CAROLINAS CLIMATE CONNECTION

Carolinas Integrated Sciences & Assessments, a NOAA RISA Team
Integrating Climate Science and Decision Making in the Carolinas

Photo Source:
Dave Allen Photography

RISA Regional Integrated Sciences and Assessments
UNIVERSITY OF SOUTH CAROLINA
CISA A NOAA RISA TEAM

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UPCOMING EVENTS

2019 SECCCoP Workshop	April 1-3 Wrightsville Beach, NC
National Adaptation Forum	April 23-25 Madison, WI
National Watershed & Stormwater Conference	April 29- May 2 Charleston, SC
Climate Prediction Applications Science Workshop (CPASW)	June 11-13 Charleston, SC

RACHEL WOODUL

CISA Featured Researcher

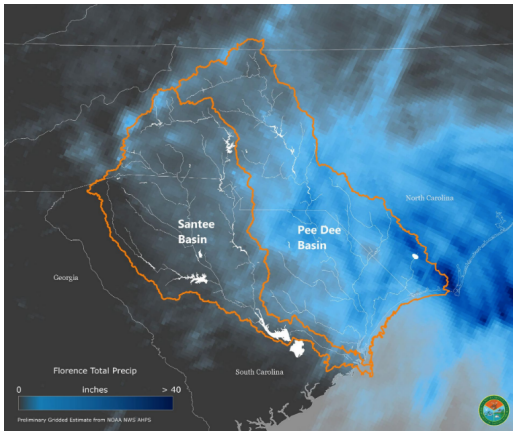
Rachel grew up in Swansboro, a small town on the Crystal Coast of North Carolina. She attended the University of North Carolina at Chapel Hill, earning a BA in Geography and a BA in Global Studies, with a focus on Global Health, as well as a minor in Medical Anthropology. Her research interests include health vulnerability to extreme climate events, health care capacity modeling, and crisis simulation and response modeling.

She is currently working on developing the Hazardous Extremes Risk Assessment Tool with Dr. Ashley Ward, as well as a project to develop methods of measuring excess mortality from extreme weather events such as hurricanes, snow storms, and extreme heat. When not working on her Ph.D. and CISA research, Rachel enjoys snorkeling and SCUBA diving, hiking, and skiing.

HURRICANE FLORENCE

SC State Climatology Office Produces Story Map of The Event

By Stafford Mullin



Last September, Hurricane Florence struck North and South Carolina giving rise to the declaration of a State of Emergency, dumping excessive amounts of rainfall, and inundating coastal communities. The South Carolina Department of Natural Resources' State Climatology Office recently published an assessment describing the impacts of Florence on the state. This assessment provides data from the Hurricane in regards to its impacts on South Carolina's residents, rainfall amounts, precipitation analyses, peak river flow, and storm surge and tidal effects.

The assessment articulates that, for South Carolina, the worst impacts of Florence were experienced not by the initial storm itself, but rather from the residual flooding that occurred due to an astonishing amount of rainfall. One CoCoRaHS station recorded an astounding 23.63 inches of rainfall near Loris, SC. This amount of rainfall constitutes what is known as a 1,000-year flood event, meaning that during any year, there existed only a 0.1% chance that a flood of this magnitude could occur. Flood-related issues from Hurricane Florence were exacerbated by the three feet of flood waters that drained down from North Carolina, where the storm initially hit, into South Carolina's Yadkin-Pee Dee River region.

In addition to the precipitation and flooding that overwhelmed the state, the coast experienced a storm surge just shy of 2.5 feet on September 16. Individuals along the coastline were highly encouraged to leave the area, causing a complete reversal of Interstate-26 to better facilitate evacuation. Furthermore, the state experienced over 180,000 power outages, 233 road closures, over 1,000 assisted evacuations, and nearly 8,000 individuals utilized evacuation shelters. Learn more about how this storm impacted the state in the **SC State Climatology Office's Story Map of Hurricane Florence**.

JOIN US For the 2019 Southeast and Caribbean Climate Community of Practice Workshop

Mark your calendars because next week, the Southeast and Caribbean Climate Community of Practice 2019 Workshop will take place in Wrightsville Beach, North Carolina, from April 1st through the 3rd.

The goal of the workshop is to discuss coastal climate related issues and opportunities to increase resilience in the region by bringing together individuals from different agencies and organizations, including local, state, and federal government workers, outreach professionals, non-profit groups, private sector organizations, and the like. Participants will have the opportunity to expand their knowledge on climate science and learn how the Southeast and Caribbean regions will be impacted by hearing from lead authors of the Fourth National Climate Assessment, which was released in November of last year.

Additionally, several open discussions will take place to encourage workshop participants to share ideas,knowledge, and expertise. Groups will evaluate and discuss strategies taken towards preparing for, responding to, and recovering from past extreme weather events like Hurricanes Florence, Irma, Maria, and Matthew. Participants will also discuss how to best create frameworks for incorporating effective climate adaptation practices into medium- and long-term planning. Furthermore, conversations will take place concerning strategies and opportunities for partnerships and collaborations across the region to strengthen climate resilience. Workshop participants will also have the opportunity to take a field trip to the US North Carolina Battleship to learn about the “Living with Water” campaign, which addresses the various impacts of sea level rise at the battleship site. A full breakdown of the workshop agenda is available here.

The workshop will be held at The Blockade Runner Beach Resort in Wrightsville Beach, North Carolina. More information can be found on the **SECCCoP Workshop website**, including hotel reservations, and event registration which is open until Wednesday, March 27th.


Photo Source: @blockaderunnerbeachresort


Photo Source: @blockaderunnerbeachresort

AGRICULTURAL DROUGHT

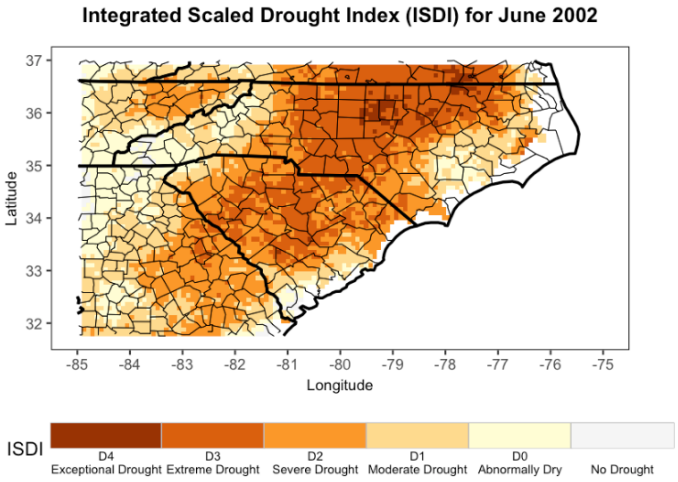
Creating the New Integrated Scaled Drought Index

CISA researchers Junyu Lu, Greg Carbone, and Peng Gao recently published an article in Applied Geography outlining the development of a new agricultural-based drought index, the Integrated Scaled Drought Index (ISDI).

The ISDI combines satellite-based observations of vegetation with climate data and information, including temperature, precipitation, and soil moisture. Comparison of ISDI values to historical US Drought Monitor and VegDRI maps and crop yield anomalies for soybeans and corn showed strong agreement in validation of the index. Because the satellite data dates back to 1981, the index allows for an assessment of historical drought for the longest time-frame during the satellite era. The ISDI can also be used for future agricultural drought monitoring.

ISDI maps are available as part of the Carolinas Precipitation Patterns & Probabilities Atlas, available here.

Lu, J., G. Carbone, and P. Gao. 2019. "Mapping the agricultural drought based on the long-term AVHRR NDVI and North American Regional Reanalysis (NARR) in the United States, 1981-2013." Applied Geography, 104, 10-20. **https://doi.org/10.1016/j.apgeog.2019.01.005**



Future Projections of Agricultural Drought

Junyu Lu and Greg Carbone also worked with John Grego to assess future agricultural drought projections using surface soil moisture outputs from a suite of global climate models for four different climate change scenarios. Their findings showed a statistically significant increase in large-scale drying by the end of the 21st century for all four future scenarios. The spatial extent for severe drought is also projected to increase around the globe. They found that the uncertainty in these projections is primarily derived from differences between model outputs because of the different ways the models treat climate variables such as clouds and precipitation as well as differences between climate models in soil depth and soil layers. Despite uncertainties in the models, the projections do show consistencies in anticipation of future drought. From an applied climate science perspective, these projections are important considerations for water resources and crop management practices to help create more resilient agricultural systems in anticipation of future droughts.

Lu, J., G. Carbone, and J. Grego. 2019. "Uncertainty and hotspots in 21st century projections of agricultural drought from CMIP5 models." Scientific Reports, 9(1), 4922. **https://doi.org/10.1038/s41598-019-41196-z**.

Photo Source:
Dave Allen Photography

ROADS TO NOWHERE

State and Local Governments in the Atlantic Southeast Facing Sea Level Rise

The Columbia Journal of Environmental Law recently published an article that assesses strategies for climate adaptation planning at the local level, with a focus on road infrastructure in four Southeastern states including Florida, Georgia, and North and South Carolina. Factors such as sea level rise, increased storm surge, and tidal flooding are posing serious threats to coastal communities in the wake of global climate change. With increasing awareness of these climate related issues in coastal areas, local governments are being recognized as crucial players in the decision-making process. These four states along the Southeast Atlantic Coast are faced with especially difficult questions regarding climate adaptation strategies due to their dependency on coastal resources, as well as the critical infrastructure systems located there.

Roads are a crucial form of infrastructure that undoubtedly requires protection from flooding due to their extensive use for transportation, trade, and defense purposes. The U.S. Department of Transportation notes three areas of vulnerability within the transportation sector that require attention. These include the resilience of existing infrastructure, new infrastructure, and transportation systems. In Florida, Georgia, and the Carolinas, the majority of roads are owned either by the state, or local counties and municipalities; however, there is often a patchwork of ownership between these various levels of government for many roads throughout the transportation system. This further emphasizes the importance of coordinated local government action in protecting critical infrastructure from climate related threats.

The article also explains the complex and sometimes contradictory legal landscape for addressing road maintenance and repairs at various levels of governance. Even if continued repair of a repeatedly flooded coastal roadway or upgrade to raise the road is financially unfeasible for a small municipality, failing to maintain the road could make the government liable for negligence. And, although some abandonment procedures exist in the four states, abandonment can lead to takings claims by property owners who may lose access to their land if the road is not maintained.

The authors makes several proposals regarding how states should move forward with climate adaptation planning efforts. They argue that implementing an adaptive duty to maintain critical infrastructure systems, such as roads, should be adopted to best facilitate planning initiatives. An adaptive management strategy would allow local governments to develop a transportation system that balances costs and available resources to accommodate changing conditions over time. This approach should also incorporate policies for abandonment when maintaining the status quo is no longer feasible within the context of functionality of the entire system. Incorporating feedback loops into planning through an iterative assessment process would allow new information to be incorporated into maintenance policies as conditions change over time.

Finally, the authors recommend applying laws and regulations at the state level as the most effective way of implementing these strategies. They argue that state-level policies would reduce piecemeal litigation at different levels of jurisdiction and send a “clear and consistent policy signal that adaptation planning is valued and expected – and that governments will be protected from liability.” Sea level rise and flooding will not follow jurisdictional boundaries and an adaptive duty to maintain would affirm a more holistic approach to infrastructure maintenance.

Despite the challenges these communities face in addressing the impending threat of sea level rise, there are examples throughout the region of those who are looking towards the future and testing new approaches and policies to adapt in order to protect their communities. To learn more about the full suite of author recommendations, check out the article here.

Jones, S., T. Ruppert, E. Deady, H. Payne, J.S. Pippin, L. Huang, and J. Evans. 2019. "**Roads to Nowhere in Four States: State and Local Governments in the Atlantic Southeast Facing Sea-Level Rise**" Columbia Journal of Environmental Law, 44(1).