

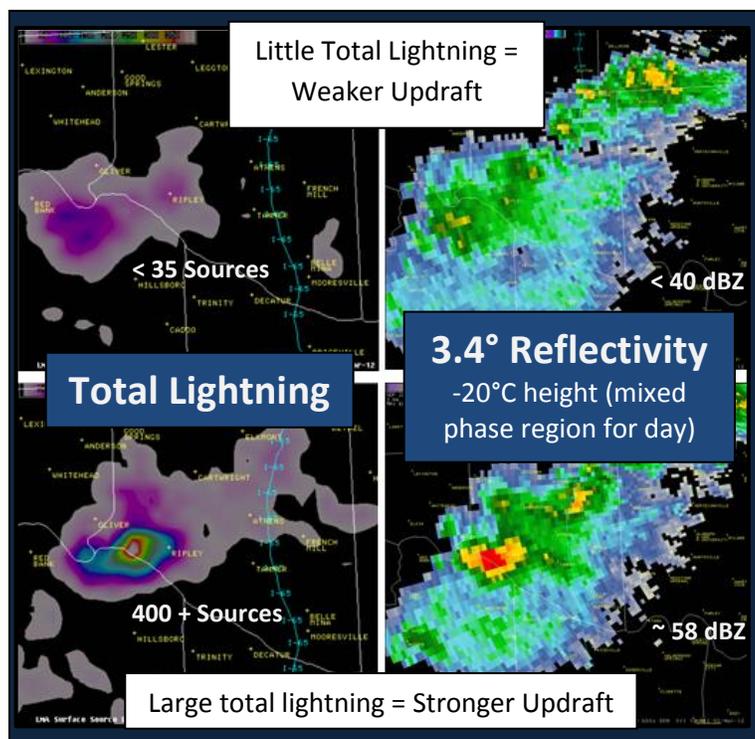
Total Lightning Quick Guide by NASA SPoRT

What is Total Lightning?

Total lightning observes both cloud-to-ground strikes and intra-cloud flashes. On average, the majority of all lightning flashes in a given thunderstorm are intra-cloud flashes. As a result total lightning provides far more information than National Lightning Detection Network data alone. Furthermore, the amount of total lightning is related to a storm's overall updraft strength in the mixed phase region. Total lightning is currently available from ground-based lightning mapping arrays (LMAs). In the GOES-R era, total lightning will be available from the Geostationary Lightning Mapper (GLM) that will provide almost full disc coverage.

Product Categories

NASA SPoRT provides two total lightning product sets. These include the ground-based LMA observations at a 1-2 km resolution, and SPoRT's pseudo-geostationary lightning mapper (PGLM) product suite with 8 km resolution. The PGLM demonstrates future GLM capabilities. The operational uses below are valid for either product set.



Advantages of Total Lightning

- More observations than National Lightning Detection Network data alone.
- Spatial extent of a lightning flash, i.e. it is not a point observation.
- Sub-radar volume scan updates of 1-2 minutes.
- Total lightning is non-linearly related to a storm's updraft strength in the mixed phase region.
 - More total lightning equals a much stronger storm updraft and vice versa.
 - Special case: Lightning Jumps are often precursors to severe weather.
 - Can precede severe weather by 10-20 minutes.

Operational Uses

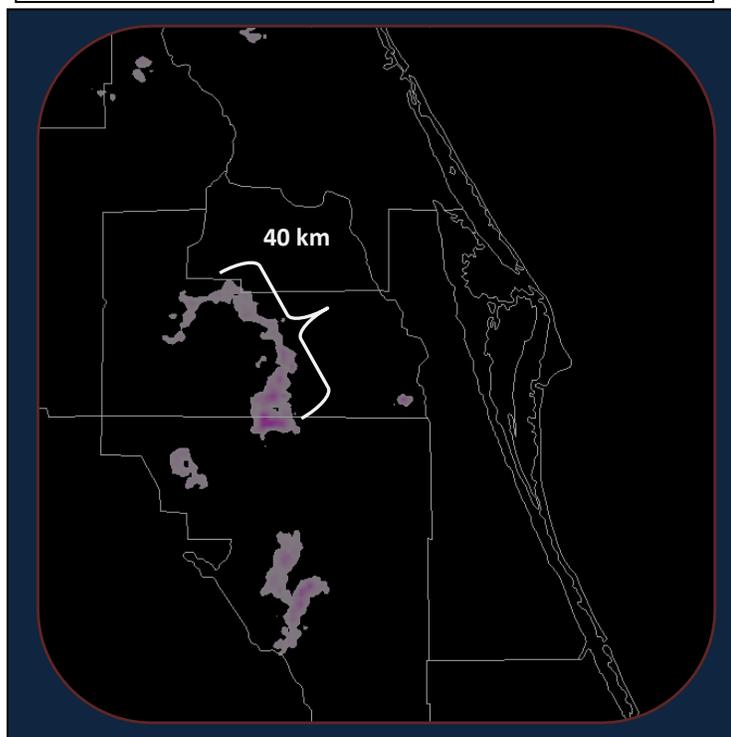
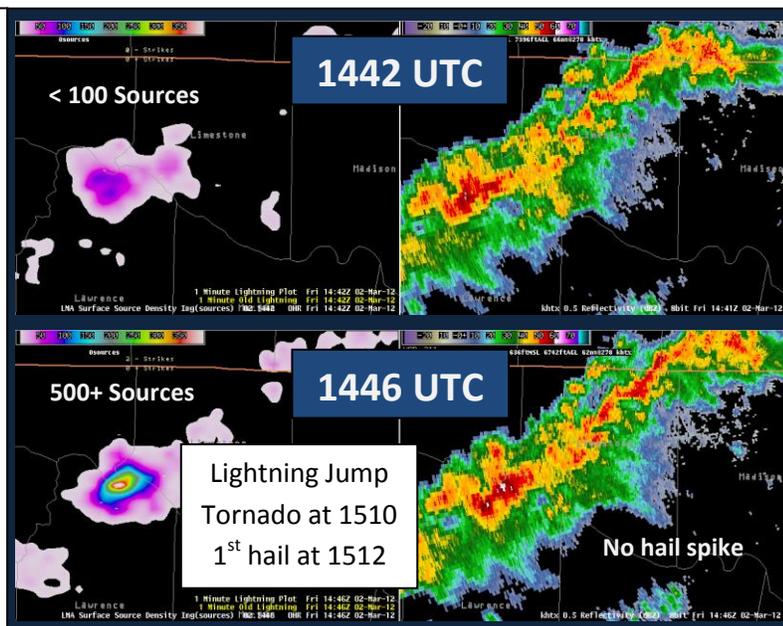
First Cloud-to-Ground Lightning Strike Lead Time

- On average, the majority of all lightning flashes are intra-cloud.
- Approximately 80% of thunderstorms initiate with an intra-cloud flash.
- Often, the first intra-cloud flash will precede the first cloud-to-ground strike by 5 minutes.
- Can enhance Airport Weather Warnings, Terminal Aerodrome Forecasts, and improve lightning safety.

Operational Uses (cont.)

Lightning Jumps and Severe Weather

- Most common use of total lightning observations.
- Lightning jumps are large and rapid (within 10 minutes) increases of total lightning.
- Often precede severe weather by 10-20 minutes on average.
- Lightning jumps often “tip the scales” for forecasters determining whether or not to issue a warning.
- Provides situational awareness of which storms are strengthening / weakening or possibly becoming severe.
- Does not specify the type of severe weather, and forecaster must consider the environment.



Spatial Extent of Lightning Flashes

- Total lightning is not a point source and provides a better observation of the lightning threat.
- Most lightning remains within 10 miles of the core of a thunderstorm.
- Some flashes may extend many tens of kilometers.
- Visualization of total lightning can be used to demonstrate lightning’s threat and the importance to remain indoors for 30 minutes after the last lightning strike was seen or heard.

Resources

Operational applications of total lightning can be seen on the Wide World of SPoRT blog (<http://nasasport.wordpress.com/>). The training modules are available on the SPoRT web page (<http://weather.msfc.nasa.gov/sport/training/>) and *What is Total Lightning: Part 1* is available on NOAA’s learning management system. Additional information can be found on the SPoRT page about lightning mapping array data (<http://weather.msfc.nasa.gov/sport/lma/>).