MONDAY, FEBRUARY 11, 2019

7:30 a.m. to 5:00 p.m.
Cambridge Hall
REGISTRATION CHECK-IN

7:30 a.m. to 5:00 p.m.
Pembroke
SPEAKER READY ROOM

8:30 to 11:30 a.m.
Windsor A
S01. SPECIAL INTEREST MEETING: DATA DISCOVERY AND DISSEMINATION DURING DISASTERS

NOAA and our emergency response partners around the nation need to be in the best position possible to respond to coastal threats quickly, safely, and effectively. Although proper situational awareness is essential for an effective response operation, access to key spatial data can be difficult during rapidly evolving events. To help prepare for future responses, session speakers will focus on planning and training, field data collections, access to existing data portals, and lessons learned from past incidents.

Windsor C
S02. SPECIAL INTEREST MEETING: HIGH-RESOLUTION LAND COVER MAPPING NOW AND TOMORROW

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

This session will focus on discussing 1) recent advancements in mapping technology (including artificial intelligence), 2) the current state of NOAA's Coastal Change Analysis Program (C-CAP) mapping efforts, 3) several example land cover products (hands-on exploration), 4) uses of local-scale land cover information, and 5) needs expressed from those attending the workshop (through interactive polling and group discussion).

Somerset
S03. SPECIAL INTEREST MEETING: 3D NATION

3D Nation is the federal elevation data theme, consisting of the topography-focused 3D Elevation Program (3DEP) and the bathymetry-focused Interagency Working Group on Ocean and Coastal Mapping, with synergistic interests at the coast. This session provides a venue to learn about the activities and products of 3D Nation and an opportunity to provide feedback to agencies on current and future elevation needs.

1:00 to 4:00 p.m.

Windsor A

S04. SPECIAL INTEREST MEETING: Developing Decision-Support Tools for NOAA's Water Initiative

Too much water, too little water, or water of poor quality endangers life, property, economies, and ecosystems. In response, NOAA has come together, with all levels of government, stakeholders, and academic, nongovernmental, and private-sector organizations to implement the NOAA Water Initiative. Central to this cross-agency effort is the provision of timely, accurate data and information to support water-related decisions.

This special interest meeting will introduce efforts to provide data and information products through the National Water Model and decision-support tools from the NOAA Office for Coastal Management. Through interactive demonstrations, participants will learn how these products work and how communities can leverage and apply the information from these efforts. Participants will then be engaged in a facilitated dialogue to identify opportunities to support these efforts through the development of new decision-support products and services that address water-related issues (i.e. flooding, drought, and water quality) in the coastal zone.

Windsor B

S05. SPECIAL INTEREST MEETING: Digital Coast Resources to Jump-Start Open Space Preservation Analysis for Community Rating System Credit

Through FEMA's Community Rating System (CRS) program, communities can increase their resilience to flooding while lowering flood insurance rates by engaging in activities that exceed minimum floodplain management requirements. This interactive session primarily focuses on the application of GIS tools to support Activity 420 Open Space Preservation within the CRS program, where communities have the potential to earn up to 2,870 CRS credits by preserving open space and maintaining or restoring the natural functions of floodplains.

Through hands-on exercises, participants will learn how to use the Association of State Floodplain Managers and Coastal States Organization's Green Guide, NOAA's open space preservation how-to and GIS workflow, and The Nature Conservancy's Community Rating System Explorer. Attendees are encouraged to bring their own community GIS data and software. They will have the unique opportunity to have experts guide them through best practices to maximize their community's participation in the CRS program, perform Open Space Preservation GIS analyses, and explore decision-support tools to help guide their CRS planning process so they achieve economic and ecological benefit.

Windsor C

S06. SPECIAL INTEREST MEETING: Open Source Software for GIS and Remote Sensing

In today's realm of GIS and remote sensing, professionals have several software packages available to use, including both licensed and open source software. Both provide advantages and disadvantages unique to themselves. This special interest meeting is intended to introduce beginner to intermediate GIS and remote sensing users to the world of open source software and to demonstrate how to integrate open source software solutions into their own workflows.

Somerset

S07. SPECIAL INTEREST MEETING: UNMANNED AIRCRAFT SYSTEMS FOR COASTAL RESOURCE MANAGEMENT

Unmanned aircraft systems (UAS) provide a range of remote sensing solutions for observing and mapping in the coastal zone. These technologies offer new insights into real-world phenomena at scales that are difficult to observe using either traditional field-based approaches or aircraft- and satellite-based observing systems. UAS allow us to bridge this gap and acquire data in a more flexible and user-defined manner . . . or do they? Participants in this special interest meeting will share their experiences with UAS and learn about the challenges and successes of using these exciting and innovative technologies for coastal management.

5:30 to 7:30 p.m.

Kensington D, E, F

EXHIBITOR RECEPTION

TUESDAY, FEBRUARY 12, 2019

7:30 a.m. to 5:00 p.m.
Cambridge Hall
REGISTRATION CHECK-IN

7:30 a.m. to 5:00 p.m.
Pembroke
SPEAKER READY ROOM

8:00 a.m. to 3:00 p.m.
Kensington D, E, F
EXHIBITS

8:00 to 8:30 a.m.
Kensington D, E, F
COFFEE

8:30 to 10:00 a.m.
Kensington G
WELCOME AND KEYNOTE PLENARY

Moderator and ASFPM Welcome:	Chad Berginnis, Executive Director, Association of State Floodplain Managers (ASFPM)
South Carolina Welcome:	The Honorable Tom Rice, U.S. House of Representatives, South Carolina District 7 (Invited)
NOAA Welcome:	Nicole L. LeBoeuf, Acting Assistant Administrator, NOAA National Ocean Service (Invited)
Keynote Address:	The Dramatic Pace of Innovation in Geospatial Analytics for Land, Sea, and Space Anne Hale Miglarese, Chief Executive Officer, Radiant Earth The speed of innovation occurring in the geospatial profession is mind-numbing. From the exponential number of Earth observation satellites in orbit to machine learning and autonomous drones, the amount of data and the tools we use to analyze this information is growing daily. While disruptive to our workflows and many existing business models, the opportunities

Along coastlines with bluffs or cliffs, like the Great Lakes, bluff erosion both provides much of the sediment available to the nearshore and poses a threat to land owners. All of these features vary significantly along the coast on sub-kilometer scales, but influence coastal resilience on a regional scale. In order to understand this interplay, methods must be developed to map and quantify these elements. Given the large spatial extent of the U.S. coastal zone, remote sensing data is uniquely suited to support such a regional analysis. This feature detection work utilizes remotely sensed data collected as part of the U.S. Army Corps of Engineers' National Coastal Mapping Program. Parameters such as dune peak and toe, beach and barrier island width, slope, volume of the barrier island, impervious surface, and dune vegetation were derived from lidar elevation data and hyperspectral imagery along the sandy shorelines of Texas. Along the bluff coastlines of the Great Lakes, bluff crest and bluff toe were extracted. These datasets can be used to better understand coastal storm impacts and the influence of coastal erosion on near shore sediment budgets. Dune and sandy coastline parameters can be ranked and weighted based on relative importance to produce a final product, illustrating areas of greatest or least concern. Bluff crest and toe data can be used to map bluff retreat and quantify sediment volume contributions. Coast-wide assessments such as these are broadly applicable and allow for the consideration of small-scale coastal features on a regional scale.

Windsor C

POWER OF MOTHER NATURE: FLOOD AND EROSION PROTECTION

A09. Are Living Shorelines Suitable Here? Are They Feasible? Answering Shoreline Management Questions "Smartly" Using a Geospatial Approach

Vidya Balasubramanyam, Tridec Technologies/New Hampshire Department of Environmental Services; Kirsten Howard, New Hampshire Department of Environmental Services

Did you know that 70% of New Hampshire's Atlantic Coast and 12% of its estuarine shoreline is hardened? This is of concern because with rising seas and intensifying storm surges, armored shorelines will impede marsh migration, negatively impact shoreline stability and habitat condition, and potentially fail during major storms if built or maintained poorly. Recognizing the need to transition to softer approaches for shoreline protection, the NH Department of Environmental Services Coastal Program (NHCP) and its partners embarked on the New Hampshire Smart Shorelines project. This is a two-pronged geospatial modelling effort which asks two questions for any given site along the NH tidal shoreline: 1) Will a living shoreline project be suitable for this site given its biophysical conditions? 2) Is a living shoreline project actually feasible to implement for this site given its sociopolitical conditions? Borrowing from geospatial site suitability modelling approaches in Maine, Connecticut, Maryland, North Carolina, and Florida, the NH model crunches data on hydrodynamic, geophysical, ecological, and sociopolitical characteristics of NH's entire 326-mile tidal shoreline. It even attempts to incorporate characteristics unique to the northeast such as the effects of ice, nor'easters, and a large tidal range. Each shoreline segment was scored on a scale of 1-6; 6 being most likely suitable for soft stabilization, and 1 being least likely suitable for soft stabilization (it also politely suggests to the user when not to mess with a particular section of the shoreline at all!). In this presentation, we will share technical details about the iterative modelling process, as well as information on how we engaged stakeholders and end-users in developing the model using a variety of techniques such as stakeholder meetings, one-on-one interviews with experts, site walks, and solicitations for "problem sites" through living shoreline workshops.

- An ecological assessment with synthesis of habitat, living resource and water quality data needed for future sanctuary condition reports.
- Hundreds of annotated HD underwater video characterizing different lakebed habitats .
- Several NOAA technical memoranda summarizing work and results.
- A publicly-accessible online data and map viewer.

3:00 to 5:00 p.m.

Kensington A, B, C, and G

TOOLS SHOWCASE

T01. Immersing Yourself into the Floodplain: Use of Mixed Reality to Highlight Flooding Risks

Scott Aldridge and Brian Caufield, CDM Smith

The social, economic, and environmental impact of flooding on surrounding communities can be effectively addressed through the use of immersive mixed reality. Mixed reality brings the flooding extents out of the screen and provides users the ability to interact with design data more intuitively. Immersion into the floodplain overlain onto the real world provides a rich environment that supports decisions and enables efficient community collaboration. Using immersive mixed reality 3D visualization enhances collaboration and provides teams with the ability to experience flooding at scale in the world around you. Furthermore, these applications could increase public participation in the planning and development process through home use of these devices for virtual town halls. The ability of the public to visualize policy impacts in a three-dimensional world could have significant implications for public outreach efforts associated with floodplain management projects. At CDM Smith, we're harnessing the power of Microsoft's HoloLens, a mixed reality technology, to help our clients design, build and operate their infrastructure assets faster and more efficiently. For the architectural, engineering and construction (AEC) industry, this signifies a new working environment, where architectural design collides with reality, and construction teams transform digital content into physical objects. Using this immersive mixed reality platform enables CDM Smith teams to interact with 3D design models including hydraulic model results at scale using Microsoft's HoloLens wearable holographic computer, creating new ways to visualize, identify, share and manage information and changes on even the most complex projects.

T02. Resilience Modeling with City Simulator

Stephen Bourne, Atkins

Coastal communities face myriad challenges as they peer into a climate-change impacted future. A warming earth continues to wreak havoc with larger storms, more severe heat waves, longer droughts, and rising sea levels. Paradoxically, people continue to flock to the coasts seeking better jobs and higher quality of life. How can communities increase their resilience and clear the way for safe growth in the future? They are starting to realize that understanding the potential impacts needs to be done in a combined way, where the interdependencies between urbanization and severe weather are brought to light. Atkins' R&D group has developed City Simulator to help communities tackle this problem. City Simulator is a GIS-based tool that simulates growth of a community over time. Using an agent-based approach, it creates a virtual human population that matches the real population statistically in the base year. Then it adds the necessary built environment to support the virtual population as it grows over a 30 to 40 year time frame. As new urbanization occurs, the tool evaluates the impact to the ecosystem, evaluating shifts in floodplains, wetlands, ecosystem services, and carbon footprint. To capture the impact of climate change, the simulator uses daily time-step rain

and temperature forecasts based on general circulation model projections and historic local data to hit the community with storms, droughts, and heat waves that carry the climate change signal. Using existing disaster models, like FEMA flood models, the tool evaluates which infrastructure is impacted when these events occur and simulates them recovering over time based on the city's preparedness. Atkins is helping community stakeholders use the tool in workshops, as they design their own adaptation scenarios and stress-test them with simulation. This tool showcase will allow users to build adaptation scenarios and run them in real time.

T03. NOAA Shoreline Data Explorer Application

Douglas Graham and David Ermisch, NOAA National Geodetic Survey

The NOAA Shoreline Data Explorer provides the Continually Updated Shoreline Product (CUSP), National Shoreline, and historic raster T-Sheets. This presentation will focus primarily on CUSP and the NOAA Shoreline Explorer application. CUSP provides the most current shoreline representation of the United States and its territories. Shoreline data supports coastal mapping applications and assists decision makers in developing coastal community plans, managing resources, mitigating hazard events, and conducting environmental analyses to meet our nation's economic, social, and environmental needs. Over the years, several continuous shorelines have been developed, but many have not been maintained and therefore no longer adequately represent current conditions. CUSP has been designed to deliver continuous shoreline with frequent updates. Where applicable, CUSP will reference a mean high water shoreline based on vertical modeling, images acquired near mean high water, or image interpretation using water level stations and shoreline indicators. CUSP is built upon NGS National Shoreline data and uses both NOAA and non-NOAA contemporary sources to replace older vintage shoreline areas. NOAA data sources and processing tools combined with available external data has allowed NGS to create this Continually Updated Shoreline Product.

T04. Massachusetts Coast Guide Online: A Unique Parcel-Based Approach for Discovering Public Access to the Coast

Samantha Coccia-Schillo and Daniel Sampson, Massachusetts Office of Coastal Zone Management

Massachusetts has a long-standing commitment to helping people enjoy the coastline, with the Office of Coastal Zone Management (CZM) taking a primary role in making the coastline accessible to the public. One way we do this is via Coast Guide Online (CGO), an online map that contains over 1,900 public access sites ranging from large National Seashores and state beaches to little-known municipal rights-of-way and non-profit land trust holdings. CGO is unique in that all access points are parcel-based with data coming from up to date standardized assessors' parcels. Public access locations exist throughout Massachusetts tidelands, not just along the open Atlantic Ocean shoreline. CGO is powered by Esri's ArcGIS Online mapping engine and leverages the Story Map interface to allow Users to search for specific place names, change their basemap and find their current location on the map. The Story Map also highlights popular access categories, such as beaches and boat ramps, in their own tabbed web maps. Next steps for Coast Guide Online include the creation of a native app, which will allow users to more easily access Coast Guide while on the go via smart phone. New feature highlights such as public hiking trails and fishing piers will be forthcoming in future updates.

T05. Making Forecasts Smarter: Exploiting GIS to Produce Georeferenced Harmful Algal Bloom Forecasts

Edward Davis, NOAA Center for Operational Oceanographic Products and Services

Located on the southeast coast of Florida in Martin County, Bathtub Reef Beach is a favorite spot to locals, tourists, and habitat to more than 500 marine creatures, including endangered sea turtles. During summer, absent impacts from hurricanes, the Sabellariid worm-reef sitting offshore breaks incoming waves, creating a "bathtub effect." During the spring and summer calmer seas, the emergence of sandbars creates favorable conditions for recreation.

Fall nor'easter storms often arrive in conjunction with the highest tides of the year. The worm-reef is neither tall nor sturdy enough to break up this wave energy, offering little protection to the beach. The reef's height can however prevent sandbars formed with eroded beach sand from moving back onshore when the seas subside. The result is a thin beach where continuing effects of erosion threaten infrastructure and valuable habitat. The County regularly schedules beach restoration work mitigate erosion.

To avoid sea turtle nesting season, beach restoration work occurs when beaches are typically crowded with tourists in Florida. To help with the public outreach efforts, the County created the "Bathtub Beach Betty" character. She is the "face" of Bathtub Reef Beach in social media, Web, news, and has its own GIS web application.

The ArcGIS Online Bathtub Beach Betty application was first launched February of 2016 and was also active during construction activities in 2017 and 2018. The tool includes information about beach and park access closures, work areas, sand placement progress along beach sections, location of equipment on the beach and in waterways (i.e. dredge vessel and pipeline location) and is updated daily.

This presentation will show case the Bathtub Beach Betty web GIS application and the related public outreach strategies adopted by the County to promote the application in social media and keep beach and waterway users informed.

T12. The Georgia Wetlands Restoration Access Portal (G-WRAP)

Tony Giarrusso and Sheldon Leiker, Georgia Tech Center for Spatial Planning Analytics and Visualization

The Georgia Wetlands Restoration Access Portal (G-WRAP - http://geospatial.gatech.edu/G-WRAP/) is a publicly- available geospatial gateway to wetland-specific interactive maps, data, and resources for coastal Georgia. Created through funding made available by the EPA, Georgia's Coastal Resource Division uses G-WRAP to actively manage their wetland resources. Built using ESRI online tools (Web App Builder and Story Maps), G-WRAPs provides access to map applications containing over 25 wetland-related datasets for coastal Georgia. G-WRAP contains a customized site summary widget in addition to standard tools available through ESRI's Web App Builder. Two ESRI Story Maps are also available, one of which is a detailed tutorial on how to use the main G-WRAP application, while the other provides background information on previous geospatial wetlands' initiatives in Georgia.

T13. Creating a Dynamic Digital Reality

Jeff Van de Vaarst and Trent Tinker, Hexagon US Federal

NOAA and the Coastal Community are called on in times of natural disaster and other crises to provide critical support to evacuation planning, search and rescue operations, and a range of other missions at the federal, state, and local levels. In order to achieve this goal, analysts and other professionals within that community must work with large quantities of critical data from many sources in a variety

of formats. This data comes in the form of imagery, LiDAR, maps, and real-time data feeds, such as weather and traffic flow, as well as a host of other business and systems data. Once the analyst has identified the appropriate sources of data they must then integrate all of it into an accurate digital representation of the area of interest, perform necessary analysis, and rapidly share results with a wide range of individuals. In the past, this has been a very difficult, costly and time consuming task. Hexagon has developed a web-based solution that address these challenges and provides the analyst with a 3D interactive environment that improves the ability to integrate, visualize, and analyze the wealth of data critical to making decisions under these conditions. This Hexagon solution provides direct connections to all necessary sources of information and creates an interactive, accurate 3D digital recreation of the area of interest. The solution also incorporates powerful analytical tools such as change detection, point-cloud analysis, and route planning that previously were only available in costly and complex desktop applications. Attend this session to learn how Hexagon can enable the Coastal Community to effectively connect to and integrate a wide range of critical information to create an accurate, real-time digital reality that improves NOAA and the Coastal Communities' ability to make better decision more confidently and provide effective support in times of crisis.
Available for download, and (3) an ArcGIS calculator tool for creating GIS layers of SLR inundation.

T14. Dashboard Uncovers Great Lakes Wave and Surge Modeling Insights

Ayman Halaseh, CDM Smith

As part of a Federal interagency initiative for the Great Lakes Coastal Forecasting System (GLCFS), FEMA's mapping partner, STARR, performed a flood hazard analysis including basin-wide wave and water level modeling study using an ADvanced CIRCulation (ADCIRC) model coupled with a Simulating WAves Nearshore (SWAN) model. The lake wide output results from model was used in nearshore wave setup, runup, overtopping and overland wave propagation engineering analysis. The flood hazard engineering analysis output was used in developing the Flood Insurance Rate Maps (FIRM). A response-based flood frequency analysis was used to determine the 100 year total water elevation (TWEL), which involved running 150 events. The historical record of storm surge and wave observations in Lake Michigan, Superior and Huron was used to identify 150 events for use in basin wide storm surge and wave models. STARR developed tools to extract the results from the storm surge and wave model and other tools to identify map coastal flood hazards along the coastline of the three lakes. This presentation will highlight and demonstrate three data analysis tools that was developed to help enhance the study quality and efficiency, the three tools includes (1) the lake wide model node selection and data extraction, visualization and QAQC process, (2) Wind event separation tool that was used to separate wind data time series into events and separate them. (3) Coastal mapping decision tool that compiles transect input and output data and analyze them to mapping decision sheet.

T15. Gulf TREE, a Resource for Climate Resilience Tools

Mikaela Heming, Northern Gulf of Mexico Sentinel Site Cooperative, Mississippi State University, Mississippi-Alabama Sea Grant; Kristin Ransom, The Baldwin Group at the NOAA Office for Coastal Management

Gulf TREE (Tools for Resilience Exploration Engine) is a filter-based search engine designed to match users with relevant climate resilience tools quickly, easily, and confidently. With over 100 tools relevant to the Gulf of Mexico (and more being added all the time), Gulf TREE sorts through all these options to match users with a climate resilience tool that meets their criteria. The new web resource, released February 2018, was created by the Northern Gulf of Mexico Sentinel Site Cooperative, the Gulf of Mexico Alliance, and the Gulf of Mexico Climate and Resilience Community of Practice. Gulf

T19. The Who, What, How, and Why of Using Story Maps to Enable Resilient Post-Disaster Recovery

Alaurah Moss, Dewberry

This tool showcase will highlight the suite of data products and tools that were developed to support Hurricane Maria and Irma recovery efforts. In the aftermath of the devastating 2017 hurricane season, Dewberry supported the Federal Emergency Management Agency (FEMA) in developing flood hazard advisory data and tools to enable a more resilient recovery. Advisory Base Flood Elevations (ABFEs) provide information on the elevations communities should build to in order to reduce mitigate future flood hazard risk and guide recovery in areas impacted by hurricanes. Dewberry developed ESRI Story Maps for Puerto Rico and the US Virgin Islands to support data accessibility and stakeholder outreach. These Story Maps provide guidance for federal, state, local officials, business and homeowners, real estate and insurance professionals, builders, architects and engineers, and others on how best to use the advisory data and products. Topics covered include:

- What are advisory products and how were the ABFEs developed?
- How do I access and apply the ABFEs?
- What are the implications of the use of ABFEs and advisory maps on floodplain management and insurance?
- How do ABFEs fit into mitigation and disaster grant and assistance programs?
- What are other available mitigation and recovery resources?

Contained within the Story Maps are tools that provide quick and easy way to access advisory flood hazard information for any location. Software engineers at Dewberry designed the 'What's My ABFE Tool' to allow users to query locations to obtain the following information:

- Advisory flood zone
- Advisory Base Flood Elevation (ABFE)
- Advisory depth of flooding
- Advisory storm-induced erosion area
- Advisory 1% annual chance flood hazard erosion area
- Current effective flood zone
- Current effective Base Flood Elevation (BFE)

T20. Adopting Stormwater Management for Coastal Floods

Josh Murphy, Maria Honeycutt, and Doug Marcy, NOAA Office for Coastal Management

Stormwater management is an essential function of communities large and small. Through plans, policies, and regulations and an integrated system of engineered structures and natural features, runoff is collected, stored, and ultimately transported via gravity or pump through an outfall into a receiving water body. In many coastal communities, this water body is tidally influenced, and thus subject to inundation from tidal and storm surges. When outfalls are partially or completely inundated, stormwater is unable to travel out of the system, causing backups that could lead to flooding within the community. Rising sea levels are increasing the frequency and duration of coastal inundation, thus increasing the chances that a community may face flooding from heavy precipitation that occurs during a coastal flooding event. These combined flooding events pose significant challenges to low-lying coastal communities. To effectively tackle this complex issue, communities need to know when they should expect to see coastal flooding, how long it will last, and how it may impact their ability to effectively manage stormwater. "Adapting Stormwater Management for Coastal Floods" is a web-based decision-support resource, available through NOAA's Digital Coast platform, that provides timely and relevant information to address these concerns. Developed for stormwater and floodplain managers, as well as land use planners, this interactive website incorporates tools and

data into a uniform data model. Data includes: interpreted sediment samples, bathymetry, seismic, and side scan sonar surveys; NEPA, dredged, and sand resource data. The culmination of this effort is the MMIS viewer which allows public access to an interactive support tool with data and information relevant to the offshore mineral resources throughout the U.S. Atlantic, Gulf and Pacific OCS. The viewer also utilizes publicly available web services (mostly via MarineCadastre.gov) that are critical to identifying multi-use conflicts. Functionality within the viewer includes MMIS web services which can be used within ArcGIS Online or a desktop mapping application, the ability to locally download selected data and related tables, access to a blank template schema of the MMIS, and access to a data dictionary. The goal of this viewer is to act as a resource for state partners to view sand resources and other relevant geological data within the OCS that may be of used for coastal infrastructure and /or nourishment projects. With access to templates and supporting documents, partner agencies can also ensure that data exchanges between them and BOEM are seamless. The MMIS Viewer is important resource for information and a tool to coastal communities and a guide for the responsible resource stewardship.

T28. The Mid-Atlantic Ocean Data Portal

Karl Vilacoba, Monmouth University Urban Coast Institute

The Mid-Atlantic Ocean Data Portal (portal.midatlanticocean.org) is a free and publicly accessible mapping and information site focused on ocean areas from New York through Virginia. The Portal offers a selection of over 4,000 interactive maps depicting commercial fishing hot spots, marine life habitat, shipping vessel concentrations, Naval training zones and many other human activities and natural processes taking place at sea. The Portal is being developed by the Mid-Atlantic Regional Council on the Ocean (MARCO) — a partnership of the governors of Delaware, Maryland, New Jersey, New York and Virginia — with a project team that includes the Monmouth University Urban Coast Institute, Rutgers University, The Nature Conservancy and Ecotrust. The technology is designed to help policymakers and regulatory agencies make science-based decisions that promote healthy marine ecosystems and sustainable ocean use, as well as provide the public and stakeholders with readily accessible spatial data and the best information available about ocean environments and economies. The Portal has grown in importance as an ocean planning tool, particularly for its ability to illustrate where there are possible conflicts and compatible uses at sea. Examples of recent Portal uses include government agencies determining areas suitable for offshore wind farms; submarine cable developers designing alignments that avoid bottom-tending fishing and other threats; and conservationists conducting research and outreach on areas around New York Harbor where vessel traffic poses the greatest hazard to whales. The Portal also served as the chief information source and a key public outreach tool for a first-of-its-kind Mid-Atlantic Ocean Action Plan produced in 2016 by a Regional Planning Body composed of representatives from states and federal agencies, tribal entities, and the Mid-Atlantic Fishery Management Council. Karl Vilacoba is the Monmouth University Urban Coast Institute's communications director and the communications lead for the Mid-Atlantic Ocean Data Portal. Prior to the UCI, Karl worked for the North Jersey Transportation Planning Authority, where he oversaw a variety of public outreach efforts and served as managing editor of a national transportation magazine. Karl previously spent a decade as a journalist at newspapers in the Jersey Shore area and USA Today's Manhattan Bureau. A lifelong Shore resident, Karl also served for several years as a member of the Lake Como (N.J.) Planning Board and the borough's Environmental Commission.

corrected for the refraction using a rapid first order correction method and the results compared to the topo-bathymetric lidar collected during the same timeframe. We present here the methods and workflow used to generate depth corrected SFM point clouds, and the results when of the comparison with lidar.

Windsor C

MODELING FOR FLOOD RISK

C09. Jupyter Notebooks: The Right Tech at the Right Time

Seth Lawler, Jeff Gangai, and Tyler Miesse, Dewberry

Notebook technology is rapidly becoming the go-to standard for software development, testing, and scaling across industries. Boosted by the pioneering work of data scientists at academic institutions (e.g. U.C. Berkeley, Harvard) partnering with industry giants (e.g. Netflix, Capitol One) and open source sponsors (e.g. Anaconda, NumFocus) the Jupyter ecosystem is challenging traditional workflows and creating opportunities for improvement at a remarkable pace. This presentation will demonstrate the power and flexibility of notebook technology as applied to coastal flood hazards modeling and assessment. Two use cases will be discussed: 1.A step by step presentation demonstrating how Jupyter notebooks were used to retrieve input data, develop models, and manage simulations to recreate the inland flooding resulting from Hurricane Harvey in Houston, and 2. Examples of how notebooks are being applied to manage storm surge modeling using ADCIRC + SWAN on a High Performance Computing cluster. Throughout the talk, emphasis will be placed on OS-independent, open source alternatives for GIS, data processing, and data visualization tools equally suitable for a Desktop PC or HPC/cloud computing environments.

C10. Uncertain Seas: Probabilistic Mapping of Future Flood Risk

Christopher Amante, CIRES and NOAA NCEI

The National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI) develops digital elevation models (DEMs) to support the modeling of coastal processes including tsunami, storm surge, and sea-level rise inundation. Deviations in elevation values from the actual seabed or land surface constitute errors in DEMs. The magnitude and spatial distribution of the errors are typically unknown, and the lack of knowledge regarding these errors represents the uncertainty in the DEM. DEM uncertainty should be considered in the modeling of coastal processes, such as sea-level rise inundation. This study implements a Monte Carlo technique to incorporate the DEM uncertainty, as well as the uncertainty of present-day storm surge risk and future sea-level rise projections, to map the future flood risk in the Tottenville neighborhood of Staten Island, New York City. Generated statistical products, such as the probability of inundation by a given year, are visualized on an interactive web map, UncertainSeas.com, and indicate the spatially- and temporally-varying future flood risk in Tottenville. The statistical products indicate that future flood risk varies both spatially and temporally because of the uncertainty in the input data sources, as well as the terrain variability within the Tottenville neighborhood itself. The uncertainty of future flood risk is larger in low-lying areas of Tottenville with smaller terrain slope because small changes in relative water levels result in large changes to the areas at risk of flooding. There is also larger uncertainty in future flood risk in later decades due to increasing uncertainty in sea-level rise projections over time. The methods and results of this study provide decision-support tools that can inform coastal planning to mitigate potential loses and support resilient coastal communities.

- Hyperspectral imager
- High-resolution areal frame camera

The CZMIL system in conjunction with the Optech HydroFusion software suite within a data fusion paradigm, makes CZMIL an integrated lidar-imagery system for the highly automated generation of physical and environmental information products beyond topographic and bathymetric mapping. These products include benthic classification, water column and bottom type characterization, 3D imaging of water column inhomogeneities, detection of submerged hazardous objects, etc. Its system capabilities are the reason why CZMIL has been applied to various environmental surveys aimed at the detection of distributed pollutions (oil spills, industrial leaks) or discrete targets (plastic debris, sunken objects, etc.) in the water column as well as bottom disorders (silt or sandy sediments). In this presentation we will discuss several examples of CZMIL and its predecessor (SHOALS) engaging in environmental disaster surveys:

- Detection of 3D imaging of leak from a sewer pipeline in Ft. Lauderdale, Florida
- 3D visualization of BP oil spill in Gulf of Mexico
- Coastal zone change detection and its implications after Hurricanes Sandy and Matthew
- Detection and volume estimation of floating and submerged debris in North Pacific Garbage

E04. Mapping and Analysis of Coral Reefs Utilizing Unmanned Aerial Systems

Robert O'Conner, NOAA National Marine Fisheries Service

Use of Unmanned Aerial Systems (UAS) is becoming a widely accepted tool within coral reef management as a quick and effective way to map and monitor large swaths of the reef. The learning curve to get operational is steeper then it might initially appear. This special presentation will provide an overview of UAS within NOAA, and an introduction into the requirements needed to fly a drone as an employee of the Federal government. Discussion will include on overview of the FireFlyPRO 6 UAS, and it's benefits and limitations. Highlights of data collected and future applications will be included.

Windsor B

MAPPING WITH UNMANNED AERIAL SYSTEMS

E05. Geodesign and Sea Level Science: Integrating Drone Mapping, Ecosystem Models, and Green Infrastructure Alternatives for Coastal Resilience

Thomas Allen, Old Dominion University

Coastal communities witnessing sea level rise and increasing coastal flooding impacts are challenged to envision future consequences and make important policy and planning decisions. Sea level science has advanced to the state of providing increasing accuracy and precision for coastal water level rise and subsidence, even if long-range uncertainty persists. Geodesign, as a set of concepts and methods, has also evolved to invite collaboration and empower the identification of alternatives and optimal future built and natural environments. Seeking to integrate geodesign and sea level science, this pilot project sought to demonstrate the state of the art in unmanned aerial vehicle (UAV) image and surface modeling, wetland response modeling, storm surges, and geovisualization in order to provide communities a salient and scientifically robust vision of alternative futures. Using case study sites in Hampton Roads, Virginia, the project focuses on the integration of fine-scale drone imagery, 3D modeling, and modeled wetland responses to future sea level rise. The products of the project demonstrate that alternative future states of the coast will depend on communities' planning and policy decisions in the face of short, medium, and long-term sea level changes and variable degrees of adaptation, mitigation, and strategic retreat.

for the growing number of 'urban beaches' which, like roads that serve them, are maintained essentially as infrastructure. Although unfortunate, this is a new reality for many coastal towns, so results and potential use in planning and budgeting are discussed.

E10. Using Holistic City Simulation to Test Resilience Adaptation Strategies

Stephen Bourne, Atkins

Coastal communities face myriad challenges as they peer into a climate-change impacted future. A warming earth continues to wreak havoc with larger storms, more severe heat waves, longer droughts, and rising sea levels. Paradoxically, people continue to flock to the coasts seeking better jobs and higher quality of life. How can communities increase their resilience and clear the way for safe growth in the future? They are starting to realize that understanding the potential impacts needs to be done in a combined way, where the interdependencies between urbanization and severe weather are brought to light. Atkins' R&D group has developed City Simulator to help communities tackle this problem. City Simulator is a GIS-based tool that simulates growth of a community over time. Using an agent-based approach, it creates a virtual human population that matches the real population statistically in the base year. Then it adds the necessary built environment to support the virtual population as it grows over a 30 to 40 year time frame. As new urbanization occurs, the tool evaluates the impact to the ecosystem, evaluating shifts in floodplains, wetlands, ecosystem services, and carbon footprint. To capture the impact of climate change, the simulator uses daily time-step rain and temperature forecasts based on general circulation model projections and historic local data to hit the community with storms, droughts, and heat waves that carry the climate change signal. Using existing disaster models, like FEMA flood models, the tool evaluates which infrastructure is impacted when these events occur and simulates them recovering over time based on the city's preparedness. Atkins is helping community stakeholders use the tool in workshops, as they design their own adaptation scenarios and stress-test them with simulation. This presentation will review the simulator's methodology and present several case studies.

E11. GeoCoast: 3D Inundation Visualization and Decision-Support System

John Cartwright and John VanderZwaag, Mississippi State University, Geosystems Research Institute

The Geosystems Research Institute at Mississippi State University has developed an interactive, web-based tool to allow decision-makers to simulate sea level rise along the Mississippi coast. GeoCoast is a publicly accessible website allowing users to visualize sea level rise impacts in both two-dimensional (2D) and three-dimensional (3D) environments. In each of viewers users can identify the impacts of sea level rise on critical infrastructure, such as government and medical facilities. GeoCoast (2D/3D) has traffic routing capabilities allowing users to view these impacts on local road networks for various, user defined, inundation levels. The base inundation model in GeoCoast uses a simple linear superposition approach built on QL2 lidar data collected in 2015. This base model allows users to visualize buildings and roadways by depth of inundation (up to 15 feet) with a simple map slider. Recent data additions to GeoCoast includes NOAA's sea level rise data from the digital coast and storm surge/flooding data based on ADCIRC model runs. The ADCIRC runs include hind cast data for hurricane Katrina and other significant tropical systems affecting the northern gulf coast. Sea level is estimated to rise up to two meters in the next century. This coupled with the increasing possibility of tropical system frequency and intensity puts the nation's coastal communities at risk.

stakeholders can view the highest concentrations of significant areas. UConn CLEAR's CT Eco platform will act as the primary delivery mechanism, with sharing out to the portals listed in 1) above.

E16. Discovery Tool for Information used in Decision Support

Jonathan Blythe, Bureau of Ocean Energy Management; Adam Bode, The Baldwin Group at NOAA Office for Coastal Management

Federal agencies are required under the National Environmental Policy Act (NEPA) to use the best available science to consider the impacts of their activities to the natural and human environment. Availability of scientific information is partially determined by the accessibility of publication outlets, such as the peer reviewed or gray literature that is in the public domain. However, another aspect of availability is the ease with which accessible information is searchable, and NEPA provides exceptions from consideration of public information that is difficult to find. Internet publishing and web search provides a solution for this kind of problem, because technology is making it much easier to find relevant information on the web. In this presentation, we will discuss improvements to web search that are being implemented in the Bureau of Ocean Energy Management's Environmental Studies Program Information System, in collaboration with the NOAA Office of Coastal Management under the umbrella of the Marine Cadastre platform. An analysis of user experience will be conducted for the period of time preceding and after the deployment of search improvements, using google analytics. Success will be defined by user sessions that more frequently result in successful outcomes, such as downloading a BOEM final report, or a reduction in the number of searches that result in dropped sessions or other non-constructive terminus. Discovery will continue to be the subject of future improvements to ESPIS, but once ESPIS search has been optimized, BOEM will be able to focus much more deliberately on managing the vast body of knowledge within to ensure its consistent and reliable use supporting BOEM regulatory process, improving the management of ocean resources, and support the informed agency decision making on ocean energy and marine mineral development.

7:00 to 10:00 p.m.

Kensington D, E, F, G

SPONSOR RECEPTION: 20TH ANNIVERSARY 80S STYLE

made about the reach of future storm-driven flooding. Traditional methods of setting flood-lines have traditionally relied on elevation-based watershed-analysis with little reference to ground checked information from known flood events. This paper explores the use of resident-sourced damage claims and recorded seed and stain line locations, combined with high a resolution digital elevation model to perform multi-criteria scoring of flood locations to interpolate a 'estimated flood reach' (EFR) for the purposes of informing flood mitigation decisions such as structural alterations, evacuation mobility, or migration. Seed and stain line data, which is the visual presence of water lines on walls, was gathered by the USGS for both Hurricane Matthew and Irma. Resident reported damage was collected as part of a secondary analysis of interviewee data from Orland and Welch-Divine's research on the experiences and perceived risk of coastal Georgia residents who experienced Hurricane Matthew and Irma. EFR derived in this way will better inform mitigation decisions than traditional flood line estimates in two ways: 1) EFR reflects time-of-storm flood evidence that captures the complexity and dynamism of wind and water movement during a storm while traditional methods assume linear and steadily incremental movement, and 2) The data has spatial and temporal validity reflecting current-condition elevation, spatial planning and land use.

F10. Next Generation Flood Hazard Risk Communication Website

Tonda Shelton, North Carolina Department of Public Safety, Emergency Management Division

North Carolina's investment in providing digitally assessable flood hazard data, models, maps, risk assessments has been further enhanced by the release of a new public website, www.flood.nc.gov. This new website is a complete overhaul of the previous website this mapping partner was using to communicate to the general public about the floodplain mapping efforts in North Carolina. Feedback from focus groups was incorporated into the website design to create building-specific flood insurance rates on-the-fly, various pages for the NFIP and mitigation programs, and floodplain mapping program documents. It only takes 10 seconds for a user to type in a building address and then decide what information they want to see about flood hazard risk for a building: level of hazard, financial impacts, estimated insurance premium, possible mitigation options, and nearby real-time stream gauge reporting. All of this information is displayed on an easy to use dashboard Statewide. For each property, a "dashboard" will be shown that walks users through discovering their risk and presents mitigation options such as flood insurance, mitigation and ultimately directs users to the State's flood warning application FIMAN. The "Hazard" section of the dashboard allows users to understand what Flood Insurance Study their building is included in. The "Impacts" and "Insurance'" sections allows users to customize the building information so that estimated costs to repair and insurance coverage options can be calculated to be as realistic as possible. The "Mitigation" section provides cost effectiveness ratios for up to 7 common actions a building owner can implement to reduce flood risk (i.e. wet flood proofing and elevation). This presentation will show how North Carolina leveraged its robust next-generation mapping program to more effectively share and distribute flood risk information to the general public in a user-friendly, dynamic website.

F11. Creating and Using Inundation Pathways to Assess Flooding Resilience for Buildings in Coastal Virginia

Julie Herman and Jessica Hendricks, Center for Coastal Resources Management, Virginia Institute of Marine Science

Resilience to storm-driven flooding is improved by the presence of natural and nature-based features (NNBFs) such as wetlands, wooded areas, living shorelines, and beaches. For a NOAA-funded project

to protect and increase the use of these features, we developed a method using GIS to link NNBFs with coastal buildings that are at risk.

Inundation pathways (IPs) were created that represent the lowest areas where rising waters would begin to flood onto the land and approach buildings. The pathways were based on elevation data (lidar bare-earth dems), and were generated for primary buildings at elevations less than 3m (10 ft) in the coastal areas of Virginia. There are more than 190,000 buildings that meet the criteria and over 350,000 polygons representing NNBFs, in an area of about 4400 km^2 (1700 mi^2). The magnitude of the data and large spatial extent challenged the GIS effort.

The IPs allow us to create metrics for coastal flooding protection potential. To assess how well buildings are protected by NNBFs, the number and types of NNBFs intersecting the IPs for each building will be counted. To determine the relative importance of each NNBF based on the number of buildings it protects, the number of IPs crossing each NNBF will be counted. Results will be provided to local governments (45 in coastal Virginia) to aid in resource management and better utilize hazard mitigation programs, such as the National Flood Insurance Community Rating System, the Chesapeake Bay TMDL program for nutrient and sediment load reductions, and the Virginia stormwater management program.

F12. SERA and FIMAN: Innovative Tools for Emergency Managers and First Responders

David Key, ESP Associates, Inc.

This presentation will cover new and existing tools developed by NC Emergency Management (NCEM) to assist in providing situational awareness to Emergency Managers and First Responders. The presentation will cover two GIS-based web applications: Application #1: State Emergency Response Application (SERA) for Dam Inundation: In 2017, NCEM initiated a project to develop an online tool for first responders called the State Emergency Response Application (SERA). SERA is a secure, GIS-based web application that is used by local first responders when responding to natural disasters and other emergencies and threats. SERA securely displays critical information about critical assets such as K-12 public schools, community colleges, universities and prisons. In 2018, NCEM added high hazard dams to the growing list of critical facilities included in the SERA database and application. This new added functionality to SERA displays information about hazard dams such as Emergency Action Plan (EAP) information, type, spillway information, contact information, breach inundation mapping, impacted buildings including building location, depth, timing and damage estimates. Also included is details on expected road impacts and closings. Application #2: Flood Inundation Mapping and Alert Network (FIMAN) – Tested Again with Hurricane Florence: This presentation will provide an overview of NC's FIMAN application for real-time and forecasted flood inundation events. The application and data were a critical component to the State of North Carolina's response during the flooding following Hurricane Florence in September 2018. This presentation will show how the tool was used to provide important situational awareness for first responders and assist in developing metrics used for FEMA disaster declarations. We will highlight several comparisons (or ground truthing) of actual flood extents compared to the predicted inundation levels from FIMAN.

Somerset

PARTNERSHIPS FOR GEOSPATIAL COLLABORATION

F13. NOAA and Water: Connecting End User Needs with Technical Tool Development

Brenna Sweetman, The Baldwin Group at the NOAA Office for Coastal Management;
Karen Bareford, National Water Extension Program

As water-related crises become increasingly common and complex, society is confronted with developing and implementing strategies to better manage water resources and build more resilient communities. The NOAA Water Initiative (NWI), a collaborative effort across NOAA line offices, is working to enhance existing—and when necessary, develop new—tools to assist communities and individuals in making more informed decisions regarding water and water-related events. In coordination with the NWI, the National Water Extension Liaison, as the National Water Extension Program (NWEP), and a social scientist from NOAA's Office for Coastal Management are working toward the goal of transforming how the country thinks about and plans for water. The goal of the NWEP is to facilitate the delivery of tools that will allow communities and organizations to accurately and efficiently make vital short- and long-term planning decisions regarding the safety and security of their citizens and water resources. A key element of this effort is focused on evolving relationships and increasing engagement between tool developers and end users to ensure that tools are user-driven rather than data-driven. This shift in developing and delivering water-related decision-support tools marks a transition toward a new era of actionable intelligence that will allow decision makers, communities, and stakeholders to make better, more informed decisions about water security, long-term community resiliency, and the safety of individuals. This presentation will provide an overview of current and future efforts of the NWI and the NWEP to develop and deliver enhanced water-related decision-support tools.

F14. Geospatial Technologies to Understand and Communicate Coastal Hazards

David Hart, University of Wisconsin Sea Grant Institute

Since 1995, Wisconsin Sea Grant and partners have developed several geospatial applications to better understand and communicate the impacts of dynamic Great Lakes coastal processes. These include maps to explore shore characteristics, oblique photos and details about how coastal communities address hazards, along with tools to visualize coastal bluff erosion processes and the need for coastal development setbacks. This presentation will: 1) provide a retrospective of 25 years of research and outreach at the Wisconsin Sea Grant addressing geographic information science and coastal hazards; 2) showcase maps, tools and learning resources about coastal resilience topics featured in the Wisconsin Coastal Atlas (http://wicoastalatlas.net/); and explore new geospatial applications that are being developed as part of a NOAA-funded regional coastal resilience grant in southeastern Wisconsin.

F15. Spatial Prioritization Widget: Collaborative Planning for Data Collection

Ken Buja, NOAA National Centers for Coastal Ocean Science

Globally there is a lack of resources to survey the vast areas of the seafloor in need of even basic mapping data. Consequently, smaller areas must be prioritized to address the most urgent mapping needs. To address this, we developed a systematic, quantitative approach and Web AppBuilder widget to gather mapping suggestions from a group of stakeholders. Inputs are standardized into a GIS framework using a grid overlaid on the area and through pull-down menu choices that enabled participants to convey the types of mapping products that they need and the rationale used to justify their needs. This enables different groups of respondents to identify common interests and potential collaborations and more effectively invest limited mapping funds to achieve common goals. The

approach can be easily scaled and customized to accommodate much larger geographic areas and numbers of participants.

F16. HRGEO – A Regional GIS Data Initiative for Hampton Roads, Virginia

Sara Kidd, Hampton Roads Planning District Commission

The Hampton Roads Planning District Commission (HRPDC), in partnership with the Hampton Roads Sanitation District (HRSD), and the Hampton Roads Transportation Planning Organization (HRTPO), has recently launched a new open GIS data site called HRGEO (Hampton Roads Geospatial Exchange Online). HRGEO currently houses over 30 regional GIS layers covering the 17 jurisdictions of southeastern Virginia regarding planning, environmental topics, recreation, transportation, water resources, and coastal resiliency. Additionally, the HRPDC worked with local jurisdictions to develop a process for constructing "collaborative" layers. Collaborative layers are generated on the HRGEO server by reading published map services from each locality, standardizing the attributes to a regional data schema through scripts in FME, and publishing a single map service containing the data from all localities which is made available on HRGEO for download. The regional data schemas were developed through discussions with various stakeholders but are only used for generating the collaborative layers – the localities are not required to alter their existing data. HRGEO is now the primarily method for sharing regional GIS data in Hampton Roads and in the future will be the platform upon which other regional initiatives and applications can be built and supported.

10:30 to 11:00 a.m.

Cambridge Hall

BREAK

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

CONCURRENT SESSIONS

Windsor A

HURRICANE FORECASTING AND RESPONSE

G01. Advanced Forecasting and Mapping of Catastrophic Flood Inundation in South Carolina Coastal Communities

Jason Currie, AECOM; Maria Cox-Lamm, SCDNR, Flood Mitigation Program

In 2016, Hurricane Matthews brought record levels of precipitation and flooding to communities in the Pee Dee River watershed in the Carolinas.The magnitude of this event, reaching close to 1,000 year rainfall totals, caused state and local emerg ency managers and disaster response agencies to rethink what was possible regarding the scale and devastation potential of flooding in the area. Nearly 2 years later, these same communities were once again devastated by yet another record setting precipitation and flooding event in the form of Hurricane Florence. The precipitation totals and associated flooding that followed during Florence caused even more widespread flooding, resulting in damage to private properties, public infrastructure, and loss of life as flood waters inundated populated areas. Advances in the availability and understanding of 2D modeling techniques that occurred in recent years have provided federal and state agencies with tools that enable proactive decision making in advance of the storm's landfall. Specifically, these forecast models allowed state and local agencies to develop and disseminate worst case scenario inundation forecasts, facilitating interagency coordination in the staging and deployment of personnel and resources needed for the disaster response effort. Additionally, South Carolina Department of Natural Resources (SCDNR)

deployed a public-facing web portal to provide information to private citizens to help communicate the degree of inundation that could be expected based on information available. SCDNR posted periodic updates and revisions throughout the event to provide the most current information in a timely manner. This public outreach effort helped to minimize the need for rescue activities by communicating the need for evacuations in at-risk areas. This presentation will explore the methods used to develop forecast models and mapping data, as well as the public outreach tools used to update and disseminate the ever-evolving information in a complex and dynamic event.

G02. Models, and Models, and Models Oh My! Timeline of Hurricane Florence Flood Models

Catherine Bohn and Jeff Gangai, Dewberry

Hurricane Florence caused significant flooding across the Carolinas. Even before the storm made landfall, the question was asked, “What will the impacts be?” After landfall, as the storm slowed and resulted in heavy rainfall, the question was asked, “Where will the flooding occur?” Many different models across several federal and state agencies to include North Carolina, South Carolina, U.S. Geological Survey, National Oceanic and Atmospheric Administration, Pacific Northwest National Laboratory, U.S. Army Corps of Engineers, NASA, and the Federal Emergency Management Agency, provided answers to these questions. This presentation will follow the timeline of Hurricane Florence to discuss when the models were used, the model differences, and how they were used for actionable decisions.

G03. Development of Long-Term Erosion Hazard Areas to Aid in the Post-Maria Recovery of Puerto Rico

Brian Batten, Dewberry; Andrew Martin, FEMA; Joel Plummer, Dewberry

In September 2017, Hurricane Maria made landfall on Puerto Rico as a Category 4 storm. Wind, storm surge and waves from Maria resulting in extensive damage to buildings and infrastructure. The extent of damage was catastrophic and best described by NOAA as the “most destructive hurricane to hit Puerto Rico in modern times” with damage estimates for both Puerto Rico and the USVI on the order of $90 billion (Pasch et al. 2018). Wind damage was widespread, and waves riding over the storm surge caused damage around the perimeter of the island, especially to structures exposed due to beach erosion. In the wake of this devastation, Puerto Rico must recover and rebuild. The recovery process must consider and improve awareness of natural hazards to ensure resilience in new construction. To assist, FEMA, with the support of the Puerto Rico government, undertook a host of actions, including damage assessments to inform structural design, as well as updates of coastal and riverine flood hazards and mapping. Review of existing products indicated that limited geospatial data were available depicting areas subject to long-term coastal erosion hazards. In response, a unique geospatial product was developed to fill this gap in hazard awareness. Our presentation will provide an overview of how a coastal erosion hazard area layer was developed by FEMA to aid the Puerto Rico recovery process. We will provide highlights and lessons-learned from development of the layer under tight time constraints. Topics will include the shoreline change calculations, ground-truthing of results, treatment of results for mapping, considerations for the final cartographic representation of the hazard, and limitations of the final product. We will also share how the government and communities of Puerto Rico are utilizing this information to support the recovery and how FEMA is considering long-term beach erosion in related efforts.

G04. Rapid Response Change Detection and Analysis following Hurricanes

Christopher Macon and Jennifer Wozencraft, U.S. Army Corps of Engineers, JALBTCX

The Joint Airborne Lidar Bathymetry Technical Center of Expertise (JALBTCX) has surveyed hurricane-impacted coasts for the past two decades. The first post-hurricane survey was collected in 1995 at East Pass, Florida after Hurricane Opal. Later survey efforts shifted focus from quantifying project-level impacts to quantifying regional impacts of storms after the hurricane seasons of 2004 (Charley, Frances, Ivan, Jeanne), 2005 (Dennis, Katrina), 2006 (Wilma), and 2009 (Gustave, Ike). From these experiences JALBTCX developed a capability to collect post-hurricane lidar data and to deliver maps and quantities of change in elevation, shoreline position, and beach volume caused by storms, on time scales relevant to the emergency response community. The first requirement for rapid collection and delivery of data (within days) along with elevation, shoreline, and volume change analyses came in 2012 in the aftermath of Hurricane Sandy. JALBTCX identified a number of operational, processing, analysis and delivery challenges during execution of the post-Sandy work. JALBTCX evolved operations, processing, delivery and communications to address these challenges, and had an opportunity to test them in the aftermaths of Hurricanes Matthew (2016) and Irma (2017). Final, bathy-topo lidar point clouds, first-return DEMs, bare earth DEMs, aerial photography, shorelines, and metadata, were delivered within a week of collection. Web services were employed to communicate the progress of collection, processing, change analyses, and delivery. Challenges that remain are schedule and consistency of pre-event data. Despite common standards, classification of lidar data and development of DEM deliverables are inconsistent among providers and can cause artifacts in change detection products that invalidate the results and often require rework of data. This presentation will briefly describe the evolution and current state of the JALBTCX emergency response coastal lidar mapping capability, products, delivery mechanisms, remaining challenges and proposed solutions.

Windsor B

DATA AND TOOLS FOR WATER MANAGEMENT

G05. Change Detection in Coastal Geomorphology Using Lidar Data

David McKittrick, Blue Marble Geographics

Technology improvements over recent years have seen the cost of 3D point cloud data acquisition decrease and consequently, the coverage and availability expand dramatically. Hardware miniaturization has given rise to on-demand data collection with UAVs taking the place of manned fixed-wing or rotary aircraft in the collection process. As a consequence, point cloud data is increasingly used as the raw material for precise measurement and visualization of change over time. Nowhere is this process more evident than in coastal areas where shifting patterns of erosion and deposition can have devastating effects on shoreline communities. In this presentation, we will examine an area on the coast of the state of Maine in the U.S. that has been subject to significant beach erosion. Using point cloud data collected over a five-year time period, we will explore the procedure whereby the raw data can be processed to create precise bare-earth models and how the difference between these surfaces can be calculated and visually represented to show areas of significant erosion or deposition.

G06. Climate Adaptation on The Digital Coast: A Trinity of Tools for Resilience in Southeast Asia

Tim Tsang, One Architecture & Urbanism (ONE); Zach Ferdana, The Nature Conservancy

In a 2009 report by the US National Intelligence Council, Southeast Asia was identified as the most likely region, globally, to immediately experience the compound effects of climate change and natural disasters in its cities, impacting agriculture, water resources, densely urbanized coastal areas, and national economies. In this presentation, researchers and designers from The Nature Conservancy and One Architecture & Urbanism (ONE) will discuss a trinity of tools developed both independently and collaboratively to address and support decision-making around these issues. Tool #1: Resilient Coastal Cities. Since 2015, The Nature Conservancy has been supported by US-AID to support the American Red Cross-led, Resilient Coastal Cities (RCC) program to enhance coalition-building for resilience solutions in vulnerable regions around Southeast Asia and the Pacific, including Vanuatu, Indonesia, and Myanmar. A key aspect of the program has been the development of data-driven, geospatial tools to better understand and support decision making around environmental risks and the benefits of combined natural and infrastructural interventions to counter the long-term effects of climate change. At present, RCC, in partnership with the American Red Cross and local Red Cross Red Crescent Society in Indonesia, have developed a specific decisions support tool in Semarang, Central Java. This is in collaboration with The Nature Conservancy as part of a larger Coastal Resilience program in Australia, the Caribbean, Mexico, Central America, and the United States. Senior program manager Zach Ferdaña will walk through a web responsive app for Semarang that illustrates flood risk and potential nature-based adaptation solutions in enhancing natural resource management using machine learning, spatial analysis, and innovative conservation and disaster management planning. Tool #2: Global Resilience Partnership -- Site Selection Tool for Nature-based Restoration. In the Philippines, Tacloban City was one of the locations most devastated by Typhoon Yolanda in 2013. In 2016, One Architecture & Urbanism (ONE) was awarded a seed grant by the Global Resilience Partnership to advance a selection of pilot projects from the country's coastal master plan developed following the storm. The two resultant pilots, a beach forest project and a mangrove restoration project, experienced significant delays in moving forward, largely due to the necessity to eliminate "false positives" unable to be remotely established due to the lack of reliable aerial imagery and context on land tenureship. In response to these obstacles, ONE proposed the development of a site selection tool to disentangle the often complicated process of determining the status of potential restoration sites throughout the watersheds surrounding the city (rather than solely along the coastline), eliminating inefficiencies and accelerating the site selection process by deliberate curation of crowd-sourced data, as well as lateralizing data sources currently siloed between various government agencies. Tool #3: Water as Leverage -- Countering Climate and Urban Risks in Semarang, Indonesia. In the final portion of the presentation, Ferdaña (TNC) and Tsang (ONE) will discuss the potential applications of data-based tools and previous analysis of adaptive infrastructure along the coastline of Semarang, Indonesia, a rapidly subsiding deepwater port facing the compound risks of flooding, landslides, and more. The trinity of tools developed between the two organizations will lead into discussion of the broader role of geospatial analysis in vulnerable coasts and dense urban areas facing climate risk across the Pacific.

G07. Waterway Asset Management: Bridging the Gap between Field and Office Staff through Map-Based Decision Support Tools

Sierra Davis, Tridec Technologies, Inc./Delaware Department of Natural Resources and Environmental Control; Jesse Hayden and Ashley Norton, Delaware Department of Natural Resources and Environmental Control

Obtaining a real-time working knowledge of waterway management issues such as storm impacts to channel shoaling, the loss or displacement of navigational markers, identification of obstructive debris, or dredge operation progress can be difficult from the office. In an effort to bridge the gap between field observations and desktop analysis by office staff, Delaware's Department of Natural Resources and Environmental Control (DNREC) is working toward monitoring and managing waterway assets (e.g. buoys, channel markers, channel conditions) through map-based decision support tools built in the Arc Explorer, Arc Online, and Survey123 environments. There are key advantages to these methods, including the elimination of paper-based data collection to encourage transparency between field crews and office staff for monitoring and maintenance needs. Additionally, location data and corresponding notes are kept in an organized digital format, allowing for rapid internal data sharing and enabling a more efficient response. Presented here are the pilot phases of tools developed by DNREC in the above-mentioned ArcGIS platforms for waterway asset management in Delaware as well as a preliminary assessment of their effectiveness for communication between the field and the office staff. Methods are currently being tested with internal government staff. Our adaptive management strategy for the tools and long term goals, such as launching the tools for broader stakeholder use and waterway maintenance prioritization, will also be presented.

G08. Cancelled

Windsor C

UNDERSTANDING RISK EXPOSURE

G09. Low Cost, Computationally Efficient Approach to Hydrodynamic Modeling of Barrier Islands and Tidal Inlets as a Decision Support Tool

Kenneth Hunu, Atkinsglobal

Coastal cities are usually characterized by barrier beaches and islands with tidal inlets. Upland, backwater areas consist of estuary with low-lying marsh areas, tidal rivers and wetlands. Overtopping and erosion (and possible breaching) of the barrier beach/islands as well as flow through the tidal inlets are often the primary cause of flooding of the islands and beach areas as well as the upland areas during extra-tropical and tropical cyclone storm flood events. The hydrodynamics of flooding in these types of geomorphological environments is quite complex and are a function of the flow hydrodynamics as well as the storm characteristics (translational speed, size, intensity, etc.), in particular the effects on the shape of the storm surge hydrograph. Understanding and predicting the complexity of flooding in these environments is a necessary component of efficiently and cost-effectively developing coastal resiliency. In this presentation, a low cost, less computationally intensive, alternative approach to modeling coastal barrier islands and tidal inlets is proposed. The approach involves the use of two-dimensional, localized, high resolution hydrodynamic models to evaluating the flood risk of the Long Island Beach and upland, backwater areas. The flood risk is characterized for several different return periods (up to 1000-year). The coastal model output (using synthetic hydrographs). The results of the model simulations aided in decision making and were highly informative as to the cause and effect of both the beach and backwater, upland flooding and clearly indicated where flood mitigation measures would be most effective. The results were used to

establish the flood design basis for the design and construction of new critical infrastructure in the area, as well as design flood mitigation measures. The models were also used to evaluate the performance of natural and nature-based features (NNBFs) as a cost effective and ecologically desirable way to create coastal resiliency.

G10. Coupled Coastal and Riverine Risk Mapping for The Nature Conservancy's North Coast Resilience Project: Mitigating Flood Risk through Nature-based Solutions

Keil Schmid, Geoscience Consultants, LLC; Joy Brown, The Nature Conservancy

The North Coast project in Georgetown and Horry Counties (SC) grew from TNC's Coast Summit in 2016 where riverine flooding was highlighted as a problem that held opportunity for nature based mitigation solutions. Geoscience Consultants was hired to provide an understanding of localized flood risk at present and under future climate change. This information will help community stakeholders identify locations where nature based solutions can be used to mitigate increasing flooding issues. Four separate products were developed to inform the stakeholders in each county. Hindcasted flooding maps from Hurricanes Joaquin and Mathew depicted the extents of flooding that played a large part in developing the needs of the project. The 'historical' flooding extents were developed from high resolution elevation data and empirical data collected during these storms. Predicted and projected future flooding risk maps built on the empirical data and included time series information from tide and stream gages along with projections for sea level changes and extreme rain events. This information was analyzed using a z-score technique originally developed for use in NOAA's SLR Viewer. The extents of the risk envelop are similar to FEMA's special flood hazard zones but the technique provides results in discreet scores adding context. To help inform project ideas a 'hydro land cover' product was developed that includes flooding pathways and habitats where flooding is likely now and in the future. Finally, for emergency management, a storm surge risk product was developed from 64 Category 1 SLOSH outputs. This is a significant amount of information for stakeholders to digest and use in developing 'shovel ready projects'. To help, TNC is holding county-wide stakeholder meetings and has included it in their online mapping portal. This presentation will focus on specific development processes, outputs of these models, and how they can inform other studies.

G11. Inundation Exposure Assessment for Majuro Atoll, Marshall Islands Using a High-accuracy Elevation Model

Dean Gesch, Jeffrey Danielson, and Monica Palaseanu-Lovejoy, U.S. Geological Survey

Low-lying island environments, such as Majuro Atoll in the Republic of the Marshall Islands, are particularly vulnerable to inundation (coastal flooding), whether the increased water levels are from episodic events (storm surge, wave run-up, king tides) or from chronic conditions (long term sea-level rise). Land elevation is the primary geophysical variable that determines exposure to inundation in coastal settings. Accordingly, coastal elevation data are a critical input for assessments of inundation exposure. Previous research has demonstrated that the quality of data used for elevation-based assessments must be well understood and applied to properly model potential impacts.The vertical uncertainty of the input elevation data controls to a large extent the increments of water level increase and planning horizons that can be effectively used in the assessment. When properly characterized, the vertical accuracy of high-resolution, high-accuracy elevation data can be used to generate maps and report results with the uncertainty stated in terms of a specific confidence level or likelihood (probability) category. A quantitative analysis of inundation exposure was conducted for Majuro Atoll, including rigorous accounting for the cumulative vertical uncertainty in the input geospatial data (elevation model) and data processing (datum transformations). The project employed

a recently produced and validated digital elevation model (DEM) derived from structure-from-motion processing of very high resolution aerial imagery. Areas subject to marine inundation (direct hydrologic connection to the ocean) and low-lying lands (no direct hydrologic flowpath to the ocean) were mapped and characterized for different inundation levels. An example episodic inundation event, in this case projected high wave run-up, has also been mapped using deterministic and probabilistic approaches. Other widely available, less accurate global DEMs were analyzed to demonstrate the substantial value of high-resolution, high-accuracy DEMs for assessing inundation exposure of low-relief islands and the enhanced information from accounting for vertical uncertainty.

G12. Development of a Geomorphology-Driven Habitat Vulnerability Model for Great Lakes Coastal Zone Management

Ethan Theuerkauf and Katherine Braun, University of Illinois at Urbana-Champaign; Eric Cole, Woolpert; Francis Wiese and Ryan Cooper, Stantec

Shoreline erosion drives the destruction of coastal habitat and leads to the loss of ecosystem services. This feedback is widely recognized; however, few studies have mechanistically linked geomorphic processes to the loss of ecosystem services. This lack of process-based research hinders accurate modeling of the future of ecosystem services and robust coastal habitat valuation for management purposes. In this talk we present preliminary results from a study to develop a geomorphology-driven coastal habitat vulnerability model for Illinois Beach State Park (IBSP); a beach ridge and swale complex in Western Lake Michigan. This model accounts for dynamic coastal processes, such as erosion and overwash, that result in habitat loss and is motivated by a need for state and federal coastal managers and stakeholders in this region to have a data-driven tool for prioritizing investment in shore protection. This study leverages a range of expertise and capabilities through a collaboration between academia, private consultants, and federal and state agencies. Beach and dune topography and nearshore bathymetry were collected repeatedly to characterize geomorphic changes at IBSP in response to physical processes, such as waves and fluctuating water levels. Physical processes were measured with an acoustic wave and current profiler deployed in the nearshore. Coastal geomorphic change data will be coupled with measurements of soil carbon to quantify the impacts of erosion and accretion on coastal carbon storage. These data are one component of a complete coastal habitat ecosystem service valuation performed in this study. The field data will be coupled with the ecosystem service valuation to build the habitat vulnerability model. This model, which is the first of its kind in the Great Lakes region, will provide managers with a quantitative understanding of present and future habitat vulnerability as a function of habitat value, coastal geomorphic, and hydrodynamic processes.

Somerset

ACCESSING PUBLIC KNOWLEDGE

G13. Using Mobile Augmented Reality for Environmental Communication and Collaboration

Micah Shane Taylor, University of Georgia

Mobile augmented reality offers the chance to enhance people's direct experience of a landscape with supplemental multidimensional data, culturally and environmentally significant information, and personal narratives from residents and visitors. We are developing a mobile device-based application, Landscape Recon, that uses auditory and visual augmented reality for sharing information but also prompts the user to contribute their own voice recorded recollections and impressions about the place. The dual functions of environmental communication and interrogation prompt the user to supplement formal information about the landscape they are traveling through with their personal stories and knowledge, their perceptions of the landscape, or perhaps a previously undocumented

cultural, historical, or environmental entity that can then be disseminated through the application for others to experience. The application is being prototyped using a coastal Georgia highway where adequate GIS point data is available to use as augmented locations. Auditory augmentation, functioning much like a pod-cast, is directed at vehicle drivers while minimizing driving distractions. Visual augmentations will be available for passengers and those not in a vehicle. Augmenting information is triggered by geo-fences based on the users GPS location when a user comes within a reasonable distance of the point of interest. We argue that this crowd sourced based application creates three distinct additions to traditional socio-environmental data collection methods: 1) the ability to provide an information-rich context that facilitates the recollection and articulation of new insights, 2) the ability to communicate and collaborate with the public at their own pace, *in situ* and *in vivo*, and 3) the absence of the researcher allowing for more authentic and truthful user responses. This technologically inclusive approach will help contribute to ongoing studies of place-based perceptions and attachments, and the role of technology in citizen science. Landscape Recon enables equality in collaboration, expert vs. non-expert; contributes to ecological validity of place-based environmental inquiry, and illuminates critiques of technological augmentations of every-day environmental decision making.

G14. Developing a Regional Resiliency Action Plan for Hampton Roads

Benjamin McFarlane, Hampton Roads Planning District Commission

The Hampton Roads region is particularly vulnerable to the impacts of flooding and sea level rise due. In response, the Hampton Roads Planning District Commission (HRPDC) has identified coastal resiliency as a focus area for its work program, with the goals of developing policy recommendations, acting as a liaison for local governments with academic institutions and state and federal agencies, and advocating for support from higher levels of government. One focus over the past year has been the development of a regional assessment of local resiliency efforts that have been recently completed, are underway, or are being planned. For many Hampton Roads localities, resiliency crosses the lines between departments and budget programs, making it challenging to get a comprehensive picture of all the work that is being done in a single locality, much less an entire region. The HRPDC has been working with staff from all seventeen of its member jurisdiction to gather and process information on local efforts to create a regional picture of resilience planning and implementation projects. This involves assessing local projects, programs, and policies, developing a common categorization system, and creating a geospatial database and visualization tool to display the information in an accessible format for decision-makers, staff, and the general public. This effort serves three primary goals: educating the public on what is being done to address flooding and other coastal hazards throughout the region, assisting in coordination between jurisdictions, and providing a regional-scale assessment to assist local, state, and federal officials with policy decisions. The long-term strategy for this effort is to be a living database that will form the backbone for a regional resiliency action plan.

G15. How We Badgered, er, *Enticed* People to Submit 6,500 Storm Damage and King Tide Reports

Wesley Shaw, Blue Urchin LLC.

Since 2012, MyCoast has been helping people submit reports on coastal incidents including storm damage, king tides, beach cleanups, abandoned boats, shoreline change, and even fog. Through our time working on this project, we've evolved from a system based on telephone calls and scraps of paper to PDFs to a framework of webservers and mobile apps. In its current iteration, MyCoast allows users to quickly submit photos from the field via our mobile

apps. Our servers augment reports with meteorological and tidal data, and then present the information in various formats based on users' needs. You can read more about MyCoast at mycoast.org. We've always had a set of broad goals: 1) Inform better short and long-term decisions (from emergency response to planning); 2) Help with coastal hazard and sea level rise outreach and engagement efforts; and 3) Provide hard data for ground-truthing oceanographic and meteorological models. And based on these goals, we set the following priorities (in this order): 1) Maximize the amount of data we get; 2) Maximize the data quality; and 3) Maximize the data's utility; The topic for this talk will be to ask the simple question: with over 6,500 reports and 12,000 photographs, how are we doing at meeting our goals and priorities and what have we learned along the way? What might we be able to tell from stepping back and looking at this mass of data holistically?

G16. Multidisciplinary Knowledge Integration to Support Louisiana Coastal Indigenous Communities' Response to Natural and Technological Disasters and Adaptation to Climate Change

Tara Lambeth, University of New Orleans Center for Hazards Assessment, Response and Technology (UNO-CHART); Jessi Parfait, Louisiana State University and Louisiana Sea Grant; Matthew Bethel, Louisiana Sea Grant

The project team is collaborating with two United Houma Nation communities to document how environmental stressors affect the livelihoods of these communities and shape the mitigation strategies they use. The researchers, in collaboration with the tribe, make use of traditional ecological knowledge and current mitigation efforts in order to understand the tribe's adaptive capacities. We will produce a story-map based resource that can be used by the UHN and other indigenous communities facing similar challenges. This work may encourage other mitigation and adaptation planning efforts and increase communication between communities and policymakers.

Goals and Objectives

- Goal 1: Integrate policy, science and local knowledge to aid the UHN in adapting to chronic and acute environmental stressors
- Goal 2: Analyze the adaptive capacity of the UHN using physical science, social science, and TEK
    - Objective: Examine and compare structural and nonstructural mitigation measures implemented in the area by the tribe and policymakers
- Goal 3: Assist the tribe in honing its adaptive capacity to adapt to chronic and acute environmental stressors
    - Objective 1: Prepare a timeline of historical events in collaboration with the tribe
    - Objective 2: Share the analysis with the tribe so that the tribe can hone its adaptive capacity for future chronic and acute environmental stressors and influence mitigation policy implemented to lessen those stressors
- Goal 4: Engage local agencies in the adaptive capacity analysis and disseminate the results beyond the case study communities

So far:

- We've interviewed 5 out of 5 TEK experts, and conducted follow up interviews with 3 of them.
- Creating a timeline of stressors in order to track adaptations over time.
- Acquiring and processing historical aerial and satellite image data of areas of interest that emerge from the analyses of the TEK expert interviews to include in the story map resource.
- Contents will be used to create an online tool, to help with future adaptation efforts.