Resilience Assessment of Bridges Subjected to Hurricane

Presenter: Amirhossein Iranmanesh, Rowan University

Contributing Authors: Uriel Clark, Beena Sukumaran, Ralph A. Dusseau, Rouzbeh Nazari

Abstract:

Past hurricane experiences revealed that coastal bridges are vulnerable to storm surges and wave loads. Bridges form vital links in the transportation network, especially during and after a hurricane event for evacuations and emergency responses. Only recently, few researches have been conducted in an attempt to develop a probabilistic framework to quantify the probability of failure of bridges subjected to hurricanes. This paper reports on the development and application of a probabilistic framework that quantifies the demand, capacity and conditional probability of failure for the bridges susceptible to deck unseating, which is the primary failure mode for the simply supported bridges. The uncertainties in the demand and capacity of the bridges were modeled by assigning distribution functions to various parameters of geometrical and structural properties and wave characteristics. Probabilistic modeling of demand and capacity allows for the derivation of a fragility surface that presents the probability of failure as a function of relative surge elevation and wave height. The developed model was applied to a case study for a vulnerability assessment of bridges in Brick Township, NJ. The maps of failure probabilities for all bridges located in the area of Brick Township, NJ were developed for hurricane categories one through five. The results of the vulnerability analysis will eventually be used for resilience assessment of bridges located in various areas in the state of New Jersey.

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A Geo-economic Model to Explore Hard Structure Impacts on Coastal Evolution and Management on Long Beach Island, New Jersey

Presenter: Arye Janoff, Montclair State University

Contributing Authors: Jorge Lorenzo Trueba, Porter Hoagland, Di Jin, And Andrew Ashton

Abstract:

Coastal communities in New Jersey are highly developed, with only a fraction of land area remaining vacant. In response, managers use hard structures such as seawalls, revetments, bulkheads, and groins to protect a significant portion of coastline. Despite the high density of hard structures, these communities are still vulnerable to erosion, sea-level rise, and storm inundation as seen during Superstorm Sandy. In particular, although trapping of alongshore sediment transport by groins can add protective and recreational value locally, they also enhance erosion in coastal stretches downdrift. Thus, a key management question is whether groins are efficient and sustainable given their potentially negative impacts. To tackle this question, we have developed an integrated geological-economic model that simulates beach width dynamics. We apply this model to Long Beach Island, New Jersey, a site replete with hard structures. Groin construction began in the 1920's by state and local governments to stabilize receding shorelines. After the March 1962 storm's pervasive damage to homes and infrastructure, the Army Corps of Engineers installed 86 groins across LBI. Today, there are 99 groins present on the ocean-side of the barrier, and they continue to impact coastline shape and stakeholder interests. Our model will simulate the progression of LBI groin construction, and we will compare the results to historical LBI shoreline locations. These results will help validate the model to serve future extensions. Ultimately, we will utilize the framework to compare possible management responses to heightened storm risks such as groin shortening, notching, removal, and managed retreat.

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Onsite Bioremediation of Oil Spills Using Electrokinetic Processes

Presenter: Brian Wartell, NJIT

Contributing Author: Michel Boufadel

Abstract:

Oil contamination, both from spills offshore and hydrocarbon releases onshore have contributed to the contamination of large portions of North Jersey coastal waters. The contamination could result both from natural events, such as Hurricane Sandy and anthropogenic activities, such as leaking tanks or pipelines. Among the more harmful compounds of oil are the polycyclic aromatic hydrocarbons (PAHs). However, they and many oil components are amenable of being degraded by microorganisms such as bacteria and archaea. However, the oil could be in environments that lack sufficient oxygen and/or nutrients for chemical or biological degradation to take place. Our research focuses on the use of electrokinetic technology to deliver oxygen and nutrients to the oil, as well as increase contact between the organisms and the contaminants in order to increase biodegradation rates. Experiments are being conducted with 3-ringed PAHs, and the microbial community is being assessed for response to these compounds.

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Unintended Consequences: Assessing the risks and benefits of small chemically-intensive businesses in an industrial waterfront community

Presenter: Erika Meza, Rand Corporation

Abstract:

The preservation and expansion of blue-collar manufacturing and industrial sectors, a reliable source of stable employment for working-class communities, is critical to a dynamic and equitable economy. However, the clustering of heavy industrial uses into mixed-use neighborhoods has also led to a legacy of public health and environmental contamination risks for low-income communities of color. Following Superstorm Sandy in 2012, industrial waterfront communities in New York City were concerned about the potential for unsecured chemicals in local businesses to be dislodged by storm damage and dispersed into surrounding residential areas through floodwaters. Yet, little information existed to help communities understand the types of chemical hazards that may be present in their neighborhoods, assess factors that increase potential for chemical releases, and determine populations vulnerable to exposure. This presentation describes community-based participatory research that examines the spatial distribution of small chemically-intensive businesses and other residential and commercial uses (e.g., homes, restaurants, playgrounds) in the industrial waterfront community, Sunset Park, NY. We discuss development of workplace chemical categories for one business, auto shops, to understand the chemical hazards that may exist on a block level based on the type of auto shop present. Careful design is required to preserve the economic engine of industrial areas, reduce associated environmental hazards, mitigate risks posed by extreme weather, and maintain the walk-to-work nature of mixed-use neighborhoods. This work is a foundational step for communities seeking to enhance the benefits of mixed-use neighborhoods while working in concert with small businesses to prevent and mitigate unintended harms.

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A Coastal Geo-Economic Model for Artificial Dune Management in New Jersey

Presenter: Jesse Kolodin, Montclair State University

Contributing Authors: Jorge Lorenzo-Trueba, Porter Hoagland, Di Jin, Andrew Ashton

Abstract:

Since Superstorm Sandy hit the New Jersey coast in October 2012, the US Army Corps of Engineers has constructed several homogeneous dune-and-berm features along the coastline to protect New Jersey barrier island communities from future storm impacts. A basic management question is whether the benefits generated by these projects justify their costs over time. To tackle this question, we have developed a morphodynamic model of the evolution of coastal dunes that accounts for beach and dune erosion and dune migration via storm overwash. The model investigates the volume of beach and dune nourishment required to combat coastal erosion. In the model, levels of protection reflect choices made either collectively (by government) or by an individual coastal property owner, where property value is positively correlated with the protective benefits provided by a proximate beach (its width) and a proximate dune (its height). We also account for the ancillary costs that arise as a dune's size increases, which comprise the loss of recreational beach areas and residential ocean views. We derive mathematical expressions for optimal berm and dune size as a function of geologic and economic parameters. Model results suggest that both the costs of nourishment and baseline property values play key roles in determining the optimal cross-sectional area for a dune-and-berm system in the long-term. These results could enable improved cost-benefit analyses to help support local decision-making. Future work will explore the possible "geo-economic" impacts artificial dunes could impose on barrier island communities.

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Quantitative Assessment of Resilience for Earthen Structures Using Coupled Plastic-Damage Model for Geological Materials

Presenter: Mohammad Motamedi, Rowan University

Contributing Author: Rouzbeh Nazari

Abstract:

Buildings play a key role in community resilience owing to their contribution in providing the first line of defense and as a mean of emergency response during and after occurrence of extreme natural events. Moreover, the economic costs and potential loss of life due to building damage or collapse has escalating influence over adverse impact of hazards and significantly reduce the resilience of communities. Robustness is a paramount aspect of a buildings resilience, which controls the spread of damage within the structures. At present, there is no established engineering methodology to assess the overall structural robustness as a multistage process. In this work, structural resiliency is revisited as a composite term consists of three interrelated capacities (absorptive, adaptive and transformative.) This study aims to develop the computational platform for quantitatively assessing the disaster-resilience of earthen structures with the use of a coupled plastic-damage constitutive material model. This numerical framework addresses the resistance, damage sequences, residual state, post-event capacity, recovery functions as well as resilience metrics and indicators. In particular, the plasticity model is furnished with combined isotropic-kinematic hardening internal variables accounting for the adaptive capacity of structural resilience. Localized failure is detected by a bifurcation analysis with assumption of the material plastic flow is non-associated. To simulate the transformative capacity at structural level, the model adopts the enhanced strain finite element method capturing the propagating fracture through the structural components. Finally, we evaluate the performance of an earthen structural wall under lateral loading for two intact and pre-damaged conditions.

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Coastal impoundments of the Northeast and Mid-Atlantic: A regional approach to mapping and assessing value to birds and vulnerability to climate change.

Presenter: Nellie Tsipoura, NJ Audubon

Contributing Authors: Rachel Katz, Mike Allen, Taj Schotland, Karl Schrass, Austin Kane, Becky Boger, John Miller, Clay Emerson, Hector Galbraith, David Mizrahi

Abstract:

In response to damage caused by Superstorm Sandy in 2012, we received DOI funding to map federal, state, and locally-owned coastal impoundments from Maine to Virginia and collect information on their history, management, importance to birds and people, and vulnerability to climate change. These man-made water bodies adjacent to tidal waters and contained by embankments that have control structures allowing managers to manipulate water levels, are often drained in the spring to expose mudflats for migrating shorebirds, and then raised in fall to provide open water for ducks and other waterbirds through the winter. Damaging and expensive breaches to embankments occurred at numerous impoundments in the path of Superstorm Sandy, including Kingsland Impoundment. We conducted literature searches and manager interviews to compile information on ecological and societal services provided by each impoundment and assessed their vulnerability to sea level rise using on-the-ground engineering surveys and remote sensing (lidar). In addition, we compiled information on ecological services of these sites and assessed their vulnerability to sea level rise. Using Integrated Waterbird Management and Monitoring (IWMM) and eBird data, we calculated species richness, maximum counts, and bird-use days for shorebirds, long-legged waterbirds and waterfowl in impoundments where data were available. Societal value was assessed via indirect, census-derived measures of potential site use including population density, age, income level and racial / ethnic diversity. We present preliminary results of the analysis of potential values and vulnerability of impoundments across the northeastern US to aid in improving resiliency and management planning.

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Using Green Bonds to Securitize Energy Resilience and Climate Adaptation

Presenter: Philip Ludvigsen, First Environment, Inc.

Abstract:

In response to Superstorm Sandy, the State of New Jersey created its first Energy Resilience Bank (ERB). Funded with $200 million from New Jersey's second Community Development Block Grant-Disaster Recovery allocation, the ERB supported distributed energy resources at critical facilities designed to remain operational during extended power outages. Unfortunately this grant money quickly ran out. Because of the continued acceleration of climate change and sea rise, there is a growing need to develop self-sustaining funding sources to address energy resilience and Climate adaptation.

Municipalities have become creative in developing revenue streams to fund green infrastructure. For example PACE (Property Assessed Clean Energy) programs allow property owners to pay for energy efficiency upgrades, renewable energy, and water conservation through a special assessment based on increased value of the property. This eliminates upfront costs while spreading out and offsetting the payback through real energy savings. According to New Jersey PACE, a local 501C3:

Every $10M spent on PACE projects results in 150 new jobs.

$10M invested in retrofits adds $25M to the local economy and as much as $2.5M in additional tax revenue.

$20M spent adds a megawatt of renewable electrical generation and eliminates 600 tons of CO2 emissions.

Cost savings can be securitized into a green bond creating funding from private investors resulting in no cost to the Tax Payer.

This presentation will cover the fundamentals of issuing a green muni-bond. Examples will illustrate how municipalities are using green bonds to create additional investor demand while reducing the cost of capital.

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The Impact of Hurricane Sandy on Real Estate Prices in Northern New Jersey

Presenter: Jason M. Barr, Rutgers University

Contributing Authors: Dimitrios Ntarlagiannis, Ildiko C. Pechmann

Abstract:

Did hurricane Sandy impact the real estate industry in New Jersey? Five years later we have enough information to draw conclusions on the impact of hurricane Sandy on real estate in NJ. With this work we compare the real estate transactions, post and pre Sandy, for 5 counties (Bergen, Essex, Hudson, Middlesex and Union) in North NJ. Preliminary analysis (hedonic regressions) suggest a correlation of real estate transactions with the property location (elevation, distance to shore) and the Sandy storm surge (flood boundary and height) characteristics.

For those properties that were not flooded, our goal is to see how the informational "shock" of the storm changed the perceptions of future storm risks. We will investigate how the properties were or were not affected based on their distance to the storm surge and based on their distance to the FEMA flood boundary. Before the storm, the FEMA flood distance presented information on the likelihood of flooding. This information was then updated by the distance to the surge after the storm. We plan to use both hedonic ordinary least squares regressions and locally weighted regressions to affect the likely heterogeneous effects across towns and counties in New Jersey.

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Anthropogenic alterations of the Raritan River, NJ from pre-European settlement through the present

Presenter: Margaret Christie, Rutgers University

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Abstract:

Although the Raritan River has been impaired by human activities since at least the 17th Century, anthropogenic impacts have only been quantified for the modern industrialization of the 20th and 21st century. The wetlands of the Raritan River provide an archive of altered habitat and water quality through time, observable through the pollen and diatoms assemblages contained within their sediment. Sediment cores recovered from these wetlands extend the understanding of habit and water quality from modern industrialization to European settlement and pre-European settlement, baseline conditions.

Here, we investigate changing habitat and water quality for the past 500 years in the Raritan River from sediment cores collected from three locations. The locations were selected along a transect from Cheesequake to New Brunswick. We analyzed the cores for (1) heavy metals and organic pollutants associated with local and regional activities; (2) pollen to identify the deforestation horizon and other vegetation changes; and (3) diatoms to determine changing nutrient levels. We placed changes in pollutants, vegetation, and nutrients in a chronological framework by using radiocarbon dating of rhizomes, timing of deforestation, and known deposition of heavy metals, 210Pb, and 137Cs. Extending the record of pollution history to include pre-European Settlement conditions allows us to compare impaired conditions to unimpaired conditions prior to settlement. This allows us to make informed decisions for restoration and more accurately monitor remediation progress.

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Impacts and Recovery Related to Hurricane Sandy at Plumb Beach, Gateway National Recreation Area

Presenter: Katherine Ames, Rutgers University

Contributing Authors: Norbert P. Psuty; Andrea Habeck; William J. Schmelz

Abstract:

Plumb Beach, a coastal park within GNRA, is located along the margin of Belt Parkway, a major highway in Brooklyn. Monitoring of shoreline position, beach dune profiles, and coastal topography began in 2007, and has been conducted seasonally into 2017. In October 2012, two major events affected the beach-dune system at Plumb Beach: a beach nourishment project and Hurricane Sandy. The beach nourishment project placed 97,000 m3 of sand on 730 m of beach. The fill protected Belt Parkway from Hurricane Sandy which occurred days after completion. In 2013, two stone groins were built to bound the fill, and a stone breakwater was built offshore. Datasets collected before and after these major topographic changes provide metrics of storm impacts, and vectors of change through time.

Hurricane Sandy caused a loss of ~12,000 m3 of sediment from the initial fill (September 2012 to January 2013 data). Outside the fill area, there was erosion in the dune and beach features. From 2014 to 2016, there was a volumetric loss of 4,350 m3/yr, similar to the estimated loss of 5,000 m3/yr from 2008 –2012, before the fill and construction of structures. However, the area of greatest volumetric loss has shifted downdrift of the eastern groin, no longer directly seaward of the Belt Parkway. There was accumulation inland of the breakwater, on the updrift side of both groins, and some recovery in the dune feature. The vectors of change at Plumb Beach are useful to management, especially for the protection of the Belt Parkway.

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Storm Impacts and Recovery at Great-Kills: 5-years Post-Hurricane Sandy

Presenter: Norbert P. Psuty, Rutgers University

Contributing Authors: Katherine Ames, Andrea Habeck, William J. Schmelz

Abstract:

The beaches and communities along the coast of Staten Island NY were greatly impacted by Hurricane Sandy in October 2012. Great Kills is a component of Gateway National Recreation Area (National Park Service) located along the ocean-facing side of Staten Island, NY. Three monitoring protocols were employed to track changes in shoreline position (1D), beach-dune profiles (2D), and coastal topography (3D) at this site. Datasets from these monitoring protocols were collected before and after Hurricane Sandy, and continued to the spring of 2017. They resulted in a quantification of storm impacts and recovery. During Hurricane Sandy, Great Kills lost 12,600 m3 of sediment from September 2012 to December 2012. Much of this loss was focused at the embayment at the northeastern portion of the site, downdrift of an outfall pipe and marsh remnant that restricted sediment transport to the southwest. There was volumetric gain downdrift of the erosional embayment during this period. Post-Hurricane Sandy, erosion in the northeastern embayment persisted, leading to 19,100 m3 of volumetric loss from April 2013 to May 2016. To the southwest, there was a post-storm volumetric gain of 15,000 m3. Driven by restricted sediment input at the northern margin, the pre-storm and post-storm pattern of erosion (northeast) and deposition (southwest) has expanded the log-spiral configuration of the embayment and has impacted aspects of the park's road and parking infrastructure, and has influenced management decisions regarding sediment placement, re-vegetation, pedestrian walkways, parking, access points, and recreation facilities.

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Small Community Projects for Coastal Cities and Countries to Improve Sustainability and Resilience

Presenter: Ugo Amadioha, NJIT

Contributing Author: Wen Zhang

Abstract:

In 2009, the Government of Australia and Small Grant Programme (SGP) started the Community-Based Adaptation (CBA) programme with 12.4 million USD aimed at improving the resilience of communities in 42 countries, many of them small island developing states (SIDS). Small island developing states are particularly vulnerable to climate change impacts due to their large coastal boundaries, small land area, susceptibility to natural disasters, geographical isolation, limited natural resources and sensitive ecosystems. The programme focuses on piloting and testing of CBA approaches on the ground, while also promoting the horizontal replication of successful community practices and the integration of the lessons into national and sub-national policies. This study surveyed and examined global practices mainstream community-based projects that seek to enhance the sustainability and resiliency of communities to address climate change impacts. The outcome of this study's deliverables is three-fold: (i) to improve the adaptive capacity of communities, thereby to reduce vulnerability to the adverse effects of climate change risks' (ii) to provide countries with concrete ground-level experiences with local climate change adaptation, and (iii) to provide holistic designs and protocols for communities to test, implement, and upscale. Particularly, this poster will demonstrate case studies: (1) Rain water harvesting from rooftop catchments; (2) moisture water harvesting from fog and cloud; (3) solar desalination; (4) seawater intrusion prevention; (5) permeable/porous pavement for aquifer recharge and runoff prevention; (6) other adaptation approaches to sea level rise.

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Coastal ocean circulation during Hurricane Sandy

Presenter: Travis Miles, Rutgers University

Abstract:

Sandy was the second costliest tropical cyclone to impact the United States and resulted in numerous lives lost due to its high winds and catastrophic storm surges. Despite its impacts little research has been performed on the circulation on the continental shelf as Sandy made landfall. In this study integrated ocean observing assets and regional ocean modeling were used to investigate the coastal ocean response to Sandy's large wind field. Sandy's unique cross-shelf storm track, large size, and slow speed resulted in along-shelf wind stress over the coastal ocean for nearly 48 hours before the eye made landfall in southern New Jersey. Over the first 18 hours this along-shelf wind stress drove onshore flow in the surface of the stratified continental shelf and initiated a two-layer downwelling circulation. During the remaining storm forcing period a bottom Ekman layer developed and the bottom Cold Pool was rapidly advected offshore ~70 kilometers. This removed the bottom Cold Pool from the of the shallow continental shelf and limited ahead-of-eye-center sea surface temperature (SST) cooling, which has been observed in previous storms on the MAB such as Hurricane Irene (2011). This cross-shelf advective process has not been observed previously on continental shelves during tropical cyclones and highlights the need for combined ocean observing systems and regional modeling in order to further understand the range of coastal ocean responses to tropical cyclones.

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The Stevens Flood Advisory System: Operational H3E Flood Forecasts For The Greater New York / New Jersey Metropolitan Region

Presenter: Nickitas Georgas, Stevens Institute of Technology

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Abstract:

This work presents the automation, website interface, and verification of the Stevens Flood Advisory System (SFAS, http://stevens.edu/SFAS). The fully-automated, ensemble-based flood advisory system dynamically integrates real-time observations and river and coastal flood models forced by an ensemble of meteorological models at various scales to produce and serve street scale flood forecasts over urban terrain. SFAS is applied to the Greater NY/NJ Metropolitan region, and is used routinely by multiple forecast offices and departments within the US National Weather Service (NWS), regional and municipal Offices of Emergency Management, as well as the general public. Every six hours, the underlying H3E (Hydrologic–Hydraulic–Hydrodynamic Ensemble) modelling framework, prepares, runs, data-assimilates, and integrates results from 300 dynamic model simulations to produce actionable, probabilistic ensemble forecasts of upland and coastal (storm surge) flooding conditions with an 96-h forecast horizon. Meteorological forcing to the H3E models is provided by 100 weather model ensemble members as well as deterministic weather models from major weather agencies (NCEP, ECMWF, CMC) and academia. The state-of-the-art SFAS, a replacement of the well-known, but deterministic, Storm Surge Warning System (SSWS) that was highlighted during Hurricanes Irene and Sandy and more recently extratropical cyclone Jonas, has been operational since the end of 2015.

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An Ensemble-Based Forecasting Framework for proactive management of water resources

Presenter: Venkatsundar Ramaswamy, Stevens Institute of Technology

Contributing Author: Firas Saleh

Abstract:

Increasing frequency of extreme precipitation and drought events are stressing the need to manage water resources on shorter timescales. Short-term management of water resources becomes proactive when inflow forecasts are available and this information can be effectively used in the control strategy. This work investigates the utility of short term hydrological ensemble forecasts for operational decision making during extreme weather events. An automated hydrologic prediction framework integrating a regional scale hydrologic model, GIS datasets and the meteorological ensemble predictions from the European Center for Medium Range Weather Forecasting (ECMWF) was coupled to an implicit multi-objective dynamic programming model to optimize releases from a water supply reservoir.

The proposed methodology was evaluated by retrospectively forecasting the inflows and optimizing the releases from Oradell reservoir in the Hackensack River basin in New Jersey during Hurricane Sandy. Additionally, the flexibility of the forecasting framework was investigated by forecasting the inflows and optimized releases for the extreme hydrologic event Hurricane Irene.

The proposed forecasting framework seeks to provide a flexible, assistive tool to alleviate the complexity of operational decision-making and proactively managing water resources.

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Go To High Ground - Social, Political and Economic Aspects of Disaster Preparedness 5 Years after Superstorm Sandy

Presenter: Alan I. Benimoff, College of Staten Island

Contributing Authors: William J. Fritz, Michael E. Kress

Abstract:

Although geologists often give warnings and no one listens we have a professional responsibility to inform government, the private sector, and the public about coastal and other hazards and the risks they pose and to encourage responsible and sustainable policies. In areas of NY impacted by Super Storm Sandy, decision makers at the local, city, state, and federal level from at least 19 different agencies joined forces with scholars as an interdisciplinary team to prepare for future storm surges and rising sea level. The process included scholars from many disciplines (e.g. creative writing, economics, environmental sciences, geology, psychology, sociology, and social work), elected officials (city, state, and national), community leaders, urban planners, offices of emergency management, and public transportation leaders.

We started with the science by modeling the effects of hurricane storm surges and then held an interdisciplinary forum, a serious conversation, in which we moderated a discussion of aspects of storm surge and flooding. We had to confront issues such as the human impact, the economic and political aspects, and the need for education. The governor's task force for storm recovery served as a catalyst for the conversations where we presented our hurricane storm research. Our work on "Go To High Ground" in which we are modeling evacuation strategies for automobiles and are collaborating with the NYC and NYS offices of emergency management has already changed evacuation signage on Staten Island. We hope that other geologists can learn from our experience in working with public agencies to effect change.

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NJ Meadowlands Watershed Delineation

Presenter: Michael Stepowyj, Meadowlands Environmental Research Institute

Contributing Authors: Brian Wlodawski, Dom Elefante

Abstract:

The New Jersey Meadowlands is an area that has high commercial, industrial, and residential value being in close proximity to New York City. It is a transitional area where land and freshwater sources mix with the ocean and its rivers swell and recede with the tide. Because it's a low lying area in proximity to the coast, its communities must grapple with predicting and mitigating extreme flooding caused by storm surge events like Hurricane Sandy in Fall 2012. MERI referenced the 'New Jersey Department of Environmental Protection Rebuilding Subwatershed Boundaries Using LiDAR-Derived Terrains' (NJDEP, Michael Baker) documentation to delineate watersheds for the Lower Hackensack Estuary region in the Meadowlands.

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Measuring Sandy Impact and Recovery through Water Consumption

Presenter: Aaron Damiani, New Jersey American Water

Contributing Authorr: Chris R Kahn

Abstract:

The recovery from Super Storm Sandy in late October 2012 has been slow and uneven in the Northern Barrier Island communities of New Jersey (Bay Head to Ortley Beach). The initial impact of Sandy is evident in the precipitous drop in water use from the 2012 to 2013 summer seasons. As many sections of the island wait for funding, huge areas remain vacant and, as a result, do not use water. In fact, the "Reduction Delta" pattern of water use drop nearly perfectly aligns with storm surge, breach, and over wash patterns the islands suffered. Bay Head, however, experienced a reduction in water use unrelated to damage in 2015. Using GIS, New Jersey American Water is tracking the pace and patterns of recovery through water use statistics each summer. Usage rates continue to climb towards pre-Sandy levels. The pace of recovery has declined slightly, partially due to the type of recovery (seasonal mansions replacing year round bungalows).

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Testing A New Multi-Proxy Presence/Absence Method To Produce A Mid Holocene Relative Sea-Level Record In New Jersey

Presenter: Jennifer Walker, Rutgers University

Contributing Authors: Horton, B.P. Kemp, A.C., Shaw, T.A., Kopp, R.E.

Abstract:

Most high resolution relative sea-level (RSL) records for the U.S. Atlantic coast using salt-marsh microfossils as a proxy only extend through the Common Era, which limits our understanding of driving mechanisms of RSL change and how sea-level is influenced by changing climate. Records beyond the Common Era are limited by the depth of continuous sequences of salt-marsh peat, which is suitable for high resolution reconstructions, as well as contamination of the RSL record by local processes such as sediment compaction.

We devise a new Multi-Proxy Presence/Absence Method (MP2AM) to develop a mid Holocene RSL record. We extract a series of 1 m basal salt-marsh sediment cores that overlap along an elevational gradient. To reconstruct RSL, we analyze each core for a combination of three sea-level indicators: foraminifera, testate amoebae, and stable carbon isotope geochemistry. The RSL records from each 1 m individual short basal core are combined to create a "stack," or in effect, one long core of salt-marsh material. We have completed a stratigraphic survey from 16 cores in Edwin B. Forsythe National Wildlife Refuge in southern NJ and have identified a basal peat along a uniform elevational gradient above an incompressible basal sand contact. Preliminary radiocarbon dates suggest the basal salt-marsh sequence is at least 4246-4408 cal yrs BP. This new method removes the issue of compaction in order to create a continuous mid Holocene RSL record for southern NJ to address temporal changes and to identify periods of climate and sea-level variability.

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Meadowlands National Park

Presenter:Rob Freudenberg, Regional Plan Association

Contributing Authors: Sarabrent McCoy, Ellis Calvin

Abstract:

The Meadowlands is one of the largest contiguous tracts of urban open space remaining in all of the northeastern United States, an estuary of national significance. Filled-in, choked off, drained and re-routed, it is the quintessential scarred landscape that illustrates both the impact of human influence and the triumph of natural systems. There are many examples around the country of natural systems manipulated by human kind, but none so significantly iconic as the Meadowlands.

It is both a hallmark landscape and a regionally significant labyrinth of critical transportation, energy, distribution and warehousing infrastructure, so much of which is located in flat, low-lying areas at increasing risk of temporary and permanent flooding. As such, to ensure future regional prosperity, the Meadowlands' populous cores must be protected, its critical warehousing and distribution centers transformed, its key stretches of high-risk transportation infrastructure either elevated or rerouted. But where projected flooding and inundation are so extreme as to prompt a complete reimagining of land use and landscape, RPA with its Fourth Regional Plan proposes a new role for the Meadowlands: Meadowlands National Park.

The Park's designation would invoke a new model of national park, where park boundaries expand as the effects of climate change are felt, and where three primary functions are served: to protect, improve, and educate. A shifting boundary would be redrawn in ways that protect the residents behind it, ensure and improve habitat and biodiversity within it, and demonstrate how climate change will redraw our coastlines both nearby and far beyond it.

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1, 4-Dioxane Contamination Survey at River Estuaries and Wastewater Treatment Plants in Northern New Jersey

Presenter: Fei Li, NJIT

Contributing Authors: Daiyong Deng, Mengyan Li

Abstract:

1, 4-Dioxane (dioxane) is an emerging water contaminant that has been reported as a possible human carcinogen by both USEPA and IARC. It is widely used as a stabilizer in chlorine solvents in industry and commonly found in daily consumables, such as cosmetics, shampoo products, and detergents. The combination of its hydrophilic nature, extensive usage, and extreme recalcitrance makes dioxane a prevalent and persistent contaminant once it enters the aqueous environment. In our lab, we developed a sensitive and simple analytical method to detect dioxane in a variety of water samples. This method integrated Frozen Microextraction (FME), which only used 500 μL aqueous sample and 500 μL dichloromethane for extraction, and gas chromatography tandem mass spectrometer (GC/MS) for detection. Selected ion monitoring (SIM) mode was employed for sensitive detection of dioxane when its concentration is lower than 100 μg/L. The method detection limit (MDL) was estimated as low as 0.73 μg/L with a linear regression curve ranging from 0.78 to 100 μg/L. this method was used to investigate the contamination of dioxane in the Hackensack River and four local wastewater treatment plants (WWTP) in northern New Jersey area. Dioxane was positively detected in 6 out of 14 river samples and all WWTP samples. The highest dioxane concentration along the river was 32.2 μg/L, which is probably associated with the unintentional discharge from a nearby landfill facility. All four WWTPs received dioxane-contaminated influents. However, current wastewater treatments were inadequate to remove dioxane below guidance level (i.e., 0.4 μg/L), suggesting dioxane is inevitably accumulated in environment and poses a potential risk for human health.

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C2R2: Training Students To Build Coastal Resilience

Presenter: Carrie Ferraro, Rutgers University

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Abstract:

In the United States, about 23 million people live within 6 meters of sea level. In many parts of the country, sea-level rise between 1960 and 2010 has already led to a 2-5-fold increase in the rate of 'nuisance' flooding. On top of rising seas, intensifying hurricanes and more frequent extremes of heat, humidity and precipitation pose additional risks to coastal societies, economies and ecosystems. Addressing risks posed by changing climate conditions in coastal areas demands innovative strategies that intersect multiple disciplines including engineering, ecology, communication, climate science, and community planning. To be usable, it also requires engaging coastal stakeholders in the development of research questions, the assessment of implications of research for planning and policy, and the communication of research results. Yet traditional, disciplinary programs are poorly configured to train the workforce needed to assess coastal climate risk and to develop and deploy integrated strategies for increasing coastal climate resilience. Coastal Climate Risk & Resilience (C2R2) is an NSF Research Traineeship (NRT) working to prepare the workforce that will build coastal resilience in the face of climate risks. C2R2 trains graduate students who conduct research to better integrate all the elements of coastal systems and to communicate effectively with coastal stakeholders. Through their research and practice, C2R2 graduates will contribute to significantly improved public- and private-sector decision-making in the face of global, regional, and local change.

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