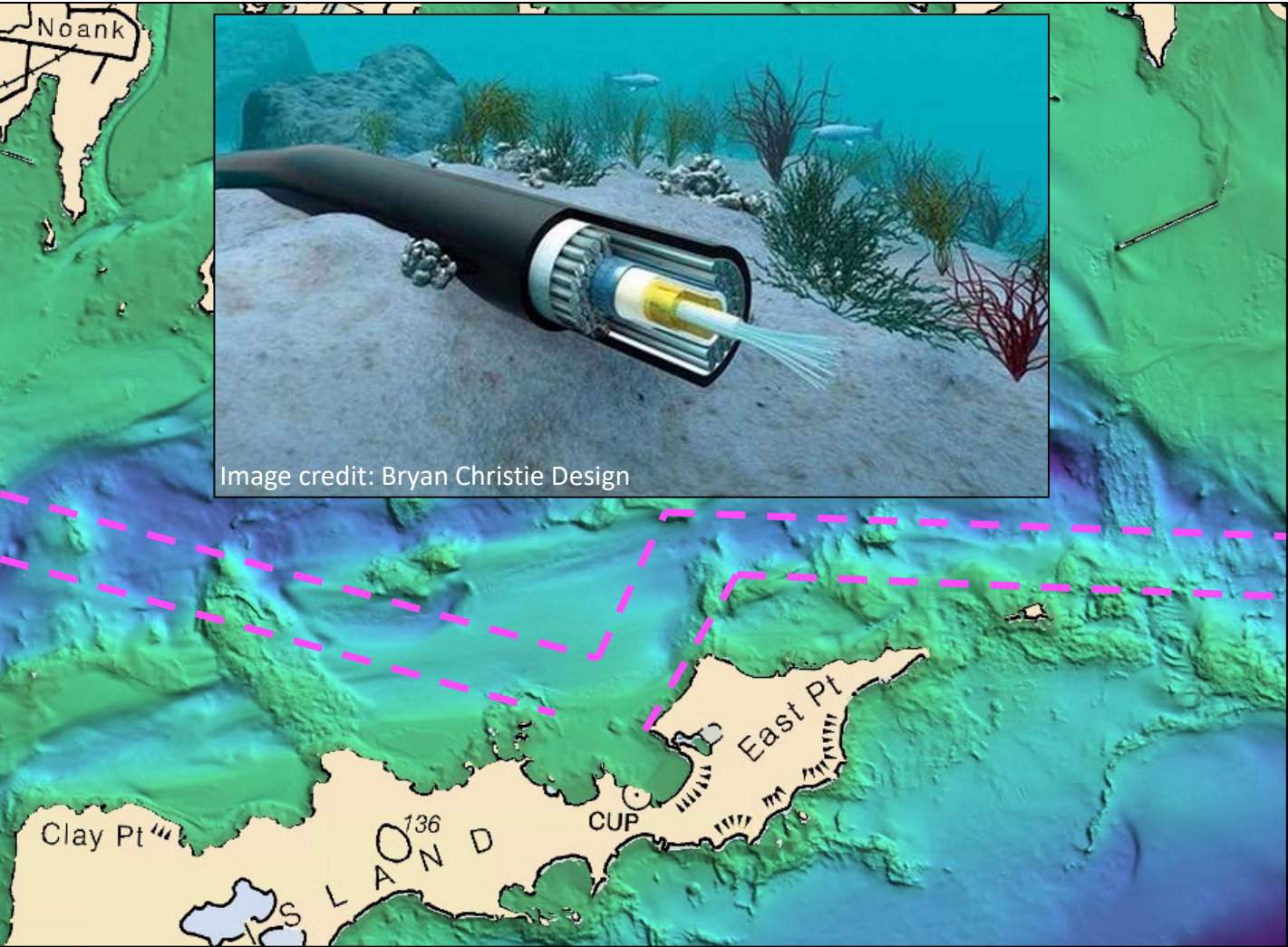
# The National Bathymetry



# National Bathymetry and Habitat



# National Bathymetry and Utility Siting



# National Bathymetry and Coastal Management

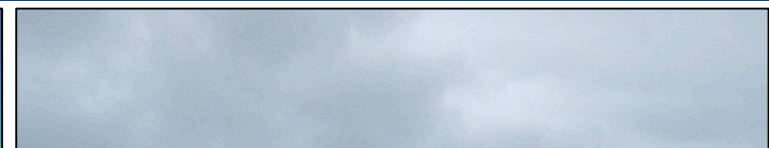
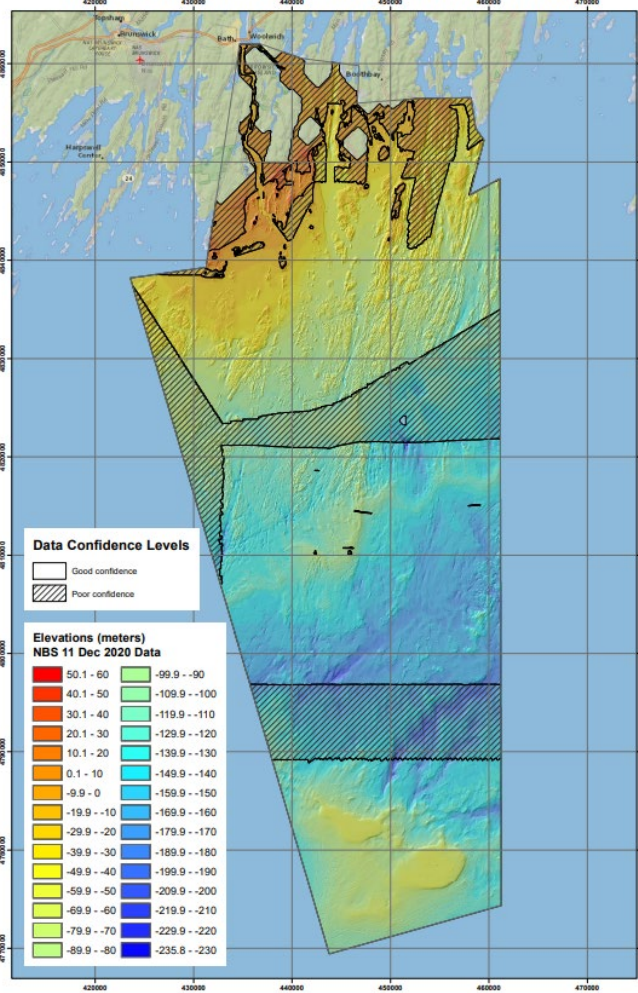


Image credit: Kit Noble & Katie Kaizer

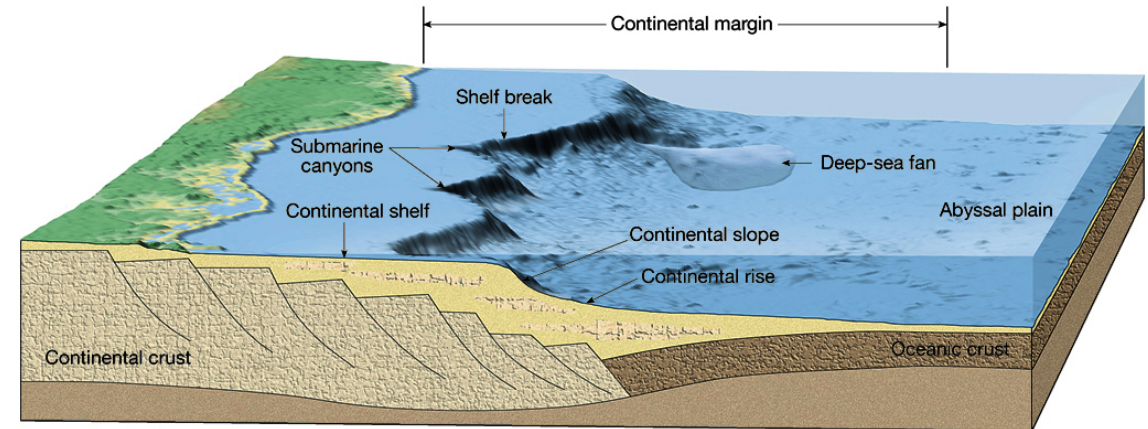
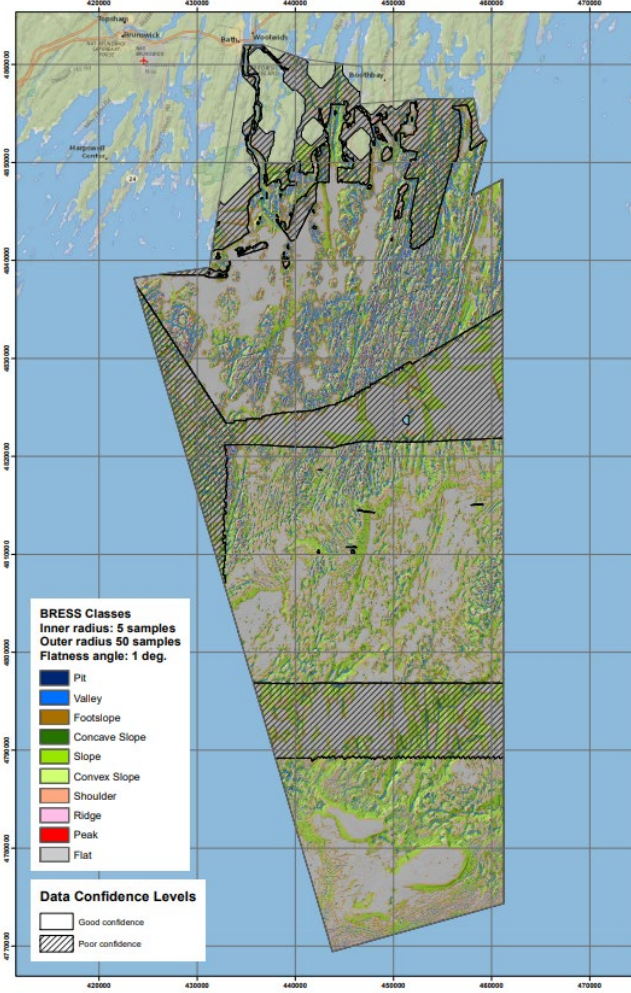


# National Bathymetry and Seafloor Segmentation

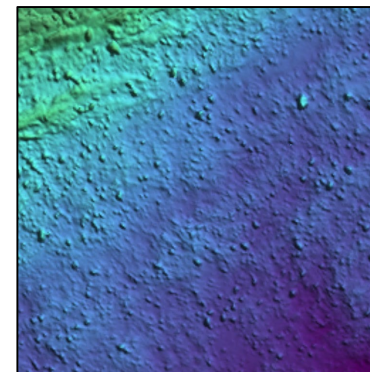
Kennebec Pilot AOI Bathymetry/Topographic Elevations



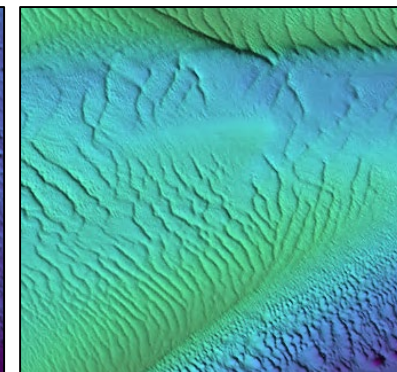
Kennebec Pilot AOI BRESS Analysis



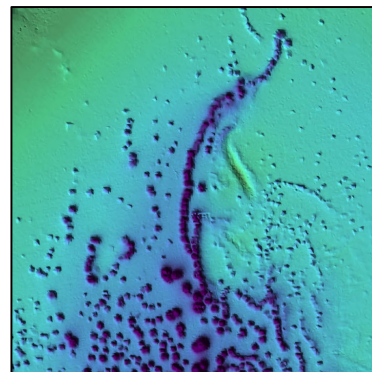
TASA Graphic Arts, 2002



Boulders



Megaripples

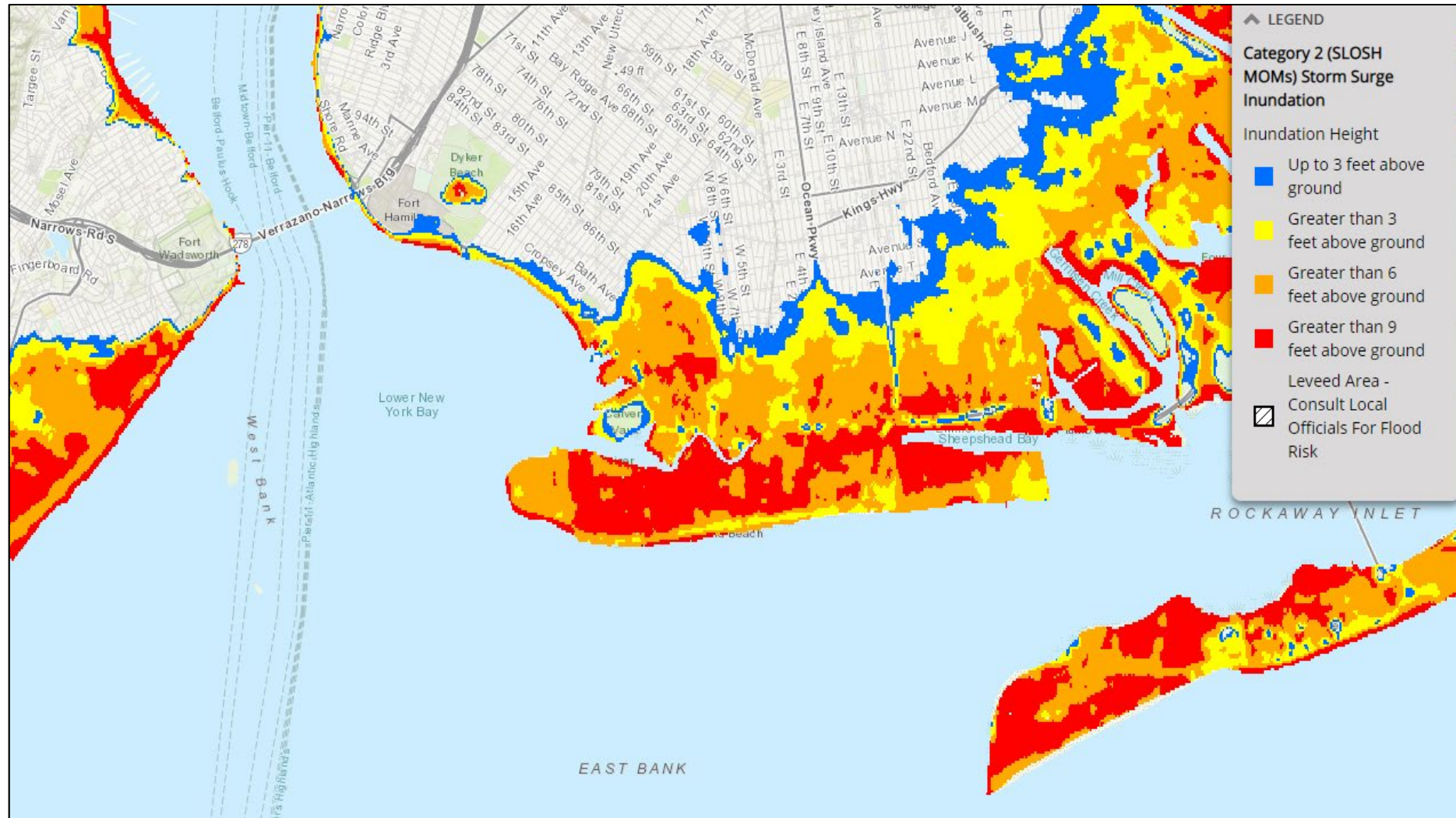


Pockmarks





# National Bathymetry and Coastal Resilience



Flooding



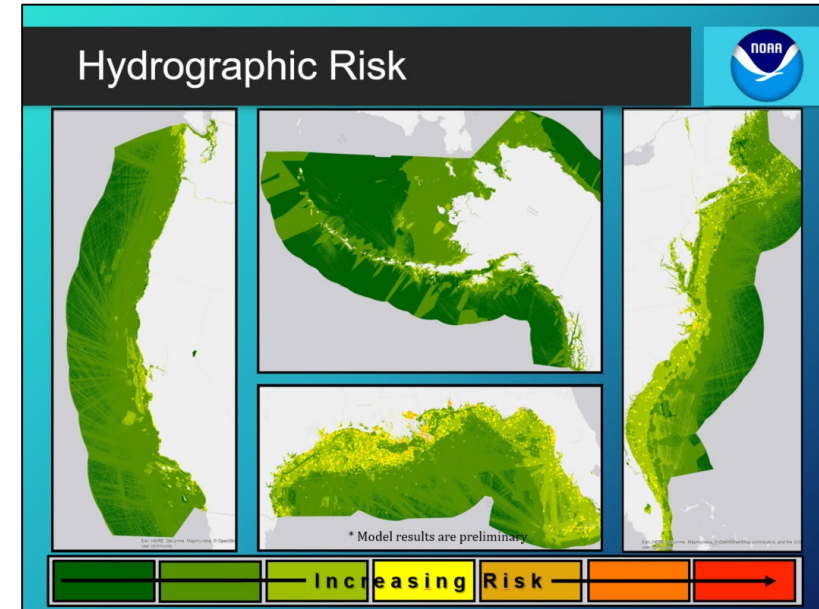
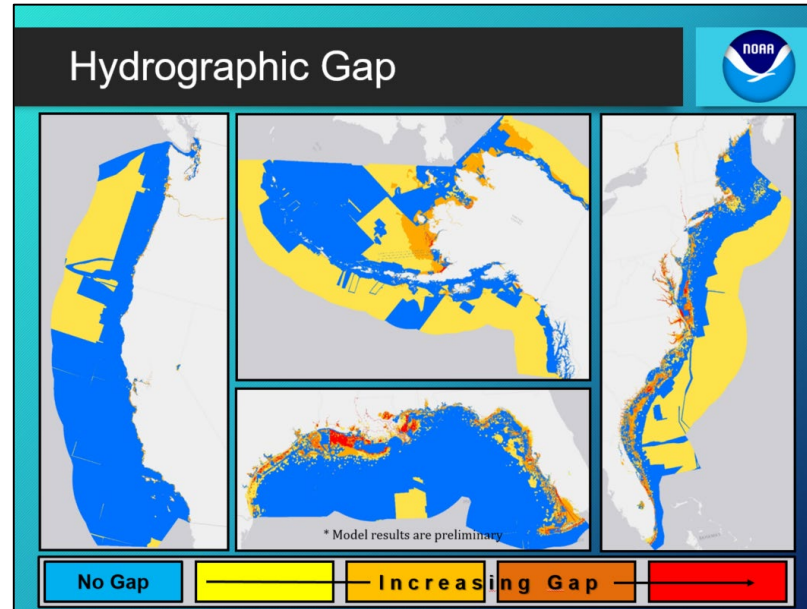
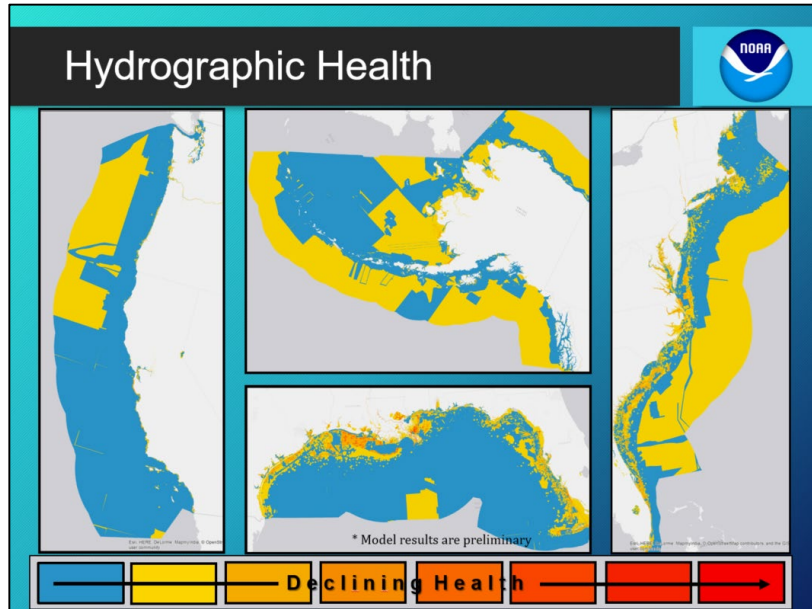
Storm Surge



Sea Level Rise



# National Bathymetry and Hydrographic Health

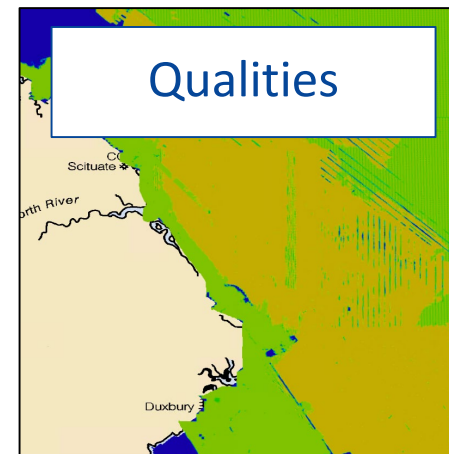
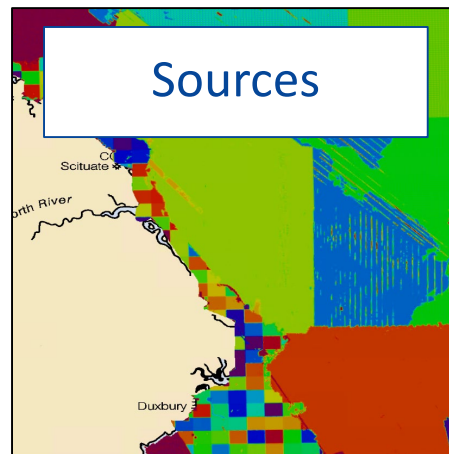
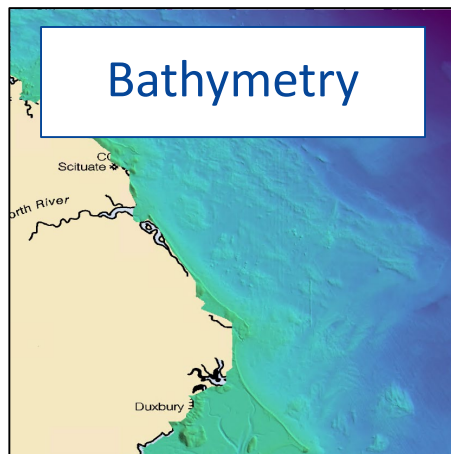


$$\text{Hydrographic Health} = \underbrace{\left( \text{Desired Survey Score} - \text{Present Survey Score} \right)}_{\text{Hydrographic Gap}} \times \underbrace{\sum \left( \text{Consequence} \times \prod (\text{Likelihood}) \right)}_{\text{Hydrographic Risk}}$$



# HSRP: Recommendations

- Educate downstream users of bathymetry quality factors for appropriate use
- Generic datum transformation needs to be made more accessible to the public
- Coast Survey model of temporal and spatial change is needed



Thank you!  
[ocs.nbs@noaa.gov](mailto:ocs.nbs@noaa.gov)

