

A satellite image showing Hurricane Laura as it made landfall in the United States. The eye of the hurricane is visible in the center, surrounded by a massive, swirling cloud structure. The coastline of the Gulf of Mexico is visible in the background.

Disaster Communication During Hurricane Marco & Hurricane Laura.

Image: GOES 16 GeoColor Satellite Image of Hurricane Laura at 2301 UTC (6:01 PM CDT) on August 26, 2020. Source: [NOAA](#).

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UEP 237 Final Presentation
12/12/2022

A photograph of a single-story house with light blue horizontal siding. The roof is dark shingles, and the front door is white with a decorative panel. A blue pickup truck is completely crushed against the left side of the house, with its front end resting on the ground. The house shows significant damage, including a missing section of the roof and siding on the left side where the truck impacted. Debris is scattered around the base of the house.

BACKGROUND

Hurricane Marco & Laura

Hurricane Marco

- Aug 21, 2020 – Aug 26, 2020
- Category 1
- Made landfall at the mouth of the Mississippi River on Aug 24, 2020

Hurricane Laura

- Aug 20, 2020 – Aug 29, 2020
- Category 4
- Made landfall at Cameron, Louisiana on Aug 27, 2020

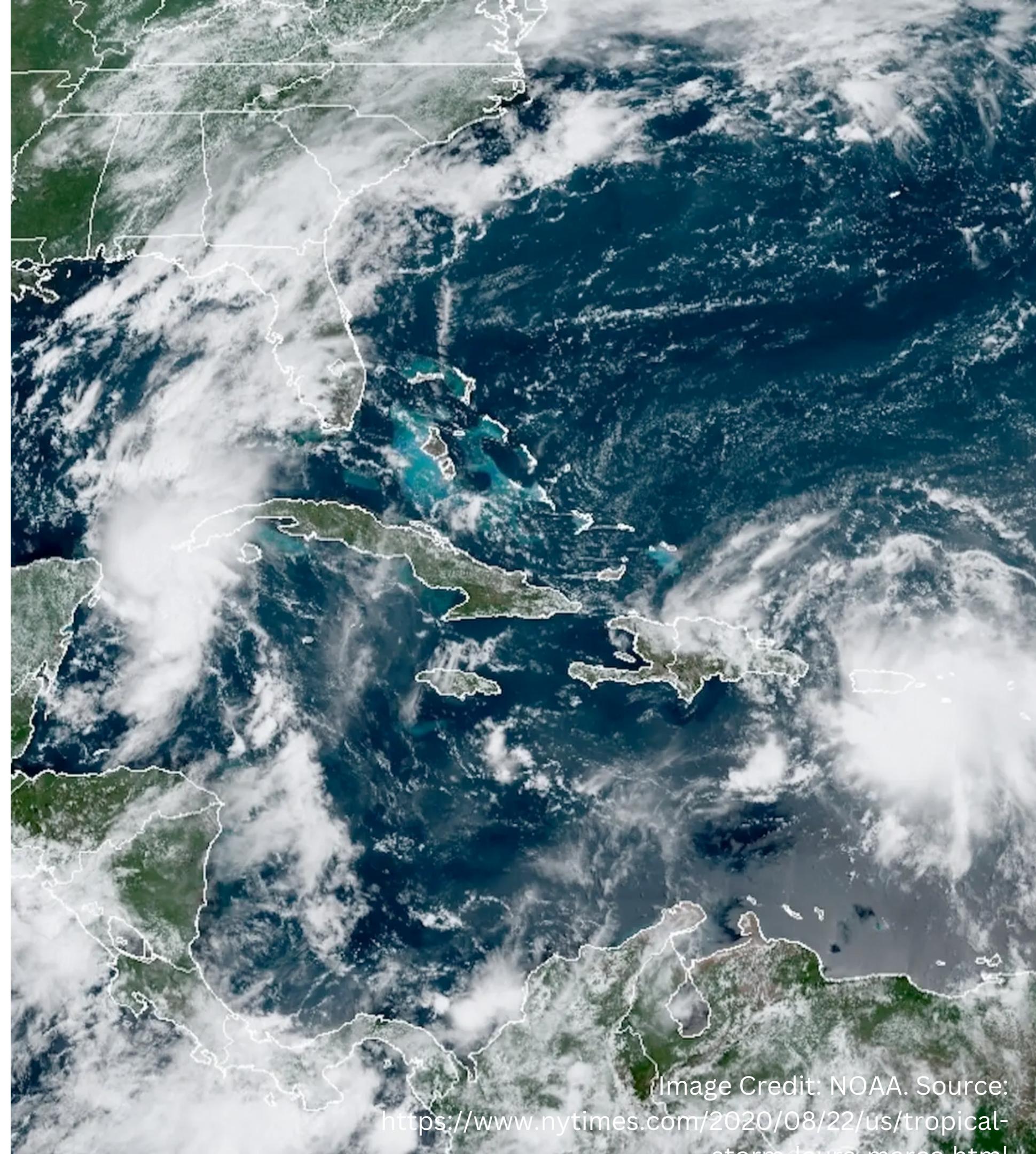


Image Credit: NOAA. Source:
<https://www.nytimes.com/2020/08/22/us/tropical-storm-laura-marcus.html>

Hurricane Damage

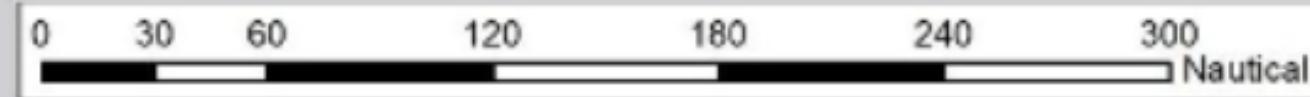
Category	Sustained Winds (kt)	Damge
1	64-82	Damage to roofs and sidings; topple trees with shallow roots and power lines
2	83-95	Many shallowly rooted trees may be uprooted and block roads; power outage could last from sevel days to weeks
3 (major)	96-112	rooft removal; roads blocked by uprooted trees; electricity and water outage for several days to weeks after the storm
4 (major)	113-136	Loss of most roofs and walls; power outages may last weeks to months
5 (major)	137 or up	Frame homes destroyed; power outage may last weeks to months; most area will be uninhabitable for weeks to months



Orleans Parish
Cameron Parish

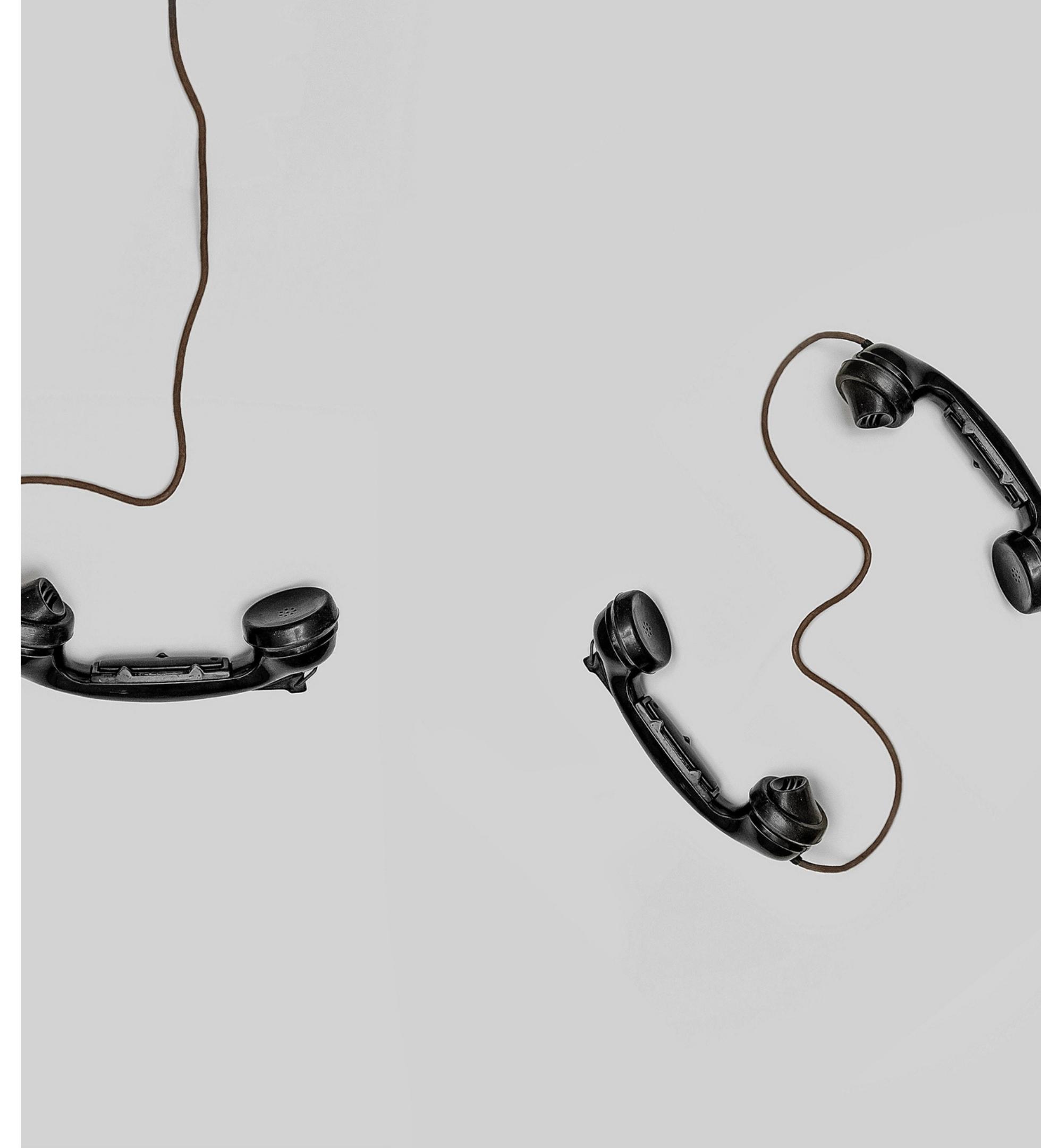
National Hurricane Center. N.d. "Saffir-Simpson Hurricane Wind Scale." Available at: <https://www.nhc.noaa.gov/aboutsshws.php>.

Image Source: Richard J. Pasch, Robbie Berg, David P. Roberts, & Philippe P. Papin. May 26, 2021. HURRICANE LAURA (AL132020). National Hurricane Center (NHC). Available at: https://www.nhc.noaa.gov/data/tcr/AL132020_Laura.pdf. Page 57.



Research Questions

1. How were Twitter and 311 Calls being used across the City of New Orleans?
2. How had the frequencies of tweets and 311 calls in the City of New Orleans changed over time in relation to Hurricanes' movements?
3. Where do people have a higher disaster communication risk -- facing greater disaster risks and lacking disaster communication resources?



LITERATURE

social media



(1) Twitter Data in Natural Disaster

In natural disaster management research, Twitter data can show insight into how people **communicate** during disasters. Twitter data also be highly valuable in helping researchers and emergency managers identify damages. (Pourebrahim et al., 2019; Rhodan, 2017)

- Content Analysis
- Temporal Analysis
- Social Network Analysis
(Rajput et al., 2020; Yeo et al., 2020))
- Human Mobility Analysis
- Sentiment Analysis

However, research also shows that Twitter data can be a **biased dataset**. Twitter users are often related to **higher social status, better educated, high employment and homeowners**. (Zou et al., 2015; Mihvnov et al., 2020)

(2) 311 Data in Social Science Research

In order to reduce bias in our research, we add in the 311 Calls dataset. However, there are limited literature on the 311 Calls data.

- Investigated the **census-tract-level variation** 311 data contracting volume with New York City. (Minkoff et al., 2016)
- Used 311 data to analyze **customer agility and responsiveness**, and researchers found the importance of **strong political leadership**. (Chatfield et al., 2018)
- Combined 311 data with emergency management to explore **the relationship between citizens and government**. (Schellong et al., 2007)
- Used 311 Calls data to **generate a forecast** for future requests. (Madkour, 2020)

(3) Disaster Vulnerability

Disaster Vulnerability is influenced by many factors, including housing features, access to social media, income, education level and so on.

- **Poor people and ethnic minorities** are more vulnerable at all stages - preparedness, response and recovery. (Morrow, 1999)
- **Socially Vulnerable groups** are more likely to die during disasters and less likely to recover after disasters. (Juntunen, 2005)
- Real-time evacuation information is generally not provided to people with **limited English proficiency, hearing and vision impairments, and other special needs groups.** (U.S. Department, 2006)
- **Inadequate funding** for government and local authorities is another indication of vulnerability. (APHA, 2006; USGAO, 2006)

(4) Disaster Risk Indices

For most of the twentieth century, disaster management focused on the **physical world** but ignored **social components.** (Flanagan et al., 2011; Juntunen et al., 2004)

Academic Commonly use a formula for calculating the disaster risk: $\text{Risk} = \text{Hazard} * (\text{Vulnerability} - \text{Resources})$ (Dwyer et al., 2004)

- 15 Baseline Resilience Index for Communities (Cutter et al., 2010)
- Community Disaster Resilience Index (Peacock et al., 2010)
- National Risk Index (Federal Emergency Management Agency, 2020)
 - Expected Annual Loss
 - Social Vulnerability
 - Community Resilience

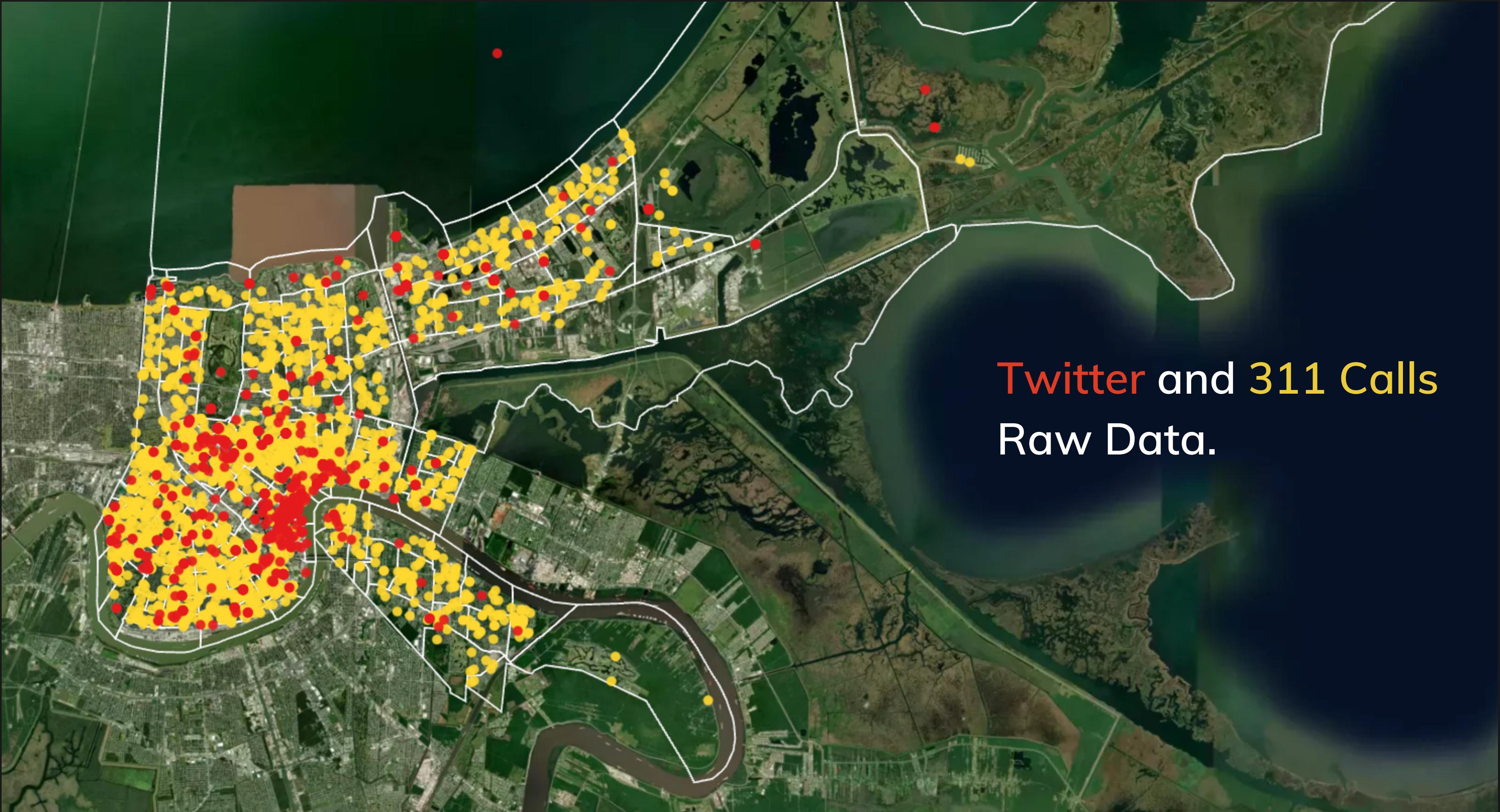
DATA & METHODOLOGY



Image. The aerial shows damage to a neighborhood outside of Lake Charles, Louisiana.
Credit: STRINGER, AFP via Getty Images. Source: [USA Today](#).

Data

1. Twitter Data
2. NOLA 311 Calls Dataset
3. Storm Warning Summary
4. Maximum Sustained Wind Speed
5. FEMA National Risk Index
6. NOLA Census Tracts Shapefile



**Twitter and 311 Calls
Raw Data.**

Methods

Temporal analysis

- Histogram
 - Temporal change of Twitter Data
 - Temporal change of 311 Calls Data

Spatial analysis

- Kernel Density Estimation

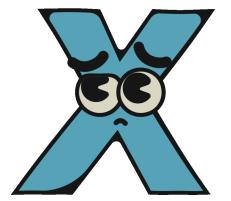
Risk analysis

- Risk Map
 - Normalized Hurricane Communication Risk

Risk Analysis

Disaster Communication Risk Index =

Expected Loss



Disaster Communication Risk

Expected Annual Loss
from FEMA National Risk Index

(Twitter data &
311 Calls/Population)

RESULTS

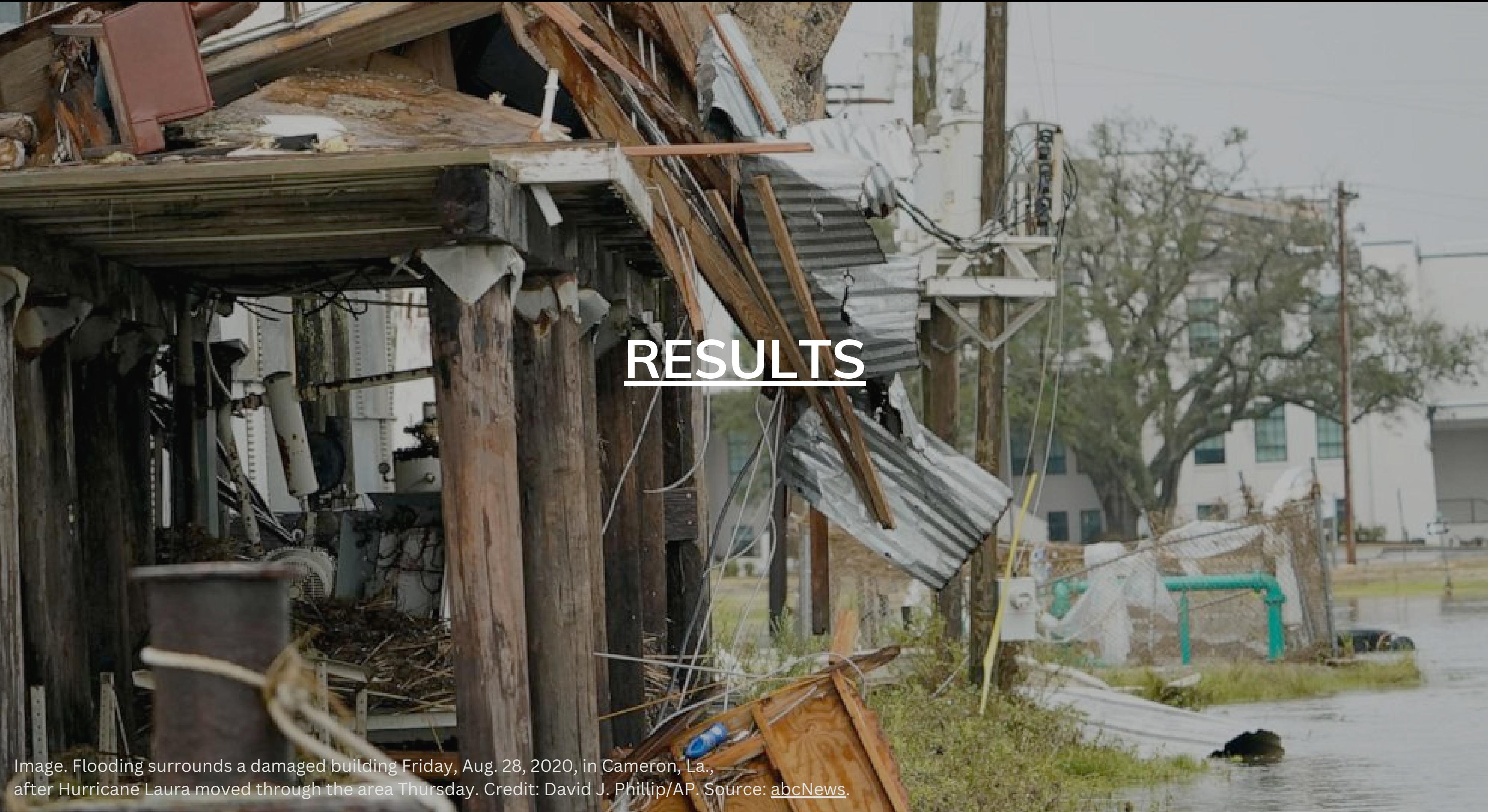
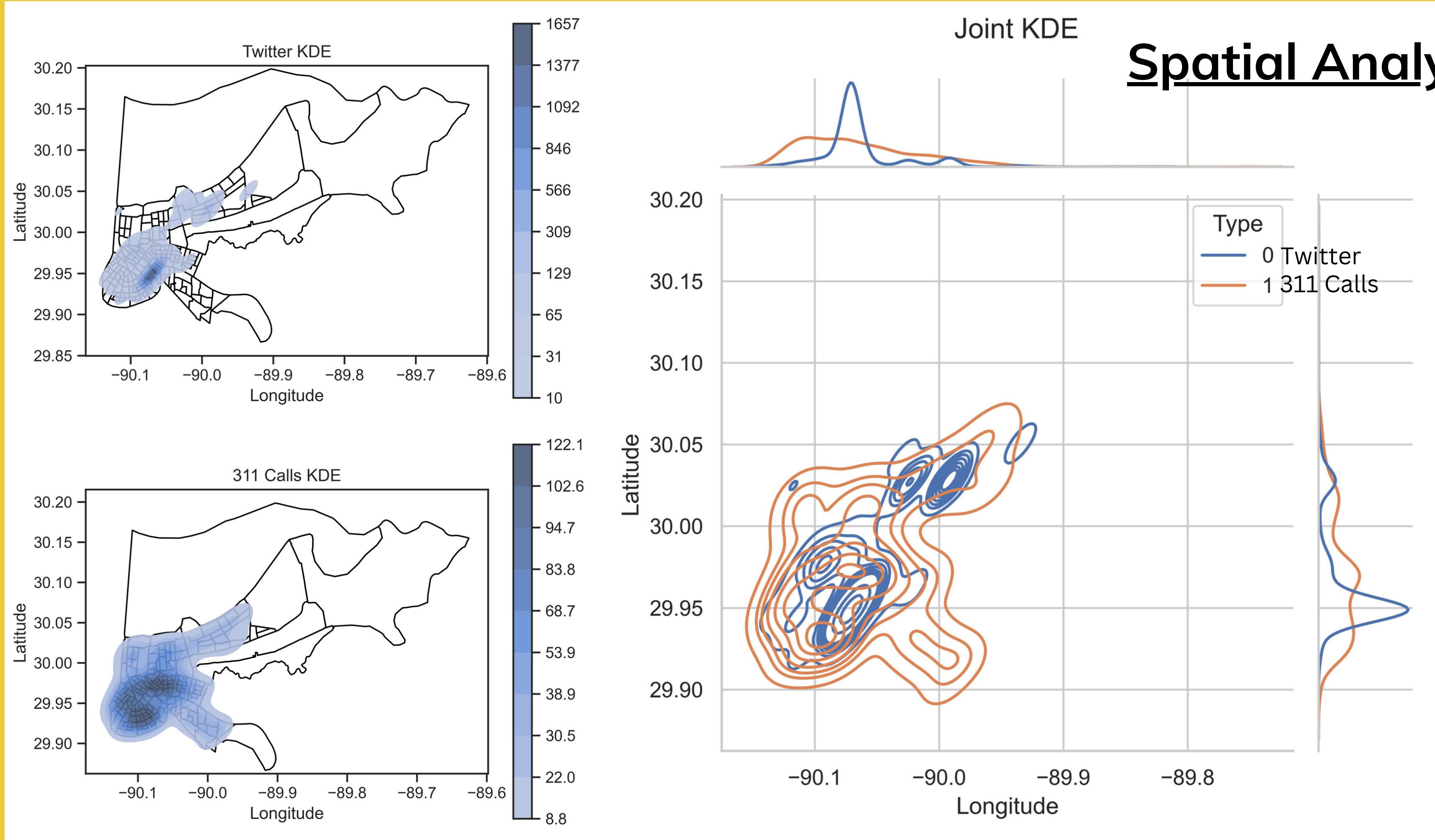


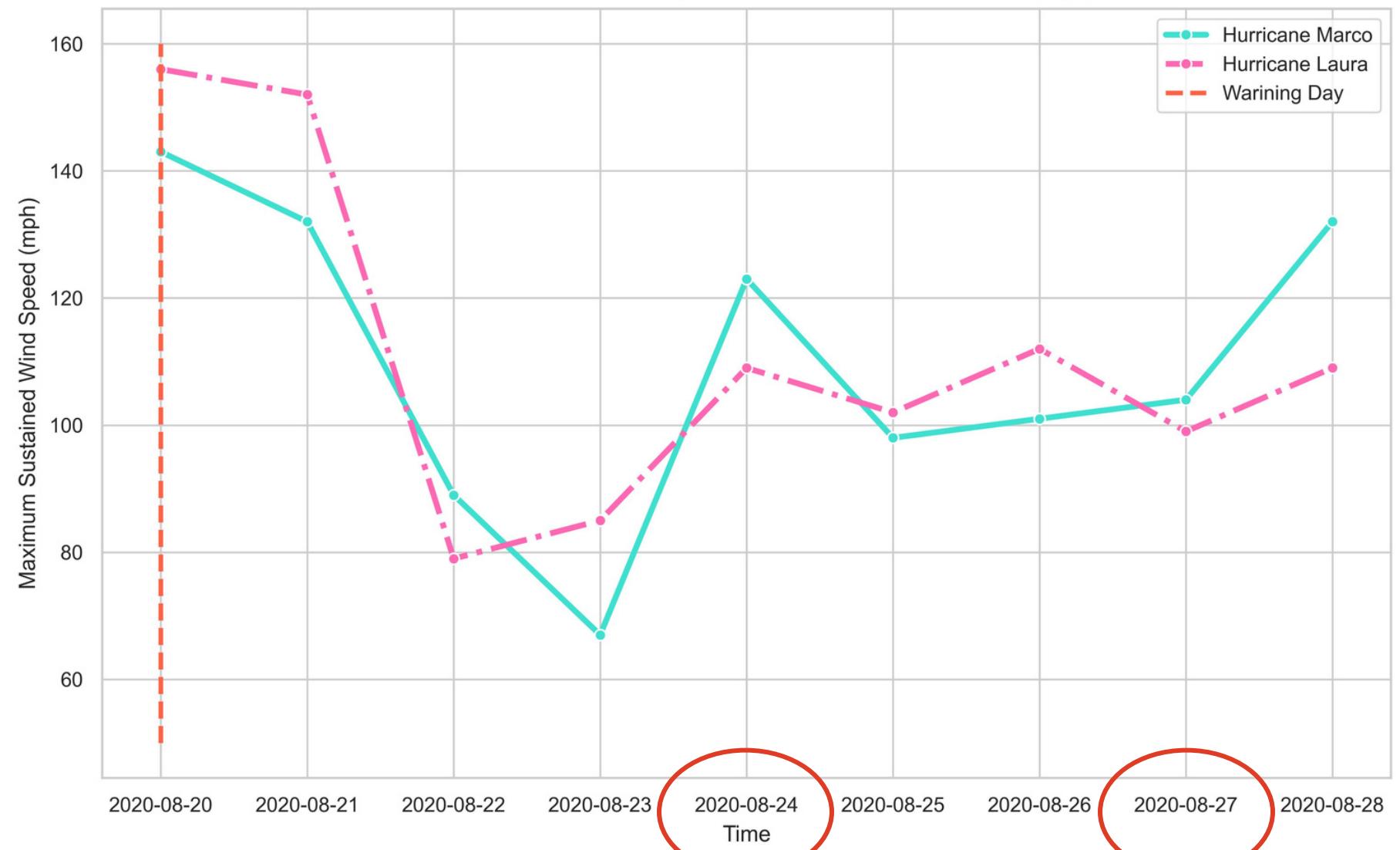
Image. Flooding surrounds a damaged building Friday, Aug. 28, 2020, in Cameron, La., after Hurricane Laura moved through the area Thursday. Credit: David J. Phillip/AP. Source: [abcNews](#).

Spatial Analysis

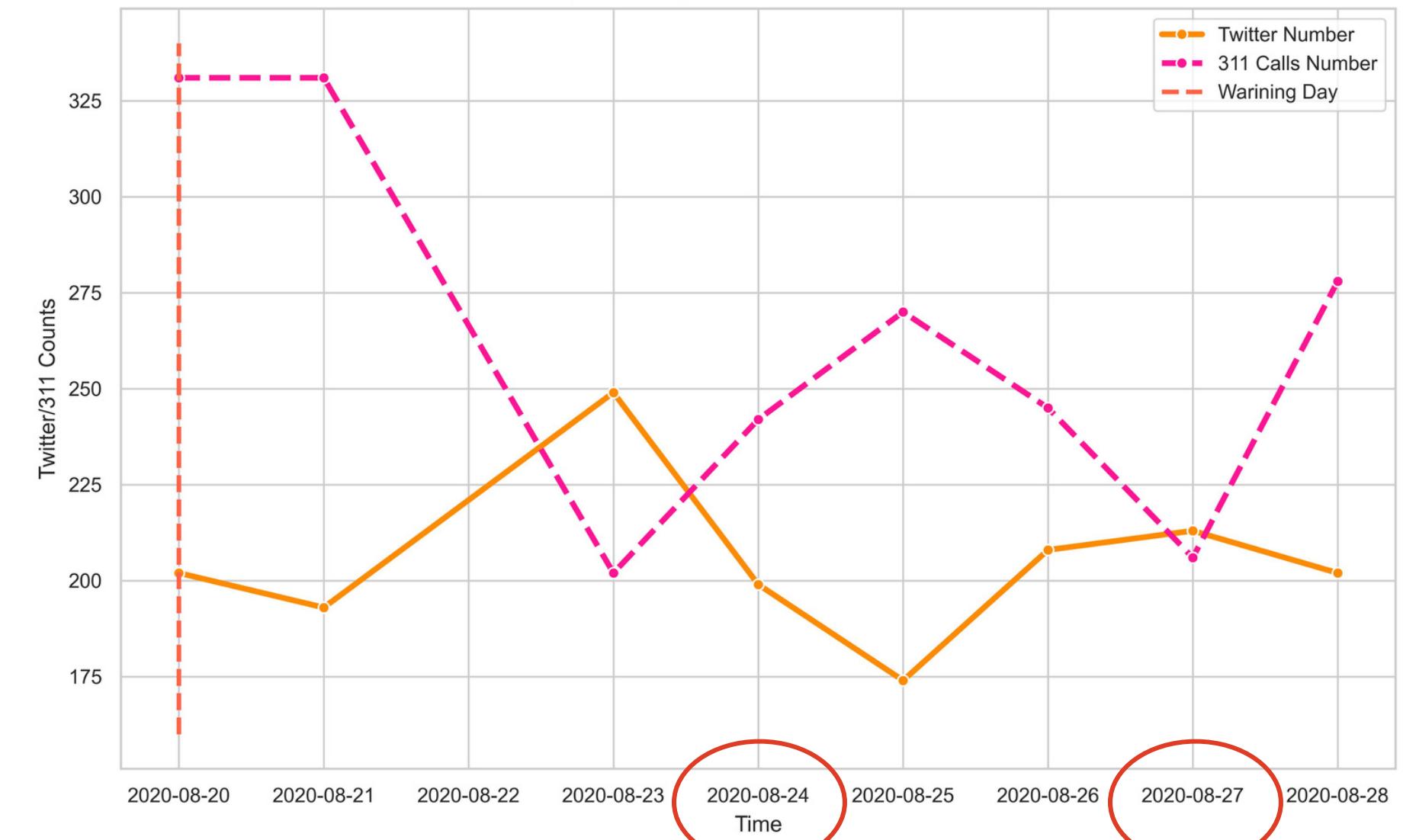


Temporal Analysis

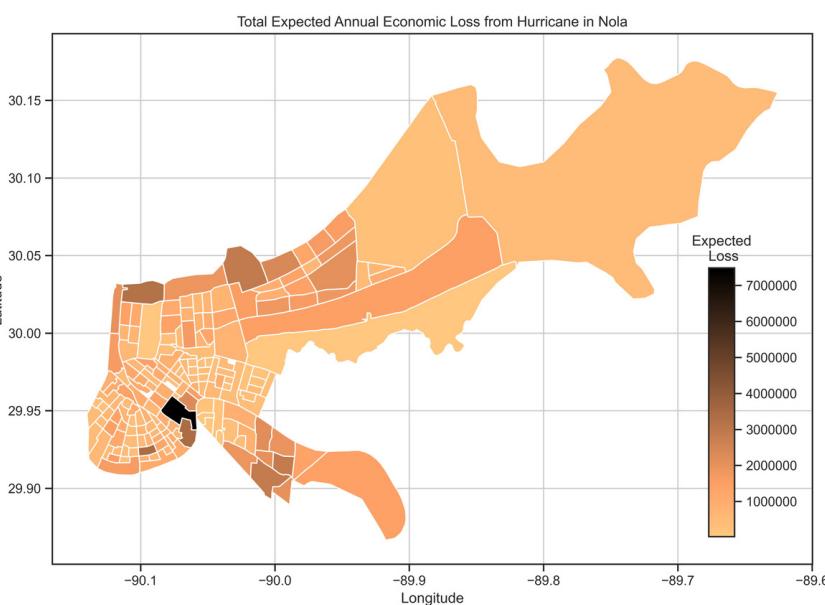
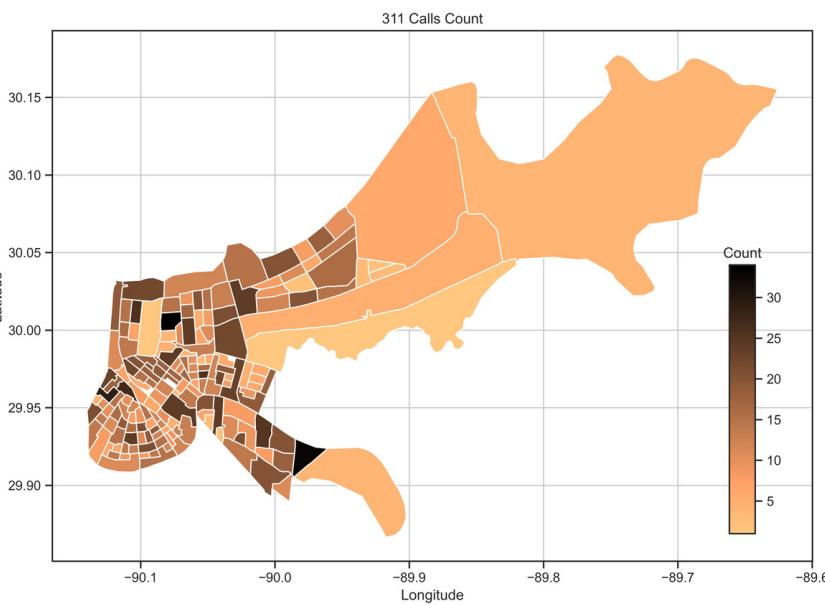
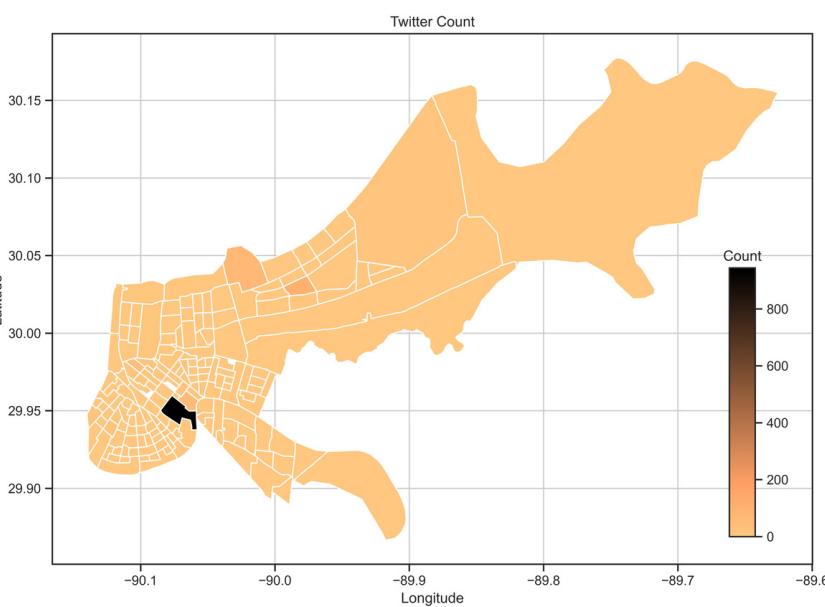
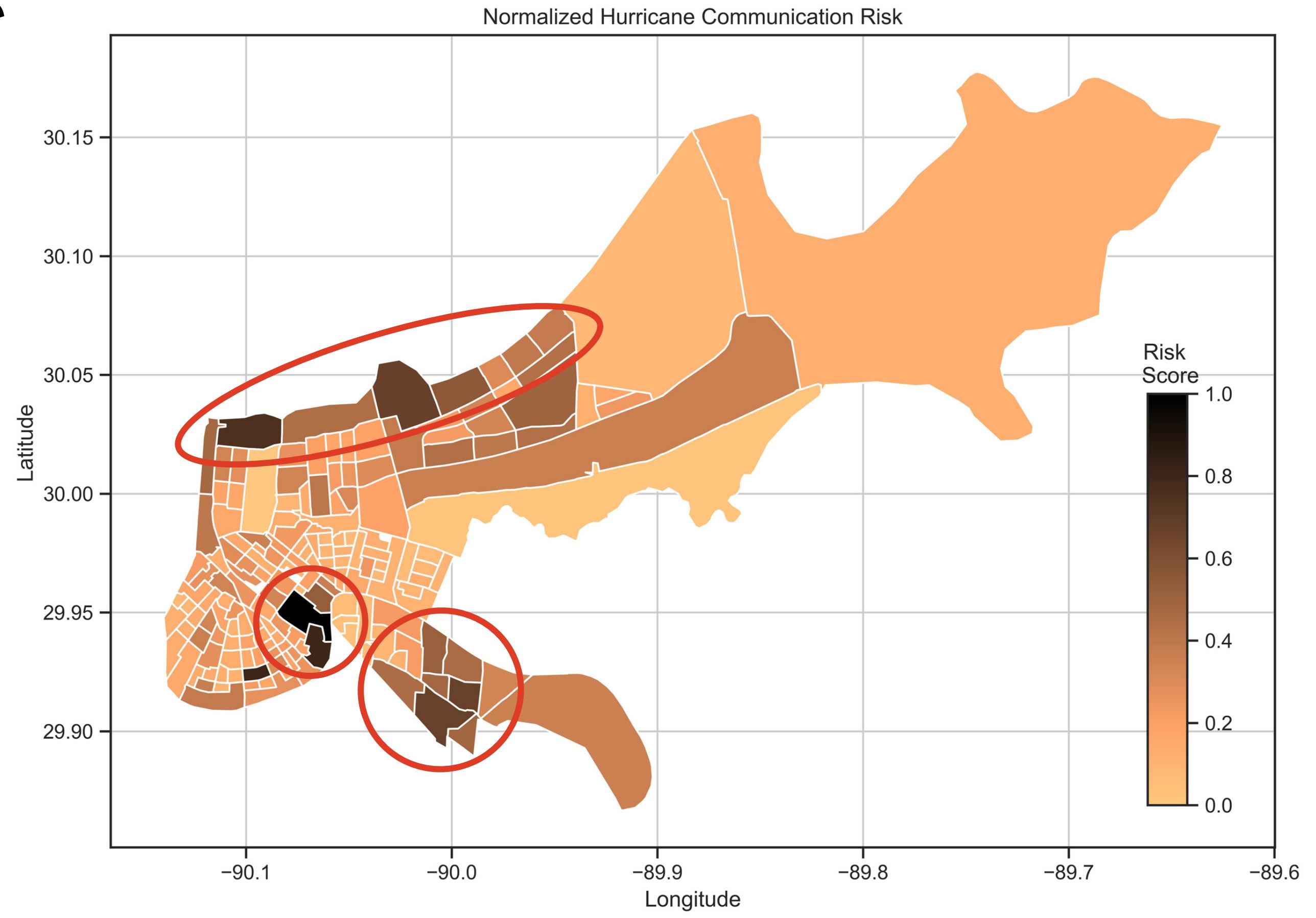
Maximum Sustained Wind Speed of Hurricane Laura and Marco (mph)



Temporal Change of Twitter Data and 311 Calls



Communication Risk Analysis



CONCLUSION



Image. Damaged homes sit among flood waters Thursday in Holly Beach, Louisiana.
Credit: Eric Thayer, Getty Images. Source: [USA Today](#).

Summary

1. Different areas in the City of New Orleans had different communication preferences during the Hurricanes
2. People used Twitter more often right before the two Hurricanes made landfall, and people used 311 Calls more often after each Hurricane
3. Coastal areas face greater disaster risks while, potentially, lacking adequate communication resources



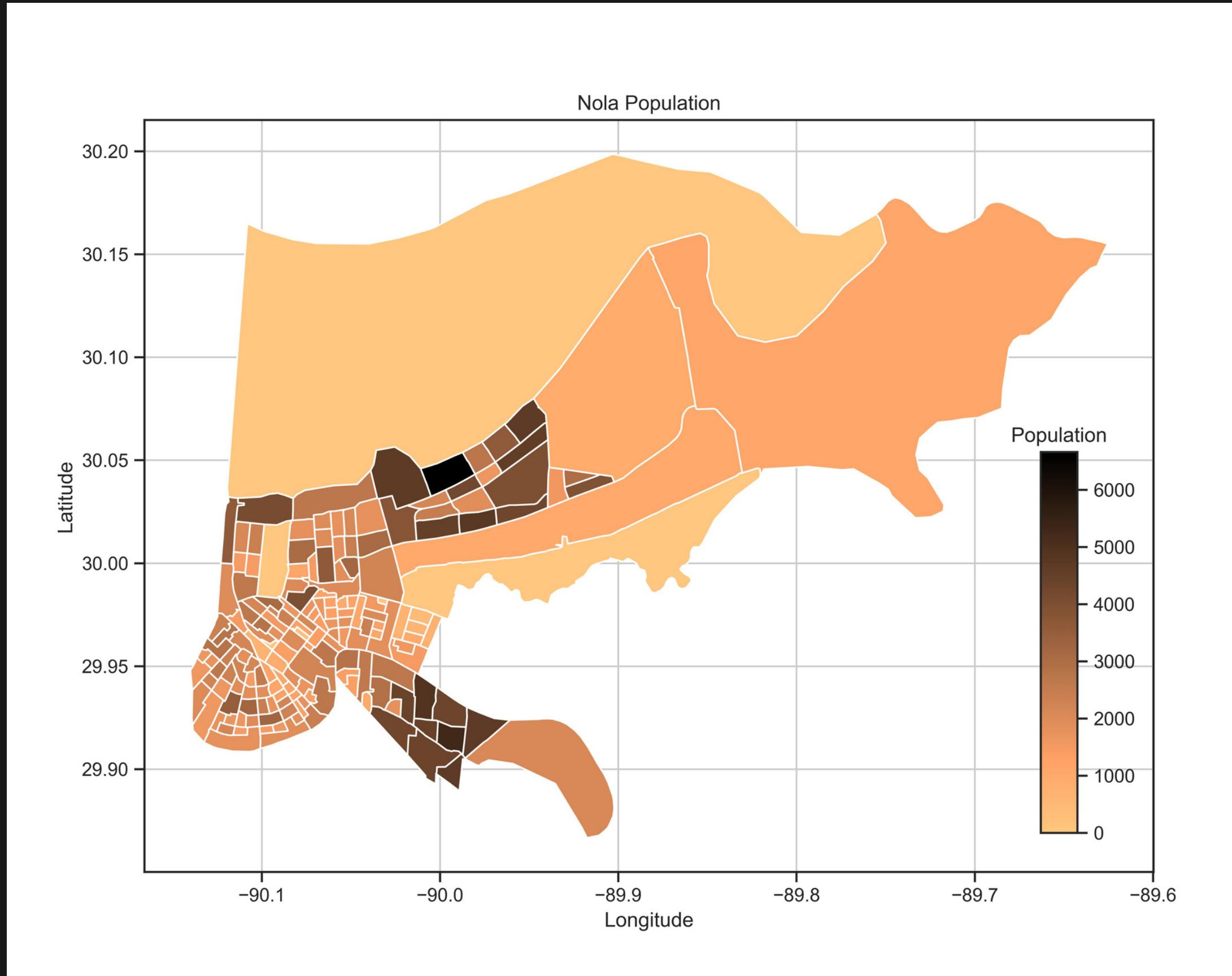
Image credit: Gerald Herbert, AP. Source: [USA Today](#).

Future Work

1. Incorporate data from other social media platforms, such as Facebook and Instagram
2. Network analysis to see how people connect with one another
3. Compare social media data with electricity data to see if there are correlations in between and determine if real-time social media data can predict power outages during a natural disaster



THANK YOU FOR LISTENING!



Notes

Hurricane watch/warning.
FEMA National Risk Index.

Rebuilding a community as it rises after a disaster is a huge effort and does not happen overnight. Lend a helping hand to those in need.

