STI Science and Technology Institute

The Impact of Single Group Flashes on the GLM Detection Efficiency and False Alarm Rate

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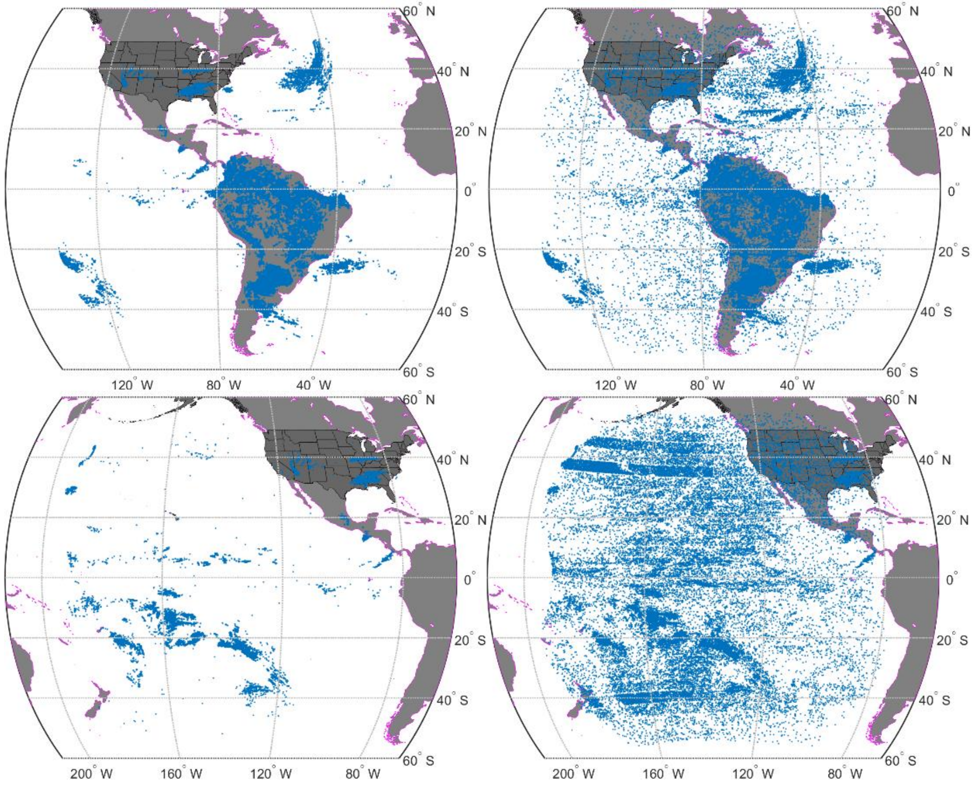
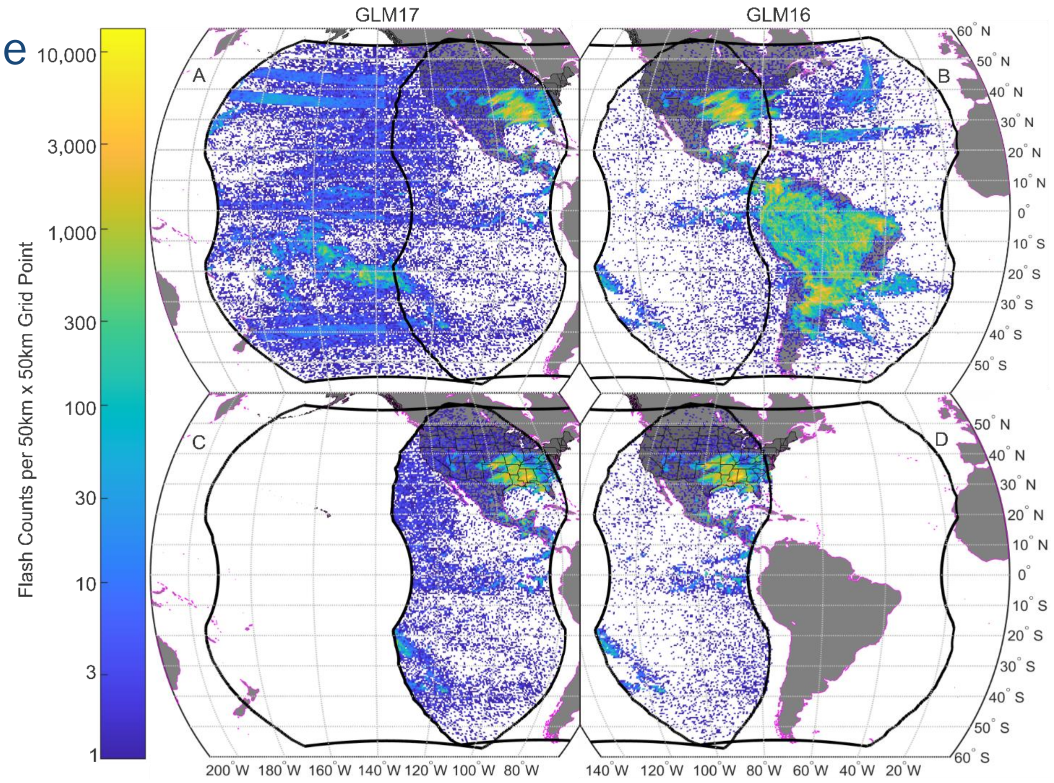
Introduction

- The filter to remove all Single Group Flashes (SGFs) was introduced 28 November 2017
  - Implemented to remove spurious non-lightning detections by the GLMs that tend to be single isolated pulses
  - These spurious non-lightning detections increase the instrument False Alarm Rate (FAR)
  - Various efforts (e.g., Cummings, 2021; Peterson et al., 2021; Thomas, 2019) indicate that at least some of these SGFs are real flashes
  - Removal of these flashes can negatively impact the flash Detection Efficiency (DE) calculation measurements.



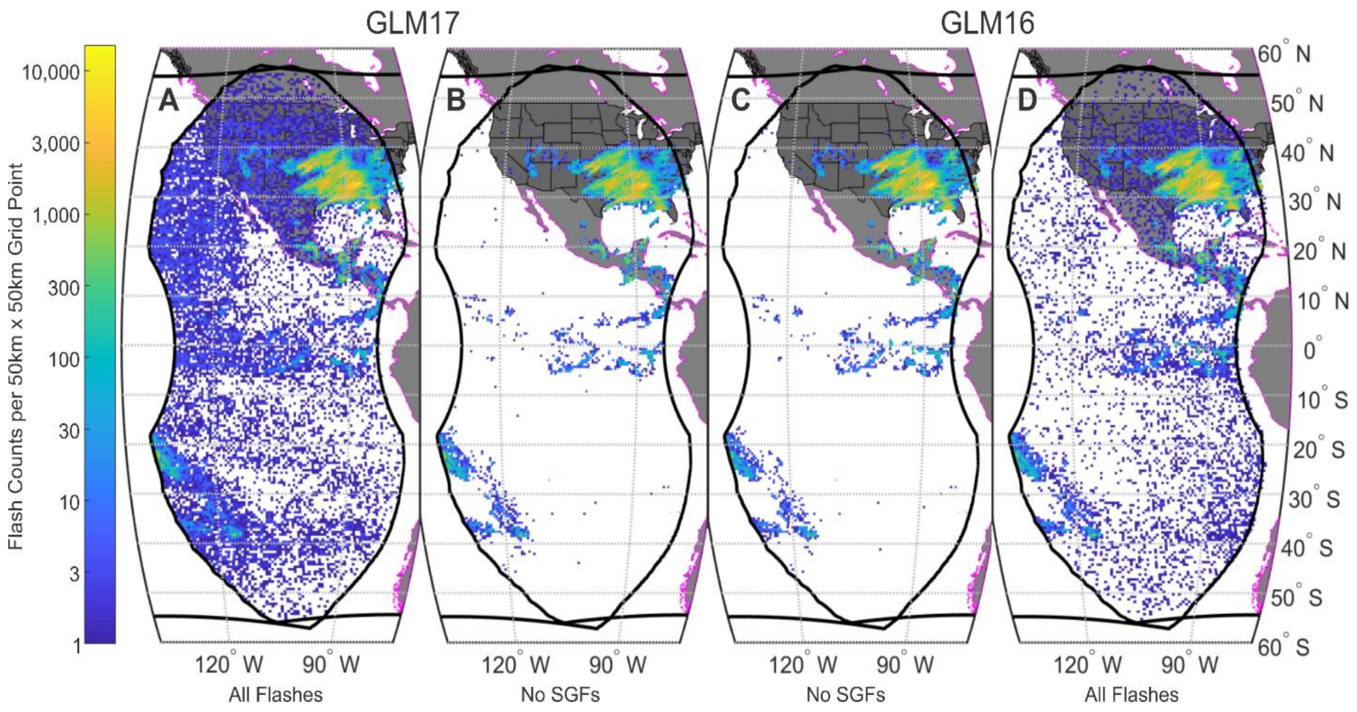
Determine What Fraction of SGFs Are Noise/Lightning

- There is a significant region where the two GLMs overlap
- Flashes detected by BOTH GLMs are very likely to be "real"
- GLM data
  - 72 hours of GLM16 and GLM17 Level 1b events
    - 16-18 March 2021
    - Clustered into groups and flashes
    - No SGF filter
    - No child count limit
    - No flash temporal limit
    - Data limited to overlap region



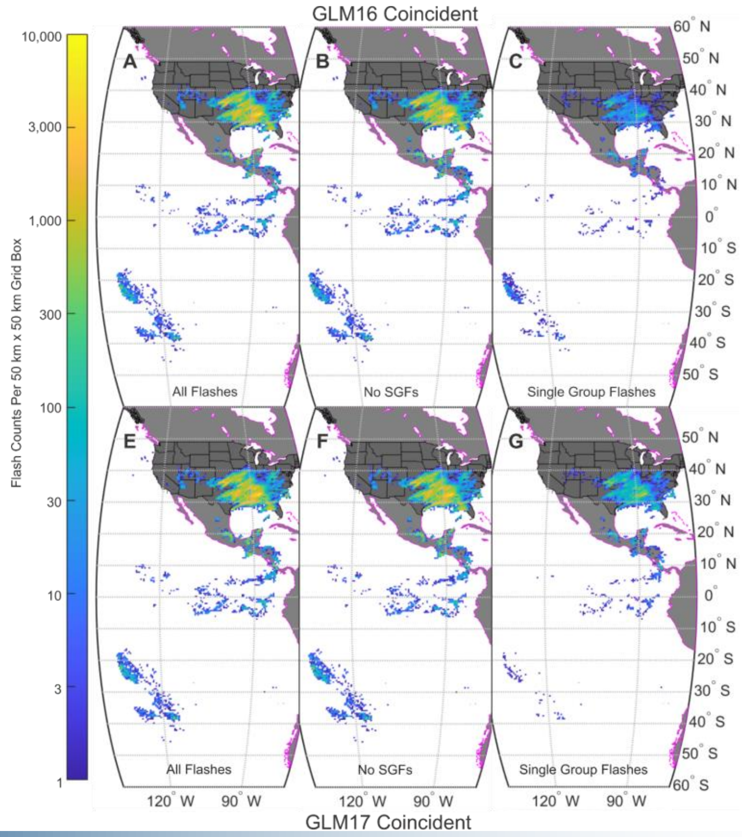
Overlap Region Dataset

- GLM data in the overlap region during the study period
  - 740,248 GLM16 flashes (total) (D)
  - 623,084 GLM17 flashes (total) (A)
  - 661699 GLM16 Multi-Group Flashes (MGFs) (C)
  - 520407 GLM17 MGFs (B)
- Find common flashes between GLM16 and GLM17 in the overlap region



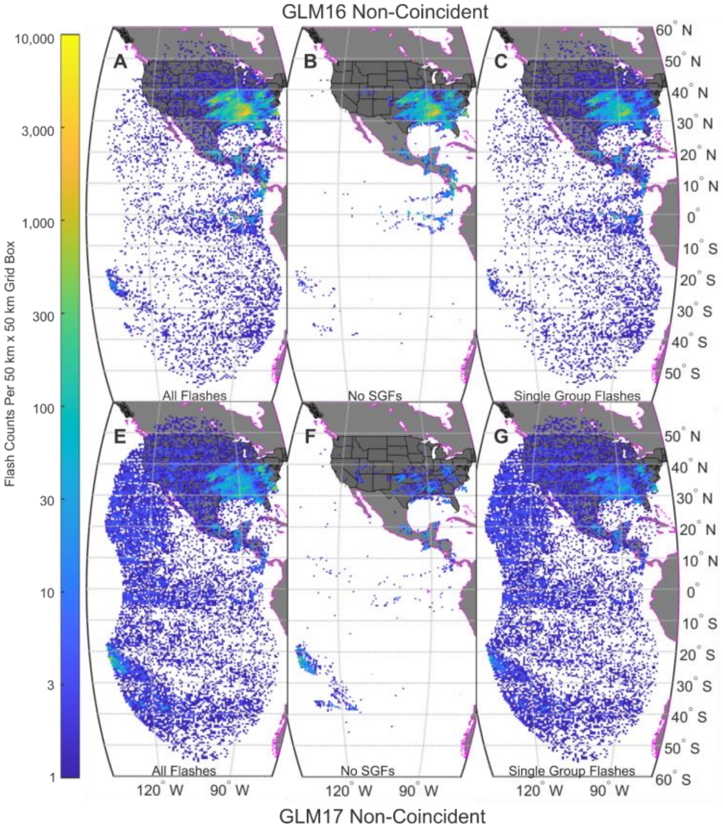
Coincident Dataset

	Flashes in Overlap Region		Coincident Flashes	
	All	No SGFs (Operational Algorithm)	All	SGFs
GLM16	740248	661699	558490	21272 (4%)
GLM17	623084	520407	586423	77969 (13%)



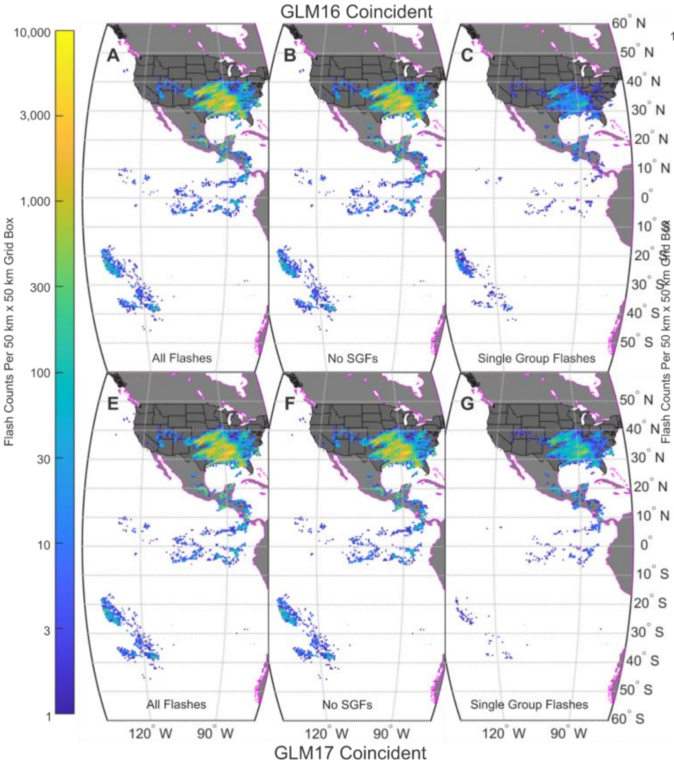
Non-Coincident Dataset

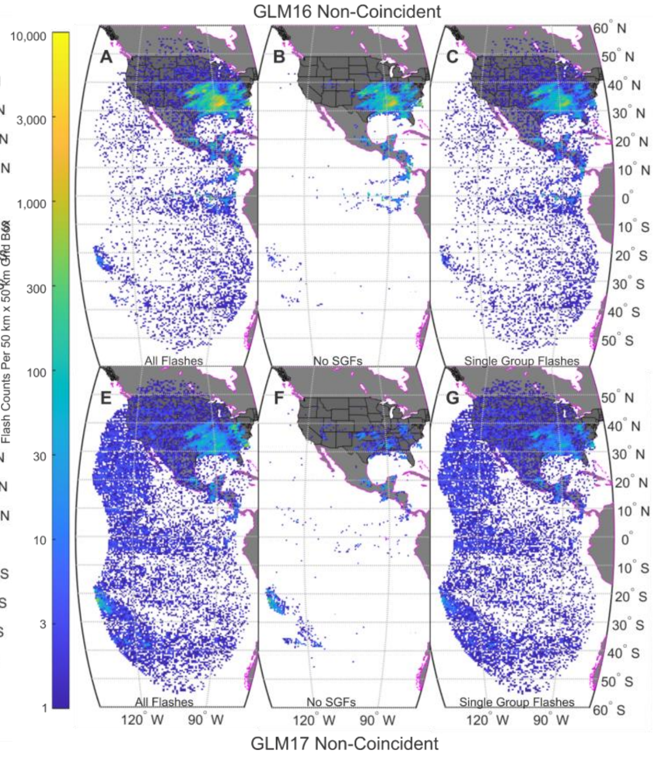
	Flashes in Overlap Region		Non-Coincident Flashes	
	All	No SGFs (operational algorithm)	All	MGFs
GLM16	740248	661699	181758	125582 (69%)
GLM17	623084	520407	36661	11953 (33%)



Observations

- The coincident data (more or less) matches the MGF dataset
- MGFs dominate the data
- The SGF filter does a decent job in eliminating “noise” flashes
- There are a significant number of SGFs (4-13%) that are coincident between GLM16 and GLM17
- There are a number of MGFs that are not coincident between the two GLMs
- **The “real” SGFs tend to cluster with the MGFs**

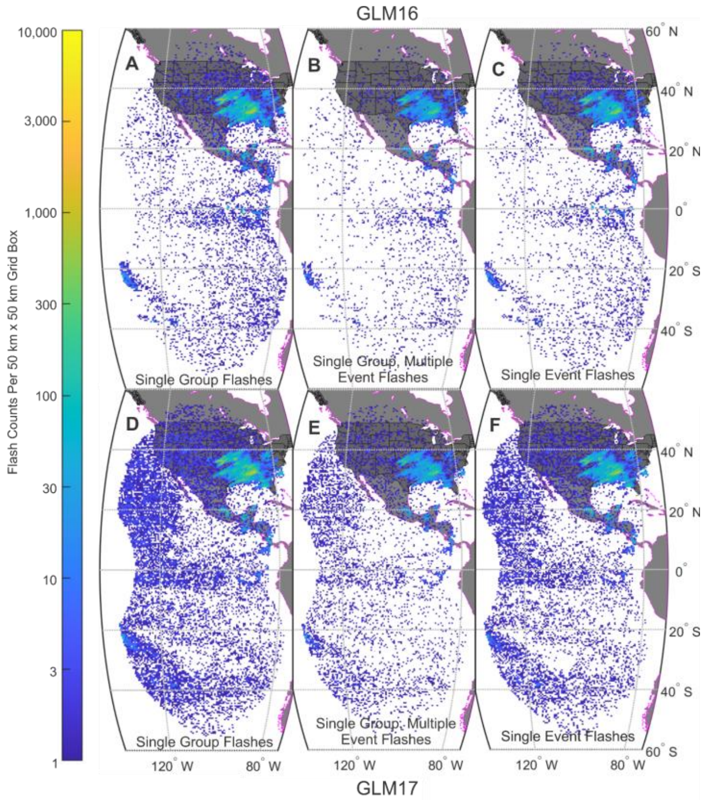




Current Work Goal

- We need to find a way to reintroduce the "real" SGFs without including the "noise" SGFs

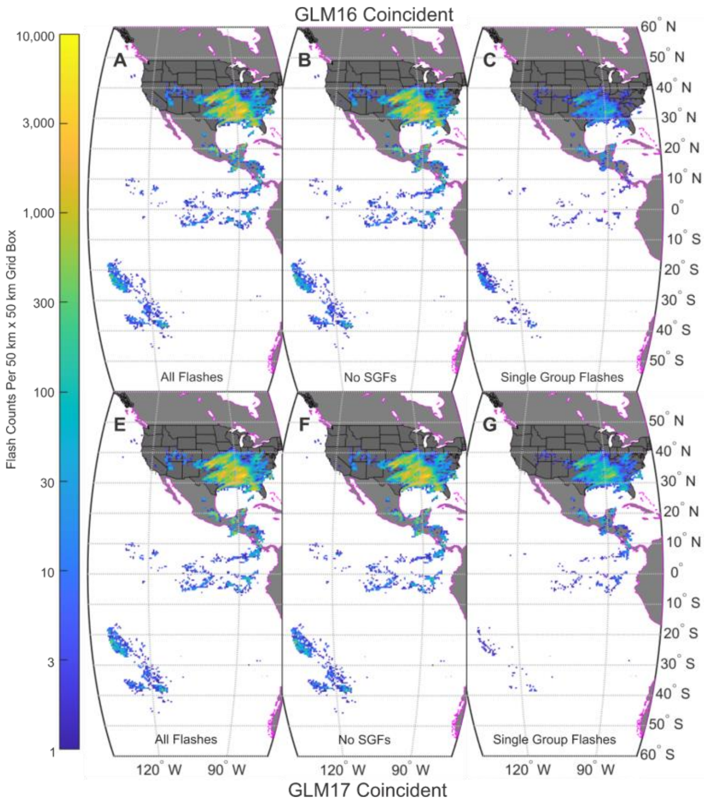
- Change Single Group Flash Filter to a Single Event Flash Filter?
  - The Single Event Flash (SEF) distribution is not very different than the distribution of SGFs
  - A more sophisticated algorithm to separate "noise" SGFs from "real" SGFs is needed



Innocence by Association Filter

- The "hint" is in one of the observations:
  - 'The "real" SGFs tend to cluster with the MGFs
- Develop a filter that keeps the SGFs that are "close" to the MGFs and remove those that are "not close"

- Filter Progress...
  - Temporal and spatial definitions of "close" are currently being explored
  - Comparing results to GLD360 and ENTLN data
  - Maximize DE gain while minimizing the impact of the added SGFs on the FAR
  - Results should be part of the GLM reprocessing task algorithm



Questions?

Determining Coincidence

- To determine if flash detections from GLM16 and GLM17 are from the same flash, we need to set temporal and spatial rules and limits for coincidence
  - Use the time gaps between flashes to determine flash coincidence
  - Take the minimum distance from any two events in the flashes
  - Spatial limit = 20 km
  - Temporal limit = 0.5 s