

# *QPE*

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**GOES-R Science Meeting**

# Outline

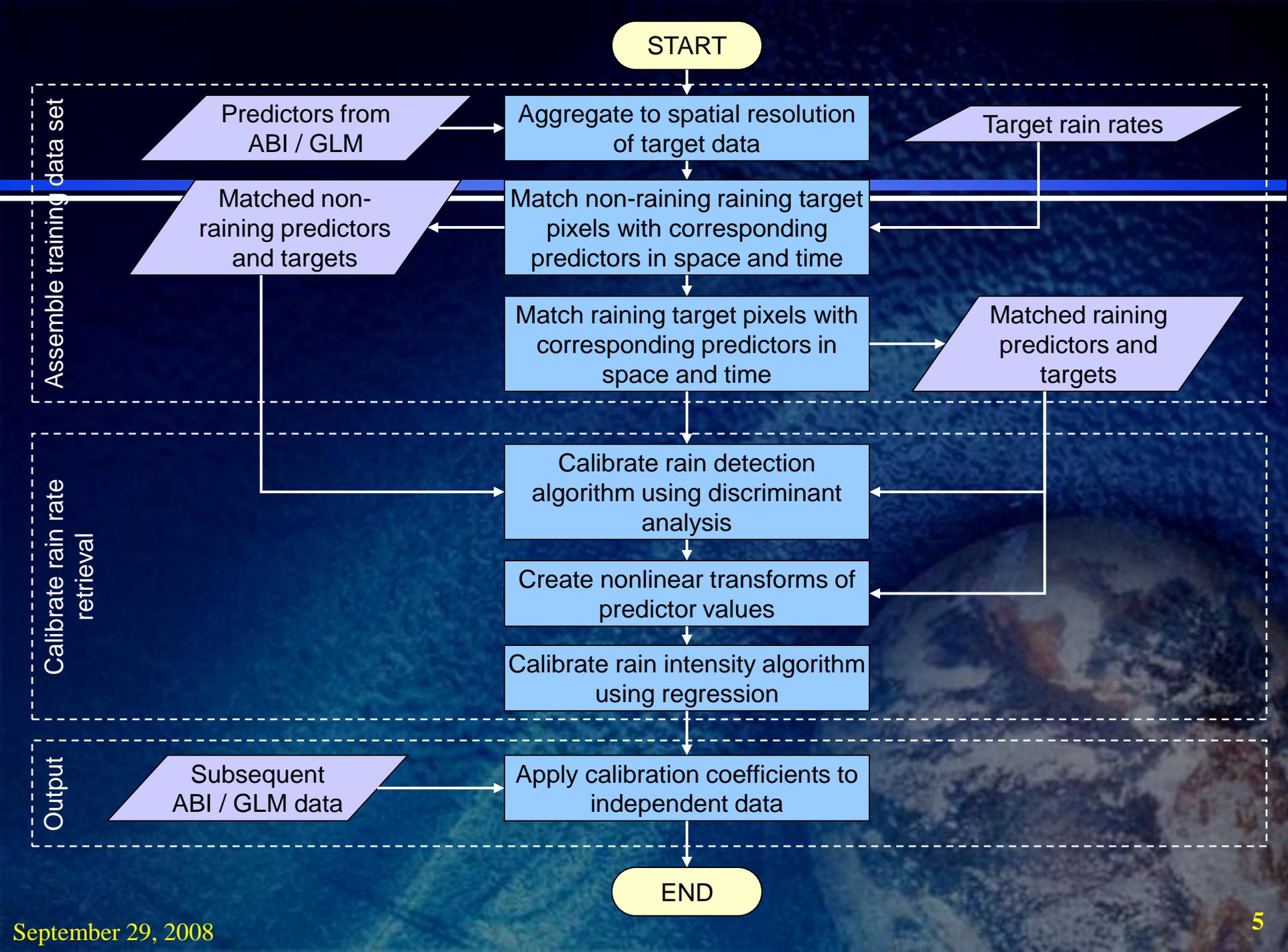
- SCaMPR Overview (Bob)
- SCaMPR and Lightning: Previous Work (Bob)
- SCaMPR and Lightning: Ongoing and proposed Work (Walt)
- Questions / Discussion (all)

# SCaMPR Overview

- Self-Calibrating Multivariate Precipitation Retrieval
- Calibrates IR predictors to MW rain rates
- Updates calibration whenever new target data (MW rain rates) become available
- Selects both best predictors and calibration coefficients; thus, predictors used can change in time or space
- Flexible; can use any inputs or target data

# SCaMPR Overview (cont.)

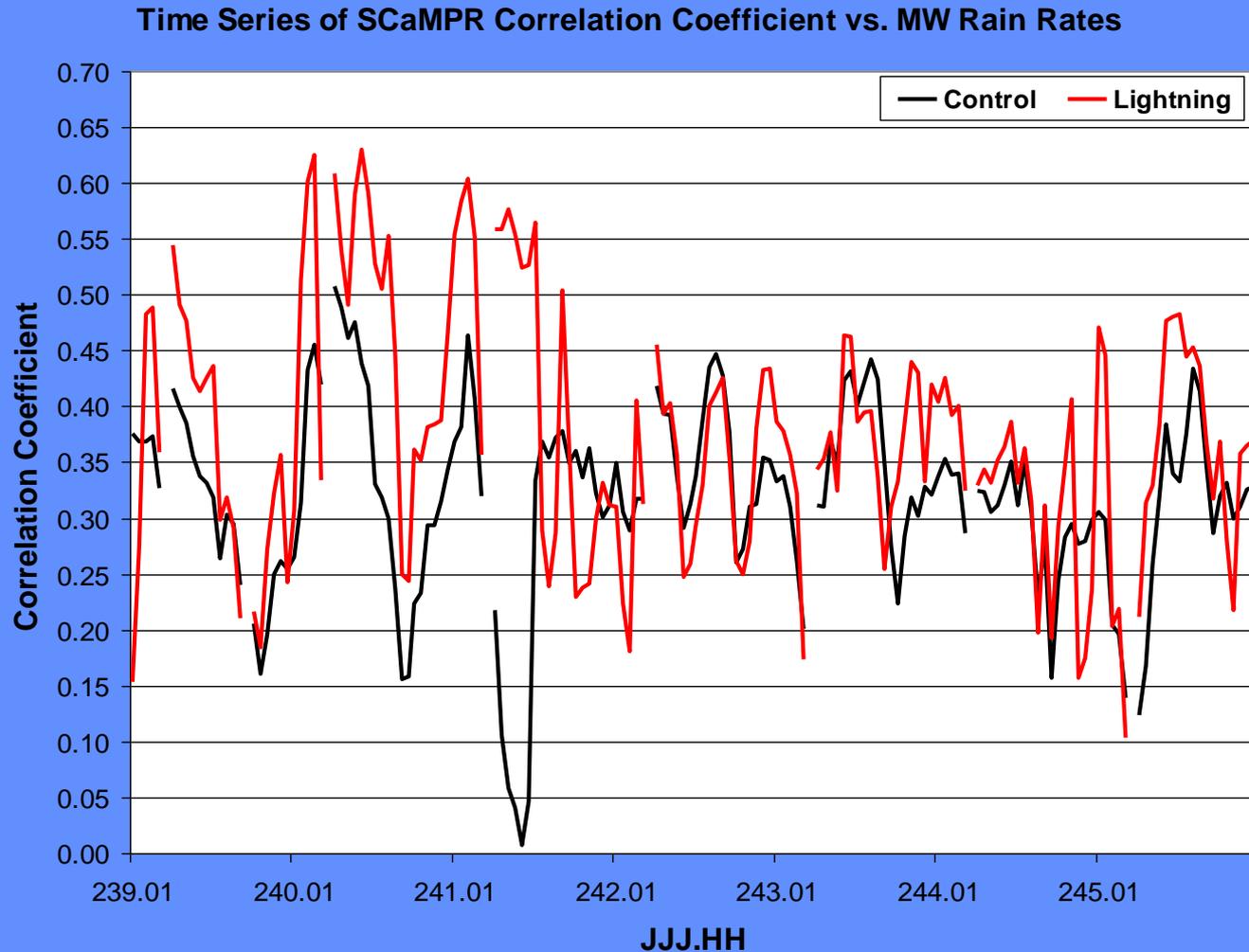
- Two calibration steps:
  - » Rain / no-rain discrimination using discriminant analysis
  - » Rain rate using stepwise multiple linear regression
- Classification scheme based on BTD's (ABI only):
  - » Type 1 (water cloud):  $T_{7.34} < T_{11.2}$  and  $T_{8.5} - T_{11.2} < -0.3$
  - » Type 2 (ice cloud):  $T_{7.34} < T_{11.2}$  and  $T_{8.5} - T_{11.2} > -0.3$
  - » Type 3 (cold-top convective cloud):  $T_{7.34} > T_{11.2}$



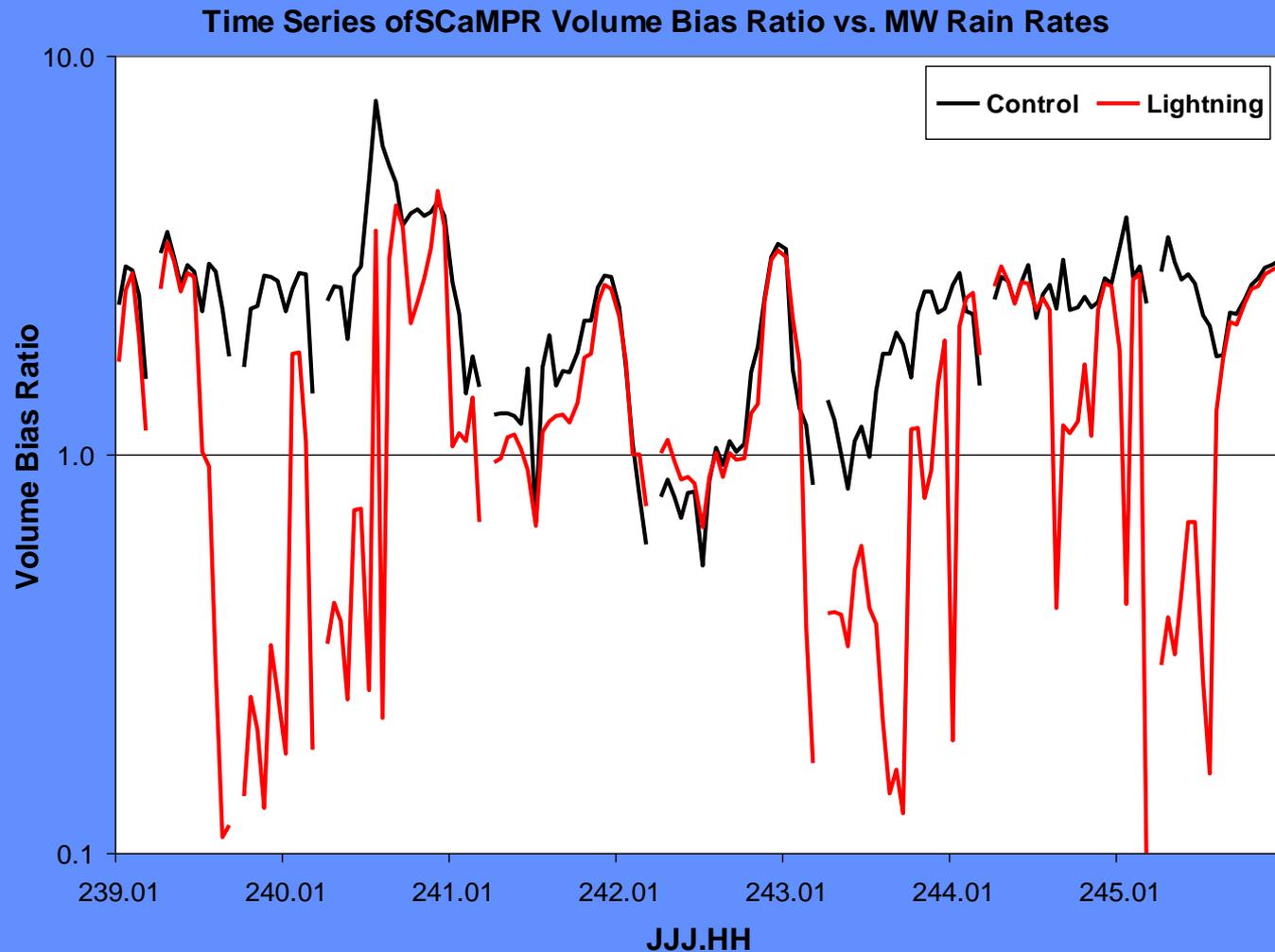
# SCaMPR and Lightning: Previous Work

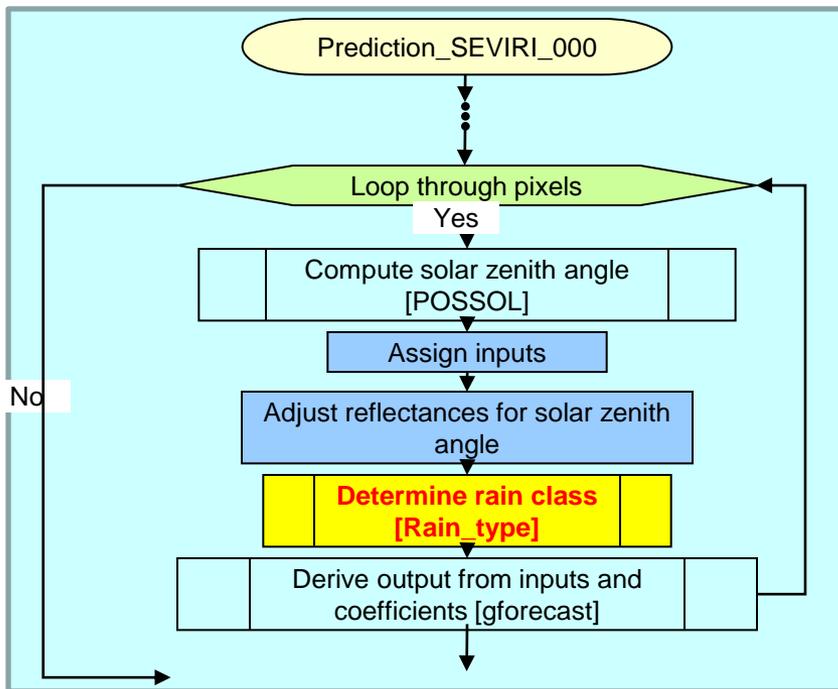
- Back in 2005, performed some experiments using National Lightning Detection Network (NLDN) data as predictors to SCaMPR
- Basic predictor was number of lightning flashes in a GOES pixel in previous 15 min
- Two uses of the predictor:
  - » Classification: separate convective (lightning present) and stratiform (no lightning) calibrations
  - » Lightning flash rate as a predictor for the convective class
- Positive impact; hoping to incorporate into the real-time version of SCaMPR by year's end

# Impact of Lightning on SCaMPR Correlation



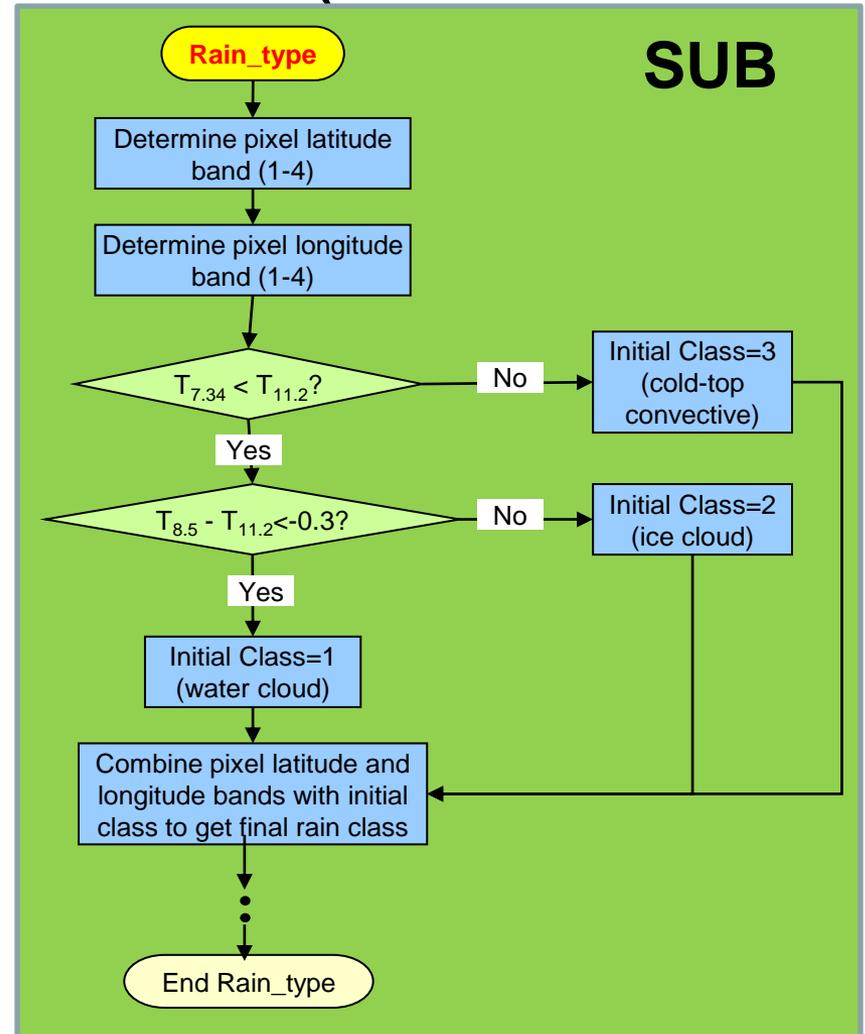
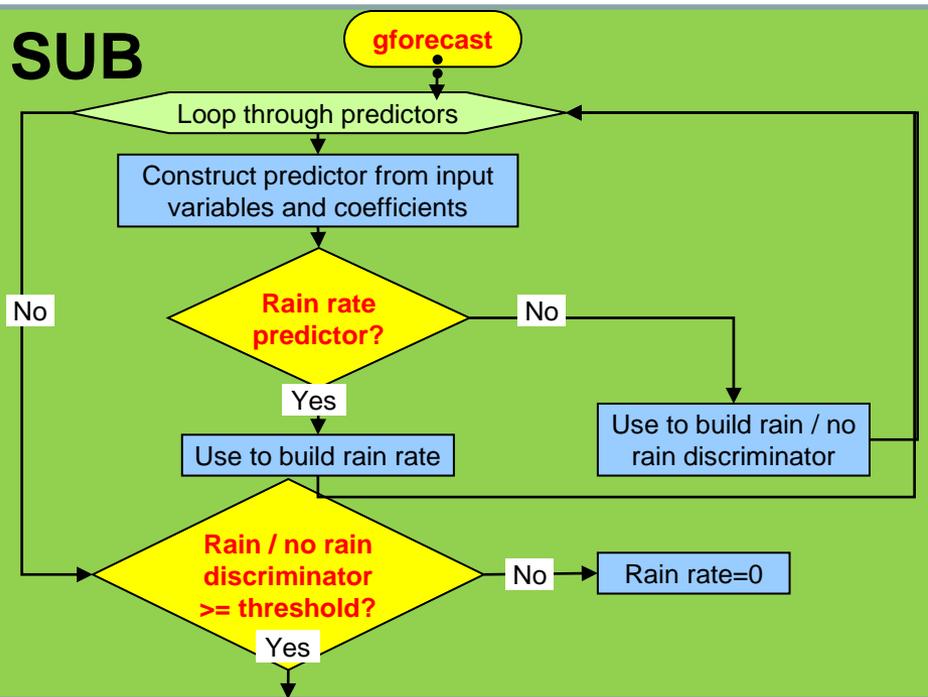
# Impact of Lightning on SCaMPR Bias





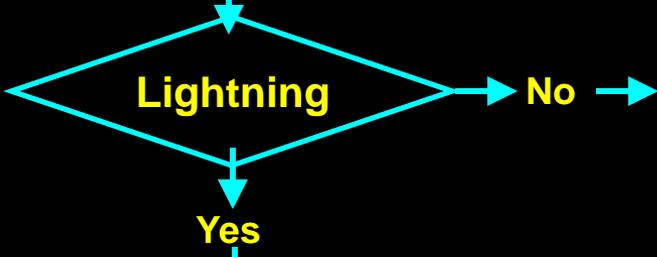
## GLM Information Content for SCaMPR

- Rain Presence
- Rain Class/Type (C/S/Other)
- Rain Rate (Gross PDF)



# GOES-R GLM QPE ALGORITHM: Conceptual.....

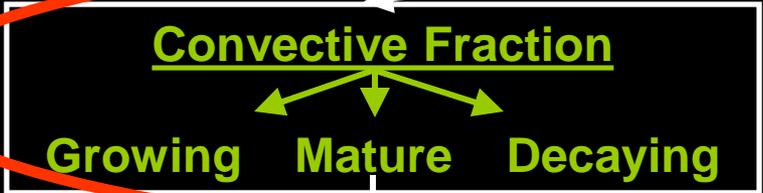
GLM, TBD DATA  
(BOLDI, ScaMPR)



ScaMPR

## Lightning-Producing Entity/Weather Type

Location, Cluster, Extent, Characteristics (Flash Rate [FR],  $D(FR)/Dt$ , location etc.)



Volume Rain Character   Ice

Volume Rain Character   Ice

ScaMPR Rain Type   ScaMPR GForecast

# Convective and Stratiform (C/S) Precipitation

Recognized in the precipitation community as a *fundamental* characteristic of convective system rainfall process since the 70's-80s

Implemented in most state of the art ground-based radar estimation algorithms (historically problematic for satellite algorithms Vis/IR and MW alike (both fundamental to SCaMPR))

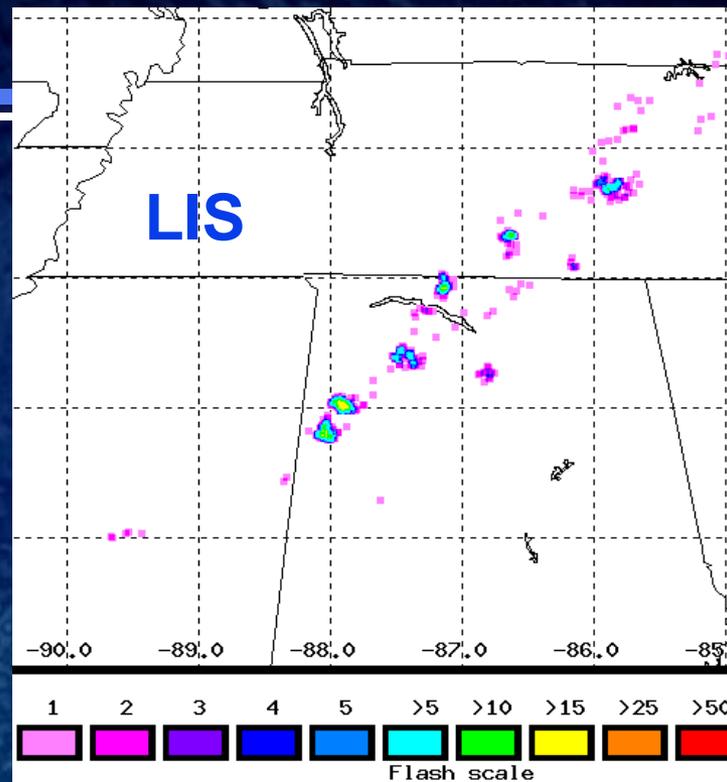
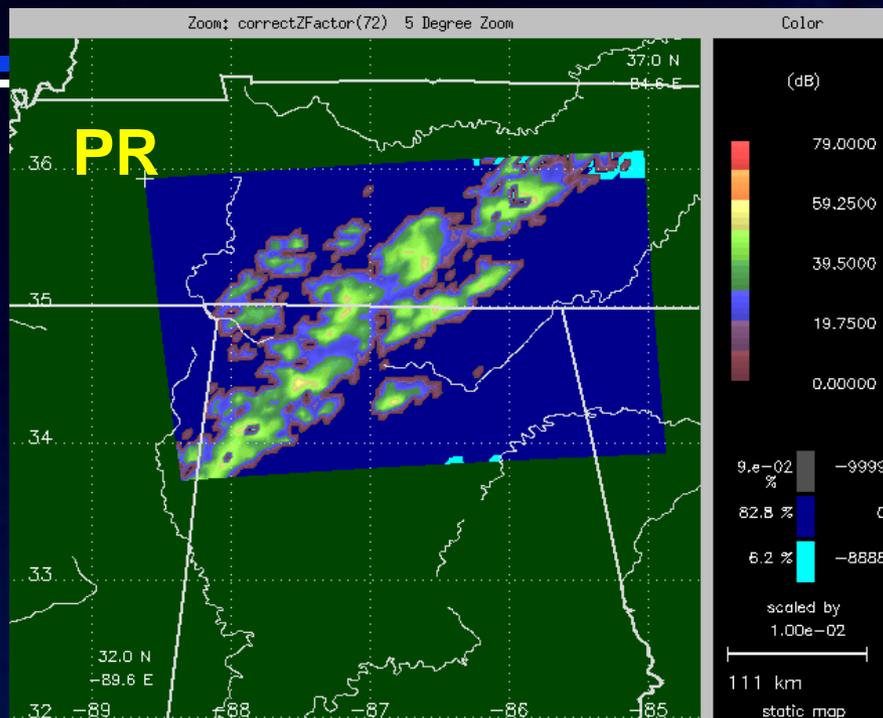
For satellite QPE- this application of lightning information is “low-hanging fruit”: Lightning occurs predominantly in precipitating convection and *when lightning does occur, it identifies/pin points convective areas of precipitation.*

When combined with other observations- can enhance the classic “presence or absence” problem and facilitate better C/S partitioning (e.g., Grecu and Anagnostou; convective/stratiform fractions and revised rain volume calculation).

Relative to applications in C/S partitioning we can ask (and suspect):

*Fundamentally, between raining convective systems of similar area coverage does the presence/absence/amount of lightning identify a systematic difference (e.g., constraint) in system-wide C/S precipitation behavior?*

# Turn to TRMM and Testbeds: Feature C/S behavior as f(lightning) Establishing broad constraints in behavior



## For each TRMM Orbit and precipitation

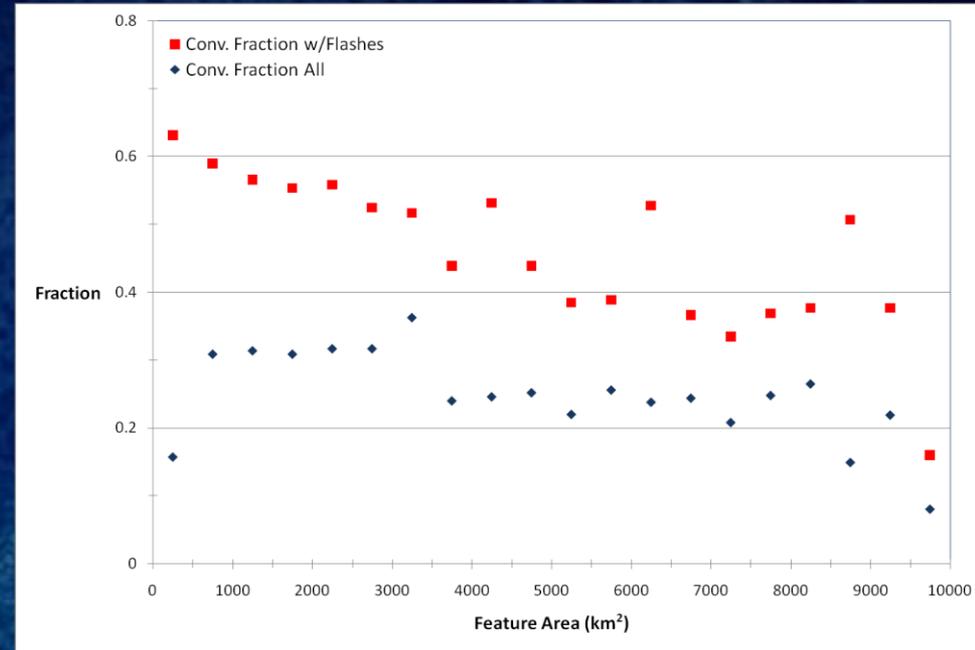
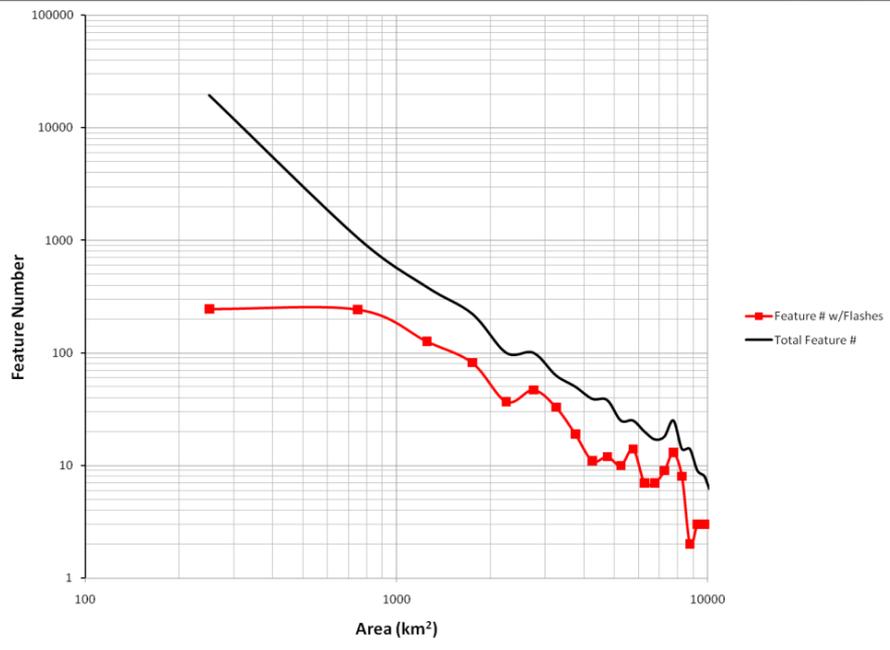
### feature:

1. 2A25/2A12 Convective/Stratiform rain fractions (within 1Z99)
2. C/S partitioned Avg./Max rain rate, volume rate, IWP, LWP, Scattering Index
3. Lightning flash count

## Evaluate over TN Valley (first)

1. C/S feature fractions as f(flash, no flash)
2. C/S feature area rain volume rates f(flash, no flash)
3. C/S Rain volume ratios f(flash, no flash)
4. Feature C/S Avg. rain rates f(flash, no flash)
5. C/S IWP/LWP f(flash, no flash)

# 7-Year TN Valley Feature Sample number and C/S Fraction



21,788 Total Features (20 dBZ / 250 K 85 GHz)

Feature area > 500 km<sup>2</sup>

• 82 % Had convection

• 33 % Had lightning

All features (including area <500 km<sup>2</sup> )

• 33% were “convective” (artifacts present)

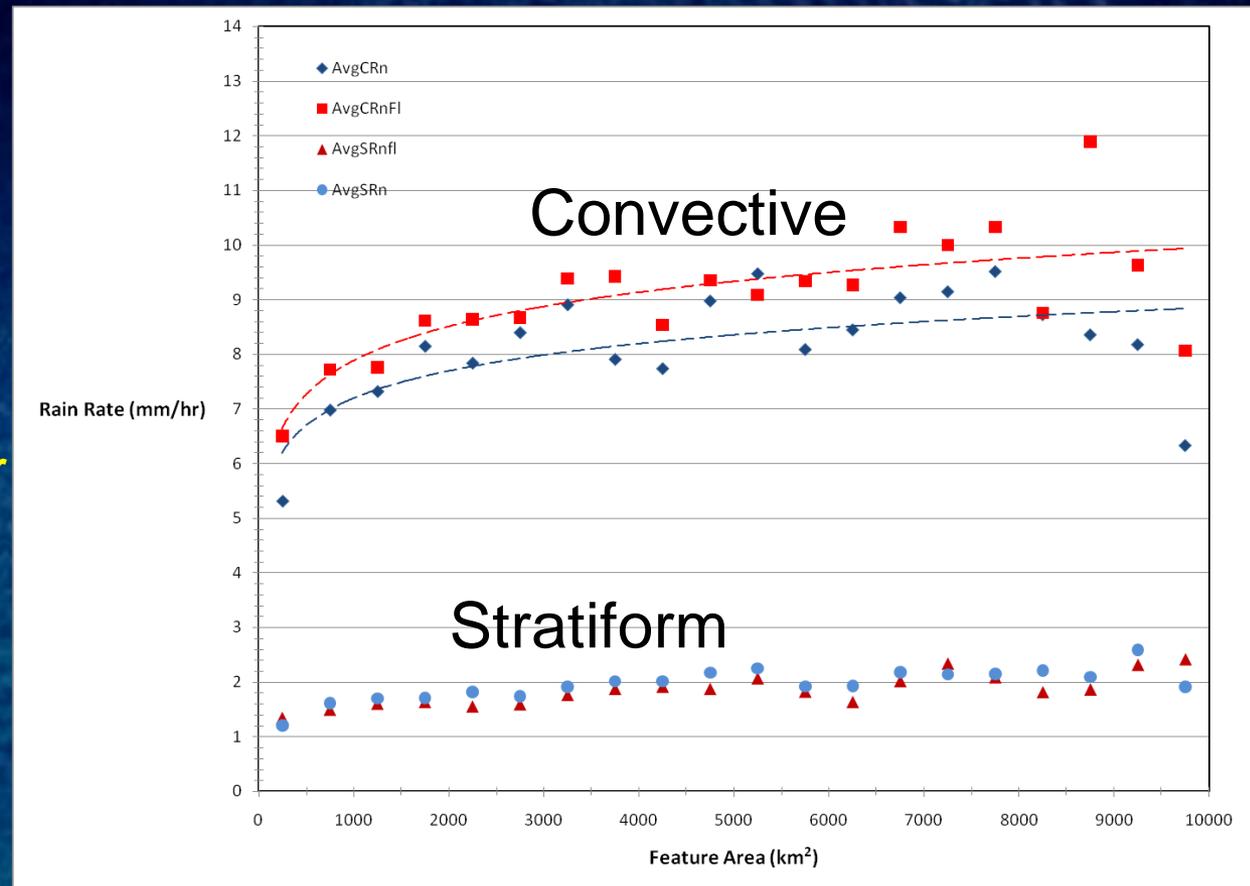
• Only 5% Had lightning

With lightning present there is a clear increase in convective fraction regardless of feature area

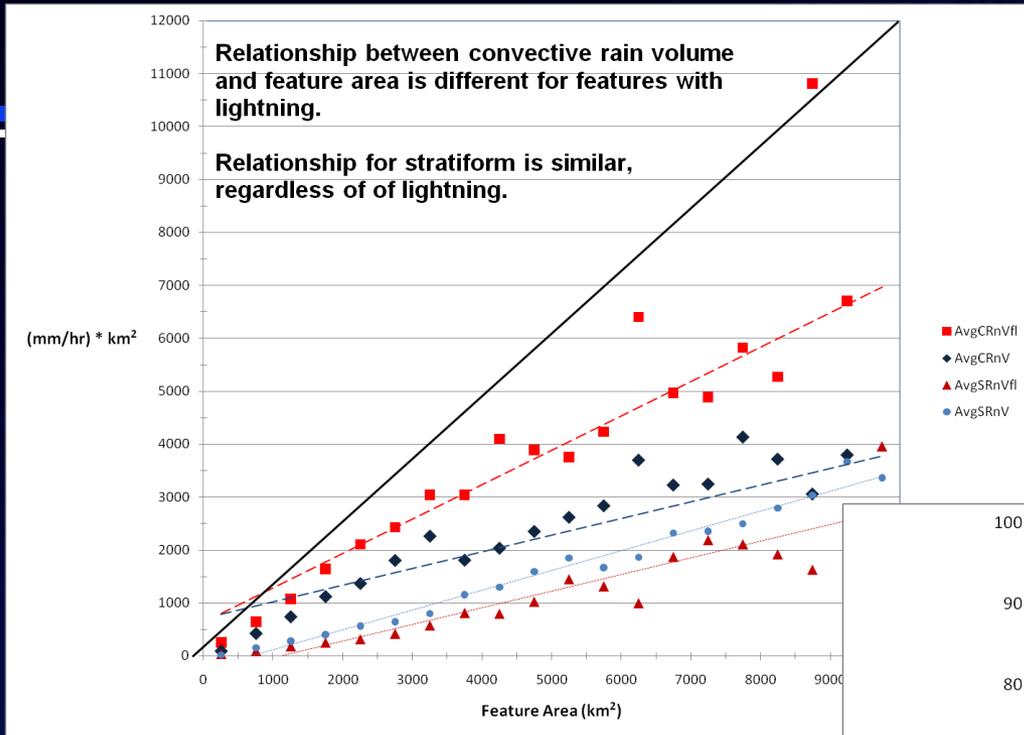
This is most pronounced for smallest features (PR/TMI partitioning artifact?)

# Average Feature Rain Rate (C/S)

- Average convective RR ~ 10%-larger for features with lightning regardless of feature area.
- No difference for stratiform. Asymptotic 2 mm/hr stratiform rain rate is similar to Adler and Negri (1988) value.



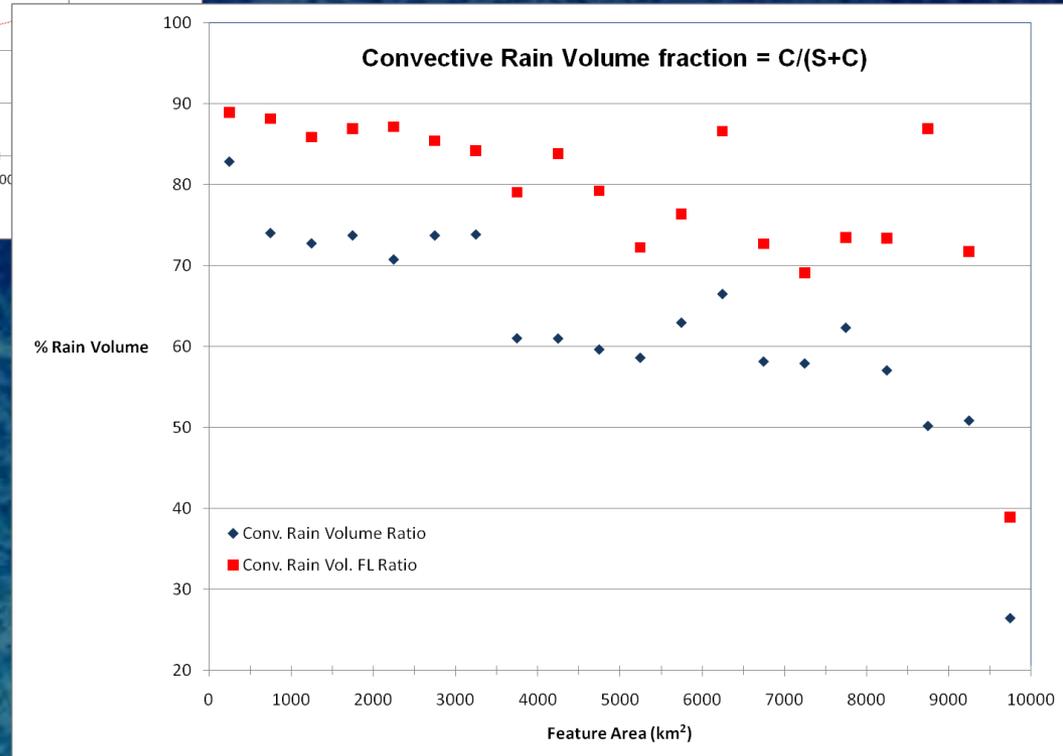
# C/S Rain Volume



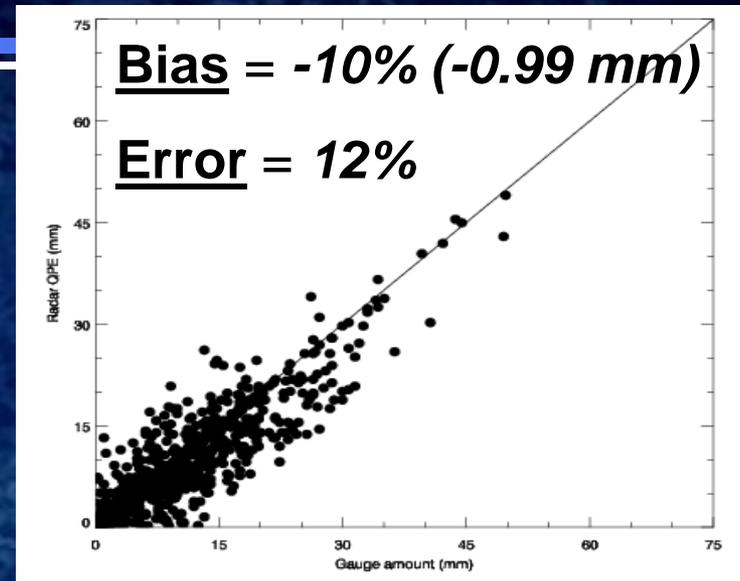
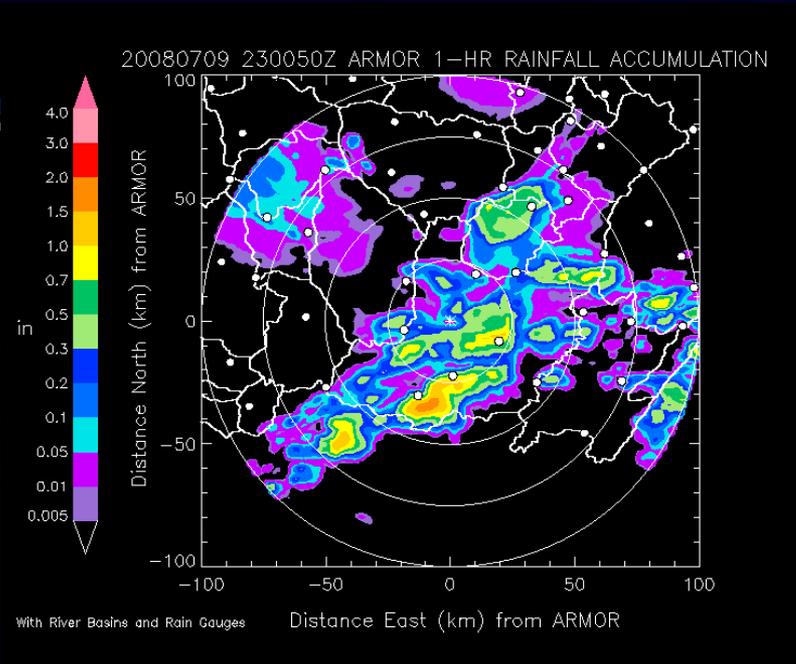
Volume rain rate behavior (e.g., slope of line) different for convective feature areas with and without lightning

About the same for stratiform

Total Convective rain volume for features w/lightning is markedly larger regardless of area



# Future/Ongoing Work



## N. Alabama Testbed

- Calibrated/QC'd dual-pol rain map C/S partitioning with LMA for TN Valley (Proxy dataset?)
- Relate statistics of C/S and flash behavior over lifecycles, compared to TRMM "snapshots".
- IWP retrieval validation (Not requirement, yet.....).

## TRMM Features/C-S/LIS

- Process ASCII features and C/S file for the globe (almost done). Freely available to those who abhor...hate...HDF.
- Extend TRMM features C/S study to global domain including African SEVIRI and other SCaMPR/GLM testbeds.
- Add C/S partition/identifier to Boldi cell ID/tracking algorithm.
- **ISOLATE BEST SCaMPR APPLICATION**



# Questions / Discussion?