Training Quick Guide for the Earth Networks Total Lightning Network (ENTLN)

Operational Use and Benefits

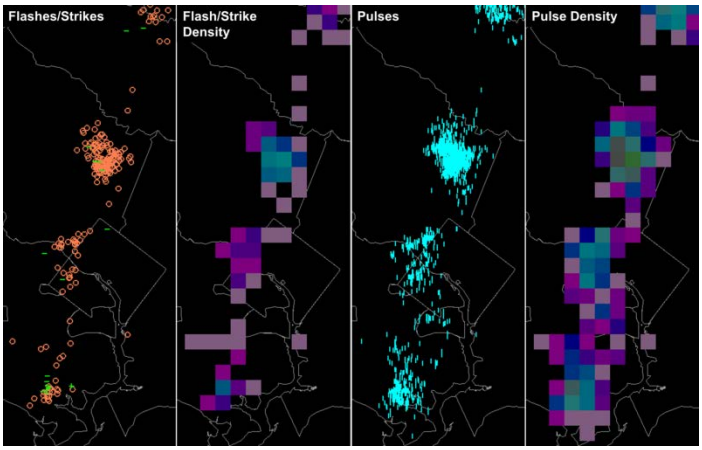
- Detect electrically active storms (IC precedes CG)
- Determine areal extent of the lightning threat
- Track convective cells embedded in larger features
- Identify strengthening and weakening storms
- Monitor convective mode and storm evolution
- Supplement radar data where coverage is poor
- Prepare for GLM spatial and temporal coverage

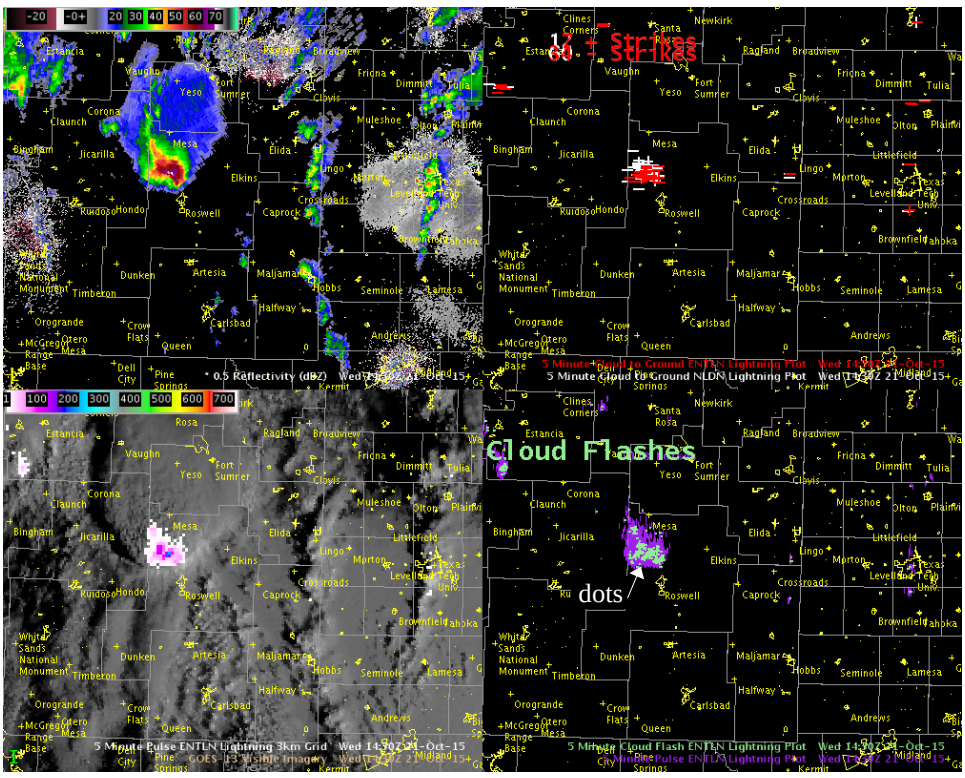
Gridded ENTLN Products

- ENTLN pulse and flash density grids in AWIPS-II simply report the flash/pulse counts within grid cells of varying size over varying periods of time
- Grids are provided at varying spatial and temporal resolutions to accommodate a variety of users
- Interpolating the grids improves their visibility
- The frequency of lightning flashes often indicates updraft/storm intensity (especially cloud flashes)

Pulses, Strokes, and Flashes

- The ENTLN detects the components of IC and CG flashes, and algorithms use waveform shapes to differentiate between the IC pulses and CG strokes (both termed pulses in AWIPS-II)
- The IC pulses and CG strokes are combined into IC and CG flashes using space (10 km) and time (0.7 sec) criteria
- A typical CG flash contains many IC pulses and one or more CG strokes, but the number of components observed per flash varies regionally





AWIPS-II Display

- Positive (negative) CG flashes are depicted by + (-) symbols (labeled strikes)
- Default cloud flash symbol recently changed from circles (above) to dots (left)
- The magnification can be increased manually to better view the cloud flash symbols
- IC pulses and CG strokes are indicated by pipe (|) symbols (both labeled pulses)
- Pulse grids better depict the spatial extent, while flash counts are more indicative of updraft intensity
- ENTLN grids are most often used to create procedures for 1) convective initiation and 2) severe weather

Composed by Dr. Scott Rudlosky (NOAA/NESDIS/STAR) – See also http://lightning.umd.edu
Contributions from Jason Jordan (NWS/LBB) and Tiffany Meyer (OU/CIMMS)

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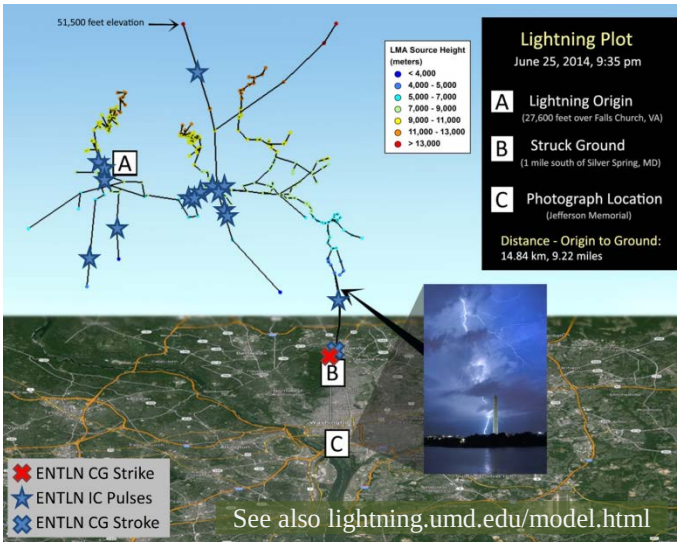

ENTLN Detection Method

- The ENTLN monitors total lightning activity using wideband sensors with detection frequencies ranging from 1 Hz to 12 MHz (i.e., VLF to HF)
- The wide frequency range enables sensors to detect CG strokes, as well as typically weaker IC pulses
- The ENTLN employs a blended technique to provide a degree of global CG coverage with better performance (i.e., IC and CG lightning detection) in regions with greater sensor density
- The expanding high density network presently covers the Contiguous United States (CONUS), Alaska, Hawaii, the Caribbean basin, Australia, SE Brazil, Lake Victoria, and Guinea

Total Lightning Conceptual Model

- The cloud-to-ground (CG) lightning flash depicted above originated ~27,000 feet AGL, covered nearly 150 square miles, and struck ground 10 miles to the northeast, well outside the parent thunderstorm
- The D.C. Lightning Mapping Array observed nearly the entire channel, along which the ENTLN reported 15 intra-cloud (IC) pulses and 1 CG stroke
- In AWIPS-II, the ENTLN reports a single CG strike where the flash connects to ground, while the cloud pulses better depict the spatial extent (page 1)
- The ENTLN does not always report the full spatial extent of lightning flashes due to the varying separation distances between its sensors

ENTLN is Not the GOES-R GLM

- ENTLN detects VLF-HF radio waves emitted by lightning, while the GLM will be an optical detector
- ENTLN reports lightning as point observations, the GLM will report lightning in 8×8 km grid cells
- The GLM will detect more than 70% of all flashes within its field of view, while the ENTLN detection efficiency varies spatially
- During 2013, the ENTLN detected 31.4% (79.7%) of all TRMM Lightning Imaging Sensor (LIS) flashes in the W. Hemisphere (Southern CONUS)
- The map below displays the fraction of all LIS flashes that were detected by the ENTLN during 2013 (white grid cells have less than 30 LIS flashes)