

Carolina Skies



Hurricane Floyd September 15-16, 1999

National Weather Service, Wilmington, NC

Fall 2001

Hurricane Season 2001?

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Storm Tide Facts:

Over 6,000 people were killed in the Galveston Hurricane of 1900 - most by the storm tide.

Hurricane Camille in 1969 produced a 25 foot storm tide in Mississippi.

Hurricane Hugo in 1989 generated a 20 foot storm tide in South Carolina.

River Forecasts Now Available for Northeast Cape Fear River Near Burgaw

With the arrival of many hurricanes in southeast North Carolina within the past five years, the region has seen some of its worst inland flooding in recorded history. No longer is the focus just on hurricane force winds and storm surge along the immediate coast, residents further inland must prepare for the flooding rains which cause local creeks, streams and rivers to swell and eventually overflow their banks.

As a result of the devastating flooding from Hurricane Fran in 1996, Pender County Emergency Management Officials teamed up with the United States Geological Survey to install an automated river gage on the banks of the Northeast Cape Fear River near Burgaw. The gage transmits river stage level readings via satellite every 15 minutes. These 15 minute readings are downloaded every six hours and are available via the internet. The gage was installed in August of 1999 and got its first test just weeks later when Hurricane Floyd brought record flooding to the area. The gage provided constant readings for residents and local Emergency Management officials and proved to be a valuable asset to the National Weather Service and the community.

Learning from this flood event and less severe events thereafter, the National Weather Service in Wilmington has worked closely with Pender County Emergency Management to determine critical river levels which will impact residents on the river. The Southeast River Forecast Center in Peachtree City, GA, has modeled the river from Chinquapin down to Burgaw to assimilate the flood levels as they move downstream. In August of this year, the National Weather Service began providing flood forecasts for the Northeast Cape Fear near Burgaw. These forecasts will be available when the river level is expected to approach or exceed its flood stage of 11 feet. For more information, please visit the hydrology section of our website at nwsilm.wilmington.net

See the article on Page 5 about the river gage just installed in Black Creek, Florence County, South Carolina.

Climate Corner

The spring months of March, April and May were slightly cooler and drier than normal across the Eastern Carolinas, and continued the below normal trends for these categories that were established during the fall and winter months. Temperatures during this period averaged 0.2 degrees below normal overall. The coldest month was March, where temperatures area-wide averaged 1.6 degrees below normal. The remaining months of April and May were slightly above normal. April proved to be the most variable temperature wise. Many new record lows and highs were established area wide in April.

Precipitation was slightly below normal for the entire area for each of the months of March, April and May. March was the wettest month across the Carolinas. Precipitation amounts were nearly two and a half inch above normal. The precipitation was well needed, since the following months of April and May were extremely dry across the Carolinas. Precipitation during these months averaged one and a half to two inches below normal. Portions of central South Carolina continue to experience a moderate drought.

An upper level trough and a strong jet stream persisted over the area in March. As a result, a series of strong spring storms moved across the region, enhancing rainfall and keeping temperatures cooler than normal. April was really the month of transition, as the upper level trough finally began retreating to the north, and a series of high pressure systems moved into the region, decreasing rainfall and causing rapidly fluctuating temperatures. High pressure continued to dominate the area in May.

Pee Dee Research and Education Center in the COOP Spotlight

In each issue of Carolina Skies, we like to shine the spotlight on one of our Coop Weather

Observers. Coop Weather Observers are a very diverse group. Many are individuals with an interest in weather and others are institutional observers who have their own reasons for collecting weather information and partnering with the National Weather Service. The Pee Dee Research and Education Center is one of those institutional observers. The center is located at 2200 Pocket Road in Florence, SC and Dr. Benjamin U. Kittrell is the Director.

The Pee Dee Region accounts for more than 50 percent of the agricultural income of South Carolina. The agriculture of the region is diverse but is dominated by the major field crops - tobacco, cotton, soybeans, corn, peanuts and small grains. The mission of the Pee Dee Research and Education Center is to focus on the problems and opportunities of these crops to provide scientific information that will help agriculture become more profitable, environmentally friendly, and sustainable for the future. Their scientists realize that each grower must integrate this knowledge, including knowledge of weather and climate into his total farming operation.

The Pee Dee Experiment Station first began collecting weather data in 1915. Since that time the name of the institution has changed and the location has changed but the weather record that they have established has remained constant. The National Weather Service would like to thank Dr. Kittrell and all those involved in collecting and sharing this valuable information.

Erin- First Hurricane of the 2001 Season

Erin became a hurricane on Saturday, September 8. It is the first hurricane in the North Atlantic Basin this year. According to records kept by the National Weather Service, National Hurricane Center, and Climatic Data Center, the last time we went this late in the hurricane season without a hurricane was 1984. Diana became a hurricane on September 10, 1984. Diana made landfall as a Category 2 hurricane near Long Beach in Brunswick County on September 13,

1984.

The following is a list of the first hurricane in the Atlantic Basin, listed by year, since 1984:

:

1984	Diana	(September 10)
1985	Bob	(July 24)
1986	Bonnie	(June 25)
1987	Arlene	(August 21)
1988	Debby	(September 2)
1989	Chantal	(July 31)
1990	Bertha	(July 28)
1991	Bob	(August 17)
1992	Andrew	(August 22)
1993	Emily	(August 28)
1994	Chris	(August 17)
1995	Allison	(June 4)
1996	Bertha	(July 7)
1997	Bill	(July 12)
1998	Bonnie	(August 21)
1999	Bret	(August 20)
2000	Alberto	(August 5)
2001	Erin	(September 8)

Just because it is later in the season than normal does not necessarily mean it will be an inactive season. There were eight named storms after Hurricane Diana in 1984. Four became hurricanes. One storm that year (Hurricane Lili) did not reach hurricane strength until December 20.

Tornadoes and Waterspouts...No Warning?

A rare waterspout/tornado event occurred on July 6 between 4:00 - 4:45 PM along the Grand Strand of Horry County, beginning just south of North Myrtle Beach and continuing along the beachfront of Myrtle Beach. Damage estimates were near \$8 million to hotels, vehicles, signs etc., and 30 to 40 people were injured.

It began as a weak push of Canadian air intercepted clouds along the afternoon sea breeze boundary over Brunswick County. The clouds quickly developed into heavy rain thunderstorms with intense cloud-to-ground lightning activity. Flood warnings were issued for Brunswick

County as the NWS doppler weather radar in Shallotte indicated rainfall accumulations around three inches in an hour. There were no indications of severe wind...only heavy summer rain and lots of lightning.

Shortly after 3:00 PM, lightning struck the radar in Shallotte, knocking it seriously out of commission for the first time since it was installed in 1994. Radar is the chief warning tool, as it provides detailed, near real-time information for every thunderstorm across our county warning area. With the radar down, we used our neighboring NWS radars near Morehead City, NC and near Charleston, SC to monitor the area. However, because those radars are more than 100 miles from the Grand Strand, they were unable to monitor clouds much below 15,000 feet. Normally this is adequate - we can still distinguish powerful cloud buildups and their potential for severe thunderstorms and heavy rain. A Special Marine Warning was issued for thunderstorms over the coastal waters, and as storms developed into Horry County, a flood warning was issued.

But this time the backup radars weren't enough. This time, a thunderstorm developing near North Myrtle Beach must have started to spin below 15,000 feet, and a short-lived F1 tornado (wind speed around 85 mph on the Fujita scale) touched down and crossed US Hwy 17 just south of the Conway Bypass cloverleaf, damaging power poles, trees and signs. As storms developed further down the coast, a weak tornado passed the Myrtle Beach Pavilion Amusement Park, and a waterspout erupted just off the beach at the 2nd Ave N Pier at about 4:20 PM. A waterspout is defined as a tornado over water, but they often develop more easily because they encounter less friction than twisters interacting with land, trees, and buildings.

The waterspout developed quickly into a large twister, briefly came ashore and moved along the beach as a tornado, doing F2 (wind speed around 125 mph) damage - flipping buses, ripping off roofs, shattering glass in hotels and stores, and downing signs and power lines.

Continuing south, the tornado moved off the beach as a waterspout again around 4th Ave S, and it moved down the coast about 100 yards off the beach all the way to 28th St S.

Before the waterspout reached Springmaid Pier, it moved ashore again as a tornado and did F1 damage to an RV park, destroying and damaging trailers, awnings, and decks. At about this time, the NWS was notified of a tornado at Myrtle Beach, and a tornado warning was issued at 4:33.

Continuing inland, the tornado weakened and did F0 (wind speed 65 mph) damage to trees and structures at Myrtle Beach International Airport before dissipating.

Because the radars gave us no indication of tornado development, we relied solely on spotter reports and 911 center information for reports. While we were late issuing a warning, it was the best we could do under the circumstances.

Since then, as in every summer, we received reports of small tornadoes and waterspouts, and if the report is reasonable, we issue warnings accordingly. Often the small twisters do not show up on radar as anything special, since the doppler radar cannot actually "see" a tornado - instead it detects rotation in a thunderstorm. We have learned that if the rotation is fast enough and tall enough, a tornado likely will form. Smaller twisters, especially small waterspouts, often do not have rotating "parent" thunderstorms.

Skywarn Spotters are critical to the warning process - ground truth is the final indicator of what is going on. Thanks for your help, and please keep it up!

NOAA Weather Radio

NOAA Weather Radio, the nation's automated radio weather warning system, will soon have a new voice. The National Weather Service evaluated five voices and reviewed 19,000 Internet survey comments from the public in the effort to find the new voice.

NOAA has awarded Siemens Information and Communication Network of Boca Raton, Fla., a \$633,615 contract for the voice

improvement. The weather service will begin implementation of the new voice's text-to-speech software program early in 2002.

The weather service first used a computer synthesized voice technology as part of a console replacement system in 1997. Automating NOAA Weather Radio enabled the weather service to send out multiple warnings over multiple transmitters simultaneously, allowing speedier delivery of severe weather warnings and more lead-time for the public.

"The old voice was state-of-the-art when first placed in service in 1997, but advances in artificial speech technology now make it possible for us to provide a service that is more understandable to the public," said retired General Jack Kelly, Director of the National Weather Service. "This reinforces our commitment to continuously use new technology to improve the timeliness and effectiveness of public warnings."

If you would like to listen to the new voice of the NOAA Weather Radio go to:

www.nws.noaa.gov/nwr/VIPstatus.htm#Status

Hurricane Season 2001

After a fairly dire prediction for the 2001 hurricane season, at the end of September most of us were breathing a collective sigh of relief. Although the likelihood of a major (Category 3 or higher) hurricane making landfall on the East Coast was half-again higher than normal, nothing had happened so far. **SO FAR!**

As of late September, there have been eight Atlantic tropical cyclones that reached Tropical Storm strength, with wind speeds reaching 34 knots or 39 mph. Three of them made landfall and caused rainwater flooding on the coast of the Gulf of Mexico: Allison, Barry, and Gabrielle. Four Tropical Storms reached Hurricane strength: 1) Erin, which became a major (Category 3) hurricane as it passed 100 miles east of Bermuda, 2) Felix, which became a major (Category 3) hurricane as it recurved eastward in the Central Atlantic, 3) Gabrielle, which crossed Florida as a Tropical Storm and became a

Category 1 hurricane well east of the Carolinas, and Humberto, which developed into a Category 2 hurricane about 100 miles west of Bermuda.

Are we out of the woods? Not yet! Although tropical cyclone activity decreases in October, the meanest hurricane to hit the Carolinas in recent history, Hazel, made landfall near Calabash on October 15, 1954...and hurricane season runs through November.

Renowned hurricane expert Dr. William Gray has chastised Americans for our arrogance against Mother Nature, quoting Federal Reserve Chairman Allen Greenspan's admonition about irrational exuberance during the late 90s heyday of the stock market. People thought Greenspan was wacky, and many take Dr Gray as an old quack. However, Gray cites historical evidence - we have had active hurricane landfall periods in the past, and we will see future damage five to ten times greater than we have ever seen before.

What's the Story with the Cool and Dry Summer We Had?

Across the area, the average temperature in July and September was on the cool side of normal by 2 to 4 degrees, while August temperatures were about normal or just a tad above normal. Temperatures never hit 100 at any of the airports in the area. Rainfall was about normal in the Sandhills and Pee Dee area, but below normal closer to the coast.

Global Warming? El Nino? La Nina? Arctic Oscillation? North Atlantic Oscillation?

Those are among many predictors that long range forecasters use to assess the weather situation, but this summer has been a real head-scratcher. The El Nino/La Nino oscillation was "neutral", meaning Pacific Ocean Temperatures were about normal, and not a factor to sway our situation. The other factors are relatively minor. What we know is what we saw, which was, generally, a pattern in the upper atmosphere where warmer and drier air prevailed over the Western states while a cooler flow from the

northwest prevailed over the East. That pattern helped to end the drought over Florida, as tropical rains were steered across the state, and it also fended off the tropical systems from the East Coast...keeping our long-term rainfall below normal.

New Automated River Gage installed along Black Creek

The El Nino Floods of 1998 along with the numerous hurricanes which have affected southeast North Carolina and northeast South Carolina during the past 5 years, have brought excessive, flooding rains to the region. These events have caused the rapidly rising Black Creek, located in Florence and Darlington counties, to come out of its banks numerous times, causing considerable damage to homes and property. The Black Creek area continues to be a closely monitored region due to the flood/flash flood potential.

The NWS in Wilmington, NC, has been working with local emergency officials and the United States Geological Survey (USGS) for several years with the goal of obtaining continuous river level readings on the Black Creek. Recently, the South Carolina USGS announced that funds would be available to both install and maintain an automated river gage along the Black Creek. The instrumentation, located in Quinby, SC, will record levels continuously and relay these readings via satellite. Continuous river level readings will be available on the South Carolina USGS website, as well as the website of the NWS Office in Wilmington, NC. United States Geological Survey personnel out of Conway, SC, installed the new gage at the end of September. Continuous readings will be available by the middle of October. This new automated gage will be an asset to the local community and the NWS. In the future, the NWS aims to utilize this new gage to provide forecasts levels along the Black Creek.. See the following websites:

nwsilm.wilmington.net/hydr/hydro.html Or
<http://www.sc.er.usgs.gov/>

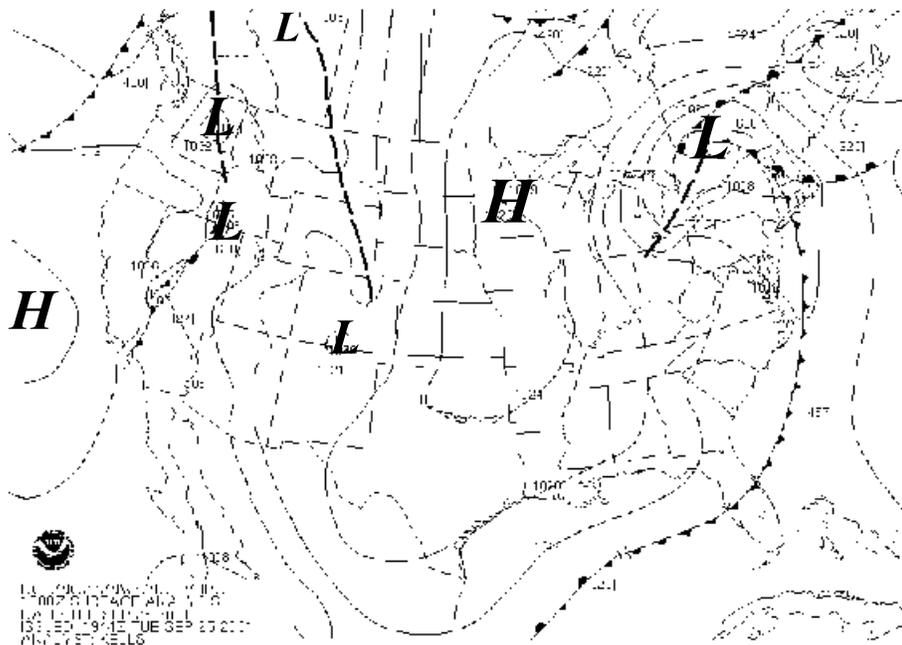
What's On the Weather Chart?

Clouds and weather swirl up, down, and around in the lowest vertical 10 miles or so of the atmosphere, and weather charts are made for many different levels. They are like snapshots taken with data from weather balloons, commercial aircraft, and satellites. Using upper level charts, we can see waves of air much like waves on the ocean. The most commonly seen chart, however, is the Surface Chart, which corresponds to conditions at about eye level.

At eye level we measure the effects of earth's gravity on the atmosphere above as Surface Air Pressure. Just as a weight scale measures your body's pressure on it, a barometer measures the pressure of the air above it. The more atmosphere above, the higher the pressure.

Here is an explanation of what the surface chart below is all about: First, see the toothy line just off the Carolina coast. This is a cold front, which is the front edge of cooler Canadian air that is pushing into the Carolinas. A front is located in the trough between two wave crests, with one crest over the Midwest, seen on the surface chart as the high pressure area centered over Minnesota (the other high pressure area is out of the picture, over the Atlantic). Behind a cold front, the air is cooler and usually drier with wind from the north, since cooler air normally comes from the North. The dashed lines also show minor pressure troughs, where the temperature and moisture in the air doesn't change much. A warm front is shown off the Massachusetts coast...as the warm front moves north, warmer air follows behind.

See how the cold front extends from the Gulf of Mexico across Florida and into New England to a Low Pressure center over southeast Canada (see the letter **L**) and all the close-spaced lines around the **L**. Those lines are called *isobars*, and the pressure is the same along those lines. As you get closer to the low pressure center the pressure gets lower. The whole low pressure mess, with troughs, cold fronts and warm fronts is spinning counterclockwise, and the air from higher pressure areas is feeding toward the Low center, and where it converges and must rise. As the moist air rises it cools, and the moisture condenses and precipitates as rain or snow, and if the condensation is fast and furious enough, as thunderstorms with hailstones.



MAR	APR		MAY		SPRING	
TMP DEP RAIN/DEP	TMP/DEP RAIN/DEP	TMP/DEP RAIN/DEP	TMP/DEP RAIN/DEP	TMP/DEP RAIN/DEP	TMP/DEP RAIN/DEP	TMP/DEP RAIN/DEP
WILMINGTON						
53.0/-1.4	8.26/ 4.38	63.8/ 1.5	0.90/-1.97	70.1/ 0.0	3.08/-1.35	62.3/ 0.0 4.08/ 0.4
NORTH MYRTLE BEACH						
52.2/-1.7	7.18/ 2.58	61.6/-0.2	0.92/-1.68	68.4/-1.3	2.29/-0.81	60.7/-1.1 3.46/ 0.1
FLORENCE						
53.7/-1.8	4.40/ 0.28	64.9/ 1.7	0.23/-2.53	72.3/ 1.3	1.76/-1.79	63.6/ 0.4 2.13/-1.4
LUMBERTON						
51.0/ N/A	4.31/ N/A	62.8/ N/A	0.22/ N/A	69.6/ N/A	4.02/ N/A	
OVERALL REGION WIDE (NOT INCLUDING LUMBERTON)						
52.9/-1.6	6.61/ 2.41	63.4/ 1.0	0.68/-2.06	70.3/ 0.0	2.38/-1.32	62.2/-0.2 3.22/-0.3

Question: What do you call the precipitation shaft underneath a shower?

Answer: The precipitation in the shower is rain, hail, snow, or virga.

Virga is defined as wisps or streaks of water or ice particles falling out of a cloud, but evaporating before reaching the earth's surface as precipitation. Virga is usually seen trailing from middle clouds—those having bases around 7,000 to 15,000 feet above the ground, but it might be seen from lower clouds with bases below around 7,000 feet.

Virga occurs when precipitation is falling through dry air and evaporating before reaching the ground. As the dry air beneath the cloud becomes more moist, precipitation will gradually fall lower and lower, eventually reaching the ground.

Virga can appear as straight lines or exhibit a hooked or curved form as the water or ice particles are blown by the wind as they fall. When seen from a distance, these streaks can be mistaken for funnels or tornadoes.

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