Carolina SkyWatcher

National Weather Service, Newport/Morehead City, NC

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Winter 2015-16 Edition

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Winter of 2014-15 Review

By Tom Lonka, Meteorologist

The winter season of 2014-2015 began dry and mild, though the second half of the winter made up for it by bringing several rounds of snow and ice, as well as some bitterly cold arctic outbreaks.

February, 2015 was the second coldest month on record at the Newport/ Morehead City NWS office since records began in 1994, and was one of the coldest months on record for many locations in the eastern United States. Cold temperatures in the teens and single digits combined with gusty winds to produce wind chills below zero on several different occasions. Eastern North Carolina was mostly spared from the threat of wintry precipitation until the second half of February, when the cold air combined with moisture from the Gulf of Mexico and Atlantic to produce several wintry precipitation episodes across the area. On February 16-17, 2015, a fast moving low pressure area moved south of the region, producing a wintry mix of precipitation across Eastern North Carolina. Precipitation fell as mix of sleet, snow, and freezing rain along and north of the Highway 264 corridor, with mainly freezing rain south of that line.

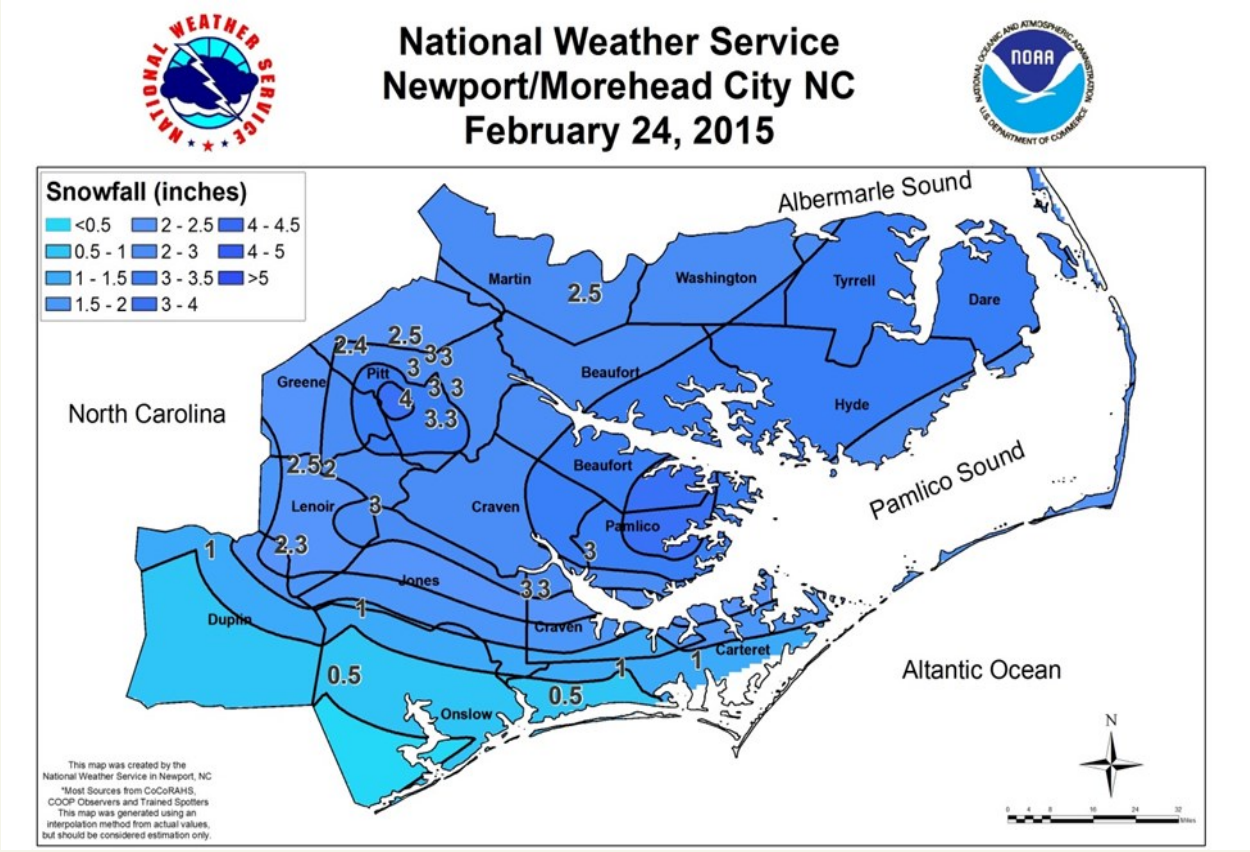
INSIDE THIS ISSUE

Ice weighing down trees in Washington County, Feb. 17, 2015. (Photo courtesy WITN TV.)

Winter of 2014-15 Review (Continued)

Only the Crystal Coast and the Southern Outer Banks escaped the wintry weather. Freezing rain accretion of a quarter to a third of an inch was fairly common across inland Eastern North Carolina. Widespread power outages were noted with numerous downed limbs and powerlines across portions of the Coastal Plains, with Pitt, Martin, Lenoir, Craven, Duplin and Jones Counties the hardest hit . Closer to the coast, precipitation fell as mostly rain, with rainfall amounts of over an inch common.

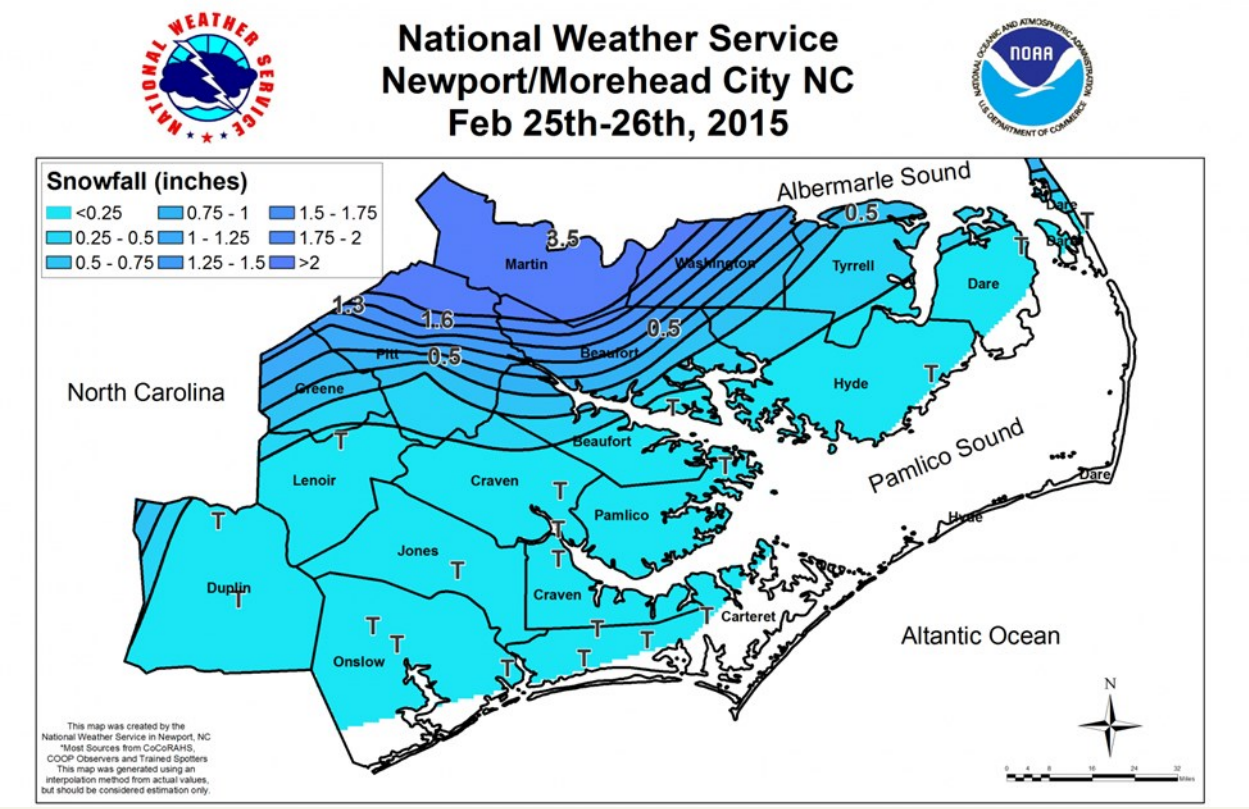
The most impactful winter storm occurred on Tuesday, February 24th, when low pressure passing by well to the south along a stationary front produced widespread precipitation across eastern North Carolina from morning through mid-evening. Ground temperatures were very cold and therefore allowed snow to accumulate quite efficiently on roads. Snowfall amounts of 2 to 4 inches were reported across a large portion of eastern North Carolina Along and just inland from the coast, around an inch of snow fell, then the precipitation briefly changed to sleet, and then a prolonged period of freezing rain with ice accretions of 0.2 to 0.3 of an inch as a warm nose aloft developed over the area.



Winter of 2014-15 Review (Continued)

The next round of wintry weather quickly followed on its heels. A stronger low pressure system formed in the Gulf of Mexico and moved northeastward just off the Carolina coastline. A period of sleet and snow fell, mainly across the northern tier of Eastern NC. Measurable snow fell generally along and north of the Highway 264 corridor, with Martin County receiving the lion's share of snow, around three inches .

In addition to the wintry precipitation, very cold temperatures were observed in mid February. On February 20th, low temperatures fell to 7 degrees in Plymouth and 9 degrees in Greenville, with daytime high temperatures remaining in the 20s at many area locations.



WINTER WEATHER SAFETY

By Tom Lonka, Meteorologist

Prepare! Don't Let a Winter Storm Take You by Surprise

Before the storm strikes, make sure your home, office and vehicles have the supplies you might need. Make sure farm animals and pets also have the essentials they will need.

Before the Storm

At Home and Work

Primary concerns are loss of heat, power and telephone service and a shortage of supplies if storm conditions continue for more than a day. Have available:

- Flashlight and extra batteries
- Battery-powered NOAA Weather Radio and portable radio to receive emergency information
- Extra food and water such as dried fruit, nuts and granola bars, and other food requiring no cooking or refrigeration.
- Extra prescription medicine
- Baby items such as diapers and formula
- First-aid supplies
- Heating fuel: refuel before you are empty; fuel carriers may not reach you for days after a winter storm
- Emergency heat source: fireplace, wood stove, space heater, properly ventilated to prevent a fire
- Fire extinguisher, smoke alarm; test smoke alarms once a month to ensure they work properly
- Extra pet food and warm shelter for pets

Review generator safety. You should never run a generator in an enclosed space. Home fires are common each winter when trying to stay warm. Review ways to keep your home and loved ones safe.

In Vehicles

Plan your travel and check the latest weather reports to avoid the storm! Fully check and winterize your vehicle before the winter season begins. Carry a Winter Storm Survival Kit:

- Mobile phone, charger, batteries
- Blankets/sleeping bags
- Flashlight with extra batteries.

WINTER WEATHER SAFETY (CONTINUED)

- First Aid Kit
- Knife
- High-calorie, non-perishable food
- Extra clothing to keep dry
- Large empty can to use as emergency toilet. Tissues and paper towels for sanitary purposes
- Small can and waterproof matches to melt snow for drinking water
- Sack of sand or cat litter for traction
- Shovel
- Windshield scraper and brush
- Tool kit
- Tow rope
- Battery booster cables
- Water container
- Candle and matches. Not only will the candle provide light if your flashlight dies, it can provide lifesaving heat.
- Compass and road maps (don't depend on mobile devices)

Keep your gas tank near full to avoid ice in the tank and fuel lines. Avoid traveling alone. Let someone know your timetable and primary and alternate routes.

Pets and Farm Animals

- Move animals to sheltered areas or bring pets inside. Shelter belts, properly laid out and oriented, are better protection for cattle than confining shelters, such as sheds.
- Haul extra feed to nearby feeding areas.
- Have water available. Most animals die from dehydration in winter storms.

Make sure pets have plenty of food, water and shelter.

During the Storm

What To Do If You're Caught Outside in a Winter Storm

When caught in a winter storm, there are life saving actions you can take to protect yourself outside, in a vehicle and inside your home or office.

Outside:

- **Find Shelter**: Try to stay dry and cover all exposed body parts.
- **No Shelter**: Build a lean-to, windbreak or snow cave for protection from the wind. Build a fire for heat and to attract attention. Place rocks around the fire to absorb and reflect heat.

WINTER WEATHER SAFETY (CONTINUED)

- **Melt Snow for Drinking Water**: Eating unmelted snow will lower your body temperature.
- **Exercise**: From time to time, move arms, legs, fingers and toes vigorously to keep blood circulating and to keep warm. Avoid overexertion such as shoveling heavy snow, pushing a car or walking in deep snow if you are not in good health. The strain from the cold and the hard labor may cause a heart attack. Sweating could lead to a chill and hypothermia.

In Vehicles:

If you must go out during a storm...

- Slow down! Even if the roads just look wet they could still be slick. More than 6,000 fatalities occur on the roadways each year due to weather conditions.
- Make sure your vehicle is completely clear of ice or snow before starting the trip
- Let someone know where you are going and what route you will take. If something happens, they will know where to start a search.
- Don't leave the house without the following:
  - Fully charged mobile phone and car charger

Emergency supplies kit for your car

- If you are driving and begin to skid, remain calm, ease your foot off the gas and turn your wheels in the direction you want the front of the car to go. If you have an anti-lock braking system (ABS), apply steady pressure to the brake pedal. Never pump the brakes on an ABS equipped vehicle.

If you are having trouble seeing due to weather conditions, pull over to the side of the road and stop your car until visibility improves. Turn off your lights and use your parking break when stopped so that another car won't mistakenly follow your tail/brake lights and end up hitting you.

If your car gets stuck during a storm...

- Stay in the vehicle!
  - Run the motor about 10 minutes each hour for heat.
  - While running the motor, open the window to avoid carbon monoxide poisoning.
  - Clear snow from the exhaust pipe to avoid gas poisoning.
  - Be visible to rescuers
  - Turn on the dome light at night when running the engine.
  - Tie a bright colored cloth, preferably red, to your antenna or door.

After snow stops falling, raise the hood to indicate you need help.

HEAVY RAIN AND COASTAL FLOODING, OCT 2-6, 2015

By Chris Collins, Meteorologist

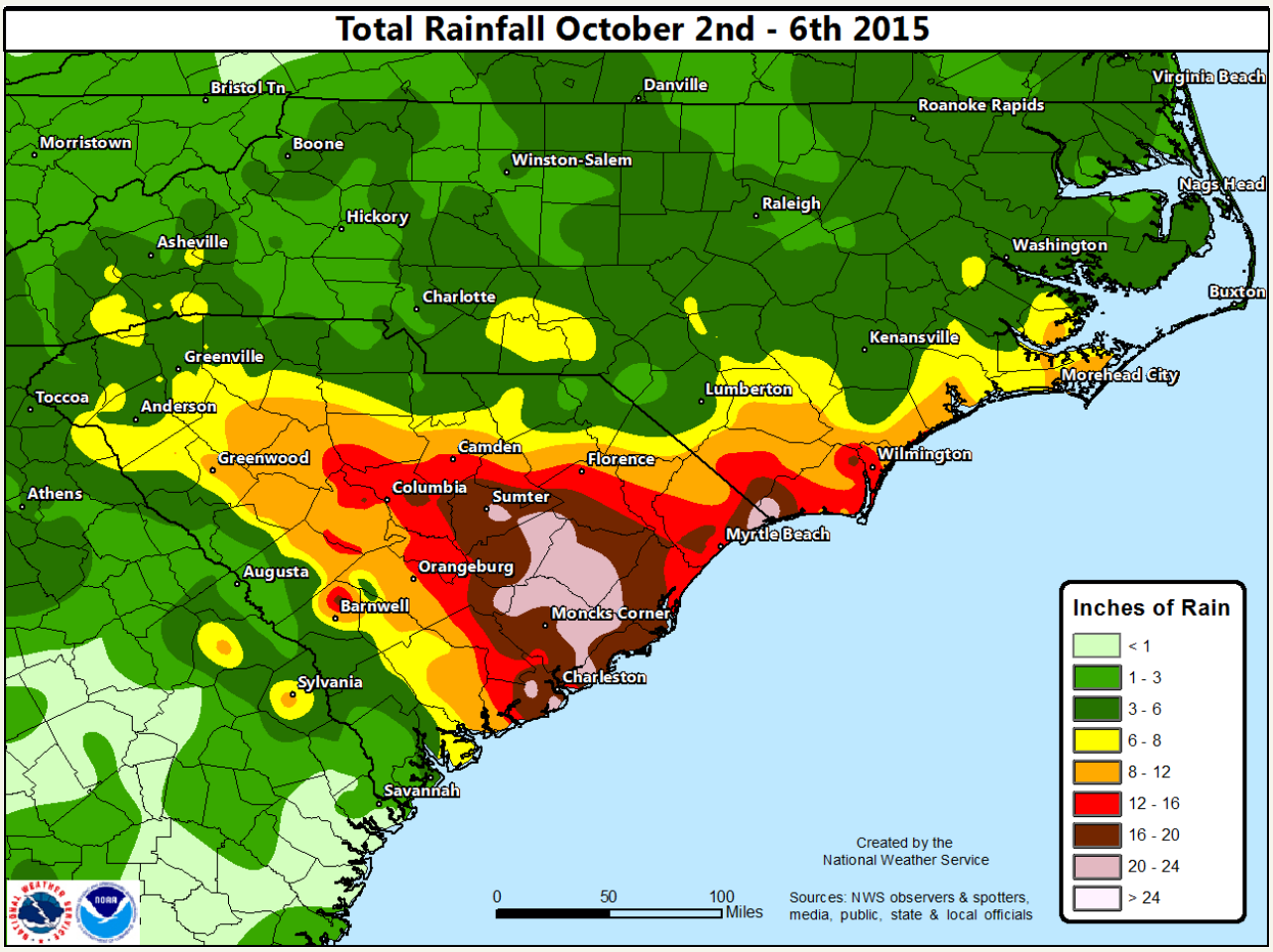
The combination of Hurricane Joaquin passing well to the east, an upper level low pressure system off the Southeast U.S. coast and a stalled cold front led to an event that produced a wide variety of impacts across eastern North Carolina during the first week of October, 2015. Major coastal flooding, very heavy rainfall and strong winds impacted much of eastern North Carolina for several days. This is the same storm system that brought historic rainfall amounts to the Charleston and Columbia areas in South Carolina, as well as parts of southeast North Carolina.

Water levels were already elevated across eastern North Carolina due to some of the highest astronomical tides of the year. These high tides coupled with persistent gusty east to northeast winds resulted in areas of moderate to major coastal flooding along the Outer Banks and many sound-side locations. Water level rises of 2 to 4 feet above normal, with locally higher values were observed. On the Northern Outer Banks, Highway 12 was closed at Kitty Hawk due to ocean overwash and dune breaches as major flooding occurred . Many streets in and around downtown Columbia flooded, roads around Aurora in Beaufort County became impassible, water rescues were conducted for 3 individuals near Hobucken in Pamlico County, and moderate to major coastal flooding was observed throughout Downeast Carteret County, especially around Cedar Island, and in the downtown areas of Beaufort and Morehead City. Major flooding and beach erosion was also reported at North Topsail Beach.

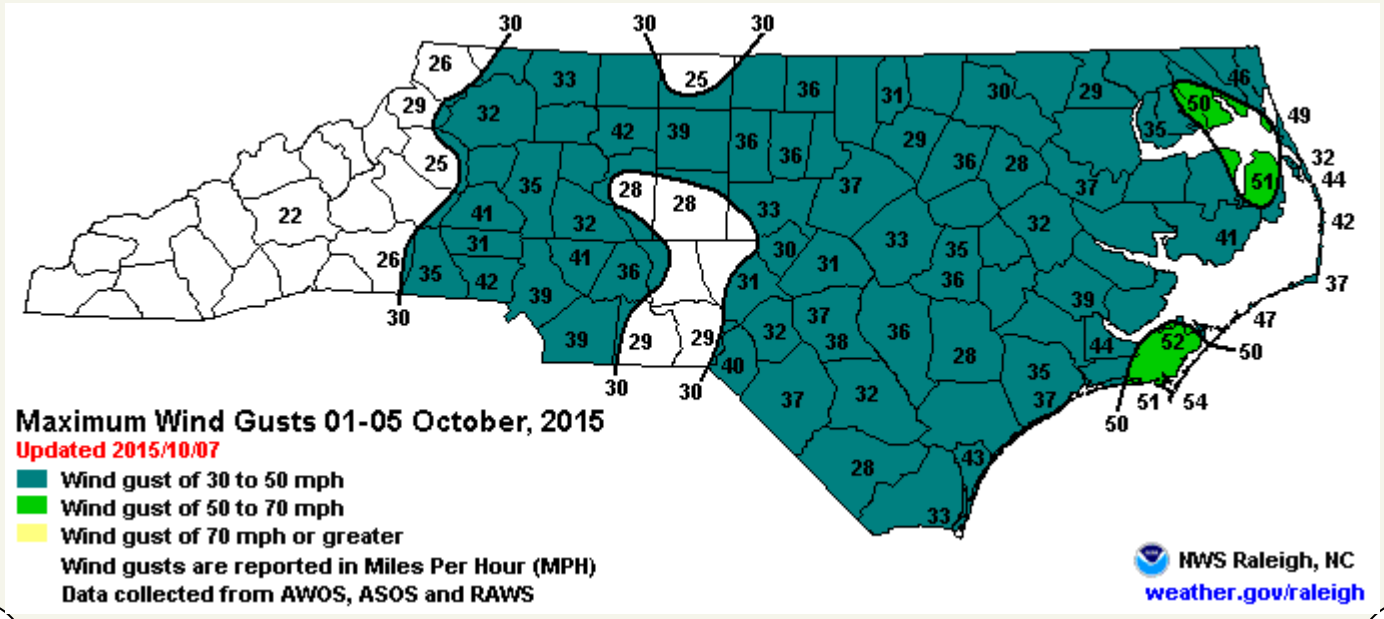
For the period from October 2 through 6, 2015, rainfall totals of 6 to 12 inches occurred across eastern North Carolina with the heaviest totals near the coast. Historic flooding was observed in South Carolina, where Charleston reported upwards of 2 feet of rainfall. Combined with another heavy rainfall event the previous week, eastern North Carolina recorded from 10 to upwards of 20 inches of rainfall. The Beaufort Airport recorded 21.57 inches of rain in the period from September 25 through October 6, 2015.

The pressure gradient between developing surface low pressure off the Georgia/ South Carolina coast, and high pressure over New England led to a prolonged period of persistent gusty northeast to east winds across eastern North Carolina and the adjacent coastal waters and sounds. This acted in concert with already elevated water levels due to high astronomical tides to greatly increase water levels.

HEAVY RAIN/COASTAL FLOODING (CONTINUED)



Rainfall Totals across the Carolinas, October 2-6, 2015



Peak Wind Gusts across North Carolina, October 1-5, 2015 (Courtesy NWS Raleigh, NC

HEAVY RAIN/COASTAL FLOODING (CONTINUED)

Coastal Flooding at Kitty Hawk

Flooding at Cedar Island

Flooding in Downtown Beaufort

Flooding in Downtown Morehead City

NEW ANALYSIS TOOLS FOR NWS FORECASTERS

By Hal Austin, Meteorologist

This fall, forecasters at National Weather Service Newport were given a new set of analysis tools. It's called Multi-Radar Multi-Sensor (MRMS). MRMS is the result of over 10 years of published research, application development, and operational testing by researchers at NOAA's National Severe Storms Laboratory (NSSL), in collaboration with the National Weather Service, marking another NOAA research to operations success.

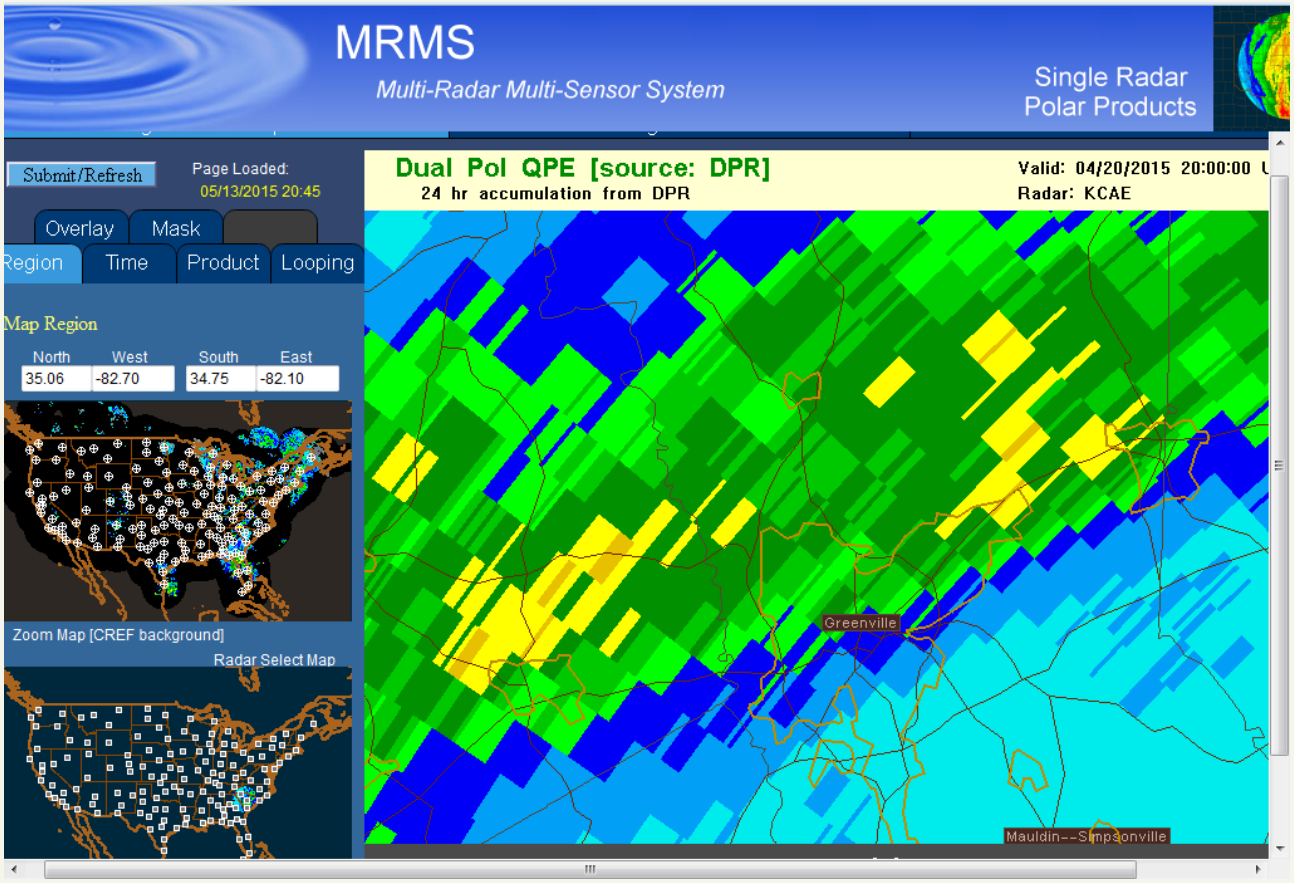
Why is it called MRMS? First, it's *Multi-Radar*. It exploits the overlapping coverage of the National Weather Service Doppler radar network with adjacent Canadian radars to build a seamless, rapidly-updating, high-resolution, three-dimensional cube of radar data. Secondly, it's *Multi-Sensor*. It objectively blends the radar data with data streams from satellites, surface observations, upper air observations, lightning detection systems, rain gauges and numerical weather prediction models to produce a suite of highly-robust, more accurate, more precise, and more timely decision-support products *every two minutes*.

How is the data used? MRMS utilizes automated algorithms to quickly and intelligently integrate all this data, providing better depictions of high-impact weather events such as tornadoes, hail, heavy rain and snow. This helps improve decision-making capabilities of NWS forecasters to quickly diagnose severe and hazardous weather. It allows them to issue more accurate and earlier warnings, advisories and forecasts, which will save lives and property. NWS Newport forecasters analyze the data on AWIPS computer system workstations.

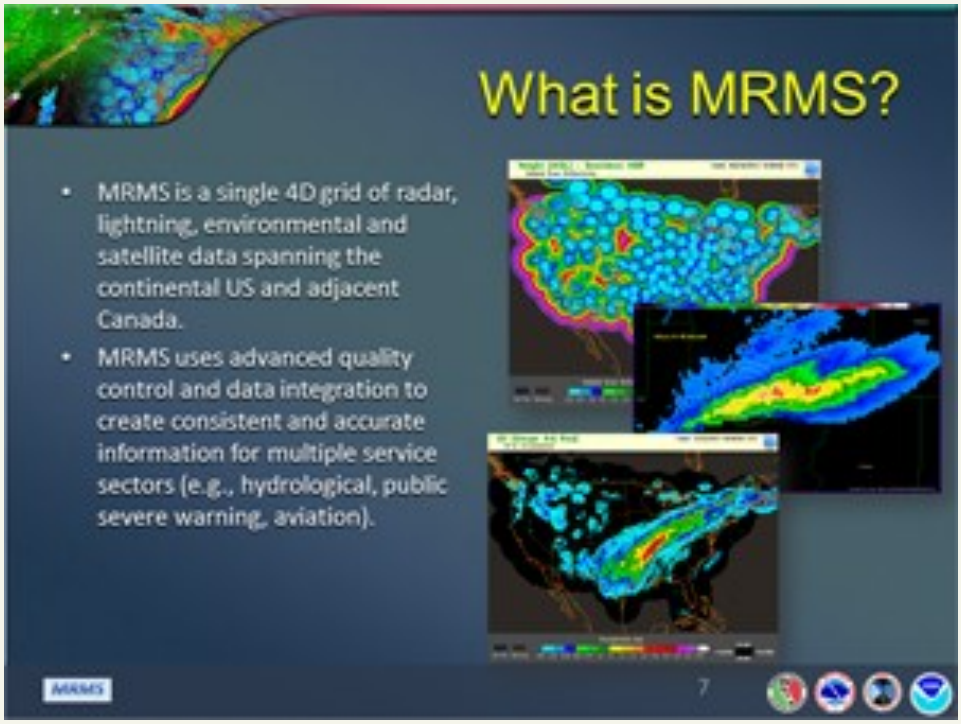
Elsewhere, MRMS data are an input into the powerful High-Resolution Rapid Refresh (HRRR) weather model, which will improve the quality of forecasts and warnings for severe weather events. MRMS is also being used to develop and test new Federal Aviation Administration (FAA) products in addition to advancing techniques in air traffic routing, quality control, icing detection, and turbulence in collaboration with the National Center for Atmospheric Research, the University Corporation for Atmospheric Research, and Lincoln Laboratories.

NSSL researchers plan to continue their collaboration with NOAA partners such as developers, trainers and NWS forecasters to collect best practices and case studies. The system is designed so that new techniques and products can be added, increasing its capabilities.

NEW ANALYSIS TOOLS (CONTINUED)



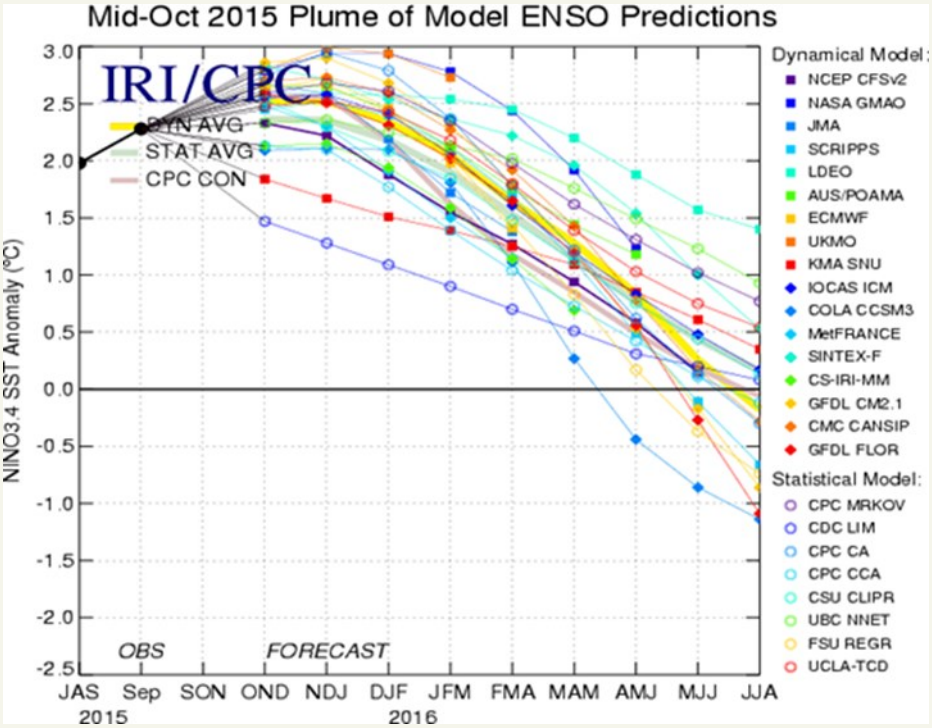
Example of data from the MRMS (Multi-Radar Multi-Sensor System) Webpage.



2015-16 WINTER WEATHER OUTLOOK

By Bel Melendez, Meteorologist

When the Climate Prediction Center (CPC) and the National Hurricane Center (NHC) predicted a less active hurricane season for the Atlantic Basin during the Spring of 2015, one of the primary reasons given was El Nino. As we head into the winter months, the waters over the equatorial Pacific Ocean continue to warm. This warming, interacting with the atmosphere is helping to change the global weather patterns. As of November, we are in a strong El Niño and the climate models continue to indicate it will become a very strong El Niño during this year's winter months.

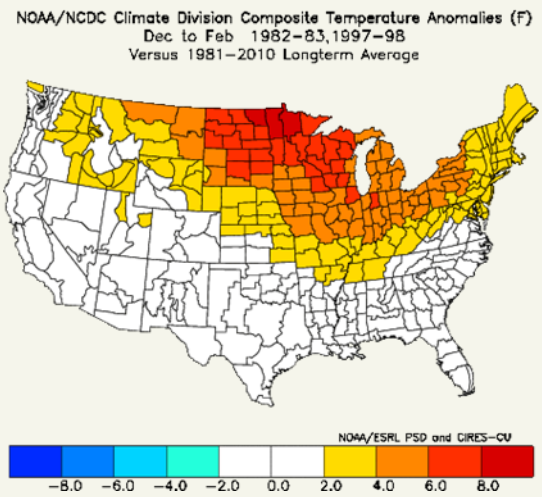


El Nino Model Predictions from October 2015

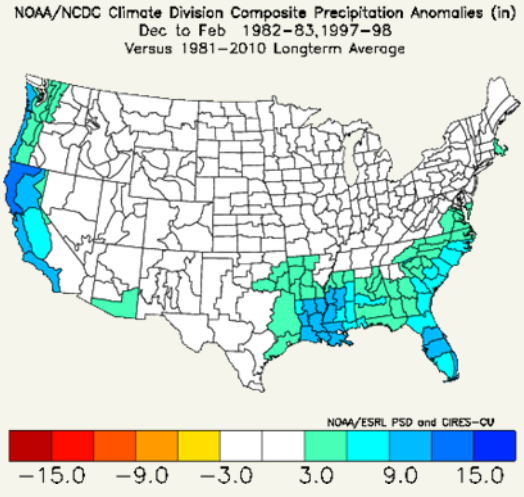
El Niño has a strong influence during our winter months, with less impact during the summer. Eastern North Carolina experienced a winter El Niño back in 2009-2010, which brought cooler and wetter conditions across the area. However, each El Niño season can bring different impacts based on its strength (weak, moderate, strong and very strong). There are other factors that can play a role during the winter months, such as the Arctic Oscillation, better known as the Polar Vortex. Therefore, the Climate Prediction Center (CPC) is predicting this winter to be one of the strongest El Niño's on record. CPC looks at various indices including previous El Niño ENSO and previous winter weather trends to assist in making a winter

2015-16 WINTER WEATHER OUTLOOK (CONTINUED)

winter weather outlook. Your local NWS office did some analysis of what we can expect for Eastern North Carolina, based on very strong El Niño's that we have had previously during the winters of 1982-83 and 1997-98.

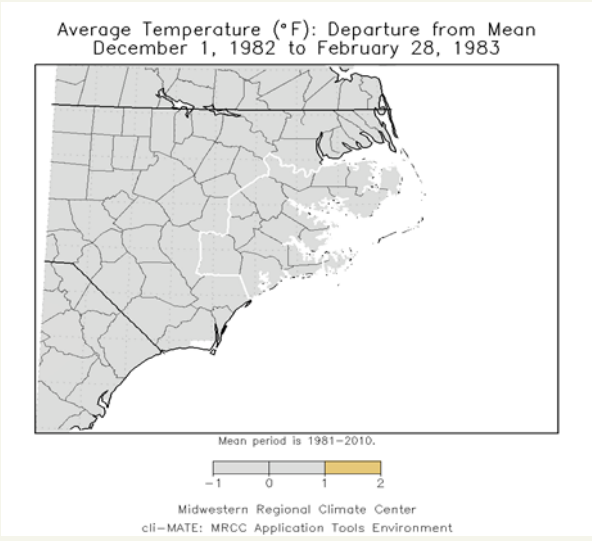


Temperature Anomaly Winter 1982-83, 1997-98

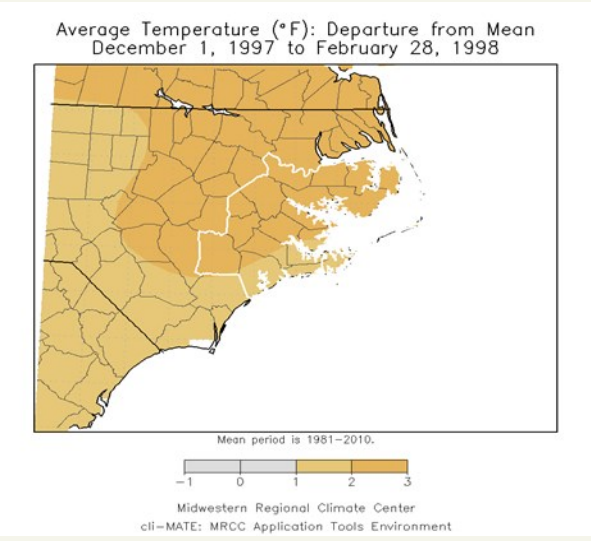


Precipitation Anomaly Winter 1982-83, 1997-98

Interestingly, there is no strong signal in the temperature anomaly data to determine if temperatures will be warmer or cooler than normal. This equates to an equal chance of warm, cool and/or average temperature for the winter months. The precipitation anomaly does indicate a strong signal of wetter conditions versus dry. NWS Newport/Morehead City looked further in what happened during the 1982-83 and 1997-98 El Niño years, but as individual seasons. The results were:



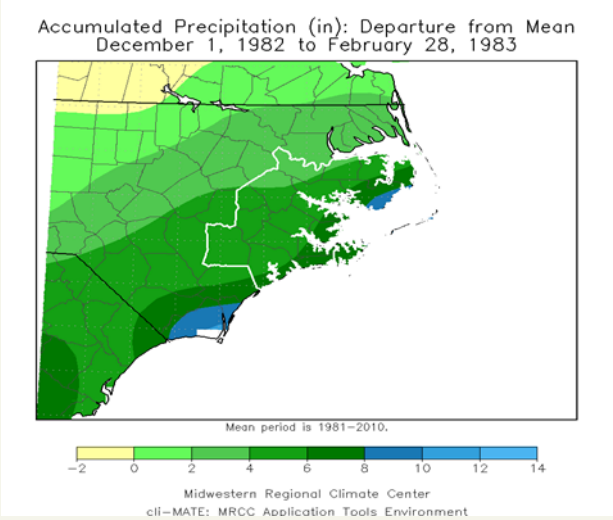
1982-83 temperature anomaly .
Temp departures for both 1982-83 & 1997-98 Winter El Niño.

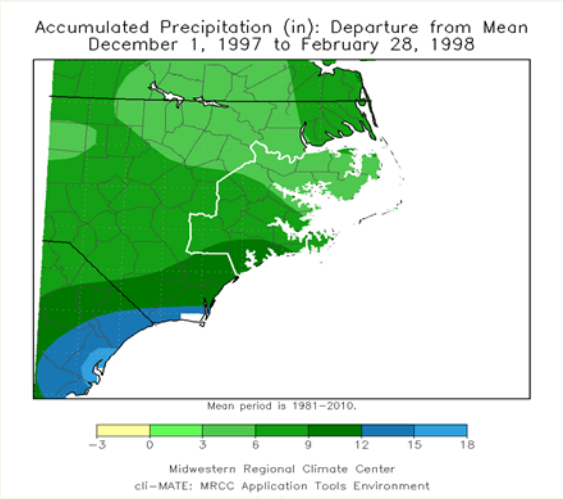


1997-98 temperature anomaly
While 1982-83 was near average, 1997-98 was 1 to 2 degrees above average.

2015-16 WINTER WEATHER OUTLOOK (CONTINUED)

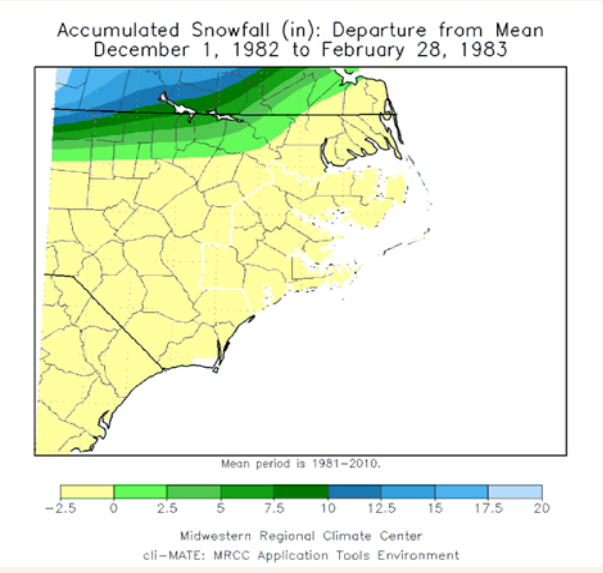
Based on these previous El Nino winters, a conclusion can be made for an average to slightly milder winter in terms of temperature. The average temperature over Eastern NC ranges between 43°F (inland) to 49°F (coast) during the winter months. Precipitation trends from the previous winters point to a wet winter.



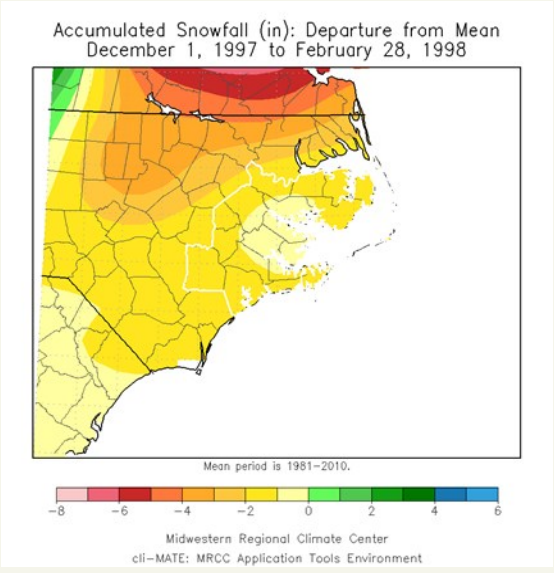


Departures from accumulated precipitation for both 1982-83 & 1997-98 Winter El Niño. In 1982-83 precipitation departures were 2 to 10 inches above normal while in 1997-98 (precipitation was 3 to 12 inches above normal. Highest precipitation mainly occurred along the coast.

During the 1982-83 and 1997-98 winter El Niño, snowfall was average to below average according to the climate records. Average snowfall over Eastern NC is 1 to 3.5 inches, and in the previous El Nino winter, below average snowfall totals was observed for both 1982-83 and 1997-98 El Niño seasons.



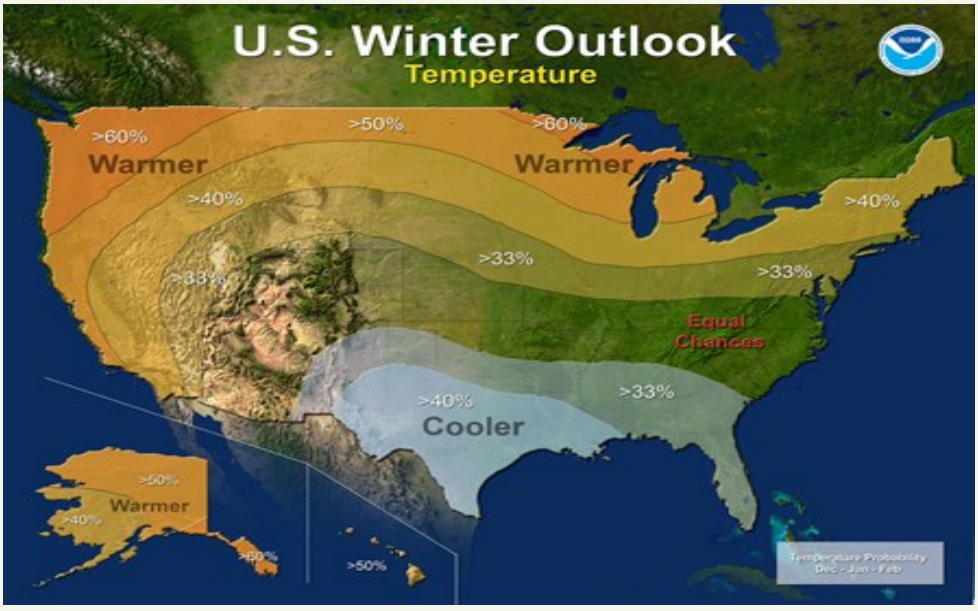
Snowfall departures for Winter 1982-83



Snowfall departures for Winter 1997-98

2015-16 WINTER WEATHER OUTLOOK (CONTINUED)

Overall, NWS Newport/Morehead City has analyzed impacts from the previous very strong El Nino winter seasons, and concludes that the forecast will be very similar to Climate Predication Center's annual Winter Outlook. El Nino will not be the only driver this winter, other factors such as Arctic Oscillation can influence our weather pattern. Remember that the frequency, number, and intensity of these weather related events cannot be predicted within a seasonal forecast.

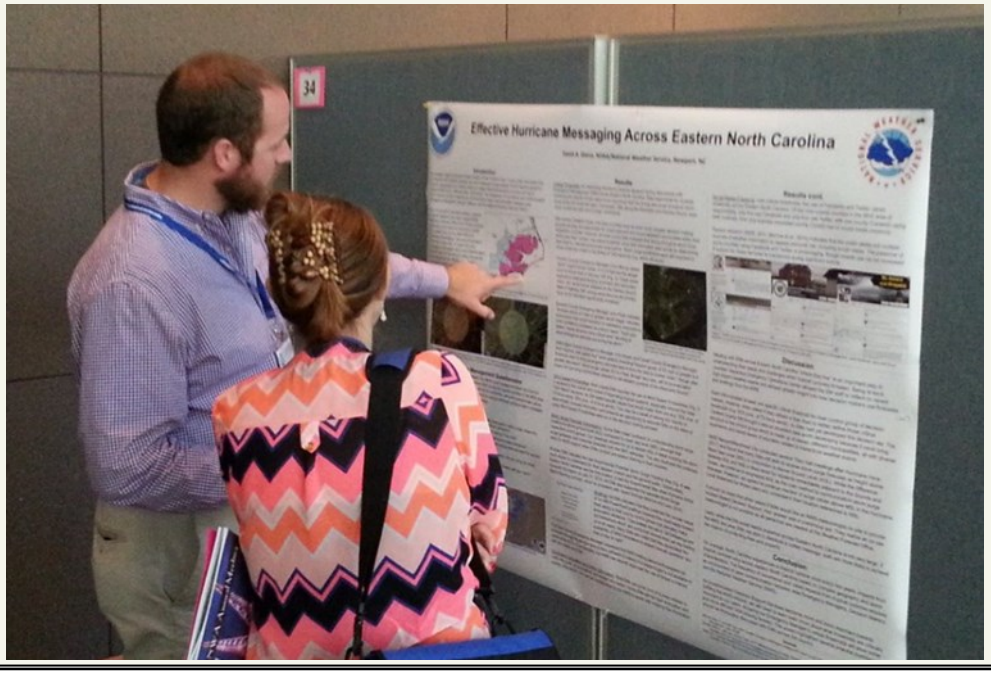


NWS NEWPORT REPRESENTED AT CONFERENCE

By David Glenn, Meteorologist

The NWS Newport/Morehead City office was represented at the National Weather Association's 40th Annual Meeting in October in Oklahoma City. General Forecaster, David Glenn, presented a poster on Effective Hurricane Messaging across Eastern North Carolina. The theme for the NWA meeting was "Power of the Past; Force of the Future."

Unfortunately, Eastern North Carolina is impacted by tropical storms or hurricanes about once every two years. The frequency of tropical impacts highlights how important effective messaging is for the various hurricane hazards across our area. The poster presented the results of meeting with coastal Emergency Managers across our area of responsibility to help better understand decision trigger points (e.g. timing of tropical storm force winds [39 mph]), storm surge forecast interpretation including the new Experimental Potential Storm Surge Flooding Map, and the local evacuation decision making process. We are fortunate to have a very strong working relationship with area Emergency Managers and gleaned very valuable information from these meetings. Results indicate that Emergency Managers and local Decision Makers have varied thresholds for issuing critical evacuation orders, often dependent on local geography and storm specific characteristics. For example, forecast values of storm are more important than wind speed for counties adjacent to the slosh-prone Pamlico Sound, while the timing of tropical storm force winds remains paramount for counties adjacent to the Atlantic Ocean. The NWA agenda is available here: http://www.nwas.org/meetings/nwas15/agenda.html. Some presentations are also available for download.

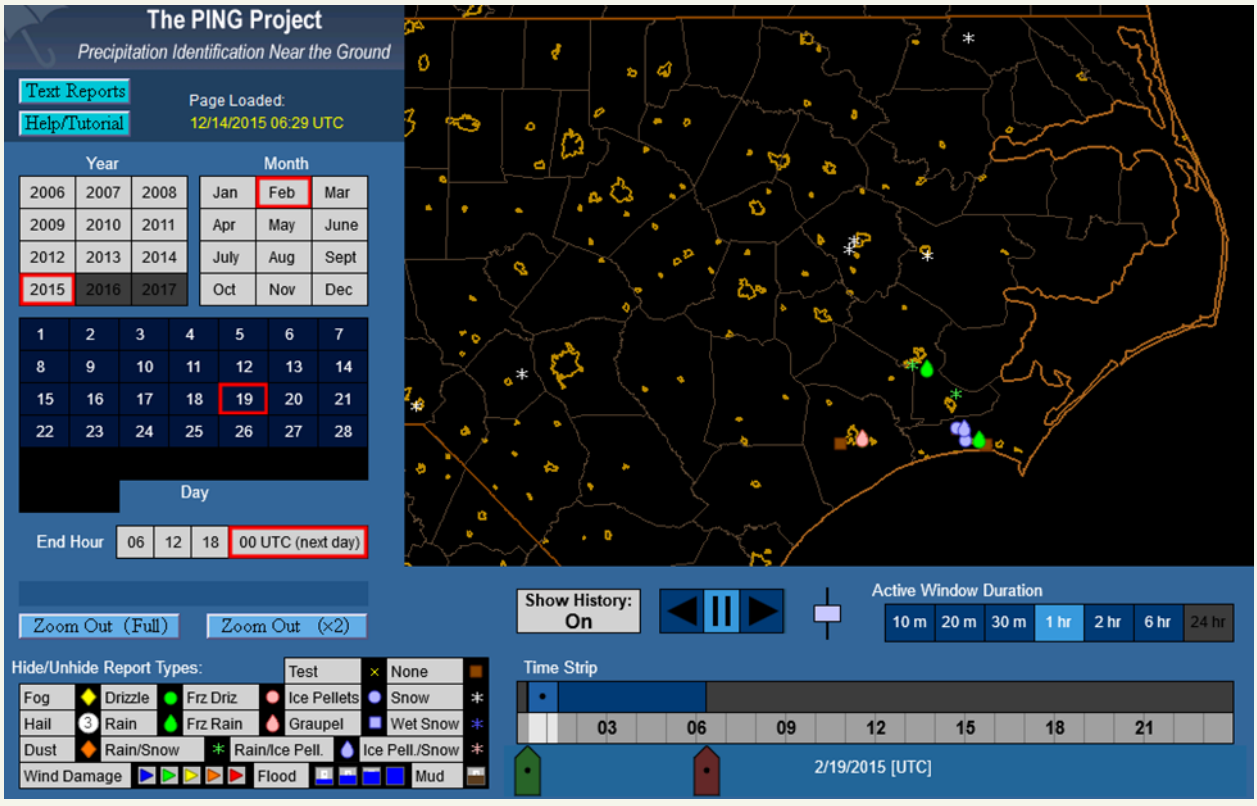


Let us know the weather where you are - join m-ping

By David Glenn, Meteorologist

The NOAA National Severe Storms Laboratory is collecting public weather reports through a free smart-phone or tablet application in a project titled *Meteorological Phenomena Identification Near the Ground* (mPing). Reports from mPing are archived and immediately displayed on a map accessible to the public.

Reports from mPing are invaluable to National Weather Service forecasters as they provide ground-truth observations at a high density, in near real-time, and below the lowest radar elevations. These reports are extremely useful during mixing precipitation type events where rain transitions to freezing rain, sleet, or snow. The mPing display below indicates snow, sleet, and freezing rain event that occurred on February 19th, 2015, across Eastern North Carolina. Note the snow reports in Pitt and Beaufort Counties, and the rain/freezing rain/ice pellets across Onslow, Craven, and Carteret Counties.



The mPing application is available on iTunes and Google Play for use on both phones and tablets. Follow this project and others on the NSSL Facebook page. Please join the mPing citizen science effort and let us know your weather!

NWS NEWPORT STUDENT VOLUNTEER PROGRAM

By Casey Dail, Meteorologist

Are you a student interested in a career with the National Weather Service or in the field of meteorology? If so, our student volunteer program may be right for you. Our program is designed to provide students with an opportunity to learn about the science of weather forecasting, along with education about other NOAA agencies. This is done through several approaches including computer based learning, research, and job shadowing.

The student volunteer program, though not a paying position, has many benefits for college or graduate students and recent graduates. Competition for positions within NOAA's National Weather Service (NWS) has increased in recent years, and it has proven beneficial for recent college graduates to have prior forecasting operational experience when they apply for positions within the NWS. Because of resource restraints, only a few students are selected to the student volunteer program through a competitive application process. Selected students may also be able to gain college credit for their time spent here at the NWS. Students will be required to complete a research project during their time at the office. The research can cover a range of topics from specific forecasting challenges to significant event reviews. Several of our previous volunteers have gone onto graduate school, jobs within the National Weather Service as well as private sector positions in the meteorology field.

The volunteer program will be available for current undergraduate or graduate level students:

Majoring in meteorology or other related sciences
Available to volunteer for at least 120 hours between late May and early August
Be in good academic standing

The 2016 application will become available in mid-January on the NWS MHX website (http://www.weather.gov/mhx/StudentInterns). If you have questions or are interested in meteorology and would like to learn more about the program please contact Casey.Dail@noaa.gov (252-223-5122).

National Weather Service

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Website: http://weather.gov/Newport

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Wind Chill Chart

Wind (mph) \ Temperature (°F)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5		36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10		34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15		32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20		30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25		29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30		28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35		28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40		27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45		26	29	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50		26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55		25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60		25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes | 10 minutes | 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T = Air Temperature (°F) V = Wind Speed (mph)

Effective 11/01/01

To report adverse weather conditions 24/7, please call us at: **1-800-889-6889**