Coastal GeoTools 2021

FINAL PROGRAM

CONFERENCE AT A GLANCE

Monday, February 8, 2021

1:00 to 3:00 p.m. Eastern Time

Special Interest Meeting (SIM): Exploring the Application of Digital Coast Tools for Multi-Criteria Analysis and Mitigation of Repetitive Flood Loss
SIM: NOAA Water Initiative and the National Water Model
SIM: Technical Considerations in Applying CMECS: What Tools Are Available?

3:30 to 5:30 Eastern Time

SIM: Mapping Coastal Inundation: Keeping Current with New Data, Tools, and Trends
SIM: High-Resolution Land Cover User Group
SIM: Using OceanReports for Offshore Permitting and Project Planning

Tuesday, February 9, 2021

11:00 a.m. to 12:30 p.m. Eastern Time

Welcome and Keynote Plenary: Building the Digital Coast

1:00 to 2:30 p.m. Eastern Time

Short and Sweet Session: Getting More Done Together
Advances in Mapping Technology and Application
Flood Risk and Mitigation
Tools for Infrastructure Planning

3:00 to 4:30 p.m. Eastern Time

Tools Showcase

4:45 to 5:30 p.m. Eastern Time

Exhibit Hall open to meet with exhibitors

Wednesday, February 10, 2021

10:00 to 10:45 a.m. Eastern Time

Exhibit Hall open to meet with exhibitors

11:00 a.m. to 12:30 p.m. Eastern Time

Plenary: The Importance of Racial Equity and Representation in Coastal Management

1:00 to 2:30 p.m. Eastern Time

Short and Sweet Session: Maps, Modeling, and Automation
National Elevation Strategies
Dredging, Ships, and Data Access
Sea Level Rise Impacts and Adaptation

3:00 to 4:30 p.m. Eastern Time

Short and Sweet Session: Topo, Bathy, and Beyond
Emerging Technologies in Elevation
Sustainable Development
Too Much Water

5:00 to 6:00 p.m. Eastern Time

Trivia Challenge from Coast to Coast

Thursday, February 11, 2021

1:00 to 2:30 p.m. Eastern Time

Short and Sweet Session: Shoreline, Tides, and Change
Mapping: Getting It Done Together
Artificial Intelligence in Mapping and Modeling

3:00 to 4:30 p.m. Eastern Time

Short and Sweet Session: Mapping, Management, and Visualization
Benthic Mapping
Tools for Science-Based Decisions

MONDAY, FEBRUARY 8, 2021

1:00 to 3:00 p.m. Eastern Time

SPECIAL INTEREST MEETING: Exploring the Application of Digital Coast Tools for Multi-Criteria Analysis and Mitigation of Repetitive Flood Loss Properties

You must pre-register to attend.

Repeatedly flooded properties have cost the National Flood Insurance Program (NFIP) more than $12.5 billion—roughly half of the program's $23-billion debt, with losses continuing to trend in the wrong direction. This troubling situation can be influenced through appropriate and timely mitigation by local and state floodplain management and coastal management programs. Analysis of mitigation options, such as buyouts or elevating structures, for repetitive loss properties should be considered in a larger context using a multiple-criteria approach that includes economic, socially equitable, and ecological data and values. Integrating benefit-cost analysis with nature-based and social vulnerability criteria can provide comprehensive solutions that achieve community resilience.

The goal of this special interest meeting is to get participant feedback that would help the Association of State Floodplain Managers, Coastal States Organization, The Nature Conservancy, and NOAA, as Digital Coast Partners, with the following: 1) better apply multi-criteria and geospatial data and tools that exist or could be developed; and 2) develop guidance and training that utilizes these data sets and tools to help local floodplain and coastal managers efficiently compare and prioritize equitable mitigation options aimed at reducing repetitive loss properties.

SPECIAL INTEREST MEETING: NOAA Water initiative and the National Water Model

You must pre-register to attend.

Challenges of too much water, too little water, and water of poor quality are increasing in severity and frequency worldwide. Through new collaboration and strengthened engagement through its Water Initiative, NOAA is working to transform integrated water prediction services. This initiative better supports society's evolving needs for actionable water information for water-related risk, use, management, planning, and security purposes. Central to this effort is the National Water Model, the nation's first continental-scale hydrologic prediction system that simulates and forecasts critical components of the water budget. This session will provide an opportunity to learn about the activities and products of the NOAA Water Initiative under development at the National Water Center, followed by a facilitated discussion to generate new ideas to support, expand, and leverage existing efforts to better address water-related challenges in the coastal zone.

SPECIAL INTEREST MEETING: Applying the Coastal and Marine Ecological Classification Standard (CMECS): Understanding Data, Tools, Technical Limits, and Possibilities

You must pre-register to attend.

The Coastal and Marine Ecological Classification Standard (CMECS) is now undergoing an update as required by the Federal Geographic Data Committee. This update to the standard will be informed and driven by users, who have developed provisional units, identified inconsistencies, and asked for additional guidance where the standard is unclear. While these updates will be primarily driven by physical and biological science, it is important to consider how remotely sensed observational

technologies, both established and emerging, support the new CMECS schema. Early feedback from the user community indicates that some challenges to applying CMECS are related to technological and mapping methods. This special interest meeting will address how commonly available technologies, such as underwater video, grab samples sonar, and active and passive optical imagery, can be successfully used to develop standardized data products.

Presentations will provide a brief CMECS overview and demonstrate how a range of technologies have been used to develop CMECS data at different scales in applied projects. These presentations will address all components of CMECS. Open discussion among the group will explore what levels of the CMECS framework can be reached using different data. Key topics will include, but not be limited to, describing complex observations including co-occurring elements, the use of modifiers, and deciding when observational data should be considered a supplement to actual CMECS units. Best practices for the development of crosswalks to other classification systems and translating existing data into the CMECS framework will also be discussed.

At the end of the session, participants will have an improved understanding about how a given technology can be applied to develop CMECS data, and an understanding of which technology might be necessary for detecting particular CMECS units. The results of the session will be posted on the CMECS forum site, and will be incorporated into technical guidance documents.

3:30 to 5:30 p.m. Eastern Time

SPECIAL INTEREST MEETING: Mapping Coastal Inundation: Keeping Current with New Data, Tools, and Trends

You must pre-register to attend.

This session focuses on the technical components of inundation mapping, including new data and methods for mapping sea level rise and high tide flooding. The session provides an informative, hands-on approach to keeping current with inundation mapping topics, as well as local and national scenarios for potential impact analysis. Technically-driven and informative, this special interest meeting will provide relevant information for both coastal managers and technical mapping staff.

The session will include lectures and mapping demonstrations that are at the core of many of NOAA's coastal products, tools, and services. A brief introductory presentation will provide an overview of updates to climate-related inundation science. Live demonstrations will include the following: 1) Exploring and visualizing elevation data from NOAA's Data Access Viewer and the U.S. Interagency Elevation Inventory; 2) Working with multiple elevation data sets to create seamless DEMs; 3) Using the VDatum online datum transformation tool, and creating tidal surfaces to account for tidal variability in mapping water levels; 4) Incorporating local scenarios into inundation mapping products; and 5) Examining new national high tide flooding thresholds with new products. Participant questions and comments are welcome during the demonstrations to promote an informal live discussion of technical topics.

SPECIAL INTEREST MEETING: High-Resolution Land Cover User Group

You must pre-register to attend.

Current, accurate land cover and change information is a common foundational data set that can be used to address a wide range of issues, from flooding risk and natural infrastructure to policy evaluation and land use planning. Knowing what exists on the ground and how it has changed through time gives planners more information, and the better that data, the better our understanding.

For almost two decades, NOAA's Office for Coastal Management has been producing high quality, standardized, 30-meter land cover and change information for the coastal U.S. through its Coastal Change Analysis Program (C-CAP). More recently, NOAA has been working to establish an operational higher resolution land cover product line, bringing the national C-CAP framework to the local level and allowing for more site-specific, local applications through the production of higher resolution (one-meter) land cover data.

This session will provide an opportunity to learn more about NOAA's high-resolution mapping efforts, application of machine learning and deep learning technology for land cover mapping, implications to data quality and cost, and appropriate uses for this type of high-resolution data. The session will also provide an opportunity to discuss these topics and possible opportunities to leverage one another's efforts.

SPECIAL INTEREST MEETING: Using OceanReports for Offshore Permitting and Project Planning

You must pre-register to attend.

OceanReports is a web-based, automated geospatial tool for analyzing and visualizing U.S. ocean space. It allows users to select or draw an ocean space and instantaneously obtain a neighborhood analysis containing over 65 infographics. The analyses provide in-depth information on energy and minerals, natural resources, industry uses, oceanography, and the ocean economy. Ocean industries such as energy, shipping, aquaculture, fisheries, and seabed mining can use the tool to navigate conflicting uses and environmental considerations, and assess economic opportunity in U.S. waters. Federal agencies can use the tool to assist with National Environmental Policy Act (NEPA) requirements.

This tool has been recognized in the recent Executive Order on Ocean Mapping and by NOAA and BOEM constituents as a critical resource for efficient permitting of mapping, exploration, and characterization activities. Since its release in April of 2019, it has been used by the aquaculture community, coastal zone managers, and educators to understand ocean space and to support siting decisions. NOAA and BOEM are collaborating with the coastal zone management, exploration, mapping, and research communities to continue to assess its utility and compile recommendations for data and application additions or enhancements.

The specific focus of this special interest meeting is to gather information from attendees on how the OceanReports tool can better support their on-the-ground work.

TUESDAY, FEBRUARY 9, 2021

11:00 a.m. to 12:30 p.m. Eastern Time

WELCOME AND KEYNOTE PLENARY: BUILDING THE DIGITAL COAST

GeoTools and the Digital Coast serve as a unifying platform for the members of the geospatial community who work on coastal issues. This plenary showcases the power of this approach, as we hear from the various sectors regarding distinct roles and capabilities and how we come together in new and exciting ways to lead our coastal communities to a more resilient future.

Moderator and Speaker:
Chad Berginnis, Executive Director, The Association of State Floodplain Management

Speakers:
Jeff Payne, Director, NOAA Office for Coastal Management
Katharine Burgess, Vice President for Urban Resilience, Urban Land Institute
Frank Winters, New York Geographic Information Officer and National States Geographic Information Council

1:00 to 2:30 p.m. Eastern Time

CONCURRENT SESSIONS

SHORT AND SWEET: GETTING MORE DONE TOGETHER

Standard Ocean Mapping Protocol

Ashley Chappell and Paul Turner, NOAA Integrated Ocean and Coastal Mapping

The June 2020 National Strategy for Mapping, Exploring, and Characterizing the U.S. Exclusive Economic Zone (at iocm.noaa.gov), calls for federal agencies to develop a Standard Ocean Mapping Protocol in order to facilitate mapping the U.S. Exclusive Economic Zone. The SOMP is intended to guide all participants (federal, state, non-governmental) in mapping data acquisitions and processing to ensure the widest access to, and use of, the data, minimize duplication of effort, and efficiently collect, process, and publish as much data as possible into archives and databases. The SOMP will be a multisystem mapping operations document with an initial focus on ocean mapping 40m and deeper. SOMP-recommended standards, specifications and/or best practices are intended to improve communication, reduce costs, and prevent unnecessary/repetitive work. I will provide an overview briefing of this protocol including the strategic guidance and primary features that will be included.

Canada-United States Elevation Model Collaboration to Improve Tsunami Inundation Mapping

Christopher Amante, Matthew Love, and Kelly Carignan, Cooperative Institute for Research in Environmental Sciences (CIRES); NOAA National Centers for Environmental Information (NCEI)

The tectonic environment, complex physiography, and multi-jurisdictional setting of the Washington State and southern British Columbia (BC) trans-boundary region poses numerous challenges for scientists modeling coastal inundation. Additional challenges include the lack of a seamless, coastal digital elevation model (DEM) that extends across the international border of Canada and the United States and a common framework for modeling cross-border tsunami inundation. To address the issue

of a cross-border coastal DEM, the DEM development group at the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI) collaborated with Ocean Networks Canada (ONC) at the University of Victoria (UVic), BC in providing instruction on coastal DEM development. The two-part DEM workshop was hosted by ONC at UVic for a diverse assortment of geospatial specialists and engineers from the public and private sectors 23-27 September and 21-23 October 2019. This workshop was part of the West Coast demonstration study of the Canadian Safety and Security Program (CSSP) Coastal Flood Mitigation Canada Project, led by Natural Resources Canada (NRCan). The output of the workshop was a coastal DEM for Metro Vancouver, BC, and a portion of northern Washington State. Documentation of the workshop proceedings are also informing Canadian best-practices for coastal DEM development. The Semiahmoo First Nation, a community that spans the international border, has expressed concern on conflicting information about tsunami hazards and risks from the Canadian and United States federal governments. Our collaborative project between Canadian and American scientists and the Semiahmoo First Nation provides a unique opportunity to co-create knowledge on coastal flood risks in the cross-border region. Ongoing collaboration between NOAA, ONC, NRCan, and the University of Washington is focusing on the coordination of tsunami modeling efforts including the establishment of consistent tsunami source events, DEM vertical datums, and spatial resolutions.

At-Risk Farmland and Guidance for Landowners in Vulnerable Areas

Julie Herman, Virginia Institute of Marine Science

This talk introduces a report that was just released entitled “Farm Resiliency Education for At-Risk Coastal Areas in the Chesapeake Bay”. It was a collaborative effort to analyze aspects of agricultural lands that are vulnerable to sea level rise and saltwater intrusion, and to integrate the science with socio-economic aspects. Using GIS land elevations below 10 ft were identified for coastal counties in Virginia. Then land cover and soil data were extracted and summarized to provide the scale of potential impact and dominant soil types. The GIS work was straightforward but the applications are very important, such as assessing nutrient and sediment loss from flooded farmlands. The report also includes a decision tree for conservation planning considerations, a discussion of management approaches for crop production, water quality, and habitat transition, and suggestions of opportunities for implementation of priority activities. The ultimate goal was to provide stakeholders with a pathway for improved decision making to enhance the economic and ecological outcomes on vulnerable lands. The methodology and guidance are transportable to others areas. Contact us if you’re interested!

Coastal Restoration Online Tooklit for the Non-professional

Elsa Schwartz, Restore America's Estuaries; Dawn Spilsbury Pucci, Spilsbury Data/Drone Services

Staff at public agencies and non-profit organizations often receive phone calls or grant applications from individuals outside the professional restoration community (e.g. NGOs, municipalities, or individuals) who have a sincere desire to restore local habitats, but have difficulties figuring out where to begin. Restore America's Estuaries has developed an online "Toolkit" to support coastal residents and citizen scientists who identify problems with their local coastal environment and have an interest in transforming the idea into a project. The Toolkit enables community members who aspire to improve their local ecosystem, but who need the information and guidance to go from project idea, to design, to implementation. This talk will describe the process we went through to develop this tool, including listening sessions and focus groups around the country, and will give a demo of the online toolkit, going through the different elements and modules and describing how it can be used to further restoration projects. www.restoreyourcoast.org

If You Build It, They Won't Come (Probably)

Wes Shaw and Chris Rae, Blue Urchin LLC

"If you build it, they will come." It may have worked for Kevin Costner when he replaced his corn field with a baseball diamond in Field of Dreams, but the world of coastal resilience is littered with cool apps that never really gained traction. Over the past eight years, we've helped "launch" MyCoast (an app/website for collecting coastal geo-data like storms damage, king tides, marine trash/debris, abandoned boats, and storm surge) in a dozen states. Yet five of the states account for more than 95% of the 11,000 reports submitted. What gives? We've dug into the data we've collected and will talk about what has worked, and what hasn't, when it comes to engaging people using the general public to gather geo-data. Many of our findings tie to outreach techniques — emails? social media? conferences? schools? in-app alerts? ¬— but we'll also explore how an unsolicited article in a publication can sometimes, and sometimes not, spike participation. We'll discuss super-participants — the people who consistently report on whatever you're working on, week after week, month after month, year after year. How do you find them, and how do you keep them? Since we have no pride, we'll not only share our victories, but also our failures: the efforts we poured loads of days into with little to no result. Our goal is that you'll complete the presentation with a better idea of how to best use your limited time and resources to get the engagement results you want with technology in citizen science, whether that's gathering more data or just getting and keeping the public involved in your coasts.

Inundated with Models: Using the best of the Many Hurricane Sally Flood Models to Make Decisions

Catherine Bohn, Dewberry

Even before Hurricane Sally made landfall, there were flood inundation models created to predict where the surge and riverine flooding might occur. After the hurricane, post-event models were developed to represent the actual flood extents. This presentation will show how the flood models from the U.S. Army Corps of Engineers, the Pacific Northwest National Laboratory, and the Federal Emergency Management Agency were used to inform decisions throughout the emergency management lifecycle. Specific focus will be on how the models compared in area, resolution, extent, across estimated inundation depths, and how using different building footprints to provide situational awareness can give different answers.

Advances in Mapping Technology and Application

Drone-Based Citizen Science for Monitoring Coastal Hazards throughout the Great Lakes of North America

Ethan J. Theuerkauf, Lucas Rabins, Erin L. Bunting, and Elizabeth A. Mack, Michigan State University

Documenting the impacts of coastal hazards over large spatial and temporal scales is a key component of proactive coastal management. These data can be difficult for singular research teams or agencies to acquire for large regions and on short time scales (e.g. before and after storms). Citizen science presents a solution to this challenge by utilizing local teams to collect these data frequently across a broad region. While citizen science coastal erosion monitoring programs exist throughout the world, none have utilized drones. Drone-acquired imagery and the derived products (e.g. DEMs and orthomosaics) have become one of the primary tools that coastal researchers use to document and study change. Training citizens to generate these data using consumer-grade drones expands the spatial coverage of these data and empowers communities to make data-driven and proactive

management decisions. Here, we present the framework and initial findings from a National Science Foundation-funded project aimed at developing a drone-based citizen science coastal monitoring program in the Great Lakes region. In January 2020, the Interdisciplinary Citizen-Based Coastal Remote Sensing for Adaptative Management (IC-CREAM) program was established in Michigan. Within this program, citizen scientists are trained to become FAA-certified drone pilots and to collect drone-based imagery to generate DEMs and orthomosaic images. Currently, two monitoring sites have been established in the Upper Peninsula of Michigan and an an additional four sites will be established in the Lower Peninsula in 2021. Initial data collections by the citizen scientists have shown that with basic training, they can generate research quality data (<10cm horizontal and vertical accuracy DEMs, <5cm/pixel orthomosaics). These data reveal dramatic changes to coastal morphology in response to high lake levels, storm events, and human disturbance. The initial set of surveys also highlight the importance of baseline data collection, such as ground control points, for generating high-resolution data.

SFM, Lidar, and GIS to Evaluate Hurricane Impacts

Kelsi Schwind, Michael J. Starek, and Jake Berryhill,Texas A&M University Corpus Christi; Megan Lamb, Apalachicola National Estuarine Research Reserve; Eve Eisemann, U.S. Army Corps of Engineers

The impacts of Hurricane Michael on Little St. George Barrier Island off the coast of Apalachicola, Florida were evaluated by integrating structure-from-motion (SfM) data, airborne topobathymetric lidar-derived data, and GIS techniques. High-resolution UAS imagery of a barrier island was obtained prior to the impact of Hurricane Michael in July, 2018. SfM photogrammetric techniques were used to generate a point cloud from the imagery. A 1 m digital elevation model (DEM) generated from topobathymetric airborne lidar collected by the US Army Corps of Engineers (USACE) following the landfall of Hurricane Michael in October 2018 was obtained for the study. GlobalMapper was then used to filter the SfM point cloud and generate a 0.1 m resolution DEM. The impact of Hurricane Michael on the barrier island was then evaluated by importing the USACE DEM and using the Combine/Compare Terrain Layers and Measure Volume Between Two Surfaces tools in GlobalMapper. An accuracy assessment was also conducted in the GIS to evaluate the vertical accuracy of the SfM DEM compared to that of the airborne lidar.

Considerations for Push Broom Imagery Approach to Shoreline Mapping

Benjamin Downey, Fugro

When Hurricane Harvey swept the coast of Texas it left massive flooding that changed the lay of the land. Without up-to-date imagery and shoreline delineation, the extent of flood and storm surge damage to the existing shoreline were unknown. To accurately update the national shoreline post Hurricane Harvey, the National Oceanic and Atmospheric Administration (NOAA) National Geodetic Survey (NGS) tasked Fugro with acquiring 30cm orthoimagery along the Gulf of Mexico in Texas. Fugro recommended a Leica ADS push broom sensor approach given the size of the area and complexity of the project. Although unconventional for NGS, the push broom approach would reduce control points and processing hours, while increasing consistency of near-shore data products as compared to a traditional frame approach. The precise radiometry of the push broom imager would also ensure a more accurate integration with existing lidar and bathymetry provided by NGS. The success of the project resulted in a recommendation from NOAA for the implementation of a push broom approach on specific future contractor led projects. This presentation will detail the methodology of frame vs push broom sensors for shoreline mapping and detail considerations for effective shoreline delineation on post hurricane imagery.

Near Real-Time TPU Calculations

Nathan L. Hopper, Ph.D., Project Manager/Lead Scientist, Geospatial, Maritime Solutions, Woolpert

Woolpert's Maritime Research team is designing and testing a framework that will collect, process, and display Total Propagated Uncertainty (TPU) in near real-time to the operator for decisions regarding data quality during collection. Standard TPU models can consist of up to 17 parameters while some are precomputed, others must be captured and calculated during acquisition. By leveraging advancements in distributed computing platforms such as NVIDIA® CUDA® Graphics Processing Units (GPU), a high-performance GPU accelerated TPU calculation from multiple channels, each creating thousands of waveforms per second is achievable, reliable, and hopefully useful.

FLOOD RISK AND MITIGATION

Leveraging Local Data for Better Floodplain Management

Susanna Pho and JT White, Forerunner

As planning around hazards in our floodplains grows more and more complicated with new developments and changes in climate, municipalities have increasingly turned to data analytics to enable better floodplain management. For those communities, hazard modeling and analysis has the potential to enable both better planning and better resident engagement. While exposure data and predictive models can be immensely informative, they are often missing granular on-the-ground information measuring the local impacts of flooding. Accurate data around the built reality of a community's building stock has historically been difficult to come by at scale, but local municipalities are uniquely positioned to collect it through permits like Elevation Certificates (ECs). When aggregated, information contained in ECs can be utilized to make better decisions around mitigation investment and land use planning or to enable more targeted outreach to residents. Unlocking this dataset can be tricky – operational capacity, document management, digitization, and analysis can all pose challenges. This presentation will outline how Forerunner's elevation certificate extraction and mapping features utilize machine learning and web-based software to mobilize EC data for local municipalities. We'll use case studies from our work to outline potential applications of EC datasets for purposes ranging from planning to community risk education, as well as how these applications might be deployed. We'll also discuss how EC data can be utilized to predict elevations for properties without data and how digitization can enable programmatic compliance checking. The presentation will include technical insights and discuss challenges to implementation as well as transferrable lessons learned.

Probabilistic Calculation of Average Annualized Loss of Coastal Residential Buildings

Joel Plummer, Dewberry; Michael Onufrychuk, AECOM

The Federal Emergency Management Agency (FEMA) is currently exploring data and tools that can help provide an improved understanding of flood hazards and associated risks. This evolution necessitates the investigation into a more comprehensive risk analysis. Current floodplain products are largely binary in nature – with structures designated as being either "in" or "out" for a single flood frequency (1-percent annual chance). To provide a more complete picture of flood risk, metrics such as Average Annualized Loss (AAL) can be employed. AAL is a metric that represents a structure's flood damage risk to a wide cross-section of flood frequencies. The metric is calculated using input flood elevations, depth damage relationships, and building specific attributes. As opposed to binary products, AAL can provide community stakeholders the ability to identify relative severity of different flood events, target locations for mitigation action, and serve as a basis for benefit-cost analysis. AAL is typically calculated using a limited set of storm frequencies (e.g., the 10%, 4%, 2%, 1%, and

0.2% annual chance conditions) which represent a small portion of the actual event probability space. Wave effects are frequently ignored. To address these limitations, a new approach was developed using open source software to quantify risk at coastal residential structures using a Monte Carlo simulation of random, probabilistic, storm events. This effort is a modular approach, allowing users to interchange various building, surge, wave, and depth-damage datasets. In this framework, risk at each structure can be quantified by an Annual Exceedance Probability, enabling a shift from binary to probabilistic risk, as well as an AAL calculation that better represents the full range of site-specific flood hazards. Our presentation will provide an overview of this coastal AAL tool, sensitivities to approach and assumptions, as well as lessons-learned from the study effort.

Applying First Floor Elevation Data to Coastal Flooding Vulnerability

Ashley Gordon and Benjamin McFarlane, Hampton Roads Planning District Commission

Individual local governments and the regional planning organization, the Hampton Roads Planning District Commission (HRPDC), are working to address the current and potential impacts of coastal flooding and sea level rise in the Hampton Roads region of southeastern Virginia. A key component of assessing structural vulnerability is building finished first floor elevation (FFE). However, this information has not been widely available in the Hampton Roads region. To address this data gap, the HRPDC has undertaken a multi-year project with funding from the Virginia Coastal Zone Management Program and NOAA's Office for Coastal Management. To improve access to existing FFE data, a geodatabase containing key measurements from local elevation certificates was developed, which now includes approximately 4,000 elevation certificates and covers 12 communities. This database was used to inform predictive Random Forest models that incorporate building attributes to estimate first floor height (FFH), the metric required for FEMA Hazus flooding vulnerability analysis. These local FFH estimates were applied in a flooding vulnerability assessment using the FEMA Flooding Assessment Structure Tool (FAST). To compare changes in damage estimates, Hazus default FFH estimates were applied separately. Flooding scenarios included the 1% annual chance flood plus 1.5 ft and 3ft of sea level rise to account for future conditions. The findings suggest that flooding damage estimates are highly sensitive to changes in FFH values and highlight the importance of detailed building attributes in flooding vulnerability assessments. Through coordination with academic and government entities, recommendations for FFE data management and applications for local governments continue to be developed. The final database products and insights gained through this effort will support the next update of the Hampton Roads Hazard Mitigation Plan and future coastal hazard vulnerability assessments.

A Community Flood Notebook: Gilbert White Meets Crowdsourcing

Jeff Stone, GISP, CFM, ASFPM Flood Science Center

Dr. Gilbert White, considered the father of floodplain management, created the "Boulder Creek Flood Notebook" as a research program aimed at emergency managers to report, in a timely fashion, the extent of loss of life, property damage, social disruption, and environmental destruction associated with historic flooding on Colorado's Boulder Creek. Every year individuals use their smartphones to take thousands of digital photos of flooding whether it's part of their job or because the flood is directly impacting their community or property. These photos are often shared on Facebook, Flickr or in news stories, but just as often, these photos are subsequently lost once the next big flood event or news story comes along.

The Community Flood Notebook platform being developed and researched by ASFPM's Flood Science Center, would allow communities to harness the crowdsourcing capabilities of mobile devices to engage the public to document flood events. The Notebook would provide a standardized,

comprehensive platform for storage and retrieval of flood event data by the public in partnership with local professional staff including floodplain and coastal managers, planners, and emergency managers. Data could be collected before, during and after a flood and may include, but is not limited to geolocated photos, hydrographs, precipitation maps, river/tide gauges, videos and high water marks. Communities would create a unique "Flood Event" for each flood that impacts their community. Over time, a collection of events would be archived, supporting the community's institutional memory, hazard mitigation planning and flood risk communication efforts to name a few, all aimed at using information on past floods to reduce future flood losses.

This presentation will highlight the gaps in existing tools and data collection, share examples and opportunities for a standardized, integrated approach and demonstrate a prototype version of the Community Flood Notebook.

TOOLS FOR INFRASTRUCTURE PLANNING

Thinking Beyond Flood Maps: Using FEMA Coastal Data to Reduce Risk and Build Resilience

Peter Herrick, Jr., Federal Emergency Management Agency; Lisa Foster, CFM, Pinellas County, Florida

Coastal communities across the nation are using flood risk data in powerful ways. To tell these stories, the Federal Emergency Management Agency (FEMA) and community partners developed the "Thinking Beyond Flood Maps" story map. This accessible online resource explores how several diverse coastal communities are using datasets and products developed during FEMA's coastal flood risk studies for long-term planning, stronger building codes, risk awareness and education, and other innovative efforts. The objective is to inspire other communities to use flood risk data to reduce risk and build resilience. FEMA will co-present this session with Pinellas County, Florida where an innovative, targeted, and multi-faceted flood risk outreach and education program has increased flood risk awareness across a variety of local stakeholder groups. Partnering with the Pinellas Realtors Organization, floodplain managers in Pinellas County have provided training on flood map basics, flood insurance concerns, and floodplain development to hundreds of local real estate professionals. After participating in the training, realtors are better equipped to help give home buyers the information and background they need to understand their flood risk and make informed decisions. Join us to explore how your community can use FEMA's coastal data to build resilience and how partnerships can be leveraged to amplify these efforts.

Assessing and Mitigating Risks to your Coastal Stormwater System: NOAA Decision Support Tool

Ken Hunu and Stephen Bourne, Atkins North America, Inc.; Joshua Murphy, NOAA Office for Coastal Management

Rising sea levels and the changing frequency and size of extreme storm events will have a significant impact on coastal cities as the century progresses. In November 2018, the National Oceanic and Atmospheric Administration (NOAA) Office for Coastal Management released Version 1 of the Adapting Stormwater Management for Coastal Floods product. This web-based self-guided training resource was developed to provide tools and methods for coastal communities to assess the ability of their stormwater management system to effectively operate during current and future coastal flooding events, and facilitate linkages to actions they can take to address related issues. This presentation will take a look at the tool's analytical methods for 1) estimating the total water levels communities can expect and 2) estimating the potential impacts higher water levels will have on their stormwater systems. In designing stormwater facilities, a key concept is that of the "design storm."

This is an extreme storm that the modeler simulates with proposed storm control structures in place, to ensure that floods will be controlled. In the case of coastal communities, the design storm is more complex. Instead of a single rainstorm, the design storm includes multiple concurrent events that combine to influence sea level as well as overland flows. Specifically, these events include tides, storm surges, regional and seasonal phenomena such as El-Nino, wave set-up and run-up, sea level rise, and in-land rainstorms. Within the tool, three levels of analysis are proposed: Basic, intermediate, and Advanced. The methods within each level range from heuristic approaches that a planner or engineer can do with hand calculations and publicly available websites to complex numerical models that require significant skill and computational resources to use. While the detail, degree of complexity, accuracy, and development cost increase with each level, the degree of uncertainty in the results decreases.

Culvul: Culvert Vulnerability Assessments with the Wisconsin Coastal Management Data Infrastructure

Emma Cutler, Wisconsin Coastal Management Program; Ann Buschhaus, Wisconsin State Cartographer's Office; Jim Giglierano, Wisconsin Department of Administration

Extreme precipitation events hit northern Wisconsin in 2012, 2016, and 2018, causing widespread damage throughout the region. In response, the Wisconsin Coastal Management Data Infrastructure (WICDI) emerged to provide data, tools, and training to coastal communities. With an initial focus on culvert datasets in the Lake Superior region, WICDI is coordinating a hazard mapping community of practice and cloud-based collaborative support environment. This talk will cover some of the data products and analysis that the WICDI team has developed to support culvert flood vulnerability assessments, beginning with a collaborative process for creating hydro-enforced digital elevation models (heDEMs). I will discuss our process and motivation for creating heDEMs and how we are using them for statistical flood vulnerability analyses. Throughout the talk, I will also touch on challenges we have encountered, including the availability of existing data and tools, the physical geography of northern Wisconsin, and the COVID-19 pandemic, as well as how we addressed these obstacles.

Disaster Management and Visualization of Spatial Data: USGS Event Support Maps and Multi Agency High Water Mark Planning Dashboard

Lance Clampitt, Chris Cretini, and Xan Fredericks, U.S. Geological Survey

The U.S. Geological Survey (USGS) Geospatial Information Response Team (GIRT) is responsible for coordinating, communicating, and providing access to spatial information during a hazard event, such as a hurricane, flood, or earthquake. The Event Support Map (ESM) is used by the USGS GIRT to facilitate operations and to support situational awareness and resource management for the Bureau and the Department of the Interior. ESMs support a timely response to and mitigation of natural hazards and provide critical information about the Earth and its processes. Placing information, such as links to high-resolution elevation data portals, imagery, and potential flooding hazards in a “one-stop” access point is key in supporting community resiliency and sustainability and safety during a response. Additionally, the USGS has collaborated with the National Oceanic and Atmospheric Association (NOAA) and the US Army Corps of Engineers (USACE) to create a Multi Agency High Water Mark Planning Dashboard to aid in cooperative collection of high water marks post-event, when applicable. This presentation will include an ESM and Multi Agency High Water Mark Planning Dashboard demonstration showing how response data, as well as base USGS National Geospatial Program Data and information, are leveraged to plan, coordinate, and collect post-event data that document the impact of natural disasters, while supporting mitigation. https://esm-usgs.opendata.arcgis.com/.

3:00 to 4:30 p.m. Eastern Time

TOOLS SHOWCASE

Assessing Climate Change Impacts on the Port of Prince Rupert with SeaPort Simulator

Stephen Bourne, Atkins

Sea level rise and climate change will have ranging impacts on global ports. Locally, rising tides and intensifying storms will steadily increase disruption. Globally, additional disruptions along the cargo flow-paths will come into play: tropical cyclone impacts on shipping lanes; heatwave impacts on rail buckling; cold-snap impacts on the number of cars that trains can carry; winter-storm forced changes in landslide activity; socio-political protests blocking rail tracks. Through a grant funded by Transport Canada's Transport Asset Risk Assessment (TARA) program, the Prince Rupert Port Authority (PRPA) is quantifying potential disruption from 2020-2050, and exploring ways to mitigate and adapt. Utilizing Atkin's SeaPort Simulator tool, a team from SNCL/Atkins is working with PRPA and multiple Canada and US-government data curators to create a digital port that simulates all import and export cargo flows. The goal is to quantify total disruption in cargo flows caused by the various disruptions at play. Creating the digital port has included a LIDAR flight, which was used to create a port-wide facilities layer of high-detail 3D buildings (multi-patches). This layer is being used to estimate facility-specific tidal inundation on an hourly basis in the simulation. The simulation is driven by a daily gage-specific total coastal water level forecast. The forecast incorporates 1) projected local sea level rise over the simulation time frame, 2) harmonic tide predictions, and 3) predicted tide level residuals based on historic tides plus projected changes in regional winds from general circulation models (GCMs). To better project facility-by-facility tide levels around the coastline, a finite volume coastal ocean model (FVCOM) is used to transform projected tide levels at the gage to the full port coastline. Further sub-projection modules simulate climate change-influenced tropical cyclone activity, along-rail snow-pack and flood, and potential socio-politically-driven rail blockages. Results to date will be presented.

Beach Profile Web Application

Jessica Boynton and Sam Nyarkoh, SCDHEC OCRM

The South Carolina Department of Health and Environmental Control, Ocean and Coastal Resource Management (DHEC - OCRM) office has released an enhancement to its Beach Erosion Research and Monitoring (BERM) web application. Since the late 1980s, the Coastal Program has annually collected topographic and bathymetric data at over 400 beach profile locations along the South Carolina coast. Using ESRI's ArcGIS API for Javascript and ArcGIS for Server, the BERM web application allows users to visualize and download beach profile data. Users can view a single year or multiple years simultaneously. This year, OCRM increased the functionality of this application by adding a volume calculation tool. This tool allows users to calculate the volume of sand between two points on a profile. Analysis of the beach profile data allows viewers to examine beach dynamics and variability over time, and to identify erosional and accretional areas.

A 3-D BioMapper for Kachemak Bay, Alaska

Ken Buja and David Moe Nelson, NOAA National Centers for Coastal Ocean Science

We developed a web-based, 3-D mapping application that provides the public access to geospatial products for the shoreline, intertidal, and subtidal areas of Kachemak Bay, Alaska. The application is part of the NCCOS BioMapper, an online tool that allows users to interactively access and view benthic habitat maps, aerial and acoustic imagery, underwater video, ground validation sites, and other spatial

data. The results of these efforts are providing resource managers, scientists, and the public increased understanding and technical capacity for ocean exploration, management and stewardship.

The Northeast Ocean Data Portal: Data and Maps for Ocean Planning

Jenna Ducharme, Kelly Knee, Jeremy Fontenault, and Stephen Sontag, RPS; Emily Shumchenia and Nicholas Napoli, Northeast Regional Ocean Council; Peter Taylor, Waterview Consulting; Marta Ribera, The Nature Conservancy

The Northeast Ocean Data Portal (Portal) was established in 2009 as a centralized, peer-reviewed source of data and maps of the ocean ecosystem and ocean-related human activities from New York through the Gulf of Maine. For nearly 12 years, the Portal has been used to support regulatory, management and business decisions, stakeholder engagement, and educational and research activities. Users can launch interactive thematic maps, view any combination of layers using the data explorer, share maps, and download data. Recent updates to the portal provide examples of the partnerships with government agencies and the private sector that result in authoritative spatial data products including:

- Collaborating with the Bureau of Ocean Energy Management (BOEM) to update energy and infrastructure datasets and theme maps, including ongoing updates to offshore wind lease area information and offshore wind projects.
- With the Mid-Atlantic Ocean Data Portal, adding Communities at Sea data, developed by linking Federal Vessel Trip Report (VTR) data with vessel permit data, showing linkages between fishing communities and the fishing places that are most important to them.
- New vessel traffic (AIS) data for 2018 and 2019, in partnership with the Marine Cadastre and US Coast Guard.
- Collaborating with the New England Fishery Management Council and USGS to add data products that estimate the effects of various fishing gears on seabed habitats and depicting the forces of ocean waves and currents on the seabed.
- Enhance Data Explorer functions, based on user feedback, including: restructuring menus, improvement of the 'identify' tool, clickable Table of Content categories to allow easier navigation, additional basemaps, and enhanced time slider functionality.

The tools showcase will allow participants to virtually meet members of the Portal Working Group, explore the portal, and provide an opportunity for participants to and ask questions about, gain an increased understanding of the available data, tools, potential uses in management and decision-making, and plans to update/maintain the Portal in the future.

Trident's Toolbox: Software for Multi-method Space-Based Coastal Surveying

Kyle Goodrich, Ross Smith, and Caroline Aguilar, TCarta Marine

TCarta Marine's Project Trident, a National Science Foundation Small Business Innovation Research (SBIR) grant, now in Phase 2 has focused on the integration of multiple methods for deriving water depths from space-based sensors and automating these processes through machine learning. Now entering the second year of the program TCarta has produced a suite of hydrospatial analysis tools to remotely survey coastal environments globally using space-based sensors. Trident's toolbox includes a variety of Satellite Derived Bathymetry tools built within Esri ArcPro to access and process multispectral imagery to produce bathymetric surfaces. The system is optimized for operations on any multispectral imagery source and to operate on both freely available imagery from Sentinel 2 A/B or

Landsat, on commercial high resolution imagery from WorldView or Planet or aerial imagery allowing users to utilize a wide variety of data sources for coastal mapping. In combination with TCarta's ICESat-2 data extraction software to produce space-based laser bathymetry depths for in situ and calibration, these tools provide a completely remote workflow to survey coastal waters using modern satellite imagery and calibrated using space-based laser bathymetry. Trident's toolbox provides a flexible approach to deploy numerous techniques and SDB derivation methods within one integrated toolset. With an easy to follow workflow, tooltips, best practises these tools are designed to make the user experience straight forward and simplified. After a built in QA assessment and accuracy assessment, the resulting bathymetric surfaces can be exported from ArcPro to S-102 bathymetry surface compliant layers included export to Bathymetric Attributed Grid (.BAG) format for ingestion into a data management system or for onwards analysis including survey planning, coastal modeling and environmental analysis. This Tools Showcase will showcase these integrated coastal software tools and demonstrate the applicability of the resulting bathymetry data on real-world examples in U.S waters.

Safer NOAA Diving through GIS Application

Analise Keeney, Ashley Miller, Karen Kavanaugh, and Rachel Krasna, NOAA CO-OPS; Joshua Fredrick LTJG NOAA, supporting CO-OPS; Caitlin Guiren, NOAA CO-OPS, Kris Kirby, and Patrick McGovern, NOAA CO-OPS

Divers in the Field Operations Division (FOD) of NOAA's Center for Operational Oceanographic Products & Services (CO-OPS) face a number of risks each time they enter the water. Diving is routinely required to perform scheduled and emergency maintenance within our vast network of water level and current meter sites. Each body of water is unique, and unfortunately, some have contaminants due to oil spills, harmful algal blooms, heavy metals, and toxic chemical releases, which are known to inflict both acute short-term, and chronic long-term effects. Preparing a safe dive also means scouting for critical local resources like U.S. Coast Guard stations, well-equipped emergency rooms, and hyperbaric chambers. All variables are carefully assessed to determine where CO-OPS is able to dive safely, what level of personal protective equipment is necessary, or if the dive should be supported by external dive units. The NOAA CO-OPS Safe Diving Web App is a decision support tool allowing divers to complete in-depth desktop reconnaissance using a variety of data and sources within a single map. This tool integrates a network of interagency risk preparedness and mitigation information, incorporating both recent and historical data sets for efficient assessment in real-time. Already in active use within NOAA's National Ocean Service (NOS), collaboration has been achieved by integrating data from map services supported by the NOAA Corps and the Environmental Protection Agency (EPA). Together, the team has developed a NOAA GeoPlatform-based infrastructure for potential application across the agency, enabling divers to uphold the highest safety standards to perform their mission-essential duties.

A Spatial Bibliography for the Deep Waters of the Alaska Exclusive Economic Zone

Jennifer Le and Adrienne Copeland, NOAA Office of Ocean Exploration and Research; Ken Buja and David M. Nelson, NOAA National Centers for Coastal Ocean Science

The NOAA Office of Ocean Exploration and Research (OER) is the only federal agency solely dedicated to exploring the deep sea (greater than 200 meters water depth). OER partnered with the NOAA's National Centers for Coastal Ocean Science (NCCOS), which delivers ecosystem science solutions for stewardship of the nation's ocean and coastal resources, to create a spatial bibliography of scientific publications and technical reports (from 2000 to 2020) for the deep waters of the Alaska Exclusive Economic Zone to help inform potential future fieldwork in the region. First, an annotated bibliography (https://repository.library.noaa.gov/view/noaa/27087) with over 300 references

published within the last twenty years was compiled in collaboration with the NOAA Central Library. Each reference was then evaluated for relevant information on academic discipline, geographic region, sampling methods, and collected data types. Finally, these evaluation data and Alaska regional shapefiles were imported into ArcGIS Pro to create a map service on the NOAA GeoPlatform, which was used in a JavaScript application to create a spatially-explicit website with multiple query functions. The original purpose of the spatial bibliography was to help identify scientific data and knowledge gaps, as well as unexplored and underexplored areas in the Alaska region. However, it can be used more broadly to support other scientific and environmental management goals by providing geospatial research context to decision-makers in all sectors. The spatial bibliography also highlights the effectiveness of leveraging partnerships between NOAA programs to create useful products.

2 if by Sea, 3 if by Cloud . . . Modernizing AIS Dissemination

Ken Logsdon, Jr., Dewberry; Dave Stein, NOAA Office for Coastal Management; Daniel Martin, CSS at NOAA Office for Coastal Management; Christine Taylor, BOEM; Sid Pandey, Seth Lawler, and James Parker, Dewberry

Under the Marine Cadastre Project, the National Oceanic and Atmospheric Administration (NOAA) and the Bureau of Ocean Energy Management (BOEM) are building a new modern system that provides public access to the U.S. Coast Guard's Automatic Identification System (AIS) vessel data in a cloud-based and map-centric platform. Users will continue to access AIS data via MarineCadastre.gov but now use a modern geospatial viewer to locate and select areas of interest, then download custom data orders within date ranges. The platform's visioning and architecture was completed by Dewberry in May 2020 to include custom data orders that reflect specific areas of interest and time periods. The backend Azure cloud environment is a first for NOAA and serves as a roadmap for migrating other applications off-premise for improved data management in the cloud. NOAA and BOEM will be able to support more frequent, quarterly AIS updates. Full implementation is expected in Q2 2021. Because the project is implemented using an Agile development approach, this presentation is an opportunity to see the system mid-development and offer feedback.

Analysis and Visualization of Ocean Resources in the Context of Offshore Wind Energy Development

Erik Martin, Marta Ribera, Mark Anderson, Sally McGee, Chris McGuire, and Chris Bruce, The Nature Conservancy

There is an increased focus on the development of commercial offshore wind energy sites along the US Atlantic seaboard. While this low-carbon energy source may be key to reaching our renewable energy goals in the future, The Nature Conservancy (TNC) wants to ensure that the siting, construction, and operation of wind energy development offshore is done with the environment in mind, taking into consideration key species and habitats. We believe one way to do that is to provide the best scientific information to stakeholders to guide the planning and review process. To support this objective, a decision support tool (DST) has been developed by TNC with funding from the Gordon and Betty Moore Foundation and the VA CZM program. The DST is designed to help planners, regulators and others involved in offshore wind energy development easily access and interpret the voluminous data that is available along the Atlantic seaboard for marine species and habitats. The DST allows users to enter an area of interest (AOI) by uploading a shapefile, sketching a polygon, or selecting from a set of pre-defined areas. The tool then produces a report which provides summary information on potential "red flags," or features of particular import to wind development in that location, as well as summary information for habitats and species groups. Users can then drill down further to species-specific data and link out to source data available on the Northeast and Mid Atlantic Regional Ocean Data Portals. The full process of designing and implementing this tool is guided by a

steering committee of potential users and experts. The DST was developed using vector tiles and client-side geoprocessing for provide a smooth and responsive user experience. The presentation will include a walk-through of the tool and an opportunity to ask questions about the DST.

Utilize ArcGIS GeoPlanner to Design and Plan Activities

Charmel Menzel, Esri

Learn how the ArcGIS GeoPlanner webapp is used to describe a study area or assess suitability through a collaborate, iterative environment. Options with GeoPlanner include using analysis tools with geographic data to understand opportunities and risks in an area, or measure the impact of your design using key performance indicators (KPIs). The ease of running spatial analysis on the fly, comparing scenarios and sharing data-informed plans using real-time dashboards will be highlighted.

Digital Storytelling to Socialize Virginia Beach's Comprehensive Program for Addressing Sea Level Rise and Recurrent Flooding Risks

Alaurah Moss and Johanna Greenspan-Johnston, Dewberry

The City of Virginia Beach has completed a comprehensive study effort to develop integrated strategies to address the threat of future flooding. This study, known as "Sea Level Wise", has produced a wealth of information to understand what challenges the City will face and develop diverse strategies to pro-actively reduce the impacts. The study and process is a model for other localities, including citizen science and outreach, tailored strategies for different facets of the City, and many other new/best practices. To further bolster socialization of the Sea Level Wise Strategy, digital ArcGIS StoryMaps were developed to provide an engaging and simple process to communicate study outcomes to diverse stakeholders. The Sea Level Wise StoryMap Collection was developed using ESRI's next-generation digital storytelling software. Development was aligned with the more detailed Sea Level Wise Adaptation Strategy report, with five individual StoryMaps to provide users with a step-wise walkthrough of the comprehensive program. The product provides an interactive mix of narrative, graphics, and interactive maps to provide users with an understanding of Virginia Beach's motivation, challenges, and strategies to address the issue. Five individual StoryMaps were bundled together into a collection to guide users through the full story. "Getting Sea Level Wise" documents flood impacts across the City, giving users a stronger sense of place and need for action. "Understanding Flood Risks" explains anticipated future conditions and allows users to interact with mapping, economic flood risk, and habitat impact data, while exploring other compounding factors. "Adaptation Framework" provides a vision map for the integrated strategy, encompassing nature-based, engineering, planning, and educational opportunities. "Watershed Strategies" transports users to specific applications of the strategies across the City's diverse landscape using maps and artistic renderings. Lastly, "Path Forward" uses icons and links to explain the roadmap for how the City will implement the program.

Forerunner: The Floodplain Management Platform for Resilient Communities

Susanna Pho and JT White, Forerunner

Communities have a wealth of information that can help them plan around floods, but it can be hard to access. Additionally, obtaining it is only half the battle - it can be equally difficult to use it to answer questions or address specific needs. Forerunner is integrated software that address the challenges of obtaining and deploying flood risk data: our extraction tool activates static permits, our flood analysis platforms enable communities to contextualize flood risk information in decision-making, and our compliance tools help communities enforce development regulations. By making granular data more accessible using web-based tooling, Forerunner streamlines floodplain management, compliance, and outreach for partners ranging in geography and scale from Ocean City, NJ to Harris County, TX.

Tools for Remote Communication and Coordination of Large Lidar Acquisition Projects

Alexa Ramirez, Quantum Spatial

In 2018, several large storms made landfall on the US and its territories. Quantum Spatial was tasked with collecting topobathymetric lidar and imagery data over 9,000 square miles of coastline covering areas impacted by Hurricanes Michael (FL), Florence (NC), and Typhoon Yutu (Guam). Completing this required partnership with four other companies resulting in the need to coordinate and communicate between up to 9 aircraft throughout the duration of the acquisition phase. To manage this dispersed team and provide constant updates to the client, QSI developed an acquisition management tool called Q-AURA (QSI Acquisition Update and Review Application). Q-AURA utilizes an ESRI Story Map with embedded dashboards to track daily field measurements, sensor operator notes, and completed acquisition for both lidar and imagery acquisition. Data within the dashboards were updated daily using a combination of automated and manual processes. In addition, Q-AURA provides a mechanism for the client to review and comment on draft bathymetric raster products to approve the collections for further development.

Climate Central's Coastal Risk Screening Tools

Dan Rizza and Kelly Van Baalen, Climate Central

Get a walkthrough of Climate Central's Coastal Risk Screening Tools for exploring and communicating sea level rise and coastal flood risk, including our:

- **Map By Year**: This map allows users to explore coastal flood risk and sea level rise projections by decadal year for anywhere in the world, and under multiple pollution scenarios.
- **Map By Water Level:** This map allows users to explore what land is at risk from specific water levels (decimal feet, meters) that could be reached through combinations of sea level rise, tides, and storm surge.
- **Affordable Housing Map:** This map allows users to explore what affordable housing in the U.S. could be threatened by sea level rise and coastal flooding in the coming decades, under multiple pollution scenarios.
- **Risk Finder:** This tool is designed to provide citizens, communities and policy makers in the U.S. with the tailored local information they need to understand and respond to the risks of sea level rise and coastal flooding in their own

JALBTCX Volume Change Web Application

Charlene Sylvester, USACE Engineer Research and Development Center Coastal and Hydraulics Laboratory

The US Army Corp of Engineers (USACE) National Coastal Mapping Program (NCMP) began in 2004 with funding from Headquarters to acquire high-resolution, high-accuracy topographic and bathymetric lidar and imagery data along sandy shorelines of the U.S. on a recurring basis. USACE executes the NCMP through the Joint Airborne Lidar Bathymetry Technical Center of Expertise (JALBTCX). JALBTCX is a partnership among the Federal government, industry and academia to perform operations, research and development in airborne lidar bathymetry and complimentary technologies. Currently in the third update cycle, the NCMP provides scientists and engineers a suite of standardized, interoperable GIS data products that provide critical, regional updates to subaerial and subaqueous elevations along the coast. The basic suite of data products includes point clouds, digital elevation models, shoreline vectors, true-color image mosaics and hyperspectral image mosaics. The basic NCMP data products are utilized in a JALBTCX change detection framework to quantify regional-scale shoreline and beach volume changes between datasets. Products derived from

the analysis include elevation difference rasters as well as a series of alongshore bins and transects that are attributed with shoreline and beach volume change quantities. The advanced change detection products are informing decisions related to regional sediment management, coastal storm risk management, and ecosystem restoration within USACE. This tools showcase will present the results of the JALBTCX change detection analysis in a web application that provides an intuitive platform for visualization and inspection of the change detection products. Users will zoom to an area of interest, toggle product layers, and review volume change quantities. Integrated charting capabilities facilitate the selection of alongshore volume change bins and the generation of bar graphs depicting volume change quantities per bin. Data is available for direct download via the application, or users may download the results that have been rolled up into a standard pdf map product.

GeoCoast: A Decision-Support Tool for Visualizing Coastal Inundation

John van der Zwaag and John Cartwright, Mississippi State University

GeoCoast is an interactive, web-based tool for visualizing coastal inundation from sea level rise and storm surge. Users can visualize the impacts of inundation on roads, buildings, critical infrastructure, and transportation in either a two-dimensional (2D) or three-dimensional (3D) environment. Geocoast uses a ground elevation model and 3D buildings generated from QL2 LiDAR data collected in 2015. Users can choose to visualize inundation using either simple linear superposition model data, NOAA's sea level rise data from the Digital Coast, or ADCIRC surge model data. The surge model data includes hindcast runs for storms such as Katrina that greatly impacted the northern Gulf Coast. Using routing analysis, users can visualize the impact of inundation on transportation. Users can select two locations or buildings on the map and generate a route at different levels of inundation. Users can also generate a service area for a location or critical infrastructure such as a hospital, fire station, or police station. The service area allows a user to see the impact of inundation on accessibility and travel time for that location or critical infrastructure. Current efforts are focused on expanding data simulations to include results from the Effects of Sea Level Rise in the northern Gulf of Mexico project, as well as the geography to include other areas of the northern gulf coast.

SDG 14.1 Eutrophication Application

Keith VanGraafeiland, Esri; Emily Smail, NOAA; Dany Ghafari, UN Environment

"The Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including poverty, inequality, climate change, environmental degradation, peace, and justice." To be effective and actionable, Sustainable Development Goals (SDGs) require timely and objective reporting. For the past year, Esri has supported the GEO Blue Planet Team's SDG 14.1.a initiative -- Index of coastal eutrophication. Eutrophication is a process driven by enrichment of waters by nutrients, especially compounds of nitrogen or phosphorus, leading to increased growth, primary production, and biomass of algae resulting in adverse changes in the balance of organisms and water quality. Many countries do not have the quantity of nutrient measurements in an area or over time to enable Eutrophication Index assessment, therefore GEO Blue Planet and Esri worked with the UN Environment to support the development of sub-indicators related to Chlorophyll-a, a common indicator of eutrophication. Results for sub-indicator one and sub-indicator two are being made available through a web application. Sub-indicator one focuses on annual reporting, beginning with 2005, and compares each year to a baseline to identify potentially anomalous eutrophication events. Sub-indicator two focuses on monthly reporting and classifies anomalous values as moderate, high, or extreme based on the 90th, 95th, and 99th percentiles, respectively. The respective results are made available through a SDG14.1 web application. This app allows users to better understand eutrophication trends for sub-indicators, obtain associated results and visualize the locations that are being impacted over space and time.

Providing Easier Access to Environmental Data with ERDDAP

Cara Wilson, NOAA Southwest Fisheries Science Center (SWFSC) Environmental Research Division (ERD); Dale Robinson, University of Santa Cruz; Bob Simons, NOAA SWFSC ERD

Distributing large global satellite datasets to a user community working in coastal waters is challenging, particularly if the users require data from many data providers and are interested in discrete geographical and temporal ranges. The ERDDAP data server addresses these challenges, acting as middleman between disparate remote data servers, to provide a single unified pathway for data access that offers 1) a simple, consistent way to download data, 2) subsetting by user-defined areas and time periods, and 3) downloads in over 30 data, image, and metadata formats that are compatible with analysis tools such as R, MATLAB, and Python. The ERDDAP GUI allows users to visualize data and refine download requests. Download requests are completely defined within a URL, allowing machine-to-machine data exchange, bringing data directly into analysis tools, and using ERDDAP as a backend to drive customized online interfaces. ERDDAP was developed by Bob Simons at the NMFS/SWFSC Environmental Research Division. ERDDAP has been installed by over 80 organizations worldwide. The ERDDAP servers at CoastWatch Regional Nodes and other NOAA offices provide access to thousands of satellite and other ocean-related datasets NOAA's Data Access Procedural Directive includes ERDDAP in its list of approved data servers for use by groups within NOAA. In this presentation we will describe the features of ERDDAP, including subsetting and downloading data, creating mapped images, visualizing wind vector fields, and generating timeseries and Hovmöller diagrams. A live demonstration of these capabilities will be given. A tutorial explaining how to use ERDDAP is also available on the website of the West Coast Regional node of CoastWatch at coastwatch.pfeg.noaa.gov/projects/erddap

4:45 to 5:30 p.m. Eastern Time

EXHIBIT HALL OPEN

Drop by the exhibit hall to meet our exhibitors and hear all about their products and services. The exhibit hall is open throughout the conference, but exhibitor representatives will be at their booths during this time as well as during breaks between sessions.

WEDNESDAY, FEBRUARY 10, 2021

10:00 to 10:45 a.m. Eastern Time

EXHIBIT HALL OPEN

Drop by the exhibit hall to meet our exhibitors and hear all about their products and services. The exhibit hall is open throughout the conference, but exhibitor representatives will be at their booths during this time as well as during breaks between sessions.

11:00 a.m. to 12:30 p.m. Eastern Time

PLENARY: THE IMPORTANCE OF RACIAL EQUITY AND REPRESENTATION IN COASTAL MANAGEMENT

Coastal counties in the US are home to over 127 million people, including nearly 49 million people of color, and weather disasters disproportionately impact communities of color. More than ever, acknowledging and understanding the need for racial equity in coastal management is critical, and geospatial tech can help. Maps, spatial analysis, and spatially-enable apps are powerful tools for understanding systemic racism and empowering action. Hear from our panelists about the need for increased representation for members of under-represented groups and racial equity in coastal management processes.

Moderator:
Dawn Wright, Chief Scientist, Esri

Panelists:
Clinton Johnson, Leader of the Racial Equity Team, Esri
Deirdre Johnson Burel, Program Manager, W.K. Kellogg Foundation

1:00 to 2:30 p.m. Eastern Time

CONCURRENT SESSIONS

SHORT AND SWEET: MAPS, MODELING, AND AUTOMATION

Project Support with Python Scripting

Randy Dana, Oregon Coastal Management Program

Project managers rely on information to reach decisions, information that is based on data. Today, data sources are quite varied in format, size, accessibility, and refresh rate. The most informative way for these data to be presented is also quite varied. I will show how Python scripts ease the process of data collection, manipulation, and presentation, particularly for repeated actions. The scripts provide King Tides predictions, identify satellite imagery meeting specific time, tide, and cloud conditions, and plotting fishing vessel movements.

The CMECS Dynamic Standard Process: Overview and Updates

Kate Rose, Northern Gulf Institute at Mississippi State University

The Coastal and Marine Ecological Classification Standard (CMECS) was developed to enable consistency in the description of marine and coastal habitat types, and the sharing, use, and re-use of those data products. It was endorsed by the Federal Geographic Data Committee (FGDC) in 2012 as the national classification standard for coastal and marine ecological data. As Federal policies, such as the FGDC Geospatial Data Act of 2018 and the National Strategy for Mapping, Exploring, And Characterizing The United States Exclusive Economic Zone (2020), increasingly mandate the use of standards in data collection methods and data product development, maintaining the CMECS so that it can continue to support researchers in meeting those requirements is crucial. The CMECS was developed as a Dynamic Content Standard, allowing it to be updated periodically in response to improvements suggested by the scientific community. A properly-maintained CMECS will remain relevant and useful as technologies and the state of knowledge about marine environments and organisms evolve. The Dynamic Standard Process (DSP) was developed by the CMECS Implementation Group to solicit and evaluate change proposals from the scientific community, and revise the CMECS accordingly. In this presentation we will: review the DSP and informational resources for those interested in submitting change proposals, highlight select change proposals that have been submitted and their status in the process, and describe the process for managing and accessing the updated versions of the CMECS.

Property Values, Taxes, Infrastructure: What's at Stake? Assessing Coastal Infrastructure at Risk

Lauren Knapp, CSS Inc. at NOAA Office for Coastal Management

You can only manage what you can count. To understand and inform coastal investment decisions under limited budgets in the face of increasing hazards, officials must have a full understanding of the infrastructure that is at risk. This presentation will examine a series of case studies that used ESRI Business Analyst data—property taxes, property values, and extent of infrastructure—to give an indicator of the value of infrastructure at risk in vulnerable coastal areas. These economic metrics can be supplemented with other socioeconomic and demographic layers to provide answers for local areas. See how these data can be calculated and used to help prioritize important decisions on development, mitigation, adaptation, and managed retreat.

Marine Economies at Risk: Capturing Sectors and Industries using Point-level Business Data

Ravi Chittilla, Lynker at NOAA Office for Coastal Management

As communities plan for rising water levels from future flood events, including both storms and other coastal hazards, it will be important for local planners and elected officials to take stock of businesses at risk. Capturing attributes of firms such as revenue and employment allows us to establish their baseline contributions and values to a given community. Using point-level business data provided by ESRI Business Analyst, we can display six marine-dependent sectors that contribute to the economic viability of coastal communities in the United States. By considering these values as assets at risk from coastal hazards and measuring potential losses, this tool allows us to classify firms based on sector—and then overlay the map with flood-projection mapping tools. The resulting map displays the risk with a visual representation that can help prioritize where local communities should recommend or discourage development. We hope this tool can be among a variety that planners can use to ask the right questions on mitigation and adaptation for a variety of coastal hazards.

Elucidating Temporal and Spatial Trends in Wildfire on Saipan

Ilan Bubb, CNMI Bureau of Environmental and Coastal Quality

Sediment core studies from Athens and Ward suggest that fire is not part of the natural disturbance regime of Mariana Islands and is instead an introduction by humans that has impacted landscapes

from first colonization to present. On the island Saipan, fires are broadly understood to interrupt the natural pattern of succession leading to the degradation of native limestone forests, the proliferation of grasslands and the eventual creation of badlands — areas in which vegetation is unable to grow. However, little baseline data regarding the spatial and temporal patterns of fire on Saipan exist in order to create effective Fire Management Plans, or understand the more nuanced impacts that fire has on both the terrestrial and marine landscape. This project uses Landsat 8 images from April 2013 to July 2020 and the Normalized Burn Index to identify historic fires in order to evaluate a wide range of fire impacts and elucidate specific spatial and temporal patterns that will inform on effective fire management policies. We found that over the study period more than 3,973 acres of Saipan burned, with four specific hotspots that burned repeatedly. Of the acres burned, 40% were in grasslands, 31% in evergreen forests and 21% in scrub-shrub; 41% of all acres that burned more than once throughout the study period were grasslands indicating that they were the most vulnerable to repeat burn events. We also found a high seasonal correlation to fires, with the average amount of burnt land detected in the dry season being 280% higher than the average amount of burnt land detected in the wet season. Finally, precipitation metrics was highly correlated to the amount of burn area identified ($p < 0.05$).

Artificial Intelligence to Monitor Coastal Change in the Arctic

Leslie Canavera, Lauren Decker, and Miya Pavlock, PolArctic LLC

Up to date nearshore bathymetry data and the ability to monitor coastal change are critical needs in Arctic and sub-Arctic Alaska. Currently, some of the Alaskan NOAA bathymetric surveys have not been updated since the late 1800s. Traditional bathymetric surveying is costly and dangerous due to the extreme environment, which includes high turbidity waters, constantly changing nearshore conditions, and the sheer quantity of coastline. The research funding provided by NSF through an SBIR supported the development of PolArctic's CENA: Coastline Evolution & Nearshore Approximation; an Artificial Intelligence (AI) engine that synthesizes multiple methodologies to automatically generate tailored software that estimates nearshore bathymetry. We designed the architecture of our AI engine and trained it to understand several scientifically-derived methods of estimating nearshore bathymetry from remotely sensed imagery. Since each scientific method succeeds under different environmental conditions, we trained the AI engine to be able to choose the most applicable method within a generalized area of interest. As an added feature, the AI engine is designed to easily and rapidly integrate the discovery of new techniques as they are developed within the scientific community and can automatically generate updates to the software. Both breadth and depth of model development are addressed in the agile architecture, as the most relevant scientific methodologies can be applied to a large area with significantly less time and resources than is usually required to manually classify and develop new models. AI is challenging paradigms in many disciplines and is well suited to meet the needs of the Arctic; a complex environment in need of innovative solutions. PolArctic's framework supports remote monitoring of regions that are rapidly evolving, such as the severe coastal erosion occurring on Alaska’s north slope. More up to date elevation modeling will additionally support flood inundation and risk assessment.

Launching a New Mapping Initiative – History and Topography to Improve Decision-making for Estuary Restoration (HiTIDER)

Suzanne Shull, Padilla Bay National Estuarine Research Reserve; Laura Brophy, Institute for Applied Ecology; Andrea Woolfolk, Elkhorn Slough National Estuarine Research Reserve; Charlie Endris, Moss Landing Marine Laboratories

Understanding trajectories of change is instrumental for coastal management. To measure that change, a recent West Coast mapping effort utilizing historic T-sheets, elevation and tidal inundation maps has documented that less than 15% of historic estuaries remain along the Washington, Oregon

and California coastlines (Brophy et al. 2019). In January 2021, the Elkhorn Slough National Estuarine Research Reserve (ESNERR) will lead a team of researchers and mapping advisors, including the Institute for Applied Ecology's Laura Brophy, NOAA's Office of Coastal Management, the Pacific States Marine Fisheries Commission, and the San Francisco Estuary Institute, in an elevation-based mapping approach to analyze estuarine habitat change across the 29 NERRs. The 3-year National Science Collaborative grant-funded project will provide modifications to the methods as needed for regions with different habitats, hydrological regimes, and histories of human alteration, resulting in an approach applicable to any US estuary. The project highlights the value of NOAA resources, including habitat maps, digital elevation models, tidal and lake water levels, and historical topographic sheets. It also addresses the urgent need, at individual NERRs and across the nation, to identify the extent and spatial patterns of estuarine habitat loss and restoration opportunities for the future, particularly in the face of climate change. Products will highlight differing trends among regions and estuarine habitat types, and will identify areas where estuarine habitats can be restored, along with their services such as fish habitat and carbon sequestration. Working with local and national end users, this effort will build a shared understanding of past trajectories of change to design and build support for future restoration strategies.

National Elevation Strategies

Accessing 3DEP Lidar and DEM data – USGS National Map

Rob Dollison and Jason Stoker, U.S. Geological Survey

Find out how to take advantage of new web tools and direct cloud-based access for working with 3DEP lidar and elevation data that are now available through applications on the USGS National Map Data Delivery page (https://usgs.gov/NationalMap/data) and associated sites. Can you say PDAL? Use an AWS Public Data Set? Take advantage of a Web Coverage Service to support analysis? Visualize your lidar before deciding download or use it? At this session we will introduce attendees to all these concepts and the ways to take advantage of them.

The USGS Coastal National Elevation Database (CoNED): Integrated Topobathymetric Models and Applications for U.S. Coastal Zone

Jeffrey Danielson, Monica Palaseanu-Lovejoy, Sandra Poppenga, and Dean Tyler, U.S. Geological Survey

The USGS Coastal National Elevation Database (CoNED) Applications Project develops enhanced topographic (land elevation) and bathymetric (water depth) datasets that serve as valuable resources for coastal hazards research. These datasets are used widely for mapping inundation zones from riverine flood events, hurricanes, and sea-level rise and for other Earth science applications, such as sediment transport, erosion, and storm impact models. As part of the vision for a 3D Nation, the CoNED Project is working collaboratively with the USGS National Geospatial Program, the National Oceanic and Atmospheric Administration, and the U.S. Army Corps of Engineers through the Interagency Working Group on Ocean and Coastal Mapping to build integrated elevation models in the coastal zone by assimilating the land surface topography with littoral zone and continental shelf bathymetry. CoNED topobathy development is focused in select regions around the U.S. coast, such as the Northern Gulf of Mexico, the eastern seaboard from New England to North Carolina, California, the Pacific Northwest, the North Slope of Alaska, and select central Pacific islands and atolls. Current topobathymetric digital elevation model (TBDEM) 1-meter integration work will be highlighted in the Northern Gulf of Mexico and Northern California along with plans for future work. The CoNED methodology improves and implements techniques for the integration of coastal topobathymetric mapping data, such as land water masking algorithms and complex geospatial multitemporal

frameworks. Finally, the use of satellite imagery to derive elevation data using structure-from-motion (SfM) and satellite-derived bathymetry (SDB) techniques will be demonstrated for Cape Cod, Lake Michigan, and Unalakleet, Alaska.

The 3D Nation Elevation Requirements and Benefits Study – Preliminary Results

Ashley Chappell, NOAA; Sue Hoegberg, Dewberry; Allyson Jason, U.S. Geological Survey

This presentation will provide an overview of the 3D Nation Elevation Requirements and Benefits Study being conducted by NOAA and USGS and which aims to understand the nationwide requirements and benefits of elevation data both on land and underwater. This presentation will explain the 3D Nation Study background and goals, which include refreshing the National Enhanced Elevation Assessment to plan for the next generation of the 3D Elevation Program (3DEP) after nationwide coverage has been completed; understanding the requirements and benefits of inland, nearshore, and offshore bathymetric data; and understanding how those requirements and benefits dovetail in the coastal zone. Stakeholders for this study include Federal, State, local, Tribal, non-profit, academia, and private organizations and agencies. The results will include a summation of the study participants, identified mission critical activities supported by elevation data, data requirements for the different geographic areas of interest in an integrated national elevation dataset, and the future benefits that could be realized if national programs could meet some or all of the stated requirements for elevation data.

Building the National Bathymetry

Katrina Wyllie and Glen Rice, NOAA Office of Coast Survey

The National Bathymetric Source (NBS) project creates and maintains high-resolution bathymetry composed of the best available data. This project enables the creation of next-generation nautical charts while also providing support for modeling, industry, science, regulation, and public curiosity. Primary sources of bathymetry include NOAA and U.S. Army Corps of Engineers hydrographic surveys and topographic bathymetric (topo-bathy) lidar (light detection and ranging) data. Data submitted through the NOAA Office of Coast Survey's external source data process are also included, with gaps in deep water filled through Global Multi-Resolution Topography, a merged model of bathymetry. While there are other models of bathymetry for the United States, the NBS effort is unique because the techniques used to combine the various sources ensures the best available data is represented first, along with their uncertainty. The resulting bathymetry directly supports the transition from product to data-driven workflows by increasing quality, accessibility, and timeliness of source data.

DREDGING, SHIPS, AND DATA ACCESS

New Age Marine Spatial Planning with Vessel Traffic

Keith VanGraafeiland, Abhijit Doshi, and Kevin Butler, Esri; Mimi Diorio, NOAA

Vessel traffic data or Automatic Identification System (AIS) data are an invaluable resource made available to our community by the US Coast Guard, NOAA and BOEM through Marine Cadastre. These information can help marine spatial planners better understand who the users of ocean space are and identify potential space-use conflicts. AIS data are collected by the U.S. Coast Guard through an onboard navigation safety device that transmits and monitors the location and characteristics of large vessels in real time. AIS data can be used for a variety of coastal planning purposes including offshore site analysis, use-conflict studies, and the understanding of marine transportation patterns. Although the information is made available, it is often difficult to work with because the incredible amount of records and size of the dataset. This presentation discusses a repeatable analytical workflow within ArcGIS Pro to derive useful AIS characteristics that can be used for marine spatial planning efforts. This

study analyzes vessel traffic movements within the US for 2017, 2018 and 2019 calendar years, and provides summaries of vessel activities that are accessible through web services, notebooks and a supporting web application.

The West Coast Ocean Data Portal: Building Relationship, Providing Access to Coastal Data, and Evolving to Meet New Needs

Marisa Nixon, West Coast Ocean Data Portal and West Coast Ocean Alliance; Tanya Haddad and Andy Lanier, West Coast Ocean Data Portal and Oregon Coastal Management Program; Ryan Hodges, Ecotrust; Emilio Mayorga, Applied Physics Laboratory, University of Washington; Allison Bailey, Natural Capital Project

The West Coast Ocean Data Portal (WCODP) began as a product of the West Coast Governors Alliance (WCGA) on Ocean Health in 2014. It was launched with the intention of increasing access to and discovery of critical ocean and coastal data for resource managers and policymakers on the West Coast, and parallels the efforts of other regional data portals around the U.S. The WCGA is no longer active, but the WCODP maintains its purpose and now works in close coordination with the West Coast Ocean Alliance (WCOA), taking guidance from the Alliance (composed of state, tribal, and federal managers and policymakers) on the development of data products. As the audience of the portal has evolved slightly, so has the technology behind the WCODP, in order to remain relevant in an increasingly data-driven landscape. The portal received several upgrades at the end of 2019, including an updated content management system and visualization tool, and in 2020 it received upgrades that better integrated the catalog and other portal functions. These upgrades have improved the overall functionality, query and visualization abilities of the portal, and also improved efficiency of portal maintenance. These improvements have allowed an increasing focus on not just accessible coastal and ocean data, but data-related projects. These include a West Coast Ocean Health Scorecard and the hosting of OROWindMap, a visualization tool that supports Oregon's offshore wind planning process. The creation of the WCODP in 2014 brought together a unique community of data users, providers and maintainers whose network has endured and met new challenges over the last six years. This presentation will chronicle what the WCODP has accomplished since its inception and how it continues to bring together and serve the coastal data community, as well as highlight the functions of its most current data products.

Charting the Course for Delaware's Waterway Management Using Geospatial Tools

Nicole Metzger and Naomy Perez-Sanchez, Atkins; Ashley Norton, State of Delaware DNREC; Sierra Davis, NOAA Center for Operational Oceanographic Products and Services

The State of Delaware is responsible for maintaining its navigable waterways, including rivers, canals, and bays. Dredging is often needed to maintain adequate depths of water for safe navigation and can support beach sand replenishment and coastal hazard mitigation through beneficial use of dredged sediments. To optimize state funds to support maintenance of its coastal channels and beneficial use of sediment, the Department of Natural Resources and Environmental Control (DNREC) contracted Atkins to develop a tool that supports a data-driven approach to prioritize dredging projects for its Shoreline and Waterway Management Section. DNREC sought to prepare a baseline bathymetric dataset for all state-maintained channels and to develop a tool with which to view, assess, and actively manage historical and new data. The first phase of this project included an assessment of each waterway to develop a channel-specific survey plan that included characteristics, recommended survey lines for data acquisition, and control monuments. The first phase also included development of a geodatabase to house historical navigational data collected by different sources over many years. Depths were displayed using a warm-cool color ramp for intuitive interpretation. Other data layers

included buoys, channel markers, and NOAA navigational charts. Using this data, DNREC prioritized the waterways for survey. The second phase of the project included collection of new hydrographic survey data for priority waterways and incorporation of that data into the geodatabase. With this geodatabase, DNREC can access all their available navigational GIS data as well as the survey plan developed for each waterway in one centralized location, allowing a state-wide view to manage the state's coastal waterways. DNREC can also isolate a single waterway or area to evaluate trends, such as channel shifts or shoaling occurring over time in the waterway. The geodatabase now serves as a regional management tool for waterways in Delaware.

Living Shipwrecks 3D: An Interactive, Online Tool for Spatial Data Visualization

Avery B. Paxton and Erik F. Ebert, NOAA National Centers for Coastal Ocean Science–CSS-Inc.; Tane Casserley, NOAA Monitor National Marine Sanctuary; J. Christopher Taylor, NOAA National Centers for Coastal Ocean Science

A key challenge in coastal resource management is visually conveying large spatial datasets in an intuitive manner, easily accessible to stakeholders and the general public. Here, we showcase an approach to bridge this data-access gap by displaying coastal spatial data in a 3D, interactive online format. Our case study documents the workflow that we developed to provide public access to 3D data from mapping historic shipwrecks and marine life within and around the NOAA Monitor National Marine Sanctuary off North Carolina, USA. We simultaneously mapped shipwrecks and their associated fish within and around the marine sanctuary using echosounders. A multibeam echosounder collected high-resolution multibeam bathymetry of the shipwrecks and detected the broad extent of fish schools. A splitbeam echosounder using a narrower beam width than the multibeam echosounder detected and estimated sizes of individual fish and schooling fish. After processing the echosounder data using software including CARIS, Echoview, R, and ArcGIS Pro, we built an interactive, online 3D data visualization tool complemented by multimedia and story text using ArcGIS Hub. The freely-available, quantitative tool, called "Living Shipwrecks 3D" (link: https://3d-shipwreck-data-viewer-noaa.hub.arcgis.com/) allows diverse users groups to interact with and explore the data in a format customizable to their needs. We anticipate that additional data tools can be constructed using a similar workflow allowing stakeholders and the public to seamlessly explore complex spatial data.

SEA LEVEL RISE IMPACTS AND ADAPTATION

Evaluating Seal-level Rise Impacts on Tidal Marsh Sustainability in Different Geomorphic Settings

Karinna Nunez and Y. Joseph Zhang, Virginia Institute of Marine Science

There is an increasing concern over how accelerated rates of sea-level rise (SLR) will impact tidal marsh ecosystems. The present study evaluates the potential impacts of SLR on marsh sustainability using the Tidal Marsh Model (TMM) and GIS technology. The TMM, developed within the SCHISM framework (Semi-implicit Cross-scale Hydroscience Integrated System Model), presents unique features which allow it to overcome many limitations that current marsh models possess. Using two SLR scenarios (intermediate and extreme SLR rates), we projected the changes in marsh extent over the next 50 years in two representative marsh systems within a subestuary of Chesapeake Bay. Each study site (Carter Creek and Taskinas Creek, VA) has marshes associated with different physical settings and anthropogenic components. Carter Creek experienced a net marsh loss of 7.3% and 60% in the intermediate and extreme SLR scenario, respectively. In some places, due to the local geomorphic settings, marshes were able to migrate inland and offset part of the total loss, whereas marsh transgression was truncated near development and hardened shoreline structures. In Taskinas

Creek, marshes are associated with natural lands, but higher topography. Marsh net decline was 23.1% (intermediate scenario), and 89.6% (extreme scenario). Marsh transgression was not substantial in this site, suggesting that marsh migration was mainly impacted by upland bank conditions rather than accelerated SLR rates. The findings produced with this model approach have diverse management implications for the Chesapeake Bay region. Highly-resolved model outputs provide valuable and necessary information for restoration, strategic planning, and monitoring activities to support marsh sustainability in an evolving system.

Quantifying Future Marsh Loss and Benefits of Restoration to Inform Adaptation Planning for Virginia Beach, VA

Alaurah Moss, Brian Batten, and Xiaohai Liu, Dewberry

Virginia Beach is a coastal community with a diverse landscape of urban, semi-urban, and rural areas with large amounts of natural resources, including marshes. The City has implemented a multi-faceted adaptation framework of nature mitigations, engineered defenses, adapted structures, and prepared communities, socialized as “Sea Level Wise”. As part of the foundational analyses for the Sea Level Wise strategy, historical and future marsh loss were examined. Sea level rise affects marsh systems, adding environmental pressure through higher water levels. This results in increased water velocities, wave heights, and potentially reduced water quality. In many cases, local sedimentation may not be able to offset such factors and result in gradual degradation and drowning of the marshes. In turn, degradation impairs, and eventually removes the beneficial function of the marshes to attenuate waves and water velocities. While this system-level process offers challenges for adaptation, it also offers opportunities. In development of the Sea Level Wise Strategy, a GIS-based site suitability assessment was conducted to determine appropriate locations for implementation of different types of natural and nature-based strategies. The conceptual strategies were prioritized based on vulnerable locations identified from the historical and future marsh loss assessment. Further, coastal numerical modeling tools were used to quantify the benefits of implementing priority projects. Our presentation will provide an overview of how we leveraged coastal tools to quantify such issues, inform adaptation planning, and evaluate the potential benefits of marsh restoration strategies for the City of Virginia Beach. Outcomes of these analyses resulted in adopted strategies that are currently being implemented by the City through follow-on feasibility and design activities.

Effects of Erosion and Sea Level Rise on Wetlands in the Cape Fear River Estuary, North Carolina

James Kapetsky, Eagles Island Coalition

2014 LiDAR showed that 26% of the estuarine wetlands have eroded to maximum depths of nearly one meter since earliest traces found on aerial photography in 1949. Over about the same time period the relative sea level trend in the estuary showed an increase of about 17 cm. By removal of substrate, erosion increases the depth, volume of water and duration of inundation in the affected areas compared to non-eroded areas on every tidal cycle. Sea level rise has the same depth and duration consequences, but affects the entire estuary. The concern is that these co-acting physical changes will reverberate through the biota of the estuarine system, ultimately affecting the capacity of the estuary to support recreational and commercial fisheries. The combined effects of erosion and SLR, if any, should be expressed in the wetland vegetation. The Normalized Difference Vegetation Index (NDVI) was interpreted as vegetation health using National Agriculture Imagery Program (NAIP) 4-band images at 1m resolution. NDVI is influenced by vegetation variety, phenology, and the presence of damp ground and water. Linear Spectral Unmixing was used to perceive water bias on the NDVI in eroded areas. With no erosion effect on vegetation, species would be in common and occur in the same relative amounts between eroded and non-eroded areas. Image classification was used to

compare 15 classes of vegetation between eroded and non-eroded areas as an additional check on erosion effects. Drone imagery was acquired for localized field verification. This research was conducted entirely with freely accessible data

Using Atkins City Simulator to Explore Sea Level Rise Adaptation Options in South Florida

Stephen Bourne, Atkins

Quantifying coastal sea level rise impacts is complex due to interplay between physical, economic, and social systems. Each inch of rise creates new base conditions, influencing acute risk (storm surge elevations), and chronic risk (daily sunny-day tidal flooding). The additional inch's impact can vary greatly from structure to structure. Human risk-response increases complexity. As risk has grown, coastal economies have largely been immune, with metrics like home prices increasing steadily. But recently, studies show market prices reducing, reflecting reducing confidence. Communities, developers, and homeowners increasingly need objective and detailed information to support decisions about how to act. The American Flood Coalition (AFC) and Atkins are using Atkins' City Simulator to explore options for Surfside and Sunny Isles Beach, two south Florida communities. They started in 2019 by creating community digital twins, GIS replicas that include all building stock, stormwater and transportation infrastructure. Agent-based, the twins include a population of avatars that matches the real population statistically. In a 2020 to 2050 run, the team simulated the community economy driving new real estate and infrastructure development, and job and population growth. Driven by an ensemble of daily rain, temperature, and sea level projections derived from global climate model projections, City Simulator estimates building-by-building flood damage for each storm along with road-by-road flood disruption to daily traffic and commerce. Tidal flooding is also simulated and a newly developed housing market price model is used to project sea level rise impacts on housing prices. The team is trying a range of adaptation scenarios from simple, pragmatic adjustment to the stormwater control systems to elaborate district-elevation that enables better master-planning the community's stormwater controls, street layouts, undergrounded utilities, park space, and more. Results to date will be presented including animations of the communities evolving and weathering disasters and infographics summarizing scenario costs and benefits.

3:00 to 4:30 p.m. Eastern Time

CONCURRENT SESSIONS

SHORT AND SWEET: TOPO, BATHY, AND BEYOND

U.S Bathymetry Coverage and Gap Analysis: A Progress Report

Meredith Westington, NOAA Office of Coast Survey

Knowledge of the depth, shape, and composition of the seafloor are foundational data elements necessary to explore, sustainably develop, understand, conserve, and manage our coastal and offshore natural resources. The 2020 National Strategy for Ocean Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone and the 10-year strategy for Mapping the Coast of Alaska make comprehensive ocean mapping a priority for the coming decade. In support of these goals as well as the international Seabed 2030 initiative, NOAA has been monitoring and analyzing the openly accessible, bathymetric data holdings at NOAA's National Centers for Environmental Information and NOAA's Office for Coastal Management to compute the areas mapped and unmapped within U.S. waters. As we strive to reach 100% mapped by 2030, this presentation will explore the latest status of the U.S. Bathymetry Coverage and Gap Analysis and demonstrate its utility

to encourage data sharing as well as strategic survey planning in support of the integrated ocean and coastal mapping goal to “map once, use many times.”

Topobathy LiDAR for USGS 3DEP

Mischa Hey and Cathy Power, Quantum Spatial Inc.

The USGS 3D Elevation Program has been mapping the United States with lidar (ifSAR in AK) since 2016. Over the last 5 years 3DEP has covered ~%75 of the nation with high-accuracy and high-resolution elevation data. The recent introduction and subsequent expansion of Topo Bathymetric lidar has created both opportunities and complexities to ingest these data into the 3DEP dataset. This brief presentation will review some example projects of coastal and riverine environments and how the data products, requirements, and use cases differ between traditional Topobathy lidar and 3DEP compliant lidar.

Hydrographic Survey Estimation Tools

LT Matthew Sharr, NOAA Ship *Rainier*; Megan Greenaway, NOAA Office of Coast Survey; Amber Batts, NOAA National Centers for Coastal Ocean Science

Beets – Batts/Bathy Effort Estimation Tools is a hydrographic survey estimation tool that can be used to gain insight into how long it should take to survey an area. Using basic principles of trigonometry and an efficiency factor, Beets calculates the number of linear nautical miles (LNMs) to survey a given area with full coverage multibeam. Users can then easily apply this LNM estimate to get a sense of the time to complete a survey. We’ve utilized Beets to approximate total LNM for a variety of projects already, and at different scales, from individual surveys around Hawaii and Southeast Alaska, to the entire Pacific US EEZ. Here we present how we use the tool, how it has benefited our operational planning, and how we see it being used in the future.

Merged Multibeam Bathymetry Data in the Channel Islands National Marine Sanctuary for Benthic Habitat Mapping

Edward Sweeney, NOAA National Centers for Coastal Ocean Science–CSS, Inc.; Bryan Costa, NOAA National Centers for Coastal Ocean Science; Chris Caldow, NOAA National Marine Sanctuaries

Over the past 20+ years, multibeam echosounder surveys collected by National Oceanic and Atmospheric Administration (NOAA), United States Geological Survey (USGS), Monterey Bay Aquarium Research Institute (MBARI) California State University, Monterey Bay (CSUMB) and Ocean Exploration Trust (OET) have mapped the seafloor within the Channel Islands National Marine Sanctuary (CINMS). These surveys provide nearly complete bathymetric coverage of an area greater than 3,800 square km (~1,470 square mi) extending from the Channel Islands coastlines to more than 1,700m water depth. The high-resolution and comprehensive coverage of these seafloor bathymetry data provides a new opportunity to update existing benthic habitat models in this highly productive and biologically diverse region. In preparation for habitat prediction modeling, we filtered and resampled bathymetry survey data into five depth ranges at raster cell-size values to match NOAA object detection multibeam coverage grid-resolution thresholds as a function of depth range (depth ranges/cell-sizes: 0-40m/2m, 36-80m/4m, 72-160m/8m, 144-320m/16m and deeper than 300m depths/24m). NOAA hydrographic surveys were used as a vertical reference surface and non-hydrographic surveys corrected to overlapping hydrographic surveys using an average depth difference calculation. Surveys were prioritized by survey type, collection date, mapping system, and survey line plan and merged. The merged bathymetry surfaces can be used with ground truth data (bottom video, photography and samples) to produce spatially-continuous benthic habitat models across the entire CINMS to better predict and understand the wide variety and distribution of benthic communities found throughout

the sanctuary. This work was funded by the West Coast Deep-Sea Coral Initiative (WCDSCI) and the Expanding Pacific Research and Exploration of Submerged Systems (EXPRESS) projects.

Collecting Elevation Data in the Low-Lying Islands of the Republic of the Marshall Islands

Maria Kottermair and Andrea Jalandoni, Griffith University

Low-lying areas like atolls are especially vulnerable to sea level rise and other extreme weather events. To support modeling efforts and to ultimately mitigate the adverse effects of such events high-accuracy, high-resolution elevation data are needed. During an expedition to the very remote Northern Marshall Islands, we collected survey-grade ground control points (GCPs) and imagery with an unmanned aerial system on several low-lying islands. The images were processed to create digital surface models (DSM) and orthomosaics based on Structure-from-Motion technology and the GCPs. The resulting elevation data are then used to assess the accuracy of the Advanced Topographic Laster Altimeter System (ATLAS) which measures heights from the Ice, Cloud, and land Elevation Satellite (ICESat-2) using laser beams and potential usability of the satellite data for modeling remote areas. Besides the direct outcomes of this study, challenges of collecting elevation data in remote places in the Pacific are discussed.

Morro Bay Topographic/Bathymetric Elevation Modeling

Steve Raber, Quantum Spatial; Keith Merkel, Merkel & Associates; Colin Cooper and Steve Schuetz, Quantum Spatial

In 2019, NOAA Office for Coastal Management (OCM), in partnership with the Morro Bay National Estuary Program (NEP), tasked Quantum Spatial (QSI) with creating a current comprehensive topographic and bathymetric elevation model for the Morro Bay Estuary near San Luis Obispo, CA. In addition to characterizing the bedform of the bay, QSI was also tasked with installing temporary water level monitoring stations at two locations to provide calibration data for updating hydrodynamic circulation models developed more than 20 years ago. These data are now providing valuable scientific insight into geomorphic changes in Morro Bay, sediment transport, eel grass habitat, restoration efforts, and potential impacts to water quality. The presentation will provide an overview of the project and team members, the use of state-of-the-art aerial topobathy lidar technology and interferometric sidescan sonar, data processing, and the data integration approach used to develop the seamless topobathy surface of the Bay.

EMERGING TECHNOLOGIES IN ELEVATION

Partnering Together in Paradise: Multiple Agencies Work Together to Collect Topographic and Bathymetric Lidar Data in the Pacific Islands

Megan Blaskovich, Woolpert

Since 2017 Woolpert has received multiple task orders from USGS and NOAA to collect topographic and bathymetric lidar for multiple islands in the Pacific including many of the CNMI and the major Hawaiian Islands. This presentation will provide an overview into the work we have conducted in the region: adventures and challenges collecting data in remote locations, processing approaches, and our hopes looking forward to seeing how the data is used.

Hurricane and Rising Sea Level Protection: Lessons Learned from High Accuracy, Emerging Geospatial Data Collection and Fusion in Coastal Communities

Paul Braun, Continental Mapping Consultants, LLC

To successfully mitigate the risks of hurricanes and rising sea levels, we need both regional scale mapping and site-specific, very high accuracy geospatial data. This presentation will review the

challenges and lessons learned with collecting and fusing very high accuracy, site-specific geospatial data in coastal environments.

The City of Port Arthur, TX and the Port of Port Arthur lie on the Gulf of Mexico coast, 90 miles east of Houston adjacent to the Louisiana border. The City is home to approximately 55,000 people and the Port, located on the Gulf Intracoastal Waterway (GIWW), is a significant economic engine to the country as it moves millions of tons of forestry/paper, iron and steel cargo. The City and Port have been hit with many significant weather events; in 2017, Hurricane Harvey caused over 100 deaths, and in 2020 Hurricane Laura and Hurricane Delta were direct hits. These storms highlighted challenges in maintaining the health and safety of residents while supporting economic and environmental sustainability. In 2019, the City and Port engaged the US Army Corps of Engineers–Galveston District (USACE) to "improve the existing hurricane flood protection system at Port Arthur, TX to address risks associated with overtopping and relative sea level rise." Continental Mapping, an IDIQ prime contract holder with USACE, was brought in to complete a comprehensive surveying and mapping effort to support design scenarios.

Continental Mapping employed a variety of surveying and mapping technologies including aerial lidar @ 20ppm, imagery at 3.5cm GSD, land survey for utilities, radio detection of subsurface utilities, and bathymetric survey around gates and structures. Continental Mapping assessed current data repositories, scoped all efforts and, with the help of teammates, completed field work. Extensive quality control and data fusion procedures resulted in high accuracy geospatial deliverables to USACE. Follow-on design work has already begun.

Remote Sensing Shallow Water Bathymetry in Turbid Coastal Environments

Ron Abileah, jOmegak

Hydrographers use multispectral radiance and LiDAR for remote sensing (RS) shallow water (≤ 50 m) bathymetry. Those methods are used only in low turbidity areas. Another technique, wave celerity inversion, is the only RS option for high turbid waters. Celerity-based implementations use a time series of ocean wave images obtained with marine radar and aerial video and satellite stereo image pairs (e.g., DigitalGlobe's WorldView). This paper evaluates celerity inversion with the Sentinel 2 A/B satellite constellation. Sentinel 2s are multispectral but not stereo capable. However, the 1.72 s separation of two spectral bands, B08 (842μ) and B8A (865 μ) (due to their relative placement in the focal plane), is sufficient to measure wave celerity. There are cost and technical trade-offs between Sentinel 2s and the other RS sensors. The Sentinel 2s have a cost-competitive advantage since the imagery is free. Typical products are bathymetry in the 0 to 35 m depth range, with 200 m spatial resolution, rmse 10% depth, and depth contours at 10 m intervals up to 50m (70m under most favorable conditions), with 4 km resolution. As of this writing, we have evaluated the method on 500,000 km2. In this presentation, we report on two test areas. First, a 300 km coastline from Grey to Geographe Bay on the west coast of Australia, extending out 70 km from shore. In this area, the Fugro's 2016 LiDAR bathymetry is the ground truth. Second is the 10,000 km2 Golfe d'Arguin (Mauritania) compared with GEBCO 2020. The presentation will include lessons from other test areas, including, South American coastline (from Trinidad to Amazon), Nigeria, Somalia, Newport, OR, and the FRF, Duck, N.C. Previews are available on the following links. Australia coastline: http:\jOmegak.com\GeoTools\Australia0-35m.jpg Australia coastline, 10-m contours: http:\ jOmegak.com\GeoTools\Australia10mcontours.jpg Mauritania Golfe d'Arguin: http:\jOmegak.com\GeoTools\Mauritania0-35m.jpg Mauritania Golfe d'Arguin, 10-m contours: http:\jOmegak.com\GeoTools\Mauritania10mcontours.jpg

Riverine Mapping: The Upper Colorado River

Ben Hocker, CH, PLS, Woolpert Canada, Inc.

In 2020, Woolpert acquired topo-bathy lidar in a riverine environment, in support of the "Upper Colorado Topo-bathy" task order for USGS. In addition to standard ground check points and water quality information including turbidity, bathymetric check points were collected over the full range of river depths in order to assess the accuracy of the submerged portion of the bathymetric lidar. The shallow water environment required a unique approach to collecting single beam sonar from a small, portable unmanned survey vessel (USV) remotely operated from shore. This project approach could also be utilized in lakes, reservoirs, and other near-shore and littoral zone environments, when deployed with the latest generation of topo-bathy lidar sensors.

SUSTAINABLE DEVELOPMENT

Using Esri Tools to Help Countries Report on UN Sustainable Development Goal 14.1 Indicators

Emily Smail, NOAA, University of Maryland, GEO Blue Planet; Keith VanGraafeiland, Esri; Dany Ghafari, United Nations Environment Programme; Leah Segui, NOAA

Addressing the global nature of marine pollution needs tools to monitor and measure its extent in the ocean. With Sustainable Development Goal (SDG) 14 target 14.1, the United Nations established a charge for countries to "by 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution". While In-situ measures of Ynutrient pollution would provide high-resolution data, not all countries have the capacity to provide this information. To address this gap, GEO Blue Planet, Esri and the UN Environment Programme have developed the methodology to report on SDG 14.1.1a - Index of Coastal Eutrophication. This collaboration includes the production of statistics for the global indicators for eutrophication so the data can be included in the 2021 SDG Progress report. Additionally, this collaboration is developing application dashboards on satellite-derived chlorophyll-a for countries to assist with the identification of potential eutrophication hot spots.

Coastal Change Hazards and the State of Our Nation's Coast

Emily Himmelstoss, Kara Doran, Erika Lentz, and Andy O'Neill, USGS Coastal and Marine Science Center

Coastal change hazards present significant challenges to the coastlines and communities across our nation, which are vulnerable to coastal erosion, shoreline and dune change, sea-level rise and storms. These hazards are widespread and include response to both natural forcing and human disturbances across diverse environments. The newly organized U.S. Geological Survey (USGS) Coastal Change Hazards (CCH) program focus was born from a goal to better serve communities' needs using the best science available to support effective coastal management and inform decision making from local to national scales. The USGS delivers relevant, robust products and tools that support the mitigation of coastal hazards, including protecting life and property. The CCH program focus advocates for integrating stakeholder engagement, public communication, and technical needs with traditional research expertise and external collaborators to continuously align federal priorities with science and products most beneficial, relevant and useful to our coastal communities. Several examples of co-developed research and engagement efforts will be presented. To complement the CCH program focus, the USGS State of Our Nation's Coast project is working to develop a comprehensive data access and visualization product to support coastal risk reduction. We will feature the iterative co-design process under development that is intended to repeatedly and robustly engage target

audiences and ensure our data access and delivery mechanisms address current informational barriers and provide data and tools that are easily discoverable by our users.

Using GeoDesign to Promote Green Infrastructure for Stormwater Management in Green Bay, Wisconsin

Kayla Wandsnider and David Hart, Wisconsin Sea Grant Institute

Green Bay is a large freshwater estuary on the northwest side of Lake Michigan. The city of Green Bay, Wisconsin is located at the mouth of the Fox River, where it flows into the southern tip of Green Bay. The landscape along the southern shore of Green Bay is characterized by low, flat topography and is vulnerable to flooding from multiple sources. This includes heavy downpours directly over the urban area, riverine flooding and coastal flooding from storms blowing from the northeast during periods of high Lake Michigan water levels. Northeastern Wisconsin has seen fewer extreme precipitation events than the rest of the state in past decades, but this has changed in the past two years. Geodesign can help identify where green infrastructure projects can be placed to reduce flooding and improve water quality. The geodesign process integrates GIS, landscape design, graphic design, and scenario planning into a common framework. This framework emphasizes visual communication and design which are especially important in communicating multiple design scenarios for public engagement. This presentation will showcase a multi-scale geodesign process to measure how green infrastructure can make a difference to reduce flooding at the site, neighborhood, sewershed and municipal levels. Templates were created using GeoPlanner for ArcGIS to specifically address green infrastructure for stormwater management in a coastal city. The challenges of using a geodesign process in a virtual setting during a pandemic will be discussed.

The Application of a Living Shoreline Site Suitability Assessment Model to Biloxi Bay, Mississippi

Toby Gray, John Cartwright, and Randall McMillen, Mississippi State University

Living Shorelines provide an alternative to traditional hardened shoreline stabilization techniques such as bulkheads, revetments, and seawalls by using vegetation and offshore structures to reduce erosion. Living Shorelines provide ecosystem services such as fish habitat, nutrient pollution reduction, and buffering of coastal areas from the effects of wave action and storms. NOAA has funded well over a hundred living shoreline projects, predominantly along the coasts of the Atlantic Ocean and the Gulf of Mexico. The process for assessing site suitability for implementing living shoreline projects varies across communities and organizations. Recently a living shoreline site suitability model from the Virginia Institute of Marine Science was adapted to provide recommended best management practices for shorelines in coastal Alabama, Lake Pontchartrain, Louisiana, and Galveston Bay, Texas, as part of the RESTORE Science Program. Our presentation will describe efforts by researchers at Mississippi State University to adapt that same model to Biloxi Bay, Mississippi. The model generates a single polyline shoreline output with an attribute table describing segments and providing management recommendations based on a set of input layers characterizing features in the landscape. The application of this model to a major feature of the Mississippi Coast is intended to promote living shoreline protection options to local managers based on a transparent and scientific site suitability assessment process.

Too Much Water

The Evolution of the NOAA Water Initiative: Expanding our Water Services

Brenna Sweetman, NOAA Office for Coastal Management

In the U. S. and globally, water security is in jeopardy. Challenges of too much water, too little water, and water of poor quality are becoming increasingly severe. Over the last five years, the NOAA Water Initiative has strived to transform the development and delivery of water information, products, and services—to address our unique water issues through new partnerships and stronger collaboration than ever before—for more resilient ecosystems, communities, and economies. Gaining a better understanding of user needs, identifying gaps, and shifting the process of development for water-related products and services to a user-centric approach has been key to support stronger, more effective decision-making. This presentation will provide a high-level overview of recent Water Initiative activities around topics that include enhanced engagement and risk communication with underserved communities, updates to the Adapting Stormwater Management for Coastal Floods product, the National Water Model, and an overview of the new model of service delivery.

Measurement of the Floodplain's Downstream Flood-Reduction Value

Keil Schmid, Geoscience Consultants, LLC; Elizabeth Fly, The Nature Conservancy

A heightened threat of riverine flooding is being felt by many communities in the southeast from increased development and change in climate. Given this situation it is important to document the level of flood mitigation benefits natural floodplains provide. These floodplains are, however, increasingly becoming targeted for development resulting in more flooding damage and costs. To address these issues The Nature Conservancy and GeoScience Consultants teamed on a project to communicate the level of flood benefits from existing floodplains. The study focused on a 65 sq. mile area around Conway, South Carolina, that has seen several years of moderate to major flooding. A GIS-based approach was developed to quantify the ability of floodplains to reduce downstream flooding by assigning monetary values to the floodplains. Use of dollar values per-year per-acre ($/yr/acre) helps define the benefits of maintaining the floodplains compared to the revenue from development. The technique modeled water storage of the floodplains for different flood levels and yearly return risk of each. River levels with- and with-out floodplains were used to define the level of damage to structures in the study area. The difference in damage costs ($/m3) was associated with each level and the volume of water held in each acre used to assign a value/acre. The yearly risk was then used to correct to the per-year costs. The result is a 'value-surface' of the floodplains in dollars/year/acre. The study results suggest that the floodplains in the study area (about 30.5 sq miles) reduce flood depths by up to 1.5 feet and contribute over $6 million/year in flood damage savings. Based on the climate predictions for high intensity rain events and sea level rise the projected value of the floodplains in the area increase to about $8 million/year by 2035 not including changes in development or inflation.

Mapping Future Flood Vulnerability for Resilient Design Standards

Benjamin J. McFarlane, Hampton Roads Planning District Commission

Southeastern Virginia is one of the most vulnerable regions in the United States to coastal flooding and sea level rise. For more than a decade, the Hampton Roads Planning District Commission (HRPDC) has focused on developing policy recommendations, vulnerability analyses, GIS data, and mapping products to aid its member jurisdictions and other local, regional, and state entities in Virginia in addressing these challenges. Recently, these efforts have focused on the development of resilient design standards for local governments to adopt as part of their floodplain management programs. Most of these programs are based on minimum standards provided by the Federal Emergency Management Agency and state floodplain management agencies, which in most cases do not account for future flood risk or inundation due to sea level rise. In response, the HRPDC has developed policy recommendations and supporting mapping and data products to help local governments to incorporate future risk into their floodplain management plans and ordinances. These

recommendations utilize three primary inputs: regional sea level rise projections based on climate scenarios and observed trends, a regional storm surge model from FEMA and the U.S. Army Corps of Engineers (USACE), and a future risk model developed by the USACE for the North Atlantic Coast Comprehensive Study. The HRPDC has combined these inputs to create a suite of probabilistic floods (1-year to 500-year) across three different regionally adopted sea level rise scenarios. Based on this analysis, the HRPDC has developed three products for local planners and engineers: design tailwater elevations for local public facilities standards, maps of projected future floodplains, and design flood elevations for local floodplain management regulations. Adopting these standards will allow localities to reduce current and future risk from coastal flooding events.

TIDEeye – Harvesting Real-time GIS Date for Flood Planning and Response

Emma Paz and Robert Hauck, City of Charleston

The City of Charleston, SC has been increasingly impacted by flooding due to severe storms, higher tides and extreme-rain since 2015. In efforts to respond to these growing disruptions, the City of Charleston has taken these problems as an opportunity to learn how to better track local tides, weather and road closures in real-time. In pursuit of innovative solutions, the GIS Division has developed a curated platform called TIDEeye, that compiles live sensor data from reputable sources, like NOAA's COOPS API, into a mobile-friendly app to aid decision-makers and the general public in ongoing adaptation measures. This presentation will walk through the components of TIDEeye, which include tools, scripts, and ArcGIS platform services. The goal is to provide creative and practical examples, including lessons-learned, on how to harness the power of real-time GIS.

5:00 to 6:00 p.m. Eastern Time

TRIVIA HOUR FROM COAST TO COAST

Put on your favorite hat or show off a fun mask you have acquired in the last year and join us for an hour of trivia. We'll be split randomly into teams and will work together to see which team can answer the most questions correctly. Questions will cover a range of topics including one special round of water-themed ones. This will be fun and casual and a great way to reconnect with colleagues and meet some new ones as well. There will be prizes for the winning team!

THURSDAY, FEBRUARY 11, 2021

1:00 to 2:30 p.m. Eastern Time

CONCURRENT SESSIONS

SHORT AND SWEET: SHORELINE, TIDES, AND CHANGE

Minimum Elevation Data Needs for Designing a CoastWise Tidal Crossing

Jamie Carter, NOAA Office for Coastal Management; Slade Moore, Maine Coastal Program; Matt Craig, Casco Bay Estuary Partnership; Joe McLean, Acadia Civil Works

Wetlands like saltmarshes, clam flats, and others need adequate tidal exchange to remain healthy and provide benefits important to people and the environment. Structures that extend across tidal wetlands like roads and dams often restrict tidal flow. Most (85%) of Maine's 900 tidal restrictions are caused by road crossings. Most of these crossings were not designed to avoid risks associated with accelerated sea level rise, like flooding, interrupted access to important services, and higher road maintenance costs. The CoastWise Approach was developed to inform the planning, design, and construction of tidal road crossings in Maine. This presentation discusses one of the key steps when designing a resilient tidal crossing: compiling geospatial data for the engineer's hydrodynamic model. The model itself provides insights into current and future tidal exchange characteristics, but the model is driven by the topographic and bathymetric elevation data and water surface elevations. Lidar data, available from Digital Coast, are extremely valuable for this application but often need refinement to meet the stringent accuracy requirements of an engineer's model. We will discuss the minimum elevation data needs that meet these requirements in a CoastWise project site in Phippsburg, Maine.

Temporal Changes of Tidal Prism and Water Volume in Morro Bay, California

Nick Chandler and Thomas Loecherbach, Tetra Tech

Morro Bay estuary near San Luis Obispo in southern California is a natural harbor, providing economic and ecological value as a shipping lane and as a refuge for marine wildlife. Morro Bay is also a major site of sediment accumulation, with both human activity and natural processes threatening the long-term viability of the estuarine basin. In-situ data collection over a twenty-year period (1999-2019) with three epochs, in conjunction with coastal topobathymetric LiDAR made available from NOAA, and historic data beginning in 1885 were used to compare the tidal prism and water volumes at varying tide levels. Our research will discuss our methods to normalize data at each epoch and in the historical record to determine temporal changes. Volumetric calculations of the estuary at an epoch require three input sources: a terrain surface model, the mean low tide elevation (MLW), and the mean high tide elevation (MHW). Three remote sensing technologies are used to model the basin: topographic LiDAR (infrared spectrum), bathymetric LIDAR (green spectrum), and sonar (acoustic). We will discuss how these technologies can be combined to present the most accurate model of the basin, and how GIS tools can use this model to quantify the data. We will address possible error sources, including the reliability of the historical record, void areas in collected data, and the accuracy and precision limitations of current and past remote sensing technology. These results will be used by the Morro Bay National Estuary Program to help understand the development of water volumes and water exchange in the estuary over time.

Creating Seamless Topo-Bathymetry Maps to Study the Dynamic Nearshore of the Great Lakes' "White Ribbon"

Katherine N. Braun and C. Robin Mattheus, Illinois State Geological Survey; Ethan J. Theuerkauf, Michigan State University

High-resolution data are difficult to generate along many coasts of the Great Lakes, especially in shallow nearshore environments that are challenging to survey with traditional LiDAR and vessel-based methods. Surveying these areas, often referred to as the "white ribbon," is essential for tracking the movement of sediment and elucidating coastal process-response relationships. The white ribbon is where hydrodynamic parameters (e.g., ice, waves, littoral currents) interact with the shoreline. Significant changes occur at the event scale; frequent surveys that bridge the land-lake interface are therefore required to study the morphodynamics of these environments. We combine multiple surveying methods to produce seamless topo-bathymetric maps along the highly dynamic shoreline of Illinois Beach State Park, the most natural and dynamic stretch of Lake Michigan coastline in Illinois. Onshore data is generated with a sUAS (small unoccupied aerial system), while offshore data is collected with RTK-GPS surveys (in water depths <1m) and single-beam bathymetric surveys in both remotely controlled and human-occupied vessels in water depths >0.5 m and >2 m, respectively. ESRI ArcGIS tools are used to clean, merge, and interpolate datasets into continuous rasters. GPS surveys and remote-controlled bathymetry surveys constrain the horizontal gap between the subaerial and subaqueous data to a maximum of 10m. Elevation change maps, generated from finished topo-bathymetric maps, paint a more complete picture of sedimentary dynamics at play between surveys. This is illustrated by a case study tracking the placement of 70,000m3 of nourishment sand in 2019. Tracing the movements of such shoreline deposits would be impossible without data coverage in the white ribbon: Sand can overwash, migrate and form nearshore bars, and/or exit the nearshore system entirely. Only seamless coverage of the entire shoreline and its proximal environments, from the back beach to the toe of the foreshore, can capture the full story of coastal change.

Reconciling Different Beach Responses to the Same Lake-Level Rise: A Look at Embayed Systems along Chicago's Urbanized Lake Michigan Coastline

Robin Mattheus and Katherine Braun, Illinois State Geological Survey; Ethan Theuerkauf, Michigan State University; Jennifer Santoro, Villanova University

Great Lakes coastal environments respond to seasonal, inter-annual, and decadal lake-level variances (of up to 1.5 m) and drastic year-to-year differences in winter-ice cover. Changes in these hydrodynamic parameters have varying implications for the degree of shoreline exposure to wave and current energies. The influences of coastal infrastructure (e.g., groins) on local hydrodynamics and shoreline change are an additional factor that is not well understood. Digital resources such as historic aerial photographs and coastal LiDAR provide valuable insights into past shoreline behaviors and beach-nearshore elevation changes, which, upon evaluation against available hydrodynamic data (i.e., USACE lake-level records, NOAA ice-cover information, and wave-hindcast information), may help tease apart regional from local controls on morphodynamics. Research along the Illinois coast of Lake Michigan is addressing beach responses to the recent lake-level rise episode (from 2013 to 2020), making use of online USGS and NOAA resources (historic aerial photographs and coastal LiDAR) and a GIS-based analytical approach. While Chicago beaches (n = 22) experience the same changes in water level, differences in coastal aspect and the characteristics of shoreline infrastructure (e.g., length and orientation of groins) have site-specific implications for wave and current hydrodynamics. A variety of beach responses are thus documented for the around 1-meter rise in lake level between 2012 and 2017, including beach rotation, uniform overwash and shoreline retreat along strike, and total beach loss. Ongoing efforts are underway to model and better understand these dynamics on a systematic basis. Reconstructing shoreline positions for previous lake-level rise episodes, many of similar magnitude and rate to the most recent (e.g., 1964 to 1974), may also reveal the potential for

repetition of geomorphic behaviors, which would provide coastal managers with useful information for long-term planning purposes.

Informing Lake Superior's Coastal Communities Decision-making on Erosion Hazards

Melanie Perello and Clinton Little, Minnesota's Lake Superior Coastal Program, Department of Natural Resources; Charles Moore, Arrowhead Regional Development Commission

Minnesota's North Shore of Lake Superior is facing extensive and costly shoreline erosion. High lake levels, intense coastal storms and increased development have accelerated natural erosion processes. Coastal erosion threatens private property and public infrastructure, costing millions in damages. To address the impacts of coastal erosion, Minnesota's coastal communities need to identify where erosion hazards exist. Yet, erosion hazards were last mapped in the late 1980s. The Coastal Erosion Hazard Mapping (CEHM) project is a collaboration of local governments and state agencies. To update these maps, CEHM has developed mapping methods to identify erosion hazards. Erosion rates are calculated with the US Geological Survey's Digital Shoreline Analysis System using historical shoreline datasets. Historical shoreline positions were derived from aerial imagery, harbor charts, and LIDAR. We demonstrate this approach to mapping erosion hazards on pilot sites representing Minnesota's diverse shorelines. The CEHM project is working to meet the needs of Minnesota's coastal communities by providing erosion hazard maps and support tools for property owners and decision-makers.

The Digital Shoreline Analysis System: Applications for the Coastal Environment and Other Boundary Change Analyses

Rachel E. Henderson, Meredith G. Kratzmann, and Emily A. Himmelstoss, U.S. Geological Survey, Coastal and Marine Hazards Resources Program

The Digital Shoreline Analysis System (DSAS) v5 software is an add-in to Esri ArcGIS desktop 10.4-10.7 that enables a user to calculate rate-of-change statistics from multiple shoreline positions. It provides an automated method for establishing measurement locations, performs rate calculations, and provides the statistical data necessary to assess the robustness of the rate estimates. The major steps of using DSAS will be reviewed, including: compiling shoreline (or boundary) data, defining a reference baseline, creating metadata based on user-specified input, generating and editing measurement transects, calculating rates, and using visualization options to display rates of shoreline change. In addition, the use of DSAS for other boundary change applications, such as measuring glacier limits, analysis of marsh slope, and tracking of permafrost headwalls, will be explored.

The "Coordinate Reference System" – More than Just a Metadata Field

Nic Kinsman, NOAA National Geodetic Survey

If you rely on the "Coordinate Reference System" metadata section to align your geospatial data, you don't want to miss this presentation! NOAA's National Geodetic Survey (NGS) is responsible for defining, maintaining, and providing access to the nation's consistent reference frame, the National Spatial Reference System (NSRS). Coastal managers and others routinely rely on the NSRS for accurate field measurements or to combine data and map products, such as those provided on Digital Coast, in support of floodplain or sea level inundation mapping, ecosystem monitoring, and construction design. The North American Vertical Datum of 1988 (NAVD88) is the official vertical datum of the NSRS at this time, but NGS is working to replace NAVD88 with the North American-Pacific Geopotential Datum of 2022 (NAPGD2022). This modernized vertical reference frame will primarily rely on a Global Positioning System (GPS) framework in combination with an updated gravity model that approximates local MSL, called the geoid. The time-dependent nature of the modernized NSRS, combined with more

systematic ties between NAPGD2022 and tidal datums, will significantly improve the quality of geospatial data in coastal environments through improved accuracy in the definition of heights in areas experiencing relative sea level change. Furthermore, primary access to the NSRS with GPS creates new efficiencies and provides a spatial framework that is more compatible with GPS-based technology, such as unpersoned infrastructure monitoring systems or precision navigation.

MAPPING: GETTING IT DONE TOGETHER

NOAA 2020 Nationwide Spatial Priorities Study

Karen Gouws, NOAA Office of Coast Survey (Spatial Front Inc); Ashley Chappell, NOAA Office of Coast Survey

This presentation will describe the usage and rollout of the NOAA 2020 Spatial Priorities Study, a study conducted across NOAA offices and programs to gather information about where different offices have mapping needs and priorities. This spatial priorities study, in conjunction with the National Ocean Mapping, Exploration and Characterization Strategy, allows users to determine which regions of ocean (nearshore and offshore) and Great Lakes have the most mapping need so that resources can be allocated efficiently. Other goals include providing a means for participants to be able to reach out to others for coordination and funding assistance where there is a shared mapping need between organizations. Participants entered their office's mapping priorities in the spring and summer of 2020 with an easy-to-use online GIS tool developed by NCCOS. These results were combined and analyzed using geospatial tools to identify areas of greatest mapping need, and areas where there can be increased coordination between offices. The study is now rolling out to the agencies of the Interagency Working Group on Ocean and Coastal Mapping, followed by interested non-federal partners such as state and local governments, regional groups and academia/private sector stakeholders, in order to increase mapping coordination and encourage collaborative mapping opportunities.

High Resolution Land Cover: From a Vision to Operational Implementation

Nate Herold, NOAA Office for Coastal Management; Chris Robinson, Lynker at NOAA Office for Coastal Management

Understanding current land cover patterns and past change trends is essential to comprehensive management, assessment, and future planning. For more than two decades, NOAA's Office for Coastal Management has been producing consistent, accurate land cover and change information for the coastal U.S through its Coastal Change Analysis Program (C-CAP), with the goal of continually updating these maps every 5 years. In recent years, NOAA has been working to establish an operational higher resolution land cover product line, bringing the national C-CAP framework to the local level and allowing for more site specific applications. This work has been possible because of the wealth of available imagery and lidar data, improved software and hardware capabilities, and artificial intelligence classification techniques. This presentation will highlight past lessons learned, current status, upcoming data releases, and plans for additional data and updates in the future. We will also compare some of these next generation, higher resolution products to coarser, national standard data, highlight some of the applications that this data has supported, and discuss how interested organizations could partner with NOAA to help get this data produced, for the common benefit of all.

NOAA High Resolution Land Cover Data Comes to Connecticut

Emily H. Wilson, Cary Chadwick, Qian Lei-Parent, and Chet Arnold, University of Connecticut

The University of Connecticut Center for Land Use Education and Research (UConn CLEAR) has a long history of creating and using moderate resolution land cover and land cover change datasets. In the fall of 2020, after working closely with UConn CLEAR, the NOAA Office for Coastal Management (OCM) released high resolution (1 meter pixel) land cover for Connecticut. It is part of NOAA's expanded Coastal Change Analysis Program (C-CAP). UConn CLEAR is using the land cover for multiple projects including watershed planning, watershed metrics, source water protection area analysis and more. To better understand the implications of transitioning from 30m to higher resolution data, CLEAR is also conducting visual and quantitative analyses such as using simple regression models to compare the watershed metrics based on land cover datasets with different spatial resolutions. The presentation will cover the growing number of applications of the exciting new dataset as well as the comparison results to date.

The Florida Coastal Mapping Program (FCMaP): Coordinating High-Resolution Mapping of Florida's Coastal Waters

Xan Fredericks, US Geological Survey; Rene Baumstark, Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission; Cheryl J. Hapke, University of South Florida St Petersburg; Ryan Druyor, Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission; Kimberly Jackson, Florida Geographic Information Office

Based on a data inventory and gap analysis conducted in 2017, a majority (80%) of Florida's coastal waters have never been mapped using modern, high-resolution technologies. High-resolution mapping is needed to support critical statewide initiatives including sea level rise adaptation planning, coastal inundation modeling, red tide forecasting, and fisheries management. Given the enormity of the effort needed to comprehensively map Florida's coastal waters, the Florida Coastal Mapping Program (FCMaP) was created (1) to unify Florida's approach to coastal mapping by coordinating across state and federal agencies, academia, and the private sector, and (2) to support efficient and cost-effective data collection focused on the state's highest priority areas. In 2018 and 2019, FCMaP led a statewide, stakeholder driven process to identify mapping priorities. A series of regional stakeholder workshops were held across the state to explain the process and collect stakeholder information using a web-based GIS tool. The result of this effort is a statewide geospatial reference layer representing the cumulative perspective of mapping priorities from a broad range of coastal managers, planners, and scientists. The intent of the prioritization is to inform decision making on how to best focus limited efforts and funds moving forward. The results of the prioritization and information about FCMaP have been compiled into a Story Map by the Florida Geographic Information Office and will be shared during this presentation.

Artificial Intelligence in Mapping and Modeling

The Use of Drones in Coastal Environments: Benefits and Challenges

Andrew C. Reicks, Brendan Brown, and Amy Kopale, CDM Smith

The availability of affordable small unmanned aerial systems (sUAS), or drones, equipped with lightweight sensors and powerful photogrammetry software has made sUAS a flexible tool to collect elevation and land cover data. Data collection via sUAS offers several advantages over traditional methods, including real-time data collection, up-to-date mapping of project site conditions, reduced level of effort, improved site access, and worker safety. The ability to collect large datasets in a fast,

cost-effective, and repeatable manner provides substantial benefits. In this presentation we provide an overview of drone technology and capabilities, highlighting various sensors, including light detection and ranging (LiDAR), multispectral cameras, and optical cameras. We will present cases studies of sUAS monitoring of a tidal salt marsh restoration site where LiDAR, 5-band multispectral cameras, and optical cameras were used to evaluate and track the progress of restoration. We will also discuss the process of sUAS project execution, challenges of sUAS data collection, and limitations of the technology. Case study topics will include the following:

Topography and Erosion Monitoring
Accurate mapping of topography can be accomplished with LiDAR and optical cameras. A camera-equipped sUAS can collect photographs that are used to generate digital elevation models with commercially available photogrammetry software. Under the right conditions, near-survey grade measurements of land surface elevations can be determined. Comparisons of LiDAR and structure from motion within the marsh environment will be presented.

Monitoring Vegetative Growth
Sensors can be used to collect data on vegetative coverage and health at spatial and temporal resolutions greater than that of satellites. Multispectral data is used to calculate normalized difference vegetation index (NDVI) and fractional vegetation coverage.

Segmentation and Object Detection with AI
The high resolution data collected via drone can be combined with AI models to segment different land cover classes and detect objects such as fallen trees.

Stochastic Shoreline Change Modeling for Risk-informed Decision Making

Bin Wang and Daniel Stapleton, GZA GeoEnvironmental, Inc.

This presentation will provide an overview of the Risk-Informed Decision-Making (RIDM) method and its potentially versatile applications for assessing and managing flood risks. Risk information includes the probability and consequence of risks as well as uncertainty. RIDM has been adopted by several federal agencies, including FEMA and the U.S. Army Corps of Engineers. Using RIDM, hazards are characterized probabilistically, typically in terms of both the annual exceedance probability (AEP) and the structure life-cycle exceedance probability (LEP). The RIDM approach starts with a framework for identifying components of a system (e.g., variables), and understanding relationships of the components (e.g., correlations and/or cause-consequence relations), constructing an event tree, estimating probabilistic characteristics of each element (e.g., input probability distributions), and predicting outcomes of the overall performance (e.g., numerical modeling). Finally, stochastic modeling technique such as Monte Carlo simulation is used to establish a risk-frequency curve to aid risk-informed decision making. Cost-benefit analysis can be performed based on the risk assessment results, for selecting the optimal flood protection design or management scheme. This presentation will present a case study of a shoreline protection project in the Northeast to demonstrate the process of incorporating stochastic modeling technique to better understand the relationship between storm tides and shoreline change due to coastal erosion for risk communication and long term project planning. @RISK and Decision Tree (software developed by Palisade) will be used as the tool for risk analysis.

Deep Learning Approaches to Quantifying Urban Water Use in California

Andrew Brenner and Aron Boettcher, Quantum Spatial; Peter Brostrom, California Department of Water Resources; Micha Hey, Quantum Spatial

The State of California is now conducting the first step in a major water conservation initiative: an irrigated landscape analysis of all 12 million single and multi-family residences in California. This initiative is in support of the legislation (SB 606 and AB 1668) requiring equitable, district level water budgets. The California Department of Water Resources, working with Quantum Spatial, has now mapped 400 water districts in the state covering 16,000 square miles. The mapping was developed using 1 ft summer imagery captured in 2018 using remote sensing approaches that integrate contextual modeling and machine learning. These approaches have shown to be able to develop reliable estimates of outdoor irrigated landscape area. The presentation will provide an overview of the approach, outline the challenges encountered by the project and the solutions developed in order to overcome them. It will also cover the accuracy assessment approach and results. The application of these data to managing water use in California will be demonstrated.

Coastal Benthic Mapping: A Data Fusion Approach in Western Lake Michigan

Molly Reif, USACE Engineer Research & Development Center/Joint Airborne Lidar Bathymetry Technical Center of Expertise; Brandon Krumwiede, NOAA Office for Coastal Management; Steven Brown, Illinois State Geological Survey at the University of Illinois at Urbana-Champaign; Ethan Theuerkauf, Michigan State University

Understanding bottom type variation of shallow aquatic and marine environments is critical to coastal management and for identifying methods for creating mutually supporting economic and environmentally sustainable solutions to coastal planning challenges consistent with the Corps' Environmental Operating Principles. As part of research funded by the USACE Ecosystem Management and Restoration Research Program, the project aims to utilize existing and new geospatial technologies to improve our understanding of bottom type variation in the nearshore zone as a critical habitat parameter that influences important ecosystem functions and their derived services, such as fisheries production. Geospatial data resources and technologies suitable for benthic characterization in coastal environments were collected and analyzed, including USACE National Coastal Mapping Program high resolution imagery and bathymetric lidar data. The Coastal and Marine Ecological Classification Standard (CMECS) schema was applied to identify features that support sensitive, recreational, and commercial species in a pilot study in western Lake Michigan. The presentation will highlight capabilities for bridging resources (e.g., people, spatial analysis, and data) across agencies with a shared mission. More specifically, the discussion will include methodologies for a repeatable approach to map bottom types that could be applied to shallow coastal environments, allowing state and federal agencies to: 1) use a consistent framework to identify characteristics in underwater features using remote sensing data (lidar, sonar, imagery, etc.), 2) support restoration goals of many agency partners, and 3) support planning for economic and environmentally sustainable solutions to coastal management challenges. With parallel mapping strategies developed by USACE and NOAA, the approach will provide benefits to support restoration prioritization, identification of areas for preservation and conservation, monitoring restoration progress, and adaptive management objectives.

3:00 to 4:30 p.m. Eastern Time

CONCURRENT SESSIONS

SHORT AND SWEET: MAPPING, MANAGEMENT AND VISUALIZATION

Visualizing Coastal Flooding with Augmented Reality (AR) Technology

John Cartwright and John van der Zwaag, Mississippi State University, Geosystems Research Institute

The frequency of flooding events in coastal areas has been increasing for several decades. Current sea-level rise projections for this century will make the extreme events of today the norm by 2100. As the frequency of these events increases so does the need for improved education and decision making. Augmented Reality (AR) technologies are allowing real-time interactions with geospatial data through mobile devices that enhances what is typically seen in web and desktop applications. Augmented reality technologies provide the capability to overlay simulated geo-referenced data to the real world with a mobile device's integrated camera. The Geospatial Education and Outreach (GEO) Project at Mississippi State University is coupling augmented reality and geospatial technologies to allow users to visualize simulated coastal flooding. The flooding of the landscape is simulated with simple linear superposition model data that is computed from QL2 lidar collected in 2015. The augmented reality application allows the user to increase and decrease simulated inundation levels on the actual landscape as they navigate the area through the camera on their mobile device. Future project efforts are focused on improving the model for specific areas of the landscape with high-resolution lidar collected with unmanned aerial systems and enhanced three-dimensional (3D) structures. The application will be used to provide improved education, decision-making, and management of coastal resources and how they may be impacted by flooding and seal level rise.

Utilizing USGS Historic Scanned Quadrangles for Coastal Change Analysis

Tom Carlson, US Geological Survey

Coastal managers, planners, hydrologists, geographers and others, are often involved in conducting varying types of change detection analysis over the Nation's coastal zones. In order to determine the amount of change over an area, there must be some starting point in time to begin the study. Often it is challenging to find a source of early information about a place or an area to begin. One solution to this problem are US Geological Survey Historic Quadrangles or topographic maps that cover the United States and its territories. Since 1879 the USGS has been mapping the Nation's topography. In 2011, the USGS began digitizing its 1:250,000 scale and larger topographic maps. Currently there are some 178,000 of these maps in the Historic Topographic Map Collection. Digitized and georegistered, these historic maps have intrinsic value as a spatial-temporal resource and are now easily brought into GIS software. Utilizing TopoView, these maps are now readily available and have been preserved for all to use. This presentation describes the access and use of USGS Historic Quadrangles with examples in how they may be utilized in coastal change detection studies.

Digital Atlas of Micronesia

Maria Kottermair and Danko Taborosi, Island Research and Education Initiative

This presentation showcases the newly published Digital Atlas of Micronesia (islandatlas.org). The atlas is a comprehensive collection of GIS layers, interactive and static maps depicting the full range of physical, ecological, cultural, and social setting of the islands.

Marine Spatial Mapping as Spatial Project Management: The Greater Atlantic Region GIS Mapper

Talya ten Brink, NOAA Fisheries

The Greater Atlantic Region GIS Program created a mapper to aid internal NOAA partners to interpret impacts, analyze patterns, view overlapping regulatory areas and inform NOAA staff of data layers. Through incorporating layers of other data portals as well as internally generated data, the mapper allows users to quickly overlay, print, measure, and analyze spaces for decision-making. It allows lay users to quickly understand and use spatial data and overlay regulatory areas or draft regulatory areas with fisheries hotspots. Input on additional improvements and opportunities for incorporating and analyzing fisheries data for the mapper are welcome.

Statewide 3D Lidar Point Viewer

Emily H. Wilson and Qian Lei-Parent, University of Connecticut

Connecticut's statewide colorized Lidar points (yes, points!) and are now in The Connecticut 3D Lidar Viewer, a 3D web scene created in ArcGIS Online. Colorized means that a RGB color was assigned to each Lidar point based on underlying summer NAIP imagery, which provides a 3D-visualization of the aerial imagery. The web scene means that the points are fully interactive for viewing with 3D tools to pan, zoom, rotate and alter the viewing elevation. The colorized Lidar layer is just one option in the viewer. Other layers include Buildings and Bridges, Class Code Modulated (intensity), Enriched Flood Hazard Zones and a pilot area of 3D buildings and 3D trees where clicking on a building returns roof structure, height and size and clicking on a tree returns height, radius and diameter. Base layers include statewide DEMs, 1 foot contours and 1 foot impervious surfaces. The viewer is the first of its kind for an entire state and is available on the CT ECO website which is a partnership between the University of Connecticut Center for Land Use Education and Research and the Connecticut Department and Energy and Environmental Protection. Check it out at http://cteco.uconn.edu/projects/lidar3D/.

A CMECS Geoform Map for the Gulf of Mexico

Kate Rose and Just Cebrien, Northern Gulf Institute at Mississippi State University

A map of seafloor geomorphology of the Gulf of Mexico demonstrates a crosswalk of existing datasets to the CMECS Geoform Component. The resulting map provides a conceptual and geospatial framework for mappers to apply CMECS to their own work, and an iterative workflow for classifying and integrating additional Geoform products to the original map. The Geoform is one of the four CMECS components that can be used independently or combined with other components to describe ecosystem characteristics. It relies on interpreted bathymetry data to identify geomorphic features on the seafloor, which are then defined and described with the CMECS vocabulary and organized in a semi hierarchical structure based on the features' spatial scale. The continually updated Gulf of Mexico Geoform map as a stand-alone product can be used to inform gap analyses, data collection and interpretation, and to help identify marine habitats of interest. Within the accompanying web mapping application, additional data and map layers can be overlaid with the Geoform Component layer to derive spatial relationships between other ecosystem components and marine fauna.

Benthic Mapping

Deep Learning to Support Analysis of Benthic Towed Video Sled Surveys for Offshore Wind Farm Development

Tara Franey, RPS

Construction and Operation Plans (COP) and Environmental Impact Statements (EIS) for offshore wind farm development often require assessments of the benthic environment to detect complex habitats important for fishery management. In order to meet such requirements, surveys are conducted for the wind development areas and offshore export cable corridors. Recently, towed video sled surveys were completed offshore of Massachusetts. The surveys were analyzed by video reviewers to describe seafloor features, identify and enumerate epifaunal and demersal organisms, and characterize the benthic habitat. The species counts and video observations, along with percent cover analysis and grab sample information, were then summarized and used to classify the habitat in the project areas according to the Coastal and Marine Ecological Classification Standard. The personnel time and effort required to count epifaunal organisms can be substantial. In some cases, thousands of individual sand dollars, sea stars, or similar epifauna are clustered along a video transect. Deep learning and computer vision techniques were employed to help increase the efficiency of the video review. This process included training the model to detect specific types of organisms and applying an algorithm to track observations through video frames. Results from this process can include annotated video and listing of observations and their geographic location for each transect. Using this process, manual review of the video can be completed more efficiently. This presentation will, explain the need for benthic assessments in offshore wind farm planning and development, explain and demonstrate the deep learning approach applied to benthic video surveys, and discuss the efficiency benefits possible using this approach. Also, this presentation will demonstrate the potential for deep learning methods even in the absence of extensive training libraries and high-performance computer hardware.

It Takes a Team: Updating Benthic Habitat Mapping in the South Shore Estuary Reserve of New York State and Resulting Trends Analysis

Jeremy Campbell, New York Department of State, South Shore Estuary Reserve Program; Mark Finkbeiner, NOAA Office for Coastal Management

Participants will hear how mapping efforts in the SSER were completed. Validation methods will be discussed as well as process implementation using a broad spectrum of partners, from National Park resources to Town Bay Constables to State University partners. Change detection analysis will be reviewed, results displayed and discussed. Lessons learned between the first mapping effort of 2002 and this current effort based on 2018 imagery. Participants considering benthic mapping efforts of their own will find this session useful, as will Coastal Managers with interests in sea grass bed trends.

Non-tidal Potomac River Topo/Bathymetric Airborne Lidar Maryland-Virginia-West Virginia with Field Calibration and Supplementary Sensor Data

Roger Barlow and Jeff Danielson, USGS; Cherie Schultz, ICPRB; John Young, USGS

The presentation will show the partnership for data collection between the Interstate Commission on the Potomac River Basin (ICPRB) and the U.S. Geological Survey (USGS) October 21-26, 2019 which acquired high-resolution digital elevation topo/bathymetric data from airborne lidar for 67 river miles upstream from Washington, DC.The data collection included a 200-meter buffer of land on both shorelines and included all islands within the river. The ICPRB in conjunction with the USGS Leetown Science Center, the USGS Hydrologic Remote Sensing Branch, the USGS Coastal National Elevation Database project, and the USGS National Geospatial Program (NGP) determined that overlapping interests and use-cases existed to acquire topo/bathymetric data for the mid-Potomac River and that a coordinated approach for data acquisition would benefit all parties. The interdisciplinary use-cases include: detailed bathymetric characterization to improve time and travel modeling of potential spills into the Potomac threatening water supplies; improved bathymetric data for identification of benthic habitat for fish species; a comparison of UAV sensors with airborne lidar, GPS wading surveys, and sonar acquired by boat. The NGP is identifying partner use-cases for science support and external

partnerships, the development of inland topo/bathymetric collection standards, and identifying supplemental data sensors that may offer data integration for topo/bathymetric data drop out and voids.

Applying Species Distribution Models of Marine Fish into a Decision-Support Tool for Sand Dredging

Bradley Pickens, CSS-Inc./NOAA National Centers for Coastal Ocean Science; J. Christopher Taylor, NOAA National Centers for Coastal Ocean Science; Mark Finkbeiner, NOAA Office for Coastal Management; Alexa Ramirez and Elizabeth Rogers, Quantum Spatial, Inc.; Lora Turner and Deena Hansen, Bureau of Ocean Energy Management

Marine ecosystems are under increased pressure to accommodate multiple resource uses, yet fish spatial distributions and habitat relationships are often not identified at the scale needed to assess potential impacts from human activities. Contributing information, such as life history metrics, oceanographic characteristics, substrate attributes, and legal designations, are needed, but data sources are often spread across various organizations. Here, we used species distribution models of marine fish to inform planning and assessment of sand dredging in federal waters of the Gulf of Mexico and Atlantic Coast. We modeled species-habitat relationships of select fish species, including shrimp, juvenile reef-associated fish, and shark species. The most influential variables were determined and species' distributions were mapped. Stakeholder meetings contributed to the creation of a decision-support tool to coalesce all relevant information into a single framework. The findings showed that fish distributions were most determined by oceanographic conditions, prey, and nearby estuarine wetlands, while the influence of geomorphology was limited. The decision-support tool, ShoalMATE (Shoal Map Assessment Tool for EFH) brings together geospatial data on sand shoals, oceanography, seafloor characteristics, Essential Fish Habitat designations, and modeled marine fish distributions. ShoalMATE provides an interactive mapping platform that automates a consistent report to aide in the Essential Fish Habitat (EFH) assessments to minimize impacts to fish. ShoalMATE is intended for coastal managers, National Marine Fisheries Service, Bureau of Ocean Energy Management (BOEM), and US Army Corps of Engineers. The tool itself is available as an internal tool to BOEM, but output reports will be given to NOAA National Marine Fisheries and other organizations involved with sand dredging projects. Data underlying tool is available online. The project demonstrates that science and data can be efficiently integrated into decision-making and reporting.

TOOLS FOR SCIENCE-BASED DECISIONS

Oregon's Federal Consistency Portal: Leveraging GeoTools to Support Coastal Management

Adrian E. Laufer and Deanna Caracciolo, Oregon Coastal Management Program

The Coastal Zone Management Act grants state coastal management programs the authority to review federal activities and permit applications occurring within their coastal zone for consistency with state standards (also known as enforceable policies). This federal consistency authority has traditionally had little support from GIS or digital tools while other coastal program components (i.e. ocean resources, estuary planning, etc.) nearly always contain a geo-spatial component. Over the past year, the Oregon Coastal Management Program (OCMP) has explored innovative ways that GeoTools may support the federal consistency review process. Multiple rounds of exploration and evaluation resulted in the development of an Oregon Federal Consistency Portal: a web-based platform designed with Esri's ExperienceBuilder that uses maps and widgets to guide applicants through the federal consistency application process. Applicants may find maps and resources to support coastal effects analyses, use an original tool to develop an enforceable policy analysis (Esri Web AppBuilder), and submit their application through a survey form (Esri Survey123). Notably, the portal provides technical support for

the creation of enforceable policy analyses. The OCMP has a robust network of enforceable policies that can easily be overwhelming for applicants and staff. GeoTools simplified this network by establishing a formalized method for managing enforceable policies within a dataset, visualizing the geospatial extent of Oregon's standards, and creating a tool that reports applicable enforceable policies based on the location of the proposed activity. This innovative design has benefits for both federal consistency applicants and staff; it ensures equal access to information, delineates clear expectations, and creates a record for troubleshooting. This decision support tool highlights an area of opportunity for coastal management programs to leverage the capabilities of GeoTools to support marine and coastal policy.

Informing Long-term Coastal Management in East Hampton, New York

Brian Batten, Joel Plummer, Alaurah Moss, and Megan McKinley, Dewberry

In the face of continued and accelerating sea-level rise (SLR) coastal communities are facing increased pressure to manage shoreline retreat. Techniques to manage and prevent this retreat include adding sediment to the littoral system in the form of beach nourishment, stabilization of the coast, or retreat. As communities plan for the future, they seek to inform decision-making through gaining understanding of future conditions and long-term implications of alternative management strategies. The Town of East Hampton is located in New York State, USA, on the eastern most end of Long Island. On large parts of the town's north shore and in the vicinity of Montauk Point the shoreline is backed by high bluffs. These bluffs, specifically those of Montauk Point, are thought to be the major sediment source for the adjacent and downdrift beaches. A large number of homes, buildings, and infrastructure in the Town have been threatened by erosion, and in response, coastal armoring and beach nourishment have taken place along a significant portion of the shoreline. Continued stabilization of the bluff could result in a long-term deficit of sediment supply and exacerbate erosion. In order to plan for effective shoreline management in the future, the effects of these measures on the littoral system need to be understood and proactively managed. The study progressed through development of a series of products to improve understanding of the coastal littoral system and inform decision-making. These include a shoreline structure inventory, historical shoreline change analysis, future shoreline change analysis, and sediment budget. Geospatial products included symbolized classification of historical shoreline change, projected areas of shoreline retreat for multiple future SLR scenarios and time horizons, which were used to inform adaptation planning efforts. Our presentation will provide an overview of the effort, products, limitations and lessons-learned from the study.

N-Sink, a Web Tool to Support Community Nitrogen and Land Use Decisions in Watersheds

Qian Lei-Parent, Chester Arnold, Cary Chadwick, Emily Wilson, and David Dickson, University of Connecticut Center for Land Use Education and Research; Q Kellogg, University of Rhode Island; Jeffery Hollister, EPA Office of Research and Development; Arthur Gold, University of Rhode Island

Nitrogen(N) pollution is a major threat to coastal watersheds, estuaries and embayments, and the communities within their watersheds. As a result, federal water quality programs have mandated that decision makers address N pollution in land use policies and decisions. N-Sink, a tool that uses geospatial analysis to map N sources and sinks, can help land use managers to better understand the relationships between land use and N pollution in watersheds. N-Sink is a geospatial visualization tool that assists in identifying the areas in watersheds that are important to N pollution management. N-Sink uses the best available science on land use/nitrogen interactions, plus widely available data on hydrography, soils and land use, to highlight major sources and sinks of N in a watershed. N-Sink is a partnership between the University of Rhode Island and the University of Connecticut and has been

supported for the past several years by EPA Office of Research and Development (ORD). UConn Center for Land Use Education and Research (CLEAR) is currently transforming N-Sink to a web-based interactive mapping tool, built using R and the ArcGIS platform, that can be accessed by stakeholders through a web browser. In addition, the tool will allow users to specify a source location and generate a flow path of N to a watershed's outlet and estimate N reduction along the flow path.