Evaluation of Lightning Safety Metrics Using Spatial Information from Lightning Mapping Technology

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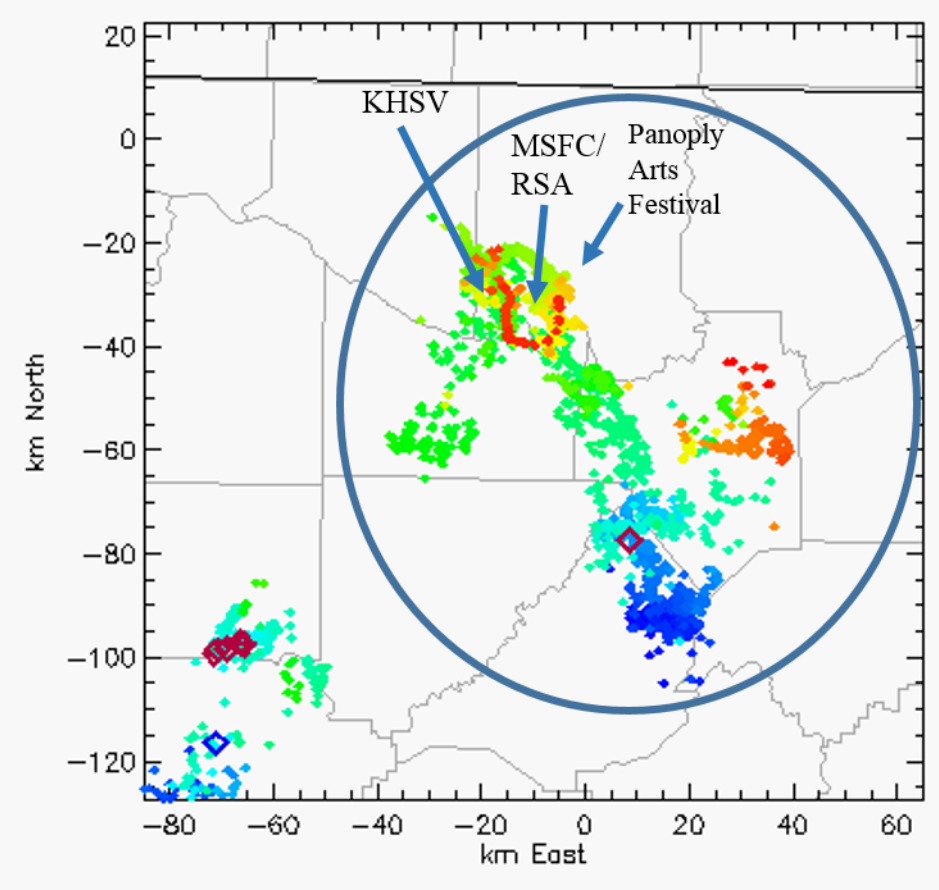
Our motivation…



There were several instances where the MSFC Emergency Operations Center would hear thunder, but nothing would appear in their commercial weather software.

They wanted an idea of how often this occurs in their area and the types of storms that produce these events.

Left - An example where lightning directly impacts MSFC (colored dots), but no detections by the commercial lightning systems (diamonds) that are used by TV or smart phone apps are within 50 km of MSFC.

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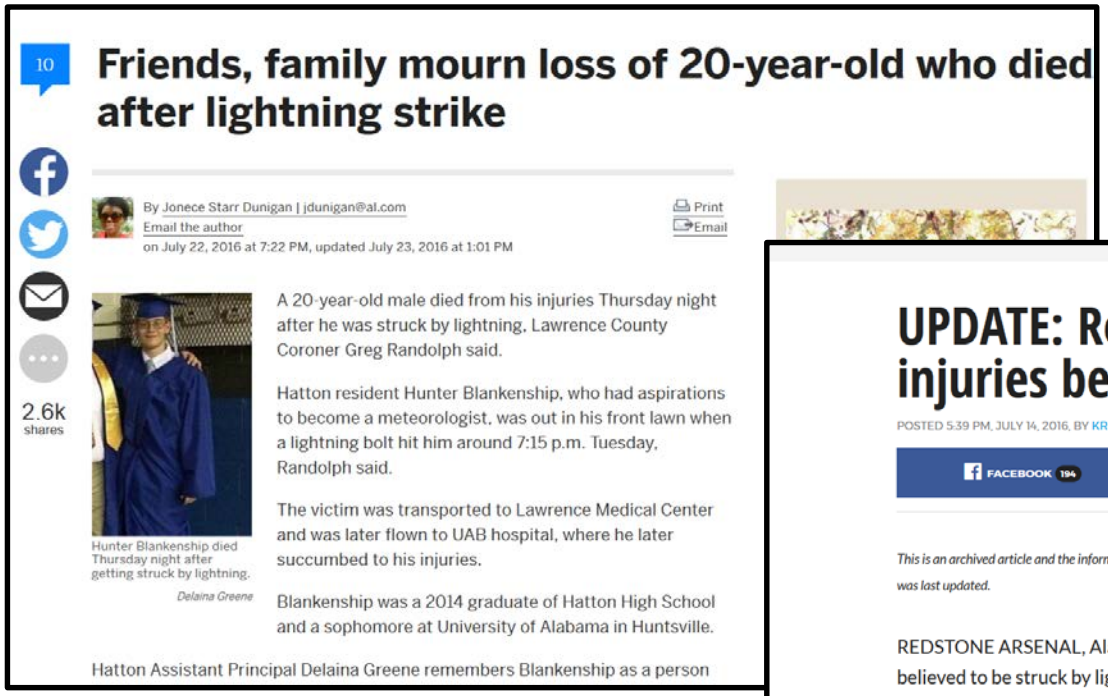
A second motivation, two fatalities that were close to home…



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Friends, family mourn loss of 20-year-old who died after lightning strike

By Jonece Starr Dunigan | jdunigan@al.com
Email the author
on July 22, 2016 at 7:22 PM, updated July 23, 2016 at 1:01 PM

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Hunter Blankenship died Thursday night after getting struck by lightning.
Delaina Greene

A 20-year-old male died from his injuries Thursday night after he was struck by lightning, Lawrence County Coroner Greg Randolph said.

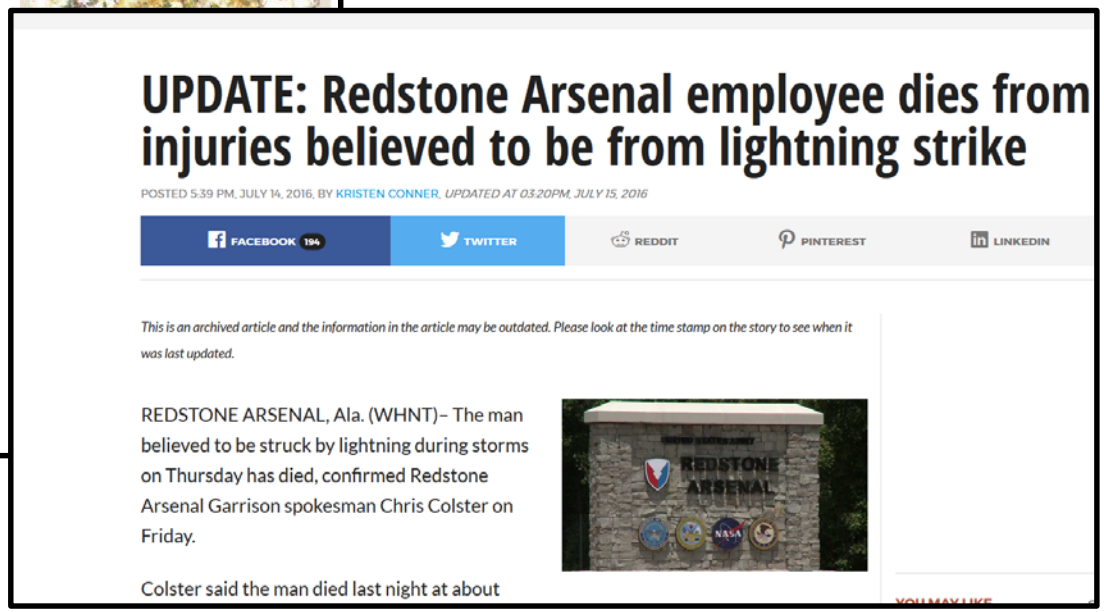
Hatton resident Hunter Blankenship, who had aspirations to become a meteorologist, was out in his front lawn when a lightning bolt hit him around 7:15 p.m. Tuesday, Randolph said.

The victim was transported to Lawrence Medical Center and was later flown to UAB hospital, where he later succumbed to his injuries.

Blankenship was a 2014 graduate of Hatton High School and a sophomore at University of Alabama in Huntsville.

Hatton Assistant Principal Delaina Greene remembers Blankenship as a person

Struck by a bolt from the blue while watching a thunderstorm pass by his home. It was not raining at his location.



UPDATE: Redstone Arsenal employee dies from injuries believed to be from lightning strike

POSTED 5:39 PM, JULY 14, 2016, BY KRISTEN CONNER, *UPDATED AT 03:20PM, JULY 15, 2016*

FACEBOOK 194 TWITTER REDDIT PINTEREST LINKEDIN

This is an archived article and the information in the article may be outdated. Please look at the time stamp on the story to see when it was last updated.

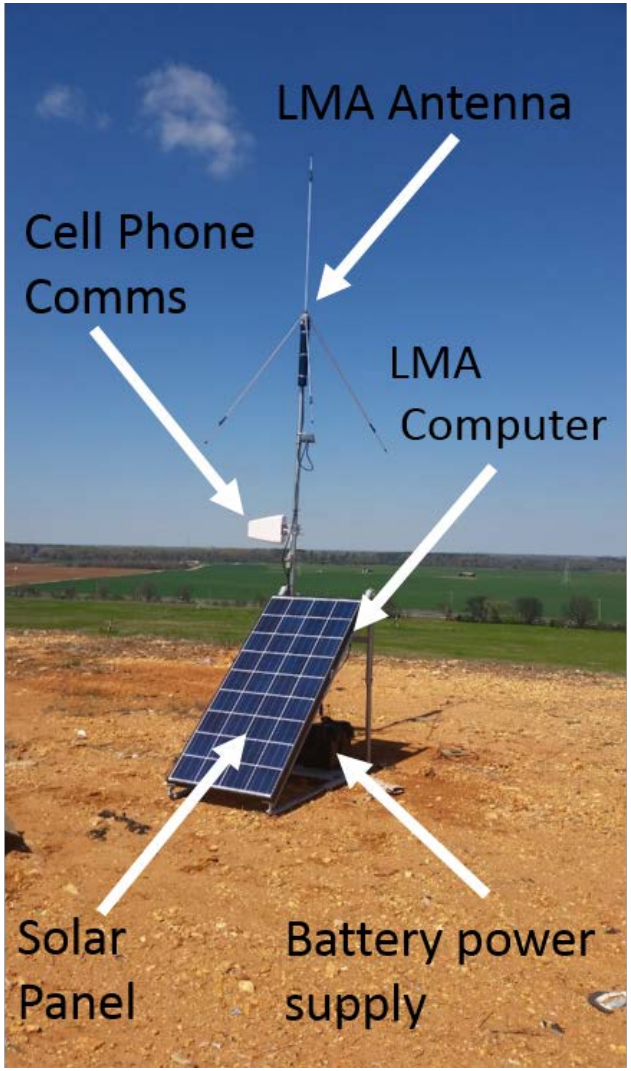
REDSTONE ARSENAL, Ala. (WHNT)– The man believed to be struck by lightning during storms on Thursday has died, confirmed Redstone Arsenal Garrison spokesman Chris Colster on Friday.

Colster said the man died last night at about

Working on roof and waited until it was starting to rain at the location to start shutting down operations in spite of thunder and lightning in the area for over 30 minutes.

…and both were preventable.

The Experiment



- We utilized 13 years of LMA data from North Alabama (NALMA) and the NLDN total and CG data.
  - 2003-2015, 1298 days
- Three range criteria were used for the assessment
  - 9, 16, and 32 km
- The NALMA flash time was subtracted from the NLDN flash time to compute the lead time for each range ring.
  - One experiment used CG only data to replicate MSFC lightning procedures
  - The second focused in between 2008 and 2015 to understand the impact of the IC data (e.g., Holle et al. 2016).

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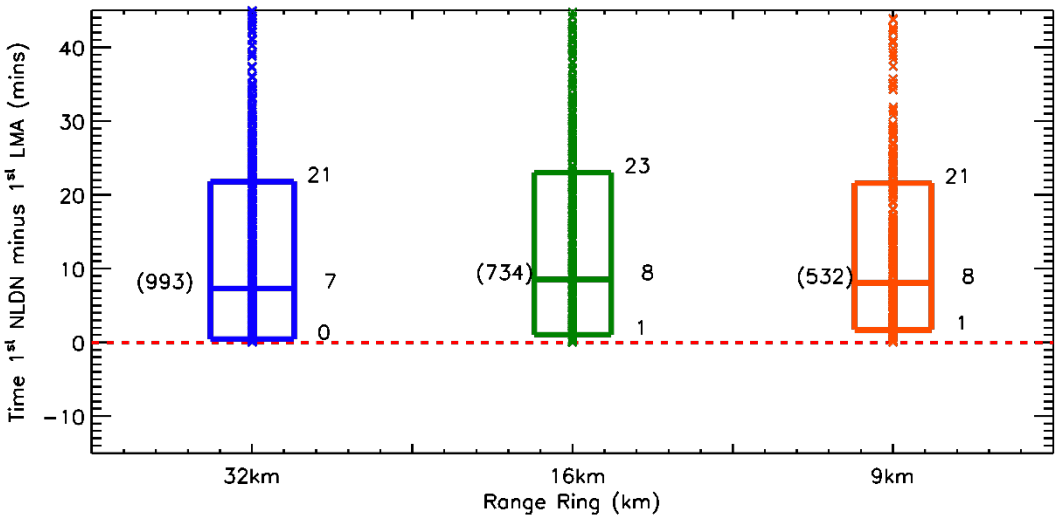
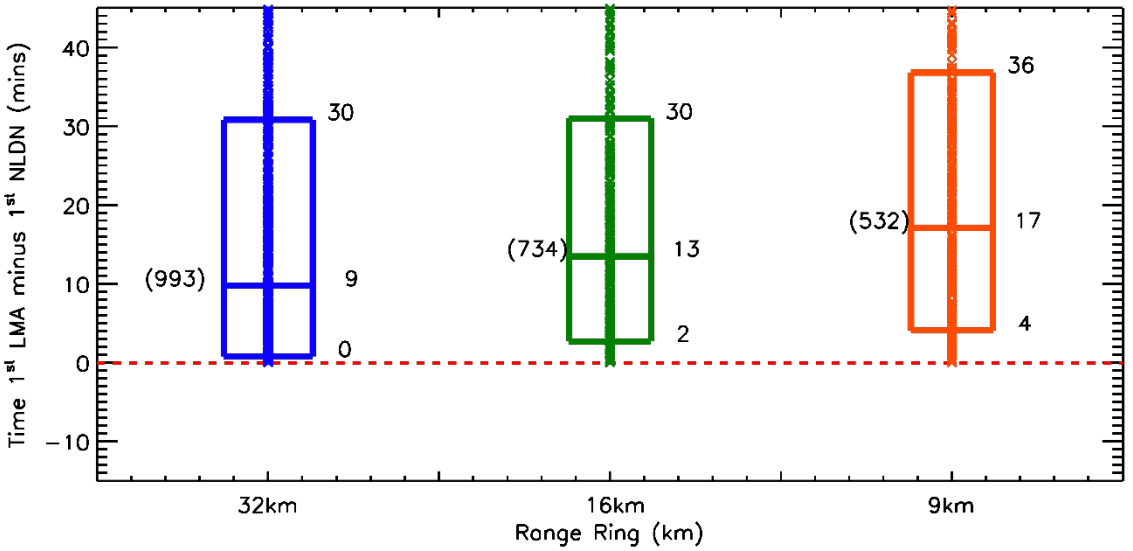
Additional Lead and Down Time (CG only)



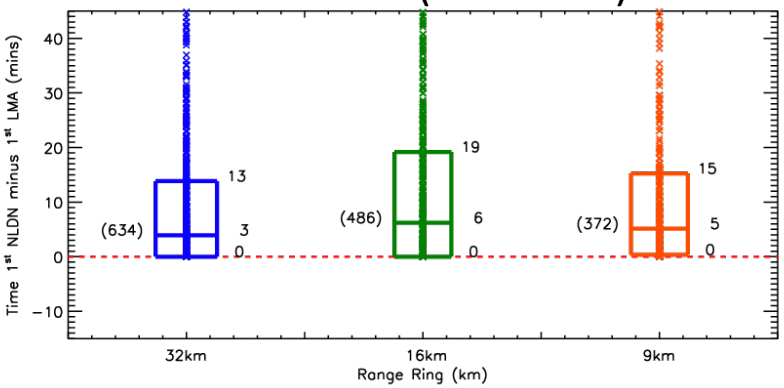
Additional Lead Time the NALMA provides vs CG only data.
(CGtime-LMAtime)

Additional Down Time incurred by the use of NALMA vs CG only data (LMAtime-CGtime)

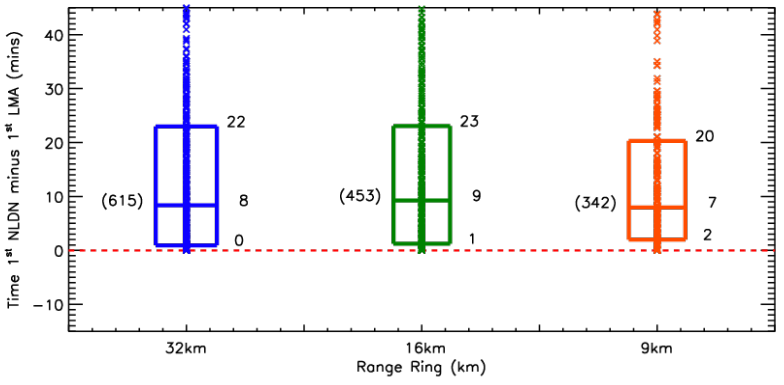


Additional Lead and Down Time (IC and CG, 2008-2015)

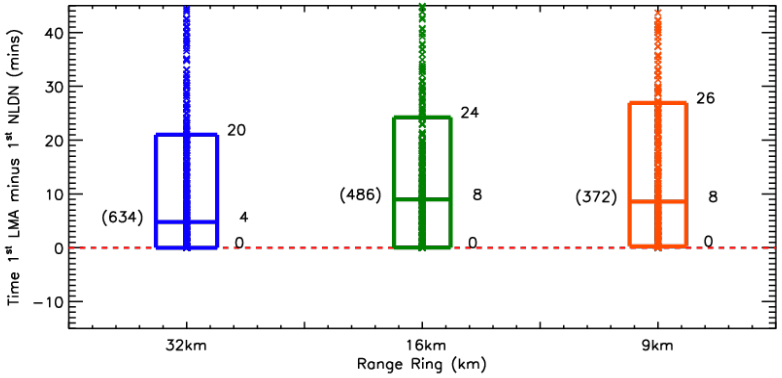
IC+CG (lead time)



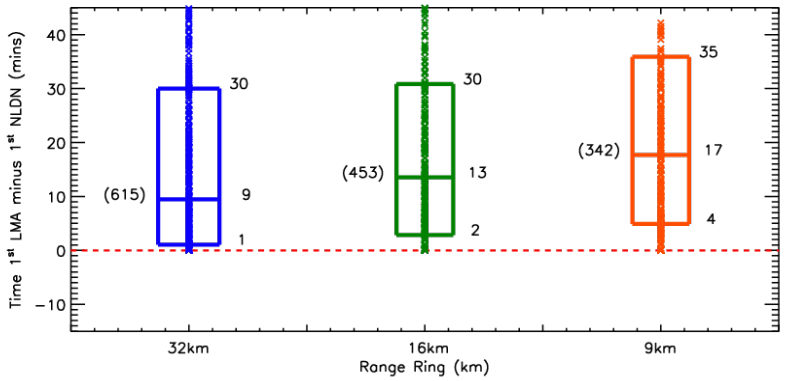
CG only (lead time)



IC+CG (down time)



CG only (down time)



Inclusion of the IC data reduces the extra lead time by 3-5 minute. Areal information from LMA provides approximately 5-6 minutes of extra lead time.

Impact on Total Lightning to EOC Operations

Schultz, C. J., G. T. Stano, P. J. Meyer, B. C. Carcione, T. Barron, 2017: Lightning decision support using VHF total lightning mapping and NLDN cloud-to-ground data in North Alabama. *J. Operational Meteor.*, **5** (11), 134-145, doi: https://doi.org/10.15191/nwajom.2017.0511

Lightning Decision Support Using VHF Total Lightning Mapping and NLDN Cloud-to-Ground Data in North Alabama

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(Manuscript received 19 December 2016; review completed 8 May 2017)

ABSTRACT

This study focuses on lightning safety applications at NASA's Marshall Space Flight Center in preparation for the use of new Geostationary Lightning Mapper data once operational in 2017 from GOES-16. A total of 13 years of North Alabama Lightning Mapping Array and National Lightning Detection data are analyzed for lightning safety applications. Data are analyzed using three range ring criteria used by the Marshall Space Flight Center Emergency Operations Center for monitoring and warning on lightning hazards (32-km, 16-km and 9-km). Approximately 75% of the time, the total lightning observations from the North Alabama Lightning Mapping Array provide additional lead time on the first cloud-to-ground flash, with the 25th to 75th percentile of these lead times between 0 and 23 minutes. The use of NALMA also incurs additional downtime of up to 36 minutes versus the use of cloud-to-ground data alone. Seventy-nine percent of the time that lightning is detected by the lightning mapping array in the 16-km range ring, lightning also is observed to impact Marshall Space Flight Center directly. Thirty percent (309/1043) of these events inside the 16-km range ring do not contain a cloud-to-ground flash, but continue to pose a threat to personnel and property. Thus, the threat of lightning is likely under-realized to the public because safety criteria are often based on cloud-to-ground data alone. Minor seasonal differences in lead time are observed, with the most notable difference between autumn and winter,

http://nwafiles.nwas.org/jom/articles/2017/2017-JOM11/2017-JOM11.pdf

Provides an median of 8 additional minutes on the first cloud-to-ground lightning flash to MSFC EOC to warn MSFC personnel of the threat of lightning.

- Maximum lead time of 36 minutes

A total of 309 (of 1043) additional events were captured by the LMA where CG activity was not detected within the MSFC 16 km safety domain.

20% of the days, the first flash was a cloud-to-ground flash (i.e., zero lead time).

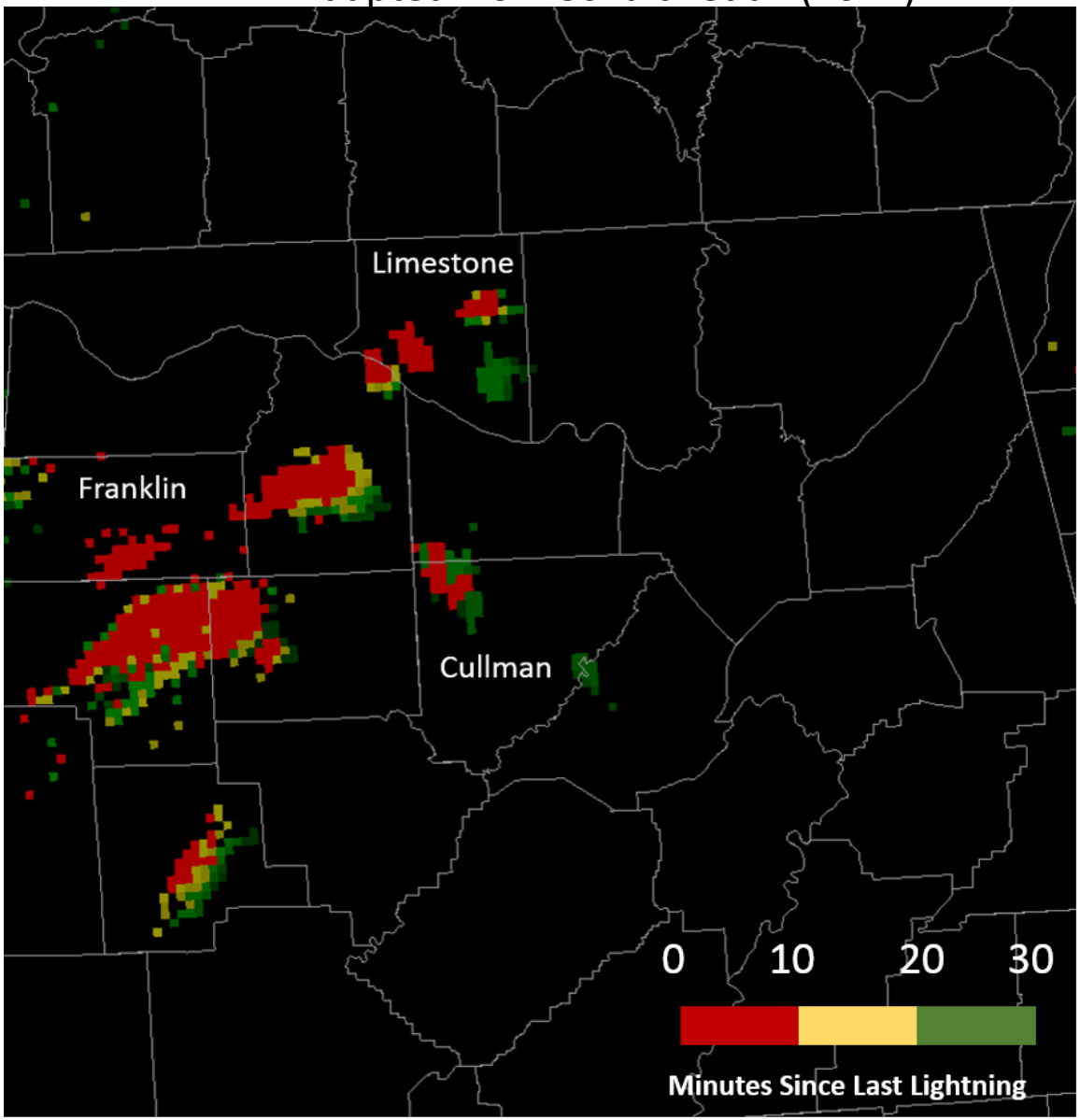
Inclusion of IC data from the NLDN increases lead time on CG only lightning safety criteria by 2-3 minutes. (supports Holle et al. 2016)

30 Minute Safety Product

Adapted from Schultz et al. (2017)

One can integrate the spatial information from the LMA to develop to help end users understand when lightning threat is ramping up or winding down.

Now that GLM is operational, how viable is the 30 minute window we are all accustomed to using?



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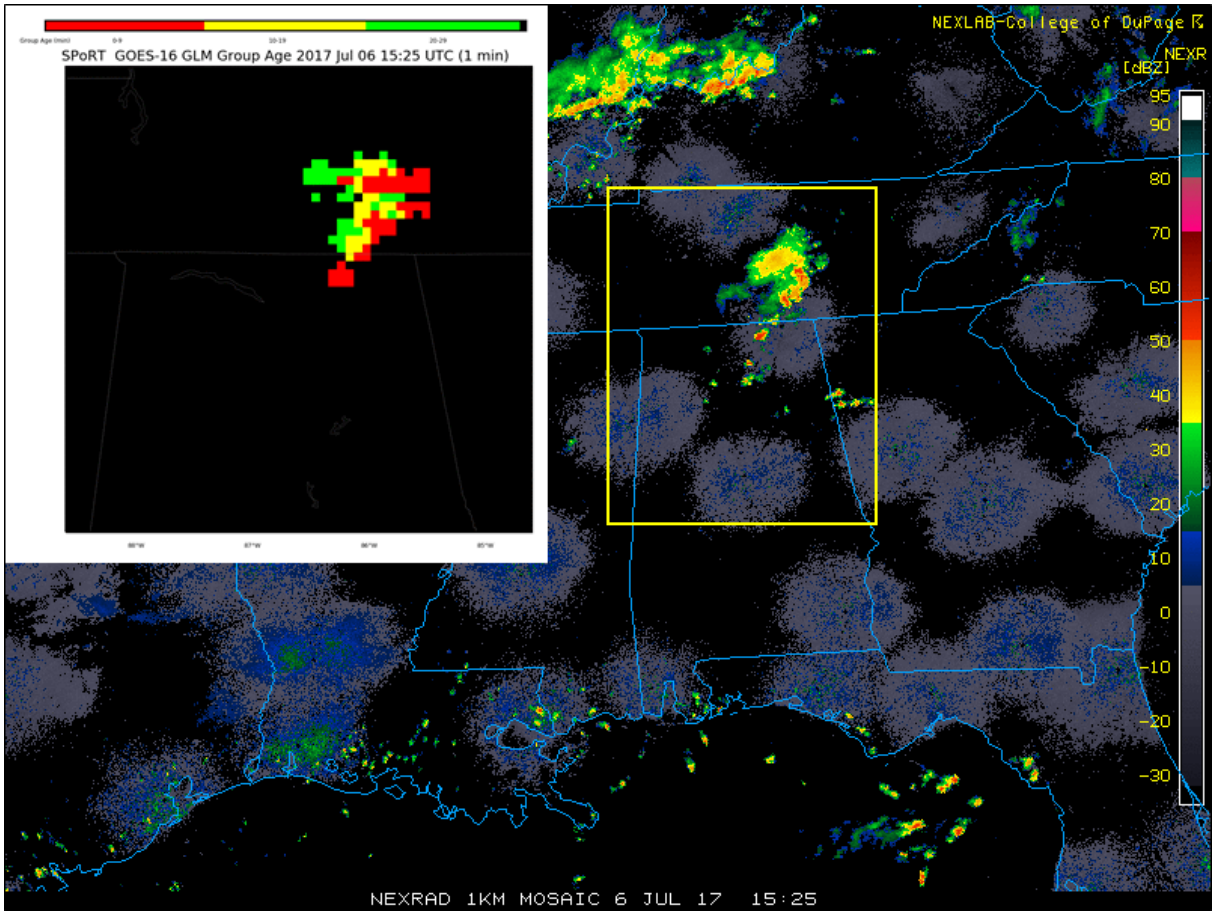
- We took 80 hours of GLM Validation Campaign data to determine the number of instances when the inter flash interval over a GLM pixel was between 30 and 45 minutes.
  - Each GLM pixel was considered an individual location similar to that of a decision maker like an emergency manager.
- Approximately 218 million GLM pixels that contained lightning were examined. Of those 218 million pixels, only 120,500 exceeded an interstroke interval of 30-45 minutes (0.000005%).

Our next steps are:

To characterize the events where the 30 minute interstroke interval was exceeded to determine storm type in these instances.

Test the display in the field with EOC partners at MSFC, in AL and TN.



Summary

- Areal information from systems like LMA were found to provide between 6 and 8 extra minutes of lead time on the first CG flash in the median.
  - IC information from the NLDN also provided an extra 2-3 minutes on the first CG flash
- Additional downtime will be incurred by moving away from the CG only approach that has been used for a long time.
- GLM data demonstrate that the 30 minute after last lightning rule used for lightning safety were only violated approximately 0.000005% of the time in the 80 hour GLM dataset used.

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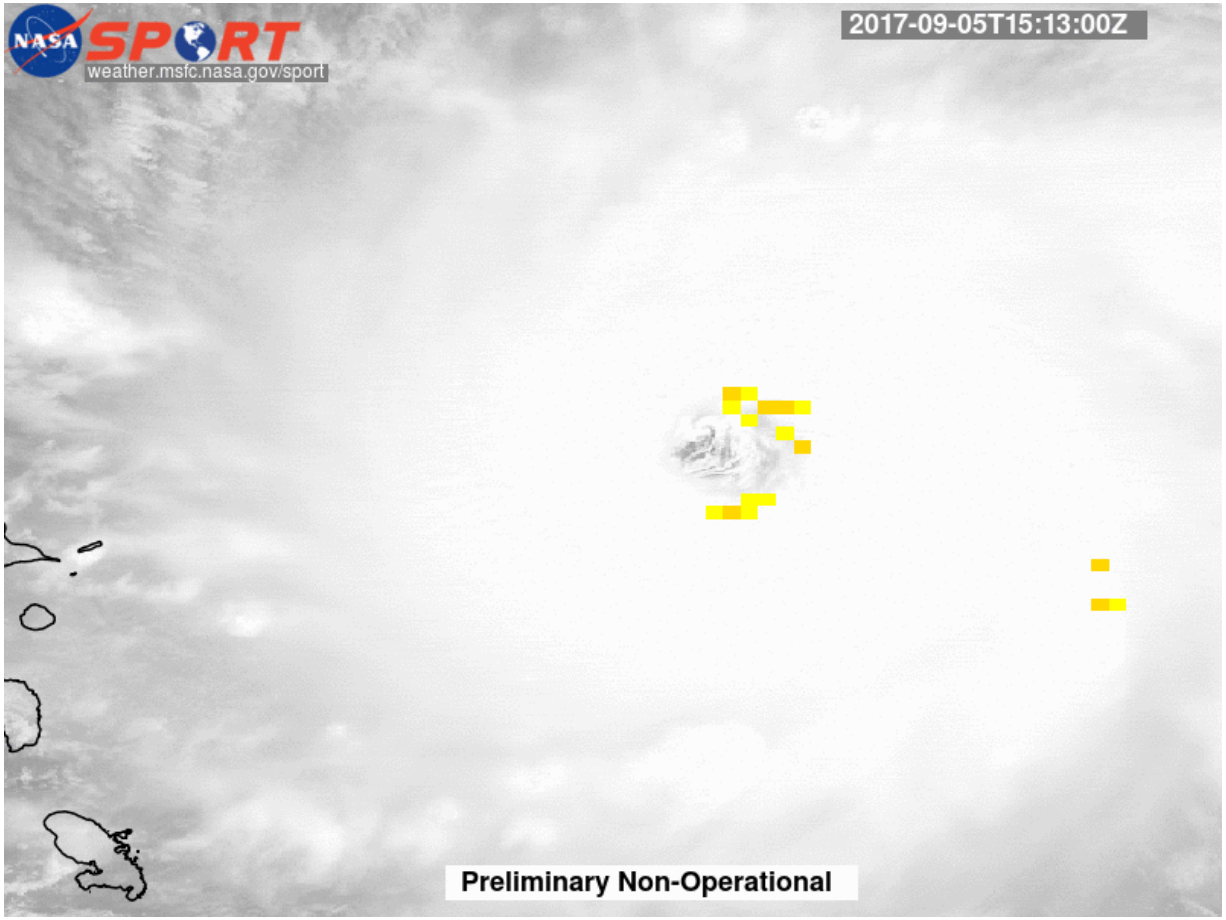
QUESTIONS?



GLM Data,
Hurricane Irma, 1513-1700 UTC, 5 September 2017