The GOES-R Geostationary Lightning Mapper (GLM)

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Presentation Outline

- 100% ATBD (Changes from 80%)
- GLM Proxy Datasets and Their Development
- Clustering Algorithm Details

100% Algorithm Theoretical Basis Document

- Sections Significantly Modified Since 80%
  - 3.2 Processing Outline
    - Added description of post L0b filter “hooks”
    - Added note about “continuous data”
  - 3.4 Theoretical Description
    - Modified Tables and added detailed descriptions of each table element
    - Added metadata table and description
  - 5.4 Exception Handling
    - Added details to each description
    - Added description of Event QA bits
- Sections Added Since 80%
  - 5.3 Quality Assessment and Diagnostics
    - Code processing speed
    - Cluster results
    - Marking Non-Lightning Events, Groups, and Flashes
    - Diagnostics Imported from L0-L1b Code
  - 6.2 Assumed Sensor Performance
  - 6.3 Pre-Planned Product Improvements (none)

100% Algorithm Theoretical Basis Document

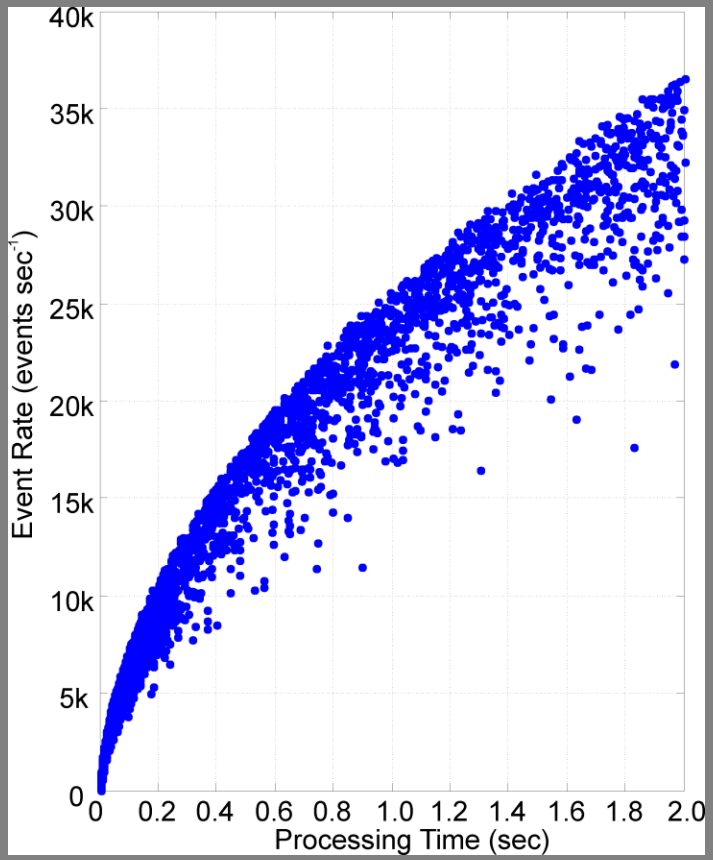
- Added Appendixes
  - Algorithm Implementation and Test Plan
    - Added AITP document as an appendix
    - Simplifies references to information in AITP
    - Reviewer requested change
    - Downside: two documents to track changes
  - A Physical Understanding of the Event, Group, and Flash "Radiance" Data Products
    - Presently, the Lightning Cluster Filter Algorithm (LCFA) follows what was done for OTD/LIS, which was only approximate. This writing attempts to quantify what those OTD/LIS "radiance" data products are, in physical terms.
  - The Flash Radiance Data Product
    - In the prior appendix, the flash "radiance" data product, based on heritage OTD/LIS definitions, was described in terms of familiar physical quantities. In this appendix, additional rigor is added in describing this product.
  - Additional Considerations on Centroiding
    - Theoretical definition of "radiance weighted centroid"

Proxy Datasets

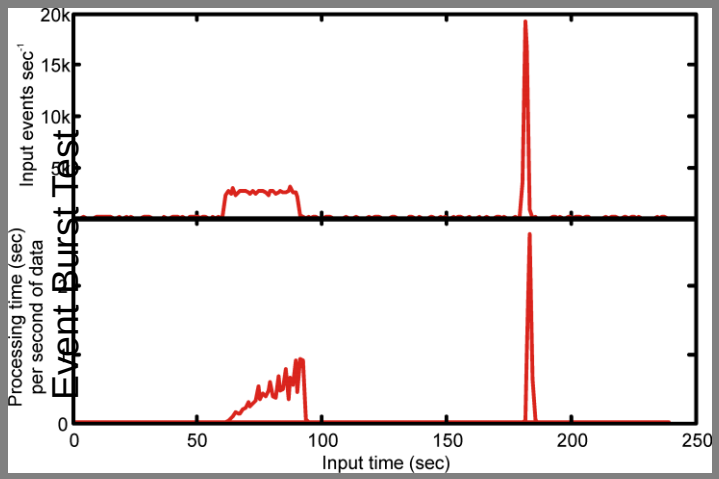
- Types of Proxy Data
  - Speed Tests
    - A speed test checks how many events per second the LCFA can process, and determines if the LCFA can keep up with latency requirements.
  - Accuracy Tests
    - An accuracy test involves first constructing (by simulation or by using a data source) an event-level dataset. Next, one clusters the event-level dataset to construct a known flash-level dataset. Finally, the event-level dataset is input to the LCFA and the LCFA output is compared to the known flash-level dataset to assess LCFA clustering accuracy. Note that the input event-level dataset has no errors (effect of input errors is examined in resiliency tests).
  - Resiliency Tests
    - A resiliency test examines how well the LCFA can control/minimize the deleterious effects of input errors or other peculiar/unusual input conditions (e.g., event radiance noise or location errors, corrupted data packets, extremely long-duration flashes, events near the prime-meridian or international date-line, negative event times, event times that run backwards, latitudes/longitudes that are out-of-range).

Proxy Datasets

- Speed Tests
  - Proxy data tests on single thread GLM code on target system indicate that the code can process 20,000 to 25,000 events in less than 1 second of computer time
  - Current estimates of maximum GLM data rates are around 40,000 events/sec (mean rates nearer 150 events/sec)
  - We can process a nominal second of GLM event data in less than one second of computer time
  - Even with very high burst data rates, the code “recovers” in less than one second



Max Event Rate Test

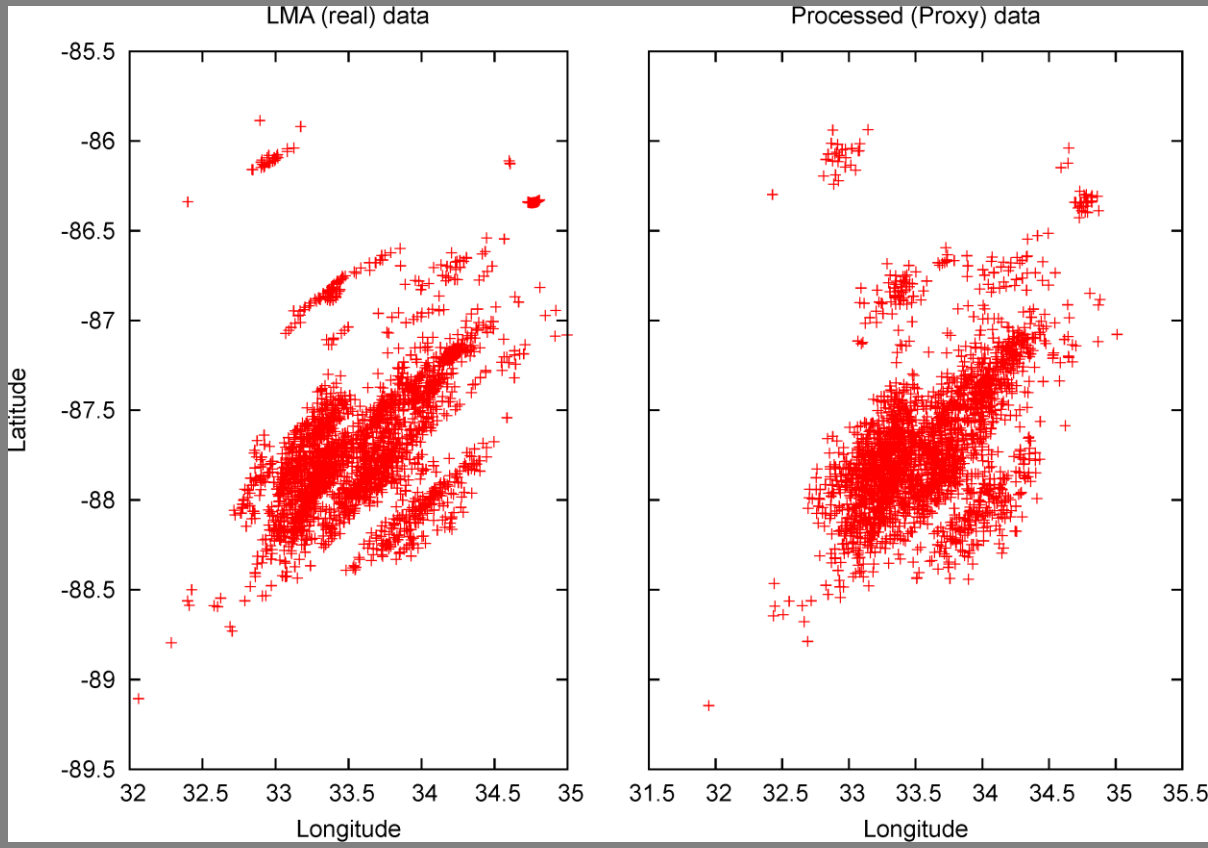


Event Burst Test

Proxy Datasets

- Accuracy Tests
  - LMA data is used to create GLM Proxy data
  - The lower GLM resolution (~10 km vs. < 1 km) “spreads out” the LMA proxy data

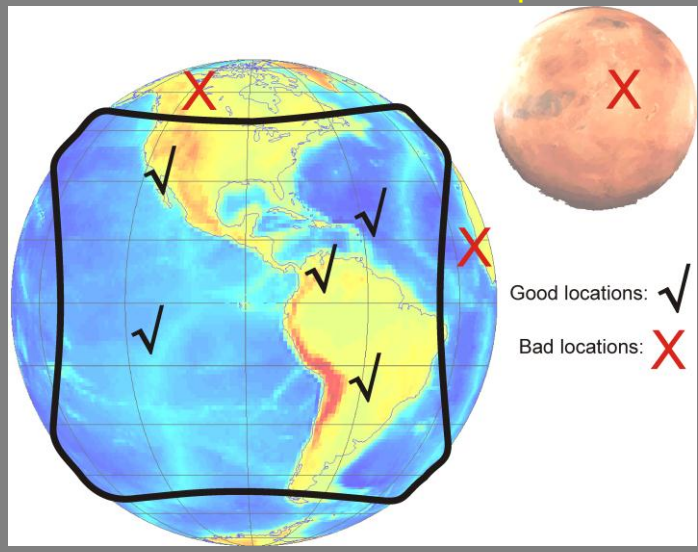
LMA to GLM proxy to GLM Algorithm Output

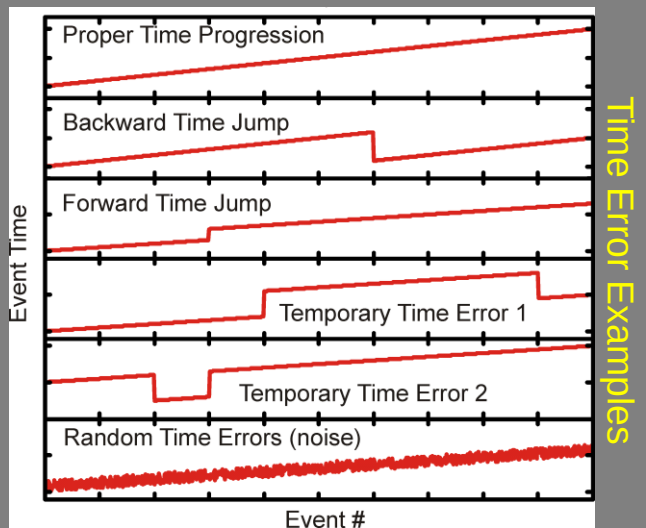


Proxy Datasets

- Resiliency Tests
  - Code is able to handle amplitude and location errors by simply rejecting the erroneous data (outside of GLM FOV or outside of GLM amplitude range)
  - Timing errors are more problematic, but are handled by resetting the group/flash time clocks (for clustering)

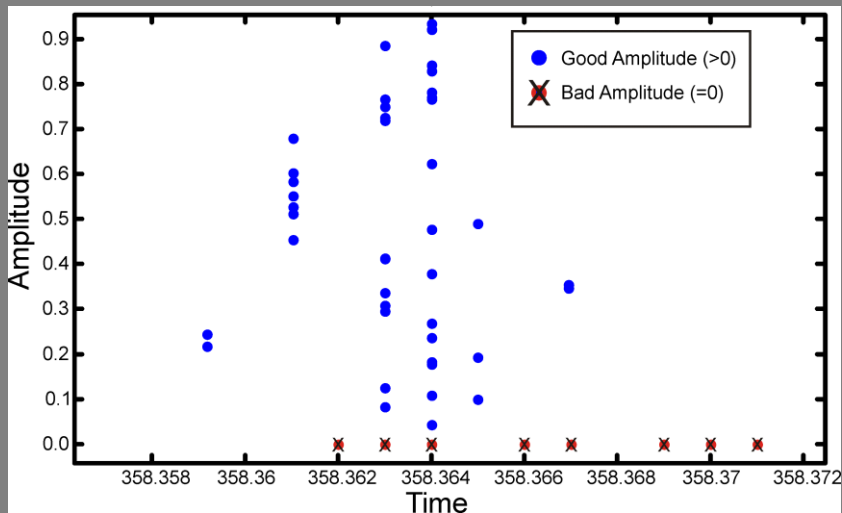
Location Errors Example





Time Error Examples

Amplitude Errors Example



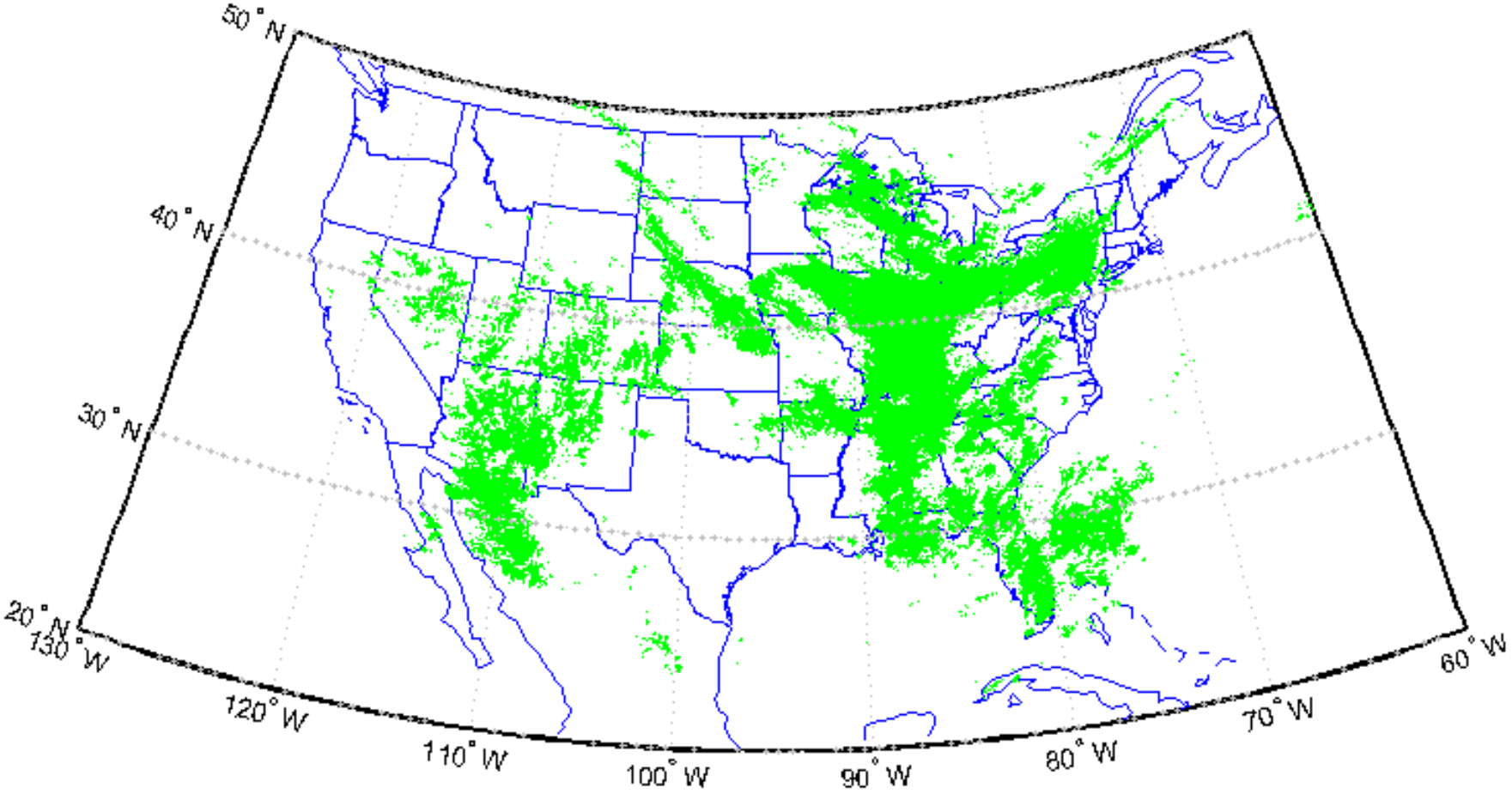
Proxy Datasets

- What new datasets are needed?
  - “Realistic”
  - Corresponding to ABI storm datasets

Clustering Algorithm Details

- Improvements Over OTD/LIS Clustering
  - Full fit vs. first fit
  - Cluster on events, not centroids
- Coding Aspects
  - Leaving “hooks” for filtering
    - Filtering opportunities after each clustering step
    - Flashes/Groups/Events “marked”, not removed
  - Horseshoes_Handgrenades()
    - Speeds processing of large FOV data
    - Quick checks proximity of “new” event to current “open” flashes

Horseshoes_Handgrenades



Is the new event “close to” an active flash?

“Close only counts in horseshoes & handgenades”

Questions?

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