



Carolina SkyWatcher



National Weather Service, Newport/Morehead City, NC

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Summer 2020 Edition

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A Look At The 2020 Hurricane Season

By Chris Collins, Meteorologist



June 1 through November 30 marks the 2020 Hurricane Season for the Atlantic Basin. However, for the sixth consecutive year, the Atlantic Basin recorded [a named storm](#) prior to the official start to the hurricane season. The 2019 hurricane season was the fourth consecutive above-average season and is tied with 1969 as the fourth-most active Atlantic hurricane season on record. In eastern North Carolina, Hurricane Dorian moved just south of the Crystal Coast on September 6, clipping Cape Lookout and eventually making landfall at Cape Hatteras. Dorian produced several tornadoes on September 5, including an EF-2 at Emerald Isle. Peak wind gusts recorded during Dorian included 110 mph at the Cedar Island Ferry Terminal, 89 mph at Fort Macon and 85 mph at Beaufort. Severe storm surge flooding occurred at Ocracoke, where several people were trapped in the attic by flooding from the 4 to 7 foot storm surge. More than 190,000 North Carolina homes lost power during the storm.

Hurricanes can cause catastrophic damage not only to coastlines, but several hundred miles inland. Learn what you can do if a hurricane is headed your way and how to take action before, during and after the storm.

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2020 ATLANTIC BASIN NAMES

Arthur	Hanna	Omar
Bertha	Isaias	Paulette
Cristobal	Josephine	Rene
Dolly	Kyle	Sally
Edouard	Laura	Teddy
Fay	Marco	Vicky
Gonzalo	Nana	Wilfred

List of 2020 Hurricane Names

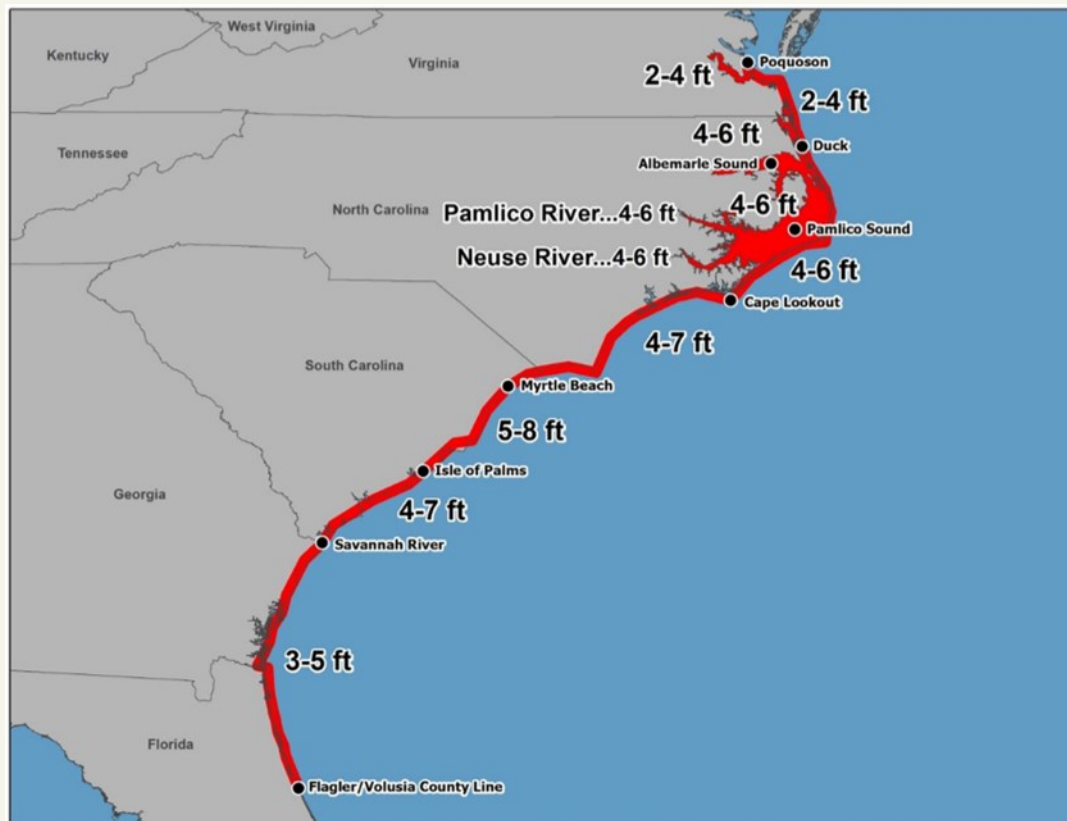
NHC Adds New Products for 2020 as Forecasting Improves

By Ryan Ellis, Science and Operations Officer

Year after year, the National Hurricane Center (NHC) continues to raise the bar on hurricane forecasting, continually adding new products and services while continuing to improve the quality of hurricane forecasts available to the public. The year 2020 will be no exception, as NHC adds a graphical depiction of storm surge inundation values, 60-hour forecast information, and new local time zones for systems in the eastern Atlantic Ocean. Let's take a look at these in more detail.

Graphical Depiction of Storm Surge Inundation Values

NHC will begin providing an experimental graphic in 2020 that will depict the expected storm surge inundation values for the United States Gulf and Atlantic coasts, Puerto Rico, and the U.S. Virgin Islands that are provided in the tropical cyclone public advisory. These values represent the peak height the water could reach above normally dry ground somewhere within the specified areas. This graphic will be made available on the NHC webpage.

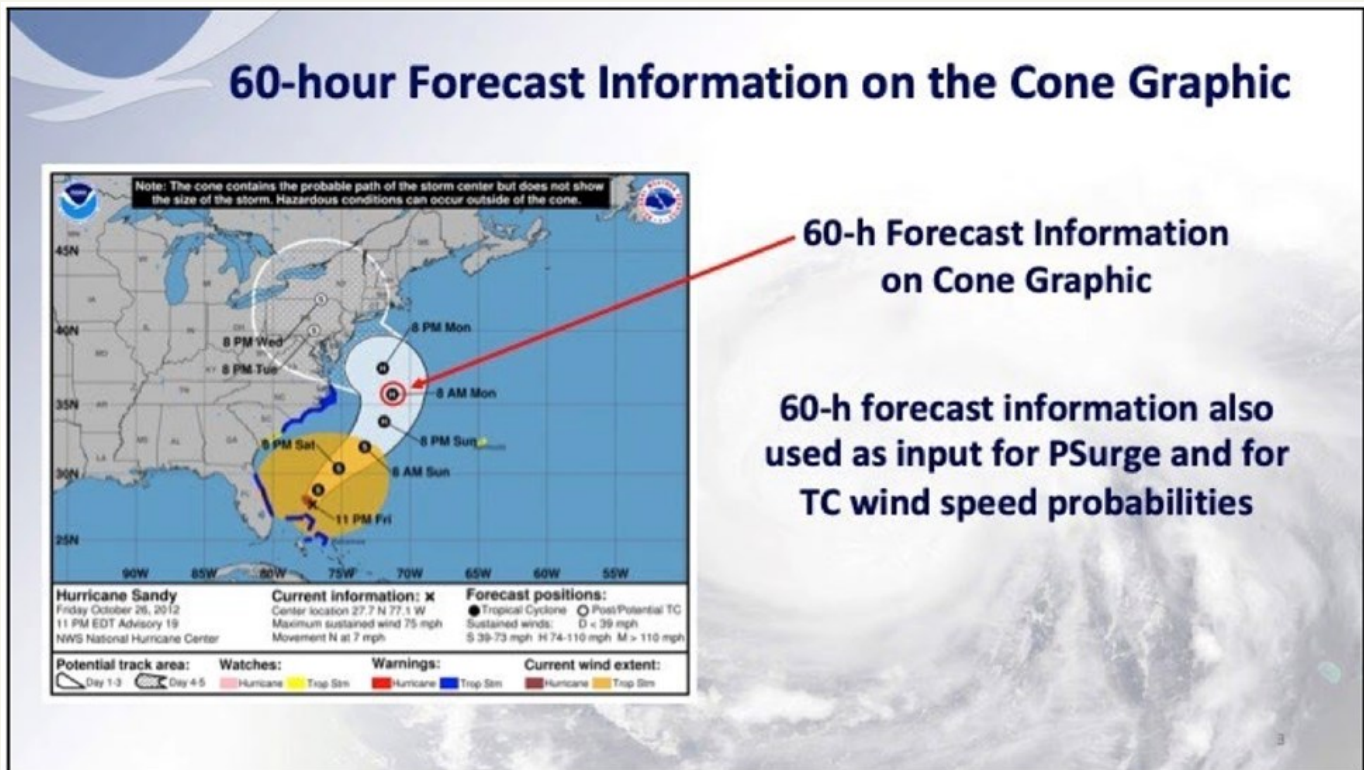


New National Hurricane Center Storm Surge Inundation Graphic

NHC Adds New Products for 2020 (Continued)

60-hour Forecast Information

NHC will begin providing 60-hour track, intensity, and 34-knot and 50-knot wind radii forecasts. These forecasts will be included in the tropical cyclone forecast/advisory, tropical cyclone discussion, and referenced within the tropical cyclone public advisory. The 60-hour forecast information will also be included on the NHC cone graphic and will be used in the computation of the NHC wind speed probabilities, time of arrival graphic and probabilistic storm surge products.



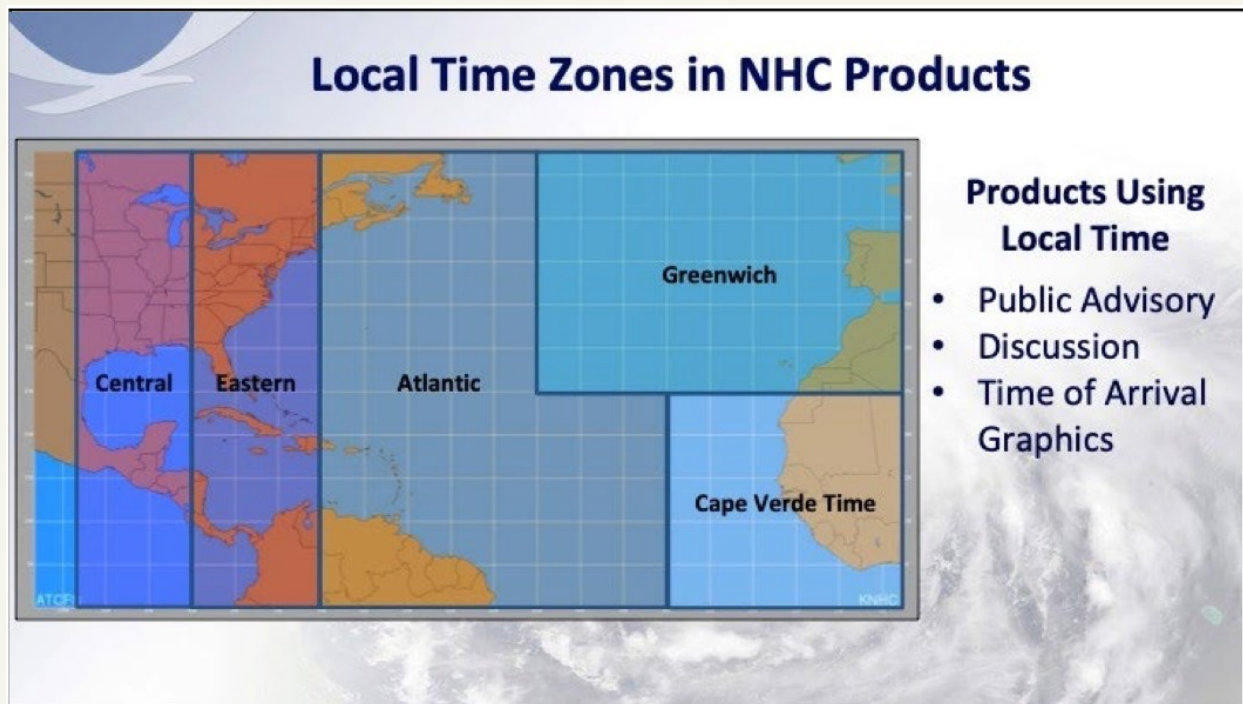
New National Hurricane Center 60-hour Forecast Information on Cone Graphic

NHC Adds New Products for 2020 (Continued)

New Local Time Zones for Systems in the Eastern Atlantic

The NHC public advisories, tropical cyclone discussions, tropical cyclone updates, and some graphical products have used local time within the product header based on the time zone where the center of the tropical cyclone is currently located. For example, advisories for tropical cyclones centered in the central and western Gulf of Mexico have used Central Time, and those near the east coast of the United States or in the eastern Gulf have used Eastern Time. All other Atlantic basin tropical cyclone advisories have referenced Atlantic Standard Time. This however, can be problematic for systems affecting the Cabo Verde Islands or other locations in the northeastern Atlantic basin where locations are 3 to 4 hours ahead of Eastern Time. Beginning in 2020, systems located south of 25°N and east of 30°W will use Cape Verde Standard Time (GMT-1) and systems north of 25°N and east of 45°W will use Greenwich Mean Time (equivalent to Azores Summer Time). These times will be used for the public advisory, discussion, updates, and all graphical products that use local time.

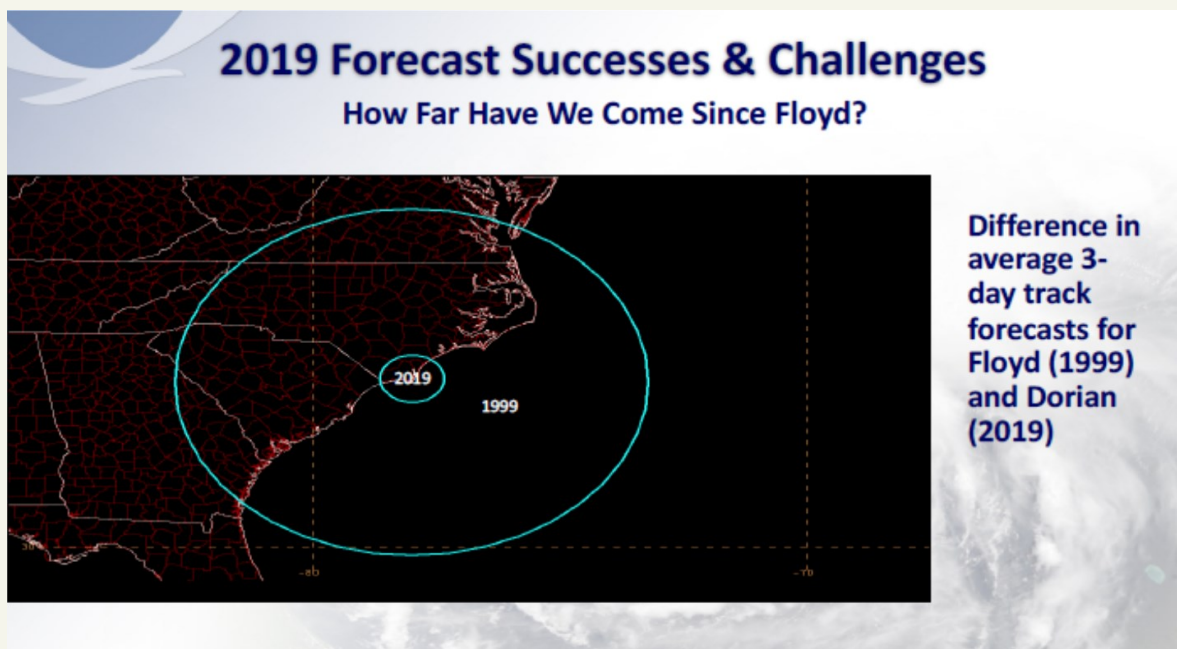
The actual issuance times of these products remain the same with full advisory packages issued at 0300, 0900, 1500, and 2100 UTC (5 am, 11 am, 5 pm, and 11 pm EDT). Intermediate public advisories are issued at 0000, 0600, 1200, and 1800 UTC (2 am, 8 am, 2 pm, and 8 pm EDT) whenever coastal tropical cyclone watches or warnings are in effect.



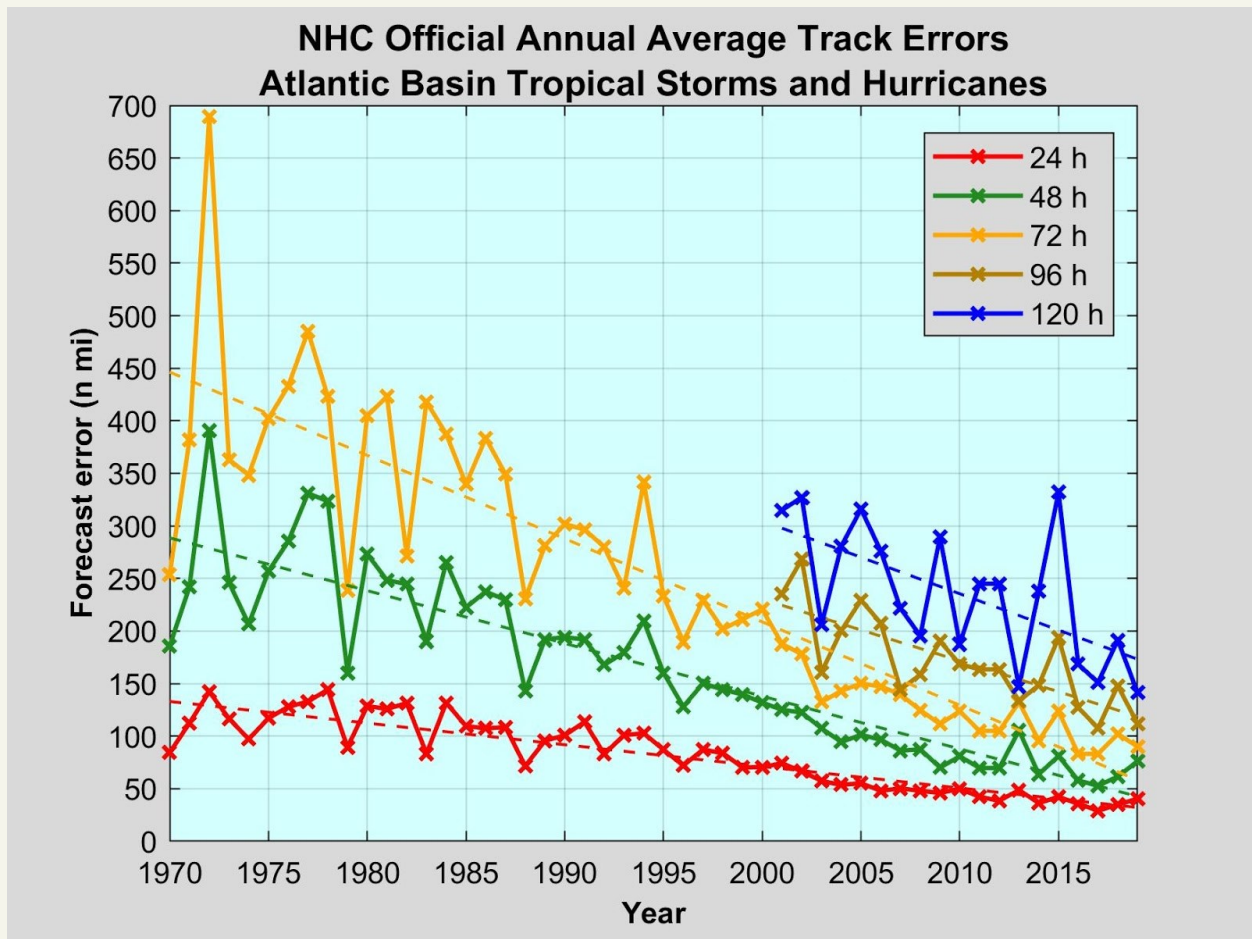
NHC Adds New Products for 2020 (Continued)

While looking ahead to new products and the future of hurricane forecasting, it is also important to look back at how far we have come over the decades and the improvements in accuracy are astounding when you look back to where we were just 20 years ago. If you have been in eastern North Carolina for a while, of course we all remember that in 1999 Hurricane Floyd made landfall and put a lot of places under water. Since then, tropical cyclone track forecasting has improved leaps and bounds. Looking at the figure below, the difference between the 3 day forecast from 1999 and 2019 is astounding. In 1999, the forecasted landfall 3 days out took up a span of the coastline that ranged from the tip of the Delmarva Peninsula to almost the Florida/Georgia state line. If the same forecast were done using the 2019 forecast cone, the range would be from Topsail Island to the North Carolina/South Carolina border. A dramatic improvement to say the least.

So why such a big improvement in just 20 years? Well to find the answers to that we have to go back a bit further in time. The average forecast track error in nautical miles has steadily dropped since the 1970. This was around the time the first steady global observations from satellites arrived on the scene. The TIROS-1 satellite was actually first launched in 1960 but it wasn't until the Nimbus satellite program came around in 1964 that tropical cyclone forecasting really started to make a leap forward. Suddenly, forecasters could now see tropical cyclones developing over the oceans consistently. As satellite improved, over the years, so did the track accuracy.

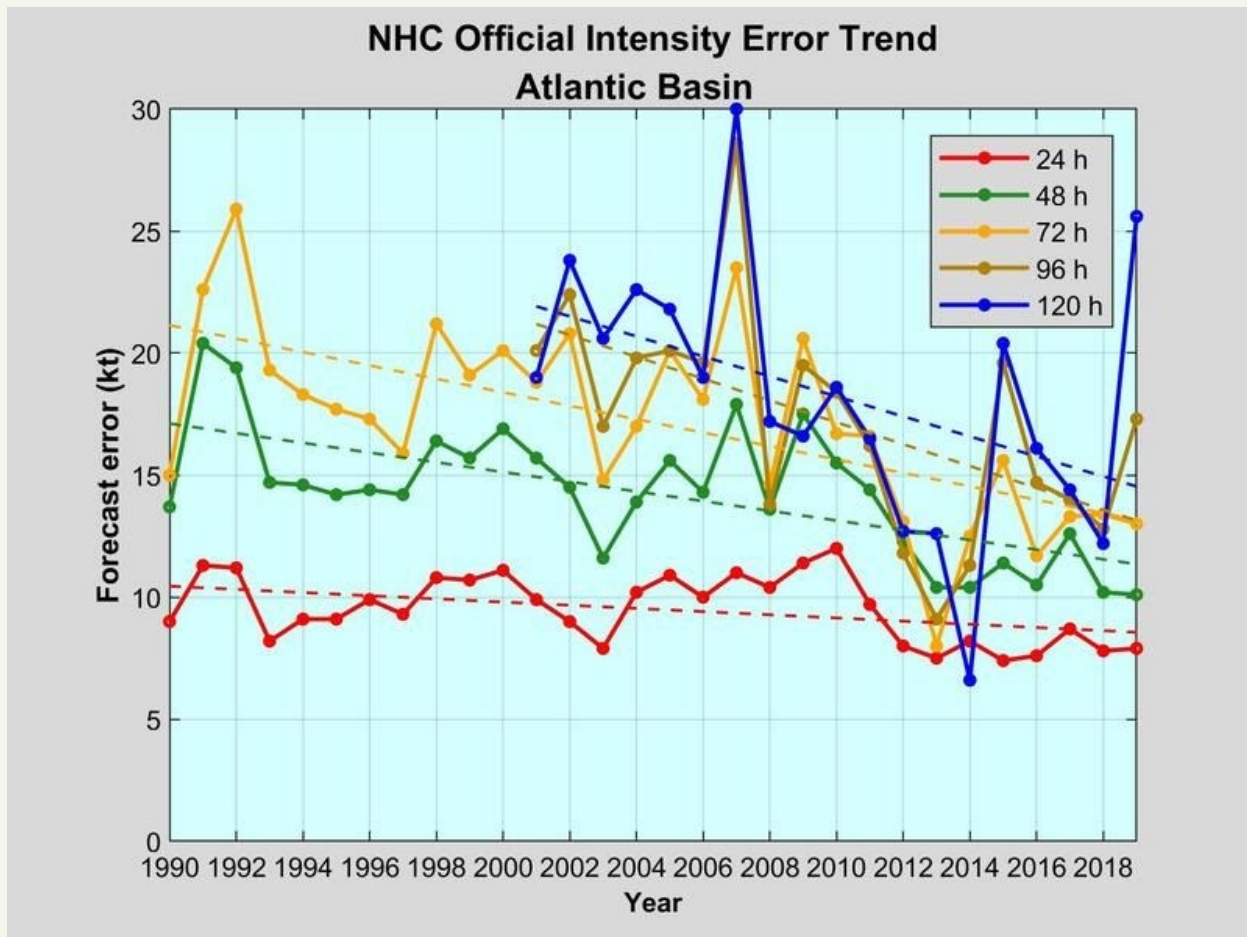


NHC Adds New Products for 2020 (Continued)



The second big piece of the puzzle comes from drastic improvements to technology and weather forecast models. Talking about the latest model run is something that forecasters and weather gurus do every day but we shouldn't take it for granted. While the math behind what we now know as numerical weather prediction was being explored for quite some time, it took technology a very long time to catch up to the supply the computing power needed to run a global forecast model. The National Meteorological Center's Global Spectral Model was first introduced in August of 1980 and the European Centre for Medium-Range Weather Forecasts or what we today know as "The Euro" didn't come online until 1985. Meanwhile, the U.S. ran the Nested Grid Model (NGM) from 1987 until 2000 and the Environmental Modeling Center ran the Aviation (AVN) model starting in 2000 which eventually became what is known as the Global Forecast System, or today's GFS in 2002. That's not that long ago. Remember, Floyd was in 1999 and forecasters didn't even have the benefit of even having the GFS model around at that time.

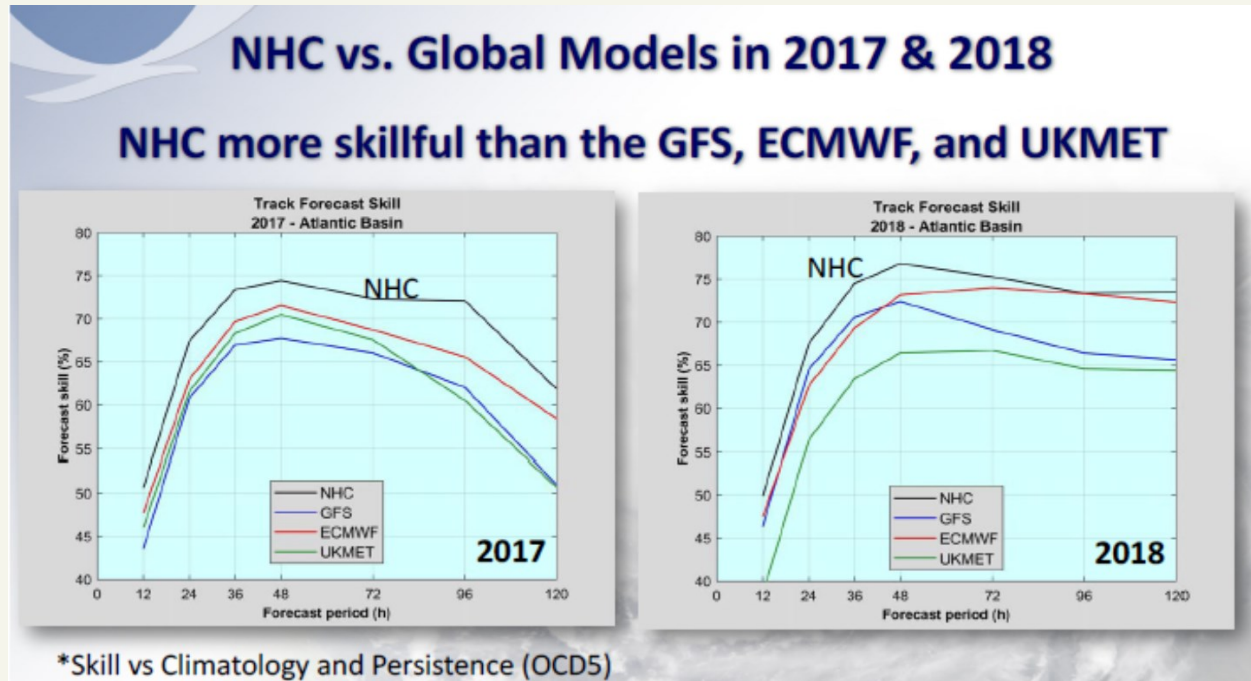
NHC Adds New Products for 2020 (Continued)



Over time forecast models have gotten better and better for various reasons. Forecast resolution, or the distance between grid points has vastly improved. Models now go out further in time than they did before. Model physics and techniques have also greatly improved as scientists figure out more about the processes that go on in a tropical cyclone. Satellite and forecast models now work together better than ever, with the satellites supplying the forecast models with much better data to start with, allowing the end products to be that much better. Through all of this, Hurricane Hunters with both the U.S. Air Force and NOAA continue flight missions to bring back even more great data for both research and operational purposes.

There are things that remain a challenge to forecasting. Intensity remains more difficult to forecast than track. Things like rapid intensification and genesis near the coast, and interactions with warmer waters such as the Gulf Stream can happen quickly and be very hard to forecast. Despite this, intensity forecasts are improving, just at a slower rate than track forecasts.

NHC Adds New Products for 2020 (Continued)



You might ask the question, if we have all this technology, what does the human forecaster bring to the table? The short answer is, A LOT! While folks often get tangled up in the latest model run going this way or that, the National Hurricane Center forecasters bring a tremendous amount of experience to the table and the data backs that up. No matter what model is your favorite, the NHC has shown time and time again the skill to beat those models, especially in the longer time periods, when a lot of folks are making key decisions on whether to evacuate and to board up their houses and businesses.

Forecast models are certainly not without flaws and forecasters study their biases and shortcomings in order to make a better forecast in the end. Also remember, leading up to, during, and after landfall, it's your local National Weather Service office that will keep you informed and provide the local expertise needed to make sure that everyone across eastern North Carolina remains safe when hurricanes and tropical storms come to the neighborhood.

Tropical Storm Arthur Leads Off A Week Of Heavy Rain

By Chris Collins, Meteorologist

[Tropical Storm Arthur](#) formed during the evening hours of May 16, 2020 in the Bahamas and moved steadily up the Southeast Coast and passing off the North Carolina coast May 18. With the formation of Arthur, the 2020 Atlantic hurricane season became the sixth consecutive season with a tropical cyclone before the official June 1 start date. While the primary wind field with Tropical Storm Arthur remained offshore, the storm did produce locally heavy rainfall amounts across eastern North Carolina.

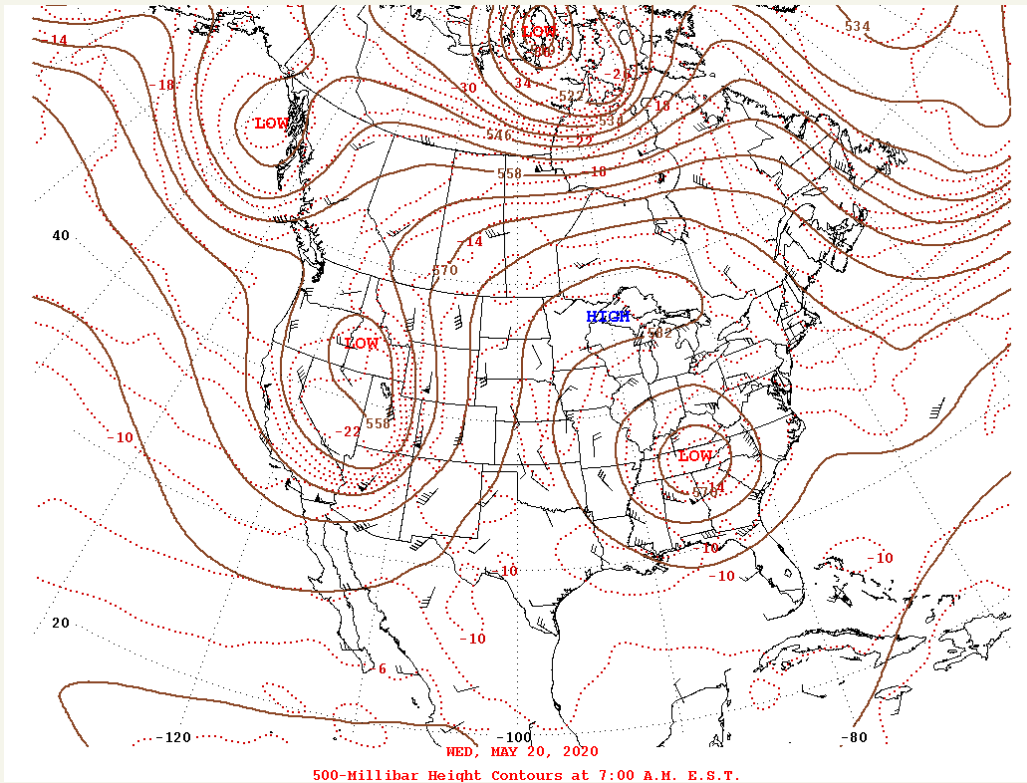


Rainfall reports from Tropical Storm Arthur, on the morning of May 18, 2020.

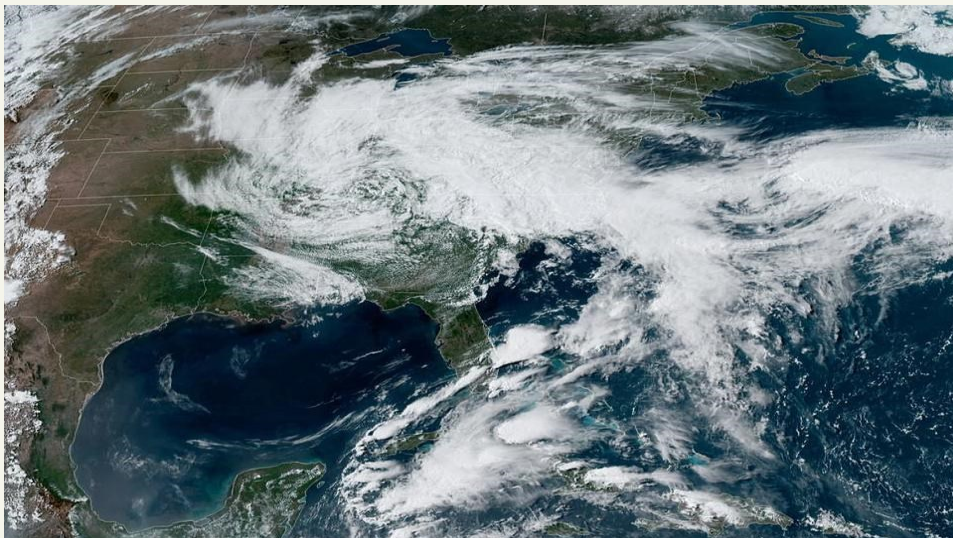
Arthur moved offshore late on May 18 and became extratropical on May 19 as it moved away from land well east of southern Virginia. The heaviest rainfall during Tropical Storm Arthur impacted Carteret County with generally 3 to a little over 5 inches of rainfall was observed.

Tropical Storm Arthur Leads Off A Week Of Heavy Rain (Continued)

On the heels of Tropical Storm Arthur, a persistent upper level low pressure system moved south into the Tennessee Valley from the Great Lakes and moved very little from May 19 through May 22. The combination of this upper level low and deep moisture in the low levels across the eastern Carolinas led to periods of widespread heavy rainfall with embedded thunderstorms over a 4-day period.



Strong closed upper level low centered across the Tennessee Valley, Map from May 21, 7 AM.



Visible Satellite Image of closed low over the Tennessee Valley, May 21, 2020

Tropical Storm Arthur Leads Off A Week Of Heavy Rain (Continued)

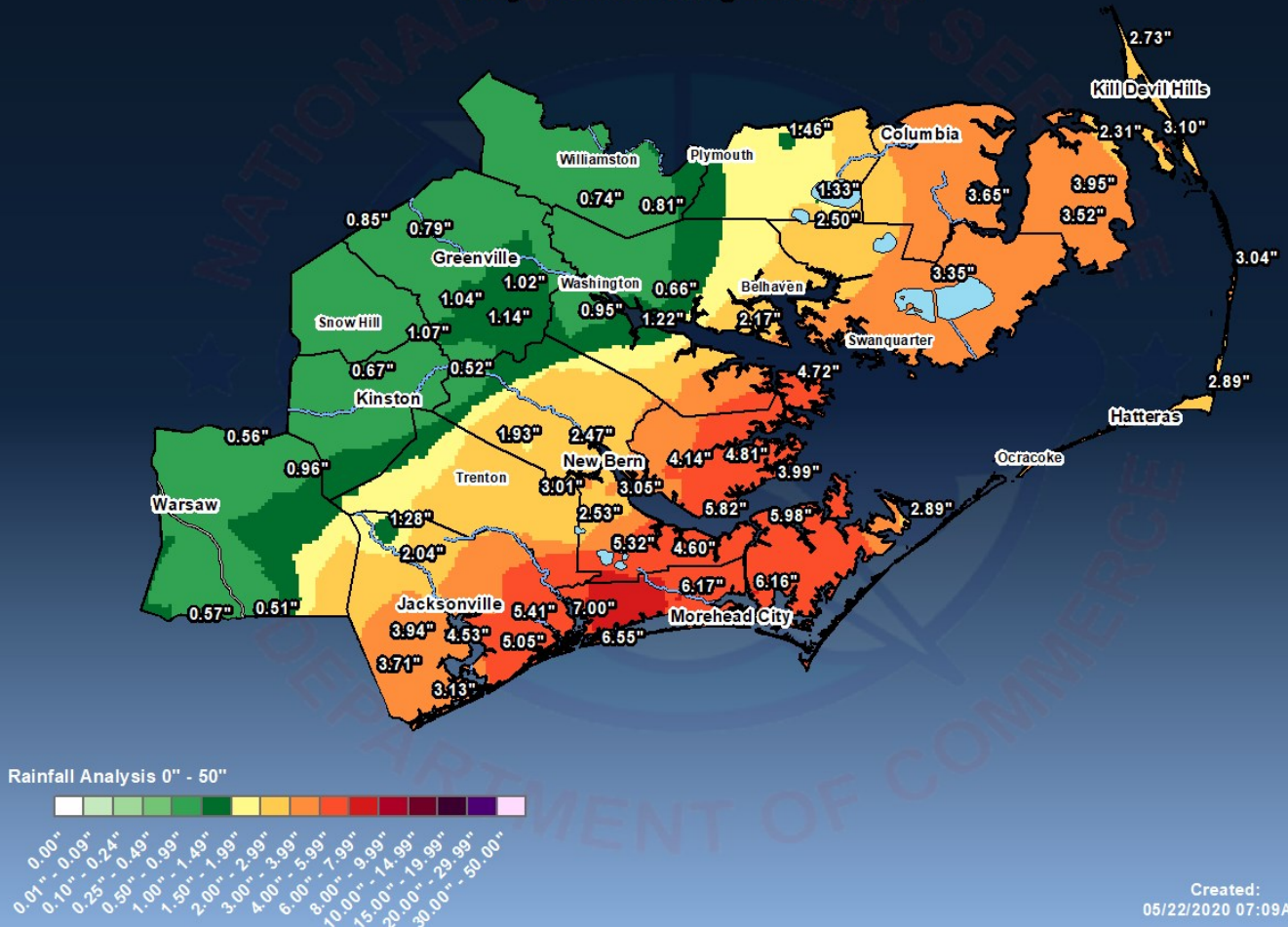
The Weather Prediction Center placed portion of eastern North Carolina in a Moderate Threat of Excessive Rainfall, while a rare High Threat of Excessive Rainfall was issued for the mountains of western North Carolina.

For eastern North Carolina, the upper low brought another 3 to 7 inches of rain, making a weekly total of 7 to over 10 inches along coastal eastern North Carolina, especially Carteret and Onslow Counties.

National Weather Service Newport/Morehead City North Carolina

Rainfall Analysis 05/18/2020 08:00PM to 05/21/2020 08:00PM

Analysis Data Source: Regional Observations



This is an experimental product. Care should be taken in using the data. Unofficial observations are plotted. Values at interpolated locations may not represent actual precipitation totals at that location.

Rainfall Amounts May 18 through May 21 from the Upper Level Low.

New Hurricane Preparedness Page

By Erik Heden, Warning Coordination Meteorologist

Hurricane season has officially started, but as we saw with [Tropical Storm Arthur](#), hurricane preparedness in our area should really start as early as May. Arthur marks the sixth straight season a named storm has occurred prior to June 1, and the first one to impact North Carolina since Tropical Storm Anna in 2015.

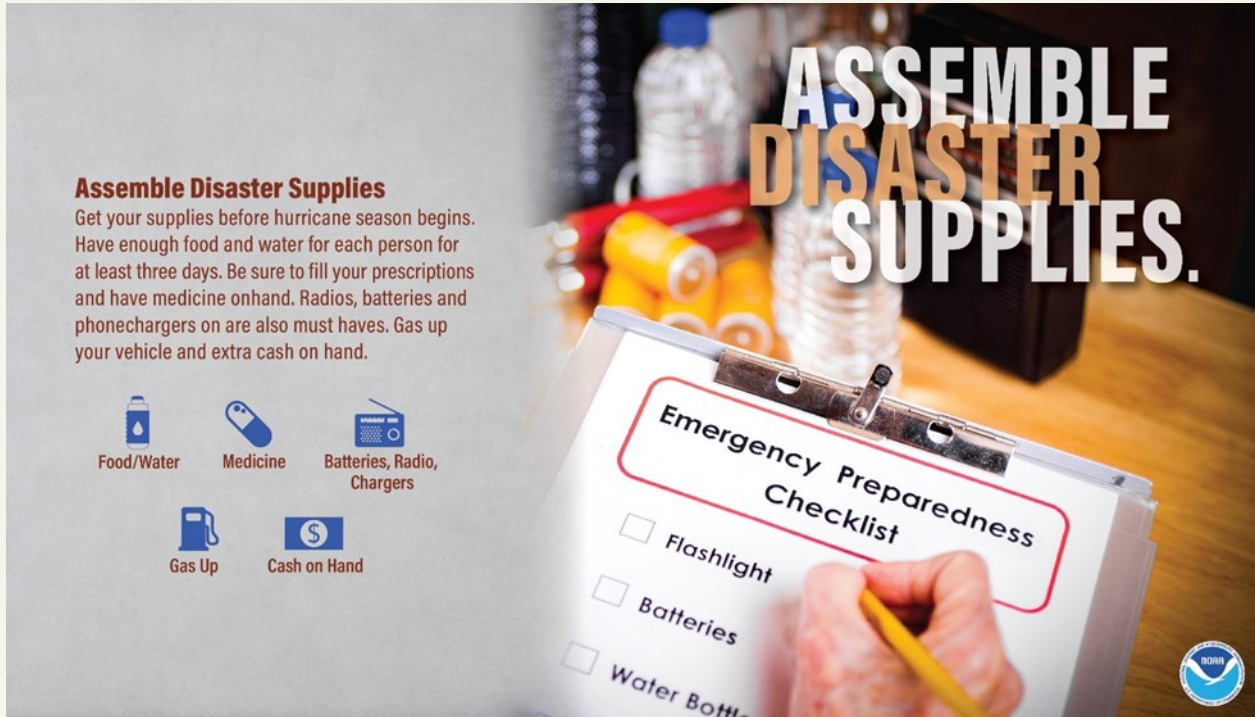
To increase awareness of hurricane preparedness information we created a new website this year. You should prepare each and every year for hurricane season because it just takes one storm to make an impact on your life. The website, <https://www.weather.gov/mhx/hurricaneprep> follows the format of hurricane preparedness week which occurred in early May.

New information on this page includes a new campaign in North Carolina called Know Your Zone. North Carolina Know Your Zone is a tiered evacuation system that highlights areas most vulnerable to impacts from hurricanes, tropical storms, and other hazards. If it becomes necessary, local officials will order evacuations using pre-determined zones created by coastal counties. The Know Your Zone lookup tool is a new color-coded interactive map you can use to determine the evacuation zone where you live, work, or are visiting based upon your street address.

Evacuation zones highlight areas most at risk to storm surge and flooding. Local officials will determine which areas should be evacuated. Areas in Zone A will typically be evacuated first, followed by areas in Zone B, etc. While all zones won't be evacuated in every event, emergency managers will work with local media and use other outreach tools to notify residents and visitors of impacted zones and evacuation instructions.

On this page you can also find information on how to prepare a hurricane kit and how to strengthen your home. Learn about all the risks of tropical cyclones, including not just wind, but storm surge, heavy rain, tornadoes and rip currents. We encourage you to visit our website now so you can better prepare for hurricane season. We also ask that you share this information with your neighbors, especially those that are new to the area and have not experienced a hurricane before. For more information you can also view our latest hurricane preparedness video here: <https://youtu.be/nSywzehzXVY>

New Hurricane Preparedness Page (Continued)




**ASSEMBLE
DISASTER
SUPPLIES.**

Assemble Disaster Supplies
Get your supplies before hurricane season begins. Have enough food and water for each person for at least three days. Be sure to fill your prescriptions and have medicine on hand. Radios, batteries and phonechargers on are also must haves. Gas up your vehicle and extra cash on hand.

- Food/Water
- Medicine
- Batteries, Radio, Chargers
- Gas Up
- Cash on Hand

Emergency Preparedness Checklist

- Flashlight
- Batteries
- Water Bottle



Hurricane Preparedness

Are YOU Ready?

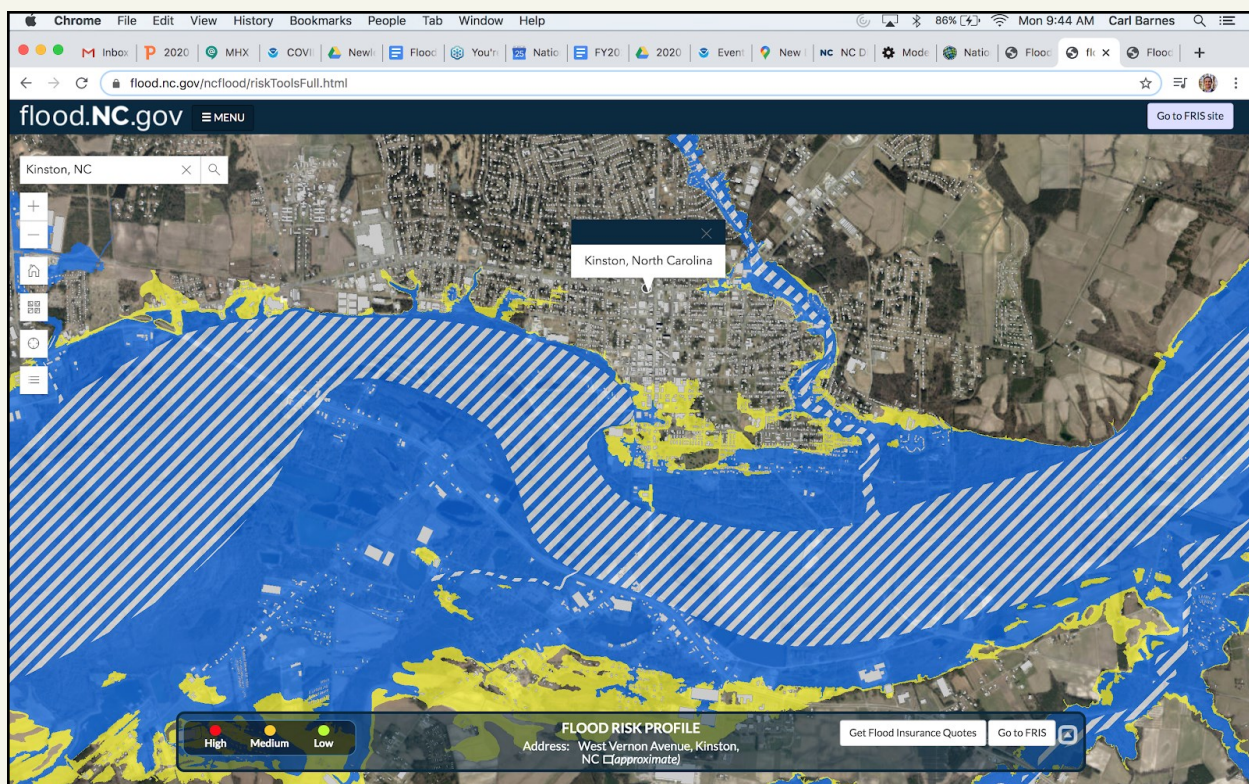
Understanding Your Vulnerability to Flooding

By Carl Barnes, Meteorologist

A key aspect of hurricane preparedness is understanding your vulnerability. Storm surge and flooding from rainfall account for the vast majority of direct hurricane-related fatalities - more than 80% since the 1960's - yet many people do not know if they live in a location that is vulnerable to either threat. For example, during Hurricane Florence, hundreds of water rescues were required in and around New Bern, where, despite forecasts of extreme storm surge impacts, some residents did not think that they were under threat of storm surge because "It's never happened here before." Fortunately, recent advancements in technology and initiatives at the state and national levels have resulted in improved tools for determining your vulnerability to flooding. NOW is the time to check these resources out so that you can understand your vulnerability and make your plan BEFORE there is a storm threatening.

North Carolina Floodplain Mapping Program

A great resource for getting a comprehensive look at the vulnerability of your home and community is the North Carolina Floodplain Mapping Program, which can be found by visiting Flood.NC.gov. You can enter your address to quickly see your flooding risk, your FEMA flood zone, and, if applicable, the most likely flooding source for your property. There is also an interactive mapping feature, which can be used to see



Example image from NC Floodplain Mapping Program showing possible flooding areas near Kinston.

Understanding Your Vulnerability to Flooding (Continued)

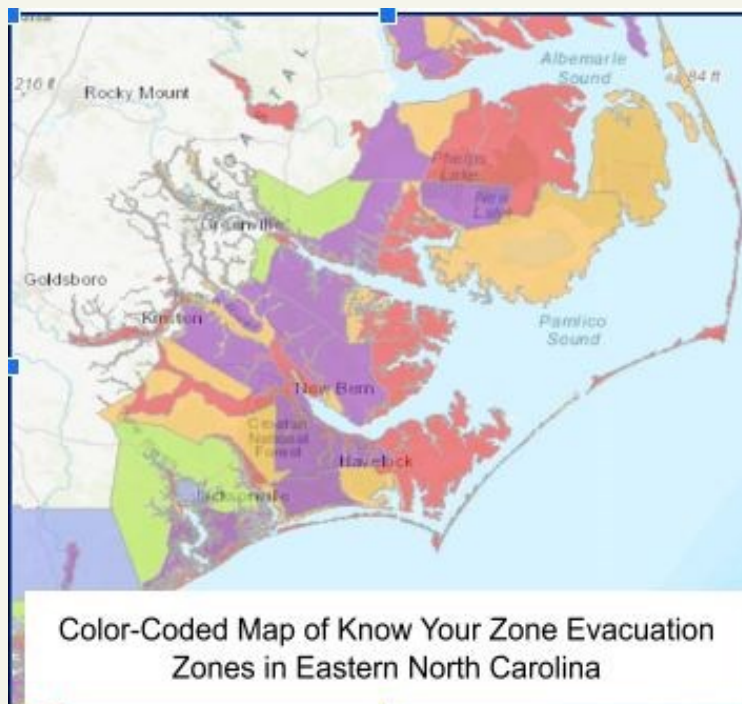
other areas in your community that are vulnerable to rainfall flooding and/or storm surge. The flooding areas are based on the probability of flooding in that location in any given year.

PRO TIP: Don't forget to check the flooding potential along your evacuation route, and have a backup plan in case it is flooded. Remember to NEVER DRIVE THROUGH FLOODED AREAS!

North Carolina Know Your Zone/Evacuation Zones

Available for all of coastal North Carolina in 2020, North Carolina Know Your Zone is a tiered evacuation system that highlights areas most vulnerable to impacts from hurricanes, tropical storms, and other hazards. You can find your zone by visiting ncdps.gov/know-your-zone. Evacuation zones are assigned based on the vulnerability of the zone, with areas in Zone A, typically the most vulnerable to hurricane impacts, followed by areas in Zone B, etc. Zone A will typically be evacuated first, followed by Zone B, etc., with the extent of the evacuations determined by local and state officials.

PRO TIP: This is the first year that zones have been assigned for most of the counties in eastern NC. Check your zone NOW so that you know what to look for when a storm threatens.

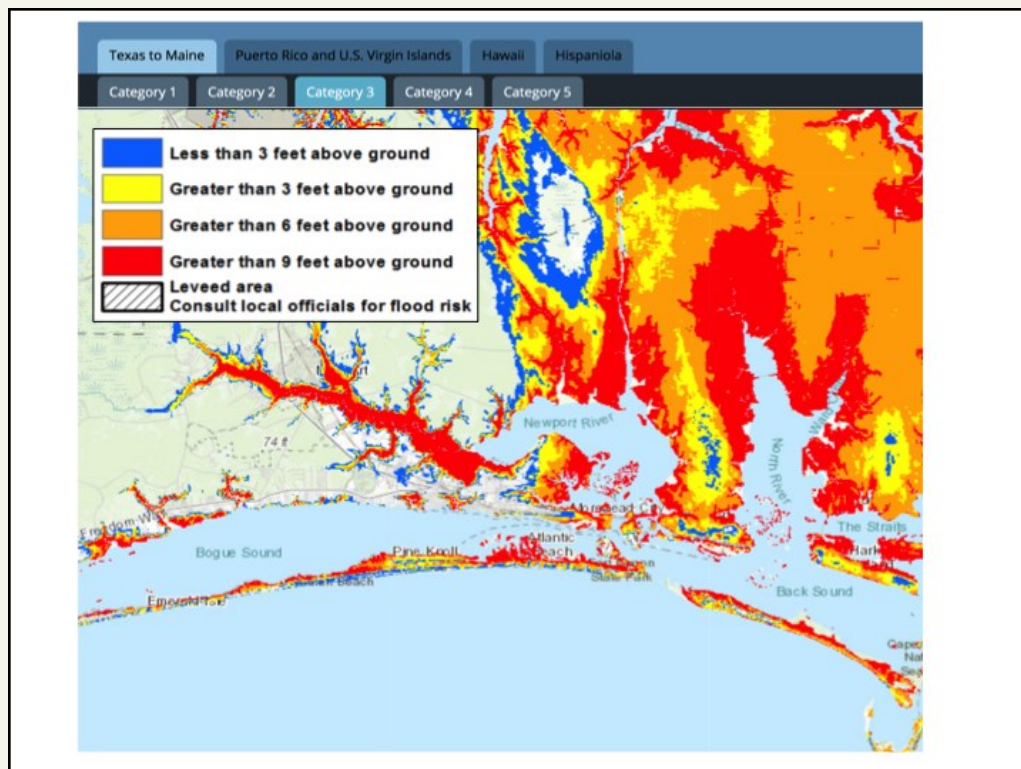


Understanding Your Vulnerability to Flooding (Continued)

For coastal areas, the NOAA Storm Surge Threat Viewer found at hurricanes.gov/nationalsurge is a useful resource for understanding how high (inundation above ground level) the storm surge could get in your community. This mapping is based on plausible worst case storm surge scenario for various storm wind speed categories and does not account for additional flooding from rainfall. This is especially useful for planning before specific forecasts are made for a threatening storm. These maps make it clear that storm surge is not just a beachfront problem, with the risk of storm surge extending many miles inland from the immediate coastline in some areas. If you discover that you live in an area vulnerable to storm surge, decide today where you will go and how you will get there.

PRO TIP: If you don't live in an area vulnerable to storm surge, then perhaps you can identify someone you care about who does and you could plan in advance to be their inland evacuation destination - if you live in a structure that is safe from the wind and outside of flood-prone areas.

In addition to these resources, many North Carolina counties have local programs in place to help their residents understand their vulnerability and prepare for a hurricane. If you still have questions about your vulnerability, please reach out to your county. Finally, when evaluating your flooding vulnerability, keep in mind that the amount of rainfall or storm surge that a hurricane will produce is not accounted for in the category of the storm, so make sure you are accounting for all of the impacts, not just the storm's category, when making decisions to keep you and your loved ones safe.



Example Potential Storm Surge Inundation Map

Hurricane Preparedness: Before The Storm

YOUR HOME

- Know the hurricane risks for your area.
- Find out if your home is subject to storm surge flooding.
- Inspect your property for potential problems that may arise during a hurricane.
- Consider installing permanent protection for your windows. Learn how to install any manual window protection that you may have so that you can do so quickly if a hurricane threatens the area.

YOUR PROPERTY/INSURANCE

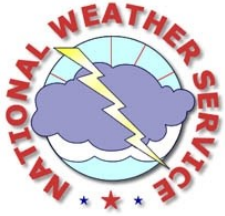
- Investigate flood insurance. Your local Emergency Management office or insurance agent can inform you about the National Flood Insurance Program.
- Inventory your property by making a list, taking photographs, or making a video. Store in a secure, dry place like your safety deposit box.

YOUR FAMILY

- Devise an emergency communications plan with your family so that you will know what to do in the event you are separated.
- Also, ask an out-of-state friend or relative to be the family contact. If family members need to call this person, it will be easier since local lines may be disrupted.
- Make sure that family members know how to respond during a hurricane emergency. Teach them how and when to turn off gas, electricity, and water.

EVACUATION/SHELTERS

- Plan your evacuation route to an area well inland. This plan should include information about the safest routes and nearby emergency shelters.
- Check how long it will take you to reach your safe area during peak evacuation traffic.
- Make advance arrangements for pets. **EMERGENCY SHELTERS CANNOT TAKE PETS!**



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