The GOES-R GLM Lightning Jump Algorithm (LJA): Research to Operational Algorithm

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Objective

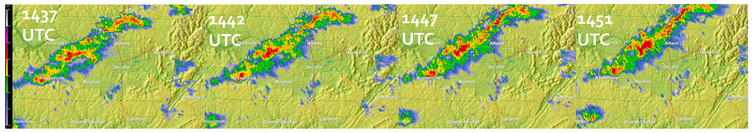
To refine, adapt and demonstrate the LJA for transition to GOES-R GLM (Geostationary Lightning Mapper) readiness and to establish a path to operations

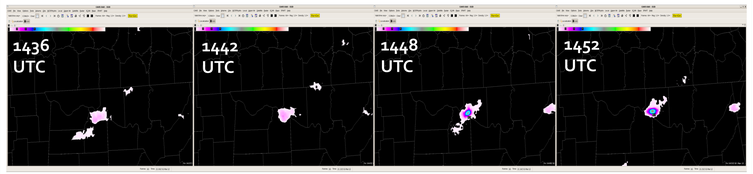
Year 1 Goals

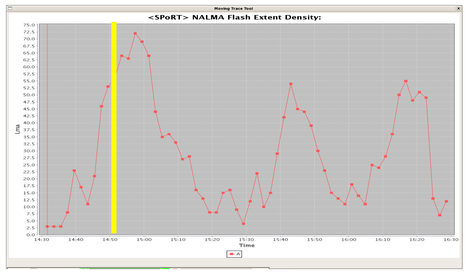
- Reducing risk in LJA algorithm automation,
- Cell tracking,
- GLM lightning proxy and data fusion

Situational Awareness

March 2, 2012

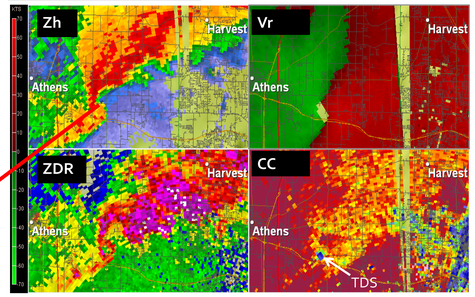




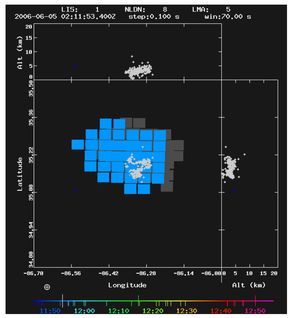


1451 UTC – Forecaster notes increase in lightning
- NWS Huntsville Issues Warning
- First reports of severe weather 1520 UTC
- Debris signature observed on ARMOR at 1513 UTC
- Lead time on event 19 minutes (touchdown 1510)

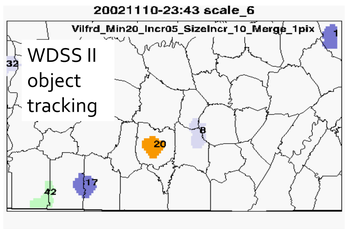
19 Minute lead time on first report of severe weather.
- Similar to avg. lead time in Schultz et al. (2011)

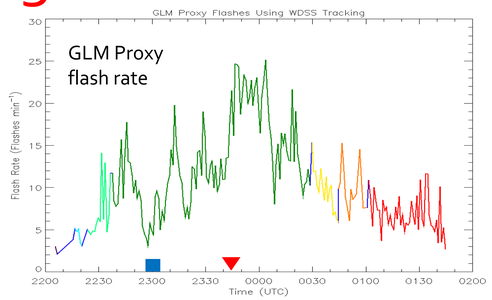


GLM Proxy and Cell Tracking

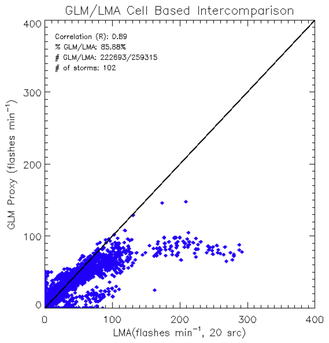


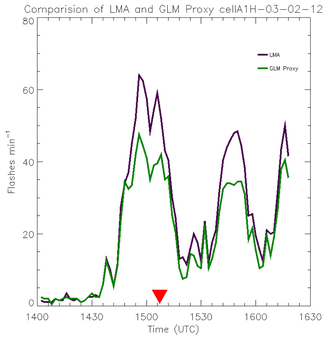
- Observations from LMA ≠ GLM
  - Different instrument
  - Different observation
    - Optical vs VHF
  - Different part of flash
- GLM Proxy flash count is ~86% of the LMA flash count (102 storms; lower left)
- GLM flash rates have a ceiling at ~100 flashes per minute (lower left)
- Correlation is strong but non - linear
  - R= 0.89
- Trends still present in GLM proxy data (e.g., below)





- Schultz et al. '09, '11 studies used TITAN, with manual changes when needed
  - Storm splits, mergers
  - Cells change shape/size
- Ultimate goal: Incorporate LJA into an accurate objective tracking system using GLM proxy.

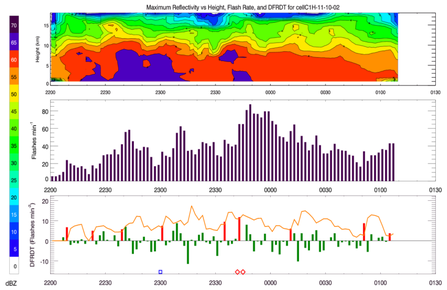




WDSS-II changes storm ID a few times during lifecycle of storm (color changes in flash rate plot, upper right)

Importantly, the track is maintained during the period which the storm is most hazardous (~2300 -0030 UTC)

Jump time in GLM data correspond well with lightning jump times from Schultz et al. (2011) (lower right)



Accomplishments to Date

- Recent work Published in WAF (Schultz et al. 2011)
  - 711 storms, POD 79%, FAR 36%, avg. lead time 20.65 mins
- Developing LJA as an automated objective system
  - Began adaptation of LJA (rules, thresholds) to GLM proxy and multi-sensor object tracking improvements
  - Investigated environmental controls on LJA for identification and mitigation of known LJA biases during low topped convection
  - Explored fusion of LJA with radar products
- Improving multi-sensor (GLM proxy, radar) cell (object)-oriented tracking
  - Optimized current WDSS-II/K-means cell tracking algorithm to reduce tracking ambiguity for LJA
- Refining and developing GLM lightning proxy database
  - Transformed VHF-based NA-LMA to optical lightning proxy using LIS and statistical-physical methods
  - Developed representative proxy lightning (e.g., GLM resolution, 8 km) for 20 events (100's of cells) from 2002-2010 over NA-LMA
- Participating in NOAA Lightning Jump Test (LJT)
  - Assisted with implementation of Schultz et al. (2009, 2011) LJA on VHF-based flash data at LMA-native (non-GLM) resolution

Year 2 Objectives

- Complete LJA modifications
  - Finalize optimal thresholds and logic for representative GLM optical-proxy data at GLM resolution
  - Develop LJA Algorithm Theoretical Basis Document (ATBD)
- Merge LJA with ongoing WDSS-II cell tracking
  - Test LJA within cell-tracker in post event "real-time" simulations
  - In collaboration with Carey, Feltz, Bedka GOES-R3 Aviation Project, adapt LJA and cell tracking system to improve GLM/ABI-based hazard products for aviation routing
- Begin initial planning for Proving Ground (PG) demonstration of GOES-R GLM optical-proxy LJA
  - User interactions and feedback within NASA SPoRT and local NWS offices
- Continue participation in NOAA Lightning Jump Test (LJT)

Expected Outcomes Year 3

- Test LJA/Cell-tracker/GLM proxy system in Proving Ground (PG) and local WFO's
  - Make improvements to LJA, Transition to PG, AWIPS II plugin
- Develop training materials
  - Educate end users on LJA strengths/weaknesses, situational awareness
- Explore LJA in multi-sensor/multi-parameter forecaster methods and algorithms