



Gulf of Maine Significant Events - September–November 2016

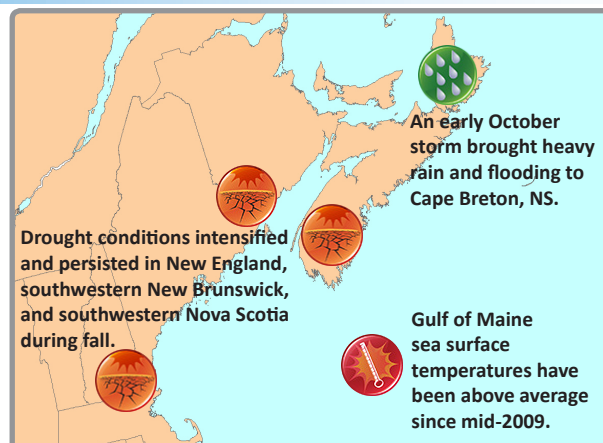
Despite several heavy rain events, long-term precipitation deficits and drought conditions continued in New England and parts of the Maritimes. The drought intensified in September and persisted through October and November, affecting water resources and agriculture (see Impacts section for details).

Severe thunderstorms hit Massachusetts, New Hampshire, Maine, and New Brunswick in **mid-September**. Strong winds downed dozens of trees and power lines, with more than 22,000 customers in southern New Hampshire losing power. Downpours caused localized flooding in Concord, NH; Ashland, ME; and Juniper, NB.

An intense low pressure system fueled by the remnants of Hurricane Matthew tracked east of New Brunswick from **October 9–11**. More than a dozen extreme 24-hour precipitation records were broken in the Maritimes, primarily in Nova Scotia. Sydney, NS, received 219 mm (8.60 in.) of rain on October 10, making it the site's wettest day since 1870 and the third wettest day on record for Nova Scotia. Sydney also had its wettest October on record. The heavy rain caused significant flooding (see Impacts section for details). Other parts of the region saw up to 88 mm (3.46 in.) of rain. In addition, wind gusts of up to 137 km/h (85 mph) led to vehicle restrictions on bridges, cancelled ferry crossings, and downed trees and wires. At least 90,000 Maritimes customers lost power, some for more than two days.

From **October 21–23**, a post-tropical low from the south merged with a trough from the west to produce up to 161 mm (6.34 in.) of rain, with the greatest totals in southern Maine. Several feet of water flooded roadways, stranding cars and closing roads in parts of the three states and Halifax, NS. The storm also produced strong winds, which contributed to power outages and rough seas.

More than 30 high temperature records were broken in the Maritimes on **October 7 and 8**, with several sites nearing 25°C (77°F). Caribou, ME, set a record high of 24°C (76°F). On **October 22**, temperatures once again approached 25°C (77°F), setting about a dozen new high temperature records in the Maritimes.



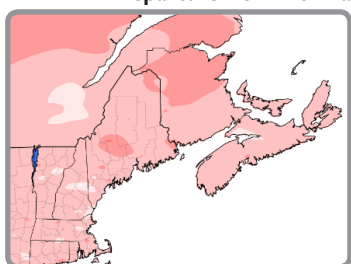
Back-to-back storms brought heavy snow to northern Maine and the Maritimes in late November. From **November 27–29**, up to 38 cm (15 in.) of snow and wind gusts to 110 km/h (68 mph) led to more than 35,000 customers losing power in the Maritimes. Then from **November 30–December 1**, up to 43 cm (17 in.) of heavy, wet snow fell, with the greatest totals in northern Maine. Downed trees and power lines left nearly 80,000 customers without power in the Maritimes and Maine.

It was the first above-normal Atlantic hurricane season since 2012. There were 15 named storms, including seven hurricanes, three of which were major hurricanes.

Regional Climate Overview - September–November 2016

Temperature

Departure from Normal

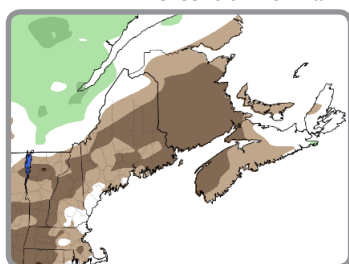


Autumn temperatures (averaged over September, October, and November) ranged from 0.5°C (1°F) to 3°C (5°F) above normal. Temperatures in **September** ranged from near normal in portions of Nova Scotia and New Brunswick to 3°C (5°F) above normal in portions of Maine and Massachusetts. In **October**, temperatures ranged from near normal in southern Maine and parts of Nova Scotia to 3°C (5°F) above normal in central Maine and northeastern New Brunswick. **November** average temperatures ranged from near normal in southern Maine to 4°C (7°F) above normal in northeastern New Brunswick.

Temperature and precipitation normals based on 1981–2010.

Precipitation

Percent of Normal



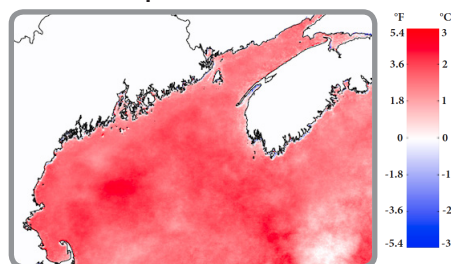
Autumn precipitation (accumulated from September–November) ranged from 25–125% of normal, with most areas seeing 50–90% of normal. **September** precipitation ranged from 25–90% of normal for a majority of the region. Northern New Brunswick near the Quebec border and a few spots in northern Nova Scotia were the main exceptions, seeing up to 150% of normal. **October** precipitation varied, ranging from 50% of normal in portions of Maine and New Brunswick to 225% of normal in eastern Cape Breton, NS. In **November**, precipitation ranged from 25% of normal to near normal for most areas. The driest areas were in southwestern New Brunswick, southern Nova Scotia, and Cape Cod, MA, while portions of Maine saw up to 125% of normal.

Sea surface temperature anomalies based on 1985–2016.

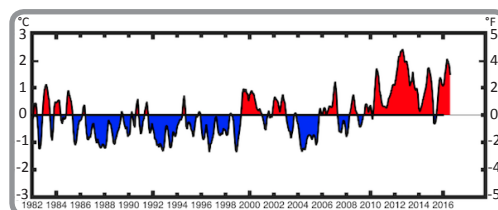
Mean SST anomalies from NOAA AVHRR data. Credit: University of Maine School of Marine Sciences and NERACOOS

Sea Surface Temperatures

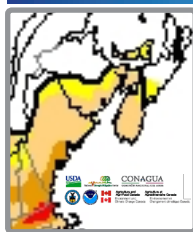
Departure from Normal



Autumn sea surface temperature (SST) anomalies in the Gulf of Maine ranged from around 1°C (2°F) to greater than 2°C (4°F). The plot below shows monthly SST anomalies for the Gulf from January 1982–October 2016. With the exception of four individual months, anomalies have been positive since mid-2009. Positive anomalies in 2016 have been second only to those of 2012. Peaks in the positive anomalies during this warm period are the largest deviations from the mean in the entire time series.

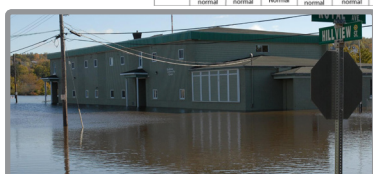
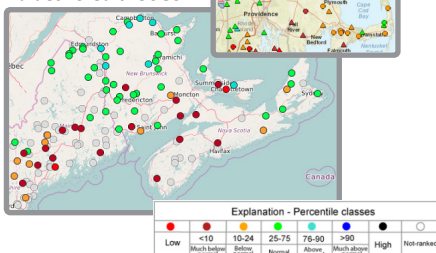


Regional Impacts - September–November 2016



Intensity:
 D0 Abnormally Dry
 D1 Drought - Moderate
 D2 Drought - Severe
 D3 Drought - Extreme
 D4 Drought - Exceptional
The October 2016 North American Drought Monitor.

Sept. 12 [streamflow](#) (below) and Sept. 28 [groundwater](#) (right) compared to historical values. Credit: USGS.



Credit: Communications Nova Scotia.

Drought

Water levels of rivers, lakes, wells, and reservoirs were well below normal in New England and parts of the Maritimes. Preliminary data indicated more than 20 long-term gauges in the three states had record or near-record [low streamflow](#) in late September. During the same period, more than 345 Massachusetts and New Hampshire water suppliers had bans or restrictions. Mandatory water restrictions were also in place in southwestern Nova Scotia. In Massachusetts, [fish were stranded](#) along portions of some rivers and there was a higher rate of fish kills. Numerous shallow, private [wells ran dry](#). Residents [drilled new wells](#), hauled in water, or [relied on bottled water](#). In southern Nova Scotia, community centers, parks, and schools were made available for showering. York, ME, activated its emergency interconnection with a nearby water district, while Cambridge, MA, bought water from the Massachusetts Water Resources Authority for an estimated [\\$1.2 million per month](#).

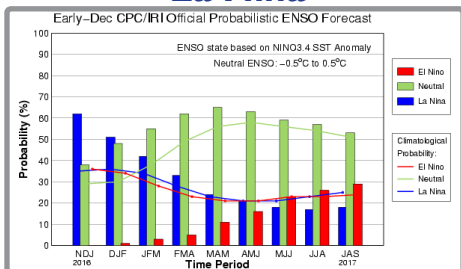
Dwindling water supplies challenged growers in New England and southern Nova Scotia, with some farmers hauling in water. Hay yields were below average in many of these areas. Several cranberry growers in Massachusetts had ["little or no water for harvest"](#). All crops in Massachusetts showed some loss, with significant losses of hay, cranberries, and potatoes. Several Nova Scotia farmers lost [Christmas tree seedlings](#) due to the drought. Poor pasture conditions led some farmers to [sell off livestock](#) and others to use supplemental feed, requiring them to buy more to get through winter. Beekeepers in southern Maine reported that [honey production was down](#), with several having no crop at all. In the U.S., farmers in more drought-stricken counties became eligible for federal aid. Due to the dry conditions, officials kept burn restrictions and seasonal fire crews in place [a week longer](#) than usual in southwestern Nova Scotia.

Canadian Thanksgiving Day Storm

Significant flooding occurred in Cape Breton, NS, from October 9–11. More than 1,800 homes reported water damage, with 38 deemed uninhabitable. The Southend Community Centre, pictured on the bottom left, was severely damaged and is [expected to be torn down](#). Numerous roads, [bridges](#), culverts, and the region's only railway line were washed out or severely damaged. Seventeen people were rescued from vehicles, and up to a dozen [fire service vehicles](#) were damaged. Over 5,000 insurance claims were filed, totaling [\\$85 million](#) in damage. The province is seeking Disaster Financial Assistance.

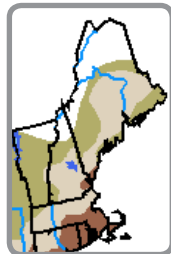
Regional Outlook - Winter 2016–17

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.

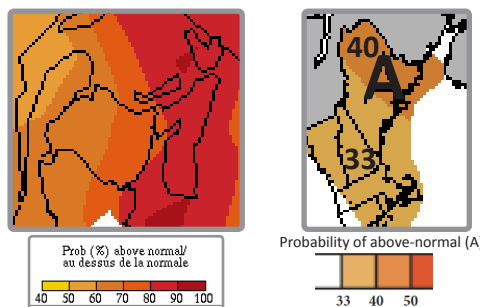
Drought



Legend:
 Brown: Drought persists
 Tan: Drought remains but improves
 Light Green: Drought removal likely
 Yellow: Drought development likely

The U.S. Drought Outlook from NOAA's Climate Prediction Center for December 15, 2016–March 31, 2017 calls for drought conditions to persist or remain but improve in Massachusetts, southern New Hampshire, and portions of central and southern Maine. Drought conditions are expected to ease in the rest of Maine and New Hampshire.

Temperature and Precipitation



For December 2016–February 2017, Environment and Climate Change Canada and NOAA's Climate Prediction Center are both calling for an increased chance of above-normal temperatures for the entire Gulf of Maine region. The forecast for New England is linked to long-term temperature trends.

For precipitation, both groups are calling for equal chances for the region for winter 2016–17. This means there is a 33.3% chance each of above-, near-, or below-normal precipitation.

La Niña can influence the region's temperature and precipitation patterns. However, this La Niña is expected to be weak and short-lived, so its impacts may be more variable. Also, other patterns of climate variability such as the [Arctic Oscillation](#) or [North Atlantic Oscillation](#) may dominate the region's weather patterns.

Environment and Climate Change Canada map (above left) produced on November 30. NOAA's Climate Prediction Center map (above right) produced on November 17.

Gulf of Maine Region Partners

Gulf of Maine Council on the Marine Environment, Climate Network

www.gulfofmaine.org/climate-network

Environment and Climate Change Canada

www.ec.gc.ca

National Oceanic and Atmospheric Administration

www.noaa.gov

National Centers for Environmental Information

www.ncei.noaa.gov

Regional Climate Services

www.ncdc.noaa.gov/rcsd

Northeast Regional Climate Center

www.nccc.cornell.edu

National Weather Service

www.weather.gov

Northeast River Forecast Center

www.weather.gov/nerfc

NOAA Sea Grant Network

www.seagrants.noaa.gov

Climate Prediction Center

www.cpc.ncep.noaa.gov

University of Maine, School of Marine Sciences

www.umaine.edu/marine

Gulf of Maine Research Institute

www.gmri.org

State Climatologists

www.stateclimate.org

National Integrated Drought Information System

www.drought.gov

Cooperative Institute for the North Atlantic Region

www.cinar.org

Northeastern Regional Association of Coastal and Ocean Systems

www.neracoos.org

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www.drought.gov/drought/resources/reports

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