

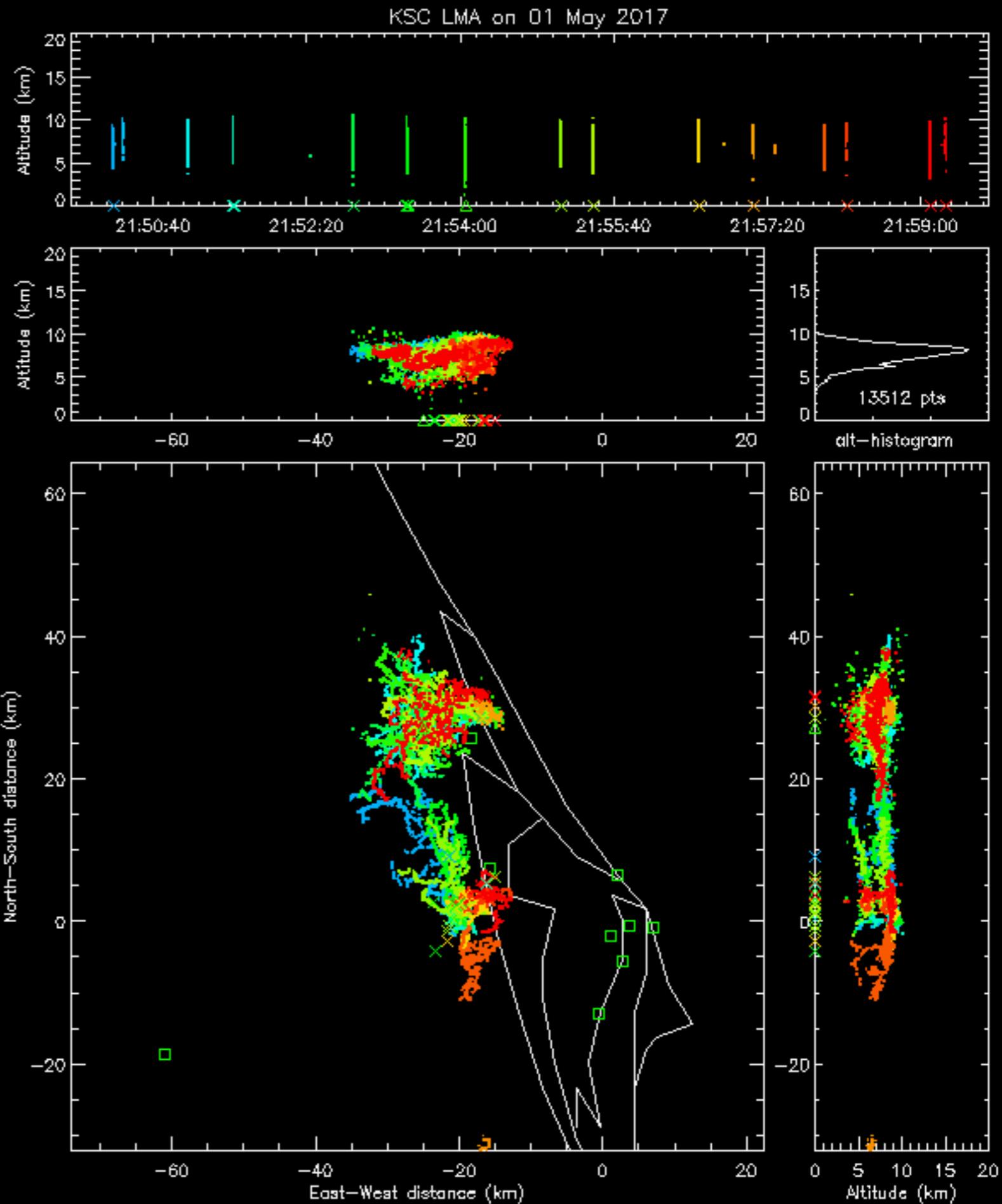
GLM/LMA Cal/Val results using xlma

Ron Thomas, Paul Krehbiel, Alex Attanasio
New Mexico Tech

LMA-GLM Flash Comparison

- Are both systems seeing the same lightning?
- What is the detection efficiency of GLM?
- What flashes does GLM miss?
- Are the GLM flashes accurately located?
- What is the GLM false alarm rate

Small Storm in Florida



Small Storm in Florida

GLM detected most flashes

Detected 13 of 15 lma flashes
with more than 75 sources

No false alarms

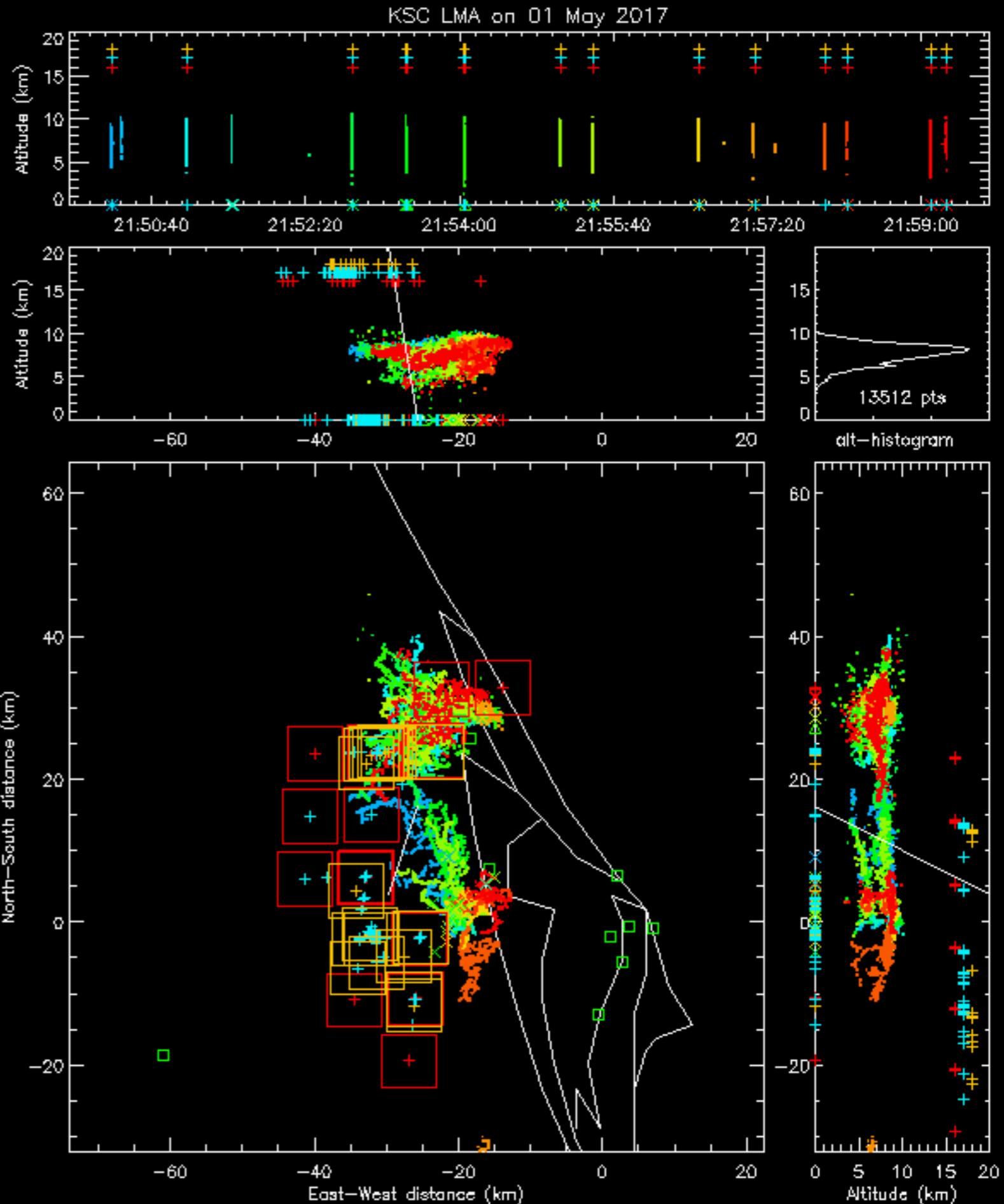
offsets longitude and latitude
10.9 km and 6.6 km

Flashes must overlap in time
and centers be closer than 15
km after offsets

Yellow - GLM flash

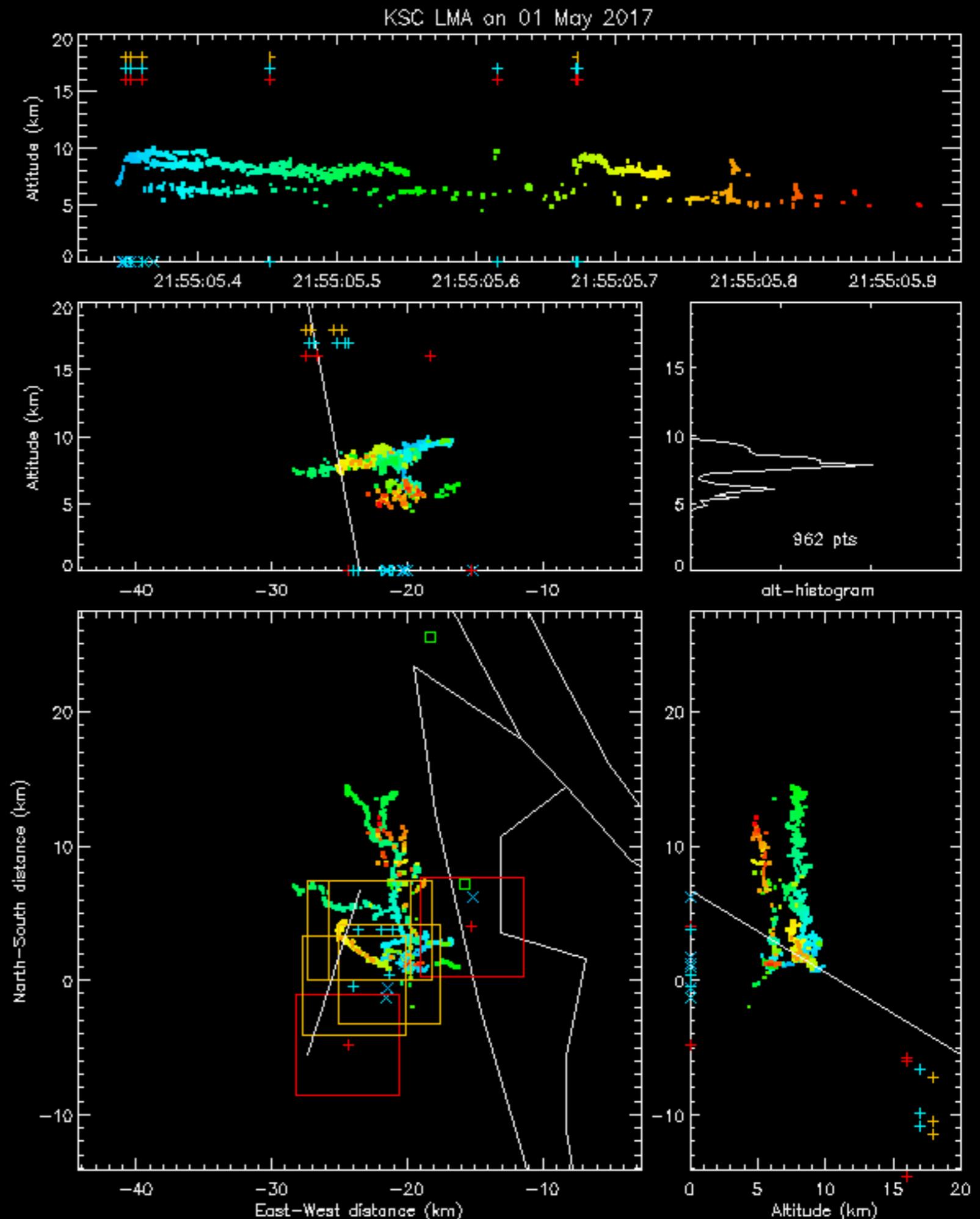
Blue - GLM group

Red - GLM event



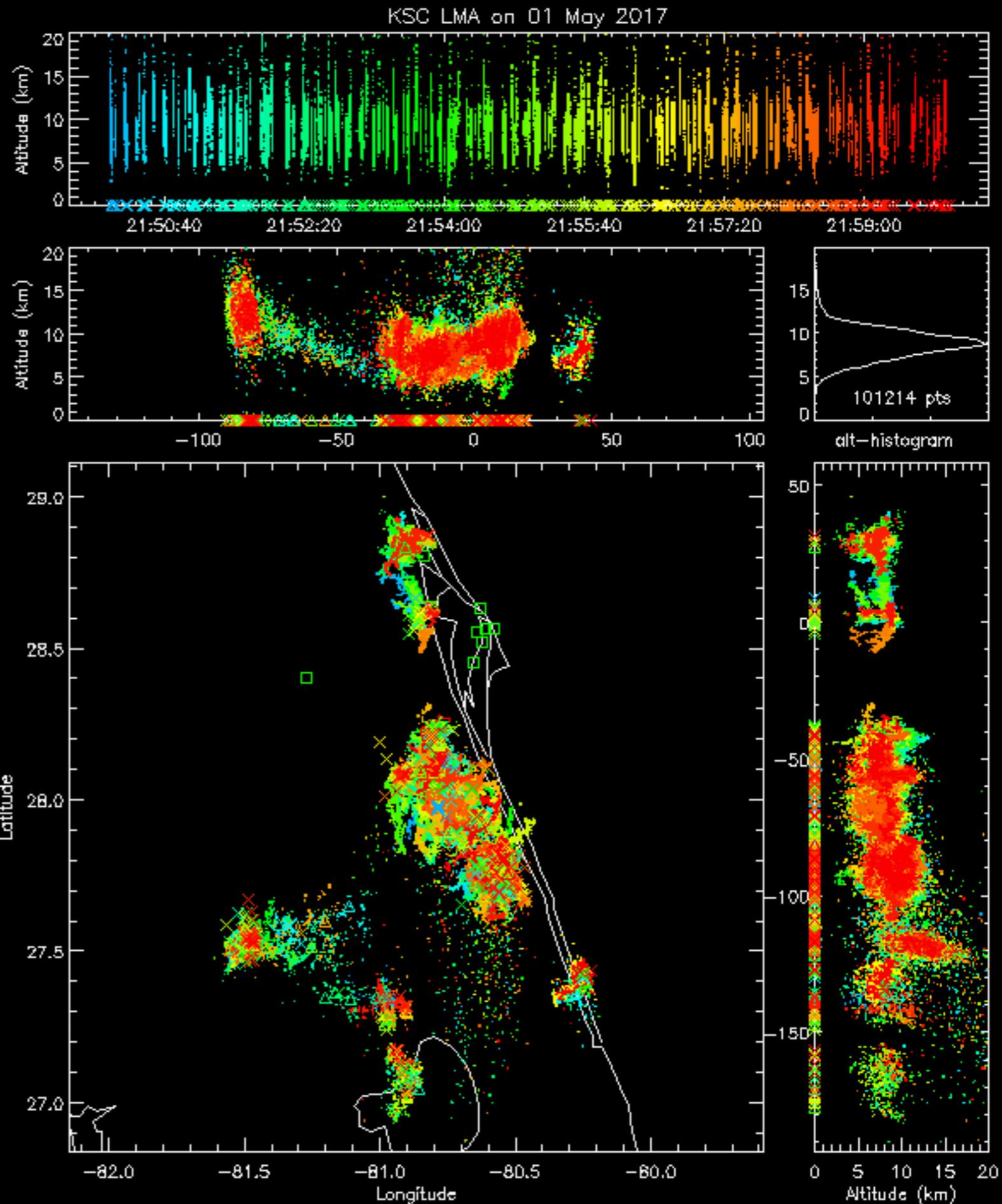
Bilevel IC Flash

- GLM divided this flash into 4 flashes
- GLM location assumed to be at ground level
- Since GOES is over the equator the view is slanted as shown by the white lines (from center of plot)
- GLM sees light within 5 ms after the first LMA point
- GLM time is the time light was detected at GOES. To compare to LMA we needed to subtract the transit time from the lightning to GLM



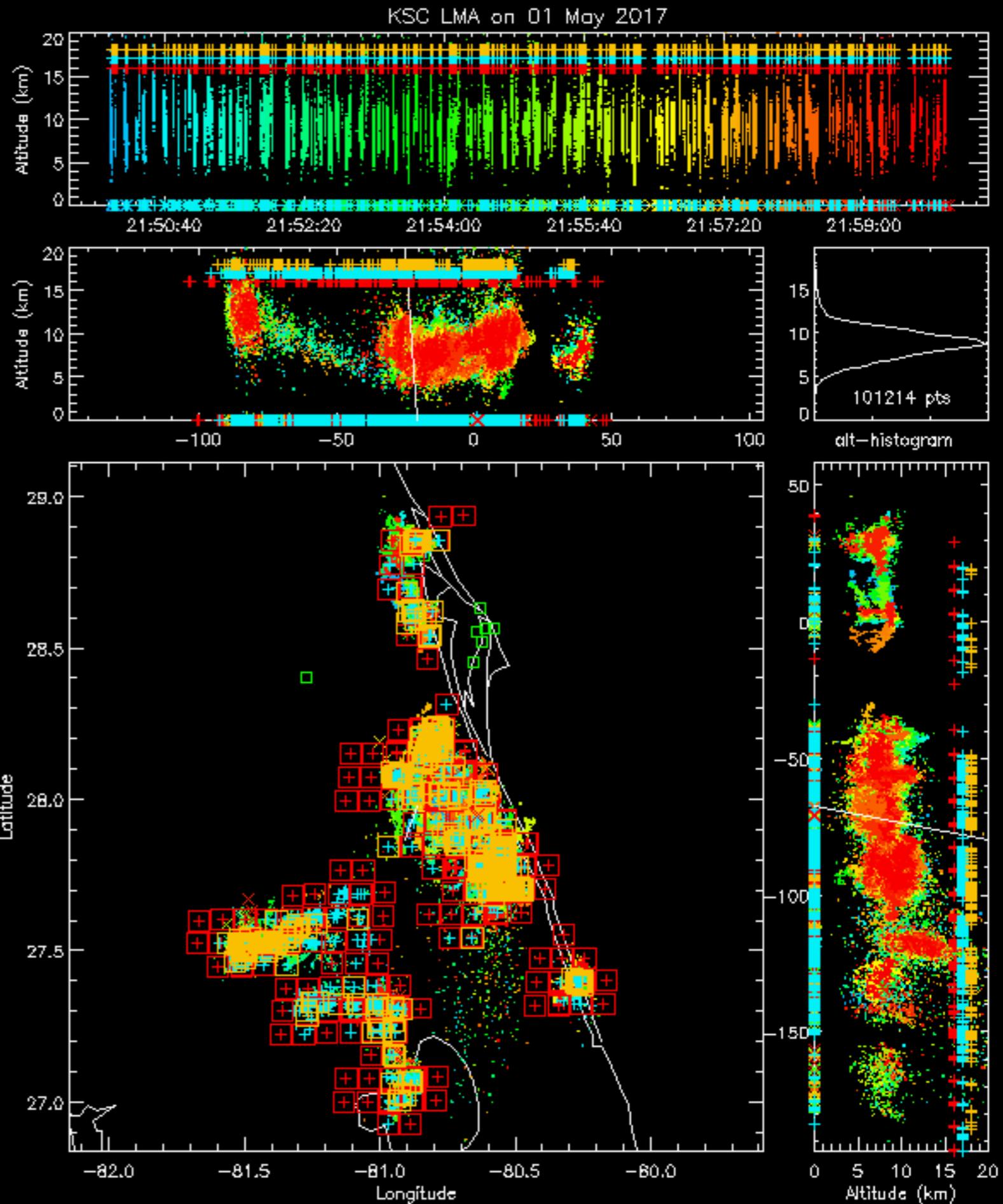
Detection Efficiency for Entire Storm

- Compare all flashes in this region
- LMA detected 383 flashes
- Large - 223
- Medium - 42
- Small - 84

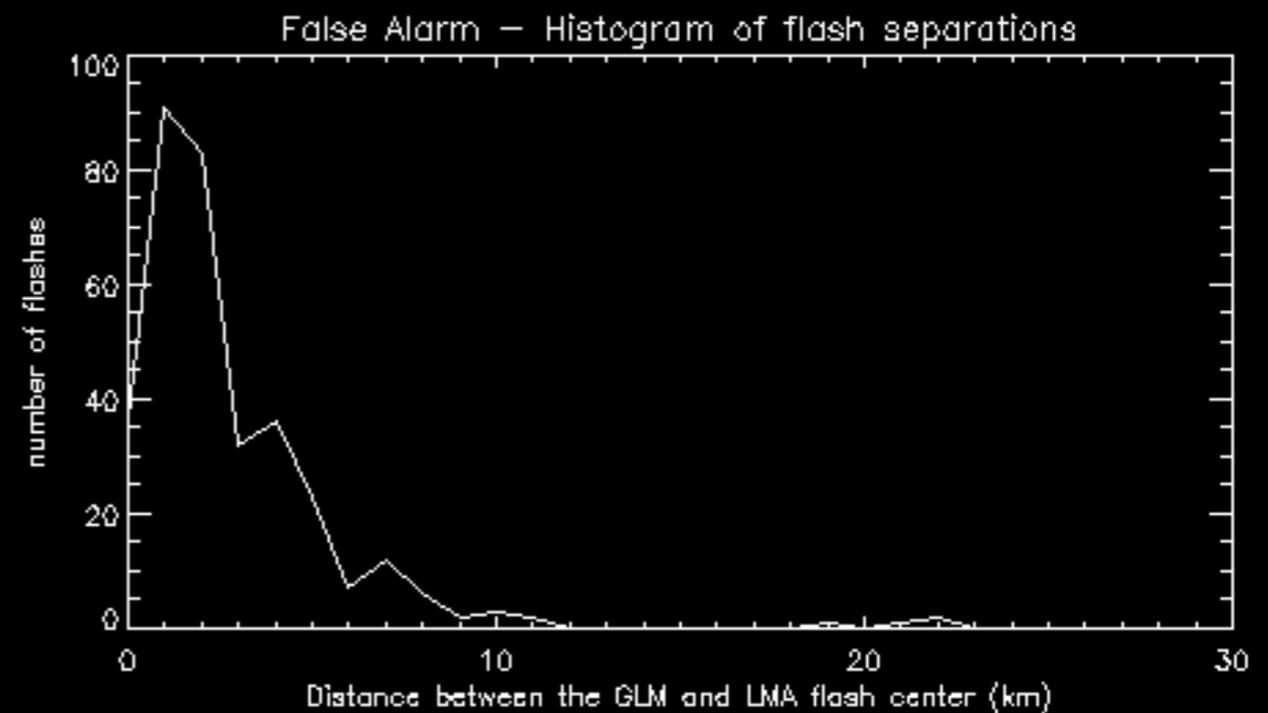
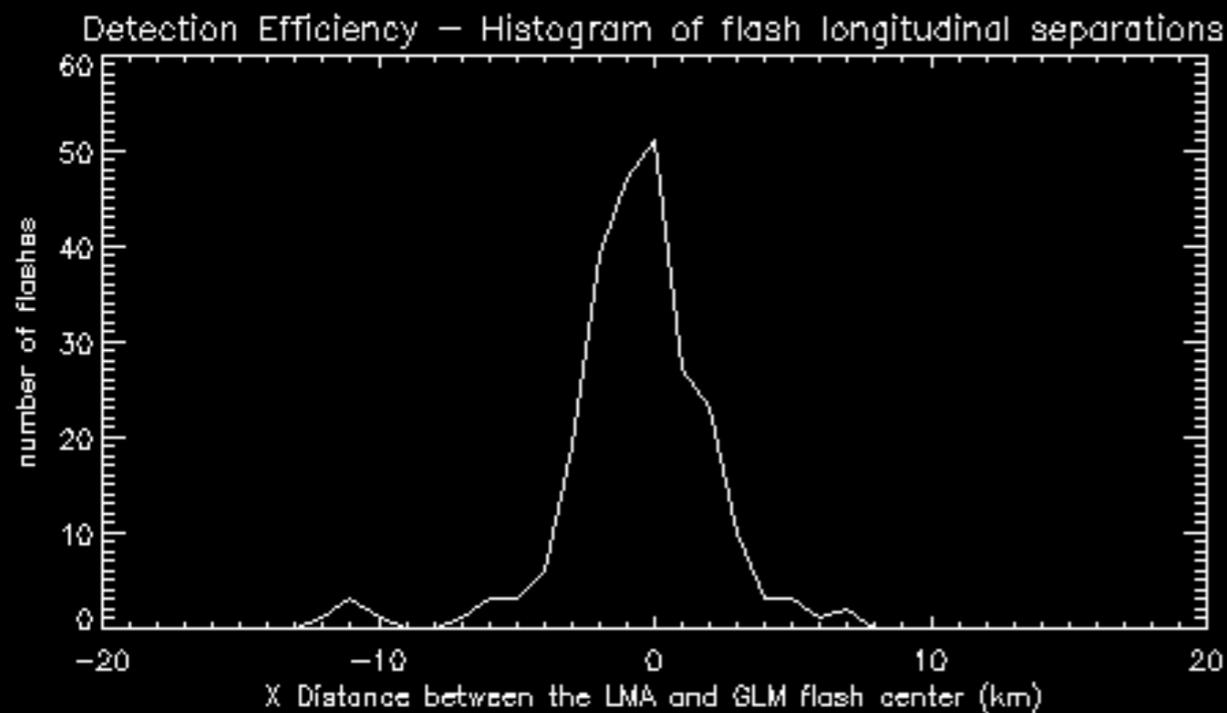
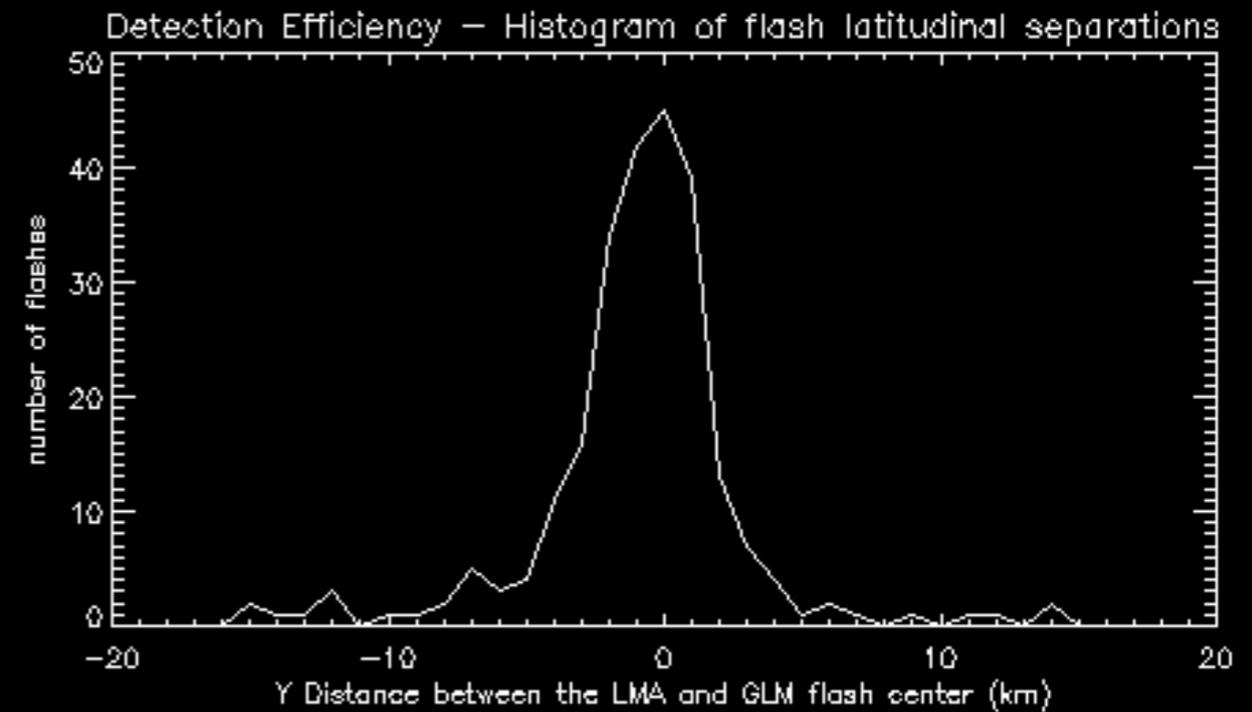
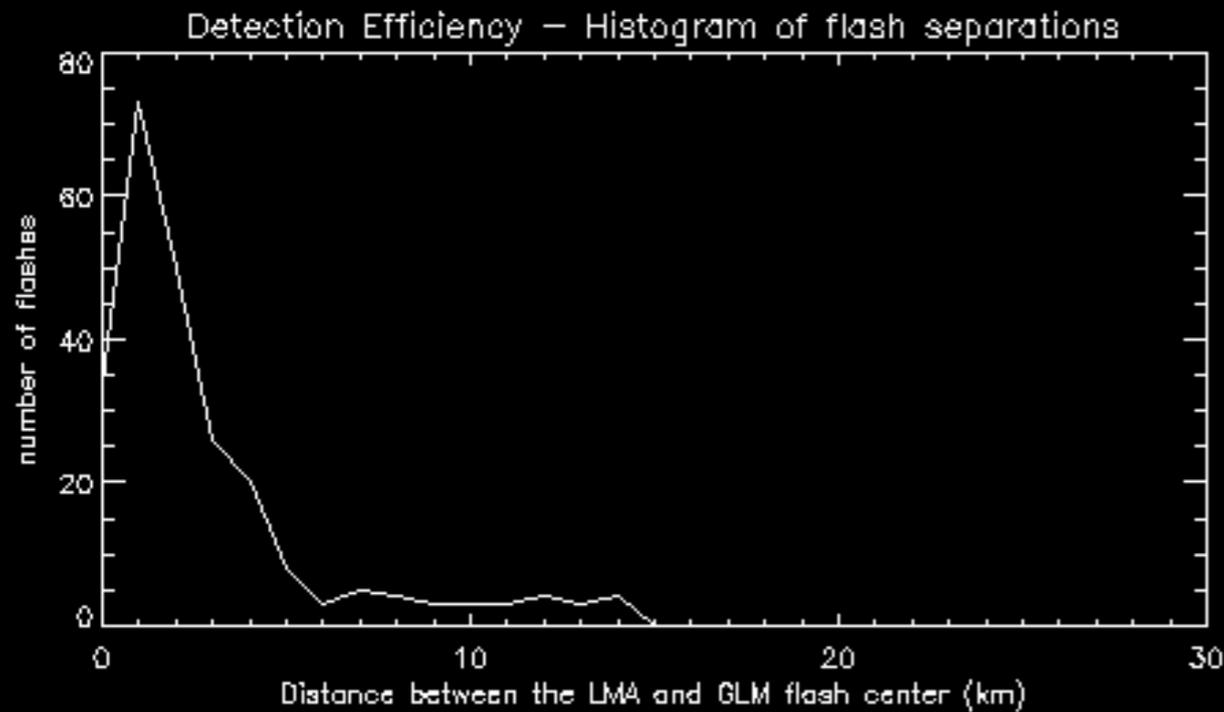


Detection Efficiency for Entire Storm

- GLM works very well on these storms
- GLM detected 88% of LMA flashes with more than 75 sources - 223 in total
- False alarm rate is 10%
- DE for medium flashes 57%
- DE for small flashes 25%

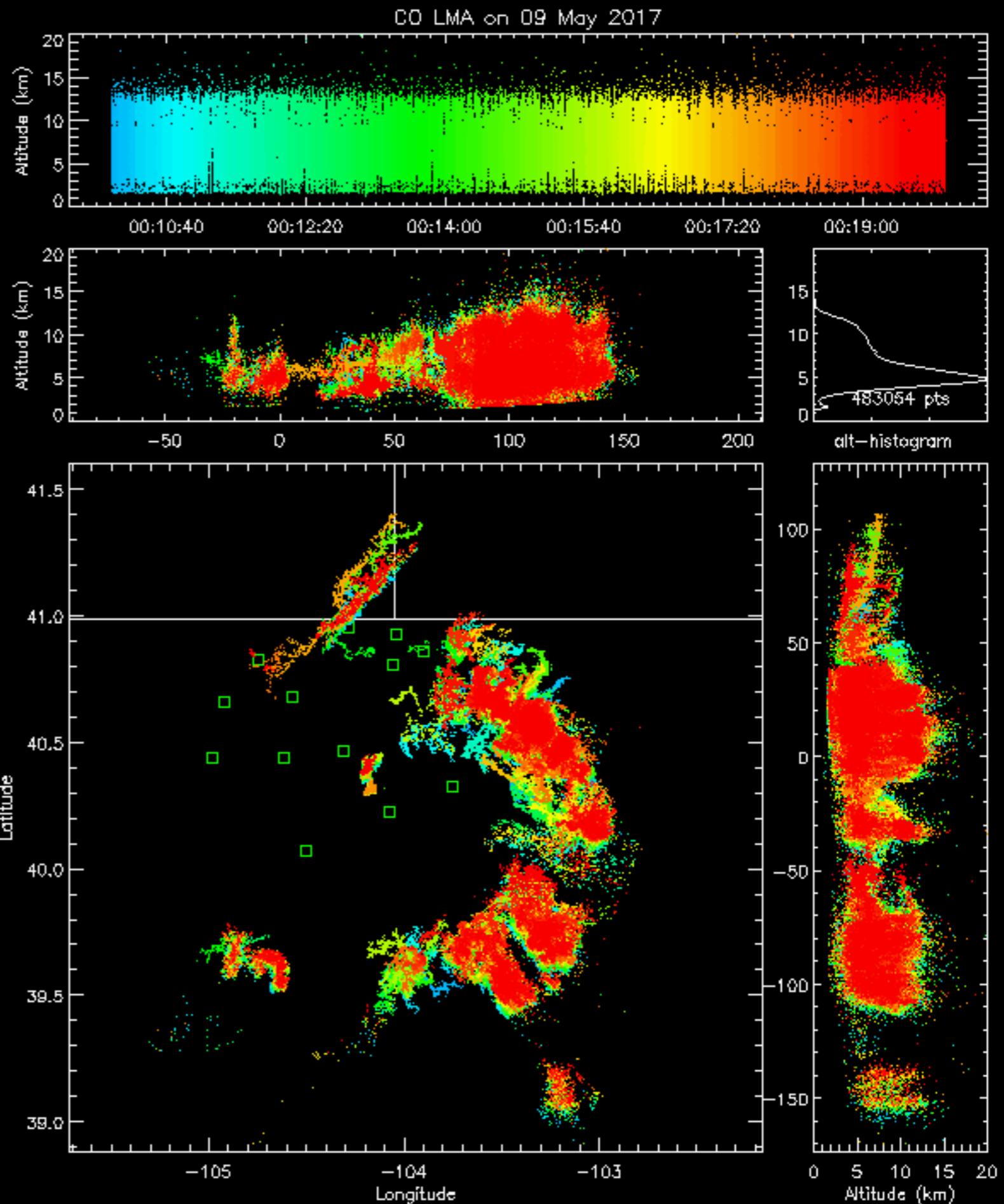


Flash location agreement after correcting for offsets is better than about 5 km



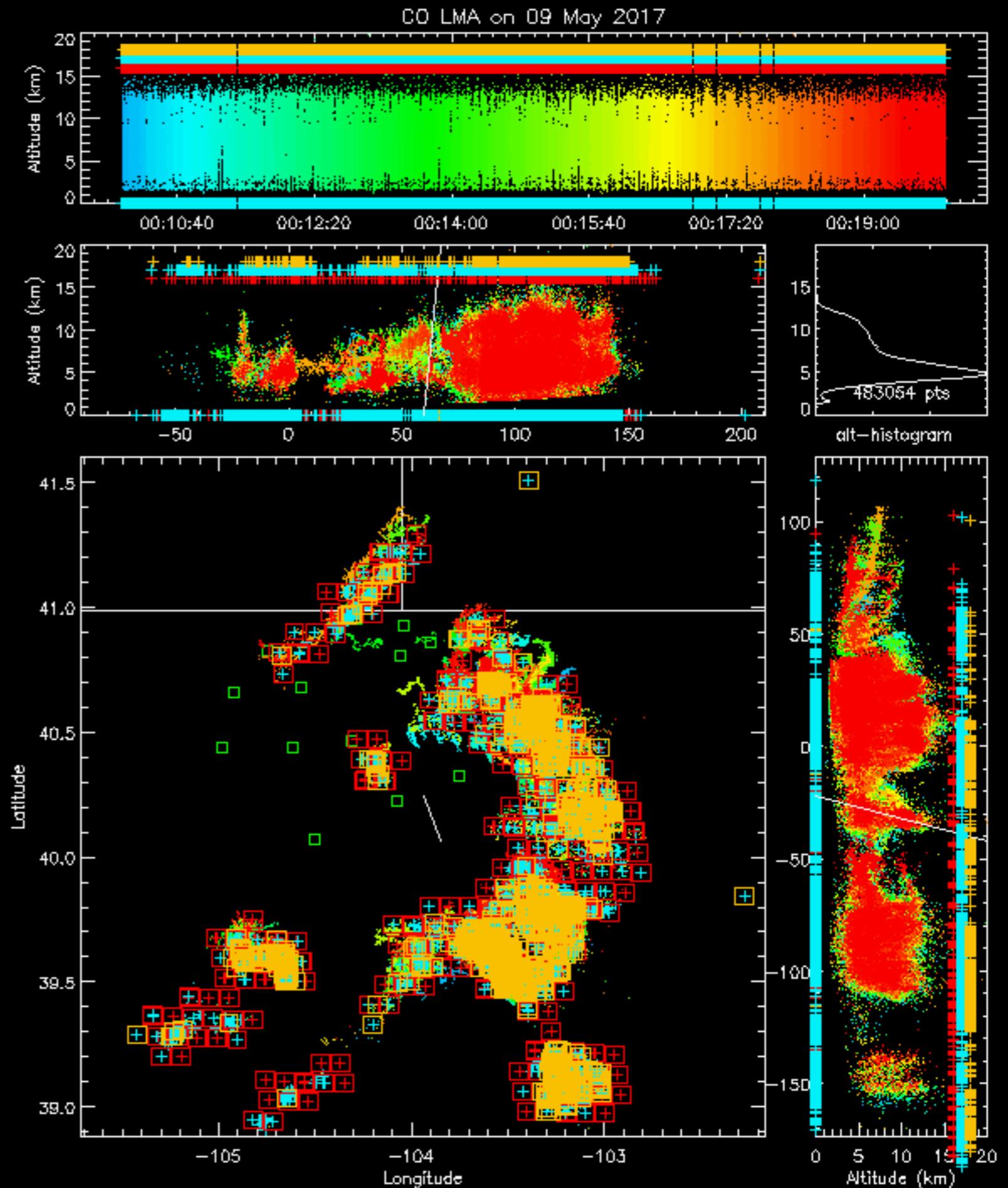
May 9 Storm over Colorado

- Large storm system over North-East Colorado
- ER2 over flight
- High flash rate
- 486 flashes per minute
- Inverted charge structure in some storms



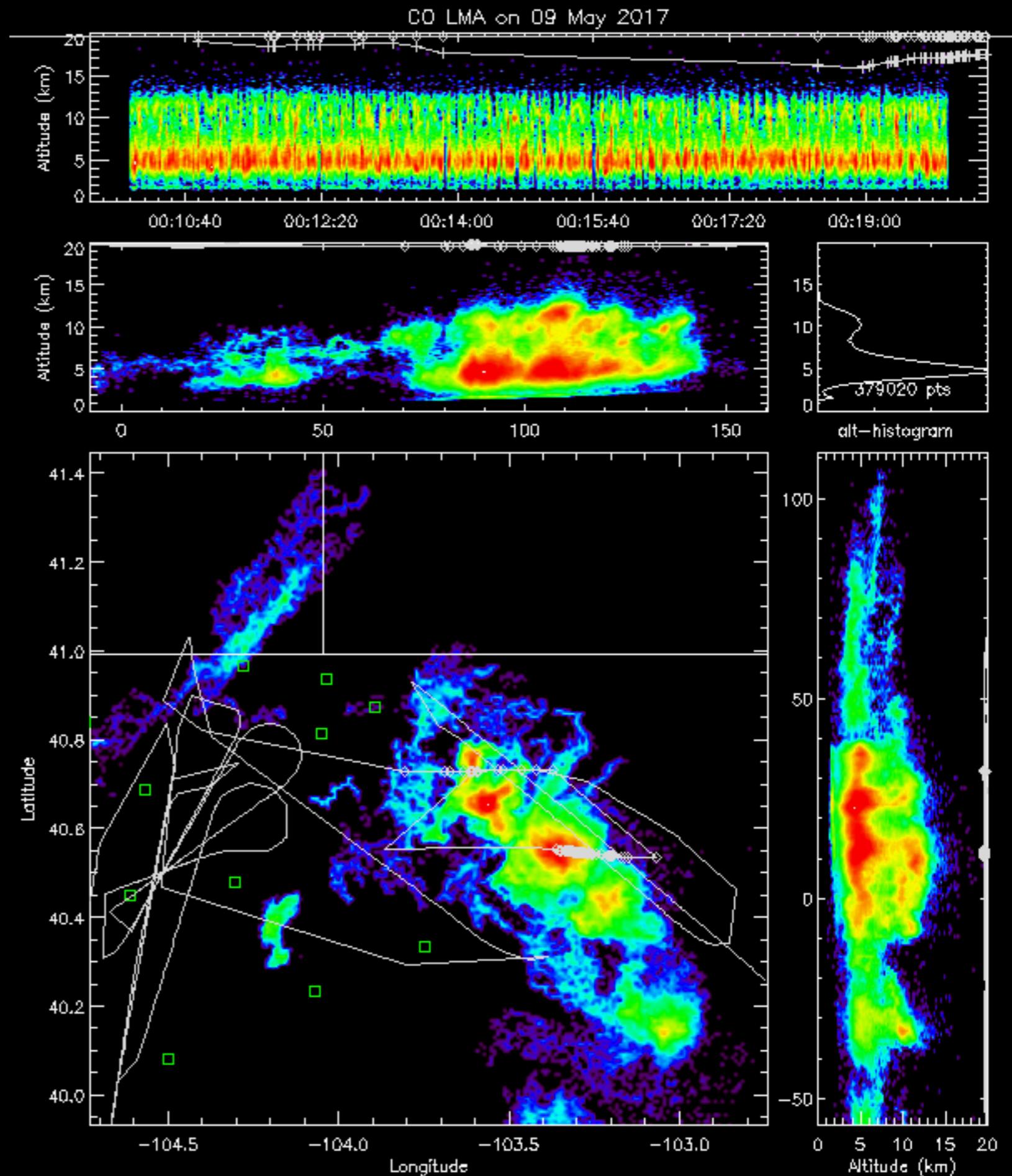
Add GLM Data

- Overall GLM detection efficiency 51% (LMA Flashes with more than 75 sources)
- 79% DE for very large LMA flashes (more than 600 sources)
- 14 % False alarm rate



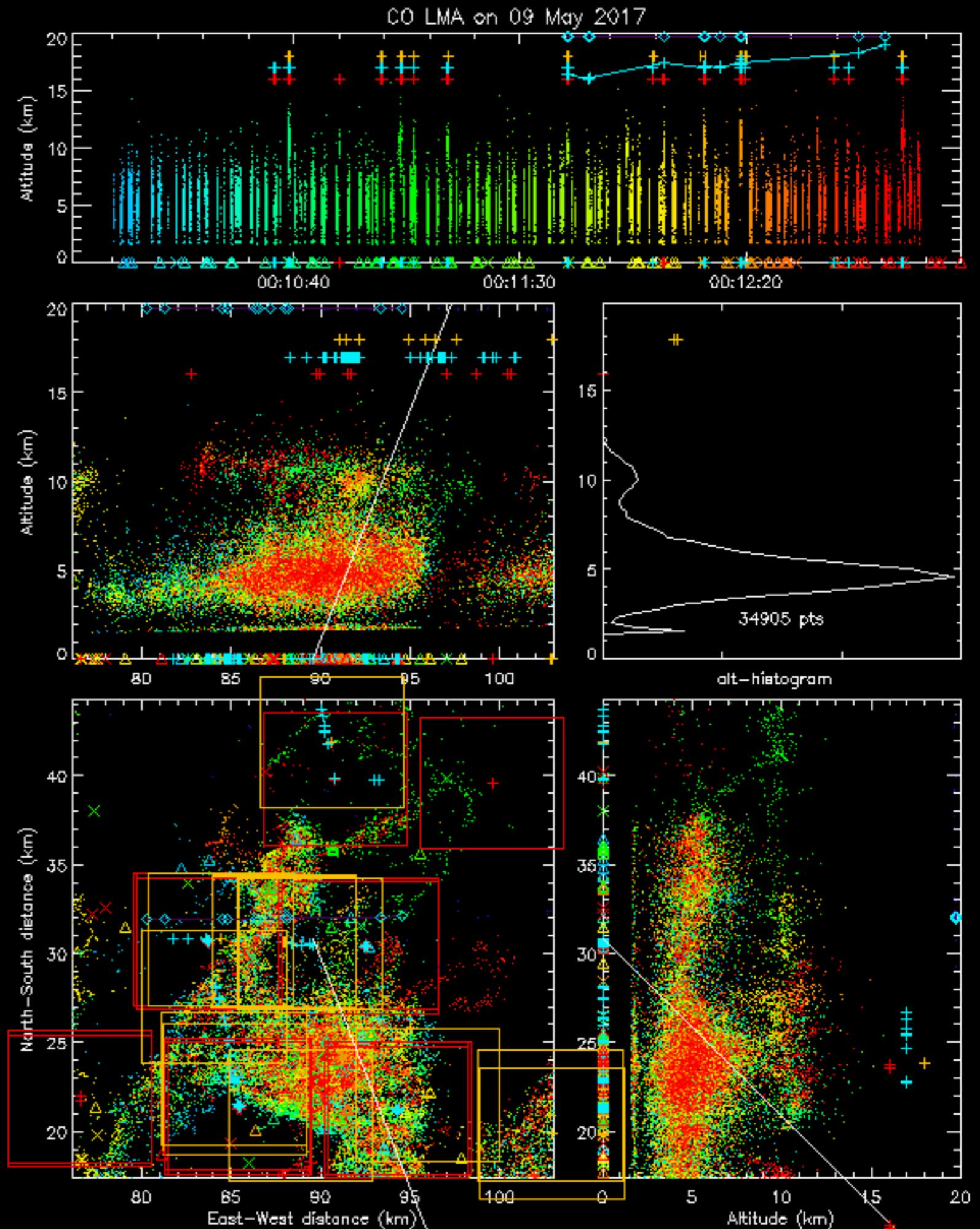
ER2 and Fly's Eye

- ER2 Path and FEGS data
- Diamonds are FEGS data for this 10 minutes



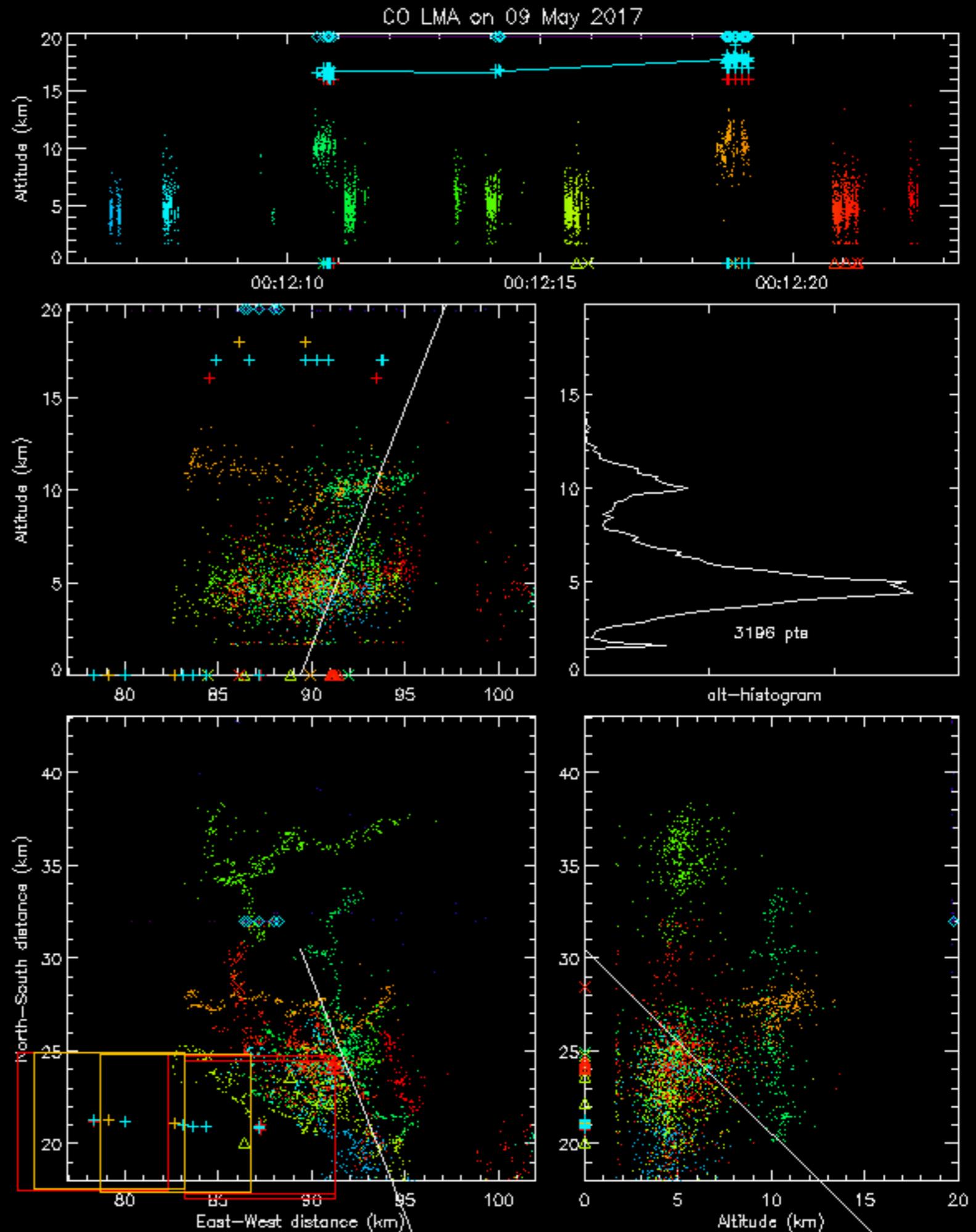
GLM and FEGS data

- In this region only the high altitude flashes are seen by either GLM or FEGS
- DE drops to 10%
- Many of missed flashes are detected by NLDN as CGs



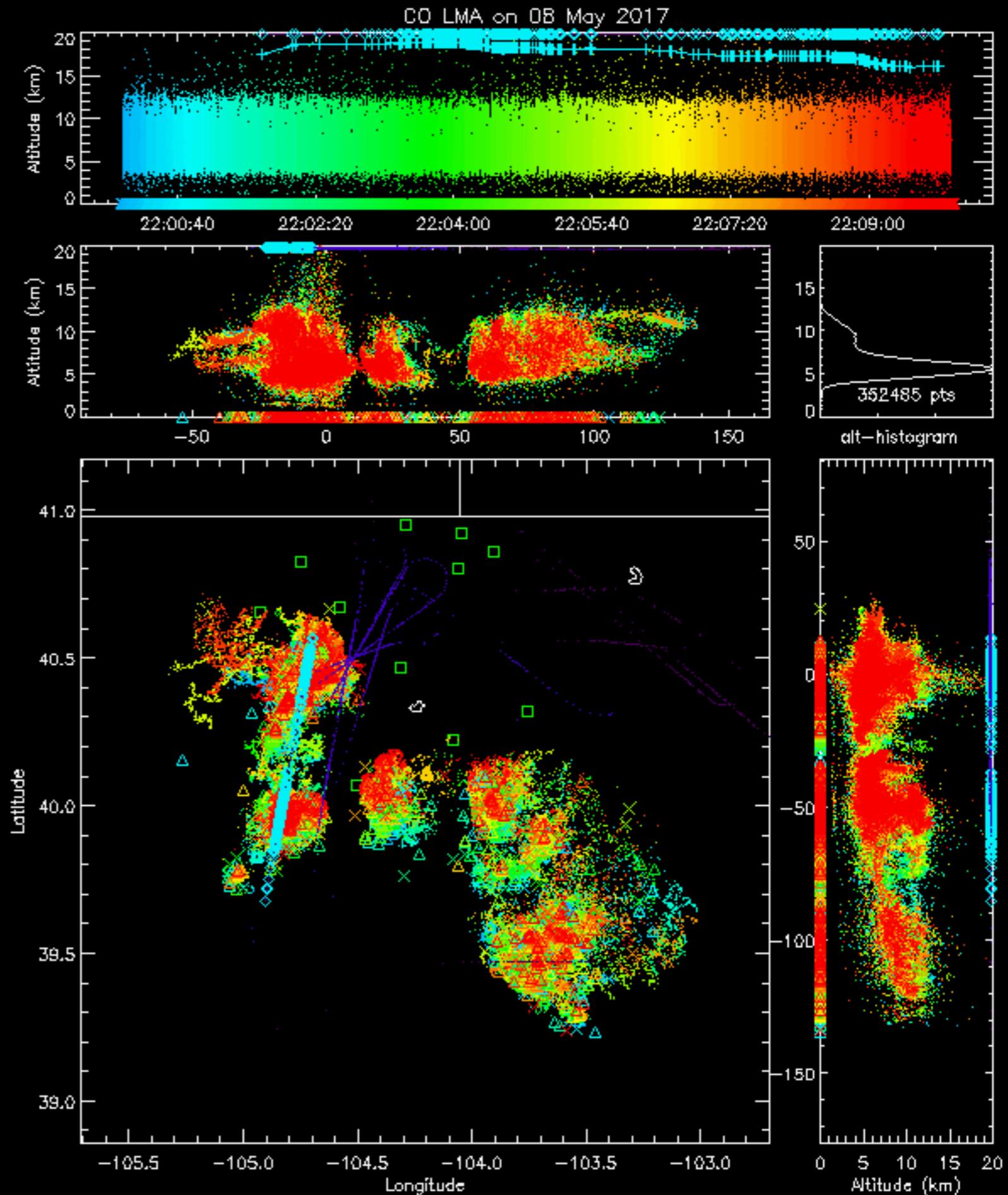
Individual Flashes

- Zoomed in in time
- GLM only sees the high altitude flashes
- FEGS see one low flash just below the aircraft



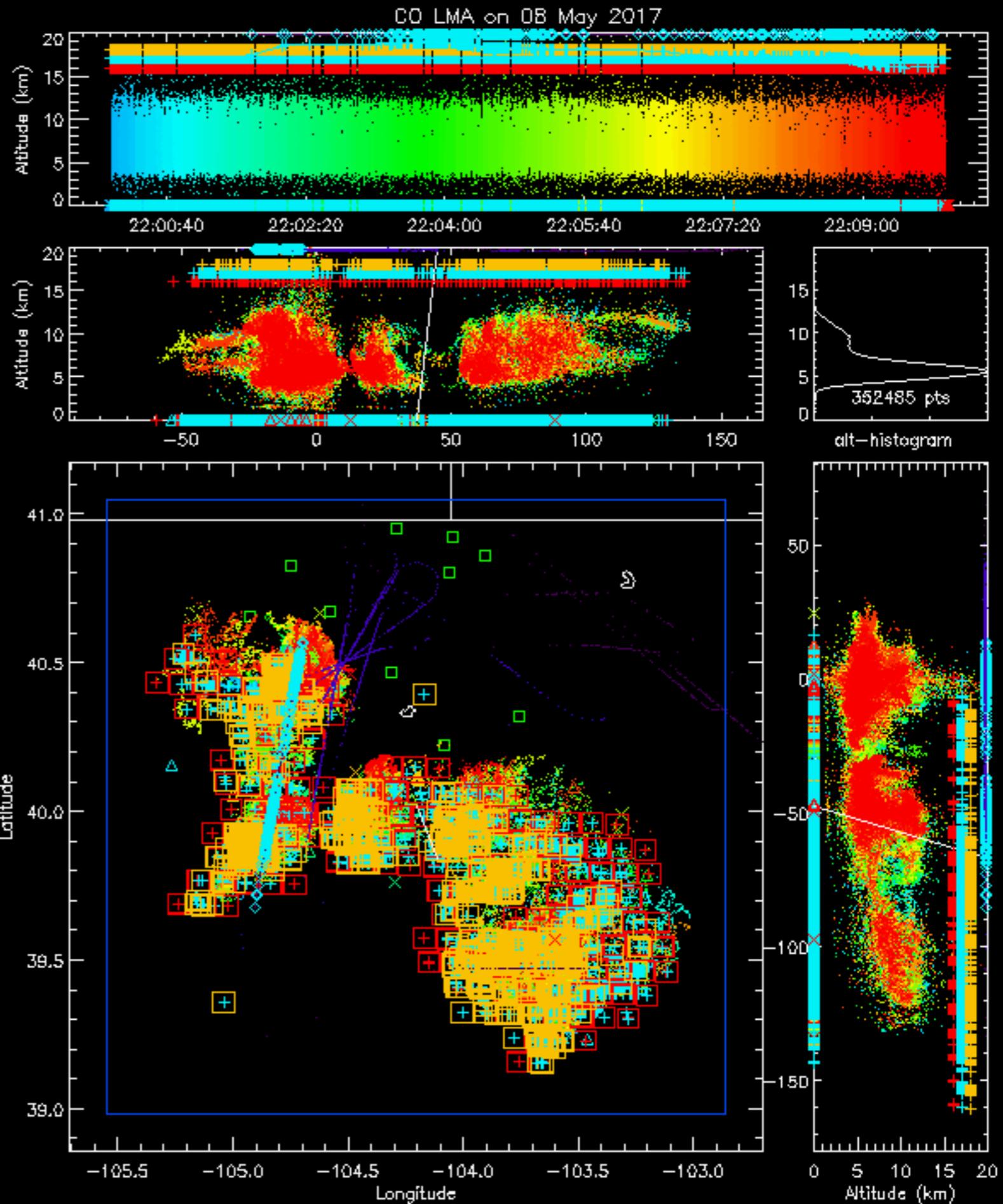
Earlier in May 9 Colorado Storm

- Large Storm and ER2 over CHILL Radar
- Cells with inverted charge structure
- High flash rate - 800 flashes per minute



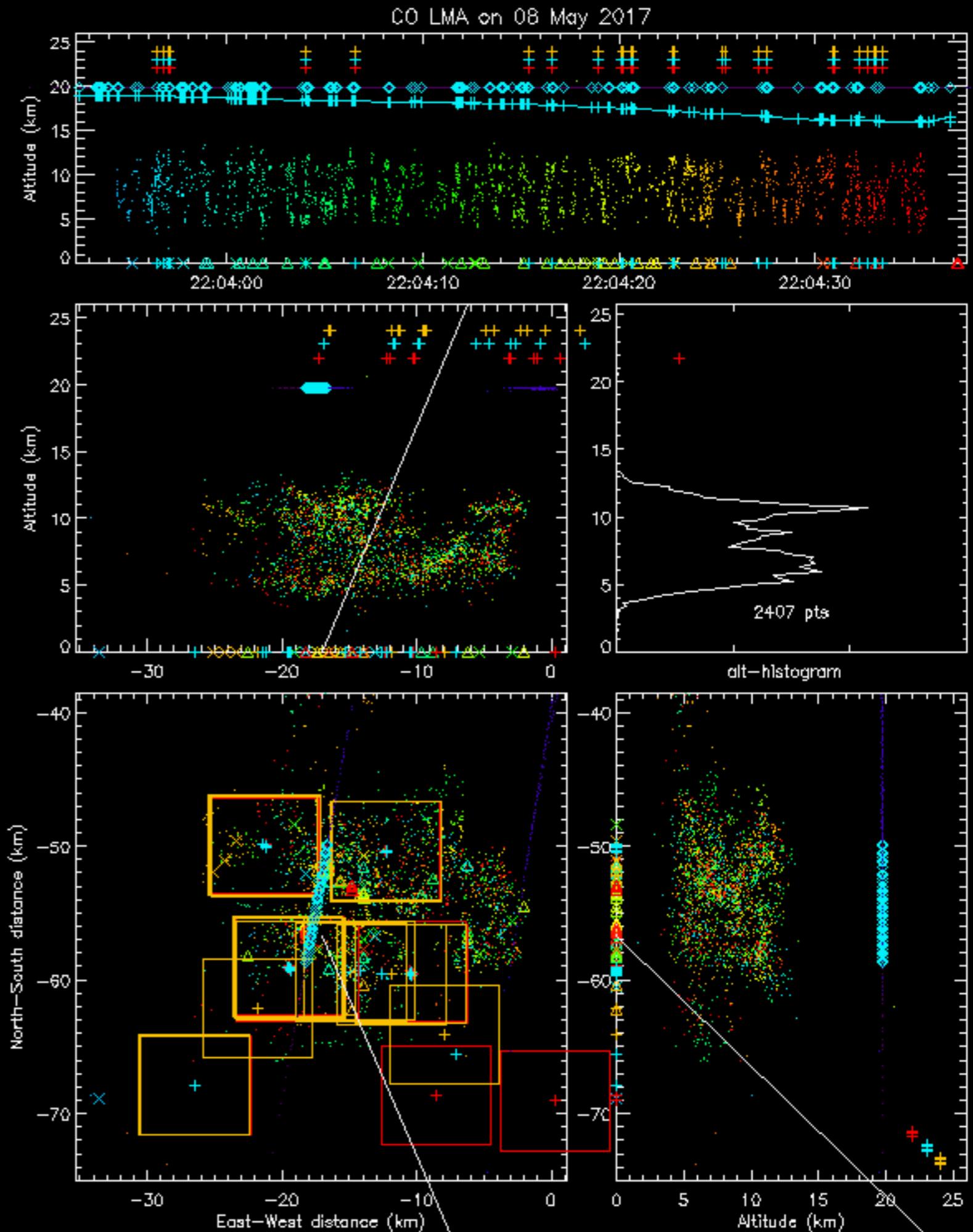
Earlier in May 9 Colorado Storm

- Add GLM data
- Low GLM detection efficiency 30% flashes with 75 sources 31% for 200 or more sources 79% for 600 or more sources
- 24 % false alarm rate
- Offset in Longitude and Latitude - 9.0 and 8.5 km



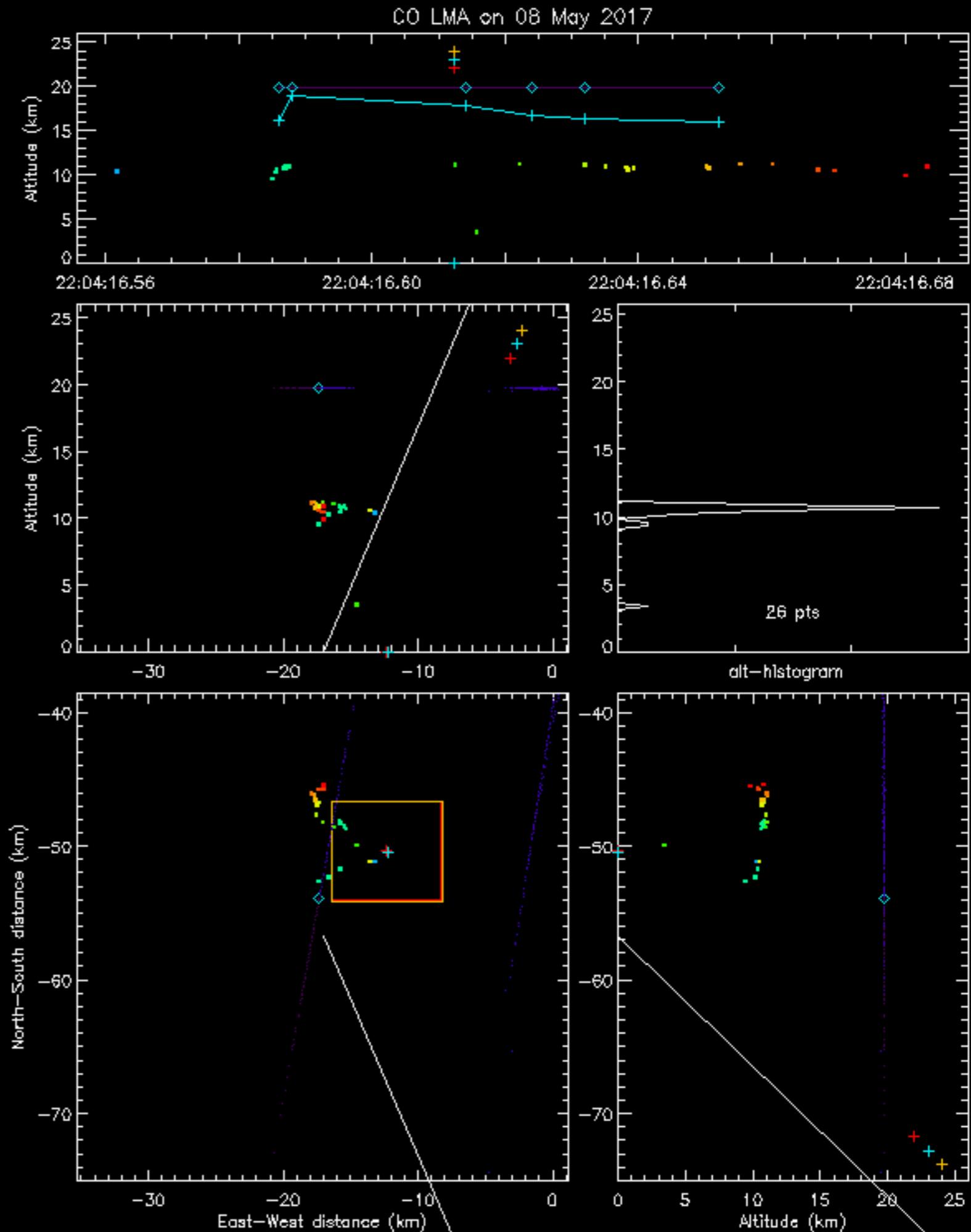
Southern storm

- FEGS and GLM data
- FEGS sees more flashes
- LMA sees many smaller flashes
- FEGS intensity decreases as it goes north
- Many NLDN detections



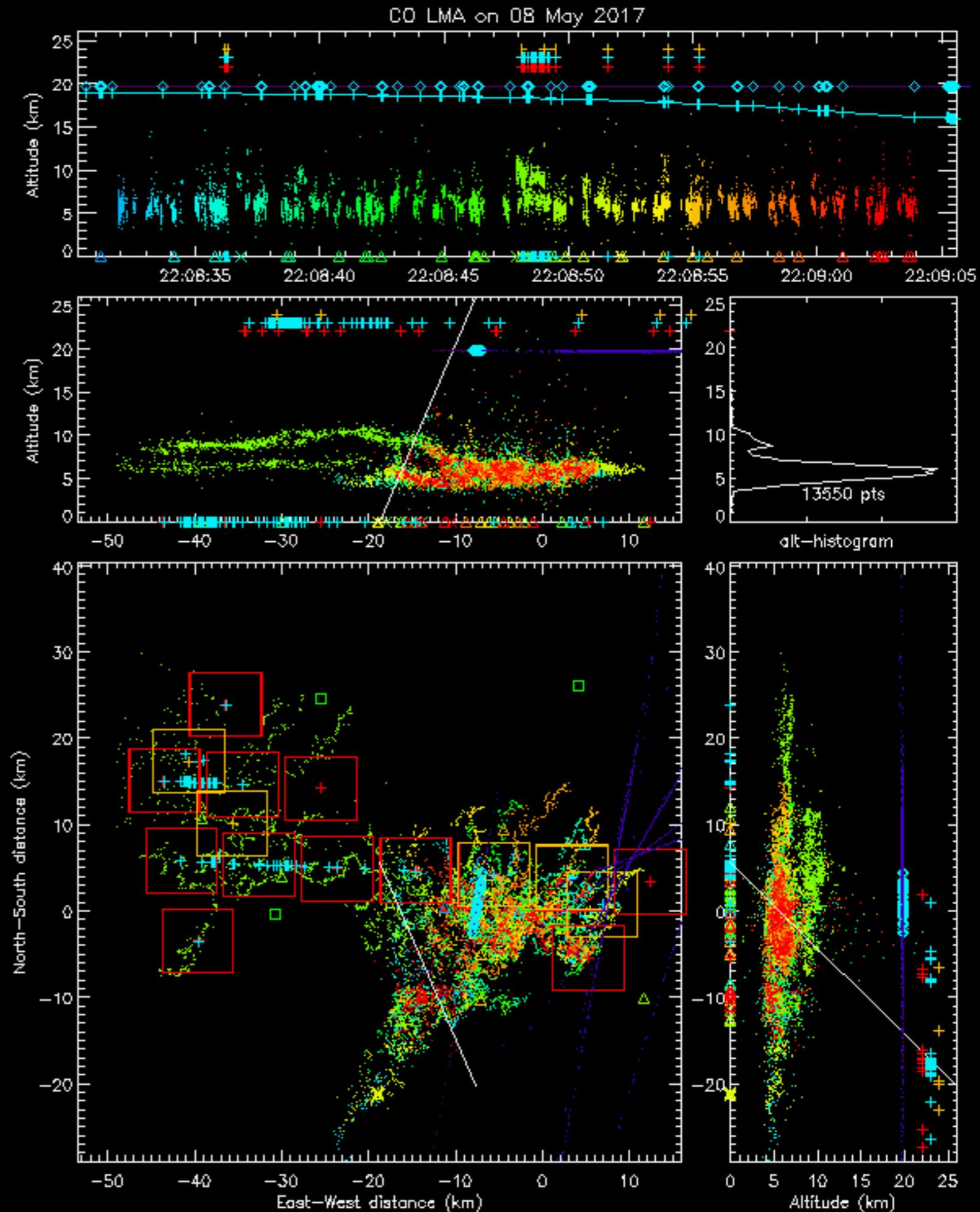
Zoom into one Small Flash

- Only 26 LMA sources
- lasts about 100 ms
- Detected by both FEGS and GLM
- High altitude flash



Zoom into FEGS data in northern storm

- FEGS data Blue diamonds and pluses joined with line
- FEGS sees many more flashes than GLM
- Plots include offsets



Zoom into a large Flash

- This flash was seen by both FEGS and GLM
- ER2 was about 25 km east of most of the GLM observed events
- This flash was at higher altitudes than others in this period

