

An Evaluation Study of the International Space Station Lightning Imaging Sensor (LIS)

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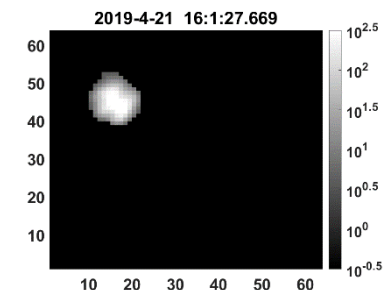
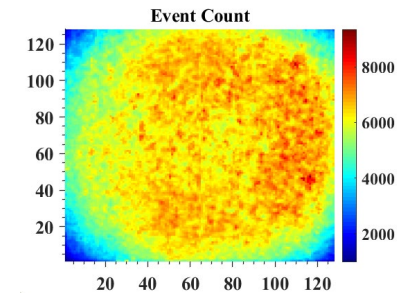


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Outlines

- Overview of TRMM- and ISS-LIS
- Event-level comparison
- Group-level comparison



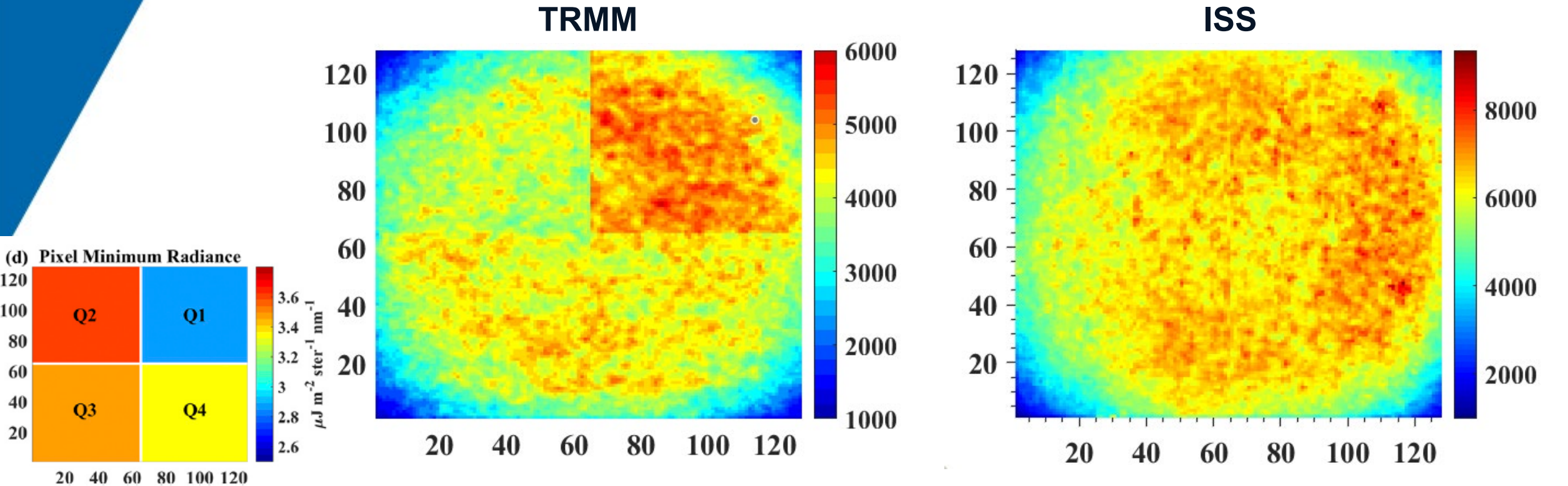
Overview

- TRMM-LIS
 - 1997-2015 (this study 2012-2013)
 - Coverage: 38° N – 38° S
 - Spatial Resolution: ~ 4 km
 - Flash DE: 70-90%
 - ISS-LIS
 - 2017- current (this study 2017-2019)
 - Coverage: 55° N - 55° S
 - Spatial Resolution: 4-8 km
 - Flash DE: 51-75%
-
- Wavelength: 777.4 nm
 - Temporal Resolution: 2 ms
 - Sampling Duration: 90 s
- Wavelength: 777.4 nm
 - Temporal Resolution: 2 ms
 - Sampling Duration: 90 s

(Blakeslee et al., 2002
Blakeslee et al., 2020)

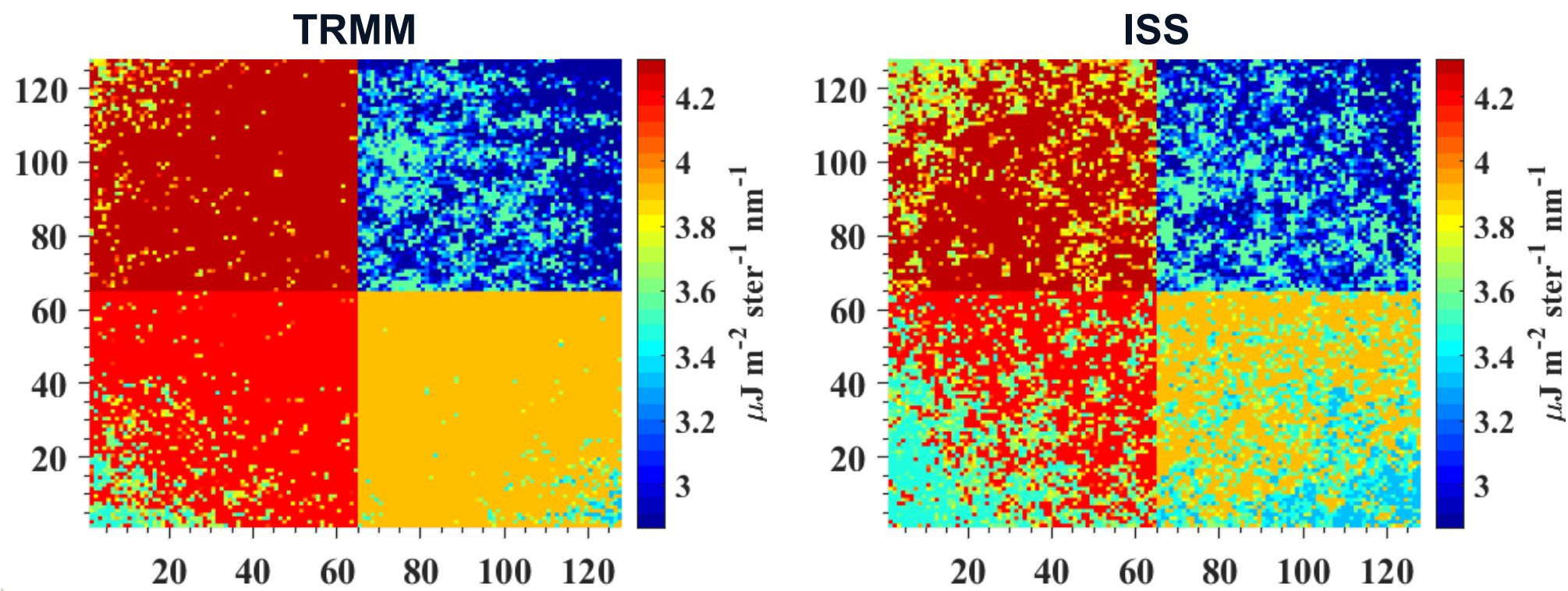
Dataset provided by GHRC

Event Count

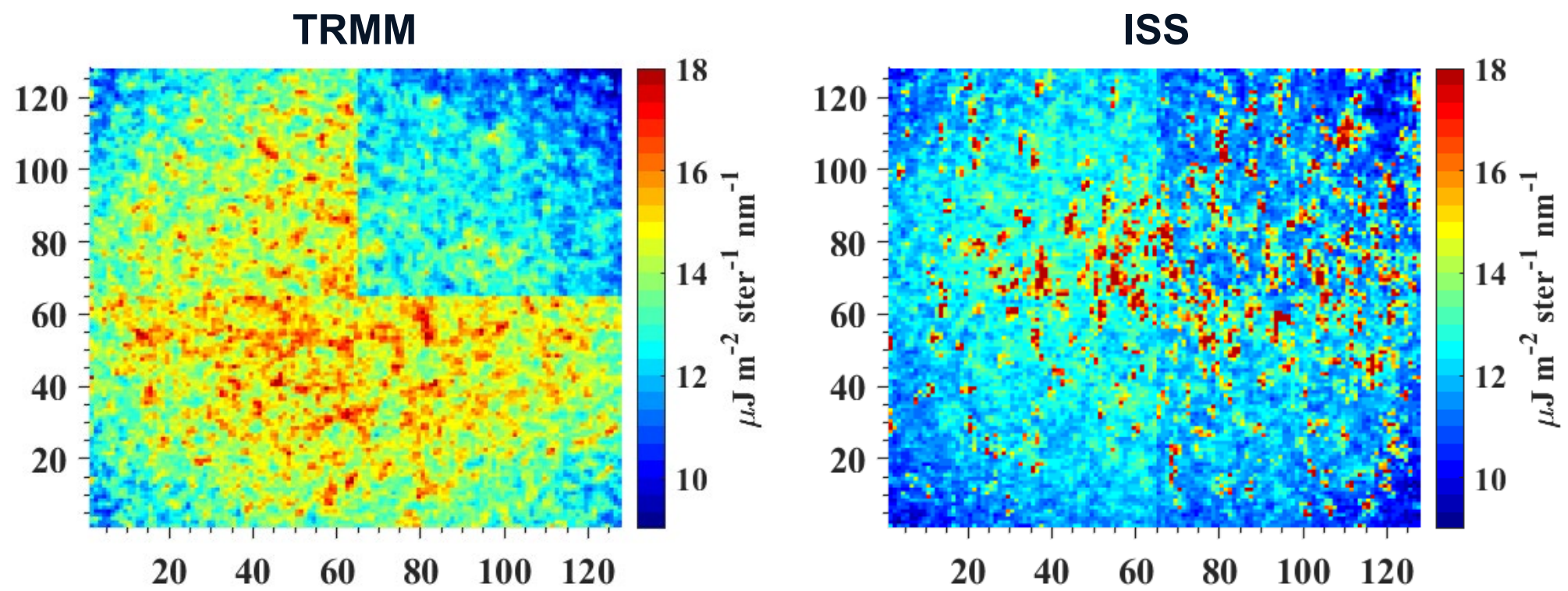


(Zhang et al., 2019)

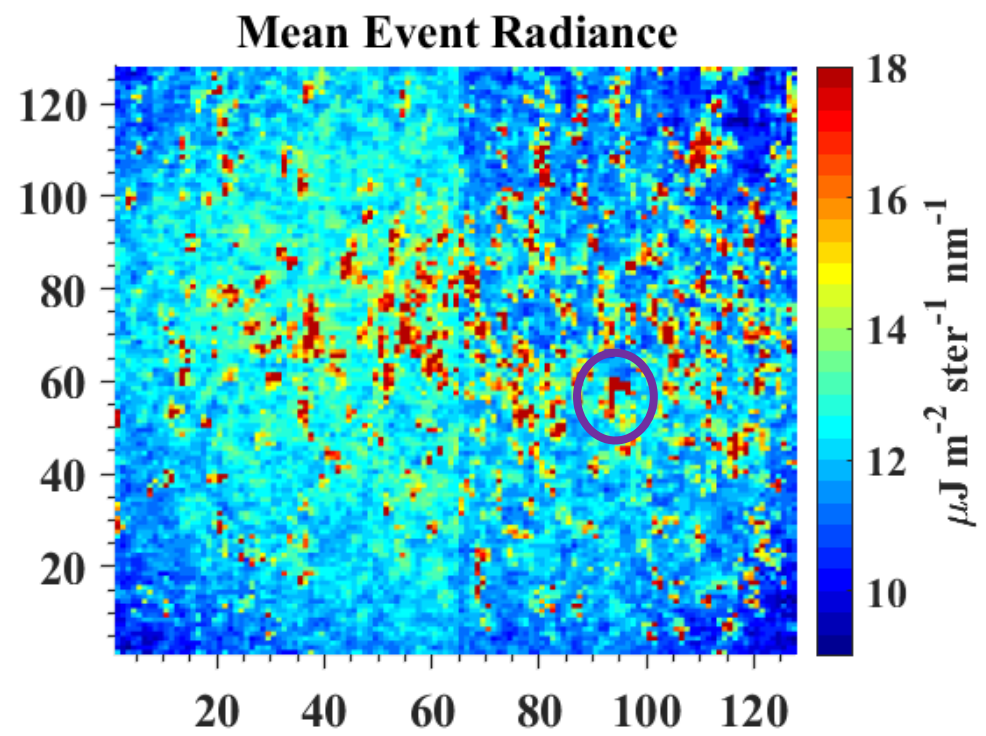
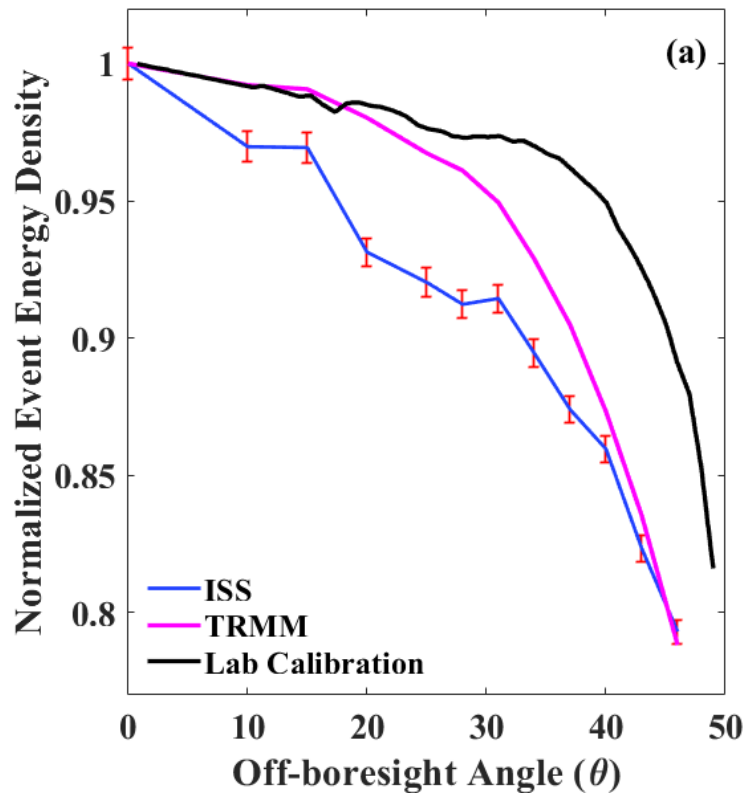
10th percentile Event Energy Density



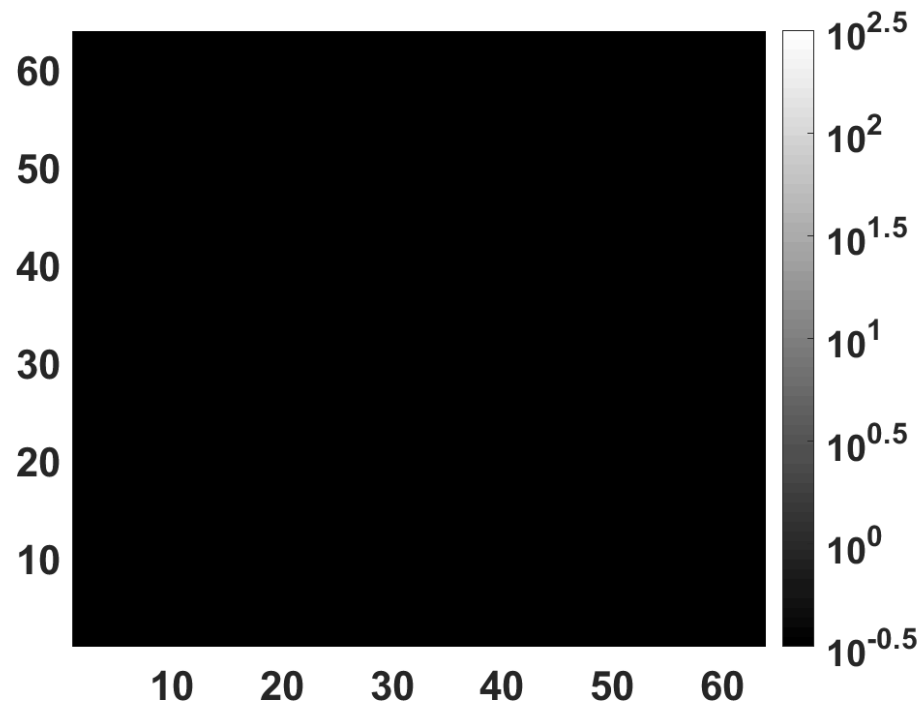
Mean Event Energy Density



Normalized Energy Density (Center to Edges)

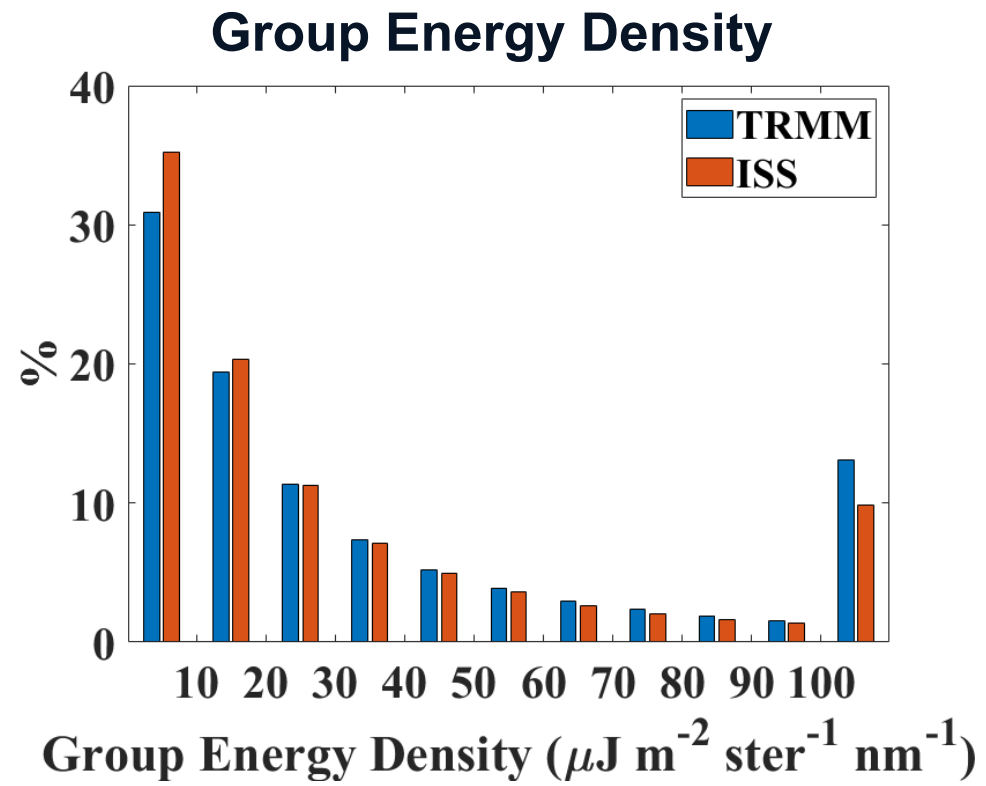
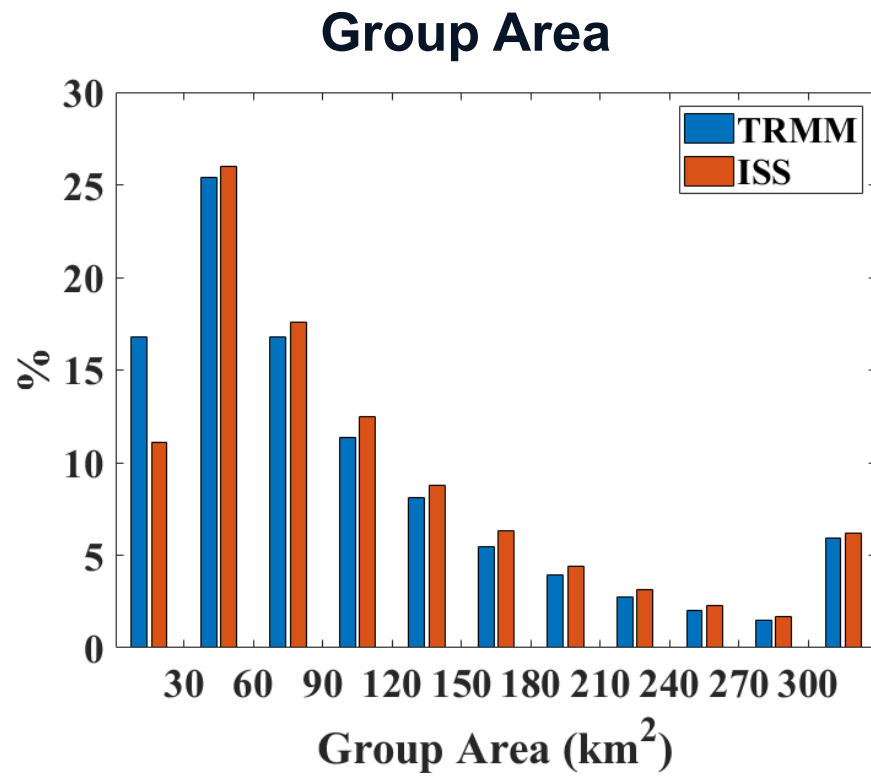


Superbolts

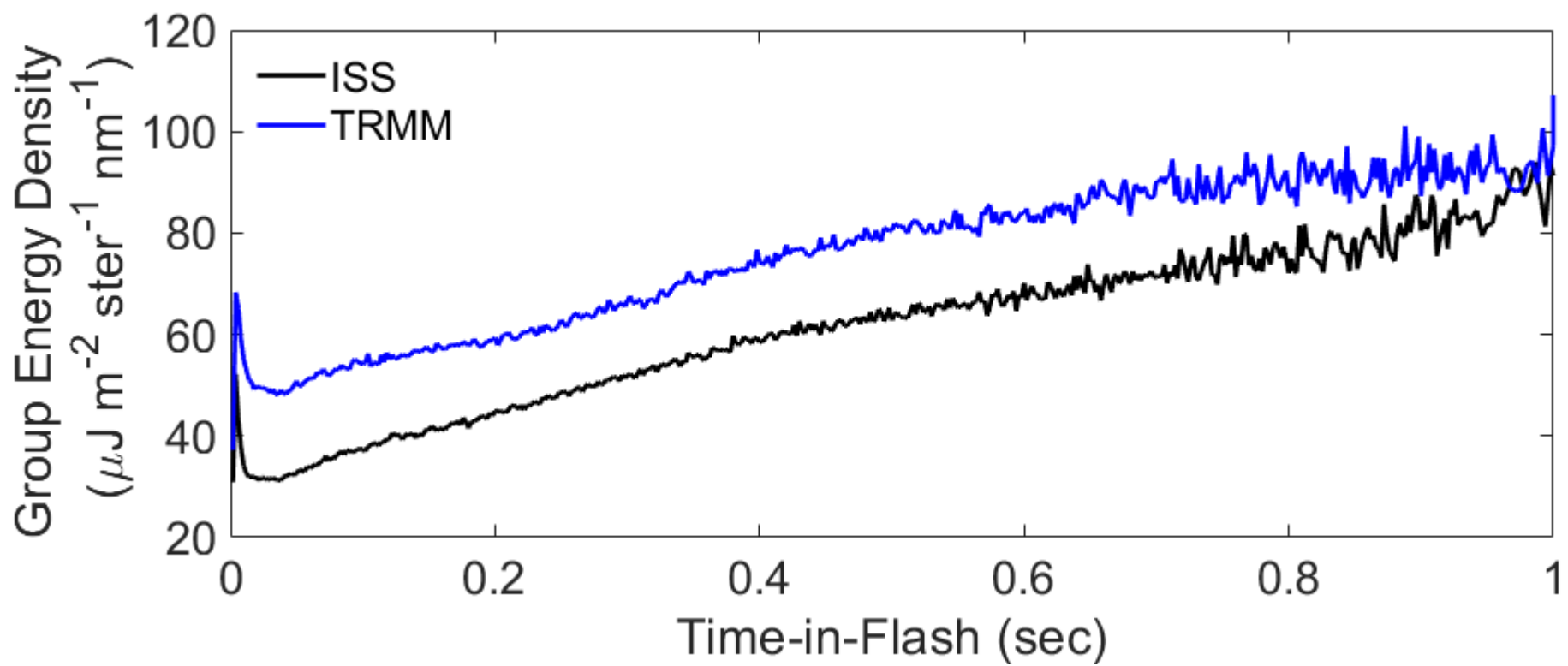


- Cloud-top group energy larger than 10^6 Joules
- 70% (19/27) had a GLD360 match
- 11 were associated with a negative CG and 8 were associated with a positive CG.
- 89% (17/19) had a peak current over ± 90 kA
- Max peak current 273 kA

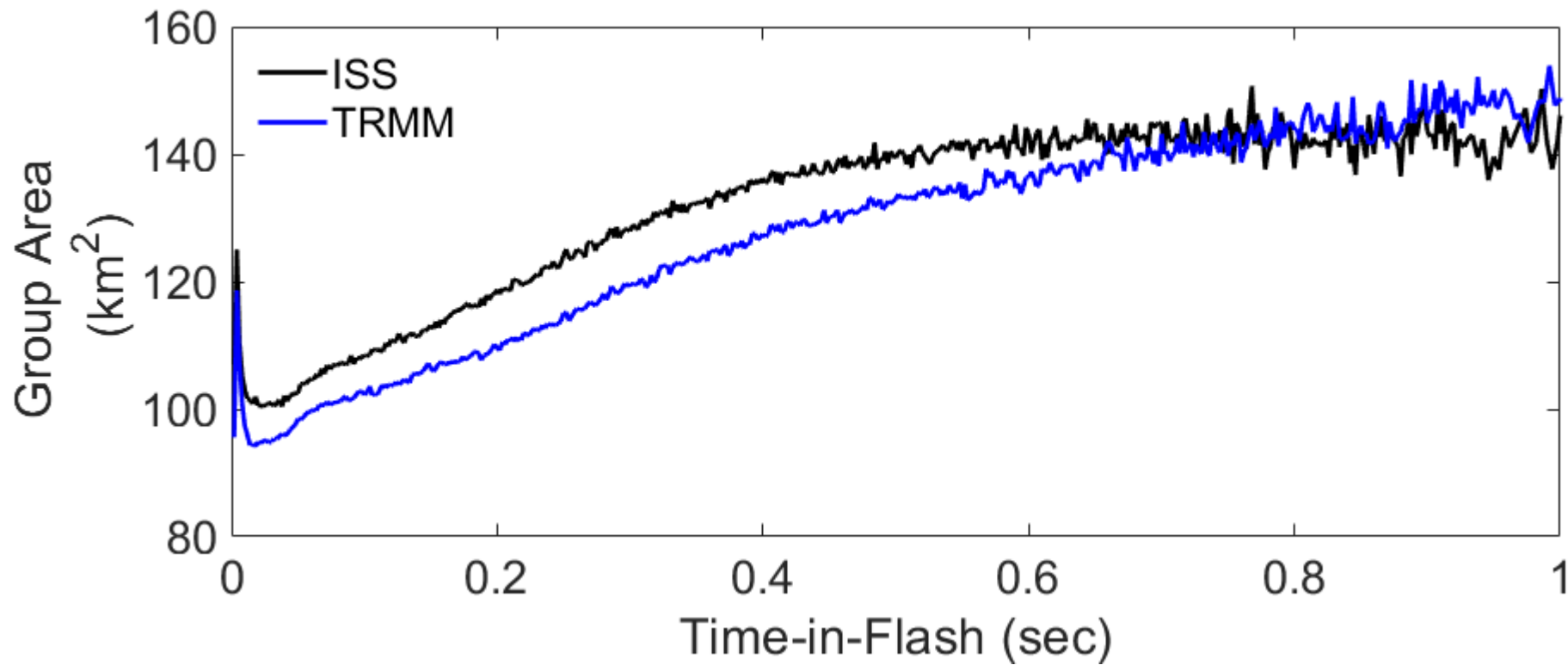
Group Parameter Distributions



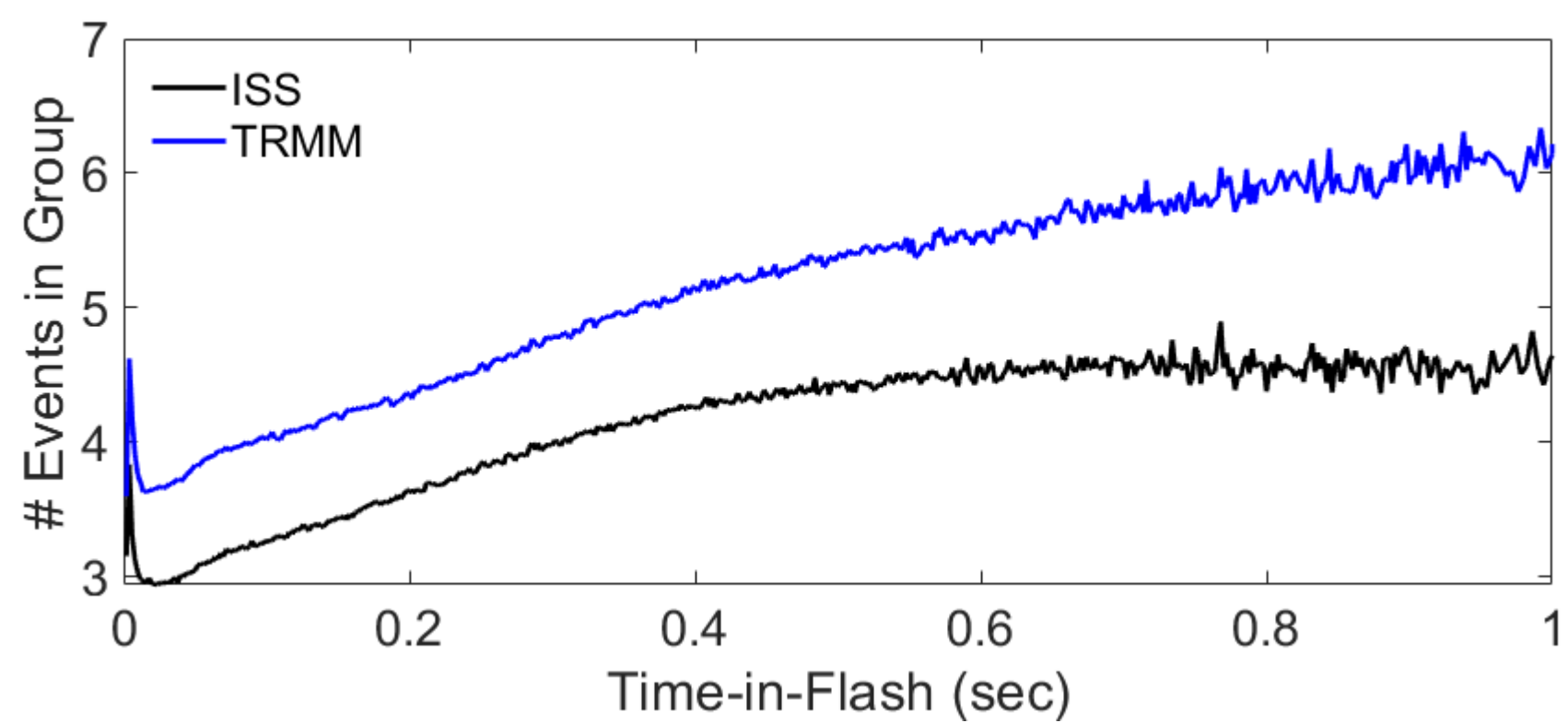
Time-in-Flash Evolution of Group Energy Density



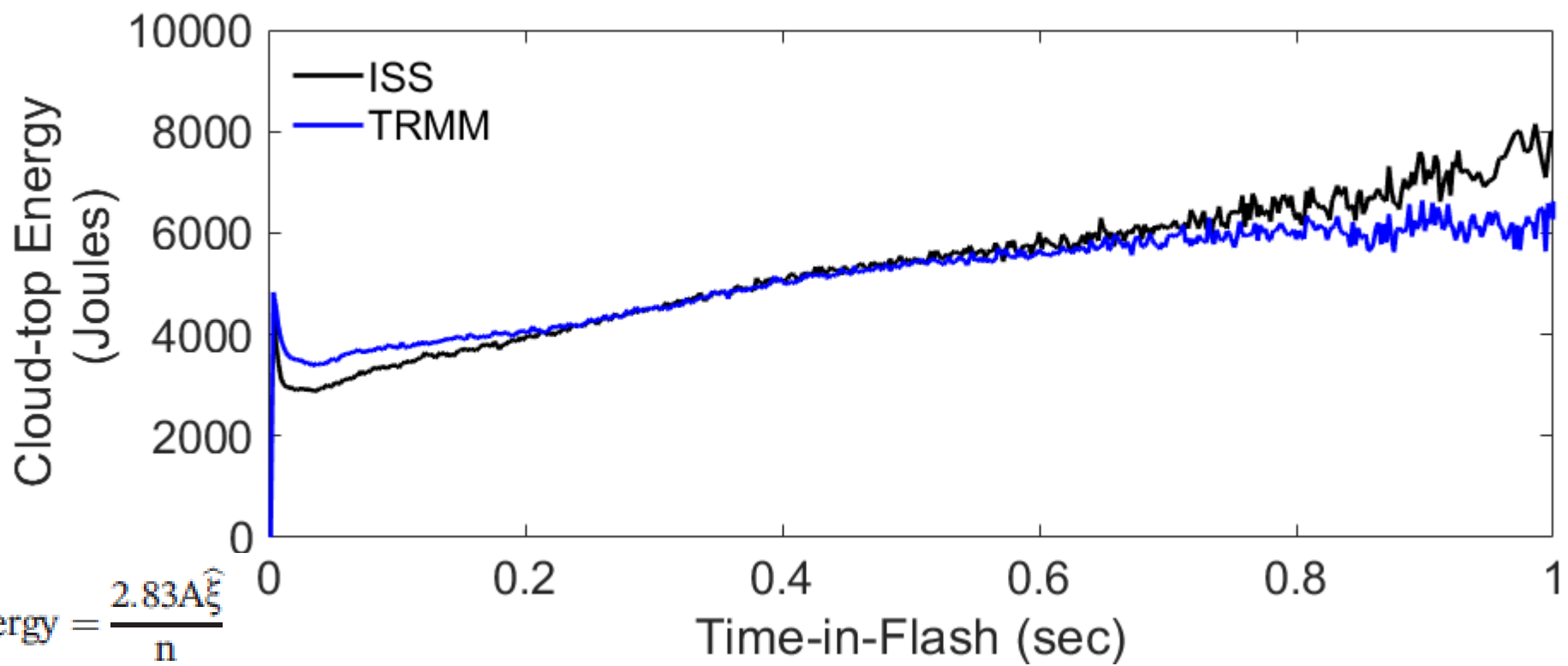
Time-in-Flash Evolution of Group Area



Time-in-Flash Evolution of # Events in Groups



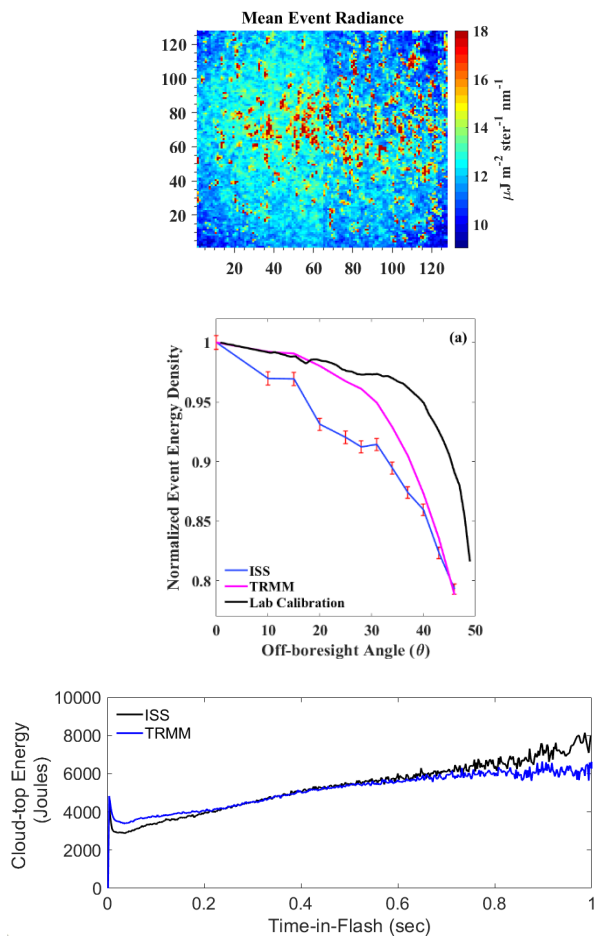
Time-in-Flash Evolution of Cloud-top Energy



LIS Group Cloudtop Energy = $\frac{2.83A\hat{\xi}}{n}$

(Zhang and Cummins, 2020)

Summary



- ISS LIS has lower mean event (and group) energy density
- ISS LIS has a higher decrease rate in the mean event radiance over the CCD array, probably due to the larger footprints
- On average, ISS LIS has a 10-15% lower value of cloud-top energy over the first 200 ms in flash.

Thank you!

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<https://lightning.umd.edu/glm/>

