

GLM Observations of Extraordinary Lightning Including Two New World Lightning Records

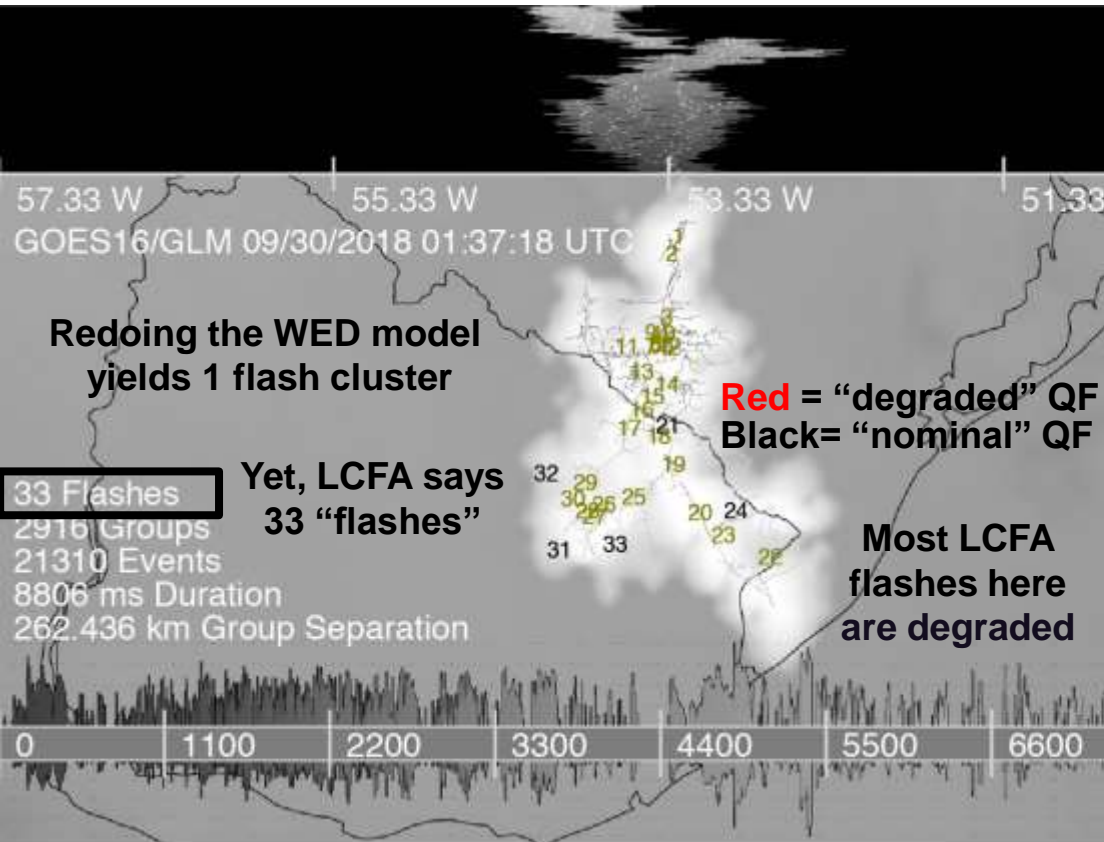


Michael J. Peterson



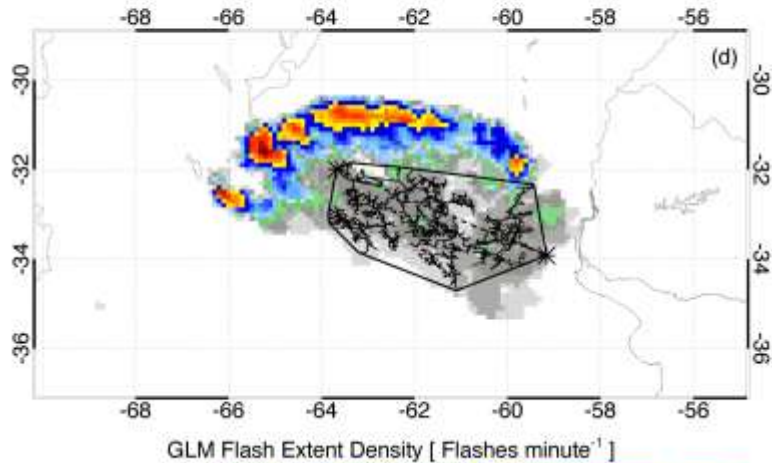
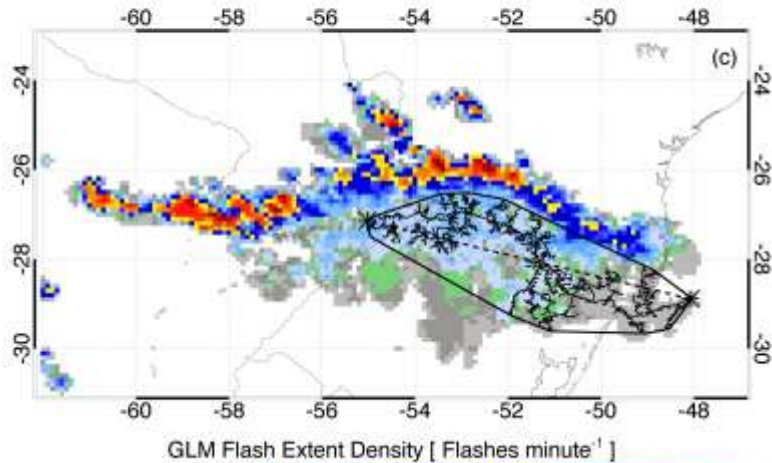
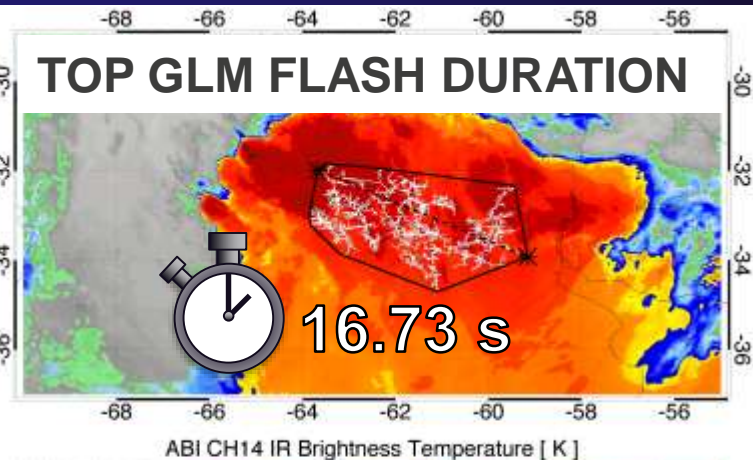
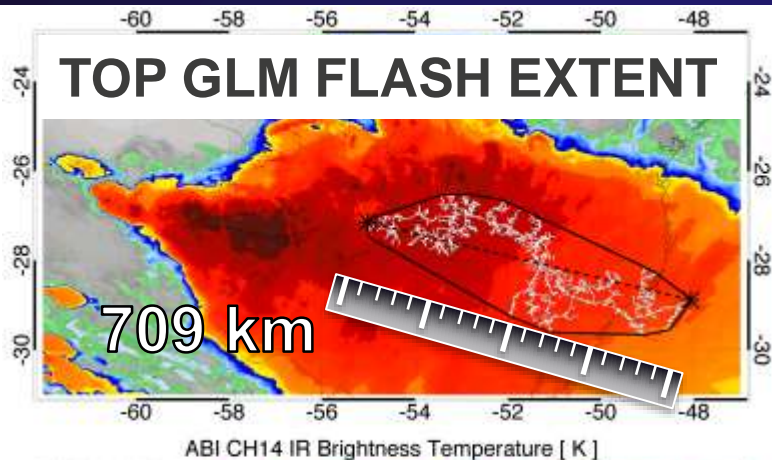
Managed by Triad National Security, LLC for the U.S. Department of Energy's NNSA

The Search for Extraordinary Lightning Starts with Repairing the Operational GLM Flash Clusters



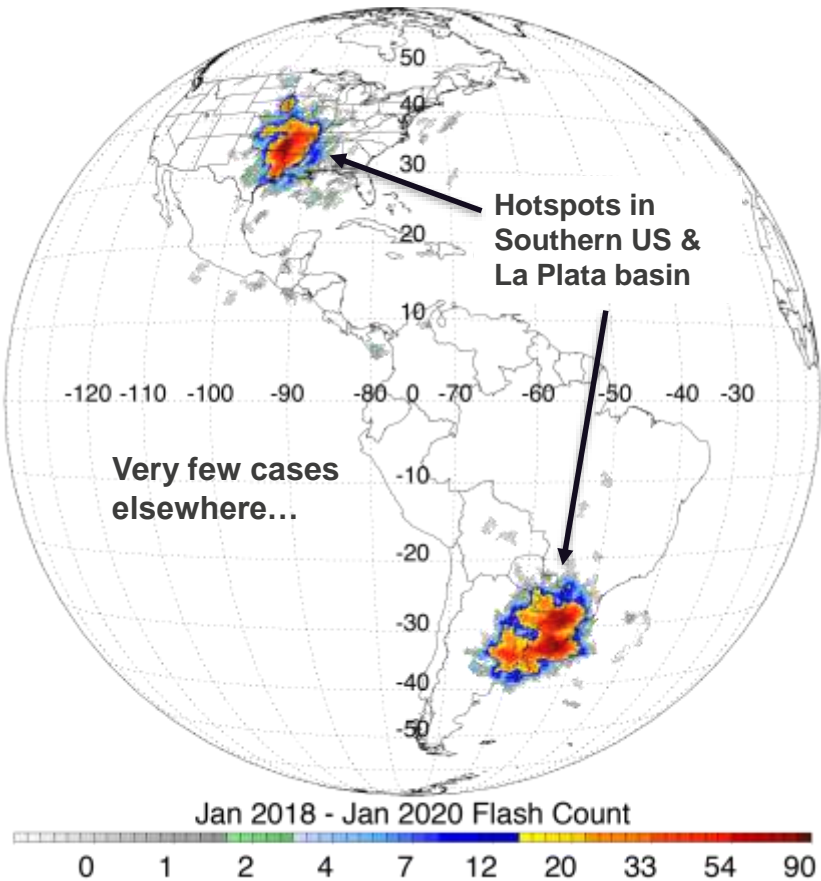
- Continuous GLM observations permits detection of rare flashes
- However, hard thresholds in the LCFA split complex flashes in the cluster data and gridded products
 - After 101 groups, the flash is terminated and marked as "degraded"
 - A new separate flash then begins
- GLM data is reprocessed to repair flash cluster splitting, and this has led to the discovery of some extraordinary lightning

The Global Lightning Extremes are now Exceptional GLM Megaflashes

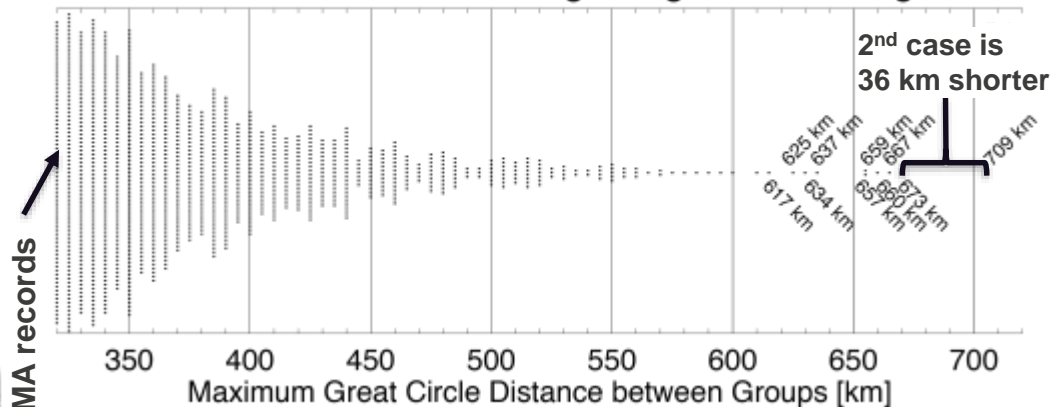


GLM More than Doubles Previous Lightning Records and Identifies Key Hotspot Regions for Extreme Flashes

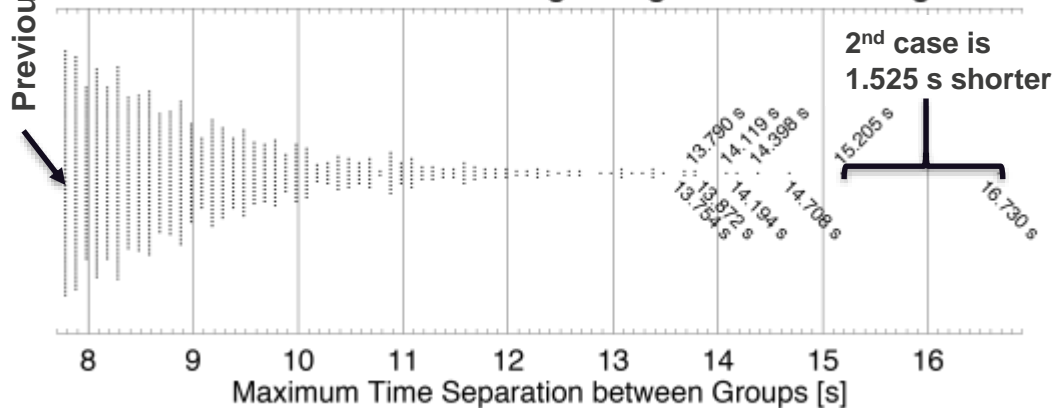
GLM >321 km or 7.74 s Flash Extent Density



GOES16 GLM Mesoscale Lightning Extent Histogram



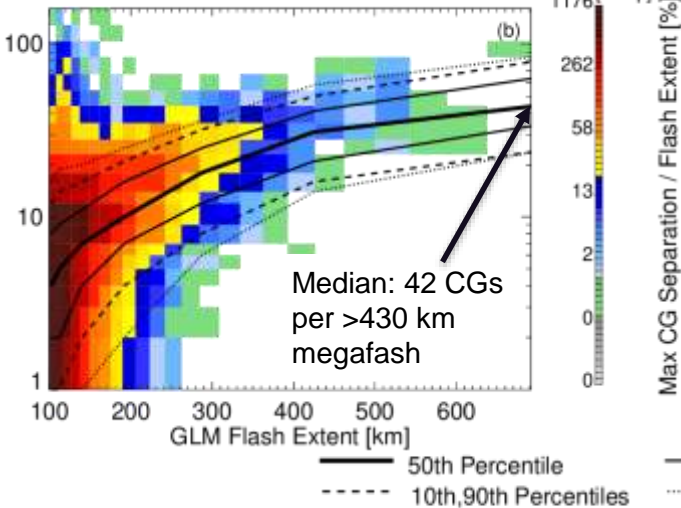
GOES16 GLM Mesoscale Lightning Duration Histogram



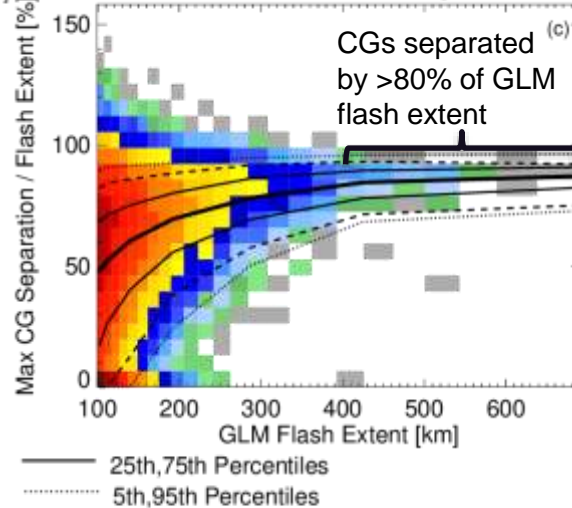
Previous LMA records

Large Megaflashes Pose a Unique Lightning Hazard and Are Also Associated with Intense Lightning Superbolts

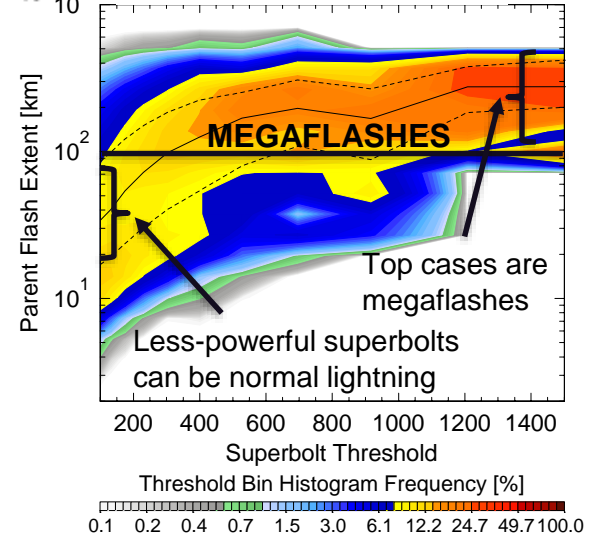
Megaflash ENGLN CG Count



Megaflash CG Max. Separation



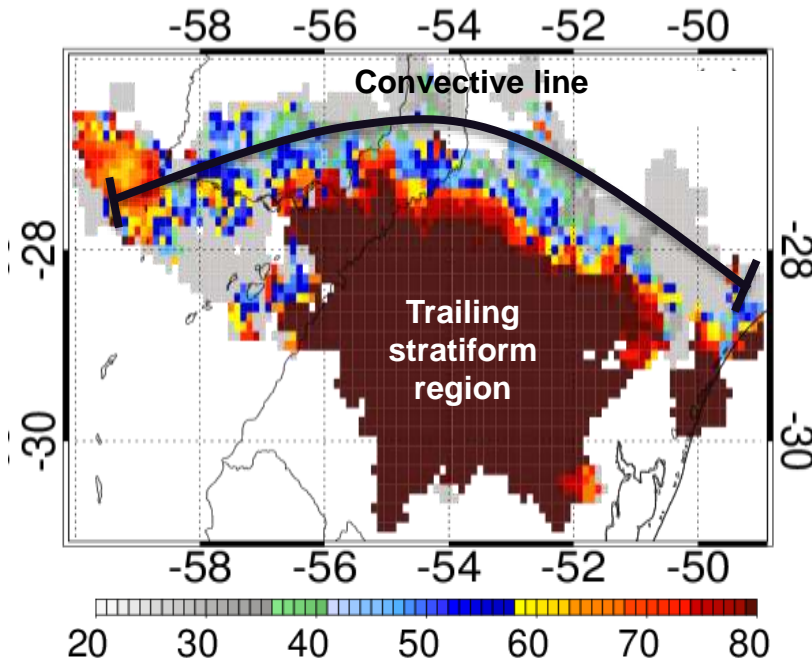
Superbolt Flash Extent



- Megaflashes can individually put down up to **100 CGs**
 - Larger megaflashes more likely to have more CGs - **greater per-flash impact to the public**
 - CGs in larger megaflashes occur over 80% of the flash extent – **there is no safe place**
 - Megaflashes can be only lightning in the previous hour – **the 30/30 rule doesn't apply**
- Megaflashes often generate optical lightning superbolts
 - Most of the brightest superbolts come from megaflashes, usually high peak current +CGs

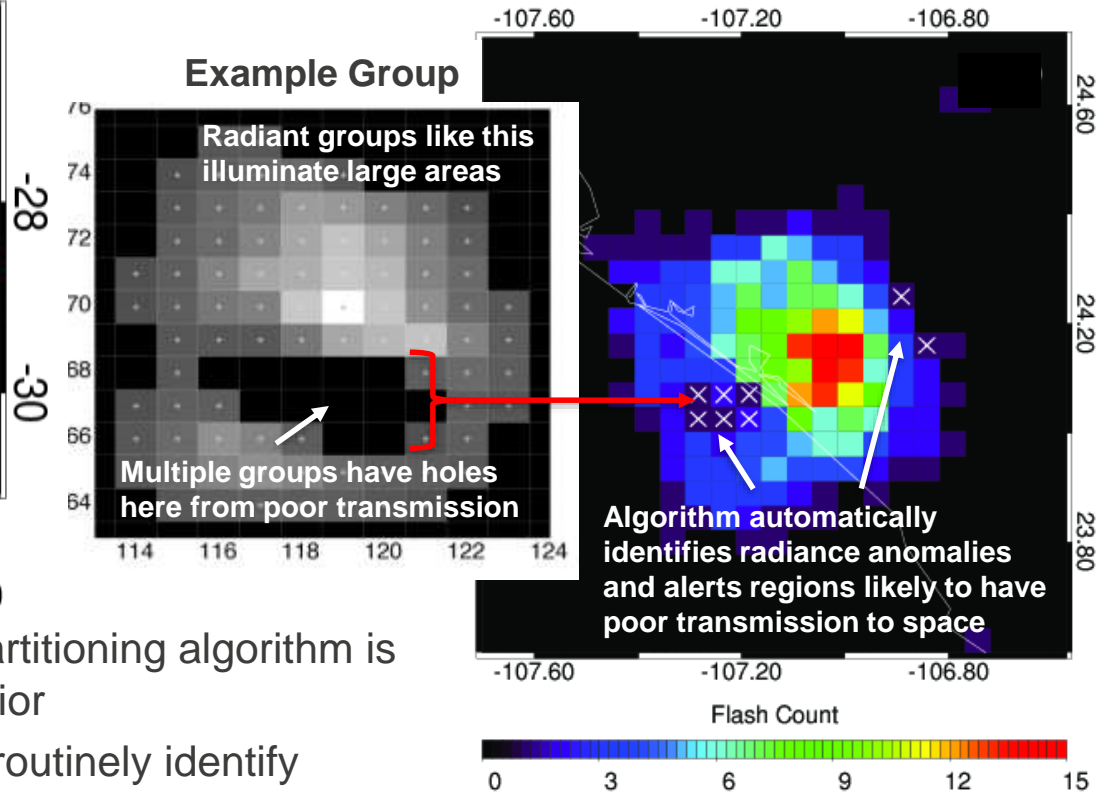
Current and Future Work is Exploring what Optical Lightning Signals Reveal about Thunderclouds

GLM Non-Convective Cloud Probability [%]



- A convective / non-convective partitioning algorithm is developed based on flash behavior
- Spatial radiance data is used to routinely identify poorly-transmissive clouds

Flash Extent Density (color contour) & Poorly-Transmissive Cloud Alerts (X's)



Questions?

