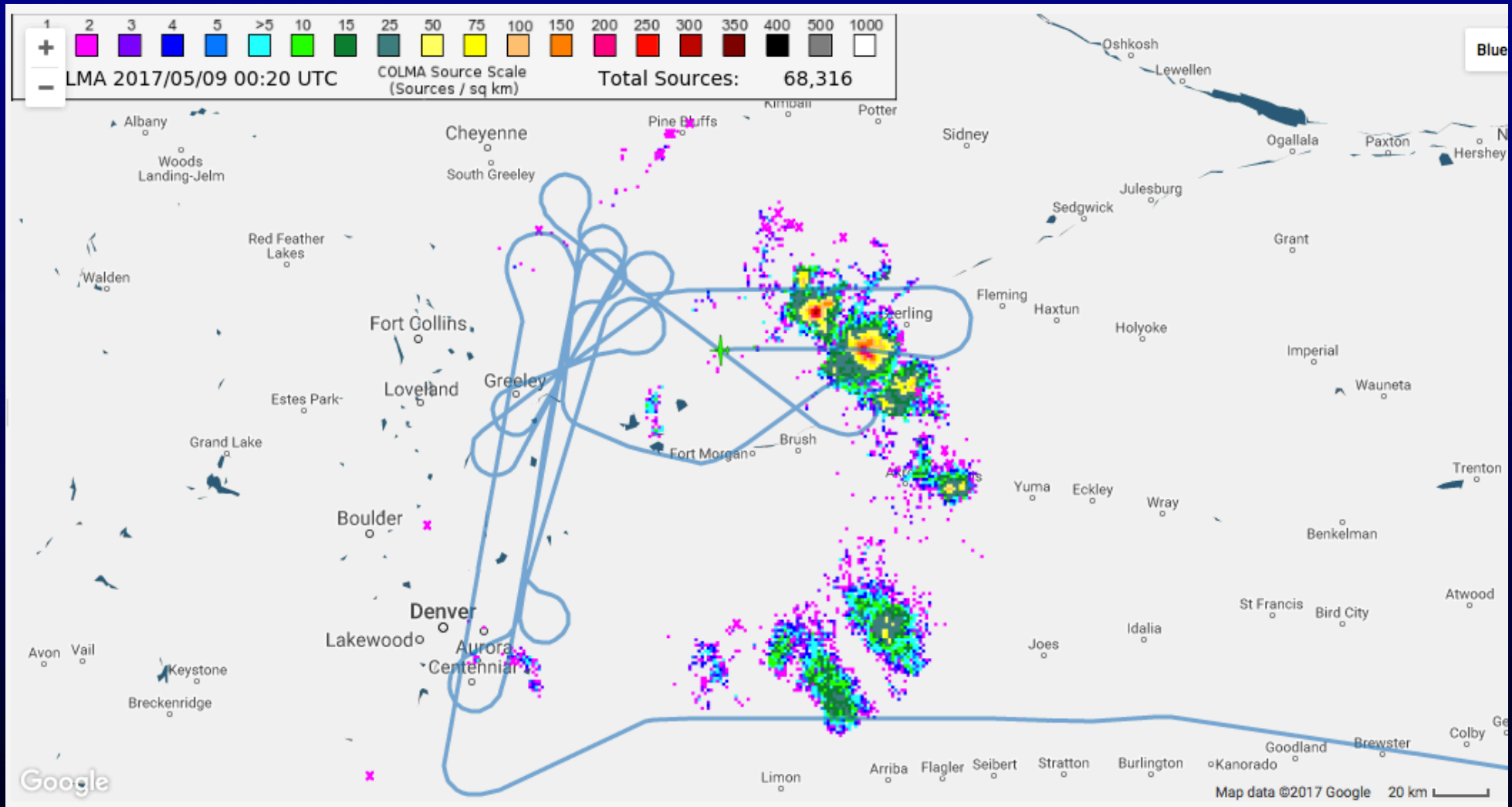


Comparison of LMA & GLM observations Colorado, Oklahoma, Houston/Harvey

Paul Krehbiel, Ronald Thomas,
Alex Attanasio, William Rison
New Mexico Tech
Socorro, New Mexico

Annual GLM Science Team Meeting
Huntsville, September 12-14, 2017

Colorado ER-2 Overflight, 8 May 2017

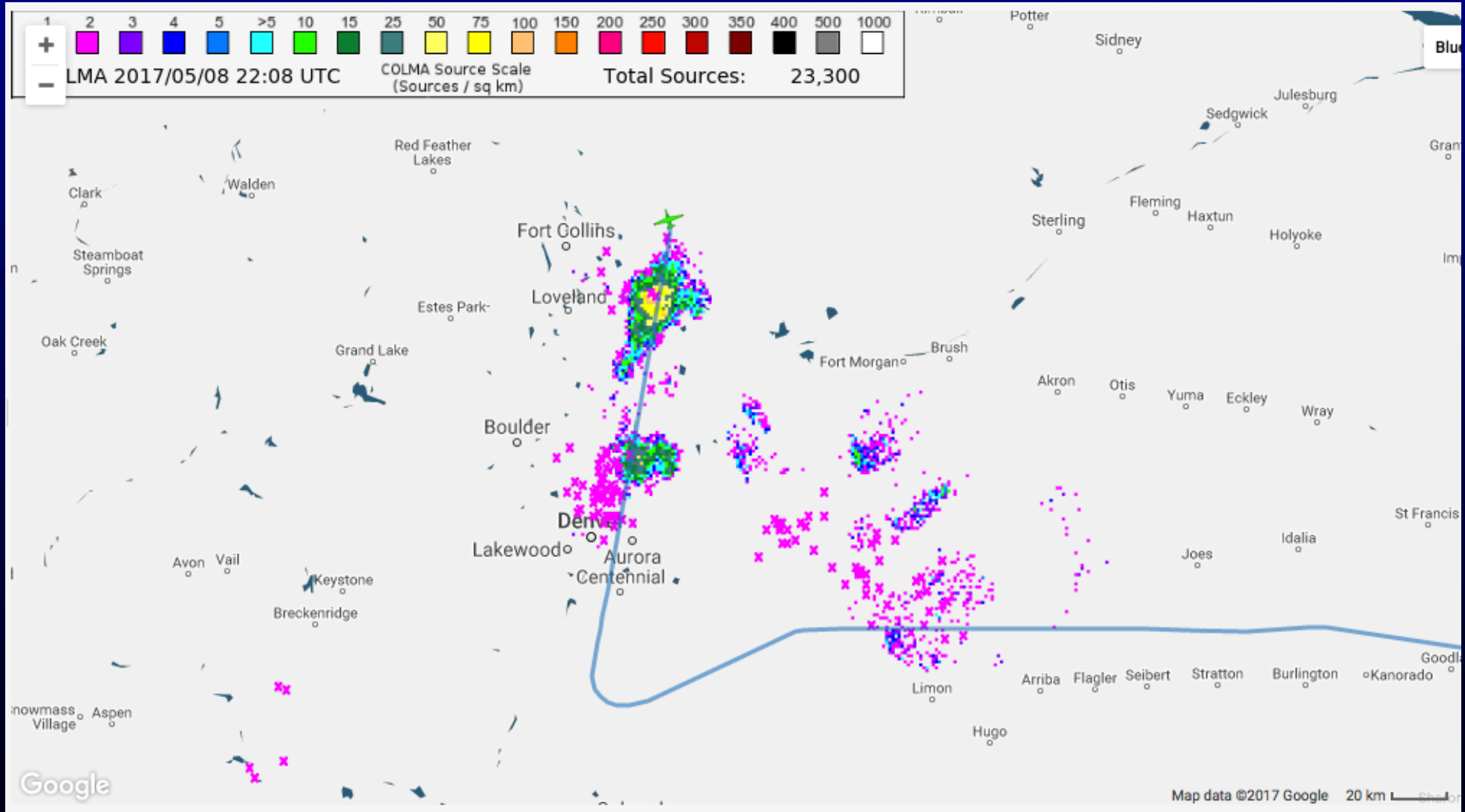


Background: Real-time LMA data of Fort Morgan storm system

Initial part of overflight

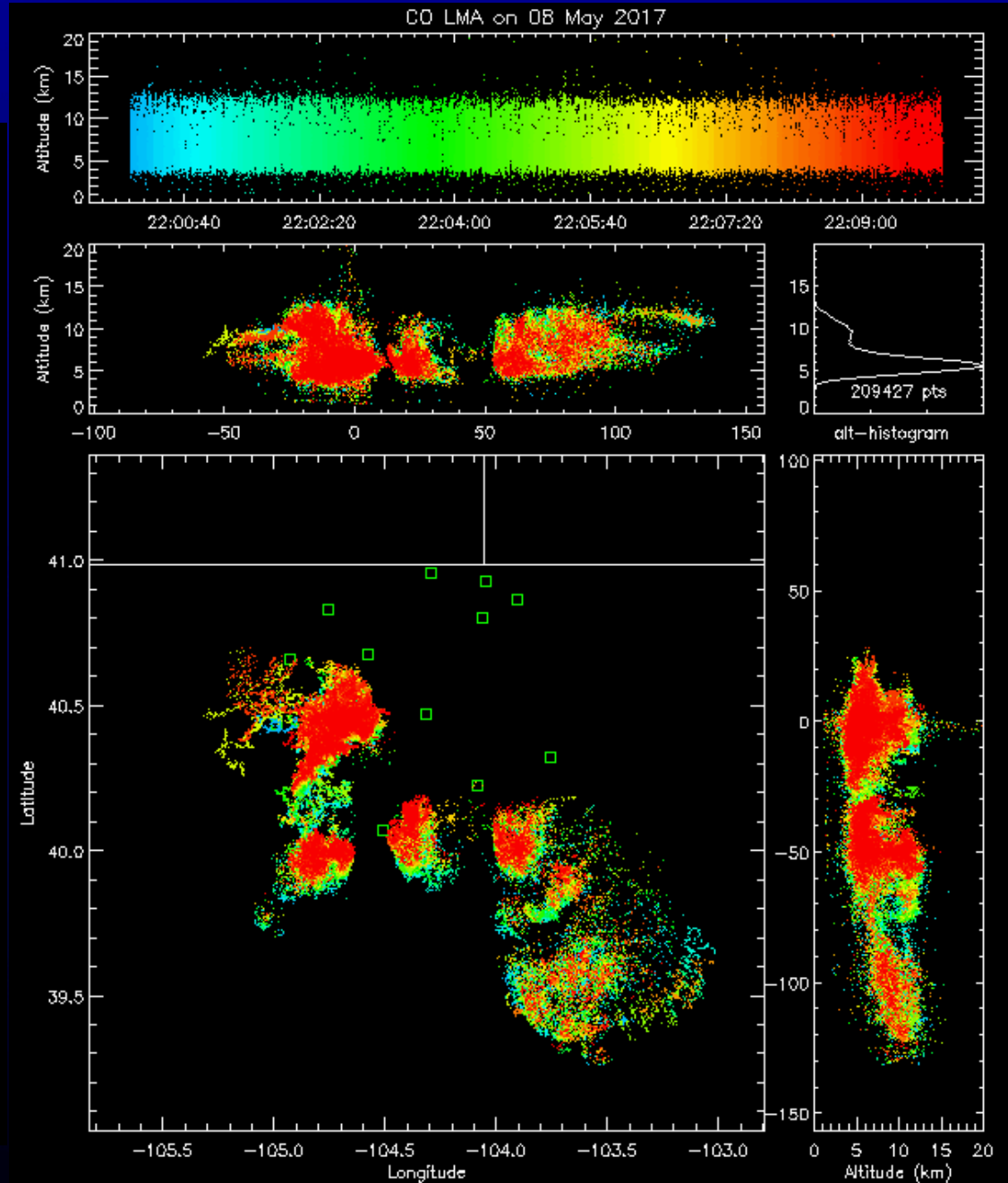
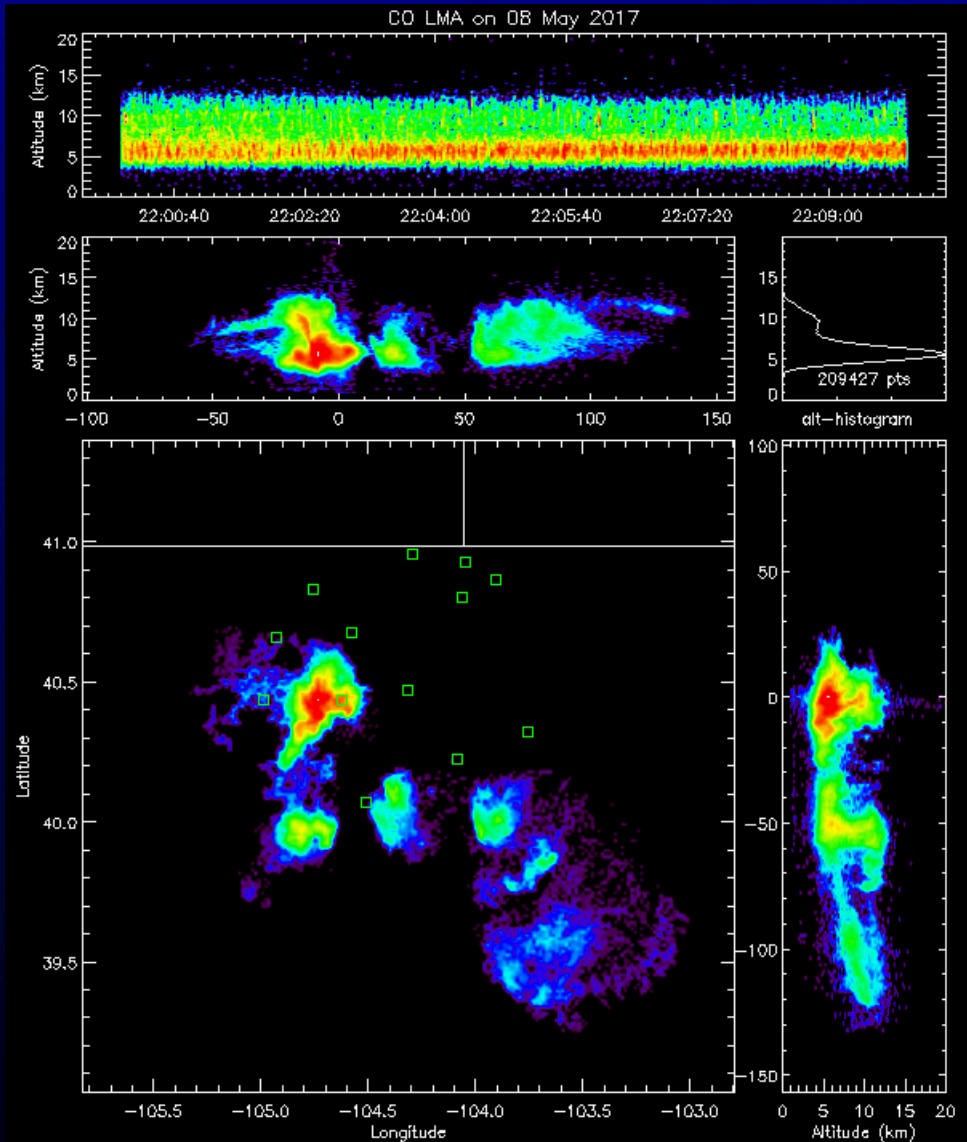
Two major storms (bullseye overpasses)

North storm: CSU-CHILL Greeley; South storm: Denver hail storm



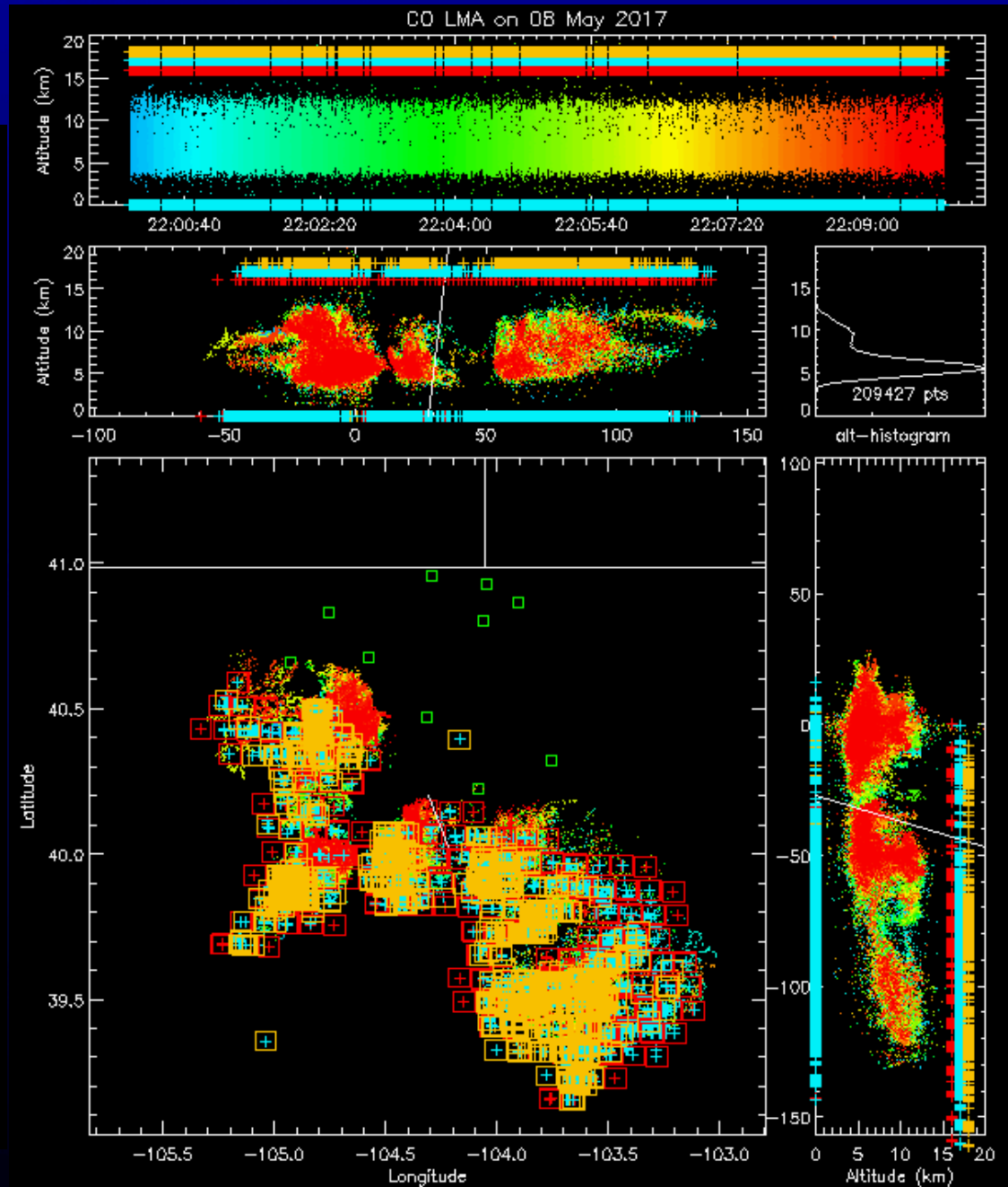
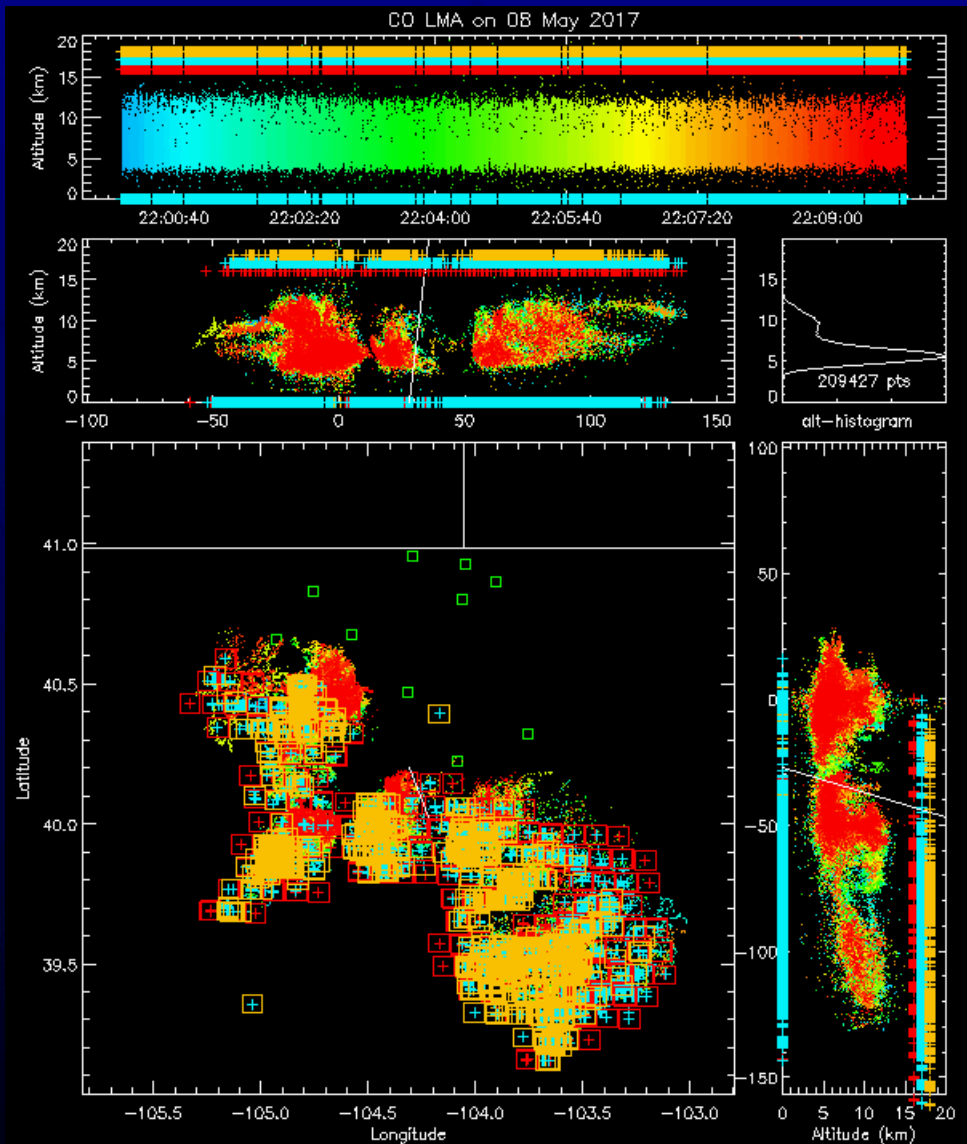
LMA activity around time of initial overflight (2200-2210)

Northern storm most intense



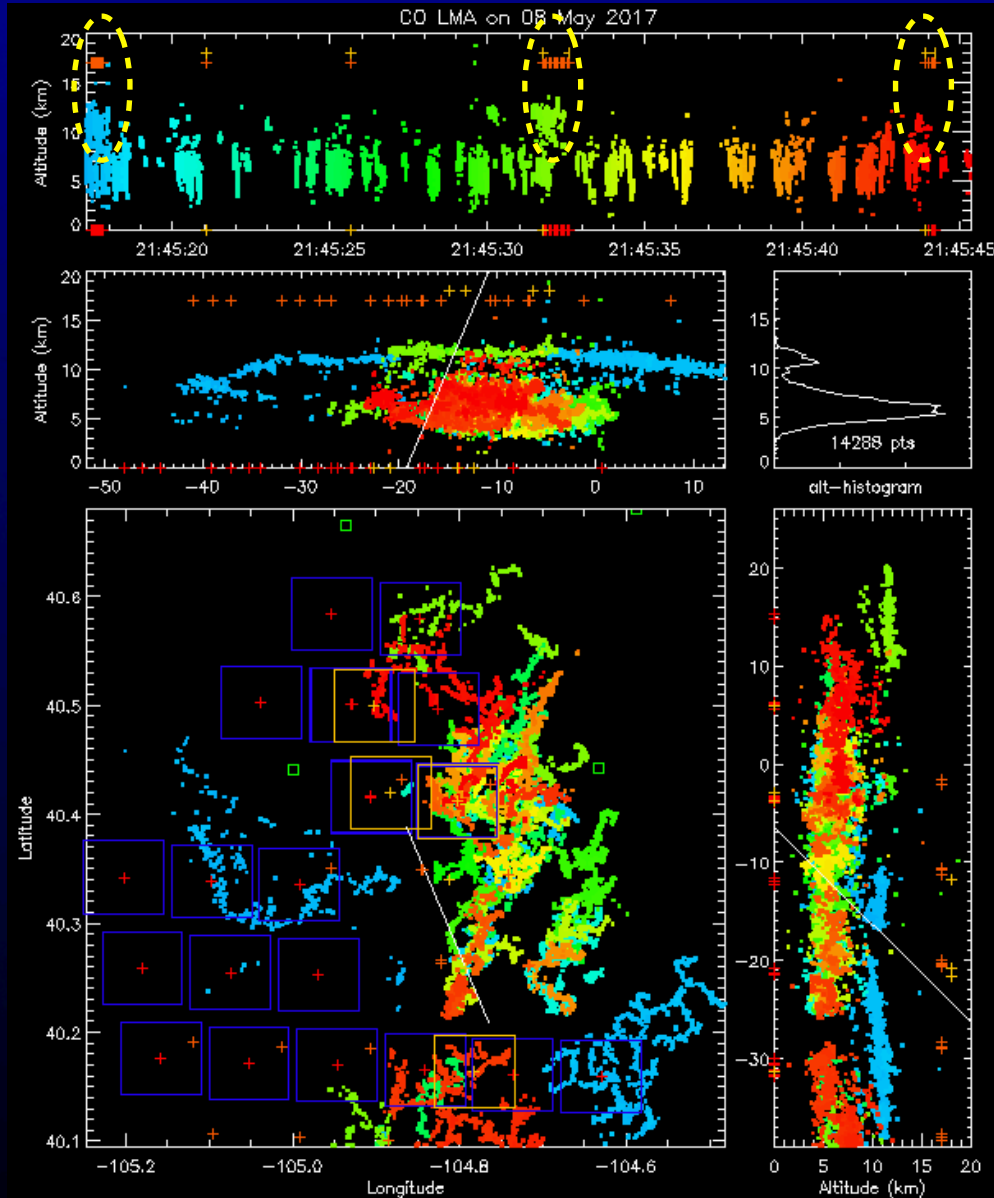
GLM/LMA Comparison (10 min overview)

(Flip with previous page to see offset)

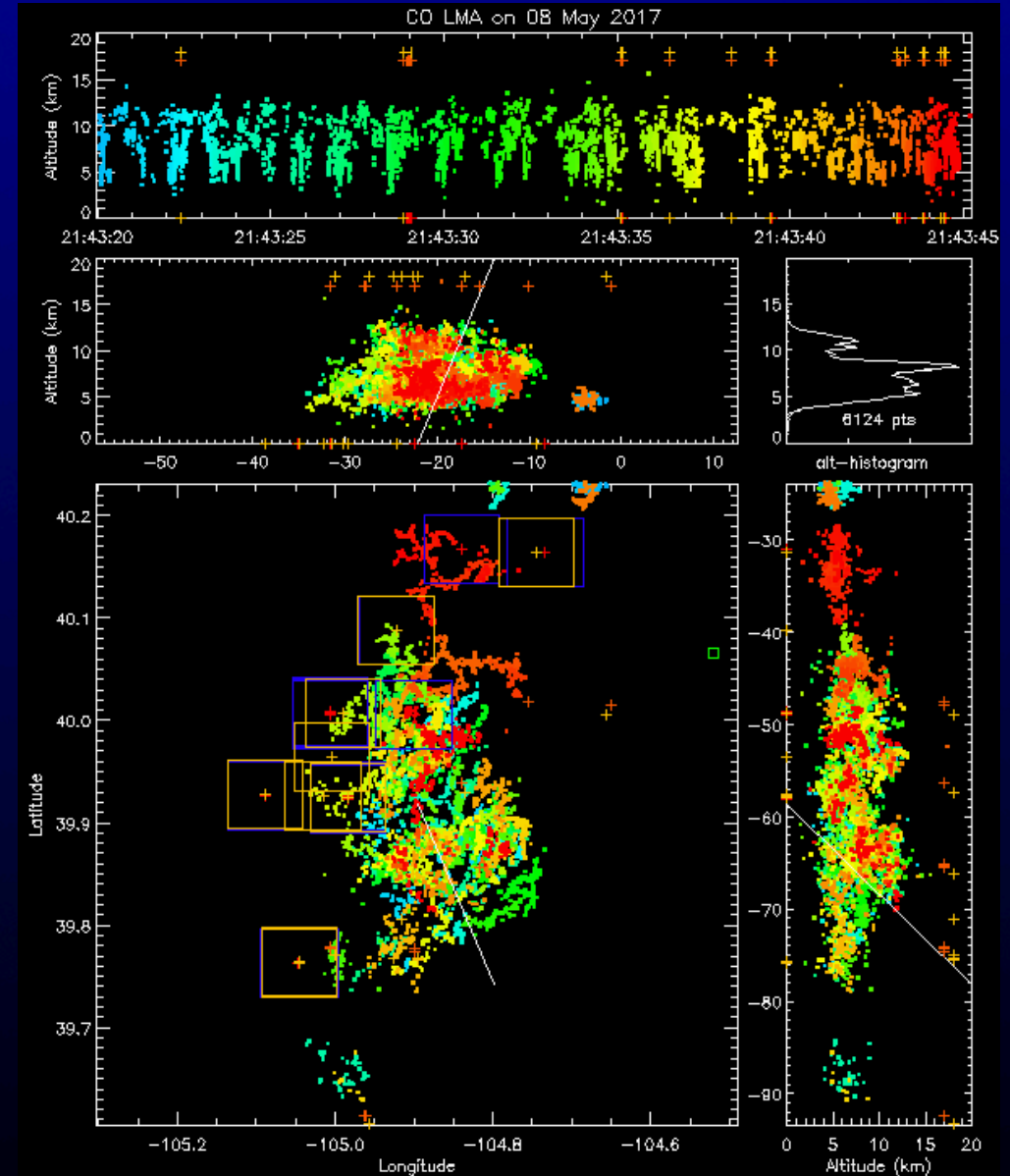


Western Storms (Low DE)

North storm (30 seconds)
Primarily detects higher-altitude events

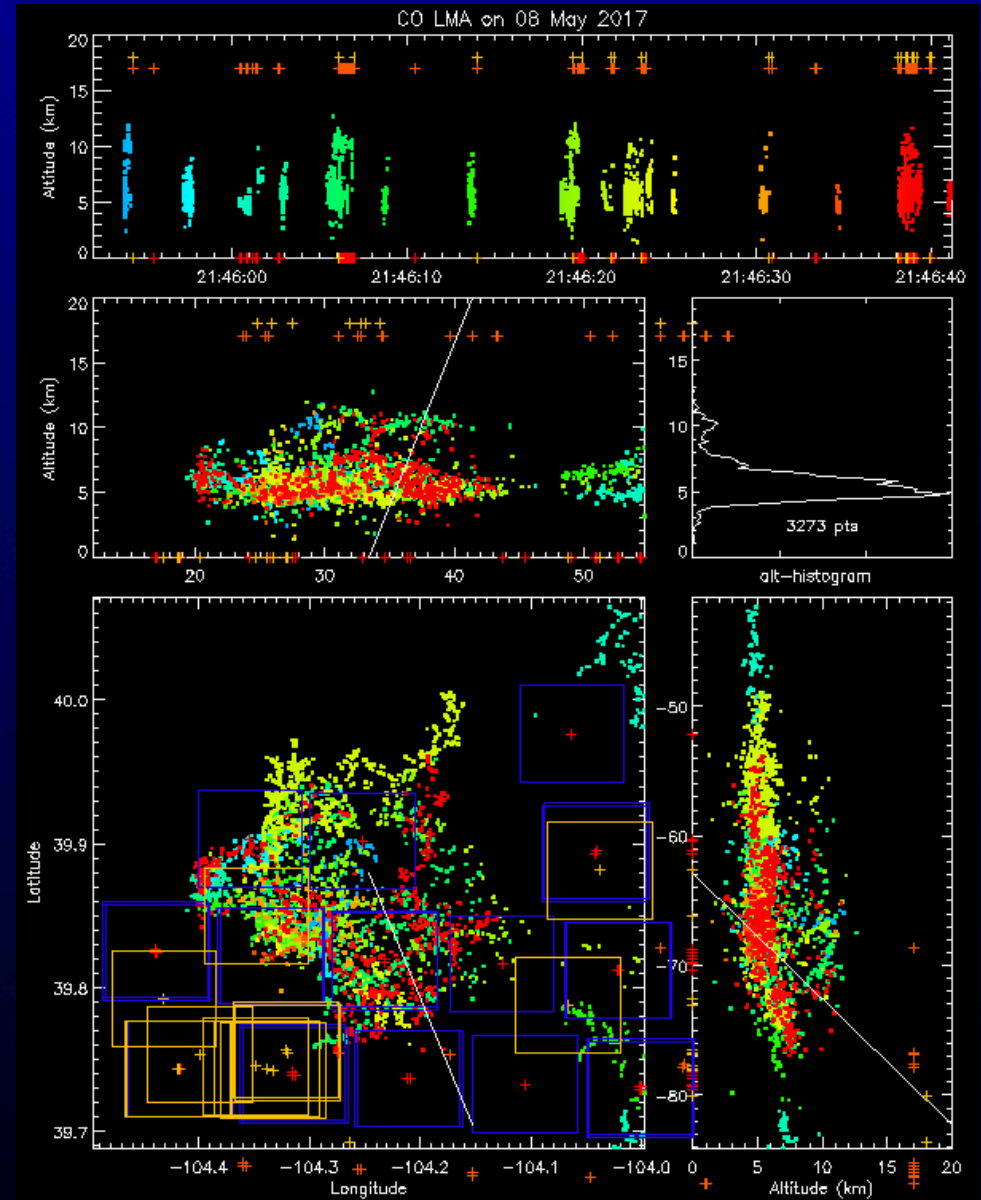
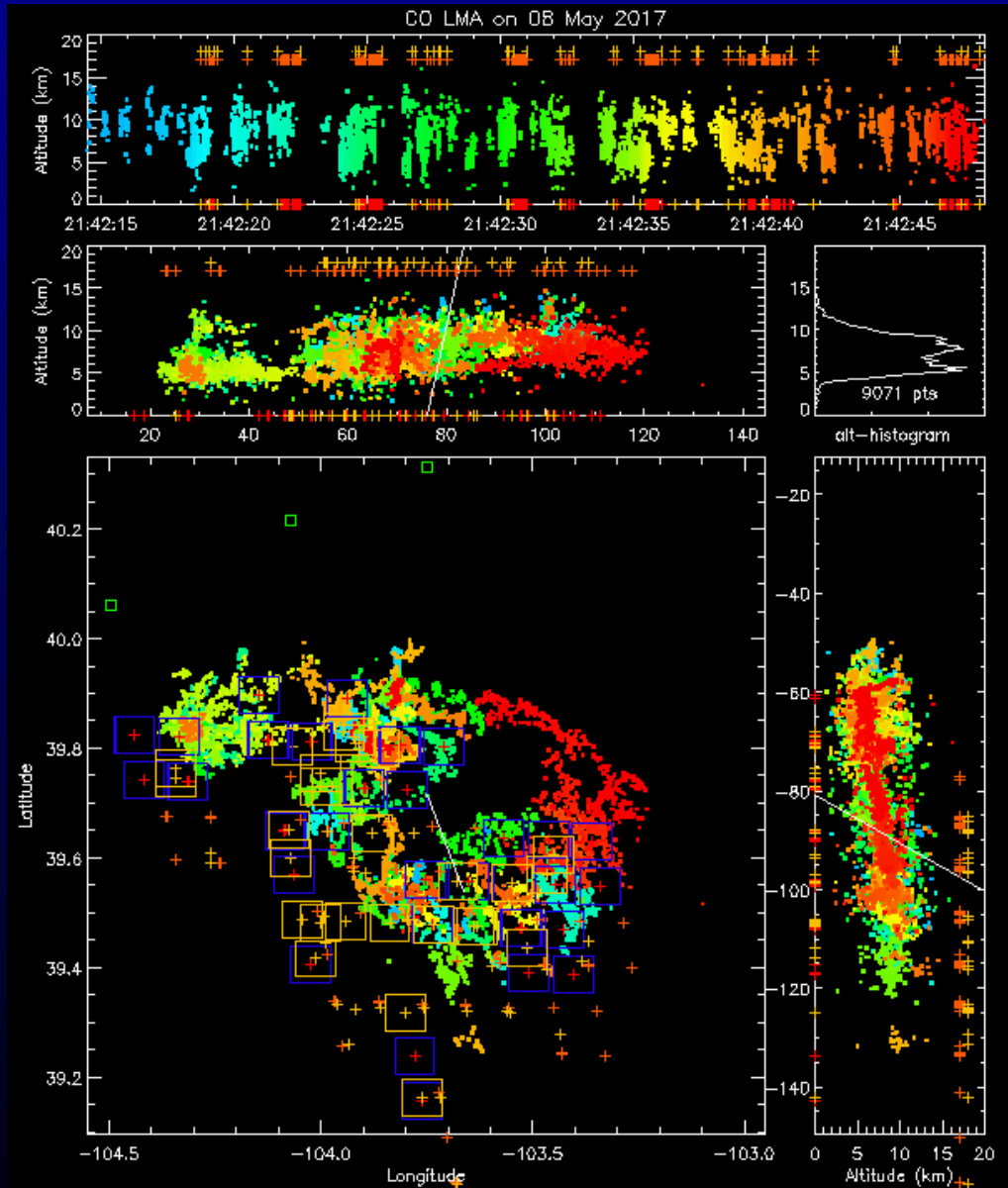


South storm (25 seconds)
Hit or miss detection (mostly miss)



Eastern Storms

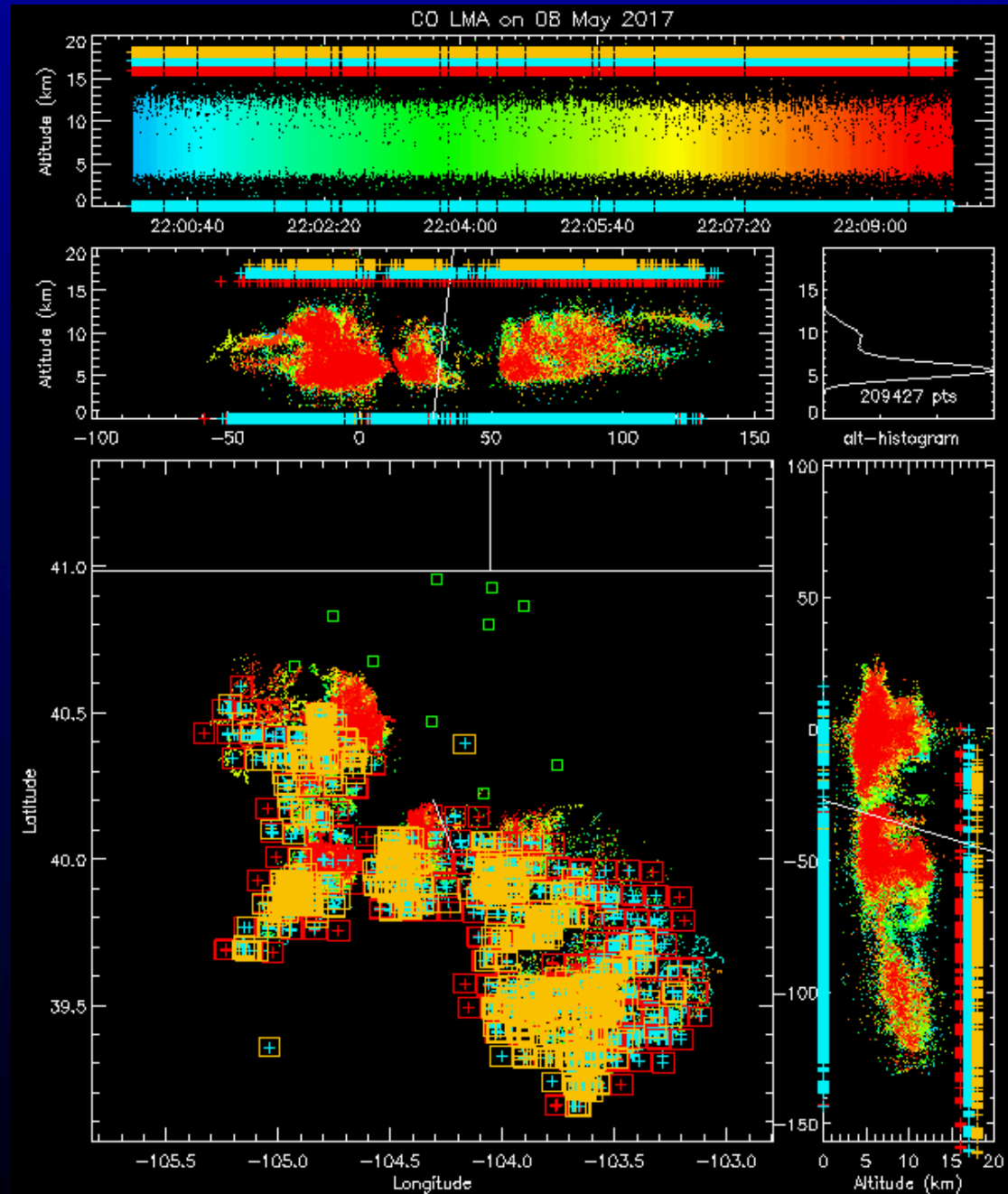
Also anomalous, but lesser flash rates and high detection efficiency



(Noticeable southwest offset)

Comparison Summary

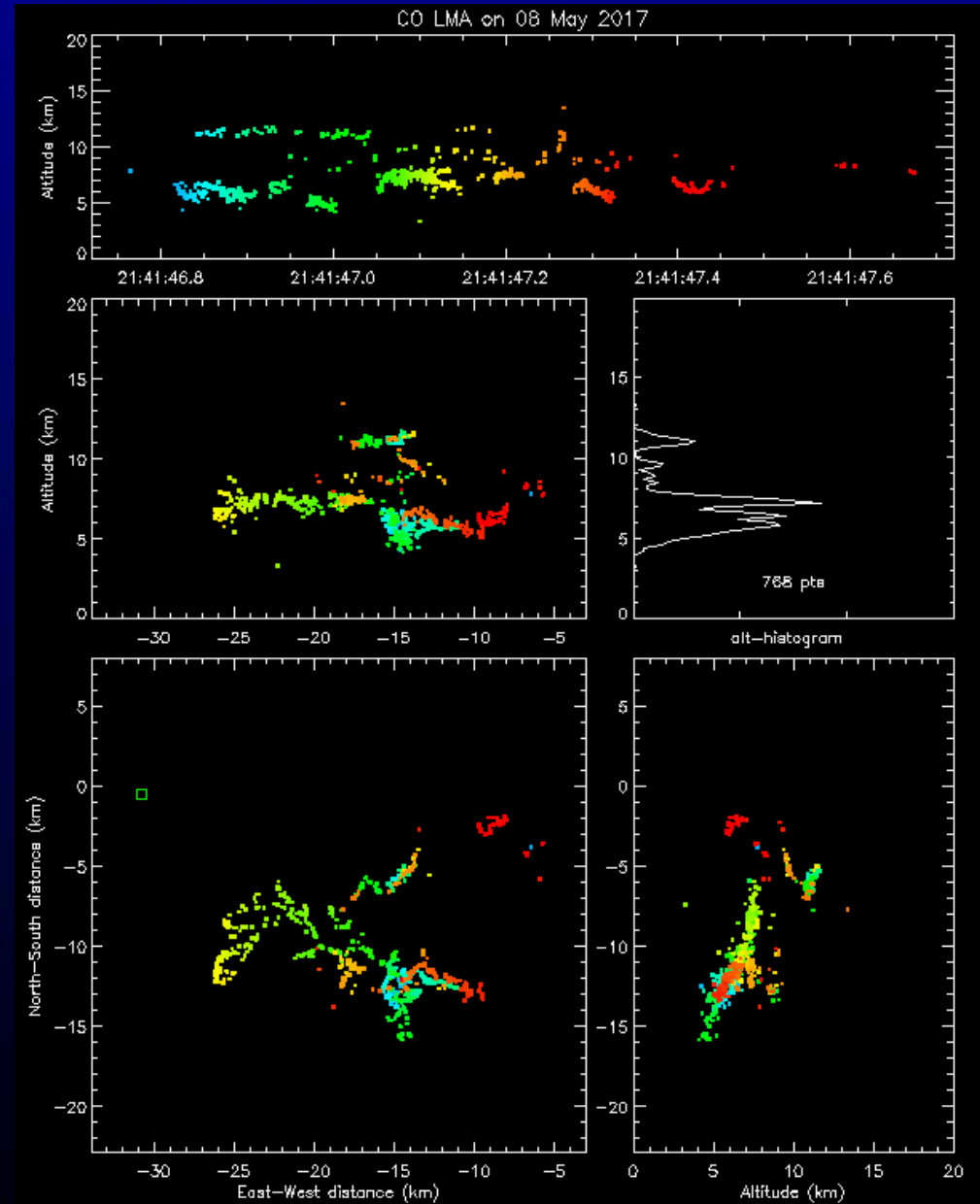
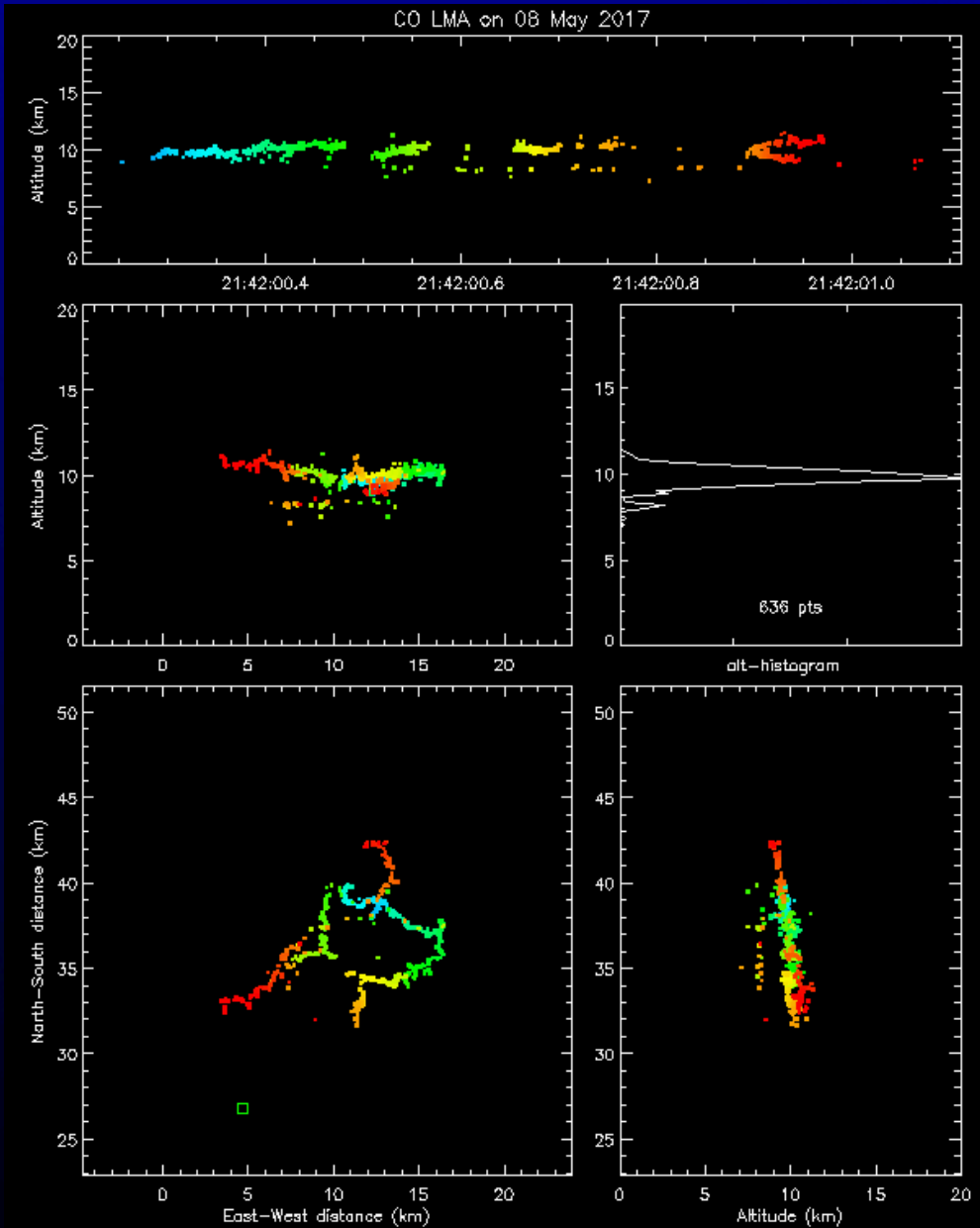
- Low detection efficiency in the two major western storms (< 50%)
- Anomalously electrified storms: descending, low-altitude IC flashes
- High DE in weaker eastern/southeastern storm cells (90-100%) - despite also being anomalous
- Western storms well-identified by GLM due to higher flash rates
- Eastern storms apparently less vertically developed - less upward optical attenuation



Normal vs. Anomalous IC Flashes

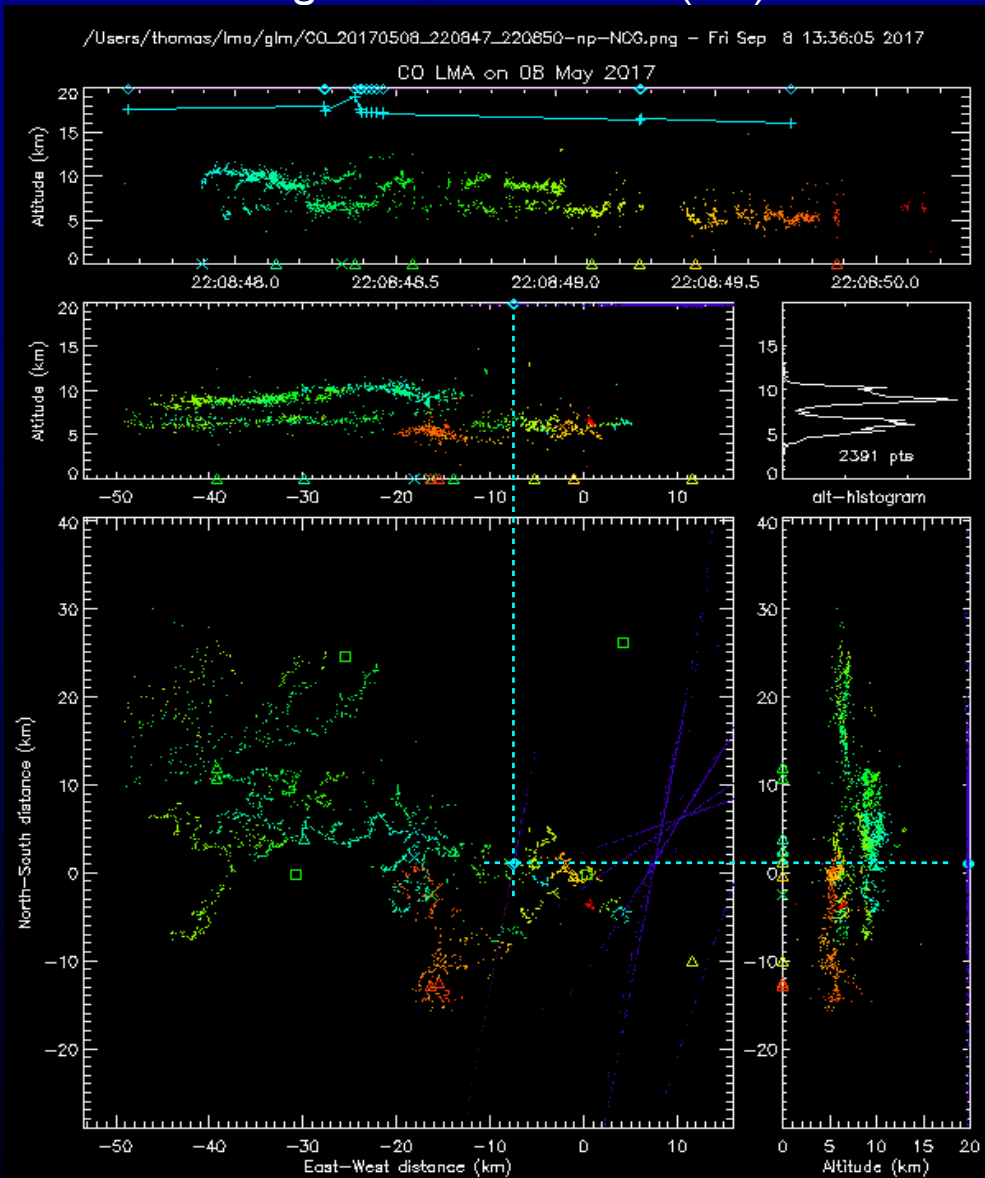
Normal polarity (upward negative) IC
More light output from upper level breakdown

Inverted polarity (downward negative) IC
Less light output from upper level breakdown

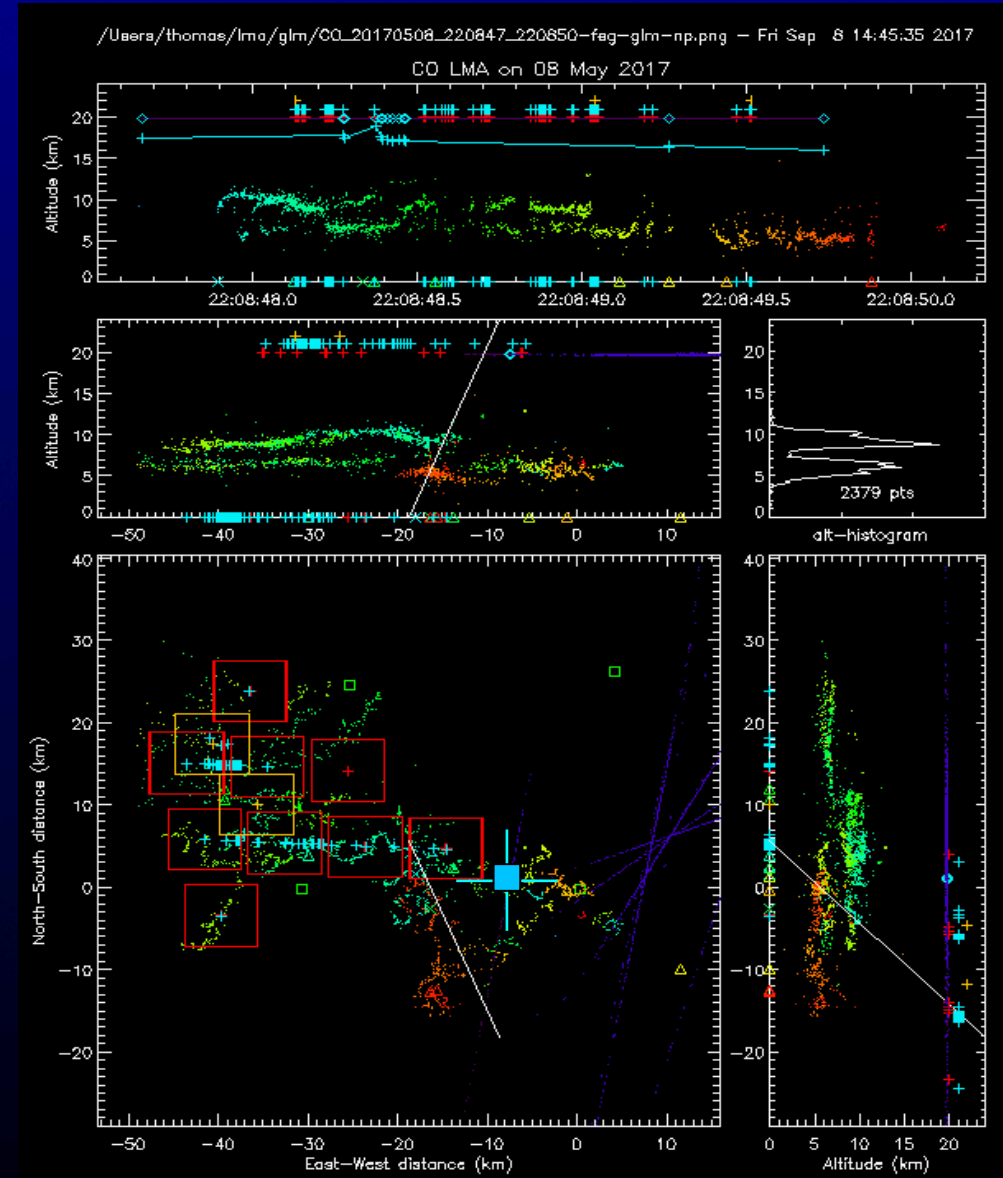


Extensive flash in Greeley storm (with GLM & FEGS)

Normal-polarity bilevel IC flash
ER-2 to east of flash (purple)
single FEGS detection (----)



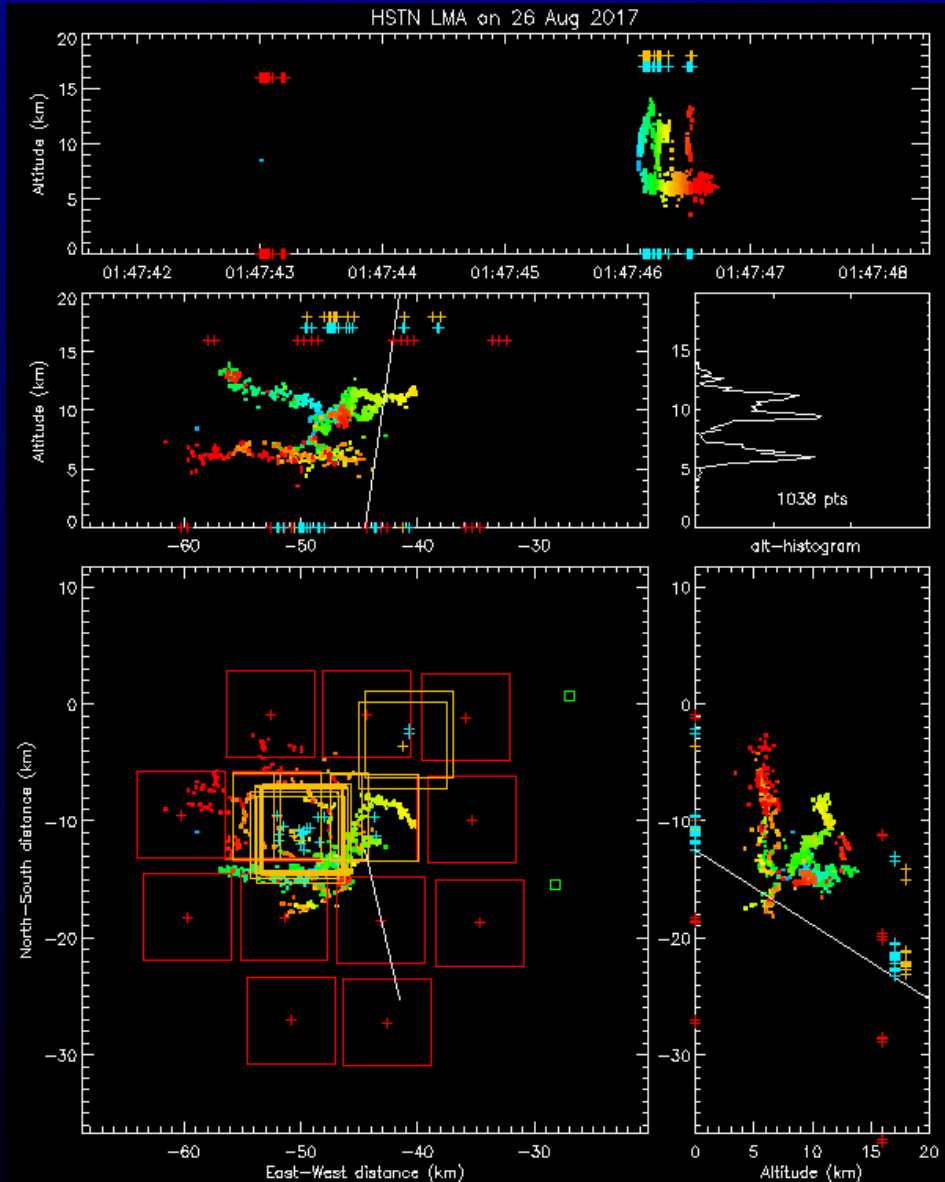
Flash detected by GLM outside of storm core
ER-2 event location (cyan square)



Flash identification problem: Fort Morgan examples

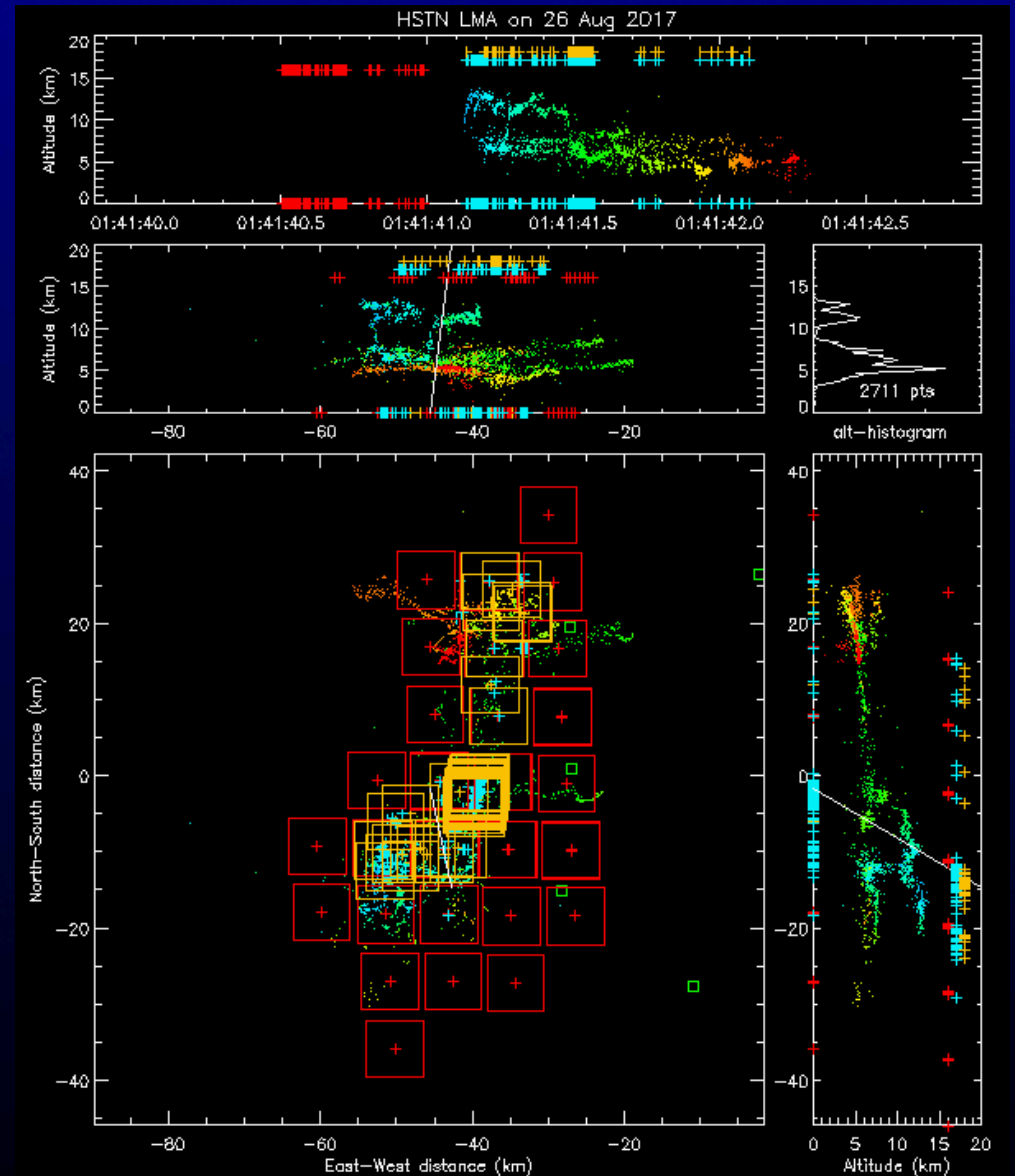
Normal polarity, bi-level IC flash

L2 identified as *numerous* flashes (yellow squares)
 (Event times misread in netcdf: red + times)



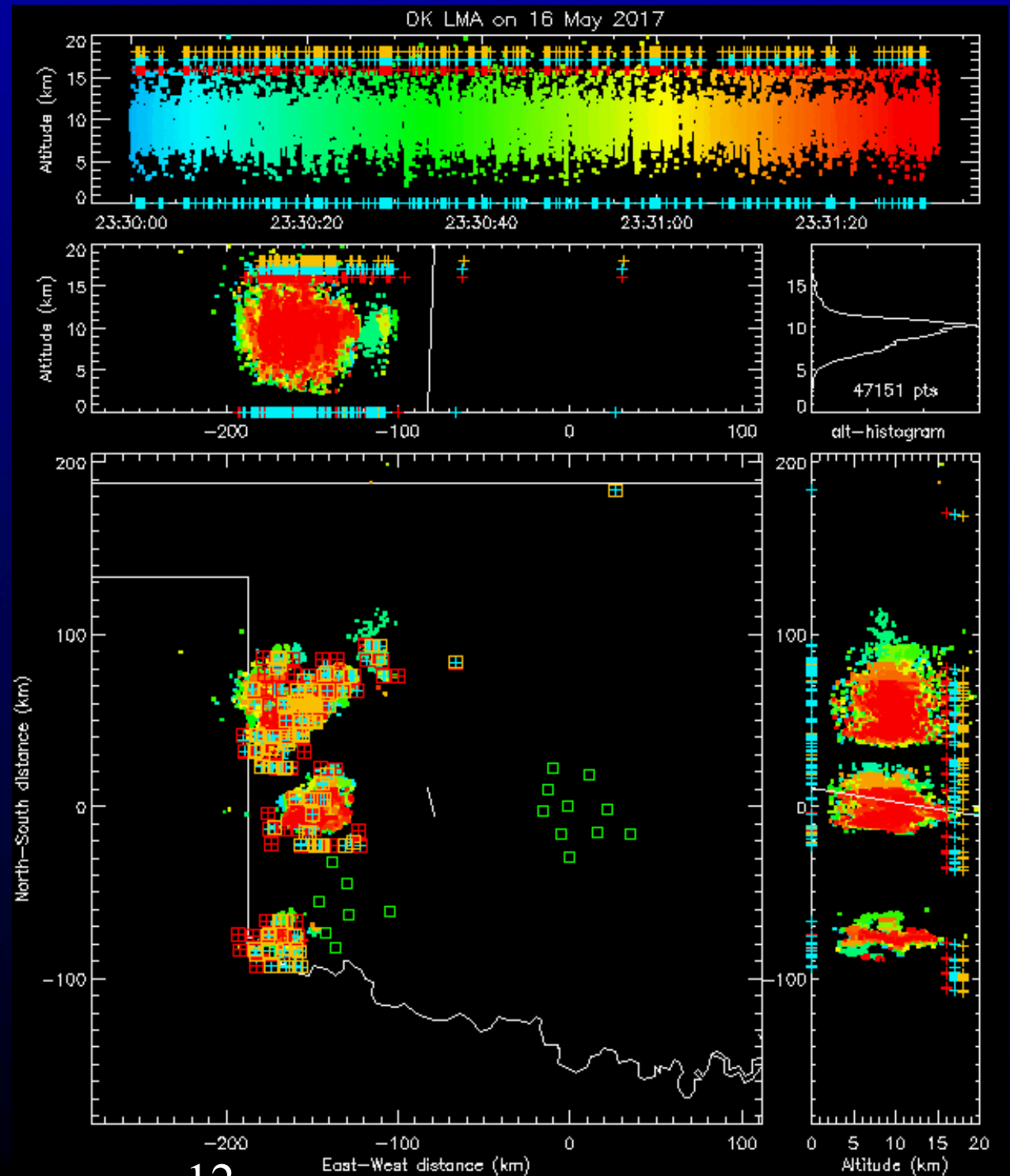
Extensive normal polarity, multi-level IC

L2 identified as even *more numerous* flashes
Major Problem with L2!!



Oklahoma Storms

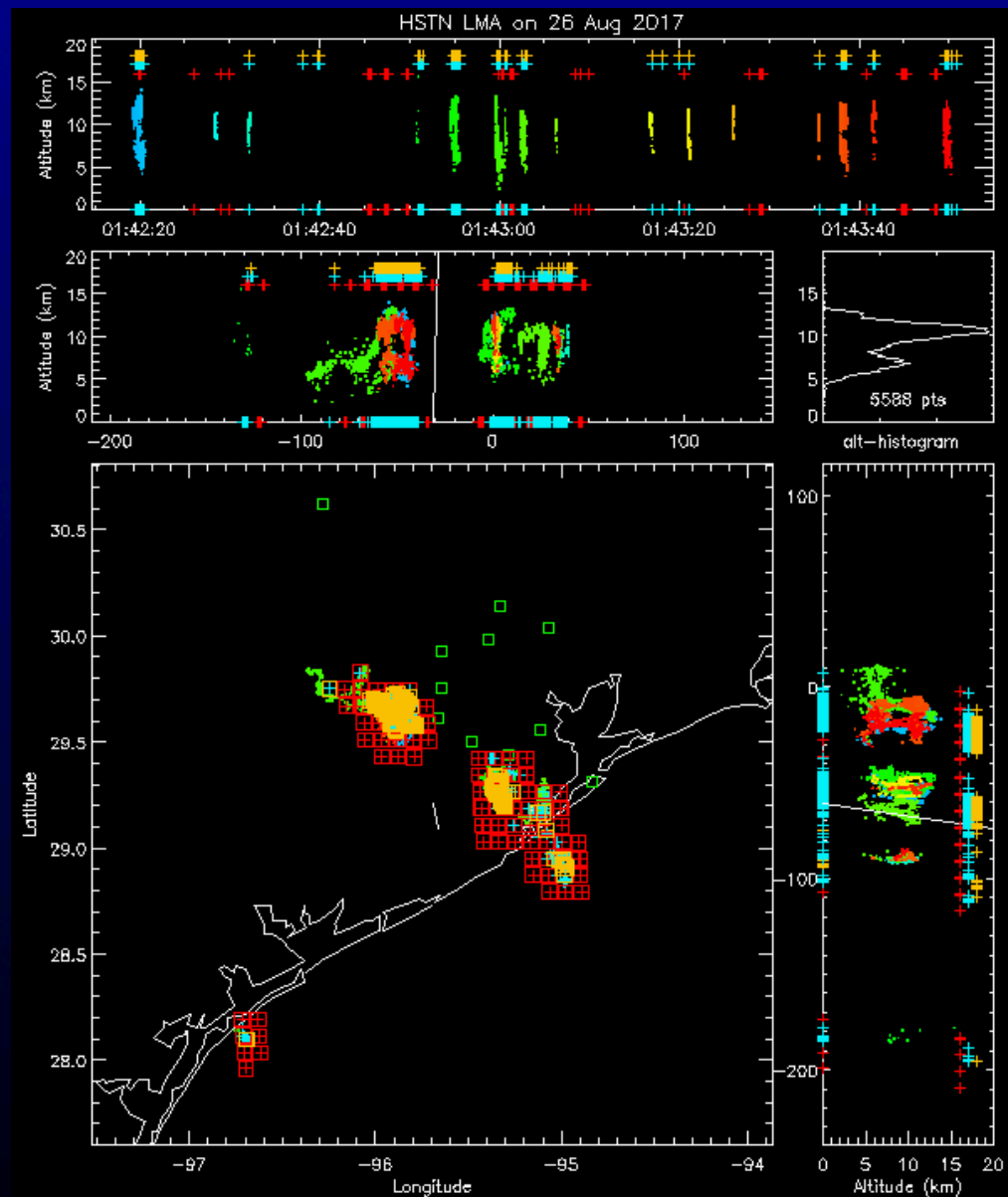
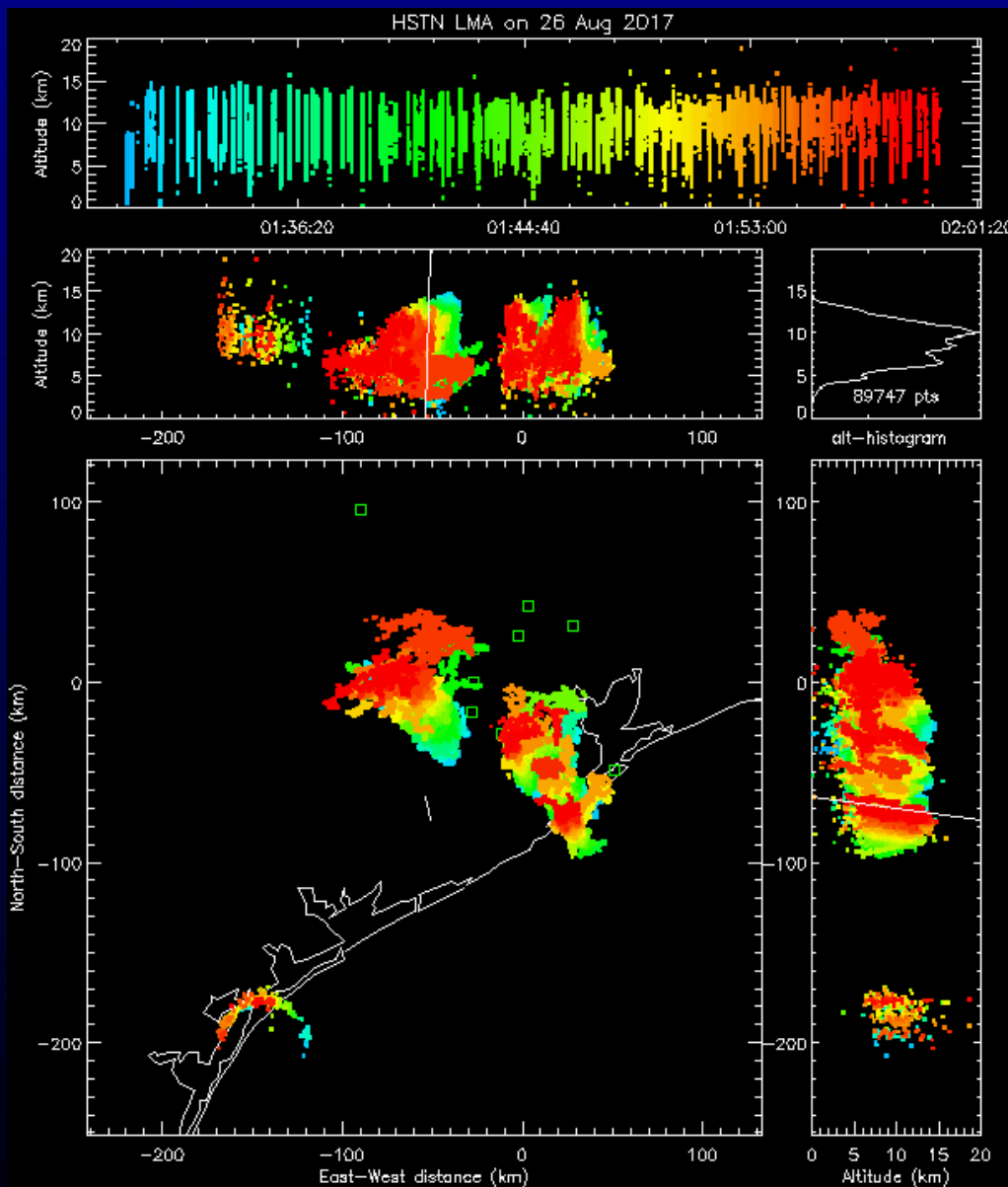
- During 16 May ER-2 transit back to CA, with OK over-passes later in the storms
- Results similar to Colorado storms: mid- to low-DEs, but storms well-detected
- Middle storm tornadic (Elk City tornado)
- No difference from the other storms in GLM (or LMA) observations



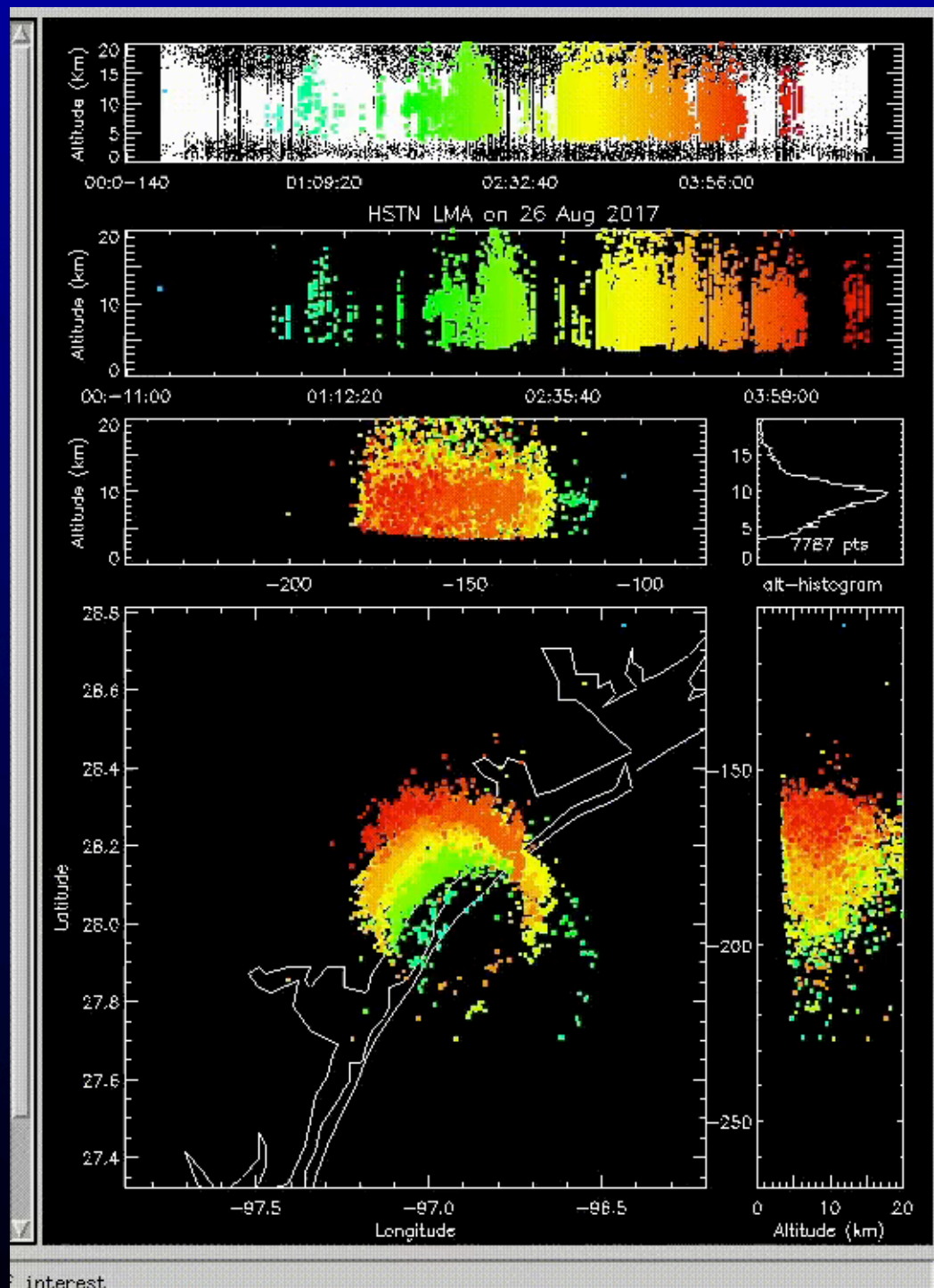
Houston LMA observations for hurricane Harvey

Eyewall and rainband lightning
(30 min; Eyewall at ~240 km range)

GLM observations
(Eyewall ~240 km range from HSTN LMA)



Harvey Eyewall 3 hr animation



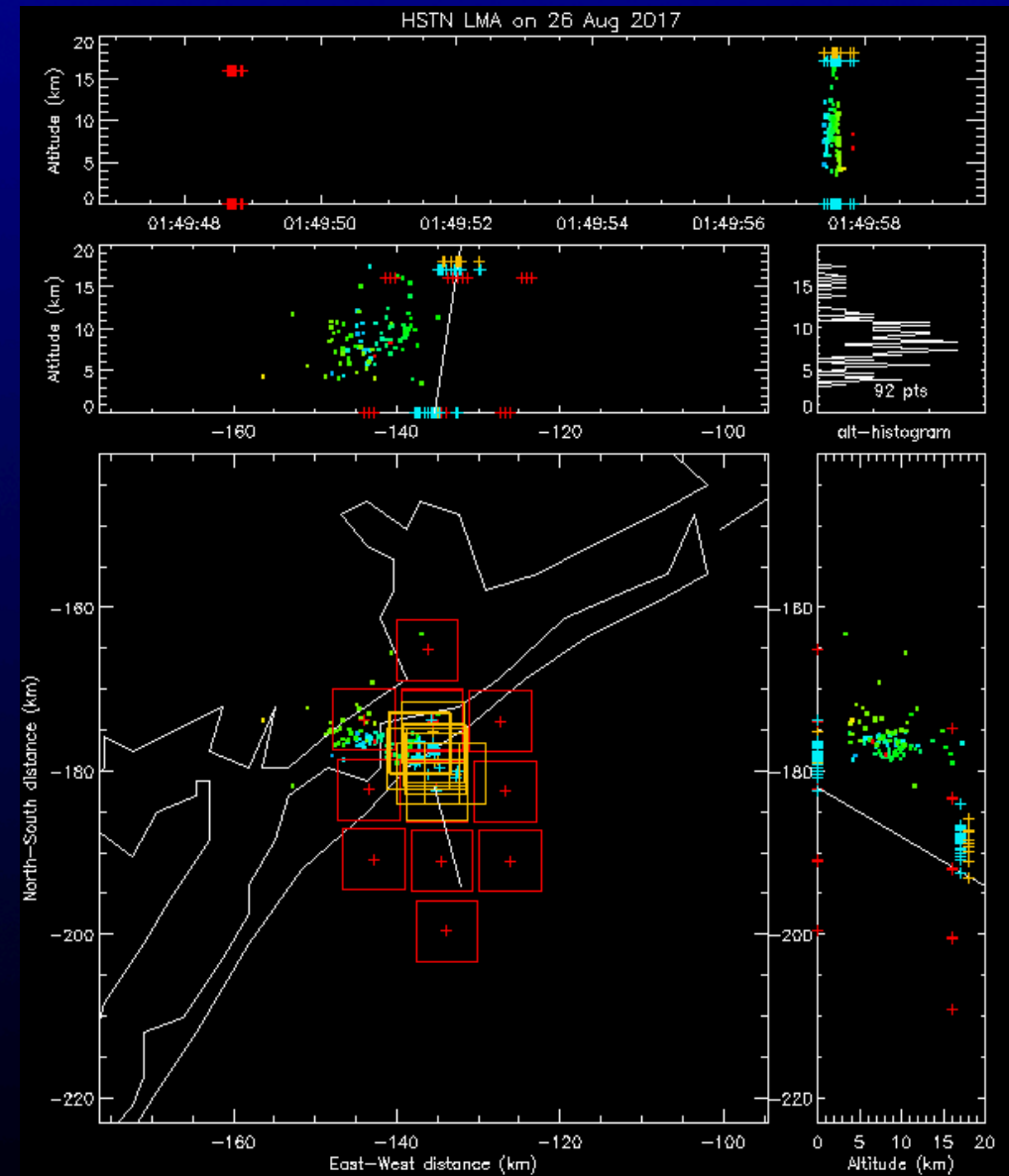
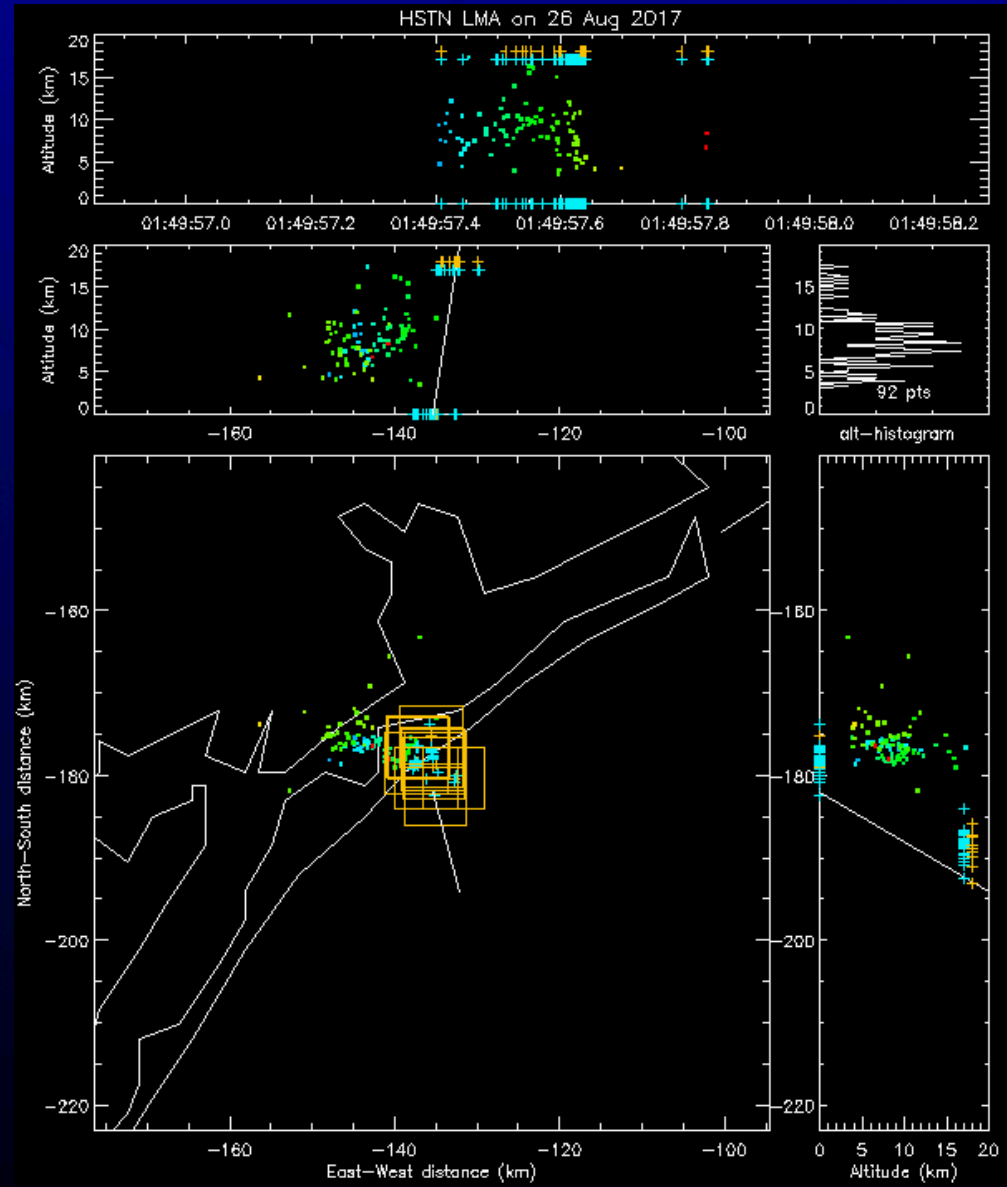
interest

Single eye-wall flash

Corpus Christi - 240 km distance

Flash location and times correct,
but multiple flashes! (orange squares)

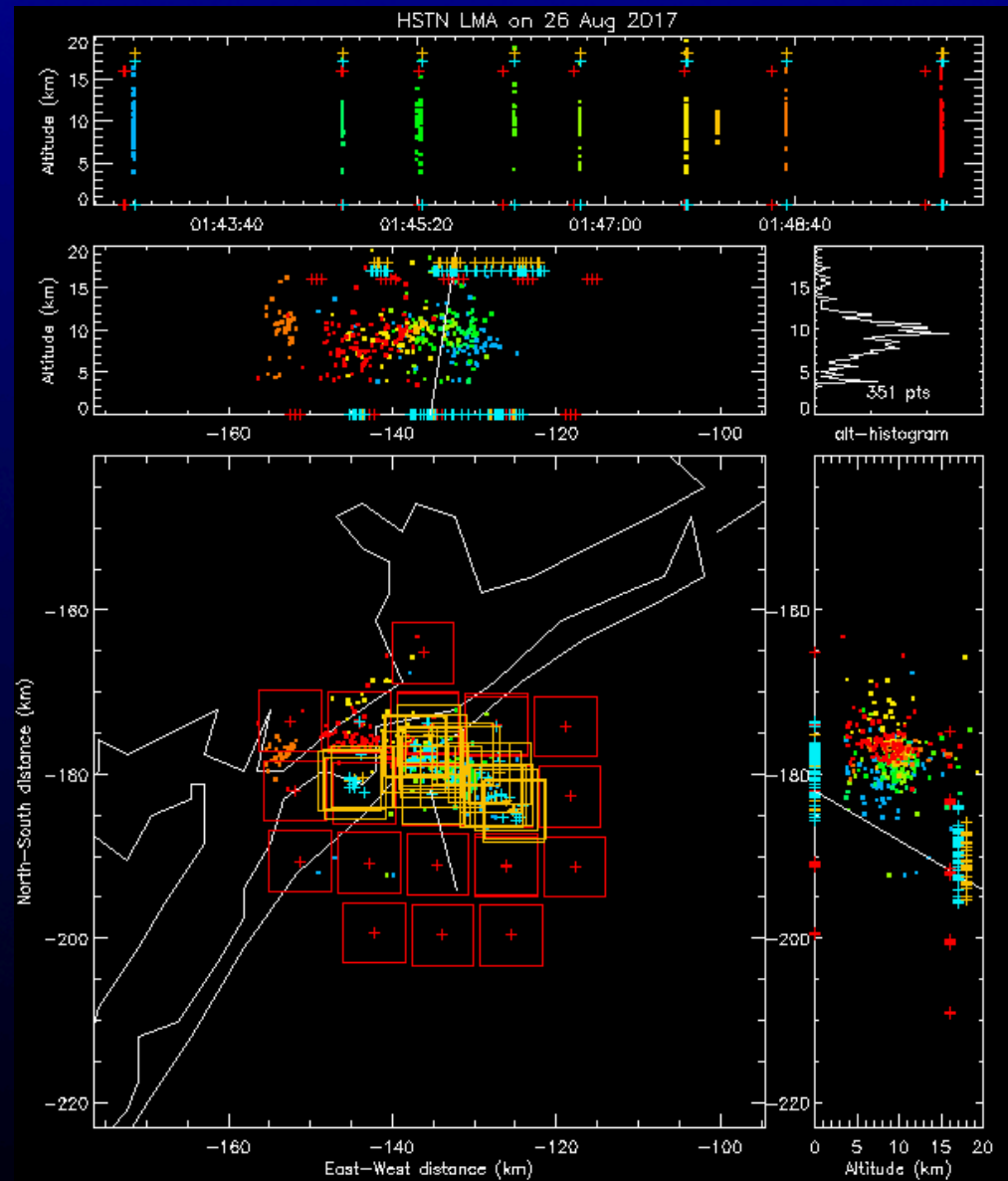
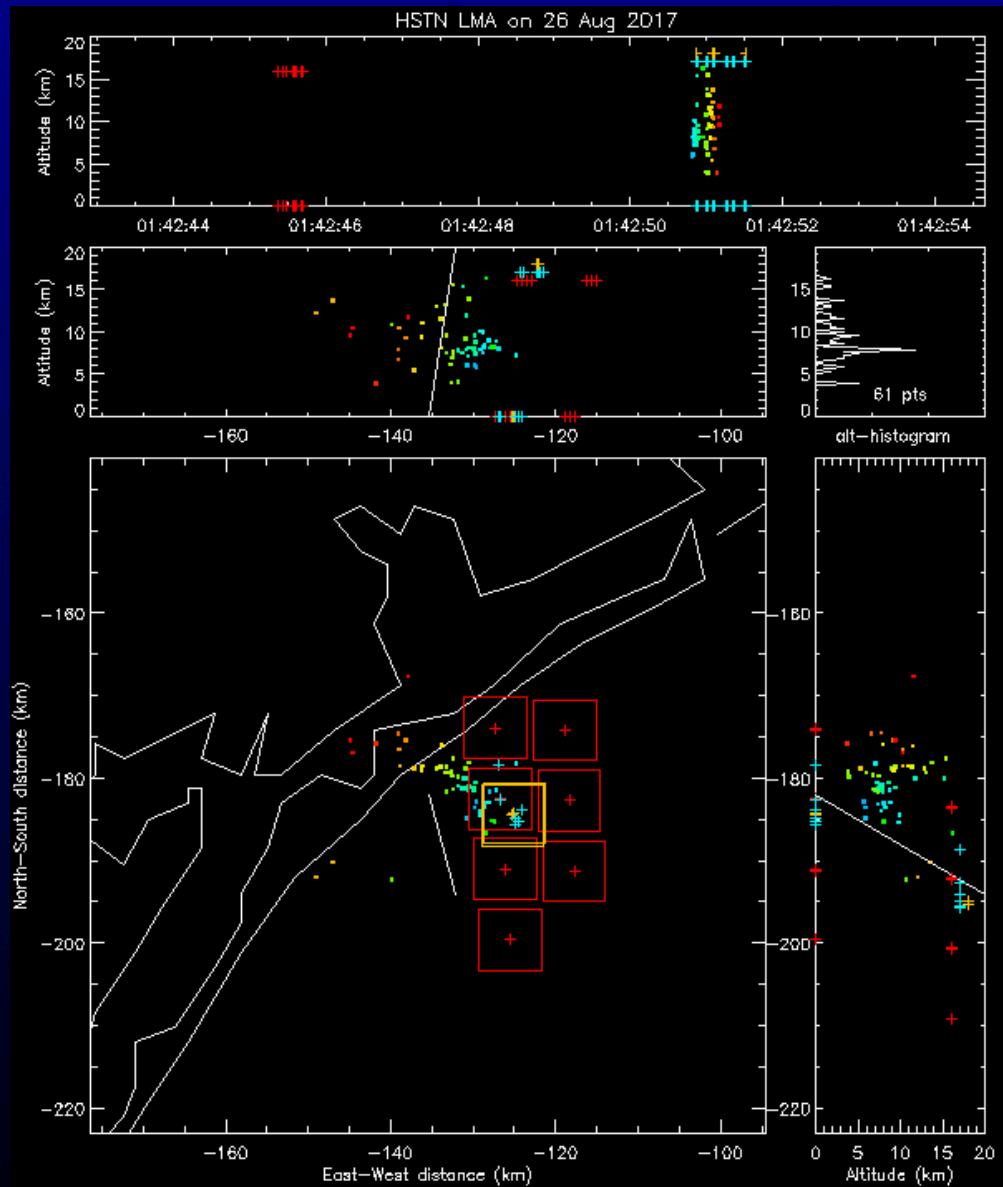
Event locations (red squares) correct,
but event times mis-read in netcdf file



Other Eye-wall Flashes

Locations and detectability good
L2 Flash ID incorrect

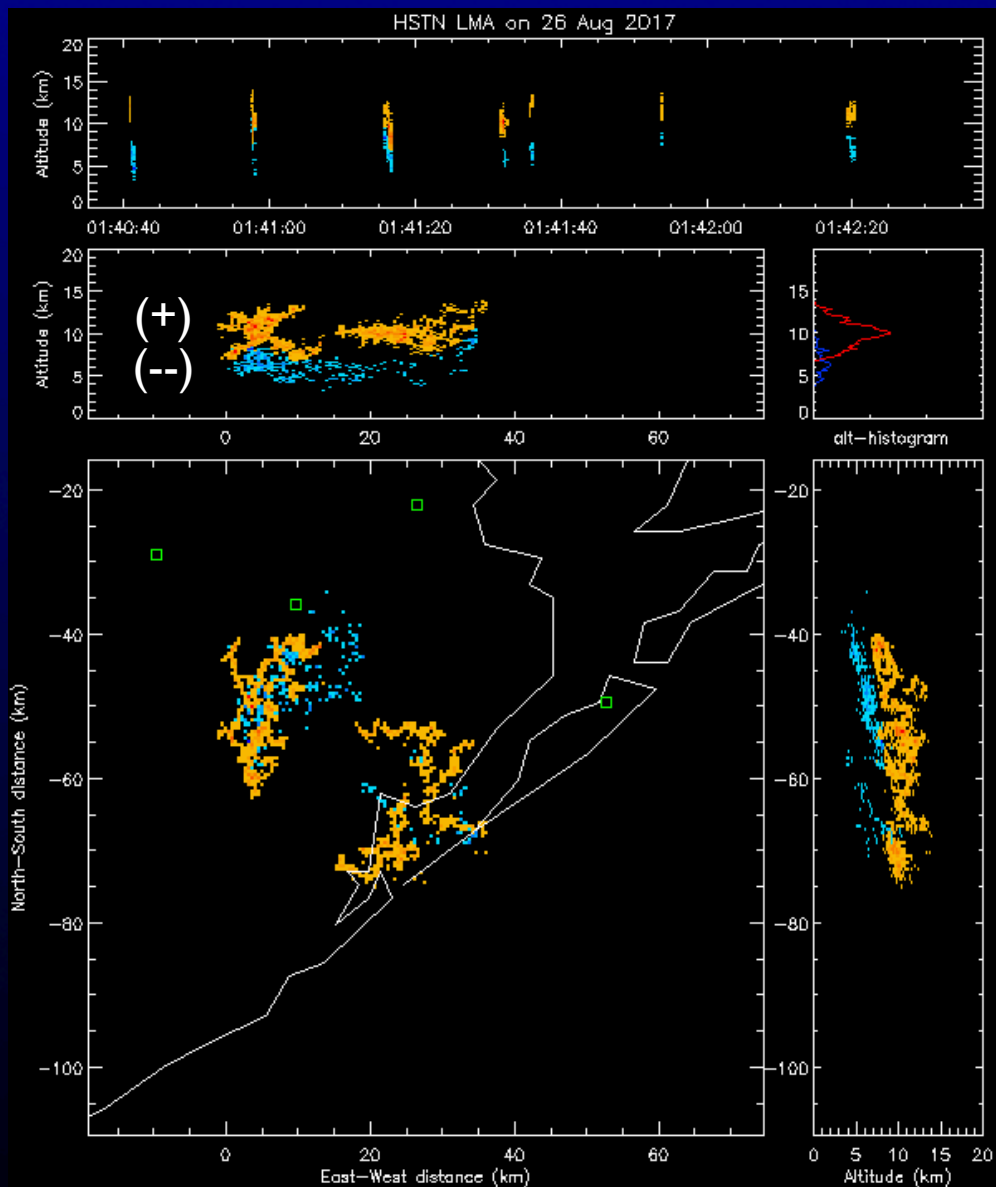
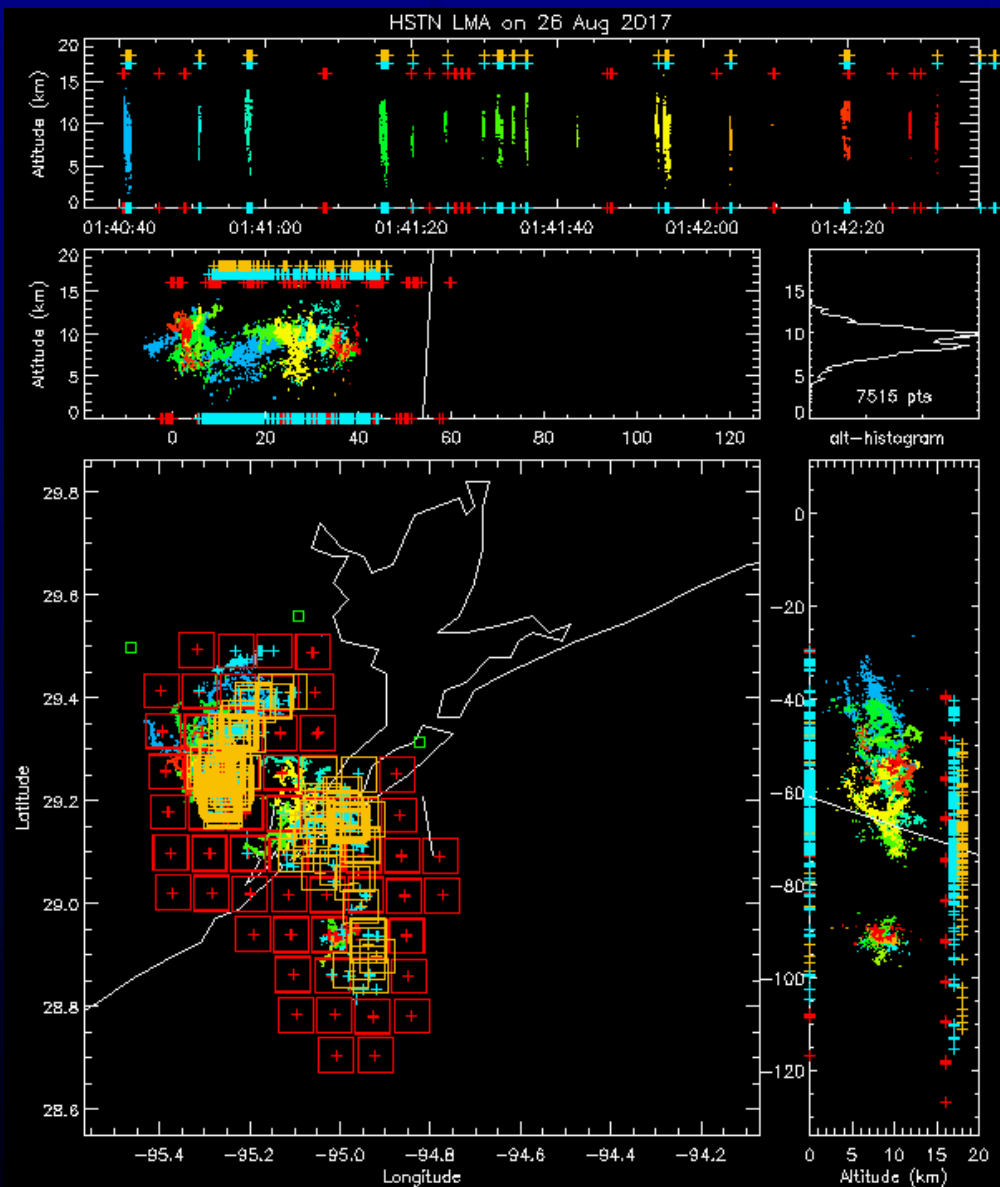
Multiple flashes
80-100% overall detection efficiency



Rainband flashes (over Houston)

GLM/LMA correlation
Accurate locations; incorrect flash IDs

Electrical charge structure
Normal polarity



End