

311 & Pluvial Flooding in NYC

Assessing risk and vulnerability with 311 calls,
GIS, and data analysis.

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What is pluvial flooding?

A pluvial flood is a surface water flood **caused by an extreme rainfall event.**

Pluvial floods are **not caused by an overflowing body of water.**

A common misconception about flooding is that being near a large body of water is the only way to be at risk.



Remnants of Ida

- On September 1st, 2021, the remnants of Hurricane Ida hit NYC
 - Rainfall from the cloudburst caused extreme pluvial flooding
 - Weather stations in NYC recorded over 3 inches of rain within a single hour
 - Out of 13 total fatalities in the city, 11 of Ida's victims drowned in basement homes
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311 Calls

- 311 is NYC's non-emergency line for city services and info
 - The complete 311 dataset is open source & available through NYC Open Data
 - Dataset is updated daily and goes back to 2010
 - All calls/requests are logged with their coordinate location, address (if applicable), and other descriptors
 - Only a **non-emergency** helpline
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Research Questions

- How are flood-related 311 calls distributed over the years?
- How are flood-related 311 calls distributed over days?
- What weather events caused the top 36 flood-related 311 calls over a 24-hour period?
- How much location error is associated with geocoding the 311 calls to street centerlines?



Methods

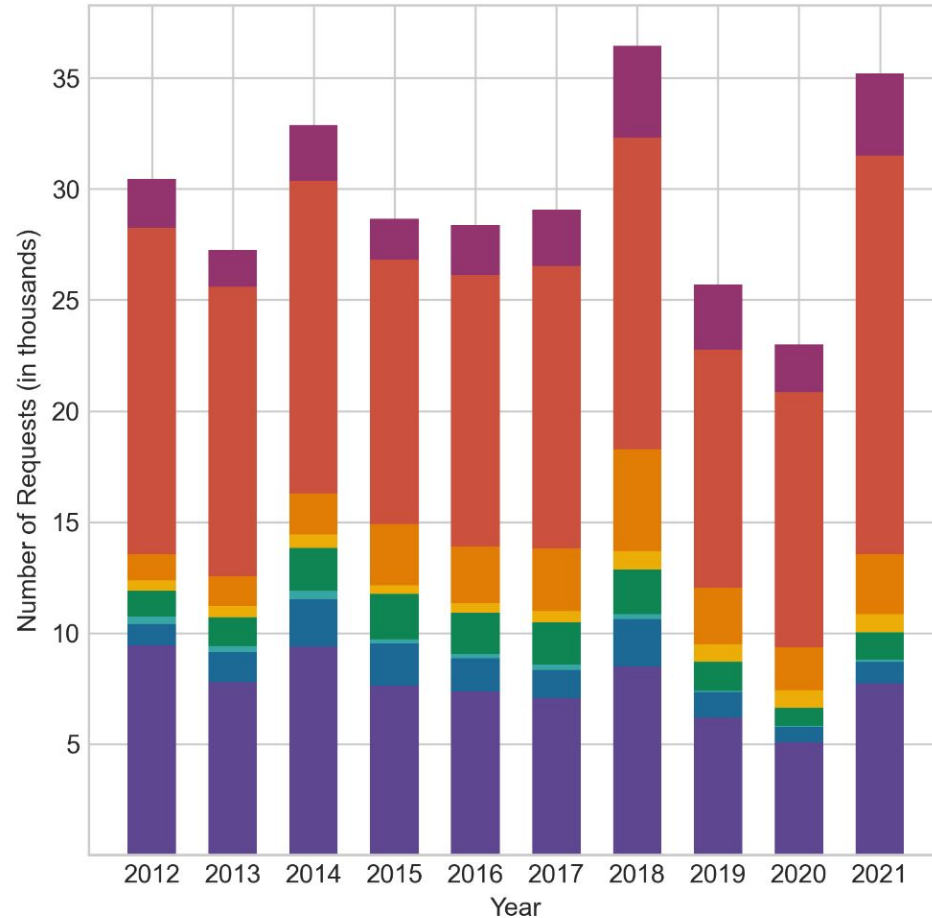
All scripts were written with Python 3.10.2 using PyCharm and Jupyter Notebook

All mapping was done with QGIS 3.22.3

Geocoding was done using Google's Cloud Service Geocoding API

Descriptors used for **flood-related** requests:





Question 1

How are flood-related 311 calls distributed over the years?

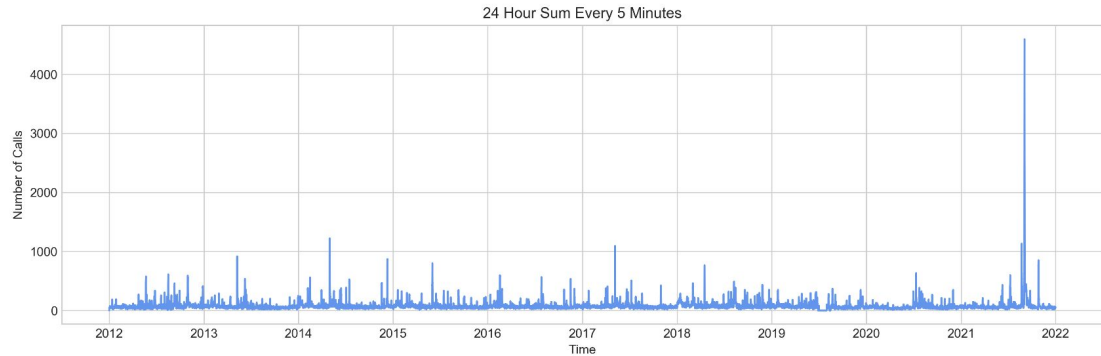
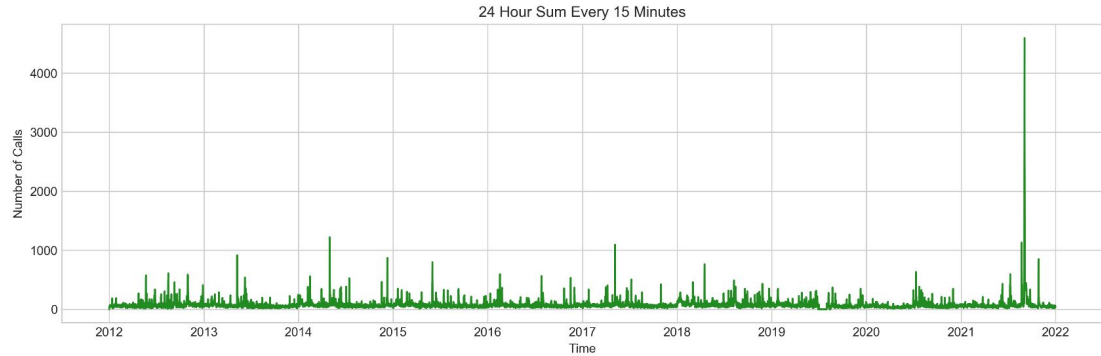
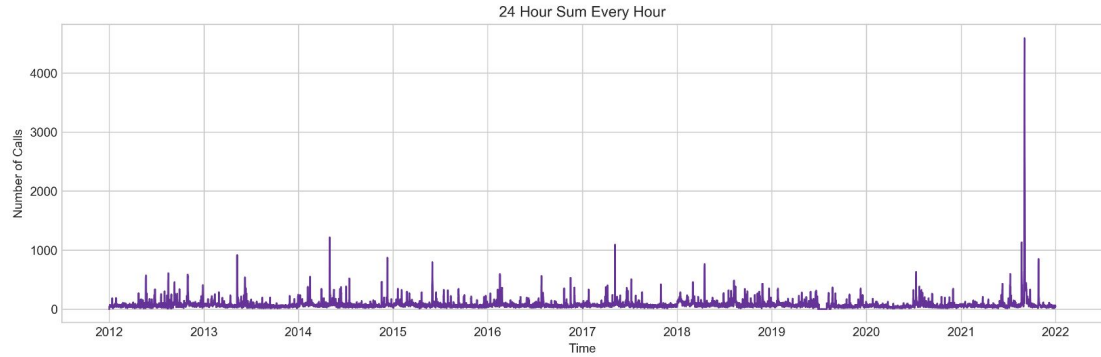
- No clear increase over time



Question 2

How are flood-related 311 calls distributed over days?

- Massive spike during Ida
- Used 3 window frequencies: 60 minutes, 15 minutes, & 5 minutes
- Minute differences between plots of 3 window lengths
- Usually calendar-day sums are used
- Flooding doesn't use the Gregorian calendar!



	CALLS		START		END						
0	4590.0	2021-09-01 19:00:00	2021-09-02 19:00:00	22	485.0	2018-08-07 18:00:00	2018-08-08 18:00:00				
1	1214.0	2014-04-30 12:00:00	2014-05-01 12:00:00	23	464.0	2014-11-17 08:00:00	2014-11-18 08:00:00				
2	1131.0	2021-08-21 19:00:00	2021-08-22 19:00:00	24	460.0	2013-05-09 05:00:00	2013-05-10 05:00:00				
3	1091.0	2017-05-05 10:00:00	2017-05-06 10:00:00	25	457.0	2012-09-08 09:00:00	2012-09-09 09:00:00				
4	915.0	2013-05-08 03:00:00	2013-05-09 03:00:00	26	457.0	2018-03-01 21:00:00	2018-03-02 21:00:00				
5	904.0	2021-09-02 19:00:00	2021-09-03 19:00:00	27	445.0	2021-09-07 13:00:00	2021-09-08 13:00:00				
6	869.0	2014-12-08 22:00:00	2014-12-09 22:00:00	28	431.0	2021-08-22 19:00:00	2021-08-23 19:00:00				
7	848.0	2021-10-25 23:00:00	2021-10-26 23:00:00	29	429.0	2021-06-08 15:00:00	2021-06-09 15:00:00				
8	796.0	2015-05-31 16:00:00	2015-06-01 16:00:00	30	428.0	2018-11-24 20:00:00	2018-11-25 20:00:00				
9	763.0	2018-04-15 23:00:00	2018-04-16 23:00:00	31	426.0	2018-11-26 12:00:00	2018-11-27 12:00:00				
10	631.0	2020-07-10 12:00:00	2020-07-11 12:00:00	32	419.0	2017-10-29 12:00:00	2017-10-30 12:00:00				
11	608.0	2012-08-15 12:00:00	2012-08-16 12:00:00	33	412.0	2021-09-03 19:00:00	2021-09-04 19:00:00				
12	596.0	2021-07-08 14:00:00	2021-07-09 14:00:00	34	406.0	2012-12-26 19:00:00	2012-12-27 19:00:00				
13	594.0	2016-02-16 02:00:00	2016-02-17 02:00:00	35	402.0	2017-04-06 11:00:00	2017-04-07 11:00:00				
14	586.0	2012-10-29 07:00:00	2012-10-30 07:00:00								
15	570.0	2012-05-21 07:00:00	2012-05-22 07:00:00								
16	561.0	2016-07-25 16:00:00	2016-07-26 16:00:00								
17	549.0	2014-02-13 16:00:00	2014-02-14 16:00:00								
18	536.0	2013-06-07 03:00:00	2013-06-08 03:00:00								
19	529.0	2016-11-14 19:00:00	2016-11-15 19:00:00								
20	521.0	2014-07-14 20:00:00	2014-07-15 20:00:00								
21	505.0	2017-07-07 06:00:00	2017-07-08 06:00:00								

This table is from the 60 minute window moving summation.

Question 3

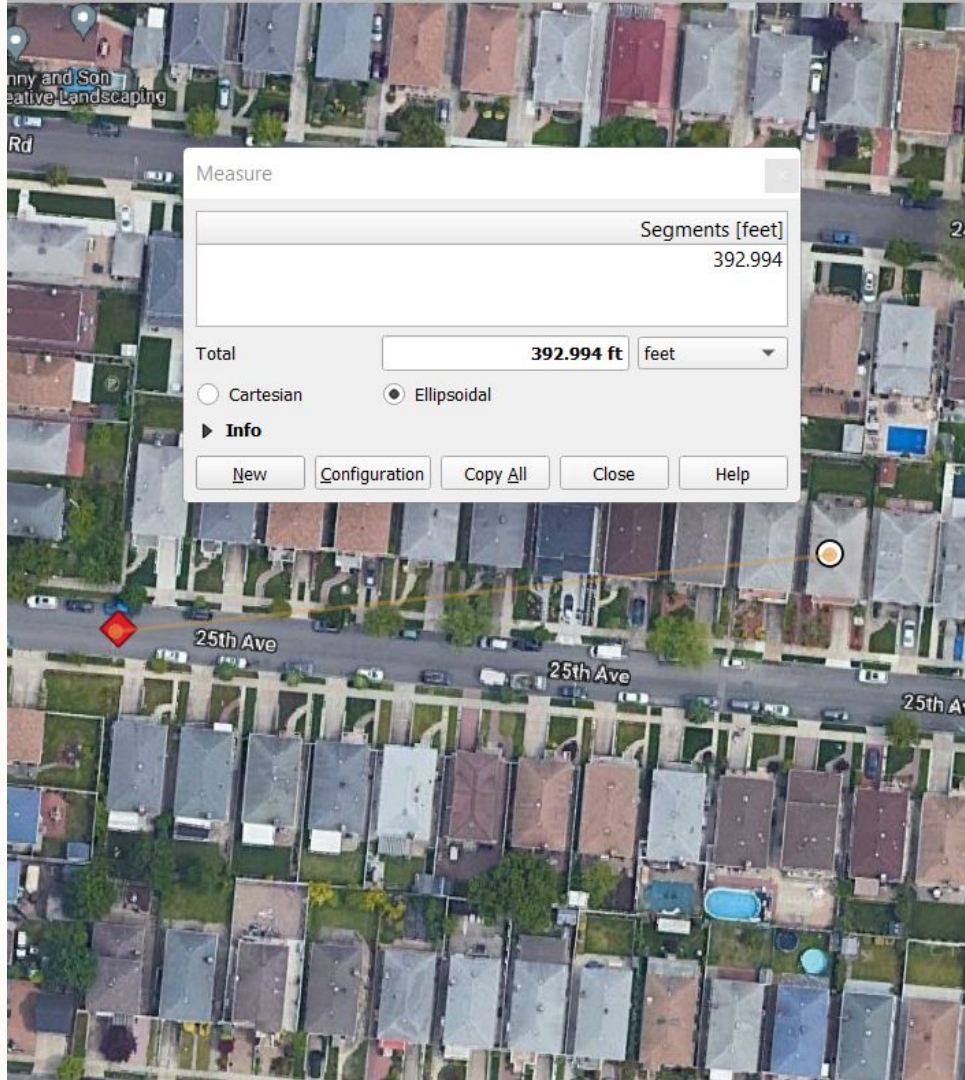
What weather events caused the top 36 flood-related 311 calls over a 24-hour period?

- Used an exclusive moving sum for 3 windows to find distinct 24-hour sums
- The top 36 24-hour periods are the top 1%
- Can use these times moving forward to identify which kinds of weather events provoked the most calls

Question 4

How much location error is associated with geocoding the 311 calls to street centerlines?

- From a sample set of flood-related calls
- Distance between original coordinates and geocoded addresses for the same call are very different
- Location error this large can make for incorrect analyses





• Next Steps

- Once geocoded, 311 data are corrected for more accurate spatial analyses
- Compare flood-related calls to radar data for case study events like Ida
- Make time series analyses of case study events like Ida
- Use demographic data to see **who** is most vulnerable to flooding in NYC

Thank you!

Contact:

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