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National Weather Service, Newport/Morehead City, NC

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The Unforgettable Winter of 2013-14

By Tom Lonka, Meteorologist

Residents of Eastern North Carolina won't soon forget the winter of 2013-2014, as several major snow and ice storms affected the area, in addition to several other minor winter weather events, making the winter quite the active one. One thing that stood out was the amount and duration of sleet and freezing rain that affected coastal areas, namely the Crystal Coast region and southern Outer Banks, areas that are very unaccustomed to icy weather.

The winter season began on an early note, as a rare early snowfall occurred on the evening of November 12, where many locations received a trace to as high as half an inch of snow. In fact, for several cooperative observing station locations, this was the earliest snowfall on record, with the period of record dating back to the late 1800s and early 1900s.

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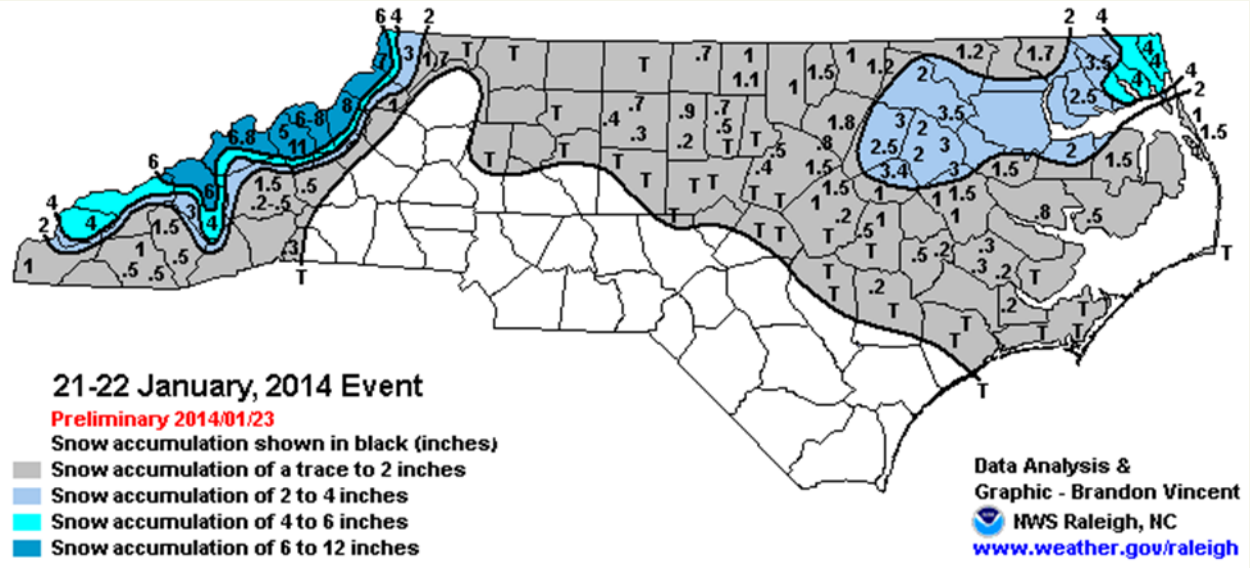
Light Snow January 21, 2014

A developing area of low pressure, coupled with a strong Arctic cold front, combined to produce a light snow event across mainly northern portions of Eastern North Carolina during the evening hours of Tuesday January 21, 2014. Ahead of the front, temperatures were unseasonably warm with New Bern reaching 68 degrees on Tuesday afternoon. As a strong mid-level disturbance dove east across the state, a surface low formed over central and western North Carolina, then strengthened off the North Carolina coast in the early evening. As the low raced northeastward and the strong Arctic front advanced south into Eastern North Carolina, light rain quickly changed to light snow in the early evening. A band of snow dropped between 1 and 2 inches over portions of Pitt, Martin, Washington and Tyrrell Counties. As the precipitation continued east, up to 1 to 1.5 inches of snow was observed over the northern Outer Banks While light snow was observed further south, only trace amounts were observed.



Snowfall Totals from January 21, 2014 Event

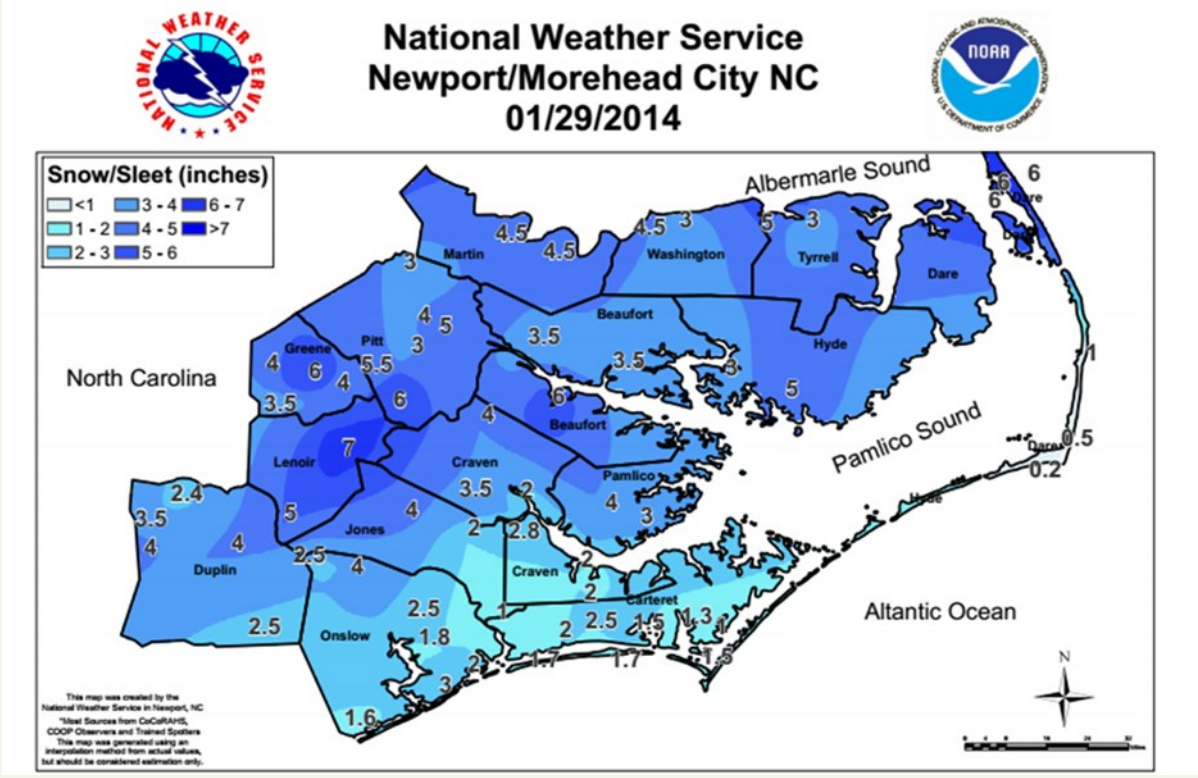
Major Winter Storm January 28-29, 2014

A highly unusual, prolonged winter storm affected the region beginning the morning of Tuesday January 28 and lasting through the morning of Wednesday

The Unforgettable Winter of 2013-14 (Continued)

January 29. This was an especially high-impact event for Eastern North Carolina as many schools and businesses were closed for 3 to 4 days due to widespread hazardous road conditions. Arctic high pressure gripped the region following the event, allowing for very little melting on roadways. This event was unusual in the large accumulations of ice and sleet that occurred near coastal locations. Inland locations received mainly snow and sleet.

A low pressure system formed along a stalled arctic cold front south of the North Carolina coast on Tuesday January 28. With a deep layer of cold air in the low levels, and a pronounced warm moist layer aloft, mixed wintry precipitation fell across the area. Areas near the Crystal Coast and southern Outer Banks received a sleet and freezing rain mix. 1 to 3 inches of sleet fell, while locally up to a quarter inch of freezing rain coated the area. Further north, where cold air was entrenched through the atmosphere, mainly snow fell, where 4 to 7 inches accumulated. The arctic high pressure system remained in place for several days following the event, with daytime highs near or below freezing and overnight lows well down into the teens. These cold temperatures allowed for treacherous roadways days after the event, and many public schools cancelled classes for the duration of the week.



Snowfall Accumulations January 29, 2014

The Unforgettable Winter of 2013-14 (Continued)

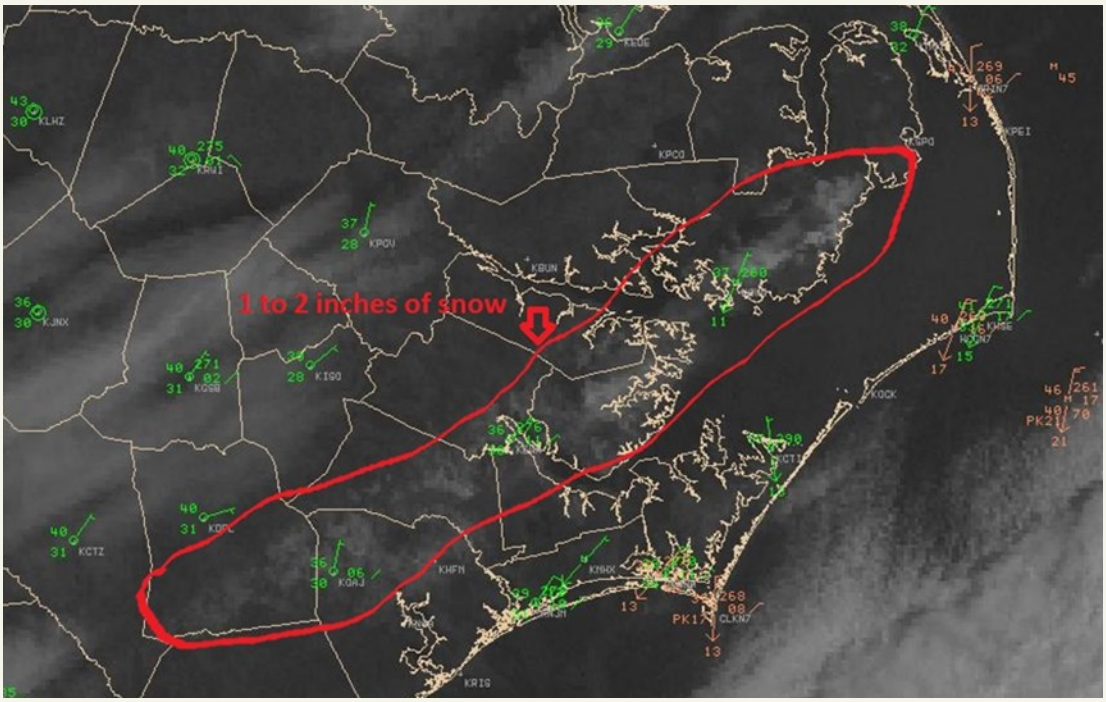
Three inches of sleet covers the ground at the NWS office in Newport, NC

A thick accumulation of sleet blankets a neighborhood in Morehead City, NC

February 6-7, 2014 Light Snow Event

A fast moving mid-level disturbance led to a quick one to two inches of snow across East Central North Carolina with some sleet reported near the coast. New Bern reported 1.5 inches of snow, while numerous locations in Craven, Onslow and Pamlico Counties reported 1 to 2 inches, as did a couple of locations on the Outer Banks. The fast moving though potent low pressure area led to a 2 to 3 hour period of moderate to occasional heavy snowfall rates. With temperatures near or just above freezing at the surface, the wintry precipitation was able to overcome an initially dry lower atmosphere, reaching the ground and producing light accumulations. The brief heavy snowfall led to slick roads, especially in Onslow, Craven and Pamlico Counties. Many schools in the region were on a 2 hour delay Friday morning, February 7, as slick spots remained on area roadways through the morning hours.

The Unforgettable Winter of 2013-14 (Continued)



Visible satellite image depicting a band of snow across Eastern NC on the morning of February 7, 2014.

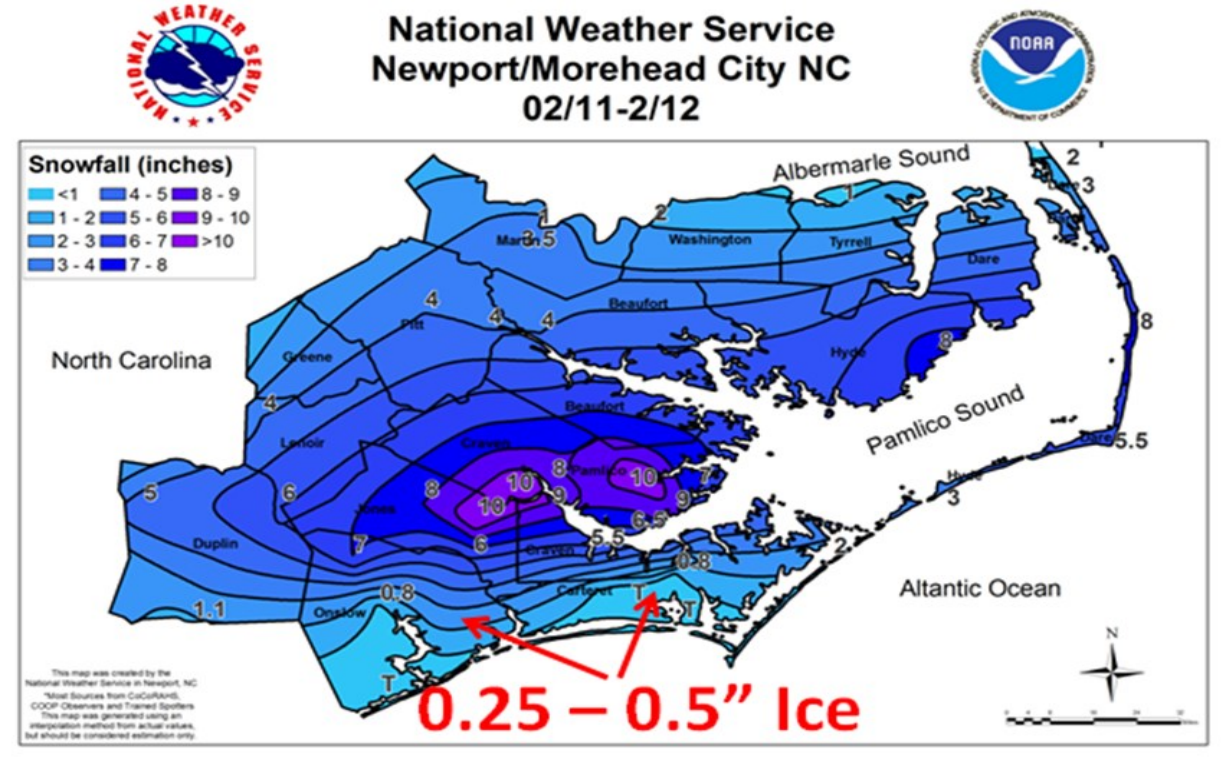
Major Snow/Ice Storm Feb. 11-12, 2014

Low pressure formed offshore of North Carolina along a stalled frontal boundary during the evening of Monday February 10, 2014 and tracked off the Carolina coast during the day Tuesday, February 11. With cold air in place, this led to snowfall over most areas, with the exception of the Crystal Coast and Southern Onslow County, where primarily sleet and freezing rain occurred. A heavy band of snow developed and led to accumulations of 8 to 10 inches in a band from Jones County east northeast to central Outer Banks Dare County during the day Tuesday. A secondary low led to additional light wintry precipitation over inland areas early on Wednesday before temperatures warmed and precipitation turned to rain.

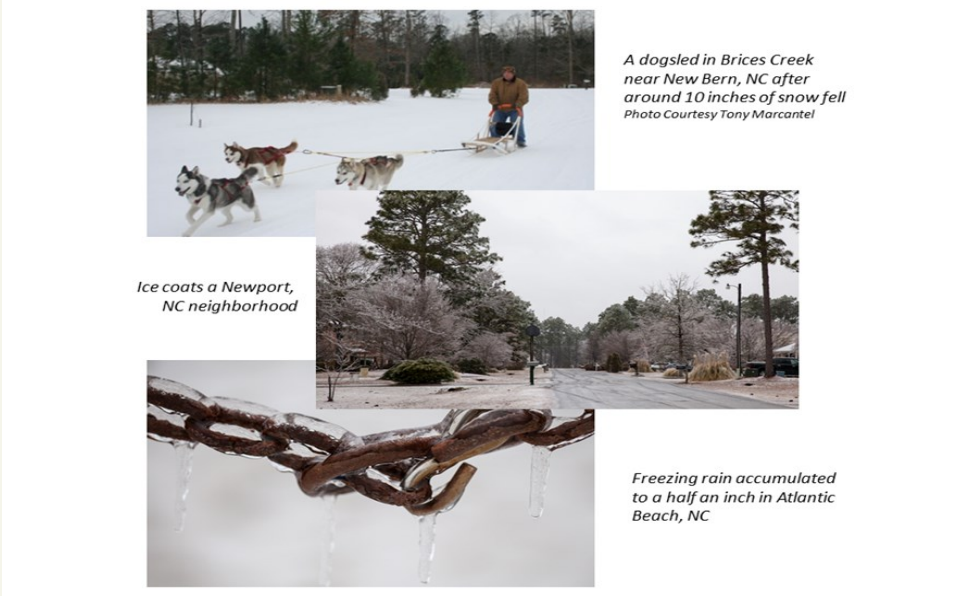
Up to one half inch of ice accretion was reported along the Crystal Coast and southern Onslow County, as a warm layer aloft was present here. To the north, all snow was reported. As with the major winter storm in January, this one was a high impact event as it occurred during the daylight hours of a work/school day. Roads became snow and ice covered, and travel became treacherous through the day Tuesday. Precipitation came to an end Tuesday night, though temperatures

The Unforgettable Winter of 2013-14 (Continued)

remained below freezing with roadways remaining treacherous. A second wave of wintry weather developed the morning of February 12. Minor accumulations of snow and freezing rain occurred inland, especially across the coastal plain, before changing to all rain during the afternoon.



Map depicting heavy snow band across East-Central NC, in addition to significant ice accretion.



A dogsled in Brices Creek near New Bern, NC after around 10 inches of snow fell
Photo Courtesy Tony Marcantel

Ice coats a Newport, NC neighborhood

Freezing rain accumulated to a half an inch in Atlantic Beach, NC

The Unforgettable Winter of 2013-14 (Continued)

Light Snow, Sleet, and Freezing Rain
March 3 - 4 , 2014

A light wintry precipitation event rounded out the busy 2013-2014 winter season in early March. A backdoor cold front moved through the region from the north during the morning of March 3. Precipitation started as rain in the morning, then transitioned to a light freezing rain, sleet, and snow mixture during the afternoon and evening. Up to 1 inch of snow fell across the northern areas of Eastern NC, generally along the Highway 264 corridor. Further south, a mixture of light freezing rain and sleet coated the ground. Only minor travel issues were noted with this wintry event.

As the winter of 2013-14 shows, significant winter weather can and does occur in eastern North Carolina. Here are the products that the National Weather Service issues in advance of winter weather.

Winter Storm Outlook - Winter storm conditions are possible in the next 2 to 5 days.

Winter Weather Advisory - Winter weather conditions are expected to cause significant inconveniences and may be hazardous. When caution is used, these situations should not be life threatening.

Winter Storm Watch - Winter storm conditions are possible within the next 36 to 48 hours. People in a watch area should review their winter storm plans and stay informed about weather conditions.

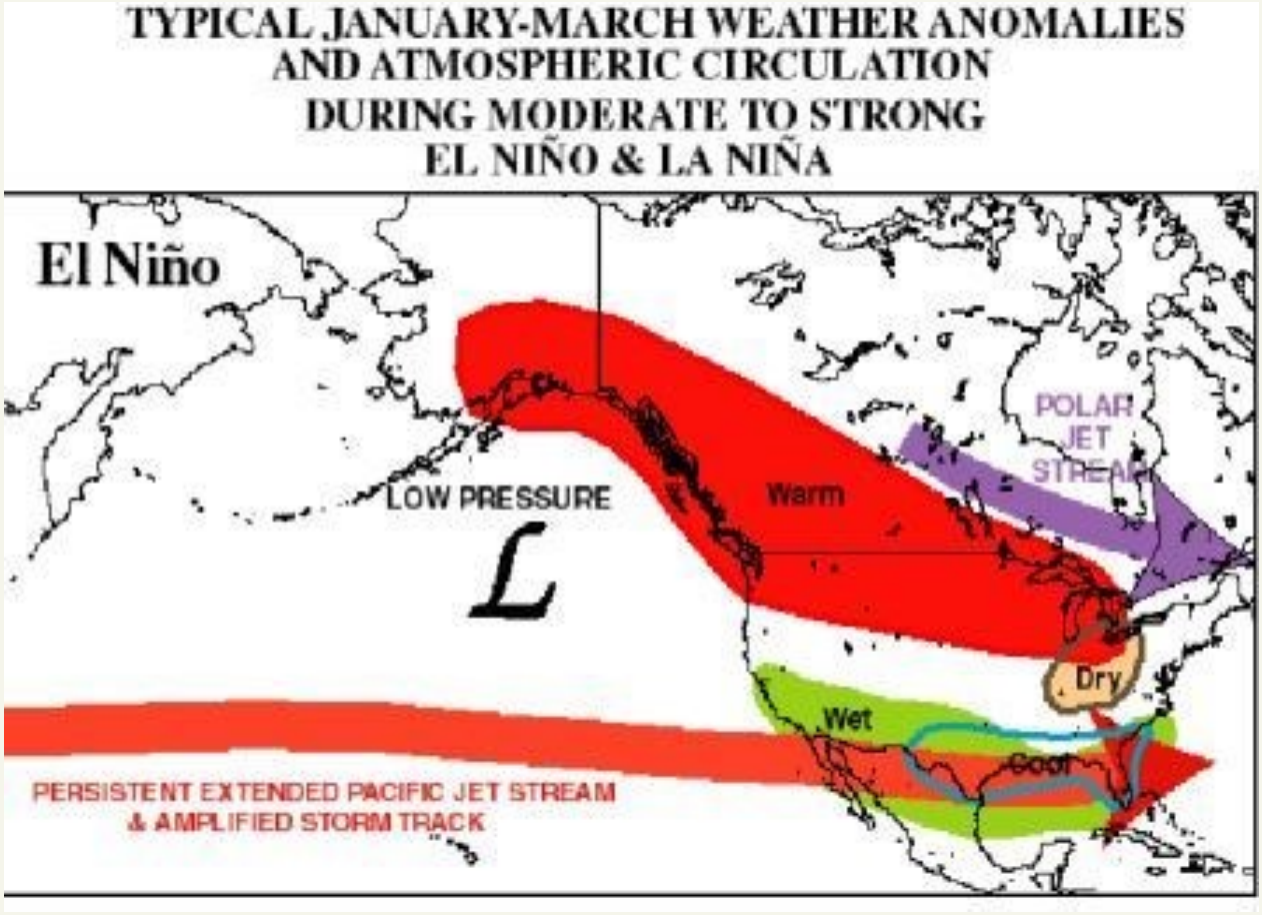
Winter Storm Warning - Life-threatening, severe winter conditions have begun or will begin within 24 hours. People in a warning area should take precautions immediately.

Winter 2014-15 Forecast

By Bel Melendez, Meteorologist

Since last year, long range climate models have been hinting at the development of El Nino for this coming winter. El Nino has not yet materialized, but the Pacific waters are gradually becoming warmer.

So, you may ask, what is El Nino? El Nino is when the Pacific waters become warmer along the equator and causes the warm ocean waters to interact with the atmosphere and change the global weather patterns. As a result, the United States tends to have an increase of rainfall for the southern tier of the county and cooler temperatures from the northwest coast to the Great Lakes region . According to the latest Climate Prediction Center (CPC) ENSO Discussion, the probability of El Nino developing is 60% favorable and 40% unfavorable. CPC looks at various indices/guidance including previous El Nino patterns and previous winter weather trends to assist in making a winter weather outlook. CPC also examines other factors that can affect our weather pattern such as anomalies from the Arctic region.

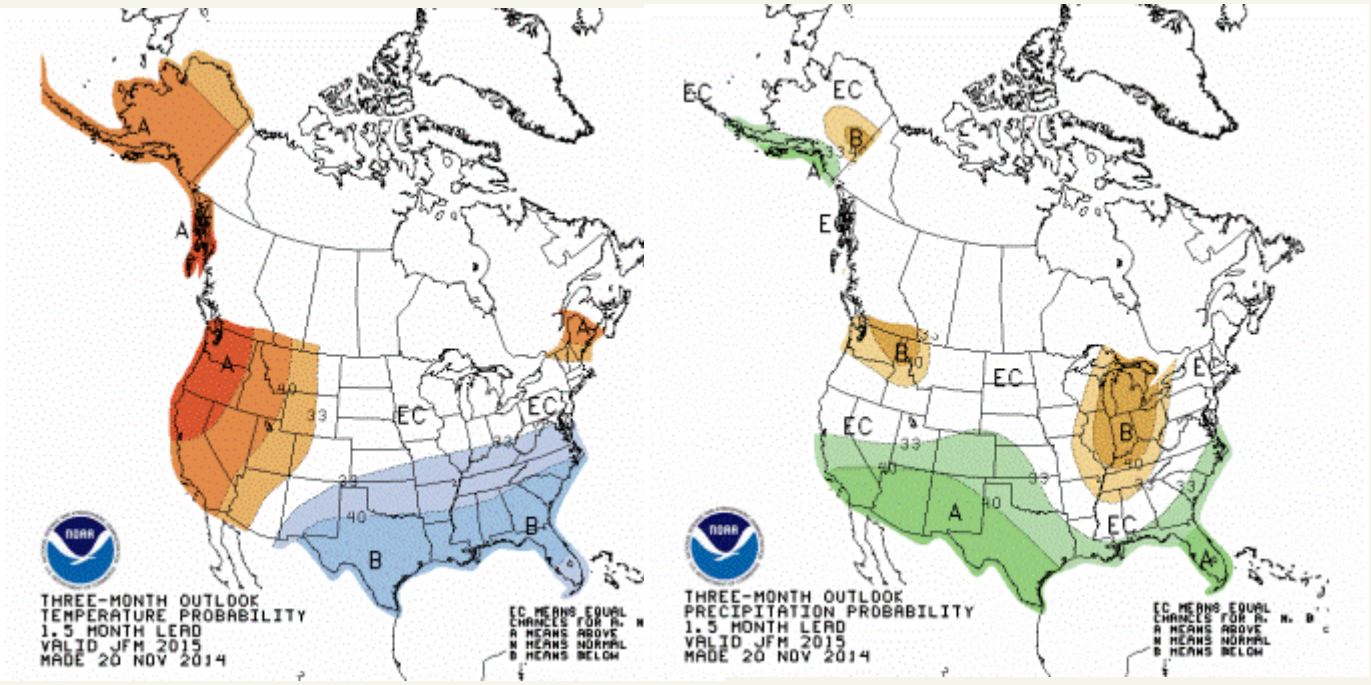


Typical El Nino setup across North America.

Winter 2014-15 Forecast (Continued)

When North Carolina experienced cold air outbreaks last winter, this cold air came from two different locations, the Arctic/North Pole region and from the Siberia region (Russia). When monitoring these anomalies of the Arctic/mid-latitude region, meteorologists are monitoring the Arctic Oscillation (AO) generally located around the North Pole and East Pacific-North Pacific Oscillation (EP-NP) generally located in the vicinity of Alaska and eastern Russia. When the Arctic Oscillation goes negative or the Eastern Pacific Oscillation becomes positive, the will result is cold air into the southeastern United States. When combined with El Nino, this will reinforce the cold air across our region. There is an additional factor that may affect our weather pattern in the United States this year; it's called the Pacific Decadal Oscillation (PDO).

The PDO is a slow evolving pattern that affects the water temperatures off on the western side of North America. When sea surface temperatures (SST) are warm off the coast (warm phase), this will result cold temperatures and wet conditions for the eastern half of the United States. The PDO has been in a warm phase trend since last winter. With El Nino being predicted to develop this winter and having a warm phase PDO, the cold air and wet conditions will be enhanced over the Southeast. Given the factors of the El Nino and warm phase PDO, CPC has updated their winter forecast to predict a cool, wet winter this year for North Carolina.



The 90-Day Outlook January-March, 2015 shows a good probability of below normal temperatures and above normal precipitation for eastern North Carolina.

NWS Meteorologist Attends NWS Conference

By Bel Melendez, Meteorologist

Nearly all professions have some type of professional organization. Luckily, for meteorologists we have two, the American Meteorological Society (AMS) and the National Weather Association (NWA). These organizations have annual conference meetings that provide the opportunity to increase professional development by sharing research, information, and news. In October 2014, National Weather Service Newport/ Morehead City Meteorologist Intern Bel Melendez went to Salt Lake City to attend the meeting and present a local case study at the 39th Annual National Weather Association conference. The case study, was entitled, " The Impact of a Madden-Julian Oscillation Event over Eastern North Carolina in Late June 2013". The Madden-Julian Oscillation (MJO) is an abundance of moisture propagating eastward from the Indian Ocean to the Americas that can enhance precipitation within low pressure systems and/ or tropical development. This case was an great example of tracking the abundance of moisture from southeast Asia and into the East Coast of the United States. This increased moisture can enhance the rainfall amounts for more than a week at a time across the area. Fortunately, Eastern North Carolina was abnormally dry during the summer of 2013 and this event only resulted in three flood warnings and five advisories. If conditions were not abnormally dry, impacts would have been have been much greater.

Many of the conference presentations were geared toward this year's theme; "Building a 21st Century Weather Enterprise: Facilitating Research to Operations-Optimizing Communication and Response". Keynote speakers talked about the updates of the Weather-Ready Nation initiative and future plans within the National Weather Service. Others presented research in increasing our communication skills to the general public with the types of impacts they will be facing with upcoming weather. Several presentations involved new techniques and/or applications for forecasting severe and winter weather, improving heavy rain and flood forecasts, and the use of GOES-R, the latest satellite planned to be launched early 2016.

NATIONAL WEATHER ASSOCIATION

The Future of Aviation Services

By Casey Dail, Meteorologist

Here at the National Weather Service, we are responsible for issuing forecasts for four of our airports: Pitt-Greenville Airport (KPGV), Coastal Carolina Regional Airport (KEWN), Albert J. Ellis Airport (KOAJ), and Kinston Regional Jetport (KISO). These forecasts are known as Terminal Aerodrome Forecasts (TAFs). A typical TAF consists of forecasts for wind speed/direction, visibility, cloud height and weather type.

Throughout the next year our local office will be changing the way we create the TAFs, and transitioning to enhanced digital aviation services in support of the changing needs of the aviation community. Several NWS forecast offices are already producing digital forecasts of ceiling and visibility, from which TAFs are generated. These enhanced digital aviation services will continue to expand to additional forecast offices over the next few years and eventually to the national level. The end result will be a national mosaic of aviation forecast elements available for the aviation community to utilize in their decision making process. This initiative will result in seamless and consistent forecast products from the local TAF to the regional and to the national en-route aviation weather products, providing a consistent and cohesive message for the National Airspace System.

Creating and producing digital aviation grids will ultimately lead to improved short term and aviation forecasts, as well as improved decision support services for the aviation community. Improved aviation forecasts will also lead to improved economic productivity. These new grids/parameters will not only benefit the aviation community, but other groups and organizations as well. Other NWS offices have received positive feedback from the Coast Guard, medical helicopter pilots, as well as mining and construction groups.

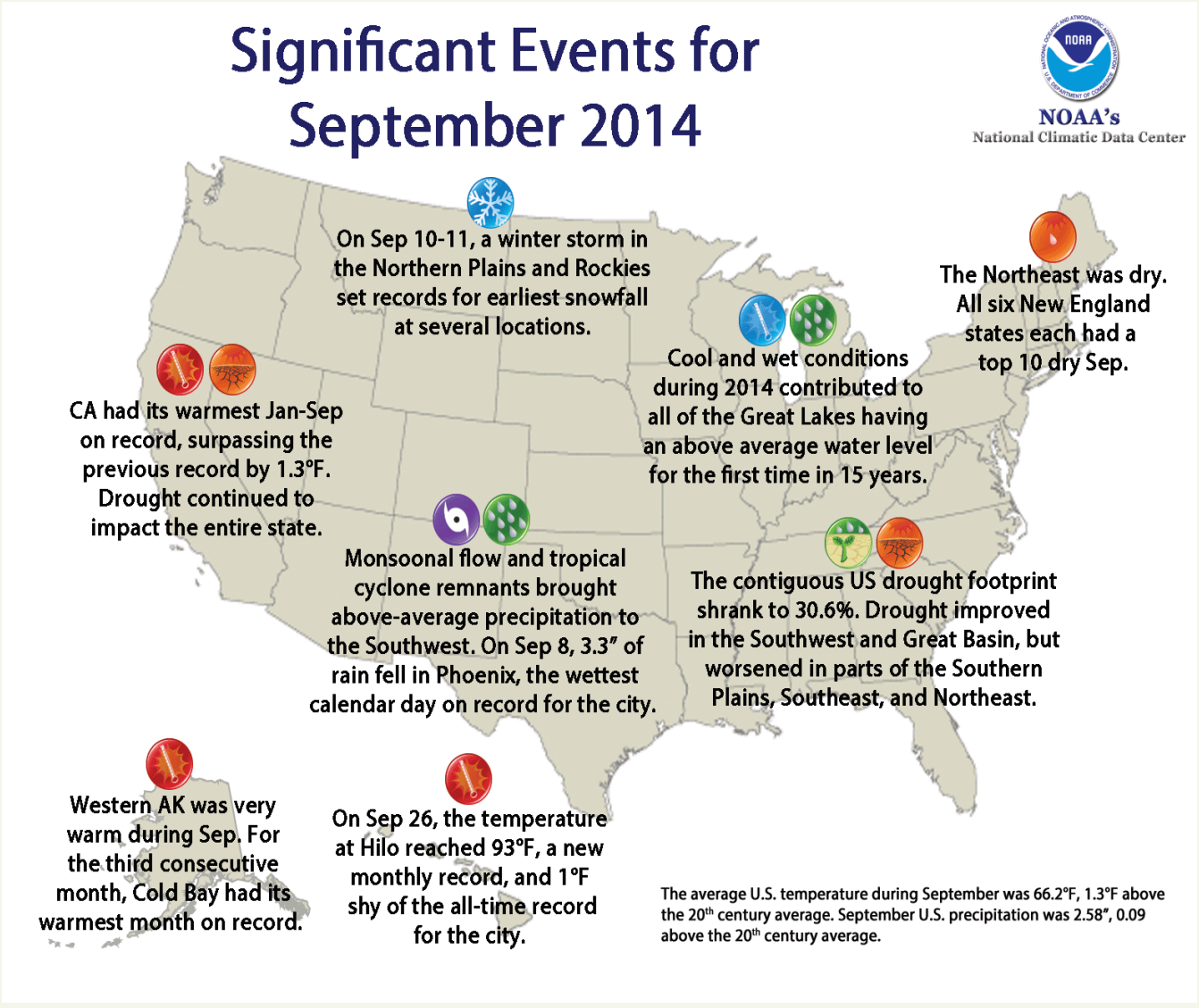
Our timetable for this project locally is to have the enhanced visibility grids available late this winter/early spring 2015, and then the ceilings grids early 2016. This project has required a great deal of collaboration, so special thanks to fellow NWS offices in Sterling, Virginia and Taunton, Massachusetts for their assistance with this endeavor.

If you would like additional information or have any questions, feel free to contact Casey.Dail@noaa.gov.

Warm September in 2014

By Chris Collins, Meteorologist

September 2014 was the 4th warmest September here at the National Weather Service in Newport with a mean temperature of 74.6 degrees, about a degree above normal. Most of eastern North Carolina recorded above normal temperatures in the month of September. The September national temperature was 66.2°F, 1.3°F above average. This ranked as the 26th warmest September in the 120-year period of record. The average maximum September temperature for the contiguous U.S. was 78.3°F, about 0.5°F above the 20th century average, ranking near the median value in the 120-year period of record. The average minimum September temperature was 54.1°F, which was 2.2°F above the 20th century average, the eighth warmest on record. Here are some other nationwide climate highlights for the month of September 2014.



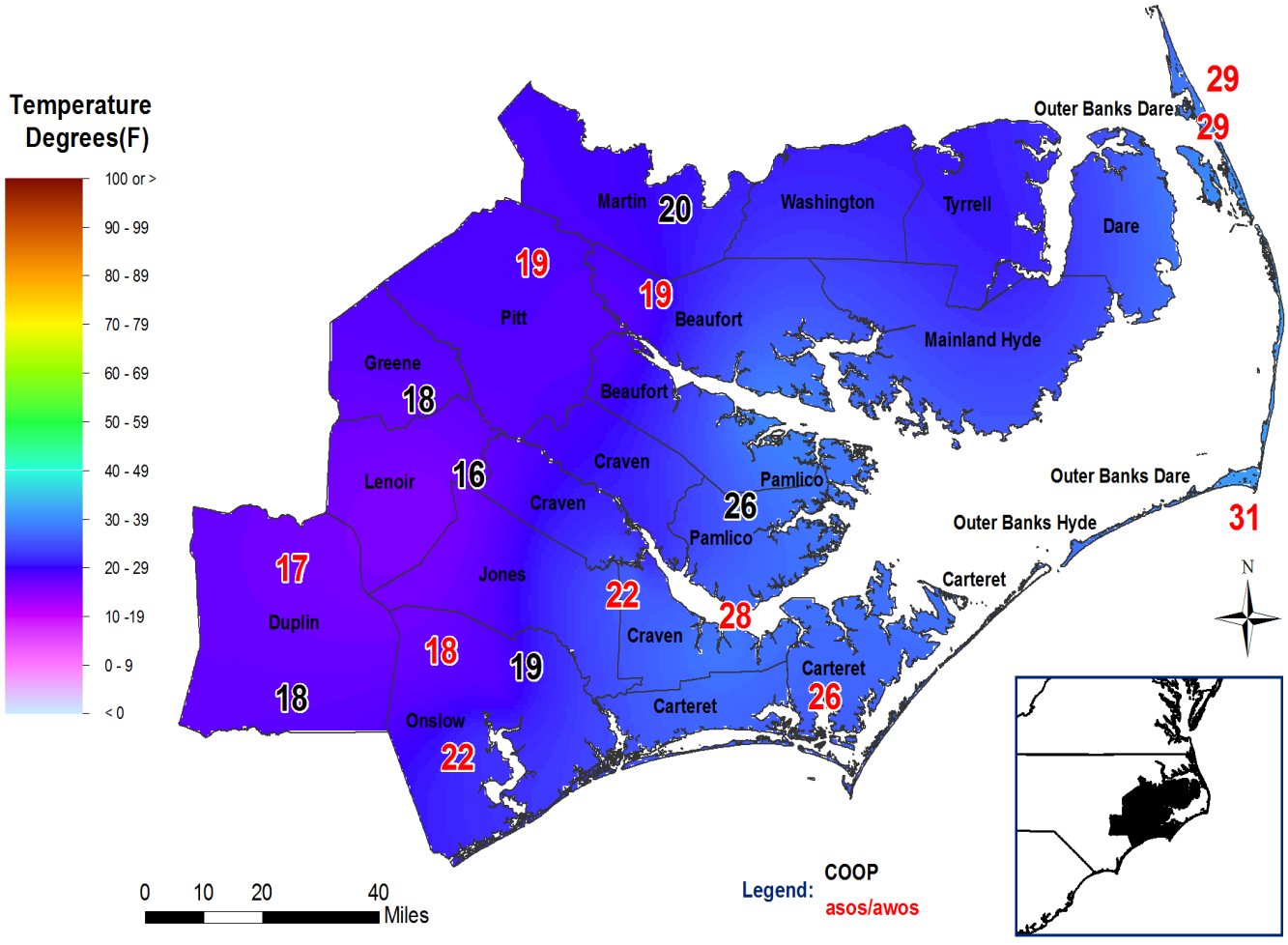
Early November Cold Spell

By Chris Collins, Meteorologist

An unusually strong early-season cold front moved across the region during the evening of November 17, 2014. This cold front was part of a larger system that brought record-breaking snowfall to the Great Lakes. Low temperature records were equaled or broken over much of the eastern United States on the morning on November 19. Here is a map of minimum temperatures across eastern North Carolina from the morning of Wednesday November 19 2014.

Newport/Morehead City 24Hr Lows - Thru 8AM 11/19/2014

This map is an interpolation of actual reported values, but should be considered an estimation only. Not all reports used in the analysis will be displayed due to space constraints. Reports are 24 hour low temperatures from yesterday morning through this morning.



Data Sources:
National Weather Service Official Stations
National Weather Service Cooperative Observers

Maps created by the National Weather Service Forecast Office in Newport/Morehead City, North Carolina

Morning Low Temperatures, Wednesday November 19, 2014

Student Volunteer Opportunities

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 2015 application will become available in mid-January on the NWS MHX website. 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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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

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