



# Actuarial Weather Extremes October 2020





# Actuarial Weather Extremes: October 2020

## Western US Wildfires, Hurricane Delta, Hurricane Zeta, Winter Storm Billy

**AUTHORS** Rob Montgomery, ASA, MAAA, FLMI  
Patrick Wiese, ASA  
Society of Actuaries

### **Caveat and Disclaimer**

This study is published by the Society of Actuaries (SOA) and contains information from a variety of sources. The study is for informational purposes only and should not be construed as professional or financial advice. The SOA does not recommend or endorse any particular use of the information provided in this study. The opinions expressed and conclusions reached by the authors are their own and do not represent any official position or opinion of the Society of Actuaries or its members. The SOA makes no warranty, express or implied, or representation whatsoever and assumes no liability in connection with the use or misuse of this study.

Copyright © 2020 by the Society of Actuaries. All rights reserved.

## Overview

This report examines three costly phenomena in October 2020: Wildfires in the Western US states, Hurricanes Delta and Zeta, and Winter Storm Billy which occurred near and about the same time as Hurricane Zeta, leading to a compounding effect.

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

The National Interagency Fire Center (NIFC) reports that in the US, as of November 9 there have been 49,149 wildfires that have burned over 8.7 million acres this year. This is almost double the acreage burned to date in the 2019 season.<sup>1</sup>

### Hurricane Delta

Hurricane Delta made landfall October 9 near Creole, LA. Catastrophe risk modeling firm AIR quantified the insured damage from Hurricane Delta at from \$1billion to \$3billion<sup>2</sup>

### Hurricane Zeta

Hurricane Zeta made landfall on October 28 near Cocodrie, LA, about 150 miles east of Hurricane Delta's landfall 19 days earlier. Catastrophe risk modeling firm AIR Worldwide estimates onshore insured losses will range between \$1.5billion and \$3.5billion. Hurricane Zeta was the 27<sup>th</sup> named Atlantic storm of the season tying a record set in 2005.<sup>3</sup>

### Winter Storm Billy

On October 27 a rare October ice storm hit portions of Oklahoma and Texas. Combined with the outages from Hurricane Zeta's landfall in Louisiana (October 28), the two events left nearly 3 million homes without power regionally on October 29.<sup>4</sup>

---

<sup>1</sup> Center for Disaster Philanthropy. 2020 North American Wildfire Season. November 19, 2020. <https://disasterphilanthropy.org/disaster/2020-california-wildfires/>

<sup>2</sup> October 14, 2020. Long, Kevin. AIR Worldwide Estimates Insured Losses for Hurricane Delta Will be Between USD 1 Billion and USD 3 Billion.

<https://www.verisk.com/press-releases/2020/october/air-worldwide-estimates-insured-losses-for-hurricane-delta-will-be-between-usd-1-billion-and-usd-3-billion/#:~:text=AIR%20Worldwide%20Estimates%20Insured%20Losses,USD%203%20Billion%20%7C%20Verisk%20Analytics>

<sup>3</sup> November 2, 2020. AIR Worldwide Estimates Insured Losses for Hurricane Zeta Will Be Between USD 1.5 Billion to USD 3.5 Billion. <https://www.air-worldwide.com/news-and-events/press-releases/air-worldwide-estimates-insured-losses-for-hurricane-zeta-will-be-between-usd-1-5-billion-to-usd-3-5-billion/>

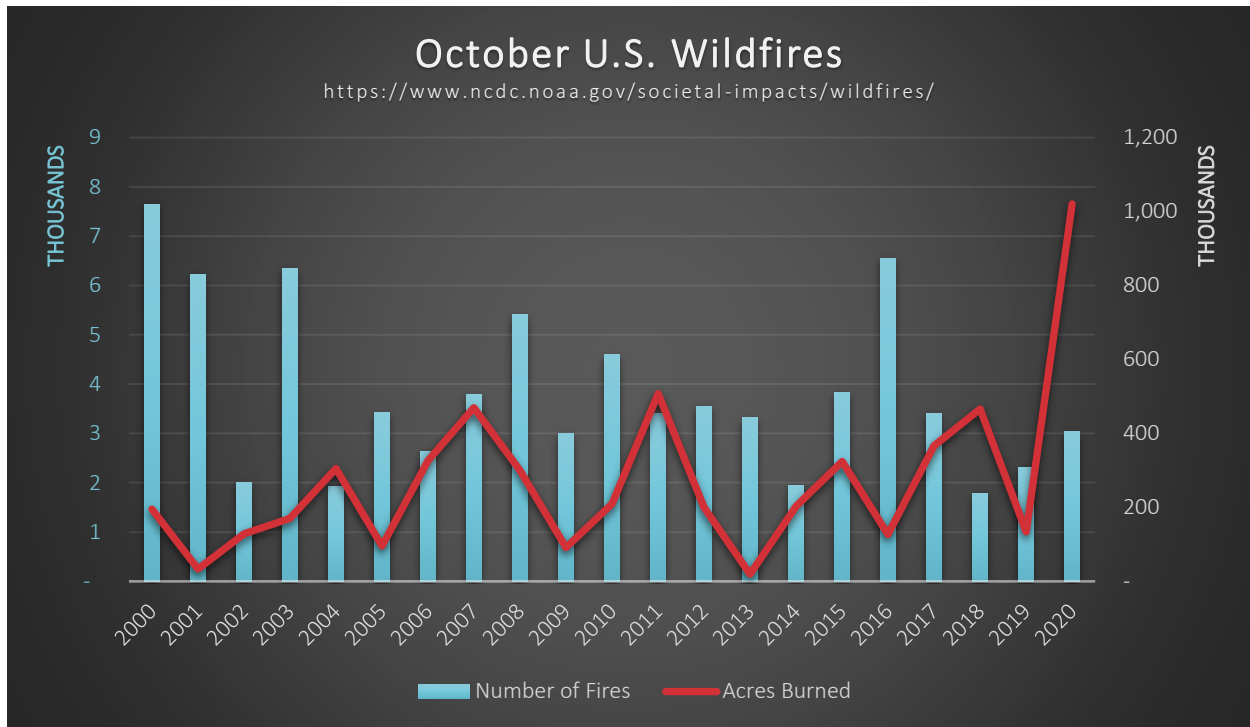
<sup>4</sup> More Than 40,000 Still Without Power 10 Days After Oklahoma Ice Storm. Jan Wesner Childs. November 08, 2020 <https://weather.com/news/news/2020-11-06-power-outages-oklahoma-ice-winter-storm>

## Wildfires in the Western US

**Figure 1**

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

### WILDFIRE COUNT AND ACRES BURNED IN MONTH OF OCTOBER LAST 21 YEARS IN THE U.S.



Source: NOAA Wildfire data (Accessed November 18, 2020). <https://www.ncdc.noaa.gov/societal-impacts/wildfires/month/10.csv>


The California Department of Forestry and Protection lists information about the 20 largest California wildfires. It's November 3, 2020 update, shown in Figure 2, indicates that many are 2020 wildfires, and for several of those the amounts of acres burned was still incomplete at the time.

Figure 2

TWO OF THE FOUR LARGEST WILDFIRES IN CALIFORNIA ARE NOT YET FINAL

Top 20 Largest California Wildfires					
FIRE NAME (CAUSE)	DATE	COUNTY	ACRES	STRUCTURES	DEATHS
1 <b>AUGUST COMPLEX</b> ( <i>Under Investigation</i> )*	August 2020	Mendocino, Humboldt, Trinity, Tehama, Glenn, Lake, & Colusa	1,032,649	935	1
2 <b>MENDOCINO COMPLEX</b> ( <i>Under Investigation</i> )	July 2018	Colusa, Lake, Mendocino & Glenn	459,123	280	1
3 <b>SCU LIGHTNING COMPLEX</b> ( <i>Under Investigation</i> )*	August 2020	Stanislaus, Santa Clara, Alameda, Contra Costa, & San Joaquin	396,624	222	0
4 <b>CREEK FIRE</b> ( <i>Under Investigation</i> )*	September 2020	Fresno & Madera	377,693	853	0
5 <b>LNU LIGHTNING COMPLEX</b> ( <i>Under Investigation</i> )*	August 2020	Sonoma, Lake, Napa, Yolo & Solano	363,220	1,491	6
6 <b>NORTH COMPLEX</b> ( <i>Under Investigation</i> )*	August 2020	Butte, Plumas & Yuba	318,930	2,352	15
7 <b>THOMAS</b> ( <i>Powerlines</i> )	December 2017	Ventura & Santa Barbara	281,893	1,063	2
8 <b>CEDAR</b> ( <i>Human Related</i> )	October 2003	San Diego	273,246	2,820	15
9 <b>RUSH</b> ( <i>Lightning</i> )	August 2012	Lassen	271,911 CA / 43,666 NV	0	0
10 <b>RIM</b> ( <i>Human Related</i> )	August 2013	Tuolumne	257,314	112	0
11 <b>ZACA</b> ( <i>Human Related</i> )	July 2007	Santa Barbara	240,207	1	0
12 <b>CARR</b> ( <i>Human Related</i> )	July 2018	Shasta County & Trinity	229,651	1,614	8
13 <b>MATILJA</b> ( <i>Undetermined</i> )	September 1932	Ventura	220,000	0	0
14 <b>WITCH</b> ( <i>Powerlines</i> )	October 2007	San Diego	197,990	1,650	2
15 <b>KLAMATH THEATER COMPLEX</b> ( <i>Lightning</i> )	June 2008	Siskiyou	192,038	0	2
16 <b>MARBLE CONE</b> ( <i>Lightning</i> )	July 1977	Monterey	177,866	0	0
17 <b>LAGUNA</b> ( <i>Powerlines</i> )	September 1970	San Diego	175,425	382	5
18 <b>SQF COMPLEX</b> ( <i>Lightning</i> )	August 2020	Tulare	170,384	228	0
19 <b>BASIN COMPLEX</b> ( <i>Lightning</i> )	June 2008	Monterey	162,818	58	0
20 <b>DAY FIRE</b> ( <i>Human Related</i> )	September 2006	Ventura	162,702	11	0

There is no doubt that there were fires with significant acreage burned in years prior to 1932, but those records are less reliable, and this list is meant to give an overview of the large fires in more recent times.  
 This list does not include fire jurisdiction. These are the Top 20 regardless of whether they were state, federal, or local responsibility.  
 \*Numbers not final.



11/3/2020

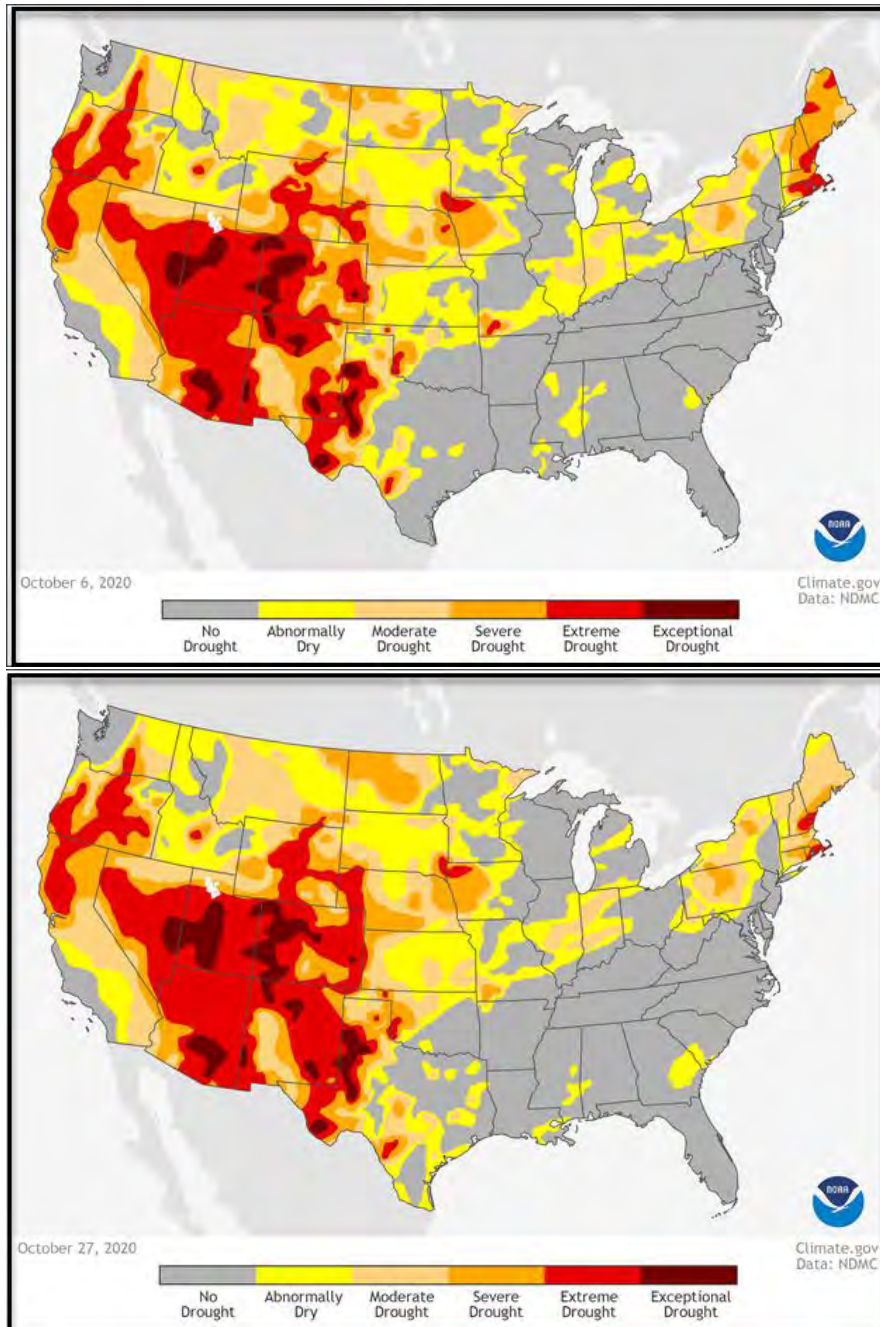
Source: California Department of Forestry and Fire Protection As of November 3, 2020  
[https://www.fire.ca.gov/media/11416/top20\\_acres.pdf](https://www.fire.ca.gov/media/11416/top20_acres.pdf)

## Drought and High Temperatures

Figure 3 shows that during the month of October drought conditions worsened in much of the western US, including in those areas that have been impacted by wildfires.

**Figure 3**

**DROUGHT CONDITIONS IN THE CONTINENTAL U.S. EARLY AND LATE OCTOBER**



Source: NOAA Climate.gov Drought Monitor (Accessed November 18, 2020).

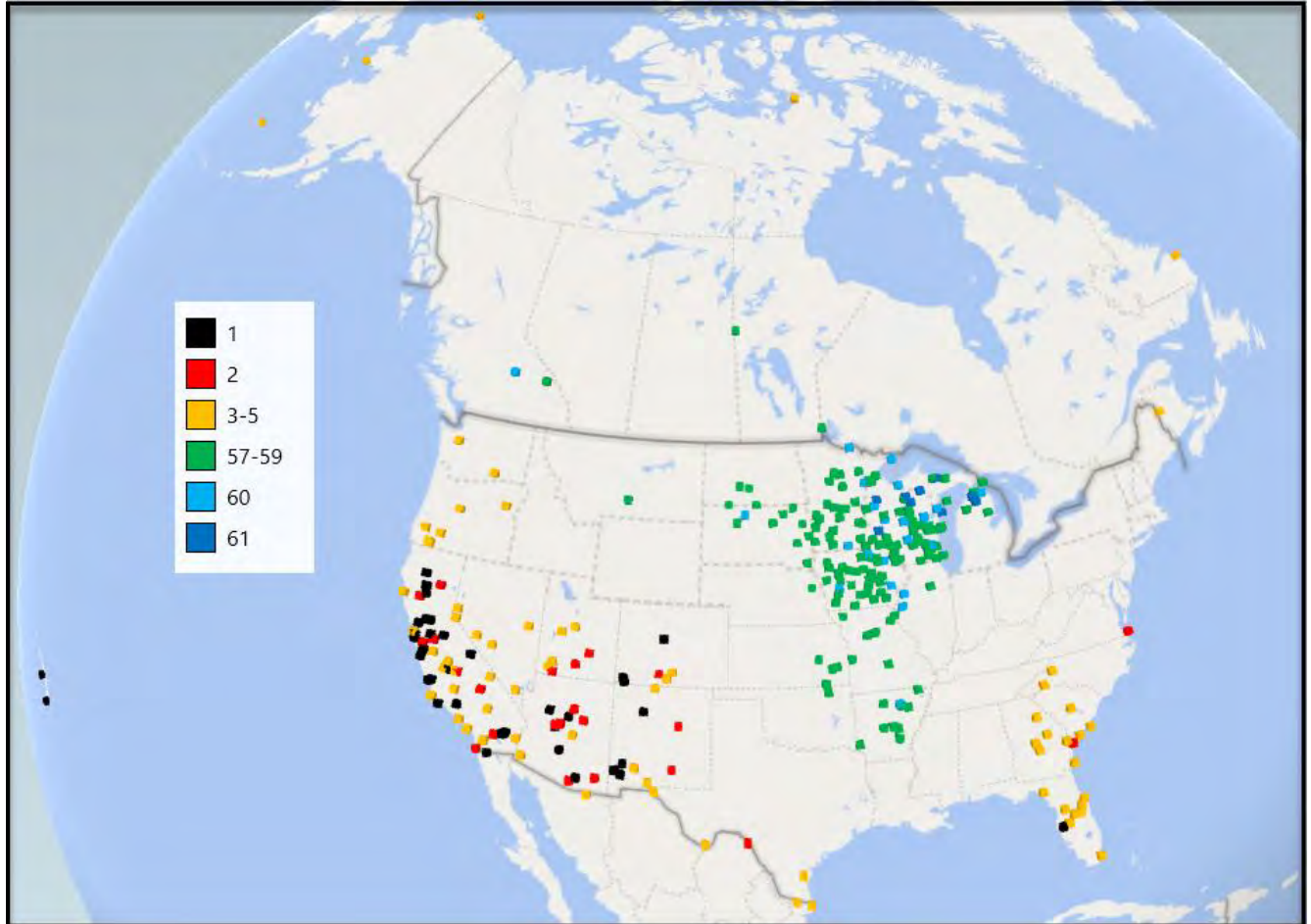
<https://www.climate.gov/maps-data/data-snapshots/usdroughtmonitor-weekly-ndmc-2020-10-06?theme=Drought>

<https://www.climate.gov/maps-data/data-snapshots/usdroughtmonitor-weekly-ndmc-2020-10-27?theme=Drought>

Coincidental with the worsening drought conditions in the Western US states in October, Figure 4 shows many Global Historical Climatology Network (GHCN) stations experienced their highest average daily high temperatures for the month of October in 2020, compared to all October station average values dating back to 1960.

**Figure 4**

**STATIONS IN THE US AND CANADA WHERE OCTOBER 2020 AVERAGE DAILY HIGH TEMPERATURE WAS AMONG FIVE HIGHEST (1-5) AND FIVE LOWEST (57-61) DURING OCTOBERS DATING BACK TO 1960.**



Source: Global Historical Climatology Network (GHCN) station data (Accessed November 6, 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)

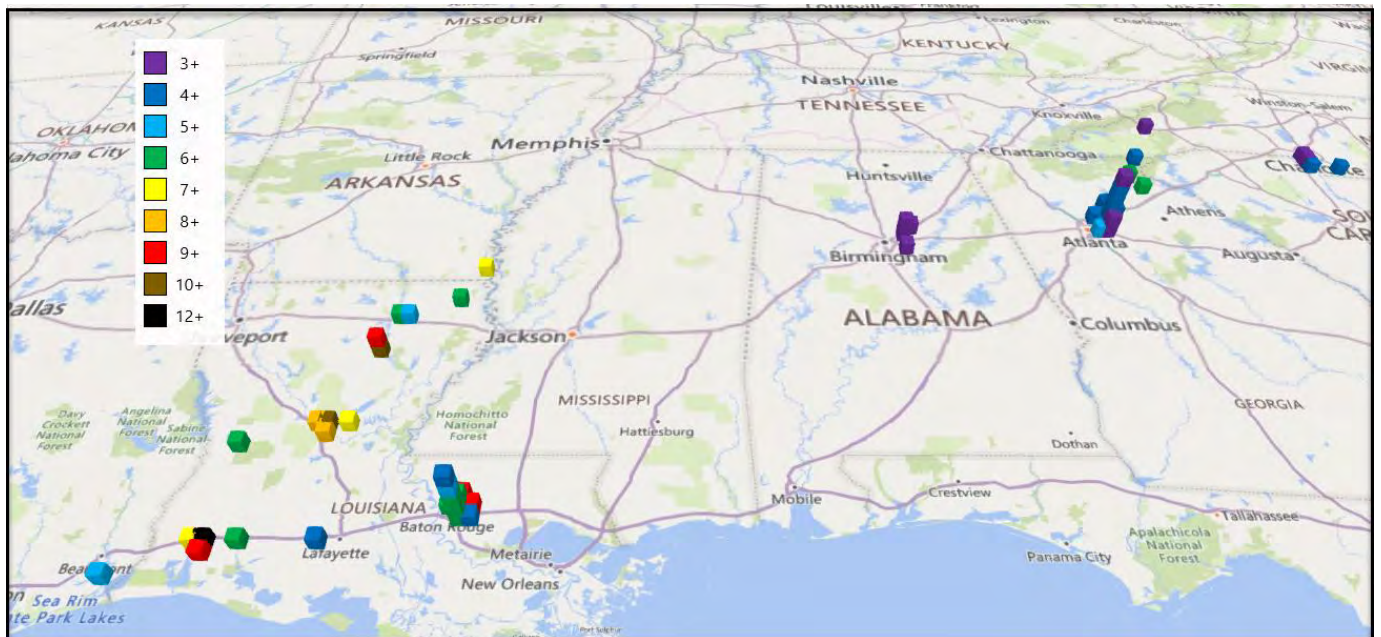
## Hurricane Delta

### Precipitation

Hurricane Delta made landfall near Creole, LA on October 9, 2020. <sup>5</sup> Figure 5 shows that several GHCN stations had record daily rainfall totals for October vs October daily totals back to 1960. Some stations recorded 10 or more inches of rain within a single day during October 6-13, 2020.

**Figure 5**

GHCN STATIONS WITH US PRECIPITATION RECORDS IN EXCESS OF 3 INCHES SET ON OCTOBER 6-13, 2020 FOR OCTOBER DAILY PRECIPITATION BACK TO 1960. THE CHART INDICATES INCHES OF DAILY RAINFALL.



Source: GHNC station data (Accessed November 6, 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>5</sup> October 14, 2020. Long, Kevin. AIR Worldwide Estimates Insured Losses for Hurricane Delta Will be Between USD 1 Billion and USD 3 Billion.

<https://www.verisk.com/press-releases/2020/october/air-worldwide-estimates-insured-losses-for-hurricane-delta-will-be-between-usd-1-billion-and-usd-3-billion/#:~:text=Air%20Worldwide%20Estimates%20Insured%20Losses,USD%203%20Billion%20%7C%20Verisk%20Analytics>

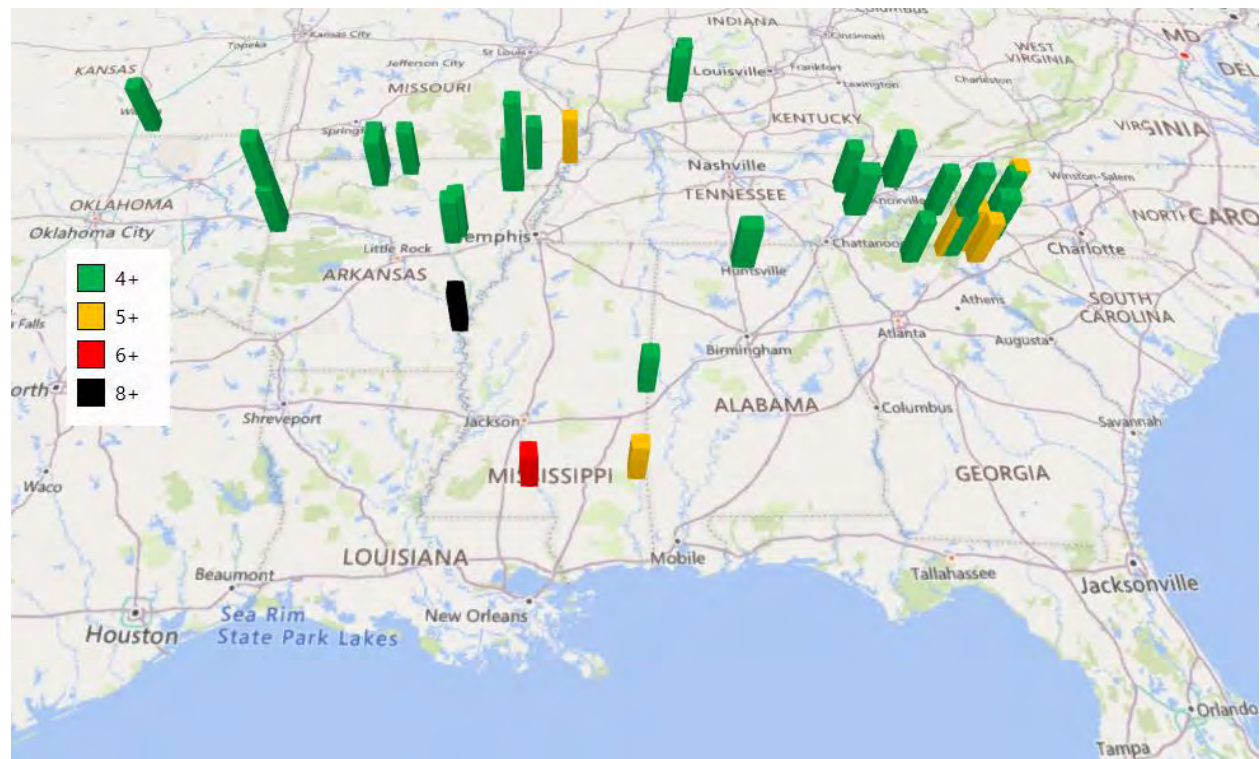


# Hurricane Zeta

## Precipitation

Hurricane Zeta made landfall near Cocodrie, LA on October 28, 2020. <sup>6</sup> As shown in Figure 6, Many GHCN stations had record daily rainfall totals for October vs October daily totals back to 1960. Several stations reported daily rainfall totals of five or more inches of rain during October 28-30, 2020.

**Figure 6**  
 US PRECIPITATION RECORDS IN EXCESS OF 4 INCHES SET ON OCTOBER 28-30, 2020 FOR OCTOBER DAILY PRECIPITATION BACK TO 1960. THE CHART INDICATES INCHES OF DAILY RAINFALL.



Source: GHCN station data (Accessed November 6, 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>6</sup> November 2, 2020. AIR Worldwide Estimates Insured Losses for Hurricane Zeta Will Be Between USD 1.5 Billion to USD 3.5 Billion. <https://www.air-worldwide.com/news-and-events/press-releases/air-worldwide-estimates-insured-losses-for-hurricane-zeta-will-be-between-usd-1-5-billion-to-usd-3-5-billion/>

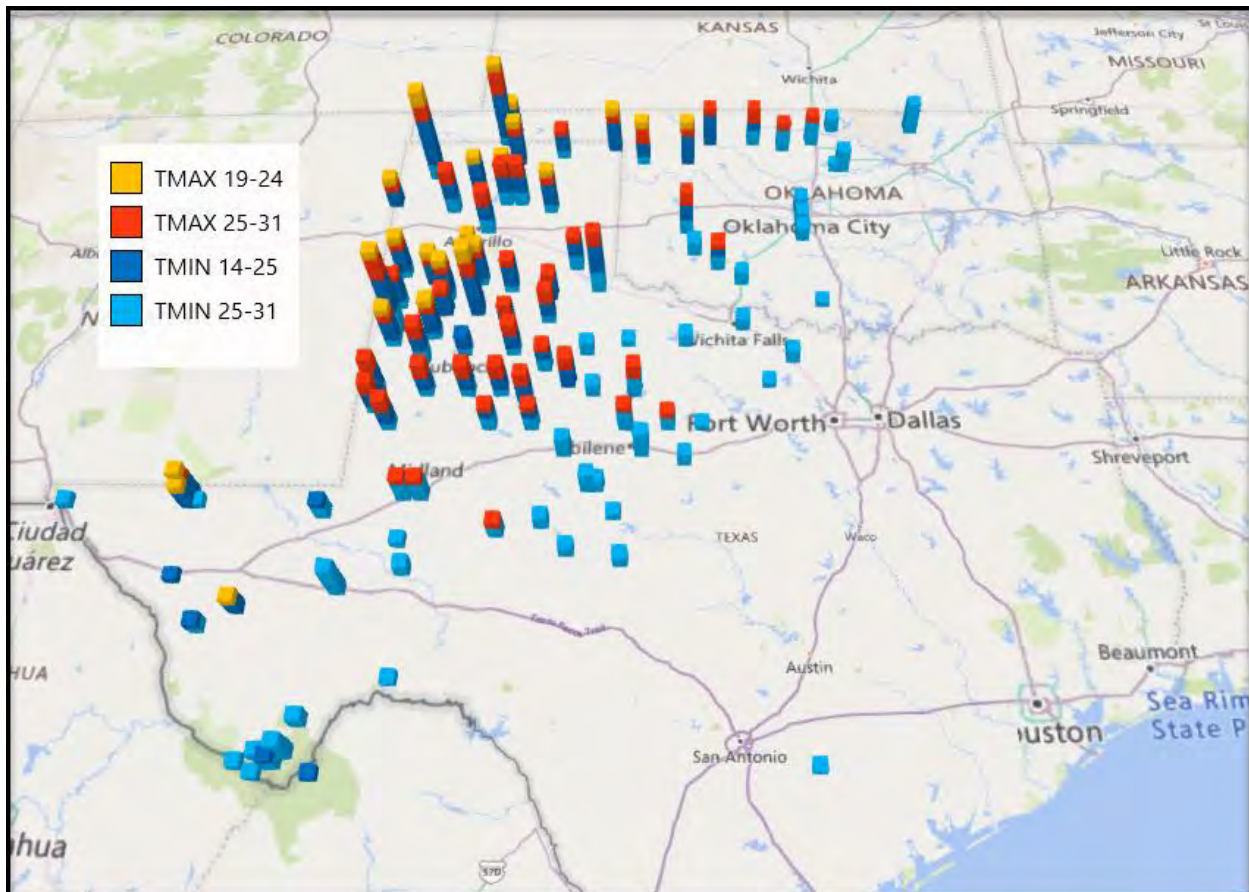
## Winter Storm Billy

### Daily Minimum and Maximum Freezing Temperatures

Winter Storm Billy, an October ice-storm which impacted portions of Texas and Oklahoma on October 27, occurred during the lead-up to Hurricane Zeta.<sup>7</sup> As shown in Figure 7, many stations experienced both high and low temperatures below freezing during October 25-28, 2020.

**Figure 7**

STATIONS WITH US DAILY HIGH (TMAX) AND DAILY LOW (TMIN) TEMPERATURES BELOW FREEZING ON OCTOBER 25-28, 2020. THE CHART INDICATES DEGREES FAHRENHEIT.



Source: GHNC station data (Accessed November 6, 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)

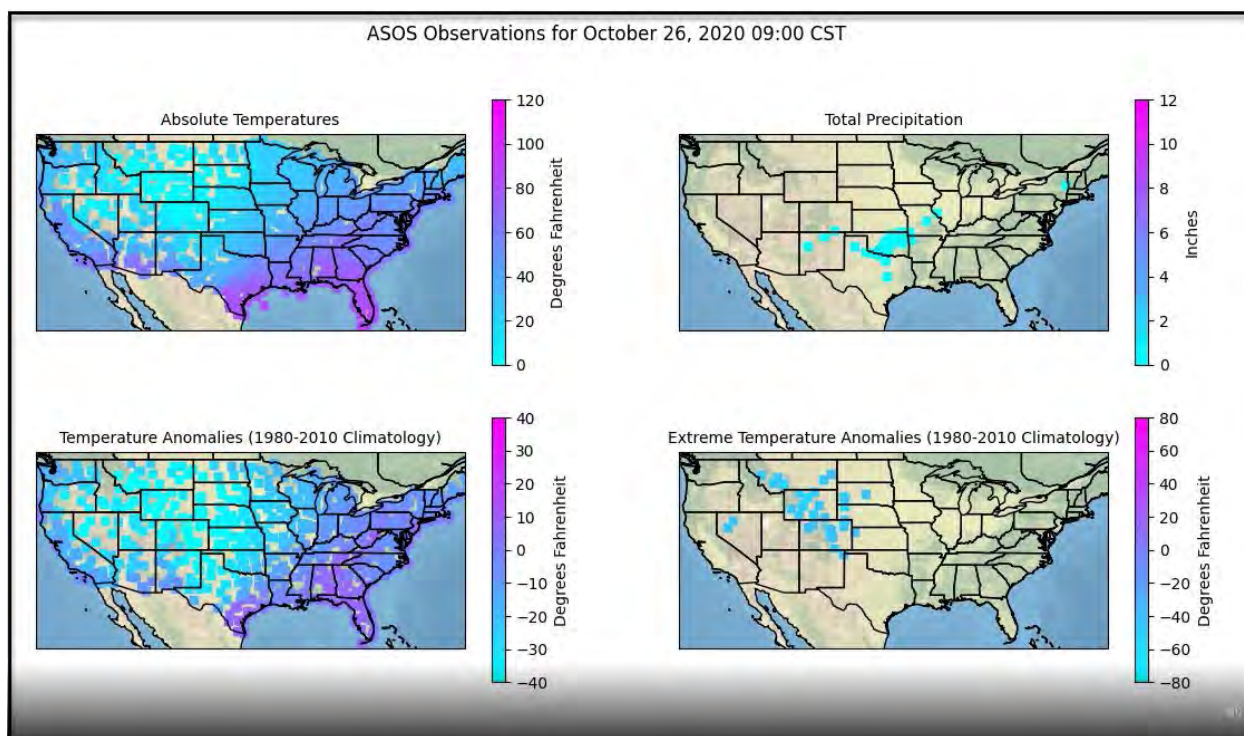
<sup>7</sup> More Than 40,000 Still Without Power 10 Days After Oklahoma Ice Storm. Jan Wesner Childs. November 08, 2020 <https://weather.com/news/news/2020-11-06-power-outages-oklahoma-ice-winter-storm>

## Compound Assessment

### Time Lapse of Temperature and Precipitation

By clicking on the link below Figure 8, you can see the October 2020 hourly time lapse of temperature, precipitation and departure from the 1980-2010 average. The Figure 8 snapshot shows the colder temperatures and precipitation coincidental with Winter Storm Billy. The time lapse will also show the onset of precipitation associated with Hurricanes Delta and Zeta. From this you can see in the late part of October 2020, the compounding impacts of Winter Storm Billy with Tropical Storm Zeta October 27/28.

**Figure 8**  
 TEMPERATURE AND PRECIPICATION OCTOBER 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 November 1, 2020.

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

[https://drive.google.com/file/d/1qOxx1QUvIKa5X-gKH3ACPJK\\_Kz657YsQ/view?usp=sharing](https://drive.google.com/file/d/1qOxx1QUvIKa5X-gKH3ACPJK_Kz657YsQ/view?usp=sharing)

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

## Rough Assessment of the Losses Caused by 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.

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

The National Interagency Fire Center (NIFC) reports that in the US, as of November 9 there have been 49,149 wildfires that have burned over 8.7 million acres this year. This is almost double the acreage burned to date in the 2019 season.<sup>8</sup>

### October 9, 2020 Hurricane Delta

Hurricane Delta made landfall October 9 near Creole, LA. Catastrophe risk modeling firm AIR quantified the insured damage from Hurricane Delta at from \$1billion to \$3billion. Since Hurricane Delta made landfall only about six weeks and 12 miles from Hurricane Laura's landfall (August 27, Cameron, LA), some areas affected by Delta could have been affected already by Laura. AIR assumes independence between these hurricanes in their modeling approach, and this reflected in the loss range. AIR's estimates are for losses to onshore properties, automobiles, contents and time element coverages.<sup>9</sup>

### October 28, 2020 Hurricane Zeta

Hurricane Zeta made landfall on October 28 near Cocodrie, LA, about 150 miles east of Hurricane Delta's landfall 19 days earlier. Catastrophe risk modeling firm AIR Worldwide estimates onshore insured losses will range between \$1.5billion and \$3.5billion. Hurricane Zeta was the 27<sup>th</sup> named Atlantic storm of the season tying a record set in 2005. The insured damage estimates include onshore property, automobile, contents and time element coverage.<sup>10</sup>

### September 16, 2020 Winter Storm Billy

On October 27 an unusually early<sup>11</sup> October ice storm hit portions of Oklahoma and Texas. In Oklahoma, more than 400,000 homes and businesses were without power at the peak of the outages and more than 40,000 homes in and around Oklahoma City were still without power November 7.

Combined with the outages from Hurricane Zeta's landfall in Louisiana, the two events left nearly 3 million homes without power regionally on October 29.<sup>12</sup>

---

<sup>8</sup> Center for Disaster Philanthropy. 2020 North American Wildfire Season. November 19, 2020. <https://disasterphilanthropy.org/disaster/2020-california-wildfires/>

<sup>9</sup> October 14, 2020. Long, Kevin. AIR Worldwide Estimates Insured Losses for Hurricane Delta Will be Between USD 1 Billion and USD 3 Billion.

<https://www.verisk.com/press-releases/2020/october/air-worldwide-estimates-insured-losses-for-hurricane-delta-will-be-between-usd-1-billion-and-usd-3-billion/#:~:text=AIR%20Worldwide%20Estimates%20Insured%20Losses,USD%203%20Billion%20%7C%20Verisk%20Analytics>

<sup>10</sup> November 2, 2020. AIR Worldwide Estimates Insured Losses for Hurricane Zeta Will Be Between USD 1.5 Billion to USD 3.5 Billion. <https://www.air-worldwide.com/news-and-events/press-releases/air-worldwide-estimates-insured-losses-for-hurricane-zeta-will-be-between-usd-1-5-billion-to-usd-3-5-billion/>

<sup>11</sup> Oklahoma Ice Storms Leave Thousands Without Power on Eve of Early Voting. October 28, 2020.

<https://www.nytimes.com/2020/10/28/us/ice-storm-oklahoma.html>

<sup>12</sup> More Than 40,000 Still Without Power 10 Days After Oklahoma Ice Storm. Jan Wesner Childs. November 08, 2020

<https://weather.com/news/news/2020-11-06-power-outages-oklahoma-ice-winter-storm>

## 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 November 18, 2020).

<https://www.ncdc.noaa.gov/societal-impacts/wildfires/month/10.csv>

Source: California Department of Forestry and Fire Protection As of November 3, 2020

[https://www.fire.ca.gov/media/11416/top20\\_acres.pdf](https://www.fire.ca.gov/media/11416/top20_acres.pdf)

### 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)

---

## 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 temperature and precipitation data and information that the author's used for this analysis.

## About The Society of Actuaries

With roots dating back to 1889, the [Society of Actuaries](#) (SOA) is the world's largest actuarial professional organizations with more than 31,000 members. Through research and education, the SOA's mission is to advance actuarial knowledge and to enhance the ability of actuaries to provide expert advice and relevant solutions for financial, business and societal challenges. The SOA's vision is for actuaries to be the leading professionals in the measurement and management of risk.

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:

**Objectivity:** The SOA's research informs and provides analysis that can be relied upon by other individuals or organizations involved in public policy discussions. The SOA does not take advocacy positions or lobby specific policy proposals.

**Quality:** The SOA aspires to the highest ethical and quality standards in all of its research and analysis. Our research process is overseen by experienced actuaries and nonactuaries from a range of industry sectors and organizations. A rigorous peer-review process ensures the quality and integrity of our work.

**Relevance:** The SOA provides timely research on public policy issues. Our research advances actuarial knowledge while providing critical insights on key policy issues, and thereby provides value to stakeholders and decision makers.

**Quantification:** The SOA leverages the diverse skill sets of actuaries to provide research and findings that are driven by the best available data and methods. Actuaries use detailed modeling to analyze financial risk and provide distinct insight and quantification. Further, actuarial standards require transparency and the disclosure of the assumptions and analytic approach underlying the work.

Society of Actuaries  
475 N. Martingale Road, Suite 600  
Schaumburg, Illinois 60173  
[www.SOA.org](http://www.SOA.org)