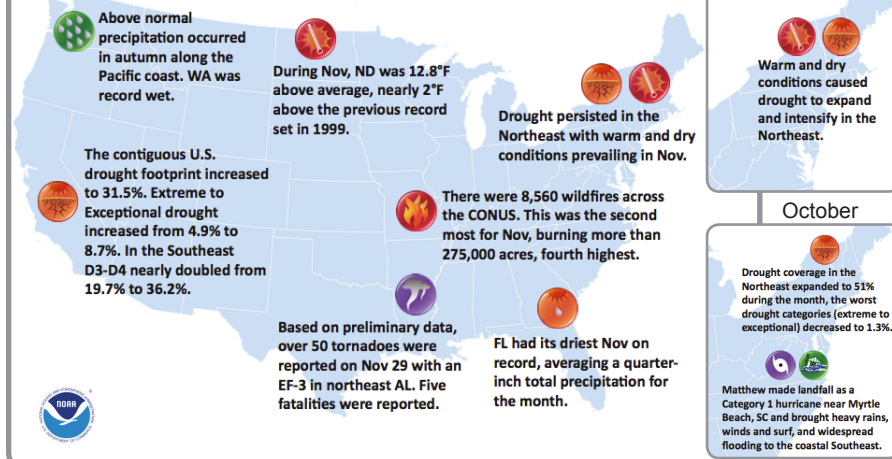


National - Significant Events for September–November 2016

U.S. Selected Significant Climate Anomalies and Events November and Autumn 2016



Highlights for the East

Fall was a season of two extremes. **Drought** conditions persisted or worsened in the Northeast and western Carolinas, affecting water resources, agriculture, and fire activity. Conversely, Hurricane Matthew dumped up to 19 inches of rain on the eastern Carolinas and Virginia from October 7–9. Six sites in the Carolinas had their all-time wettest day. Saturated soils and heavy rain led to devastating **flooding**. See Impacts section for details.

There were several other notable events during fall.

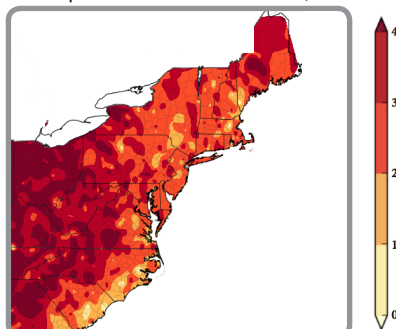
- **September 19–22:** A stalled front and remnant moisture from Tropical Storm Julia dumped up to 18 inches of rain on parts of Virginia and North Carolina. Norfolk, VA, set a daily precipitation record on three consecutive days, which was a first for the site.
- **September 28–30:** Up to 14 inches of rain fell from southern Delaware to central North Carolina. The 29th became Wallops Island, VA's all-time wettest day.
- Record warm **September** for Charleston, SC; Worcester, MA; and Dulles Airport, VA.
- **November 20–21:** Up to 54.5 inches of lake-effect snow fell south and east of Lake Ontario. Syracuse and Binghamton, NY had their greatest two-day snowfall total on record for November.
- Highest count of **November** days with no measurable precipitation for Charleston, SC, and Charlotte, NC.
- Record warm **fall** for LaGuardia Airport, NY; Washington National, DC; and Bridgeport, CT.

The contiguous U.S. had its warmest autumn on record with an average temperature of 57.6°F, 4.1°F above the 20th century average. It was the ninth warmest September on record with an average temperature of 67.2°F, 2.4°F above average. The U.S. had its third warmest October on record with an average temperature of 57.7°F, 3.6°F above average. November's average temperature of 48.0°F was 6.3°F above average, making it the second warmest on record. Autumn precipitation for the contiguous U.S. was 6.88 inches, which was average. The U.S. precipitation total for September was 2.70 inches, 0.21 inches below average, while October precipitation was 2.33 inches, 0.17 inches above average. November precipitation totaled 1.73 inches, 0.50 inches below average.

Regional - Climate Overview for September–November 2016

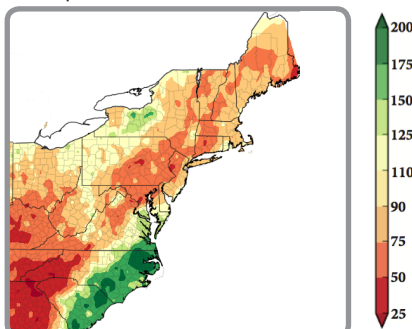
Temperature and Precipitation Anomalies

Departure from Normal Temperature (°F)
September 1–November 30, 2016



The Eastern Region had its second warmest **fall** on record at 3.1°F above normal. All sixteen states ranked this fall among their top six warmest on record. It was the region's third warmest **September** at 4.2°F above normal. This September ranked within the top eleven warmest for all sixteen states, with departures up to 5.3°F above normal. At 3.3°F above normal, the region had its ninth warmest **October**. State departures up to 4.7°F above normal. Eleven states ranked this October among their top 20 warmest. It was the region's 18th warmest **November** at 2.0°F above normal. This November ranked within the top 20 warmest for nine states, with departures up to 3.5°F above normal.

Percent of Normal Precipitation (%)
September 1–November 30, 2016

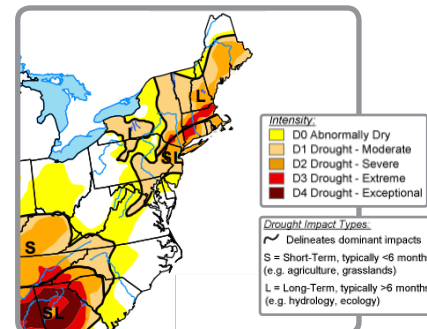


The Eastern Region received 93% of normal **fall** precipitation. Each of the three wetter-than-normal states ranked this fall among their top 20 wettest, while Vermont had its 19th driest fall. **September** precipitation was 107% of normal. Of the ten dry states, three ranked this September among their top 20 driest. Four states ranked it among their top 20 wettest. **October** precipitation was 118% of normal. Eight states were wetter than normal, with four ranking this October among their top 20 wettest. The region had its 13th driest **November** at 51% of normal. All states were drier than normal, with seven ranking this November among their top 20 driest.

Normals based on 1981–2010

Drought in the East

U.S. Drought Monitor
December 15, 2016



Drought conditions worsened through September and into October in the Northeast and western Carolinas. Precipitation in late October and early November led to improvement in the western half of New York and temporarily kept drought conditions from deteriorating in the rest of the Northeast. Conditions continued to worsen in the western Carolinas and Virginia, while the eastern Carolinas experienced flooding. During the rest of November, drought conditions generally persisted or deteriorated in the Eastern Region, except in western and northern New York. Drought conditions persisted across the region in early December, with the Carolinas seeing some improvement.

Regional - Impacts and Updates for September–November 2016

Drought



Pinnacle Mountain Fire near Pickens, SC, in November. Credit: Transylvania County, NC

Water levels of rivers, lakes, aquifers, and reservoirs were well below normal in many drought-stricken areas during fall. More than 60 waterways in the Northeast had record or near-record [low streamflow](#) in mid- to late September. In November, salt water was located 19 miles [farther upstream than normal](#) due to low flow on the Delaware River. Numerous shallow, private wells ran dry. The Round Valley Reservoir in New Jersey hit record low levels in November. Cambridge bought

water from the Massachusetts Water Resources Authority at an expected [cost of \\$1.2 million](#) per month. Hundreds of water suppliers in New England had bans or restrictions in place.

Dwindling water supplies [challenged growers](#). Poor conditions of pastures and hay fields led some farmers to sell off young cattle and others to [use supplemental feed](#), requiring them to buy more to get through winter. Nectar production in flowers was slowed by the drought. As a result, beekeepers in southern Maine reported that honey [production was down](#), with some having no crop at all. Farmers in more drought-stricken counties became [eligible for federal aid](#).

Dry conditions contributed to [at least 20 wildfires](#) that burned more than 73,000 acres in western North Carolina during fall. Thousands of residents were evacuated. The cost to fight the fires was estimated at [nearly \\$30 million](#). South Carolina and Virginia also saw wildfires that charred more than 10,000 acres. Smoke from the numerous fires in the Southeast caused [poor air quality](#) in portions of the Carolinas and Virginia.

Hurricane Matthew

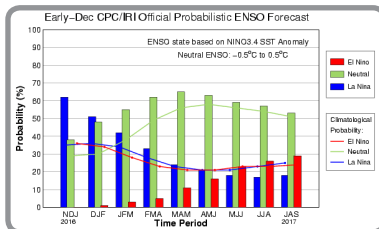


Flooding in Lumberton, NC. Credit: SCEMD and Civil Air Patrol

Matthew made landfall as a Category 1 hurricane near McClellanville, SC, on October 8. It was the first hurricane to make landfall in the state since Gaston in 2004. Storm surge of 2–6 feet caused [coastal flooding](#) in Virginia and the Carolinas, with [record high water levels](#) at Hatteras, NC; Wilmington, NC; and Oyster Landing, SC. Winds gusted to 103 mph along the coast, and two weak tornadoes touched down in the Carolinas. Saturated soil and Matthew's heavy rain led to [catastrophic flooding](#), which lasted more than a week in North Carolina. Preliminary USGS data indicated 28 gauges in North Carolina and five in South Carolina had [new record peaks](#) (streamflow and/or water level). In North Carolina, the Little River near Manchester set a record-high water level in late September and then surpassed that record two times after Matthew's heavy rainfall. The Neuse River at Kinston crested [more than 14 feet](#) above flood stage. Over 2,000 water rescues were performed in the state. There were at least 35 (mostly flood-related) fatalities in Virginia and the Carolinas, with 28 of those in North Carolina. More than 1,000 roads and bridges were closed in the three states, and nearly 2 million customers were without power. In addition, there were major crop losses in the Carolinas and over five million farm animals drowned in North Carolina. News reports indicated flooding caused an estimated \$1.5 billion in damage to 100,000 buildings in eastern North Carolina. [In Virginia](#), more than 2,300 homes were damaged, with an estimated \$13.2 million in damage to public facilities and structures. As of November 9, [nearly \\$70 million](#) in disaster assistance has been approved for victims of the storm.

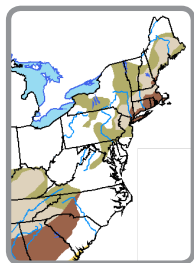
Regional - Outlook for Winter 2016–17

La Niña



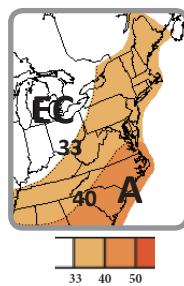
In November, cooler-than-normal sea surface temperatures in the equatorial Pacific Ocean and atmospheric patterns indicated weak La Niña conditions. NOAA's Climate Prediction Center [indicates weak La Niña conditions](#) are favored to persist through winter 2016–17, with a transition to ENSO-neutral conditions expected during January–March 2017. ENSO can impact weather patterns in the region.

Drought



The [U.S. Drought Outlook](#) for December 15, 2016–March 31, 2017 calls for drought conditions to persist or remain but improve in portions of Maine, southern New Hampshire, southern New England, southeastern New York, northern New Jersey, eastern Pennsylvania, and the Carolinas. Drought conditions are expected to develop in southeastern South Carolina and improve in the rest of the Eastern Region.

Temperature and Precipitation



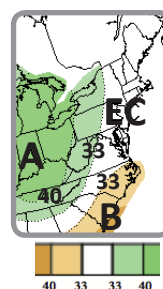
A: Above-normal
B: Below-normal
EC: Equal chances of above-, near, or below-normal
#: Probability of above- or below-normal

NOAA's [Climate Prediction Center](#) is calling for an increased chance of above-normal temperatures for most of the Eastern Region for January–March, with equal chances of below-, near-, or above-normal temperatures for Ohio, northwestern Pennsylvania, and western New York (left).

The January–March precipitation outlook calls for an increased chance of below-normal precipitation for the eastern Carolinas.

There is an increased chance of above-normal precipitation for Ohio, West Virginia, and western portions of Pennsylvania, New York, Maryland, Virginia, and North Carolina. Equal chances were forecast elsewhere (below).

A transition to ENSO-neutral conditions is expected during January–March, so other [patterns of climate variability](#) such as the [Madden-Julian Oscillation](#) could impact temperatures in the region. Lingering effects from La Niña are expected to play a role in the precipitation pattern.



Eastern Region Partners

National Oceanic and Atmospheric Administration
[www.noaa.gov](#)
National Centers for Environmental Information
[www.ncel.noaa.gov](#)
National Weather Service, Eastern Region
[www.weather.gov](#)
NOAA Fisheries Science Centers and Regional Offices, Atlantic
[www.nmfs.noaa.gov](#)
Office for Coastal Management
[www.oceanservice.noaa.gov](#)
NOAA Research, Climate Program Office and Geophysical Fluid Dynamics Lab
[www.research.noaa.gov](#)
NOAA National Sea Grant Office
[www.seagrant.noaa.gov](#)
NOAA's North Atlantic, South Atlantic, and Great Lakes Regional Collaboration Teams
[www.regions.noaa.gov](#)
Climate Prediction Center
[www.cpc.ncep.noaa.gov](#)
National Operational Hydrologic Remote Sensing Center
[www.nohrsc.noaa.gov](#)
Northeast Regional Climate Center
[www.nrcc.cornell.edu](#)
Southeast Regional Climate Center
[www.sercc.com](#)
National Integrated Drought Information System
[www.drought.gov](#)
Carolinas Integrated Sciences and Assessments
[www.cisa.sc.edu](#)
Consortium on Climate Risk in the Urban Northeast
[www.ccrun.org](#)
Cooperative Institute for North Atlantic Research
[www.cinar.org](#)
Eastern Region State Climatologists
[www.stateclimate.org](#)
Mid-Atlantic RISA
[www.midatlanticrisc.org](#)