

Sterling Reporter

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National Weather Service Baltimore MD/Washington DC Forecast Office

Fall 2016



MIC's Corner

*By, James E. Lee
Meteorologist in Charge*

Activity level at our office has been very high, which is not uncommon. As an example, we recently had multiple visitors to our office on one busy November day: We had facilities personnel retrofitting our Upper Air Inflation Shelter to utilize hydrogen gas instead of helium, we hosted a visit from the Eastern Region Headquarters Observation Program Manager, technicians were onsite to seal the WSR-88D radome, and technicians were here to install a new video-based Hurricane Hotline, all in one day! These types of visits, coupled with our daily forecasting, administrative, and maintenance work, comprise the effort that is necessary to fulfill the mission of the NWS locally here in the Baltimore/Washington region.

The past year was very successful at our office. Some of our major achievements from last year including our office hosting an Open House in April 2016 that was attended by approximately 4,000 people; we accurately forecast a record blizzard in January 2016 – identifying a high threat of a major storm six days before it actually happened; we reformed our daily routine forecast procedures so we can focus on high-impact hazardous weather; and we increased our office's performance, particularly relating to Flash Flood Warnings.

So what does our office have planned for this coming year? 1) We will be the lead federal agency in providing *(continued next page)*

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Ellicott City Flood of 2016 *by Jason Elliott, Senior Service Hydrologist*

On Saturday, July 30th, 2016, torrential rainfall occurred in and near Ellicott City, Maryland, causing severe flash flooding and destruction to the historic Old Town portion of the city. Two fatalities have been reported. Many buildings in Old Town Ellicott City were damaged, some significantly, and hundreds of vehicles were impacted. Significant land erosion also occurred.

Several convective cells formed ahead of a larger area of rain, which then was followed by persistent heavy rain, with very little lightning, in a west-to-east band for around 90 minutes between 6:45pm and 8:30pm. The National Weather Service issued a flash flood warning, which included Ellicott City and Baltimore, at 7:18pm. The first report of flooding near Ellicott City was in the

MIC's Corner (continued) meteorological support services to the 58th Presidential Inauguration in January 2017; 2) our office will start providing statements on the potential of winter commuting hazards (those events where small amounts of winter precipitation fall on frozen roads during rush hours); 3) we are expanding our assessment of the threat of winter storms, starting three days out and continuing through seven days in the future; 4) serve as a stop on the 2017 Hurricane Awareness Tour in the Washington DC Metropolitan area (an event where people can look at one of the Hurricane Hunter airplanes and meet the pilots who fly into the storms to gather data), and 5) identify areas of extreme hydrologic vulnerability, and to coordinate outreach, education, and responsiveness efforts with local emergency management.

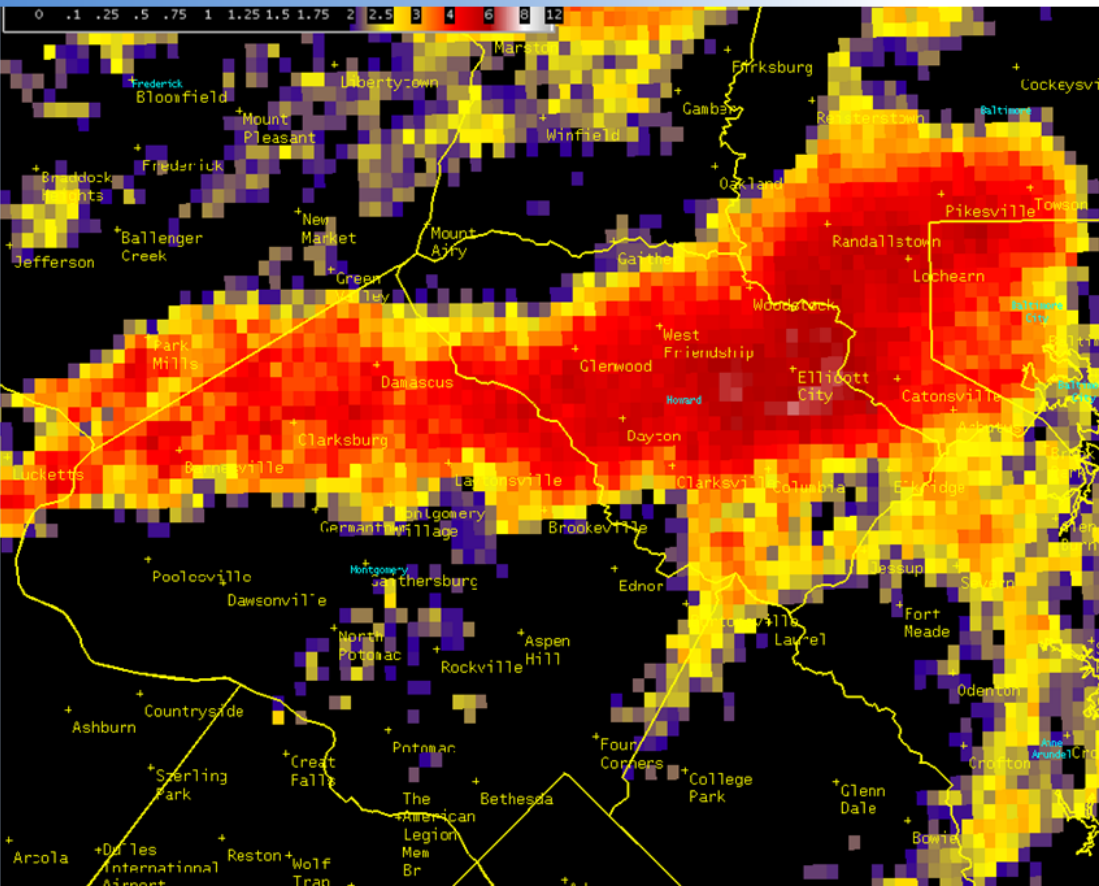
As you can see, this should be a very busy year, and we hope to achieve our continued success. Happy Holidays and best wishes to everyone for a prosperous 2017!

If you have any questions, please call me at 703-996-2200, extension 222, or email me at James.E.Lee@noaa.gov.

Ellicott City Flood (continued) Chatham area west of downtown at 8:01pm. The most severe flooding reports came in between 8:45pm and 9:15pm.

The MRMS (Multi-Radar/Multi-Sensor) precipitation estimates from the event show the swath of most persistent heavy rain that occurred from northern Montgomery County, Maryland to Baltimore City. The image below is filtered to show only amounts over two inches. Areas in yellow are over 2.5 inches; red is over 4 inches; and the pixels of white near Ellicott City are estimates of over 6 inches. Much of this rain fell in 90 minutes or less.

Precipitation Estimates – July 30, 2016

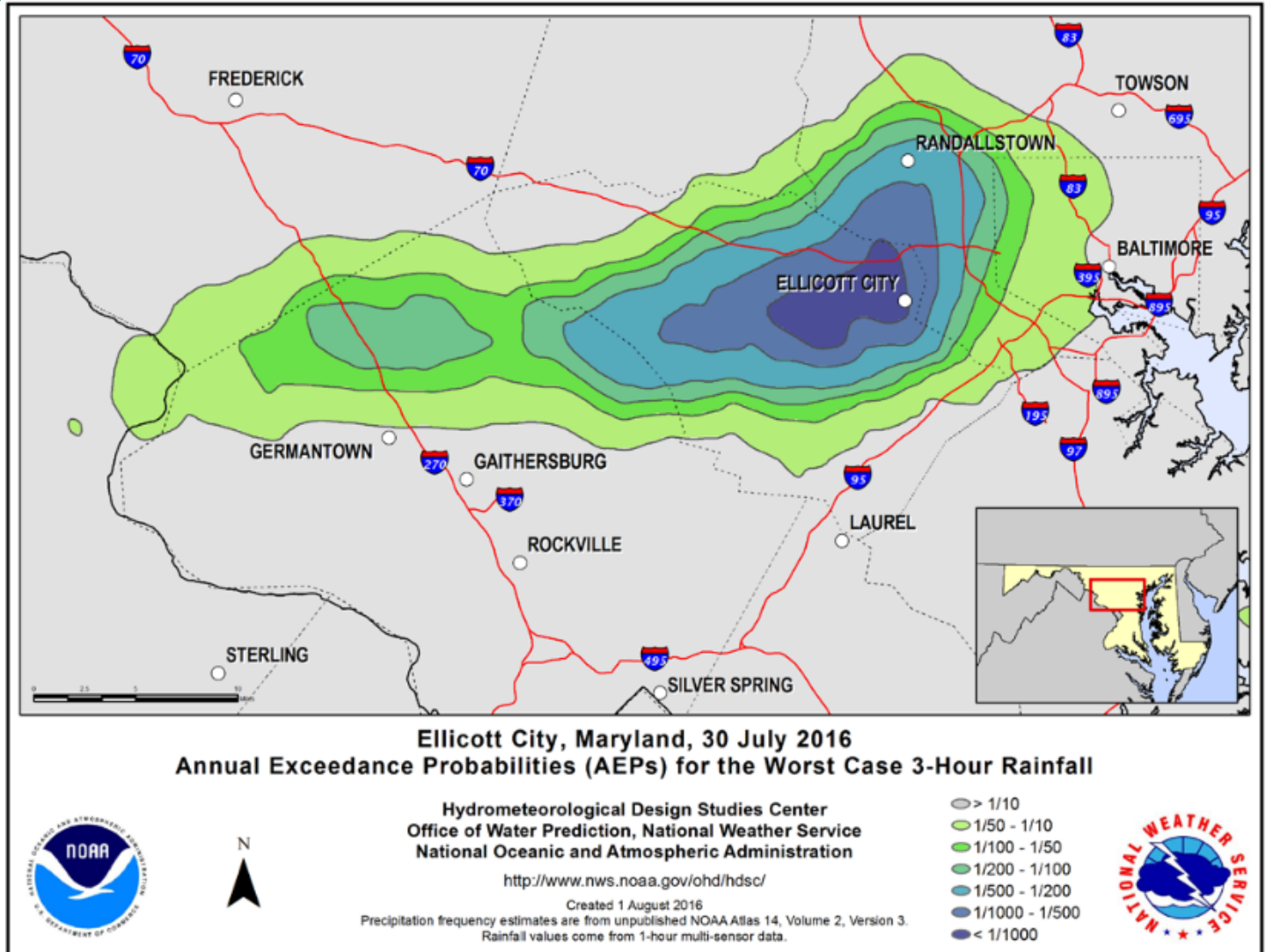


of white near Ellicott City are estimates of over 6 inches. Much of this rain fell in 90 minutes or less.

The National Weather Service's [Hydrometeorological Design Studies Center](#) (HDSC) has completed an exceedance probability analysis for this rainfall event, based on the rainfall estimates and observed data shown (left).

At time durations of 5 minutes to 3 hours, the observed rainfall at the

(continued next page)

Ellicott City Flood (continued)

Ellicott City gauge has a probability of occurrence of less than or equal to 1/1000. *This does not mean this extreme rainfall will only occur once in a thousand years.* However, it is a rare and unlikely event. Based on statistical analysis, there is a 0.1% chance or less of this rainfall occurring in these time durations and location in any given year.

Certainly, rain of this severity will cause a sharp rise on streams, and this was reflected in numerous automated stream gauges monitored by the NWS. The largest river impacted in this event was the Patapsco River, which is the county border between Howard and Baltimore Counties for much of its reach. At Ellicott City, the Patapsco rose just over 13 feet in 100 minutes (7:20pm - 9:00pm), and rose over two feet in just five minutes (8:40pm-8:45pm). This sharp 2+ foot rise coincides with the time when the most significant reports of flooding began to be received by the National Weather Service.

Although the values at Catonsville and Elkridge exceeded the "record" level, it is important to note that gauge readings at these two locations have only been in place since October 2010. Upstream at Hollofield, records date back to 1933, and the water levels observed in this event were nowhere near the record flood.

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Ellicott City Flood (continued) The National Weather Service joined the Howard County Office of Emergency Management and Howard County Department of Public Works in conducting a survey of affected areas of Ellicott City, Maryland on August 1st, 2016. The survey revealed clear signs of flooding both from the Patapsco River and from flash flooding within Ellicott City. Signs of flooding, including damaged pavement, were observed as far up as the intersection of Rogers Avenue and Frederick Road, where Hudson Branch came out of its banks. From this location, eyewitnesses reported seeing water not only in the creek, but moving swiftly down Main Street beginning "just after dark". The intersection of Rogers Avenue and Frederick Road is about 140 feet higher in elevation than the lower part of Old Town Ellicott City. Erosion was noted on both the street side and the creek side of homes along Main Street in a portion of the 8500 block.

The next signs of damage were in the 8300 block of Main Street, with damage again observed both on the creek/river side and the street side of Main Street. The creek/river side is where the most vehicles were impacted, in "Lot D".

The most significant damage observed was near 8100 Main Street, where the street curves slightly. Based on topographic maps, this general area is also approximately where the extent of the Patapsco flooding would have reached based on the observed peak of 128.05 feet. Although we cannot say for certain, it is possible that this area being the meeting point of the upstream and Patapsco floodwaters could have caused more significant damage in that immediate area.

Main Street & Maryland Avenue



Closer to the Patapsco, damage continued with water marks observed 6-8 feet high on and in most buildings. The force of the floodwaters swept away the iconic Ellicott City clock as well as the historical flood marker that was attached to the railroad bridge. Although the survey team did not visit the Baltimore County side of the river during the survey, there are multiple reports of at least minor flooding of Oella Avenue and Route 144 due to the Patapsco escaping its banks.

We extend our appreciation to Howard County Office of Emergency Management for coordinating the survey and accompanying the NWS to the affected area.



Piles of dirt and debris remain as cleanup was underway at the intersection of Main Street and Maryland Avenue. Note the absence of the iconic Ellicott City clock and, in the background, the absence of the flood marker pole, both of which were swept into the Patapsco River.



Open House 2016

by Chris Strong, *Warning Coordination Meteorologist*

Over the weekend of April 30th – May 1st, the Baltimore/Washington NWS weather forecast office, in concert with the NWS's Sterling Field Support Center, hosted several thousand people during their open house. To open the weekend of community interaction with their local NWS office, a ceremony was held to talk about Weather-Ready Nation and the event theme: *Building Community Awareness to Reduce Hazardous Weather Impacts*. National Weather Service's Chief Operations Officer, John Murphy, Doug Hill [Chief Meteorologist; WJLA-TV], Kevin Johnson [Coordinator; Loudoun County VA Office of Emergency Management], and Jim Lee [MIC; NWS Baltimore/Washington] all spoke to the strong partnerships that exist to move us towards becoming a Weather-Ready Nation. The ceremony also recognized Loudoun County Virginia as being Storm Ready (12 years and counting), and several of our long-standing cooperative observers were also recognized for their service – including an award for 50 years of daily reports from Aberdeen Proving Grounds in northeast Maryland.

After the opening ceremony, the weekend was spent strengthening ties with the community by giving people an opportunity to learn about multitude of weather threats we face, the National Weather Service warnings that precede those threats, and the facility and technology that allows us to give that advance notification. Several thousand people took part from all around the region. They were treated to weather balloon launches to learn about one way we regularly sample the atmosphere. There were two presentation tents which constantly ran half hour sessions on exciting and informative topics like: the Blizzard of 2016, flooding, hurricanes, tornadoes, how to become a meteorologist, how weather is forecast, and even a presentation in Spanish about services the NWS provides for that community.

In addition to the presentations, people were able to walk through the forecast office operations area - the core of our 24/7 forecast operations. There, they could read about how forecasters put together a sea of information to create an always up to date forecast, and the official NWS watches, advisories, and warnings that need to go out when the forecast turns ugly. While on the floor, people interacted with NWS forecasters, asking questions to gain even more insight on how things work, as well as the wealth of technology needed to produce an accurate weather forecast.

Open House (continued)

The Sterling Field Support Center/SFSC (across the street) was the other exciting half of the event. As with the forecast office, weather balloon launches from SFSC drew big crowds. They also had a tour through their center, which tests and evaluates new gear for the NWS before it is deployed into the field. To do this, they have chambers to simulate all kinds of extreme weather, including a Category 5 hurricane wind tunnel that was one of the stars of the open house.

The driveway in between the forecast office and SFSC was filled with first responder and emergency management vehicles that kids could see and climb into – including the crash response behemoth from Dulles International Airport next door. Other partners shared information with participants from booths within our “Partners’ Tent”.

During the course of the weekend open house, almost all presentation tents were full or overflowing – we certified over 250 new SKYWARN weather spotters. The operations area was steadily busy with a stream of people passing through. Weather balloon launches thrilled the young and old. And everyone left happy with a knowledge of how to keep themselves and their families weather ready.

Atlantic Hurricane Season

by Luis Rosa, Senior Forecaster

In its most recent outlook released on Aug 11, NOAA’s Climate Prediction Center (CPC) raised their numbers slightly from their previous outlook released in late May for the number of named storms, hurricanes, major hurricanes, and Accumulated Cyclone Energy (ACE).

Their outlook indicated a near to above normal season (85% chance), with a 50% chance of a near normal season, a 35% chance of an above normal season, and a 15% chance of being a below normal season. CPC cited three main factors conducive to a more active season than the last three years: weaker vertical wind shear, weaker trade winds, and a stronger west African monsoon system.

As of late November, there were 15 named storms, 7 hurricanes and 3 major hurricanes. This marks the most active North Atlantic hurricane season since 2010.



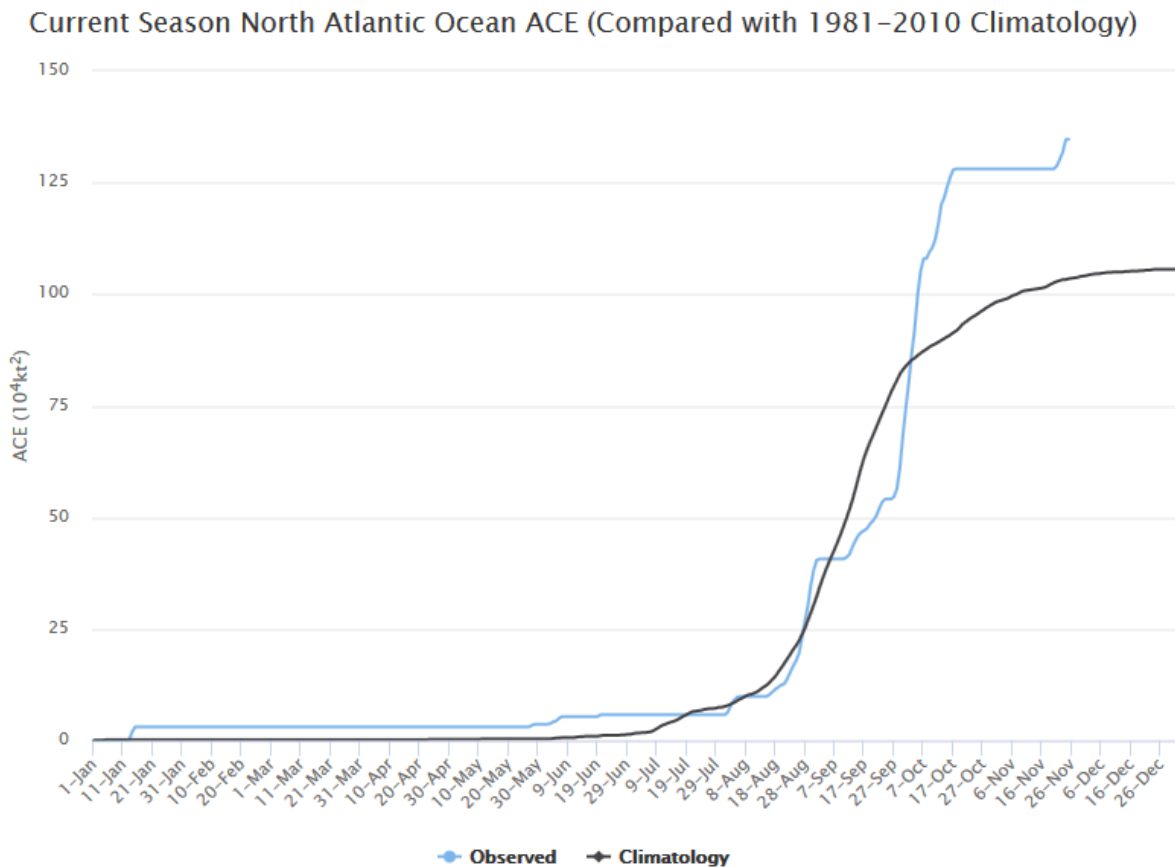
ACE is a much better measure of overall tropical cyclone activity since it takes into account the number, strength, and duration of all named storms. ACE is defined as the sum of the square of a named storm’s maximum wind speed (to the fourth power in knots squared) for each 6-hour period of its existence.

NOAA predicted ACE will be in the 85% to 150% of the 1981-2010 climatological normal.

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Hurricane Season (continued)

On average, 70% of the Atlantic ACE occurs between Aug 20 and Oct 10. The period from about Aug 20 through Sep 15 encompasses the maximum occurrence of the Cape Verde type storms, or tropical sys-



tems that originate near the Cape Verde islands off the coast of Africa. These storms can traverse the entire Atlantic and threaten to the Caribbean Islands and United States.

Preliminarily, the current ACE for the season stands at 134.7 units. The normal to date is 103.6 units. The chart above shows the current ACE compared to climatology.

Remembering the June 26–28, 2006 Baltimore MD/Washington DC Flood

by Heather Sheffield Kenyon, General Forecaster

Ten years ago, the Baltimore and Washington DC region experienced record breaking rainfall that resulted in widespread flooding, road and business closures and fatalities.

June 2006 remains the wettest June on record at Washington National. The month of June 2006 began with below normal precipitation. Then, a cold front moved into the region and stalled resulting in multiple rounds of showers and thunderstorms east of the Blue Ridge Mountains.

As showers and thunderstorms moved out of the region, record breaking rainfall continued across the Northeast United States. To learn more about the record breaking rainfall event including the meteorology, hydrology, a map of rainfall totals and impacts, go to:

<https://noaa.maps.arcgis.com/apps/MapJournal/index.html?appid=d91f870682374ab281eda95056ec4c09>

2016 Student Volunteer Program

by Andrew Woodcock, Senior Forecaster

The “class of 2016” was so deep in talent that we were able to select five students. All worked on projects which will prove beneficial to the forecast staff.



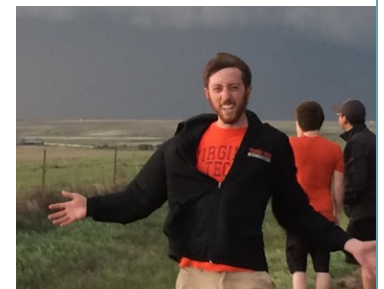
Sarah Wugofski is currently studying Meteorology at Florida State University. Her project was a verification of Small Craft Advisories and Gale Warnings on the Maryland portion of the Chesapeake Bay and tidal Potomac River. She plans to graduate in the spring of 2017. After graduation, she plans to attend graduate school to obtain a Masters degree in Meteorology. During her time at Sterling, she participated in many balloon releases and obtained her upper-air certification.

Doug Kahn is a senior at the University of Maryland majoring in Atmospheric and Oceanic Sciences and minoring in Geographical Information Sciences. During his time at Sterling, he worked with meteorologist Matt Elliott on “the utilization of lightning event heights in the warning decision process.” Meteorologically, Doug’s interests include lightning, severe weather, and tropical weather. His other interests include baseball, basketball, and golf. In addition, Doug plays drums and piano.



Eric Bunker graduated from the University of North Carolina at Charlotte with a bachelor’s in meteorology this past May. He is now attending the State University of New York at Albany to begin work on a master’s degree, working under Dr. Lance Bosart. His project at NWS Sterling was developed by Meteorologist-in-Charge Jim Lee and meteorologist Brian Lasorsa. It dealt with looking at a way to verify a winter storm threat matrix for days 4-7. The matrix is used by forecasters to portray to the public the forecaster’s confidence of a potential storm that can range from low to high, and also of the storms potential impact that can range from low to high.

Ross Stark will graduate with a B.S. in Meteorology from Virginia Tech in May 2017. His project, supervised by Jim Lee and Science and Operations Officer Steve Zubrick, and in coordination with meteorologist Rick Winther of the Leesburg ARTCC CWSU, focused on probabilistic forecasts for wind speed and direction at Dulles International Airport. Ross enjoys playing music and being outside. He plans to become a meteorologist for the Air Force after graduation.



Anna Lindeman recently graduated from Virginia Tech, receiving a B.S. in Meteorology and a B.A. in Geography. While in Blacksburg, she gained extensive experience with the National Weather Service Blacksburg office co-located with the university. She has also enjoyed volunteering in a more urban forecast area that Sterling serves. Her project dealt with a study of cold-air damming in the mid-Atlantic with meteorologist Ashley Sears. Anna plans to get her masters in Geography at Virginia Tech.

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Students (continued)

In past Sterling student intern news, class of 2007 student intern Elizabeth Thompson recently received her PhD from Colorado State University. She is now working for the University of Washington’s Applied Physics Laboratory and doing research on the NASA ship R/V Reville. She is sailing in the Pacific Ocean north the equator taking part in a six week investigation of the hydrologic cycle of the East Pacific Ocean. This affects ocean heat storage as well as the ability of the ocean to give energy back to the atmosphere. She is also providing daily meteorological briefings and radar analysis for daily operations. From the Pacific Elizabeth writes “it’s stunningly beautiful here in the middle of the ocean - studying the atmospheric circulation of the ITCZ! The seas can be so calm and glassy sometimes. Thunderstorm anvils are everywhere - in the distance or right by you. It’s incredible.”



Summer 2016 Summary

by Dan Hofmann, Climate Program Leader

The summer of 2016 was the hottest since 2012.

It didn’t start off unusually hot. June only averaged a half to one degree above normal for the month as frequent bouts of showers and thunderstorms kept temperatures in check. However, July and August were much warmer.

In fact, it wound up being the hottest July-August period on record for both the Washington DC and Dulles International Airport areas.

Washington DC Area	Dulles Airport area
Jul/Aug 2016 avg temp: 82.7 degrees	Jul/Aug 2016 avg temp: 79.5 degrees

August also ranked as the warmest August on record for Dulles Airport with a monthly average temperature of 79.4 degrees. This broke the record of 78.7 degrees set in 2007. The average monthly high and low temperatures were also the warmest on record for the month of August at Dulles.

Previous record: Jul/Aug 1980 (82.6)	Previous record: Jul/Aug 2012 (78.9)
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All climate data are considered preliminary until reviewed by the National Center for Environmental information (NCEI).

BWI Airport, Dulles Airport and Washington DC all reached 100 degrees for the first time since 2012 on July 25. Reagan National Airport near Washington DC would reach or exceed 100 degrees three more times in August, a feat accomplished only one other time in recorded history in the DC area. In 1930, the high temperature soared past the century mark five times.

As if the hot temperatures weren’t enough, oppressive humidity paid frequent visits to the Mid-Atlantic.

The dew point, or the temperature at which the air would become completely saturated, touched or come close to 80 degrees several times during late July and early August. Typically, dew points in excess of 70 are very uncomfortable, but 80 is hard to come by outside of the tropics.

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Summer 2016 (continued)

The hot July and August helped bring the average summer temperature into the top 5 for the Washington DC and Dulles Airport areas, and into the top 15 for the Baltimore area. (Note: meteorological summer runs from June 1st through August 31st.)

Preliminary

**Hottest Summers
(Washington DC area, since 1872)**

1. 81.3 degrees (2010)
2. 81.1 degrees (2011)
- 3. 80.6 degrees (2016)**
4. 80.4 degrees (2012)
5. 80.0 degrees (1980)

**Hottest Summers
(Baltimore MD area, since 1870)**

1. 79.3 degrees (2010)
2. 79.1 degrees (1943)
3. 78.8 degrees (1995)
4. 78.4 degrees (1949)
5. 78.1 degrees (1930)
6. 78.0 degrees (1934 and 1900)
8. 77.8 degrees (2011)
9. 77.6 degrees (1939)
10. 77.5 degrees (2012 and 1931)
12. 77.4 degrees (1938 and 1937)
- 14. 77.3 degrees (2016, 1991 and 1988)**

**Hottest Summers
(Dulles Airport area, since 1962)**

1. 77.8 degrees (2010)
- 2. 77.4 degrees (2016 and 2011)**
4. 76.7 degrees (2007)
5. 76.6 degrees (2012 and 1993)

As one would probably expect, many daily warm temperature records were set this summer as well. The table below lists the number of record daily high temperatures and record daily high minimum temperatures set for the Washington DC, Baltimore MD and Dulles Airport areas this summer.

Summer 2016 Daily Warm Temperature Records (Washington DC area)		Summer 2016 Daily Warm Temperature Records (Baltimore MD area)		Summer 2016 Daily Warm Temperature Records (Dulles Airport area)	
<u>June</u>		<u>June</u>		<u>June</u>	
None		None		1 record daily high 3 record daily high minimums June total: 4	
<u>July</u>		<u>July</u>		<u>July</u>	
1 record daily high 3 record daily high minimums July total: 4		1 record daily high No record daily high minimums July total: 1		1 record daily high 3 record daily high minimums July total: 4	
<u>August</u>		<u>August</u>		<u>August</u>	
3 record daily highs 4 record daily high minimums August Total: 7		No record daily highs 1 record daily high minimum August total: 1		2 record daily highs 6 record daily high minimums August total: 8	
Total record daily highs: 4 Total record daily high minimums: 7		Total record daily highs: 1 Total record daily high minimums: 1		Total record daily highs: 4 Total record daily high minimums: 14	
Summer 2016 total: 11		Summer 2016 total: 2		Summer 2016 total: 18	

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Summer 2016 (continued)

Above normal temperatures are favored during the summer months over the Mid-Atlantic following a moderate to strong El Niño and going into a La Niña. Question marks remain for the upcoming winter, as La Niña patterns usually bring warmer and drier conditions. However, current predictions suggest the upcoming La Niña may be weak in intensity, and the weaker the La Niña is, the lower the chance of a typical La Niña pattern during the winter.

NOAA's Climate Prediction Center will release its preliminary Winter 2016-17 Seasonal Outlook in mid-October, followed by the final outlook in mid-November.

Winter 2016-17 Outlook

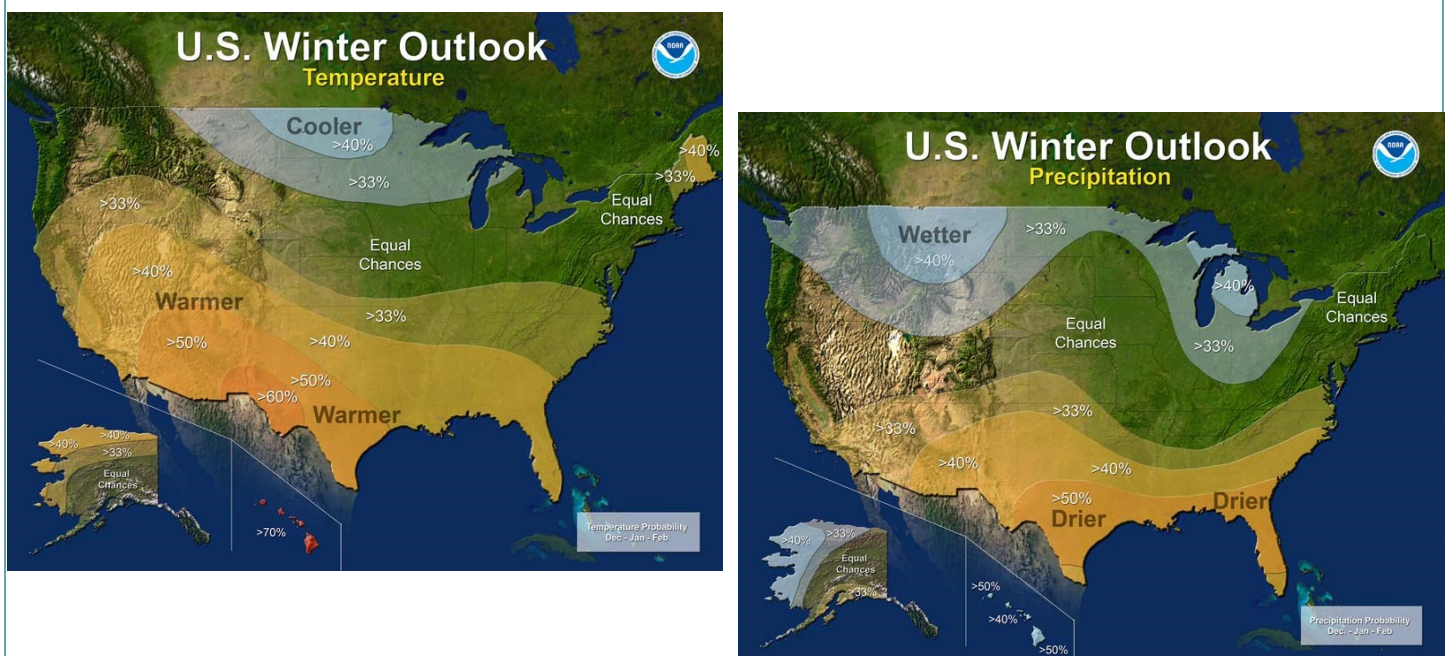
by Dan Hofmann

Climate Program Leader

Much of this fall has been very dry so far across most of our area. With La Niña conditions now present, odds tilt in favor of this trend continuing through the winter. La Niña patterns often feature a weakened sub-tropical jet stream and a blocking ridge of high pressure over the eastern North Pacific, which cuts off a lot of moisture lending to a drier pattern. Ridges of high pressure are often prevalent over the southeastern U.S., which in some cases lead to persistent milder conditions over the Mid-Atlantic, though in the past this has only worked out about half the time.

There are other competing factors, however, that suggest intrusions of cold air could be more frequent than during a "typical" La Niña winter this year. These factors include a larger than normal reservoir of cold air over Siberia, and an Arctic Oscillation (AO) running in the negative, or weak phase. A negative AO indicates ridges of high pressure over the North Pole, which displaces cold air further south.

In short, indications for temperatures during the upcoming winter are unclear, though odds tilt slightly in favor of drier than normal conditions.



SKYWARN®

We have started scheduling classes for the fall and they include our Basic/Introduction to Storm Spotting, Winter Weather and Convection. If your county or city is interested in hosting a class, please email our SKYWARN® class coordinator, Heather Sheffield. While we do not do classes for specific groups, if your group is interested, please email Heather and she can work with your county to potentially set up a class.

For more information about the class including registration details, please visit our SKYWARN® page:

www.weather.gov/washington/skywarn

If you have misplaced your spotter ID or have never received your ID, please email lwX-report@noaa.gov.

We are currently in the process of scheduling classes for the Winter/Spring 2016-17 season. Please check our website at www.weather.gov/lwx/skywarn for updates.

Don't see a class by you? Scheduling is still taking place this fall so check www.weather.gov/skywarn for updates!



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Fall 2016

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Photo Courtesy of Isha Renta



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