Mining Twitter Data to Augment NASA GPM Validation

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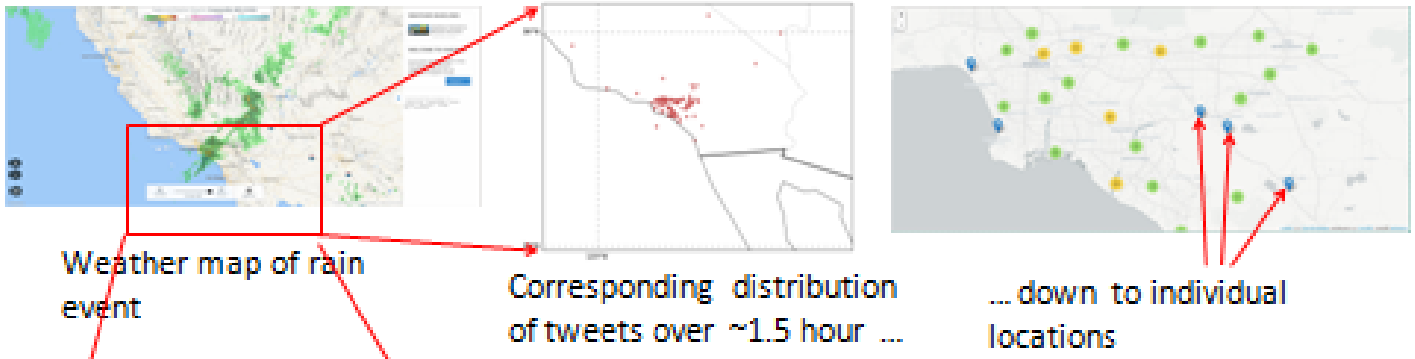
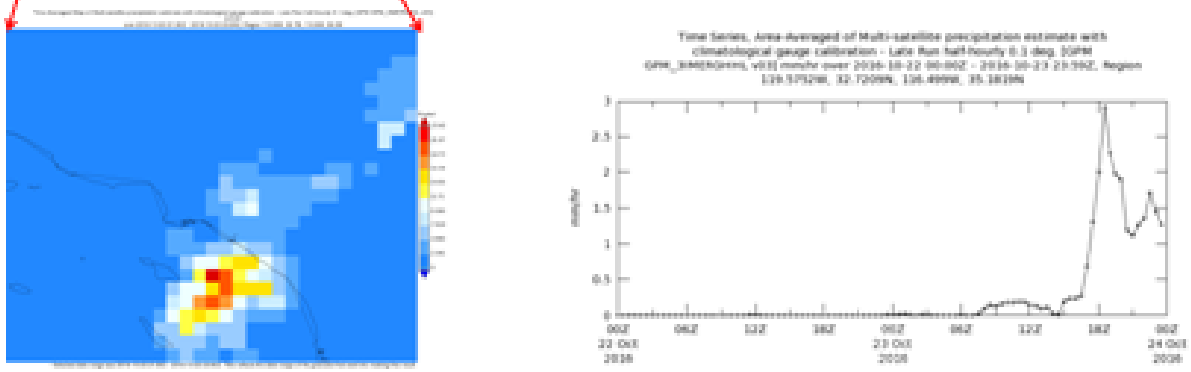
NASA CSESP (NNH16ZDA001N)

AGU 2017 Fall Meeting, Dec. 14, 2017

Motivation

Rain event in Los Angeles area





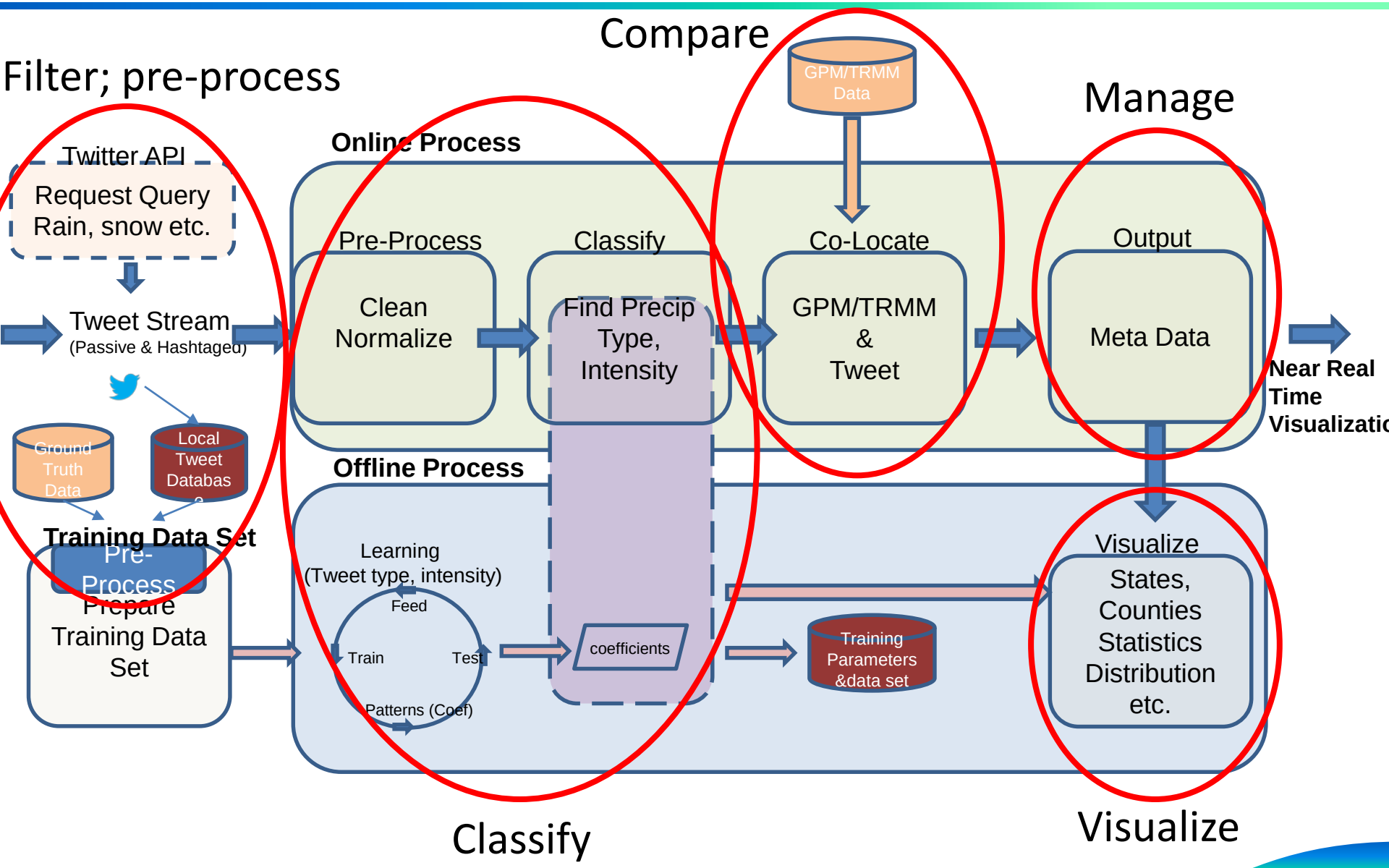
NASA Giovanni visualization of GPM map (left) and time series (right) of the LA area rain event

Organic network of rain gauges

Space-time-varying set of "precipitation tweets"

- **Reading the "gauge measurements"**
  - **Develop infrastructure for processing and analyzing tweets**
- Enhancing quality of tweets; engaging with "active" participants
- Applying processed tweets to satellite data validation
- Managing tweet data

Tweet processing infrastructure

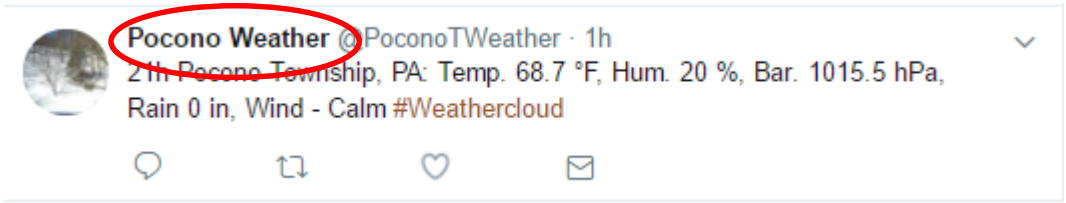


Example tweets

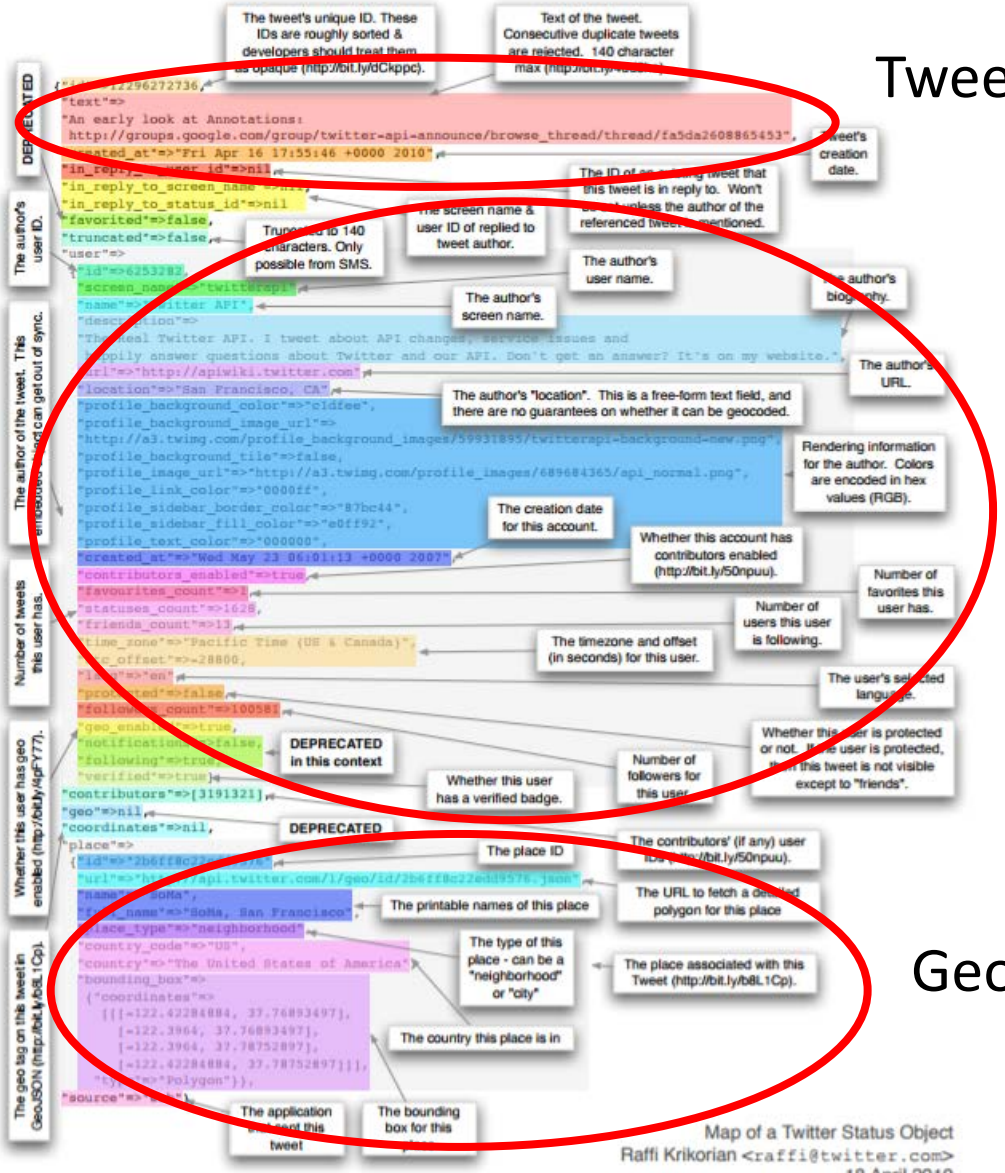
Relevant tweet

Not relevant tweet

Weather station tweet



Anatomy of a tweet (status object)



Tweet text

User info

Geo-tag info

Approach to crowd-sourcing

- *Not* require participants to explicitly “sign up” to contribute.
- To effectively crowd-source, a large source of crowd is needed.
- Twitter is such a source.

March 2017 winter storm

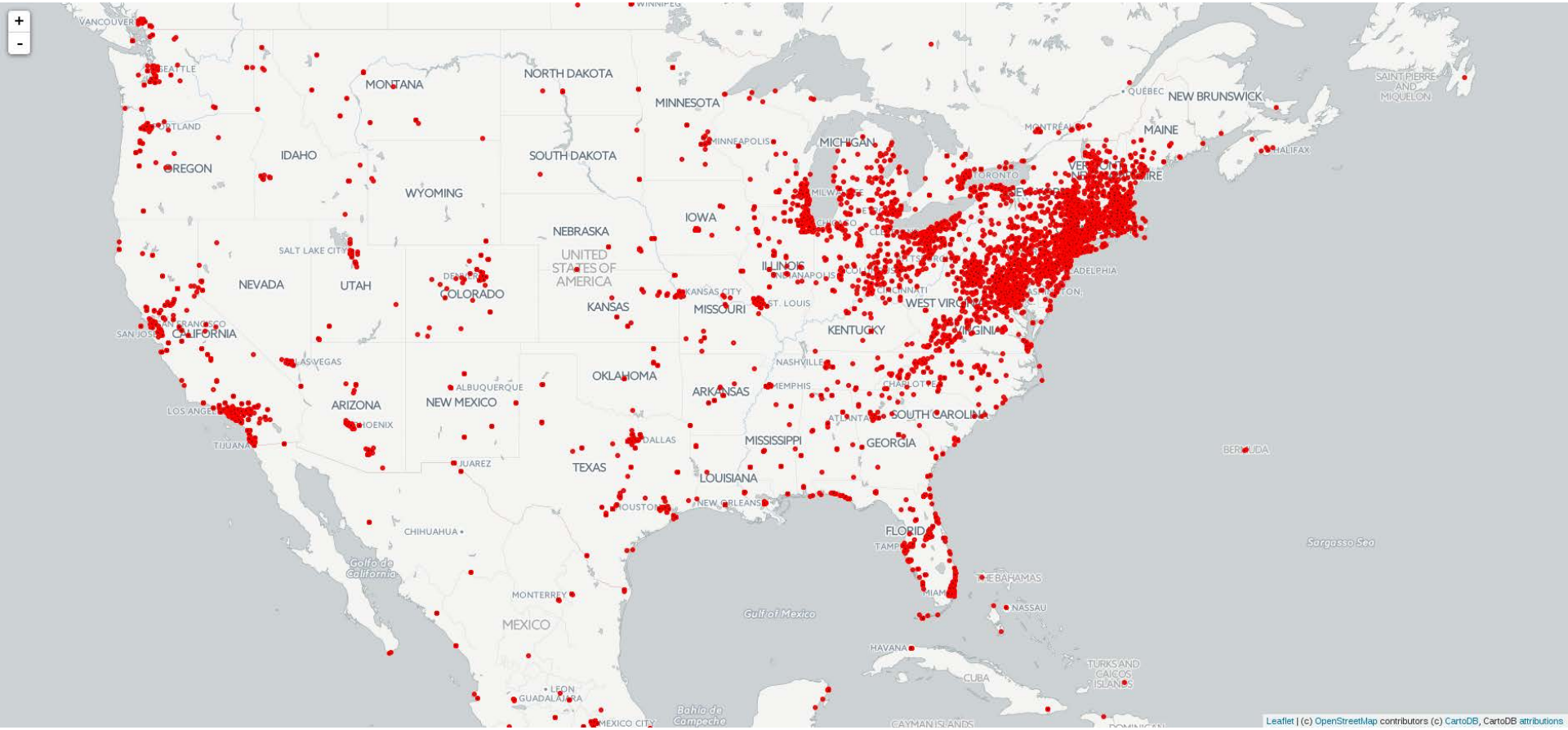
Number of tweets collected

Start: 2017-03-13 22:23:12 – End: 2017-03-14 19:05:31

	Total # tweets	# tweets w/ geo-location	# tweets w/ geo-tag (place)
Global	1,227,390	22,880	34,535
U.S.		13,269	20,349

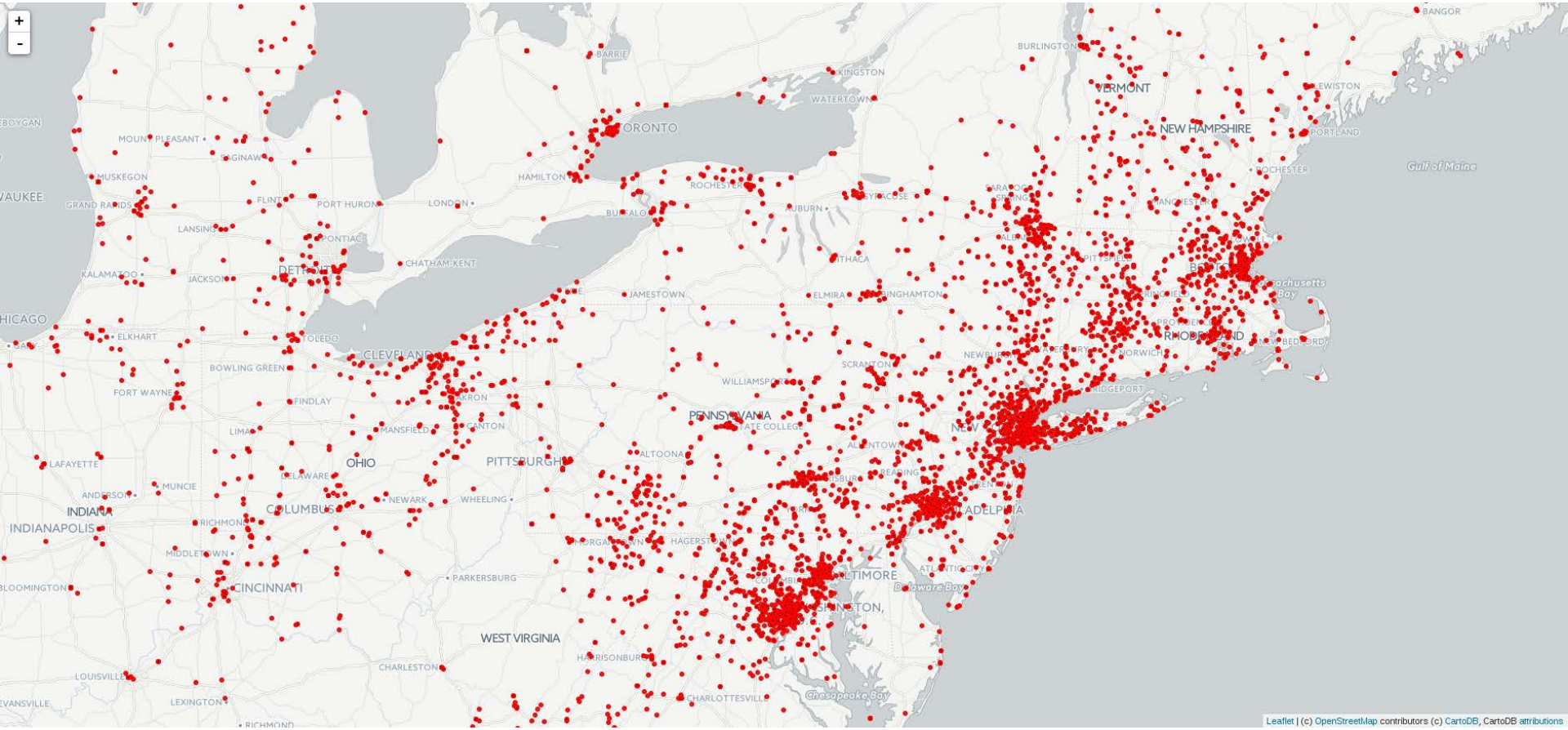
March 2017 snow event

Distribution of tweets



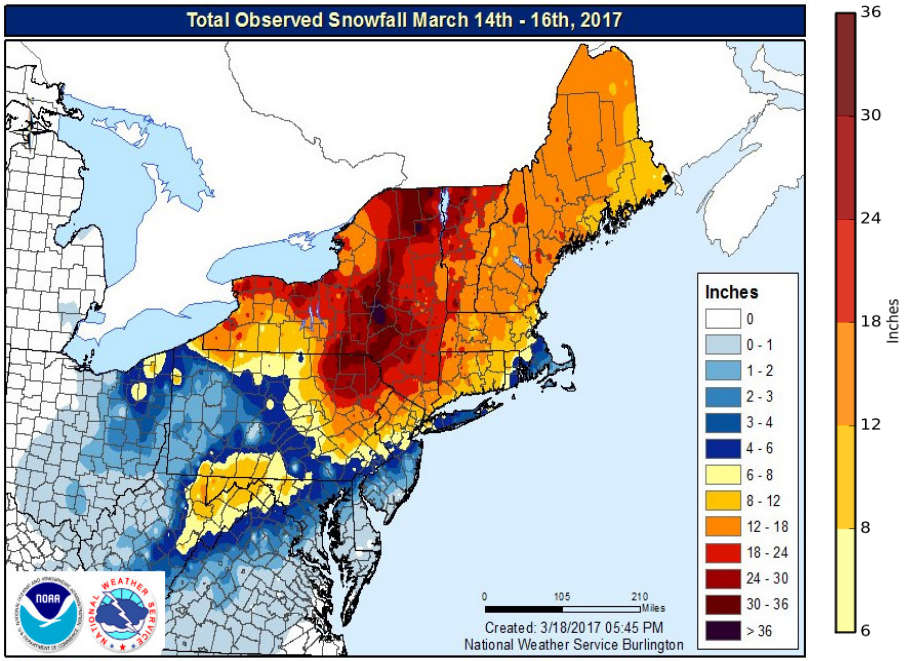
March 2017 snow event

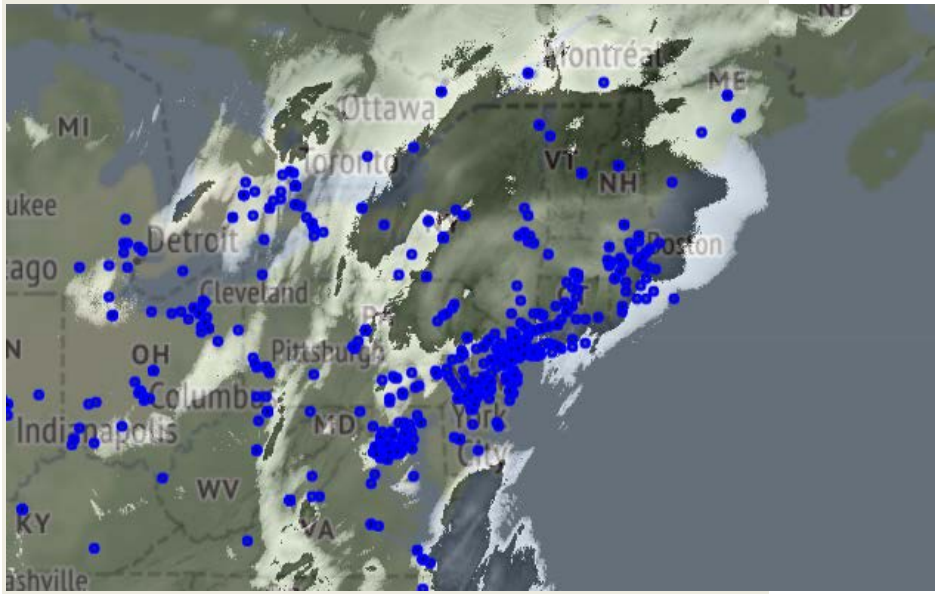
Distribution of tweets



March 2017 winter storm

Observed snowfall & MRMS*-tweet map





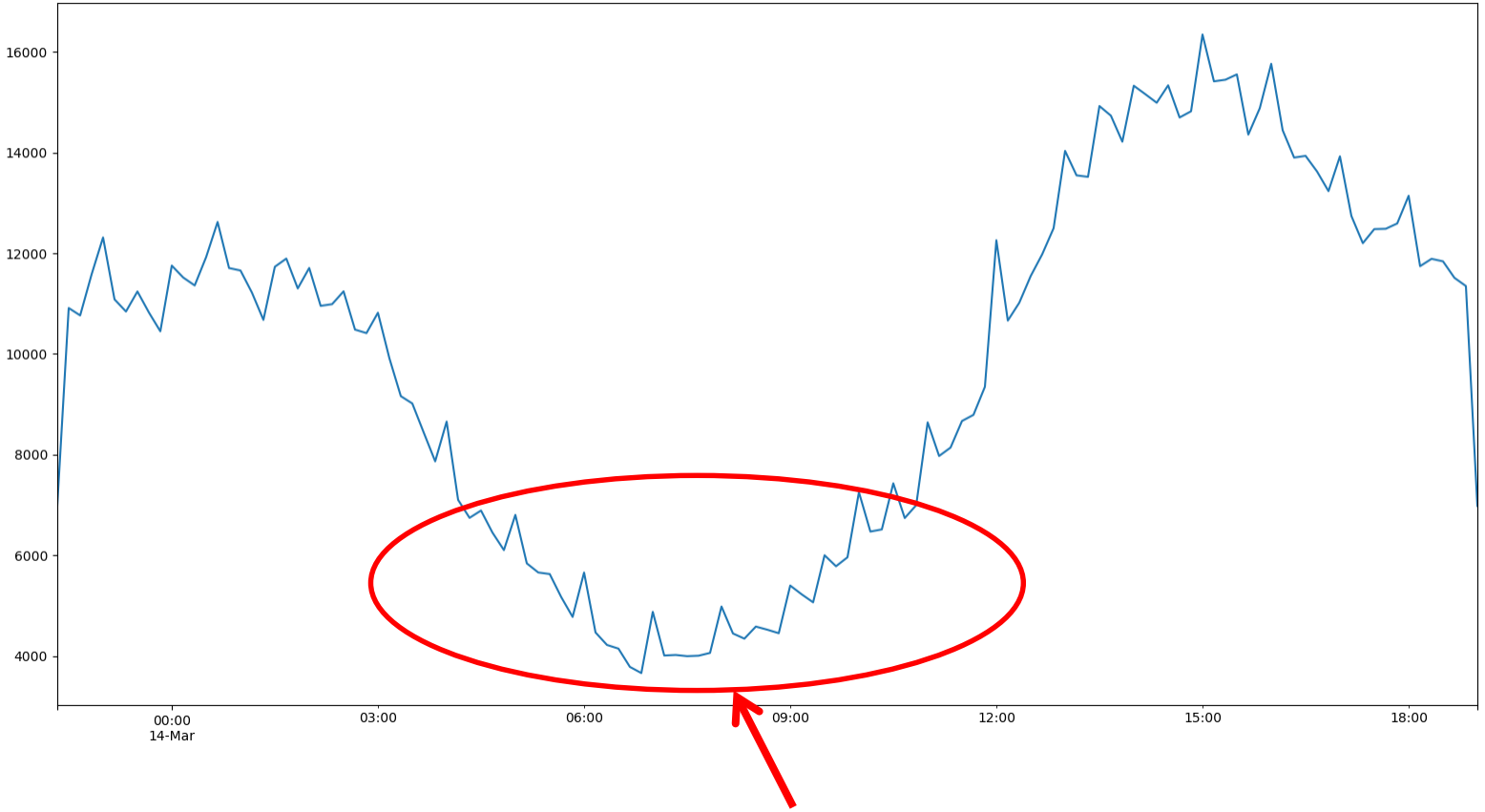
*Multi-Radar/Multi-Sensor System (NOAA NSSL)

Comparing tweets with MRMS

- Analysis ongoing; thus far, majority of MRMS-tweet pairs agree (i.e., m1/t1, m0/t0).
- Many "passive" tweets are "regular" (e.g., from amateur weather stations), e.g.,
  - Wind 0.0 km/h N. Barometer 1006.7 mb, Falling. Temperature 8.3 °C. Rain today 8.8mm. Humidity 93%
- Implication for quality of "passive" tweets.

March 2017 snow event

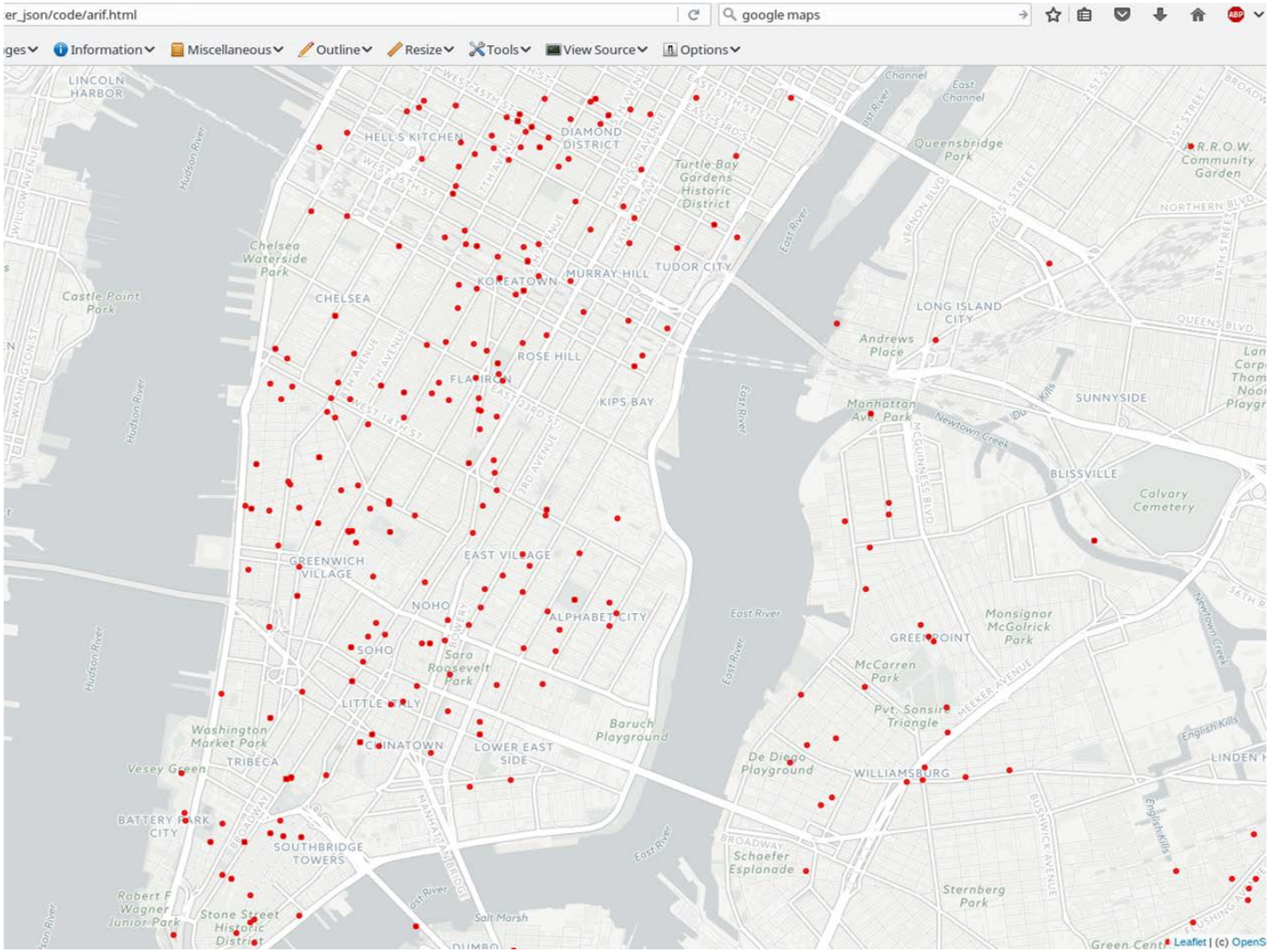
Time-varying # of tweets



~Midnight – 6 am, U.S. east coast

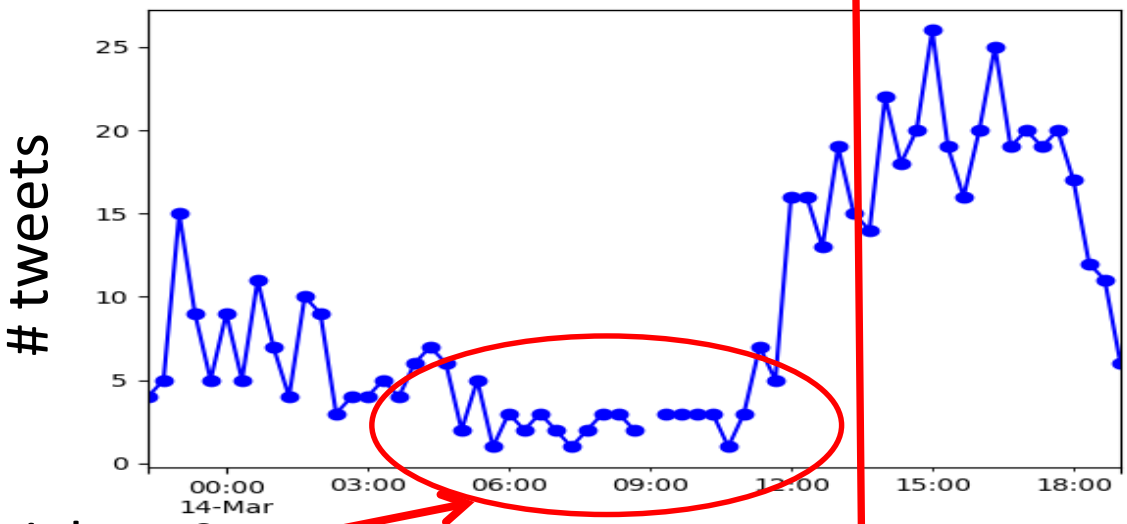
March 2017 snow event

Manhattan

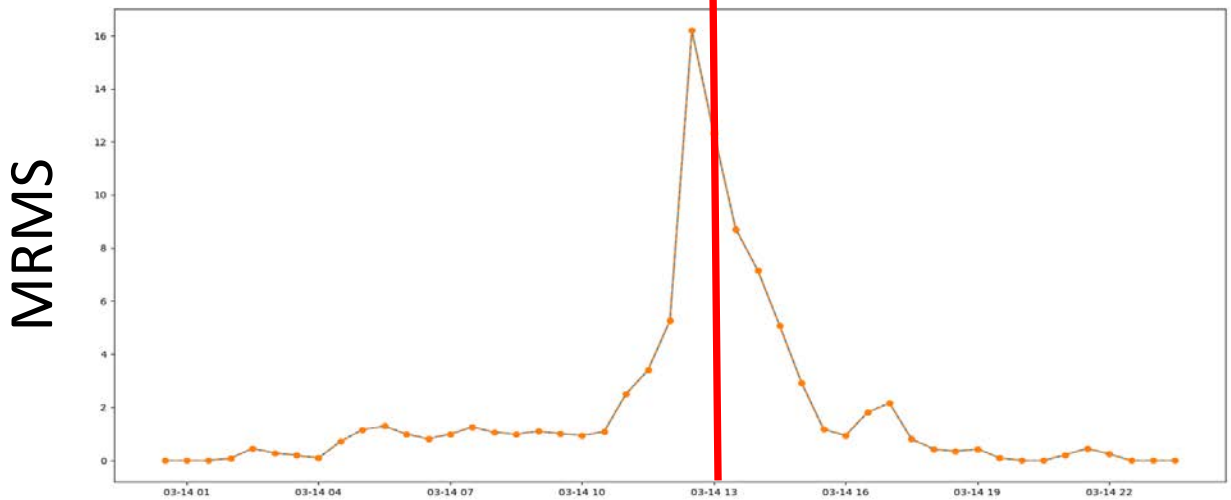


March 2017 snow event

Manhattan



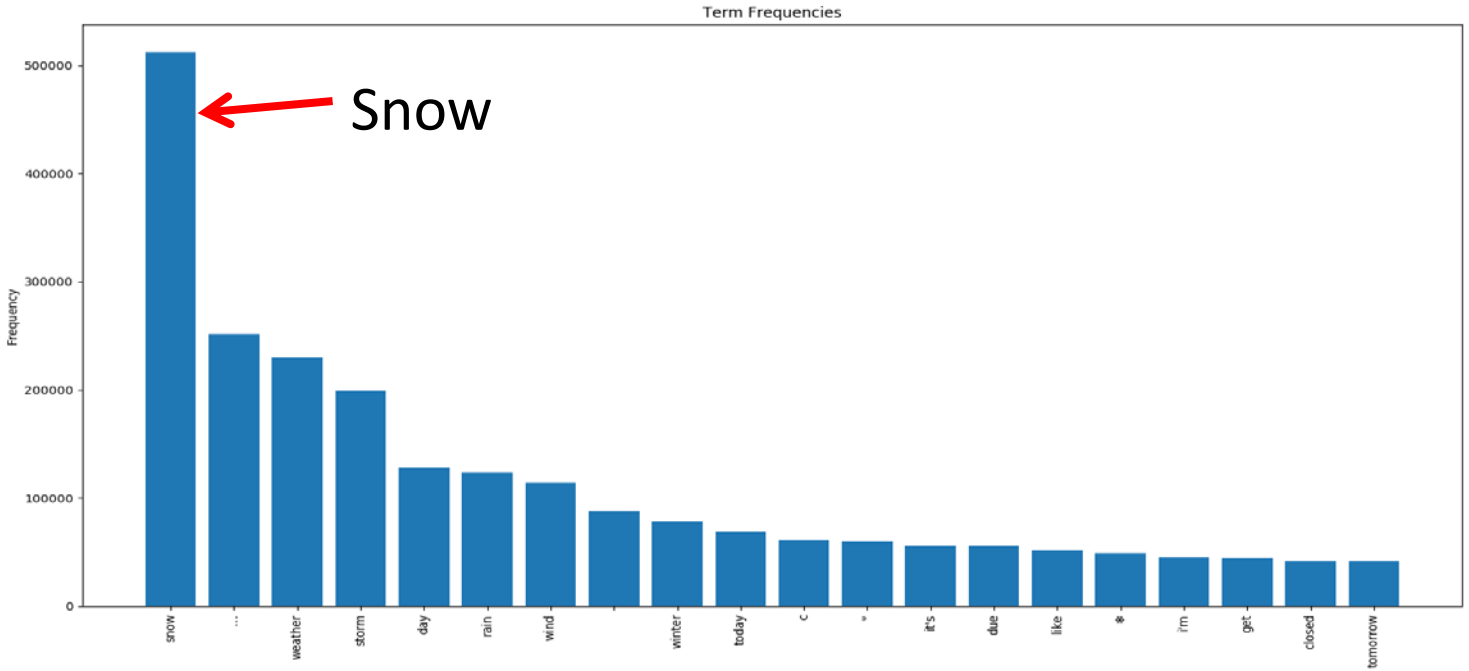
~Midnight – 6 am



March 2017 snow event

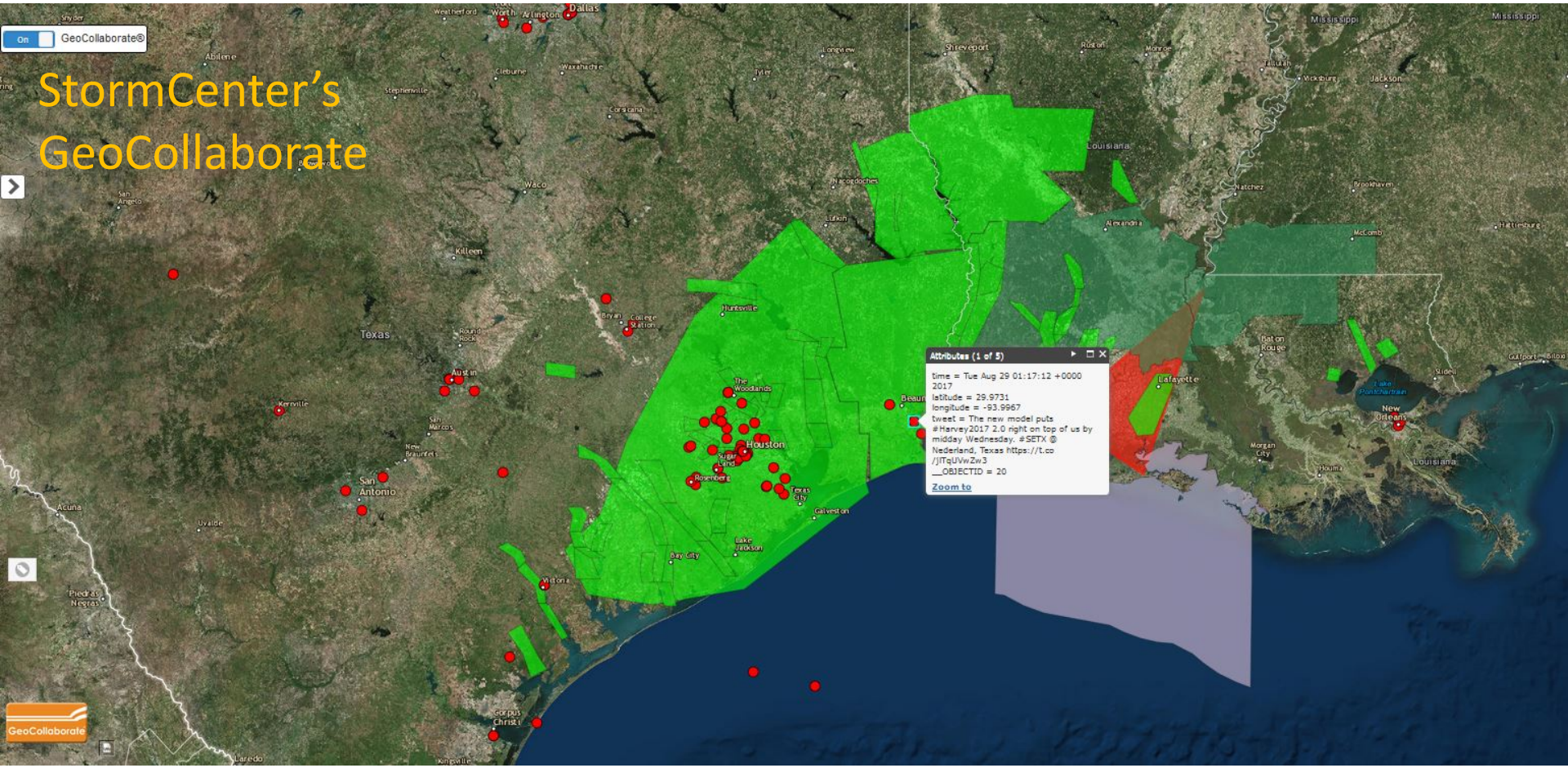
Frequency of words in tweets

	Snow	Weather	Storm	Rain	Wind	❄	☃
Global	512,414	229,836	198,798	123,773	113,915	48,789	
U.S. point location only	14,094	4,362	1,850	4,644	9,778	1,686	250



August 2017 Hurricane Harvey

Tweets in GeoCollaborate



August 2017 Hurricane Harvey

Tweets in GeoCollaborate

Summary

- Infrastructure is generic, i.e., not specific to a given measurement, social medium, or satellite mission.
- Twitter data have potential for earth science applications.

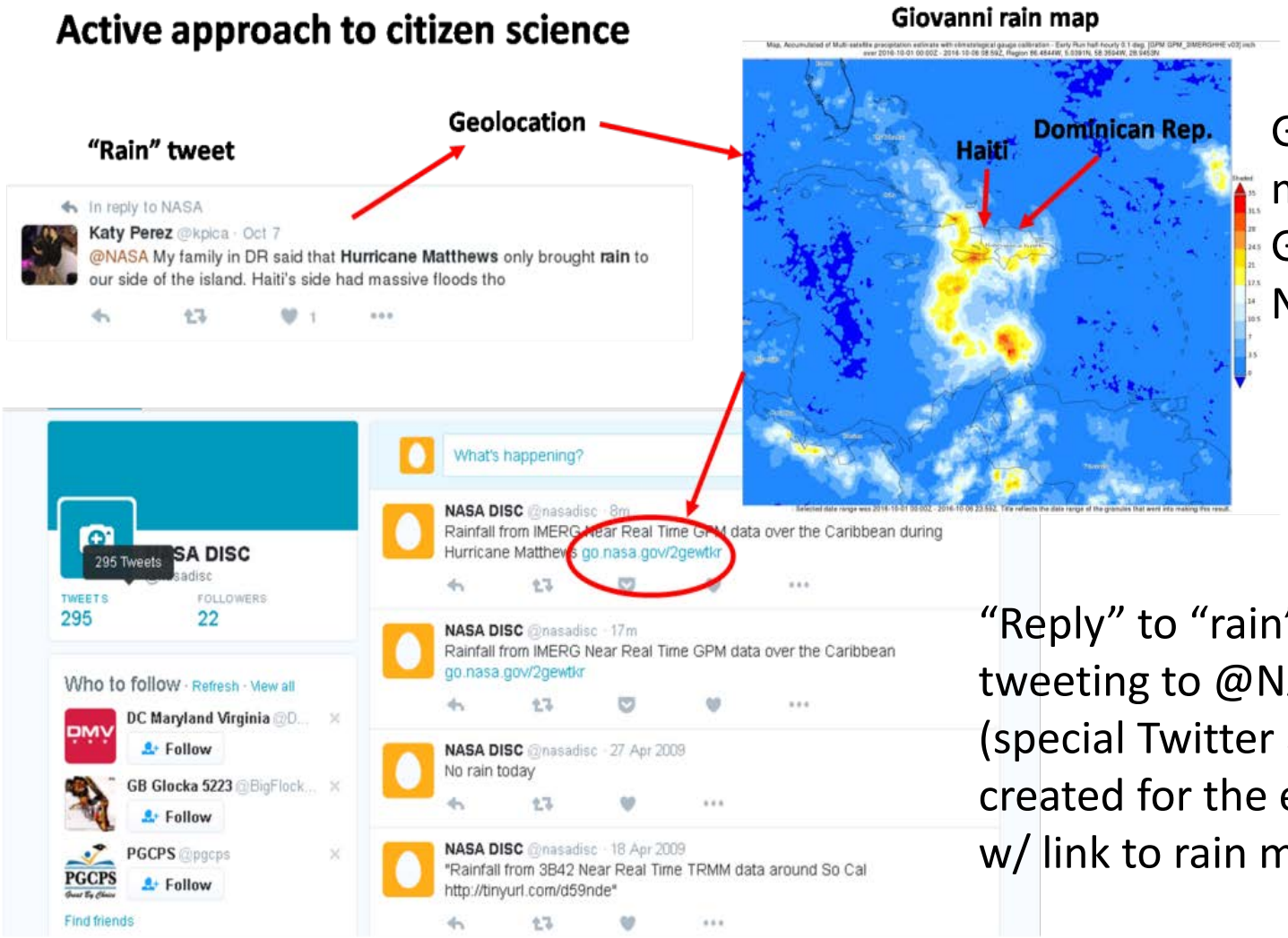
Questions?


I am tweeting in the rain .. tweeting in the rain ...
.. 'n we're happy again!

Extras

Engagement w/ Active Participants

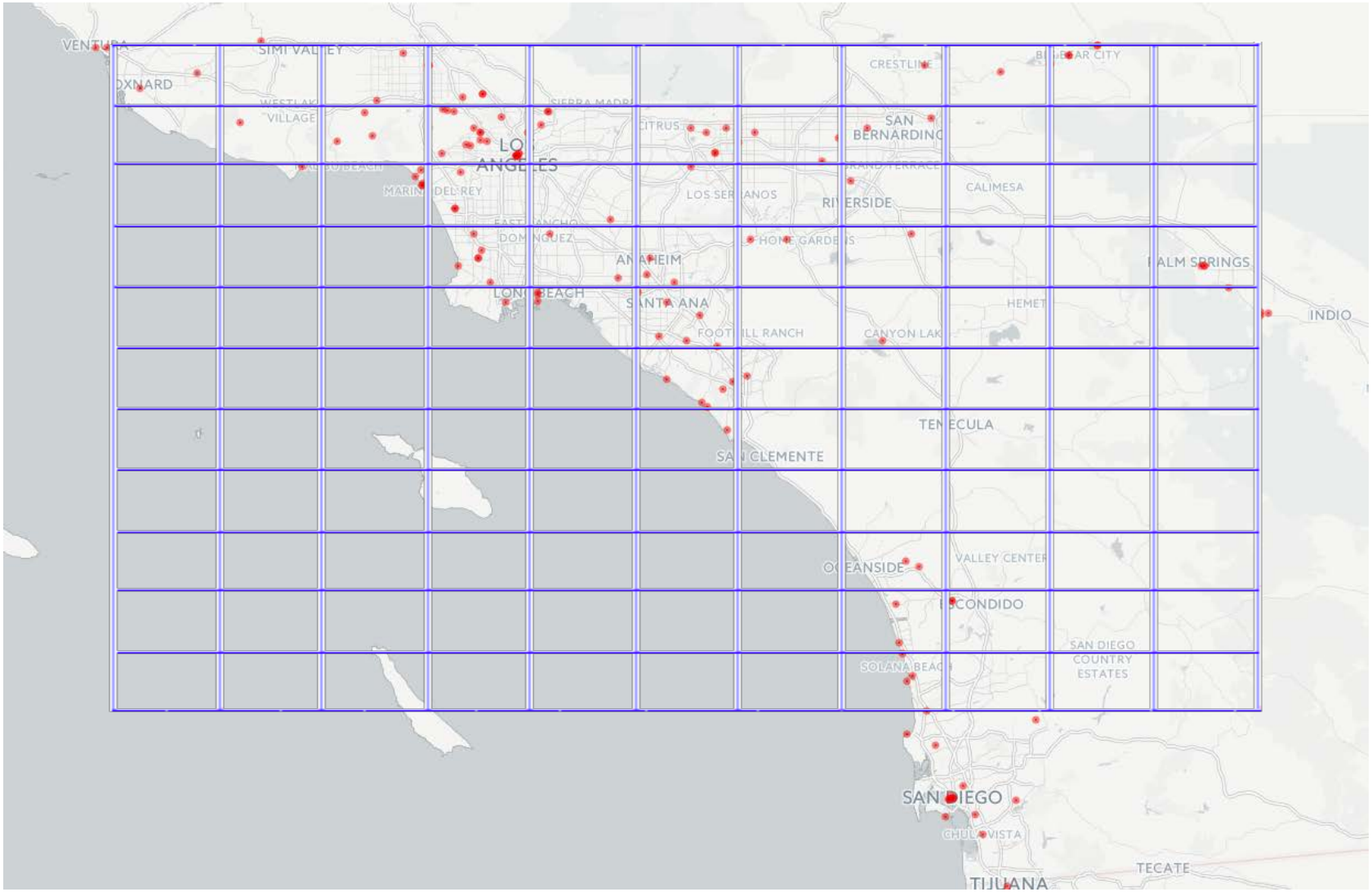
Filter and extract “rain” tweet (Oct. 7, 2016) about Hurricane Matthew.



Generate rain map from GPM, using NASA Giovanni.

“Reply” to “rain” tweet by tweeting to @NASADISC (special Twitter account created for the experiment) w/ link to rain map.

Managing tweet data



August 2017 Hurricane Harvey

Number of tweets collected

Start: 2017-08-29 00:33:21 – End: 2017-08-29 09:36:02

	Total # tweets	# tweets w/ geo-location	# tweets w/ geo-tag (place)
Global	1,571,234	6,497	84,103
U.S.		4,010	78,906

August 2017 Hurricane Harvey

Distribution of tweets