

# Carolinas Climate Connection

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

*Members of the CISA team send our deepest sympathies to those affected by Hurricane Florence. As we write this newsletter parts of the Carolinas are still in a state of emergency. As floodwaters slowly begin to recede, the path to recovery is only just beginning.*

*Many of the communities affected have been impacted by other extreme events in the last several years including Hurricanes Matthew, Irma, and the 2015 flooding. Communities have worked together toward recovery only to be impacted again and, in some places, more severely than before. As we rebuild once more, resilient and adaptive strategies must take into account ongoing changes in our climate and rising sea levels.*

*CISA is dedicated to being a resource for climate information and support for long-term planning and resilience in the face of these extreme events. We have rescheduled our biannual Carolinas Climate Resilience Conference to October 29-31 knowing many attendees are assisting communities through the event and the aftermath. Now, we look forward to hearing about lessons learned, recovery efforts, and coming together to discuss how best to move forward.*

*This newsletter contains recovery and adaptation resources developed by CISA and our partners. We hope the information is useful and look forward to serving the Carolinas in our fullest capacity as we all work towards a more resilient future.*

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**Rescheduled**  
**Registration for the**  
**2018 Carolinas Climate Resilience**  
**Conference is reopened**

More information available here.



## Upcoming Events

South Carolina Water Resources Conference  
October 17 - 18, 2018  
Columbia, SC

Carolinas Climate Resilience Conference  
October 29 - 31, 2018  
Columbia, SC

National Adaptation Forum  
April 23 - 25, 2019  
Madison, WI

## 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.



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## By the Numbers: Rainfall Totals for Florence and Comparison to October 2015

The **map to the right** shows the three day rainfall totals from September 15-17, 2018 that fell on the Carolinas. The base layer is from the **Parameter-elevation Relationships on Independent Slopes Model (PRISM)** dataset. Observed 3-day totals (from the **National Centers for Environmental Information (NCEI)**) are shown in red for individual weather stations. These are compared with 3-day totals that have a 1-in-500 and 1-in-1000 chance of occurring in any given year. These are often called 500-year or 1000-year events. Probabilities are derived from **NOAA's Atlas-14**. Elizabethtown, NC stands out as having received over twice the rainfall expected in a 1000-year event during Florence.

### In Comparison

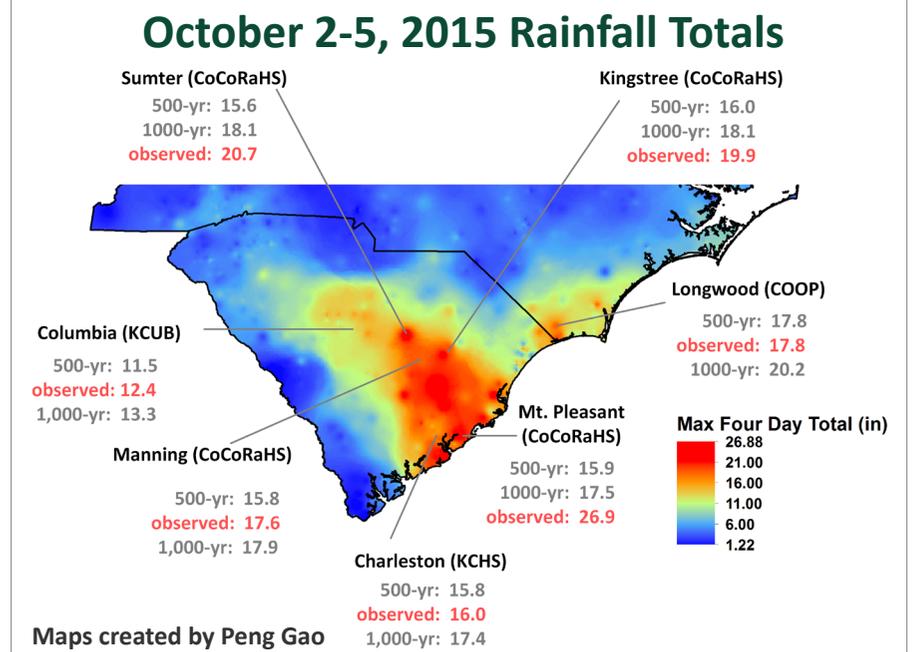
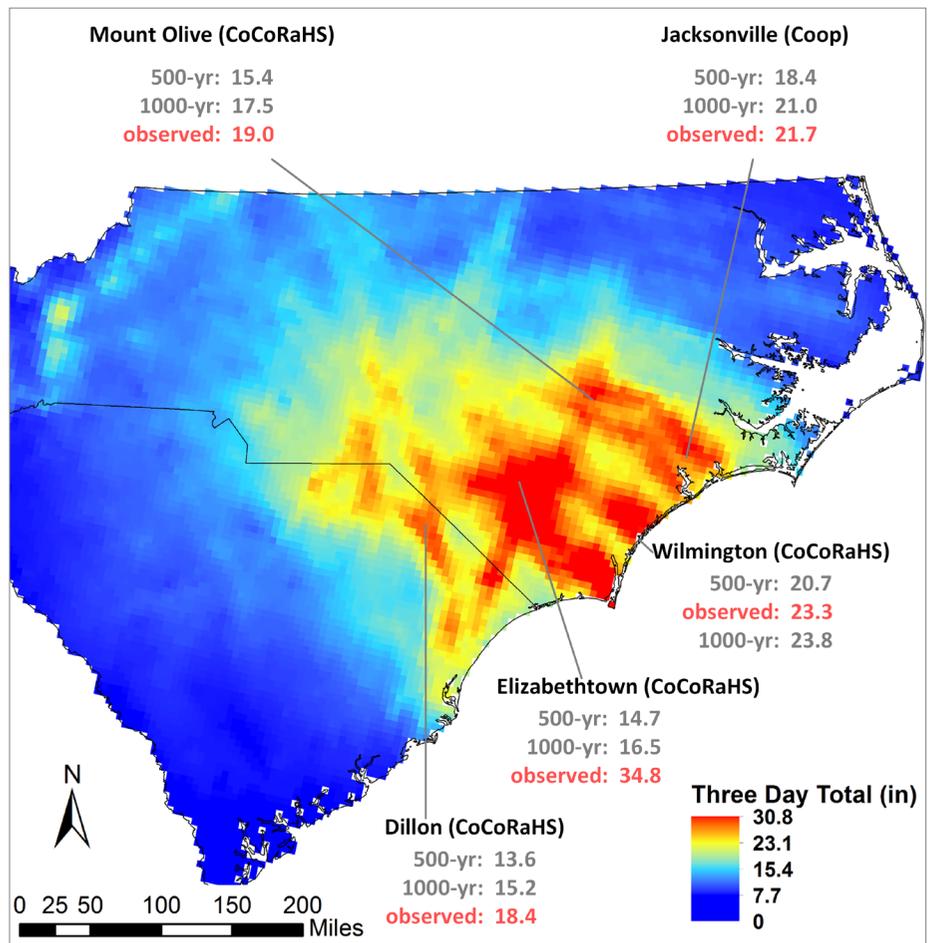
The **map below** shows the PRISM data and weather station rainfall totals that fell over a 4-day period during the October 2015 flooding event.

The areal extent is comparable between these two events. However, the weather systems that led to the rainfall totals were quite different. The slow movement of Florence from the coast and across the coastal plain of the Carolinas over several days led to heavy rainfall which exceeded the 1000-year storm estimates in many places. In contrast, the October 2015 event was triggered by a deep moisture layer fueled from the Atlantic and a stalled front that remained in place for several days.

### Moving Forward

These two events brought rainfall levels above, and in the case of Elizabethtown far above, totals we think of as having a 1 in 1000 chance of happening. As we begin to think about incorporating greater resilience into our recovery, the question of how much risk and protection are planned for in the design is a critical topic for consideration.

CISA researchers Greg Carbone and Peng Gao have investigated methods to estimate probabilities of occurrence, such as those available in Atlas-14. Learn more here: <https://onlinelibrary.wiley.com/doi/epdf/10.1111/gean.12148>.



## Assessing Mortality from Extreme Events

By: Rachel Woodul

Mortality from major hurricanes is rarely captured accurately in post-event assessments. The particular nature of hurricane fatalities makes it difficult to obtain a complete measure of associated fatalities until weeks or months after a storm. Emerging awareness of this issue is outlined in this [recent article in The New Yorker](#).

It is critical to long-term planning and design of hazard mitigation policies that fatalities from hurricanes and other extreme events be accurately measured, and that the causes of these fatalities, both immediate and proximate, be consistently and accurately reported. When initial fatality assessments are prepared post-disaster, it is also necessary to consider that it is likely a limited mortality assessment accounting primarily for fatalities that happened near the time of the event. As evidenced in Hurricane Maria, however, the period in which fatalities can be linked to the disaster can be months long. A nuanced and accurate assessment of all causes of death in the wake of a disaster is crucial to our ability to effectively reduce the health impacts of future storms.

This need is the basis of current CISA work with state and local partners. We are collaborating to develop methods to more accurately measure fatalities. This will inform the development of critical planning and preparedness procedures that save lives. Mitigation of future fatality is dependent upon accurate assessment of these historic events.

### Accurately Measuring the Public Health Impacts of Extremes

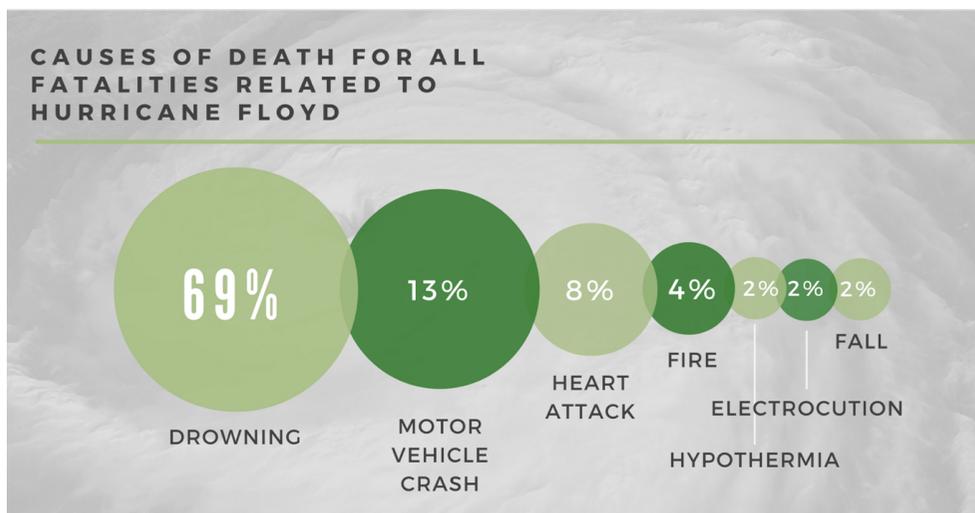
The difference between proximate and immediate causes of death is an important distinction when understanding hurricane mortality and each carry equal weight. Though both should be reported on death certificates, they typically are not reported; only immediate cause is coded consistently. For example, after Hurricane Maria, only 64 deaths in Puerto Rico were reported to have occurred in the immediate mortality assessment. These are the individuals who may have drowned in the storm surge or been struck by lightning. For these fatalities, the immediate cause of death was the hazardous weather. There is no proximate cause of death, as there was only one event precipitating the death - the hurricane. Fatalities such as these are easily reported as being a direct result of the storm.

However, as the new report from researchers at George Washington University has indicated, there were 2,975 fatalities that were the result of Hurricane Maria. These are fatalities for which the immediate cause of death may not be a weather hazard, but without the hurricane, the cascading chain of events that led to death would not have occurred. Loss of power may have prevented someone from getting necessary care, such as dialysis. For these fatalities, the hurricane is the proximate cause of death. Though not immediately a result of the hurricane, these deaths are still attributable to this event.

### A Similar Story in the Carolinas

In North Carolina, Hurricane Floyd provides a similar case study. There were initially 20 deaths attributed to the storm, as only 20 death certificates were coded with the ICD-9 E-code for a hurricane (X37), indicating that the death of the individual was a direct result of a hurricane. International Statistical Classification of Disease codes, or ICD codes, are a set of medical classification codes developed by the World Health Organization (WHO). The use of these codes set a standard for diagnoses that are universal worldwide. However, the mortality investigation from the North Carolina State Medical Examiner reported 52 fatalities caused by the storm. We analyzed the death certificates and found that the 32 fatalities not originally attributed to the storm were a result of hypothermia, falls, heart attacks, motor vehicle crashes, electrocution, and fire in the days following the storm (dark green circles in the figure to the right). The cascading chain of events that led to the fatality (whether that be the need to repair a roof, causing a fatal fall, or a circumstance in which an individual is without adequate shelter and develops hypothermia) would not have occurred without Hurricane Floyd. Therefore, the deaths are indirectly a result of the storm.

As part of a long-term strategy aimed at reducing fatalities related to hazardous events, CISA is currently working to develop appropriate and effective methodologies to improve our understanding of these impacts.



# DISASTER RESPONSE & RECOVERY

Disaster recovery is a multi-stage process that takes far longer than many realize. Below is an abbreviated version of the overall process, adapted from the National Disaster Recovery Framework\*, which was developed by federal agencies with roles in disaster recovery.

How each community implements recovery programs differs based on needs and organizational structures. Much of the initial energy focused on recovery from areas outside of disaster zones tends to come during the short-term and intermediate phases, but the hardest work is in the long-term recovery phase.

## SHORT-TERM

During the immediate response in the days following a disaster, residents and stakeholders are concerned with meeting basic life needs.



Providing mass care and sheltering



Providing emergency and temporary healthcare services



Clearing primary transportation routes

## INTERMEDIATE

Helping communities return to basic function in the weeks to months following a disaster



Providing accessible interim housing



Planning for immediate infrastructure repairs and restoration



Conversations about resilience and adaptation begin with stakeholders and residents

## LONG-TERM

Helping communities and residents fully rebuild and recover in the months to years following a disaster



Rebuilding and restoring permanent housing



Rebuilding infrastructure to meet future community needs



Implementing resilient and risk-reducing strategies at all levels



Implementing adaptive measures occurs primarily in this phase, but this is also when stakeholders and residents are struggling the most as they are ready for things to return to normal. Informative and effective communications and engagement are essential.

\* Learn more at:  
<https://www.fema.gov/national-disaster-recovery-framework>

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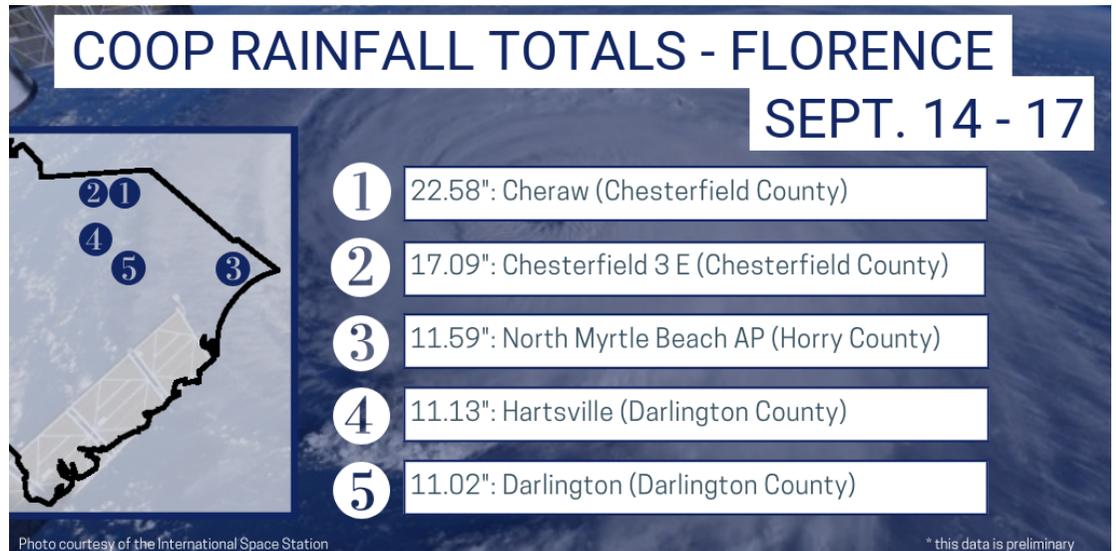
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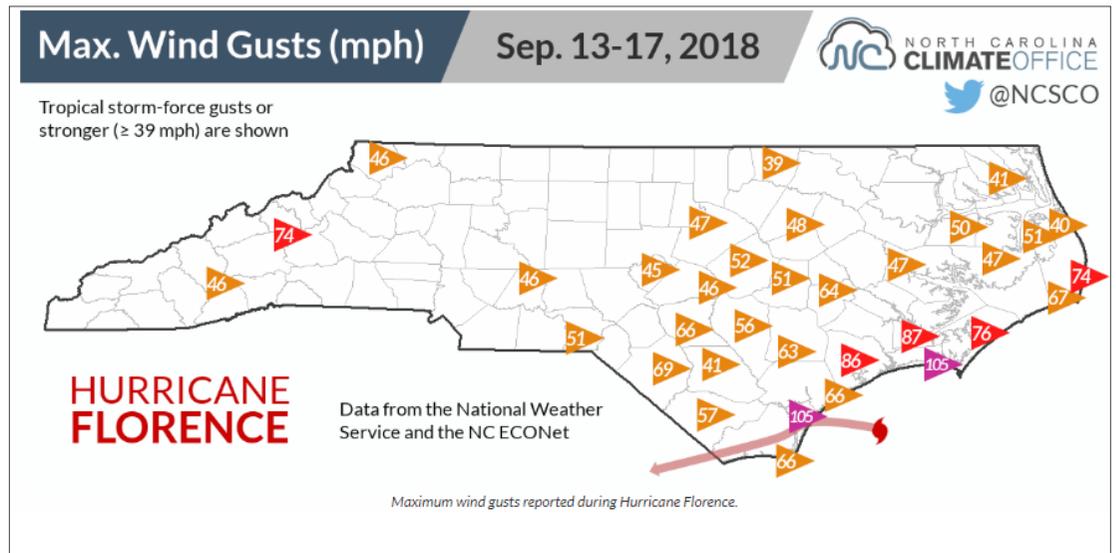
## NC and SC State Climate Office Florence Informational Resources

The South Carolina State Climatology Office is working to produce an online interactive journal to describe the climatology and impacts of Hurricane Florence. The SC SCO produced similar journals for both the October 2015 Historic Rain and Flooding Event and Hurricane Matthew, available at: [dnr.sc.gov/climate/sco/](http://dnr.sc.gov/climate/sco/)

The State Climate Office of North Carolina released a new blog post on September 18, "Rapid Reaction: Record Rainfall and Flooding Follow Florence." This article provides a concise synopsis of the storm history; wind, storm surge, and rainfall analysis; and places the event in the context of other extremes events that have impacted the state.



Preliminary Graphic for SC SCO Hurricane Florence Online Interactive Journal



## South Carolina Water Demand Forecasts: Stakeholder Feedback Request

The SC Dept. of Natural Resources, the SC Water Resources Center, and the US Army Corps of Engineers have partnered to develop methods for projecting water demand across the state. Once these methods have been developed and reviewed by stakeholders, they will be applied for each major category of off-stream water demand. Estimates of future water demand will inform water planning at local and regional levels and will be used to develop the 3rd edition of the SC State Water Plan.

Stakeholders are invited to provide feedback on the water demand projection methods as they are developed. Comments received within 30 days of posting draft reports will be compiled and responses will be provided when the final reports are published. A series of meetings will be hosted online to facilitate discussion, and in-person meetings may be arranged as needed. The resulting water demand projections will be subject to further review during stakeholder meetings in each major river basin of the state. The next meeting is scheduled for October 10th at 9:30 AM. The topic will be public and domestic supply. Public comment period is ongoing, and there will be additional Technical Advisory Committee meetings scheduled through November at least.

More information at [www.scwatermodels.com](http://www.scwatermodels.com). Send comments or feedback to [scwatermodels@clemson.edu](mailto:scwatermodels@clemson.edu).

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## Funding Response and Recovery

Funding can be one of the primary barriers to any stage of disaster response and recovery. We have compiled a list of available funding sources that may be applicable to those who were impacted by Florence. Brief descriptions, deadlines, and links for more information are included.

### **FEDERAL RESOURCES**

#### ***Disaster Assistance Improvement Program*** *(Informational resource)*

<https://www.disasterassistance.gov/>

This site connects to all federal resources, from grants to recovery guidebooks, and provides guidance on how to look for state and local resources. Example, FEMA's Planning guide is designed to assist communities in finding resources to recover from disasters: <https://www.fema.gov/national-disaster-recovery-framework/community-recovery-management-toolkit>.

#### ***U.S. Small Business Administration Disaster Loan Assistance***

<https://disasterloan.sba.gov/ela/>

Businesses of any size and private non-profits in declared disaster areas are eligible to apply for loans to be used for repair or replacement of real property, equipment, inventory, etc.

The application period closes:

- November 20, 2018 for physical disaster loans
- June 21, 2019 for economic injury disaster loans

#### ***Federal Emergency Management Agency 2018 Flood Mitigation Assistance***

<https://www.grants.gov/web/grants/view-opportunity.html?oppld=307867>

State, local, and tribal governments are eligible to apply for grants to increase resilience to repetitive flooding events.

- The application period closes January 31, 2019

#### ***USDA Natural Resources Conservation Service Emergency Watershed Protection Program***

<https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/ewp/>

#### ***Recovery Program***

Public and private landowners (sponsored by a local or tribal government) are eligible for the Recovery program. Further information about the program is available from the EWP Program Manager, Shawn Anderson, at (202) 720-5795 or [shawn.anderson@wdc.usda.gov](mailto:shawn.anderson@wdc.usda.gov).

#### ***Floodplain Easement Program***

State and local governments and private landowners are eligible for the Floodplain Easement program. Contact your local USDA NRCS Field Office to apply.

#### ***USDA Rural Development Emergency Community Water Assistance Grants***

<https://www.rd.usda.gov/programs-services/emergency-community-water-assistance-grants>

State, local, and tribal governments, and nonprofit organizations in rural areas, with median household incomes lower than the state median, are eligible for water transmission line or water source grants.

- Applications are accepted year-round through your local RD area office
- North Carolina contacts: [https://www.rd.usda.gov/files/NC\\_%20Sept2017Area%20Boundaries%20Map%20-%20Web\\_1.pdf](https://www.rd.usda.gov/files/NC_%20Sept2017Area%20Boundaries%20Map%20-%20Web_1.pdf)
- South Carolina contacts: [https://www.rd.usda.gov/files/Map%20of%20South%20Carolina%20Area%20Offices\\_0.pdf](https://www.rd.usda.gov/files/Map%20of%20South%20Carolina%20Area%20Offices_0.pdf)

### **NON-FEDERAL RESOURCES**

#### ***National Fish and Wildlife Foundation Resilient Communities Program***

<https://www.nfwf.org/resilientcommunities/Pages/home.aspx>

501(c) non-profits, local governments, and Indian tribes are eligible for grants to increase their resiliency to water quality and quantity declines, forest health concerns, and sea level rise.

- Applications are closed for 2018, but based on this year's schedule, proposals for the program in 2019 will be due in mid-February.

#### ***Foundation for the Carolinas***

<https://www.fft.org/HurricaneFlorence>

Non-profits providing relief to victims of Hurricane Florence in North and South Carolina will be eligible for grants. Grants will be distributed to areas of greatest need once the full impact of the hurricane is realized September 25, 2018.

- Visit <https://www.fft.org/grants> to apply.

#### ***Duke Energy Water Resource Fund***

<http://www.nccommunityfoundation.org/page/other-grant-opportunities/duke-energy-water-resource-fund-grants/applying-to-the-duke-energy-water-resources-fund>

Non-profits and local governmental organizations are eligible for funds for a variety of water quality and quantity and conservation projects in North and South Carolina

- Applications are due by noon on November 1, 2018

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## **Prudential**

<http://news.prudential.com/prudential-commits-1-million-in-grants-to-help-hurricane-florence-victims.htm>

National and local organizations providing direct response to Hurricane Florence victims are eligible for grants from The Prudential Foundation.

- For more information contact Caitrin O’Sullivan at (973) 367-6633 or [caitrin.osullivan@prudential.com](mailto:caitrin.osullivan@prudential.com).

## **Petsmart Charities**

<https://www.petsmartcharities.org/pro/grants/emergency-relief>

Organizations aiding pets and pet families in the areas affected by Hurricane Florence are eligible for grants. Apply online.

## **STATE RESOURCES**

### **North Carolina**

**North Carolina Voluntary Organizations Active in Disaster Regional Recovery Resources Contacts**  
(Informational resource)

<https://www.ncvoad.org/cms/RecoveryOrganizations>

### **Foundation of NC East**

<https://www.cfnceast.org/news/hurricane-florence-relief-fund>

Non-profits and government agencies are eligible for grants for Hurricane Florence relief. Contact the organization at (252) 756-8549 for more information.

### **NC Community Foundation Disaster Relief Fund**

<http://www.nccommunityfoundation.org/section/funds/disaster-relief>

Grants are designed to address community needs after emergency needs have been met. Application information will become available on their website in February and March 2019.

### **Cumberland Community Foundation, Inc.**

<https://www.cumberlandcf.org/hurricane-florence-fund/page.html>

Grants are available for non-profits located and providing services in Cumberland County, North Carolina. The Fall 2018 grant cycle is currently closed.

## **Outer Banks Community Foundation**

<https://www.obcf.org/disaster-relief-fund-donate/>

Non-profits in Dare County are eligible for grants for community enrichment projects. Apply online at <https://app.smarterselect.com/programs/47416-Outer-Banks-Community-Foundation>.

- Applications are due Friday, October 26.

## **North Carolina Arts Council**

“The North Carolina Arts Council wants to assist in your recovery from Hurricane Florence in any way they can. If your organization has closed due to storm damage or is dealing with flooding or other related issues, please update your primary staff contact or e-mail Brenna McCallum at [brenna.mccallum@ncdcr.gov](mailto:brenna.mccallum@ncdcr.gov). This information will help us understand how we can best assist your organization.”

## **South Carolina**

### **One SC Fund**

<https://www.yourfoundation.org/community-impact/one-sc-fund-sc-flood-relief>

Non-profits are eligible for grants for state-declared emergencies to provide relief, recovery and/or rebuilding assistance programs.

- Application materials are available from <https://www.yourfoundation.org/OneSCGrants>.

### **Waccamaw Community Foundation**

<https://www.waccamawcf.org/>

Non-profits in Georgetown and Horry County providing disaster relief and recovery work in Horry, Georgetown and/or Williamsburg counties are eligible for grant funds. Organizations must be members of their local VOAD (Voluntary Organizations Active in Disaster) or COAD (Community Organizations Active in Disaster).

- Applications are currently being accepted via <https://ccf.spectrumportal.net/Accounts/LogOn>.