



Actuarial Weather Extremes

August 2020





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Hurricanes, Earthquake, Derecho, Extreme Heat and Wildfire

AUTHORS

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

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Overview

This report examines weather extremes in tropical cyclones, wind, heat, and drought, as well as catastrophe associated with earthquakes during August 2020.

The report uses temperature data from the Global Historical Climatology Network (GHCN), drought and wind data from the National Oceanic and Atmospheric Administration (NOAA), and earthquake data from the U.S. Geological Survey (USGS).

Hurricanes Isaias and Laura impacted the US in early and late August, respectively. According to its press release, CoreLogic (a data analysis firm) estimated between \$8 Billion to \$12 Billion in insured losses due to wind and storm surge caused by Hurricane Laura and described this storm as "... the most intense hurricane to make landfall in the northwestern Gulf Coast since 1856..."¹ Additional information about Hurricane Laura can be found in the SOA's Hurricane Laura report.²

According to a press release by catastrophe risk solutions company RMS, total insured losses in the United States from **Hurricane Isaias** will be between \$3.0 billion and \$4.5 billion, including losses to the National Flood Insurance Program of between \$400 million and \$700 million.³

The strongest **earthquake** in North Carolina in over 100 years was recorded on August 9 near the Virginia border (see Table 1 and Figure 1). 525 buildings were damaged in the earthquake, including 60 that were considered to have major damage.⁴

On August 10, 2020, a system of straight-line wind storms known as a "derecho" caused damage along a 700-mile path that stretched from Nebraska to Indiana (see Figure 2).

In California, several weather stations recorded daily temperature records in August, and one station recorded an observation of nearly 130 degrees Fahrenheit (see Figure 3).

Significant **wildfires** in Colorado and California in August coincided with severe drought conditions in those areas (see Figure 4).

¹ CoreLogic. (2020, August 28). "CoreLogic Estimates \$8 Billion to \$12 Billion in Insured Losses From Hurricane Laura Wind and Storm Surge." Press Release. <https://www.corelogic.com/news/corelogic-estimates-8-billion-to-12-billion-in-insured-losses-from-hurricane-laura-wind-and-storm-surge.aspx>.

² <https://www.soa.org/globalassets/assets/files/resources/research-report/2020/weather-extremes-hurricane-laura-aug-2020.pdf>

³RMS press release (2020, August 14) RMS Estimates that Insured Losses from Hurricane Isaias Will Be Between US\$3bn – US\$5bn. Losses to the National Flood Insurance Program expected to be between US\$400m and US\$700m of total insured losses" <https://www.rms.com/newsroom/press-releases/press-detail/2020-08-18/rms-estimates-that-insured-losses-from-hurricane-isaias-will-be-between-us3bn-us5bn>

⁴Allman, Megan; Winters, Jessica (2020, August 18). "525 buildings damaged | Sparta earthquake destruction worse than initially thought, emergency officials say." WCNC-Charlotte <https://www.wcnc.com/article/news/local/sparta-earthquake-damage-worse-than-initially-thought-emergency-officials-say/83-a8a402d5-c949-40c8-99b3-de435c11290c>.

Earthquake

Table 1 and Figure 1 present the magnitude, date and location of all earthquakes in North Carolina, dating back over 100 years, of magnitude 3.5 or greater. August 2020 saw the strongest North Carolina earthquake since 1916, a magnitude 5.1 earthquake. This was only the 2nd earthquake of magnitude 5.0 or greater recorded since 1900.

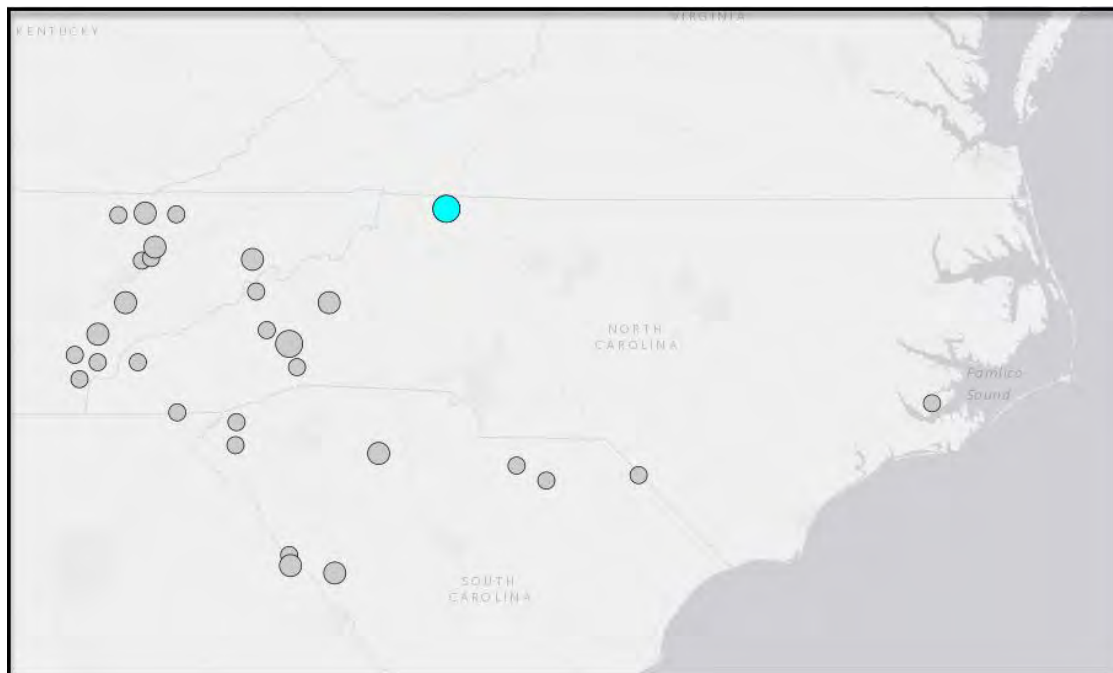
Table 1
MAGNITUDE 3.5 OR GREATER EARTHQUAKES IN NORTH CAROLINA SINCE 9/4/1900

Magnitude	Location	Location Detail	Date	Date/Time
5.2	North Carolina	35.500°N 82.500°W	1916-02-21	1916-02-21 23:39:00 (UTC) km
5.1	4 km SE of Sparta, North Carolina	36.476°N 81.094°W	2020-08-09	2020-08-09 12:07:37 (UTC) 7.6 km
4	North Carolina	35.799°N 82.142°W	1957-05-13	1957-05-13 14:24:51 (UTC) 5.0 km
3.9	Tennessee-North Carolina border region	35.000°N 83.500°W	1957-11-24	1957-11-24 20:06:17 (UTC) km
3.8	North Carolina	35.067°N 76.751°W	1994-08-06	1994-08-06 19:54:09 (UTC) 5.0 km
3.7	7km W of Rowland, North Carolina	34.540°N 79.375°W	2006-09-25	2006-09-25 05:44:20 (UTC) 5.0 km
3.7	13km NW of Marshall, North Carolina	35.880°N 82.795°W	2005-08-25	2005-08-25 03:09:41 (UTC) 7.9 km
3.7	North Carolina	35.600°N 82.700°W	1957-07-02	1957-07-02 09:33:01 (UTC) 7.0 km
3.5	Tennessee-North Carolina border region	35.366°N 83.853°W	1988-02-18	1988-02-18 00:37:45 (UTC) 5.0 km
3.5	North Carolina	35.330°N 82.430°W	1981-05-05	1981-05-05 21:21:57 (UTC) 13.2 km

Source: United States Geological Survey (USGS). "USGS Search Earthquake Catalog." (Accessed September 11, 2020).
<https://earthquake.usgs.gov/earthquakes/search/>.

Using the USGS Search Earthquake Catalog, a rectangular search area was drawn to include the state of North Carolina. This rectangular area was parameterized to include earthquakes of magnitude 3.5 or greater, and back to 9/4/1900. Figure 1 shows the result of the search. Table 1 above provides the details for the points in and on the border of North Carolina.

Figure 1
MAGNITUDE 3.5 OR GREATER EARTHQUAKES SINCE 1900 IN A SEARCH AREA ENCOMPASSING NORTH CAROLINA



Source: United States Geological Survey (USGS). "USGS Search Earthquake Catalog." (Accessed September 11, 2020).
<https://earthquake.usgs.gov/earthquakes/search/>.

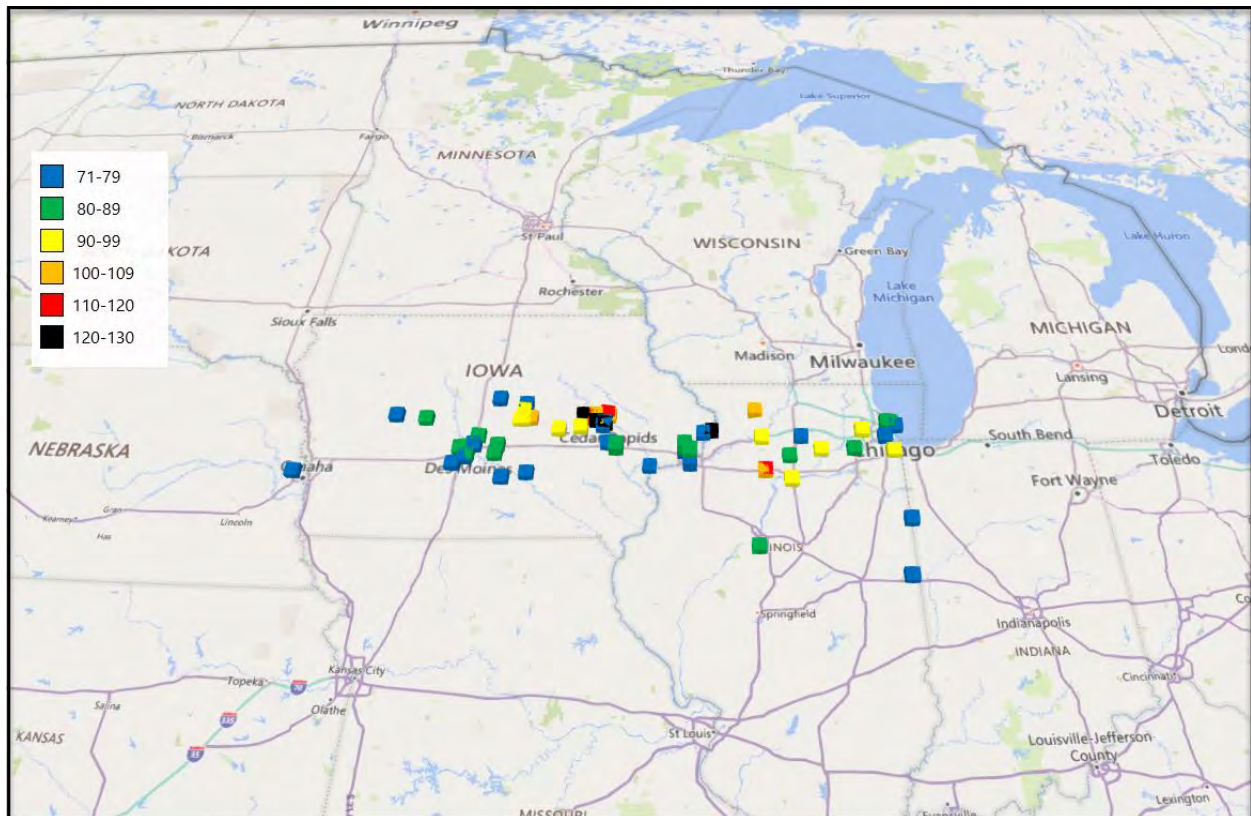
Derecho

On August 10, 2020, a derecho moved through the Midwest in the afternoon and early evening. Several wind speeds were recorded over 100mph. The derecho traversed over 700 miles from Nebraska to Indiana, producing wind speeds equivalent to a category 3 or 4 hurricane.⁵

According to a PBS NOVA Planet Earth article, in Iowa, the hardest-hit state, three deaths were reported and hundreds of thousands of people went without power for days. More than 40% of the state’s corn and soybean crop was severely damaged by the storm, whose winds reached 110-140 mph, equivalent to those of a Category 3 or 4 hurricane.⁶

Figure 2

HIGH WIND READINGS ABOVE 70MPH FROM 3PM TO 10PM ON AUGUST 10, 2020 IN NEBRASKA, IOWA, ILLINOIS AND INDIANA IN MILES PER HOUR (MPH)



Source: NOAA Storm Prediction Center data (Accessed September 2, 2020). https://www.spc.noaa.gov/climo/reports/200810_rpts.html

⁵ Bennett, Sukee (2020, August 21). "Inside the derecho that pummeled the Midwest." PBS NOVA Planet Earth. <https://www.pbs.org/wgbh/nova/article/derecho-wind-storm-iowa/>

⁶ Bennett, Sukee (2020, August 21). "Inside the derecho that pummeled the Midwest." PBS NOVA Planet Earth. <https://www.pbs.org/wgbh/nova/article/derecho-wind-storm-iowa/>

Extreme Heat

Death Valley, CA recorded a high temperature of 129.9 degrees Fahrenheit on August 16, 2020. This was the highest official temperature recorded in Death Valley since July 1913. The table below shows record August daily high temperatures in August 2020 vs the period 1960-2019.⁷

Figure 3
AUGUST 2020 RECORD DAILY HIGH TEMPERATURES SINCE 1960 (ABOVE 120 DEGREES FAHRENHEIT)

Station Name	Country	State	Date	Daily High Temp Deg Fahrenheit
DEATH VALLEY	US	CA	20200816	129.92
DEATH VALLEY	US	CA	20200817	127.04
HAVASU ARIZONA	US	AZ	20200815	123.08
NEEDLES AP	US	CA	20200815	123.08
TACNA 3 NE	US	AZ	20200815	120.92
IRON MTN	US	CA	20200816	120.02
LEMOORE REEVES NAS	US	CA	20200816	120.02

Source: GHNC station data (Accessed September 7, 2020). ftp://ftp.ncdc.noaa.gov/pub/data/ghcn/daily/ghcnd_all.tar.gz

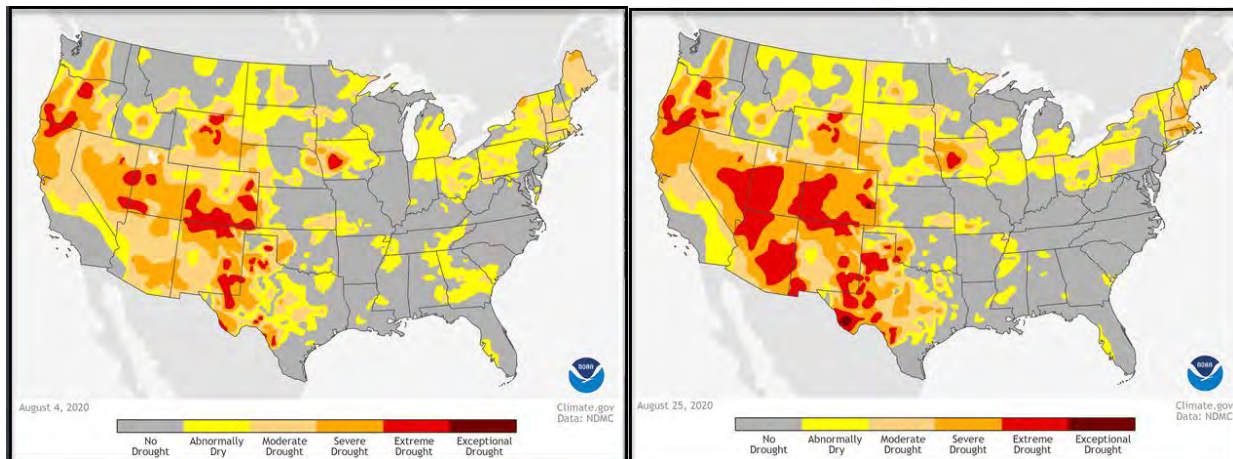
⁷ <https://www.weather.gov/vef/DeathValley130>

Wildfires

Colorado: According to NOAA Climate.gov, the four largest wildfires in the state have, as of August 19, burned through over 170,000 acres of western Colorado. The largest fire, the Pine Gulch Fire, was started by lightning on July 31 near Grand Junction. It has burned over 125,000 acres and is the second largest fire in state history. At least a quarter of the state has been in drought since October 2019, with almost 94% in drought now, (August 20, 2020).⁸

California: According to NOAA Climate.gov, in just nine days, more than three times the average acreage was burned in California relative to a “normal” wildfire *season* in the state. An area the size of Rhode Island burned in less than two weeks. Over the second half of August, 1.42 million acres of land burned, larger than the state of Delaware.⁹

Figure 4
DROUGHT CONDITIONS IN THE CONTINENTAL US EARLY AND LATE AUGUST



Source: NOAA Climate.gov Drought Monitor (Accessed September 16, 2020). <https://www.climate.gov/maps-data/data-snapshots/usdroughtmonitor-weekly-ndmc-2020-08-04?theme=Drought>

<https://www.climate.gov/maps-data/data-snapshots/usdroughtmonitor-weekly-ndmc-2020-08-25?theme=Drought>

⁸ Di Liberto, Tom. (August 20, 2020). “A Colorado summer: Drought, wildfires and smoke in 2020”. NOAA Climate.gov. <https://www.climate.gov/news-features/event-tracker/colorado-summer-drought-wildfires-and-smoke-2020>

⁹ Di Liberto, Tom. (August 26, 2020). “Over a million acres burned in California in second half of August 2020”. NOAA Climate.gov. <https://www.climate.gov/news-features/event-tracker/over-million-acres-burned-california-second-half-august-2020>

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.

August 24-29, 2020 Hurricane Laura

The Lafayette (Louisiana) Daily Advertiser provided an early estimate of August 2020 wind and storm surge damage in Louisiana and Texas: “Hurricane Laura caused as much as \$12 billion in wind and surge damage to more than 500,000 insured residential and commercial properties, according to property data analysis firm CoreLogic. The vast majority of property damage occurred in southwest Louisiana, where Laura made landfall early Thursday as a Category 4 hurricane with 150 mph winds. The majority of the residential and commercial insured property losses were due to wind and storm surge, according to CoreLogic's post-landfall estimates. Louisiana's estimated damage ranges from \$8 and \$12 billion, while Texas was estimated at \$550 million.”¹⁰

August 2-4, 2020 Hurricane Isaias

According to a press release by catastrophe risk solutions company RMS, total insured losses from Hurricane Isaias will be between \$3.0 billion and \$4.5 billion in the US, and the estimate includes estimated losses to the National Flood Insurance Program to be between \$400 million and \$700 million.¹¹

August 9, 2020 North Carolina Earthquake

A magnitude 5.1 earthquake in North Carolina caused damage to 525 buildings, 60 of which were considered to have major damage.¹²

August 10, 2020 Derecho:

According to PBS NOVA Planet Earth, in Iowa, the hardest-hit state, three deaths have been reported so far and hundreds of thousands of people went without power for days. More than 40% of the state's corn and soybean crop was severely damaged by the storm.¹³

August 2020 Wildfires [Note: Wildfires continue in the Western US in September. We will look for more comprehensive damage estimates then.]

¹⁰ Dodge, Victoria. (2020, August 31). “Hurricane Laura: Louisiana's Insured Property Damage Ranges from \$8 Billion to \$12 Billion.” Lafayette Daily Advertiser. <https://www.theadvertiser.com/story/news/local/louisiana/2020/08/31/hurricane-laura-damage-estimates-up-12-billion-insured-losses/5657746002/>.

¹¹RMS press release (2020, August 14) RMS Estimates that Insured Losses from Hurricane Isaias Will Be Between US\$3bn – US\$5bn. Losses to the National Flood Insurance Program expected to be between US\$400m and US\$700m of total insured losses” <https://www.rms.com/newsroom/press-releases/press-detail/2020-08-18/rms-estimates-that-insured-losses-from-hurricane-isaias-will-be-between-us3bn-us5bn>

¹² Allman, Megan and Winters, Jessica. (August 18, 2020). “525 buildings damaged | Sparta earthquake destruction worse than initially thought, emergency officials say”. WCNC Charlotte. <https://www.wcnc.com/article/news/local/sparta-earthquake-damage-worse-than-initially-thought-emergency-officials-say/83-a8a402d5-c949-40c8-99b3-de435c11290c>

¹³ Bennett, Sukee (2020, August 21). “Inside the derecho that pummeled the Midwest.” PBS NOVA Planet Earth. <https://www.pbs.org/wgbh/nova/article/derecho-wind-storm-iowa/>

Data

Temperature 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

Filename: [ghcnd_all.tar.gz](#)

Wind data is from NOAA Storm Prediction Center data (Accessed September 2, 2020).

https://www.spc.noaa.gov/climo/reports/200810_rpts.html

Earthquake data is from

<https://earthquake.usgs.gov/earthquakes/map/?currentFeatureId=usp0000pwm&extent=31.09998,-89.05518&extent=39.04479,-71.47705&range=search&sort=largest&timeZone=utc&search=%7B%22name%22:%22Search%20Results%22,%22params%22:%7B%22starttime%22:%221900-09-04%2000:00:00%22,%22endtime%22:%222020-09-11%2023:59:59%22,%22maxlatitude%22:36.531,%22minlatitude%22:33.779,%22maxlongitude%22:-76.025,%22minlongitude%22:-84.507,%22minmagnitude%22:3.5,%22orderBy%22:%22time%22%7D%7D>

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Society of Actuaries
475 N. Martingale Road, Suite 600
Schaumburg, Illinois 60173
www.SOA.org