Characterizing Lightning-Initiated Wildfire to Develop New Nowcasting Techniques for Wildfire Identification

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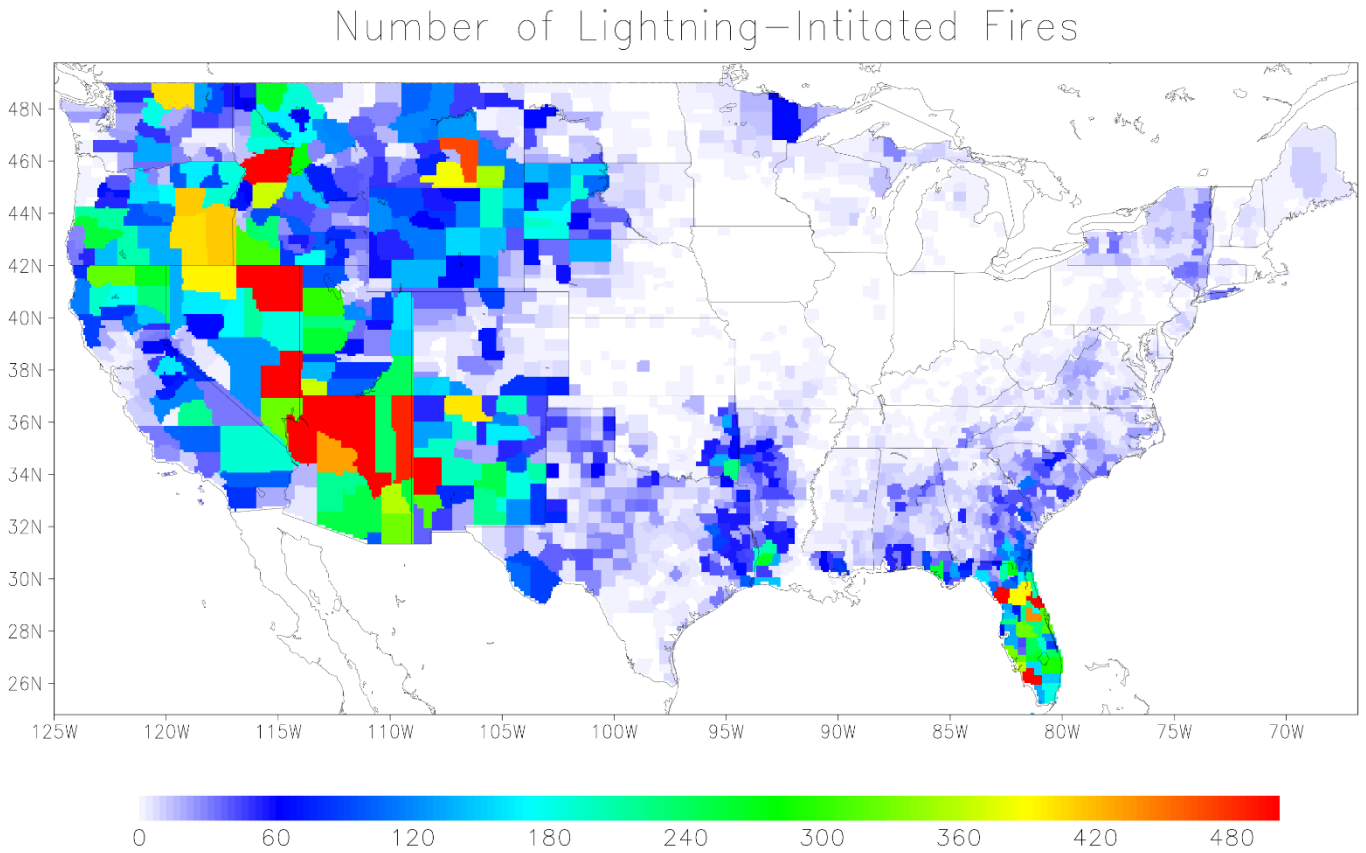
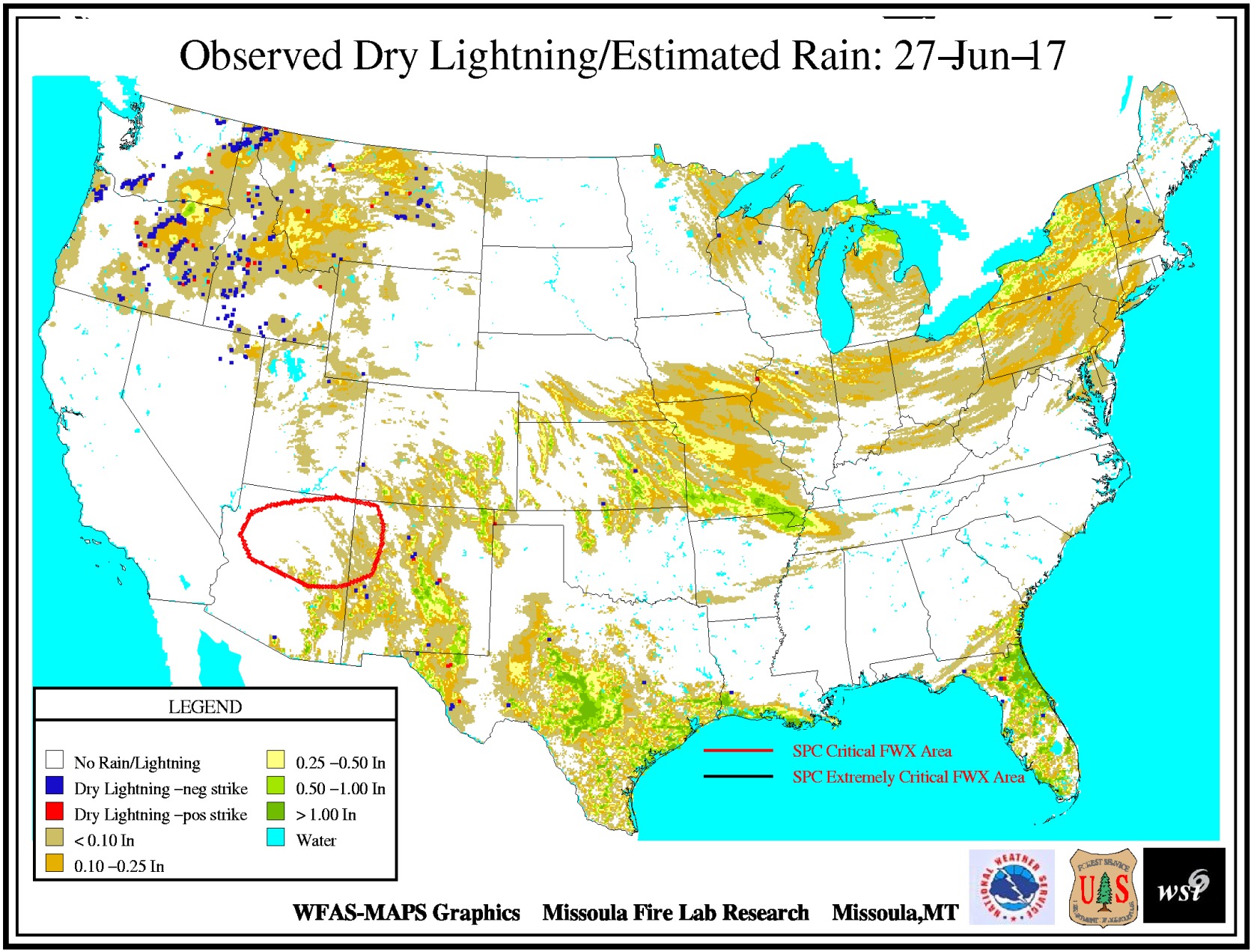
Why Lightning-Initiated Fire?

- While only 16% of the total number of wildfires within the US, lightning initiated fire accounts for 56% of the acreage burned (Balch et al. 2017)



1992-2015 lightning initiated fires by county. Data source, USFS Wildfire Database, Short (2017).

Current Methods



Potential Areas to Improve Real-Time Information for Identification and Decision Making

- Development of a real-time probability for lightning initiated fire.
  - Current procedures are updated 1 day later
- Indication of areas where holdover events are possible.
  - The 1 day map highlighting wildfire potential does not account for holdover events (Sopko et al. 2016).
- GLM, GLM, GLM
  - Continuing current a key parameter in fire ignition from lightning.
  - GLM has the capability to detect continuing current.

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Purpose and Goals

- Can we use modeled information of the land surface and characteristics of lightning beyond flash occurrence to increase the identification and prediction of wildfires?

- The goals of this study are to:
  - Combine observed cloud-to-ground (CG) flashes with real-time land surface model output, and
  - Compare data with areas where lightning did not start a wildfire to determine what land surface conditions and lightning characteristics were responsible for causing wildfires.

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The First Hurdle: Fire Reporting

- Like severe storm reports, fire reports have their challenges for specific timing and location.

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A Tale of Two Searches

Fire Radius

	total percentages	
	IC+CG	CG Only
Percent of ltng fires	0.83	0.77
Percent of ltng fires before report date	0.81	0.75

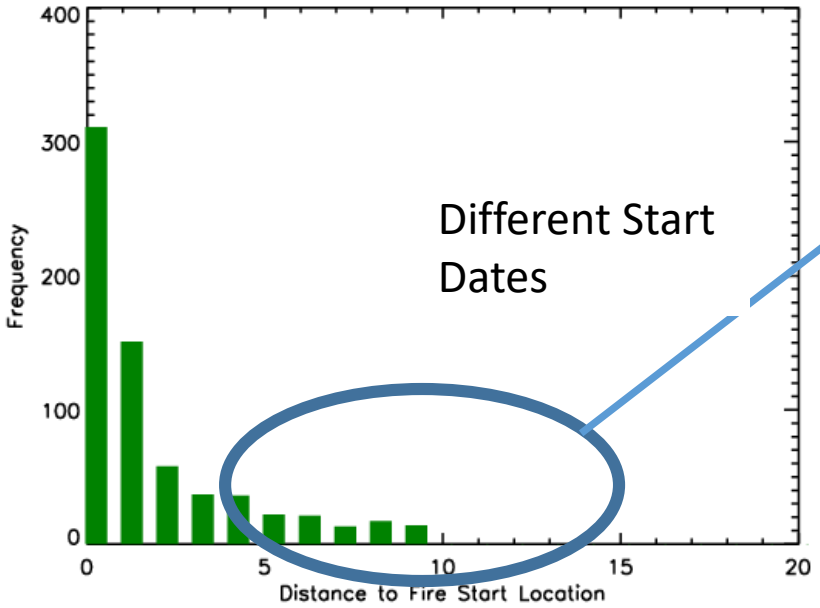
Fixed Radius

total percentages		All Flashes			
10 km	5 km	2 km	1 km	0.5 km	0.25 km
93%	89%	68%	46%	27%	9%
88%	77%	60%	40%	23%	8%

*Searches for these tables went 14 days back from the start date and 14 days ahead of the start date to find corresponding flashes.

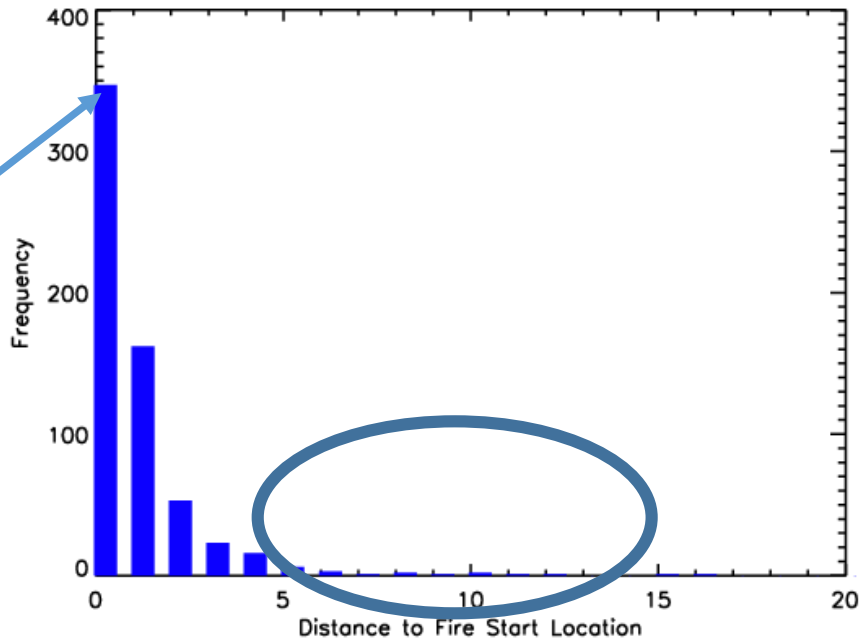
Fire Start Location Error

Fixed 10 km radius



Different Start Dates

Fire Radius

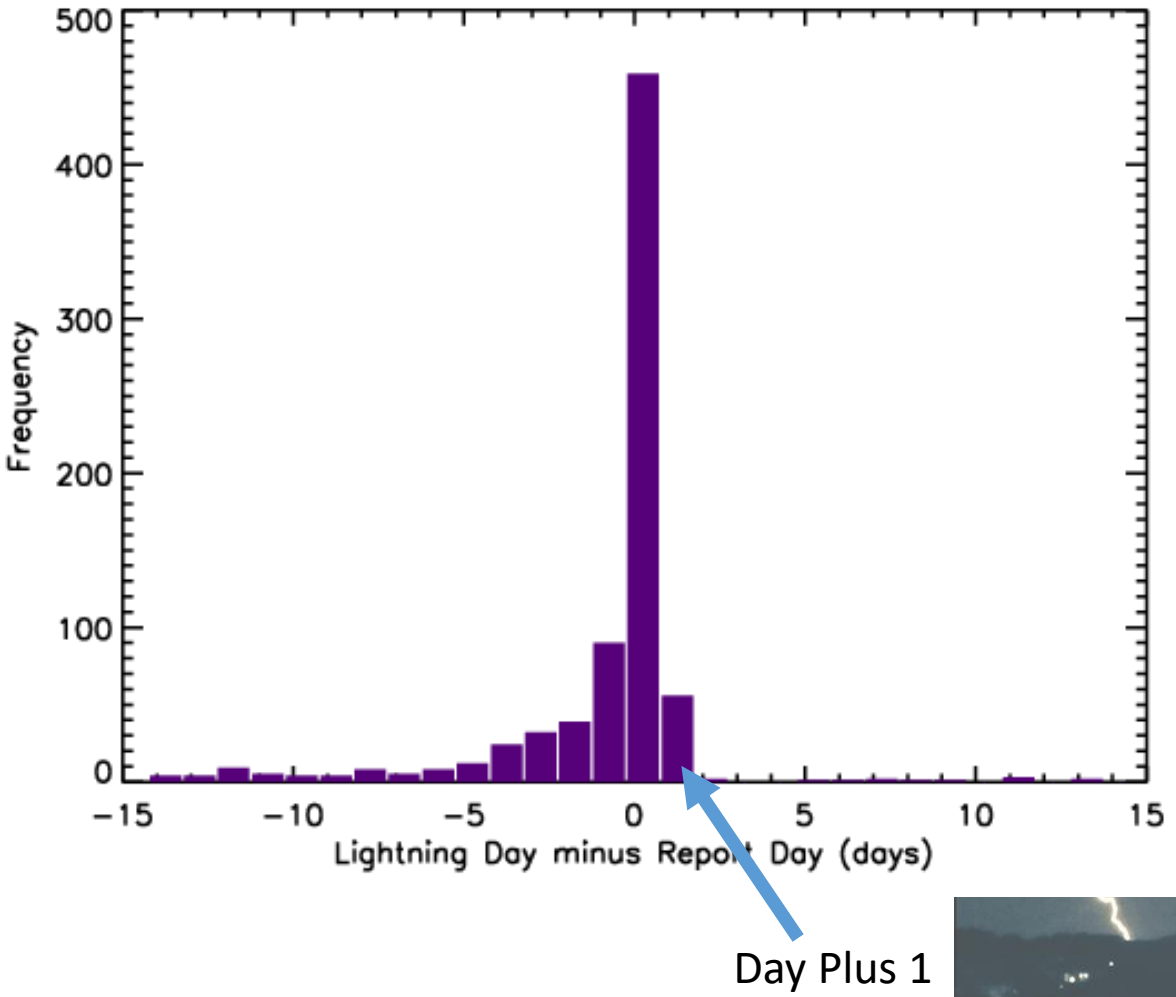


Based on the literature of the NLDN, the 95-98thth percentile distance error is between 5-6 km. 75th percentile distance error is around 1.6 km.

Fixed search radius assigning lightning events not associated with the fire itself.
- Distance to the fire start point is greater than the size of the fire.

Distribution of Fires in Time – Fire Radius Method

	IC+CG	CG Only
-14	0.44%	0.33%
-13	0.44%	0.22%
-12	0.99%	0.88%
-11	0.55%	0.55%
-10	0.44%	0.44%
-9	0.44%	0.44%
-8	0.99%	0.66%
-7	0.55%	0.44%
-6	0.88%	0.22%
-5	1.33%	0.88%
-4	2.76%	2.54%
-3	3.76%	3.43%
-2	4.53%	3.87%
-1	10.83%	10.17%
0	52.38%	50.17%



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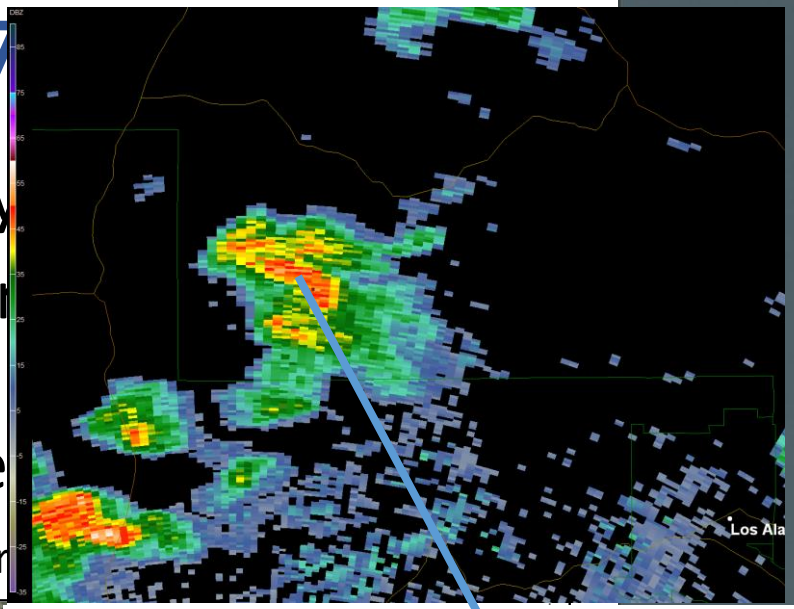
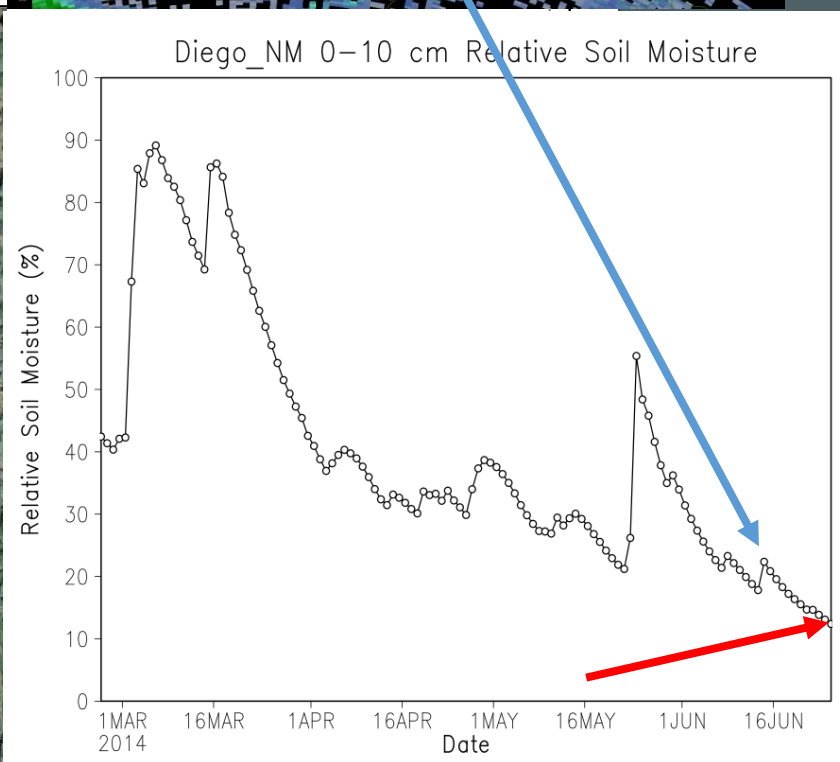
The other 7

- Closest flash is before 14 day
- Some are misreported – mor started
- Some have the wrong day (e



Closest lightning to fire start

Star



Conclusions

- Somewhere between 83% and 93% of lightning initiated fires can be associated with lightning within a 14 day period near fire start.
  - Sources of missing events:
  - Incorrect day
  - Incorrect cause
  - Missed flash
  - Holdover events that last longer than the 14 day window
- Approximately 52% of events occur on the same day as they are reported.
  - An additional 10% occur the day before
  - 77% of lightning flashes that are best associated with the fire occur within 7 days of the report date.
- The fire start location will be misreported