Storm Surge Animated Visualizations were created by RENCI@ECU faculty, staff and students using National Hurricane Center SLOSH models and Google Earth products.
Summary of Year 4 Accomplishments

The faculty and staff of RENCI @ ECU Center for Coastal Systems Informatics and Modeling are pleased to report on a year of abundant research and engagement activities. Despite the awkward beginning of budget cuts and prospect of non-renewal, our faculty, staff, and students persevered and overcame obstacles under a severely reduced operating level (-50%). The austere budget environment propelled our participants to further engage with potential funding agencies and stakeholders, resulting in new major grant-seeking activity (NASA and NSF) and expanded collaboration with State (North Carolina Division of Emergency Management), federal (Albemarle Pamlico National Estuary Program), local (Dare and New Hanover Counties) as well as non-profit entities (The Nature Conservancy). At the close of FY 2009-2010, new projects are underway with funding from NC National Estuarine Research Reserve, APNEP, NC Sea Grant, and the National Park Service while other major initiatives are pending (NSF MRI, NASA Climate Change and MODIS Science programs, and NSF Climate Change Education.)

This report summarizes the scope of research activities, highlights results, and identifies participating personnel and student. Highlighted accomplishments include:

- Conducted the Hurricane Floyd 10th Anniversary Symposium in collaboration with Center for Natural Hazards Research and NC Division of Emergency Management
- Designed and facilitated the Dare County 2010 Hurricane Felix exercise.
- Co-organized and hosted 1st Annual NC Hurricane Workshop with NC Emergency Management and Center for Natural Hazards Research
- Implemented a continuously operating estuarine observing platform in the Albemarle Sound for scientific and operational users (involving ECU, CSI, Army Corps of Engineers, National Weather Service, etc.)
- Supported 6 graduate students (from programs including CRM, Geography, Geological Sciences, English, and Economics)
- 14 scholarly presentations
- 9 grant proposals (6 funded $343,647; 3 pending $2.8M)
- Published 10 scholarly papers and chapters
- Offered 15 visualization wall demonstrations, 8 student and group presentations in the ECU VizChallenge
Core Personnel
Thomas R. Allen, Director and PI (Geography)
J.P. Walsh, Associate Director and Co-PI (Geological Sciences & ICSP)
Donna Kain, Director of Outreach and Co-I (Professional and Technical Communications)
Michelle Covi, Outreach Coordinator (PhD student, CRM)
Stephen Sanchagrin, Technology Coordinator

Affiliated Faculty
Tom Crawford, Co-I (Geography)
Reide Corbett, Co-I (Geological Sciences & ICSP)
Craig Landry, Co-I (Economics)
Enrique Reyes (Biology & ICSP)

Collaborating Faculty
Nick Murray, Fellow (Exercise and Sport Science)
Alex Manda, (Geological Sciences & ICSP)
Nathan Richards (Maritime Studies)
Catherine Smith (Professional and Technical Communications)

North Carolina Stakeholders and Contacts
N. Sandy Sanderson (Dare County Emergency Management)
Michael Sprayberry (NC Division of Emergency Management)
Brian Boutin, The Nature Conservancy
Rich Bandy, John Cole, Mark Willis (National Weather Service Morehead/Newport)
Steve Underwood, Guy Stefanski, Tancred Miller, Scott Geis, Bonnie Bendell, Sea McGuire
(NC Division of Coastal Management)
Bill Crowell, Dean Carpenter (APNEP)
John Fear (NC National Estuarine Research Reserve)
Jeff Hanson (Army Corps of Engineers)
John Dorman (NCEM Office of Geospatial Technology Management)
Jack Thigpen, Gloria Putnam (NC Sea Grant)
Brian Roth (Mayor, Town of Plymouth)
Noel Lee (Pitt County Emergency Manager)
Nancy White (UNC Coastal Studies Institute)

Students supported:
Laurynas Gedminas (Geography, MA student)
Steve Anstine (Geological Sciences, MS student)
Danielle Zebrowski (Exercise and Sport Science, MS student)
Daniel Siepert (Technical and Professional communications, MA student)
Robert Howard (Geological Sciences, MS student)
Nick Lee (Geography, BS student)
Caroline Brooks (Technical and Professional Communications, PhD student)

Hurricane Workshop Presenters (from left): Dr. Patrick Long, Dr. Catherine Smith, Dr. Burrell Montz, Mr. Mike Sprayberry, Dr. Ken Wilson, Dr. Jamie Kruse, Dr. Tom Allen
Engagement with Emergency Management

Hurricane Workshop for North Carolina Emergency Management
The North Carolina Division of Emergency Management in partnership with the ECU Center for Natural Hazards Research and RENCI @ ECU held a Hurricane Workshop for Emergency Managers. About 100 emergency management personnel, ECU faculty, National Weather Service meteorologists, and emergency technology specialists attended the May 26, 2010, workshop at ECU. The workshop provided participants with information about the technological improvements in hurricane forecasting, response, and decision-making. Sessions focused on meteorology, Hurrevac software, evacuation and sheltering and recovery.

Hurricane Felix Exercise for Dare County
RENCI@ECU worked with Dare County Emergency Management and the National Weather Service to organize a hurricane response tabletop exercise for decision makers in several coastal counties on June 8, 2010 in Manteo, N.C. RENCI modeled a simulated hurricane named Felix, a major hurricane with land-fall occurring in Dare County, which would trigger a mass evacuation of Dare County and the Hampton Roads, Virginia, area. Attendees included local elected officials and their government staff, law enforcement supervisors, the Hatteras National Seashore superintendent and emergency management officials from Dare County and from the state of Virginia.

Hurricane Floyd 10th Anniversary Symposium
RENCI @ECU supported this high profile symposium on the 10th anniversary of Hurricane Floyd, North Carolina’s worst natural disaster. Over 200 participants were attracted, including former Gov. Jim Hunt and several members of the legislature, regional emergency managers, and dozens of scientists. The public forum attracted a packed room and TV media coverage, with many attendees hailing the event and calling for more such engagements in the region. RENCI was vital to the organization, operation, and successful implementation.

Dean Allan White addresses the audience at the Hurricane Floyd Symposium
Projects and Research

Storm Surge Visualization Project (SurgeVis)

In support of the risk communication of hurricane storm surges, a SLOSH and ADCIRC-based library of visualizations are in preparation for Dare County Emergency Management (as a prototype, New Hanover is also in preparation.) The web-based dissemination will allow the emergency manager to utilize video and animations of storm surge model output for communicating risk of approaching storms and issuance of public evacuation orders. In addition, this research has initiated an integrated biofeedback and geovisualization risk perception project. Next quarter initial results will be reported on the efficacy of this approach to link visual risk perception, involuntary psychomotor response, and expressed responses revealed in surveys.

Visualization can be found at: http://nccohaz.ecu.edu/stormvis/index.html

Project Bioviz

The RENCI team is investigating the effect of different versions of the “cone of uncertainty,” which is used in NOAA weather center advisories to illustrate hurricane track forecasts. Using ArcGIS software, researchers have developed three sets of hurricane advisory maps based on a hypothetical “Hurricane Laurie” scenario. Each set consists of a sequence of 20 maps which show Hurricane Laurie approaching the North Carolina coast. The first set uses the typical NOAA cone of uncertainty, which includes both a track line and location points (with dates) within the cone. The second set uses a cone that omits the track line. The third set uses a cone that omits both the track line and the location points, but retains the location dates.

As the 20–40 student volunteers watch these map sequences, researchers will collect biometric data: eye-tracking, brainwaves (capturing positive and negative emotions), heart rate, and facial muscle movement. Approximately 40 subjects have been surveyed, and results are now being tabulated. Preliminary results and methodology have been shared with the Director of the National Hurricane Center and regional National Weather Service staff.

Storms 2 Life Project

The Storms 2 Life project has sought to bring historical North Carolina “storms to life” using historic accounts, multimedia, and web-based content. A timeline and gallery have been created, with the anniversary of Floyd and Hazel attracting TV media attention. In addition, this project is linked to NC Coastal Hazards Decision Portal, which has implemented a recurring blog-like news report, NC COHAZ “Bytes.”

Results of eye tracking for one participant in Project BioVis

Storms to Life Website: www.ecu.edu/renci/stormstolife
North Carolina Coastal Hazards Decision Portal (NCCOHAZ)
We have continued to develop the web-based information portal on coastal hazards (www.coastal.geology.ecu.edu/NCCOHAZ) with colleagues in Geological Sciences and Geography. The web site regularly is receiving publicity through web sites, as well as local and regional newspapers (e.g., NOAA, Greenville’s Daily Reflector). Blog-like news reports were initiated in Summer 2009 to keep people aware of relevant news.

Shoreline Change
We have completed a regional predictive tool for shoreline erosion was developed based on data collected from the Neuse River Estuary. We have also continued to collaborate with the NC Division of Coastal Management to create a modern digital shoreline for the APES (see grant proposals below). As part of this work and related to our RENCI-efforts, we are constructing a digital shoreline, including its associated shoreline type and structures inventory.

Geospatial Technology
National Hurricane Center SLOSH model runs have been developed into a prototype library. Models are now being run for 3d video animations, which in turn will be posted to an online library with user queryable conditions. This is the cooperative effort of RENCI ECU and Dare County Emergency Management. Results were presented in a briefing to the Dr. Bill Read, Director of the National Hurricane Center. Model visualizations have been incorporated into the regional National Weather Service Forecast Office briefings.

A library of Coastal GIGPIXAN images has been created and posted for public access using RENCI’s GIGAPIXEL imaging system. We successfully imaged and stitched a half dozen sites, including historic lighthouses and monuments and vulnerable locations. Stitched gigapan images have been posted to the RENCI ECU website and are available on Gigapan.org community site.

Coastal Observing
The Estuarine and Coastal Observing initiative has maintained the Albemarle Sound observing station in collaboration with the Coastal Studies Institute. In addition, RENCI ECU’s Sound Rover PWC vessel has been used to calibrate coastal radars for wave modeling and forecasting off the NE coast (in association with UNC-IMS and USACE Duck Field Research Facility.) Working with USACE FRF staff, data have been incorporated into their coastal observing system and website: http://www.frf.usace.army.mil/.
Presentations and Publications

Presentations

- Catherine F. Smith, Ken Wilson, Donna Kain. 2010 Communicating Hurricanes: How People Get and Use Storm Risk and Emergency Information. March 2010 NCEM meeting, Sunset Beach, NC.
- Craig E. Landry, Tom Allen, Todd Cherry, and John Whithead. 2010. “Wind Turbines and Coastal Recreation Demand” ECU Dept of Geography Wind Colloquium, Greenville, North Carolina (April) & Ocracoke/ Hatteras Islands Chamber of Commerce, Rodanthe, North Carolina (February)
- Reyes - Presentation at a NOAA sponsored workshop focused on Sea Level Rise. July 16, 2009.


Publications


• Kain, Donna, 2010 Risk Perceptions and Emergency Communication Effectiveness in Coastal Zones Preliminary Findings on Interpretations of Weather Related Messages and Maps. (Report provided to the Director of the National Hurricane Center. 2010.


External Funding and Grant Proposals

Funded


Pending

- “Carolina Coastal Climate Explorers Program.” T. Allen, S. Curtis, E. Reyes, and R. Miller with 6 other UNC-system campuses. NASA. 1/2011-12/2013. $1.1M.


Outreach and Engagement Activities

• Michelle Covi presented “Understanding Coastal Hazards through GIS” to a group of over 30 teachers and staff of TechMath, a STEM project for students and teachers designed to teach how science, technology, engineering, and mathematics are used in real-life businesses and careers. March 6, 2010, Kitty Hawk, NC

• Tom Allen, Donna Kain, Michelle Covi, Daniel Seipert. Outreach at the North Carolina Region 1 Science and Engineering Fair. February 27, 2010. Greenville, NC.

• Tom Allen and Laurynas Gedminas. “VisWall Demonstration of 3D Outer Banks Wind Farm Simulation” Wind Energy Colloquium. February 26, 2010, Greenville, NC


• Craig Landry presented ‘Human Involvement in Barrier Islands’ for the AIG Summer School for Gifted Middle School Students.

• Under the supervision of Drs. Craig Landry and Jamie Kruse, Jingyuan Li, RENCI graduate assistant and doctoral candidate in Coastal Resources Management, assisted the Town of Topsail Beach with mapping and analysis of flood mitigation costs and FEMA’s CRS system. His work helped facilitate the town’s saving $200,000 in discounted insurance premiums.

• Michelle Covi “Don’t Get Blown Away By Hurricanes” Outreach Programs for parents and school-age children. July 9, 2010 Windsor, NC and Washington, NC

• HAZUS is FEMA’s certified disaster loss estimation software. In August RENCI ECU staff and Director participated in the 3rd Annual HAZUS User Conference in Raleigh as the only RENCI affiliated participants. In concert with our MOU, we proposed the creation of the NC HAZUS user group and will lead this group for the eastern NC region. Although our offering of HAZUS training was withdrawn from plans following budget cuts, staff continue to participate in monthly conference calls and a wiki-site. Plans for future HAZUS service to the region are possible with new funding from FEMA and NC DEM.

Press Coverage in Print and Television

• North Carolina Estuarium ROVER program (July, 2009) pre-publicity in Reflector, WCTI coverage

• Hurricane Floyd Symposium (September, 2009)-WCTI coverage

• Hurricane Workshop for NCEM (May, 2010)- local news coverage, WCTI, WNCT, ECU

• BrightLeaf Amateur Radio Field day (June, 2010)- WNCT news coverage of ROVER