



# CAROLINAS INTEGRATED SCIENCES & ASSESSMENTS

## About CISA

The Carolinas Integrated Sciences & Assessments (CISA) program is 1 of 11 NOAA-funded Regional Integrated Sciences & Assessments teams. CISA works at the intersection of climate with water, coasts, and health to create, tailor, and provide climate information to improve planning and management approaches that build healthier, safer communities in the Carolinas.

CISA supports a coastal climate extension specialist to assist coastal communities and stakeholders in addressing the impacts of climate variability and change.

## CISA Connects Coastal 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

## Coastal Climate Partners

- » College of Charleston
- » East Carolina University
- » N.C. Sea Grant
- » S.C. Sea Grant Consortium
- » National Institute of Standards & Technology
- » NOAA Southeast and Caribbean Regional Team (SECART)

# FOCUS AREA: COASTAL CLIMATE

## What is Coastal Climate?

Climate is the long-term average weather conditions that are characteristic of a region, such as the Carolinas coast. Climatology is the study of climate and includes historical climate characteristics, natural variations in climate, and long-term climate change. Coastal climate also includes the ways the ocean interacts with the land and the air. This means that coastal climate studies consider both atmospheric and marine data, including maritime winds, salinity, currents, wave characteristics, and tides.

## How Does Climate Affect the Carolinas Coast?

The Carolinas coast is vulnerable to hurricanes and strong coastal storms. On average, hurricanes strike the South Carolina coast every 8 to 9 years, and between 5 and 7 years for the North Carolina coast<sup>1</sup>. Heavy rains and droughts also affect the Carolinas coasts. The 2015 floods caused by a rare weather pattern brought record rainfalls to South Carolina and into southeastern North Carolina. Hurricanes Matthew and Florence also brought extreme rainfall to southeastern North Carolina. Major droughts have occurred in the Carolinas, including multi-year events from 1998 to 2002, 2007-2008, and 2011-2012. These droughts contributed to increased salinity and saltwater intrusion in coastal waterways.

Long-term climate and weather events in the Carolinas have several impacts on the coast. These include:

- » Flooding
- » Erosion
- » Degraded water quality
- » Habitat disturbance
- » Degraded air quality

Many important sectors of our economy rely on coastal resources and are affected by climate and weather events:

- » Water resources (e.g. availability of freshwater during drought)
- » Utilities and infrastructure (e.g. increased energy demands during warmer periods, flooded roads during heavy rainfall events)
- » Fisheries (e.g. changes in ocean temperature and salinity can affect fish migration and reproduction)
- » Recreation and tourism (e.g. warm temperatures on the Carolinas coast are a draw for beachgoers, while storms and hurricanes can keep tourists away)

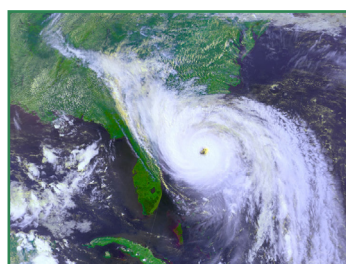


Source: NOAA

## Climate Change and the Carolinas Coast

**Sea level rise:** Observations since the 1920s and 1930s indicate that the sea level in Wilmington, N.C. rose at an average rate of about 0.68 feet per century; in Charleston, SC the rate was about one foot per century.<sup>2</sup> Globally, climate scientists expect sea level rise to range from 8 inches to 6 feet in the next 100 years; sea level rise in the Carolinas may be more or less depending on regional factors such as wind patterns and vertical land movement.<sup>3</sup>

**More frequent rainfall extremes:** Rainfall is difficult to predict over long periods of time. Climate models cannot say precisely how much average rainfall the Carolinas will get in the coming decades; however, more frequent extremes of both drought and heavy rainfall are expected.<sup>4</sup>



Hurricane Hugo, Source: NOAA

**Hurricane intensity:** Scientists are uncertain about the frequency and tracks of hurricanes in the future. However, storms that do form will likely be stronger in terms of wind speed and rainfall amounts because warmer seas will provide more fuel for storms.<sup>5</sup>

**Extreme heat:** While the location of coastal lands next to the ocean moderates some of the more extreme temperature highs experienced in inland NC and SC, the coastal Carolinas still are subject to intense summer heat. Scientists project average summer temperatures to increase significantly, leading to more frequent heat waves.<sup>4</sup>

# COASTAL CLIMATE PROJECTS

## COMMUNITY PLANNING & ADAPTATION

CISA's work in coastal communities integrates climate science and outreach expertise. We provide decision support to inform sea level rise and climate change adaptation as well as preparedness for coastal climate hazards such as hurricanes. The project descriptions below provide highlights of our work in the South Carolina Lowcountry.

### City of Folly Beach, SC

The City of Folly Beach is a small barrier island community that faces a variety of coastal hazards, including the threat of rising seas from the ocean and marsh sides of the island. With technical assistance from CISA and the S.C. Sea Grant Consortium, the city is now actively planning for long-term impacts from sea level rise and chronic erosion. In 2019, the city adopted a suite of land use and building ordinances designed to help residents prepare for long-term impacts. The city also adopted SC's first marsh management plan, a recommendation that came from the [2017 Sea Level Rise Adaptation Strategy](#) which CISA helped develop.



### Beaufort County, SC

Since 2015, Beaufort County has worked with CISA, along with the S.C. Sea Grant Consortium and the College of Charleston, to understand how sea level rise will affect the county. Recommendations from the 2015 Beaufort County Sea Level Rise Adaptation Strategy were incorporated into the county's comprehensive and hazard mitigation plans. A local government task force was established in 2019 to explore ordinance and policy recommendations and further identify how to incorporate and implement sea level rise adaptation into county planning and policy. Representatives from surrounding municipalities also serve on the task force to provide input and take ideas back for municipal-level policy and planning.

### City of Beaufort, SC

The City of Beaufort, SC is currently impacted by various types of flooding. These impacts are anticipated to increase due to sea level rise and climate change. CISA, along with the S.C. Sea Grant Consortium and the College of Charleston, assessed the City's vulnerability to sea level rise and extreme rain events through flood mapping to identify the most at-risk areas today and in the future. The project report also provides assessment of local business impacts due to flooding to better understand the human dimensions of their vulnerabilities. The team presented their findings in a [publicly available report](#) and during a presentation to City Council.



### Charleston, SC

#### *Building Community Resilience to Water-Related Hazards*

This project, funded through NOAA's Regional Coastal Resilience Grant program, will result in a high-resolution flood model that incorporates rainfall and climate change projections with tidal flooding and sea level rise. This method creates a more realistic image of flooding causes and impacts at the neighborhood level. CISA and the S.C. Sea Grant Consortium led neighborhood-level community education and engagement activities to help residents understand impacts and identify solutions.

#### *Understanding Small Business Disruption due to Coastal Climate Hazards*

In partnership with the National Institute of Standards and Technology (NIST), CISA is conducting a survey of impacted businesses in Charleston, SC to better understand the true cost of hurricanes and identify strategies to make local economies more resilient. Early findings reveal that Hurricane Irma was a catalyst for businesses to not only create hurricane plans, but also to floodproof their buildings. However, businesses are limited in their recovery efforts due to flood-prone locations and supply chain disruptions. Suggestions by business owners to improve their capacity to recover include additional resources for flood proofing their buildings, a business hotline for reliable information, rent assistance due to loss of revenue, and expedited small business loans after an event.



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## Other Ways to Connect

CISA publishes a quarterly newsletter, the Carolinas Climate Connection, and manages the Carolinas Climate Listserv in order to share up-to-date information about climate research, upcoming events, funding opportunities, or other relevant news.

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1 NOAA National Hurricane Center "Tropical Cyclone Climatology". [www.nhc.noaa.gov/climo/](http://www.nhc.noaa.gov/climo/). Accessed 21 April 2014.

2 <http://tidesandcurrents.noaa.gov/sltrends/sltrends.html>

3 Parris, A., P. Bromirski, V. Burkett, D. Cayan, M. Culver, J. Hall, R. Horton, K. Knuuti, R. Moss, J. Obeysekera, A. Sallenger, and J. Weiss. 2012. Global Sea Level Rise Scenarios for the US National Climate Assessment. NOAA Tech Memo OAR CPO-1. 37 pp.

4 Ingram, K., K. Dow, L. Carter, J. Anderson, eds. 2013. Climate of the Southeast United States: Variability, change, impacts, and vulnerability. Washington DC: Island Press.

5 Christensen, J.H., et al. 2013. Climate Phenomena and their Relevance for Future Regional Climate Change. In Climate Change 2013: The Physical Science Basis. Contribution of WGI to the Fifth Assessment Report of the IPCC. Cambridge University Press, Cambridge, UK and New York, NY, USA.