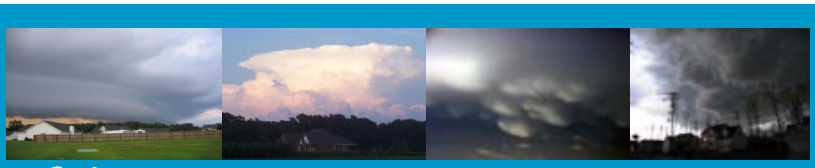


Changing Skies
Over Central North Carolina

VOLUME 14, ISSUE 1 WINTER 2017
NOAA'S NATIONAL WEATHER SERVICE RALEIGH, NC

INSIDE THIS ISSUE:

GOES-R Satellite Launches From Cape Canaveral

GOES-R Launch

On November 19, 2016 GOES-R, the first of NOAA's highly advanced geostationary weather satellites, lifted off from Cape Canaveral, Florida, at 6:42 p.m. EST. The satellite will boost the nation's weather observation network and NOAA's prediction capabilities, leading to more accurate and timely forecasts, watches and warnings.

Now situated in orbit 22,300 miles above Earth, it is known as GOES-16. Within a year, after undergoing a checkout and validation of its six instruments, the new satellite will become operational.

"The next generation of weather satellites is finally here. GOES-16 is one of the most sophisticated Earth-observing platforms ever devised," said NOAA Administrator Kathryn Sullivan, Ph.D. "GOES-16's instruments will be capable of scanning the planet five times faster and with four times more resolution than any other satellite in our fleet. With these new instruments and powerful new capabilities, GOES-16 will strengthen NOAA's ability to issue life-saving forecasts and warnings and make the United States an even stronger, more resilient Weather-Ready Nation."

GOES-16 will scan the skies five times faster than today's GOES spacecraft, with four times greater image resolution and three times the spectral channels. It will provide high-resolution, rapid-refresh satellite imagery as often as every 30 seconds, allowing for a more detailed look at a storm to determine whether it is growing or decaying.

GOES-16 data will help improve hurricane tracking and intensity forecasts, the prediction and warnings of severe weather, including tornadoes and thunderstorms. Additionally, GOES-16's improved rainfall estimates will lead to more timely and accurate flood warnings.

"We are ready to receive and process GOES-16 data into our forecasts as soon as it is available," said NOAA National Weather Service Director Louis W. Uccellini, Ph.D. "Forecasters will not only have sharper, more detailed views of evolving weather systems, they will have more data – better data – ingested into our weather models to help us predict the weather tomorrow, this weekend and next week. This is a major advancement for weather forecasting."

For the aviation sector, GOES-16 will deliver clearer views of clouds at different atmospheric levels, generating better estimates of wind speed and direction and improved detection of fog, ice and lightning. This will improve aviation forecasts and flight route planning to avoid hazardous conditions such as turbulence.

(continued on page 2)

GOES-R Satellite Launch (continued from page 1)

"GOES-16 will significantly improve the ability of emergency managers across America to prepare for, and respond to, weather-related disasters. Better situational awareness will result in better outcomes -- from where to best position resources ahead of a storm to delivering more targeted information to local officials to decide if an evacuation is necessary," said Craig Fugate, FEMA administrator.

GOES-R Launch Path

GOES-16 is flying six new instruments, including the first operational lightning mapper in geostationary orbit. This new technology will enable scientists to observe lightning, an important indicator of where and when a storm is likely to intensify. Forecasters will use the mapper to hone in on storms that represent the biggest threat. Improved space weather sensors on GOES-16 will monitor the sun and relay crucial information to forecasters so they can issue space weather alerts and warnings. Data from GOES-16 will result in 34 new, or improved, meteorological, solar and space weather products.

"We've crossed an historic performance threshold with GOES-R," said Stephen Volz, Ph.D., director, NOAA's Satellite and Information Service. "NOAA is now operating the most sophisticated technology ever flown in space to help forecast weather on Earth."

There are four satellites in the GOES-R series: –R, –S, –T and –U, which will extend NOAA's geostationary coverage through 2036.

"NOAA and NASA have partnered for decades on successful environmental satellite missions," said Sandra Smalley, director of NASA's Joint Agency Satellite Division, which worked with NOAA to manage the development and launch of GOES-16. "Today's launch continues that partnership and provides the basis for future collaboration in developing advanced weather satellites."

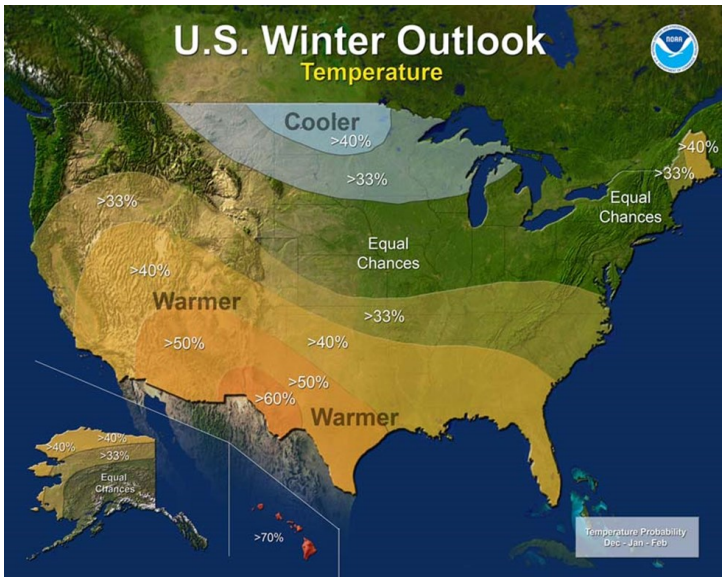
Beyond weather forecasting, GOES-16 will be part of SARSAT, an international satellite-based search and rescue network. The satellite is carrying a special transponder that can detect distress signals from emergency beacons.

NOAA manages the GOES-16 Series Program through an integrated NOAA-NASA office. NASA's Goddard Space Flight Center oversees the acquisition of the GOES-R series spacecraft and instruments. Lockheed Martin is responsible for the design, creation and testing of the satellites and for spacecraft processing along with developing the Geostationary Lightning Mapper and Solar Ultraviolet Imager instruments. Harris Corp. provided GOES-16's main instrument payload, the Advanced Baseline Imager, the antenna system for data receipt and the ground segment. The Laboratory for Atmospheric and Space Physics provided the Extreme Ultraviolet and X-Ray Irradiance Sensor, and Assurance Technology Corporation provided the Space Environment In-Situ Suite.

Additional GOES-16 satellite information is available online at http://www.goes-r.gov

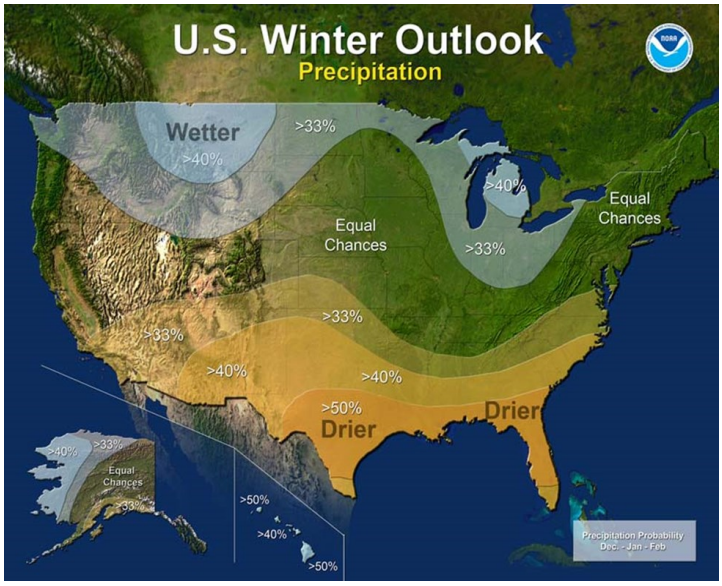
-NOAA

La Niña Indicates Drier and Milder Winter Possible



Woolly worms, thunder, and squirrels and acorns are all traditional winter weather predictors rooted in folklore.

For meteorologists at the National Weather Service, the El Niño Southern Oscillation (ENSO) has shown great promise in providing clues about the types of weather that can be expected during a winter season. La Niña conditions, the phase of ENSO where ocean temperatures are cooler than normal in the eastern Pacific, developed this past Fall. La Niña is typically associated with drier and warmer conditions in the Southern US, while the Northern US typically sees cooler and wetter conditions.



This year's Winter Outlook accordingly calls for drier and milder weather across the Southeast U.S. This does not mean we do not expect any wintry weather, however. There are sub-seasonal factors that strongly influence our winter weather as well.

Two main ingredients needed for our winter storms are sources of cold air and moisture, and these are readily impacted by factors such as the Arctic Oscillation and the track of storms along the East Coast. When a source of cold air and a precipitation-producing low pressure phase together over the Carolinas, we can still get a winter storm despite the ENSO phase. A La Niña simply provides some context for the frequency of such conditions through the season.

We will undoubtedly see impacts from one or more winter storms in the next couple of months, but our best indicator, La Niña this year, signals an overall drier and milder than normal winter ahead!

-Barrett Smith

Hurricane Matthew: An Historic Event for North Carolina

"Hurricane Matthew's eye never made landfall in North Carolina, but it will go in the record books as one of the costliest and deadliest tropical cyclones in history for the state."

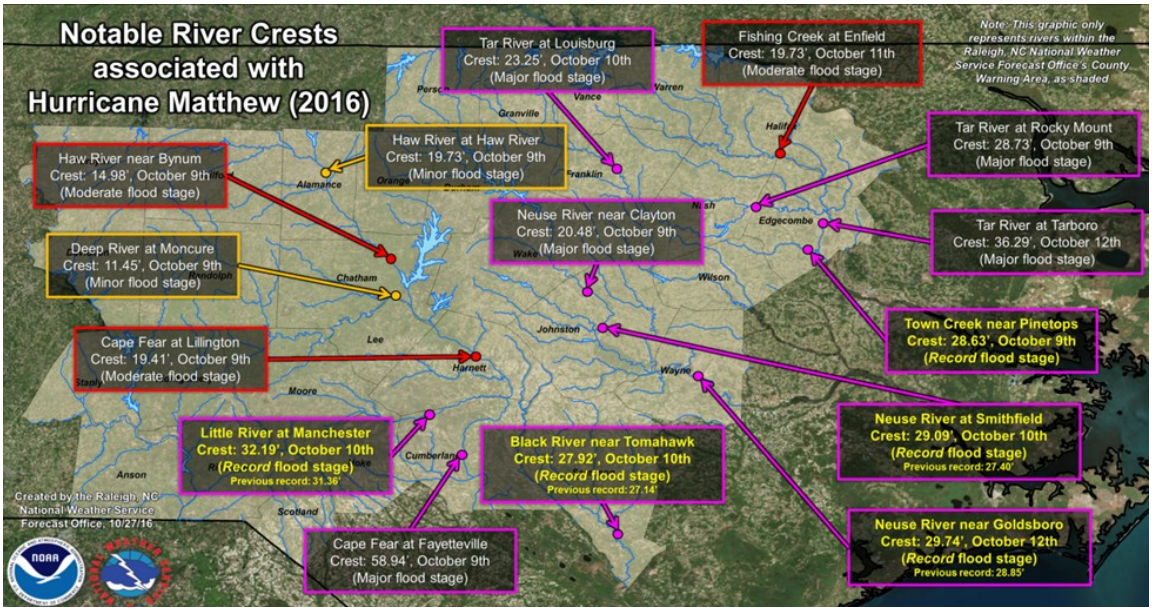
Flooding in Princeville, NC (Photo: NCDOT)

From late Friday, October 7th through Saturday, October 8th, Hurricane Matthew brought devastating impacts to central North Carolina. Despite its center largely paralleling the Southeast coast and never coming ashore in North Carolina, Matthew's large and asymmetrical structure led to several hours of damaging winds and heavy rainfall, contributing to widespread power outages and catastrophic flooding. A total of 27 fatalities were attributed to Matthew in North Carolina, primarily due to drowning in freshwater flooding, while damages related to Matthew totaled approximately $1.5 billion. This would make Matthew the 5th deadliest and 4th costliest tropical cyclone on record for the state.

The tropical wave that evolved into Matthew moved westward from Africa toward the Lesser Antilles in late September, strengthening into Tropical Storm Matthew on September 28th. The next day, Matthew strengthened to a hurricane. Over the next 24 hours, Matthew exploded into a Category 5 hurricane on the Saffir-Simpson scale, the first of such intensity in the Atlantic basin since Felix in 2007. Matthew remained a major hurricane (category 3 or above) as it moved northward through the Caribbean, making landfall in Haiti and Cuba as a Category 4 hurricane.

Matthew gradually weakened while it continued its trek northward through the Bahamas and along the Southeast U.S. coast, eventually dropping out of major hurricane status east of Florida. On Thursday evening, approximately 24 hours before Matthew began to impact central North Carolina, the National Hurricane Center's official forecast track took the storm's center eastward shortly after passing the Georgia/South Carolina border. This eastward turn did eventually occur; however, it was much more gradual than forecast, leading to a brief landfall on the South Carolina coast and a near miss for the Outer Banks. Overall, the 48 hour forecast position valid at 5 PM on Saturday, October 8th had an error of over 100 miles, leading to much more prolonged and significant impacts to central North Carolina than expected even two days prior to the event.

As Matthew's wind field weakened, the storm became increasingly asymmetric, with the majority of its precipitation focused on its north and west sides. This, coupled with the center tracking near the Carolina coastline, provided 12-24 hours of moderate to heavy rainfall for portions of the area, particularly across the Sandhills, eastern Piedmont, and Coastal Plain. Daily rainfall totals for Saturday, October 8th were stag-

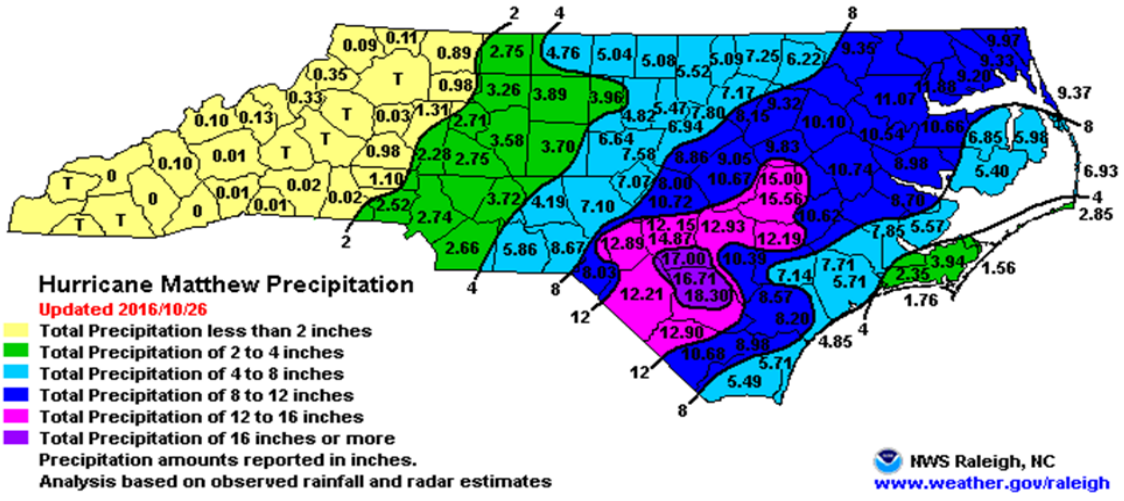


gering. Many locations across central and eastern North Carolina set daily rainfall records, while numerous others saw daily amounts in their respective all-time top 3. Widespread rainfall amounts of over half a foot were observed, with over 18 inches of rainfall observed in Cumberland and Bladen Counties. This led to major flooding on several area rivers, including all-time record crests on the Little River at Manchester and the Neuse River at Smithfield and Goldsboro. Flooding continued in some locations for up to two weeks following the storm.

Wind was also a concern, with gusts over 40 mph and up to 68 mph observed area-wide. These winds, coupled with saturated soils, led to widespread downed trees and power lines. Over 1.6 million customers lost power due to Matthew, with outages persisting for several days in some locations. As a result of flooding and power outages, over 4,000 people were in shelters across the state October 9th.

Hurricane Matthew's eye never made landfall in North Carolina, but it will go in the record books as one of the costliest and deadliest tropical cyclones in history for the state. The majority of impacts to life and property were a result of freshwater flooding, a factor not included in the storm's category or in the National Hurricane Center's official track cone and other cyclone-related products. Despite considerable attention dedicated to the flooding threat in briefings leading up to the storm, we still lost 27 North Carolinians during this event. 21 of these were due to flooding, a majority of which occurred in vehicles. The onus is on both us at the National Weather Service and the public to prevent these unnecessary losses in future events.

-Keith Sherburn



Back by Popular Demand! : If I were a Cloud

"If I were a cloud, I would be a beautiful, puffy cumulus cloud. Why? I would be a cumulus cloud because cumulus clouds are so puffy and fluffy and they look like puffy marshmallows in the sky."

Last issue we ran a segment of stories from a visit to Mrs. Talley's 4th grade classroom at Trinity Academy in North Raleigh. The results were so good that we did it again. Here are some 4th graders' interpretations of what they would do if they were a cloud!

If I were a cloud, I would be a beautiful, puffy cumulus cloud. Why? I would be a cumulus cloud because cumulus clouds are so puffy and fluffy and they look like puffy marshmallows in the sky. I could be blown across the world and only appear in sunny weather. I would go to the beach and enjoy the warmth in the sky. I could go to Mexico and enjoy Cinco de Mayo. I could eat burritos, tacos, quesadillas, and wear a sombrero. I would go up north to England and sip a cup of tea with the Queen! I could go to Germany and eat authentic German chocolate. I could go to Paris, France and eat pastries with the fancy ladies and their poodles at the top of the Eiffel Tower (since I'm a cloud I could do that without going through security!). I would go to Greece and devour their exquisite Mediterranean food. I would definitely travel to Italy and inquire at the Leaning Tower of Pisa. I could journey to Saudi Arabia and catch a magic carpet ride to India and eat mangoes with the monkeys. Then, alas, I'd travel back to America where I formed. I'd dream of other adventures I could have just a world away!

-Sophia George

If I were a cloud, I would be a nimbostratus cloud. I want to be a nimbostratus because I love rain, snow, and other kinds of precipitation. I would first go to my house and rain like there is no tomorrow. Then, I would go water the flowers for people. But I would not cause flooding because if I did no one would like me. And last, but not least, I would stop raining and let it be dry. Oh, and then I would cause rain over and over. I would wet teddy bears worldwide and create my own wet teddy bears worldwide company.

-Bishop Morgan

If I were a cloud, I would be a nimbostratus cloud. I would want to be a nimbostratus cloud because I could give snow to the kids. Whenever I feel I want to stop snowing, I would go someplace else in the world like North Carolina. When I finally get to North Carolina I will go to the mountain region and stay there. The next day I would watch kids drinking hot chocolate and look at them while they're watching movies. Perhaps I would tell them, "I want to watch a movie, too".

-Hannah Kissling

If I were a cloud, I would be a cumulus cloud. I would not be a cumulus cloud because it is one of the most famous clouds in the world, but because I would bring good weather, unlike my two friends, Mr. Cumulonimbus and Mrs. Nimbus. I would soar all around the world watching little kids playing and adults looking at flowers, and watching different people do interesting things. I would not want to be a cirrus cloud because I really wouldn't get to see anything I can understand because they are always above 20,000 feet. I also don't want to be a stratus cloud. I don't want to get hurt, after all, it's fog. But cumulus, that is what I want to be. I don't mind being called cotton: I just want to have a good time and see everybody have a good time.

-Reynolds Garnas

NWS Raleigh Spring Tour Dates Announced!

Join us for a tour of the National Weather Service in Raleigh during one of our upcoming tour dates this Spring!

- Tuesday January 24th
- Thursday February 16th
- Wednesday March 22nd
- Wednesday April 12th
- Tuesday May 23rd
- Wednesday June 14th

For more information and to sign up visit http://www.weather.gov/rah/tours

NWS Raleigh Celebrates Skywarn Recognition Day

WX4NC Team (Left to Right): NWS Raleigh Warning Coordination Meteorologist Nick Petro WX3H, Randy Stark WN4RSS, Ken Stark W4KJS, Kristina Benson, Chris Benson KJ4LKE, Stacy Petro KF7NPT, Cassie Lilley W2YBN, Pamela Lewis KB4PAM, Central Carolina SKYWARN (CCS) AEC Scott Lewis AB4SL, Lauren Petro KF7RCU, Steve Misel K4WEB, CCS EC Virginia Enzor NC4VA, and CCS AEC Bob Woodson WX4MMM. (Not pictured are Steve Newton KK4TTU and his son and daughter, Frank Pleshe N3FRP, ARRL NC Section Manager Karl Bowman W4CHX).

"What made this year's event special was that Wake County Emergency Management participated with NWS Raleigh and brought their mobile command post trailer to the event to assist with the communication efforts."

On December 3, 2016, the National Weather Service in Raleigh participated in the 18th annual SKYWARN Recognition Day (SRD) with members of Central Carolina SKYWARN. SKYWARN Recognition Day was developed in 1999 by the National Weather Service (NWS) and the American Radio Relay League (ARRL). It celebrates the contributions that volunteer SKYWARN radio operators make to the NWS.

Amateur radio operators comprise a large percentage of the SKYWARN volunteers across the country, and they provide vital weather reports and communication between the NWS and emergency management if normal communications become inoperative. During this event, numerous SKYWARN volunteers and amateur radio operators visited the NWS Raleigh office and contacted other radio operators across the world, and radio operators at other NWS offices.

Pamela Lewis KB4PAM (left) and Lauren Petro KF7RCU (right) made numerous radio contacts on the 40, 20 and 15 meter bands.

What made this year's event special was that Wake County Emergency Management participated with NWS Raleigh and brought their mobile command post trailer to the event to assist with the communication efforts. The trailer, which was parked adjacent to the weather office, served as an added communications platform where radio operators contacted other NWS offices and other SKYWARN volunteers across the country and across the world. This setup provided an opportunity to not only showcase SKY-

Wake County Emergency Management Mobile Command Post Trailer. NWS Raleigh would like to extend special thanks to Wake County Emergency Management and to Steve Newton for the use of the trailer.

WARN and amateur radio, but the import partnership between the National Weather Service and its emergency management partners.

The 24 hour amateur radio event, which is based on Universal Coordinated Time, ran from 7 PM EST Friday, December 2, 2016, through 7 PM EST Saturday, December 3, 2016. Members of Central Carolina SKYWARN began preparing for the event Friday afternoon, setting up antennas and radios at the NWS Raleigh office. Numerous radio contacts were made at the start of the event Friday evening, with the bulk of the contacts made on Saturday. In addition to making radio contacts, the NWS Raleigh provided tours of the NWS Raleigh weather operations facility to its trained SKYWARN volunteers.

Central Carolina SKYWARN, as well as the members of Triad SKYWARN, are integral parts of the SKYWARN community and the National Weather Service's life-saving mission. Part of the severe weather warning success of the NWS Raleigh office, year after year meeting severe weather warning goals, can be attributed to the tireless efforts of the amateur radio operators of Central Carolina SKYWARN and Triad SKYWARN. The NWS Raleigh extends a heartfelt thanks to all of the members of its SKYWARN program for making this year's SKYWARN Recognition Day a huge success.

-Nick Petro

Please visit the following websites for more information:

- **Official SKYWARN Recognition Day web site:** http://hamradio.noaa.gov
- **NWS Raleigh SKYWARN web site:** http://www.weather.gov/Raleigh/skywarn
- **Central Carolina SKYWARN:** http://www.centralcarolinaskywarn.net
- **Triad SKYWARN:** http://triadskywarn.com

2016 Hydrology Review: Feast or Famine

Per our headline, the precipitation we received during 2016 varied widely across the Tarheel State. On an annual basis, the southwest mountains typically receive greater precipitation amounts, and some areas west of Asheville average over 70 inches annually. Here in central NC, we normally receive 40 to 45 inches, and the coastal areas from 50 to 60 inches. Total precipitation amounts for 2016, as seen from the graphic at right, the normal annual amounts are nearly reversed, with the southwest receiving less than 35 inches (>20 inches below normal in some areas) and much of the east receiving >70 inches (up to 20 inches above normal).

Almost all of this anomalous distribution can be attributed to hurricane Matthew on October 8, which produced a swath of rainfall ranging up to 17 inches along the I-95 corridor.

We started off 2016 with no drought conditions across the state, but began to suffer from a rainfall deficit statewide during the spring. Drought impacts began to emerge in western NC during the summer and fall, and signs of drought were creeping slowly into central NC by late September. Hurricane Matthew's arrival in early October temporarily halted the eastward drought expansion, but once the excess water drained off, we still weren't receiving enough rain to keep drought at bay. As such, drought resumed its eastward expansion into central NC by mid November. The 2016 year end drought depiction is on the bottom right .

-Michael Moneypenny

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