SOCIETY OF ACTUARIES

Actuarial Weather Extremes: Hurricane Laura

August 2020

Report Actuarial Weather Extremes: Hurricane Laura

Coastal Wind, Storm Surge, Precipitation and Inland Flooding

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Overview

This report examines weather extremes in precipitation, maximum water level, wind speed, and flooding associated with the time period and geographic area of Hurricane Laura over the period of August 24 to August 29, 2020.

Data was collected from the Global Historical Climatology Network (GHCN) for precipitation data, National Oceanic and Atmospheric Administration (NOAA) coastal weather stations for water level and wind data, and from the US Geological Survey (USGS) for inland flooding data.

Coastal water levels rose, wind speeds increased significantly, and inland flooding occurred as seen in the six-day period (August 24–29, 2020) leading up to and during tropical cyclone Laura. (Figures 1-3)

The GHCN stations recording significant rainfall are shown for each day in August 25-29 (Figure 5) and show how the actual rainfall tracks along versus the projected path of the storm (Figure 4) during that period.

According to its press release, data analysis firm CoreLogic estimated between $8 Billion to $12 Billion in insured losses from Hurricane Laura wind and storm surge and described Hurricane Laura as **"…** *the most intense hurricane to make landfall in the northwestern Gulf Coast since 1856…."*[1]

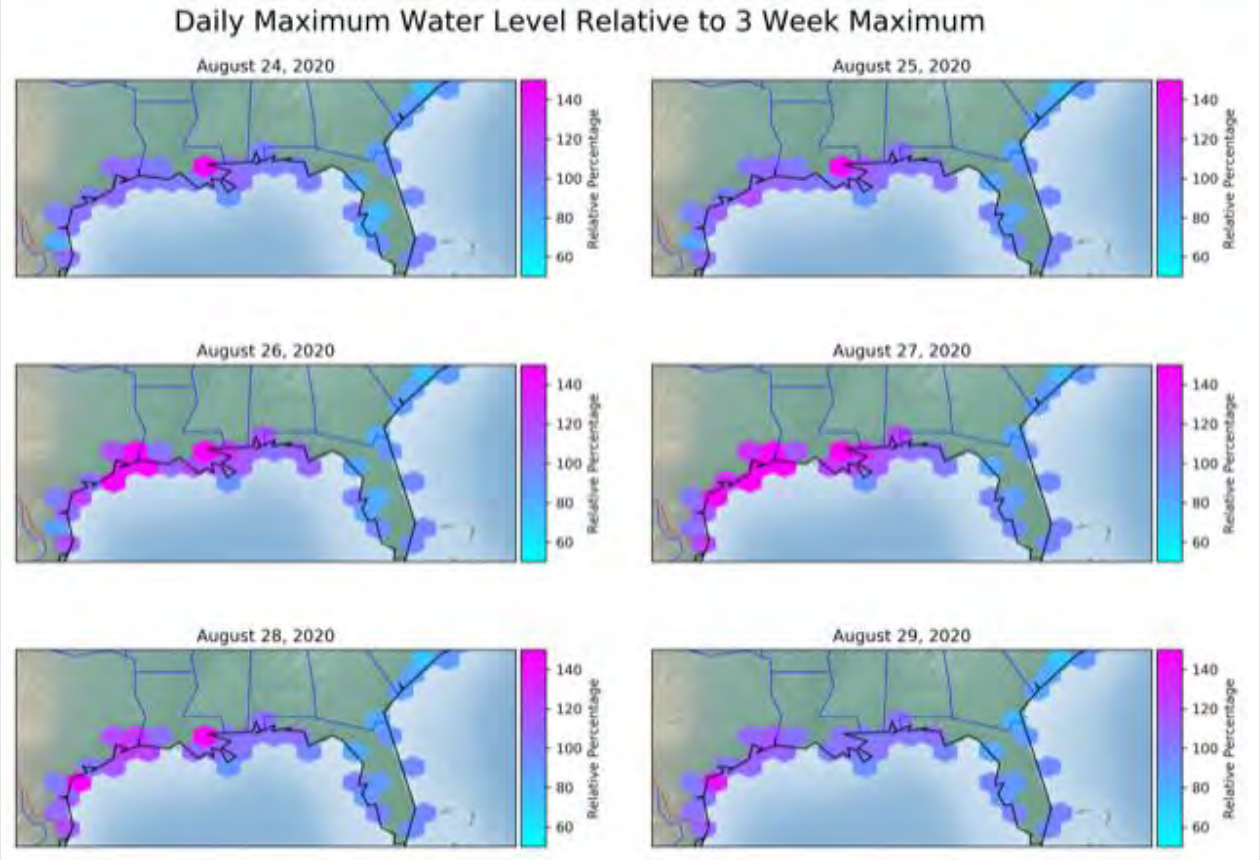
[1] CoreLogic. (2020, August 28). "CoreLogic Estimates $8 Billion to $12 Billion in Insured Losses From Hurricane Laura Wind and Storm Surge." Press Release. https://www.corelogic.com/news/corelogic-estimates-8-billion-to-12-billion-in-insured-losses-from-hurricane-laura-wind-and-storm-surge.aspx.

Water Level

Figure 1 presents NOAA Coastal Station Data showing the daily maximum water level relative to the average of maximum water levels over the period August 1–21, 2020. As Hurricane Laura approached the coastline we can see that the daily maximum water level rose to a peak corresponding to the late August 26 / early August 27 timeframe of the storm approaching the coast.

Figure 1

DAILY MAXIMUM WATER LEVEL RELATIVE TO 3-WEEK MAXIMUM



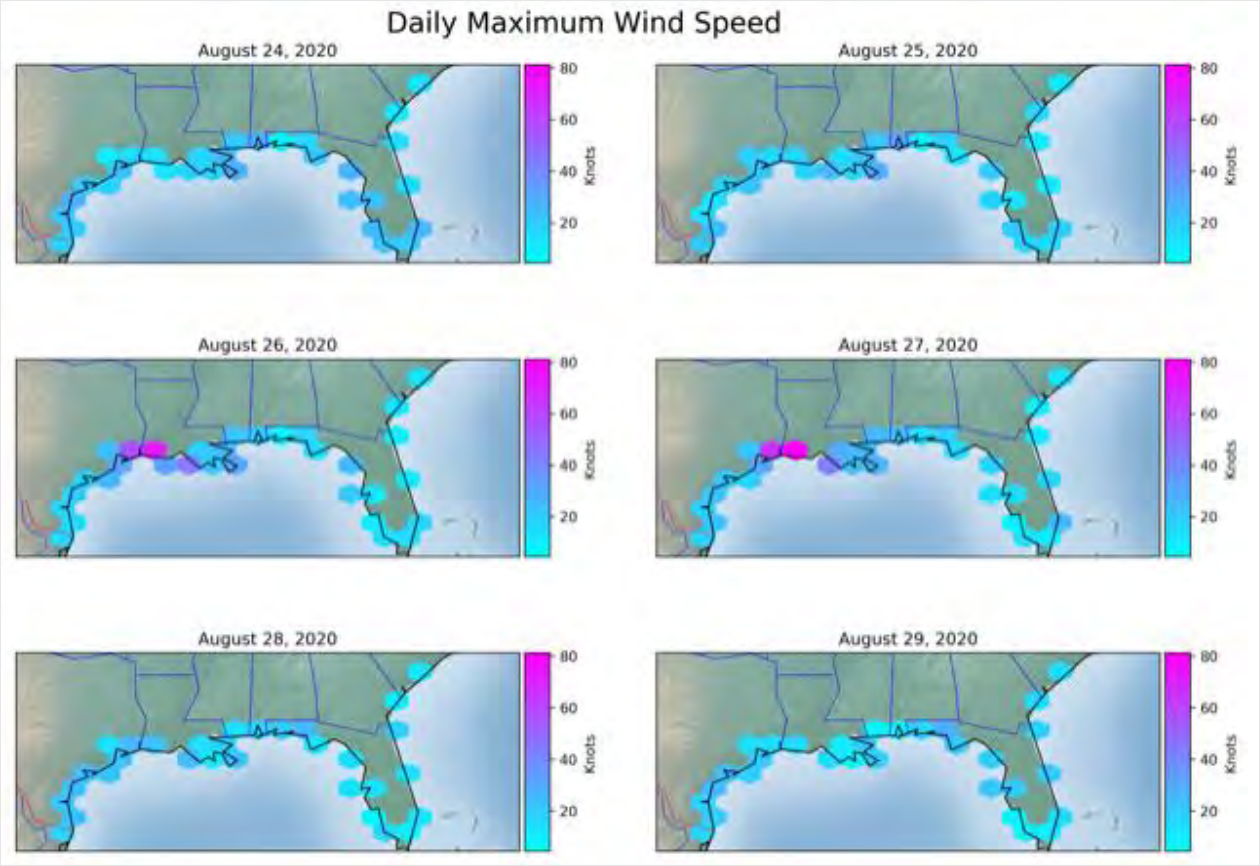
Source: Center for Operational Oceanographic Products and Services. "NOAA Tides & Currents CO-OPS API URL Builder." (Accessed August 30, 2020). https://tidesandcurrents.noaa.gov/api-helper/url-generator.html.

Wind Speed

NOAA Coastal Stations daily maximum wind speed in knots (1 knot = 1.15078 miles per hour). We can see in Figure 2 that the coastal wind speeds were highest in the days associated with the hurricane approaching land and making landfall (August 26/27).

Figure 2

DAILY MAXIMUM WIND SPEED



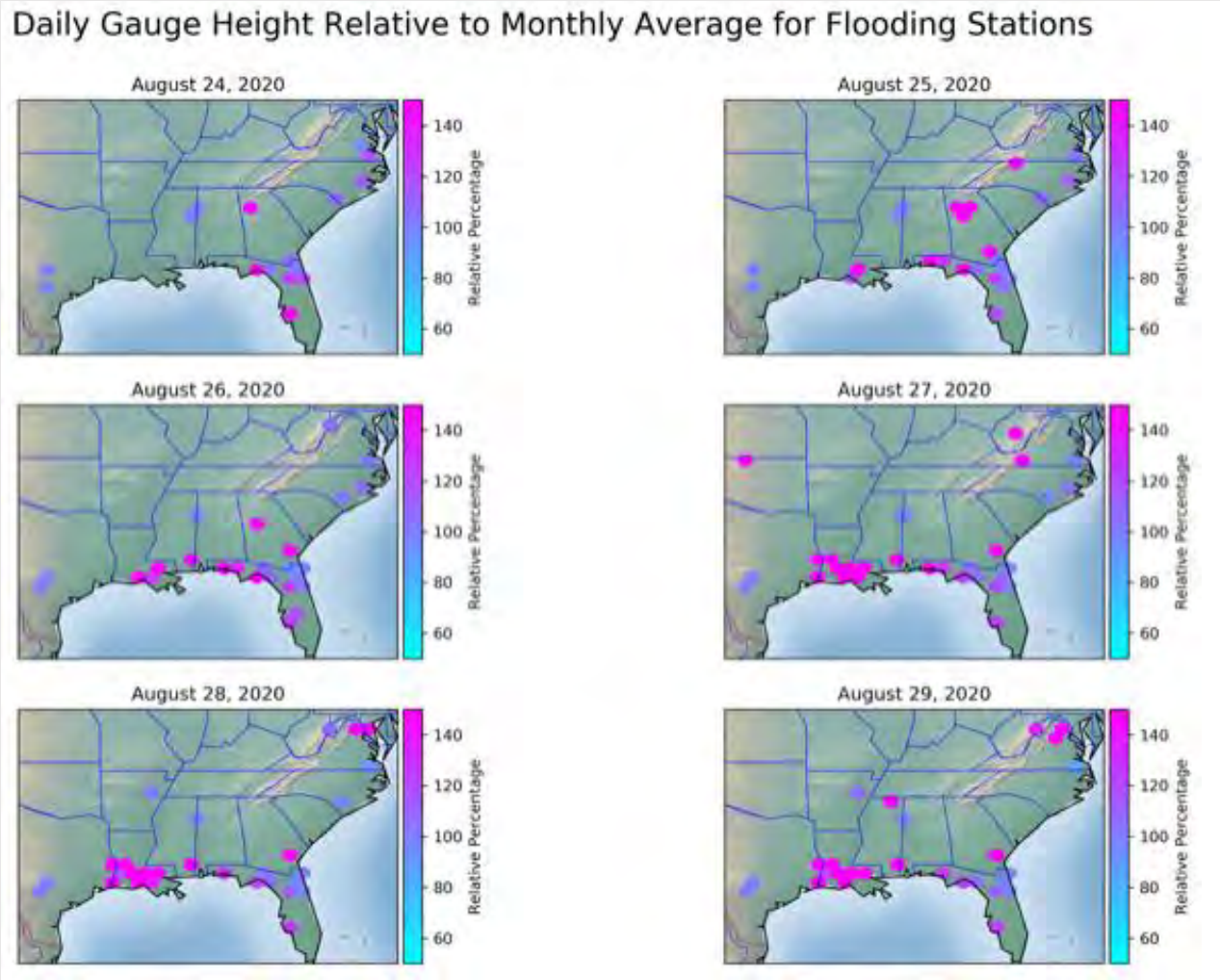
Source: Center for Operational Oceanographic Products and Services. "NOAA Tides & Currents CO-OPS API URL Builder." (Accessed August 30, 2020). https://tidesandcurrents.noaa.gov/api-helper/url-generator.html.

Flooding

In Figure 3, we see the USGS Stream Gauge stations which are at or above flood (mitigation) Action Stage, and the percentage of the average gauge height value on the given day vs the August 2020 average value gauge height.

Figure 3

DAILY GAUGE HEIGHT RELATIVE TO MONTHLY AVERAGE FOR FLOODING STATIONS



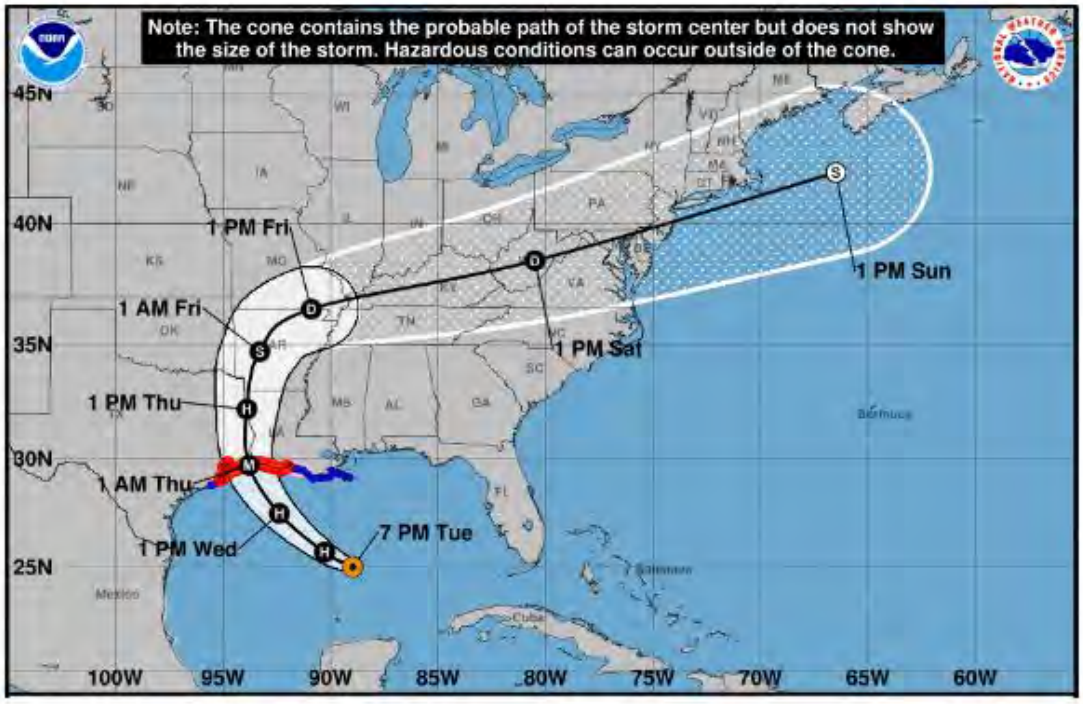
Source: United States Geological Survey. "USGS Instantaneous Values REST Web Service URL Generation Tool." (Accessed August 30, 2020). https://waterservices.usgs.gov/rest/IV-Test-Tool.html.

Hurricane Track

The National Hurricane Center projected the track of Hurricane Laura (Figure 4).

Figure 4

PROJECTED TRACK OF HURRICANE LAURA FROM TUESDAY, AUGUST 25, 2020



Track forecast for Hurricane Laura, starting Monday morning and updated every six hours. (National Hurricane Center)

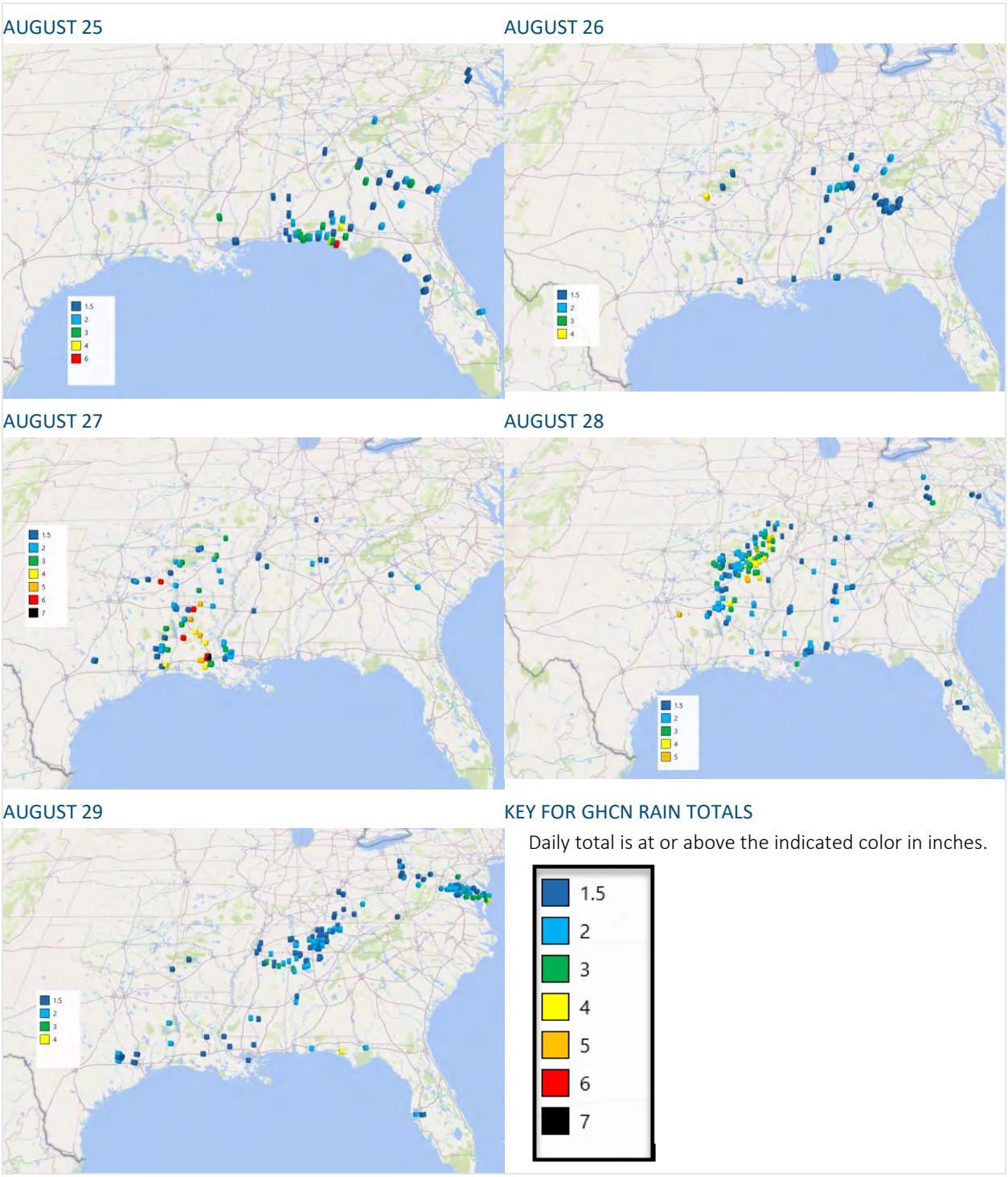
Source: The Washington Post. (2020, August 27).“National Hurricane Center Nailed Track Forecast for Laura Within a Mile and 3 Days in Advance.” https://www.washingtonpost.com/weather/2020/08/27/national-hurricane-center-forecast-laura/.

Rainfall

Figure 5 shows stations for which each daily precipitation total is at least 1.5 inches over the period August 25–29, 2020. Color codes represent at or above the indicated inches of rainfall for the day.

Figure 5

STATIONS WITH AT LEAST 1.5 INCHES OF DAILY PRECIPITATION, AUGUST 25–29, 2020



Source: GHNC station data (Accessed August 31, 2020). ftp://ftp.ncdc.noaa.gov/pub/data/ghcn/daily/ghcnd_all.tar.gz

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. 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."[2]

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/ghcnd_all.tar.gz
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.

Coastal Stations data could be verified here https://tidesandcurrents.noaa.gov/api-helper/url-generator.html by entering the Station ID, the Product and the Date. The Datum is STND, the time zone is LST/LDT, and the units are English. Results can be output as a .CSV file.

USGS Stations data could be verified here https://waterservices.usgs.gov/rest/IV-Test-Tool.html by entering the Station ID, Start Date and End Date. The Parameter Code for Gauge Height is 00065.

Flood Stage information is from https://waterwatch.usgs.gov/webservices/floodstage?format=csv&region=ALL.

Acknowledgments

The authors wish to thank Matthew Self, ASA for his contributions to the assimilation of coastal and inland station hurricane data that the author's used for this analysis.

[2] 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/.

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