WHAT IS TOTAL LIGHTNING & WHY IS IT USEFUL?

What is Total Lightning?
- Total lightning is the combination of CG and IC lightning
- NGLMA observes lightning “sources”, short sections of the lightning flash path (Fig. 3)
- Majority of all lightning is IC flashes, not CG (Fig. 4)
- Total lightning detection complements radar and CG detection systems,

Why is Total Lightning Useful?
- Observes IC flashes that other CG detection networks cannot
- IC lightning often precedes the first CG strike by several minutes
- Rapid increase in total lightning indicates a storm likely to produce severe weather in 5-15 minutes.
- Can give a forecaster confidence to issue an early warning.
- Updates every minute vs. radar update time of 5 minutes

RESULTS

- Using both subjective visual analysis and the objective LJA, a lightning jump can be seen starting about 2034 UTC. Flashes/min increased from 28 at 2034 UTC to 93 at 2037 UTC.
- Two minute average flashes/min (used in the LJA) increased from 25.5 at 2034 UTC to 62.5 at 2036 UTC, when the LJA detected the jump.
- The lightning jump may have been helpful to NWS warning operators to confirm a warning was warranted, but it did not occur early enough to contribute to the warning decision.
- The peak in the flash rate coincided with the wind event, rather than preceding it as seen in earlier studies. (Goodman, et al. 1998, 2005)
- NGLMA observes the peak in total lightning may precede microburst by several minutes

ANALYSIS METHOD

- Archived NEXRAD Level III data was used to track the center of the cell from formation at 2023 UTC, through the LSR at 2040 UTC, until 2045 UTC.
- A 0.1° x 0.1° analysis box was drawn around the storm center to encompass the storm and determine the area in which lightning should be used for analysis. (Fig. 6)
- At each new radar scan, the storm center was used to produce a new analysis box.
- XLMA software (Fig. 7) was used to determine the number of flashes occurring within the analysis box for each minute between 2023 and 2045 UTC.
- The one minute flash rates were combined to produce two second average flash rates in order to use a 2n lightning jump algorithm (LJA). (Schultz, et al. 2011)

EPISODE OVERVIEW

- Slow moving airmass thunderstorms developed over the Atlanta area on the afternoon of July 21, 2016, a number of which reached severe levels.
- NWS Peachtree City issued a severe thunderstorm warning at 2028 UTC for a cell near Alpharetta.
- A second cell developed just south of the warned storm. This second cell produced damaging winds, resulting in a LSR at 2040 UTC.

OBJECTIVE

- Provide total lightning data to decision-makers to increase situational understanding
- Increase warning lead time for severe weather events, especially in marginal or complicated cases
- Increase NWS forecaster confidence when issuing warnings

NGLMA SETUP

- System designed by New Mexico Tech, assembled and operated by GTRI
- Detects total lightning by measuring VHF in unused channel 6 TV band (82-88 MHz) at each sensor location
- Uses GPS to determine precise time of arrival of VHF at each sensor
- The processing computer receives data from sensors and calculates source locations
- VHF Antenna and GPS mounted on roof (Fig. 5, bottom) and connected to shielded box that houses a PC104 computer (Fig. 5, top) and FPGA-based analyzer.
- Data is sent back to processing computer at GTRI, analyzed and then posted to the public website
- Updates every minute

WEB SITE