Utilizing Sub-Flash Properties of GLM to Monitor Convective Intensity with Probabilistic Guidance

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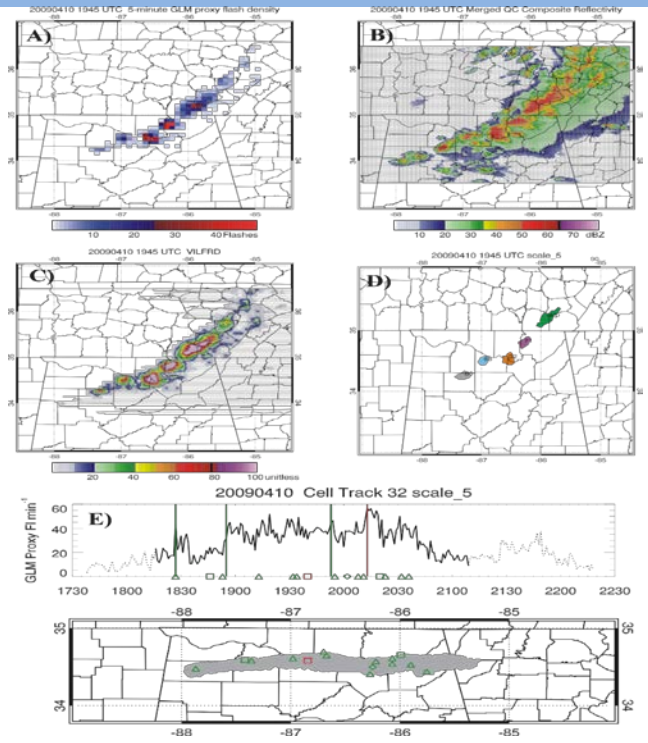
This project takes sub-flash properties of GLM (events, groups, flash energy, flash size) to enhance the flash based lightning jump algorithm for severe weather prediction and environmental monitoring in to transition new data to operations and provide additional relevant information on severe/intense thunderstorms. This project will also deliver a lightning/radar fused tracking algorithm that will allow for tracking of convective features throughout the GOES-16 FOV. The end result is a lightning jump algorithm that monitor convective intensity/severity independent of radar by using properties of lightning that are directly tied to the updraft and microphysical state within any thunderstorm.

- The main question this work proposal wants to answer: ***Does inclusion of sub-flash properties from GLM (e.g., GLM events, groups, radiances, area) improve the performance of a LJA versus the traditional use of only flash rate information*****?**
  - Sub-flash properties like radiance and area are directly related to thunderstorm updrafts and charge generation, but have yet to be proven that they are more effective than flash rate for severe storm monitoring.
- **Main goals and steps to obtain goals:**
  - Demonstrate additional utility of using sub-flash properties in the lightning jump algorithm.
  - Provide fully automated thunderstorm tracking to monitoring lightning trends in all thunderstorms within the GOES-16/GOES-S field of view for severe storm identification.

1. Case study and large sample analysis on GOES-16 mesoscale sectors to determine how sub-flash properties can enhance the lightning jump algorithm.
2. Evaluate storm tracking on GLM alone in case radar data not available (e.g., oceans) for maximum utility of tracker.
3. Refinement of current operational LJA to incorporate sub-flash properties in algorithm for severe storm identification.
4. Incorporation of new algorithm/tracking into MRMS framework and/or integration with ProbSevere model.



Above: An example of the fused GLM/radar tracking methodology adapted from Schultz et al. (2016) with lightning jump algorithm output. a) 5-min GLM proxy gridded flash density, b) merged composite reflectivity, c) Vertically Integrated Liquid Flash Rate Density (VILFRD) combined radar and lightning product, and d) tracked storm clusters at scale 5 at 1945 UTC on 10 Apr 2009. e) Top panel: Lightning flash rate time series for cell 32 with the timing of lightning jumps depicted by green (hit) and red (false alarm) vertical lines, light gray flash rate (i.e., 1730-1815 and 2120-2230) depicts the time the cluster was outside of the 125 km LMA range. Bottom panel: Cluster footprint with storm reports (green = hit, red = miss) for the current LJA from 1730-2230 UTC.