Geostationary Lightning Mapper: Regional Applications

Quick Guide

GOES-East vs. GOES-West GLM

- **Significant overlap region with variable coverage**
- **Generally, the GOES-East (G16) GLM observes more flashes east of 103° W and GOES-West (G17/G18) GLM observes more flashes west of 103° W**
- **In the northwest U.S., the G16 GLM observes 25-45% of the G17 GLM observed flashes (Fig. 1a)**
- **This reduced G16 performance relates to the proximity to the edge of the FOV, where larger pixels and steeper viewing angles reduce the sensitivity**

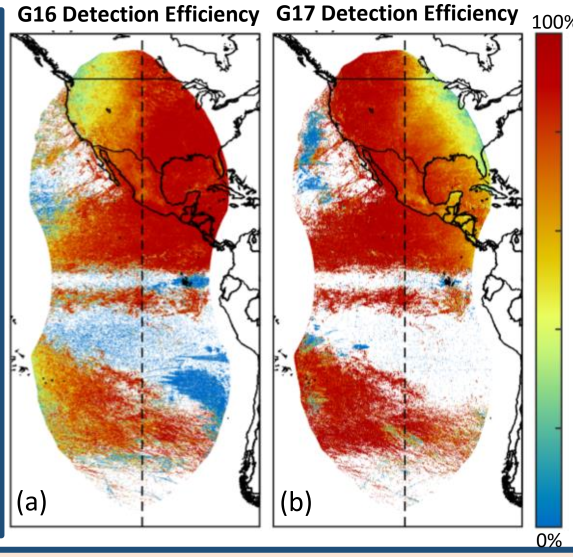

***Fig. 1**. Relative detection efficiencies - (a) percentage of G17 flashes observed by G16 (b) percentage of G16 flashes observed by G17 from Rudlosky and Virts 2021 (dashed line denotes 103° W)*

Using Both GLMs in the Overlap Region

- **It is often sufficient to use one GLM to monitor storms in the central US, but in many cases, it is beneficial to view gridded products from both GLMs, along with other lightning data to complete the picture**
- **Environmental conditions influence the proportion of flashes seen by each instrument, and under certain circumstances one GLM can observe significantly more flashes along or even east/west of 103° W**
- **Figure 2 illustrates a case where the G17 GLM observed much greater FED just west of 103° W, this discrepancy related to strong westerly shear creating a broad anvil cloud that obscured the view from the G16 perspective**
- **Best practice is to use both GLMs along with other lightning datasets in the overlap region**

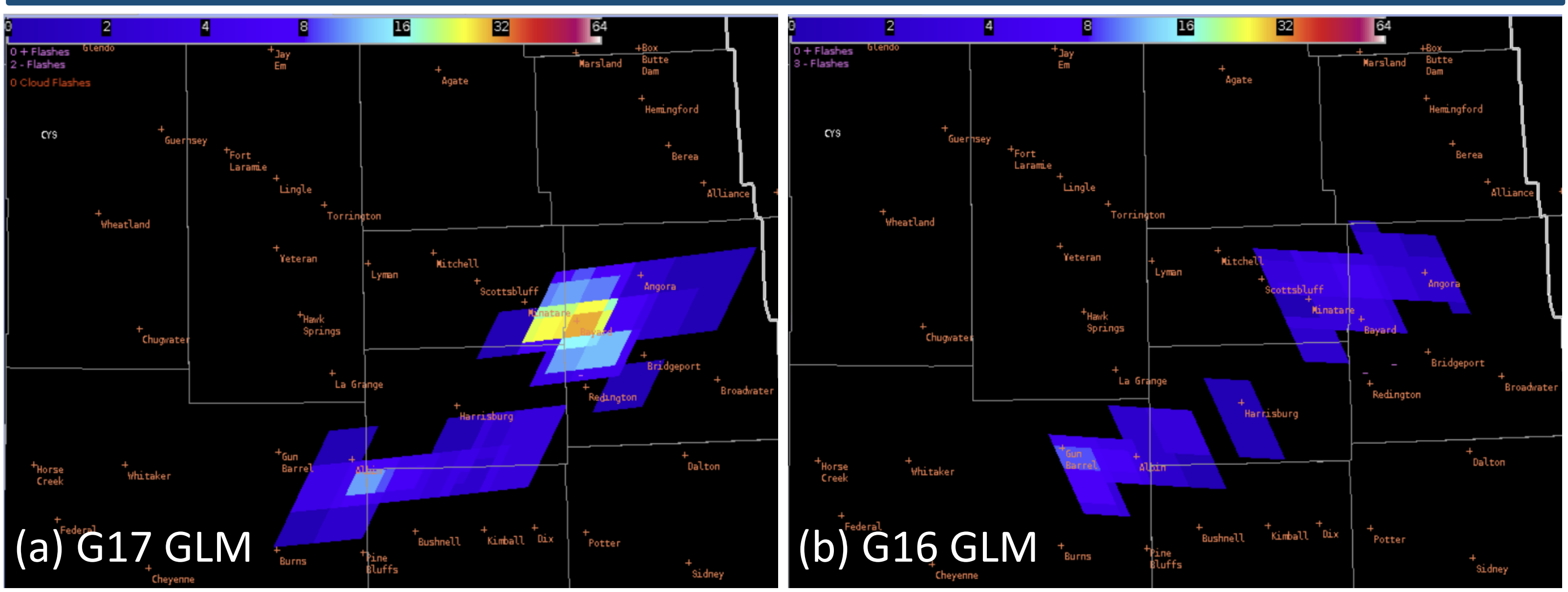

***Fig. 2**. Flash Extent Density (FED) from discrete thunderstorms in eastern Wyoming from the G17 (panel a) and G16 (panel b) perspective, showing a much greater number of flashes being observed by the G17 GLM*

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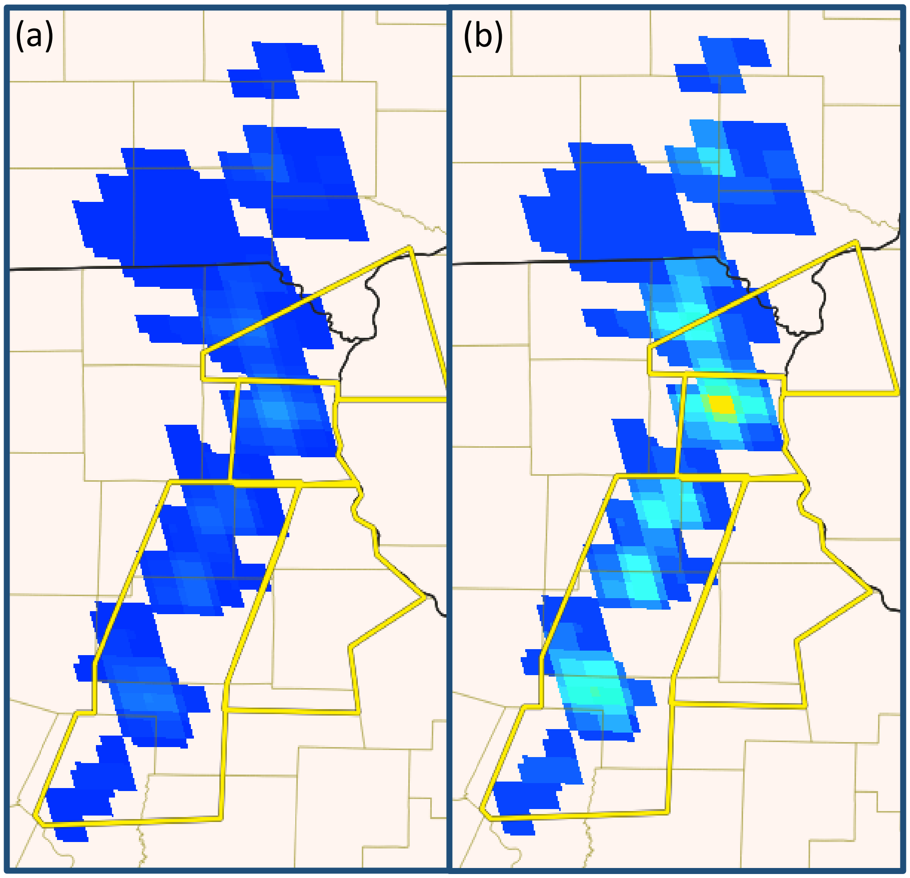

Alternative FED Color Bars

- **Standard NWS FED color range (i.e., 1-256 flashes per pixel) is best suited for mature convection and can obscure finer spatial features in weaker storms**
- **Applying an alternative FED color bar range (e.g., 1-64 flashes per pixel) can enhance lightning patterns in low flash rate environments or incipient convection**
- **Figure 3 reveals how this change emphasizes convective cores, especially the storm with the greatest flash counts (center-right) which imminently produced severe weather in the form of strong winds and large hail**
- **Many NWS offices have found that alternative FED color bars better suit their operational needs, and forecasters are encouraged to apply these as needed**

***Fig. 3**. Flash Extent Density with (a) the standard NWS color bar range (1-256 flashes per pixel) and (b) an adjusted FED color bar range (1-64 flashes per pixel), along with severe thunderstorm warning polygons (yellow)*

Additional Considerations

- **The local hour with the maximum GLM flash counts shows clear variability across CONUS (Fig. 4)**
- **The GLM detects lightning better at night, which can counter the reduced sensitivity nearer the edges of the FOV, so the preferred color bar may vary diurnally**
- **Spatial offsets between the GLM observations and ground-based networks grow with increasing distance from the satellite subpoint (Fig. 5)**
- **These spatial offsets can complicate GLM use during warning operations**
- **Forecasters commonly diagnose storm intensity trends using GLM observations, then use ground-based reference networks to collocate the GLM trends with the radar-depicted storms**

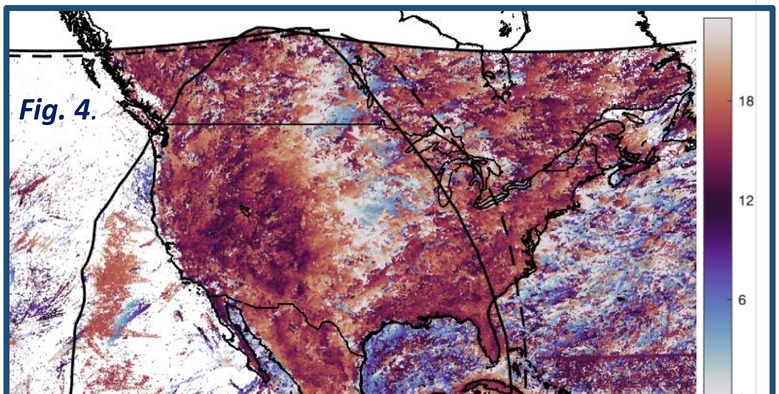

Fig. 4.

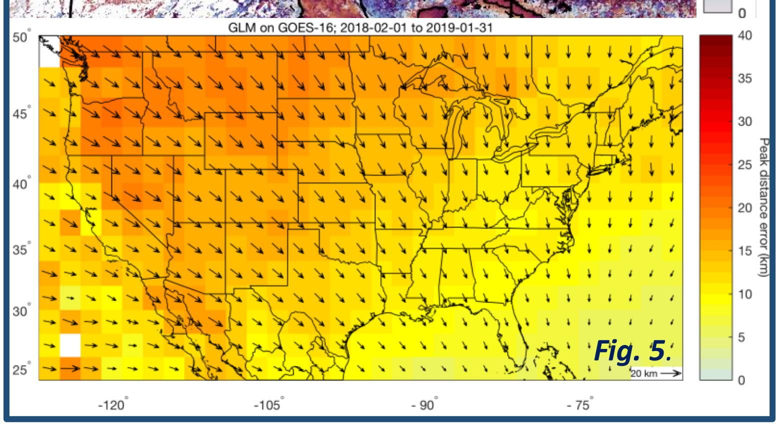

Fig. 5.