

# Carolinas Climate Connection

Carolinas Integrated Sciences & Assessments, a NOAA RISA Team

Integrating Climate Science and Resource Management in the Carolinas

## Newsletter Contents

- 2 2014-2015 CISA Annual Report Highlights
  - Drought-Related Projects*
  - Climate Model Assessments*
  - Climate and Health Research*
- 4 Beaufort County, SC Adaptation Planning Featured in U.S. Climate Resilience Toolkit
- 4 New Project - Assessing public health risks of vulnerable water and wastewater infrastructure
- 5 2015 Atlantic Hurricane Season

## Getting to Know Your RISA

### Featured Researcher: Chip Konrad

Dr. Chip Konrad is a climatologist and Associate Professor in the Geography Department at the University of North Carolina at Chapel Hill. He is also the director of the [Southeast Regional Climate Center \(SERCC\)](#), which provides climate services to a diverse group of stakeholders in the region. Chip holds a Ph.D. in Geography from the University of Georgia and has been teaching courses at UNC since 1993. His research interests include climate variability and change, especially as they relate to extreme weather events and their impacts on people.



CISA PI Chip Konrad had a chance to visit the Grand Canyon while in Phoenix, AZ for the American Meteorological Society annual meeting in January 2015.

As a CISA PI, Chip is leading the development of a web-based climate-health toolbox that, among other things, contains tools for identifying who is vulnerable to heat and how many people will visit the emergency room according to predicted daily maximum temperatures. In his work with CISA, Chip especially enjoys interacting with stakeholders and helping to answer their climate-related questions. Learn more about his work on [page 3](#).

Chip is also an avid birdwatcher. His annual sightings checklist has around 300 total species, about 180-200 of which he usually sees in a given year. Chip enjoys traveling and taking advantage of trips to new destinations to mark bird species off his annual checklist.

## About CISA

The Carolinas Integrated Sciences & Assessments (CISA) is 1 of 11 NOAA-funded [Regional Integrated Sciences & Assessments \(RISA\)](#) teams. CISA works in North and South Carolina to integrate climate science into decisions related to water, coasts and health.

### CISA connects climate science and decision making through

- » Applied research to produce relevant climate information
- » Assessments of climate impacts and adaptation strategies
- » Processes to support and inform community planning
- » Fostering climate networks and climate communities of practice

## Upcoming Events

[NC Public Health Toolbox Stakeholder Meeting](#)  
July 31, 2015  
Chapel Hill, NC

[NC Agriculture and Forestry Adaptation Summit](#)  
August 11, 2015  
Raleigh, NC

[UNC Water & Health Conference](#)  
October 26-30, 2015  
Chapel Hill, NC

[Winthrop University: Water in the World Conference](#)  
November 6-7, 2015  
Rock Hill, SC

[Social Coast](#)  
February 9-11, 2016  
Charleston, SC

## Carolinas Climate Listserv

Subscribe to the [Carolinas Climate Listserv](#) to learn about the latest climate research and information, upcoming events, funding opportunities, and other relevant news for the Carolinas.



USC Department of Geography  
Callcott Building  
709 Bull Street  
Columbia, SC 29208  
[www.cisa.sc.edu](http://www.cisa.sc.edu)

(803) 777-6875  
[cisa@sc.edu](mailto:cisa@sc.edu)  
[@CarolinasRISA](https://www.facebook.com/usccisa)

[www.facebook.com/usccisa](https://www.facebook.com/usccisa)



UNIVERSITY OF  
SOUTH CAROLINA

The University of South Carolina is an equal opportunity institution.

# Carolinas Climate Connection

Carolinas Integrated Sciences & Assessments

[Back to Page 1](#)

## CISA Annual Report May 2014 - 2015

The CISA annual report showcases projects, research findings, and deliverables from CISA's efforts to integrate climate science and decision making in the Carolinas. The next few pages include highlights from the 2014-2015 report. A copy of the full report is available on the CISA website.

### By The Numbers

#### People

- » 5 Principal Investigators
- » 16 Collaborating Investigators
- » 2 Full Time Staff
- » 2 Research Associates
- » 10 Graduate Students

#### Partners

- » Clemson University
- » East Carolina University
- » National Integrated Drought Information System
- » NC Sea Grant
- » NC State University
- » NOAA's Center for Coastal Environmental Health & Biomolecular Research
- » SC Sea Grant Consortium
- » SC State Climatology Office
- » Southeast Regional Climate Center
- » State Climate Office of NC
- » The University of North Carolina at Chapel Hill
- » USGS South Atlantic Water Science Center

#### Deliverables

- » 11 peer-reviewed publications
- » 4 book chapters
- » 3 Master's theses
- » 2 Ph.D. dissertations
- » 48 conference and workshop presentations
- » 9 conference poster presentations
- » 6 organized conference sessions
- » 3 stakeholder workshops

## 2014-2015 CISA Research Highlights

### Drought-Related Projects

Several of CISA's projects support the NIDIS Carolinas Drought Early Warning System (DEWS) pilot program, which centers on an improved understanding of drought in coastal ecosystems.

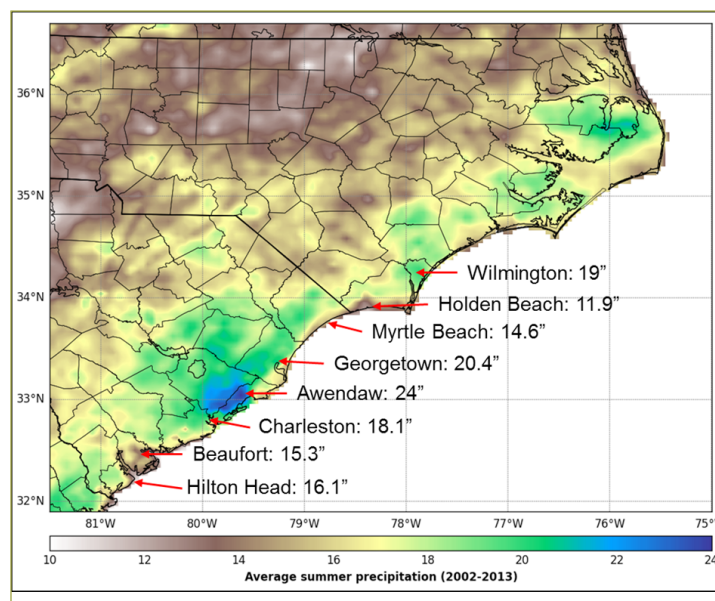
### Indicators and Indices of Drought in Southeastern Coastal Ecosystems

This project, which is supported by the NOAA Sectoral Applications Research Program (SARP), seeks to improve understanding of how the coastal resources that depend upon particular spatial and temporal patterns of precipitation, salinity, or streamflow are affected by drought and to identify needs for drought early warning. As a first step, CISA collaborating investigators at East Carolina University conducted a series of interviews with 30 land managers and natural resource specialists in the coastal Carolinas. The interviews revealed common interest for an ecological drought indicator that incorporates salinity intrusion and vegetative parameters of stress, particularly for wetland dependent species. Improving use of existing, publicly available data sets was also emphasized by interviewees, given constraints in initiating or expanding monitoring and data collection efforts. The second component of the project will involve collaboration with the USGS South Atlantic Water Science Center to inform the development of the coastal drought index (CDI). Utilizing information and priorities identified through stakeholder interviews, researchers will work to determine linkages between ecological indicators of drought and varying salinity levels expressed by the CDI.

**Take Away:** Changing salinity levels are a key indicator of drought in coastal ecosystems and will continue to be a focus of research and efforts to develop a coastal drought early warning system.

### Development of a Hydroclimate Extremes Atlas for the Carolinas

Through interaction with coastal land managers, fishers and others dependent on coastal resources and ecosystems in the Carolinas, CISA identified a need for an improved baseline understanding and information about drought and normal precipitation in the Carolinas. The atlas will include analysis of the spatial and temporal patterns of drought and precipitation. Work to date reveals a ribbon of lower summer season rainfall along the immediate coastline which may have implications for coastal drought. Work on the atlas will continue into the next year with analysis to improve understanding of drought recurrence in the Carolinas and links to drought-related impacts.



Based on daily PRISM data, this map shows the average summer (JJA) precipitation across the Carolinas coastal plain during 2002-2013. The highlighted locations indicate the marked gradient in summer season precipitation within the coastal plain, which is characterized by relative dryness along the immediate coastline (e.g., Myrtle Beach, SC) and a ribbon of wetter conditions beginning ~10 kilometers inland (e.g., Georgetown, SC).

# Carolinas Climate Connection

Carolinas Integrated Sciences & Assessments

[Back to Page 1](#)

## 2014-2015 CISA Research Highlights

### Climate Model Assessments

CISA researchers engage with stakeholders to make global climate information locally relevant for their planning and management decisions. This work often involves assessment of climate models and future climate projections.

#### Assessment of Regional Climate Models in Simulating Extreme Rainfall Events

Building on work conducted to inform the [Low Impact Development in Coastal South Carolina: Planning and Design Guide](#), CISA team members assessed the performance of downscaled climate models in replicating historic extreme rainfall events. They also looked at projections for future change in regional rainfall patterns. Models replicated the historic record reasonably well throughout the U.S., with the exception of the Southeast. Here, the models were not able to simulate the intensity, duration, and frequency of these events as well as in other parts of the country. With respect to future precipitation change, most models projected intensified 24-hour rainfall events (exceptions include some decreases in southern California, the extreme north-central U.S., Florida, and the Texas Plains).

**Take Away:** Climate models replicate the historical record of temperature rather well in the Southeast, but do not have as much skill in replicating historic rainfall patterns. This gives scientists more confidence in future temperature projections for the region while there is more uncertainty about what future precipitation will look like.

### Climate and Health Research

Diverse geographies and populations in the Carolinas are subject to a wide range of climate conditions and weather extremes, such as heat waves, hurricanes, and drought which are often associated with public health impacts. A key component of CISA's health work is to investigate the linkages between climate and human health and improve understanding of vulnerabilities and interacting stressors in order to inform the adoption of strategies to reduce risks.

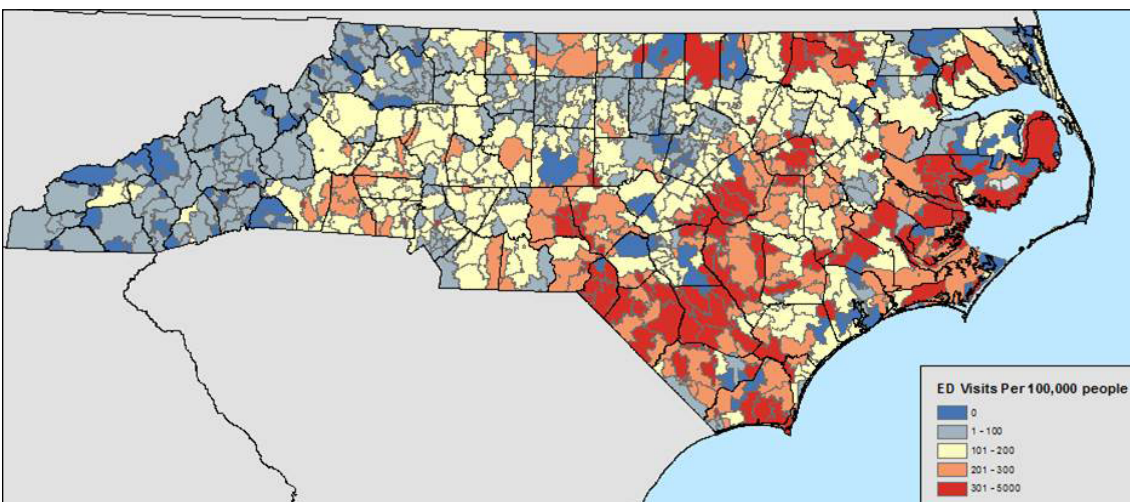
#### Assessing Climate-Related Health Vulnerabilities in North Carolina

CISA PI Chip Konrad is leading efforts to investigate linkages between climate and public health risks related to heat stress and waterborne disease. He and graduate research assistants at the Southeast Regional Climate Center (SERCC) are developing a public health toolbox that translates weather and climate conditions into useful information regarding the probability of public health emergencies. The toolbox integrates data from the North Carolina Disease Event Tracking and Epidemiologic Collection Tool (NC DETECT), climate and weather data, and geographic information in order to identify climate-public health vulnerabilities across different regions (e.g., coastal plain, Piedmont, mountains) and populations (e.g., rural vs. urban).

**Take Away:** Work to date has centered on heat-related emergency department admissions with results indicating the highest rates of heat vulnerability are found in rural areas where labor-intensive crops are grown. Demographically, the highest rates are found for males in the 21-45 year age group, many of whom engage in outdoor labor.\*

\* Kovach, M. M., C. E. Konrad II, and C. M. Fuhrmann. 2015. Area-level risk factors for heat-related illness in rural and urban locations across North Carolina, USA. *Applied Geography* 60: 175-183.

**Save the Date:** A webinar (9:30 a.m.) and in-person meeting (1:00 p.m.) will be held in Chapel Hill, NC on Friday, July 31, 2015 to demonstrate the public health toolbox and its applications. For more information, contact Marty Casarez at [mlreyes@ncsu.edu](mailto:mlreyes@ncsu.edu).



Generated by the public health toolbox, this map shows the spatial variations in emergency department admissions for heat-related illness from 2007-2012. The highest rates of heat vulnerability are found in rural areas of North Carolina where labor-intensive crops are grown. This information is being shared with public health officials and National Weather Service forecast offices who issue heat advisories.

## Beaufort County, SC Sea Level Rise Adaptation Efforts Featured in the U.S. Climate Resilience Toolkit

Team members from CISA, the SC Sea Grant Consortium, the Social and Environmental Institute and NC Sea Grant, assisted Beaufort County, SC planners and stakeholders in identifying priority actions to address the impacts of sea level rise which could be incorporated into existing planning processes such as the County's Comprehensive Plan. Through a series of stakeholder engagements and public workshops, 23 adaptation strategies were identified and prioritized. These strategies were compiled into a [final report](#), tailored for use by the County's planning department. Additional information can be found on the [project website](#).

This work is now featured as a "Taking Action" case study in the [U.S. Climate Resilience Toolkit](#). The toolkit is designed to serve a variety of stakeholders, from communities to businesses to policy leaders at all levels of government. Its contents are organized into a [step-by-step approach](#) to climate resilience, [case studies](#) to learn from others facing similar challenges, [tools](#) and [trainings](#) designed to support actions and implementation, and contact information for [experts](#) working to support climate adaptation practitioners.



U.S. Climate Resilience Toolkit

[Get Started](#) [Taking Action](#) [Tools](#) [Topics](#) [Expertise](#)

[About](#) | [Contact](#) | [Funding Opportunities](#) | [FAQ](#)

Search

[Taking Action](#) > [The Lowcountry Lowdown on Sea Level Rise](#)

### The Lowcountry Lowdown on Sea Level Rise

Recognizing increasing risks from sea level rise, leaders in Beaufort County, South Carolina, used a participatory process to help anticipate outcomes and make plans to build their resilience.

## New Project: Assessing health risks associated with vulnerable water and wastewater infrastructure in Charleston, SC and Morehead City, NC

A CISA-supported minigrant project to address the potential vulnerability of municipal water and wastewater infrastructure to coastal hazards will be part of an expanded effort to understand the public health implications of these risks. The original study, conducted by Tom Allen, Burrell Montz and Zach Oyer at East Carolina University, produced a methodology and mapping protocol to assess and visualize the threats of sea level rise, storm surge, and riverine flooding to coastal water and wastewater infrastructure using the towns of Manteo, New Bern, and Plymouth, NC as case study sites.

The new project, recommended for funding by [NOAA's Coastal and Climate Applications \(COCA\) program](#), will include a similar analysis of infrastructure vulnerability in Charleston, SC and Morehead City, NC, connecting vulnerabilities to potential public health risks such as contaminated drinking water. The research team, led by the SC Sea Grant Consortium and including CISA, East Carolina University and NC Sea Grant, will then engage stakeholders to develop a community-level susceptibility index of populations most vulnerable to these hazards. The index will be tested through table top exercises in both of the pilot communities, and a guidebook will be developed for transferability to other municipalities.

The goal of the project is to expand the capacity of public health officials, environmental agencies, emergency managers, and water and wastewater utility operators, among others, around the issues of critical coastal water infrastructure and public health. The project will help the two pilot communities to develop new benchmarks of future sea level rise threats and identify their capacity to continue to provide clean drinking water and fully operate stormwater systems under such threats.



Plum Island Wastewater Treatment Plant in Charleston, SC, one of the study areas, is shown above.

# Carolinas Climate Connection

Carolinas Integrated Sciences & Assessments

[Back to Page 1](#)

## 2015 Atlantic Hurricane Season

The outlook for the 2015 Atlantic hurricane season (June 1 through November 30), released by NOAA's Climate Prediction Center (CPC), is forecast to be below-normal with a 70% likelihood of 6 to 11 named storms, of which 3 to 6 could become hurricanes and projections for 0 to 2 major hurricanes (Category 3, 4 or 5). The percentage probability (70%) is based on the official National Hurricane Center 1981-2010 seasonal averages of 12 named storms, 6 hurricanes, and 3 major hurricanes.

The development of El Niño in the Pacific Ocean is the main factor in the forecast because of its effect on wind and pressure patterns. In a NOAA press release about the forecast, Gerry Bell, CPC's lead seasonal hurricane forecaster, indicated that the possible intensification of El Niño over the course of the season would have its greatest influence during the peak months of the season (August, September and October). Sea surface temperatures, which contribute to the intensity of tropical storms, are also forecast to remain near normal in the Atlantic.

### Hurricanes in the Carolinas

South Carolina fairs rather well when it comes to tropical storms and hurricanes which impact the state. As reflected in the chart to the right, developed by the SC State Climatology Office, 30 tropical storms and hurricanes have impacted (not necessarily making landfall) SC since 1854. Hurricanes Hazel and Hugo were the most powerful, both Category 4 storms. North Carolina, in contrast, has seen more hurricane activity over the last 175 years. The chart below, accessed on the State Climate Office of North Carolina website, shows 120 hurricanes affecting (either directly impacting or passing within 150 miles of the coastline) the state between 1851 and 2014. Of these, 4 were Category 4 storms and 19 were Category 3. Neither of the Carolinas has been impacted by a Category 5 hurricane since 1900.

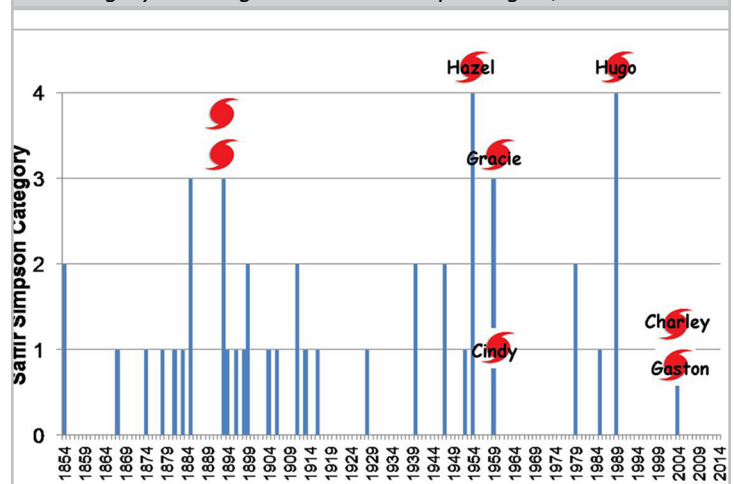
### Understanding and Preparing for Storm Surge

For the 2015 hurricane season, the National Hurricane Center (NHC) will test a prototype storm surge watch/warning system for the Gulf and Atlantic Coasts. Storm surge is one of the greatest threats posed by tropical storms and hurricanes. Although driven by a storm's wind, dangers posed by storm surge can differ from threats posed by winds. In order to raise awareness about these dangers and to provide information for those who should evacuate threatened areas, the NHC has developed separate warnings for wind and storm surge hazards. These watch and warning systems will provide emergency managers, the media, and the public better guidance on the hazards of tropical storms.

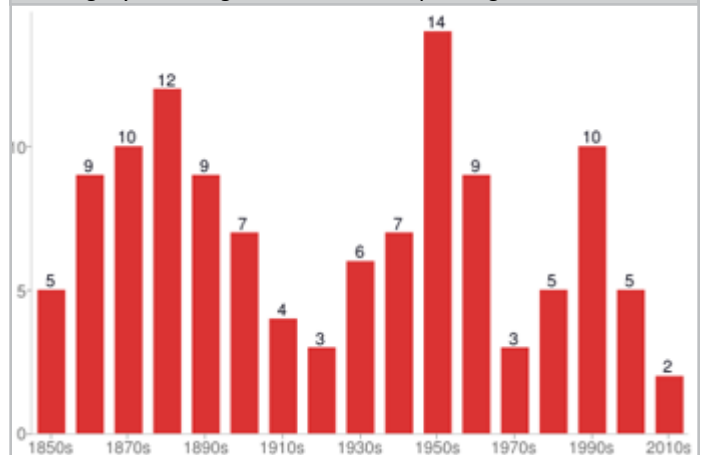
### Despite the Below-Normal Forecast, Be Prepared

In June 2015, Tropical Storm Bill was the only tropical cyclone to form in the Atlantic. Based on a 30-year climatology (1981-2010), a named storm forms in the basin in June about every other year, with a hurricane forming once every 7 to 8 years. So, although we are expecting a low-activity season and haven't seen much action so far, it's always best to follow the Boy Scout's motto. Find tips to be sure you are prepared at [ready.gov](#).

Category 1 through 4 hurricanes impacting SC, 1854 - 2014



Category 1 through 4 hurricanes impacting NC, 1851 - 2014



### U.S. Climate Resilience Toolkit: Coastal Flood Risk Resources

The Coastal Flood Risk section of the U.S. Climate Resilience Toolkit provides a wealth of information about different coastal climate hazards including storm surge. When the "storm surge" focus area is selected, "Taking Action" case studies which provide examples of communities working to address related impacts are populated in the right column of the screen. Links for tools to support planning for storm surge impacts are also highlighted.