Blue Ridge Thunder

Newsletter of the NWS Blacksburg, VA

Welcome to the spring 2017 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 and warnings to the public.

Inside this Issue:

Weather Highlight

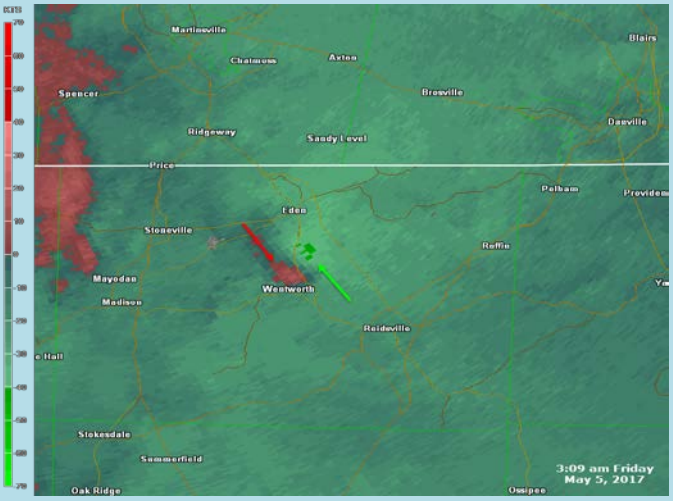
Spring Storms produce tornadoes and flooding

Peter Corrigan, Senior Service Hydrologist

Late April and early May of 2017 saw a return to a more active weather pattern across the Blacksburg County Warning Area (CWA). Two tornadoes developed during the overnight hours of May 4-5 as an upper level low tracked across the Tennessee Valley and pushed a complex frontal system through the region overnight. Low level southeast flow led to atmospheric saturation and around 3 AM a line of convective storms entered Rockingham County, NC. An embedded cell within this line became briefly tornadic around 312 AM and persisted for six minutes according to the NWS damage assessment survey conducted later that day. The survey team confirmed an EF1 tornado (on the enhanced Fujita scale) with winds as high as 110 mph along a 3.3 mile track through the western portions of Eden.

Damage from EF1 tornado in Eden, NC – May 5, 2017

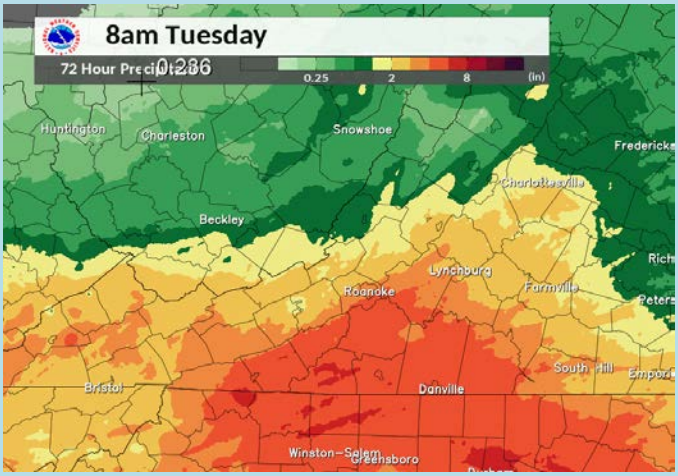
While damage was significant, with 25 homes and nine businesses sustaining damage, there were no injuries or fatalities. This was the first tornado in Rockingham County since 2009 (an EF0) and the 10th since accurate records began in 1950. In March, 1998 the county was hit by one of the strongest tornadoes to be observed in the CWA when an EF3 tornado passed near Stoneville, NC causing two fatalities. The image below shows a radar storm-relative velocity image of the Eden tornado just before dropping to the ground.



WSR-88D radar storm-relative velocity image (SRM) of Eden EF1 minutes before touchdown

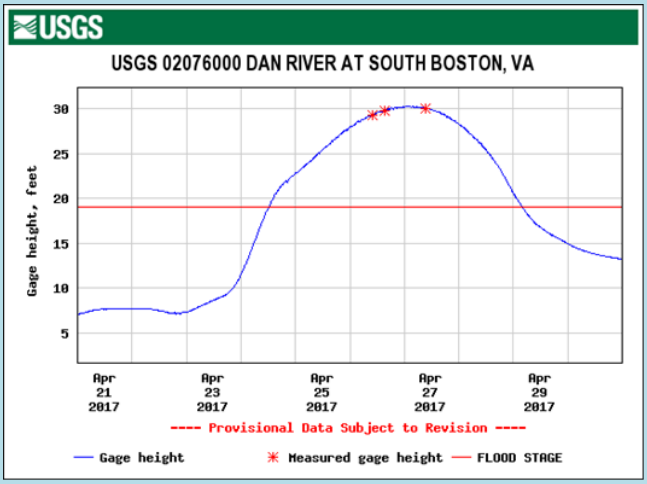
The same storm cell that produced the Eden tornado pushed further north in the early morning hours and merged with a convective line north of Smith Mountain Lake. This new storm produced a brief EF0 tornado (winds to 85 mph) near Moneta in Bedford County, VA. Another NWS survey team found that this tornado lasted only three minutes with a track of 0.3 miles. A few trees were uprooted and minor structural damage to several homes occurred. These storms developed in what is known as a high shear/low-CAPE environment which often results in very rapid spin-up times for tornadoes. The Eden storm went unwarned due to partly to this rapid spin-up, while the Moneta storm had a Severe Thunderstorm Warning, but no Tornado Warning.

In late April the story was flooding which occurred as a result of several days of heavy rainfall from April 22-25, 2017. Storm total rainfall for the event is shown below. Amounts ranged from 1-2 inches in the far northern basins including the Greenbrier and upper James up to over 7 inches (isolated 8-9") in parts of the upper New, Dan, and Yadkin basins. Much of the upper Tennessee, Roanoke, and middle James had between 3 and 5 inches.



Storm total rainfall – April 22-25, 2017

River flooding was fairly widespread with forecast points on the Clinch, Yadkin, Roanoke and Dan rivers exceeding flood stage, along with flooding on numerous smaller creeks and streams. The crest on the Dan River at South Boston (graph below) reached 30.25 feet very early on the 27th, which was the highest observed stage at South Boston since March 23, 2003 (30.34 feet).



USGS Hydrograph - Dan River at South Boston, VA

GOES-16 Goes Live!

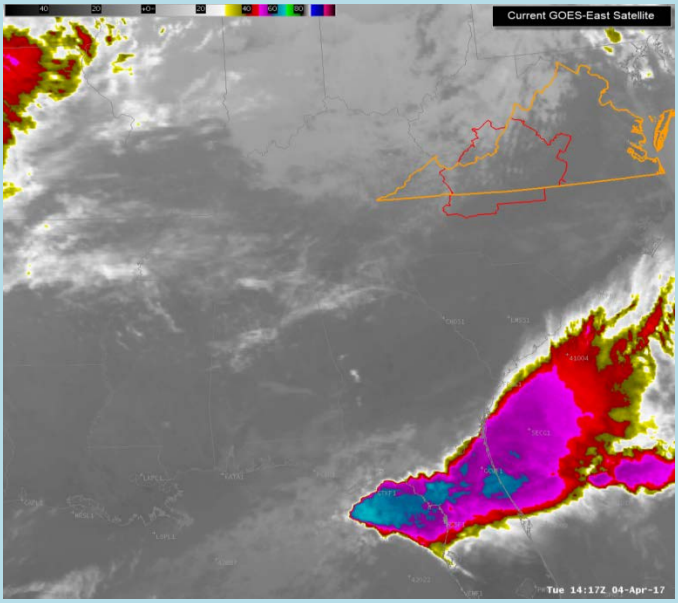
Mike Sporer, Meteorologist and Steve Keighton, Science and Operations Officer

The next generation of NOAA/NWS geostationary weather satellites was born on November 19, 2016 with the launch of GOES-16. Our latest satellite will significantly improve the detection and observation of environmental phenomena that directly affect public safety, protection of property and our nation's economic health and prosperity. The GOES satellites are geostationary, that is they maintain a single location approximately 22,300 miles above the equator allowing them to constantly surveil the earth below.

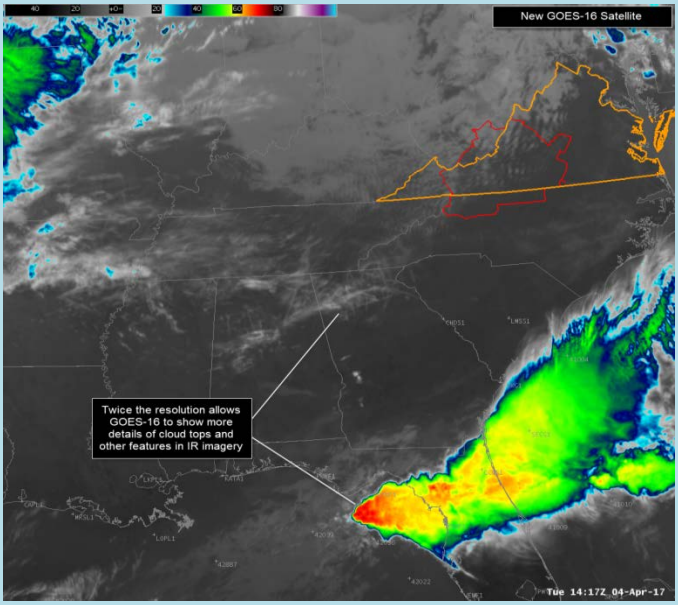
The GOES-16 satellite improved capabilities

The superlatives in terms of increased capability are many and varied. The GOES-16 Advanced Baseline Imager (ABI) has increased spatial resolution (0.5km vs 1km visible, 1km-2km vs 4km IR) and faster coverage (images every 1 to 7 minutes!) that will allow for more accurate forecasts and warnings, and the Geostationary Lightning Mapper (GLM) will allow for real-time mapping of lightning activity. Once a satellite is successfully launched there is a still a lot of work that goes into making sure it's ready to provide high quality data. GOES-16 is currently in the post-launch testing phase to allow for troubleshooting before it becomes operational later this year. Also still to be decided is where GOES-16 will be 'parked', over the eastern or western U.S.

Thus far, the preliminary, non-operational imagery we have received is simply spectacular! The combination of high quality imagery and value added satellite derived products will transform meteorological operations like never before. The figures below show infrared imagery from the current GOES-East satellite versus GOES-16



GOES-13 Infrared



GOES-16 Infrared

Since satellites are assigned a letter before launch and renamed with a sequential number after

achieving operational orbit, GOES-16 is the first satellite of the GOES-R series - a four-satellite program (GOES-R/S/T/U) that will extend the availability of the operational GOES satellite system through 2036.

The following links will provide much more information about the GOES satellites and their capabilities:

http://www.goes-r.gov/

http://cimss.ssec.wisc.edu/goes/blog/

Advances in Lightning Detection and Forecasting

Anita Silverman, Senior Forecaster

Every thunderstorm produces lightning.

Damage to a tree from lightning

Currently only ground based networks detect lightning. One primary source of lightning data is Earth Networks Total Lightning Network (ENTLN). The National Weather Service has partnered with Earth Networks to access to this expanding high density network which covers the continental United States, Alaska, Hawaii and many other locations throughout the world. The ENTLN detects both intracloud (IC) and cloud-to-ground (CG) flashes.

The second and oldest network that detects lightning is the Vaisala's U.S. National Lightning Detection Network® (NLDN). This partnership began in 1986. This group of sensors detects cloud-to-ground (CG) and cloud-to-cloud strikes (CC).

Another source of lightning detection is a Lightning Mapping Array (LMA). The closest array to southwest Virginia, northwest North Carolina and southeast West Virginia is the DC Lightning Mapper Array. This array uses a network of seven sensors around the Washington DC metro area. The sensors look like this (image below).

The GOES-16 satellites have the capability to detect **total** lightning (in-cloud (IC), cloud to cloud (CC), *and* cloud-to-ground (CG)) and has near uniform coverage of the United States and adjacent oceans. Soon, the Geostationary Lightning Mapper (GLM) system in GOES-16 will compliment land based networks that only detect cloud to ground strikes (15% of total lightning). The first images from GOES-16 arrived in February 2017. GLM data is expected to be available on a routine basis by the end of 2017.

Since in-cloud (IC) lightning often occurs five to 10 minutes or more before potentially deadly cloud-to-ground strikes there will potentially be more advanced warning for those involved in outdoor activities of the developing threat.

When combined with radar, other satellite data, and surface observations, GLM data may help forecasters anticipate severe weather and issue flood and flash flood warnings sooner. In dry areas, especially in the western United States, information from the instrument will help forecasters, and ultimately firefighters, identify areas prone to wildfires sparked by lightning. The GLM will collect information such as the frequency, location and extent of lightning discharges to identify intensifying thunderstorms and tropical cyclones.

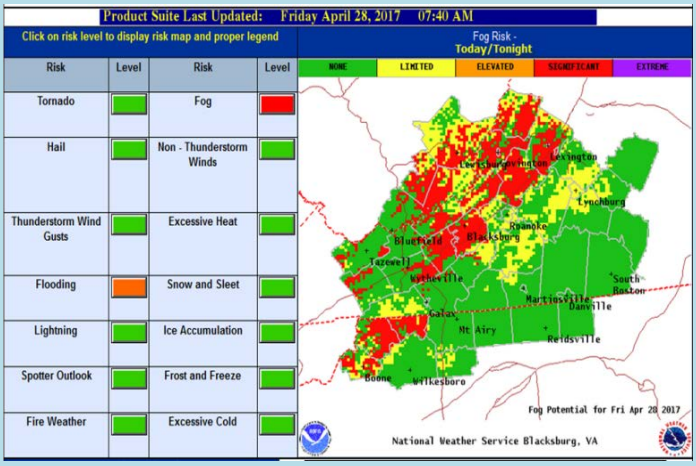
June 18, 1980 Norman, OK

The Enhanced Hazardous Weather Outlook

Jamie Morrow, Meteorologist intern

One of the primary roles of a National Weather Service Forecast Office is to predict and disseminate information on hazardous weather events to decision makers. Communicating a wide variety of weather hazards to a diverse audience living at highly variable elevations can be challenging. To better communicate these threats, our office has implemented a new graphical-based product called the Enhanced Hazardous Weather Outlook (eHWO). This experimental product is a decision support tool that aides in preparedness and response efforts prior to and during hazardous weather. The product, which includes far greater amounts of spatial and temporal details compared to its text-based counterpart, will provide decision makers with convenient access to the potential for hazardous weather events by graphically depicting the risk of certain weather hazards over the next seven days. There are five risk levels on the graphical HWO including None, Limited, Elevated, Significant and Extreme. The thresholds needed to trigger each level for each type of weather phenomena will be developed and refined in coming months.

The graphical-based eHWO can be accessed at www.weather.gov/rnk/ehwo, or under the "Current Hazards" menu on our website at www.weather.gov/rnk. If you have any comments about this product, we invite you to provide your feedback through the electronic survey linked at the bottom of the eHWO page.



Example of Enhanced Hazardous Weather Outlook (eHWO)

Winter 2016-2017 Climate Summary

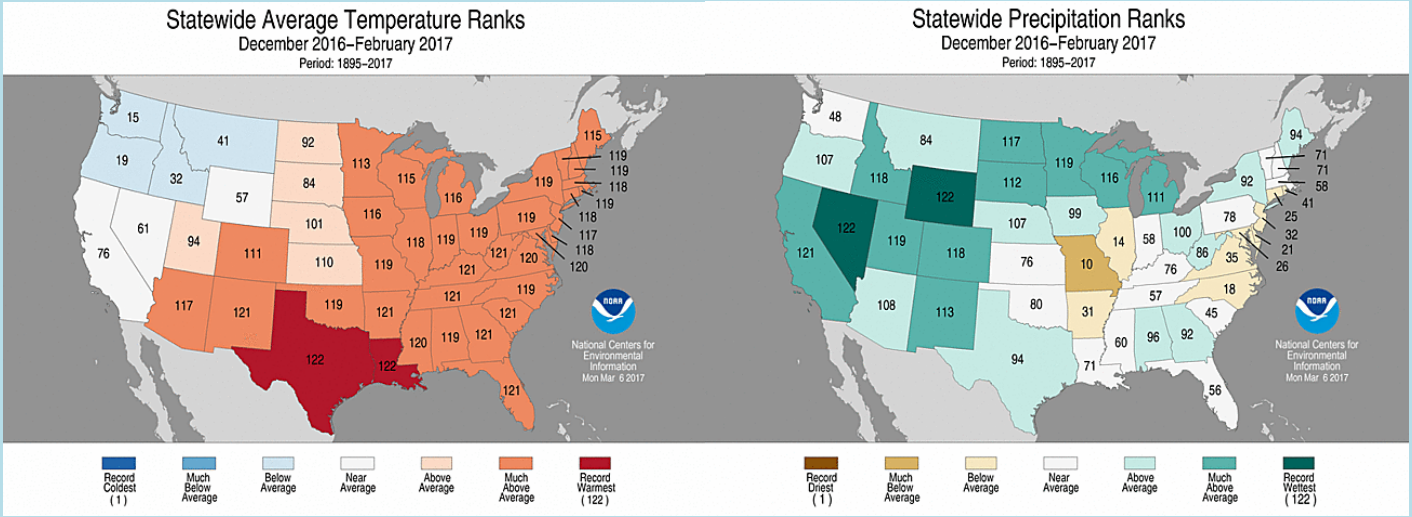
Peter Corrigan, Senior Service Hydrologist

Winter 2016-2017 (Dec 1 – Feb 28) will enter the record books as one of the warmest ever observed in this area (see table below). The season actually began with near normal temperatures in December. There was little to no snowfall and near average precipitation in December which was welcome after a very dry November. January 2017 however, was very warm, with monthly averages at local climate stations some 4 to 8 degrees above the long-term normals. At Blacksburg it was the 4th warmest January on record since 1952, Bluefield 6th warmest since 1959 and Danville 8th warmest since 1948. The only significant snow of the winter occurred January 6-7 as parts of the piedmont had 6 to 10 inches of snow. Overall it was somewhat wetter than normal in January with CWA-wide precipitation of 4.23 inches versus the normal of 3.32 inches. This included a record 20 days with measurable rainfall (0.01 inches or more) at the Blacksburg NWS office. February 2017 however 'took the cake' as a warmer than normal month. Four of the 5 climate sites established all-time February warmth records including Lynchburg with the longest period of climate observations in the CWA (since 1893) and Roanoke with records back to 1912. Temperatures were generally 7 to 10 degrees above the 30-year climatology for this area. It was also unusually dry in February with a number of Cooperative network stations setting all time dry February records.

Climatological Statistics for winter 2016-2017 (Dec-Feb).

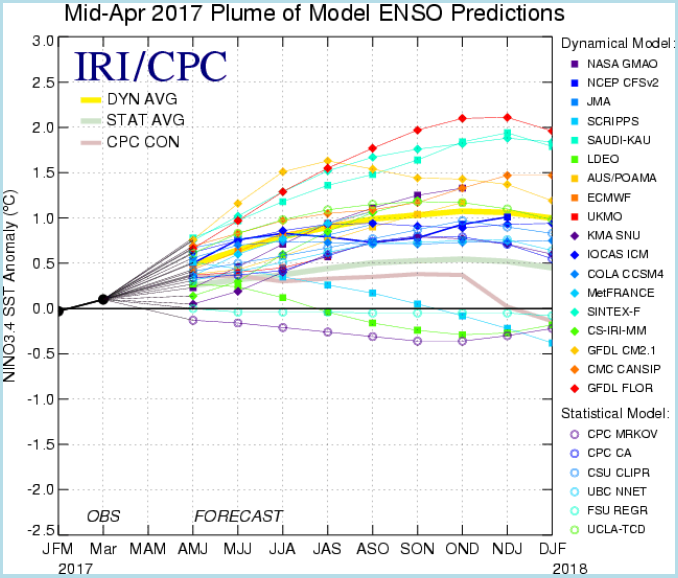
Climate Site	Average Temperature (Anomaly)	Rank (as warmest)	Period of Record	Total Precipitation (Anomaly)	Total Snowfall (Normal)
Bluefield	38.5 (+2.3)	4th (tied)	1959-2017	9.01 (+0.44)	17.2 (25.3)
Blacksburg	39.0 (+5.9)	1st (tied)	1952-2017	8.87 (+0.03)	6.6 (16.2)
Roanoke	43.2 (+4.9)	2nd (tied)	1912-2017	7.43 (-1.32)	4.5 (14.2)
Lynchburg	40.6 (+3.7)	35th	1893-2017	7.48 (-1.83)	5.9 (10.2)
Danville	43.8 (+4.3)	2nd	1948-2017	6.39 (-3.31)	8.8 (9.3)

The two figures below show winter statewide ranking for temperature (left) and precipitation (right) since 1895 across the lower 48 states for the winter period. The unusual winter warmth affected the entire eastern U.S. A full report on recent climate observations and trends can be found at the NOAA/NCEI climate web page.



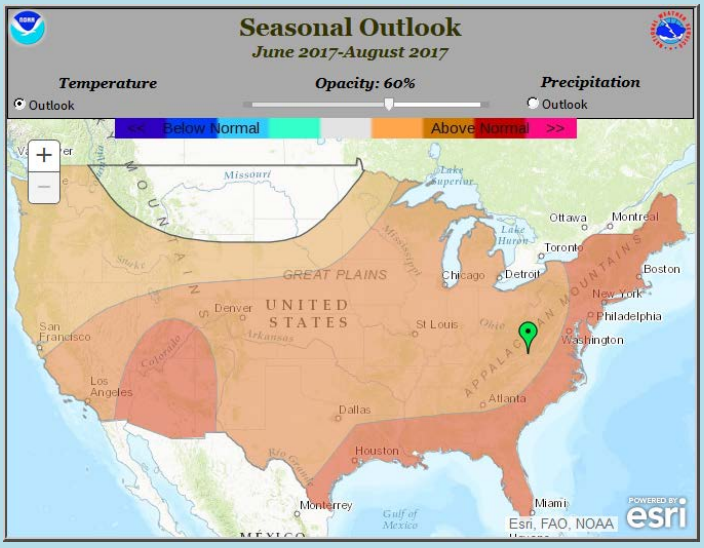
Summer 2017 Outlook: Neutral ENSO Conditions – Slight Chance for El Niño by Summer

As of mid-May the status of the El Niño/Southern Oscillation ENSO is considered to be neutral (no El Niño or La Niña) with a very small positive sea surface temperature anomaly. The latest suite of ENSO predictions from IRI/CPC (shown below) suggest that the current neutral conditions or possibly a weak El Niño are the most likely to develop by mid- to late summer. The effect of either of these patterns on the summer season weather in the mid-Atlantic/Southern Appalachian region is likely to be weak and unpredictable at best, as the influence of ENSO is generally minimal in the warm season in our region. A strong El Niño is generally detrimental to hurricane development in the Atlantic basin due to increased wind shear and greater atmospheric stability, while the converse is true for La Niña. The impact of ENSO on the tropical outlook is discussed in more detail in the next article.

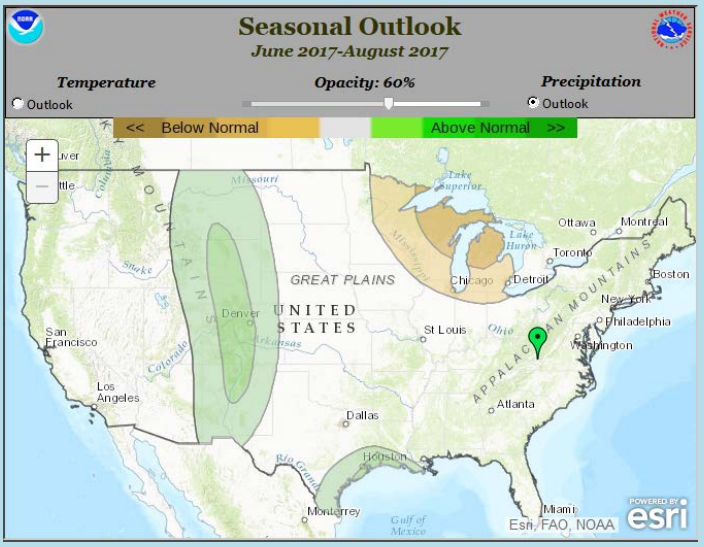


Model forecasts of ENSO through late 2017. Positive values indicate El Niño status while negative values indicate La Niña status

You can learn more about ENSO and obtain weekly expert discussions at the NWS Climate Prediction Center (CPC) web page. Current forecasts for summer 2017 (Jun-Aug) are suggesting that above normal temperatures are more likely in our region and for most of the continental U.S. (CONUS). Equal chances of above, normal or below normal precipitation are indicated for our region. The latest (May 18, 2017) CPC forecasts for summer temperatures and precipitation across the CONUS are depicted below.



Summer Temperature Outlook (Jun-Aug)

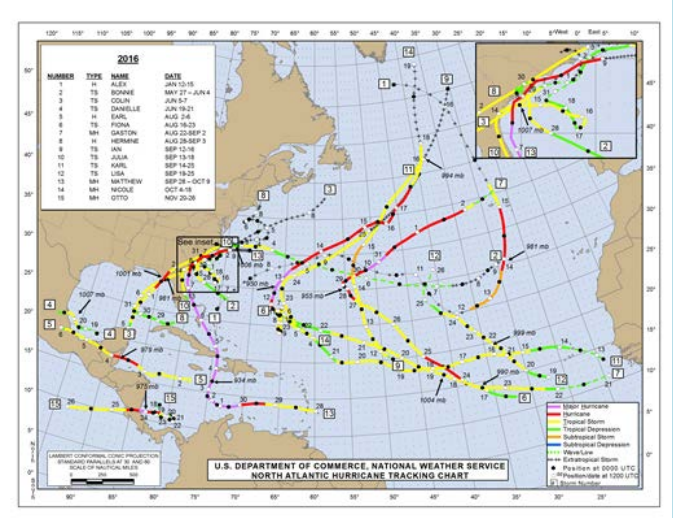


Summer Precipitation Outlook (June-Aug)

Slightly Below Normal Atlantic Hurricane Season Expected in 2017

Jim Hudgins, Senior Forecaster

After one of the more active recent Atlantic hurricane seasons in 2016, early projections point to a return to a slightly below normal 2017 season with forecasts of 11 named storms compared to a normal of 12, with perhaps 4 becoming hurricanes and 2 majors. This follows the active summer and fall of 2016 in which there were 15 named storms (figure below), including 7 hurricanes and 4 majors. A summary of the 2016 season is available here.



2016 Atlantic Basin Tropical Cyclone Tracks

The storm of the 2016 season was Hurricane Matthew (Sept. 28 to Oct. 10) that affected parts of the Southeast U.S. and was the most destructive in both life and property with over 600 deaths (mostly in Haiti) and about $15 billion dollars in damage along its path. Matthew was the first Category 5 storm in the Atlantic basin since Felix in 2007 and set a notable record for reaching Category 5 at the lowest latitude ever (13.4°N) for a storm of this intensity in the Atlantic. Locally, the storm brought heavy rainfall to the area with between 2 and 6 inches of rain in spots along and especially east of the Blue Ridge in early October that resulted in areas of small stream flooding.

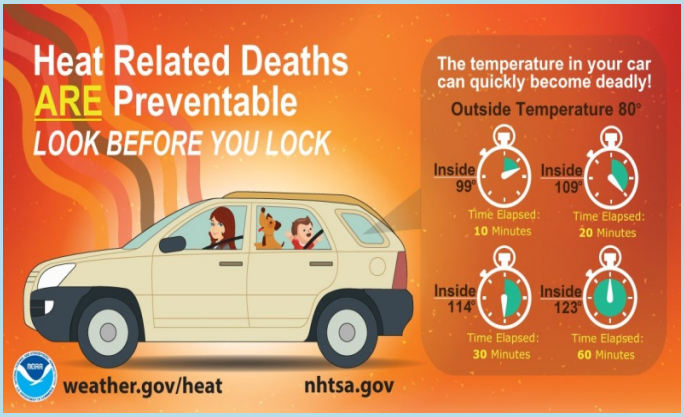
Visible Satellite image of Matthew centered just off the east Florida coast, October 7, 2016.

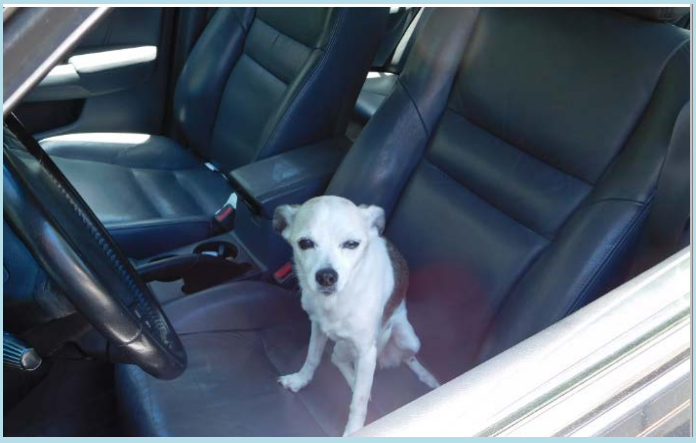
This early season forecast provided by the tropical research group at Colorado State University of below normal activity for the upcoming season suggests a combination of below normal water temperatures across the tropical Atlantic along with a transition to a weak or moderate El Niño (warming in sea-surface temperatures to above normal levels across the central and east-central equatorial Pacific) will help limit storm development. The official NOAA forecast will be issued in late May. The resultant forecast due to El Nino conditions may produce strong upper level westerly winds that could lead to higher-than-average vertical wind shear and thus reduced hurricane activity across the tropical North Atlantic. This also supports a below average threat of seeing a major hurricane make landfall along the U.S. coastline and Caribbean. However timing of the onset of the El Nino conditions and eventual strength which would act to enhance wind shear heading into later this summer remains uncertain,

as model differences continue, ranging from a continued near neutral ENSO cycle to a stronger late summer El Niño.

The storm names for the upcoming 2017 season include Arlene, Bret, Cindy, Don, Emily, Franklin, Gert, Harvey, Irma, Jose, Katia, Lee, Maria, Nate, Ophelia, Philippe, Rina, Sean, Tammy, Vince, and Whitney. The 2017 season officially begins on June 1st and ends on November 30th.

Summer is almost here! Don't forget kids and pets in the car!





Take me!

Recent WFO Staff Changes

There were no personnel changes among the WFO Blacksburg staff since last fall with several positions remaining unfilled at this time.

Jordan Pegram

Jordan was one of the top student volunteers to come through the NWS Blacksburg office from the nascent Virginia Tech Meteorology program. And now she is the second graduate of the program (after our very own intern extraordinaire Jamie Morrow) to join the ranks of the NWS. A Virginia native, she has recently traded the mountains of southwest Virginia for the deserts of southern Arizona! She accepted the position of Meteorologist Intern with the NWS office in Tucson at the beginning of 2017. After growing up in southside VA, she went on to receive her B.S. degree in Meteorology from Virginia Tech in May 2016, and she is currently pursuing her Master's in Geosciences with a concentration in Applied Meteorology through Mississippi State University's Distance Education program. During her time as an undergrad, Jordan served as a student volunteer at NWS Blacksburg for a year and a half, and she was also selected to participate in our senior Capstone course. Not only did she have a passion for working on the operational side of the office, but she also enjoyed assisting with research projects and talking with folks in the community through attending various outreach events. While Jordan does miss the four seasons and green landscapes of Virginia, she is enjoying the warm weather in Arizona and is looking forward to the upcoming Monsoon Season.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