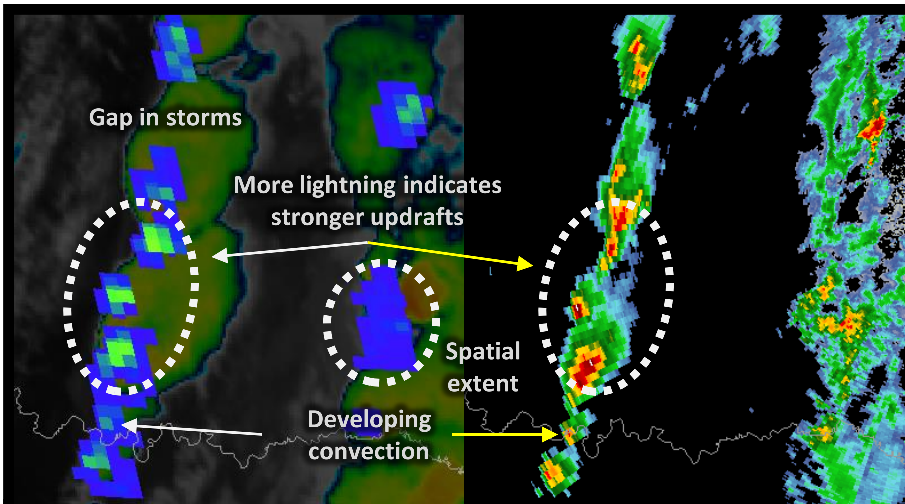
Geostationary Lightning Mapper Applications Quick Guide

Why is the Geostationary Lightning Mapper Important?

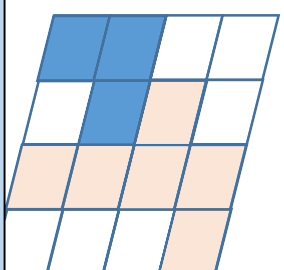
The GLM observes total lightning (i.e., both cloud-to-ground and intra-cloud flashes). Total lightning is tied to the strength and volume of a storm's updraft in the mixed phase region. This allows for investigating the intensity of convection to directly aid warning decision support. This can directly support warnings or "triage" what storms should be investigated further. The GLM supports lightning safety by observing total lightning spatial extent of lightning flashes.



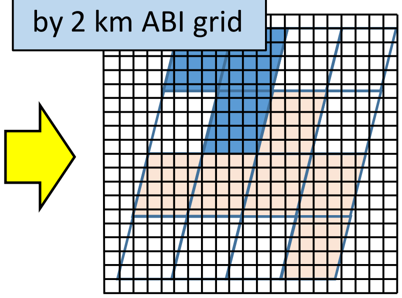
1 min GLM Flash Extent Density (remapped to 2 km) with ABI 10.3 µm IR (left) and radar reflectivity (right). Shows lightning's extent and convective intensity.

Making the Flash Extent Density (FED) Product

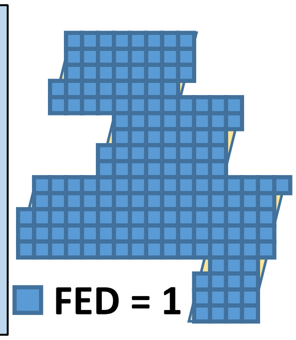
One flash polygon created from groups (blue and pink) that make up the flash placed on the GLM grid (~8 km).



GLM grid sliced by 2 km ABI grid

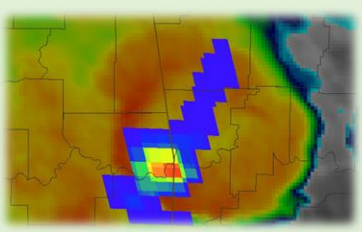


ABI grid cells fully covered by GLM, value of 1 assigned (i.e., 1 flash). Grids partially covered are arithmetically rounded to nearest integer.



Impact on Operations

Applications

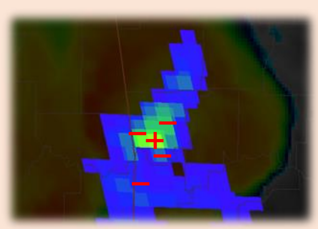


Lightning Jump: Rapid increase in total lightning signifying increasing threat of severe weather aiding in decision support.

Lightning Safety: Intra-cloud lightning often precedes the first cloud-to-ground flash. Also, GLM is not just a point observation and provides spatial extent observations to monitor how far flashes reach.

Situational Awareness: Beyond lightning jumps, the GLM can monitor or identify convective activity. This is particularly useful in data sparse regions where radar is limited or lacking.

Limitations



Does Not Distinguish Flash Type: Observes total lightning, but does not separately observe intra-cloud and cloud-to-ground flashes or the polarity.

Null Events: In certain environments (e.g., high shear, low CAPE) or shallow convection, updrafts may not reach the mixed phase region resulting in limited lightning production. Reduces or eliminates effectiveness of lightning jumps.

Diurnal Variations: Greatest detection efficiency is available at night as there is no solar reflectance.

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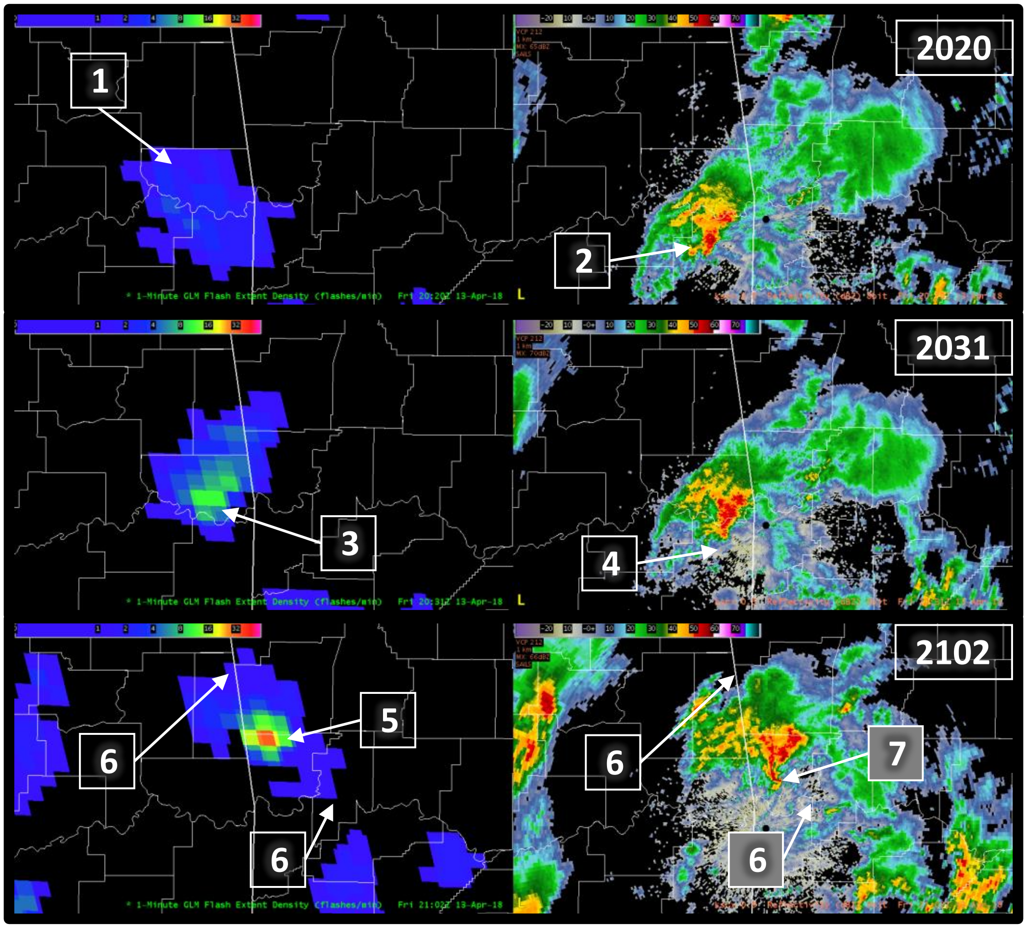
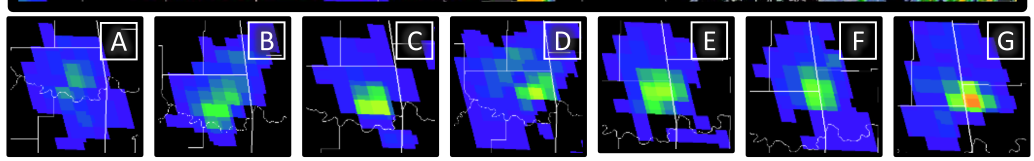
Geostationary Lightning Mapper Overview
Quick Guide

Severe Storm Interpretation

1. **Few flashes** *(Lightning covering many km², but low values. Updraft not extensively in mixed-phase region)*
2. **Strong reflectivity** *(but GLM flash extent suggests non-severe)*
3. **Monitor development** *(GLM intensifying; signifies main storm core. Stronger updraft = more charging and more lightning)*
4. **Small change in radar** *(Radar intensity little changed, possible hook, and GLM emphasizing growth here)*
5. ***Rapid increase*** *(Potential lightning jump underway, severe weather potential increasing)*
6. ***Spatial extent*** *(Lightning extending many km from main storm core)*
7. ***Hook in radar*** *(became EF-2)*

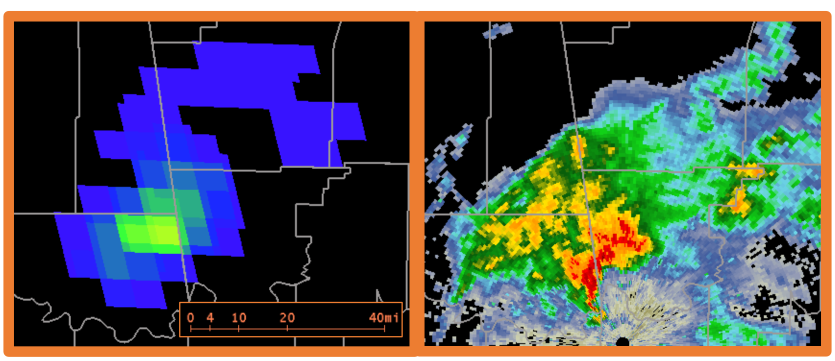




AWIPS display of GLM flash extent density and ABI 10.3 µm IR (left) and radar reflectivity (right). This is centered on Fort Smith, Arkansas and shows a sequence of observations ahead of the development of an EF-2 tornado. Small insets show GLM from 2026, 2031, 2036, 2041, 2046, 2051, and 2056 UTC (A-G) to show the trend.

GLM Fast Facts

- FoV: 54° N/S
- Detects >70% of flashes in FoV over 24 hours
- Product latency ~1 minute
- AWIPS options include temporal bins of 1, 5, and 15 min



Long Flash Example: The GLM flash extent density (left) and radar reflectivity (right). This highlights a GLM flash that initiated in the main convective updraft and then extended north and east beyond the reflectivity and into the stratiform region. The northern part of the flash extended more than 40 miles west to east.

Resources

Virtual Lab
Virtual Lab for the GLM

GOES-R Virtual Faculty Training
GLM Virtual Faculty Course

NASA SPoRT
NASA SPoRT Home Page

NESDIS/STAR – CICS/MD
Lightning Resources at CICS-MD

Hyperlinks not available when viewing material in AIR Tool