GLM Quick Brief Description

Topic: Data Quality

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Summary: This Geostationary Lightning Mapper (GLM) quick brief describes the data quality status during June 2018. The GLM is a new instrument undergoing extensive calibration and validation, which appears to be meeting its performance requirements despite the examples illustrated herein. The GLM gridded products are shown to exhibit a similar parallax effect to the Advanced Baseline Imager. Sources of false events are described, including platform disturbances, sun glint, solar intrusion, and overshoot at subarray boundaries.

Quiz Questions:

1) Which of the following is not a GLM requirement?
   a) Full disk coverage
   b) Greater than 90% detection efficiency
   c) Flash false alarm rate less than 5%
   d) Location accuracy within a half a pixel

2) For the gridded GLM products, the parallax is
   a) Accounted for by assigning the lightning to an assumed cloud top height
   b) Unimportant due to the GLM design
   c) Similar to the parallax effect for the ABI
   d) More pronounced than the ABI parallax effect

3) What is the purpose of the blooming filter?
   a) Dampen diurnal differences in detection efficiency
   b) Quench rapid growth of artifacts associated with sun glint and eclipse effects
   c) Improve the location accuracy of the Level 2 products
   d) None of the above

Transcript:

Slide 1

Welcome to the Geostationary Lightning Mapper quick brief on GLM Data Quality

Slide 2

The Geostationary Lightning Mapper is a new instrument undergoing extensive calibration and validation – GLM scientists and engineers collaborated to reach beta maturity during July 2017 and provisional maturity during January 2018

The GLM performance requirements include full disk coverage, greater than 70% detection efficiency, flash false alarm rate less than 5%, and location accuracy within a half a pixel

The GLM appears to be meeting these performance requirements despite the examples illustrated in the subsequent slides – all known issues are being worked in preparation for the full validation review

Slide 3

The GLM is a variable pitch CCD array with 56 sub arrays and a footprint of 1372 by 1300 pixels

The variable pitch was designed to reduce the growth of GLM pixel footprints away from nadir, but the pixel size and shape still vary as shown by the top two images

The instrument relies on the spacecraft position and pointing information along with a coastline identification and navigation procedure to covert the focal plane x, y to latitude and longitude coordinates

Although the GLM level 2 product attempts to navigate the observations to an estimated cloud top – the GLM gridded products do not, resulting in a similar parallax effect to the Advanced Baseline Imager – as illustrated by two screen captures of the collocated GLM FED and visible ABI imagery

The parallax results in the gridded GLM products appearing shifted away from nadir as shown in the bottom three panels relative to the NLDN and base reflectivity

Near the limbs, where the parallax is most pronounced, the GLM often observes side-cloud illumination, which partially counteracts the parallax by shifting the GLM observations towards nadir

Slide 4

Comparisons with ground-based networks allow us to quantify the collocation of these datasets.
This plot depicts the direction vector and peak distance offset that must be applied for the GLM gridded products to match the ground-based networks –the offsets generally increase as you move away from the satellite position

Slide 5

The GLM seeks to maximize detection efficiency while minimizing the false alarm rate – the false alarm rate is defined as the number of false flash detections divided by the average true flash rate

Each subarray is independently tuned to optimize the dynamic range and sensitivity, which vary based on the background scene – the example image displays a snapshot of the GLM dynamic range

56 Real Time Event Processors or RTEPS are used to tune the GLM – the RTEPS are like lawn mowers, with low sensitivity and missed events resulting from the blade being set too high or a downlink flooded with false events if the blade is set too low

Slide 6

Perhaps the most common (and obvious) source of false GLM events arises when the GLM platform shifts suddenly during day light hours – this results in many false events along the edges of clouds as shown by the far-right images

Most commonly these false events relate to brief momentum adjust maneuvers that are required to maintain proper spacecraft location and orientation,
Calibration scans for other GOES instruments also produce false events, although attempts are made to schedule these calibration scans at night to minimize their impact

Another somewhat common source of false events is river, lake, and ocean glint which occur when the proper sun angle combines with a relatively calm body of water

The images on the bottom left illustrate river glint over South America – and the center-bottom images portray glint over the southern Atlantic Ocean

Slide 7

False events also can occur at the edge of subarrays when improperly tuned RTEPS combine with bright clouds that are nearly stationary – this is presently the case in the Bahamas as shown in this animation

When bright clouds persist over the RTEP boundaries, the threshold to noise ratio drops and sensitivity increases – this issue will be fixed in the near term by uploading new RTEP thresholds to the satellite

Solar intrusion during the eclipse seasons provides an example of false events that can only be mitigated in the longer term – during certain days and times direct solar illumination nearly reaches the GLM focal plane, resulting in false detection artifacts that quickly bloom into massive numbers of false events, a blooming filter has been developed and is awaiting implementation

Slide 8

The GOES ground system (GS) produces the Level 2 GLM data, and GS updates are provided as periodic software patches,

The two most notable planned updates are the blooming filter and the L1b overshoot & second level threshold adjustments

The blooming filter quenches the rapid growth of artifacts associated with both sun glint and eclipse effects

The GOES team is working towards deploying a data quality product and gridded products from the GS The gridded GLM products are presently being produced and provided via experimental channels, with improving reliability and support planned for fall 2018

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