Automated and Objective Thunderstorm Identification and Tracking using Operational Geostationary Lightning Mapper (GLM) Data

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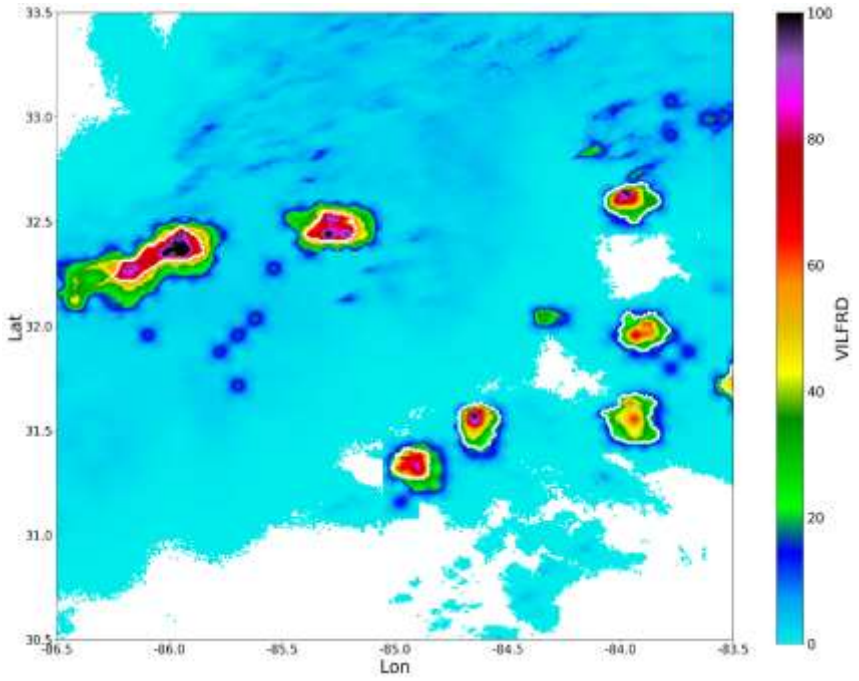

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Optimize VILFRD for use with GLM data

- Schultz et al. (2016) created a new method for objectively identifying and tracking thunderstorms using a combination of radar & lightning data

Vertically Integrated Liquid (VIL)
&
Flash Rate Density (FRD)
are combined to define storm features

$$VILFRD = 100 \times \left[\left(\frac{VIL}{45} \leq 1 \right) + \sqrt{\frac{FLCT5}{45} \leq 1} \right]$$

- **Goals for VILFRD with GLM:**
  - less variation in feature/storm size from minute to minute
  - capture as much lightning within the storm as possible
  - confirm current method as optimal, or adopt new changes
  - *track using GLM & radar, radar alone, or GLM alone*

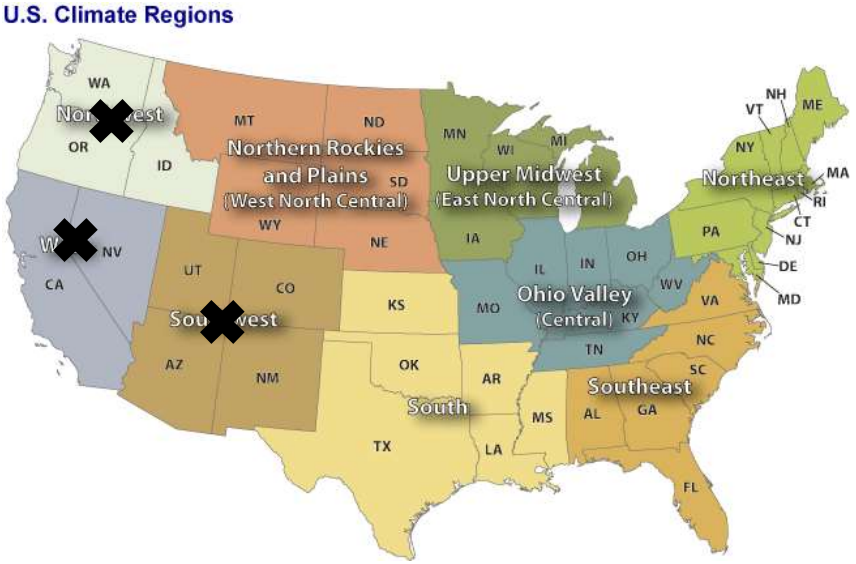
VILFRD variations & additional methods

- Four different variations of VILFRD feature identification using w2segmotionll in WDSSII:
  - **Original (O)**: finds VILFRD levels starting with 100, down to 20, by 20
  - **Original dilated (Od)**: same as **O** but with added dilation filter
  - **New (N)**: 70 down to 20, by 10
  - **New dilated (Nd)**: same as **N** but with added dilation filter

- One method not using VILFRD
  - **Non-VILFRD (NV)**: defines features using the 35dBz isosurface at -10°C

- 15 case days, 273 hours tracked

- A single case day could have anywhere from ~20 – 200 tracked features



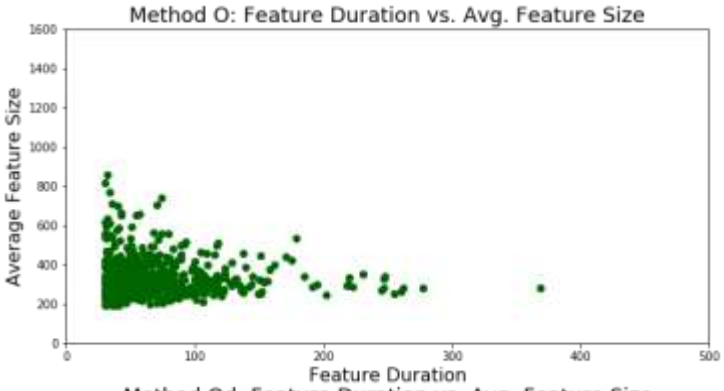
Number of tracked features

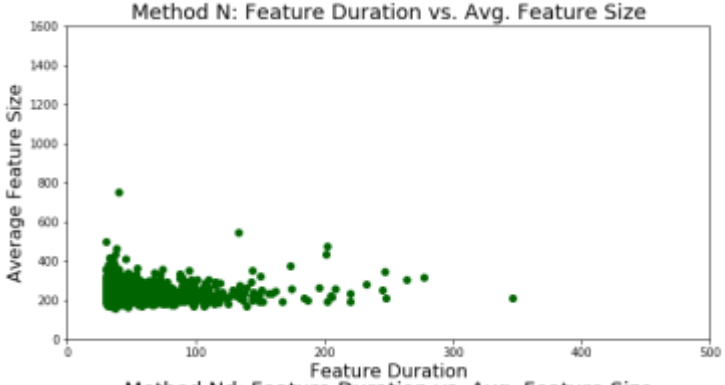
O	N	Od	Nd	NV
753	824	1343	1442	612

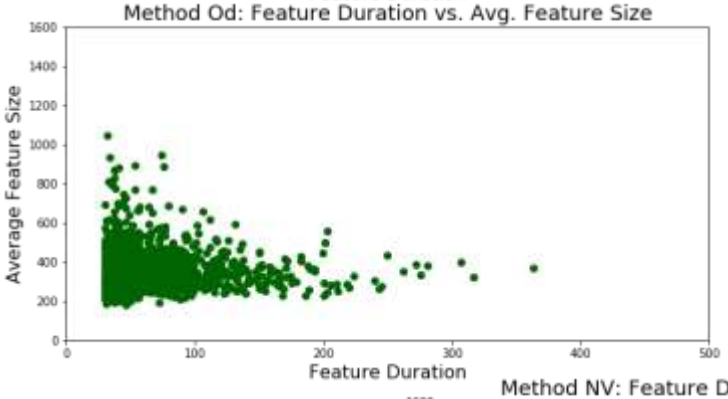
Select Results: Size & Duration

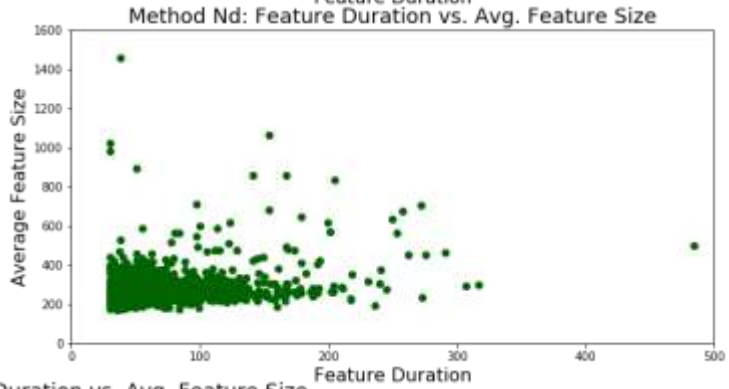
Avg. duration of a tracked feature (mins):

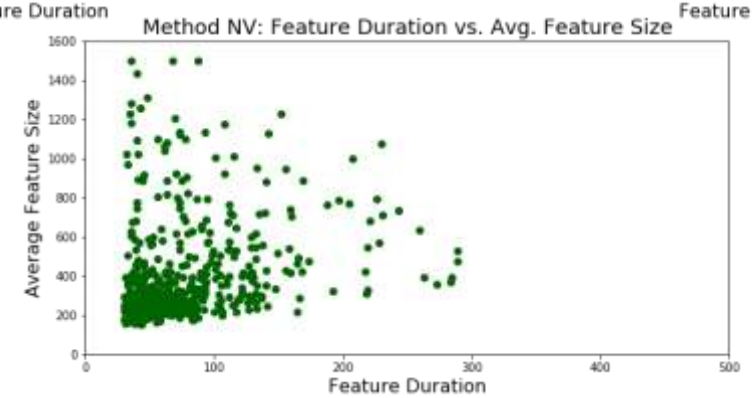
O	N	Od	Nd	NV
63.98	63.23	64.93	65.32	72.55







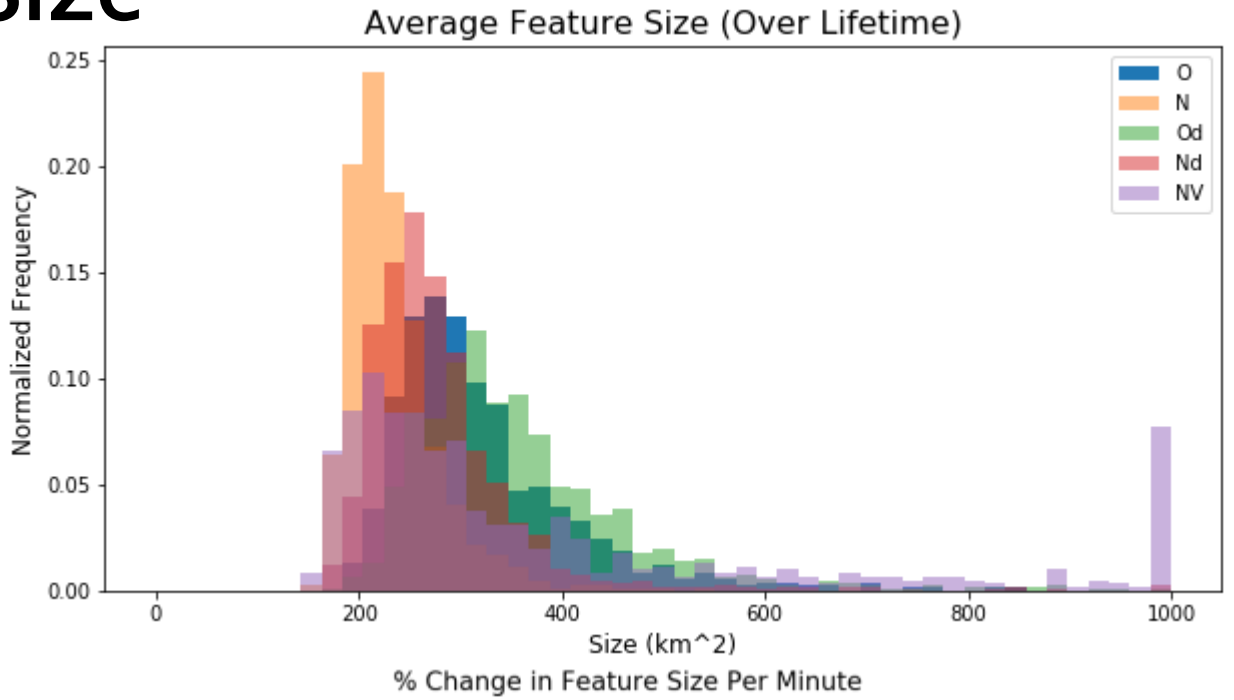




Select Results: Size

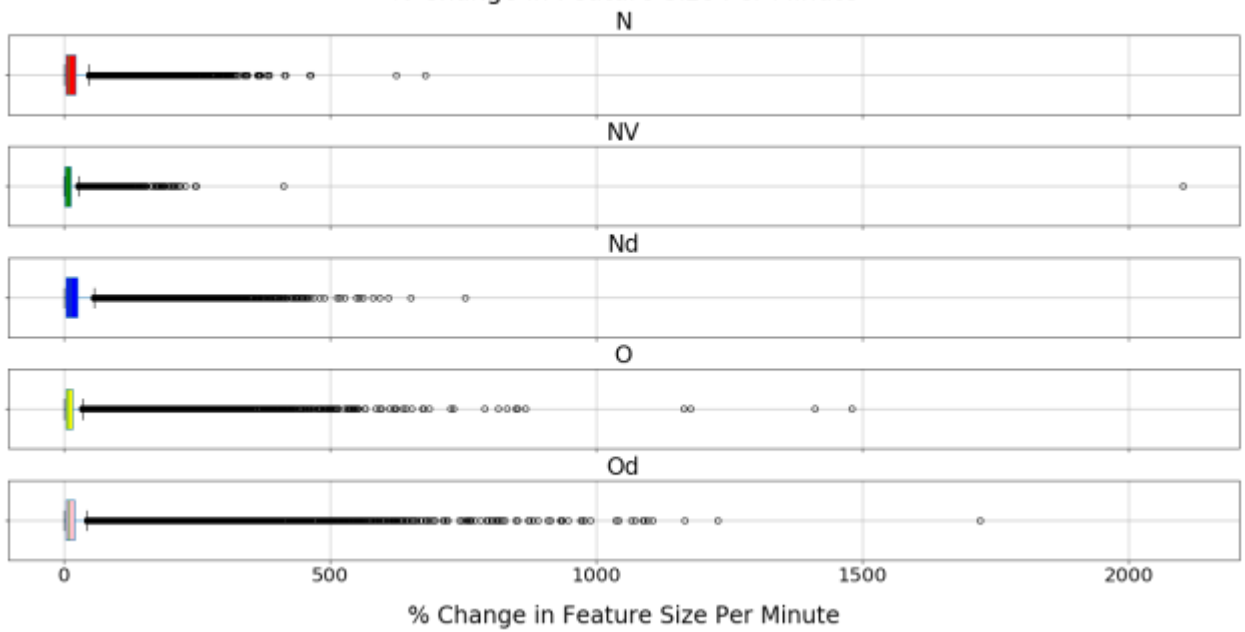
Avg. size (km^2) /min of a feature

O	N	Od	Nd	NV
322	236	356	293	517



Avg. **change** in size/min of a feature

O	N	Od	Nd	NV
54.2	42.7	67.1	55.3	45.4



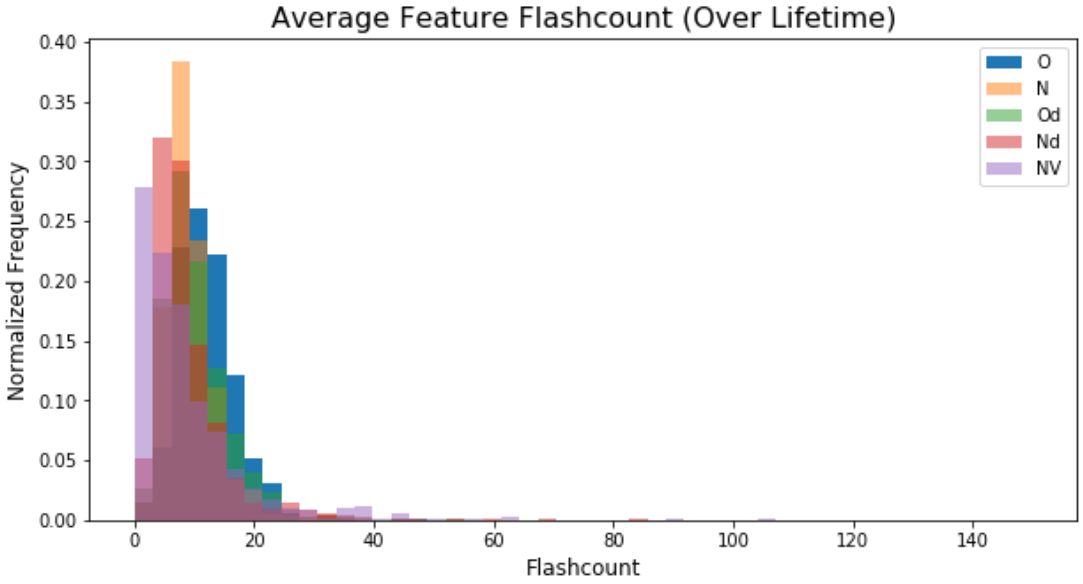
Select Results: Lightning

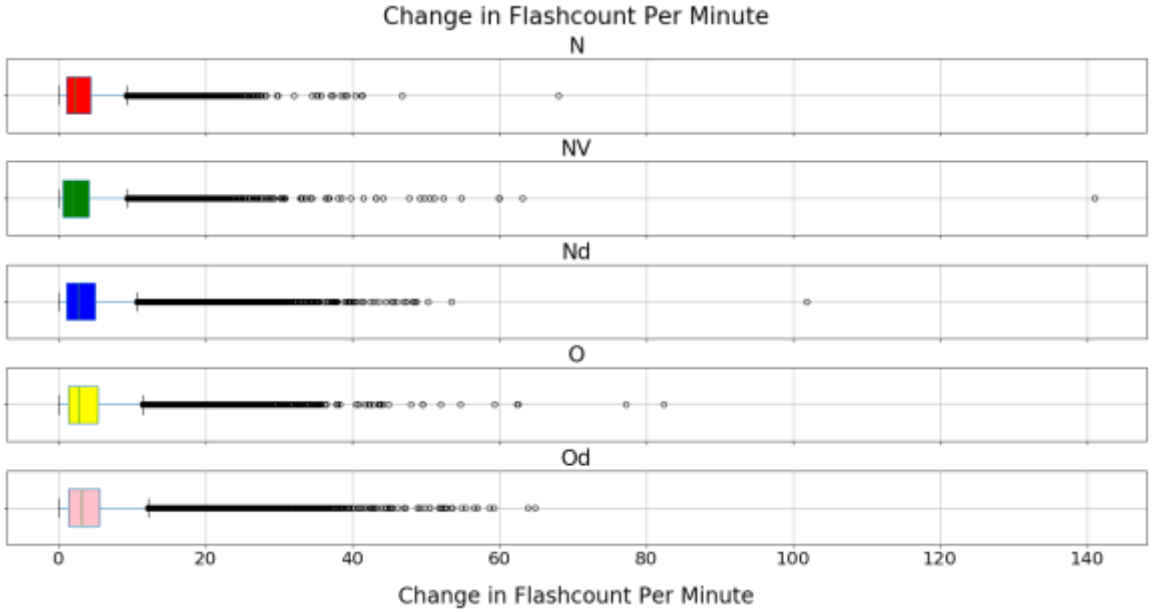
Average feature flashcount / min

O	N	Od	Nd	NV
12.7	10.3	11.1	10.6	10.8

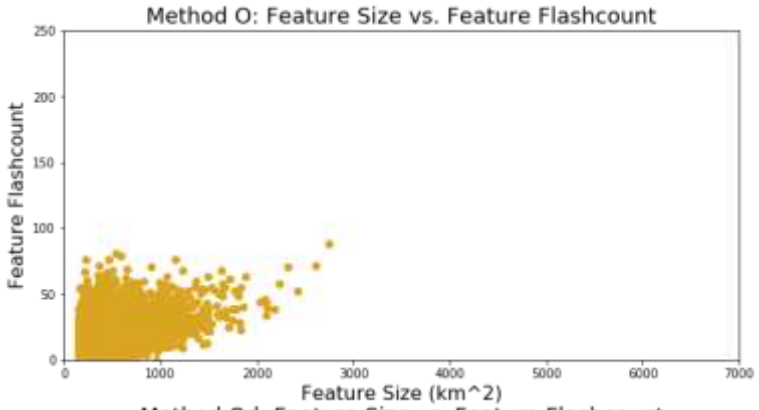
Average flash density of a tracked feature

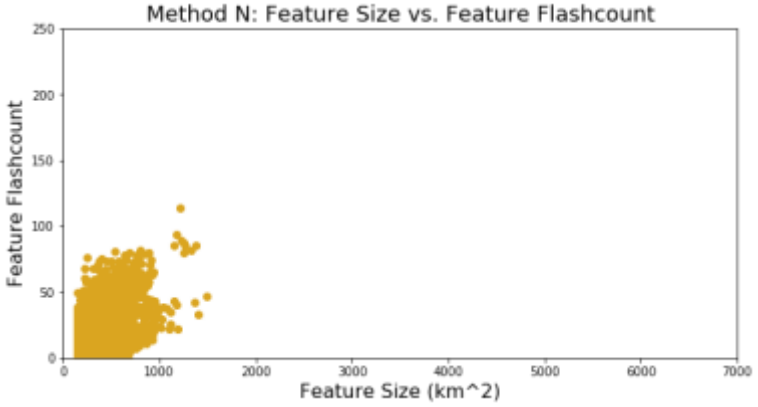
O	N	Od	Nd	NV
.0434	.0445	.0344	.0344	.0225

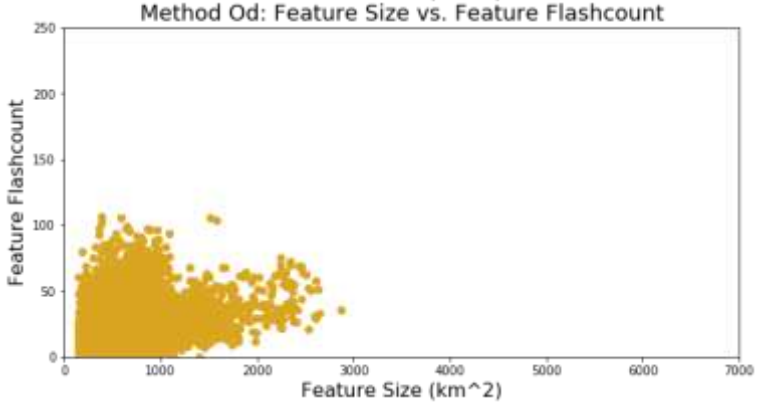


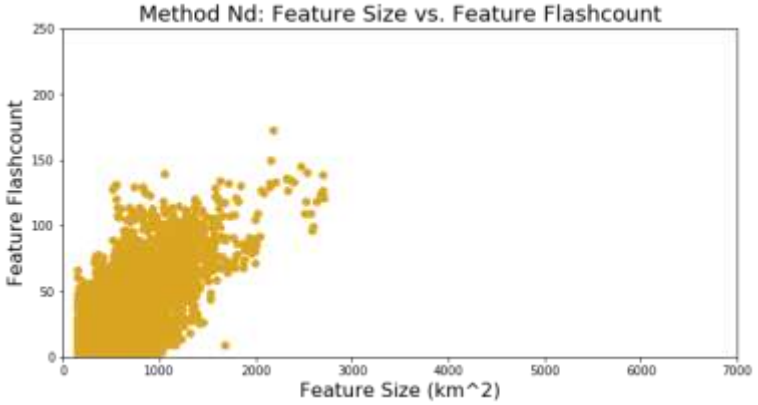


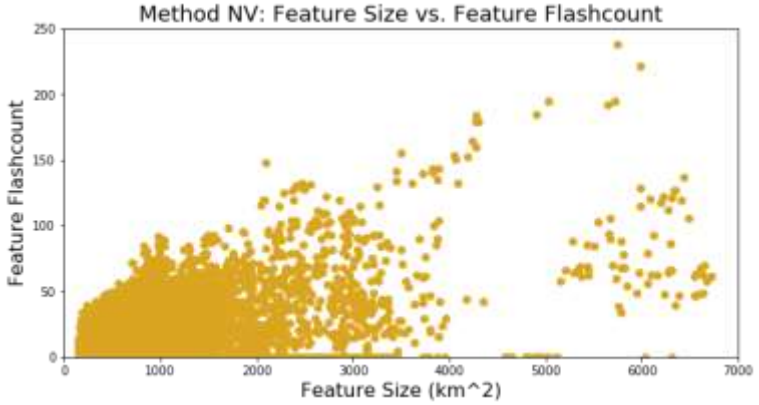
Select Results: Size and Lightning











Summary & Future Work

- Methods **N** and **Nd** create a more stable feature boundary, but capture slightly less lightning
    - Determine the cost/benefit of using feature ID that creates a more stable, but smaller feature boundary
- **Od** and **Nd** cause an increase in the total number of storms tracked
- VILFRD tracking methods identify more and smaller features than the **NV** method
- Creation of a VILFRD without VIL = **<u>lightning only</u>** tracking