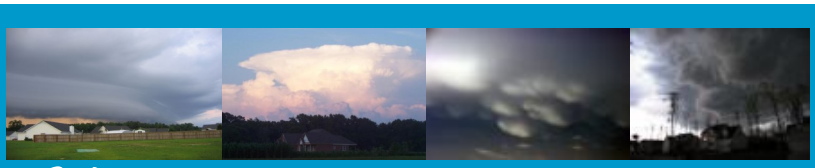

# Changing Skies Over Central North Carolina

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NOAA'S NATIONAL WEATHER SERVICE RALEIGH, NC

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# El Niño Putting Breaks on 2015 Atlantic Hurricane Season...so far.

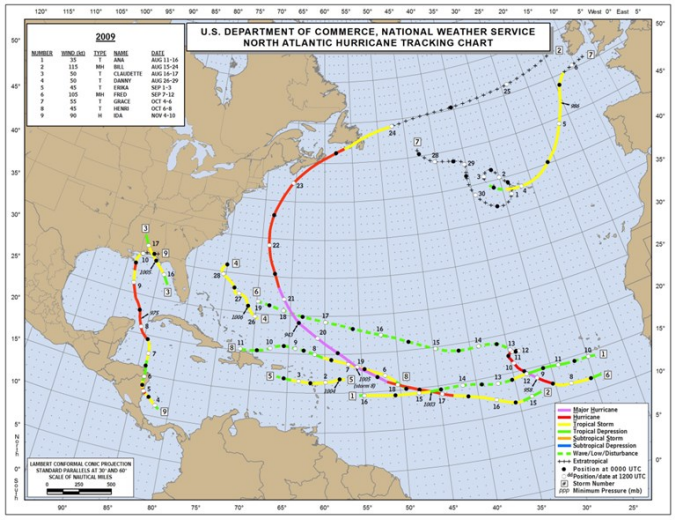



**Fig 1. 2009 North Atlantic Hurricane season Track Map**

Sometimes, it is hard to link planetary scale phenomenon, like El Niño, to smaller scale weather features, but the link between tropical cyclone activity in the Atlantic Basin and El Niño is relatively clear.

El Niño and La Niña represent the warm and cool phases of the El Niño/Southern Oscillation (ENSO) cycle, respectively. The ENSO cycle refers to the coherent and sometimes very strong year-to-year variations in sea-surface temperatures, convective rainfall, surface air pressure, and atmospheric circulation that occur across the equatorial Pacific Ocean. El Niño refers to the periodic warming (warm phase) in sea-surface temperatures across the central and east-central equatorial Pacific, while La Niña refers to the cold phase. Both are naturally occurring phenomena that result from interactions between the ocean surface and the atmosphere over the tropical Pacific. Changes in the ocean surface temperatures affect tropical rainfall patterns and atmospheric winds over the Pacific Ocean, which in turn impact the ocean temperatures and currents and can cause changes in the weather patterns around the world. Basically, El Niño shifts the global pattern and places once favorable for tropical cyclone formation are no longer as favorable. NOAA's Climate Prediction Center (CPC) declares the onset of an El Niño episode when the 3-month average sea-surface temperature departure exceeds 0.5 C in the east-central equatorial Pacific. While this may not seem like a very big difference in temperature, the energy that has to go into raising the temperature of a basin of water as large as the Pacific Ocean is quite substantial. There is also such a thing as "ENSO-neutral," which refers to those periods when neither El Niño nor La Niña is present. During these periods, the ocean temperatures, tropical rainfall patterns, and atmospheric winds over the equatorial Pacific Ocean are near the long-term average.

So, how do El Niño and La Niña affect the Atlantic hurricane season? An easy way to think of it would be that El Niño results in less Tropical Cyclone formation and La Niña results in more Tropical Cylones. During El Niño years there are more hurricanes in the Pacific and less in the Atlantic. This is largely due to the lower (higher) vertical wind shear over the Pacific (Atlantic). Wind shear is bad for hurricanes and thus lower shear is more favorable for Tropical Cyclone formation. The opposite follows for La Niña years. Currently, we are in an El Niño phase,

**(continued on page 7)**

# NC Emergency Management Urges Preparedness During Hurricane Season


**Emergency Preparedness Kit (NCDPS-NCEM)**

*"As we saw in early May with Tropical Storm Ana and last year with Hurricane Arthur, tropical storms and hurricanes can occur any time. While most storms tend to strike North Carolina between August and October, it's never too early to be ready."*

Summer in North Carolina is famous for beach trips, fresh local produce and lazy days. It's a great time to kick back and relax. In North Carolina, summer relaxing goes hand-in-hand with hurricane preparation.

"North Carolina is known for its pristine beaches and relaxing atmosphere yet it is a lightning rod for tropical storms," said Mike Sprayberry, North Carolina Emergency Management Director. "As we saw in early May with Tropical Storm Ana and last year with Hurricane Arthur, tropical storms and hurricanes can occur any time. While most storms tend to strike North Carolina between August and October, it's never too early to be ready."

North Carolina has seen its share of damaging hurricanes. Since 1954, 27 hurricanes or tropical storms have had lasting impacts on the state. According to the National Weather Service, a tropical storm or hurricane will make direct landfall on North Carolina's coast about once every two years.

"No part of our state is immune from tropical storms and hurricanes," said Sprayberry. "The heavy rain, damaging winds and flooding brought by hurricanes can devastate a community. Many residents remember the destruction Hurricanes Hugo, Fran, Floyd, Frances, Ivan and Irene caused; power outages, floods, landslides, toppled trees and wind destruction."

Hurricane Arthur, a Category 1 storm that struck July 3, 2014, made history as the earliest hurricane to make landfall in North Carolina since 1901.

**Be Ready**

Take steps to be ready long before the first storm warnings are issued. Make an emergency plan, then practice it with your family. Write down the evacuation routes you may need. Build – or update- an emergency supply kit and have it ready to go with enough non-perishable food and bottled water (1 gallon per person per day) to last three to seven days.

**Kits also should include:**

- Copies of insurance papers and identification sealed in a watertight plastic bag
- First-aid kit
- Weather radio and batteries
- Supply of prescription medicines
- Bedding
- Changes of clothes
- Hygiene items such as toothbrush, toothpaste, soap and deodorant

- Cash or checkbook
- Pet supplies including food, water, leashes, bedding, muzzle and vaccination records

Stay informed during severe weather using a battery-powered radio. Monitor the weather reports and heed the warnings of local and state officials. Evacuate quickly when told to do so. And pay close attention to flooded or washed-out roads.

Also, review and update your homeowners' or renters' insurance policies to make sure they include coverage for accidental damage, natural disasters and, if necessary, flood insurance.

Sprayberry said preparing for emergencies before they strike can make the recovery process easier and quicker.

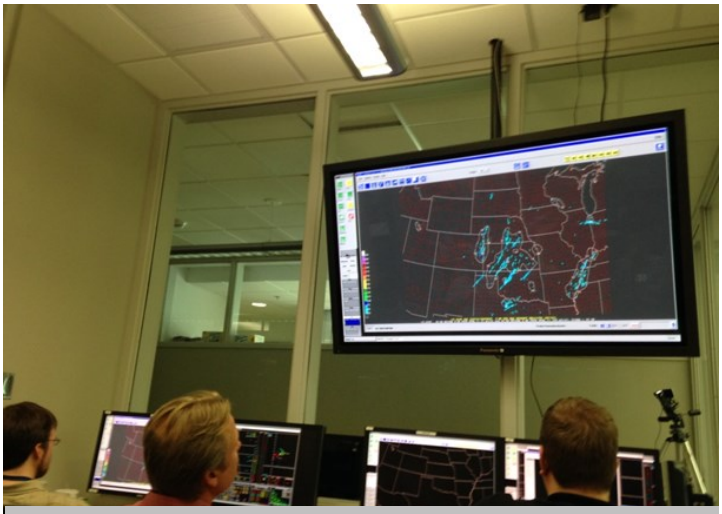
The free ReadyNC mobile app provides real-time information on traffic, weather, opened shelters and riverine flood levels. It also provides basic instructions on making emergency plans, supply kits and what to do before, during and after different emergencies. Go to

http://www.ReadyNC.org

for more information and details on how to develop an emergency supplies kit and specific details about preparing your home for a hurricane.

**-Laura Leonard**

# NWS Raleigh Forecasters Test New Forecast Techniques in Oklahoma



**Hazardous Weather Testbed in Norman, OK**

A great deal of important meteorological research is done every day around the world. The task of linking researchers and operational meteorologists is often accomplished through something called "research-to-operations", abbreviated R2O. In R2O, various tests and experiments are designed and conducted in which operational forecasters try out the latest and greatest discoveries and innovations from the research community, to assess their effectiveness and viability in an operational environment.

Over the last few years, several forecasters at NWS Raleigh have been fortunate to have been a part of a crucial R2O-focused laboratory called the Hazardous Weather Testbed, or HWT. The HWT is conducted each spring and summer at the National Severe Storms Laboratory (NSSL) in Norman, OK, and comprises several different experiments that focus on hazardous weather needs. Forecasters from around the world are brought into the HWT every year to test out new ideas and techniques.

This past May, WFO Raleigh Senior Forecaster Gail Hartfield had the opportunity to participate in the Spring

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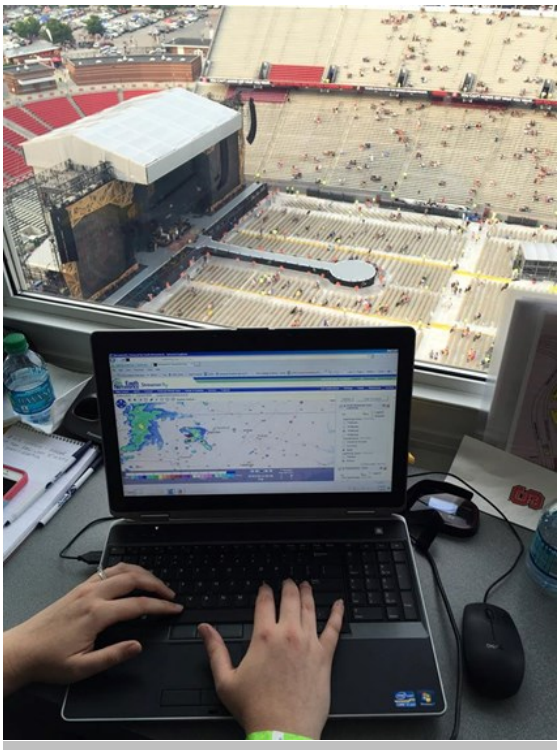
# NWS Raleigh Provides Decision Support at Rolling Stones Concert



**Forecaster Katie Dedeaux watching storms approaching Carter Finley Stadium**

*"The team briefed emergency officials as severe thunderstorms moved in from the west, potentially threatening the more than 40,000 attendees at this outdoor event."*

NWS Raleigh recently provided onsite decision support to North Carolina State University Emergency Management during the July 1st Rolling Stones Concert at NC State's Raleigh campus. Raleigh forecaster Katie Dedeaux and Hollings Scholar Raelene Campbell were on site in the stadium's fourth floor incident command post. The team briefed emergency officials as severe thunderstorms moved in from the west, potentially threatening the more than 40,000 attendees at this outdoor event. Fortunately, the storms weakened before reaching the stadium and the concert went on without weather-related delays.

Katie and Raelene learned several best practices from this event to improve on-site briefing services. The team discovered mobile internet can get quickly bogged down when 40,000 people in a confined area are using their smart phones and overwhelming the data flow provided by nearby cell phone towers. While there was just enough bandwidth available to maintain timely radar updates, they quickly adjusted their data strategy and refrained from downloading nonessential weather products.

Another best practice was the collaboration that took place not only between the onsite NWS staff and the emergency officials, but also between the onsite NWS staff and the staff back at the forecast office. Katie and Raelene frequently conferred by phone with the evening shift staff about pending thunderstorm warning decisions and storm timing. This collaboration was especially important given that severe thunderstorm warnings were in effect just a short distance west of the concert venue.

"In today's world, anyone can pull out their smart phone or tablet radar app and make a reasonable assessment about the thunderstorm potential at any given location; however, nothing beats having NWS expertise at your side when making weather-related decisions that can affect the safety of tens of thousands of people," said WCM Nick Petro, NWS Raleigh. "That's what onsite decision support services provided to our local, state, and federal government partners is all about," Petro said.

WFO Raleigh is housed on NC State's Centennial Campus. WFO Raleigh and NC State have a great relationship. In addition to supporting the university emergency managers, this decision support event provided a great learning opportunity for WFO Raleigh's Hollings Scholar Raelene Campbell. Raelene, stationed at Raleigh for the summer and working on a North Carolina Tornado Climatology project, had the opportunity to experience first-hand one of the key components of the NWS Weather-Ready Nation initiative.

WFO Raleigh has a growing decision support program that includes weekly impact weather briefings, high-impact weather webinars and email briefings, remote weather support via the state's 800 Megahertz radio system, a robust social media program, and on-site decision support services for high-impact events and incidents.
**-Nick Petro**

# When Seconds Count, StormReady Communities are Prepared

Nearly 90% of all presidentially declared disasters are weather-related, leading to around 500 deaths per year and nearly $14 billion in damage. To help Americans guard against the ravages of severe weather, NOAA's National Weather Service (NWS) designed the StormReady program. StormReady helps arm America's communities with the communication and safety skills they need to save lives and protect property.

Many laws and regulations exist to help local emergency managers deal with hazardous material spills, search and rescue operations, medical crises, etc., but there are few guidelines dealing with the specifics of hazardous weather response. The NWS recognized this need and designed StormReady to help communities of all kinds – towns, cities, counties, Tribal Nations, universities, airports, and industrial complexes – implement procedures to reduce the potential for disastrous weather-related consequences. To be recognized as StormReady, communities must meet guidelines established by the NWS in partnership with federal, state, and local emergency management professionals. More specifically, to be recognized as StormReady, communities must:

- Incorporate severe weather threats into their hazard mitigation and emergency response plans.
- Establish a 24-hour Warning Point and Emergency Operations Center.
- Establish multiple ways to receive severe weather warnings and forecasts and to alert the public.
- Create a system that monitors weather conditions locally.
- Promote the importance of public readiness through community seminars, severe weather spotter training and by conducting emergency exercises.

In early July, NWS Raleigh had the pleasure and honor of recognizing Raleigh-Durham International Airport (RDU) as its newest StormReady Community. The emergency management and safety personnel at RDU not only meet the six primary guidelines to become StormReady, but they also take the time to exercise their comprehensive hazardous weather response plan by conducting table top exercises and live drills, and NWS Raleigh representatives are often invited to participate in these drills. Communicating and collaborating with NWS Raleigh is a key component of RDU's severe weather readiness and awareness program. "I am always impressed by RDU's readiness and understanding of what they need to do to keep the folks who work at and travel through RDU safe during severe weather episodes," said Nick Petro, Warning Coordination Meteorologist at NWS Raleigh. "RDU takes severe weather seriously, and their proactive and protective actions during recent severe weather drills and live severe weather episodes have demonstrated that RDU is StormReady," said Petro.


**Raleigh-Durham International Airport officials receiving their StormReady recognition sign. From left: Michael Landguth, RDU President and CEO; Nick Petro, WCM NWS Raleigh, NC; Don Atkinson, RDU Airport Operations Officer; Duane Legan, RDU Vice President of Airport Operations; John Graves, RDU Director of Operations; and Richard (Dickie) Thompson, RDU Board Chairman.**

For more information about StormReady, please visit http://www.nws.noaa.gov/stormready.

**-Nick Petro**

# NWS Raleigh Participates in Local Broadcast Meteorology Conference

For many years, the NWS Forecast Office in Raleigh has fostered a strong partnership with our local community of TV meteorologists, helping each other in our missions to inform and protect the people of Central North Carolina. In June, we had the opportunity to meet with our media partners once again when two forecasters gave presentations at the American Meteorological Society's (AMS) Conference on Broadcast Meteorology and the Conference on Weather Warnings and Communication, which were held at the Raleigh Convention Center in downtown Raleigh. The AMS is the largest professional organization for meteorologists, with over 13,000 members from all across the weather and earth science community. The AMS publishes ten journals and conducts conferences all around the country several times a year. Over 250 meteorologists across the country attended this successful conference, whose program chairpersons included local TV meteorologist and producer Nate Johnson.

**NWS Raleigh Senior Forecaster Gail Hartfield discusses lightning prediction and communication of lightning threats to attendees of the broadcaster conference.**

Gail Hartfield, NWS Raleigh Senior Forecaster, gave a presentation titled, "Lightning Forecasts and Communicating Lightning Threats for Central North Carolina", in which she detailed the Raleigh office's past research into highly-active lightning days in North Carolina, recent research with Dr. Gary Lackmann at North Carolina State University (NCSU) concerning weather patterns associated with active lightning events, and the development of experimental lightning forecasts. Given that 23 people have been killed by lightning across the United States so far in 2015, well above the average, the topics of lightning prediction and improving communication of lightning threats to emergency officials and to the public were very timely and well received by the broadcast meteorologist audience.

Jonathan Blaes, NWS Raleigh Science and Operations Officer (SOO), gave a presentation titled, "Improving the Forecasts of Wind and Wind Gusts in Tropical Cyclones for More Effective Hazard Communication." This presentation, co-authored by NCSU PhD student Bryce Tyner and NWS Wilmington SOO Reid Hawkins, was the result of several years of intensive research and experimentation toward better forecasts of sustained winds and gusts during landfalling tropical cyclones, as well as improved presentation of these wind forecasts for the public and emergency officials. NWS Forecast Offices across the region have already had chances to apply these new forecast techniques for real-time storms, including Subtropical Storm Ana which affected the region this past May. This research group has collaborated with the National Hurricane Center to refine these forecast techniques and expand them to other areas. This new way of creating and presenting tropical cyclone wind information is expected to greatly help the broadcast meteorologists better convey the wind threats and impacts to the public.

These presentations aren't the only time that NWS Raleigh will be a part of AMS activities this summer. The AMS will be conducting their Summer Community Meeting in Raleigh in August, in which government, academia, and industry will be brought together to identify opportunities to collaborate, increase consistency, and build greater trust within the weather enterprise and outward to the public. Both Jonathan Blaes and NWS Raleigh Warning Coordination Meteorologist Nick Petro will participate in this meeting.

**-Gail Hartfield**

# El Niño and Atlantic Hurricanes (continued from page 1)

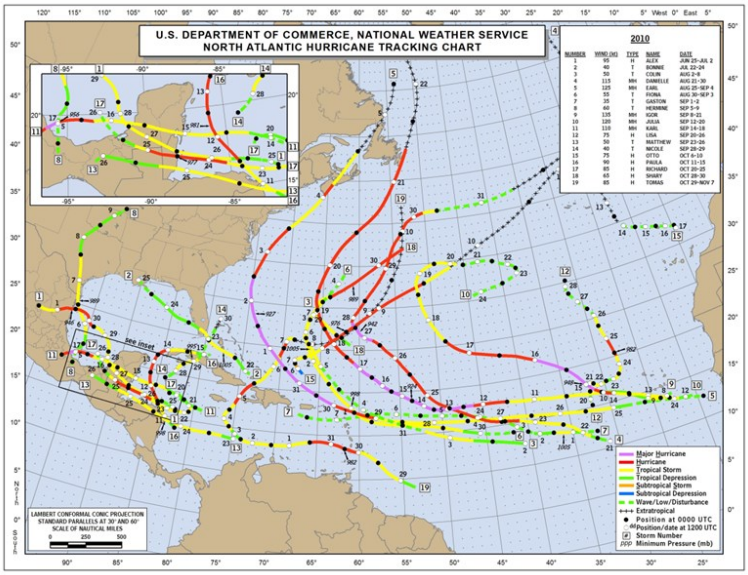



**Fig 2. 2010 North Atlantic Hurricane season Track Map**

which is fairly easy to figure out when looking at the number of tropical cyclones that have developed this season. In the Atlantic there have been 3 named storms, all of which were tropical storms and one of which (Ana) developed prior to the start of the Atlantic Hurricane season. In the Pacific, there have been 7 named storms, 4 of which were hurricanes. The Climate Prediction Center's Oceanic Niño Index (ONI) also confirms we are in an El Niño, with gradually increasing SST anomalies over the past several 3 month running averages. In fact, the current 3 month running average is 0.9°C which is almost twice the amount needed to be considered an El Niño. When the CPC released their Atlantic hurricane season forecast back in May, El Niño was the main factor expected to suppress Atlantic hurricane activity. However, just because less activity is expected in the Atlantic, doesn't mean we are off the hook. One storm, such as Hurricane Andrew in 1992, can have a significant impact on coastal and inland locations along the East coast of the U.S. and the Gulf of Mexico. NOAA will issue an updated outlook for the Atlantic hurricane season in early August, just prior to the historical peak of the season.

A quick comparison of the Atlantic hurricane season from 2009 (the last time we had an El Niño) and 2010 (La Niña) is a good demonstration of how the two impact the Tropical Atlantic and Gulf of Mexico. Ironically enough, the storm names for this season (2015) are the same as those from 2009 as they cycle every 6 years. In 2009, there were 11 tropical systems: 2 depressions, 6 tropical storms, and 3 hurricanes. Figure 1 shows the tracks of these systems. Contrarily, the 2010 season (La Niña) was much more active, with 21 tropical systems: 2 depressions, 7 tropical storms, and 12 hurricanes. That map is shown in Figure 2.

While it is clear that El Niño is having an effect on the number of tropical cyclones forming in the Atlantic, it is important to remain vigilant because one storm hitting the coast is more impactful than 15 storms that aren't hitting the coast. Now is the time to make sure your hurricane preparedness kits are up to date and for your family to make a hurricane plan so that if one does threaten, you will be ready.

**-Kathleen Pelczynski and NOAA Sources**

### El Niño / La Niña Snapshot

**El Niño**

- **At least 0.5°C Warmer Waters in the Pacific Ocean**
- **Generally less Atlantic Hurricanes**

**La Niña**

- **At least 0.5°C Cooler Waters in the Pacific Ocean**
- **Generally more Atlantic Hurricanes**

**Current Status**

- **3 month running average of 0.9°C (El Niño)**

**NOAA's National Weather Service**

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# NWS Raleigh Tests Forecast Techniques (continued from page 3)

Forecast Experiment. During this particular experiment, the primary focus was to evaluate numerous new weather forecast models and use the output to create enhanced one-hour-long "mini-outlooks" for the following 1-12 hours. These types of detailed outlooks are related to the "warn-on-forecast" concept, in which high-resolution models and other data are used to create longer alerts for severe storms; these mini-outlooks are then adjusted as new observations come in. These can be thought of as a bridge between a severe weather watch and a severe weather warning – on a longer time scale and with less confidence than a warning, but on a shorter time scale and with greater confidence than a watch. Gail and her counterparts also used this model output to create enhanced, threat-specific day-one and day-two outlooks which focused specifically on tornado, damaging wind, and large hail risks.

Also, WFO Raleigh Forecaster Brandon Dunstan participated in an HWT experiment which investigated various applications to improve severe storm detection and prediction. Products examined included the convective initiation output (which predicts the onset of storms as their parent clouds are first forming, using satellite data), the lightning jump algorithm (which calculates rapid increases in lightning activity which may precede the onset of severe weather), and a new "ProbSevere" model, a radar product which highlights storms that show increasing strength, to improve warning forecasters' situational awareness.

Finally, WFO Raleigh Senior Forecaster Barrett Smith participated in the "HWT-Hydro" Experiment. During this experiment, Barrett and other visiting forecasters worked with research scientists to assess emerging concepts and products related to hydrology, to improve the accuracy, timing, and specificity of flash flood watches and warnings. Activities included evaluating short-term forecast tools such as improved precipitation estimates and new computer models which predict river behavior, including river levels and flooding. Participants also explored the use of experimental watch and warning products which convey the uncertainty and magnitude of the flooding threat.

**-Gail Hartfield**