



# NATIONAL WEATHER SERVICE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

## STORM COURIER

**Charleston, SC**  
Weather Forecast Office

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On May 19th, 2021, NWS Charleston expanded its aviation forecast responsibilities to include issuing TAF's for the [Charleston Executive Airport \(KJZI\)](#), located on [Johns Island, SC](#). The request for TAF service came from the United States Coast Guard (USCG) Air Station Savannah, which is the USCG's principal maritime air-rescue provider for South Carolina, Georgia, and northern Florida. In support of its mission, the USCG maintains alert crews and helicopters at a permanent Air Facility at KJZI. On average, USCG crews fly approximately 500 Search and Rescue (SAR) missions out of KJZI each year. The prior lack of TAF service at KJZI necessitated additional flight planning requirements during poor weather conditions, potentially increasing response times and degrading their effectiveness.

### Aviation Forecasts Expanded to the Charleston Executive Airport (KJZI)

By Blair Holloway - *Meteorologist*

One of the responsibilities of NWS offices is to issue specialized aviation forecasts for a variety of airports across the country called Terminal Aerodrome Forecasts (TAFs). NWS TAFs consist of the expected meteorological conditions significant to aviation at an airport, including the area within 5 statute miles of the center of an airport's runway complex. TAFs are used by a variety of aviation users, including domestic and international commercial airlines, general aviation, civilian, and military operators. TAFs are issued 4 times each day and contain a forecast of conditions at the airport for the next 24 hours at most sites.

Aerial photo of KJZI from <https://www.airnav.com/airport/KJZI>  
Courtesy of the Charleston County Aviation Authority



## Aviation Forecasts Expanded to the Charleston Executive Airport (KJZI) - *Continued*

Though TAF service at KJZI was initiated at the request of the USCG, the good news is that the [KJZI TAF](#) is publicly available for use by anyone. NWS Charleston also issues TAF's for the Charleston International Airport (KCHS) and the Savannah/Hilton Head International Airport (KSAV).

To access TAF's, observations, and other resources for KCHS, KSAV, and KJZI, visit the [NWS Charleston Aviation web page](#). If you have any questions or comments regarding the NWS Charleston Aviation program, please contact us via email at [nws.charlestonsc@noaa.gov](mailto:nws.charlestonsc@noaa.gov).



[Charleston County Aviation Authority](#)

## Another Very Busy Atlantic Hurricane Season Largely Spares the South Carolina Lowcountry and Georgia Coastal Empire

By Robert Bright - *Meteorologist*

[NOAA's pre-season forecast](#) of an above-normal Atlantic basin hurricane season for 2021 came to fruition as preliminary numbers indicate 21 named storms occurred (normal is 14). Of those 21 storms, seven became hurricanes (normal is seven), and four became major hurricanes (normal is three). This made it the sixth consecutive season with above-average activity and third most active season on record! While the season was quite busy through September, a relatively quiet October occurred. The seasonal forecast was largely based on the expected neutral to cool (La Nina) phases of the El Nino Southern Oscillation (ENSO) across the tropical Pacific Ocean. This pattern typically supports the development of increased tropical activity across the tropical North Atlantic Ocean, Caribbean Sea and Gulf of Mexico, including [coastal South Carolina/Georgia](#). Fortunately, the Lowcountry and Coastal Empire were able to evade the strongest storms, although the area still experienced some significant impacts.

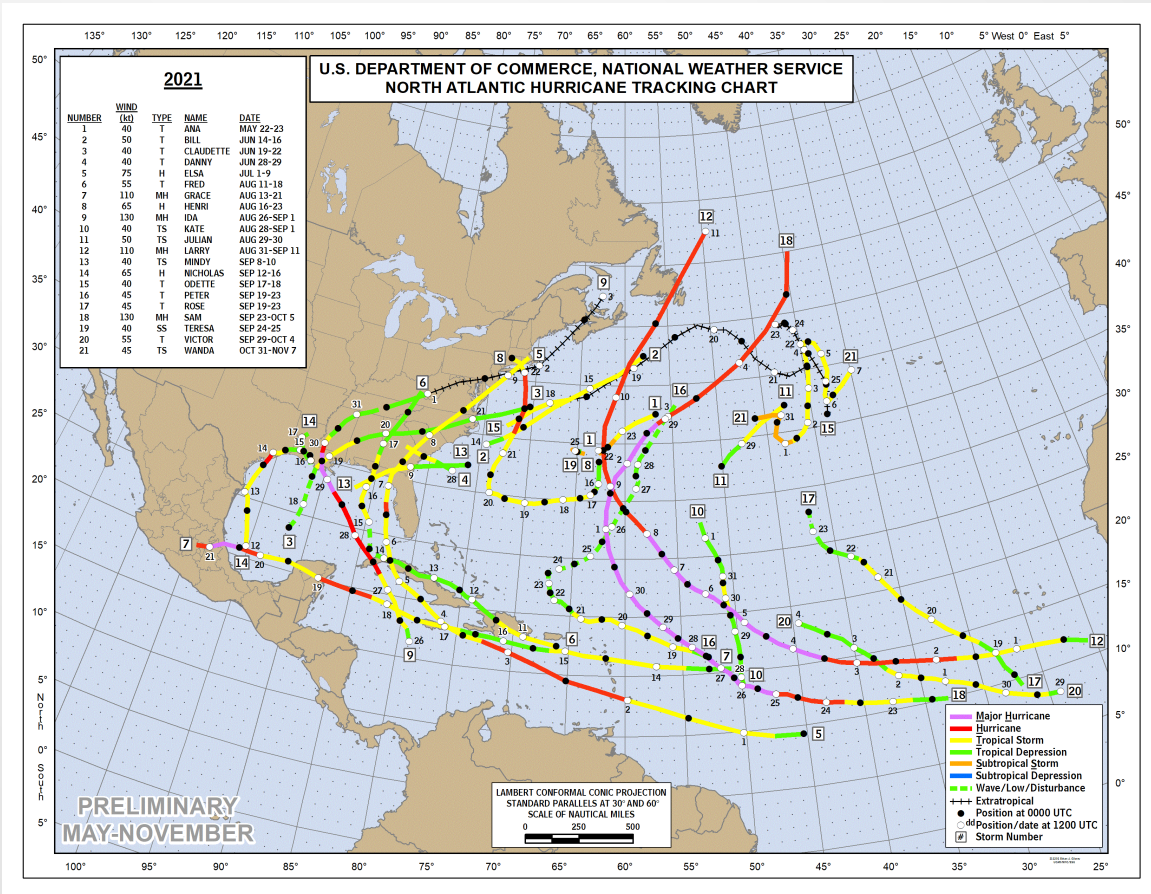
For the seventh consecutive year, the season started prior to the official beginning of June 1 with Tropical Storm Ana forming in late May. The first impacts across southeast SC/GA occurred in mid to late June when Tropical Storm/Depression Claudette passed by to the northwest bringing minor damage from tropical storm force gusts and heavy rain. Another tropical depression then formed later in June just off the SC coast, eventually becoming [Tropical Storm Danny](#) and quickly moving onshore along the southern SC coast. Fortunately, no significant impacts occurred, although some flooding occurred from the [heavy rain](#) (up to ~6 inches). Of course, the storm was another reminder that tropical systems can sometimes develop quickly and affect land without much notice.



# Another Very Busy Atlantic Hurricane Season Largely Spares the South Carolina Lowcountry and Georgia Coastal Empire - *Continued*

The area dealt with yet another storm in early July. [Tropical Storm Elsa](#) was the most impactful system of the season causing heavy rainfall (up to ~8 inches), hurricane force wind gusts and five EF-1 tornadoes across [our forecast area](#).

The area got brushed again in mid-August by Tropical Storm/Depression Fred but only minor impacts were felt. In early September, Major Hurricane Larry remained well offshore in the central Atlantic but reminded us that even fish storms can be impactful. It produced dangerous swells along the Southeast U.S. coast, which resulted in a deadly rip current in North Myrtle Beach, SC. Tropical Storm/Depression Mindy was the last tropical system of the year to affect the area as it moved northeastward through southeast GA in early September. It caused minimal impacts, although [5+ inches of rain](#) fell around Beaufort, SC.



For more information check out:

[NHC 2021 Atlantic Hurricane Season Summary](#)

[NOAA Article on the 2021 Atlantic Hurricane Season](#)

[Southeast SC/GA Tropical Cyclone History](#)

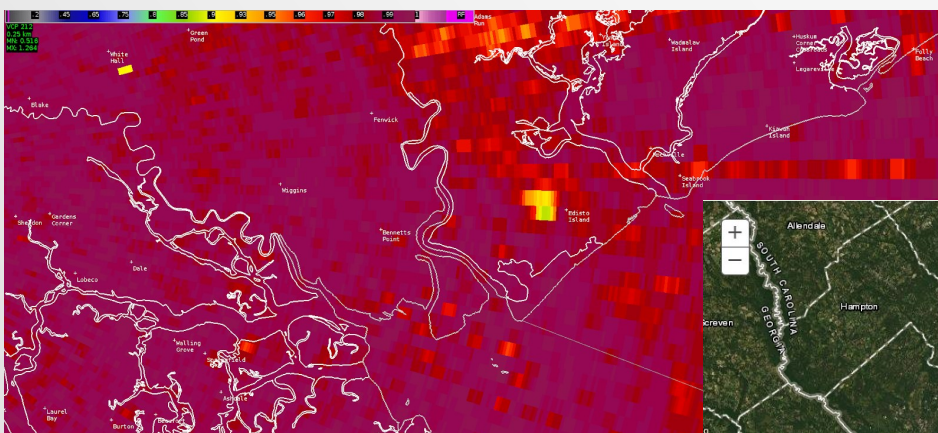
## Severe Weather 2021: A Review of a Relatively Benign Season

By Steve Rowley - *Science and Operations Officer*

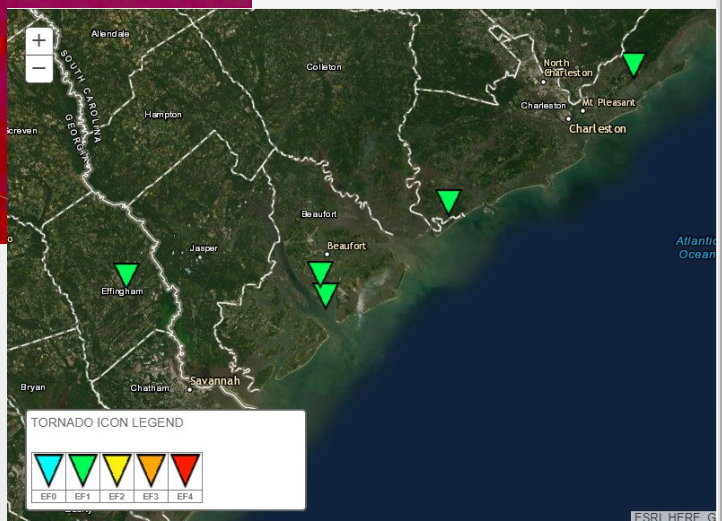
During 2021, the NWS Charleston, SC forecast area experienced an unusual dearth of severe weather – tornadoes, damaging wind gusts and large hail. We issued fewer combined (68) Severe Thunderstorm and Tornado Warnings as well as received less severe weather reports (127) than any year since 2006. Compare 2021 with 2008 when we issued 409 Severe Thunderstorm and Tornado Warnings, and with 2011, when we received 597 reports of severe weather. Also of note, for only the 3<sup>rd</sup> year since 2006, none of our severe weather events included at least 30 reports – an unofficial benchmark for a very busy event.

The reasons for our lack of severe weather are complex and difficult to pin down to any specific weather pattern without including a large dose of speculation. Further, regional differences are common: a lack of severe weather in one region of the U.S. is usually accompanied by active severe weather in another part. During 2021, the northeastern U.S. and parts of the Great Lakes experienced a busy severe weather season. For instance, the NWS office in Binghamton, NY issued 291 combined Severe Thunderstorm and Tornado warnings and received 499 severe weather reports – much busier than severe weather operations at NWS Charleston. As with all weather events, severe weather includes an undeniable element of “luck” during “slow” years – or lack thereof during busy years.

Given this background, here’s a brief description of the few NWS Charleston, SC severe weather highlights for 2021. The busiest event occurred during the overnight hours of July 7-8 when Tropical Storm Elsa produced five EF-1 tornadoes between 10:48 pm and 1:02 am EDT – our entire compliment of tornadoes for 2021.



*Below: Location of Tropical Storm Elsa EF-1 tornadoes, July 7-8 2021*



*Above: Tornado Debris Signature (TDS) near Edisto Beach, SC as depicted by the WSR-88D Dual Polarization Correlation Coefficient (CC).*

*In some cases, the Doppler Radar can detect debris lofted by tornadoes.*



## Severe Weather 2021: A Review of a Relatively Benign Season

### - *Continued*

Outside of Tropical Storm Elsa, our biggest severe weather event occurred on June 15 when a cold front produced severe thunderstorms with 16 reports of large hail and thunderstorm wind damage.

For the entire season, our largest hail reports were golf ball size hail in Berkeley County, SC (March 31 and May 11) as well as in Bryan County, GA (June 15). Our strongest measured thunderstorm wind gust was 81 mph near Hilton Head Island during Tropical Storm Elsa July 7.

In conclusion, there's no indication about how 2022 severe weather activity will compare with 2021. Keep in mind, severe weather can occur during any month of the year in this part of the country, so you should always check the latest forecasts and outlooks from your National Weather Service – and always be prepared to act if dangerous weather threatens your location. Also remember, your reports of severe weather can greatly assist our severe weather operations.

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## MIC Retires at NWS Charleston

By Julie Packett - *Administrative Support Assistant*

The Meteorologist-in-Charge (MIC) is the top position held at National Weather Service offices. The MIC is responsible for many functions, including scheduling, personal management and filling in as a forecaster from time to time. However, the most important job of a MIC is ensuring the office is running efficiently and Michael Emlaw executed that role quite well at NWS Charleston for 17 years.

[Irma Beach Erosion](#), Tybee Island, GA



Mike's NWS career began over 30 years ago in Oklahoma and he was promoted to serve as the first Warning Coordination Meteorologist at NWS Blacksburg, VA in October 1994. One of Mike's most notable memories at the Blacksburg office was during the [historic blizzard of January 1996](#). He helped dig the office 4 wheel drive vehicle out of the snow on several occasions to transport fellow staff members back and forth to work.

Mike's NWS journey brought him to South Carolina in 2004 when he accepted the lead role of MIC in Charleston. With winter storms less frequent, tropical events and associated damage surveys drove the extreme weather narrative, but Mike's fondest memories are simply serving alongside the NWS Charleston staff. In the wake of Mike's retirement, many have voiced their appreciation for him as he helped cultivate an environment where staff members enjoyed coming to work. In retirement, Mike is spending quality time with his wife and family and plans to travel, storm chase, and garden.

## NWA JOM Article

By Blair Holloway - *Meteorologist*

### Did you know???

Aside from daily forecasting, our meteorologists also do research projects. To read Blair's published article, visit: [Tide Forecast Tool](#)



The project to develop the tide forecast tool began in the Fall of 2018 with the help of two undergraduate students from the College of Charleston's Meteorology program. The students worked hard on collecting and analyzing data and thanks to their perseverance, the project was completed by Summer of 2019. The idea to create a journal article first came in November 2019 and would combine the tide forecast tool project with ongoing work to create a historical database of coastal flood events. The article underwent many alterations before initially being submitted to the National Weather Association's (NWA) Journal of Operational Meteorology in April 2021. Following an extensive peer review process, the final version of the article was accepted and published in December 2021.

## The National Blend of Models: A New Tool Contributing to the Weather Forecast Process

By Steve Rowley - *Science and Operations Officer*

When seeking a weather forecast, you may simply wish to know whether or not rain will fall this weekend – or, you may wonder if you need to prepare for hazardous weather. Whatever your need, that simple forecast is distilled from years of expertise, a mountain of guidance and a sequence of often difficult decisions. Meteorologists refer to this as the forecast process. This scientific process has benefitted from a constantly expanding and improving family of tools such as computer models.

Computer models produce mathematical simulations of the atmosphere which offer a view of possible future states of the atmosphere; these projections allow weather forecasting to exist. As a student and operational meteorologist, I have been using computer generated models of the atmosphere to assist with the creation of weather forecasts for over 35 years. During this time, professional modelers have created an expanding galaxy of models with increasing detail and improving accuracy. As the most recent iteration of this evolution, the United States has invested significant resources into the National Blend of Models.

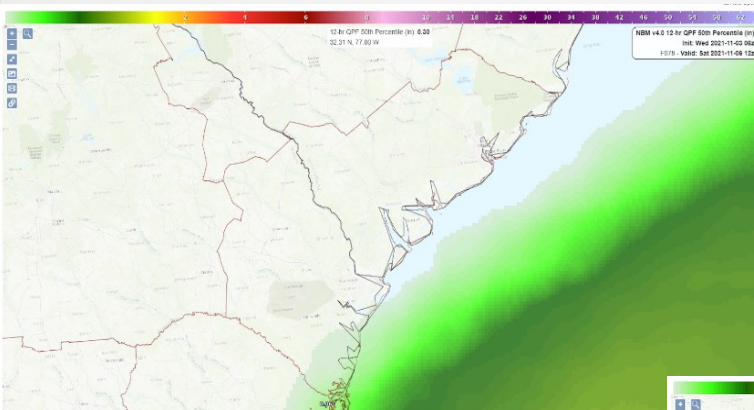
What is a model blend – and why would we blend models? Modelers determined that pooling the resources of many computer models – in the case of the National Blend, 100 individual models - can contribute critical information to the weather forecast process. A blend approach can apply the contributions from each model and can produce a more comprehensive picture of the weather which can, in turn, improve the forecast process. The rationale for this forecasting approach could fill many volumes, so let's concentrate on probabilities.

## The National Blend of Models: A New Tool Contributing to the Weather Forecast Process - *Continued*

For every weather forecast, there exists a spectrum of possible outcomes. You most commonly encounter terminology such as, "chance of rain 40 percent", and you would often prefer the answer to the question, "will it rain or not?" However, in reality the complex range of possible conditions between rain and no rain eludes simple yes or no answers. The effort to define, simplify and communicate to you the range of possible outcomes greatly challenges forecasters. The National Blend of Models can help forecasters more accurately visualize these possible scenarios.

Consider the following example from the National Blend of Models guidance for an early November 2021 rain event. Residents near the coast will recall this event for unusually high tides and salt water flooding, but forecasters also had to assess the potential for a coastal low pressure to spread significant rainfall into our area – or not.

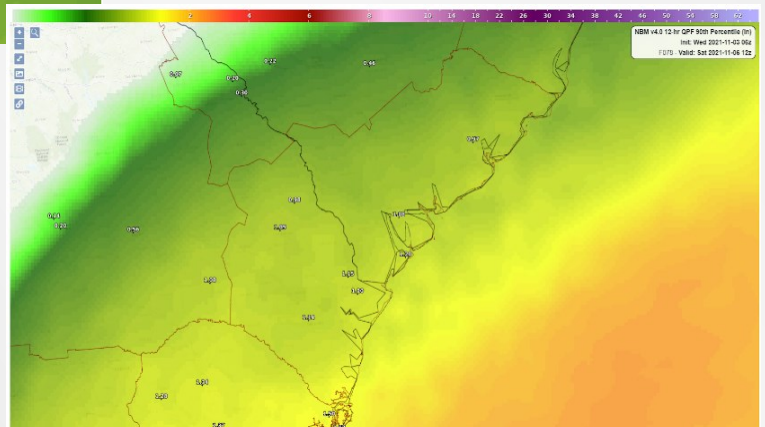
For efficient evaluation, a blended model – and, by extension, forecasters – can convert the complex spectrum of possible rainfall outcomes to 3 categories: The "best" case (no rain), the "worst" case (definite rain) and the "most likely" case (somewhere in between). These considerations don't necessarily simplify the forecast – or offer more



*The above image shows the National Blend of Models depicting the "best case" – no rain except perhaps across coastal Georgia.*

Ideally, this process will yield more meaningful and useful weather forecasts. These considerations don't necessarily simplify the forecast – or offer more forecast confidence – but before recent model innovations forecasters would expend much time/effort attempting to define the range of possible outcomes. The National Blend of Models can now provide this information so forecasters can direct resources to other critical forecast issues and decisions. Ideally, this process will yield more meaningful and useful weather forecasts.

forecast confidence – but before recent model innovations forecasters would expend much time/effort attempting to define the range of possible outcomes. The National Blend of Models can now provide this information so forecasters can direct resources to other critical forecast issues and decisions.



*The graphic above depicts the "worst" case – significant rainfall across our entire area.*



## Storm Surge: Why it Should Matter to You

By Bob Bright - *Meteorologist*

Although several storms have caused [storm surge](#) along the coasts of southern South Carolina and southeast Georgia, the last truly big storm surge event occurred in 1989 during [Hurricane Hugo](#). [Hugo](#) caused a 20 foot [storm surge](#) as measured above the Mean Sea Level (MSL) tidal datum ~20 miles north of Charleston at Bulls Bay. Storm surge refers to the additional ocean water pushed ashore by a storm and is the depth of water measured above the astronomical tide. Storm surge is historically responsible for the most deaths in tropical storms and hurricanes. Fortunately, bettering storm surge forecasts and communication have led to improved coastal evacuations and less deaths.

*Folly Beach, SC damage from Hurricane Hugo  
Photo credit: McKevlins Surf Shop*

Since storm surge can be measured (and forecast) relative to different levels (e.g., MSL), people must know their elevation relative to those levels in order to assess their risk. To help simplify this process during hurricanes (and some tropical storms), the NWS decided to provide forecasts of the [inundation](#) resulting from the storm surge. Over land this is simply the depth of ocean water above ground level (AGL) while in tidal areas ground level is approximated by the mean higher high water (MHHW) [tidal datum](#).



Unfortunately, forecasting the amount of storm surge inundation can be quite challenging given the many factors involved, including the storm's characteristics, the timing of the surge relative to the astronomical tide, and the coastal bathymetry. Given the high degree of uncertainty often associated with many of these parameters ahead of a storm, the NWS utilizes probabilistic storm surge inundation forecast information to brief core partners such as local/state government officials responsible for calling for evacuations. One product that is always based on a "reasonable worst case scenario" (i.e., the amount of inundation that should be prepared for) is the [Potential Storm Surge Flooding Map](#). Keep in mind though that this map is best utilized earlier in a storm event when uncertainty is greater in order to help guide preparations. Once the storm gets closer and confidence increases the storm surge inundation forecast will trend toward a "more likely" scenario.

If you want to learn about your area's vulnerability to storm surge inundation, check out [this tool from NOAA](#) which shows the amount of inundation possible based solely on different intensities of storms. You can also use [NOAA's Sea Level Rise Viewer](#) to see which areas become flooded at different water levels above [MHHW](#).

You can also learn more about coastal flooding at [GA Coastal Flood Literacy Project](#).



## Cooperative Observer Program (COOP)

By Dwight Koehn - *Observations Program Leader*

First and foremost, we want to pause and recognize our dedicated COOP observers in southeast Georgia/South Carolina. Those sites include Brooklet, Fort Stewart, Glennville, Sapelo Island, Rocky Ford, Jamestown, Moncks Corner, Summerville, Sullivans Island, Walterboro, and Yemassee.

The dedication of our observers allows our meteorologists to understand the many variations in weather we have across southeast South Carolina/Georgia. The office is able to use the information on a daily basis for a variety of products and services, including but not limited to, the Daily Precipitation and Temperature Summary found at: [HYD](#). The observations are critical to our daily forecast process to assess weather events like flooding and frost/freeze potential, verifying our radar precipitation estimates, and much more. Aside from our office, climate offices, the media, the public, and a myriad of other core partners and users of the National Weather Service continuously use the data on a regular basis.

We are currently looking for volunteer Cooperative Weather Observers in Georgia near Ludowici, Metter, Springfield and Tybee, and in South Carolina near Edisto, Jamestown, Hampton and Allendale. The ideal spot for COOP equipment is in an open space without influences from buildings or objects that could shelter the temperature sensor and rain gauge, as well as a spot inside a building to place the temperature readout. If you are interested or have more questions, please email [dwight.koehn@noaa.gov](mailto:dwight.koehn@noaa.gov).

### Sullivan's Island COOP Site



*This site runs off of solar energy that charges a battery and connects to the temperature readout. The temperature display is called a NIMBUS and can save up to a month worth of daily observations.*

## Community Collaborative Rain, Hail & Snow (CoCoRaHS)

By Julie Packett - *Administrative Support Assistant*

CoCoRaHS is a non-profit, community-based network of volunteers of all ages and backgrounds working together to measure and map precipitation. Volunteers take daily rain, snow and hail measurements in their backyard and report their observations online. As of 2021, CoCoRaHS is in all fifty states with over 20,000 active observers in the U.S., Canada, Puerto Rico, the U.S. Virgin Islands and the Bahamas. In the NWS Charleston forecast area, nearly 250 active CoCoRaHS observers contribute to the daily weather puzzle!



Each March, CoCoRaHS hosts a friendly recruiting contest between all 50 states to see who can recruit the most new volunteers.



For more information about CoCoRaHS and how to become a volunteer observer, Check out our [local CoCoRaHS webpage!](#)

## Annual NWS Week of Service: *10 Years of Coming Together to Give Back*

By Emily McGraw - *Meteorologist*

The National Weather Service (NWS) recently held its 11th Annual Week of Service. During this week, offices around the country make an effort to reach out to help those in need in the local communities. All of these events occur outside of normal working hours.



This year, NWS Charleston, SC collected donations for One80 Place. One80 Place is the largest provider of homelessness services in Charleston. Not only does the shelter offer meals and a place to sleep, they also provide comprehensive programs for guests to help stop the cycle of homelessness and promote self-sufficiency.

Check out the [2021 Week of Service](#) page to see what other NWS offices did as well as an event summary.



## Weather-Ready Nation Ambassadors

by Emily McGraw - *Meteorologist*

Weather-Ready Nation (WRN) Ambassadors are a vital part in improving the nation's readiness, responsiveness, and resilience against extreme weather, water, and climate events.



WRN Ambassadors are comprised of organizations, businesses, academia, and more who are committed to spreading the weather safety and preparedness message. Locally, NWS Charleston, SC has over 90 WRN Ambassadors! We'd like to thank all of our WRN Ambassadors for their efforts! Check them all out on our [local webpage](#).



### How to become a WRN Ambassador:

If you'd like your organization or business to join the initiative, [sign up here](#) or email [Emily McGraw](#) for more information.



## Thank you to our NWS Charleston Weather Ready Nation Ambassadors!

<b>ABC News 4</b>	<b>Coastal Heritage Society</b>	<b>MUSC Health</b>
<b>AECOM</b>	<b>Coastal Millwork and Supply, LLC</b>	<b>My Sister's House</b>
<b>Allendale County Emergency Management Agency</b>	<b>College of Charleston</b>	<b>Newport HOA (Port Wentworth, GA)</b>
<b>American Red Cross of Southeast &amp; Coastal Georgia</b>	<b>College of Charleston American Meteorological Society</b>	<b>Palmetto Bluff Conservancy</b>
<b>Anderson Insurance Associates</b>	<b>Colleton County Fire-Rescue</b>	<b>Palmetto Hall Property Owners Association</b>
<b>Atlantic Business Continuity Services</b>	<b>Crescent Insurance Advisors</b>	<b>PASOs and BJHCHS, Inc.</b>
<b>Awendaw McClellanville Fire Department</b>	<b>Dorchester County Emergency Management Department</b>	<b>Patriots Point Fire/Life Safety Division</b>
<b>Beaufort County Broadcast Services</b>	<b>Dunes West POA</b>	<b>Paul Davis of Greater Charleston</b>
<b>Beaufort County Economic Development Corporation</b>	<b>Effingham County ARES</b>	<b>Pinewood Preparatory School</b>
<b>Beaufort County Sheriff's Office Emergency Management</b>	<b>Effingham County Emergency Management Agency</b>	<b>Port Wentworth Emergency Management</b>
<b>Ben Pogue Law</b>	<b>Emlaw Academy</b>	<b>Queen's Grant Property Owner's Association</b>
<b>Boeing South Carolina</b>	<b>Etiwan Pointe Condominium Council of Owners, Inc.</b>	<b>Roper St. Francis Healthcare</b>
<b>Bulloch VOAD</b>	<b>Filos Tile Installers</b>	<b>Savannah Airport Commission</b>
<b>Burke High School</b>	<b>Fort Pulaski National Monument</b>	<b>Savannah Skin &amp; Pathology, LLC</b>
<b>C.T. Lowndes &amp; Company</b>	<b>Georgia Southern University</b>	<b>SC Ports Authority</b>
<b>Caesarstone Technologies</b>	<b>Great Atlantic Corporation</b>	<b>SEGAR (Southeast Georgia Radio)</b>
<b>Candler County Sheriff's Office Emergency Management</b>	<b>Grice Connect</b>	<b>Simpson Construction</b>
<b>Carolina SportsCare and Physical Therapy</b>	<b>Hampton County Emergency Management</b>	<b>Slack Tide Studio</b>
<b>Charleston Amateur Radio Society (CARS)</b>	<b>Home Owners Association of Long Creek Plantation</b>	<b>South Carolina State Climatology Office</b>
<b>Charleston County Consolidated 9-1-1 Center</b>	<b>Hunt Club Community Weather Station</b>	<b>Summerville Elks Lodge #2719</b>
<b>Charleston County Emergency Management Department</b>	<b>Jasper County Emergency Services</b>	<b>The Citadel</b>
<b>Charleston County School District</b>	<b>Joint Base Charleston 628 CES/CEX</b>	<b>The Sign Chef</b>
<b>Charleston County Park and Recreation Commission</b>	<b>Kiawah Island Community Association</b>	<b>Town of James Island</b>
<b>Charleston Junior Woman's Club</b>	<b>Kids Teaching Flood Resilience/USC Center for Science Education</b>	<b>Town of Mount Pleasant</b>
<b>Charleston RiverDogs</b>	<b>Laing Middle School of Science and Technology</b>	<b>Town of Sullivans Island</b>
<b>Charleston Water Taxi</b>	<b>LEADistics, LLC</b>	<b>Trident Technical College</b>
<b>Charleston Weather / @chswx</b>	<b>Liberty County EMA</b>	<b>Triple-T Truck Centers</b>
<b>Chatham Emergency Management Agency</b>	<b>Long County Emergency Management</b>	<b>United States Army Corps of Engineers - Savannah District</b>
<b>Chucktown Wind Report</b>	<b>Lowcountry CERT</b>	<b>USCB</b>
<b>Coastal Health District (GA Dept of Public Health)</b>	<b>Lowcountry Healthcare Coalition</b>	<b>WCB News 2</b>
	<b>Maritime Bureau, Inc.</b>	<b>West Point Subdivision Social Committee</b>
	<b>Metter Fire-Rescue</b>	<b>WJCL-TV</b>
		<b>WSAV News 3</b>
		<b>WTOC-TV</b>

**National Weather Service**

**Charleston Weather Forecast Office**

**5777 South Aviation Avenue**

**North Charleston, SC 29406**

[www.weather.gov/chs](http://www.weather.gov/chs)



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