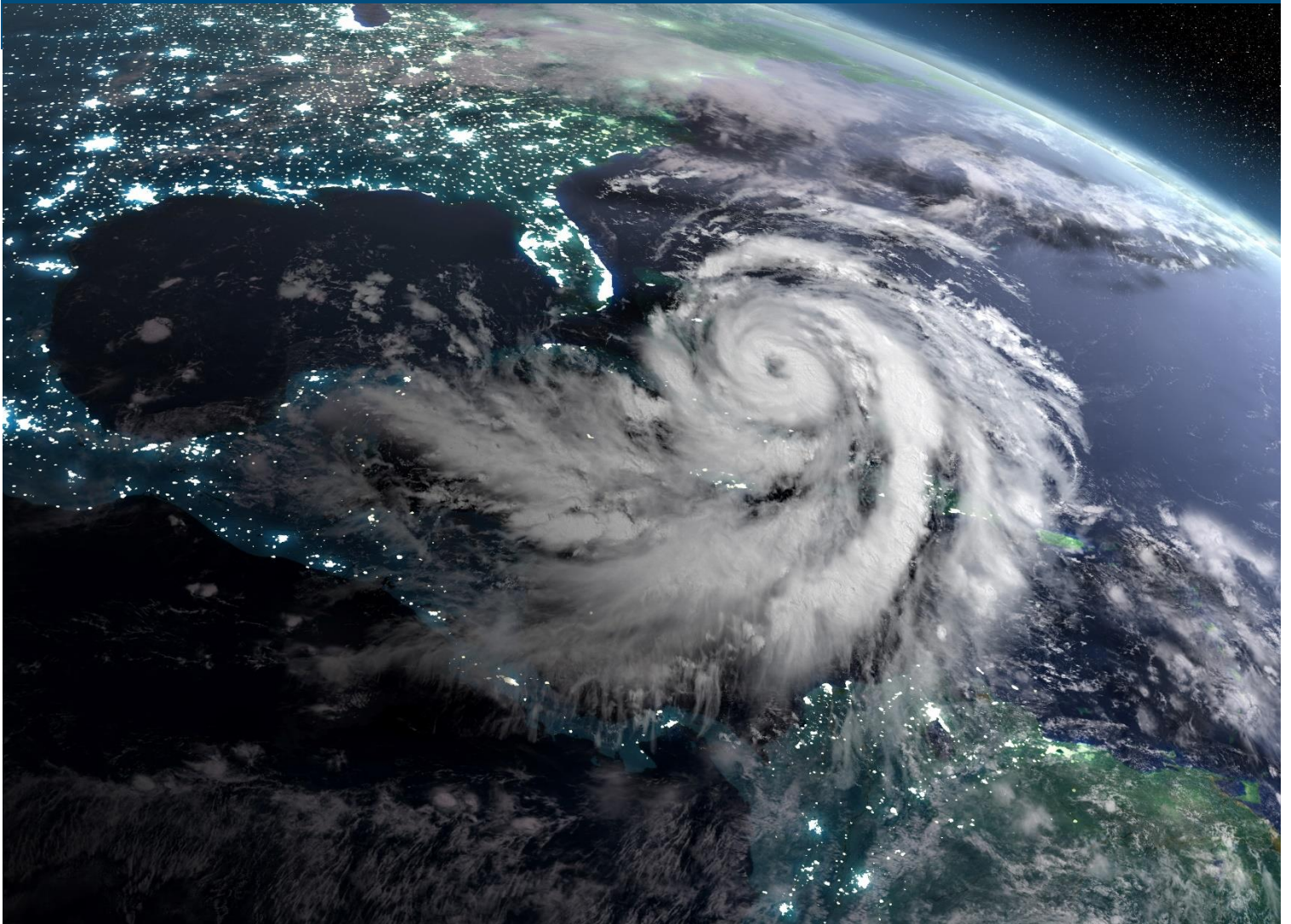




Actuarial Weather Extremes

February 2020



Actuarial Weather Extremes: February 2020

Heavy Precipitation in the U.S. Southeast, and Dry Conditions in California

Overview

During February 2020, most of the Southeastern United States (U.S.) experienced a series of storms that produced heavy precipitation. Total monthly precipitation exceeded 10 inches across large sections of Mississippi, Alabama, Georgia, Tennessee, South Carolina and North Carolina. Relative to data from 1960 to 2019 for the month of February, numerous locations experienced record or near-record precipitation¹ totals.

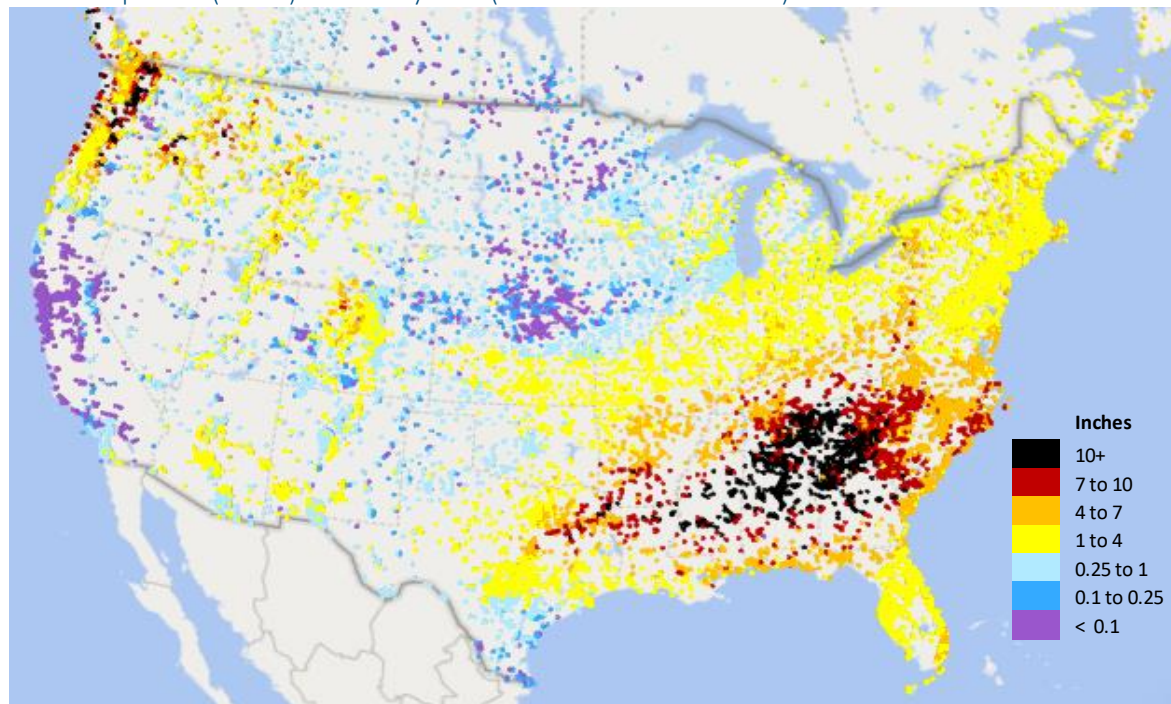
In stark contrast to the rain-soaked Southeastern U.S., much of California, western Nevada and southern Oregon experienced record or near-record low levels of precipitation during February. This comes on the heels of an exceptionally dry January, leading to significant cumulative precipitation shortfalls (relative to historic norms) across the first two months of 2020.

These precipitation extremes are illustrated in Figures 1 through 6, which reflect data obtained from the Global Historical Climatology Network (“GHCN”) weather database². Figure 1 shows all weather stations with complete precipitation data³ for February 2020, while Figures 2 through 6 reflect only on those stations that have both complete data for February 2020 and at least 30 years of historical data⁴ for the month of February.

Figure 7 identifies sites in Southeastern U.S. that have recently flooded as a result of heavy precipitation, while Figure 8 shows a large area with drought conditions in California, Oregon and Nevada, exacerbated by the lack of precipitation in February.

Figure 1

Total Precipitation (Inches) in February 2020 (source: GHCN station data)



¹ Precipitation totals presented in this report include both rain and the liquid-equivalent of snow and sleet.

² <https://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based-datasets/global-historical-climatology-network-ghcn>

³ For this analysis, a “complete” month of station data was defined as one in which at least 25 days of data was reported for the station.

⁴ To satisfy this data requirement, a station must have at least 30 years of February precipitation data falling between 1960 and 2019. This data can consist either of a continuous block of years (e.g. 1990 – 2019), or two or more separate periods which, in total, equal or exceed 30 years.

Figure 2
 Precipitation in February 2020 Minus Historic Average⁵ for February (source: GHCN station data)

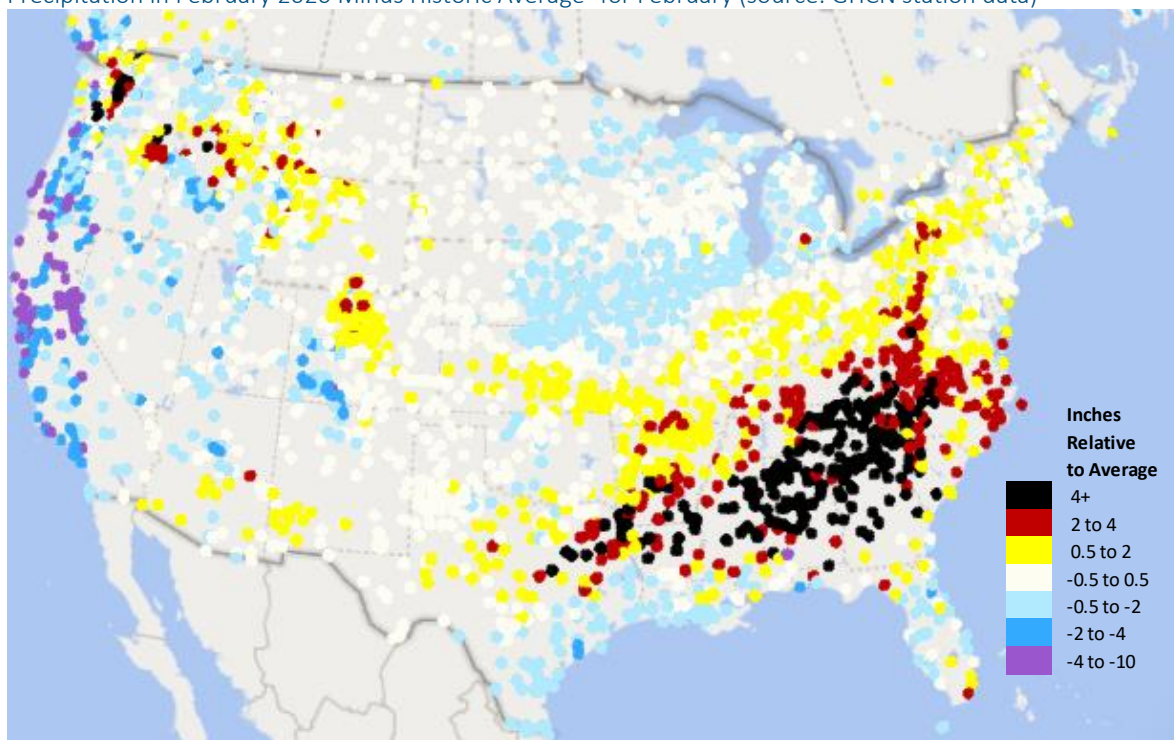
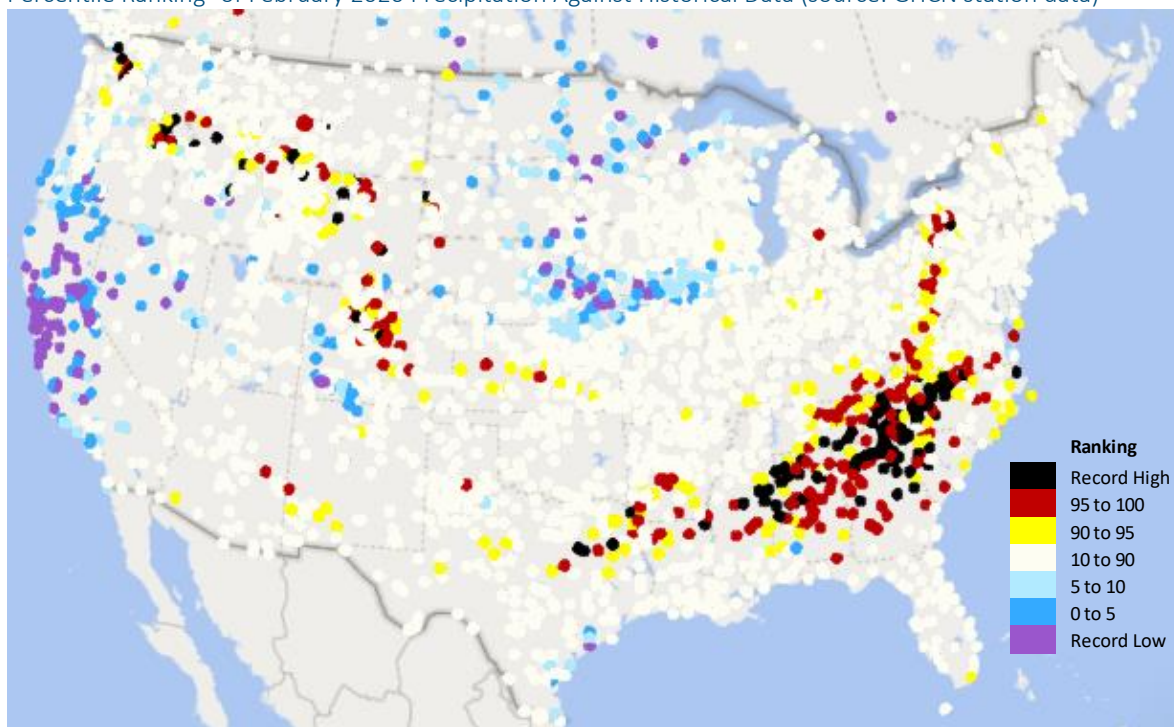


Figure 3
 Percentile Ranking⁶ of February 2020 Precipitation Against Historical Data (source: GHCN station data)



⁵ Each station's historic precipitation average was computed using all available data from 1960 to 2019 for the month of February.

⁶ A ranking of 90%, for example, means that total precipitation in February 2020 was greater than the monthly precipitation total in 90% of prior Februaries, using data from 1960 to 2019.

Figure 4
February 2020 Precipitation (Inches) Averaged Across Stations in Each State (source: GHCN station data)

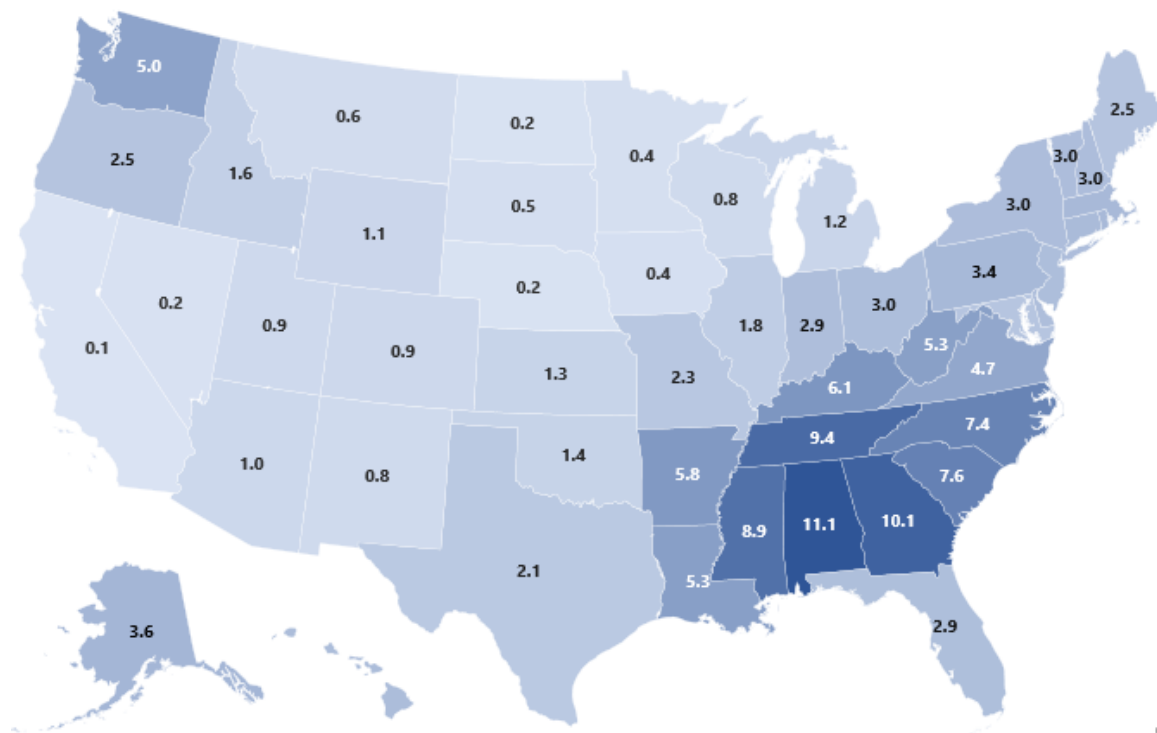


Figure 5
State-Average Precipitation in February 2020 Minus Historic State-Average for February (source: GHCN data)

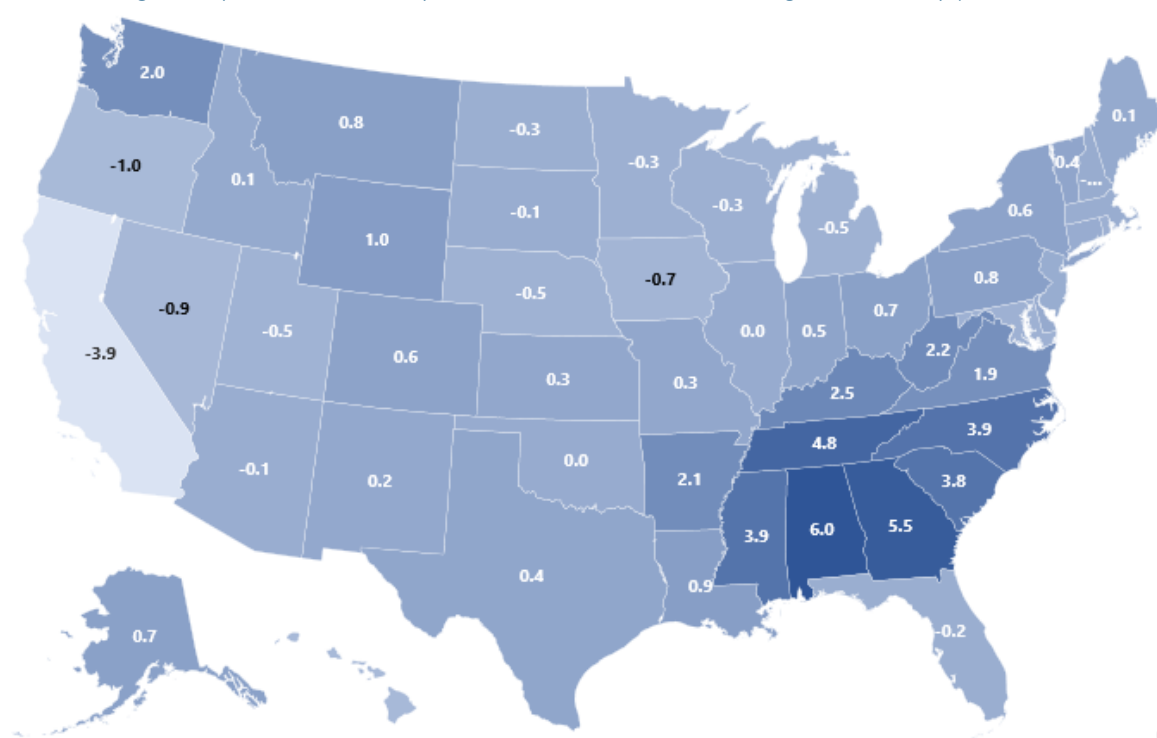


Figure 6
 Percentile Ranking⁷ of February 2020 Precipitation Against Historical Data (source: GHCN station data)

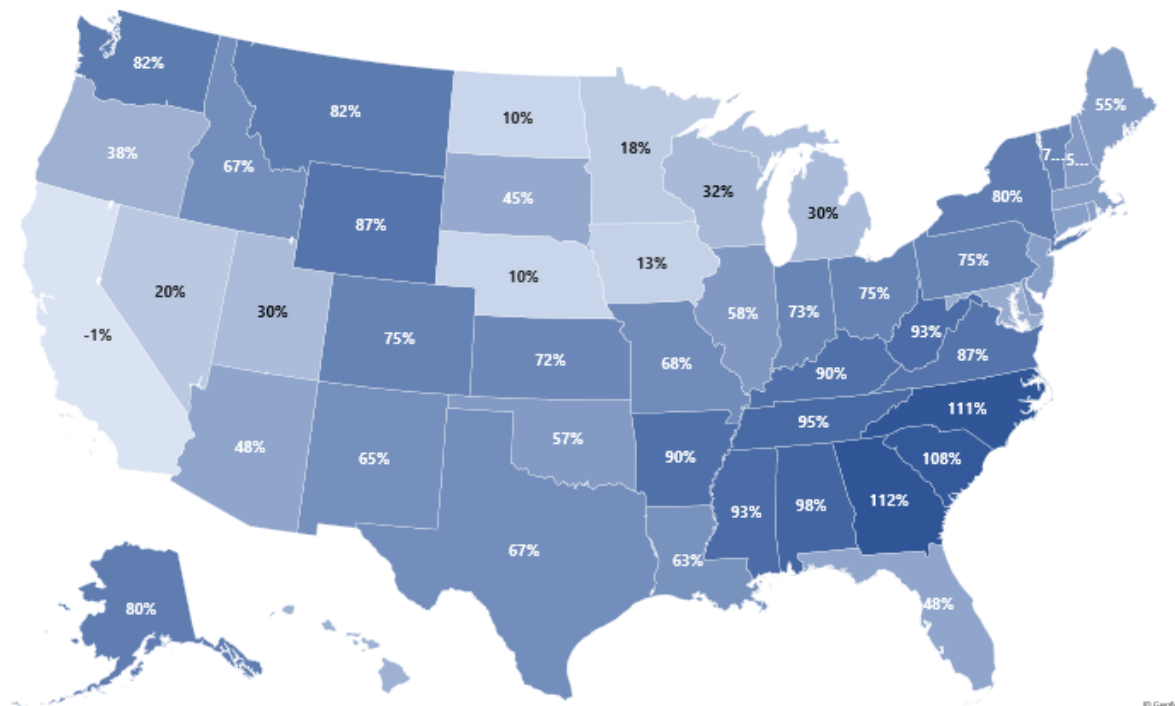
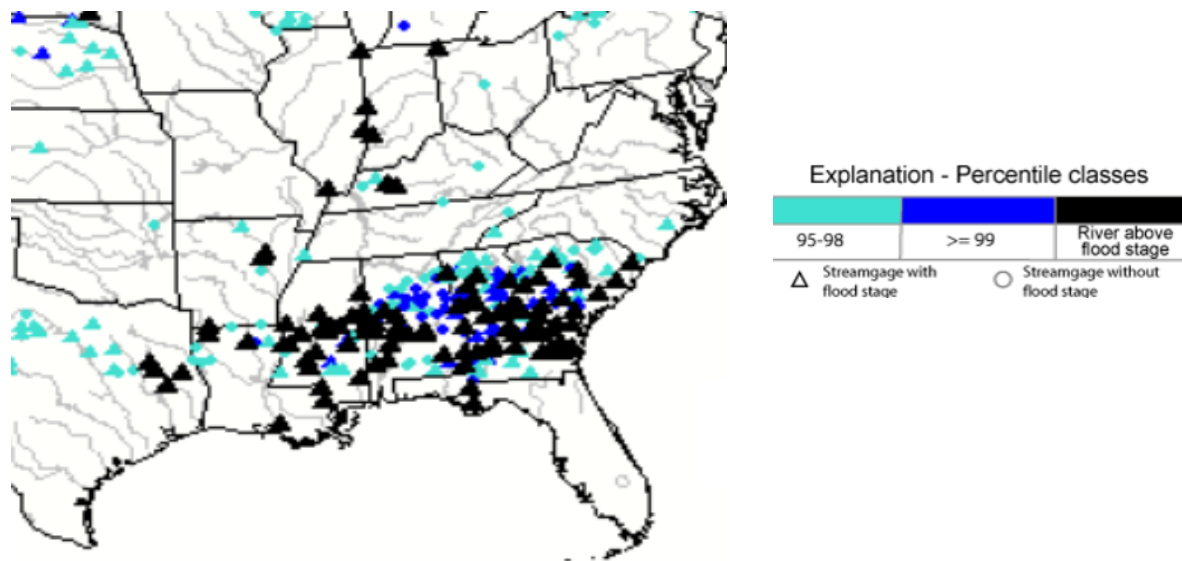


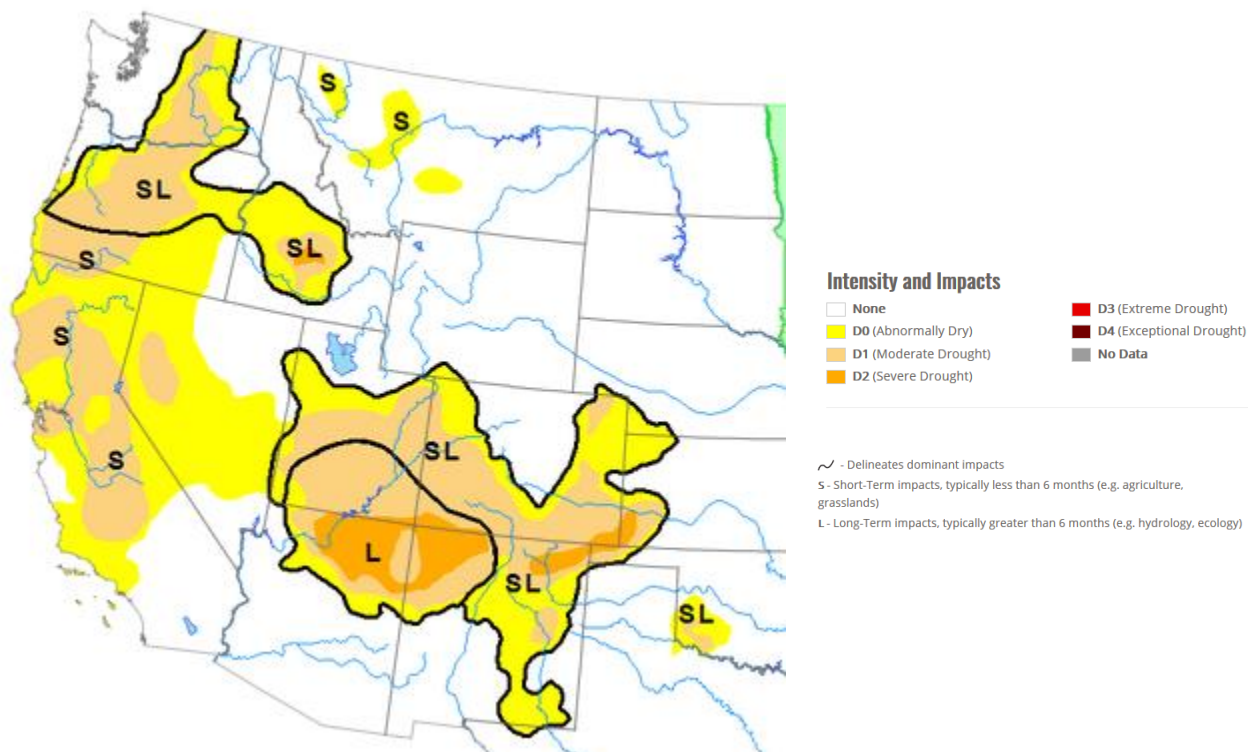
Figure 7
 Heavy Rains in the Southeastern U.S. Lead to Inland Flooding at Numerous Locations (source: USGS⁸)



⁷ A ranking of 90%, for example, means that state-average precipitation in February 2020 was greater than state-average precipitation in 90% of prior Februaries, using data from 1960 to 2019. A value of 110% indicates that the prior precipitation record was exceeded by 10%. The negative 1% value for California indicates a record low.

⁸ This map was downloaded from the United States Geological Survey's website on March 6. It reflects flooding conditions as of that date. URL: https://www.usgs.gov/mission-areas/water-resources/science/usgs-flood-information?qt-science_center_objects=0#qt-science_center_objects

Figure 8
Lack of Precipitation Contributes to Drought Conditions in California (source: U.S. Drought Monitor⁹)



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. Below, we offer a rough assessment of the cost of some of the weather events covered in our reports over the last few months:

February 2020: Heavy Rain in the Southeastern U.S.

The USA Today reported that about 1000 homes were flooded in Mississippi¹⁰, with the city of Jackson particularly hard-hit. Flooding led to an evacuation¹¹ of some parts of Montgomery, Georgia. Evacuations also occurred in northwest Alabama¹², where highway 231 was closed indefinitely due to flood damage¹³. In Savannah, Georgia, many roads were temporarily closed due to flooding¹⁴.

January 2020: Unseasonable Warmth Across Much of the Northern Hemisphere

One of the primary economic effects of the warm weather has been a reduction in the sales and consumption of fuel used for heating. According to an article in "Bloomberg Green", the loss in global oil demand due to warm

⁹ The US Drought Monitor (USDM) is a map that is updated on a weekly basis, illustrating the areas of the U.S. that are experiencing drought. It is developed jointly by the National Drought Mitigation Center, the National Oceanic and Atmospheric Administration, and the U.S. Department of Agriculture: <https://droughtmonitor.unl.edu/CurrentMap.aspx>

¹⁰ <https://www.usatoday.com/story/news/nation/2020/02/17/mississippi-flooding-swamps-southern-us/4784911002/>

¹¹ <https://www.wtoc.com/2020/02/13/flooding-causes-mandatory-evacuation-order-montgomery-co/>

¹² <https://www.al.com/news/2019/02/flooding-leading-to-home-evacuations-in-northwest-alabama.html>

¹³ <https://www.waaytv.com/content/news/Highway-231-Closed-Indefinitely--567952871.html>

¹⁴ <https://www.wtoc.com/2020/02/20/heavy-rain-flooding-affecting-roads-around-area/>

weather is in the neighborhood of 800,000 barrels a day, which is, according to the article¹⁵, roughly equivalent to the daily oil consumption across Turkey (the country). Ski resorts in France¹⁶ and Japan¹⁷ have had a difficult year due to a lack of snow. In a positive note, the warm weather may have boosted employment growth in the U.S.¹⁸

September – December 2019: Wildfires in Australia

On January 6, “Business Insider” reported¹⁹ the following damage estimates related to recent and ongoing bushfires: 1600 destroyed homes, 5000 insurance claims totaling \$375 million, and 1% of GDP growth is estimated to be wiped-out. The article suggests that, after the damages are fully tallied, the cost will run into the billions of dollars. On January 7, “Time” reported that the fires have claimed the lives of at least 24 people²⁰. On January 7, the Wall Street Journal reported²¹ that, in New South Wales, over 600 head of livestock were killed. Researchers at the University of Sydney estimate that nearly half a billion mammals, birds and reptiles have been killed²².

November: Flooding in Venice, Italy

According to a Wall Street Journal²³ published on November 25, the mayor of Venice has estimated the damage from the floods to be about \$1.1 billion. However, the estimated “cost could rise, as further damage emerges”.

November: A Series of Winter Storms Across the Northern U.S.

The most widely reported impacts of the winter storms were school closings, road closings, power outages and flight cancellations. Property damage appears to have been minimal, although it is too soon to offer a reliable cost estimate.

October: Typhoon Hagibis

According to AIR Worldwide, Typhoon Hagibis may generate between \$8 billion and \$16 billion in insured losses²⁴, with more than half of the losses due to inland flooding. According to “The Mainichi”, a Japanese newspaper, at least 83 people died²⁵ as a result of Typhoon Hagibis.

October: Cold Spell Across the U.S. and Canadian Great Plains

Some farms have reported agriculture losses due to the unexpected cold. For example, “Freight Waves” reports \$45 million of estimated damage²⁶ to the potato crop in North Dakota and Minnesota.

September: Hurricane Dorian

While Dorian had an impact in the U.S. and Canada, losses are heavily concentrated in the Bahamas where the storm was at its greatest strength. According to AON’s “Weather, Climate and Catastrophe Insight” annual report, the storm resulted in 83 deaths, economic losses of \$10 billion, and insured losses of \$3.5 billion.

September: Tropical Storm Imelda

According to the USA Today, the storm has been linked to five deaths²⁷, and, in its “Weather, Climate and Catastrophe Insight” annual report for 2019, AON estimates that economic losses are \$5 billion, while insured losses are \$1.2 billion.

¹⁵ <https://www.bloomberg.com/news/articles/2020-02-09/energy-markets-need-winter-and-climate-change-is-taking-it-away>

¹⁶ <https://www.independent.co.uk/news/world/europe/france-ski-resort-closed-snow-mourts-pyrenees-weather-winter-a9331926.html>

¹⁷ <https://www.scmp.com/news/asia/east-asia/article/3046892/worst-winter-decades-japans-ski-resorts>

¹⁸ <https://www.reuters.com/article/us-usa-economy/mild-weather-boosts-us-job-growth-jobless-rate-ticks-up-idUSKBN2010G3>

¹⁹ <https://www.businessinsider.com.au/australian-bushfires-cost-economy-surplus-government-spending-2020-1>

²⁰ <https://time.com/5758186/australia-bushfire-size/>

²¹ https://www.wsi.com/articles/australia-fires-put-farmers-in-double-jeopardy-11578388736?mod=hp_lista_pos1

²² <https://sydney.edu.au/news-opinion/news/2020/01/03/a-statement-about-the-480-million-animals-killed-in-nsw-bushfire.html>

²³ <https://www.wsi.com/articles/in-venice-a-struggle-to-rescue-damaged-art-and-architecture-11574703868>

²⁴ <https://www.air-worldwide.com/Press-Releases/AIR-Worldwide-Estimates-Insured-Losses-for-Typhoon-Hagibis-Will-be-Between-USD-8-Billion-and-USD-16-Billion/>

²⁵ <https://mainichi.jp/english/articles/20191022/p2g/00m/0dm/005000c>

²⁶ <https://www.freightwaves.com/news/mother-nature-turns-midwestern-spuds-to-duds>

²⁷ <https://www.usatoday.com/story/news/nation/2019/09/21/texas-flooding-tropical-storm-imelda-death-toll-increases-5/2402290001/>

September: Heat/Dry Spell in the U.S. Southeast

According to the Wall Street Journal²⁸, the unusual heat and dryness in the U.S. Southeast is having negative effects on agriculture. Potential effects include damage to grass used to feed livestock and damage to the cotton crop. In addition, the dry soil makes it more challenging to harvest peanuts. The Baltimore Sun (a newspaper) indicates that the drought is affecting soybean crops and could even affect next year's wheat crop which must be planted this fall²⁹.

August: Heavy Monsoon Rains in India

According to a Reuters' article published on August 14, heavy rains in the first half of August caused floods and landslides that displaced over one million persons in India and led to 270 deaths³⁰. An article in Business Today³¹ on August 16 indicates that coffee yields in the states of Karnataka, Kerala and Tamil Nadu are expected to decline by 30% to 40% due to August's rains and floods. Sugarcane, cotton and apple yields are also likely to be reduced³².

Because India's monsoon season is volatile weather phenomenon with significant rainfall variation from year to year, month to month, and region to region, flood-induced fatalities and economic losses are not unusual in India. According to data from India's Central Water Commission, across the period from 1953 to 2017 an average of 1600 persons died each year due to heavy rains and floods, and across the 5-year period from 2013 to 2017, the average was 1953³³.

August: Heat Wave in Alaska

During August, large numbers of dead salmon were found in several Alaskan rivers³⁴. According to observers, the fish died prior to spawning, whereas salmon typically die only after spawning. Some researchers are attributing these premature deaths to unusually high river temperatures caused by a combination of high air temperatures and lack of rain³⁵.

July: Heat Waves in the U.S. and Europe

Fortunately, few human lives were lost in these heat waves. In regard to economic costs, an assessment is difficult. Some examples of the impact of the heat waves are as follows: (1) in both Germany and France, a number of nuclear power plants had to be taken offline, thus temporarily reducing total power generation³⁶; (2) in the United Kingdom, railway service was disrupted because the unusually high temperatures caused train tracks to expand or kink³⁷; (3) in the United Kingdom, thousands of chickens died in a farmhouse that lacked a cooling system³⁸; and (4) on a farm in the Netherlands, over 2000 pigs suffocated³⁹ after a ventilation system failed during the heat wave.

July 13-16: Hurricane and Tropical Storm "Barry"

Over \$600 million in economic losses and nearly \$300 million in insured losses, according to industry experts.

²⁸ <https://www.wsj.com/articles/flash-drought-hits-south-as-record-heat-continues-into-fall-11570058348>

²⁹ <https://www.baltimoresun.com/weather/bs-md-drought-report-20190926-yooqxwbbuvclidise7a4oisugtm-story.html>

³⁰ <https://www.reuters.com/article/us-southasia-floods/india-floods-kill-more-than-270-displace-one-million-idUSKCN1V413K>

³¹ <https://www.businesstoday.in/current/economy-politics/karnataka-floods-landslides-brew-fresh-troubles-coffee-second-year-straight/story/372972.html>

³² <https://economictimes.indiatimes.com/news/economy/agriculture/sugarcane-cotton-apple-crops-hit-by-late-rainfall-pan-india/articleshow/70744401.cms>

³³ https://www.business-standard.com/article/current-affairs/at-107-487-india-accounts-for-1-5th-of-global-deaths-from-floods-in-64-yrs-118071900052_1.html

³⁴ <https://time.com/5661024/alaska-high-temperatures-salmon-deaths/>

³⁵ <https://observers.france24.com/en/20190821-salmon-die-alaska>

³⁶ <https://www.reuters.com/article/us-france-electricity-heatwave/hot-weather-cuts-french-german-nuclear-power-output-idUSKCN1UK0HR>

³⁷ <https://www.telegraph.co.uk/news/2019/07/25/uk-heatwave-britain-bracing-hottest-day-record-temperature-could/>

³⁸ <https://www.independent.co.uk/news/uk/home-news/chicken-uk-heatwave-farm-deaths-lincolnshire-tesco-sainsbury-a9025516.html>

³⁹ <https://veganuary.com/blog/over-2000-pigs-suffocate-on-factory-farm-as-ventilation-system-fails/>

June 21-22: Derecho in Central and Eastern U.S.

An extreme wind event known as a “derecho” caused damage across a 1000-mile path from Nebraska to South Carolina. Thousands of structures affected, with economic losses estimated to be over \$100 million by industry experts.

May: Severe Weather in U.S. Plains, Midwest and Southeast

Tornadoes, straight-line winds, hail, flooding: close to \$3 billion of economic losses and \$2 billion of insured losses, according to industry experts.

May to June: Flooding in U.S. Breadbasket

Flooding has had a significant impact on farmers’ ability to plant crops this year. Economic and insured losses are estimated to be in excess of \$4 billion by industry experts.

Data

The 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/>

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

The online documentation for the GHCN dataset does not indicate whether the precipitation field contains, in addition to rainfall, the liquid-equivalent for other forms of precipitation such as snow and sleet. Therefore, for a random sample of several hundred stations, we compared daily precipitation data against daily snowfall data. We found that, without any exceptions, the precipitation data field captures both rainfall and the liquid-equivalent amount of snowfall.

SOA Research Team for This Report

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