

The Wilmington Wave

National Weather Service, Wilmington, NC

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FALL 2015



El Niño and River Flooding

- Rick Neuherz

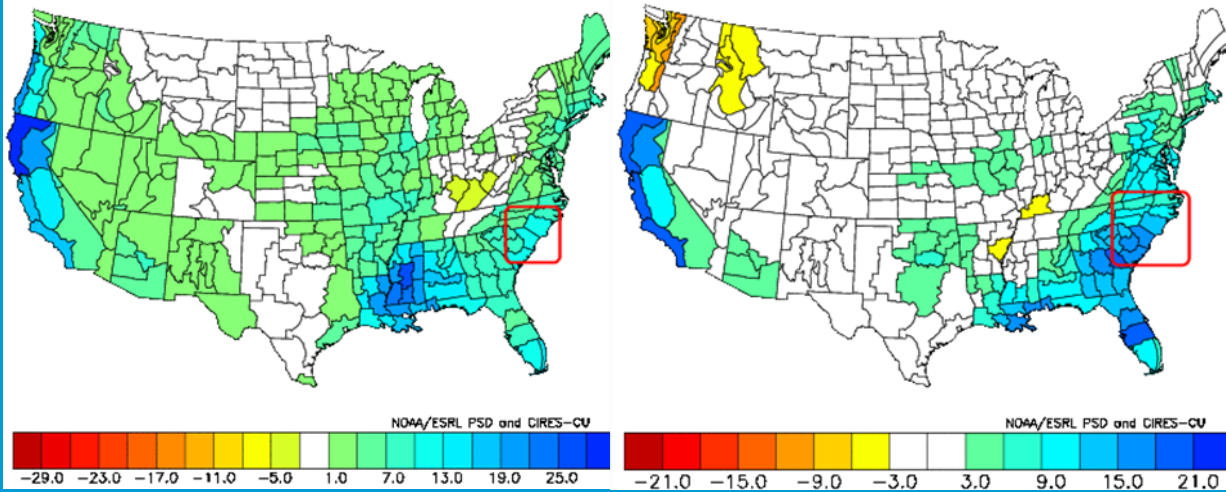
A strong El Niño is expected this winter season. Forecasts are indicating that it could rank with the strongest El Niño events on record which occurred in the fall of 1982 into the spring of 1983 and in the fall of 1997 into the spring of 1998. El Niño typically results in above normal precipitation for the area during the cool season.

The images below show rainfall anomalies for the November through April period over the area (outlined by a red box) during the 1982/1983 and 1997/1998 El Niño events. In the 1982/1983 event, rainfall over the area averaged over nine inches above normal during the period. During the 1997/1998 event, rainfall over the area averaged 12 to 15 inches above normal. In both of these cases, the average rainfall over the climate divisions was at the top of the 120 years of data in the rankings.

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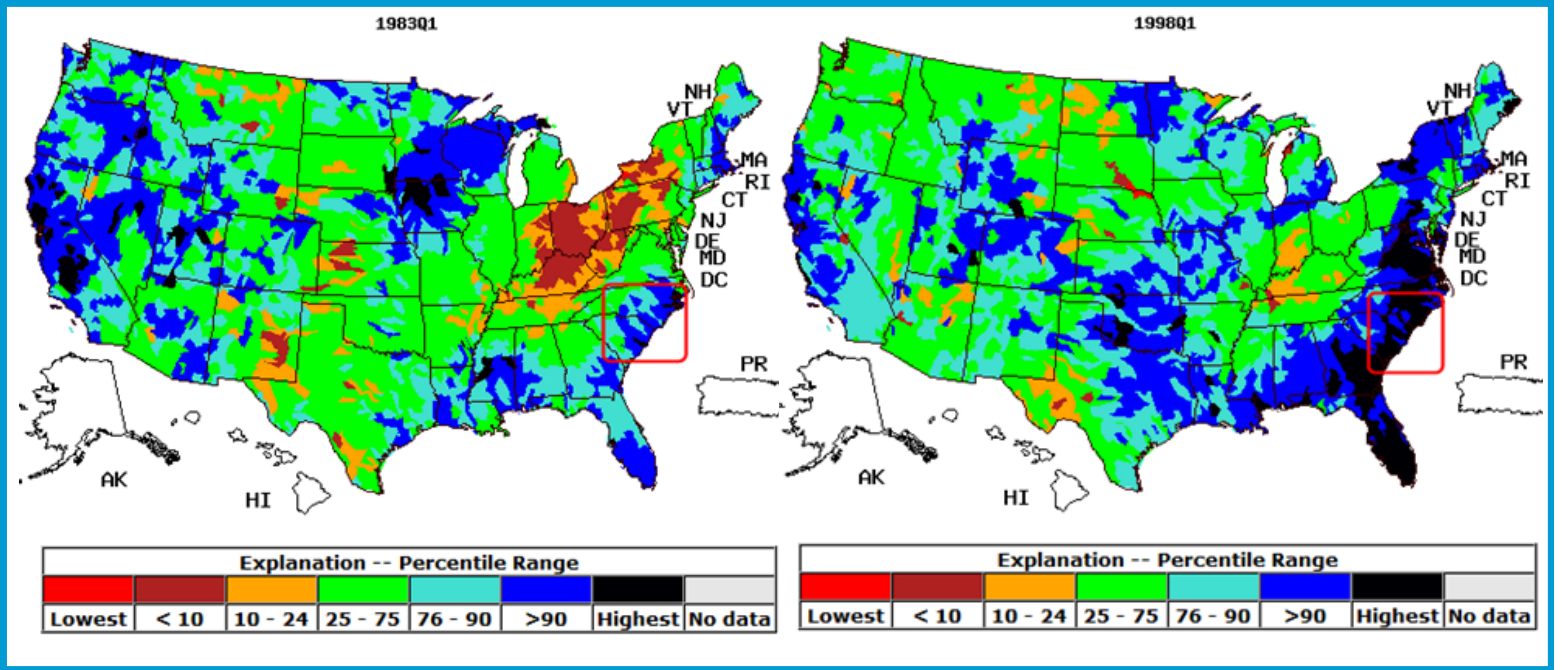
NOAA/NCDC Climate Division Precipitation Anomalies (in)
Nov to Apr 1982-83
Versus 1981-2010 Longterm Average

NOAA/NCDC Climate Division Precipitation Anomalies (in)
Nov to Apr 1997-98
Versus 1981-2010 Longterm Average



With an abundance of rainfall during the time of year when the use of water both by man and nature is at a minimum, the result can be very high runoff values. The images on page 2 show runoff computed by the U.S. Geological Survey for the January to March period in 1983 (left) and 1998. During the first three months of 1983, computed runoff across much of the area (outlined in a red box) ranked greater than the 90th percentile in the over 100 years of records in the analysis. During the first three months of 1998, computed runoff across the area ranked at the highest levels ever or at greater than the 90th percentile.





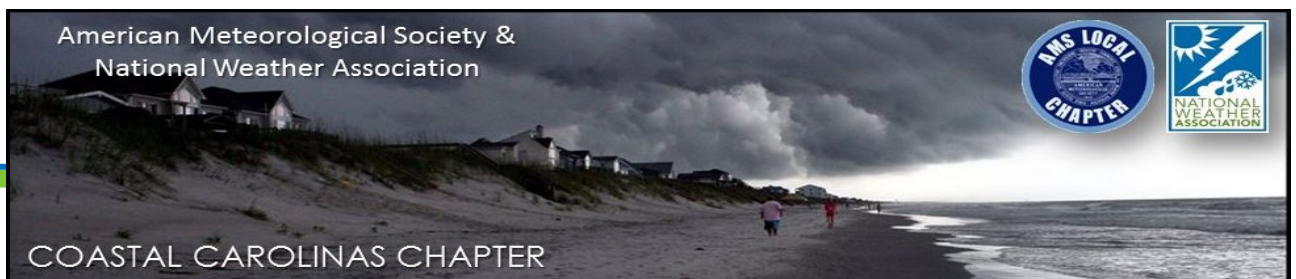
If the El Niño this winter results in similar rainfall and runoff to the El Niño events in 1982/1983 and 1997/1998, what might this mean for the winter river flood season? While there are a few exceptions, a look at the crest histories for area river gages shows that many gages did not receive a top ten crest in either of the previous events. There were floods that reached major stage on the Little Pee Dee River at Galivants Ferry and on the Waccamaw River at Conway and the Cape Fear River at William O. Huske Lock and Dam had its' second highest crest since 1982. While detailed records for the 1982/1983 event are not available, the notable thing about river floods during the 1997/1998 event was their duration. Several gage sites around the area were above flood stage from mid to late January 1998 through early March. The message from history may be to prepare now for river floods that may last weeks or months this winter.

Coastal Carolinas AMS/NWA Local Chapter

Calling all local weather enthusiasts!! Did you know that there's a new local chapter of the American Meteorological Society & National Weather Association chapter?! The Coastal Carolinas AMS/NWA chapter is still fairly new, as they were founded in 2013. The group is comprised of National Weather Service, media, and private sector meteorologists, as well as local area students, retirees, and weather enthusiasts. From Myrtle Beach, SC to Wilmington, NC, the chapter is gradually growing, and while a majority of their interests lie within this area, anyone across the Carolinas is welcome. Anyone with an interest in weather is encouraged to attend and participate as meetings are held throughout the year across the area.

For more information at the chapter, as well as upcoming meeting information, visit:

www.ametsoc.org/chapters/coastalcarolinas



Weather-Ready Nation: Become An Ambassador

- Steve Pfaff

It's no surprise for many that live in southeast NC and northeast SC that we are susceptible to a wide variety of weather impacts. In fact, our part of the country is like no other when it comes to the different hazards we have to prepare for including wind driven wildfires, hurricanes, ice storms, flooding, tornado outbreaks, severe thunderstorms, drought, etc. Although many of these events do not occur routinely if we fail to plan for them then many will become caught off guard by their impacts. The National Weather Service (NWS) is responsible for doing storm survey assessments of areas hit hard by severe weather, and a common theme we hear from those who were hit hardest is – "I can't believe this happened to me". While most people agree that we have an exposure to hazardous weather, only a small segment of the population is ideally prepared to deal with extreme weather events.

During a typical year the United States has 100,000 severe thunderstorms, 5,000 floods and flash floods, 1,000 tornadoes, and 2 land-falling hurricanes. It's no wonder why our Nation needs to be Weather-Ready. While there have been advancements in weather related technology and research that have led to the increased accuracy and warning lead time over the last decade, people are still being killed in great numbers. For instance, during 2011 there were 549 fatalities from tornadoes – almost 300 people during the Alabama outbreak on a single day! As a result, the NWS has started a new program called Weather-Ready Nation to enhance community resilience in the face of extreme weather events across the Nation.

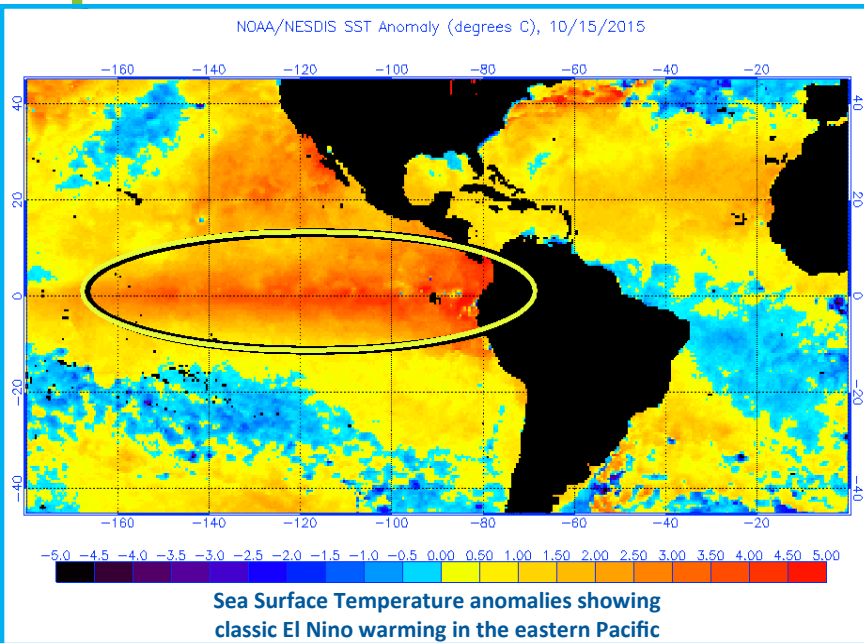
The Weather-Ready Nation Ambassador program is the initiative that recognizes a wide variety of partners in their efforts to advocate weather safety and planning. The Ambassadors help to unify weather safety efforts, are action-oriented, inclusive, and help lead to new partnership opportunities with the NWS. The Ambassador program is open to any club, organization, company, civic group, or government agency (Local/State/Federal) and is free to join. There are no formal guidelines or requirements to become an Ambassador other than to sign-up and become integrated into the pipeline of weather safety information through the Weather-Ready Nation program. Consider the following - does weather potentially impact your family, friends, club members, staff or co-workers? If you answered yes then consider joining to become a Weather-Ready Nation Ambassador. Help the NWS to better serve our local communities by signing up!

For more information visit: <http://www.weather.gov/ilm/wrn>



Winter 2015-2016 Will Feature a Strong El Niño

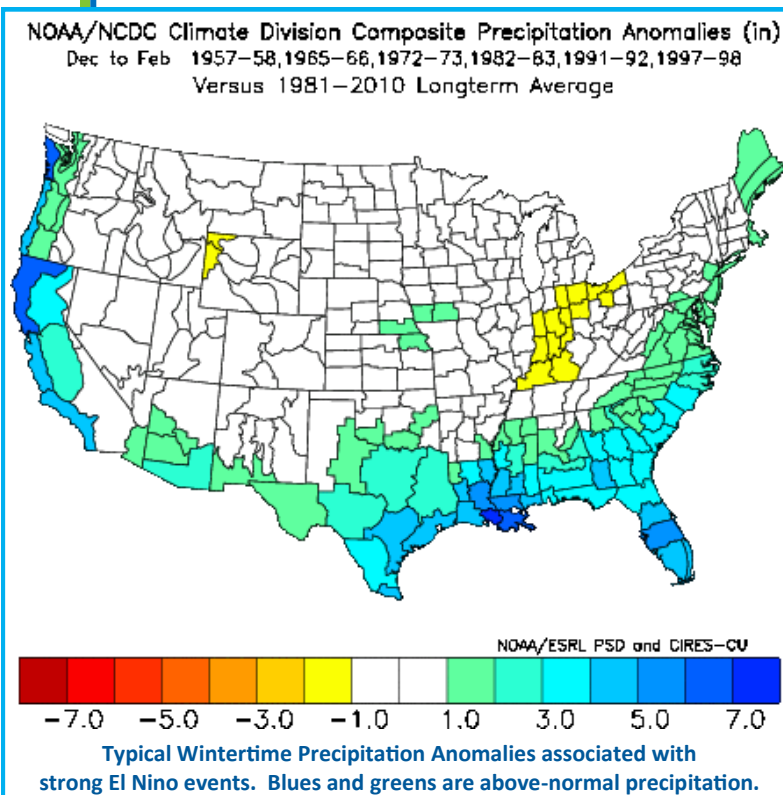
- Tim Armstrong



El Niño is expected to continue through this upcoming winter and into the spring of 2016. Although El Niño is a warming of the tropical eastern Pacific Ocean and the overlying atmosphere, it has global weather impacts with changes in temperature and precipitation patterns across the planet. El Niño typically reduces the severity of our hurricane season due to increased wind shear across the tropical Atlantic and Caribbean. However its largest local impacts are noted during the winter with heavier precipitation typically occurring across the southern United States including the Carolinas.

El Niño is actually just one phase of the El Niño/Southern Oscillation, often called by the acronym ENSO. ENSO has two phases: a warm phase we call El Niño and a cool phase called La Niña. These alternate at irregular intervals of 1 to 4 years.

This particular El Niño is expected to become strong this winter, perhaps rivaling some of the strongest events in recent history. Looking back over the past 60 years there have been six strong El Niño events we can use to base a winter outlook on. These strong events occurred during the winters of 1957-1958, 1965-1966, 1972-1973, 1982-1983, 1991-1992, and 1997-1998.



El Niño should bring lots of rain to the Carolinas

In almost all cases a strong El Niño brings above-normal rainfall to the Carolinas during the winter months of December through February. During the winters of 1981-1982 and 1997-1998 extremely large amounts of rain fell causing long periods of river flooding across the eastern Carolinas. Some of the highest river crests ever observed occurred on the Cape Fear River at William O. Huske Lock and Dam, on the Little Pee Dee River at Gallivant's Ferry, and on the Black River at Kingstree, SC during El Niño winters.

This map shows the observed winter precipitation anomalies averaged across the last six strong El Niño events. Over the three winter months (December through February) rainfall was consistently above normal across all of the Carolinas.

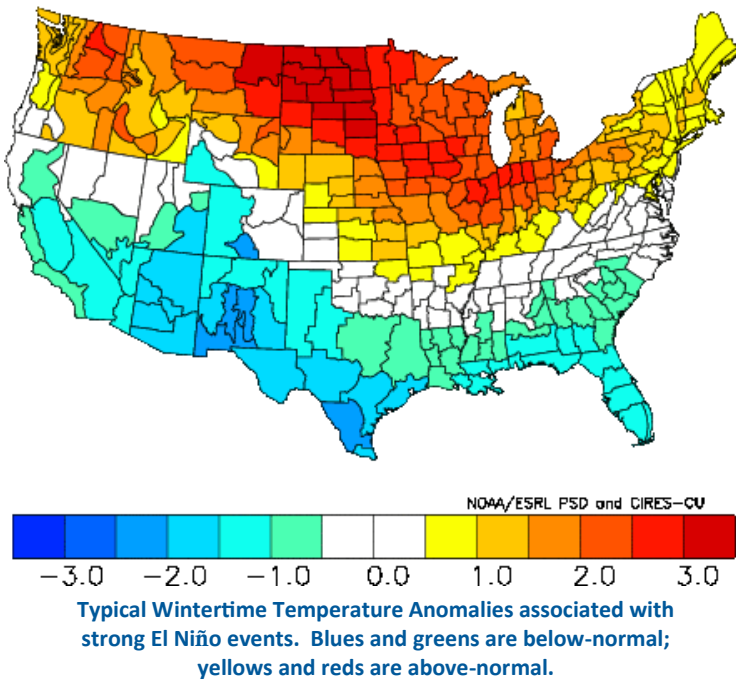
Precipitation anomalies were largest near the coast; the southern coastal plain of North Carolina averaged 3.04" above normal while the northern coastal plain of South Carolina averaged 3.37" above normal. Above-normal precipitation typically extends across much of the Southeastern United States and also along the west coast during El Niño winters.

What produces this heavy rain? Huge thunderstorm clusters over the unusually-warm tropical eastern Pacific Ocean lift tremendous amounts of moisture into the atmosphere. Powerful subtropical jet streams (frequently observed during El Niño winters) efficiently transport this moisture across the southern United States where it falls as rain -- or occasionally snow!

	Normal winter	Observed Winter Precipitation (Dec-Feb) during strong El Niños					
		1957-1958	1965-1966	1972-1973	1982-1983	1991-1992	1997-1998
Raleigh, NC	9.80"	10.09"	10.43"	13.18"	11.81"	8.68"	16.03"
Wilmington, NC	11.00"	11.87"	12.67"	14.51"	20.21"	11.37"	23.34"
Charlotte, NC	9.98"	9.81"	9.81"	14.41"	12.26"	10.58"	13.64"
Asheville, NC	11.02"	9.28"	10.09"	12.38"	13.06"	11.60"	19.32"
Florence, SC	9.16"	10.26"	11.02"	12.11"	14.60"	7.58"	16.20"
Charleston, SC	9.78"	14.81"	12.49"	14.52"	15.41"	8.78"	22.94"
Columbia, SC	10.41"	10.40"	12.40"	16.39"	12.76"	9.92"	17.54"

No clear tendency for cold versus warm temperatures

NOAA/NCDC Climate Division Composite Temperature Anomalies (F)
 Dec to Feb 1957-58, 1965-66, 1972-73, 1982-83, 1991-92, 1997-98
 Versus 1981-2010 Longterm Average



During strong El Niños there is a tendency for winter temperatures to run below normal for the southernmost United States from southern California eastward across the Gulf Coast states. This tendency for cool winter temperatures becomes much weaker across the Carolinas. Averaging the previous six strong El Niños, we find only a small deviation from normal in either winter mean temperatures or cold-est winter temperatures for North or South Carolina.

Interestingly the strong El Niños of 1957-1958 and 1965-1966 had very cold winter temperatures relative to normal for the Carolinas. This temperature pattern was reversed during the El Niños of 1991-1992 and 1997-1998.

As we have seen over the past few winters (particularly since 2010) another atmospheric pattern called the North Atlantic Oscillation (NAO) can overwhelm the weather pattern across eastern North America, creating periods of extremely cold

temperatures regardless of the state of ENSO or other patterns.

A positive NAO features a strong west-to-east jet stream across eastern North America and the North Atlantic Ocean, preventing arctic air from plunging south. A negative NAO is associated with a weaker east-to-west jet stream flow with much greater tendency for cold air to move into the eastern United States. A negative NAO pattern during the middle of February 2015 helped bring the coldest air in 19 years into Wilmington with 13 degrees measured on the morning of February 20th.

	Normal Winter	<i>Observed Average Winter Temperatures (Dec-Feb) during Strong El Niños</i>					
		<i>1957-1958</i>	<i>1965-1966</i>	<i>1972-1973</i>	<i>1982-1983</i>	<i>1991-1992</i>	<i>1997-1998</i>
Raleigh, NC	43.0°	38.8°	40.6°	41.9°	42.1°	45.5°	43.8°
Wilmington, NC	47.8°	43.8°	46.6°	48.0°	46.8°	49.8°	49.2°
Charlotte, NC	42.1°	39.8°	40.7°	42.1°	42.8°	47.3°	46.5°
Asheville, NC	38.9°	34.5°	35.5°	40.4°	40.2°	42.7°	40.0°
Florence, SC	46.9°	43.6°	43.2°	45.5°	46.8°	50.3°	48.5°
Charleston, SC	50.3°	45.4°	47.5°	50.1°	50.5°	52.9°	51.9°
Columbia, SC	46.7°	42.9°	44.7°	46.8°	45.8°	49.0°	47.8°

El Niño bring infrequent, but sometimes large snowstorms

In contrast to rainfall, snowfall anomalies are not nearly as easy to predict during strong El Niño winters. During the El Niño winter of 1972-1973 the single largest snowfall ever seen in Florence and Columbia, SC occurred February 9-11, 1973. This was also the second-largest snowstorm on record in Wilmington, NC and Myrtle Beach, SC. Strong El Niños in 1991-1992 and 1997-1998 brought very little (if any) snowfall to the Carolinas. Nearly all stations reported below-normal or zero totals for those winters.

Even in a normal (non El Niño) winter snowfall statistics for the coastal Southeastern U.S. are -- strange. For example Wilmington's annual average snowfall is 1.6 inches. However snowfall statistics also show we average less than one measurable snow event per year. The standard deviation computed for Wilmington's historic snowfall events is much larger than the annual average!

Computing a simple average snowfall across the six previous strong El Niño winters shows above-normal totals all across the Carolinas. However this statistic is dominated by a small number of very large snowstorms, particularly during the winters of 1972-1973 and 1982-1983, which overwhelms the totals. El Niño does enhance the frequency of wintertime low pressure systems with heavy precipitation, a few of which may encounter cold enough air to produce snow across the Carolinas.

	Normal snowfall	Observed snowfall during strong El Niños					
		<i>1957-1958</i>	<i>1965-1966</i>	<i>1972-1973</i>	<i>1982-1983</i>	<i>1991-1992</i>	<i>1997-1998</i>
Raleigh, NC	6.0"	7.9"	11.8"	11.3"	11.8"	0"	2.4"
Wilmington, NC	1.6"	3.0"	0"	14.4"	4.2"	1.4"	0"
Charlotte, NC	4.3"	3.2"	10.7"	11.7"	12.6"	0"	4.9"
Asheville, NC	11.9"	17.4"	24.0"	9.2"	26.7"	1.5"	17.1"
Florence, SC	1.9"	2.8"	0.5"	17.0"	2.0"	1.4"	0"
Charleston, SC	0.5"	0"	0.8"	7.1"	0"	0"	0"
Columbia, SC	1.5"	1.4"	1.0"	18.2"	0.5"	0.8"	0"

Wilmington, NC Microburst: July 23, 2015

- Mark Bacon

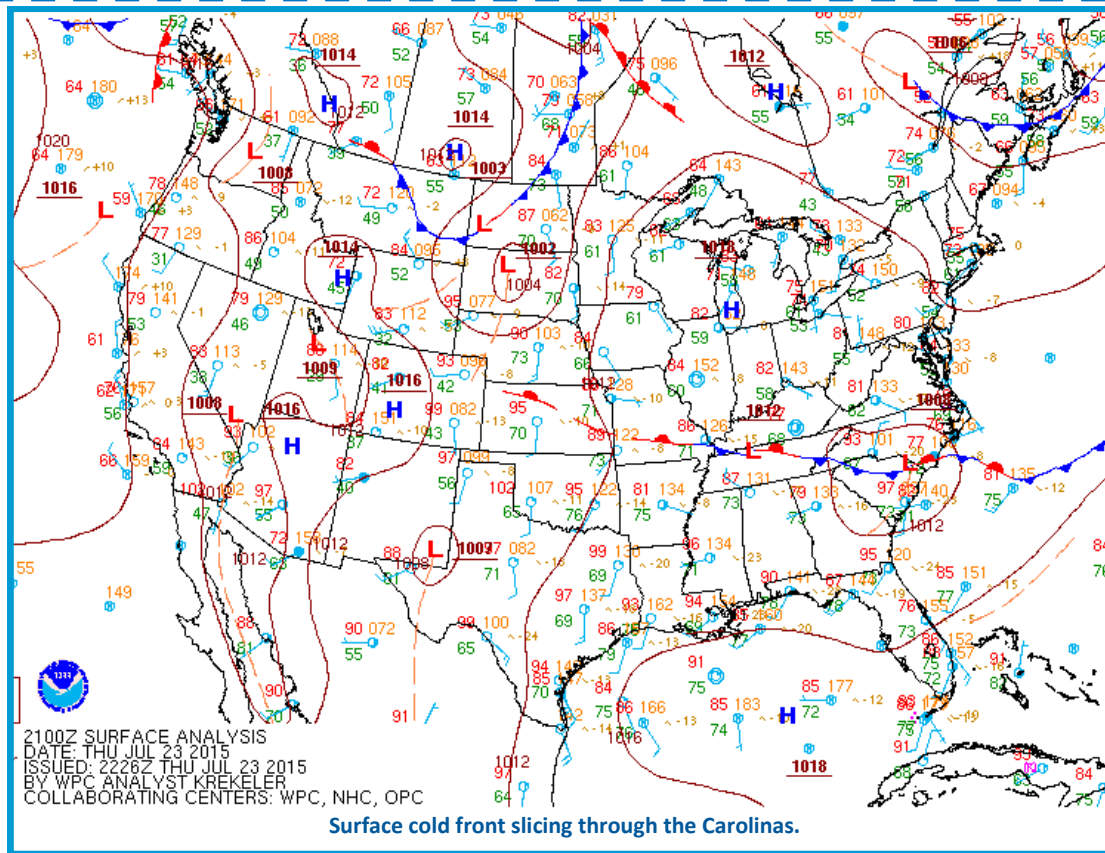
Powerful thunderstorms rolled through the coastal Carolinas during the afternoon hours of Thursday, July 23 2015. Much of the damage was fairly typical and likely indicative of 60mph winds (downed trees and powerlines). There was however a very small area of substantially more severe winds resulting in some higher end damage in parts of the city of Wilmington. The National Weather Service (NWS) Storm Survey team found that these areas-near the intersection of Market Street and New Center Drive actually experienced 90 mph winds, which is atypically strong for thunderstorms in the coastal Carolinas. The NWS Doppler radar displayed some features that may have been associated with this small area of enhanced damage. This is the main focus of this article.



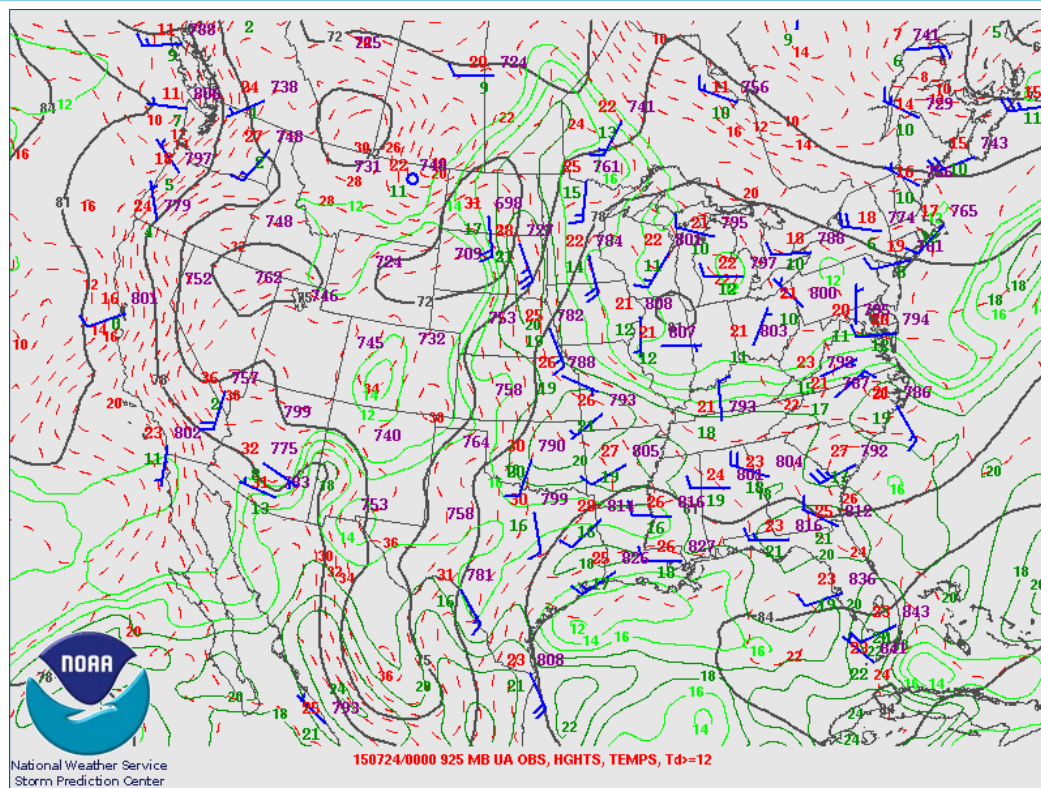
Tree down in Wilmington, NC

The NWS defines any severe thunderstorm as one that produces winds of 50 knots (58 mph) or more and/or hail with a diameter of 1" or larger. A higher category of 'significant' severe weather is defined as thunderstorms that produce 65 knots (74 mph) or higher and/or hail with a diameter of 2" or larger since only a small percentage of thunderstorms ever produce weather in this latter category.

The storms were mainly being driven by a cold front pushing through the Carolinas, which is not a common occurrence during the summer months. This front acts as a lifting mechanism for the warm and humid air mass that was in place, triggering the storms.

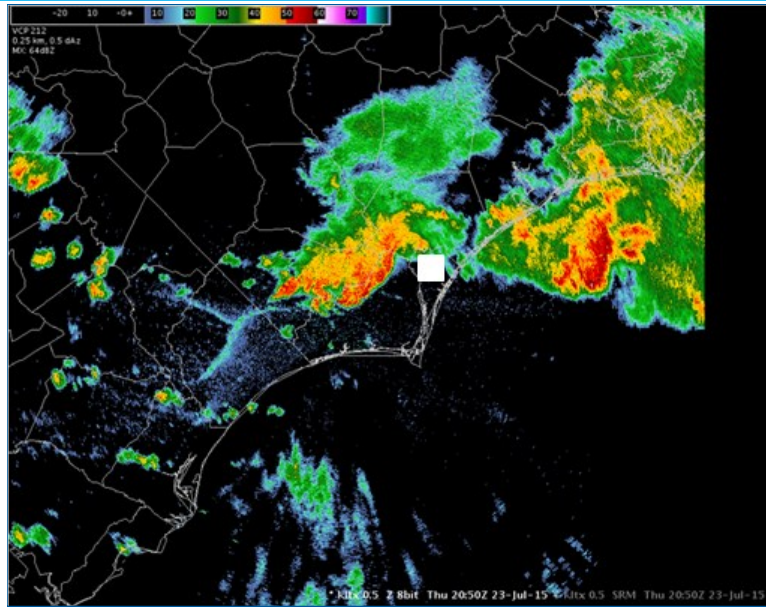


A small area of enhanced low level winds (at a height of approximately 2500 feet) may have started the process that eventually lead to the 90 mph wind gust over a small area.

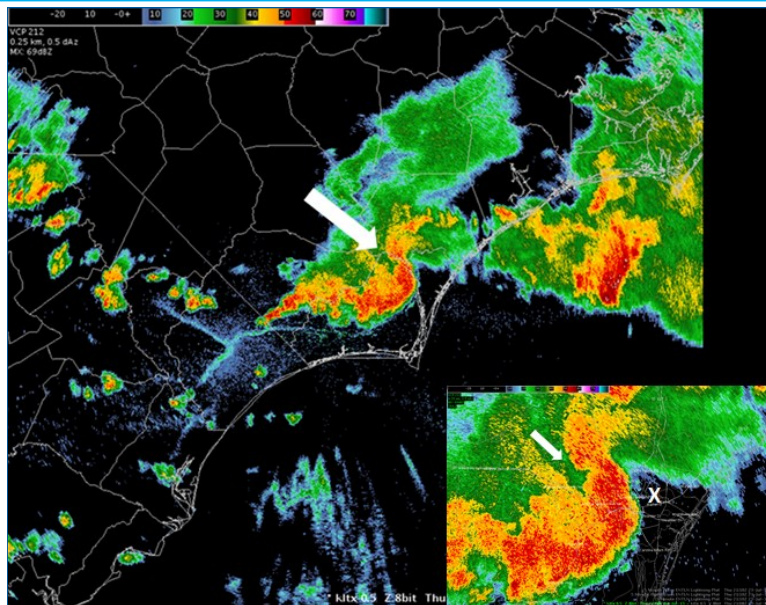


2500 ft winds showing a local maximum over Charleston, SC. The indicated wind is out of the Southwest (the direction the symbol points) of 25 knots (each long barb represents a speed of 10 knots; a short barb represents an additional 5 kt).

Thunderstorms represent one of the few examples in the free atmosphere where there is strong vertical motion. During a storm's development phase there is strong upward motion and usually during its dissipating phase there can be strong downward vertical motion. When weak the latter leads to the cooling breeze often felt before or during a storm and when strong this gentle breeze can strengthen to a damaging downburst. In an environment with wind shear (wind changing in speed and/or direction with height) thunderstorms can sometimes maintain both the updraft and downdraft for a time. When this happens an ongoing thunderstorm can sometimes channel higher wind speeds aloft to the ground via its downdraft. This air often accelerates downward due to raindrops evaporating into it, which causes it to grow cooler and thus denser and heavier. This descending inflow jet causes an erosion in the radar returns (since rainfall is associated with ascending air) on the rear side of the storm as well as a forward bow-shape.

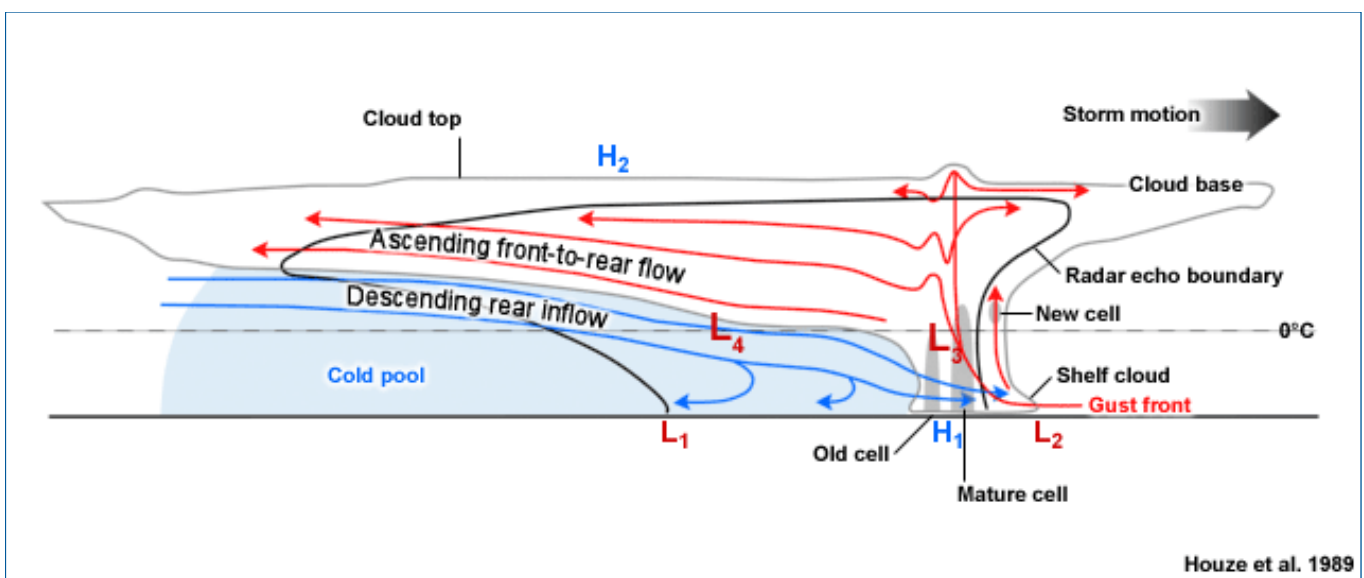


Radar Image at 4:50 PM. Thunderstorms moving quickly southeastward across Brunswick county heading towards Wilmington (location indicated by white square).

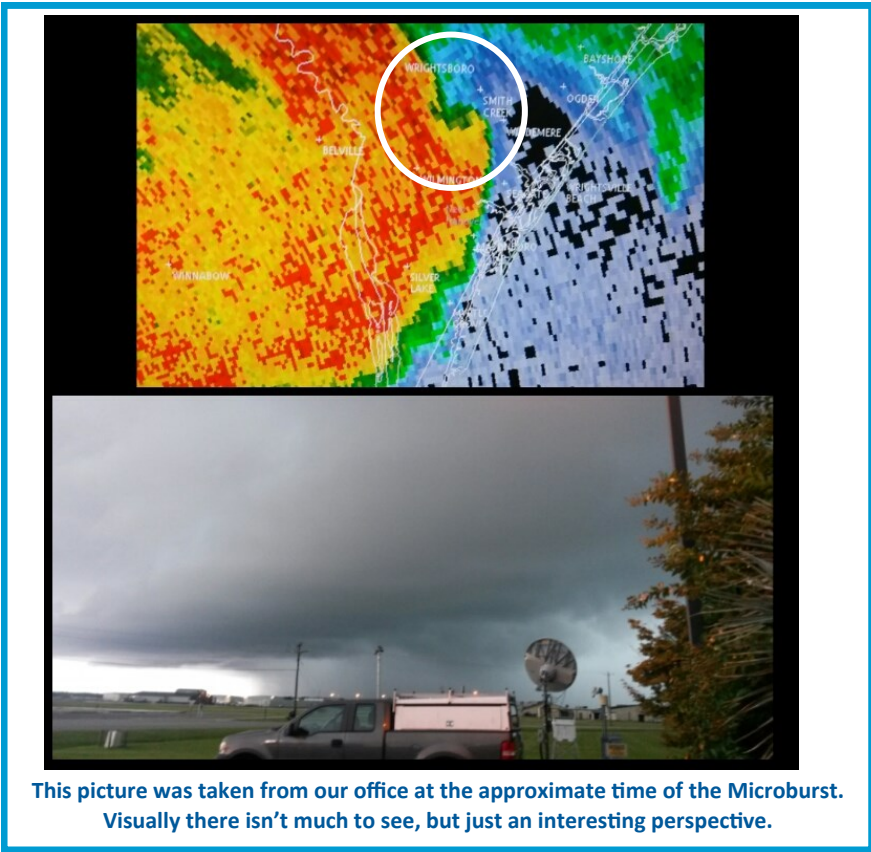


15 minutes later the storm takes on a bow shape indicating that some stronger winds may be reaching the surface. The white arrow indicates a developing minimum of radar returns indicative of a descending inflow jet (i.e. the narrow ribbon of green eroding the yellow, orange, and red). Lower right inset is a zoomed in perspective wherein white X denotes imminent area of damage.

This phenomenon is not terribly common in the Carolinas. This recent occurrence was in a highly populated area allowing the NWS to quickly and accurately survey and estimate the scale of the damage. This storm will be used as a case study in NWS Wilmington's annual Severe Weather Workshop in order to allow forecasters to see a local example and tangible result of a descending rear inflow jet within a squall line of thunderstorms. This will be done with the goal of providing more accurate and timely warnings, which is related to the main Mission Statement of the NWS to protect life and property from hazardous weather.



Schematic diagram of Rear Inflow jet showing air coming into the west side (from left) of a squall line being forced down to the ground (blue arrows).



Fall Hazards: Weather-Ready Nation

With the end of the Atlantic Hurricane Season right around the corner and the transition into Fall and Winter, it's important to be aware and make a plan for the numerous hazardous conditions that are possible through every single season. Are you ready for Fall weather hazards?



From: Weather-Ready Nation

(www.nws.noaa.gov/com/weatherreadynation/)

For many, fall brings cool air, trees displaying their brilliant colors, warm apple cider and the crunch of leaves beneath your feet. Fall marks the kickoff of football season and students returning to school. But the season can also bring weather hazards such as strong storms with whipping winds, early season snows and floods.

Don't let dangerous fall weather catch you unprepared! With just a few simple steps, you can be weather-ready for whatever comes this fall.

#FallSafety

1. Know your Risk

Check weather.gov every morning before you leave home to make sure you're prepared for what the weather might bring.

2. Take Action!

Learn about the hazards listed below to understand the weather you may experience this fall.

Make an [emergency supplies kit](#). Make a [family communications plan](#) for emergencies.

3. Be A Force of Nature

Inspire others to take action by showing your friends and family how you are prepared. You can tell them over the phone or in person, or tweet or post about it.

FALL WEATHER HAZARDS

El Niño, Late Season Hurricanes, Drought, Wildfires, Flooding, Early Season Winter

Weather.gov on Your Mobile Phone

From: Weather-Ready Nation

Take the weather with you on your mobile phone! Wherever you are, you can get the local weather forecast from the National Weather Service with one click on your home screen. Bookmark **mobile.weather.gov** to make sure that you have the latest weather news and information on the go.

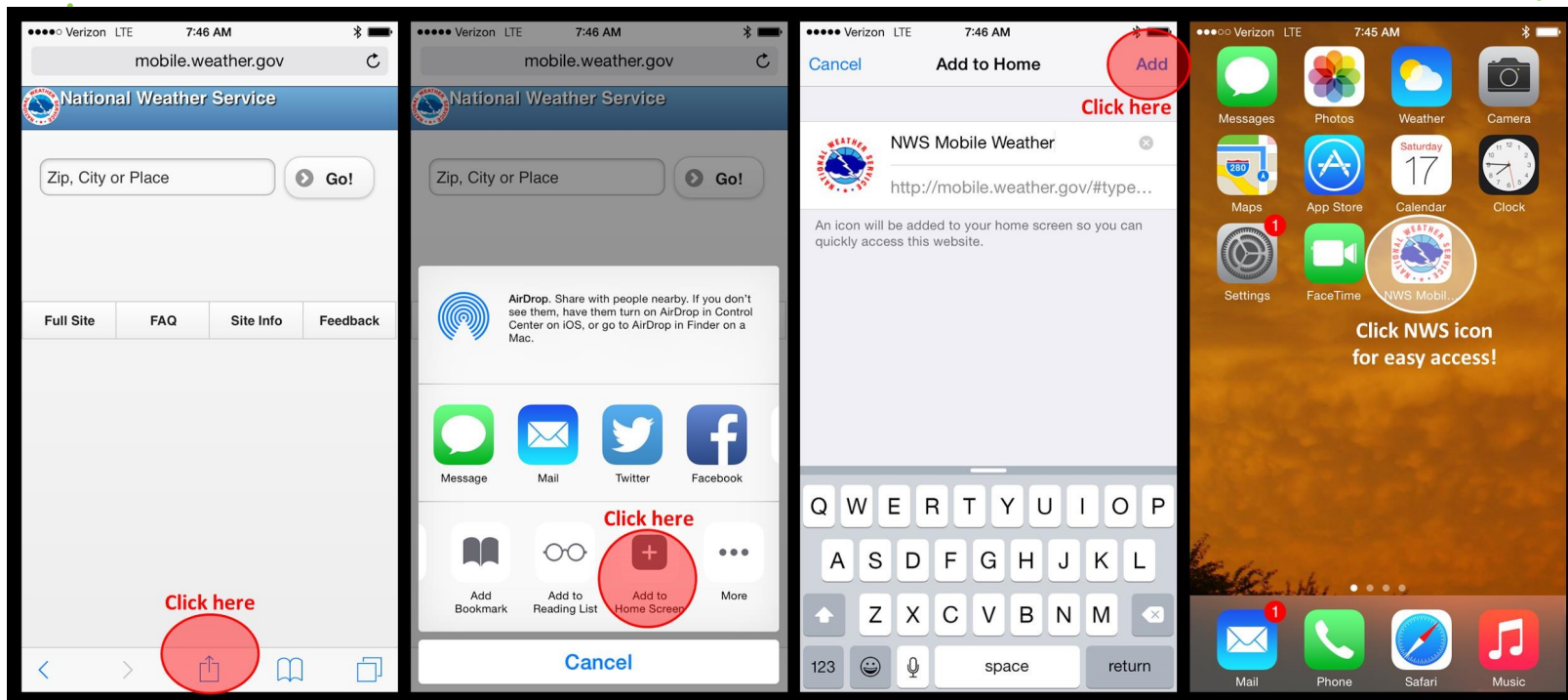
How can you add mobile.weather.gov to your mobile phone's Home Screen? t's easy! Learn how to add the mobile version of weather.gov to your iPhone or Android phone.

Follow these three steps for one-click access to your local forecast.

If you have an iPhone...

Visit **mobile.weather.gov** using Safari on your iPhone.

1. Click the Send button at the bottom of the screen.
2. Choose "Add to Home Screen" and tap "Add."



Weather.gov on Your Mobile Phone

From: Weather-Ready Nation

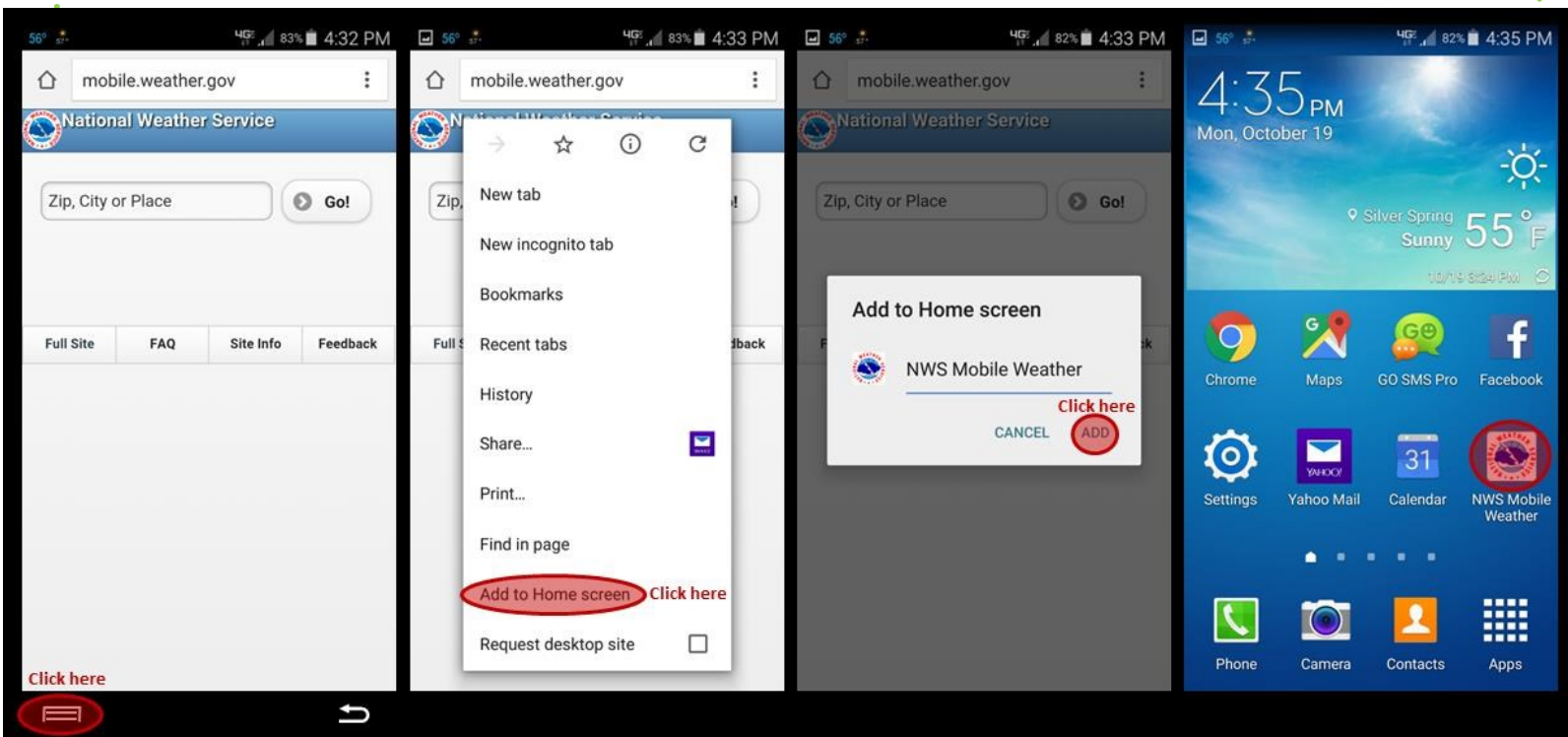
If you have an Android mobile device...

There are a number of browsers that will allow you to add mobile.weather.gov to your homescreen. For example, on Chrome for Android:

Visit **mobile.weather.gov** using Chrome on your Android phone

1. Click the menu button

Choose "Add to homescreen."



That's it! That's all it takes to get local weather information from the National Weather Service on your iPhone or other device.

For other mobile platforms, if you do not know how to bookmark a page on your phone, open your browser and search "how to bookmark a page on _____" with the blank being filled in with your model of phone.

Interested in other sources for weather alerts? Go **www.weather.gov/subscribe** for alternative options for weather alerting services or visit your mobile phone's app store for commercial app options.

Winter Weather: Are You Prepared?

Exposure to extreme cold, fires and poisoning due to the improper use of heaters, and vehicle accidents are just a few reasons as to why dozens of fatalities are reported each year due to winter weather, an overlooked significant threat. Now you may be thinking that a winter season across the Coastal Carolinas is nothing compared to, for example, the New England region. Well, we have our share of winter weather across the Carolinas, thus you should always be prepared.

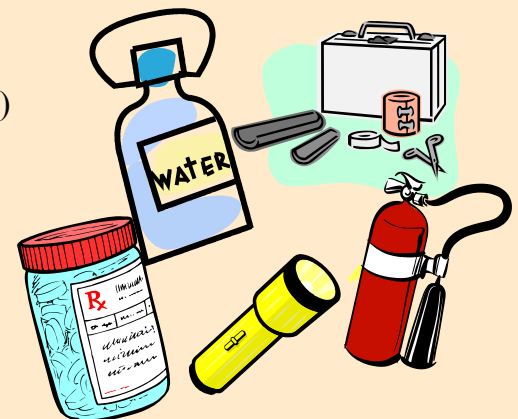
In preparation for a winter weather event, keep in mind that the primary concern will be the loss of heat, power outages, and shortage of supplies if storm or proceeding conditions persist for more than one day.

Before winter weather strikes, be sure to take necessary precautions such as maintaining, cleaning, and annually inspecting chimneys and other heating equipment, and making sure your vehicle is prepared by having a full gas tank and inspecting the antifreeze levels, brakes, battery, and more!

For additional information, visit www.ready.gov

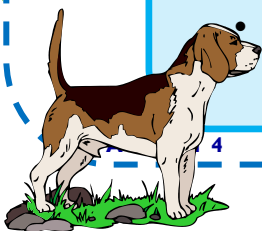
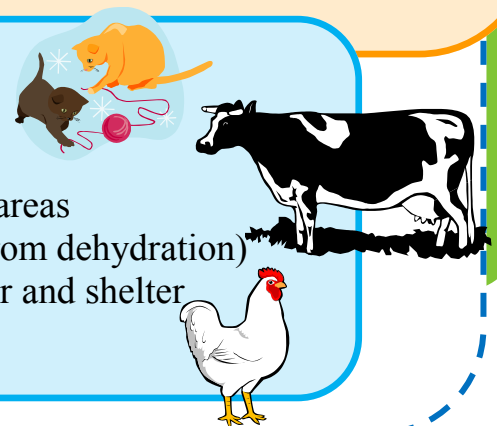
Disaster Kit: Home/Work

- Flashlight and extra batteries
- Battery-powered NOAA Weather Radio
- Extra food and water (one gallon of water per person, per day)
- Prescription medicines
- Special items for infant, elderly or disabled family members
- Emergency tools
- Cash and a credit card, emergency phone numbers
- Important documents
- Blankets and change of clothing per person
- First aid supplies
- Fire extinguisher/smoke alarm/carbon monoxide detector
- Heating fuel
- Emergency heat source (fireplace, space heater, etc)



Safety Tips: Animals/Pets

- Move animals to sheltered locations
- Have extra feed on hand or near feeding areas
- Have water available (animals may die from dehydration)
- Make sure pets have plenty of food, water and shelter





Disaster Kit: Vehicle

- Mobile phone, charger, batteries
- windshield scraper and small broom
- flashlight with extra batteries
- battery powered radio
- compass and road maps
- water and snack food
- matches
- extra hats, socks, mittens, and clothing
- first aid kit with pocket knife
- necessary medications
- blanket(s)/sleeping bags
- tow chain and/or rope
- road salt and sand, booster cables
- emergency flares/fluorescent distress flag

Safety Tips: Vehicle

- Drive only if it is absolutely necessary. If you must drive: travel during the day; don't travel alone; keep others informed of your schedule; stay on main roads and avoid back road shortcuts.
- If driving on snow or ice-covered roadways, reduce your speed. Driving at the regular speed limit will reduce your ability to control the car if you begin to slide. Leave plenty of room between you and other vehicles.
- If conditions worsen and you can no longer drive safely, pull off the highway. Stay calm and remain in your vehicle. Do not set out on foot unless you can see a building close by where you know you can take shelter.
- Let someone know your destination, your route, and when you expect to arrive. If your car gets stuck along the way, help can be sent along your predetermined route.

Carbon Monoxide: The Invisible Killer

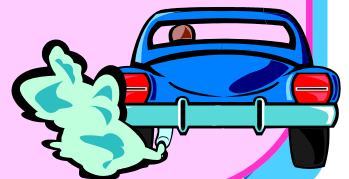
Carbon monoxide (CO) is a deadly odorless, colorless, and poisonous gas that is the cause of fatalities each year, especially during the winter weather season. It is a result of the incomplete burning of various fuels (ie coal, wood, kerosene, propane) from equipment such as generators and cars.

Symptoms

- Dizziness, nausea, fatigue, headache, shortness of breath
- High level of CO poisoning: vomiting, mental confusion, loss of consciousness

Prevent CO poisoning:

- Never operate equipment in enclosed spaces, such as a garage or locations within a home.
- Never leave car running in an attached garage (even with garage door open)
- Never burn charcoal inside home, vehicle, garage
- Never use gas appliances to heat your home (ovens, clothes dryers, etc)
- Never operate equipment where people are sleeping
- Install carbon monoxide alarms in central locations on every level of your home
- If carbon monoxide alarm sounds, move quickly to fresh air



NWS Wilmington Office History

They say everyone has a story, and for the National Weather Service office in Wilmington, NC, that story begins with December of 1870. It was then that the U.S. Signal Corps began taking sporadic snowfall measurements. Jump ahead a few years to 1973, when in April, the first complete and continuous set of weather observations began in a building located in downtown Wilmington, which no longer exists. From historic weather events to multiple moves for the office location, a lot has happened since 1870.



U.S. Post Office building slowly demolished beginning in 1936.

1936

Old office in U.S. Post Office building is demolished.

After being located in the U.S. Post office building for 41 years (1890-1931) the old building was demolished in 1936.

1931
Office moves to Water St.

1940
U.S. Weather Bureau established under the Dept. of Commerce

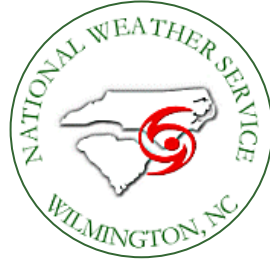


Take a ride down memory lane through our office history timeline:

<http://www.weather.gov/ilm/TimelineNWSILM>

National Weather Service
Weather Forecast Office
Wilmington, North Carolina

2015 Gardner Drive
Wilmington, NC 28405
Phone: (910) 762-4289
www.weather.gov/ilm



Webmaster's Email: ILM.webmaster@noaa.gov



We need your Storm Reports!!

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The Wilmington Wave
Volume IV, Issue I

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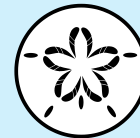
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and you share storm reports and any weather questions you might have!*