Making elevation data accessible to non-specialist users

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Topography is Fundamental Earth Science Data

- Basemaps
- Expedition & Field Program Planning
- Ocean Exploration
- Habitat characterization
- Geohazards
- Resource Management
- Tectonics
- Volcanism

- Modeling
- Ocean Circulation
- Tsunami Propagation
- Sea-level change
- Landscape evolution
- Coastal evolution
- Ocean Search & Rescue Efforts

Variable Modes of Accessing Elevation Data







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View & Interrogate via Responsive UIs

Non-specialist

Extract & Download Rasters

Search & Download Rasters & Point Clouds Query, Extract, Download via Web Services



Variable Format Requirements







Variable Resolution Requirements



Water conceals the vast majority of our planet

Global ocean maps are primarily predicted bathymetry





Bathymetry Data



- Globally sparse
- Little redundancy
- Acquired at different resolutions
- Different platforms
- Different sensors



Publicly Available Data at NOAA Archives

- Primarily raw ship-based swath data for global ocean
- Specialist knowledge necessary to process & create products





Data from >2,000 cruises



Multibeam Data Preparation

- Bad navigation
- Noisy outer beams
- Sensor offsets
- Misdetection
- Instrument problems
- Data drop outs
- Biofouling
- Bad weather
- Sound velocity
- Slow speed in turns
- Tide Corrections











Global Multi-Resolution Topography Synthesis

- Freely available data compilation
- Provide best possible elevation data for diverse user community
- Combine sparse multi-resolutional data to create more complete grids/maps
- Accessible across disciplines
- Meet needs of specialists and non-specialists
 Offer multiple access pathways & formats



https://www.gmrt.org/

Global Multi-Resolution Topography Synthesis

- Process and integrate publicly available swath data from NOAA archive
 - Improve science efficiency by mitigating redundant sonar data processing and synthesis by multiple individuals
 - Provide links to processed swath data files
- Consume and integrate publicly available gridded products
 - Provide links to source grids



https://www.gmrt.org/

Global Multi-Resolution Topography (GMRT)

- Topography (ASTER & NED)
- GEBCO 2014 (~1 km)
- Contributed Grids (< 1 to 100s of m)
- Swath Bathymetry (100m+ resolution)

Distinct components maintained and updated independently but delivered "seamlessly" to users





GMRT: Disciplinary Data Curation

GMRT v. 3.5 Metrics					
% Ocean mapped	8.3%				
Total Curated Swath Data Files	212,689				
Total Pings	200,602,365				
Total Input Data Points	>31 Billion				
Total swath file size	4.2 TB				
Total Cruises	1,007				
Total Tracklength (km)	~5 Million				
Total km ²	> 30 Million				
Years of data acquisition	1989 - 2017				

- Extensive file & cruise level metadata (PostgreSQL)
- Metadata catalog enables download of processed swath files (marine-geo.org)
- Input points stored as processed data in native sonar file formats

Challenges & Opportunities

- Blending between datasets
- Uncertainty Estimates
- Increasing data resolution
- Growing data volumes
- New processing tools & workflows
- Versioning & Archiving policies
 - Access to source data
- Scalability of architecture & formats
- Performant Services



On the horizon...

- Distributed processing?
- Cloud-based on-the-fly gridding?
- Immersive visualization
- New data sources
 - XPRIZE
 - Crowd-sourced data
 - Seabed 2030





Concluding Thoughts

Access pathways and formats must meet the needs of broad interdisciplinary user base while also enabling expert access and future opportunities

- How will we best manage and store the source data as data volumes grow and resolutions increase?
- What approaches can we leverage across communities?
- How do we ensure that products and archives will be ready for future opportunities?