Using CMECS for Collaborative Benthic Habitat Mapping

Coastal GeoTools 2019

Myrtle Beach, SC

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Intro

Comprehensive deep-sea habitat characterizations provide information for management of natural resources

- Key components of ecosystem and living marine resource assessments

This information is scarce, especially at useful scales and resolutions

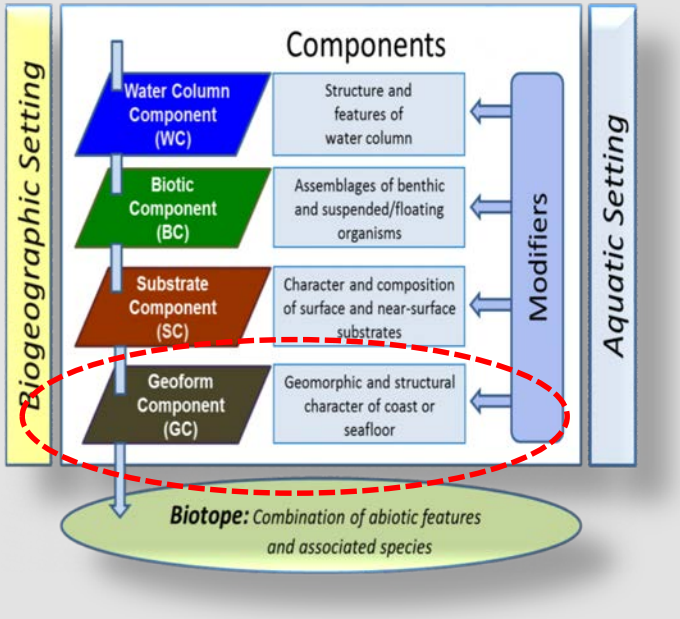
- Individual datasets exist, but most are either large scale but coarse or local or sub-regional in extent
- Integrating data collected by different institutions, programs, and instruments is often necessary, but requires a framework and process
- Existing data can be difficult to locate in repositories

This project uses the Coastal and Marine Ecological Classification Standard (CMECS) Geoform Component (GC) to identify, classify, and integrate geomorphic features from existing datasets into a single GIS application

Why CMECS?

CMECS is a vocabulary for describing ecological data that employs a hierarchical framework of **settings**, **components**, **units**, and **modifiers**

- Application of the CMECS vocabulary translates quantitative data into descriptive information that can be used for comparisons of ecosystem characteristics across geographic settings
- The nested hierarchical framework allows the classification to be applied at various spatial scales, as determined by source data
- Integration of data occurs post-classification, so is independent of collection method, instrument type.
- Endorsed by the Federal Geographic Data Committee (FGDC)



FGDC (Federal Geographic Data Committee) 2012. FGDC-STD-018-2012. Coastal and Marine Ecological Classification Standard. Reston, VA. Federal Geographic Data Committee. http://csc.noaa.gov/digitalcoast/sites/default/files/files/publications/14052013/CMECS_Version%20_4_Final_for_FGDC.pdf

Objectives & Outcomes

Encourage CMECS use among researchers, leading to improved benthic habitat data products

- Demonstrate application of the CMECS Geoform Component (GC)
  - *Geomorphic features provide structural habitat for marine biota and influence other physical environmental characteristics*
- Develop a web map app that integrates individual CMECS GC-classified datasets
  - *Enable spatial and temporal comparisons of similar geomorphic feature types*
  - *Gap analyses for data collection, development of map products*
- Develop CMECS-classified data & GIS products that are “user ready” for ecosystem modeling and natural resource management tools
  - *Facilitate ecosystem assessments & resource use planning*
  - *CMECS-classified data return more accurate data search results via metadata keywords based on standard vocabulary*
  - *Map once, use many times*
- Identify potential improvements to the CMECS GC vocabulary
  - *CMECS becomes more mature with continued application and revisions*

Phase 1: CMECS GC Basemap

Existing datatset 1: Harris et al. Global Seafloor Geomorphic Features Map

GIS polygons derived primarily from 30-arc second (~1 km) Shuttle Radar Topography Mission (SRTM) data

Crosswalk geomorphic feature descriptions to CMECS GC

- Merge existing polygons where necessary
- Assign CMECS unit codes to the re-classified polygons
- Create Esri Vector Tiles Layer ➡ **CMECS GC Basemap (v1)**

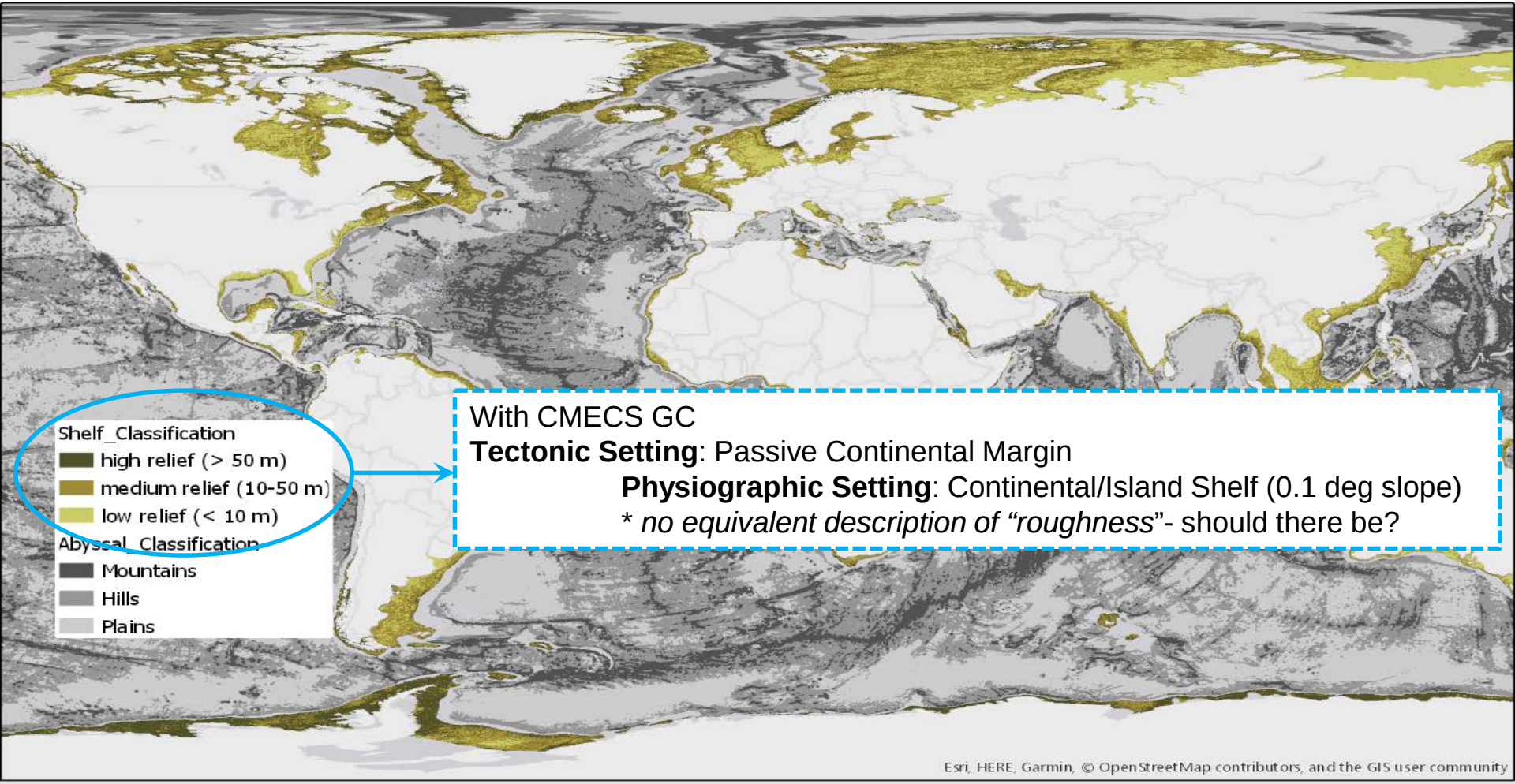
Vector tile layers display data of varying scales, resolution, detail

GIS framework for further integration of higher-resolution CMECS-classified geomorphic features (see Phase 2)

Harris, P. T., Macmillan-Lawler, M., Rupp, J., Baker, E. K., 2014. Geomorphology of the Oceans, Marine Geology, 352, 4-24

CMECS Technical Guidance Document 2014-1. Coding System Approach for Coastal and Marine Ecological Classification Standard (CMECS) Classification and Modifier Units www.iocm.noaa.gov/cmecs/documents/CMECS-Coding-System-Approach-2014

Phase 1: CMECS GC Basemap



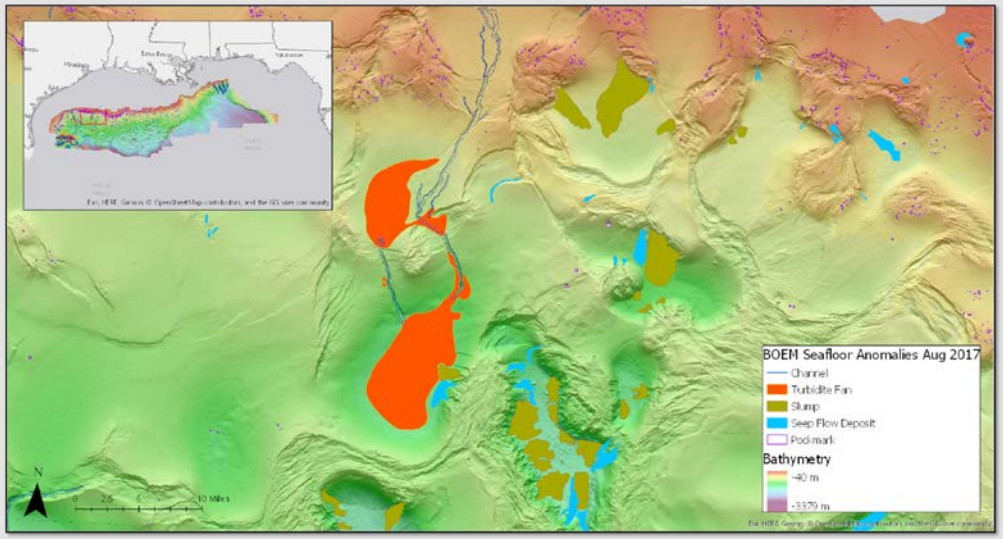
With CMECS GC
Tectonic Setting: Passive Continental Margin
Physiographic Setting: Continental/Island Shelf (0.1 deg slope)
* *no equivalent description of "roughness"*- should there be?

Original GSFM, shelf and abyssal classifications, Harris et al., 2014

Phase 2: Integration of new datasets

Existing dataset 2: BOEM Northern Gulf of Mexico Deepwater Bathymetry Grid
Existing dataset 3: Seismic Water Bottom Anomalies- Gulf of Mexico

- Raster mosaic (40 ft x 40 ft grid cell resolution, 90,000 mi2) of interpreted time-migrated seafloor returns in 3-D seismic data from over 100 surveys conducted by energy industry researchers
- Relict channel levees, ridges, dunes, mounds, and craters, many have not been identified in previous datasets, or at this level of spatial definition
- Seismic water bottom anomalies indicate potential locations of geomorphic features associated with subsurface hydrocarbon seeps and carbonate hard grounds



BOEM seismic water bottom anomalies overlying the Northern Gulf of Mexico Deepwater Bathymetry grid

BOEM Northern Gulf of Mexico Deepwater Bathymetry Grid from 3D Seismic. BOEM Regional Analysis Unit https://www.boem.gov/Gulf-of-Mexico-Deepwater-Bathymetry/
Seismic Water Bottom Anomalies- Gulf of Mexico. BOEM Regional Analysis Unit https://www.boem.gov/Seismic-Water-Bottom-Anomalies-Map-Gallery/

Phase 2: Integration of new datasets

Analysis and interpretation of BOEM high-resolution bathymetry grid of the Northern Gulf of Mexico

- Raster processing and analysis: identify and digitize new geomorphic features
- Use seismic water bottom anomalies data where appropriate
- Apply CMECS GC classification to new polygons
- Update vector tile layer

- Publish to web map application → **Enhanced CMECS GC Basemap (v 2)**

- Map of varying spatial scales and detail
- Comprises a region of highly detailed features classified to the lower levels of the CMECS GC hierarchy spatially nested within more generally described features classified to the higher CMECS level
- Repeat the process as much as possible!

Objectives & Outcomes Recap

- Demonstrate application of the CMECS Geoform Component (GC)
  - *Both the Harris et al. GSFM and the BOEM datasets are instructive of GC application*
  - *Reference product: Harris et al. –derived map is global in extent, provides examples of GC classification in all settings*
- Develop a web map app that integrates individual CMECS GC-classified datasets
  - *Can be used to track where habitat data exists, where CMECS GC has been applied*
  - *Encourages further CMECS GC use and contributions to the GC Basemap*
  - *Enable spatial and temporal comparisons, gap analyses*
- Develop CMECS-classified data & GIS products that are "user ready" for ecosystem modeling and natural resource management tools
  - *Gulf of Mexico focus of this project supports benthic habitat mapping initiatives of post-DWH projects, RESTORE, Gulf of Mexico Alliance*
- Identify potential improvements to the CMECS GC vocabulary
  - *CMECS is a **DYNAMIC CONTENT STANDARD**, undergoes periodic revisions to adapt to advances in science and the needs of coastal management communities*
  - *Will undergo a revision in 2019, conducted by the CMECS Implementation Group*
  - *Currently soliciting change proposals*

Thank You

CMECS
Coastal & Marine Ecological Classification Standard

Implementation Group Members

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Questions?

Hampton Room
Wednesday 13 February
5:30-7 pm
(before the reception)

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CMECS Confluence Community Forum
https://my.usgs.gov/confluence/display/CMECSIG

CMECS Website
https://iocm.noaa.gov/cmecs/

Searchable Catalog of Units
https://www.cmecscatalog.org/cmecs/