GLM Quick Brief Description

Topic: Gridded Products

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Summary: This Geostationary Lightning Mapper (GLM) quick brief describes the creation of the GLM gridded products. The need for gridded products is described, and methods for computing the Flash Extent Density (FED) are shown. Example FED imagery is presented to demonstrate the first GLM gridded product available in AWIPS. Additional gridded products are introduced to illustrate their potential added value in the warning and forecast process.

Quiz Questions:

1) The GLM is useful for which of the following applications?
   a) Detects electrically active storms and the areal lightning extent
   b) Identify strengthening and weakening storms
   c) Monitor convective mode and storm evolution
   d) All of the above

2) Which of the following gridded GLM products is not being examined for potential NWS deployment?
   a) Cloud-to-ground (CG) to intra-cloud (IC) ratio (fraction)
   b) Average flash area
   c) Event Density
   d) Total energy

3) The new gridded GLM FED product does which of the following?
   a) Re-navigates the GLM to the 2×2 km Advanced Baseline Imager (ABI) fixed grid
   b) Restores and disseminates the spatial footprint information
   c) Best portrays the quantity and extent of GLM flashes and events
   d) All of the above

Transcript:

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Welcome to the Geostationary Lightning Mapper quick brief on GLM Gridded Products

Slide 2

The GLM provides continuous, full disk total lightning measurements with coverage to 54° N/S
It detects greater than 70% of all flashes when averaged over 24 hours

And by observing total lightning the GLM detects electrically active storms and the areal lightning extent

Additional GLM applications include tracking embedded convective cells, identifying strengthening and weakening storms, monitoring convective mode and storm evolution, characterizing storms as they transition offshore, and providing insights into tropical cyclone intensity changes

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The original GLM plugin was eventually deemed useless in part because it was far too similar to the ground based network plugin

The left image illustrates several of these issues, most notable were the labels that indicate cloud-to-ground and polarity when the GLM does not make these distinctions

The right image fixes some of these issues, but the number of GLM points during active periods can overwhelm the AWIPS display capabilities, AWIPS also included gridding issues that prevented its use for developing simple gridded GLM products

To mitigate these AWIPS issues, a new gridded flash extent density (FED) product has been developed for AWIPS implementation

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The GLM Level 2 data are produced as points, resulting in a loss of information concerning the spatial extent

The new gridded GLM products restore and disseminate the spatial footprint information while greatly reducing file size

Gridded GLM products involve re-navigating the GLM event latitude / longitude to the 2×2 km Advanced Baseline Imager (ABI) fixed grid

The flash extent density (FED) product illustrated here indicates the number of flashes that occur within a grid cell over a one minute period, note the warmer colors indicate convective cores while the cooler colors depict the spatial extent of the lightning flashes

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The first step for developing the gridded products is to use a corner point lookup table to reconstitute the footprints of the GLM events

In this example, 5 GLM events occur during one 2 ms frame forming group number 1, six GLM events combined to form group number 2 during the subsequent 2 ms frame, if we assume that this flash ends after 4 ms, all 11 events and both groups are combined into one GLM flash

These polygons are then subdivided by slicing them with the ABI fixed grid

The next step accumulates and weights the sliced polygons

The blue squares indicate 2 by 2 km pixels completely covered by this GLM flash and the green squares indicate pixels that are partially covered

FED values are rounded to the nearest integer so pixels with greater than 50% coverage receive a value of one flash, the result is a representation of a GLM flash on the ABI fixed grid, all flashes during one minute are composited to create the FED product

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Many years of research and operational Lightning Mapping Array demonstrations have shown the flash extent density (FED) to be the preferred total lightning product

The FED best portrays, in a single product, the quantity of GLM flashes and the extent of GLM events

The initial plan is for the 1-min FED grids to reach AWIPS within 1 minute, then to be composited into longer time periods

The Flash Extent Density is the only product initially planned for AWIPS deployment, but it important to note that additional gridded products are under evaluation for potential AWIPS implementation in the future

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This first example combines the GLM Flash Extent Density product with visible imagery from an ABI mesoscale sector to illustrate the convective evolution

The imagery depicts convective processes on various scales with the strongest convective cores clearly distinguished from nearby convection

The GLM also locates flashes propagating into the anvil and stratiform regions

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The next example combines the GLM Flash Extent Density product with 1-min ABI infrared brightness temperatures to illustrate some nocturnal effects

The increased sensitivity induced by the nighttime background makes nocturnal flashes appear larger than identical flashes during the day

Some of this signal also relates to the tendency for nocturnal storms to produce larger flashes as the grow upscale into Mesoscale Convective Systems or weaken into messier convective scenes

Another important nocturnal feature is the illumination of low clouds by nearby deep convection

The optical GLM observations provide forecasters with a new perspective on lightning activity, and the forecasters will in turn help drive GLM innovation

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This concludes the quick brief on GLM Gridded Products, additional GLM information can be found by following these links, and in the other GLM quick briefs