Earth Networks Total Lightning Network (ENTLN) Quick Guide

Operational Use and Benefits

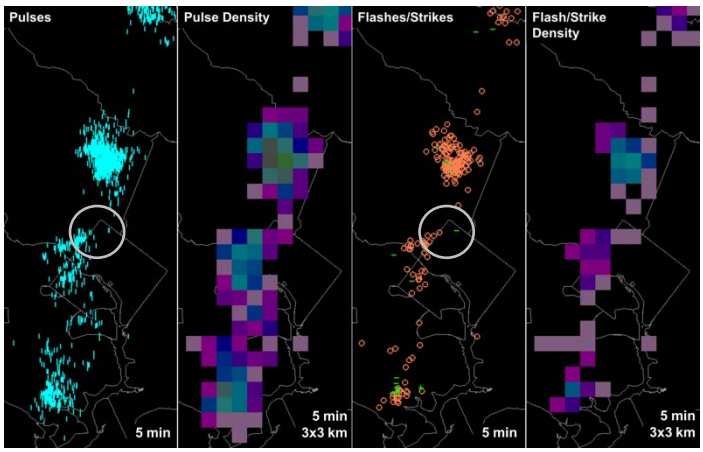
- Detect electrically active storms (IC precedes CG)
- Determine the areal extent of the lightning threat
- Track convective cells embedded in larger features
- Identify strengthening and weakening storms
- Monitor convective mode and storm evolution
- Supplement radar data where coverage is poor
- Prepare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

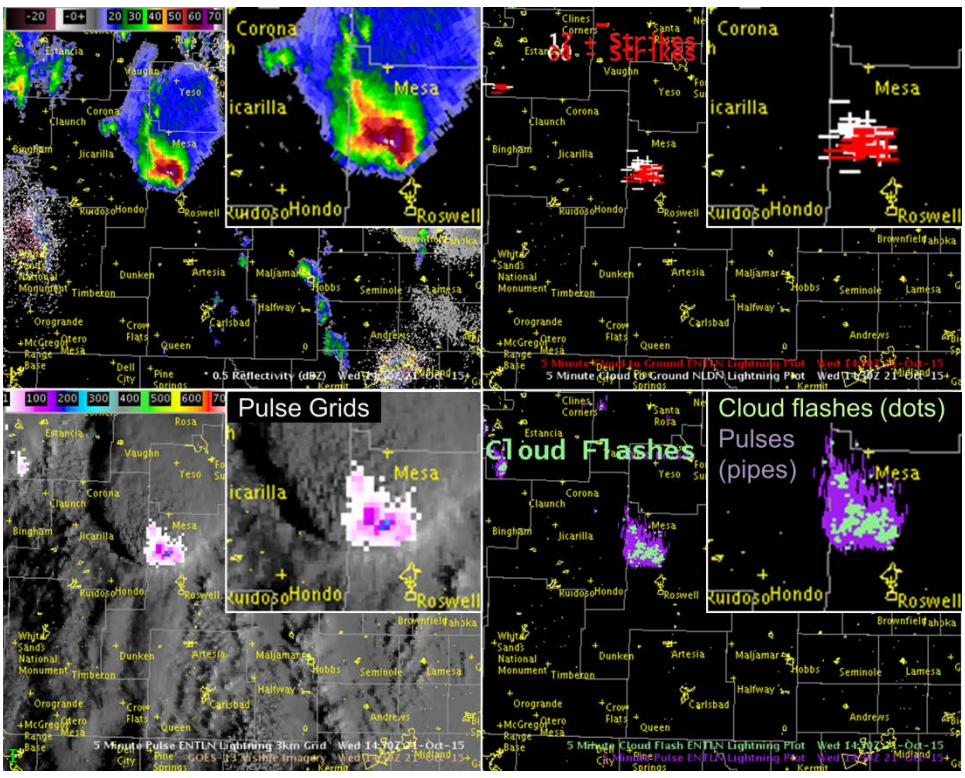
Gridded ENTLN Products

- ENTLN pulse and flash density grids in AWIPS simply report the pulse/flash counts within grid cells of various sizes over various periods of time
- Grids are provided at different spatial and temporal resolutions to accommodate a variety of users
- The frequency of lightning flashes often indicates updraft/storm intensity (especially cloud flashes)
- Spatial interpolation and alternate color curves can enhance the gridded display

Lightning Terminology

- The ENTLN detects the components of both intra-cloud (IC) and cloud-to-ground (CG) flashes, and algorithms use waveform shapes to differentiate between the IC and CG pulses (i.e., components)
- The IC and CG pulses are combined (grouped) into IC (cloud) and CG flashes using space (10 km) and time (0.7 sec) criteria
- CG flashes contain at least one CG pulse and many IC pulses (the number of pulses observed per flash varies regionally due to varying sensor density)





AWIPS Display

- Positive (negative) CG flashes are depicted by + (-) symbols (labeled strikes in AWIPS)
- Default cloud flash symbol has changed from circles (above) to dots (left)
- The magnification can be manually increased to better view the cloud flash symbols
- IC and CG pulses are both indicated by pipe (|) symbols
- Pulse grids better depict the spatial extent, while flash counts are more indicative of updraft (storm) intensity
- Forecasters often use ENTLN grids in their convective initiation and severe weather bundles (procedures)

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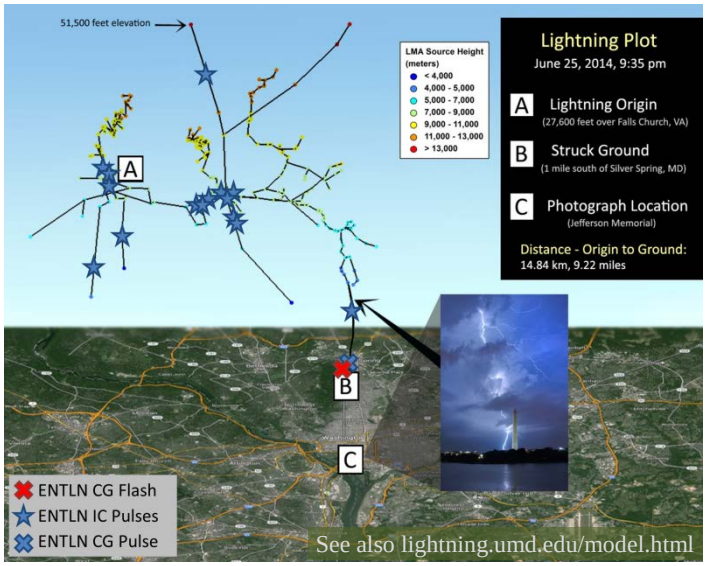
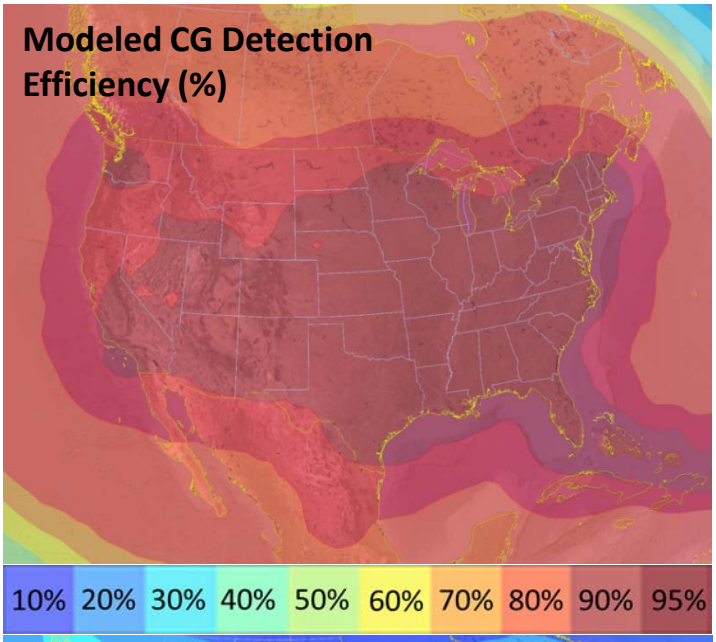
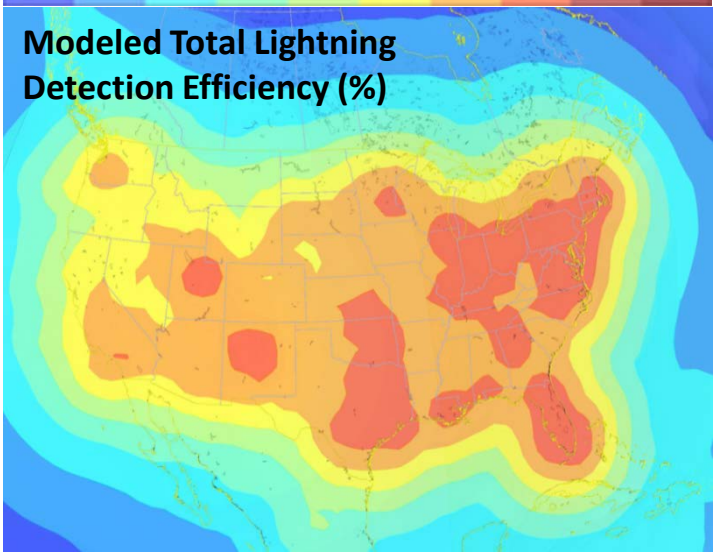
Total Lightning Conceptual Model →

- This CG lightning flash originated ~27,000 feet above ground level, covered nearly 150 square miles, and struck ground ~10 miles to the northeast, well outside the parent thunderstorm
- The Washington D.C. Lightning Mapping Array observed nearly the entire channel, along which the ENTLN reported 15 IC pulses and 1 CG pulse
- In AWIPS, this appears as one CG strike where the flash connects to ground, while the cloud pulses better depict the spatial extent (gray circles 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 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 CONUS, Alaska, Hawaii, the Caribbean, Europe, Australia, Turkey, SE Brazil, Guinea, SE Africa (e.g., Kenya), Japan, and SE Asia
- The images to the left represent the modeled detection efficiency for CG flashes (top) and total lightning (bottom) over CONUS

ENTLN Differs from the GOES-R GLM

- ENTLN detects radio waves emitted by lightning, GLM will detect optical pulses from lightning
- ENTLN reports lightning as point observations, the GLM will report lightning on an 8×8 km grid
- The GLM will nearly uniformly detect more than 70% of all flashes within its field of view, while the ENTLN detection efficiency varies spatially
- During 2014, the ENTLN detected 89.6% (36.1%) all TRMM Lightning Imaging Sensor (LIS) flashes in the Southern CONUS (W. Hemisphere)