WTLMA, LF, and GLM comparisons with updated processing

GLM Science Meeting
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Purpose

Assess updated ground network datasets

Last year: showed significant differences in cloud and ground stroke detection efficiency and classification on 9 Oct 2019 in Lubbock, TX.

Advocated for: a long term effort to cross-check and validate detection efficiency and classification performance, since innovation means ground datasets continue to change.

Both classification/location algorithms were since updated: are the changes meaningful?

Datasets:

West Texas Lightning Mapping Array (VHF band)

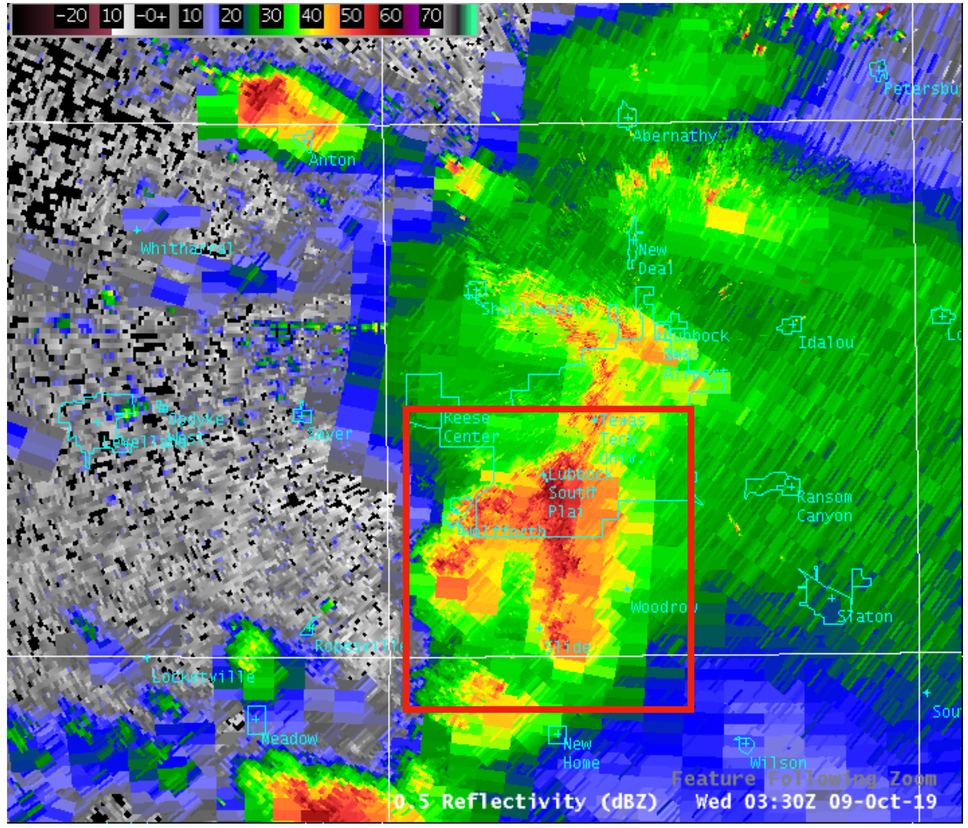
GOES-16, GOES-17 GLM (optical)

ENI and Vaisala stroke-detecting networks (~LF band) — reprocessed datasets (thanks!)

Classification: mixed messages

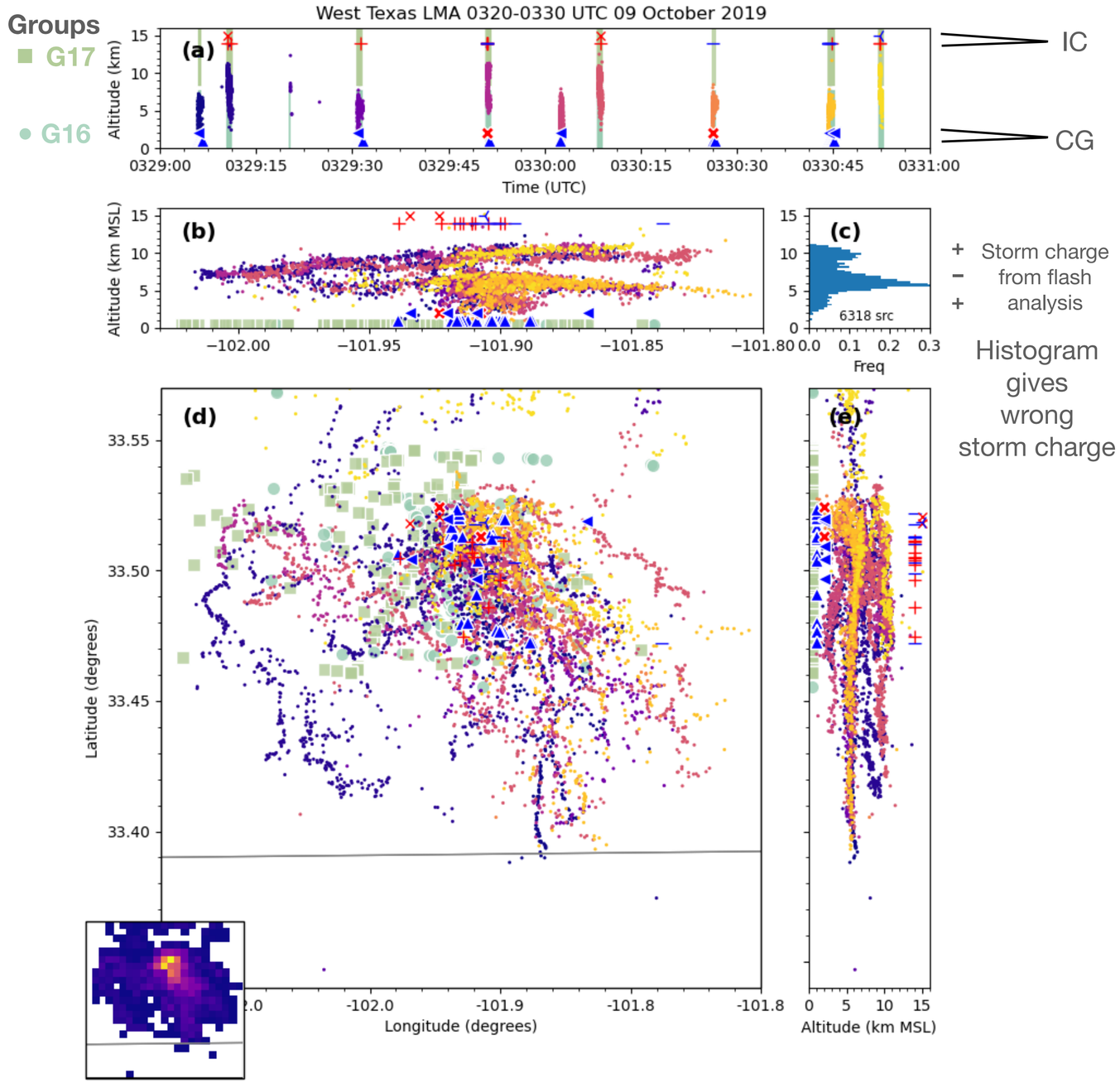
Last year:
9 flashes, two minutes, quite a bit of disagreement

- Case on 8-9 October observed by coauthor Jordan: saw two lightning flashes out window and looked at two radio-frequency stroke detection networks for their solutions.



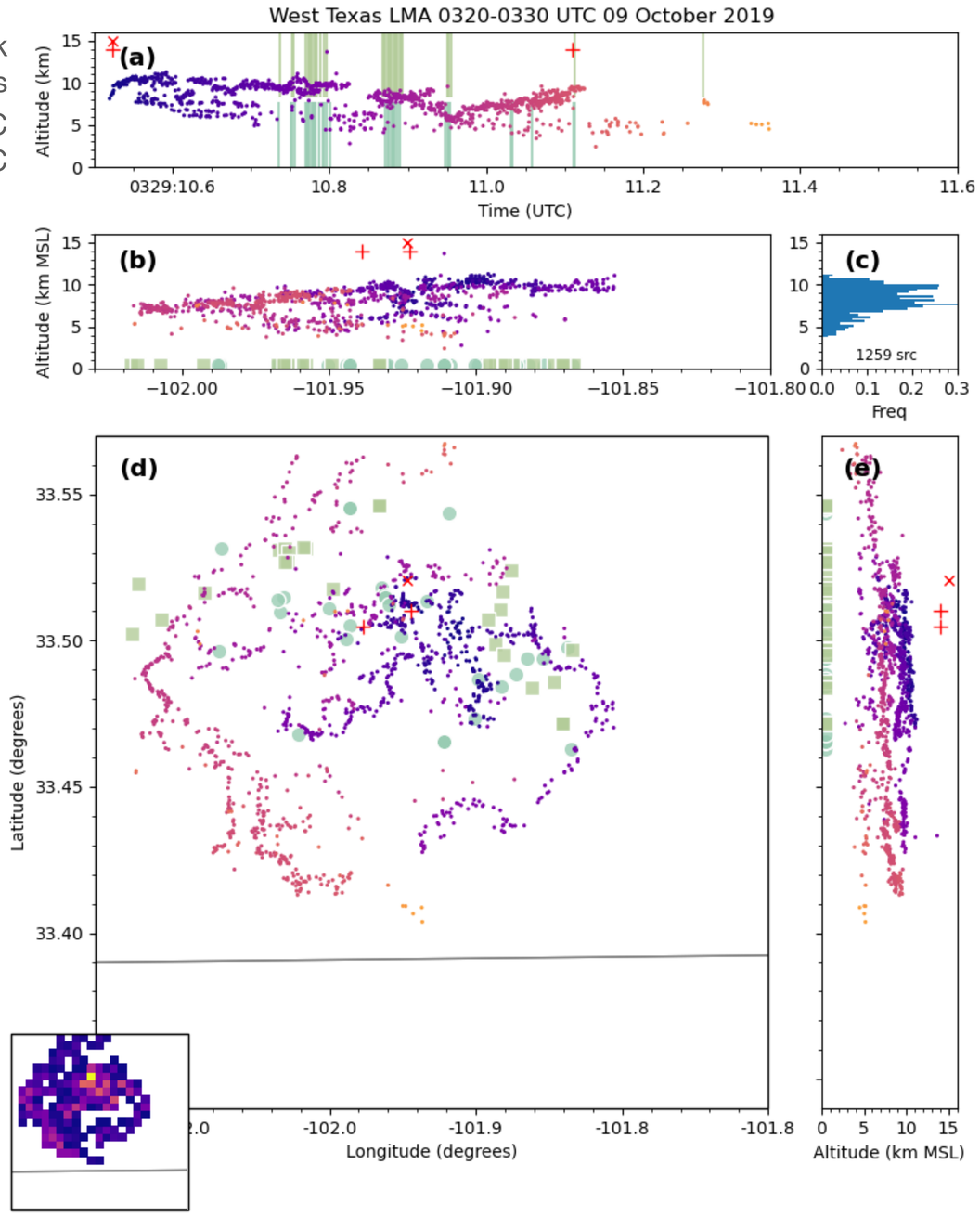
Radar reflectivity

Two stroke/pulse networks



Good overall IC performance by all sensors

Old processing



Network differences

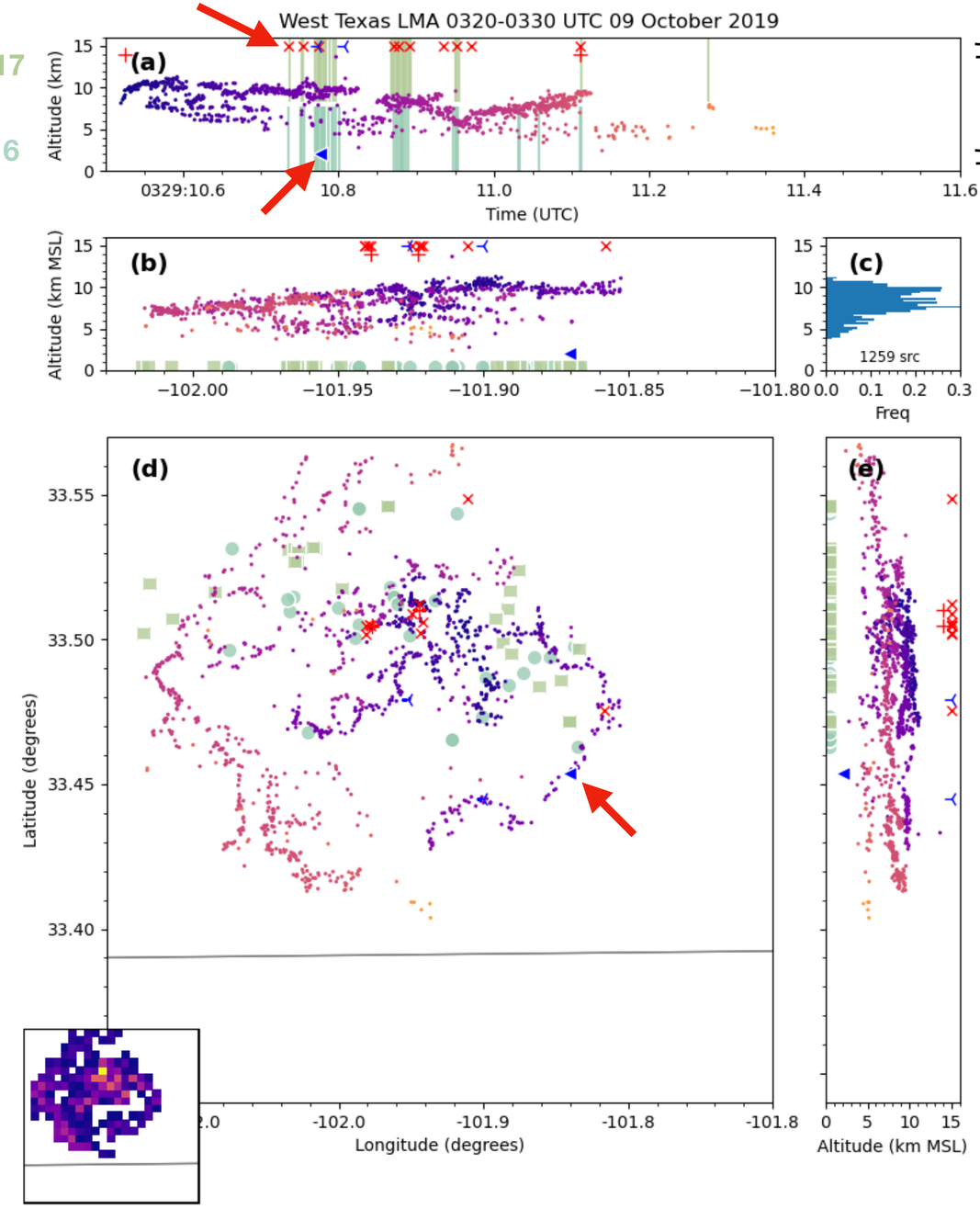
1 +IC

2 +IC

G17

G16

New processing



IC

CG

Network 1: new –CG, many more IC pulses, dropped first +IC

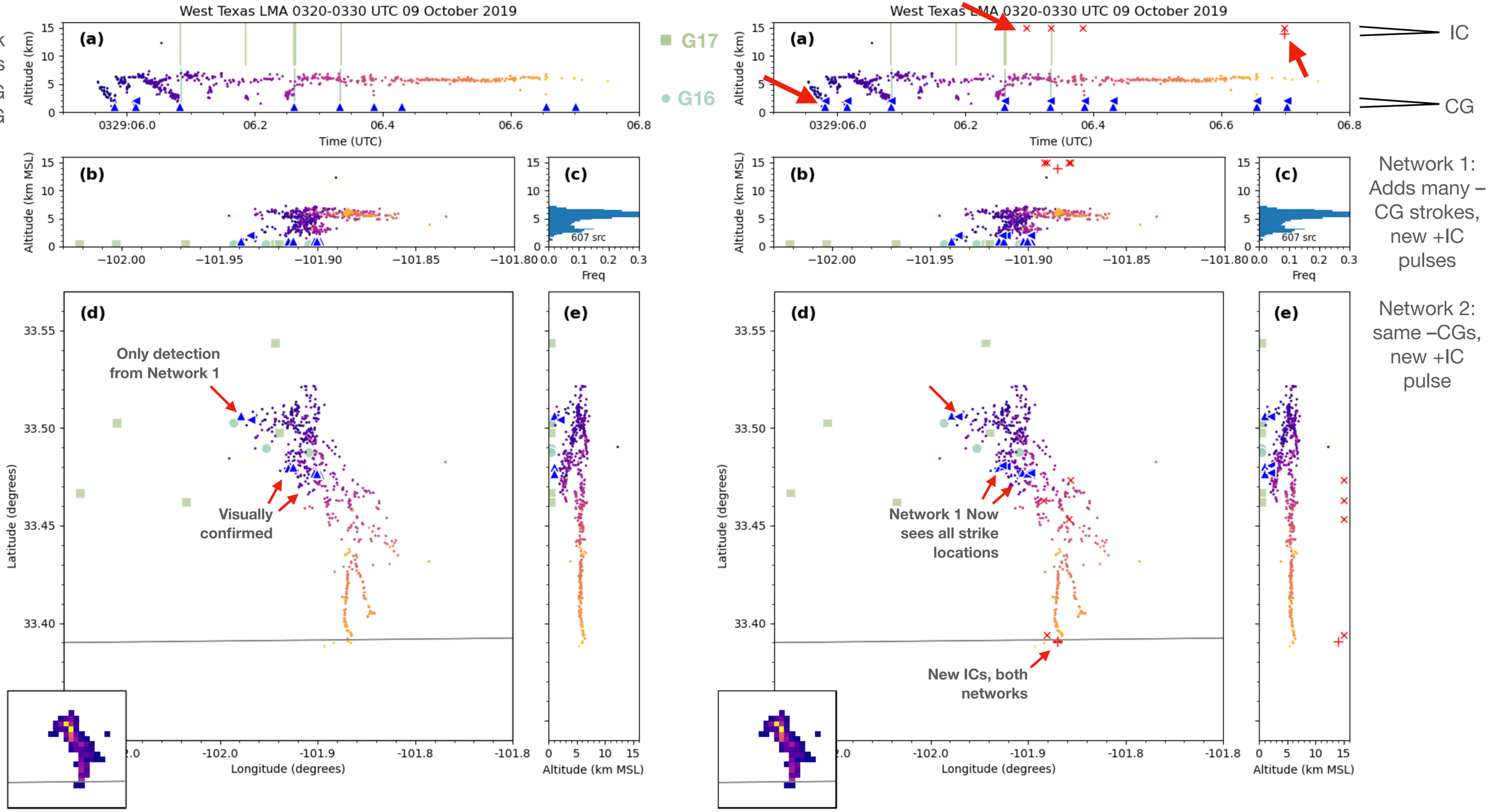
Network 2: No change

CGs close to Jason Jordan's house

Old processing

New processing

Network differences
1 –CG
9 –CG



Network 1: Adds many –CG strokes, new +IC pulses

Network 2: same –CGs, new +IC pulse

Old processing

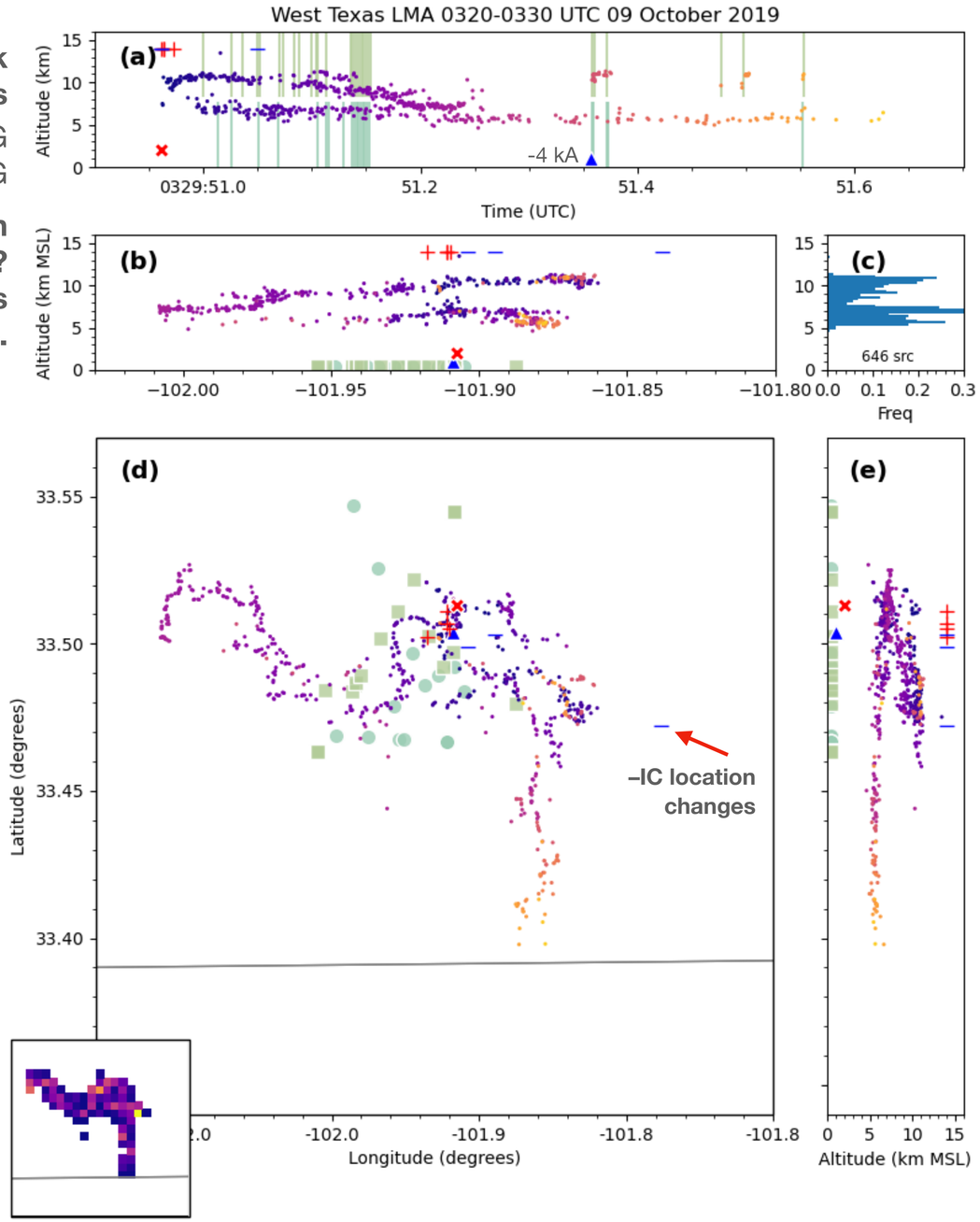
New processing

Network differences

+CG

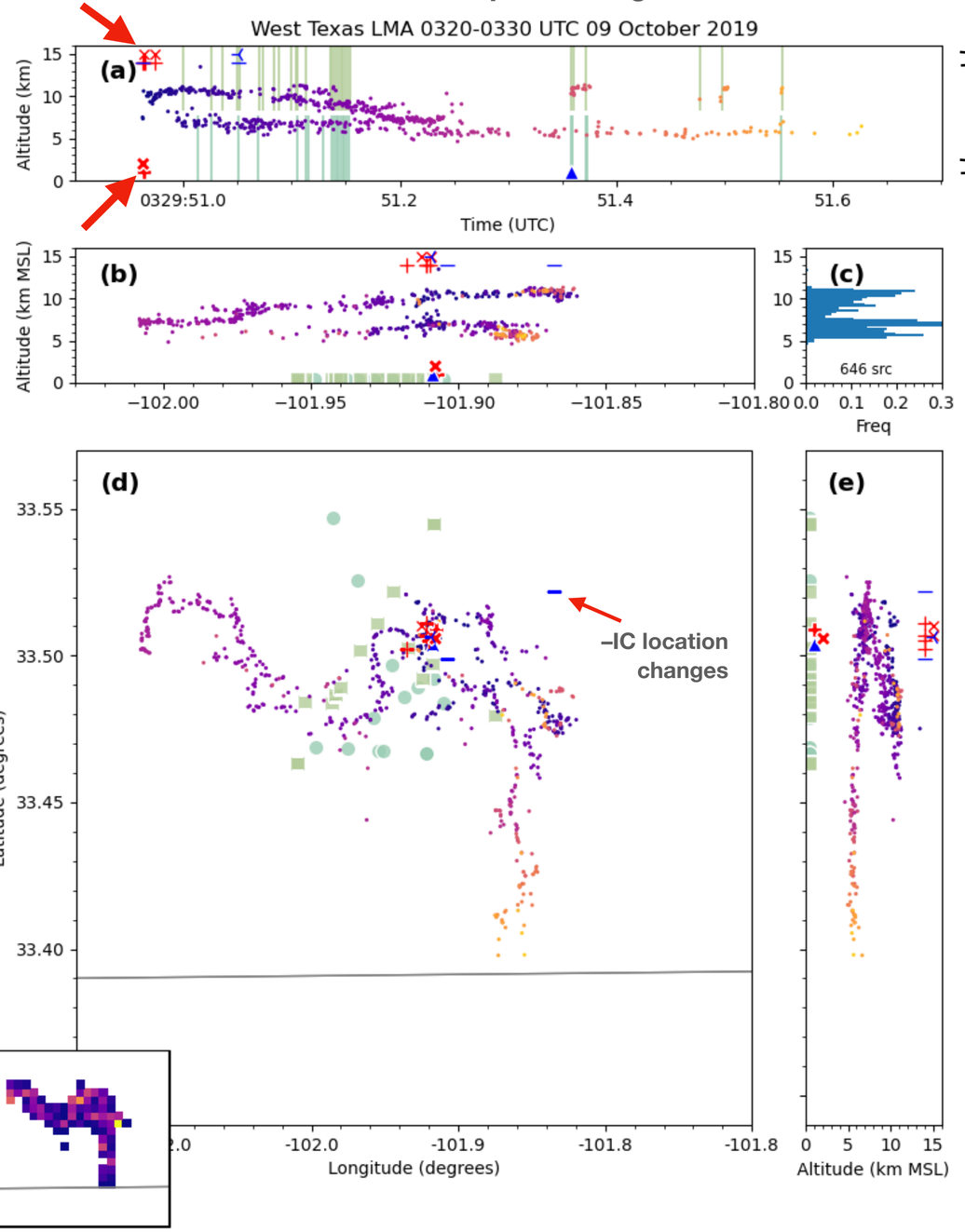
–CG

Both wrong? LMA has a +IC.



G17

G16



IC

CG

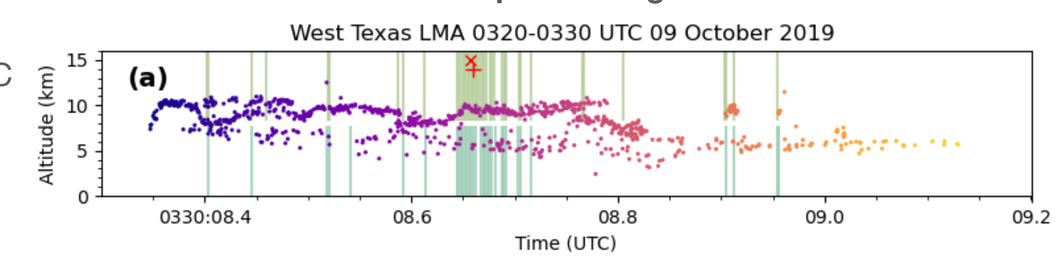
Network 1: Adds + and – IC pulses, same CGs

Network 2: Adds 1 +CG, same ICs

Old processing

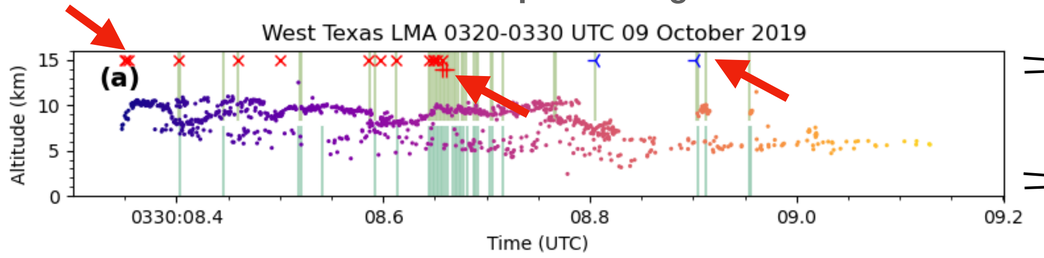
New processing

Correct IC polarity



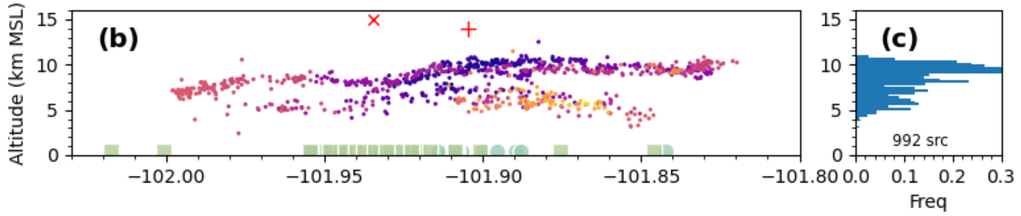
G17

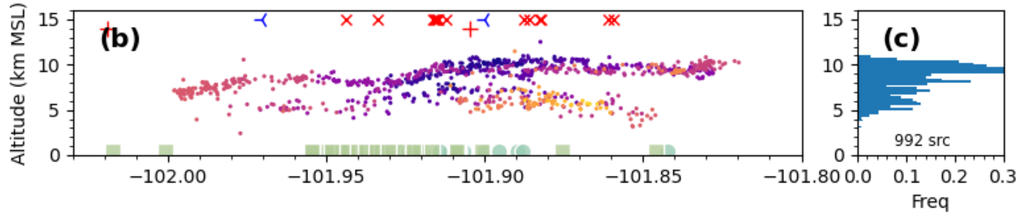
G16



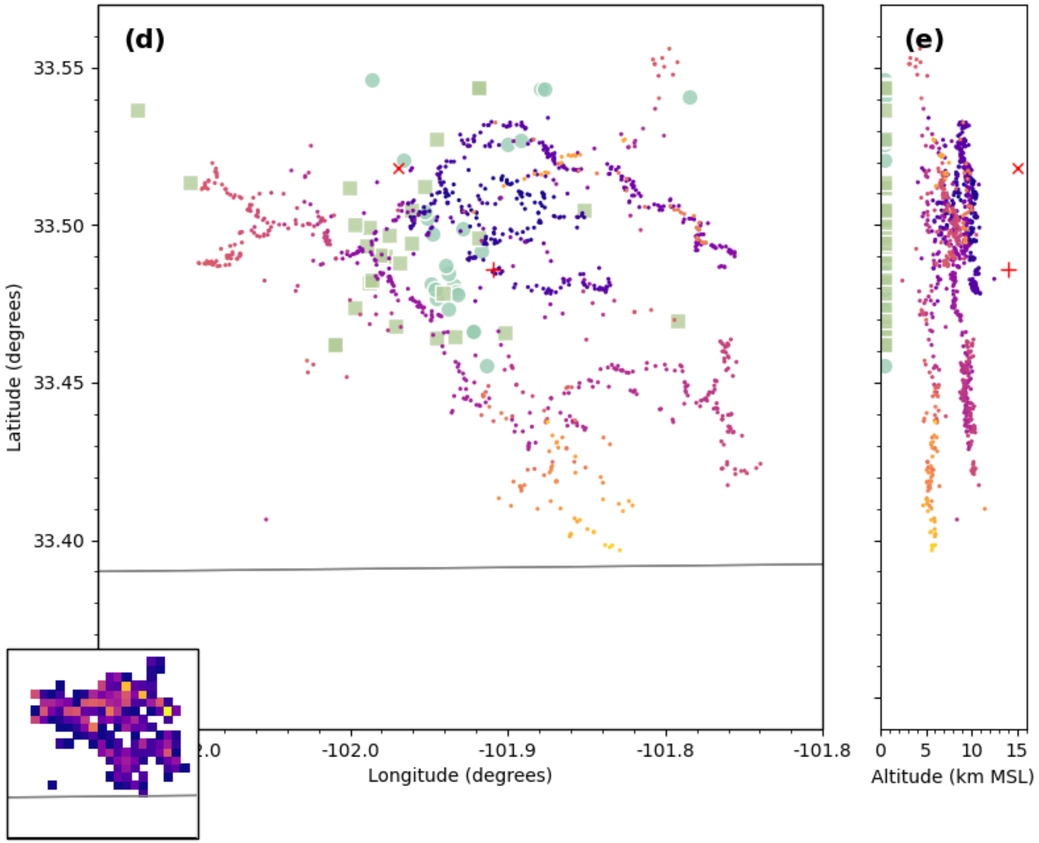
IC

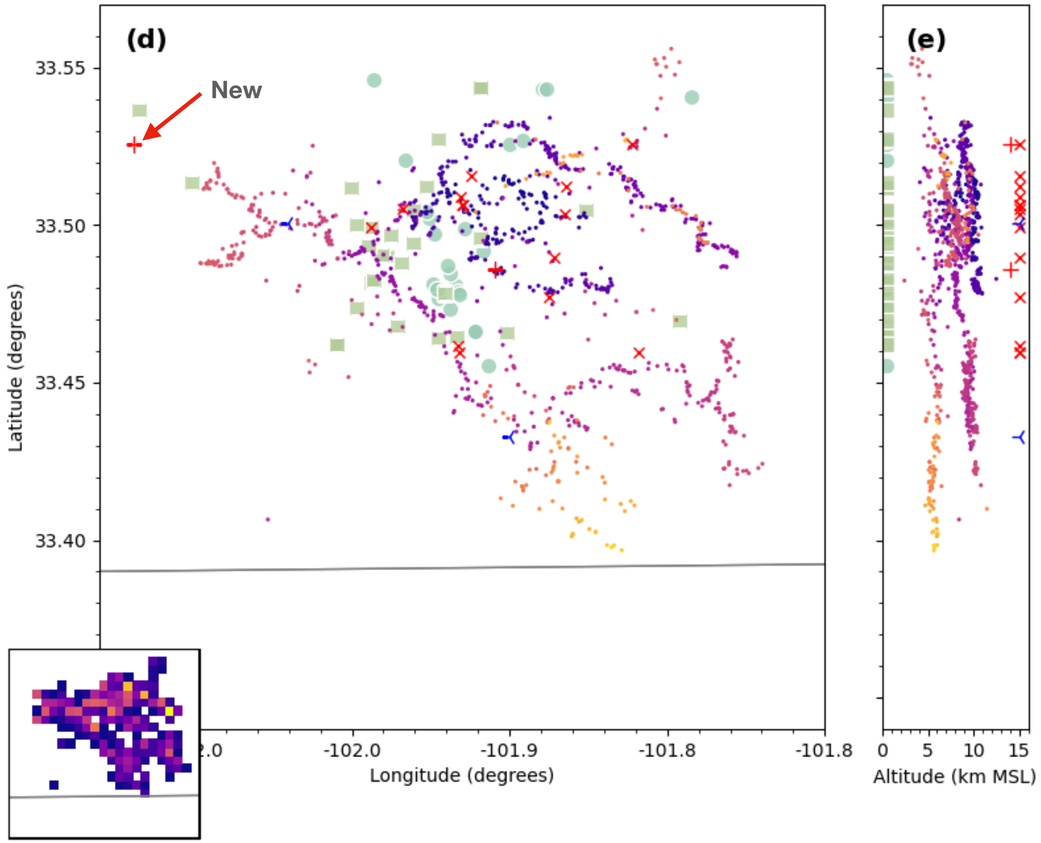
CG





Network 1: Adds many +IC pulses and two –IC pulses





Network 2: Adds one +IC pulse

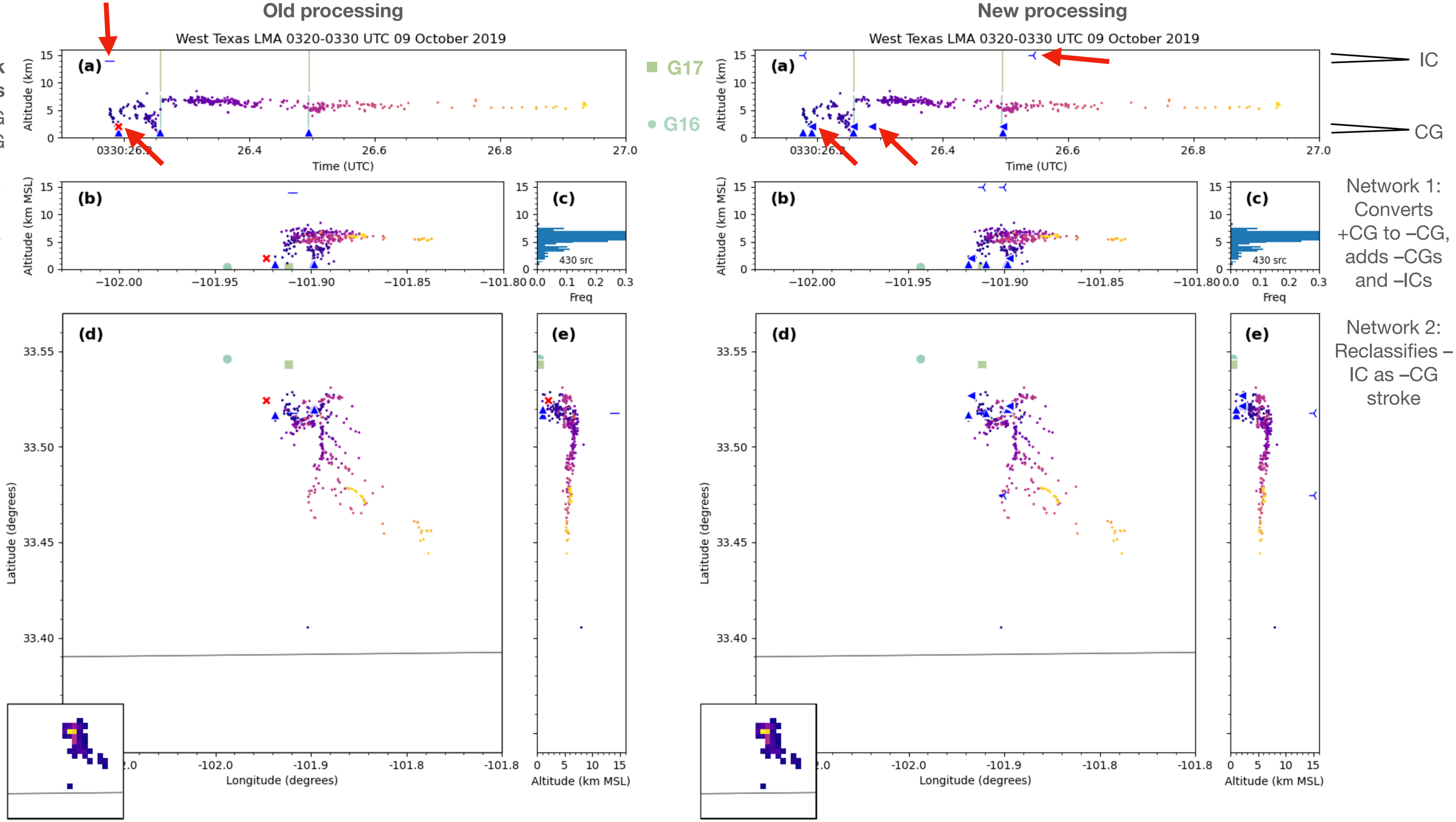
Old processing

New processing

Network differences

1 +CG
3 –CG

Wrong polarity by network A



Network 1: Converts +CG to –CG, adds –CGs and –ICs

Network 2: Reclassifies –IC as –CG stroke

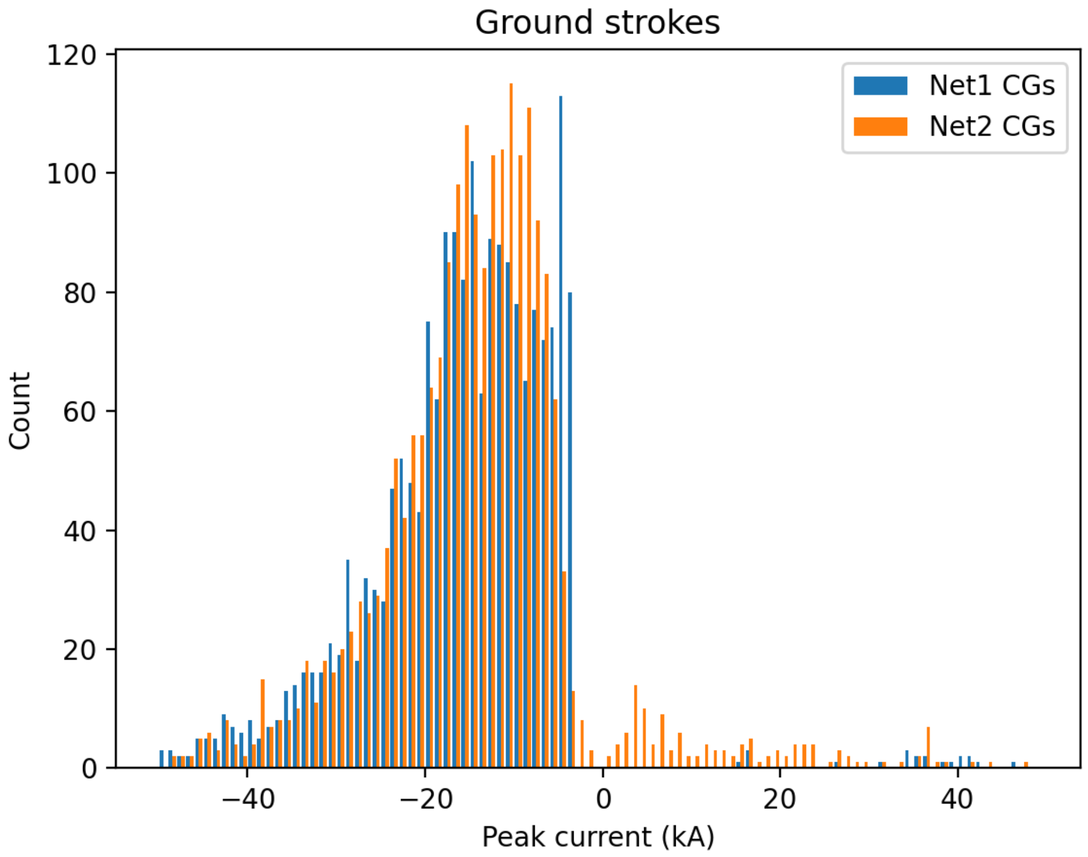
WTLMA, LF, and GLM comparisons with updated processing

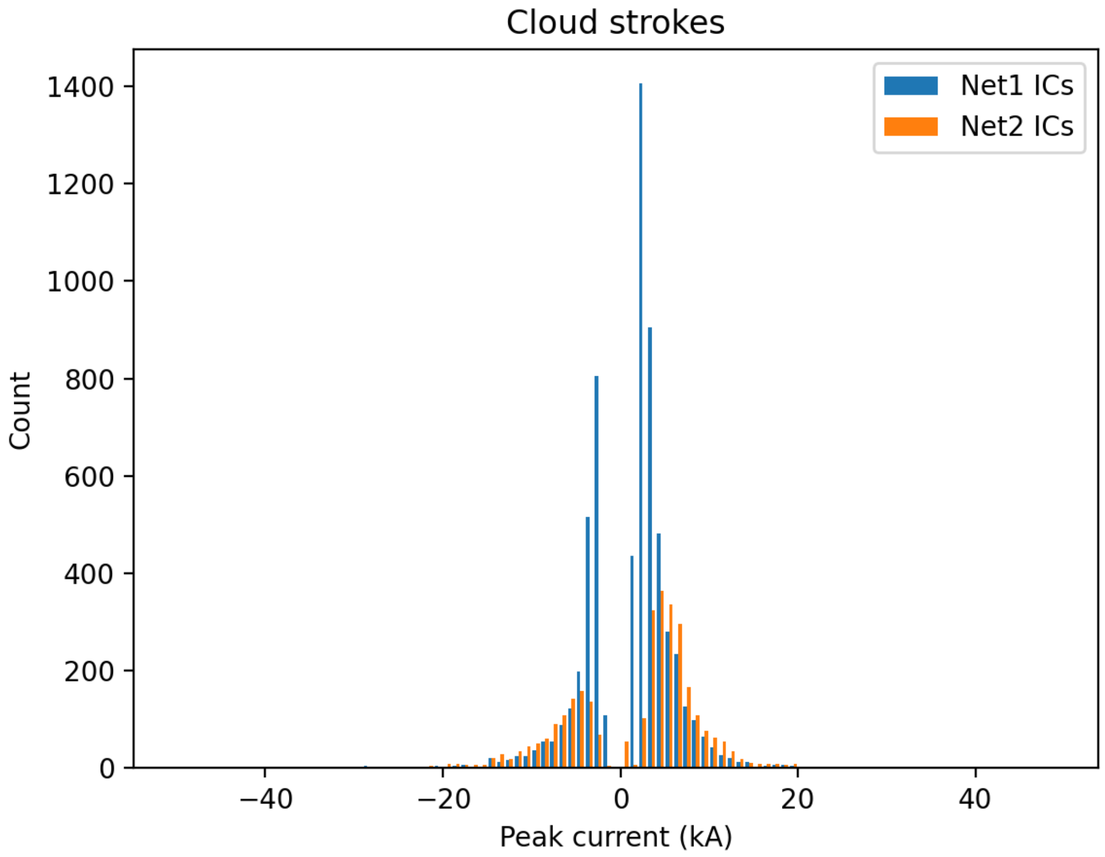
Summary

- Limited sample; no field change data for cross-validation.
- Processing changes have brought both datasets into closer agreement. Network 1 changed a lot, small differences in network 2.
- Differences in classification and errors in location are still present. QC data (# sensors, error ellipses) increasingly important for flexible filtering of low amplitude events.
- Mixed IC polarities and/or IC polarity that disagrees with CG polarity is not uncommon. Utilization of IC polarity requires a deeper background in lightning than we can expect of meteorologists?
- I still advocate for a commitment to a geographically diverse set of field change validation data to complement LMAs — ideally public and open.

Peak current distribution

With new processing

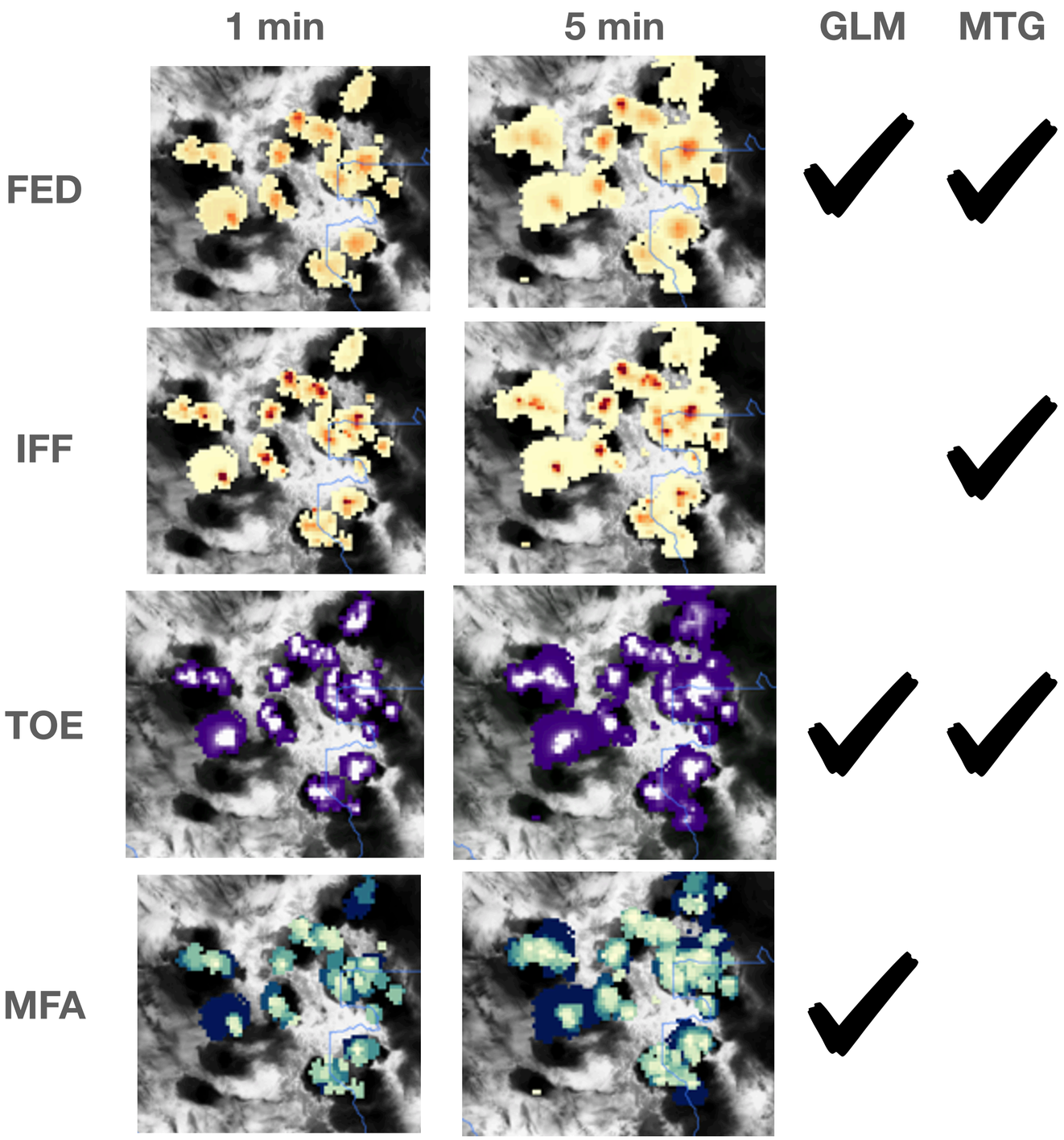




0300-0400 UTC, 33 to 35° latitude, -103 to -101° longitude

Preparatory work for MTG LI accumulated products

- Added code to `glmtools` to calculate illuminated flash fraction (IFF), a baseline MTG LI accumulated product.
  - Sum of grid is total flash rate
  - Pixels are illuminated in proportion to the fraction of time they were illuminated during the flash
- Created categorized bibliography of all 233 papers mentioning GLM from 2018 – June 2021 in AMS and AGU journals.
- Created animations in overlap region of GLM and MTG LI (next)



5 min window animations

GOES ABI Ch 13 (10 μm thermal IR) and GLM

- Overlays were constructed with SatPy, over each subregion and for all four variables.
- 00 UTC, 1 September to 08 UTC, 4 September 2018.
- Individual images and loops available at the website, http://pogo.tosm.ttu.edu/data/MTG/GLM_MTG_proxy_2018/region_images/