Western Gulf of Maine (WGOM) Bathymetry and Backscatter Synthesis

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NOAA's Open House on Nautical Cartography • July 7, 2017
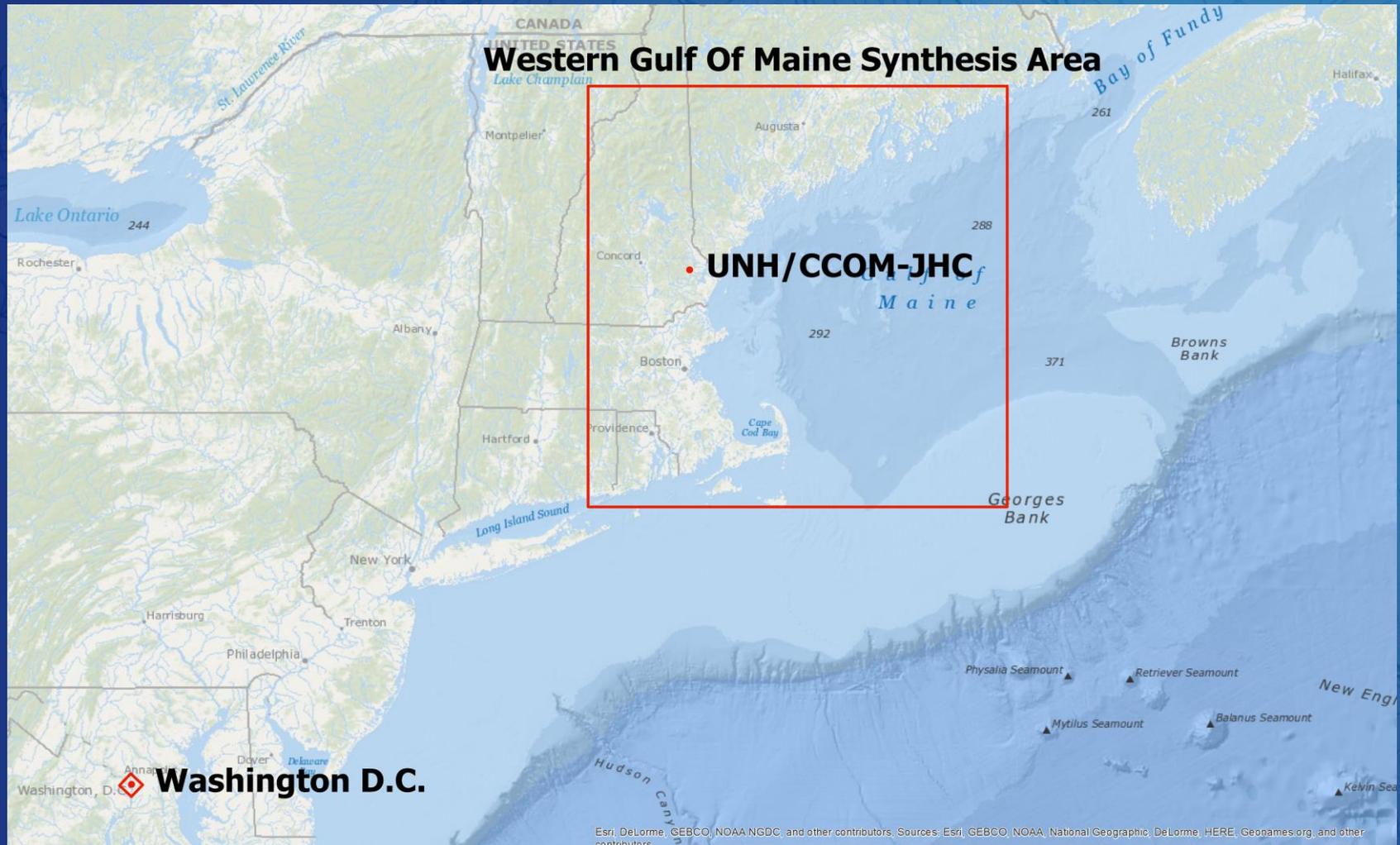
Collaborators at UNH/CCOM-JHC

Erin Nagel

Larry Ward

Thanks to

NOAA's Atlantic Hydrographic Branch

NOAA Ship *Ferdinand R Hassler*

# Western Gulf of Maine Synthesis Area

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Why are we interested in this area ?

- **Our "backyard"**
- **Large amount of historic data collected in the region**
- **Yearly hydrographic surveys done by the Center as part of the Summer Hydrographic class.**
- **Stakeholders**
  - **Researchers**
  - **Students**
  - **State Agencies**
  - **Fishermen**
  - **Local Communities**
- **BOEM Sand Resource Study**
- **Data management**

The beginning of the WGOM synthesis

- **Initial development began in 2013**
- **Installation of the Center's 1st ESRI ArcGIS Server**
- **Simple web interface to a tiled dataset of UNH/CCOM-JHC summer hydrography data**
- **Driven by 2 needs**
  - **Data management**
  - **Planning of future summer hydro missions**
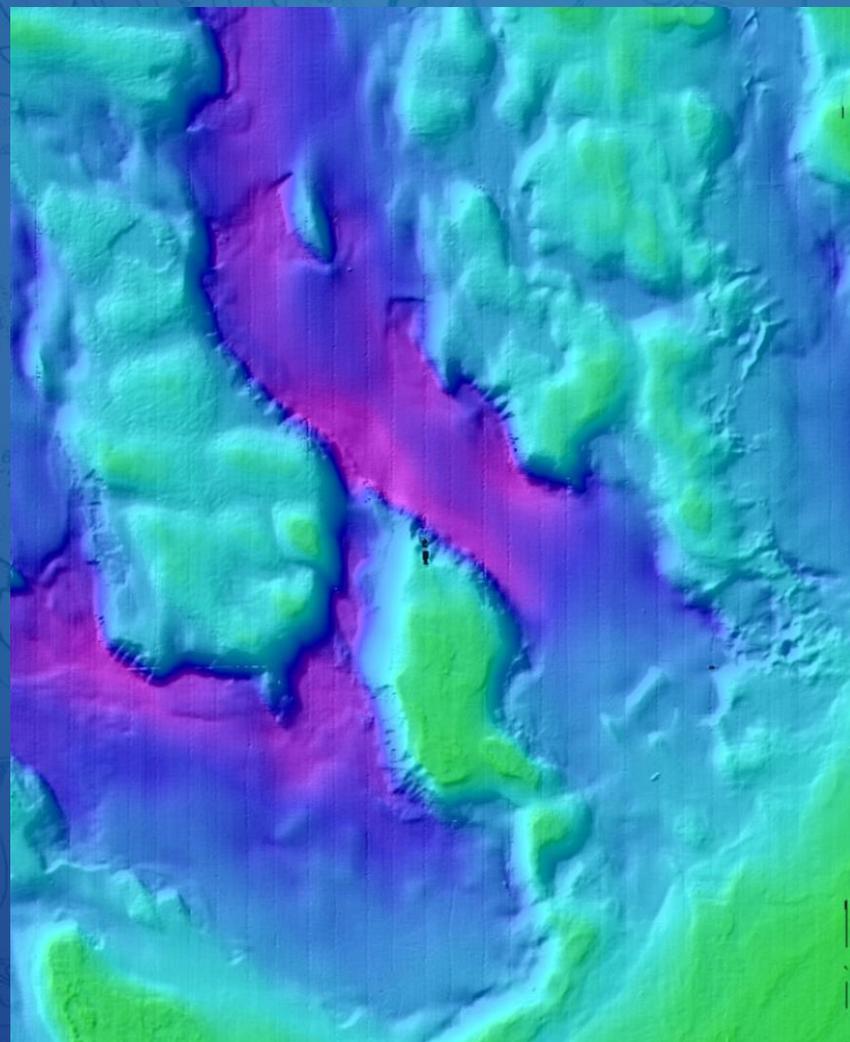- **Designed to let outside users know that the data existed**
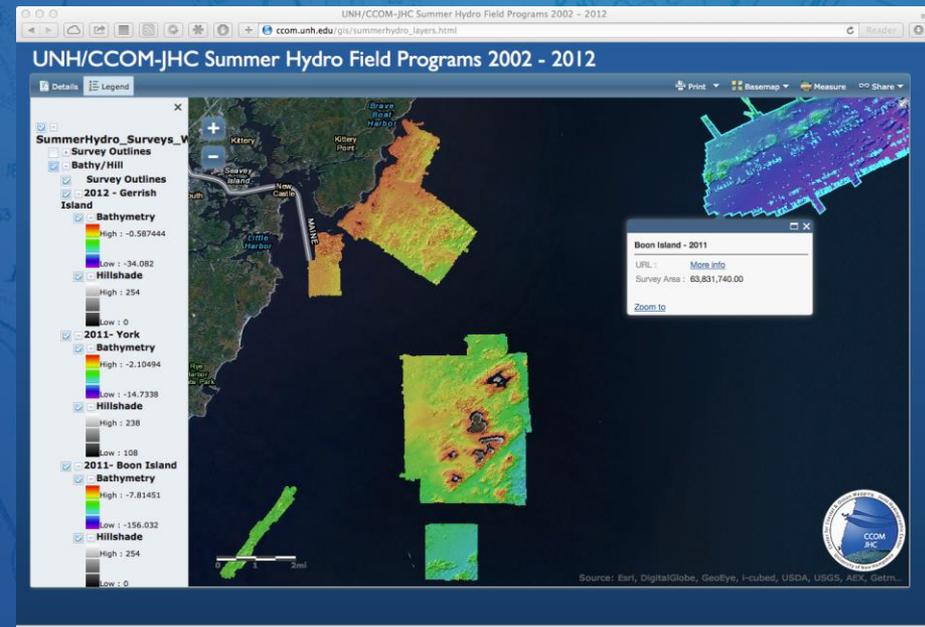
Bathymetry Data Sources

- **UNH/CCOM-JHC Summer Hydrography (15 Surveys)**
  - Little Bay 2002
  - Open Aquaculture 2003
  - Mussel Geo 2004
  - Isle of Shoals 2005
  - Gerrish Island 2006
  - Fort Point Survey 2007
  - Castine Harbor 2008
  - Isle of Shoals 2009
  - Isle of Shoals 2010
  - Boon Island 2011
  - York 2011
  - Gerrish Island 2012
  - Near Shore Rye 2013
  - Concord Point 2014
  - Rye Ledge 2015

- **UNH/CCOM-JHC (6 Surveys)**
  - Caches Ledge
  - Cod Survey
  - GOMMI
  - Jeffreys Ledge 8101
  - Jeffreys Ledge 8125
  - Sweep Day

- **NOAA (45 Surveys)**
  - D00185
  - F00508
  - F00545
  - F00553
  - F00574
  - F00603
  - H10763
  - H10771
  - H11014
  - H11277
  - H11296
  - H11421
  - H11467
  - H11636
  - H11695
  - H12256
  - H12613
  - H12614
  - H12615
  - H12696
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  - W00177
  - W00178
  - W00181
  - W00194
  - W00195
  - W00206
  - W00288

- **USACE Lidar (11 Surveys)**
  - 2010 MA
  - 2010 ME
  - 2010 NH
  - 2011 MA
  - 2014 Goat Island
  - 2014 Hampton
  - 2014 Isle Of Shoals
  - 2014 Little Harbor
  - 2014 Rye
  - 2014 Wallis Sands
  - 2015 Hampton

- **USGS (5 Surveys)**
  - Cape Ann Salisbury Beach, MA
  - Duxbury & Hull, MA
  - Massachusetts Bay and Stellwagen Bank
  - Nahant to Gloucester, MA
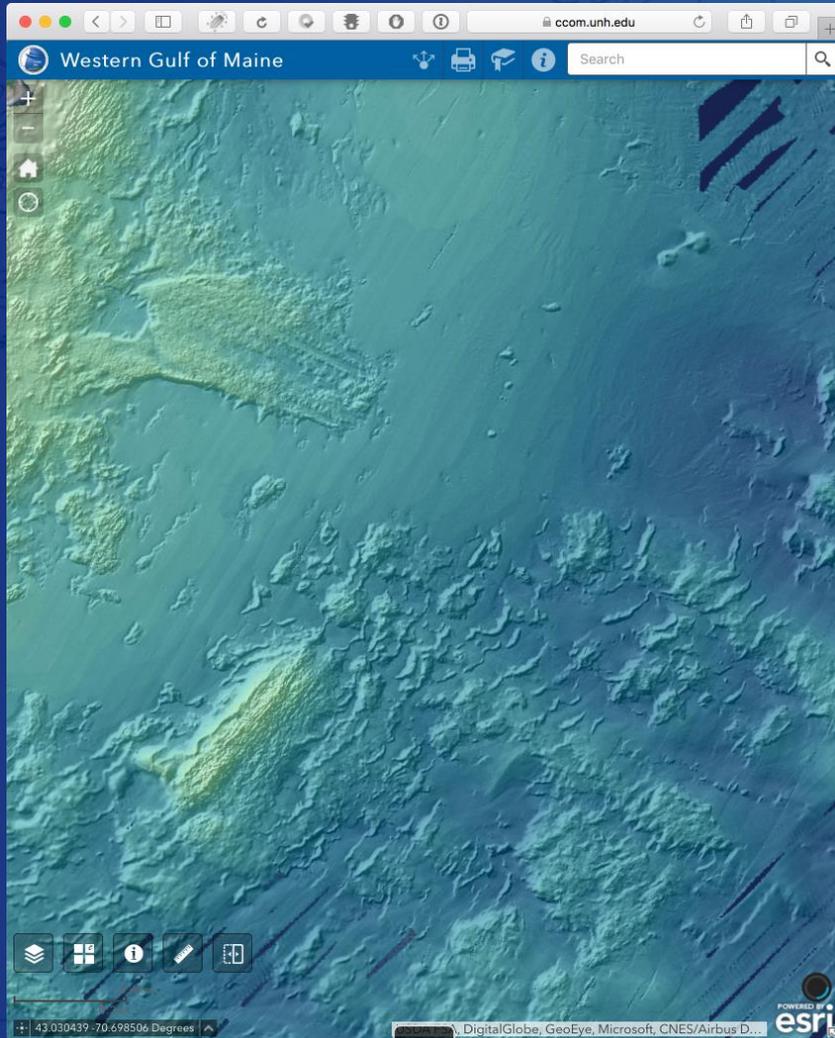 - Northern Cape Cod Bay, MA

Raster Synthesis Challenges

- **Multiple Data Types & Formats**
  - **Bathymetry BAGs**
  - **Fledermaus SD**
  - **XYZs**
  - **GeoTIFFs**
  - **Caris HIPS Projects**
- **Different Projections**
- **Different Vertical Datums**
  - **MLLW**
  - **ERS**
  - **Instantaneous or Unknown**
- **Not only bathymetry, multibeam backscatter as well.**
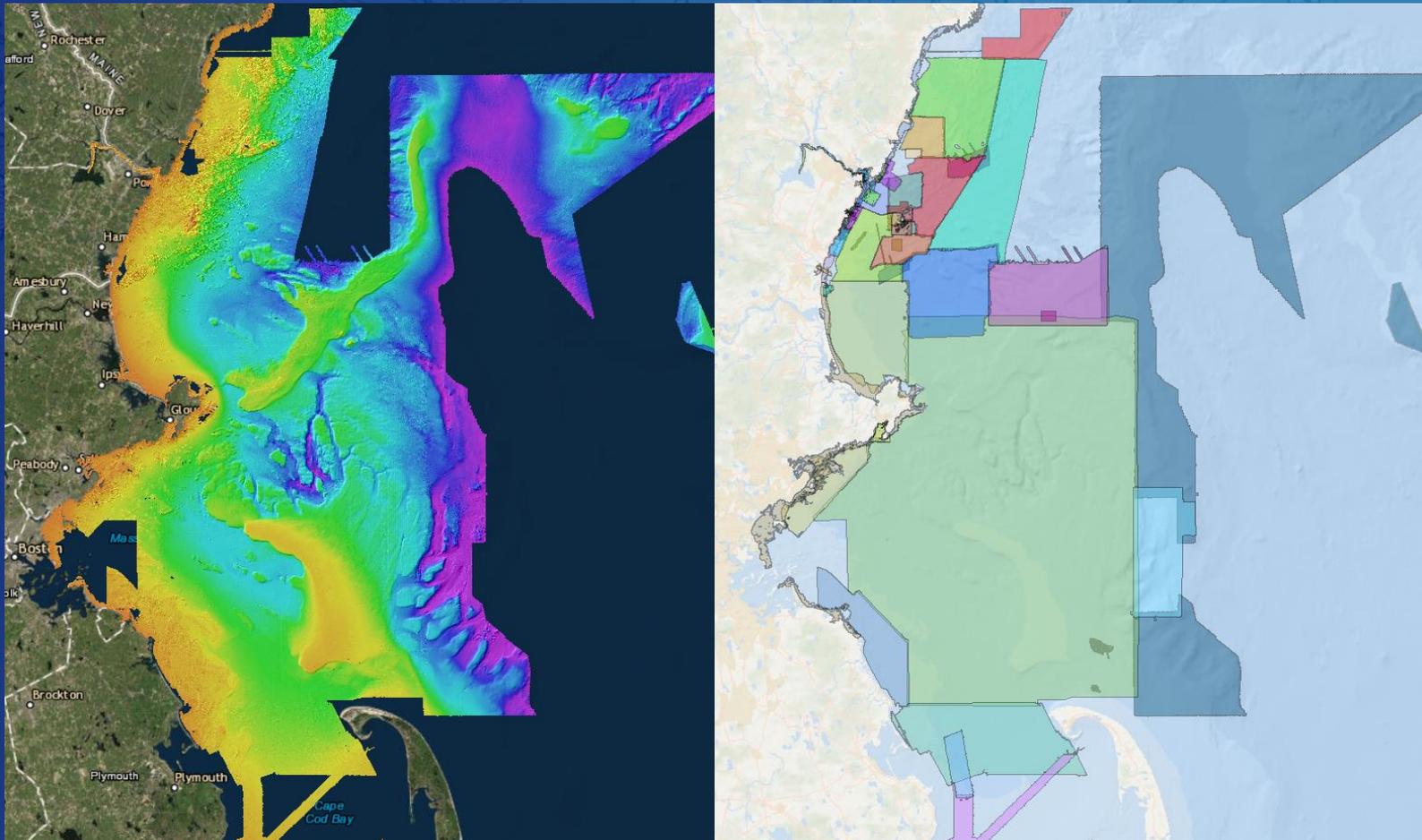
# Raster Data Validation

Where we are now ?

Bathymetry Synthesis - ESRI Mosaic Dataset
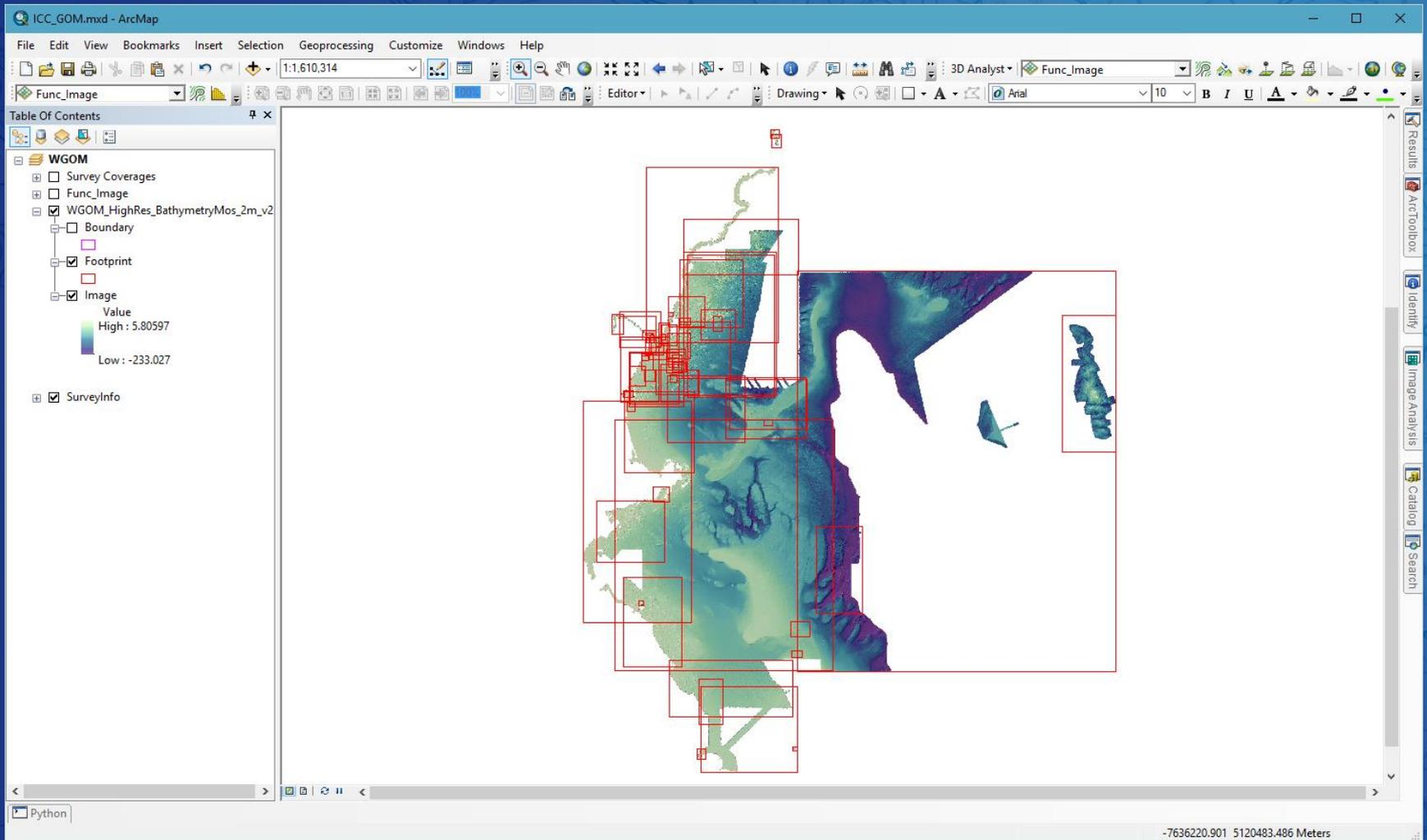
Bathymetry - ESRI Mosaic Dataset

- **Links to each surveys original resolution bathymetry grid**

- **Users can work with best resolution data for the area that they are interested in**

- **Allows for scale dependent drawing of datasets**

- **Allows for setting raster layer ordering**

- **Export to single resolution grids**

- **Work with the individual datasets as a single grid**
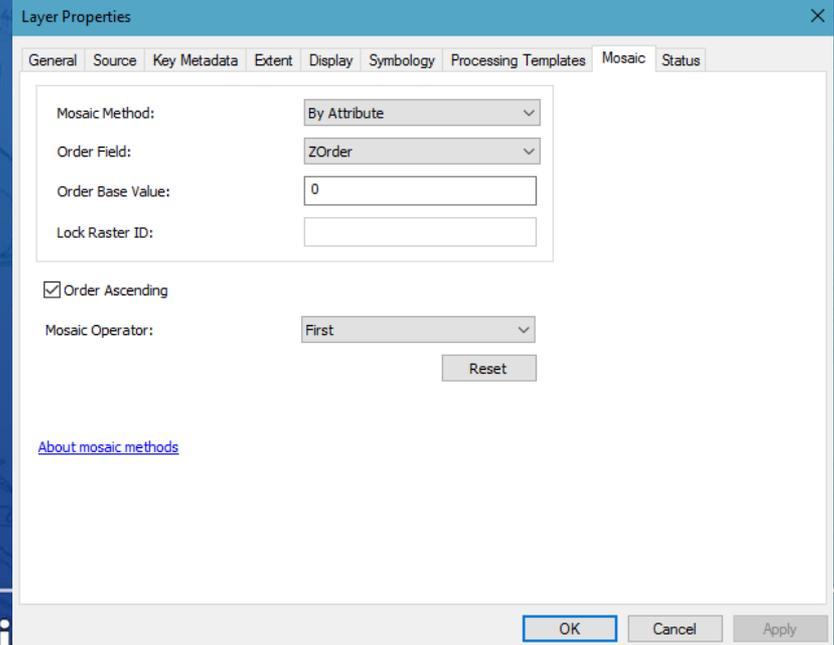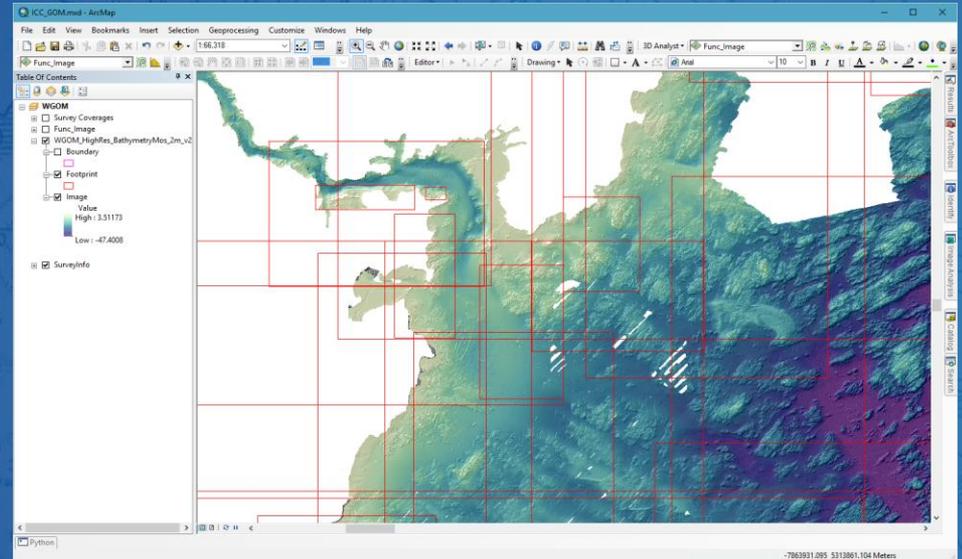
Multibeam Backscatter

- **Processed from UNH/CCOM-JHC & NOAA Ship *Ferdinand R Hassler* data**

- **Time intensive processing in order to merge data from different systems.**

- **Valuable resource for examining bottom type**

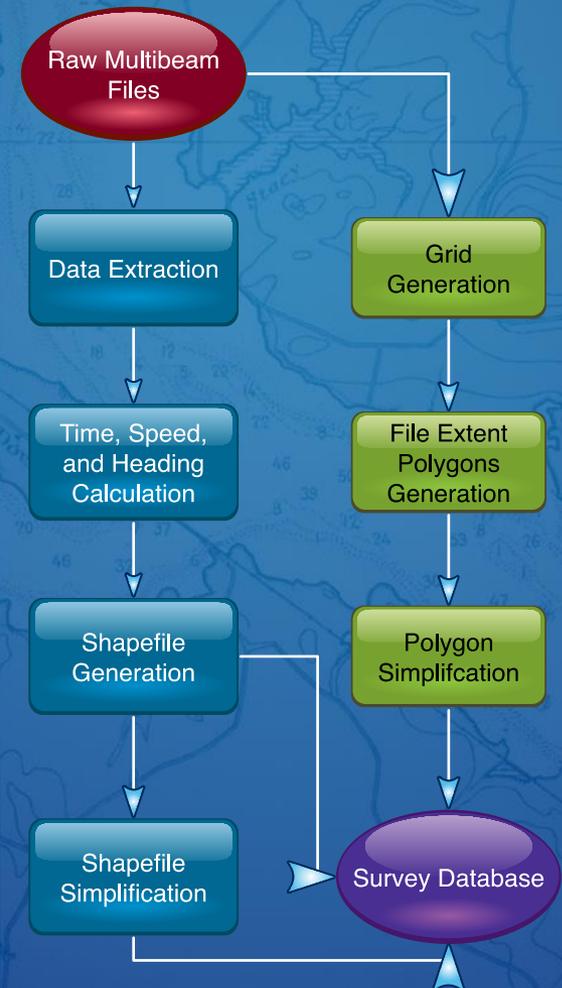- **More data being added soon.**
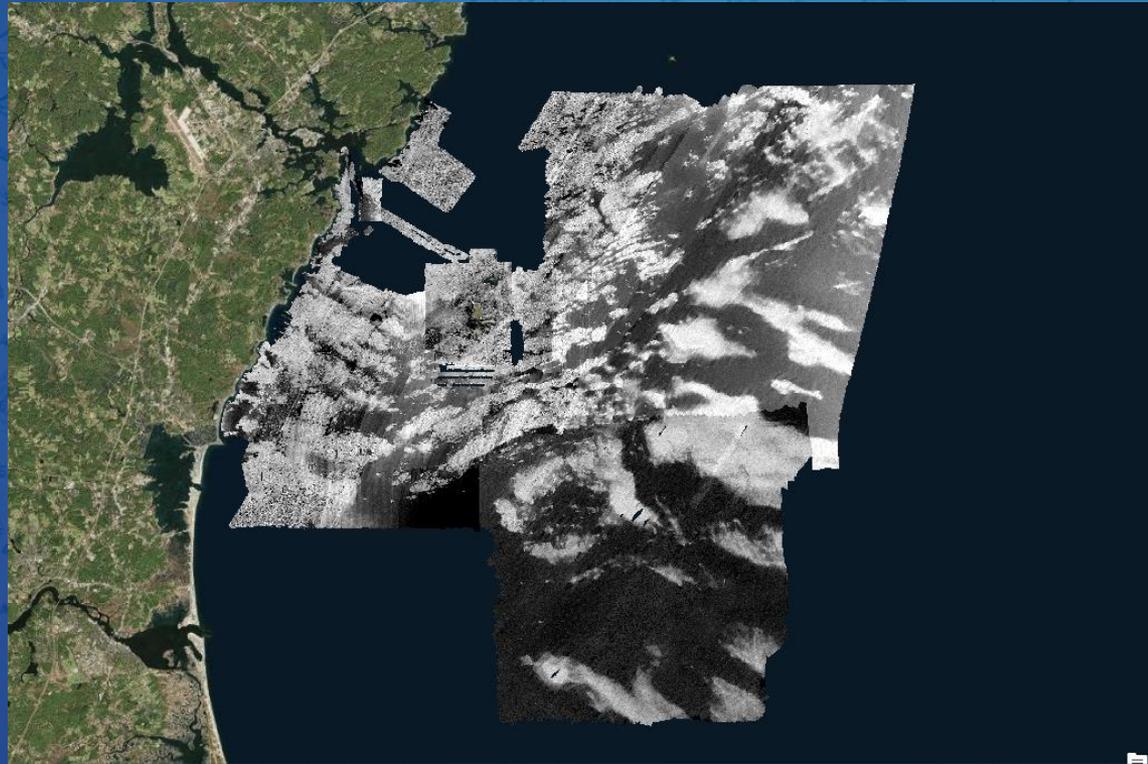
What About the Feature Layers ?

- **Survey Specific Feature**
  - Track Line Data
  - File Outlines
  - Survey Outlines
- **Too many files to do by hand**
- **Chance of mistake filling out information by manual entry**
- **Consistent data collected from each file**
- **Save time by automating the processing when possible**
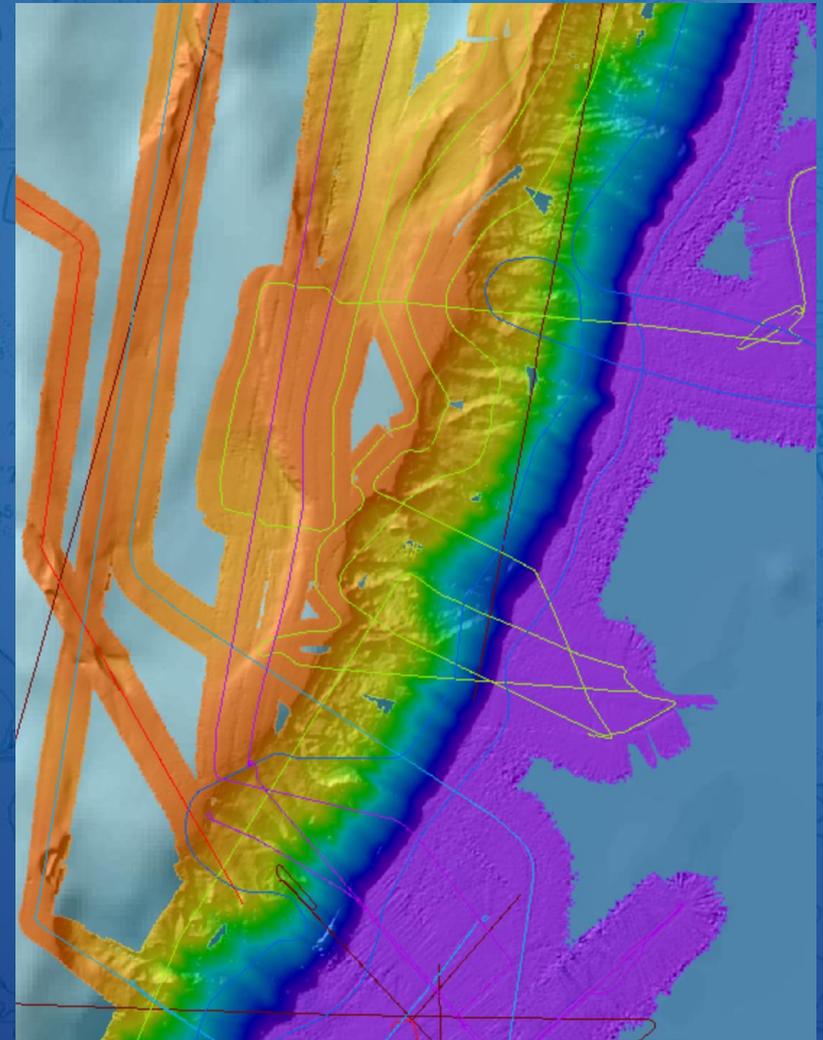
Data Harvesting

- **A work in progress**
- **1st use was for UNH/CCOM-JHC's Extended Continental Shelf LOTS datasets**
- **Similar scripts already used to generate XML metadata files**
- **Open source Software**
  - **Generic Mapping Tools (GMT) http://gmt.soest.hawaii.edu/**
  - **MB System https://www.ldeo.columbia.edu/res/pi/MB-System/**
  - **Geospatial Data Abstraction Library (GDAL) http://www.gdal.org/**
- **BASH, TCSH, and Python scripts**
- **Automated approach for information mining for track line and file polygons**
- **Designed to point script at a directory and let it run**

Raw Multibeam Files → Data Extraction → Time, Speed, and Heading Calculation → Shapefile Generation → Shapefile Simplification

Raw Multibeam Files → Grid Generation → File Extent Polygons Generation → Polygon Simplifcation → Survey Database

Shapefile Generation → Survey Database

Navigation - Raw & Processed Files

- **Information extracted from raw or processed files**

- **Metadata includes:**
  - **Survey**
  - **File Name**
  - **Start & End Time**
  - **Distance Traveled (km)**
  - **Average Speed (kts)**

- **Generate polyline shapefiles (full resolution and simplified)**

- **Incredibly useful during processing and data verification**
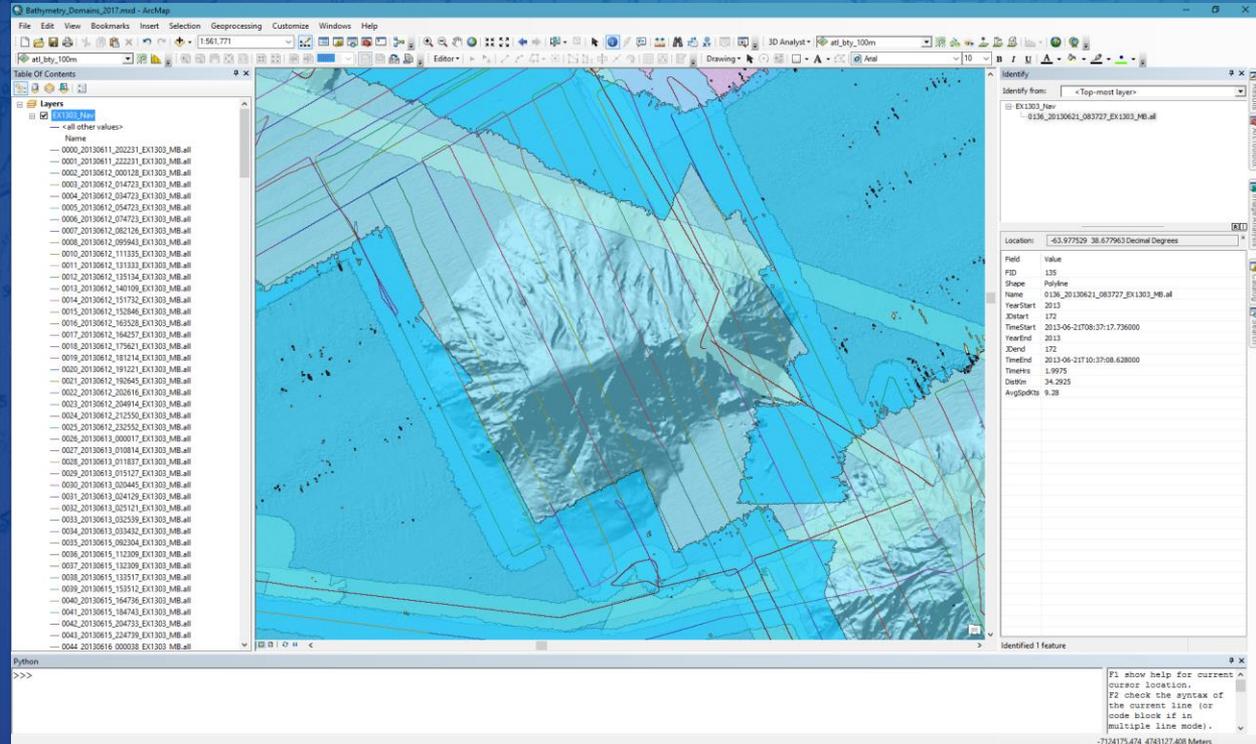
Survey Extent Polygons

- **Source diagram of data contributing to synthesis**

- **Metadata includes:**
  - **Survey Name**
  - **Year**
  - **Resolution**
  - **Agency**
  - **Vessel**
  - **Frequency**
  - **System**
  - **URL**

- **Generated for both bathymetry & backscatter**
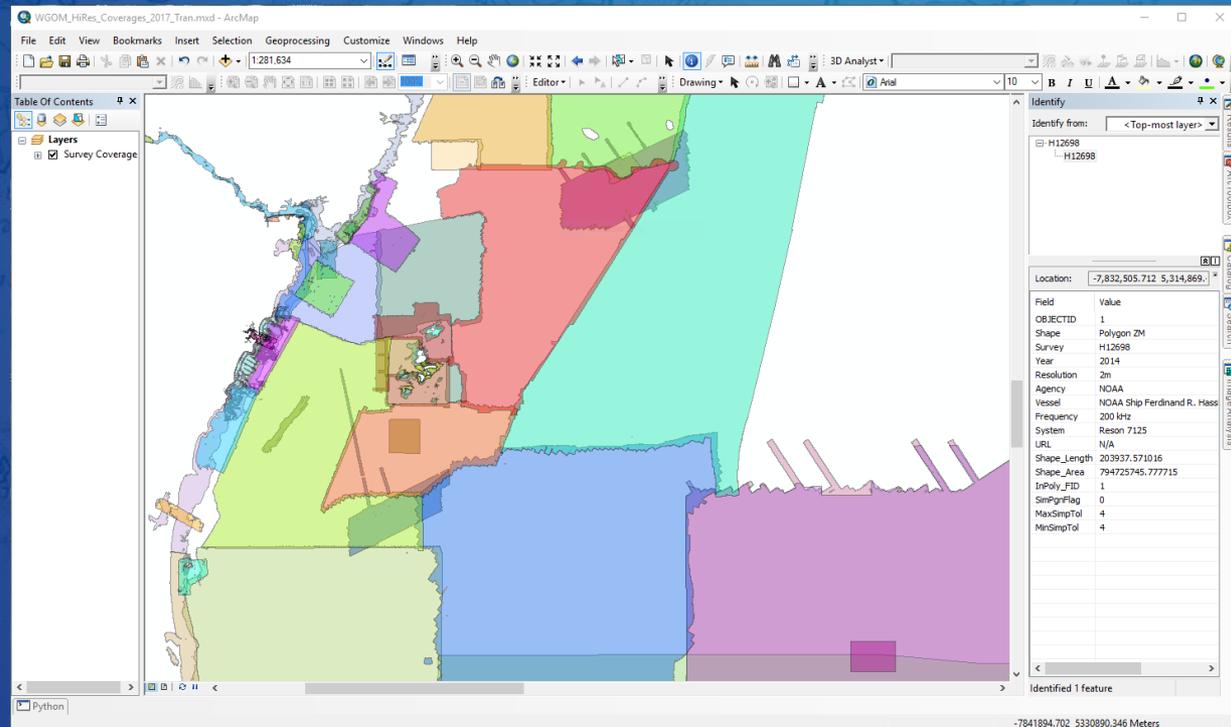
Taking the data to the web
https://www.ccom.unh.edu/maps/gis/wgom2m

Tiled Raster Bathymetry Datasets

Optimized Colors

Regional Bathymetry

The Power of Raster Layers

Bathymetry & NOAA RNCs

Backscatter & Bathymetry
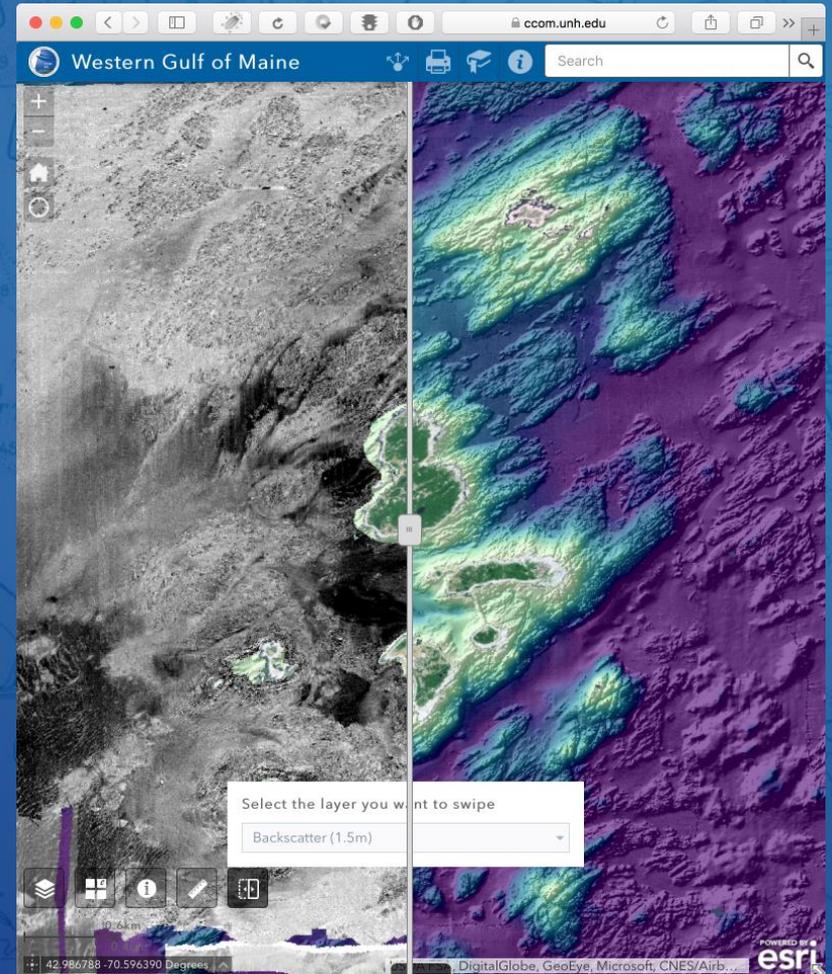
WGOM Survey Extents – Web Interface

- **Source data credit & tracking**
- **Aid in data management**

Other Features & Services
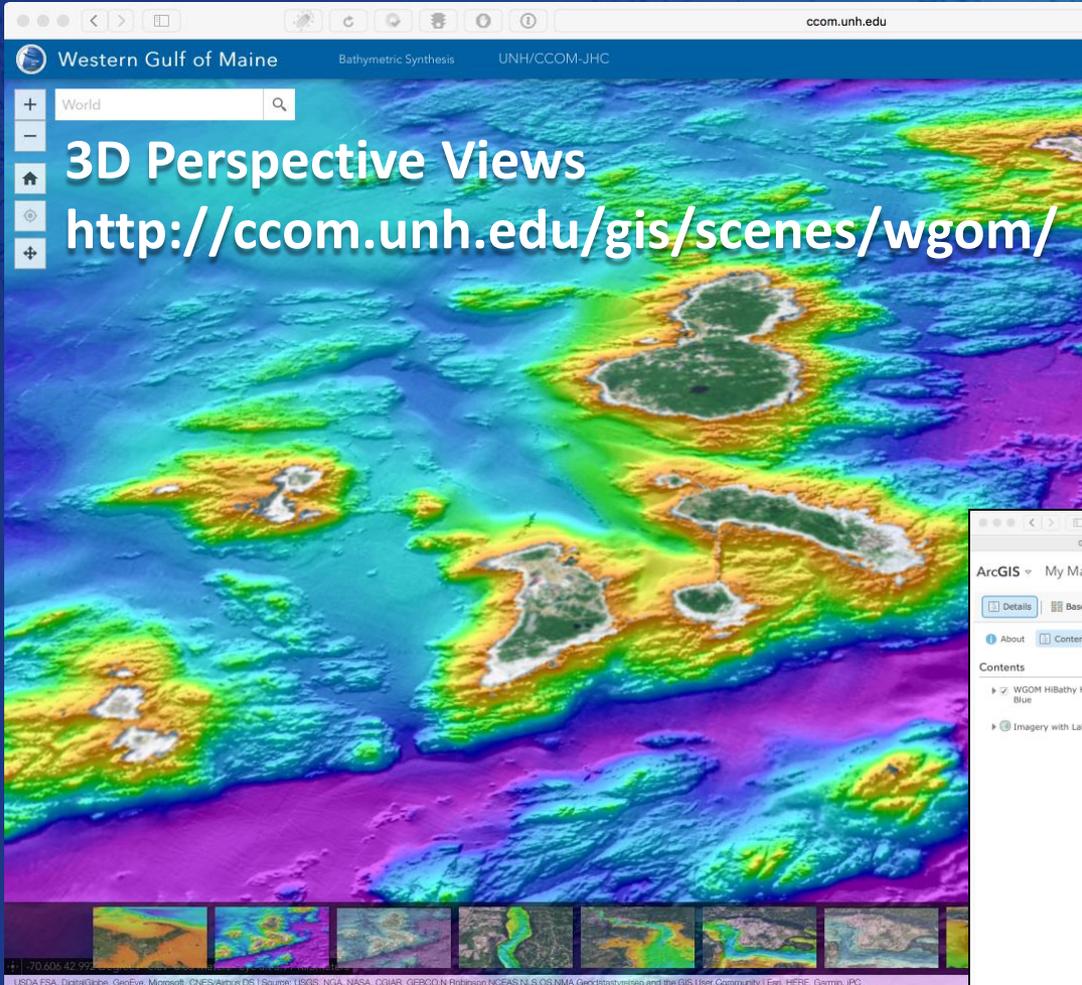
3D Perspective Views
http://ccom.unh.edu/gis/scenes/wgom/

REST Service

ArcGIS REST Services Directory

Home > services > GulfOfMaine

JSON | SOAP

Folder: GulfOfMaine

Current Version: 10.41

View Footprints In: ArcGIS Online map viewer

Services:

- GulfOfMaine/GulfOfMaine_SourceLayers (MapServer)
- GulfOfMaine/JL_GS_Stats_Aug2013 (MapServer)
- GulfOfMaine/Seafloor_Classification_Video_Aug2013 (MapServer)
- GulfOfMaine/UNH_Facilities (MapServer)
- GulfOfMaine/WGOM_Backscatter_Coverages (MapServer)
- GulfOfMaine/WGOM_Backscatter (MapServer)
- GulfOfMaine/WGOM_HiBathy_Hill_2m_v2_Shallow_Blue (MapServer)
- GulfOfMaine/WGOM_HiBathy_Hill_2m_v2_Shallow (MapServer)
- GulfOfMaine/WGOM_HiBathy_Hill_2m_v2 (MapServer)
- GulfOfMaine/WGOM_HiBathy_SourceLayers (MapServer)
- GulfOfMaine/WGOM_HighRes_Bathym
- GulfOfMaine/WGOM_HighRes_Bathym
- GulfOfMaine/WGOM_HiRes_Coverages
- GulfOfMaine/WGOM_RegBathy_Hill_8
- GulfOfMaine/WGOM_RegBathy_Hill_8
- GulfOfMaine/WGOM_Regional_Bathym
- GulfOfMaine/WGOM_Regional_Survey
- GulfOfMaine/WGOM_Survey_Coverage

- **Tiled Rasters**
- **Image Services**
- **Features**

Supported Interfaces: REST   SOAP   Sitemap   Geo Sitemap

- **KML**
- **ArcGIS.com**
- **ArcMap**

NOAA's Open House on Nau

The Bigger Picture. Where does data like this go ?

- UNH/CCOM-JHC is also heavily involved with the United States Extended Continental Shelf mapping programs.

- High quality & heavily scrutinized.

- Documented data sources

- Feature layers (survey extent and navigation) already generated.

- Predominantly deep water.

Cartography • July 7, 2017
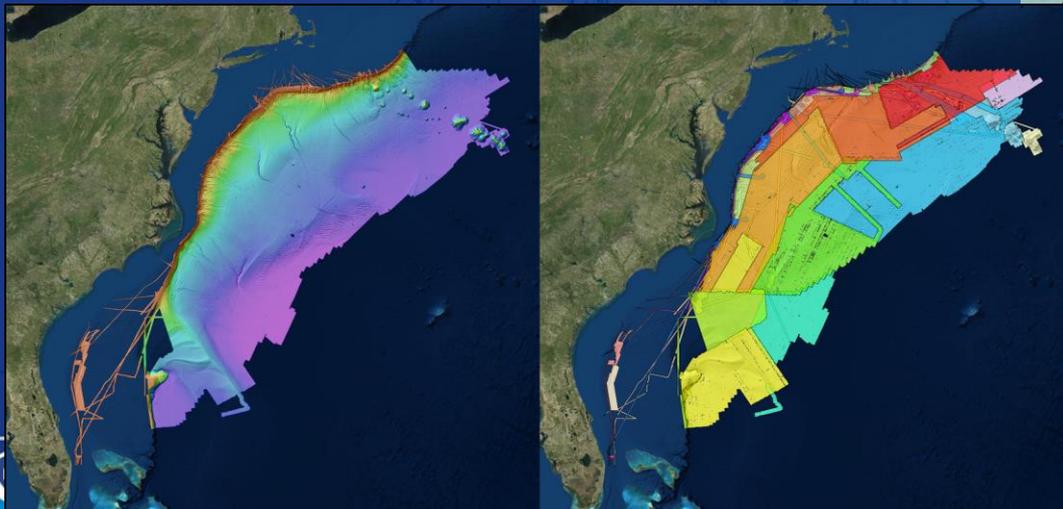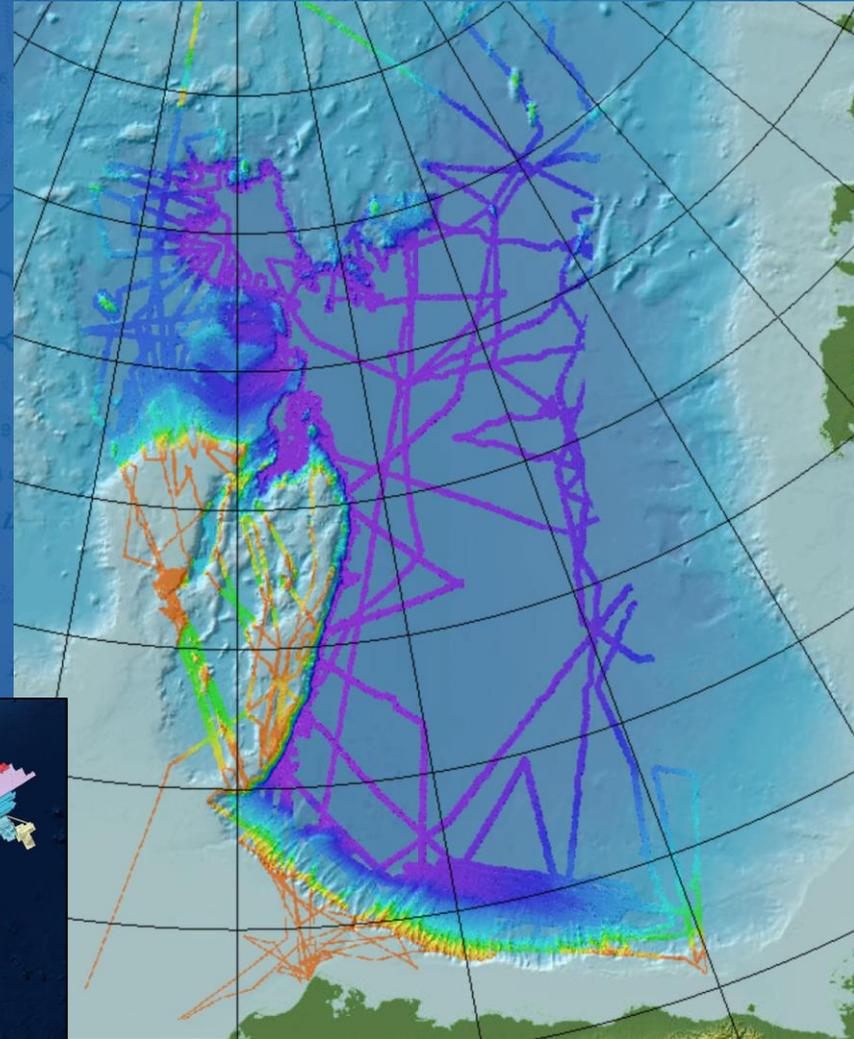
Bathymetry Data Submitted to NOAA

- Unique bathymetry data in areas where there is often no other data
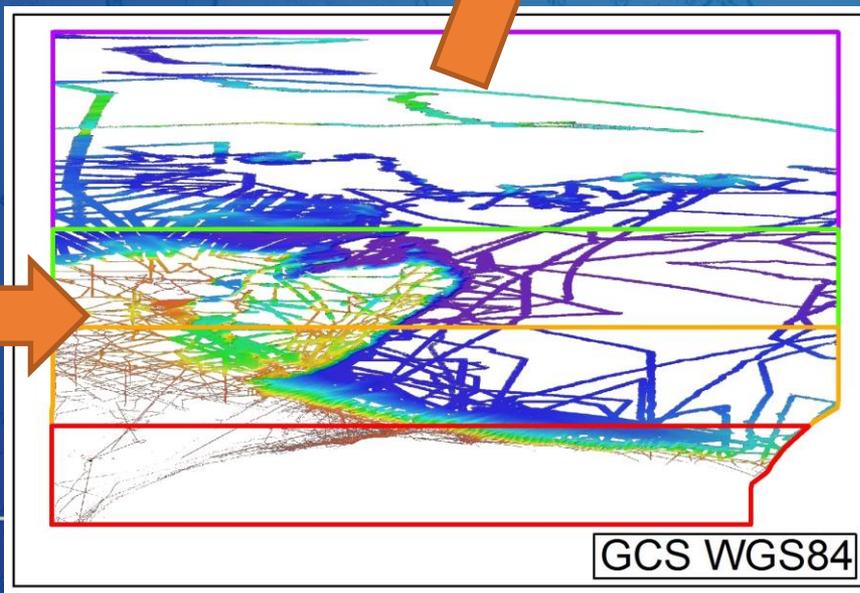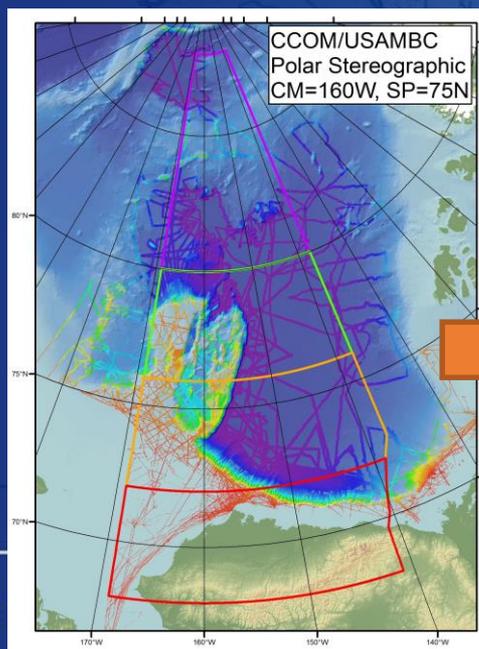
- Source control of data at the survey level and file level is documented and can be queried for all ECS data.

- Arctic ECS data and Atlantic ECS data already submitted.

- More info coming today.

CCOM/USAMBC
Polar Stereographic
CM=160W, SP=75N

GCS WGS84

2017

Observations and Conclusions

- Techniques and methods developed for the WGOM and ECS surveys to document survey and file sources and ingest this information into to a database have proven incredibly useful.

- Data management and survey planning has become much easier thanks to the creation of the synthesis along with the extracted feature information.

- Large scale syntheses of validated data have a wide range of uses that individual and unconnected data might not have, especially for inexperienced users.

- Web interfaces and services allows data to be used by a wider range of users; from researchers to the public to government organizations