GCOM-W1 AMSR2 Precipitation EDR Update

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November 7th

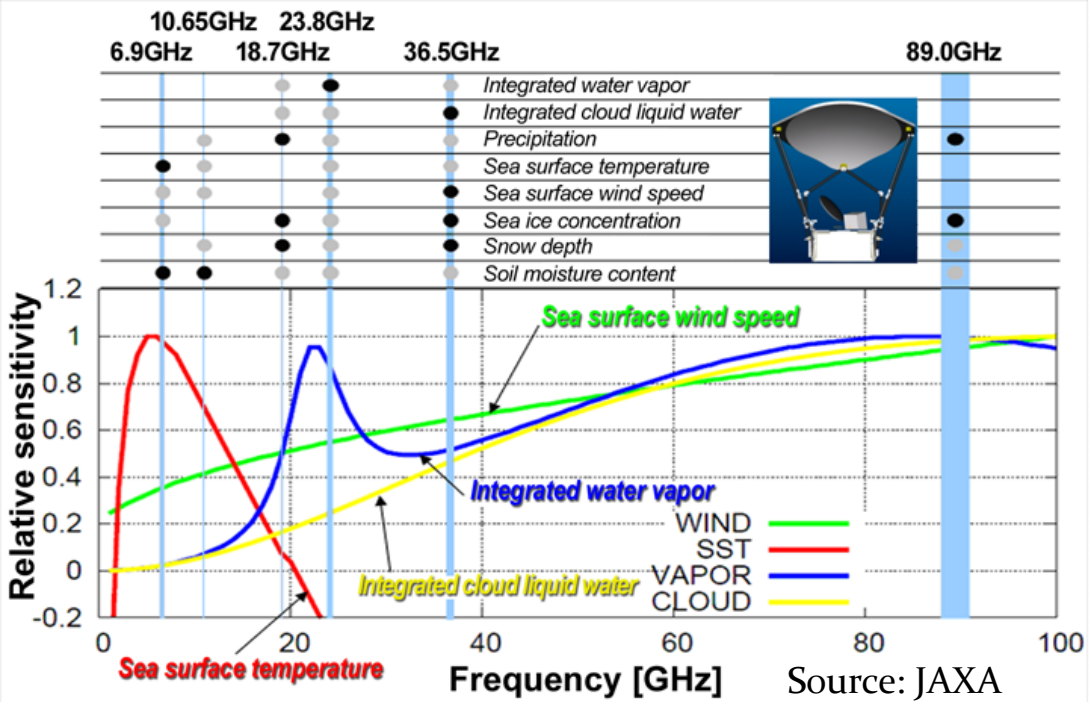
CICS Science Meeting

Overview

- Global Change Observation Mission
  - Advanced Scanning Microwave Radiometer 2
- Review of NOAA GCOM-W Precipitation EDR
  - Goddard Profiling Algorithm 2010 Version 2
- Incremental improvements for Version 3
- Evaluation of GPROF2017 and JAXA/GSMAP
- Recommendations for AMSR2 Operations

GCOM-W / AMSR2

- Launched May 2012 into the A-Train
- Conical scanning passive microwave radiometer
  - 1450km swath width; ~10 km sampling
- NOAA Operations commenced Nov 2015



Source: JAXA

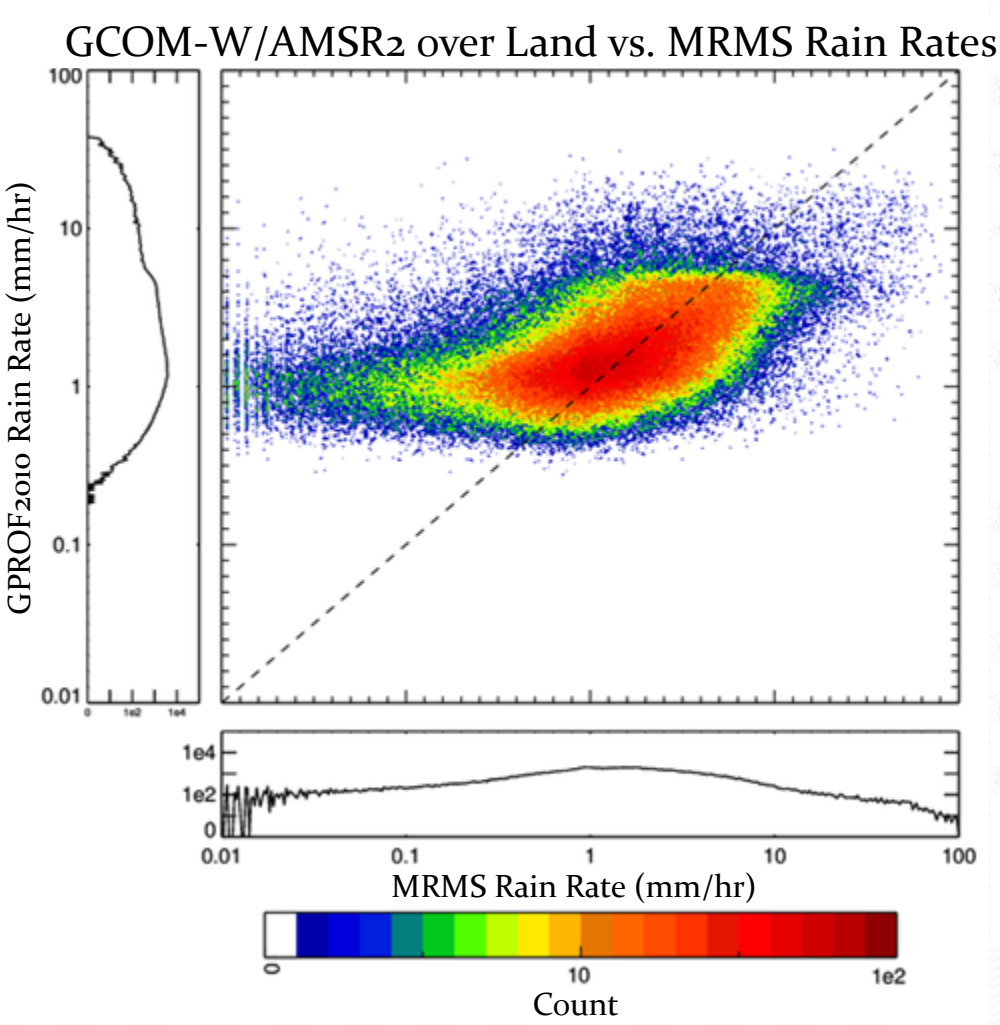
Program Requirements

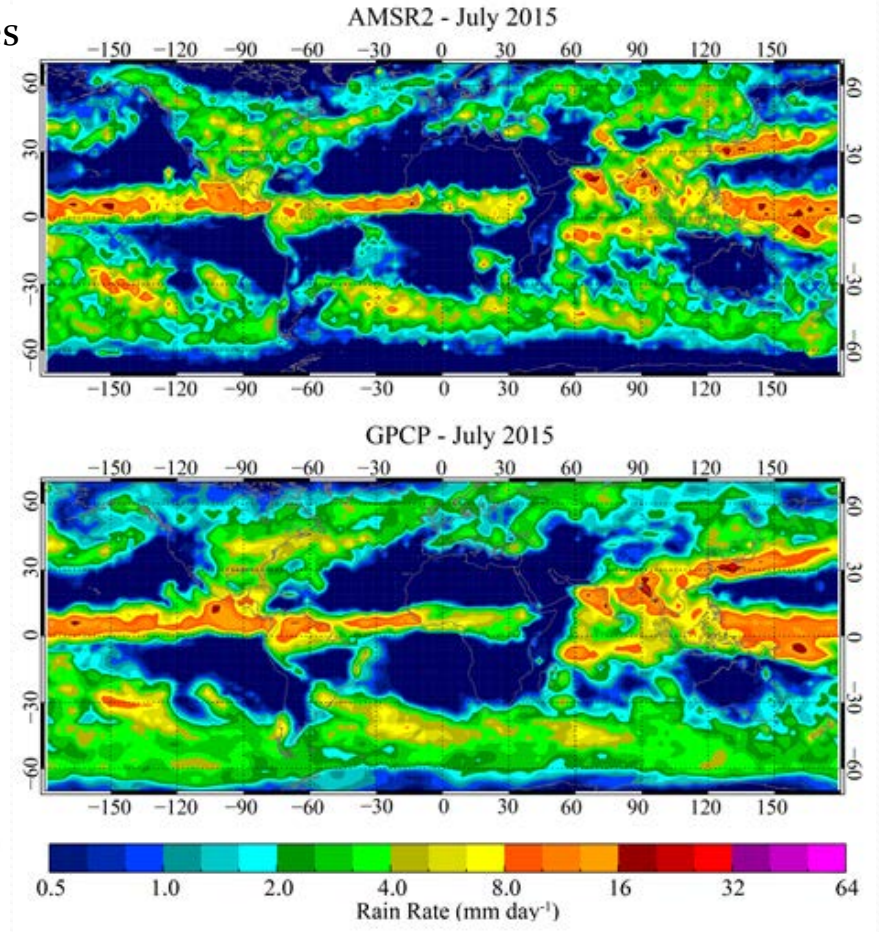
JPSS Requirements - GCOM Precipitation Type/Rate		
EDR Attribute	Threshold	AMSR2 EDR
Applicable conditions		Delivered under "all weather" conditions
Horizontal cell size	5 km land (89 GHz FOV); 10 km ocean (37 GHz FOV size); 5-10 km sampling	5.0 km (land); 10 km (ocean)
Mapping uncertainty, 3 sigma	< 5 km	~2.5 km
Measurement range	0 – 50 mm/hr	0 – 75 mm/hr
Measurement precision	0.05 mm/hr	0.01 mm/hr
Measurement uncertainty	2 mm/hr over ocean; 5 mm/hr over land	1.3 mm/hr (ocean) 3.6 mm/hr (land)
Refresh	At least 90% coverage of the globe about every 20 hours (monthly average)	91% every 20 h
Precipitation type	Stratiform or convective	Convective rain rate
Latency	25 minutes	8 min

GPROF2010V2 for AMSR2

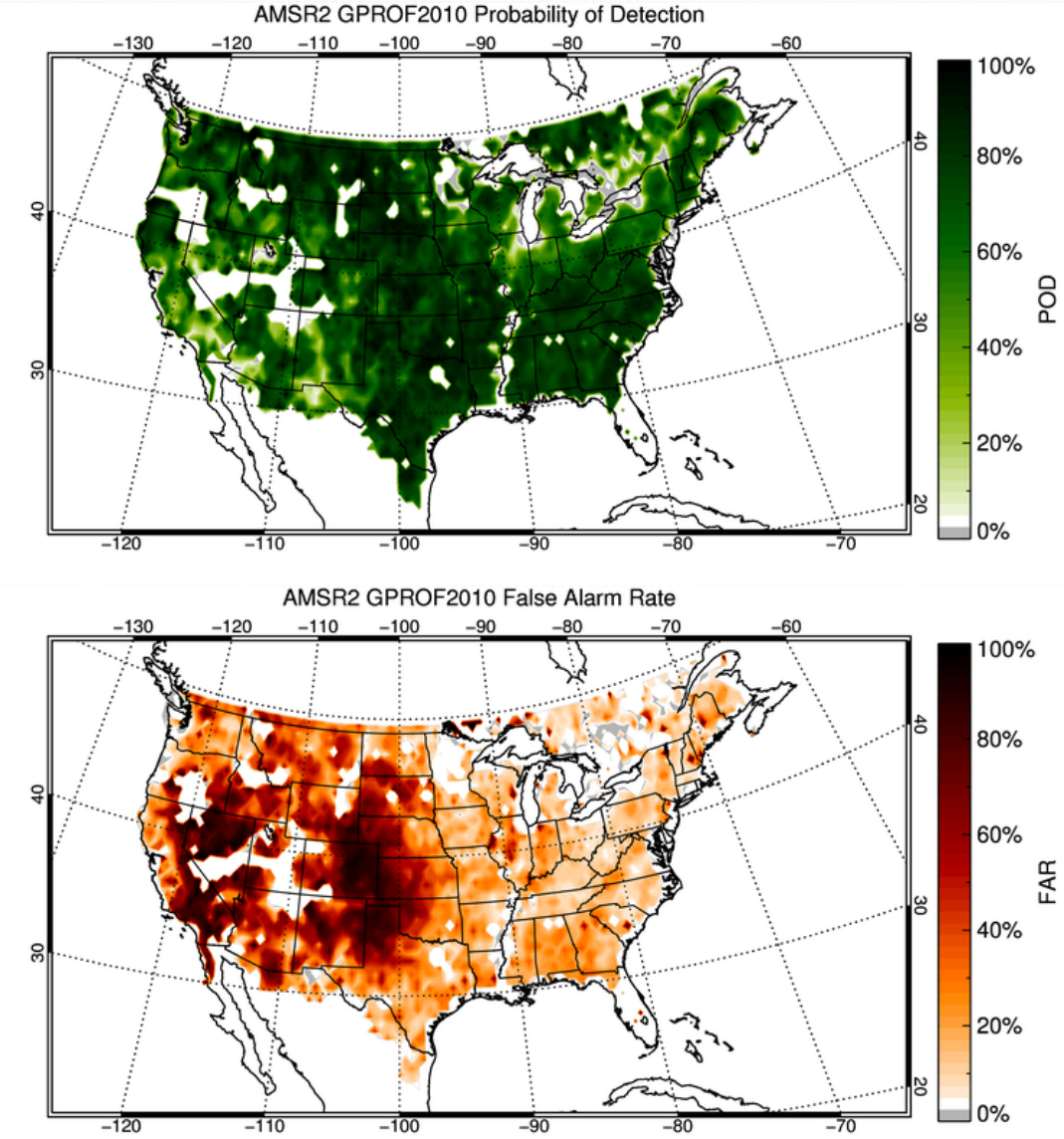
- Originally developed for TRMM, adapted for AMSR2
- Land
  - Empirical relationship between T_{89v} and rain rate
  - Convective/Stratiform separation scheme
  - Complex screening procedures for surface contamination
- Ocean
  - Bayesian retrieval based on TPW and SST
  - TRMM Precipitation Radar used as reference
- Coast
  - Conservative combination of Land/Ocean strategies

Validation of Day-1 Precip EDR



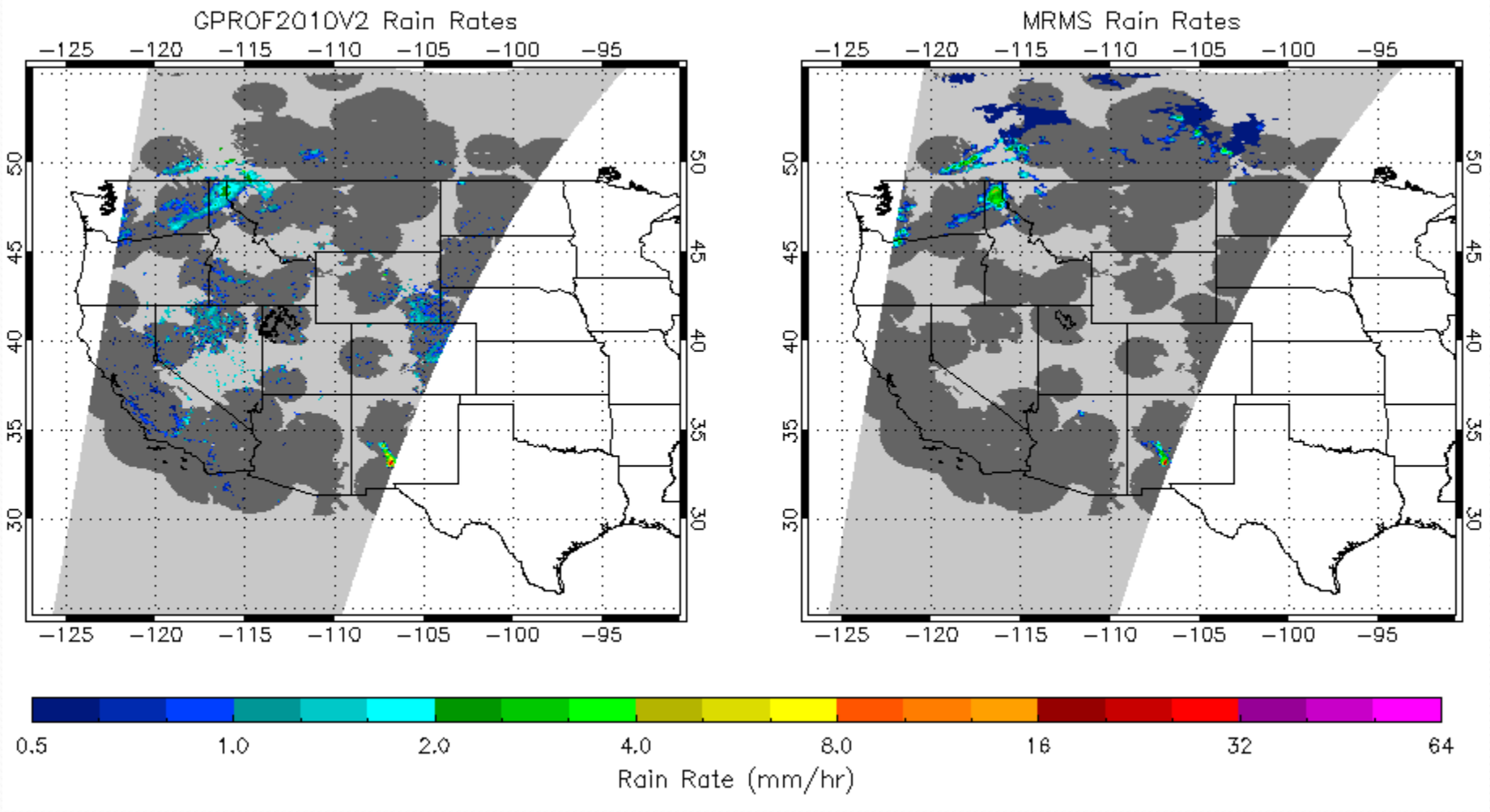


Detection Limitations

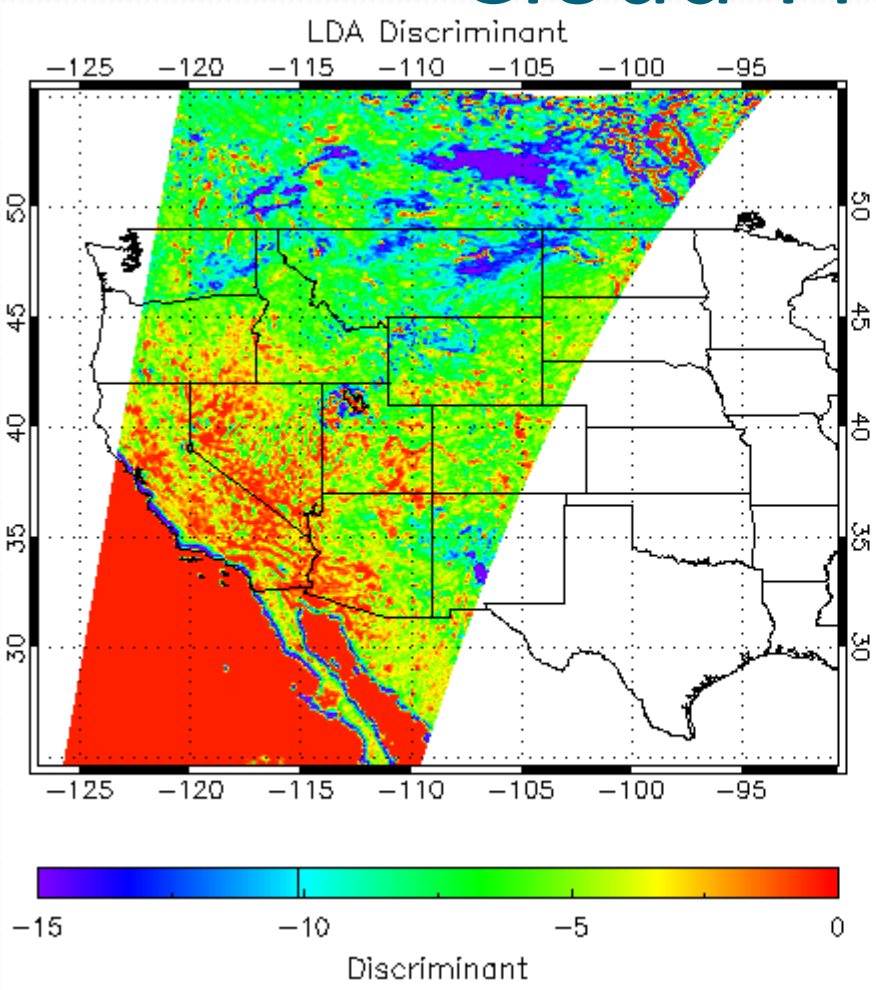


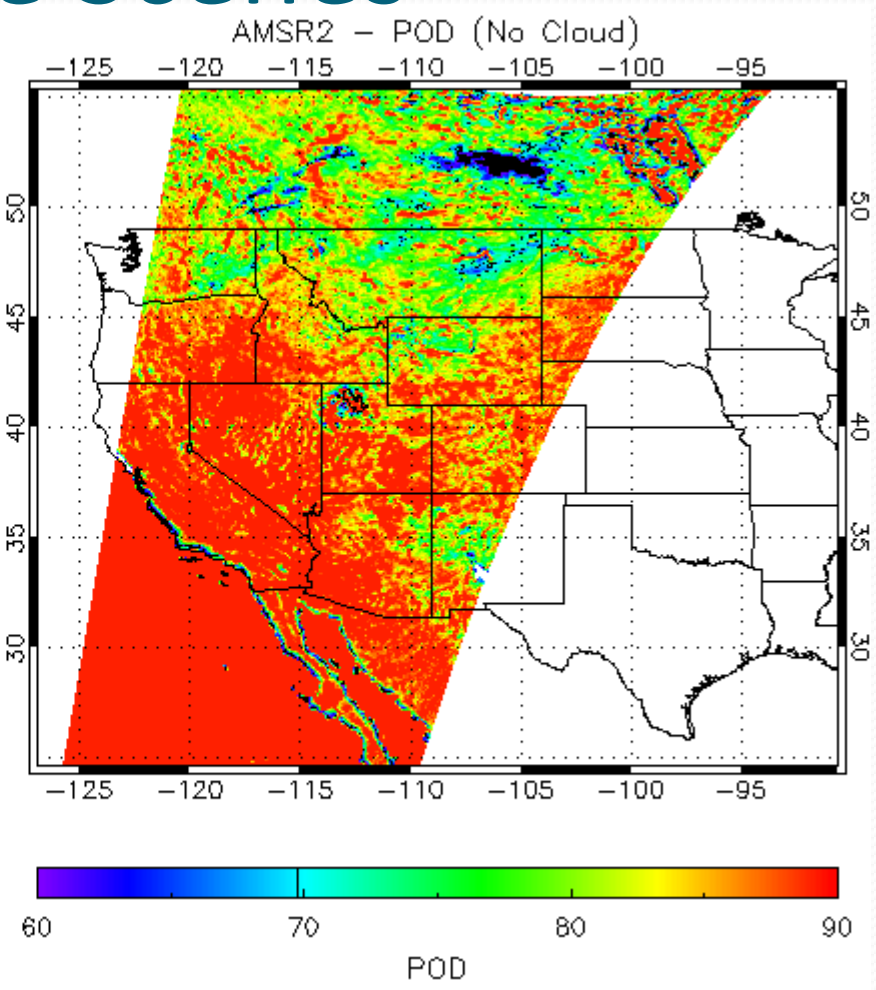
- False detection of precipitation based on Scattering Index and Tb thresholds
- Apply Turk (2016) cloud-free detection algorithm
- Use last IMS snow analysis for screening

Nighttime False Alarms

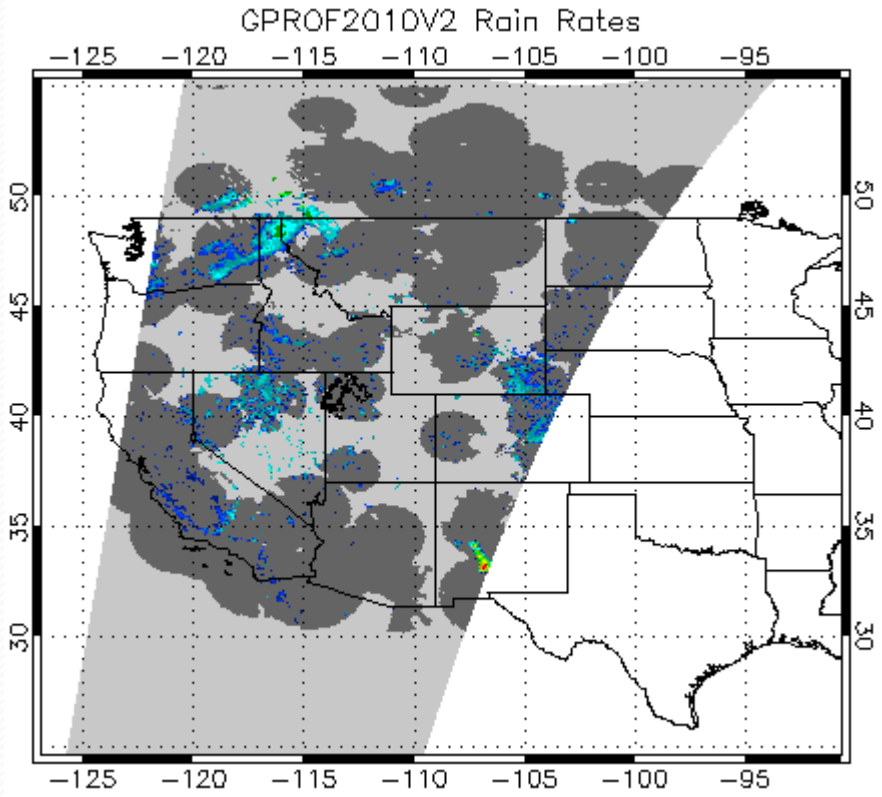


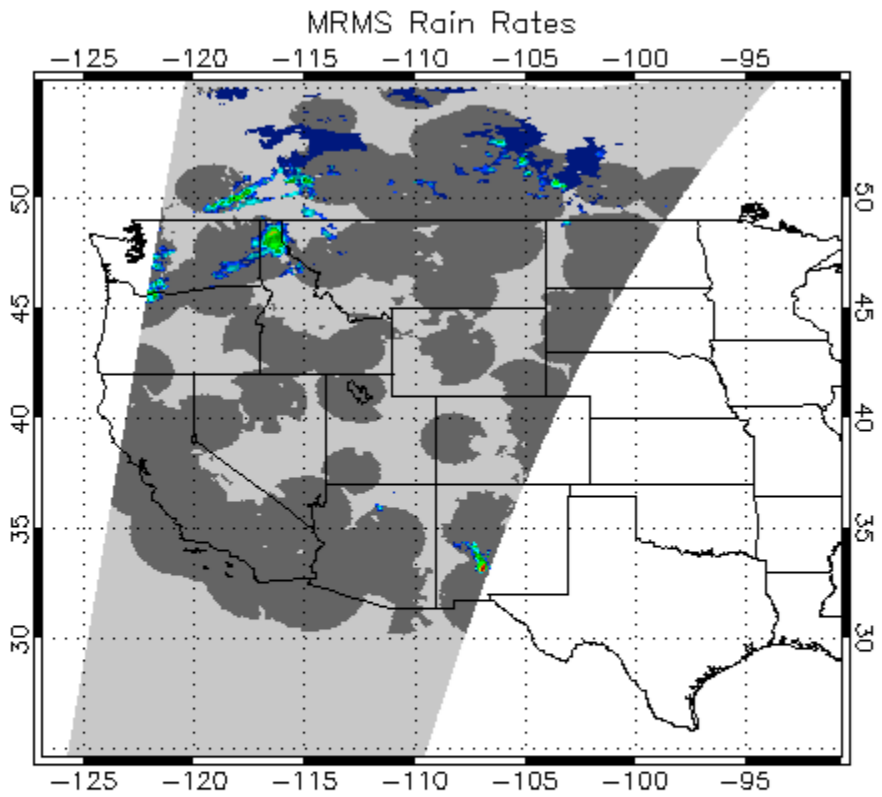
Linear Discriminant Analysis for Cloud-Free Scenes

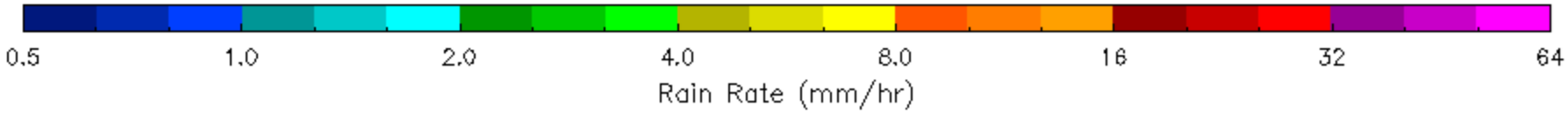




FAR Reduction







Fall-Spring:	POD	FAR	CSI	HSS
Original :	0.644735	0.535026	0.370140	0.515073
Filtered :	0.593108	0.318920	0.464190	0.618437

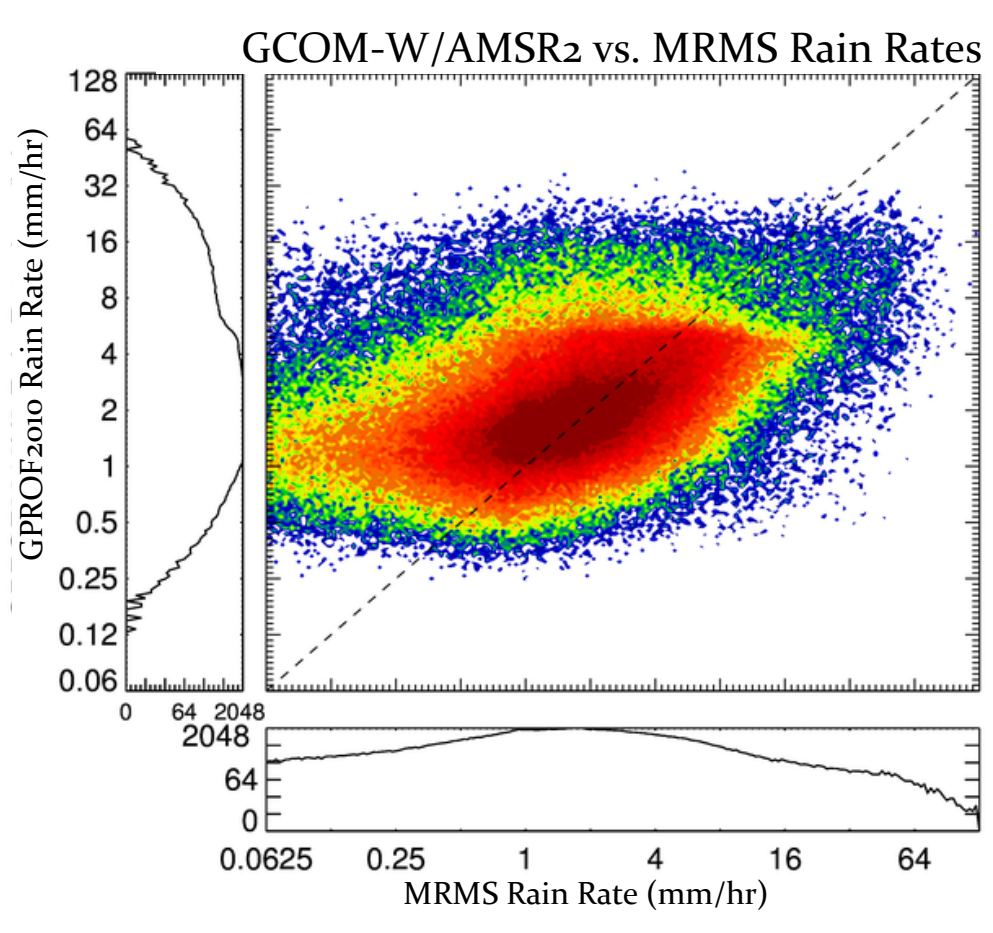
GPROF2010V3 Update

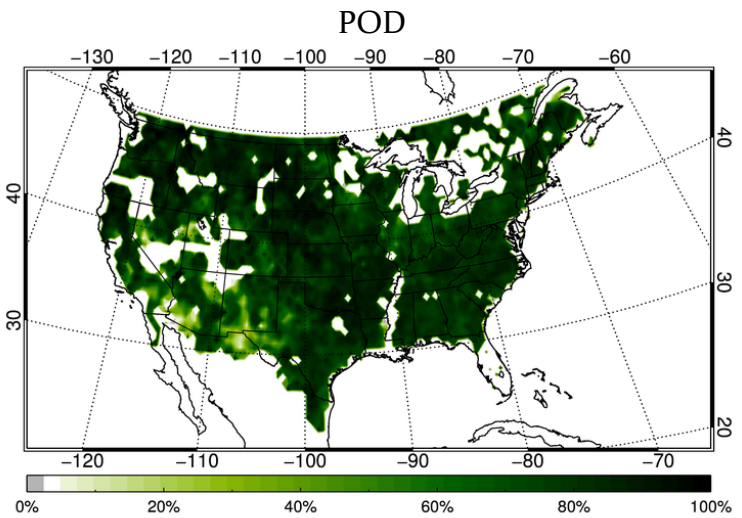
- Recalibrated AMSR2/TMI conversion
- Introduces LDA for false alarm reduction
- Daily IMS snow product instead of climatology
- Transitions to CMC SST product for ocean retrieval
  - Reynolds SST non-operational with reliability issues
- Updated flagging to reflect increased confidence

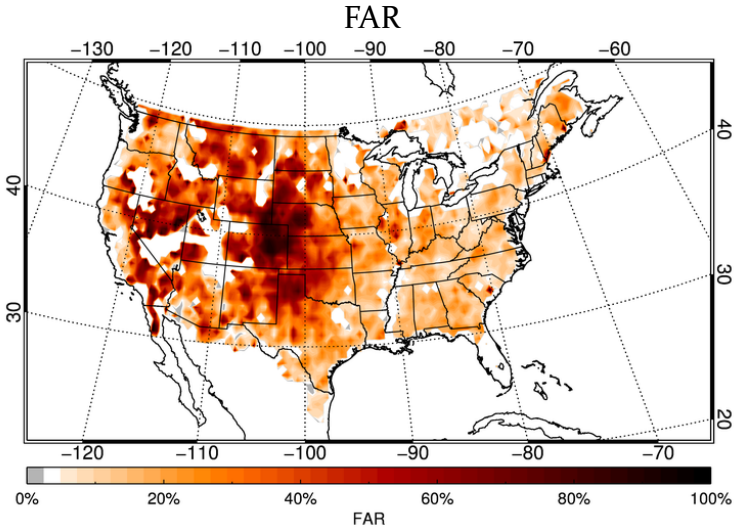
Evaluation of GPROF2017

- Developed by NASA/GPM – Collaboration w/ NOAA
- Fully Bayesian retrieval
  - Separated by surface type, TPW, and near surface temp
- Trained with GPM Dual-frequency Precipitation Radar
  - GPM orbit inclination improves coverage to mid-lats
- Evaluated as operational replacement for GPROF2010
- Compared to Multi Radar Multi Sensor instantaneous rain rates at the 89GHz footprint size (3x5km)

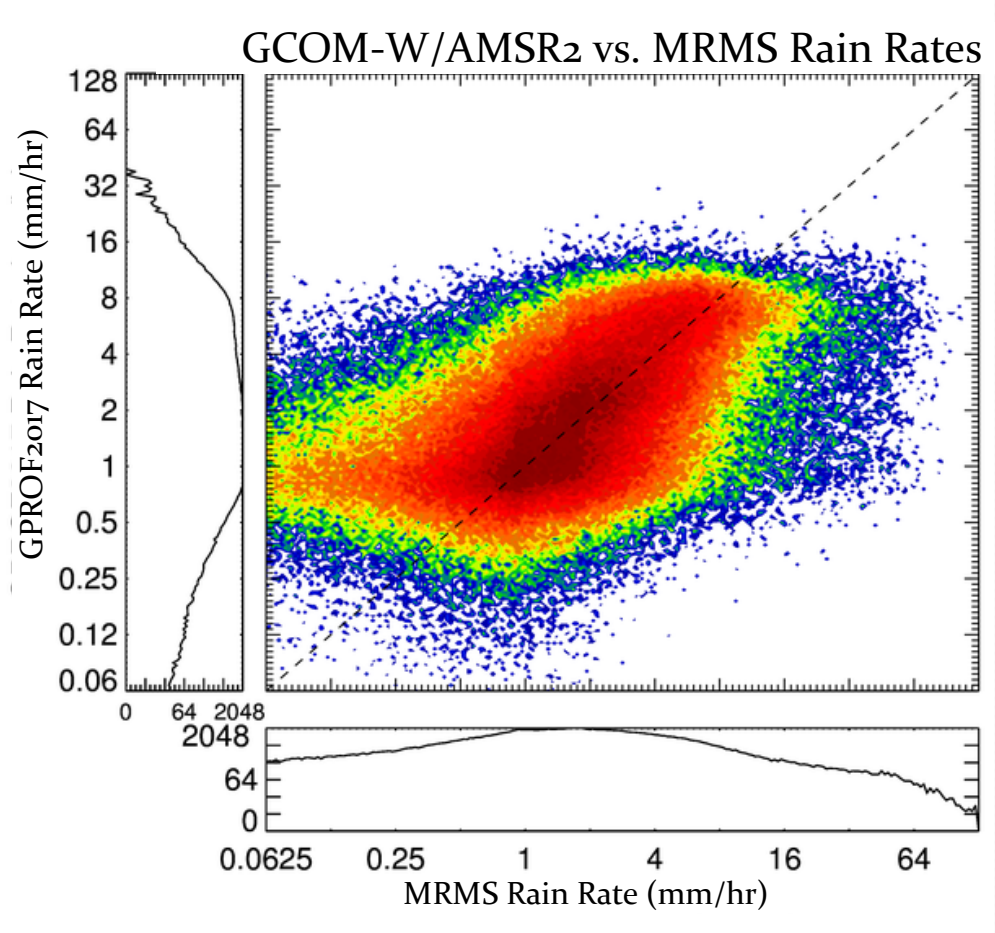
GPROF2010v3

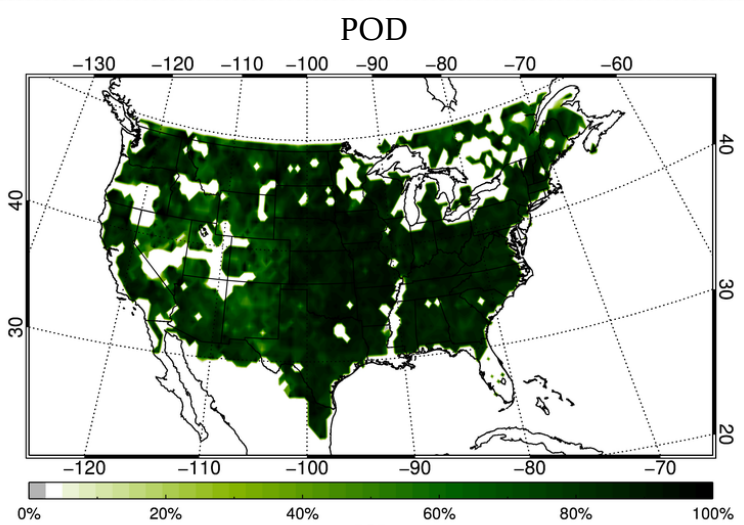






GPROF2017


GCOM-W/AMSR2 vs. MRMS Rain Rates
GPROF2017 Rain Rate (mm/hr)
128
64
32
16
8
4
2
1
0.5
0.25
0.12
0.06
0
64
2048
2048
64
0
0.0625
0.25
1
4
16
64
MRMS Rain Rate (mm/hr)


POD
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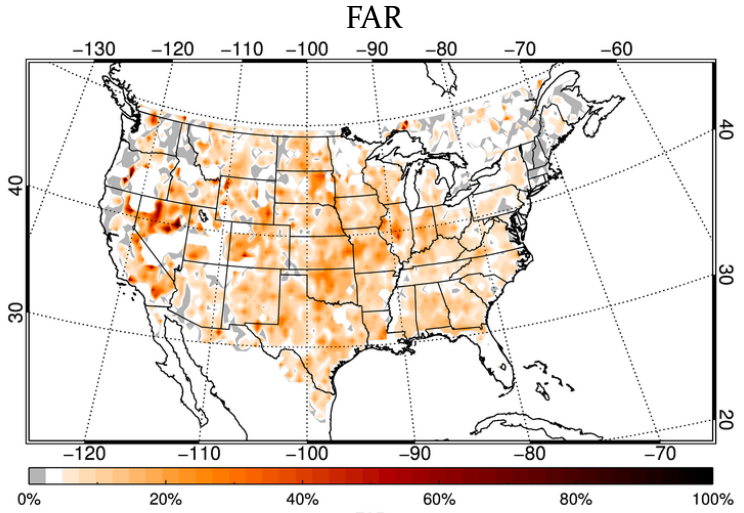
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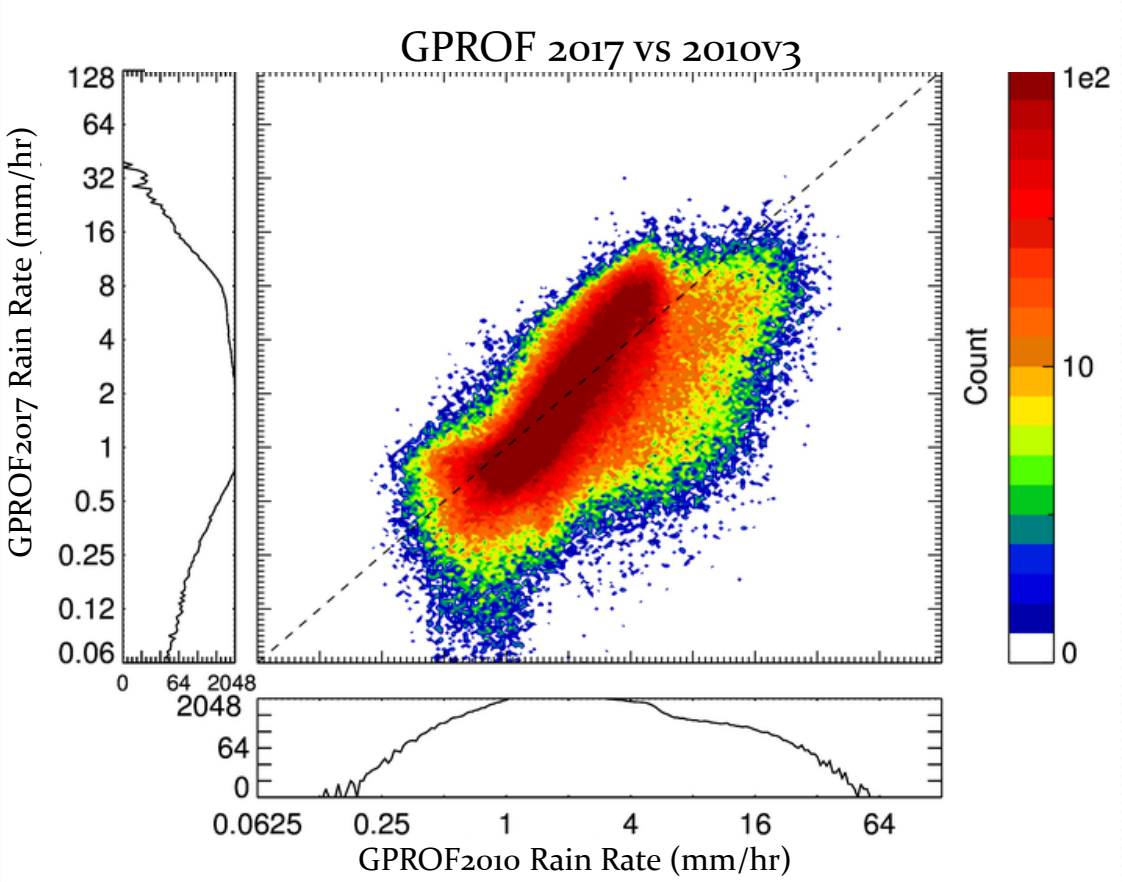
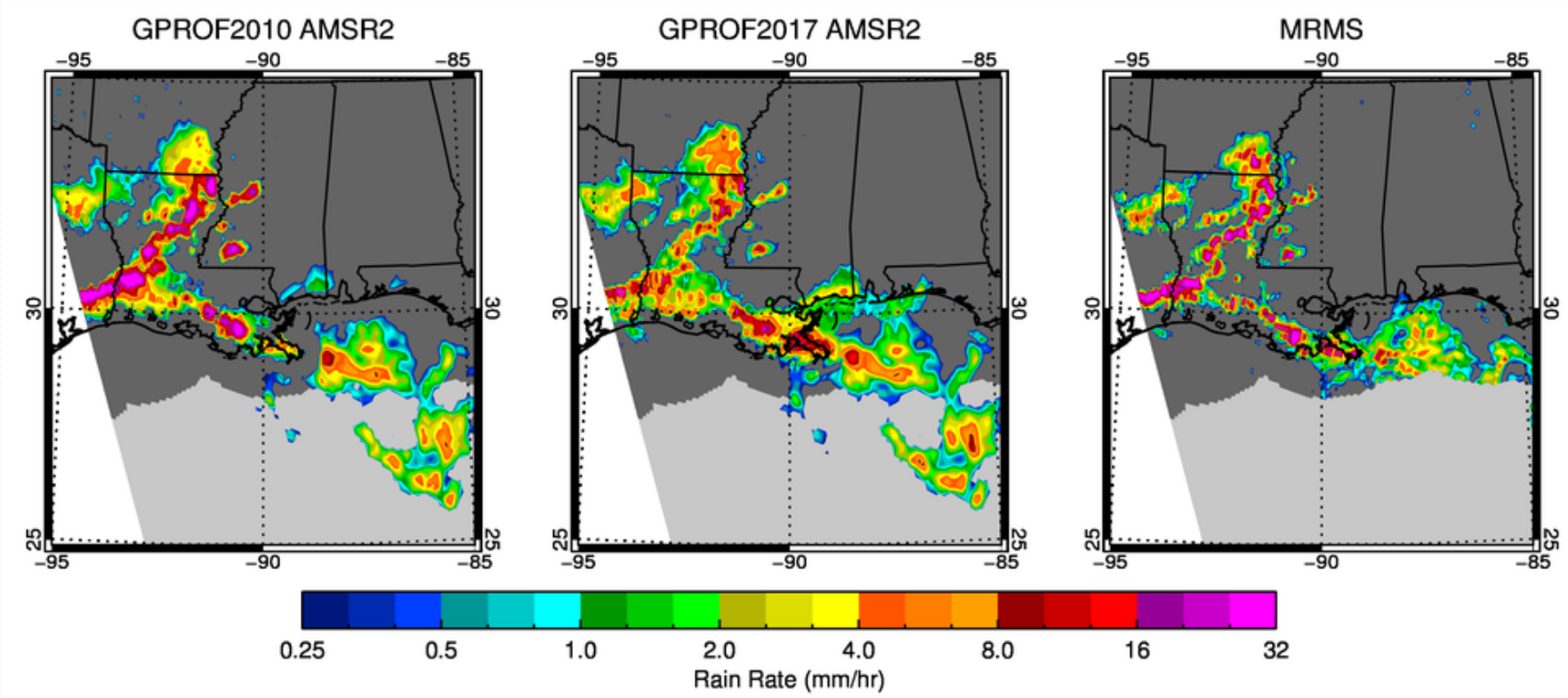
GPROF Rain Rate Comparison



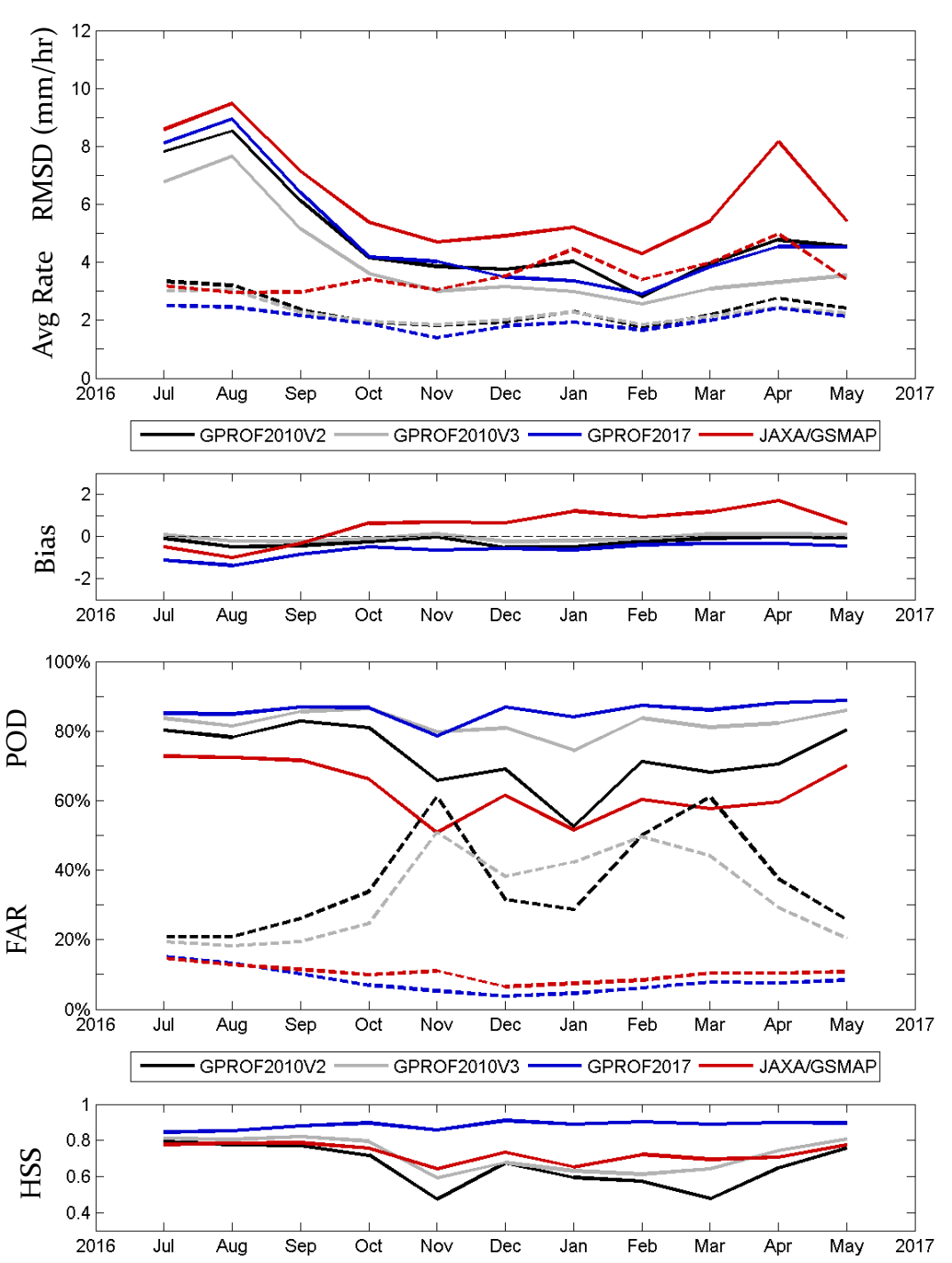
Algorithm	POD	FAR	CSI
GPROF2010V3	0.66	0.11	0.61
GPROF2017	0.86	0.09	0.79

Deeper Dive

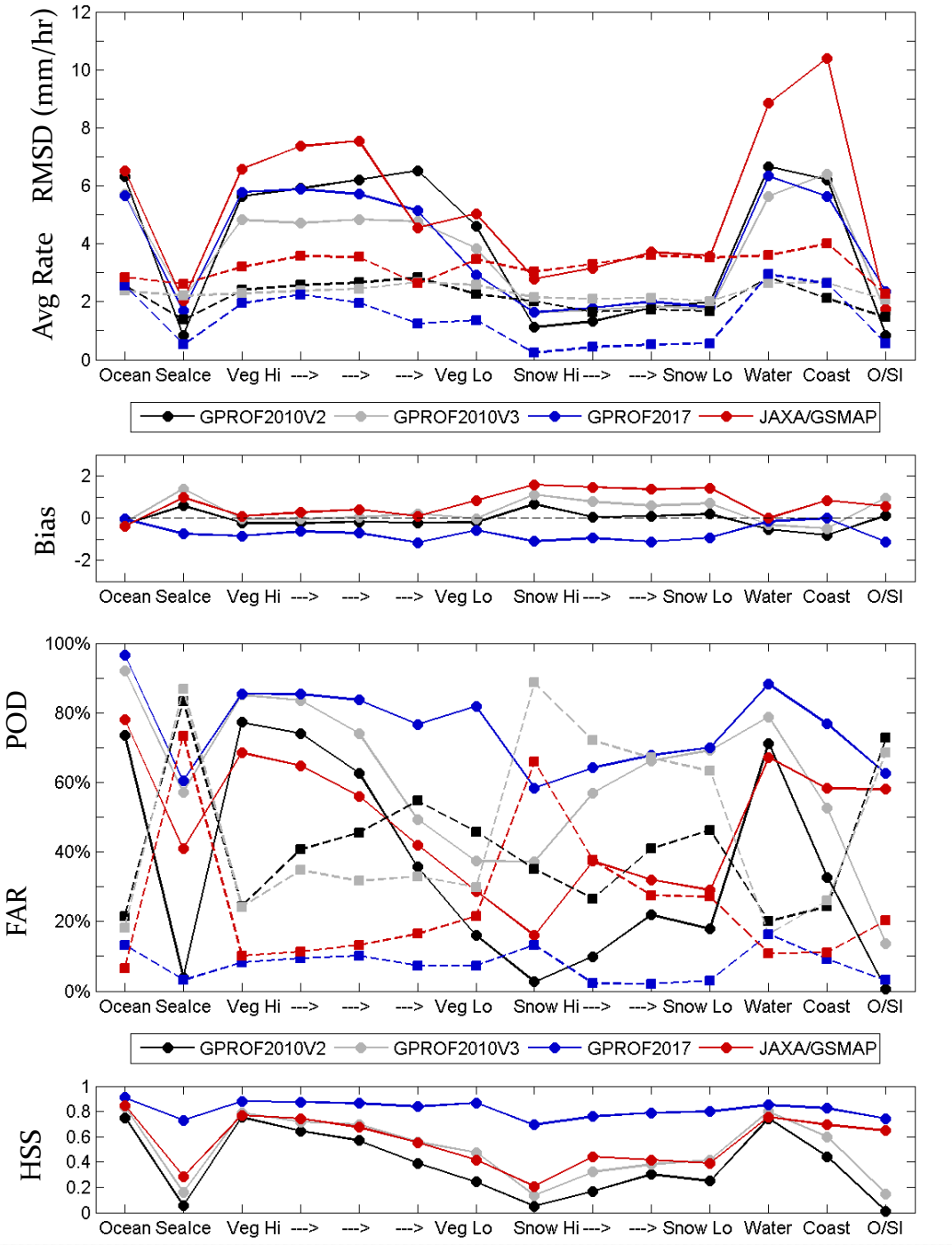
- Time of Year
- Surface Type
- Rain Rate Dependence
- MRMS Precipitation Type



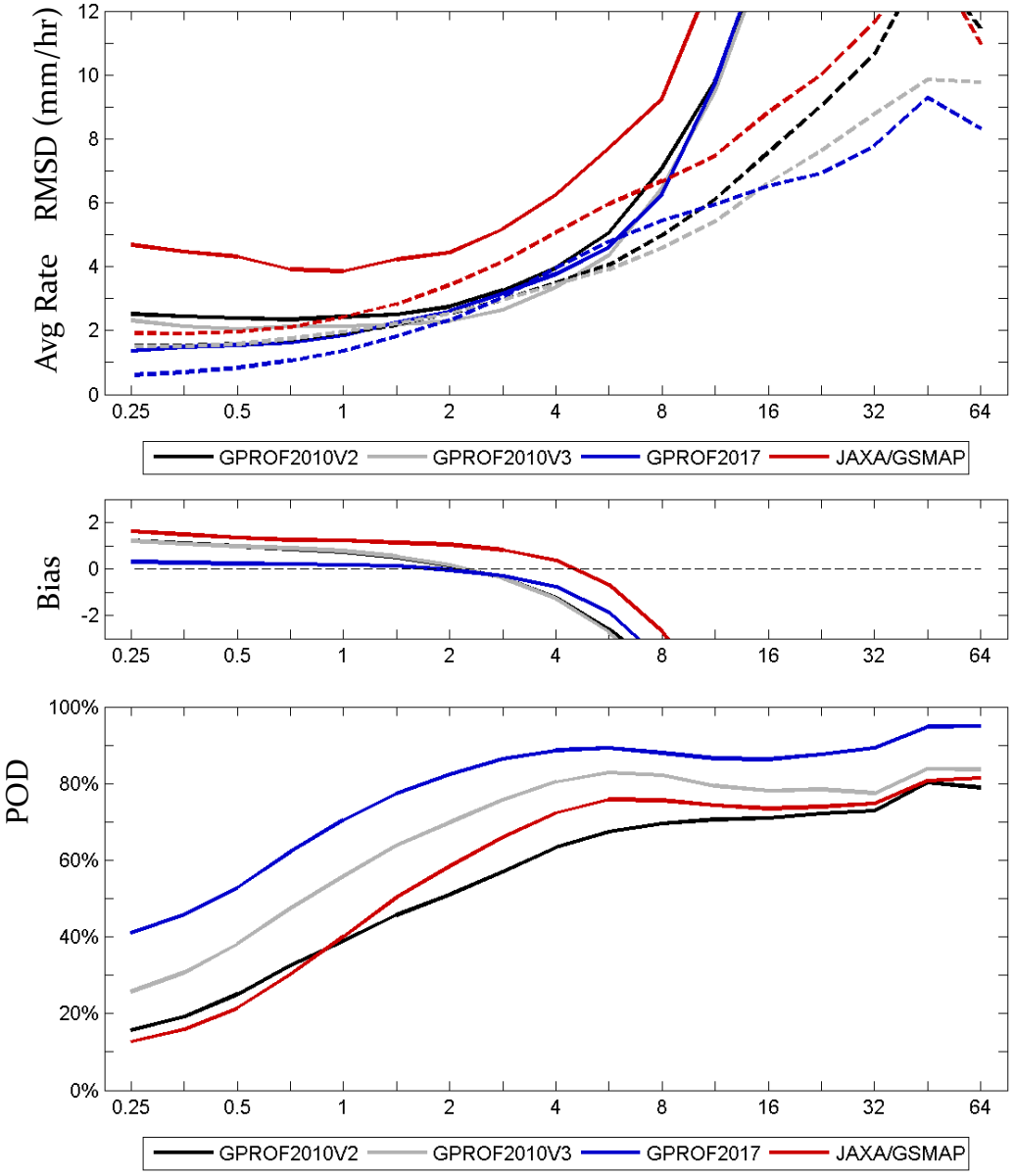
Monthly Variability



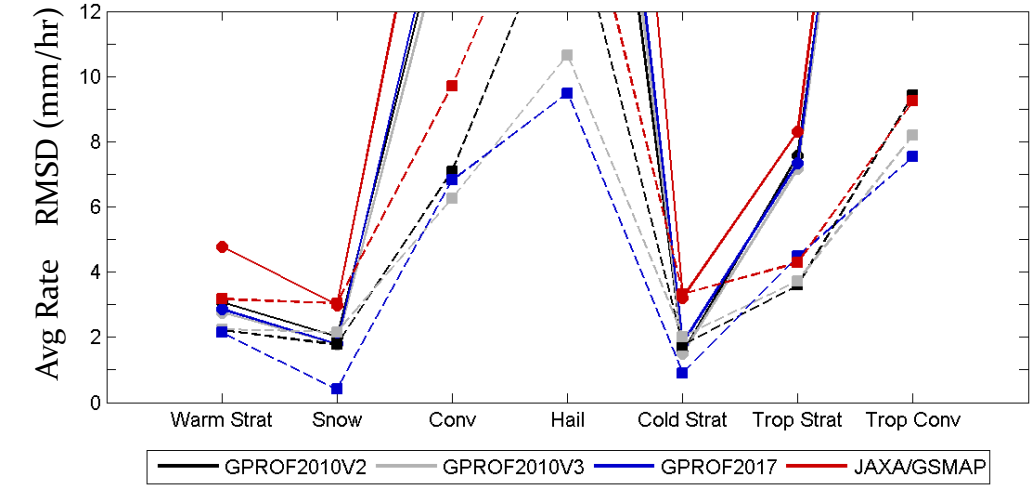
Surface Type

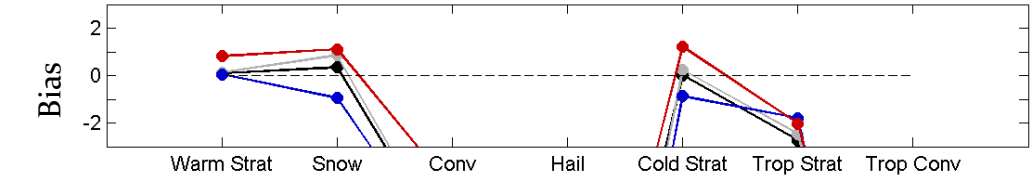


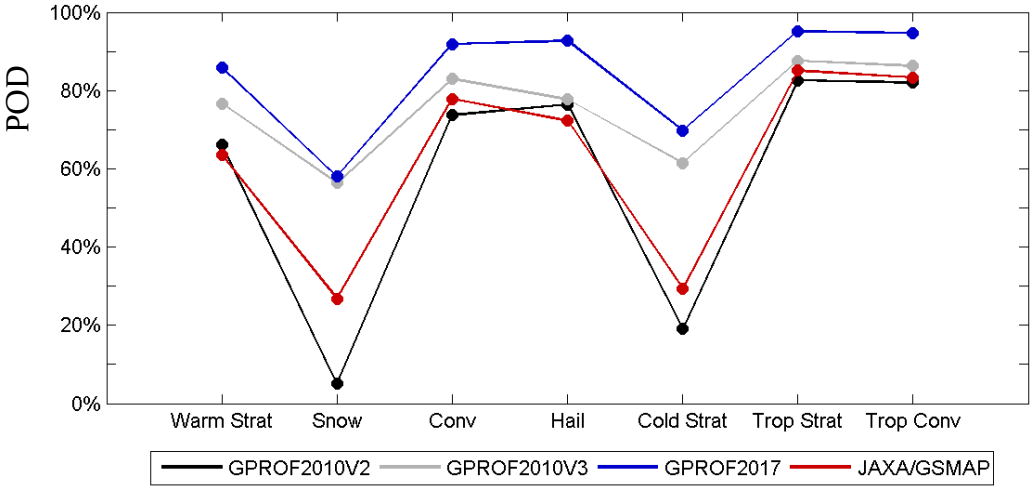
Rain Rate Dependence



MRMS Precipitation Type







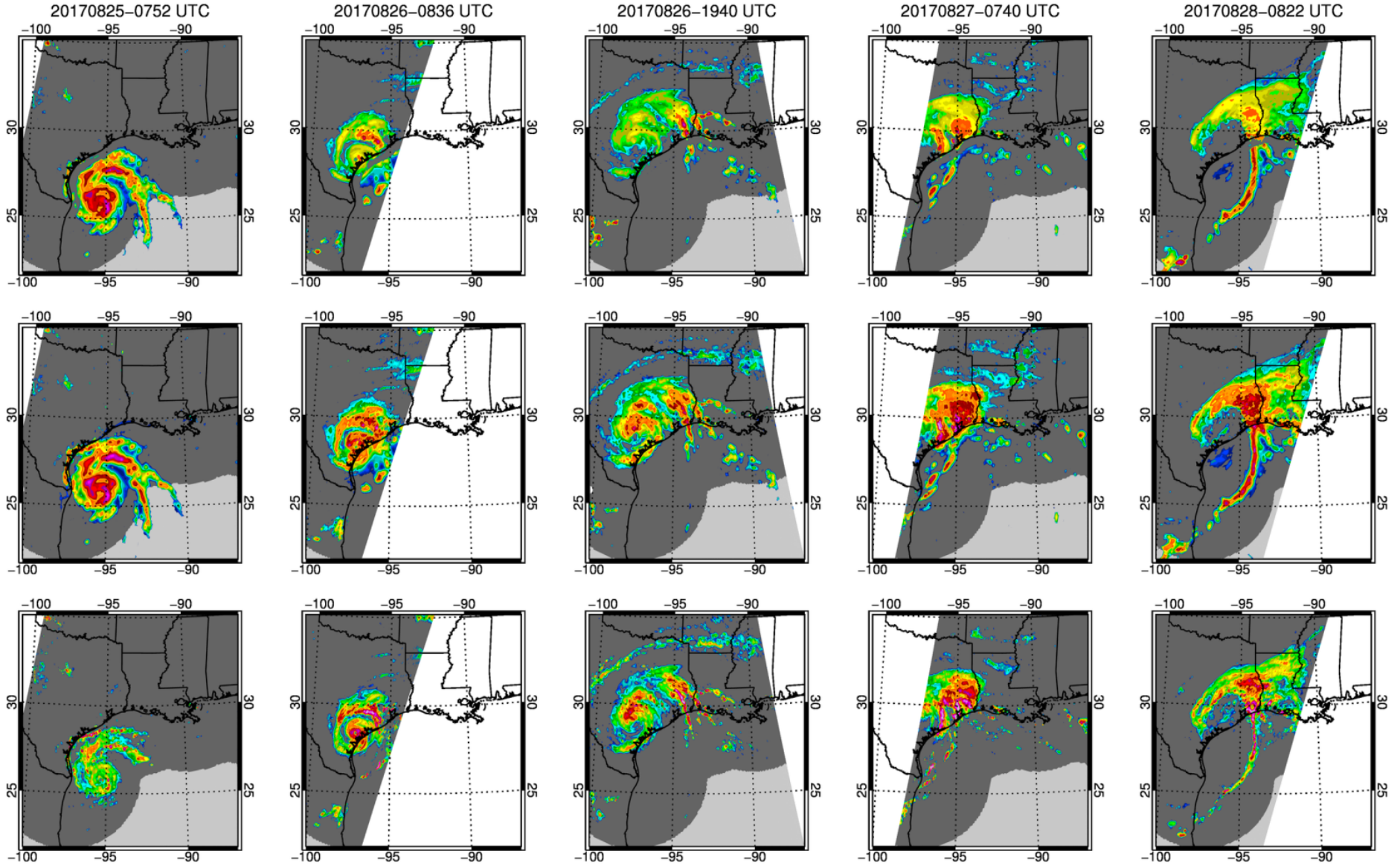
Notes on GPROF2017

- GPROF2010V3 has lower RMSD, but poor detectability
- GPROF2017 handles light precipitation well, fantastic precipitation detection, better consistency across time and surfaces
- Ongoing work to improve Conv/Strat using environmental conditions [Veljko Petkovic]
- Need to evaluate ancillary products for potential transition into STAR operational framework

Summary & Paths Forward

- Modifications of AMSR2 precipitation algorithm reduce false alarms and improve performance metrics in GPROF2010V3
- GPROF2017 is a giant leap forward, and must be tested to meet NOAA/JPSS operational requirements
- Recent Observations: http://cics.umd.edu/pmeyers/amsr2/
- Leveraging more ancillary data
  - GOES-16 ABI & GLM
  - Environmental information

Thank You

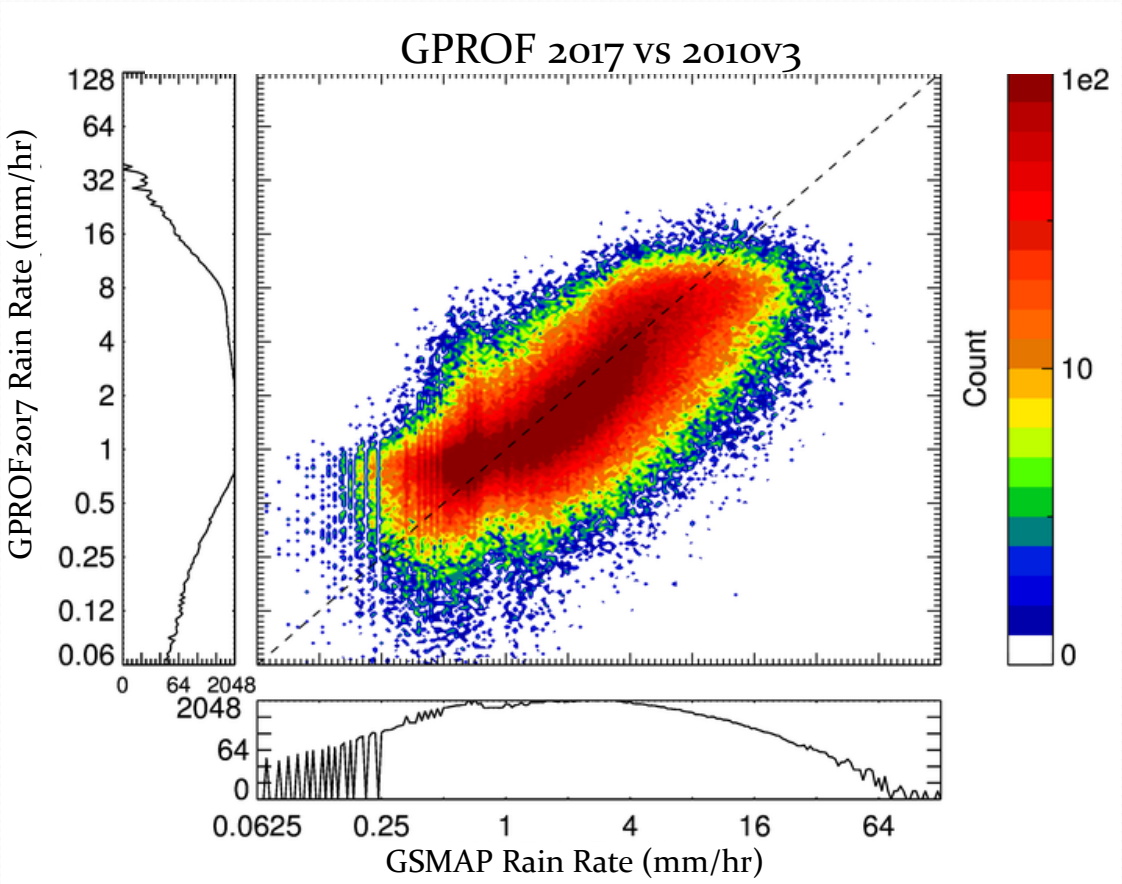

20170825–0752 UTC
20170826–0836 UTC
20170826–1940 UTC
20170827–0740 UTC
20170828–0822 UTC

Backup Slides

Overview of GSMAP

- Radiative transfer technique to match calculated Tbs with observations
- Land
  - Detection of rain area, selection of RTM LUT based on inhomogeneity, retrieval with PCT of scattering signal at 37 and 89 GHz.
- Ocean
  - Similar to Land, plus more information on emission signals at 10-37 GHz.

GPROF/GSMAP Comparison



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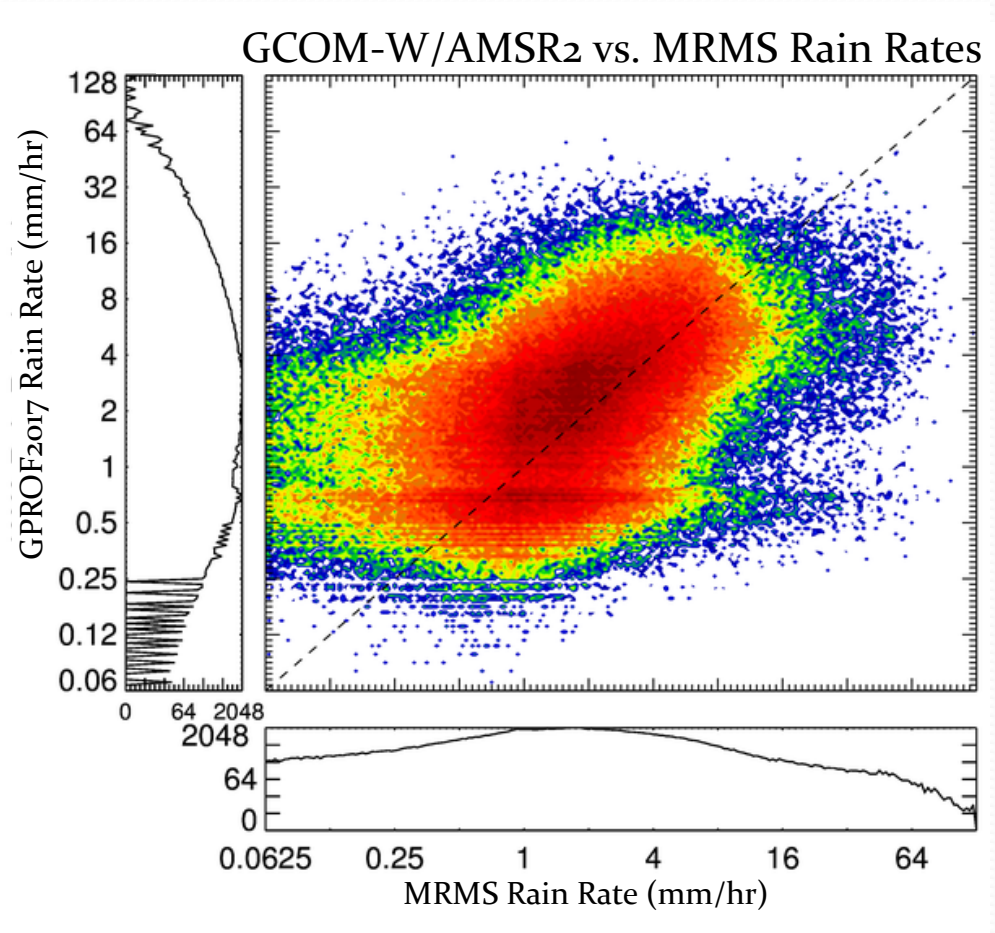
JAXA/GSMAP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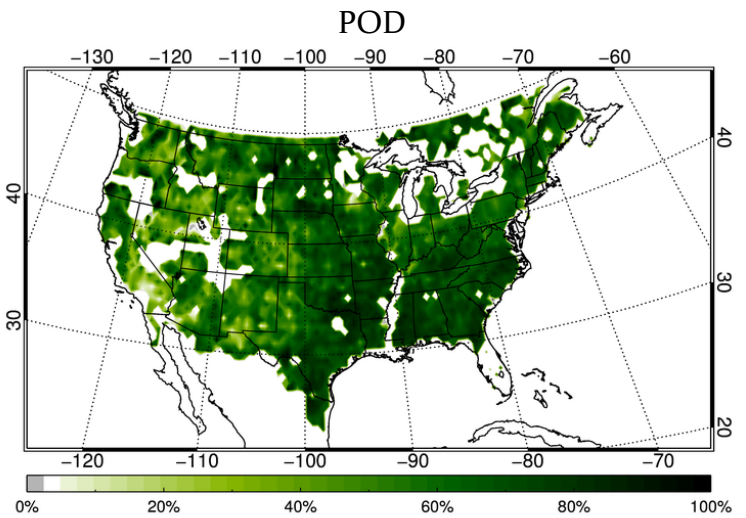
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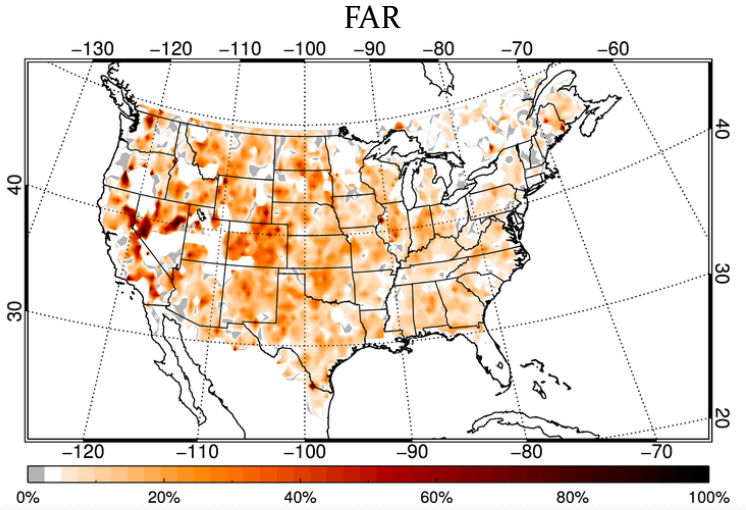
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