

# Actuarial Weather Extremes November 2020

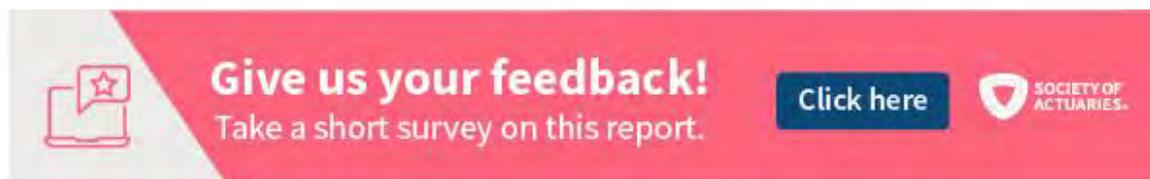




# Actuarial Weather Extremes: November 2020

Wildfires, Tropical Storm Eta, Wind, Rain, Flooding

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Society of Actuaries

A red banner with a white diagonal stripe on the left. On the left side, there is an icon of a laptop with a star in a speech bubble. The text "Give us your feedback!" is in large white font, followed by "Take a short survey on this report." in smaller white font. To the right is a dark blue button with the text "Click here" in white. On the far right is the Society of Actuaries logo in white.

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# Actuarial Weather Extremes: November 2020

## Wildfires, Tropical Storm Eta, Wind, Rain, Flooding

This report examines three costly phenomena in November 2020: Wildfires continuing in the Western U.S. states, Hurricane, then Tropical Storm, Eta, and Heat extremes in the Northern Plains States.

### Overview

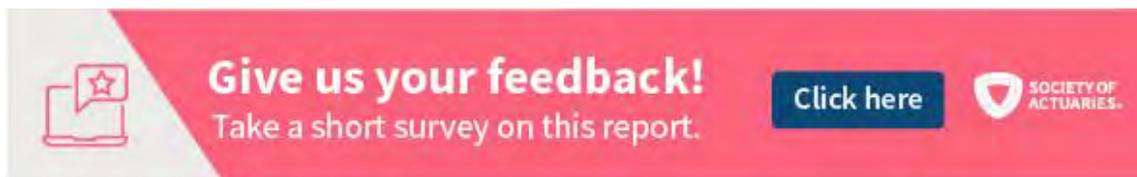
This report examines three costly phenomena in November 2020: Wildfires continuing in the Western U.S. states, Rain and Flooding in the Middle Atlantic states and high wind conditions on one day from Ohio to New York.

**Wildfires:** In the U.S., vs Novembers from 2000 to 2019, November 2020 acres burned by wildfires was nearly 1 million and was more than twice as much as other Novembers in this time period (See Figure 1). During November 2020, drought conditions worsened as more areas became under the condition of Exceptional Drought primarily in the Southwestern U.S. (See Figure 2).

**Tropical Storm Eta:** When it made a second landfall in the U.S., Tropical Storm Eta brought heavy rain to the Carolinas and Virginia. Flooding occurred to homes and roads and bridges buckled. At least four people were killed, and dozens had to be rescued. <sup>1</sup> As shown in Figure 3, daily totals of from 5 to over 8 inches of precipitation fell in the Middle-Atlantic states on November 11 and 12 and as shown in Figure 4 significant flooding occurred in Virginia and North Carolina in the several days that followed.

**November 15 Windstorms:** As shown in Figure 5, the National Oceanic and Atmospheric Administration (NOAA) Storm Prediction Center (SPC) indicated that there were over 500 strong wind events in the U.S. on November 15 and over 400 were across the states of Ohio, Pennsylvania, Maryland, New Jersey and New York. One person was killed, and more than 792,000 customers were without power. <sup>2</sup>

**Hurricane Eta and Hurricane Iota Note:** due to scarcity of data, we do not have exhibits related to Hurricanes Eta and Iota impacts to Central America. In particular, the two storms made landfall as Category 4 Hurricanes within 15 miles of each other on Nicaragua and 13 days apart (November 3 and November 16). Iota was a Category 5 for a time on November 16 and was the latest-in-season Category 5 designated Atlantic basin storm on record. <sup>3</sup>



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<sup>1</sup> CBS News. November 13, 2020 [Tropical Storm Eta hits North Carolina with deadly flooding - CBS News](#)

<sup>2</sup> The Weather Channel. November 16, 2020. [Storms, High Winds Knock Out Power to Over Three Quarters of a Million Customers; Falling Tree Kills Woman | The Weather Channel - Articles from The Weather Channel | weather.com](#)

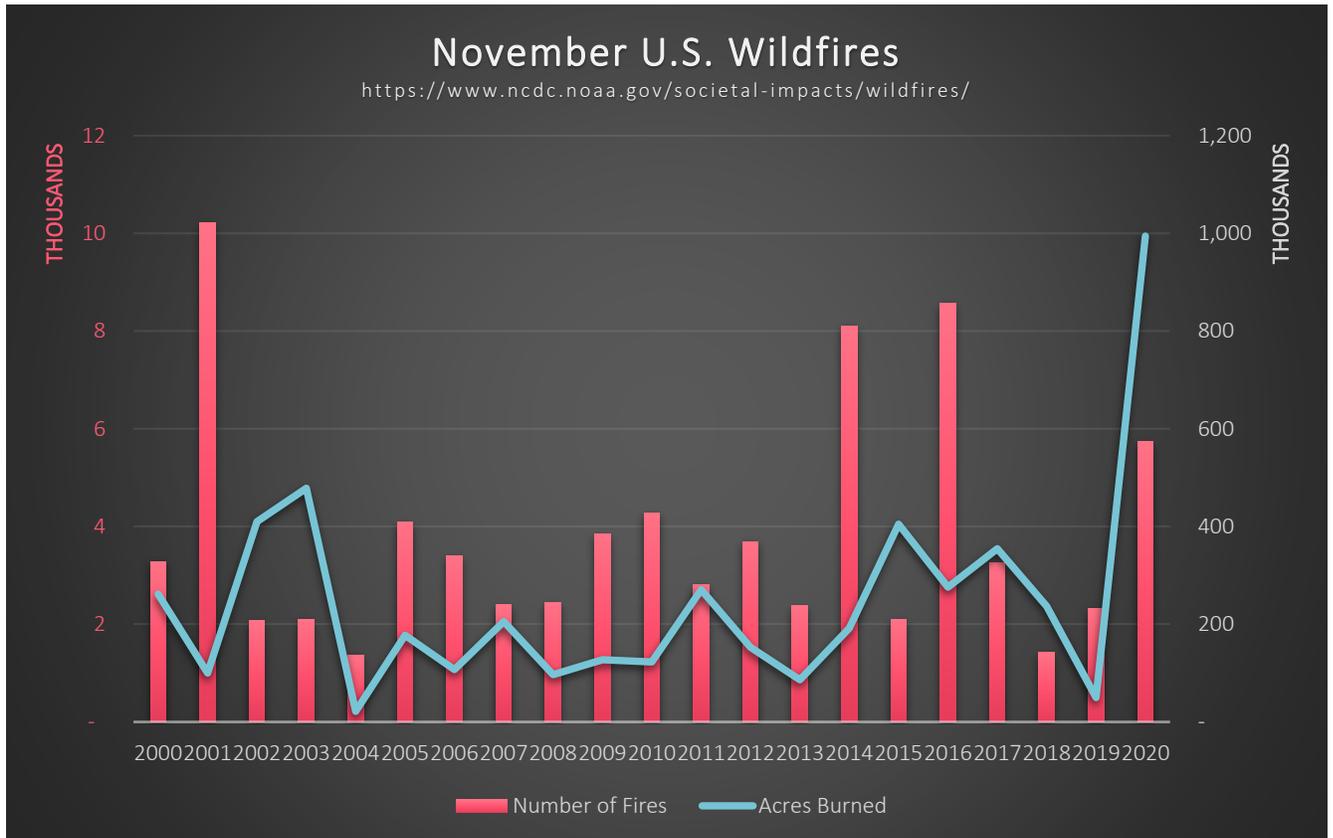
<sup>3</sup> The Weather Channel. November 18, 2020. [Hurricane Iota Was Second Category 4 Landfall in Nicaragua; 13 Days After Eta \(RECAP\) | The Weather Channel - Articles from The Weather Channel | weather.com](#)

## Wildfires in the Western U.S.

Utilizing data from the National Oceanic and Atmospheric Administration (NOAA) Societal Impacts Wildfire data in Figure 1 which provides wildfire counts and acres burned in the U.S., the size of the U.S. Wildfires in acres burned in November 2020 is the largest; looking at November U.S. wildfire data back to the year 2000.

**Figure 1**

**WILDFIRE COUNT AND ACRES BURNED IN MONTH OF NOVEMBER LAST 21 YEARS IN THE U.S.**



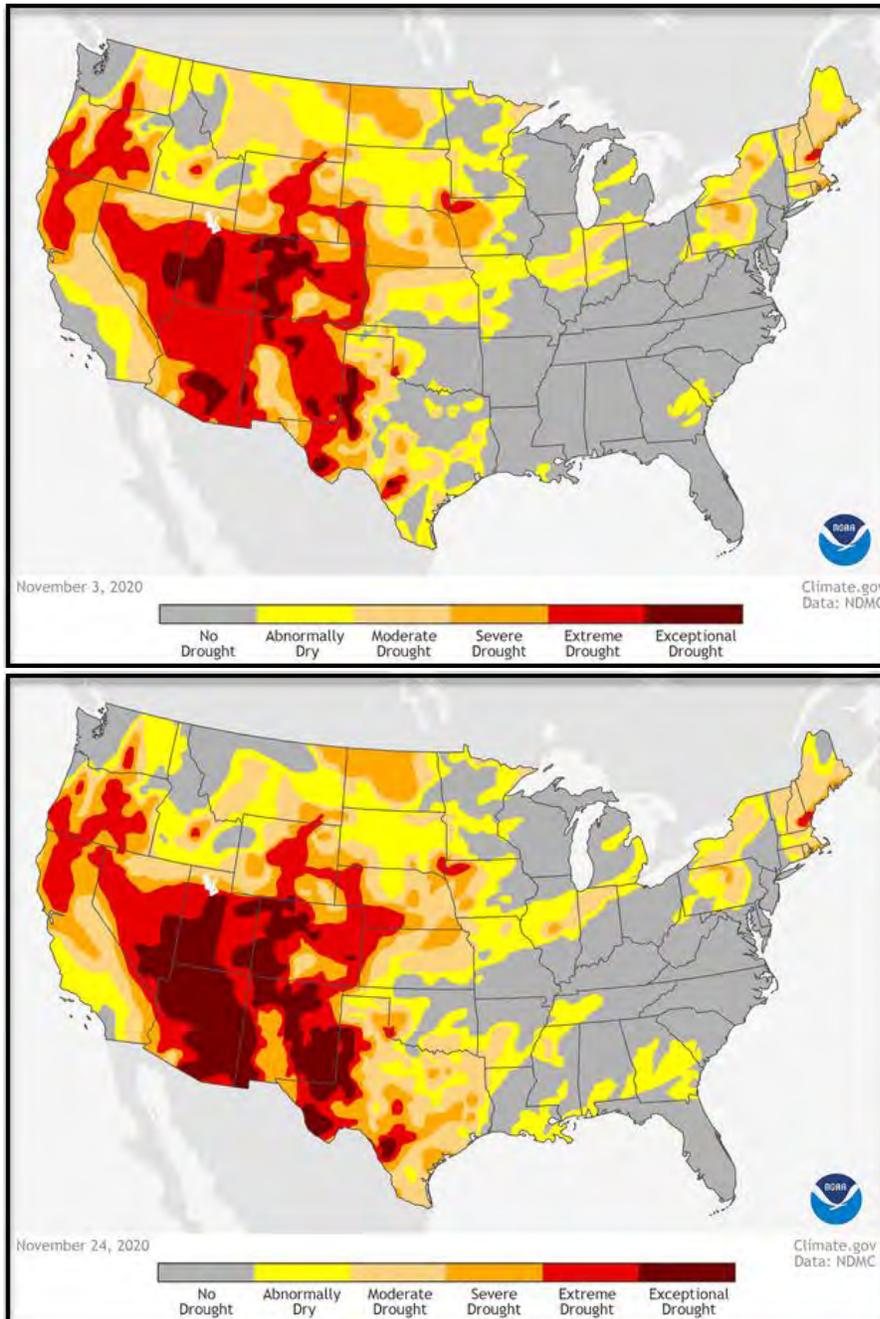
Source: NOAA Wildfire data (Accessed December 15, 2020). <https://www.ncdc.noaa.gov/societal-impacts/wildfires/month/11.csv>

## Drought

Figure 2 shows that during the month of November drought conditions worsened in much of the western U.S., including in those areas that have been impacted by wildfires.

Figure 2

DROUGHT CONDITIONS IN THE CONTINENTAL U.S. EARLY AND LATE NOVEMBER



Source: NOAA Climate.gov Drought Monitor (Accessed December 9, 2020).

<https://www.climate.gov/maps-data/data-snapshots/usdroughtmonitor-weekly-ndmc-2020-11-03?theme=Drought>

<https://www.climate.gov/maps-data/data-snapshots/usdroughtmonitor-weekly-ndmc-2020-11-24?theme=Drought>

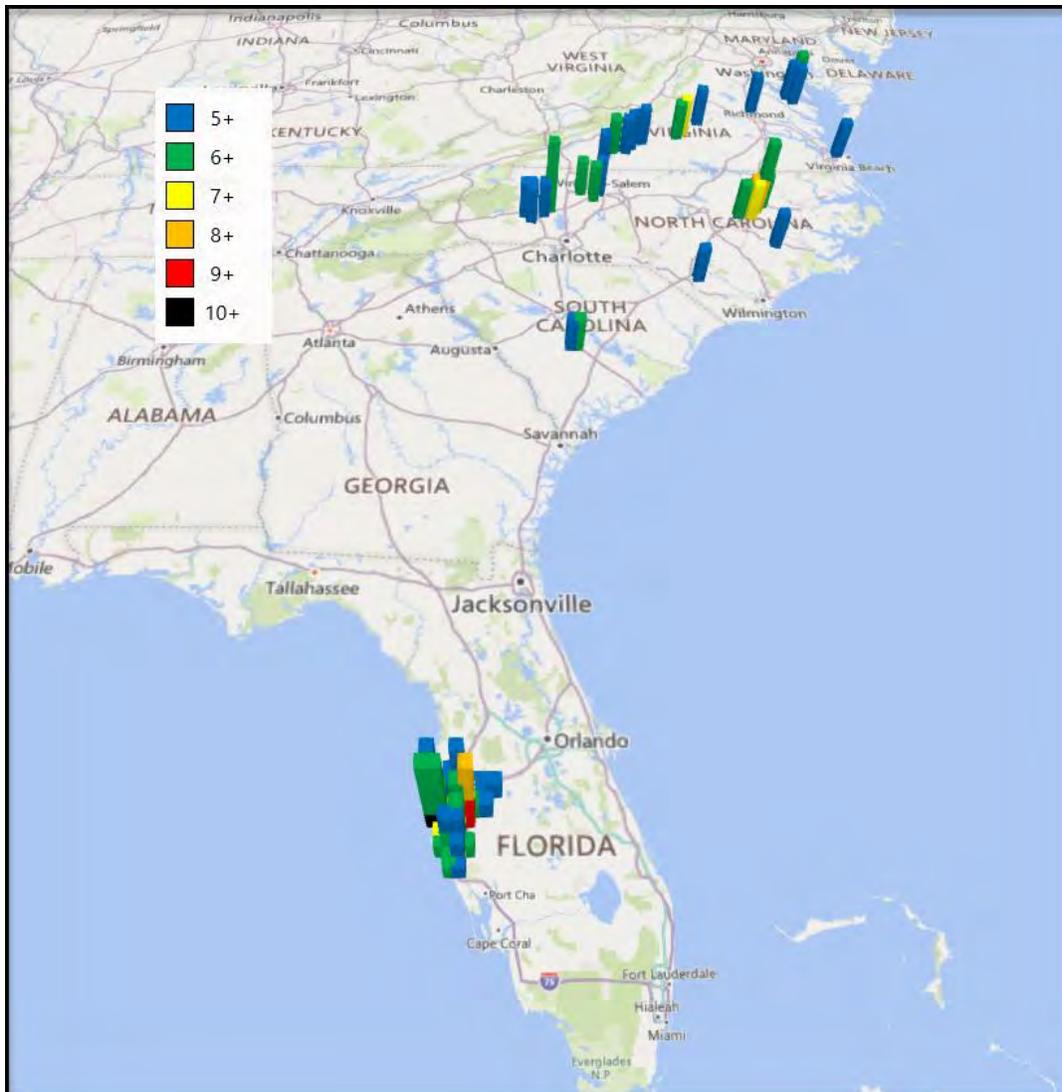
## Tropical Storm Eta

### PRECIPITATION

Tropical Storm Eta made a second U.S. landfall on early on November 12 near Cedar Key, Florida as a Tropical Storm.<sup>4</sup> Rain continued into the Carolinas and Virginia (See Figure 3).

**Figure 3**

**GHCN STATIONS WITH U.S. DAILY PRECIPITATION RECORDS IN EXCESS OF 5 INCHES SET ON NOVEMBER 11-12, 2020 FOR NOVEMBER DAILY PRECIPITATION BACK TO 1960. THE CHART INDICATES INCHES OF DAILY RAINFALL.**



Source: GHNC station data (Accessed December 4, 2020). [ftp://ftp.ncdc.noaa.gov/pub/data/ghcn/daily/ghcnd\\_all.tar.gz](ftp://ftp.ncdc.noaa.gov/pub/data/ghcn/daily/ghcnd_all.tar.gz)

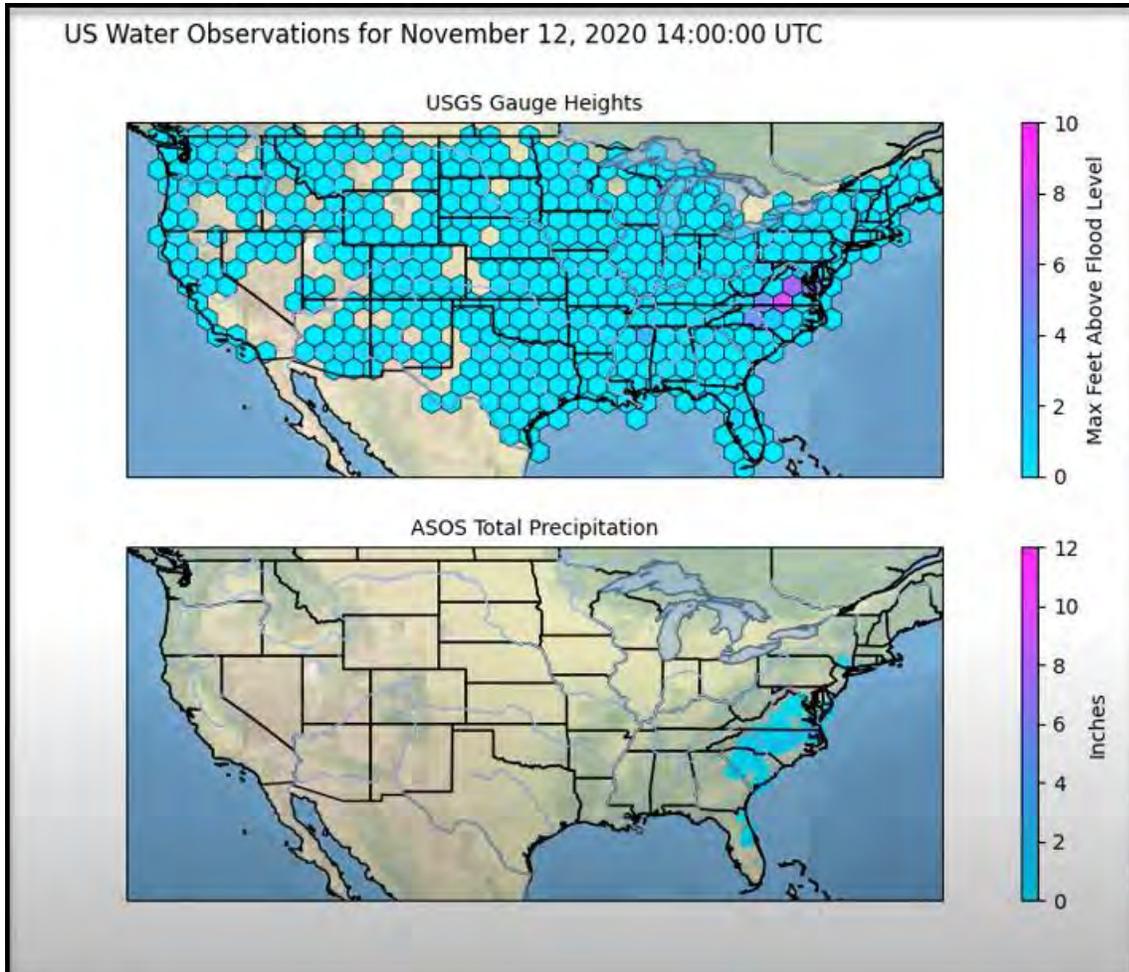
<sup>4</sup> Facts + Statistics: Hurricanes | III

**FLOODING**

**Time Lapse of Flooding and Precipitation:** By clicking on the link below Figure 4, you can see the November 2020 hourly time lapse of precipitation and subsequent flooding. The heavy precipitation seen November 11-12 is followed by flood conditions from primarily November 12-18, and in some areas beyond November 18. The precipitation shown in this time lapse gives a visualization of the heavy rains brought to Virginia and the Carolinas by Tropical Storm Eta, and the subsequent flood status indications over the remainder of November.

**Figure 4**

**FLOOD AND PRECIPITATION NOVEMBER 2020 TIME LAPSE ANIMATION USING DATA FROM THE IOWA STATE UNIVERSITY AUTOMATED SURFACE OBSERVING SYSTEM (ASOS)**



Time Lapse created by Matthew Self, ASA using ASOS data and Python programming. Data accessed December 1, 2020.

[Click this Link for Time-Lapse Animation](#)

[https://drive.google.com/file/d/1nmrclYYztWdt\\_He7HIAC6dnGvy42CwYL/view?usp=sharing](https://drive.google.com/file/d/1nmrclYYztWdt_He7HIAC6dnGvy42CwYL/view?usp=sharing)

Source: United States Geological Survey (USGS) Daily Values: <https://waterservices.usgs.gov/rest/DV-Test-Tool.html>

Source: IA State: <https://mesonet.agron.iastate.edu/request/download.phtml>

## Wind Events November 15, 2020

Figure 5

Utilizing data from the National Oceanic and Atmospheric Administration (NOAA) Storm Prediction Center (SPC) which provides storm reports information for wind, hail and tornadoes, the number of wind events by state for the period November 7 to November 7 was aggregated and illustrates the significant number of wind events that occurred in five states (OH, PA, MD, NJ, NY) on November 15, 2020.

DAILY WIND EVENT COUNTS IN THE U.S. BY STATE DURING NOVEMBER 7-30, 2020

Count of Injury/Fatality						
Row Labels	MD	NJ	NY	OH	PA	Grand Total
201107	-	-	-	-	-	5
201108	-	-	-	-	-	1
201109	-	-	-	-	-	1
201110	-	-	-	-	-	149
201111	-	-	-	-	-	7
201112	-	-	-	-	-	2
201113	-	-	-	-	-	2
201114	-	-	-	1	-	50
201115	74	54	82	106	127	536
201118	-	-	-	-	-	1
201123	-	-	-	-	-	3
201124	-	-	-	-	-	36
201125	-	-	-	4	-	9
201126	-	-	-	-	-	2
201127	-	-	-	-	-	1
201129	-	-	-	-	1	13
201130	4	6	-	-	50	67
<b>Grand Total</b>	<b>78</b>	<b>60</b>	<b>82</b>	<b>111</b>	<b>178</b>	<b>885</b>

Source: NOAA Storm Prediction Center (SPC) (Accessed December 2, 2020). [https://www.spc.noaa.gov/climo/reports/201001\\_rpts.html](https://www.spc.noaa.gov/climo/reports/201001_rpts.html)



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## Rough Assessment of the Losses Caused by the Recent Extreme Weather

Economic and insured losses are often difficult to estimate in the immediate aftermath of an extreme weather event. With the passage of time, the extent of the losses gradually becomes clearer.

### November 2020 Wildfires in Western U.S. States

The National Interagency Fire Center (NIFC) reports that as of Nov. 27 there were 52,113 wildfires that had burned 8,889,297 acres in 2020. This is approximately 2.3 million more acres burned than the 10-year average and almost double the acreage burned in the 2019 season.<sup>5</sup>

### November 12, 2020 Tropical Storm Eta

Tropical Storm Eta U.S. losses were estimated at around \$1.1 billion with about half (\$550 million) estimated to be insured.<sup>6</sup>

### November 15, 2020 Windstorm from the Midwest to the Eastern U.S.

One person was killed, and more than 792,000 electricity customers were without power in an area from Illinois to New York.<sup>7</sup>

### November 3 Hurricane Eta and November 16 Hurricane Iota Central America

Hurricane Eta and Hurricane Iota damages in Central America look to be over \$8 billion, and most of the losses look to be uninsured.<sup>8</sup>

## Data

**Temperature and precipitation data** used in this report was obtained from the **Global Historical Climatology Network** (“GHCN”) weather database, which provides daily weather observations from over 100,000 weather stations worldwide, covering over 180 countries. The database is publicly available through the National Oceanic and Atmospheric Administration (NOAA) via the following FTP site:

[ftp://ftp.ncdc.noaa.gov/pub/data/ghcn/daily/ghcnd\\_all.tar.gz](ftp://ftp.ncdc.noaa.gov/pub/data/ghcn/daily/ghcnd_all.tar.gz)

Filename: [ghcnd\\_all.tar.gz](#)

### Wildfire data

Source: National Oceanic and Atmospheric Administration (NOAA) Wildfire data (Accessed December 15, 2020). <https://www.ncdc.noaa.gov/societal-impacts/wildfires/month/11.csv>

### Storm data

Source: NOAA Storm Prediction Center (SPC) (Accessed December 2, 2020). [https://www.spc.noaa.gov/climo/reports/201001\\_rpts.html](https://www.spc.noaa.gov/climo/reports/201001_rpts.html)

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<sup>5</sup> Center for Disaster Philanthropy. 2020 North American Wildfire Season. December 7, 2020 [2020 North American Wildfire Season - Center for Disaster Philanthropy](#)

<sup>6</sup>Artemis. December 11, 2020 [Hurricane Eta US industry loss estimated around \\$550m by Aon - Artemis.bm](#)

<sup>7</sup> The Weather Channel. November 16, 2020. [Storms, High Winds Knock Out Power to Over Three Quarters of a Million Customers; Falling Tree Kills Woman | The Weather Channel - Articles from The Weather Channel | weather.com](#)

<sup>8</sup> Insurance Journal. December 14, 2020 [With Economic Damages of \\$9B, Hurricanes Eta and Iota Topped Off Record Year: Aon \(insurancejournal.com\)](#)

### Automated Surface Observing System (ASOS) temperature and precipitation data

The steps below show how to get the hourly temperature and precipitation at the STL Airport, as an example, from the Iowa State University Automated Surface Observing System (ASOS):

IA State: <https://mesonet.agron.iastate.edu/request/download.phtml>

- 1) Select “Missouri ASOS” as the network and click “Switch to Network”
- 2) In the list of available stations, select the “[STL] ST. LOUIS” station, and click “Add Selected”
- 3) In the “Select From Available Data” section, choose the “Air Temperature [F]” and “1 hour Precipitation [inch]” options.
- 4) Set the date range to 2020-October-1 and 2020-October-31 (or whatever range is desired)
- 5) Select “Yes” for “Include Latitude + Longitude”
- 6) Click “Get Data” at the bottom

These steps would give you the results from the URL below.

[https://mesonet.agron.iastate.edu/cgi-bin/request/asos.py?station=STL&data=tmpf&data=p01i&year1=2020&month1=10&day1=1&year2=2020&month2=10&day2=31&tz=Etc%2FUTC&format=onlycomma&latlon=yes&elev=no&missing=M&trace=T&direct=no&report\\_type=1&report\\_type=2](https://mesonet.agron.iastate.edu/cgi-bin/request/asos.py?station=STL&data=tmpf&data=p01i&year1=2020&month1=10&day1=1&year2=2020&month2=10&day2=31&tz=Etc%2FUTC&format=onlycomma&latlon=yes&elev=no&missing=M&trace=T&direct=no&report_type=1&report_type=2)

### USGS Flood Data

Source: United States Geological Survey (USGS) Daily Values:

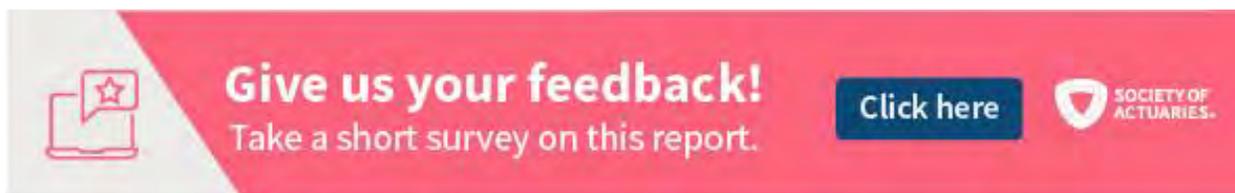
Daily Values: <https://waterservices.usgs.gov/rest/DV-Test-Tool.html>

- a) Select “List of Sites” in the Major Filters section and enter the Site Number(s) of interest
- b) In the Date Ranges section, select “Return all values within an absolute date range” and enter the Date Range of interest
- c) Enter “00003” for the Statistics Code; 00003 is the Mean Observation
- d) For “Sites serving parameter codes”, enter **00060** for Discharge, cubic feet per second or **00065** for Gage Height, feet.
- e) At the bottom click “Generate the URL” then click “Run the Generated URL”

## Acknowledgments

The authors wish to thank Janie Gilbert, ASA for her contributions to the assimilation of wildfire data and information and Matthew Self, ASA for his contributions to the assimilation of ASOS precipitation data, NOAA SPC wind storm data and USGS flood data and information that the author's used for this analysis.

## Feedback



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The SOA supports actuaries and advances knowledge through research and education. As part of its work, the SOA seeks to inform public policy development and public understanding through research. The SOA aspires to be a trusted source of objective, data-driven research and analysis with an actuarial perspective for its members, industry, policymakers and the public. This distinct perspective comes from the SOA as an association of actuaries, who have a rigorous formal education and direct experience as practitioners as they perform applied research. The SOA also welcomes the opportunity to partner with other organizations in our work where appropriate.

The SOA has a history of working with public policymakers and regulators in developing historical experience studies and projection techniques as well as individual reports on health care, retirement and other topics. The SOA's research is intended to aid the work of policymakers and regulators and follow certain core principles:

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