Blue Ridge Thunder

Newsletter of the NWS Blacksburg, VA

Welcome to the Spring 2015 edition of 'Blue Ridge Thunder' the biannual newsletter of the National Weather Service (NWS) office in Blacksburg, VA. In this issue you will find articles of interest on the weather and climate of our region and the people and technologies needed to bring accurate forecasts to the public.

Inside this Issue:

Weather Highlight:
Snowmelt Flooding: March 2015

Peter Corrigan, Service Hydrologist

Spring snowmelt floods are typically something we associate with locations further north: think Red River of the North in North Dakota or the rivers of northern New England. But flooding due to melting snow and rain is no stranger to the southern Appalachians as most recently demonstrated by flooding that occurred in March 2015 in parts of southeast West Virginia and western Virginia. The flooding was caused by rapid snowmelt of anywhere from 1 to 4 inches of snow water equivalent (SWE) during a 24-hour period ending on the evening of March 4th. Combined with 2-day rainfall of 1 to 2 inches the result was widespread flooding in parts of Tazewell, Mercer and Greenbrier counties. The Clinch River at Richlands crested at its highest level, 12.29 feet, since March 1998 (Flood Stage is 10 feet) and there was also significant flooding on the Bluestone River and numerous smaller creeks and streams.

Flooding on March 5, 2015 - Bluestone River near Spanishburg, WV

Winter 2014-2015 Climate Summary

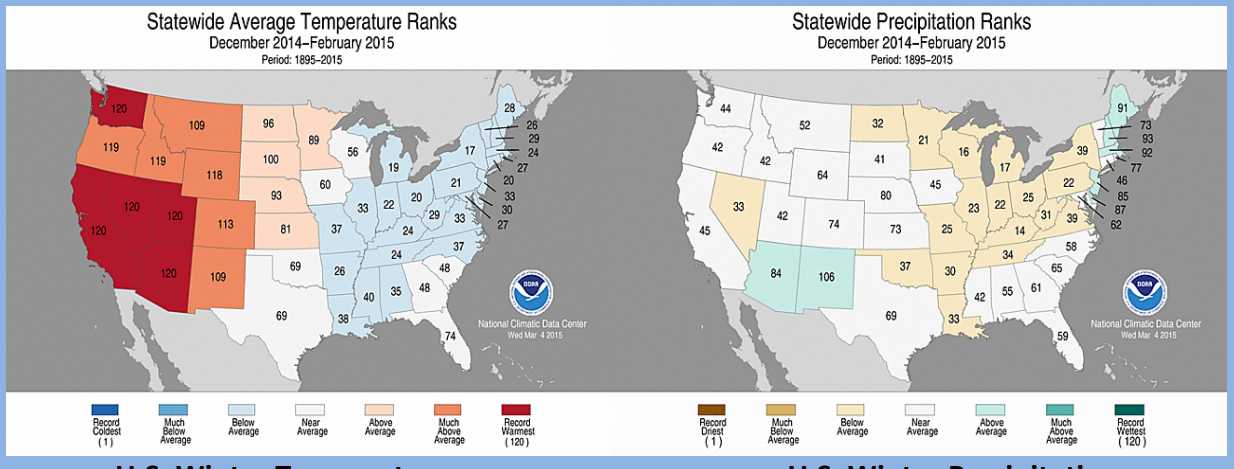
Robert Beasley, Senior Forecaster
Peter Corrigan, Service Hydrologist

What started out as a relatively mild winter in December quickly transitioned to a cold January and even colder February as a deep upper trough persisted across the northeastern U.S. opening the door to frequent intrusions of arctic air. Overall, the meteorological winter of 2014-2015 (December 1 – February 28) ended up colder (by 1-3^{o}F) and substantially drier than the long-term averages. Table 1 shows winter average temperatures and departures from normal (1981-2010 normals) at our official climate sites, along with their rank in terms of cold. February however, ranked as one of the coldest on record in the County Warning Area (CWA), coming in at the coldest all time at Danville (33.6^{o}F), 2nd coldest at Lynchburg (28.8^{o}), and 3rd coldest at Roanoke (30.6^{o}), Blacksburg (26.4^{o}) and Bluefield (26.5^{o}).

Climatological Statistics for Winter 2014-2015 (Dec-Feb).

Climate Site	Average Temperature (Anomaly)	Rank (as coldest)	Period of Record	Total Precipitation (Anomaly)	Total Snowfall (Normal)
Bluefield	33.2 (-3.0)	17th	1959-2015	5.95 (-2.62)	31.8 (25.3)
Blacksburg	32.0 (-1.1)	19th	1952-2015	6.07 (-2.77)	21.0 (16.2)
Roanoke	36.4 (-1.9)	17th	1912-2015	6.46 (-2.29)	19.3 (14.2)
Lynchburg	34.6 (-2.3)	11th	1893-2015	7.50 (-1.81)	20.4 (10.2)
Danville	Msg data	NA	1948-2015	6.46 (-3.24)	1.7 (9.3)

The two figures below show statewide ranking for temperature (left) and precipitation (right) since 1895 across the lower 48 states for the winter period. The seasonal warmth in the Western U.S. was record setting while it was colder than normal temperatures in the East but not extremely so. Winter precipitation in the CWA was generally below average by about 1 to 3 inches due mainly to an extremely dry January. Seasonal snowfall was near normal across most of the region as heavy February and early March snowfall made up for the near complete lack of snow in December and January.



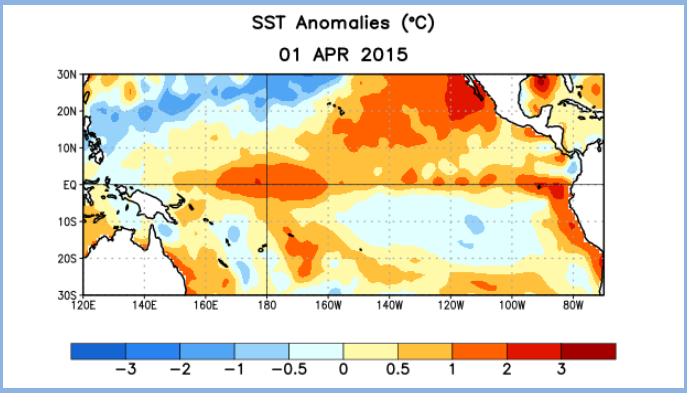
U.S. Winter Temperature **U.S. Winter Precipitation**

NWS Blacksburg Summer 2015 Climate Outlook

Will Perry, Senior Forecaster

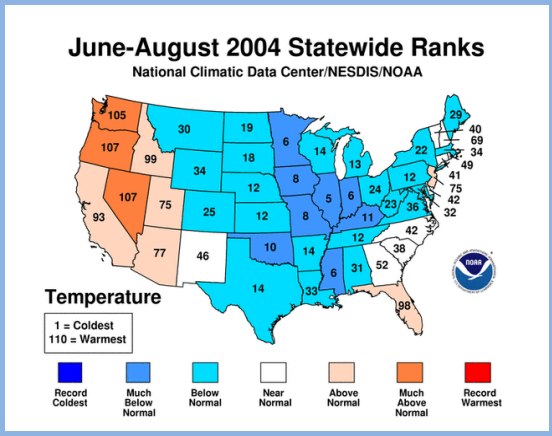
The meteorological summer (June-August) of 2015 is currently forecast to have equal chances for above, below or near normal temperatures and precipitation according to the latest NWS CPC (Climate Prediction Center) forecast. Equal chances means that there is not a clear signal for predicting any category based on 1981-2010 climate normal and in conjunction with various climate forecasting tools and data, such as the El Niño Southern Oscillation (ENSO) . Based on historical ENSO and current trends in our local weather however, it may be possible to provide more insight into the outlook.

To start off, we will look at the ENSO state and its forecast for this summer. As of early April, we were in a weak El Niño state (below) with a vast pool of warm water across the Pacific basin.

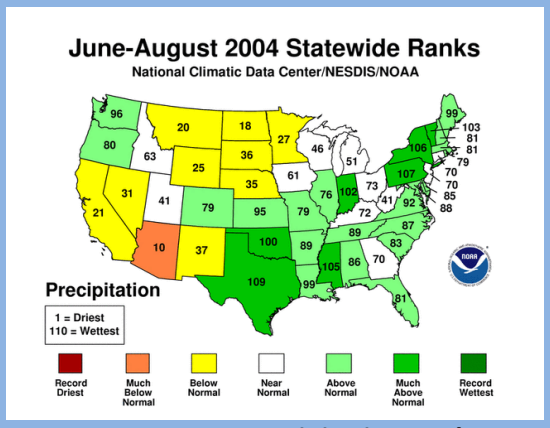


Average sea surface temperature (SST) anomalies (°C) for the week centered on 1 April 2015.

Most models are predicting a continuation of at least weak to possibly moderate El Niño conditions (warmer SST's) through this summer. However, model forecast prediction skill tends to be lower in the spring/summer than in the winter for the Northern Hemisphere. In addition to the ENSO forecast, it may be instructive to look at current and forecast soil moisture. The soil moisture content has been increasing over the Southern Appalachians into the piedmont the past month. The Constructed Analog on Soil Moisture (CAS) model, per the CPC site, is forecasting higher than average soil moisture over western North Carolina, into southwest Virginia, with near average in West Virginia, southeast into the Virginia piedmont. Higher soil moisture tends to mitigate temperature extremes. At the same increased soil moisture could aid in more precipitation due to evapotranspiration, but you also need other factors in play like fronts and to help. In terms of ENSO, the two closest analogs (similar patterns) that had us coming out of a weak El Nino winter and trending the same into the summer were 2004 and 1977. The summer of 2004 was best described as wetter than normal for most of our climate sites, and near to below normal for temperatures (see Figures below).



Jun-Aug 2004 Temperature Ranks



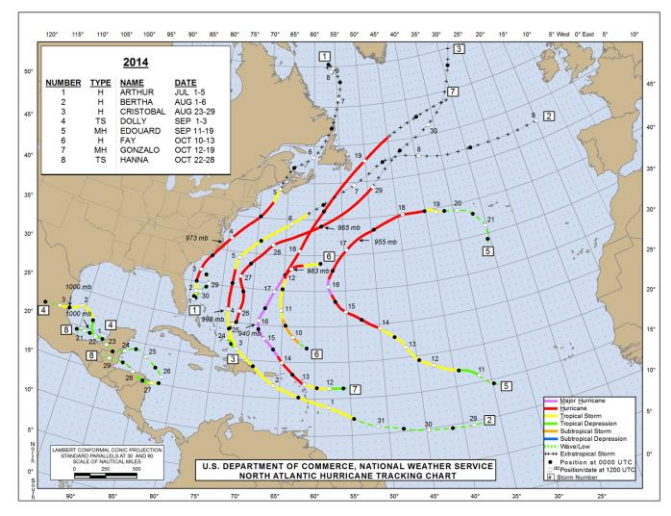
Jun-Aug 2004 Precipitation Ranks

In the summer of 1977 the mountains were near to below normal on temperatures, while the piedmont had above normal temperatures. Precipitation was different from 2004, with very dry conditions in the piedmont, to near normal in the mountains of West Virginia, and southwest Virginia. With all of the above in mind, it is not surprising that the CPC forecast is for equal chances. But the analogs suggest that the mountains will see near to below normal temperatures, and near normal precipitation. The piedmont is more variable, such that in essence a near normal temperature and precipitation forecast is preferred.

Another Quiet Hurricane Season Possible in 2015

Jim Hudgins, Senior Forecaster

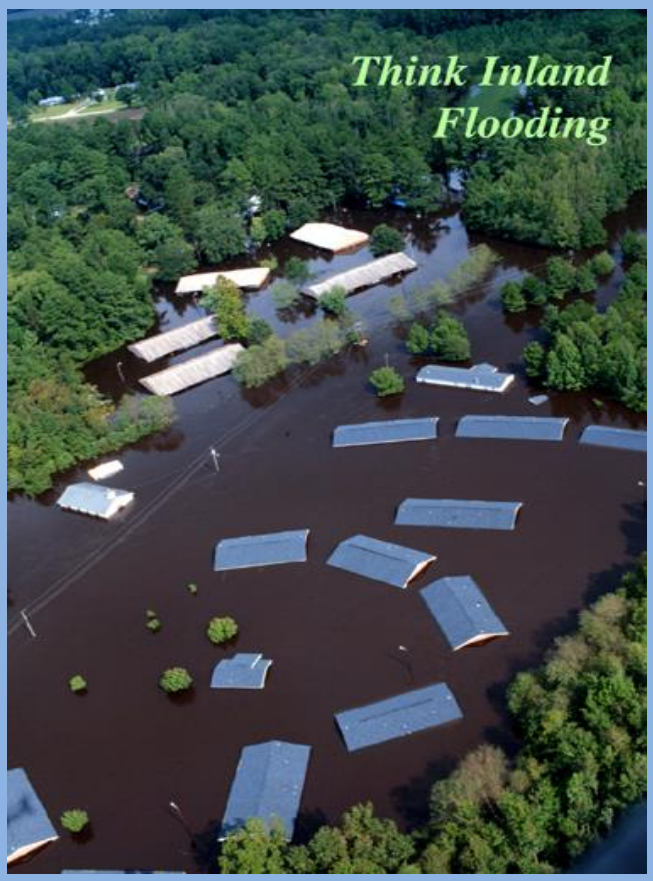
After seeing an average number of storms in the Atlantic basin during 2014, a similar scenario could play out again in 2015 given rather similar forecast conditions expected into next fall. The 2014 season did see nine tropical cyclones, with eight being named storms (Figure below), including six hurricanes, of which two reached major levels. As this figure shows however, the U.S. mainland was barely affected by tropical storms in 2014. This was the fewest named storms since the 1997 season. Hurricane Arthur was the earliest hurricane to make landfall in North Carolina when it crossed parts of the Outer Banks as a Category 2 storm on July 4th. The most intense storm of the season was Gonzalo which attained Category 4 status before weakening and crossing directly over Bermuda late on October 17th as a Category 2 storm.



Tracks of 2014 Atlantic Tropical Systems

The 2015 season again appears tied to the persistence of the ongoing weak El Niño event that may linger through the summer. This combined with cooler than normal sea surface temperatures in the development zone off Africa could again suppress activity or at least limit the number of systems that could affect the United States. This is also seen in the latest seasonal forecast from Colorado State University suggesting a below average Atlantic hurricane season with only seven projected named storms of which three are expected to become hurricanes with one being a major. A recently issued forecast for this season by NC State University also predicted a near record low number of storms. The official NOAA outlook for the 2015 season will not be issued until Hurricane Preparedness Week, May 24-30. The average numbers from the latest 30 year average are twelve named storms, with seven hurricanes, and two majors. The 2015 season begins on June 1st and ends on November 30th. The names for this year include: Ana, Bill, Claudette, Danny, Erika, Fred, Grace, Henri, Ida, Joaquin, Kate, Larry, Mindy, Nicholas, Odette, Peter, Rose, Sam, Teresa, Victor, and Wanda.

In the Blacksburg CWA the primary threat from hurricanes is not wind or certainly storm surge but heavy rainfall and inland flooding. Nearly all of the worst floods on record in this area have been due to heavy rains associated with the remnants of a tropical storm or hurricane. This includes the floods of August, 1940, Hurricane Camille in 1969 and Hurricane Agnes in 1972.

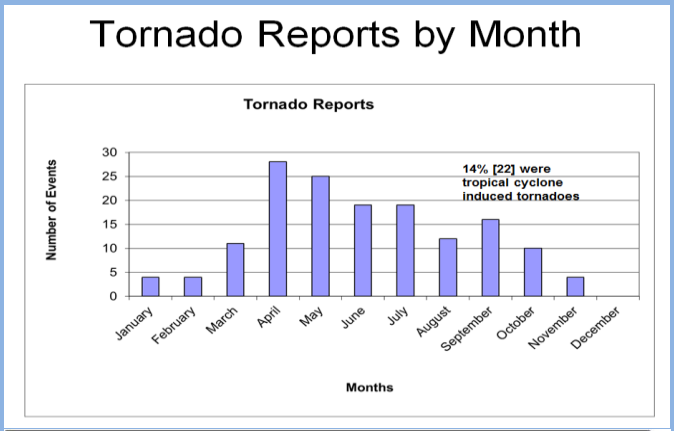


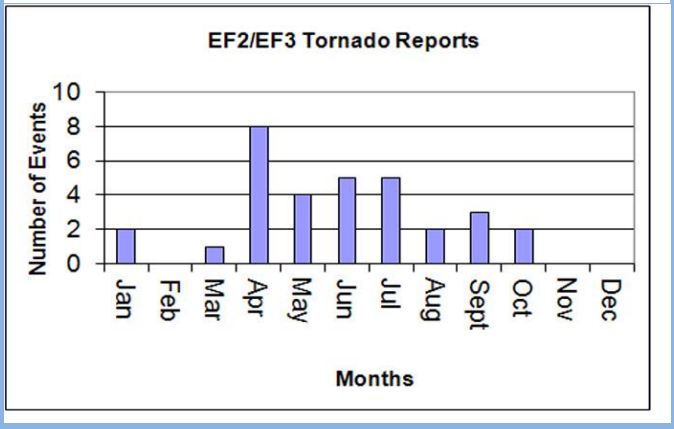
Hurricane Floyd Courtesy of U.S. Army Corps of Engineers, J. Jordan

Mountain Tornadoes in the Appalachians

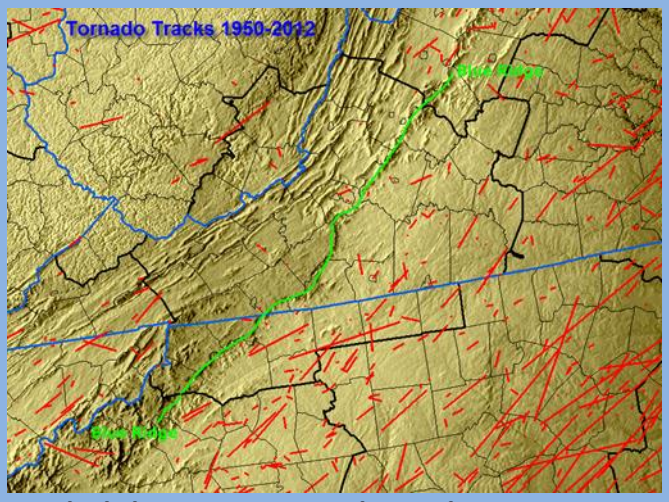
Steve Keighton, Science and Operations Officer

While we do not get as many tornadoes in the Appalachian region of the United States compared to some other parts of the county, they HAVE occurred in this area, even at fairly high elevations, with April and May being the most common months (and only slightly less coming during summer months), with April being the most likely month for particularly strong tornadoes (EF2 and EF3). The figures below show the monthly climatology of all tornadoes and strong tornadoes during the period 1950-2013 for the 40 counties in southwest Virginia, southeast West Virginia, and northwest North Carolina that are covered by the NWS in Blacksburg.





Note that during this period and in these 40 counties, we have yet to experience an EF4 or EF5 tornado (the strongest categories), but that does not mean it can't happen someday. The geographical distribution of tornado reports during essentially this same period (1950-2012) and region (including a little beyond the boundaries of the NWS Blacksburg county warning area (CWA) is shown in the figure below. This clearly indicates that the frequency of tornado occurrences increases as one goes farther east away from the Blue Ridge (the rough location drawn in green) into less hilly terrain. But you can also see that several tornadoes have occurred in the mountainous regions, and some of these were just within the last couple of years. This article provides a very brief summary of several of the more recent events in the mountains, as a reminder that while not especially common, EVERYONE in our region still needs to be prepared to take safety precautions should a tornado warning be issued for your location.



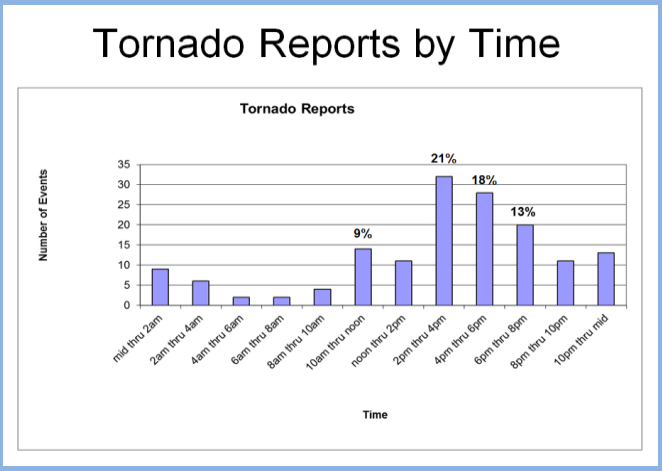
Blacksburg CWA Tornado Tracks 1950-2012

Many tornadoes that touch down in the region, including the mountains, are very brief and in fact may be almost impossible to see on this map. Others have had longer tracks and were much more significant (including a few way back in April of 1974 in western Greenbrier County WV and right over Roanoke that were associated with the end of the historical 'Super Outbreak'. Since this map does not yet include 2014, you will not see the tornado that occurred in Mercer County this past October either, which was the most recent tornado we have had in our area. In addition to the Mercer tornado, we have had several other notable tornadoes in the mountains within the past 6 years and wanted to highlight those events in the table below, which includes links to more information about some of the most significant ones:

Table of Recent Tornados Affecting the Blacksburg CWA

Date	Location	EF scale, time	Comments/Impacts
May 3, 2009	Floyd Co VA (near Indian Valley)	EF0 (~7pm)	Mainly tree damage
May 6, 2009	Near Galax VA	EF0 (~1030pm)	Mainly tree damage
May 8, 2009	Alleghany Co NC near Ennice (2)	EF2 EF1 (both just before midnight)	EF2 resulted in extensive damage to structures and trees, and 4 serious injuries; EF1 was very brief right next to EF2.
Apr 8, 2011	Pulaski Co VA(2)	EF2 (in Pulaski) EF1 (in Draper) (both around 730pm)	EF2 resulted in considerable damage to homes in Pulaski and 9 injuries; EF1 (from same storm) crossed I-81 and damaged homes and caused 1 injury in Draper area.
Apr 16, 2011	Rockbridge Co VA (Vesuvius)	EF0 (~2pm)	Mainly damage to trees and some minor damage to structures. Part of a major tornado outbreak over central and eastern NC and VA.
Apr 27-28, 2011	Smyth Co VA (2)	EF2 (near Chilhowie) EF1 (near Konnarock) (EF2 after 2am on 28th, and EF1 after midnight on 28th)	EF2 was tail end of a long track/destructive tornado entering from Washington Co (3 fatalities and 50 injuries in Glade Spring), and causing 1 injury in Smyth Co; EF1 was in Grindstone campground downing hundreds of trees.
Oct 7, 2014 (must be logged into Facebook for this link to work)	Mercer Co WV (near Spanishburg)	EF1 (just before midnight)	Damage to a number of structures and numerous trees, and 2 injuries.

One interesting aspect of most of these recent mountain tornadoes is that they occurred either in the evening or very late at night (some just before or just after midnight). This goes against the overall diurnal climatology of tornadoes in our region which are more often in the afternoon to early evening (Figure below). This may be because in order to get tornadoes in mountainous terrain, especially stronger ones, the atmosphere has to be particularly volatile in terms of both dynamic energy and thermodynamic energy (instability). These more extreme conditions can happen almost any time of day or night.



In summary, while Appalachian mountain tornadoes are relatively rare compared to both west and east of the mountain chain, some notable ones have occurred even in the last few years, and several of these have been late at night. Most of them have occurred in the months of April and May, however a few have occurred in the Fall as well. Certainly the stronger ones tend to occur during the spring months. If conditions become favorable, which is most likely in those transition seasons of Spring and Fall, tornadoes can occur at ANY time of day or night, whether you are in the mountains or not. It is important to remain aware of the severe weather potential at all times, but especially perhaps when you are ready to go to bed. Be sure to have a method for receiving weather alerts even in the middle of the night, which may include a NOAA All-Hazards Weather Radio, or a cell phone alert (and most cell phone providers now automatically send NWS Tornado Warnings through Wireless Emergency Alerts – WEA). Keep up with the latest severe weather potential from our web page or Facebook and Twitter pages, and you can also monitor the NWS Storm Prediction Center page for severe weather outlooks and watches.

Severe Weather Season is Here!

Report Severe Weather!

Trained spotters or the public should report the following to the NWS via Social Media (Twitter/Facebook) or SKYWARN: 1-866-215-4324.

- **Tornadoes or funnel clouds**
- **Wind Damage, such as structural damage or trees/power lines down.**
- **Measured or estimated wind gusts of 50 MPH or greater**
- **Hail of any size**
- **Water flowing over a road**
- **Creeks or streams leaving their banks**

The Role of the Electronics Staff at WFO Blacksburg

Drew J. Bouvette, Electronics Technician

The electronic staff is the behind-the-scene backbone support of most forecasts and advisories. Believe me, when the NEXRAD radar, a NOAA weather radio or an Automated Surface Observing System (ASOS) at an airport goes down, the action starts! Fortunately, the NWS uses backup Weather Forecast Offices (WFOs) and their equipment to address all weather events so that nothing is missed. It is definitely a team effort. Our office has an Electronics System Analyst (ESA), the work center supervisor and two Electronic Technicians (ETs). Between the three of us we maintain a wide variety of computer and electronic systems in North Carolina, Virginia and West Virginia. We work in the WFO, at airports, in the field and on mountaintops. We all have U.S. Air Force backgrounds and degrees in electronic system technology and/or computer technology. We perform calibrations, inspections, installations, emergency maintenance, and modifications on the following equipment:

*Automated Surface Observing System (ASOS)
*Advanced Weather Interactive Processing System (AWIPS)
*Console Replacement System (CRS)
*Computers, LAN, Printers, Routers, Servers, Telephone system, WAN and associated hardware & software
*Limited Automated Remote Collectors (LARC)
*WSR 88D Radar (NEXRAD)
*NOAA Weather Radio (NWR)
*Radiosonde Surface Observing Instrumentation System (RSOIS)
*Replacement Radiosonde System (RRS)

We also serve as the technical focal points for communication and environmental hazards and as project managers on safety issues. In addition, we develop, document and write best practice procedures and resolve technical problems, including research to implement cost saving solutions.

KFCX WSR 88D, Floyd County, VA

National Water Center Opens in Tuscaloosa, AL

Peter Corrigan, Service Hydrologist

The National Water Center (NWC) is a brand-new 65,000 square-foot facility located on the campus of the University of Alabama in Tuscaloosa, AL. The building was completed to LEED Gold standards in 2014 and eventual staffing for up to 200 personnel is planned. The Water Center was built to address the challenges of water resources in the 21st century from a national perspective. Initial signatories to a Memorandum of Understanding to staff and operate the NWC included NOAA (water prediction), USGS (water science) and the U.S. Army Corps of Engineers (water management). The initial focus areas for the NWC include:

•High-Resolution Water Resource Forecasts
•Flood Inundation Mapping
•System Interoperability and Data Synchronization

National Water Center, Tuscaloosa, AL

Hydrologic Program Managers (mainly Service Hydrologists) from the entire NWS will be gathering at the new NWC facility in mid-May 2015 for a national hydrologic conference. The conference will deal with a wide variety of hydrologic issues facing NWS field offices from flooding to drought to new ways of communicating risk to the public.

Recent WFO Staff Changes

Chris Fisher (Meteorologist Intern)

Meteorologist Intern Chris Fisher has recently accepted a transfer to the same position in the northern Great Plains NWS office at Glasgow, MT. Chris has been at WFO Blacksburg since January 2012 during which time he proved to be an invaluable addition to the office. He was a social media innovator and his work in the NWS COOP program was outstanding. He also displayed a willingness to fill in shifts on short notice and for extended periods, thus earning the moniker 'Ironman Chris'. Chris and his family will be heading northwest in late June, he will be greatly missed! Chris had some parting words: "My three and a half years in southwest Virginia have been amazing. Besides the friends and co-workers, I'll miss watching the mountains change with the seasons, and I'll miss the smiling and friendly faces in Pearisburg and Giles County".

Jacob (Jake) Ruckman (Meteorologist Intern)

Jake was hired into the NWS this past February. Jake got his start in weather in 2004 when he enlisted in the Air Force. During his time with the 15th Operational Weather Squadron at Scott AFB, IL he performed base, point and flight weather forecasts for over 100 locations in the continental US (many in VA and WV). He received the Air Force Achievement Medal in 2007 for time critical and mission essential forecasting. After his time with the 15th, he moved across base to the Tactical Airlift Command Center and provided flight weather graphics for pilots over six continents. He was honorably discharged in 2008. In 2009 he continued his interest in weather by attending the University of Missouri, St. Louis for one year, then transferring to Saint Louis University (SLU), where he received his B.S. in Meteorology in 2012. He was asked to stay at SLU for his Masters degree and accepted. During his time as a graduate student, he did impact based forecasting for Ameren, Missouri which provides power for most of the state, and the St. Louis Cardinals. Currently, he is in the process of completing his thesis and hopes to be degreed officially in the near future. Jake is originally from St. Louis. He is a die-hard Cardinals fan and a self-proclaimed great cook.

James (Jamie) Morrow (Meteorologist Intern)

In March of 2015, James was hired on as a Meteorological Intern at the Blacksburg, WFO. James grew up in King George County, Virginia and completed his undergraduate studies at Virginia Tech, where he received his B.S. in Meteorology, B.A. in Geography, and a Minor in Geosciences. While at Virginia Tech, James served as President of the Blue Ridge Chapter of the American Meteorological Society and National Weather Association that was nationally recognized as Chapter of the Year of the AMS organization. James has experience working with NASA as a Geospatial Consultant, weather interning at WDBJ-7 (Roanoke), and extensive weather media forecasting experience at Virginia Tech where he founded the Hokie™ Weather Watch organization. James had gained previous experience within the Weather Service Office as a student volunteer, project assistant, and capstone participant. In 2012 and 2014, he served as a forecaster and navigator for the Hokie Storm Chasers, where he found his true passion and on-going thesis project studying severe weather and tornadoes.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