Developing Collaborative Solutions for Continental-Scale Integrated Water Prediction

COASTAL COUPLING COMMUNITY OF PRACTICE

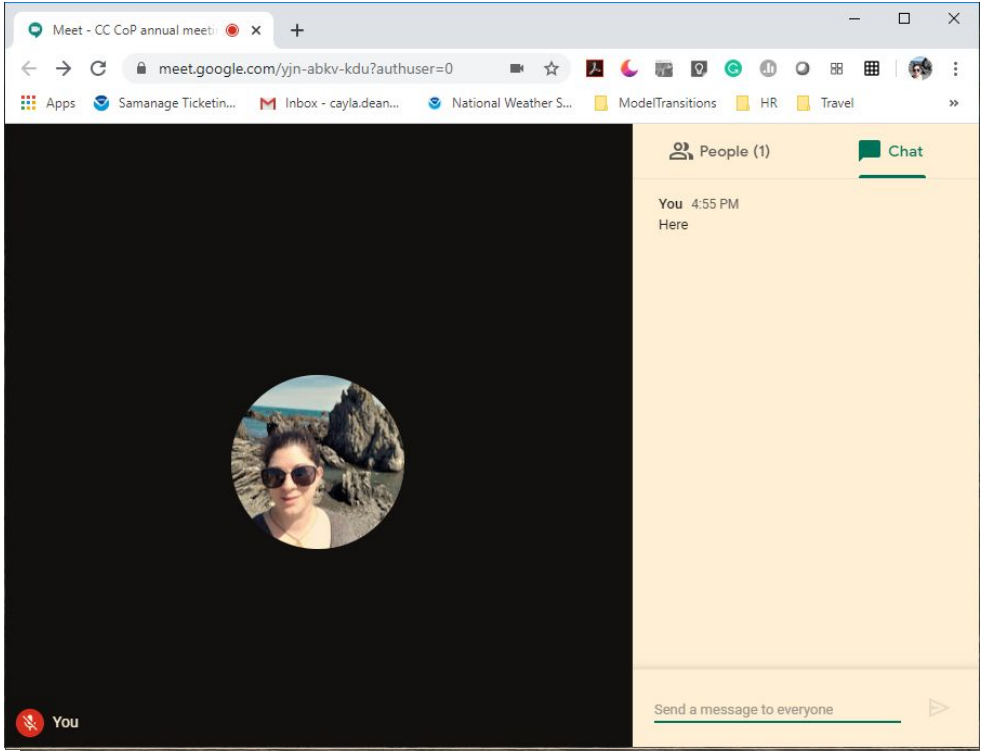
May 12, 2020

Virtual meeting: meet.google.com/yjn-abkv-kdu

www.weather.gov/watercommunity

Participants slides

Welcome


Meet - CC CoP annual meeti
meet.google.com/yjn-abkv-kdu?authuser=0
Apps
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People (1)
Chat
You 4:55 PM
Here
You
Send a message to everyone

Welcome

Ground Rules

- One person speaks at a time
- Keep the discussion relevant, add new topics to the chat box with your name, you will be called on according to topics
- Say your name before you speak
- Remember to use mute/unmute
- Speak loudly and clearly
- Come prepared to the meeting
- Avoid email and other distractions during the meeting
- Please use video when possible - this increases the effectiveness by 92% over audio only
- Share information on Google docs
- *Poll Everywhere* - put your name next to your question

Meeting Goal

The goal of the meeting is to maintain engagement between Federal agencies and model developers that supports collaborative solutions for continental-scale integrated water prediction. To identify the priorities for engagement, participants will discuss technical advocacy points and data needs (Day 1). To continue the engagement efforts over the last year, participants will engage in a facilitated discussion informed by experience- and research-guided best practices (Day 2).

Meeting Objectives

1. Review the community progress to date.
2. Determine community needs and how to address them.
3. Discuss the need for shared consistent data sets and discuss methods to achieve a centralized repository.
4. Discuss gathering stakeholder requirements and how to translate these into model requirements.
5. Identify future engagement opportunities and the timeline for sustained engagement.

Meeting Scope

Day 1

- Keynote Speakers
- Discussing the Community's Needs
- Building our Data Infrastructure

A Look Ahead to Day 2

- Developing Capabilities to Serve our Stakeholders
- Define our Community Engagement over the next year

Meeting Facilitators

CAYLA DEAN
CO-OPS Outreach Specialist/Coastal Scientist, National Water Center

AUDRA LUSCHER
CO-OPS Coastal Hazards Program Manager

KAREN BAREFORD
National Water Extension Liaison
Mississippi-Alabama Sea Grant
National Water Center

BRENNA SWEETMAN
NOAA Office for Coastal Management Social Scientist, National Water Center

Advancing Coastal Modeling to meet the Needs of Great Lakes Water Resources Stakeholders

SLIDES PENDING REVIEW

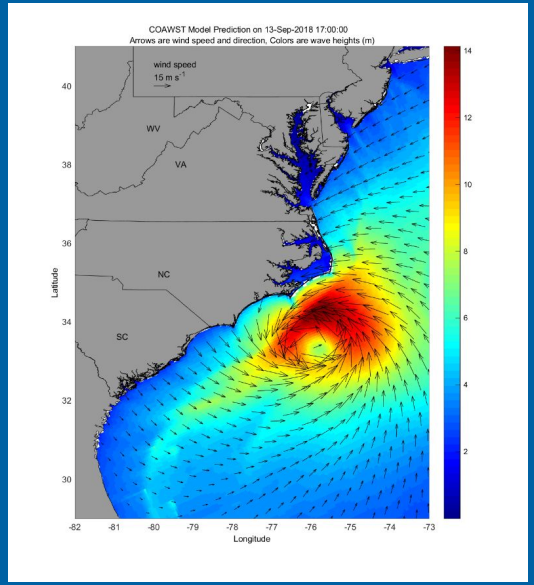
Jesse Feyen, Deputy Director

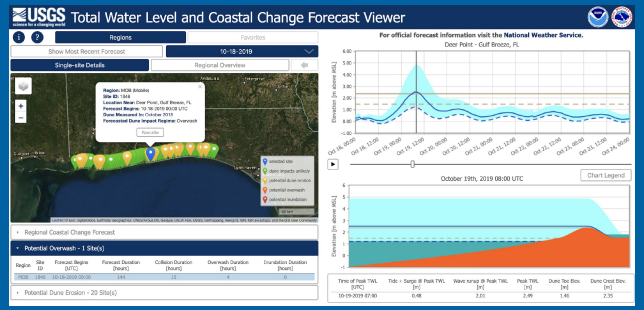
NOAA Great Lakes Environmental Research Laboratory

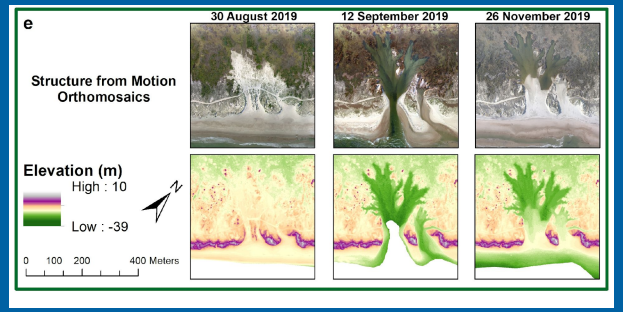
Coastal Coupling Community of Practice: common goals and approaches

John Warner

US Geological Survey
Coastal and Marine Science Center
Woods Hole, MA







U.S. Department of the Interior
U.S. Geological Survey

CC CoP Community needs

Below is a summarized list of the items we have heard so far that the community can advocate for.

- Stakeholder needs to inform model development - recognizing that there are different spatial and temporal scales needed by different stakeholder groups
- Common definitions for ambiguous terminology
- A well-defined grand challenge
- Governing framework to establish guidelines and/or best practices for cooperative methods and technical collaboration (including guidelines for open source code)
- Collaborative environment (e.g., testbed, code repositories) with interdisciplinary teams working together
- Easily accessible, open-source, **quality-controlled data at high resolution** that is updated with a regular frequency for model initialization, data assimilation, verification, and validation
- Well-organized documentation of use or test cases
- Flexible architecture to add new models in a coherent framework
- Transparent pathway to transition models into operations
- 3D modeling in the coastal transition zone

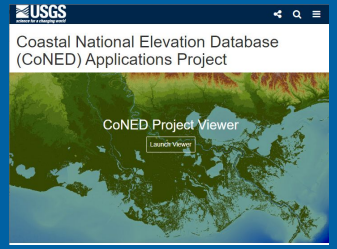
USGS

USGS plays a role in all of these areas.

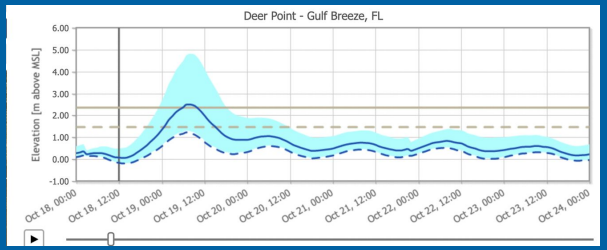
Outline

- Topo/Bathy Observations:
  - 1. Structure from Motion
  - 2. Lidar & CoNED merged data sets
- Modeling
  - 3. Total Water Level forecast
  - 4. Coupled modeling hindcasts
- Summary

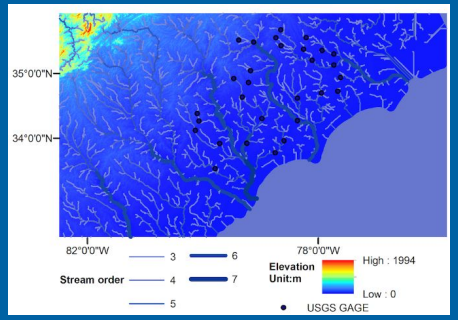
Structure from Motion



CoNED Viewer

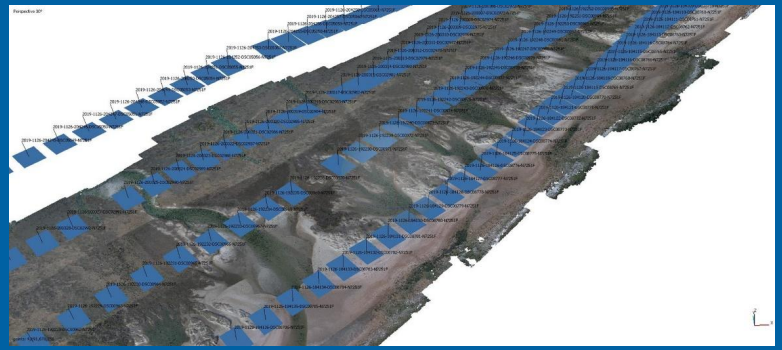


Total Water Level Viewer



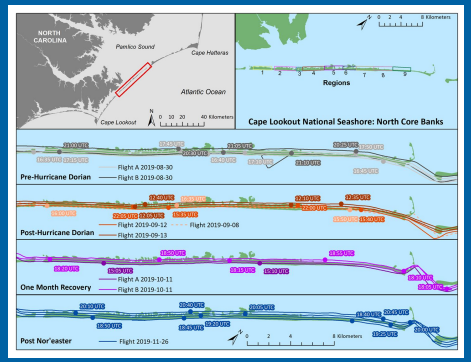
WRF_Hydro model coupling

1. Structure from motion coastal Topography



Overlapping images along the coast provide continuous coverage

Several surveys focusing on Core Banks area.



Duck, NC to Cape Lookout, NC
3 – 4 passes at 300 meters, 60 m/s
16 MP RGB camera, shutter interval 1 s
Each pixel on ground is ~25 cm
Approx. 12,000 images per survey
Quarterly + pre- post events
5 surveys so far

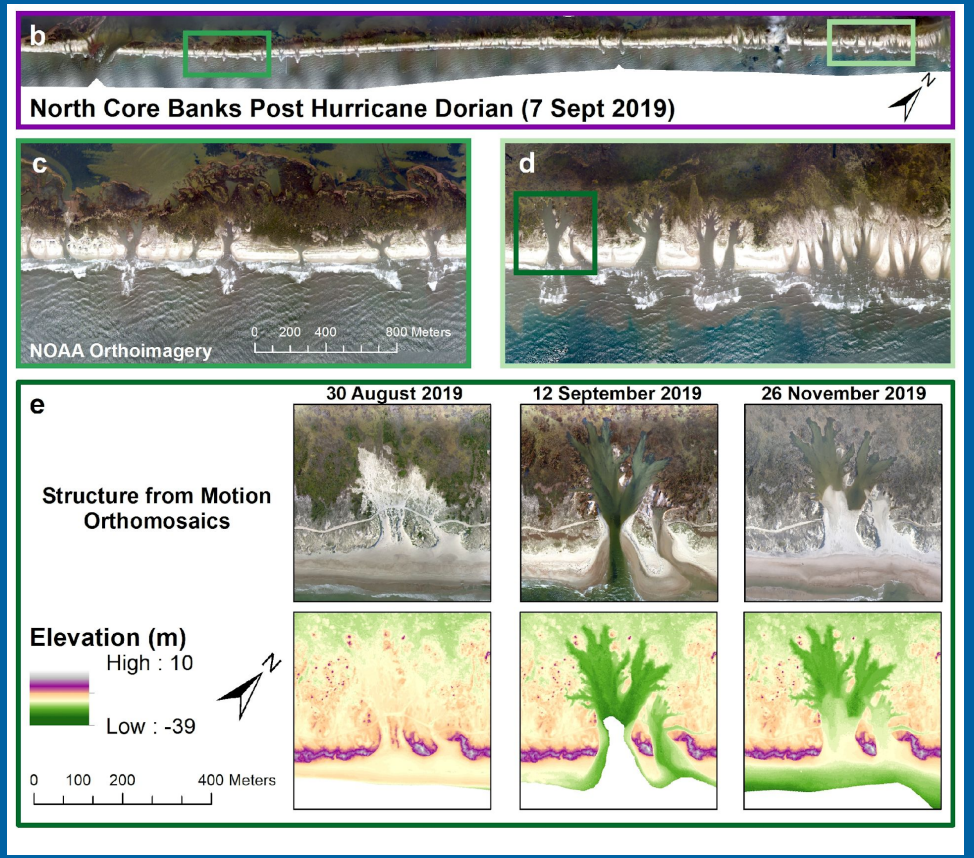
Small aircraft provide flexibility to obtain images.

USGS

Warrick, Sherwood, Brown. Contributors: Wright, Kranenburg, Ritchie, Over
Funding from CMHRP Remote Sensing Coastal Change Project, DUNEX, and Florence Supplemental

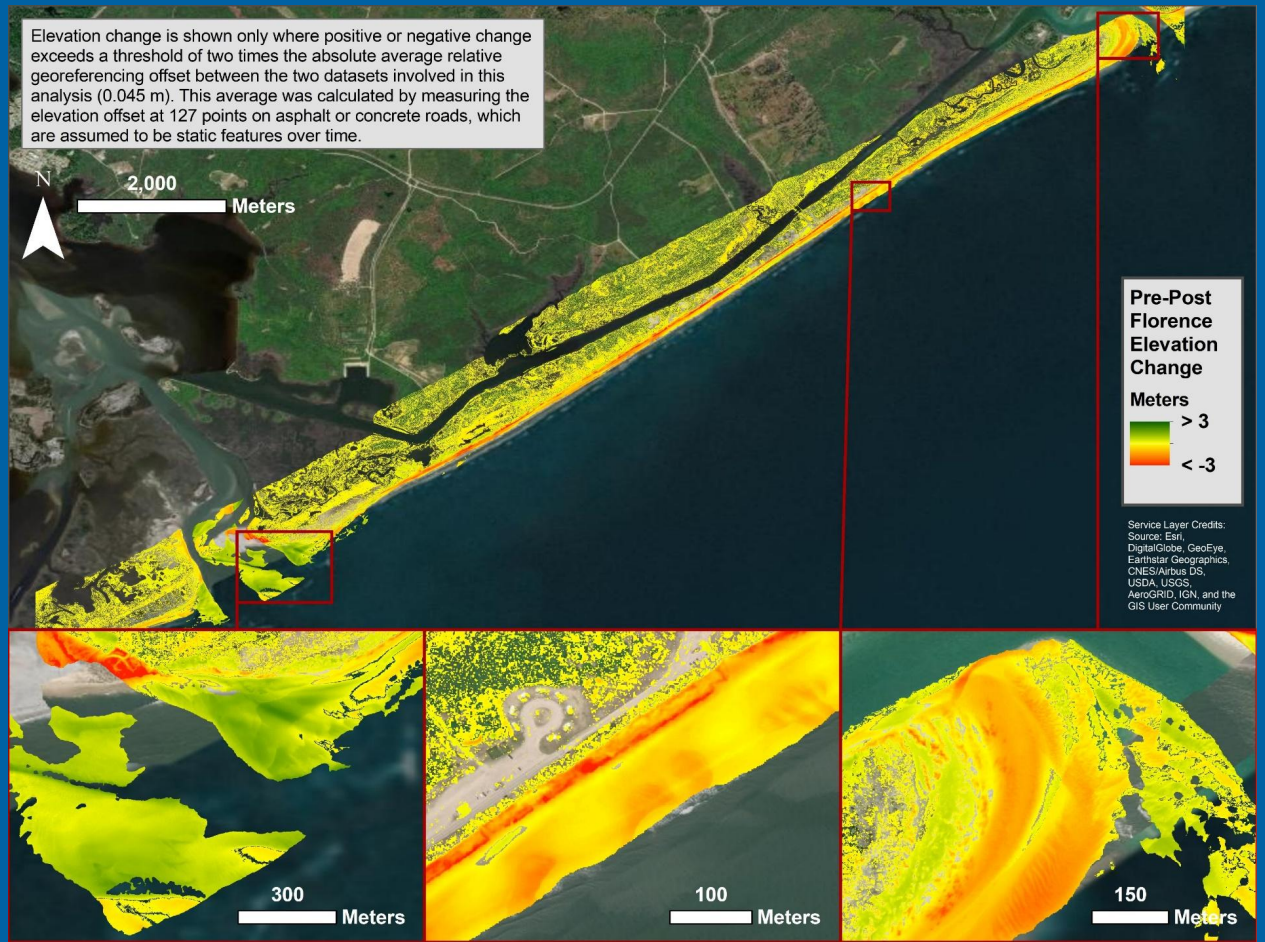
1. Structure from motion coastal Topography

- Structure-from-Motion photogrammetry: DEMs and orthomosaics
- Vertical accuracy ~12 cm
- Difference-map precision ~7 cm



Rapid determination of coastal storm impacts.

2. Coastal Topography: Lidar



Changes in elevation between 2017 pre-storm and 2018 post-storm lidar surveys near Camp LeJeune, NC show extensive dune and beach erosion. Areas near inlets show dramatic changes.

Using these two datasets, the USGS is computing coastal change metrics for North and South Carolina including: dune crest and toe, beach slope and width, shoreline change, and beach and dune volume change.

Kara Doran, USGS

2. Topography Bathy merged data: CoNED

USGS Coastal National Elevation Database (CoNED) Applications Project

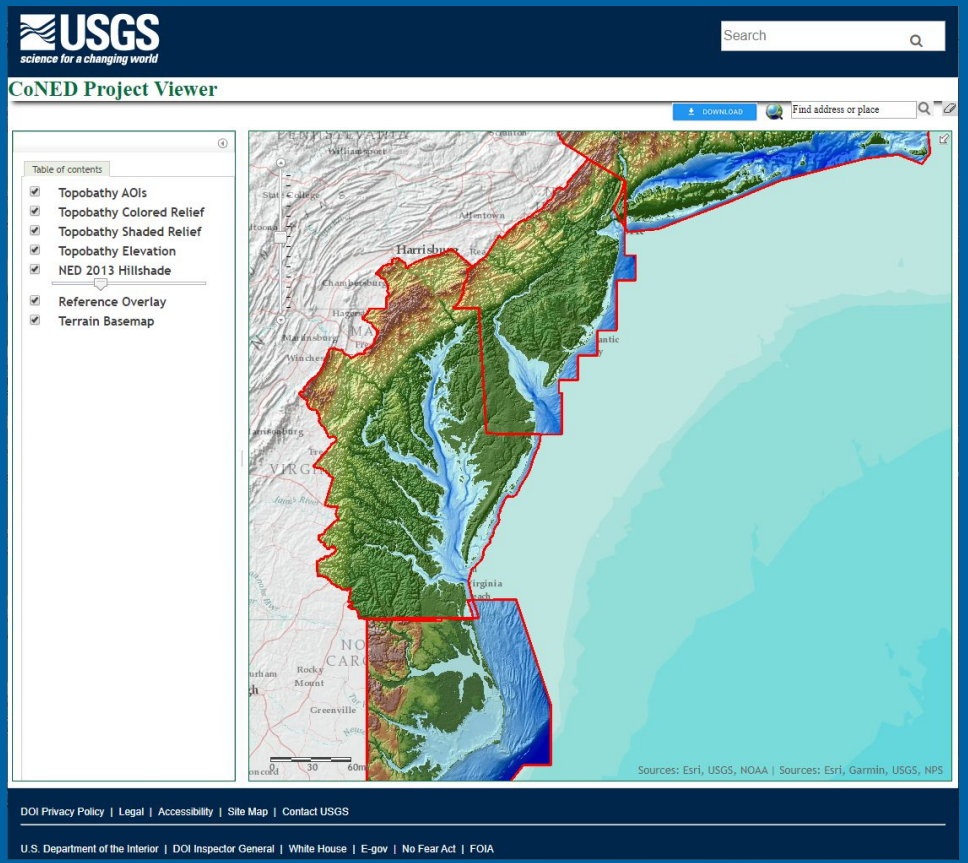
1) Support coastal and marine spatial planning, by constructing the Coastal National Elevation Database (CoNED) at select focus regions thereby establishing a topobathymetric elevation model (tbdem) baseline product for scientific investigations and applications.

2) Conduct algorithm remote sensing 3D point cloud (lidar) research to extend the data structure for topobathymetric elevation models and create methods for fostering land change science studies.

San Francisco Bay | Southern California | Central California | Hawaii - Oahu

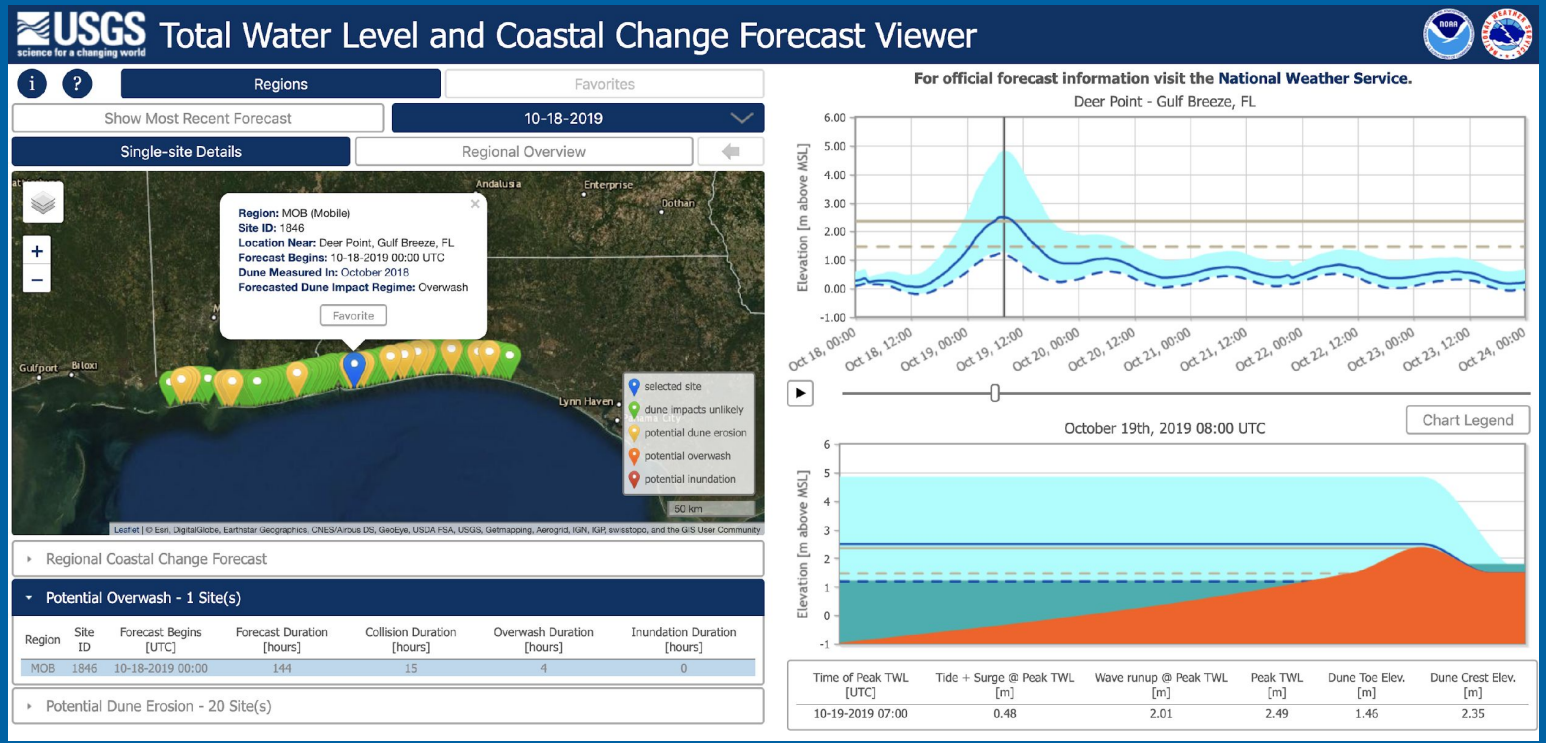
Stakeholders: USGS Coastal Storm Modeling System (CoSMoS), NOAA-OCM Sea Level Rise Viewer, NOAA National Water Model, LA CPRA Statewide Master Plan, ADCIRC Hydrodynamic Model, VIMS SCHISM Model, Nature Conservancy Coastal Resilience Viewer, and DOI Pacific Islands Climate Adaptation Science Center

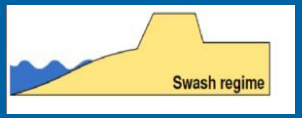
Point of Contact: Jeffrey Danielson, CoNED Applications Project Chief, daniels@usgs.gov

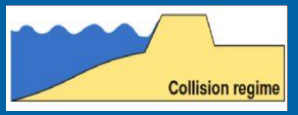


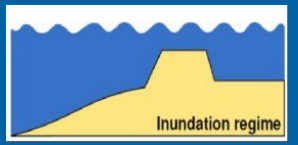
Contact: Jeffrey Danielson,
Earth Resources Observation and Science (EROS) Center
email: daniels@usgs.gov

3. Total Water Level and Coastal Change Forecast









USGS

Total water level:

- Tide (NOAA ESTOFS, 2.5km)
- Surge (NOAA ESTOFS, 2.5km)
- Wave setup (NOAA NWPS)
- Wave runup (Stockdon et al., 2006)

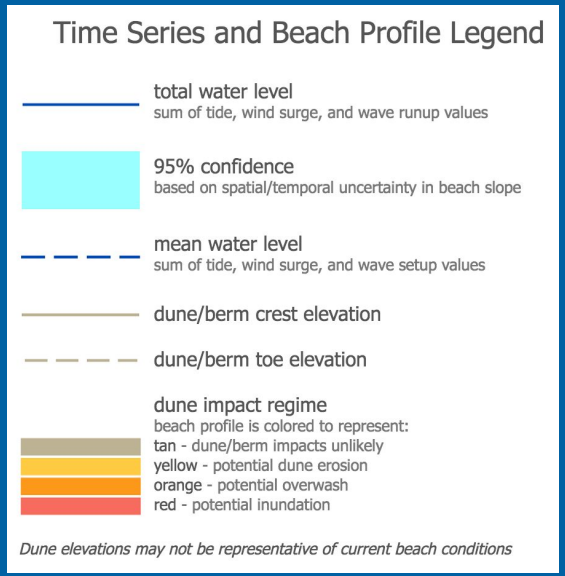
3. Total Water Level and Coastal Change Forecast

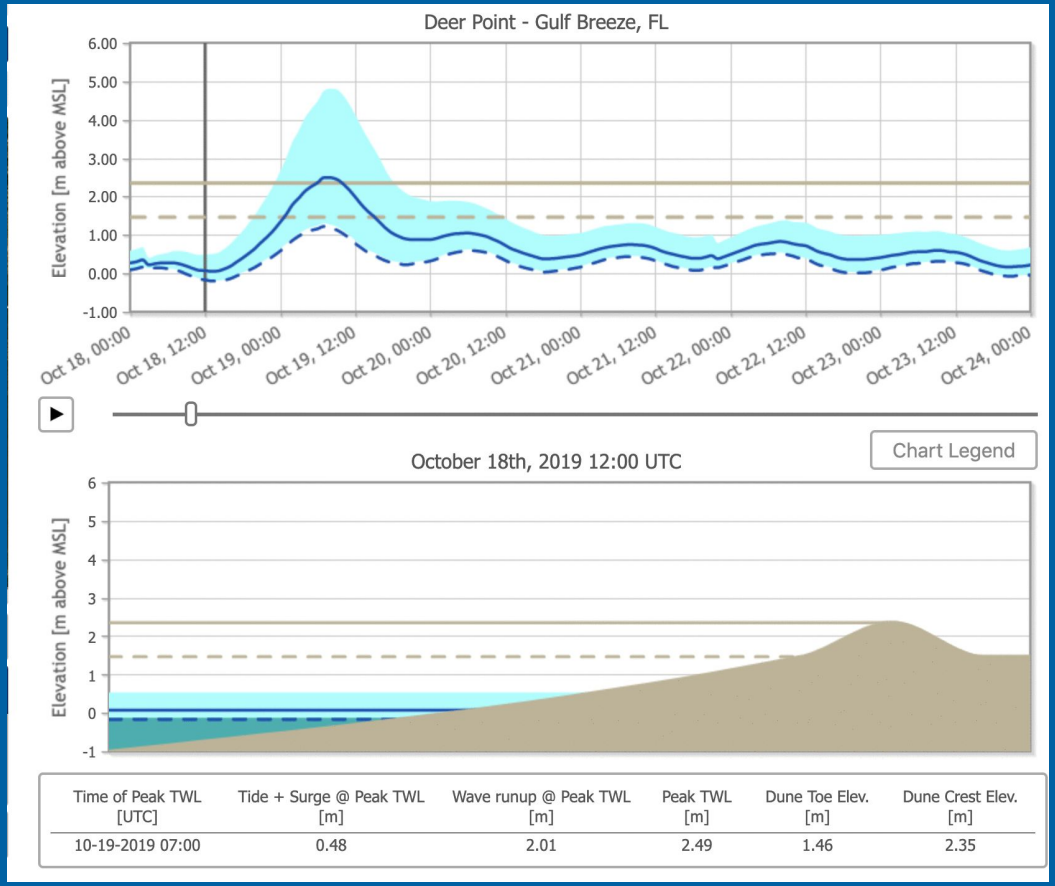
Total Water Level and Coastal Change Forecast

Tropical Storm Nestor (Oct 2019)

Stockdon et al., 2006

Doran et al., 2019



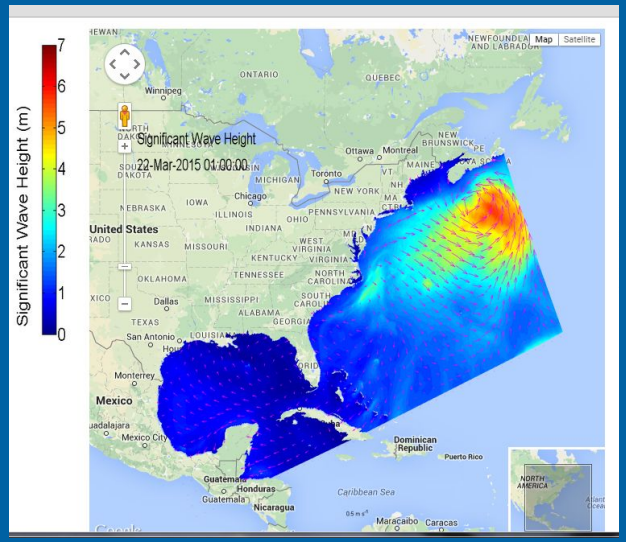


Time of Peak TWL [UTC]	Tide + Surge @ Peak TWL [m]	Wave runup @ Peak TWL [m]	Peak TWL [m]	Dune Toe Elev. [m]	Dune Crest Elev. [m]
10-19-2019 07:00	0.48	2.01	2.49	1.46	2.35

4. Coupled modeling hindcasts

COAWST

Coupled Ocean – Atmosphere – Wave – Sediment Transport
Modeling System to investigate the impacts of storms on coastal environments.



MCT http://www-unix.mcs.anl.gov/mct/

ROMS http://www.myroms.org/

WRF http://www.wrf-model.org/

WRF-Hydro https://ral.ucar.edu/projects/wrf_hydro

SWAN http://vlm089.citg.tudelft.nl/swan

WWIII http://polar.ncep.noaa.gov/waves/wavewatch/

InWave infragravity wave

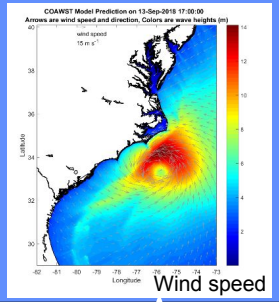
CSTMS http://woodshole.er.usgs.gov/

USGS

Daily forecast: http://woodshole.er.usgs.gov/project-pages/cccp/public/COAWST.htm

Model setup

ATMOSPHERE



Uwind, Vwind, RH, Tair, cloud, rain, evap, SWrad, Lwrad

H_{wave}, L_{pwave}, T_{psurf},

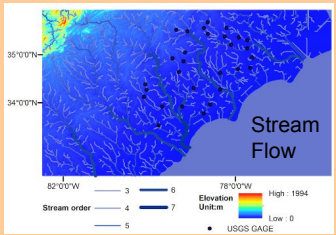
MCT

U_{wind}, V_{wind}

SST

MCT

HYDROLOGY



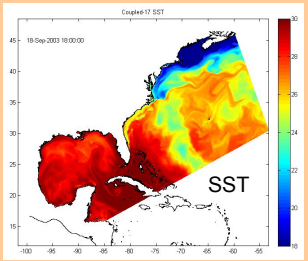
Uwind, Vwind, Patm, RH, Tair, cloud, rain, evap, SWrad, Lwrad
LH, HFX, Ustress, Vstress

Water Levels

MCT

Streamflow, Water Levels, Vertical fluxes

OCEAN

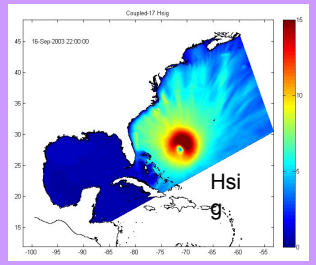


u_s, v_s, η, bath, Z_0

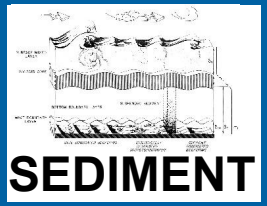
MCT

H_{wave}, L_{mwave}, L_{pwave}, D_{wave}, T_{psurf}, T_{mbott}, Q_b, $Diss_{bot}$, $Diss_{surf}$, $Diss_{wcap}$, U_{bot}

WAVE



SEDIMENT

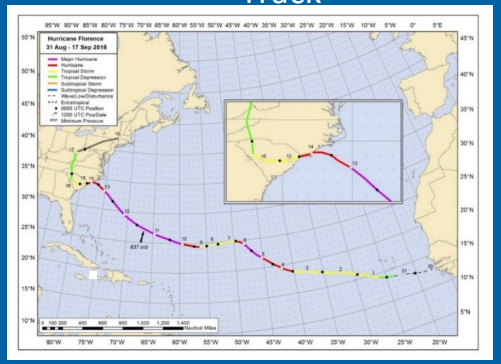


USGS

Application to Hurricane Florence

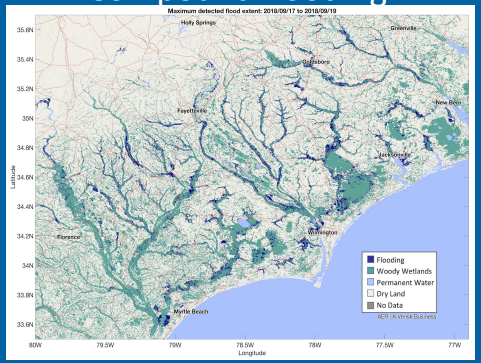
- Long-Lived Category 4 Hurricane
- 31 Aug – 17 Sept, 2018
- Category 1 at landfall
- Large precipitation after landfall

Track



NHC Report AL062018

Compound flooding



https://www.aer.com/siteassets/images/aer_maxflood_florence_2018_0917-0919.png

USGS

Results: WRF + ROMS + SWAN

Model	Physics / Parameterizations
WRF	Initial / Boundary Conditions: NCEP GDAS/FNL 1/4°, RTG_SST 1/12°, WaveWatch3 1/2° Grids Parent: 490 x 459 x 48 (9km) Vortex-Following Nested Grid: 151 x 151 x 48 (3km) Physics: WSM-6 MP, Tiedtke CP (Parent Grid-only), RRTM LW, RRTMG SW, MYJ PBL + Sfc Layer, Noah LSM
ROMS	Initial / Boundary Conditions: HYCOM/NCODA 1/12° for Spin-up and Boundary Grid: 482 x 402 x 36 (7km) Physics: GLS Turbulence Closure, Vortex-Forced Wave-Current Interaction, COARE-Taylor-Yelland Wave-Enhanced Roughness
SWAN	Initial / Boundary Conditions: WaveWatch3 1/2° GFS 1/4° winds used for spin-up Grid: 482 x 402 x 36 (7km) w/ 36 10° bins Physics: Wave PSD between 1s and 25s with 24 1s bins, Wind-Waves via Komen, Depth-induced breaking constant set to 0.73

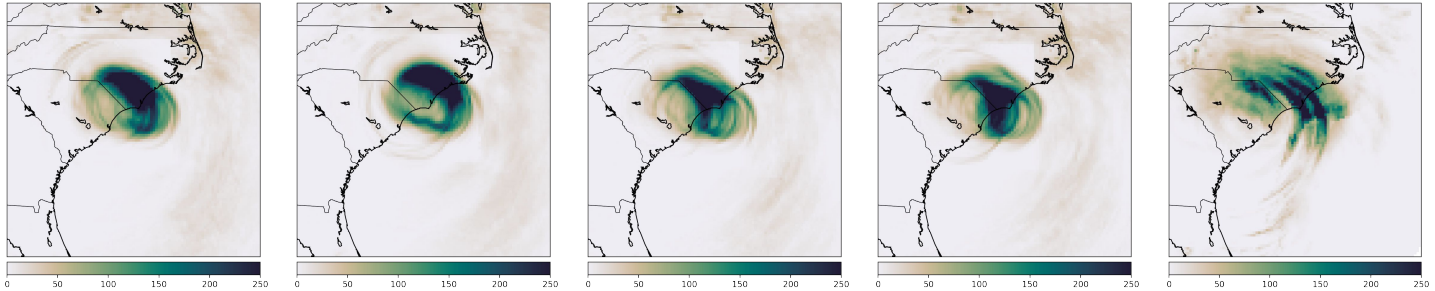
USGS

Fully-Coupled (WRF-ROMS-SWAN) 10-Day Simulation

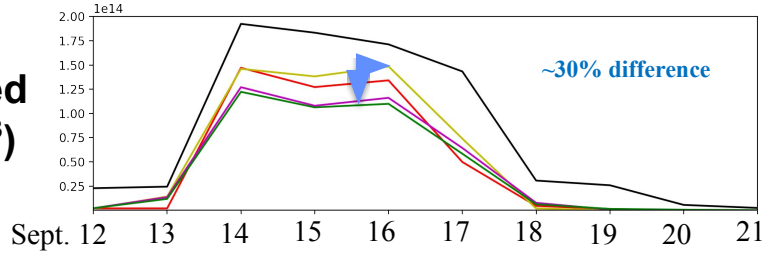
Precipitation Results

- **Precipitation after Landfall (mm; 24hr ending 16-Sept 00Z)**

Control | WRF-WW3 | WRF-ROMS-WW3 | WRF-ROMS-SWAN | NWS Obs



- **Region-Integrated Precipitation (m^3)**

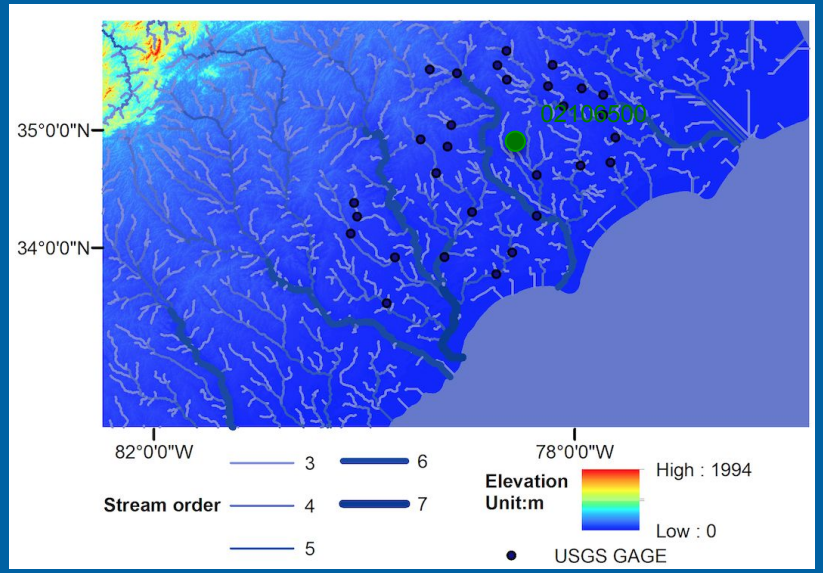


USGS

Adding Wave model modifies magnitude and locations of precipitation.

WRF-Hydro Setup

- Forcing: NLDAS-V2 1/8 Degree
- Land surface Model: Noah-MP
  1km Grid Spacing
- WRF-Hydro
  - 100m Grid Spacing
  - 1 Way Overland Routing
    DT=60s
  - Gridded Channel Routing
    DT=20s
  - Bucket groundwater model
  - Simulation period:
    01/01/2018~12/31/2018

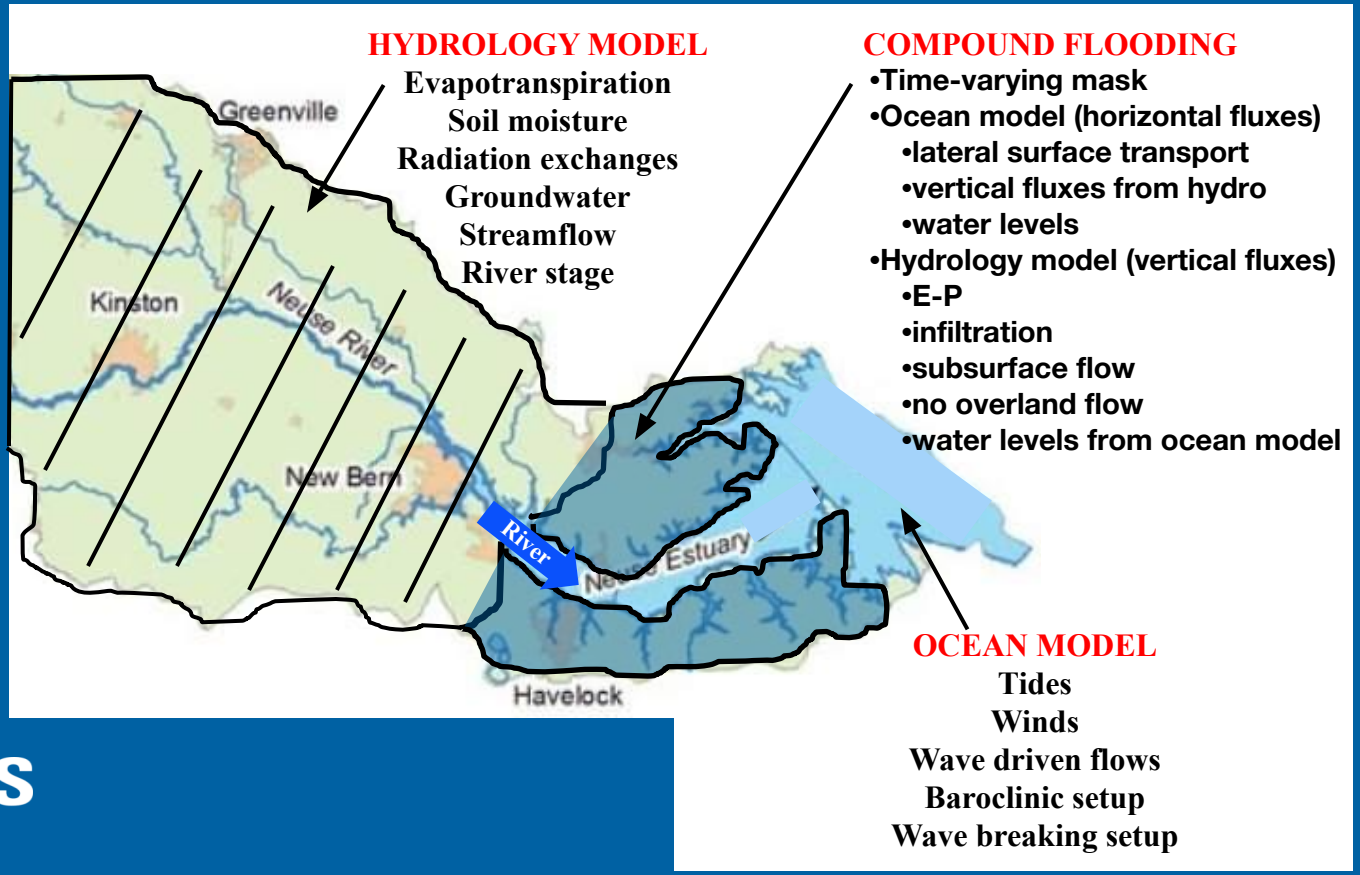


WRF-Hydro Domain for Hurricane Florence

1: DEM Data source :NHDPlus V2
2: 1st and 2nd order channels are not shown.

USGS

Conceptual coupling



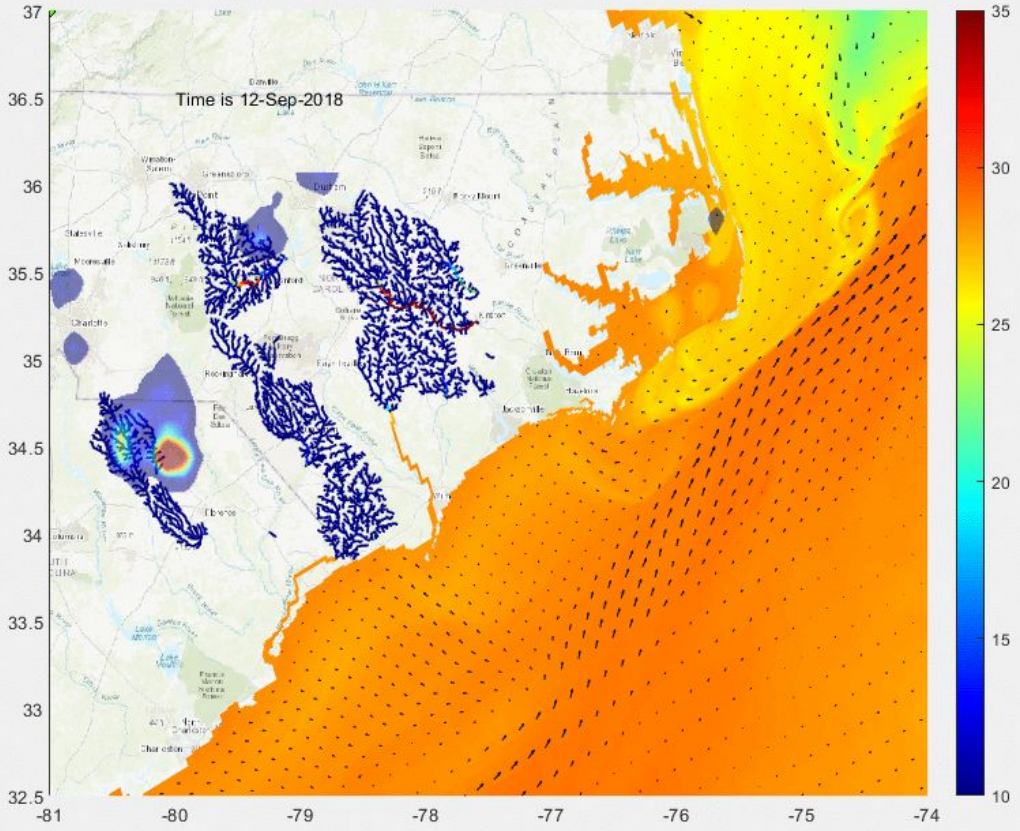
USGS

ROMS + WRF-Hydro channel flows

Ocean color = SST.
Ocean vectors = surface currents.

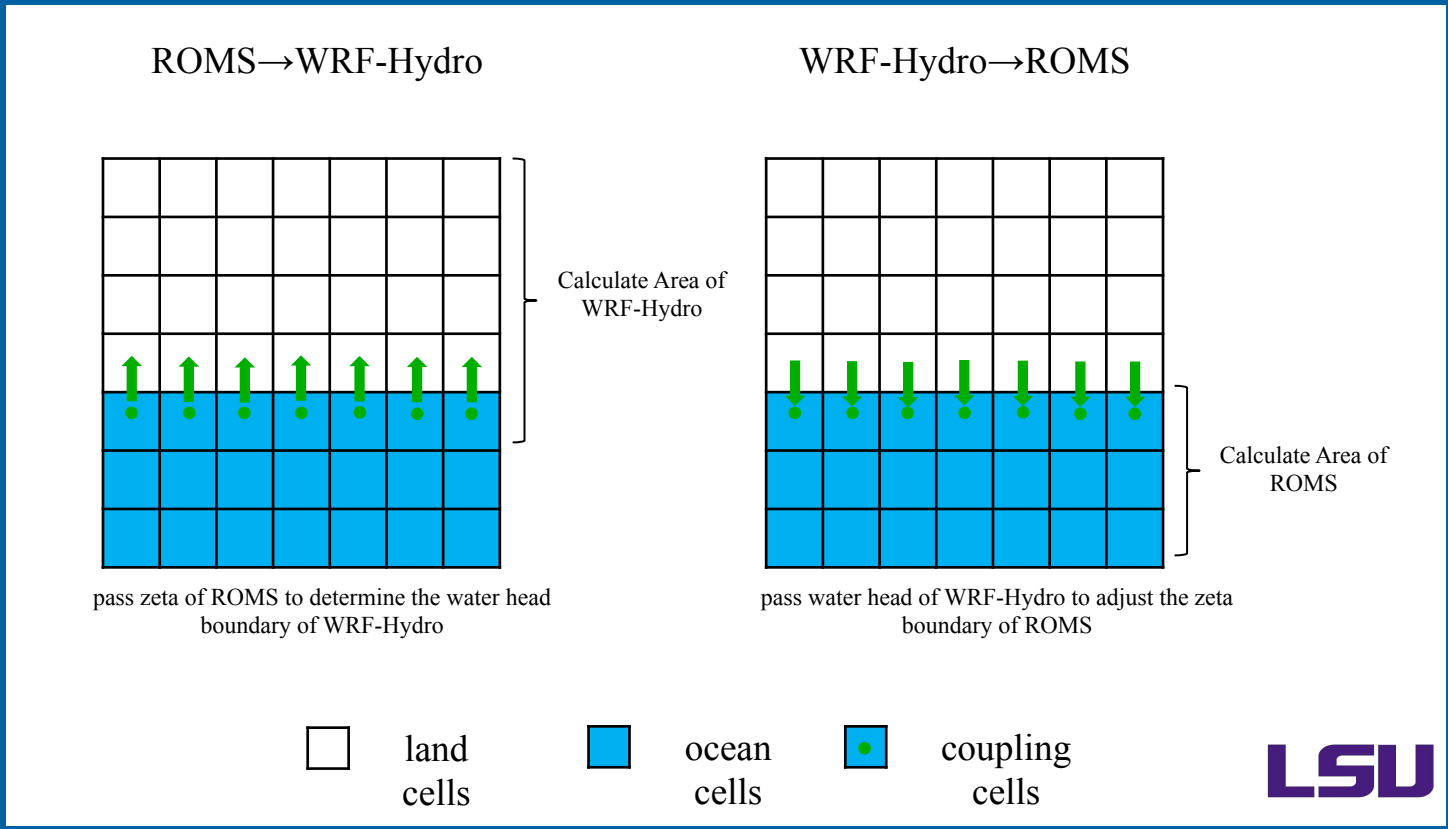
Atmosphere vectors = surface winds.
Color patches = rainfall.

WRF_Hydro channel flows are routed to ROMS river sources.



USGS

ROMS + WRF-Hydro overland flows



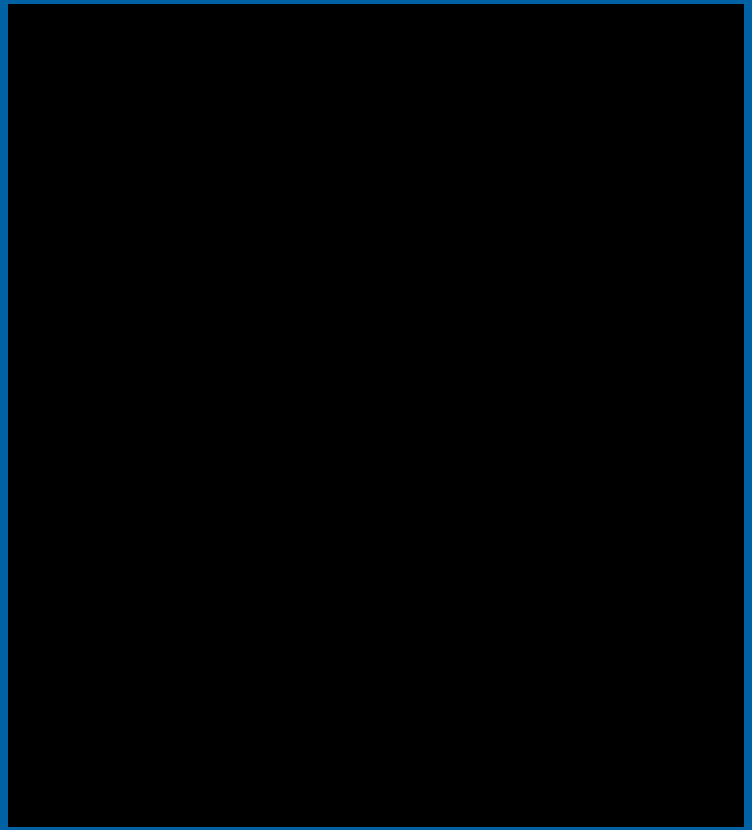
USGS

LSU

ROMS + WRF-Hydro – grid exchanges

- 3D ROMS (1km resolution) drives a 2D ROMS (100 m resolution)
- 2D ROMS shares same grid with WRF-Hydro (100 m resolution)
- WRF-Hydro running with land surface routing and channel routing activated
- ROMS water level elevation (zeta) is passed to WRF-Hydro surface routing on hourly basis along the boundary
- Next step: WRF-Hydro feedback to ROMS

Hurricane Florence



USGS

LSU

Summary

- USGS has strong involvement in CC CoP.
- Structure from Motion method to acquire high resolution nearshore topography after storms.
- Coastal Lidar – data integration into CoNED
- Total Water Level prediction system
- Coupled modeling system integrates many open-source models. Application to Hurricane Florence shows sensitivity of rainfall to model coupling. Beginning stages to couple ROMS to WRF_Hydro to increase ability to predict compound flooding.

USGS

COMMUNITY NEEDS - HELP US HELP YOU

The CC CoP has been engaging for a year now. We have hosted several events and provided opportunities for CC CoP members to voice their needs to address this challenging work of coastal coupling. In this session, we will reflect on what we've heard over the last year, gather community input on what things we may have missed, and coalesce our ideas helping to guide forward progress in a more proactive and less reactive manner.

Need Prioritization

1. *Easily accessible, open-source, quality-controlled data at high resolution that is updated with a regular frequency for model initialization, verification, and validation (1.28)*
2. Governing framework to establish guidelines/best practices for cooperative methods and technical collaboration (1.42)
3. Collaborative environment (e.g., testbed) with interdisciplinary teams working together (1.44)
4. *Stakeholder needs to inform model development (1.48)*
5. Well-organized documentation of use or test cases (1.53)
6. Flexible architecture to add new models in a coherent framework (1.53)
7. Transparent pathway to transition models into operations (1.55)
8. 3D modeling in the coastal transition zone (1.65)
9. A well-defined grand challenge (1.67)
10. Common definitions for ambiguous terminology (1.88)

Average scores based on 32 responses - 1 is high priority and 3 is low priority

CC Activities & Opportunities

Easily accessible, open-source, quality-controlled data

- Need community or community-contributed tools to read, process the high resolution open source data
- Data is needed particularly during extreme events (model development and validation)
- Focus should not be on access, but rather on regularly updating the data

Governing framework to establish guidelines/best practices

- Many commented that Governance either doesn't exist or are not aware of any examples
- Could the CC CoP leverage the best practices from Earth Prediction Innovation Center (EPIC) related to governance

Collaborative environment (e.g., testbed)

- Programs and initiatives need to be developed to fully realize this priority, as currently testbeds are focused too narrowly to suit specific models
- Collaborative environment through testbeds are beneficial especially when they include participation of stakeholders

Stakeholder needs to inform model development

- Stakeholders are many and highly variable, so need to prioritize which are key for our efforts
- A common place to document stakeholder requirements is needed
- Better connections needed between the work related to the Service Delivery Objective Team with stakeholder needs assessment and connect those back to model development

Well-organized documentation of use or test cases

- Highly supported by the Community as it encourages reproducibility, needs to be more widespread and uniform
- We should attempt to leverage what is being developed within the Unified Forecast System and EPIC using GitHub. For example, NWS just released the Medium Range Forecast via GitHub with use cases

Additional Needs Mentioned

- Deficiencies in precipitation measurements lead to inadequacies in modeling the rainfall in the flood transition zone
- A training plan on both model configuration and validation as well as on the products and services that evolve from the implementation of a coupled coastal modeling framework
- Description and evaluation of tools and technologies for visualizing model output

BUILDING OUR DATA INFRASTRUCTURE

One need that we have heard repeatedly is the need for access to shared and consistent data sets in formats that are readily usable for experimentation. This session will address this specific need and brainstorm on how this group can help to get such a dataset.

BREAK

12:00-12:15 PM CT

Participants slides

Data Infrastructure Breakout Group Discussion

- What data is needed?
  - What of the identified data already exists?
  - What doesn't?
- We know some categories of data users that have different needs:
  - Ocean model developer
  - Hydrology model developer
  - Groundwater model developer
  - Visualization or decision support tool developer
- In this session, we will gather a list of our data needs and gain an understanding how you and the community can help to address this challenge

CC Activities & Opportunities

CC CoP need: Easily accessible, open-source, quality-controlled data

- Need community or community-contributed tools to read, process the high resolution open source data
- Data is needed particularly during extreme events (model development and validation)
- Focus should not be on access, but rather on regularly updating the data

Building Our Data Infrastructure

Clint Dawson - Design Safe

University of Texas at Austin

Debra Hernandez - SECOORA data portal

Southeast Coastal Ocean Observing Regional Association

Jerad Bales - HydroShare

Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI)

Doug Marcy - Digital Coast

NOAA's Office for Coastal Management

DESIGNSAFE-CI

NHERI: NATURAL HAZARDS ENGINEERING RESEARCH INFRASTRUCTURE

DesignSafe Cyberinfrastructure for Research in Natural Hazards Engineering

Clint Dawson

John J. McKetta Centennial Energy Chair in Engineering
Dept. of Aerospace Engineering and Engineering Mechanics
University of Texas at Austin

What is DesignSafe?

- A web-based research platform that provides tools to manage, analyze, and understand critical data for natural hazards research

DesignSafe Vision

- A cyberinfrastructure (CI) that is an integral part of research discovery
  - Provide a platform for data sharing/publishing
  - Enable research workflows and access to high performance computing (HPC)
  - Deliver cloud-based tools that support the analysis, visualization, and integration of diverse data types
- Amplify and link the capabilities of natural hazards researchers in the US and abroad

DESIGNSAFE-CI

NHERI: A NATURAL HAZARDS ENGINEERING RESEARCH INFRASTRUCTURE

www.designsafe-ci.org

Research Workbench ▾ | Learning Center ▾ | NHERI Facilities ▾ | NHERI Community ▾ | About | Help ▾ | Search DesignSafe

- Data Depot
- Workspace
- Recon Portal
- SimCenter Research Tools
- User Guides

D… …sed research
pl… …twork that
pr… …al tools needed to
m… …derstand critical
d… …esearch.

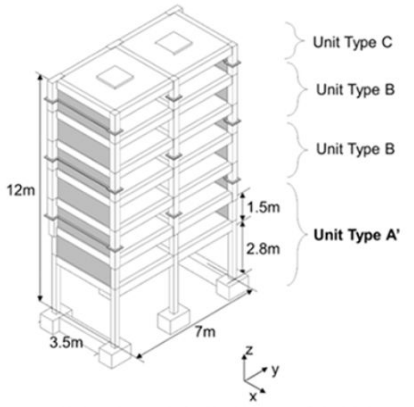
Learn how to
Start Using DesignSafe

Browse the Data Depot's
Published Data Sets

Join the conversation in
DesignSafe's Slack Channel

Learn more about
NHERI, the NCO & DesignSafe

NHERI Five-Year
Science Plan



QuakeCoRE

NCREE

DESIGNSAFE-CI
A NATURAL HAZARDS ENGINEERING COMMUNITY

3-D and first storey plan view of test specimens

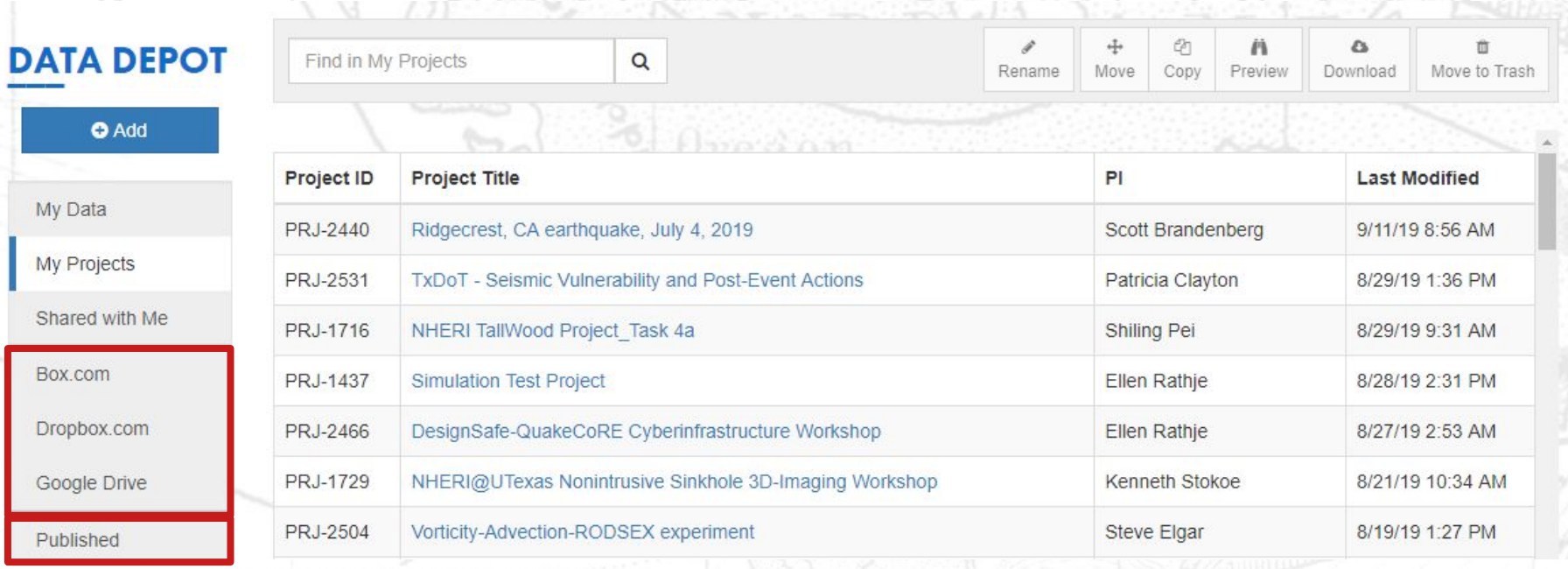
QuakeCoRE/NCREE Blind Prediction Competition

The QuakeCoRE center in New Zealand, in collaboration with the National Centre for Research on Earthquake Engineering (NCREE) in Taiwan and DesignSafe in the US, is excited to announce a competition to predict the response of reinforced concrete (RC) structures with torsional irregularities to earthquake shaking. Expressions of interest are due by 5 pm on May 01, 2019 (New Zealand time).

FIND MORE NEWS IN THE NEWSROOM

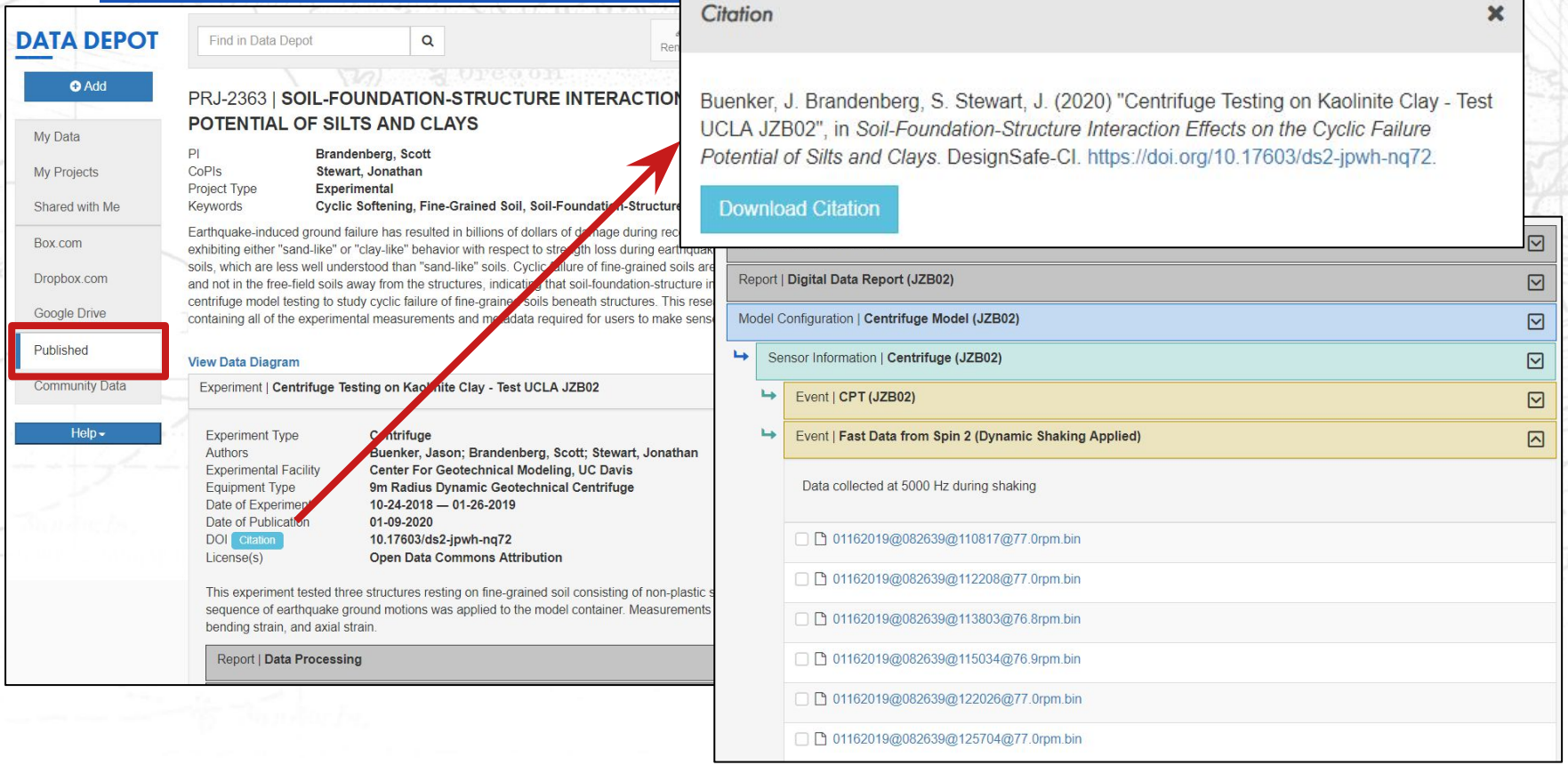
DesignSafe Research Workbench

- Data Depot Data Repository
  - Private space (My Data)
  - Collaboration space (My Projects) for data sharing and ultimate publishing
  - Publicly accessible space (Published) for curated data from My Projects
  - Publicly accessible space (Community Data) for uncurated data
- Discovery Workspace
  - Apps/tools for computational simulation, data analysis, visualization, etc. with access to files in Data Depot
- Reconnaissance Portal: discover published reconnaissance data from natural hazard events



My Projects: A space to share files/data/results with collaborators and to <u>eventually</u> publish for public use

NSF | DESIGNSAFE-CI NHERI: NATURAL HAZARDS ENGINEERING RESEARCH INFRASTRUCTURE | TEXAS The University of Texas at Austin | UCLA | TACC | RICE | Florida Tech



NSF DESIGNSAFE-CI NHERI: NATURAL HAZARDS ENGINEERING RESEARCH INFRASTRUCTURE TEXAS The University of Texas at Austin UCLA TACC RICE Florida Tech

Discovery Workspace

- Cloud-based tools and HPC enabled codes (Stampede2)
- HPC-enabled simulation codes:
  - OpenSees, LS-Dyna, ADCIRC + SWAN, OpenFOAM, more!
- These codes (and more) available at the Command Line, easy access to HPC allocation through DesignSafe

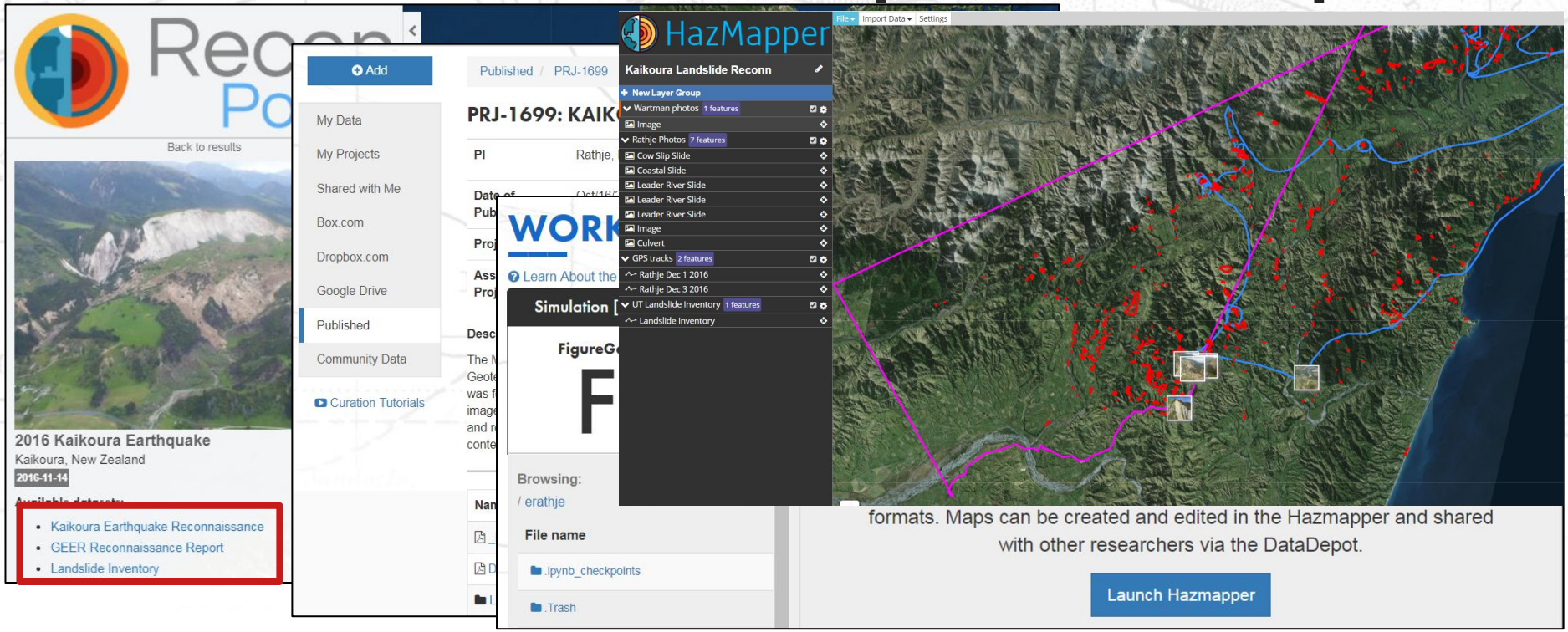
DesignSafe Discovery Workspace

- Data analysis in the cloud
  - Matlab: data analysis and plots, batch processing
  - Jupyter: electronic notebook that supports Python and R analysis
- Visualization
  - HazMapper: DesignSafe version of “Google Maps”
  - Potree: Create, view, and analyze point cloud data
  - QGIS: geospatial data analysis
  - Kalpana and FigureGen: data converter and plot generation for ADCIRC storm surge outputs

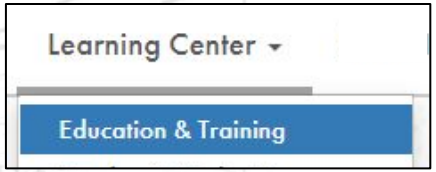
Reconnaissance Portal

Identifying Archived Datasets from Recon Events

Recon Portal → Data Depot → Workspace



Learning Center



Learning how to use DesignSafe

- **Webinars:** Archived at DesignSafe Youtube channel
- **User Guides:** https://www.designsafe-ci.org/rw/user-guides/
- **Documentation:** Look for tool tips on every screen

DesignSafe Tutorials

NEW **Publishing with the Hybrid Simulation Data Model in DesignSafe**
August 29, 2019
- Watch Tutorial

Using OpenSeesPy on DesignSafe
May 22, 2019
- Watch Tutorial
- Tutorial Jupyter Notebook

Using LS-Dyna on DesignSafe
May 13, 2019
- Watch Tutorial

The ADCIRC Suite of Storm Surge Simulators
March 6, 2019
- Watch Tutorial

Interacting with Partner Datasets in the Cloud
February 27, 2019
- Watch Tutorial

Introduction to DesignSafe
January 23, 2019

SimCenter Webinars

NEW **Earthquake Damage and Loss Assessment with SimCenter's PBE Application**
April 30, 2019
- Watch Webinar

Uncertainty Characterization in Earthquake Engineering Simulation
April 23, 2019
- Watch Webinar

Running Large-scale Regional Hazard and Loss Simulations
February 25, 2019
- Watch Webinar

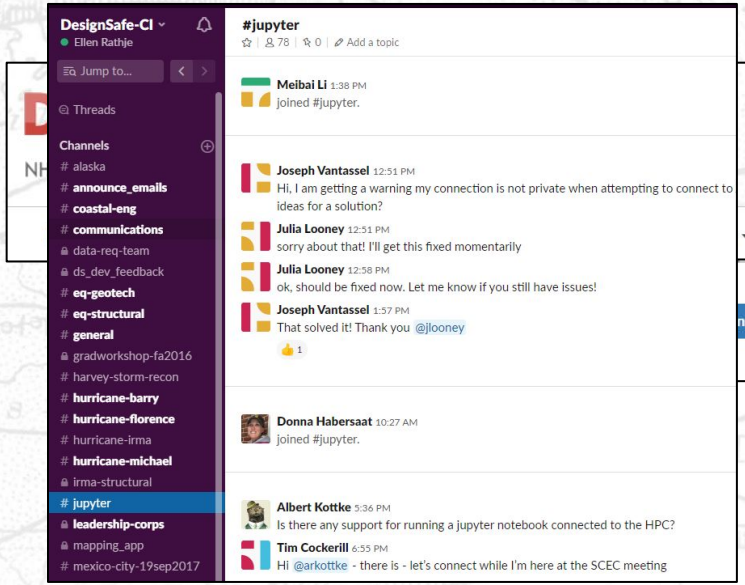
HPC Ground Motion Simulations of Large Hayward Fault Earthquakes
November 14, 2018
- Watch Webinar

AI & Machine Learning in Natural Hazards Engineering: Technical & Modelling Q&A
November 6, 2018
- Watch Webinar

DesignSafe: Open for Business

Available to the Global Natural Hazards Research Community

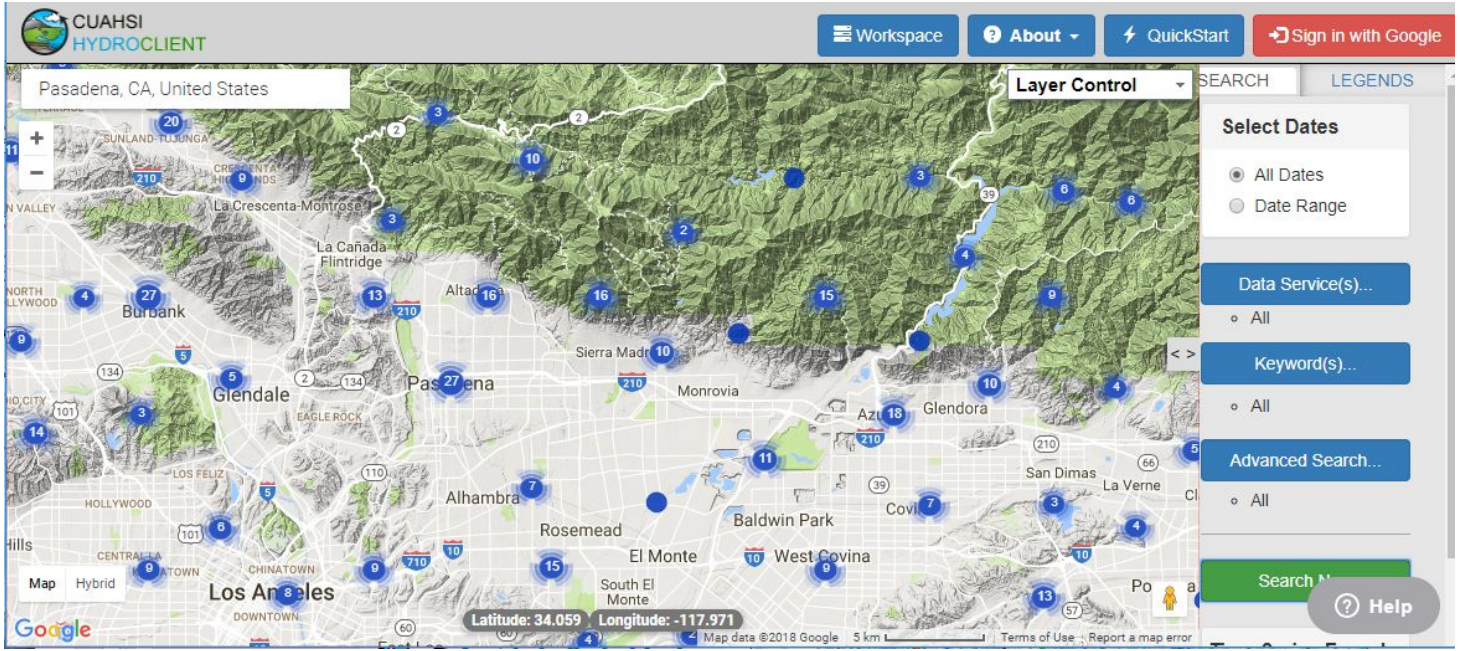
- Available for ANY research related to natural hazards (NSF, non-NSF)
- Interact with us and the community using the DesignSafe Slack team
- Cite DesignSafe marker paper (Rathje et al. 2017, *Natural Hazards Review*) if you use DesignSafe in your research



Please share your feedback, ideas, experiences!

NSF | DESIGNSAFE-CI NHERI: NATURAL HAZARDS ENGINEERING RESEARCH INFRASTRUCTURE | TEXAS The University of Texas at Austin | UCLA | TACC | RICE | Florida Tech

CUAHSI HydroShare



CUAHSI
UNIVERSITIES ALLIED FOR WATER RESEARCH

Dr. Jerad Bales, Executive Director
May 12, 2020
Coastal Coupling Community of Practice Annual Meeting

What is CUAHSI? (kuh – WAH – see)

- **CUAHSI is a non-profit consortium of about 130 U.S. academic institutions, non-profits, international universities; and private companies**

- **Mission is to advance water science by:**
  - **Strengthening interdisciplinary collaboration in water-sciences**
  - **Providing critical community infrastructure**
  - **Promoting education in the water sciences**

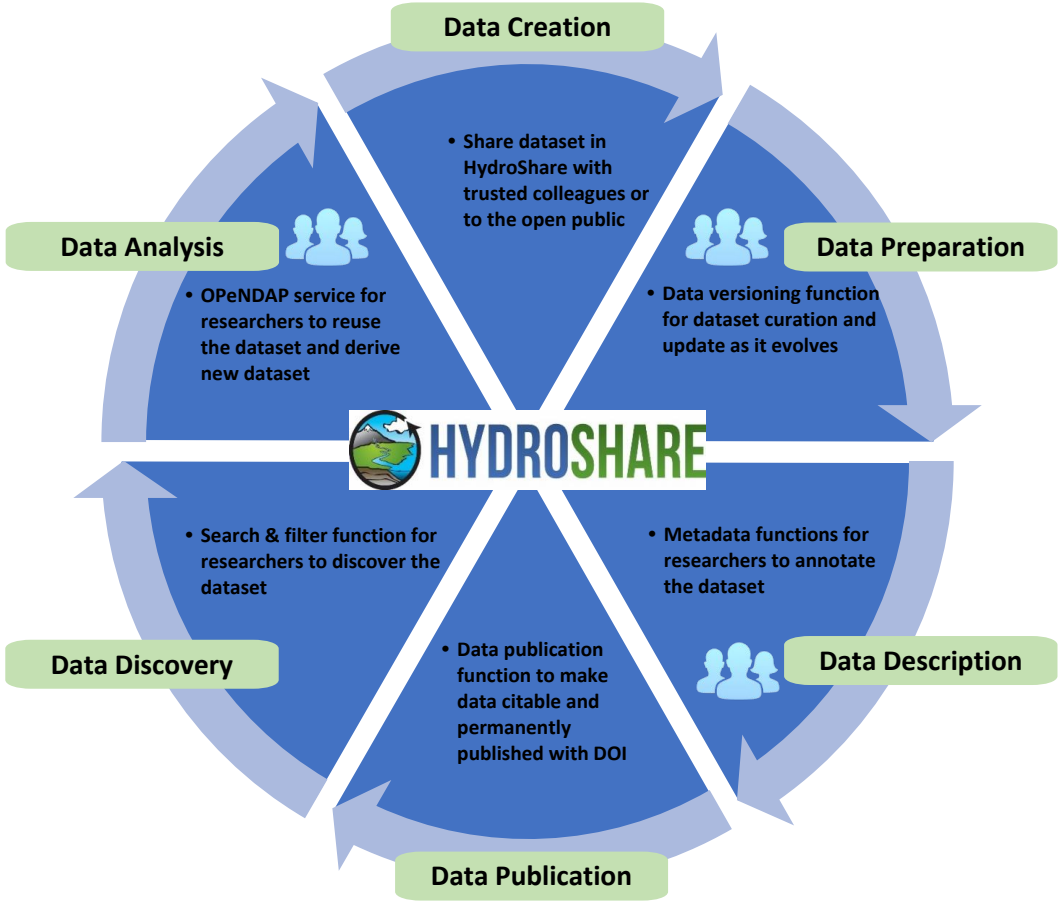
- **Activities**
  - **Community Services, such as workshops, community meetings, training, etc.**
  - **Data and Model Services, including HIS and HydroShare**

CUAHSI Summer Institute

- Partnership between NWS and CUAHSI.
- Involvement of academic community, NCAR, DHS, US ACE, USGS, local orgs.
- Participants:
  - Theme Leaders and their invitees (6+)
  - Student Course Coordinators (2 – 3)
  - Students (20 - 30 graduate students)
  - Student Advisors
- Seven-week on-site residential program at the NWC
- Coastal Coupling Theme during last 3 years

Data Infrastructure

- Metadata rich
- Control access
- Formally publish
- Document workflows



Find, Publish, and Operate on Water Data: HydroShare

HYDROSHARE MY RESOURCES DISCOVER COLLABORATE APPS HELP ABOUT

How it works

1

Create data

Collect your data using the same methods you use now. HydroShare supports a broad set of hydrologic data types.

2

Upload to HydroShare

Upload your data files to HydroShare through the web user interface. HydroShare will automatically extract as much metadata as it can from the files you upload.

3

Describe with metadata

Use HydroShare's simple metadata entry forms to finish describing your data so that your colleagues can find, access, and interpret it.

4

Share with colleagues

You choose who has access to the data and models you have uploaded to HydroShare. You can share with individual users or publish your resources for everyone to access.

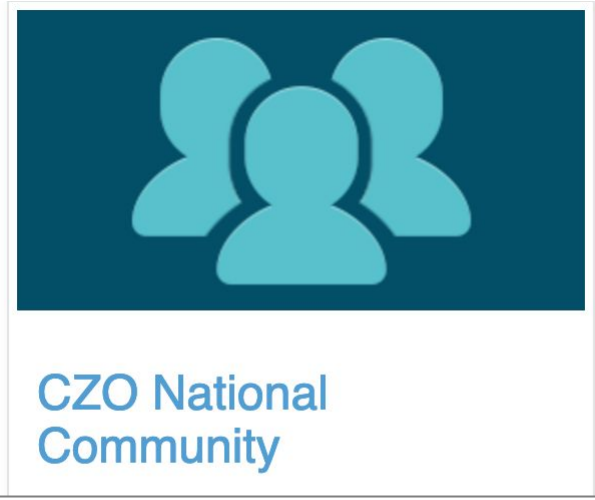
Data Infrastructure

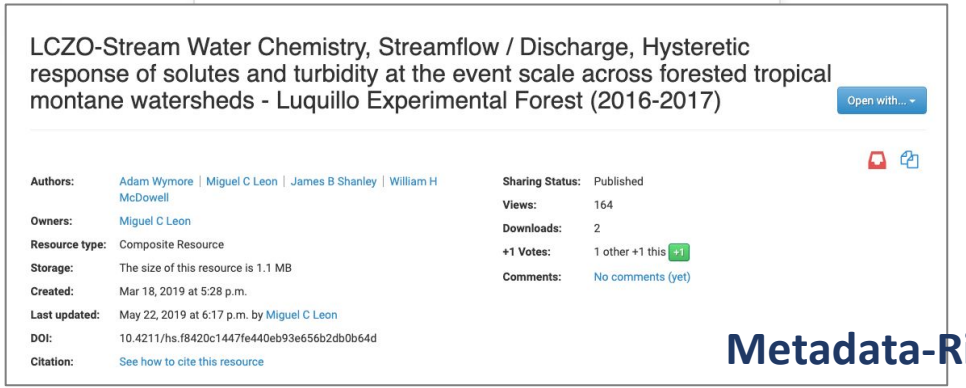
HYDROSHARE

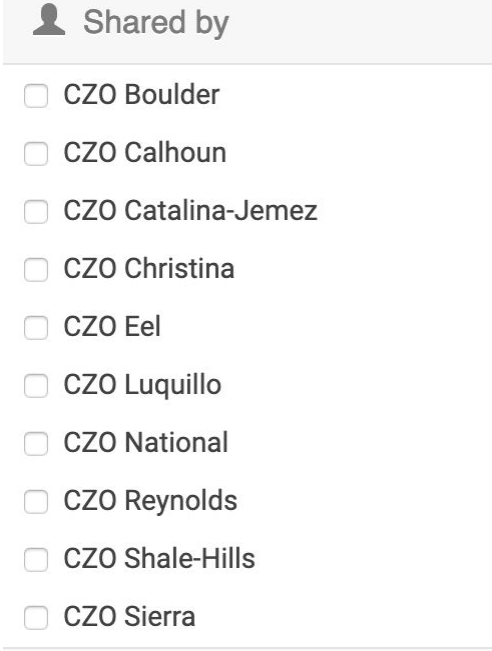
Collaborate

GROUPS

COMMUNITIES

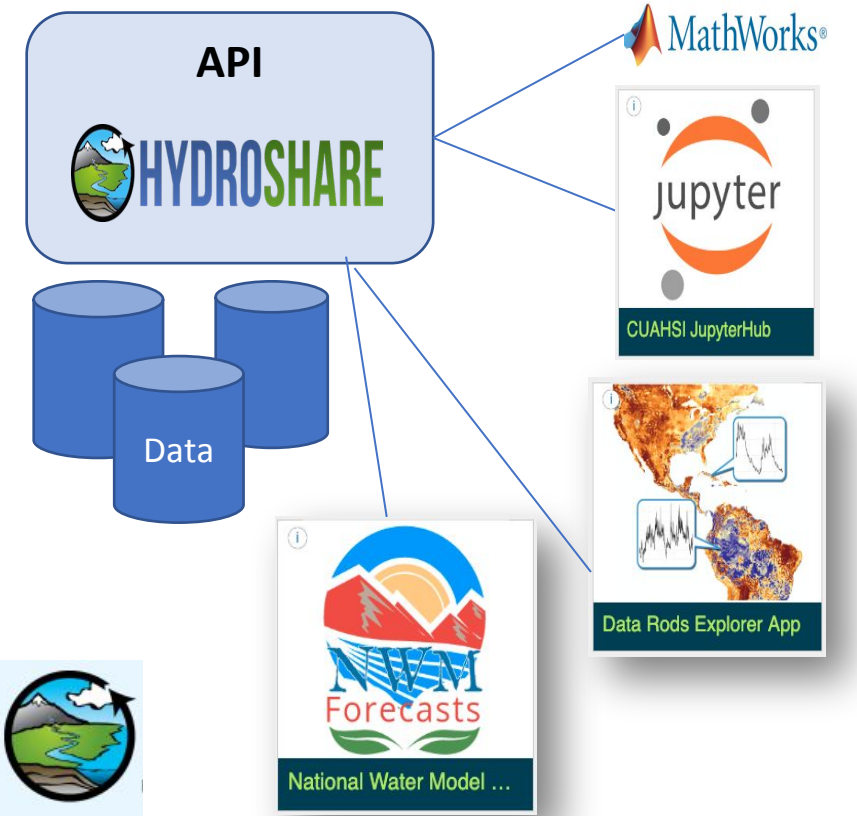






Metadata-Rich Content

Gateway to web-based computing



- **Provide immediate value**
  - **What can I do now that I may not be able to easily do on my PC? HydroShare is designed to work with 3rd party apps.**
- **Model input data preparation**
- **Model execution—link HydroShare data and cloud computing environments).**
  - **Jupyter Hub**
  - **MATLAB Online**
- **Reduced needs for software installation and configuration (platform independence).**
- **Pre-configured compute environments for classroom activities and workshops without the need for software installation and configuration.**

CUAHSI Collaboration with Federal Agencies

CUAHSI operates through a 5-year cooperative agreement with NSF. As a result, collaboration with other federal agencies is facilitated through the IAA process.

- **NWS** – Summer Institute at the National Water Center.
- **DHS** – Post-doc: CUAHSI employee, mentored by advisor at Columbia University.
- **NASA** – Training courses: CUAHSI sponsors the class and NASA teaches; exploring ROSES to secure additional support.
- **NASA** – Supporting SWOT mission as an early adopter and providing synthetic and real discharge data to the community.
- **USDA Forest Service** – Teach CUAHSI Short Courses; Support ICRW meetings.
- **USGS** – Joint workshops held under a CRADA; Supporting ELFIE-II OGC activity; host data.
- **U.S. Army Corps of Engineers**—HydroShare instance running behind Corps firewall.
- **EPA** – Hosting IWN sensor web site.
- **Federal Interagency Working Groups**.

Data Infrastructure

CUAHSI National Water Center Innovators Program Summer Institute

Jerad Bales
jdbales@cuahsi.org
https://www.hydroshare.org/landingPage/
http://data.cuahsi.org/
https://www.cuahsi.org/

CUAHSI
UNIVERSITIES ALLIED FOR WATER RESEARCH

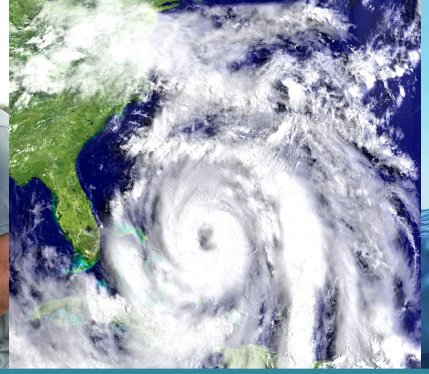


Image Credit: USF CMS

Southeast Coastal Ocean Observing Regional Association – SECOORA

Investing in ocean monitoring and providing reliable ocean and weather data to the people who need it North Carolina, South Carolina, Georgia and Florida.

SECOORA
Southeast Coastal Ocean Observing Regional Association

IOOS
Integrated Ocean Observing System

Image Credit: UNCW

Debra Hernandez | debra@secoora.org | www.secoora.org

11
Regional coastal observing systems

NOAA led
U.S. IOOS®

IOOS
Integrated Ocean Observing System

Certification and Data Portal

SECOORA meets federal standards for:

- Data gathering
- Data management
- Long-term archiving

Operate:

- inclusively
- transparently
- solicit input

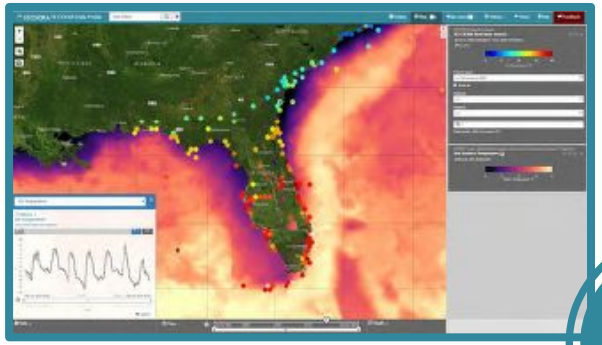
U.S. INTEGRATED OCEAN OBSERVING SYSTEM CERTIFIED REGIONAL ASSOCIATION

INTEGRATED OCEAN OBSERVING SYSTEM

Axiom DATA SCIENCE

SECOORA Data Portal - https://portal.secoora.org/

Provide an Integrated Look at Data



Map

Visualize data from many sources, download data

Over 2300 searchable datasets!

Catalog

Search data, metadata & download data

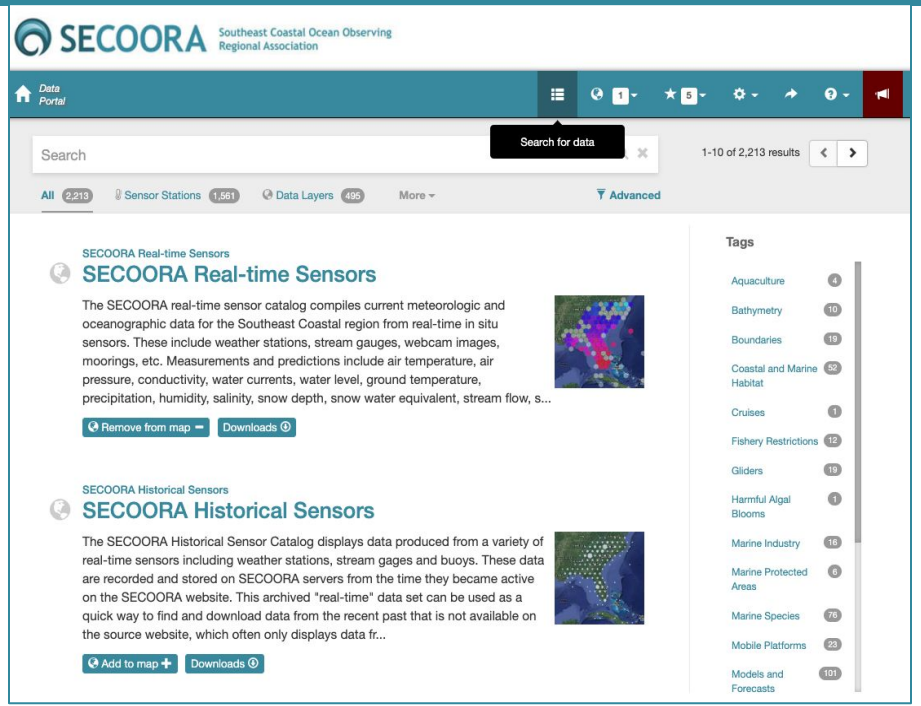
Data Views

Rapidly assimilate & compare different data streams

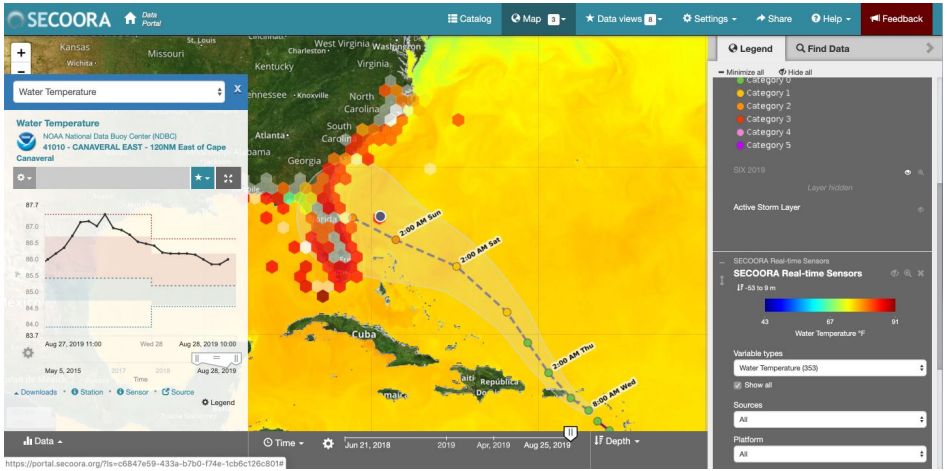
Visit the SECOORA Data Portal: *https://portal.secoora.org/*

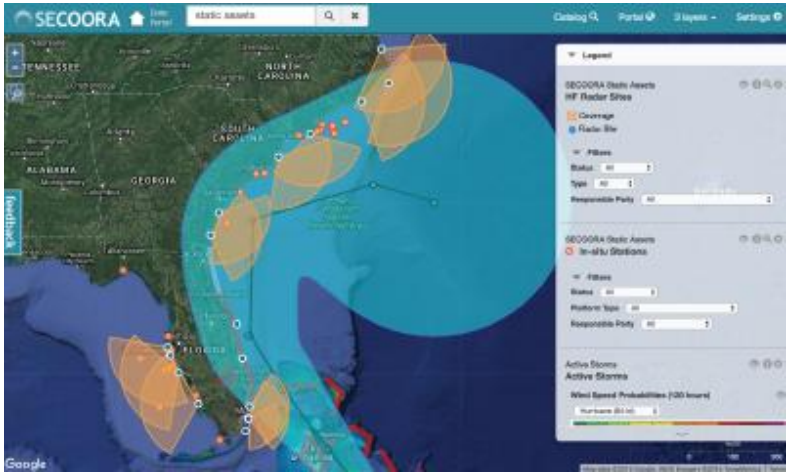
SECOORA Data Catalog
https://portal.secoora.org/

- Search over 2,300 datasets
- Use it like google
- Access metadata
- Download data



SECOORA Data Map
https://portal.secoora.org/

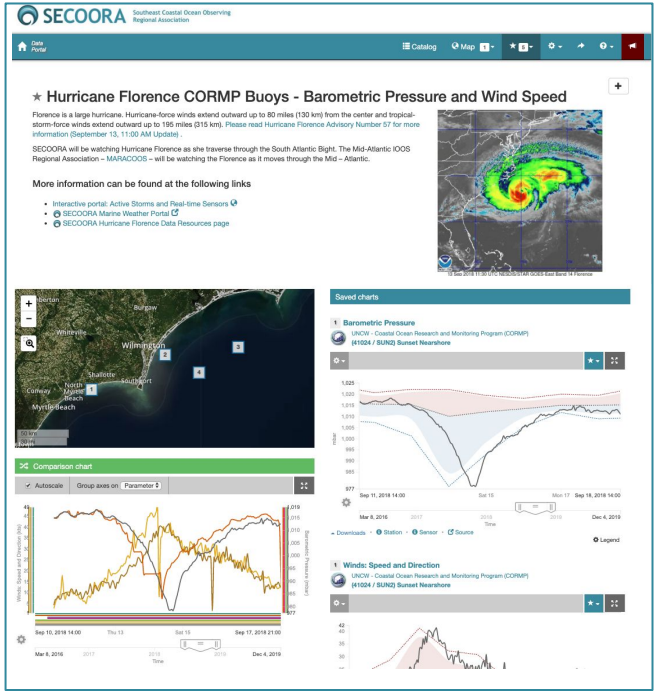




- Visualize data from the Data Catalog
- Overlay data from many different sources – from physical to modeled data

SECOORA Data Views
https://portal.secoora.org/

- Rapidly assimilate data to tell a story
- Compare different data streams
- Save Data Views for quick access



SECOORA
Southeast Coastal Ocean Observing Regional Association

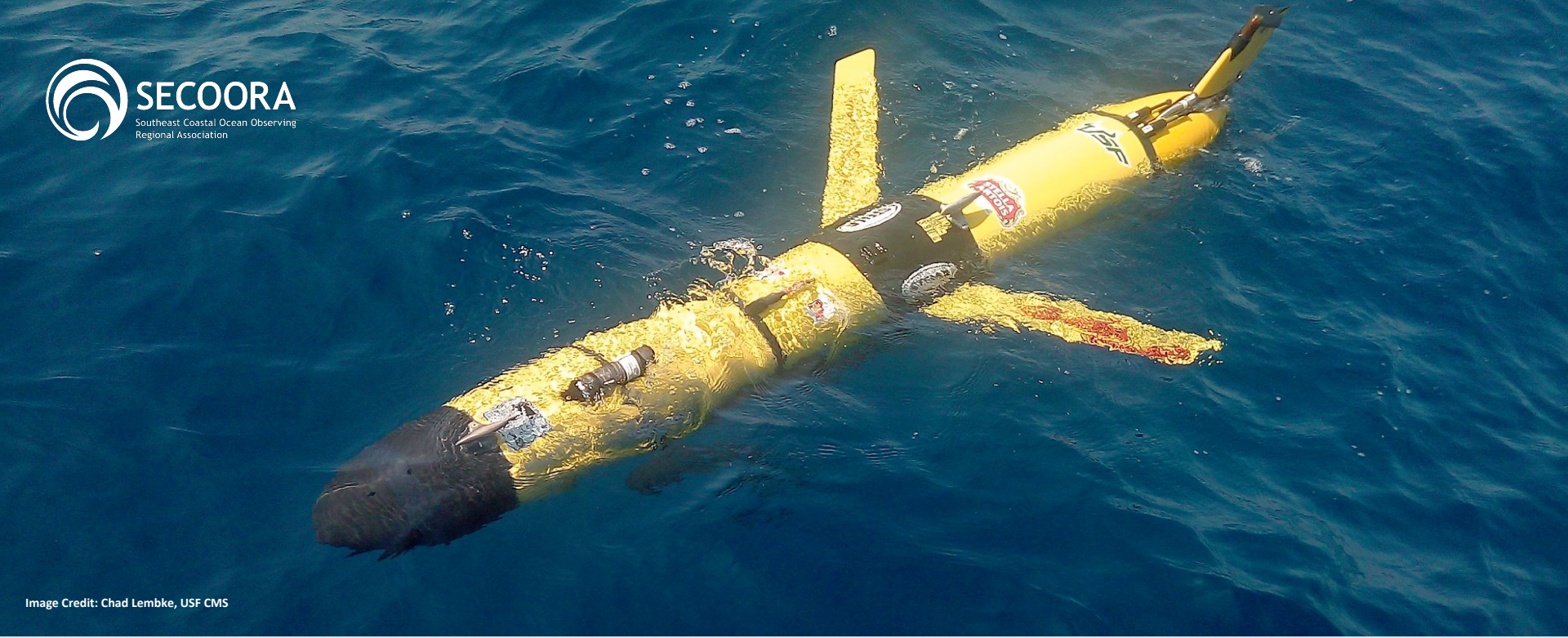


Image Credit: Chad Lembke, USF CMS

Questions?

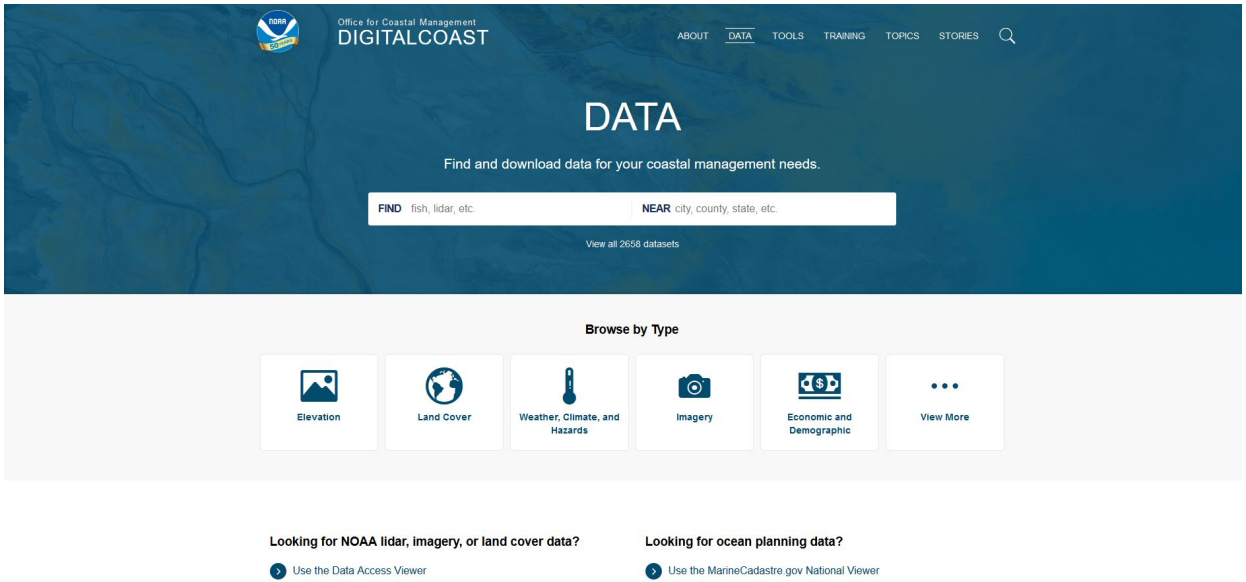
Debra Hernandez , *debra@secoora.org*

www.secoora.org

Data Infrastructure

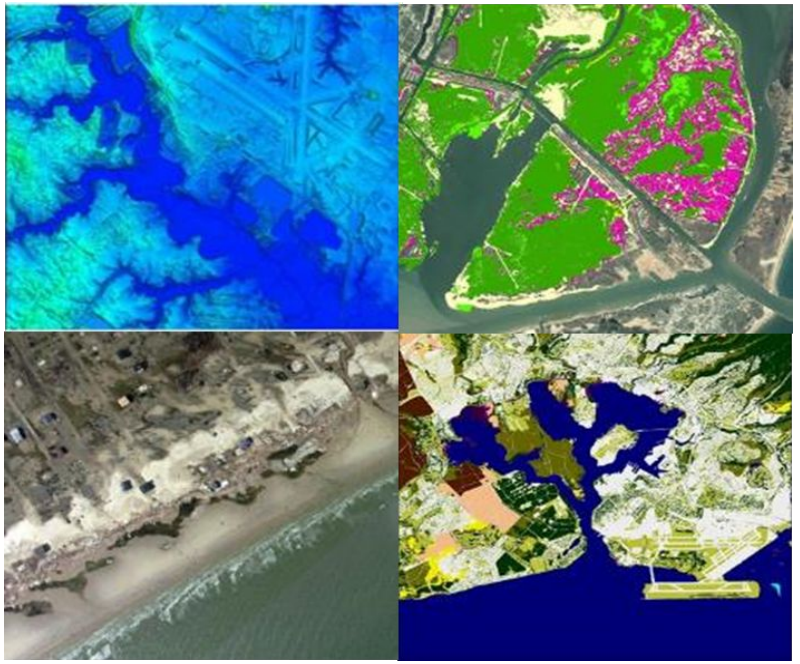
Doug Marcy- Digital Coast Data Access

NOAA Office for Coastal Management – coast.noaa.gov/digitalcoast



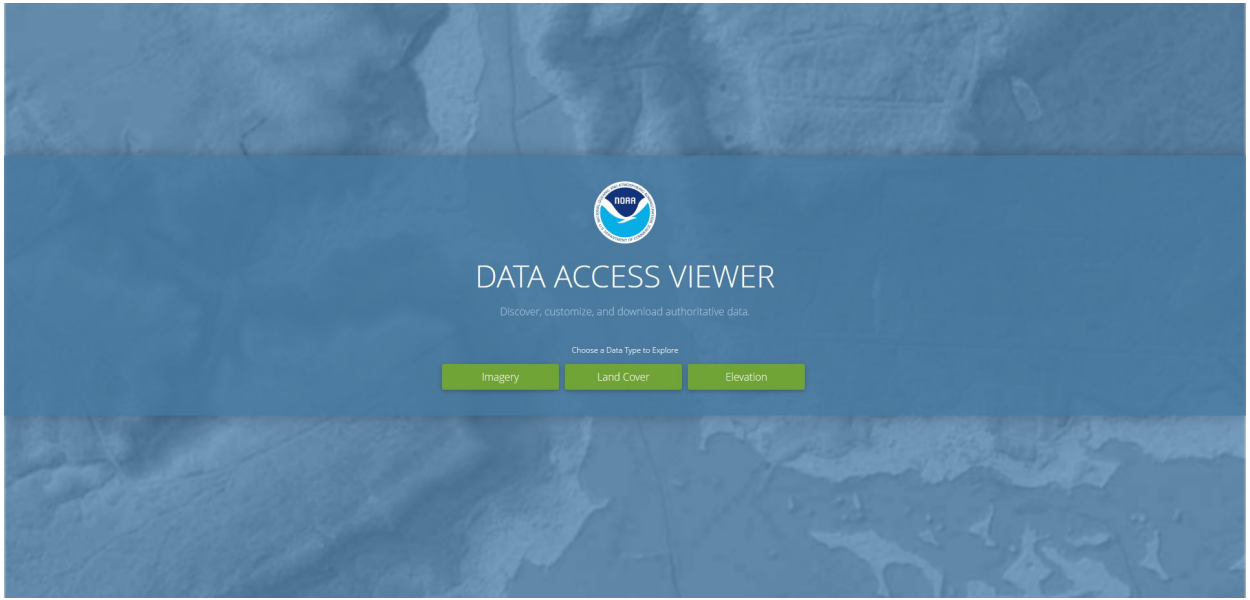
Digital Coast: Providing New Data

- Benthic data
- Hydrographic data
- Marine boundaries
- Imagery
- Coastal Land Cover data
- Lidar data
    - 3m DEMs
    - Elevation
    - Bathymetry
- Socioeconomic data
    - Economics: National Ocean Watch

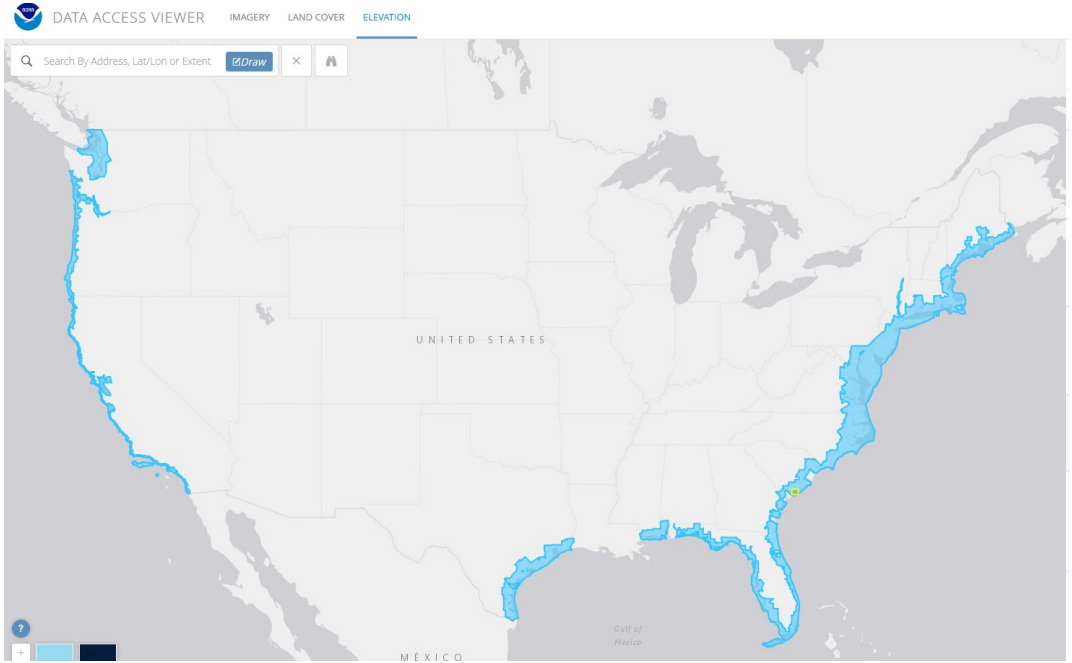


Digital Coast Data Access

Data Access Viewer : coast.noaa.gov/dataviewer



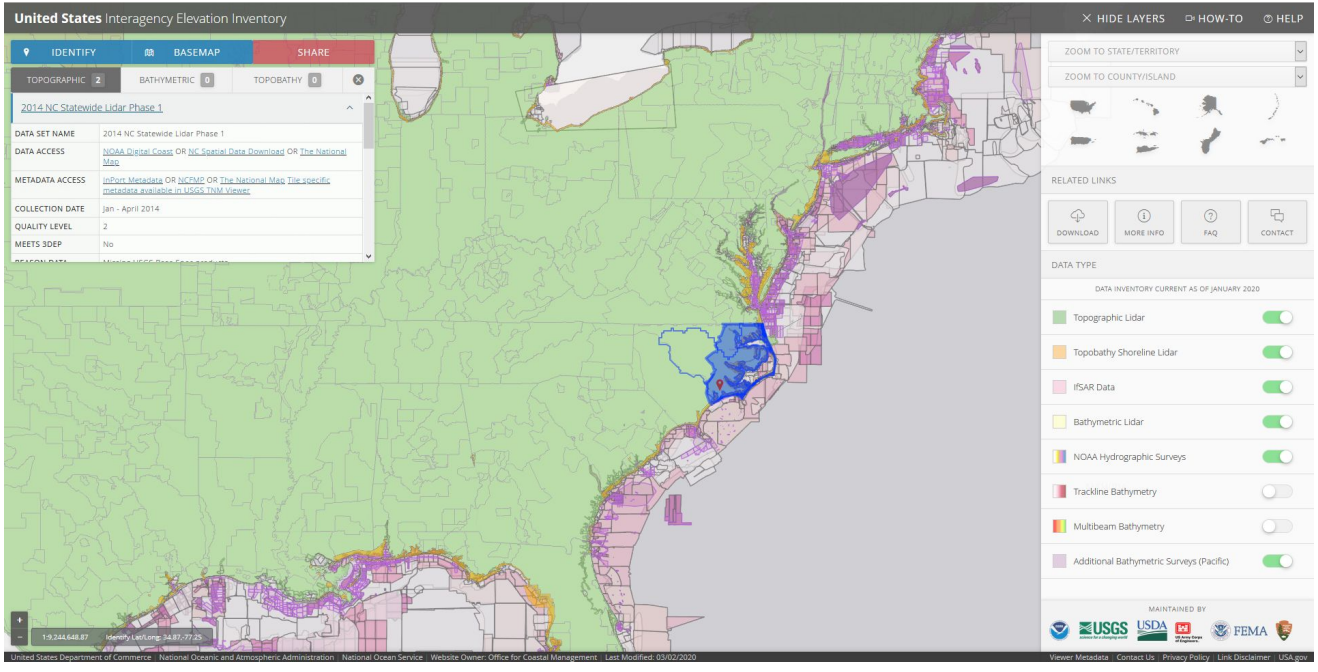
Digital Coast Data Access: Coastal DEM



Data Infrastructure

Digital Coast Data Access

U.S. Interagency Elevation Data Inventory: coast.noaa.gov/inventory



Digital Coast: Lidar Data

- 3m DEMs available as an image service and for download from best available LIDAR. Accessible here:
  https://coast.noaa.gov/arcgis/rest/services/Elevation/SLR_DEMs/ImageServer
- Metadata:
  https://inport.nmfs.noaa.gov/inport/item/48370
- Bulk download of DEMs:
  https://coast.noaa.gov/htdata/raster2/elevation/SLR_viewer_DEM_6230/
- Nationwide Elevation Inventory. Partnership between many agencies.
  https://coast.noaa.gov/inventory/

Data Infrastructure Breakout Group Discussion

In the previous breakout we discussed what data was needed. Now that we know this and some of the options for data catalogs, what are you willing to contribute

- How can we address the needs identified in the first breakout session?
- What are individual members willing to contribute?
  - Community expectation to provide data
- How can the community own this data need?
  - Working groups
  - Metadata standards
  - Where to catalog data

BREAK

1:35-1:55 PM CT

Participants slides

Breakout Group Report Out

- Group 1: Ehab Meselhe
- Group 2: Nels Frazier
- Group 3: Cary Talbot
- Group 4: Kyle Mandli
- Group 5: Camaron George

Developing Collaborative Solutions for Continental-Scale Integrated Water Prediction

COASTAL COUPLING COMMUNITY OF PRACTICE

May 13, 2020

Virtual meeting: hangouts link

Poll everywhere info

www.weather.gov/watercommunity

Participants slides

Welcome

Ground Rules

- One person speaks at a time
- Keep the discussion relevant, add new topics to the chat box with your name, you will be called on according to topics
- Say your name before you speak
- Remember to use mute/unmute
- Speak loudly and clearly
- Come prepared to the meeting
- Avoid email and other distractions during the meeting
- Please use video - this increases the effectiveness by 92% over audio only
- Share information on Google docs
- *Poll Everywhere* - put your name next to your question

DAY 1 RECAP & DAY 2 PREVIEW

Common Themes from Day 1

What data are needed?

1. River bathymetry/topography
2. Stream gauge observations, including high data mark
3. Validation and initialization data to support models
4. Wave and water currents observations
5. Land cover
6. Precipitation/water level/streamflow/discharge data (including drought conditions)
7. Water quality/temperature
8. Wave data sets, especially in near shore regions
9. Wind
10. Social science data

What of the identified data already exists?

Good examples are out there (the full list of those captured during the breakout sessions will be available in the summary); however, the coverage is lacking

What doesn't?

- Metadata standard adoption
- Future precipitation data for modeling climate change impacts (probabilistic)
- Atlas 14 projected into the future

Common Themes from Day 1 (cont.)

How can we address the needs identified in the first breakout session?

- Ensure discoverability of data sets (Too many repositories, no central search)
- Provide metadata standards and/or examples
- Reach out to specific groups for input (e.g., universities, state and local entities, IOOS and IOOS Regional Associations, Cloud and Big Data projects)
- Apply A.I. from imagery and other remote sensed data to derive missing data (including uncertainty and confidence)
- Provide base funding for certain projects (i.e., data collection for non-named as well as named storms) that are currently only funded through supplementals

Common Themes from Day 1 (cont.)

What are individual members willing to contribute (e.g., Community expectation to provide data)?

- IOOS has a national catalog
- Share knowledge and experience with low cost observation solutions for R&D
- Share crowdsourcing data/techniques

How can the community own this data need?

- Select a central public repository for uploading data
- Set metadata standards
- Ensure discoverability of data sets
- Include industry in the CC CoP
- Engage research testbed partnerships across this community and external partners
- Involve the broader community to support data collection in areas with low population counts

A Look Ahead to Day 2

- Developing Capabilities to Serve our Stakeholders
- Define our Community Engagement over the next year

Stakeholder needs to inform model development

- Stakeholders are many and highly variable, so we need to prioritize which are key for our efforts
- A common place to document stakeholder requirements is needed
- Better connections needed between the work related to the Service Delivery Objective Team with stakeholder needs assessment and connect those back to model development

DEVELOPING CAPABILITIES TO SERVE OUR STAKEHOLDERS

Brenna Sweetman

NOAA's Office for Coastal Management

Lisa Lucas

US Geological Survey

Tom Shyka

Northeastern Regional Association of Coastal Ocean Observing Systems

NOAA's Digital Coast

Actionable Information for Communities

Brenna Sweetman
NOAA's Office for Coastal Management

Office for Coastal Management

Coastal Zone Management Program
Coral Reef Conservation Program
Digital Coast
National Estuarine Research Reserves

Approximately 250 people around the country

Digital Coast – 3 Things Memo

- **Information and Data Delivery –** access to relevant coastal data, integrated tools, and training
- **Partnership –** a constituent-driven approach driving content
- **Enabling Platform –** resources being used to address issues

Digital Coast Partnership

- American Planning Association
- Association of State Floodplain Managers
- Coastal States Organization
- National Association of Counties
- National Estuarine Research Reserve Association
- National States Geographic Information Council
- The Nature Conservancy
- Urban Land Institute
- NOAA Office for Coastal Management

Digital Coast by the Numbers

Data

- 80+ terabytes
- 40+ national-level data sets

Tools

- 50+ tools

Training

- 190+ learning resources

Stories from the Field

- 120+ narratives

Digital Coast: Providing New Tools

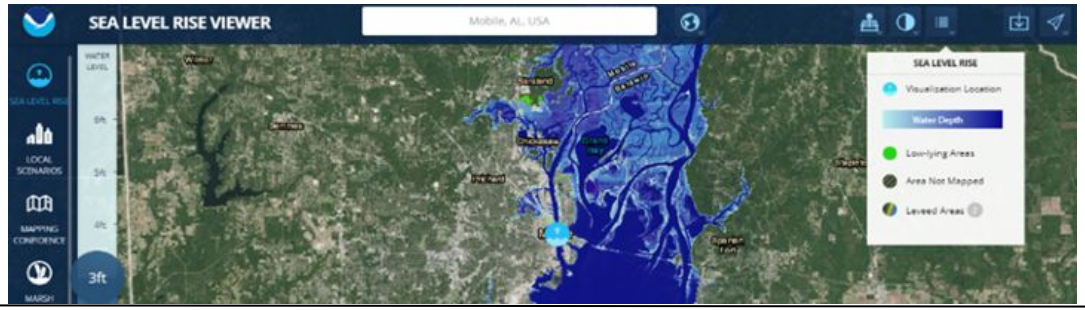
Types of Tools

- Analysis tools
- Data Visualization & Handler tools
- Simulation tools
- Informational tools

Top Products

- Sea Level Rise/Lake Level Viewer
- Historical Hurricanes Tracks
- Coastal Flood Exposure Mapper
- Coastal County Snapshots

Coastal Inundation Toolkit



Connect with the Digital Coast

coast.noaa.gov/DigitalCoast

Coastal.Info@noaa.gov

facebook.com/NOAADigitalCoast

@NOAADigCoast

brenna.sweetman@noaa.gov

Stakeholder Needs

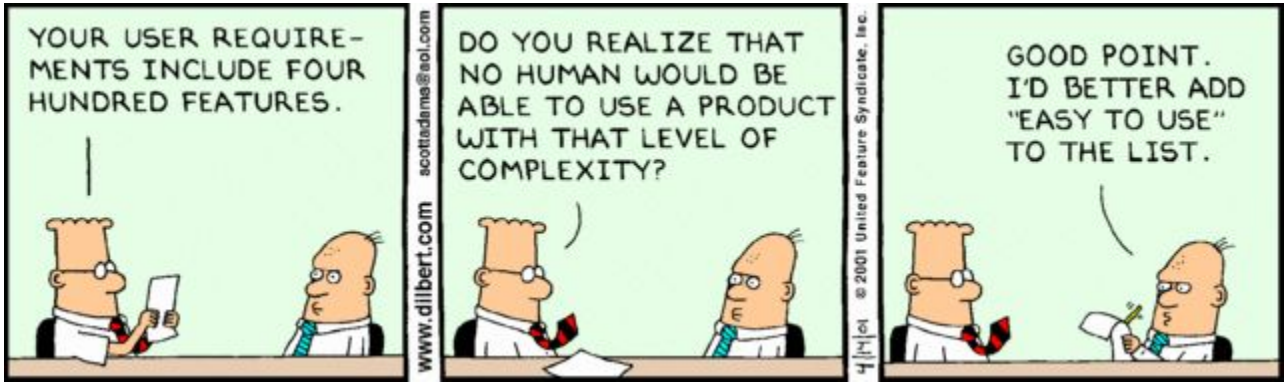
Lisa Lucas - **US Geological Survey**
Research Engineer/Ecohydrodynamicist
Integrated Modeling & Prediction Division, Water Mission Area

See PDF for slides

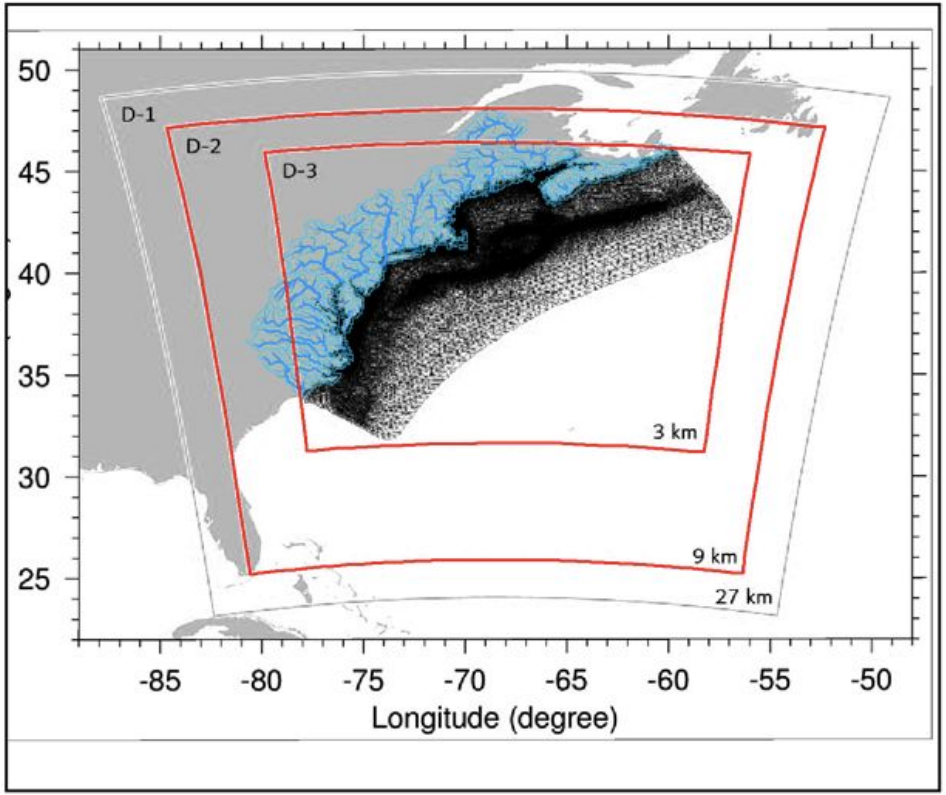
DISCLAIMER—This information is preliminary or provisional and is subject to revision. It is being provided to meet the need for timely best science. The information has not received final approval by the U.S. Geological Survey (USGS) and is provided on the condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the information.

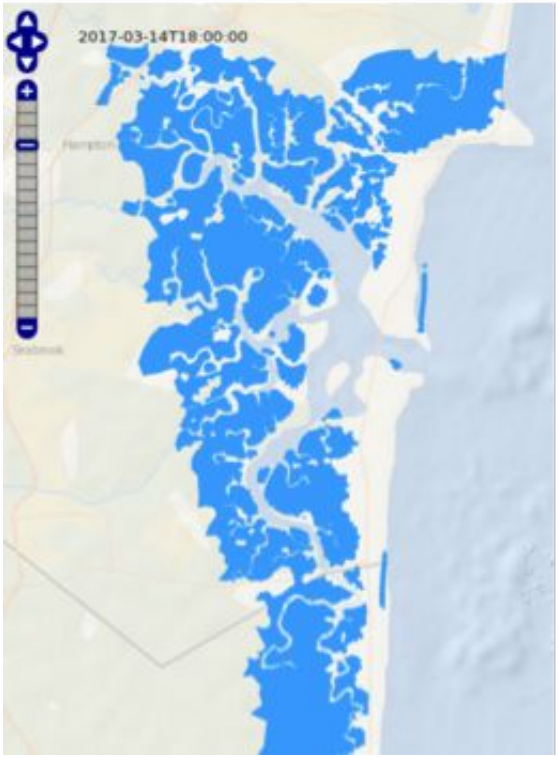
Stakeholder Needs

Tom Shyka - Northeast Regional Association of Coastal Ocean Observing Systems (NERACOOS)



Stakeholder Needs





Stakeholder Needs

Stakeholders

- NWS regional forecasters
- State coastal zone managers
- Emergency managers
- USCG response
- Agency and academic modelers

Stakeholder Needs

Requirements Development Process

Goals: Document requirements for transition plan and improving delivery and use of model products

- Kickoff Meeting
  - Modeling teams, representative stakeholders, project partners
  - Introductions and Information sharing
  - Requirements gathering
- Stakeholder Interviews
  - Requirements gathering
- Annual project meetings
  - Verify requirements
- Stakeholder follow up
- Requirements documentation and management

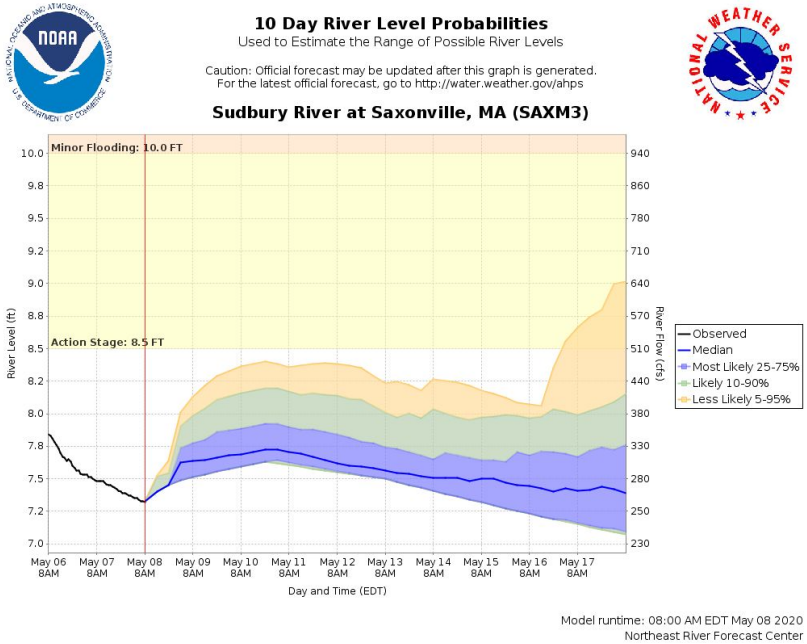
Question: What system or tool do you use for capturing and managing requirements

Stakeholder Needs

Improving Delivery and Use Model Products

- Alert services
- Delivery through GIS
- Model uncertainty presentation
- Programmatic delivery of predictions through AWIPS for NWS forecasters
- Common platform to access model output and find nearby observations for comparison

Question: Have you heard similar requests?



Stakeholder Needs

Benefits

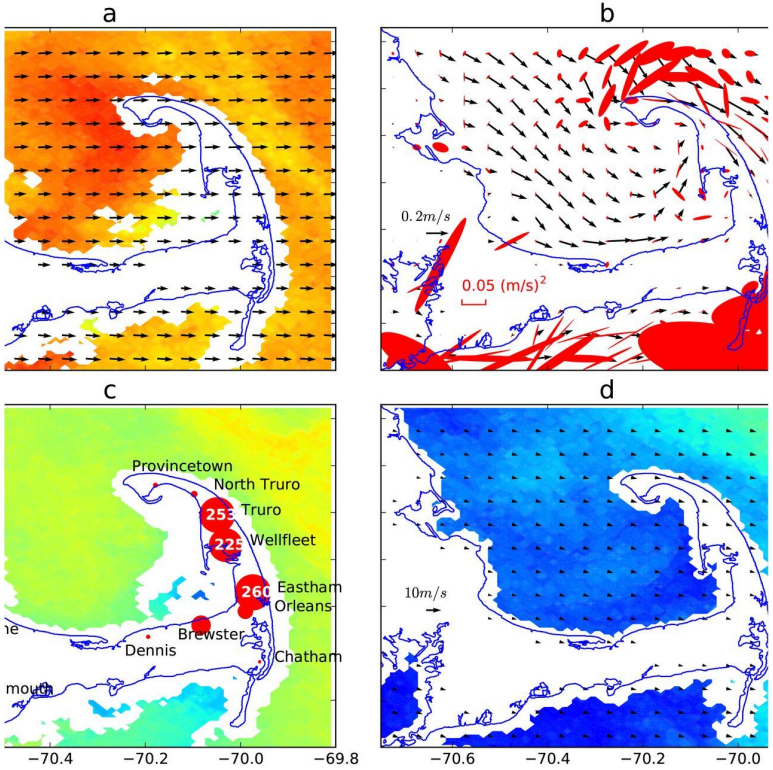
- Stakeholders have improved and streamlined access to predictions they need
- Stakeholders receive predictions in format they can efficiently use
- Stakeholders have more information to support their decision making
- Stakeholders gain a better understanding of the models and their skill
- Lines of communication established between stakeholders and modeling teams

Stakeholder Needs

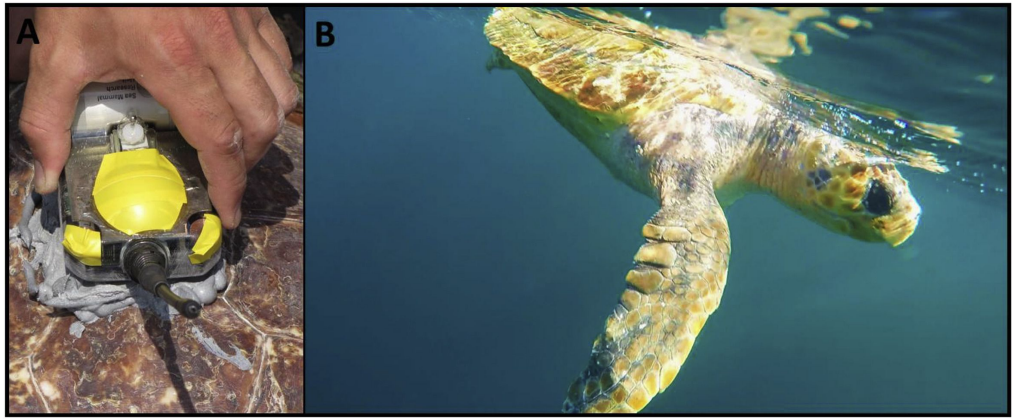
Benefits

- Broader use of model predictions
- Model teams receive additional feedback on model skill
- Potential for stakeholders to generate observations for validation
- New opportunities for model application and model development
- More interest, use, and more support for model development and operations

Stakeholder Needs



Liu Et al. 2019



Patel Et al. 2018

BREAK

11:20-11:35 PM CT

Participants slides

ANNUAL CC CoP ENGAGEMENT PLAN

We have hosted a number of scientific sessions and town halls around coastal coupling and community modeling that have been very well-received. While we have done a good job thus far at engagement, we can do a better job with coordination being transparent and clear on our work and plans for the future as a community. In an effort to accomplish this, this session addresses our first annual engagement plan.

Establishing Ongoing Engagement for the CC CoP

- What we have planned so far (go to Mural)

Establishing Ongoing Engagement for the CC CoP

Other conferences to consider

- ASCE Estuarine and Coastal Modeling conference
- Coastal and Estuarine Research Federation (CERF) biennial conference
- To engage practitioners - consider regional conferences
  - Each IOOS RA hosts an annual meeting involving stakeholders from their region
- Develop a Gordon Conference topic related to coastal coupling
- Association of State Floodplain Managers (ASFPM) conference
- https://icfm2020.org/ - postponed to August 9 - 11, 2021 - we could propose a session
- International Conference on Coastal Engineering (ICCE) - now postponed until July 2022

Establishing Ongoing Engagement for the CC CoP

Other workshops or training opportunities to consider

- Perhaps CUAHSI could put together a workshop on coastal coupling focusing on details of the hydrology models and the coastal models and various approaches to coupling OR a training on tools to access data and set-up the hydrology and coastal models
- Modeling, Prediction, and Sensor Networks for Coastal Flooding along the US East Coast, 8-9 June 2020, George Mason University, Washington DC
- GitHub training
- There are now many online training courses on machine learning from HPC centers
- Considerations for CC COP-sponsored hack-a-thons or code sprints

Establishing Ongoing Engagement for the CC CoP

Other opportunities for students

- NRL is looking for a shared post-doc with GA Tech to couple WRF-Hydro to another coastal modeling system, SHYFEM
- CUAHSI Summer Institute (canceled this year)
- USACE ERDC is always hiring good coastal engineering students for engaging work
- GLERL sponsors summer internships with our Cooperative Institute, CIGLR https://ciglr.seas.umich.edu/opportunities/student-fellowships/
- PhD student at UGA - please see here: http://www.mattbilskie.com/ms-phd-student-opportunity/
- Add opportunities page on the CoP website for students, Postdocs and faculty positions

Meeting Highlights and Wrap-up

Exit Poll

Please take a moment to provide feedback on the meeting to help us improve future engagement activities.

This survey will take less than 5 minutes to complete.

Google Form:
https://docs.google.com/forms/d/e/1FAIpQLSfLsE98--XiwqTi4VI_w7bD-Zb2tUmbu_IS_sQLIQbv6O29TA/viewform?usp=sf_link