

Verifying CORe 3-Hourly Precipitation against MRMS Multi-Sensor Radar Observations over CONUS

2023-01-02

Objectives

- Objective:

To evaluate the CORe precipitation at its native temporal and spatial resolution (3-hourly / Gaussian grid) through comparison against the MRMS Multi-Sensor (MRMS-MS) radar based quantitative precipitation estimates (QPE) over the CONUS

- Features to be examined:

- *Overall quantitative accuracy;*
- *Performance to represent precipitation of various intensity;*
- *Capacity to capture and quantify diurnal cycle;*

MRMS Multi-Sensor QPE

- MRMS:
 - *Multi-Radar Multi-Sensor observation-based precipitation estimates;*
- MRMS Multi-Sensor (MRMS MS):
 - *Radar based estimates bias corrected against gauge observations;*
 - *Gaps filled with gauge analysis over mountainous regions;*
 - *1kmx1km spatial resolution over CONUS;*
 - *Hourly temporal resolution from later 2020;*
- *MRMS MS Used in This Study:*
 - *Data for 2021;*
 - *Integrated to CORE grid and 3-hourly accumulation to match with the CORE data;*
 - *CONUS land only;*

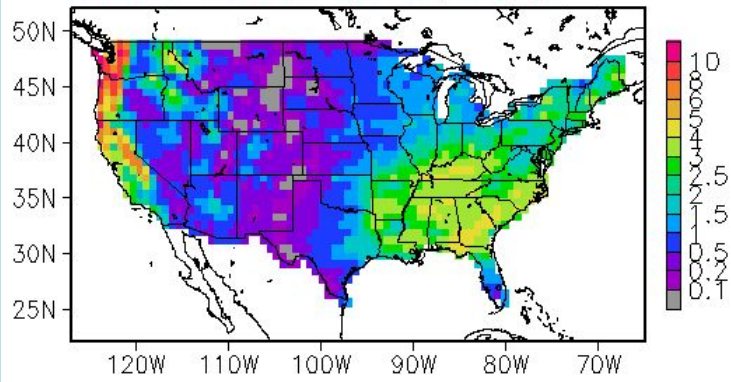
Spatial Performance of 3 Hourly Time Series

1) DJF

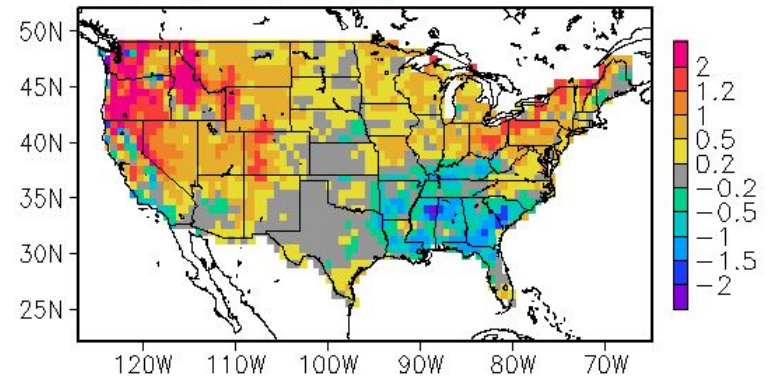
Comparison of CORe Prate agst MRMS MS Radar Observations

[3-HLY; Gaussian Grid; DJF; 2021]

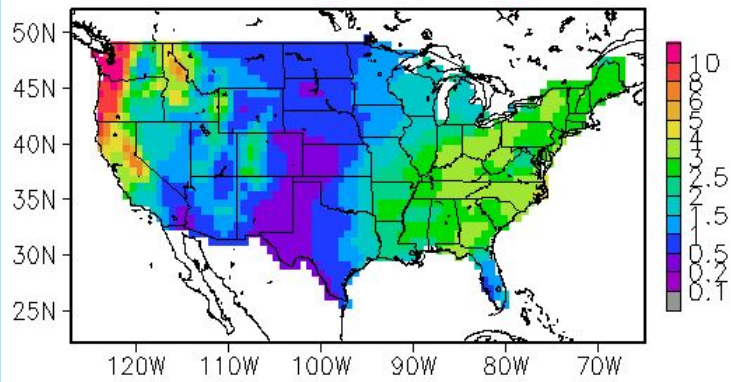
MRMS Radar [mm/day]



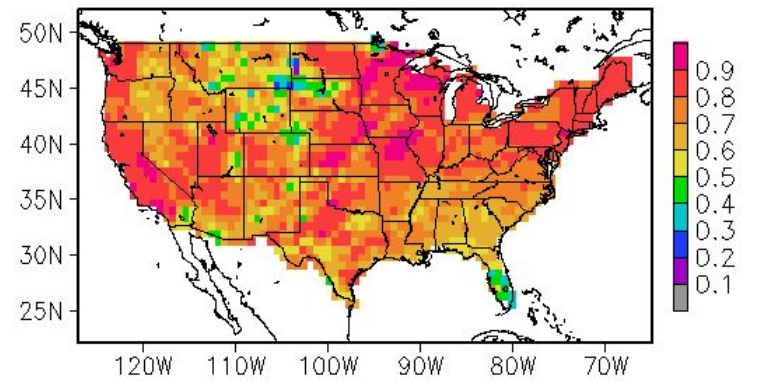
Bias [mm/day]



CORe Prate [mm/day]



Correlation

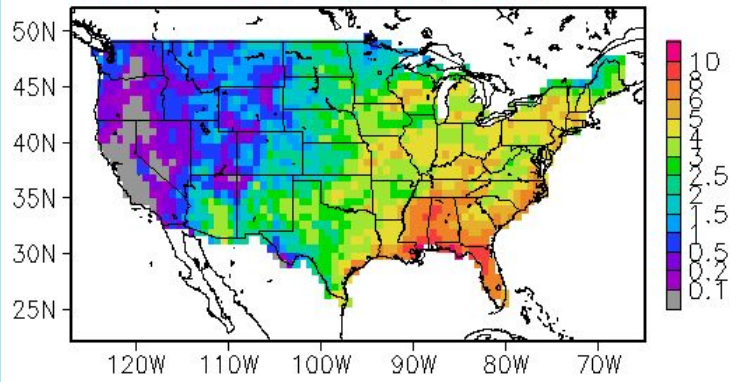


Spatial Performance of 3 Hourly Time Series

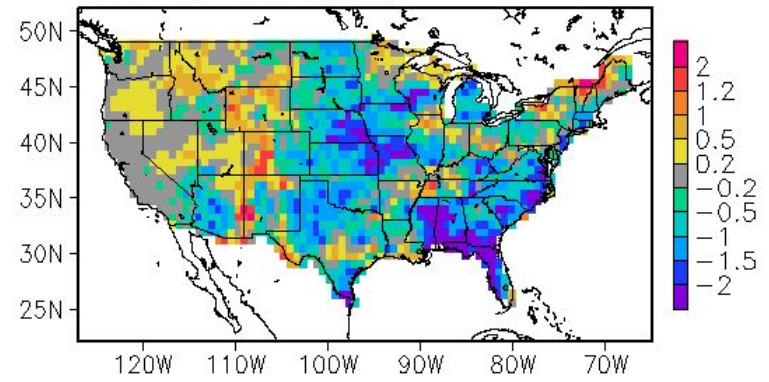
2) JJA

Comparison of CORe Prate agst MRMS MS Radar Observations
[3-HLY; Gaussian Grid; JJA; 2021]

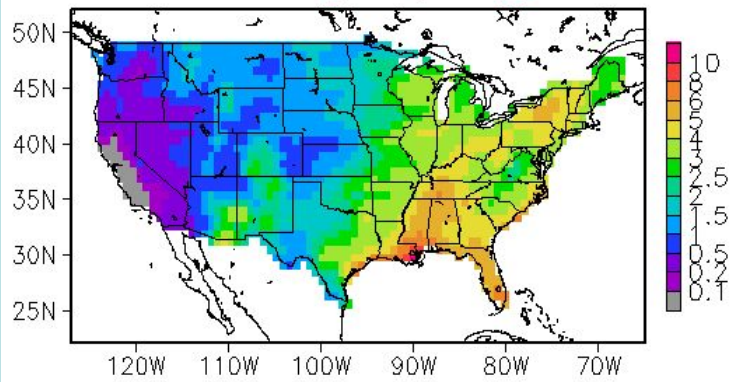
MRMS Radar [mm/day]



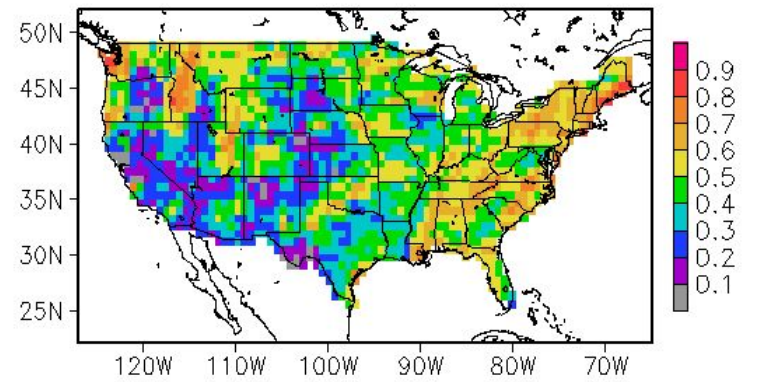
Bias [mm/day]



CORe Prate [mm/day]



Correlation



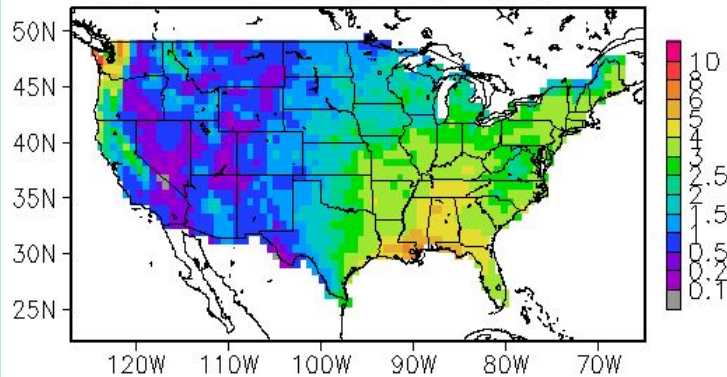
Spatial Performance of 3 Hourly Time Series

3) All Seasons

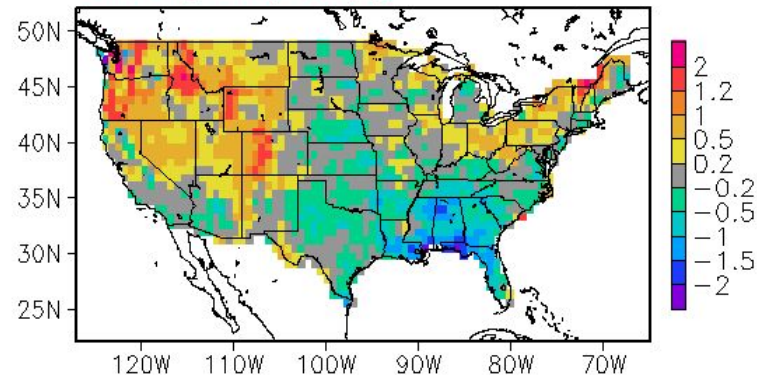
Comparison of CORe Prate agst MRMS MS Radar Observations

[3-HLY; Gaussian Grid; ANN; 2021]

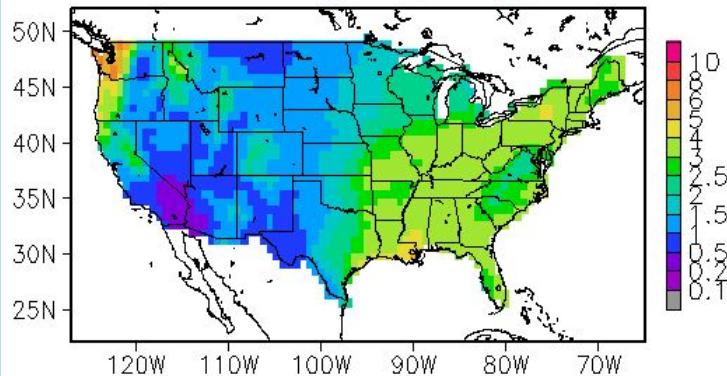
MRMS Radar [mm/day]



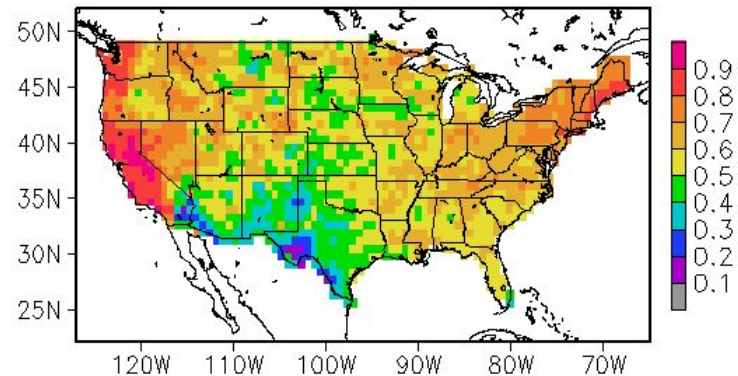
Bias [mm/day]



CORe Prate [mm/day]

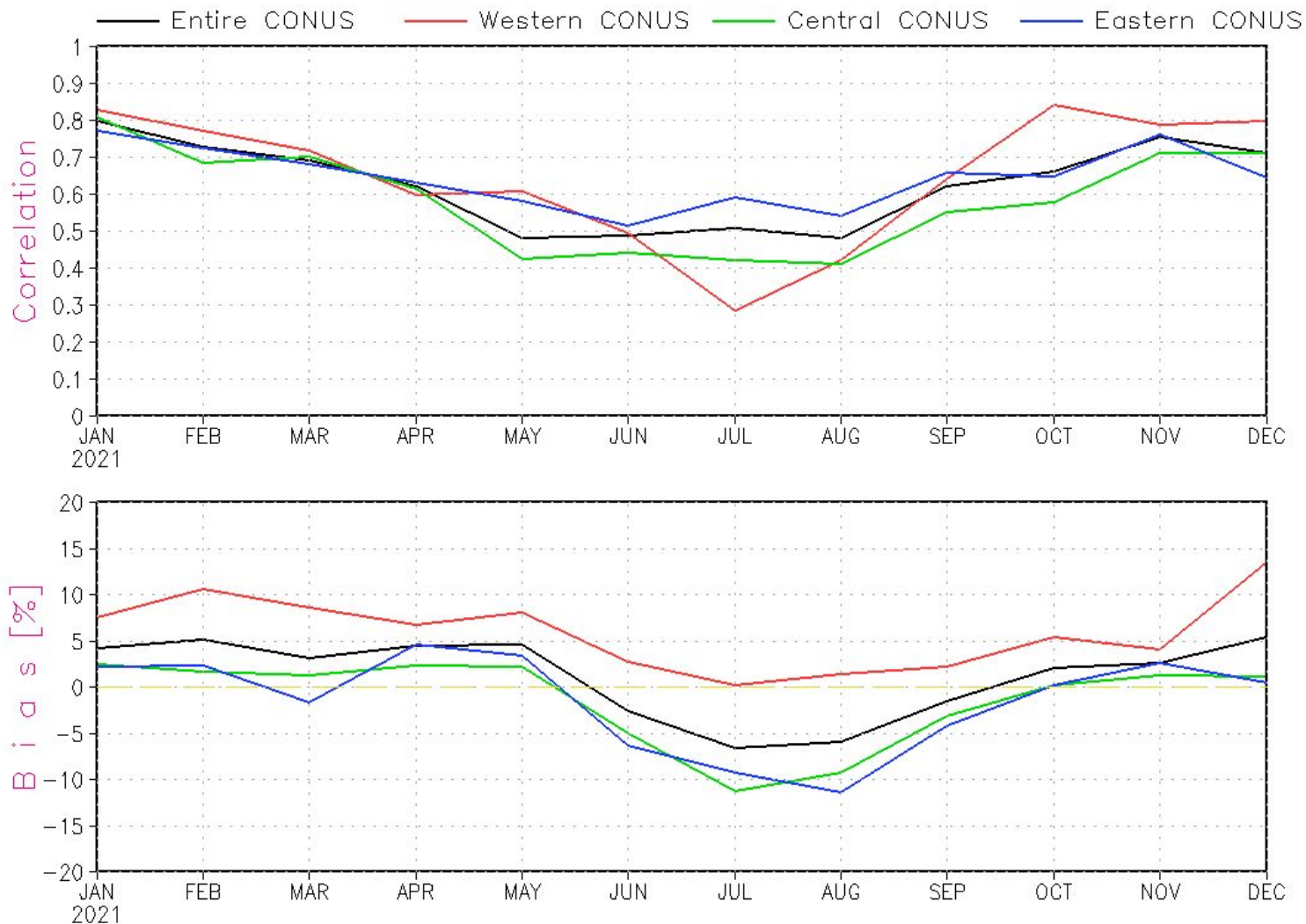


Correlation



Temporal Variations of Spatial Agreements

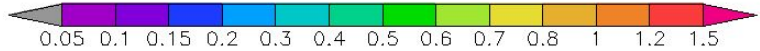
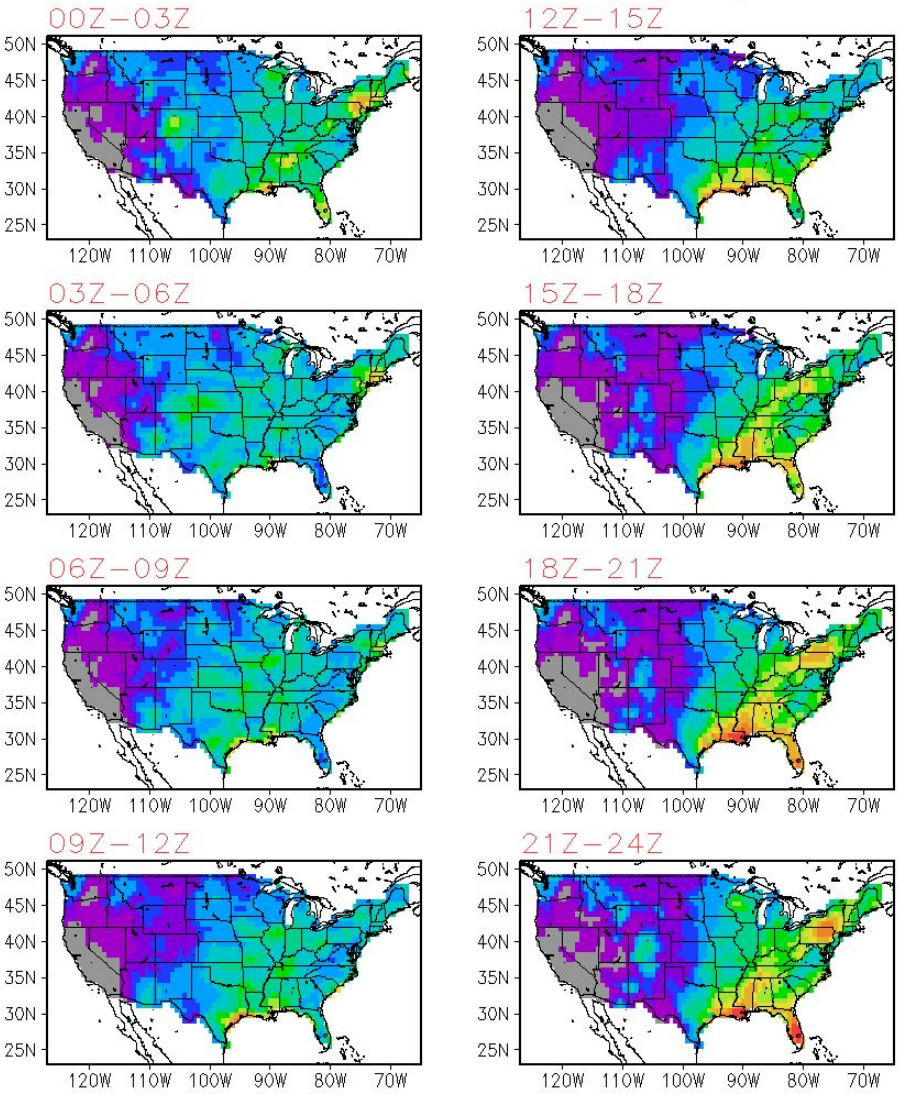
Comparison of CORE Prate agst MRMS MS Radar Observations
[3-HLY; Gaussian Grid]



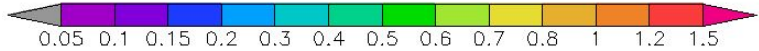
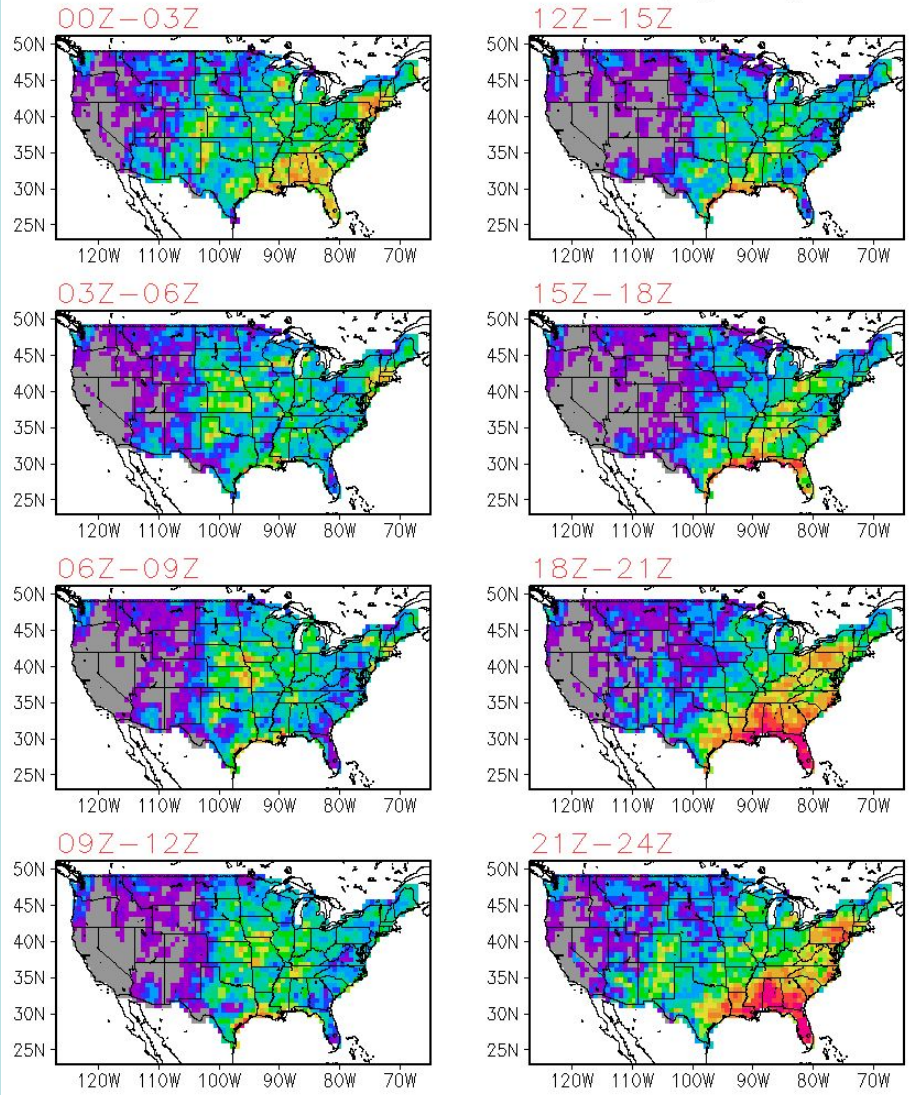
Diurnal Cycle During Warm Seasons

1) Seasonal Mean 3-hourly Precipitation

CORE 3-HLY Mean Precip [mm]



MRMS-MS 3-HLY Mean Precip [mm]

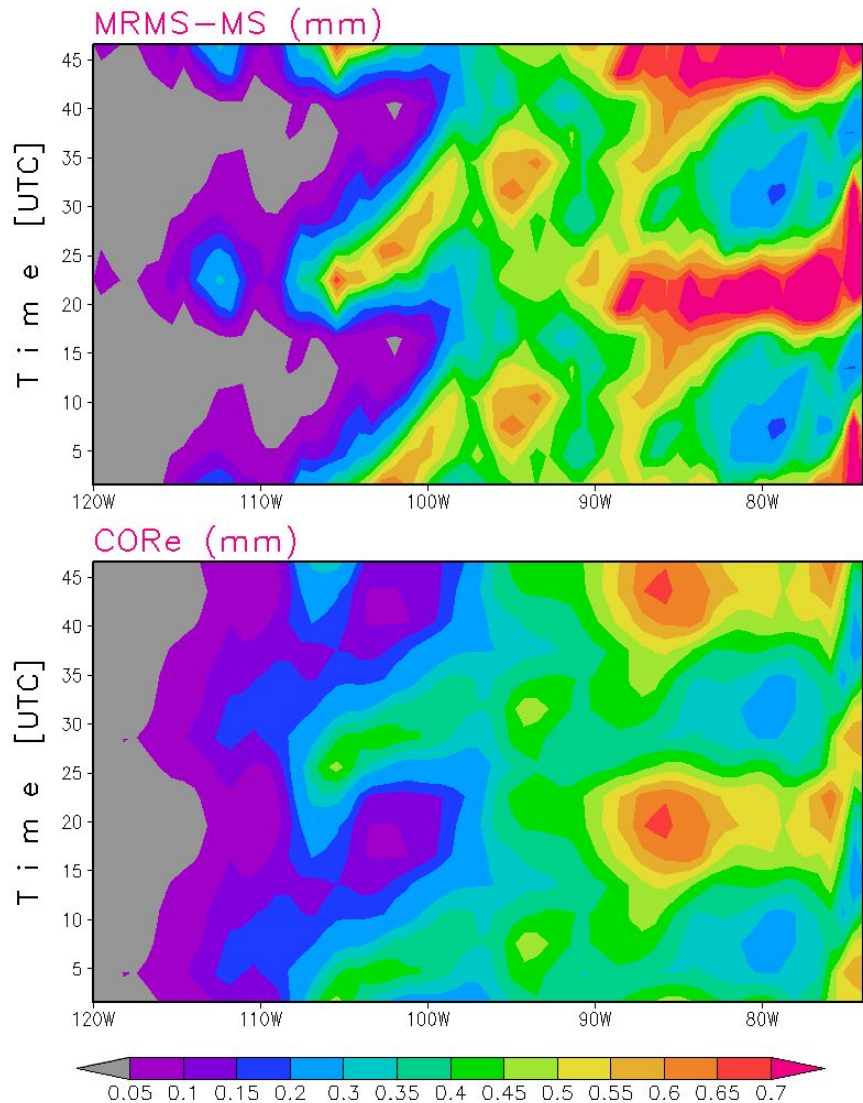


Diurnal Cycle During Warm Seasons

2) Merional Cross Section over [35°N-40°N]

Merional Section of 3-Hly Precip over CONUS

[May-Sep., 2021 / 35N-40N]



X Axis:
Longitude

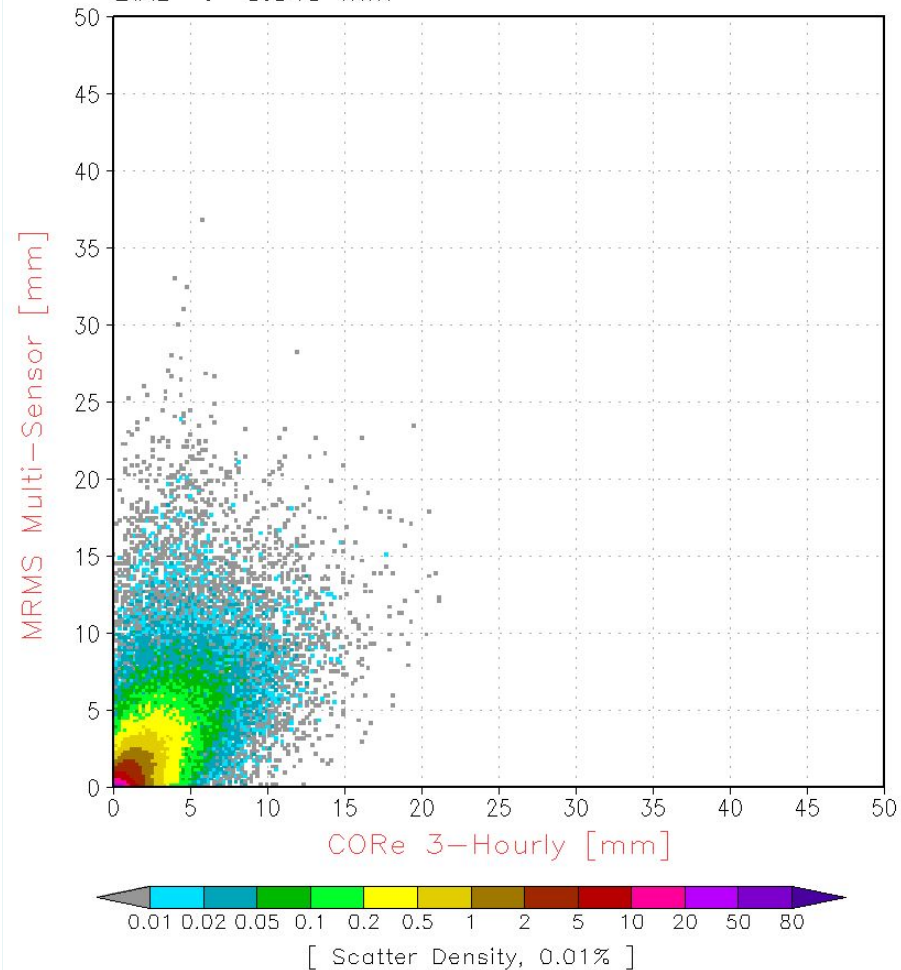
Y-Axis:
Time in UTC,
repeated for two diurnal
cycles

Quantitative Accuracy

1) Scatter Density Plots

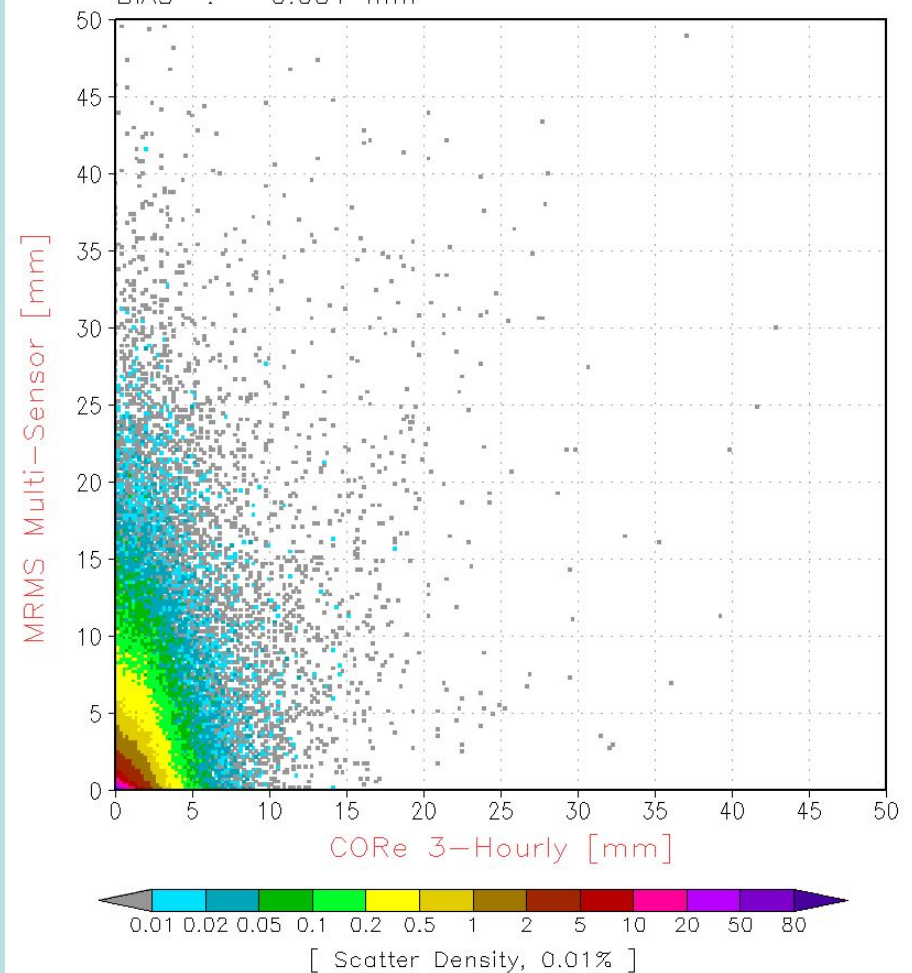
CORe 3-Hly Precip vs MRMS Multi-Sensor QPE
[2021.01. - 2021.12. / DJF]

CORR : 0.745
BIAS : 0.049 mm



CORe 3-Hly Precip vs MRMS Multi-Sensor QPE
[2021.01. - 2021.12. / JJA]

CORR : 0.492
BIAS : -0.051 mm

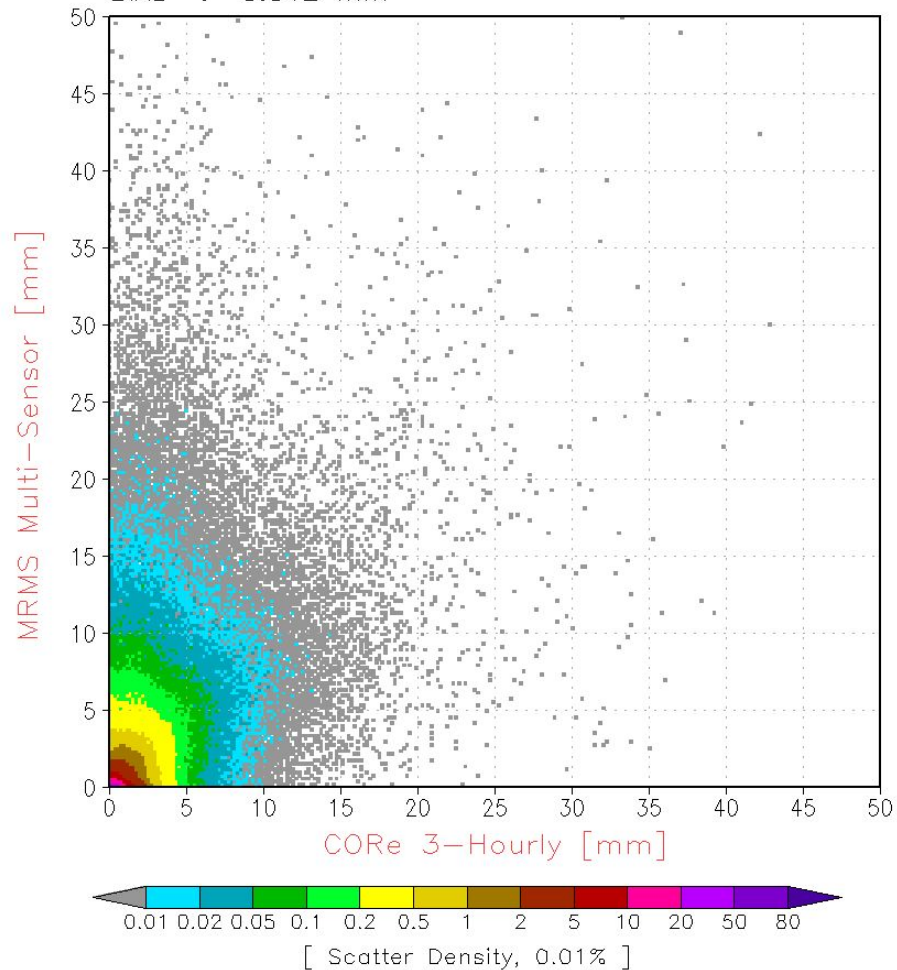


Quantitative Accuracy

2) Error as a Function of Precipitation Intensity for All Seasons

CORe 3-Hly Precip vs MRMS Multi-Sensor QPE
[2021.01. - 2021.12. / ALL]

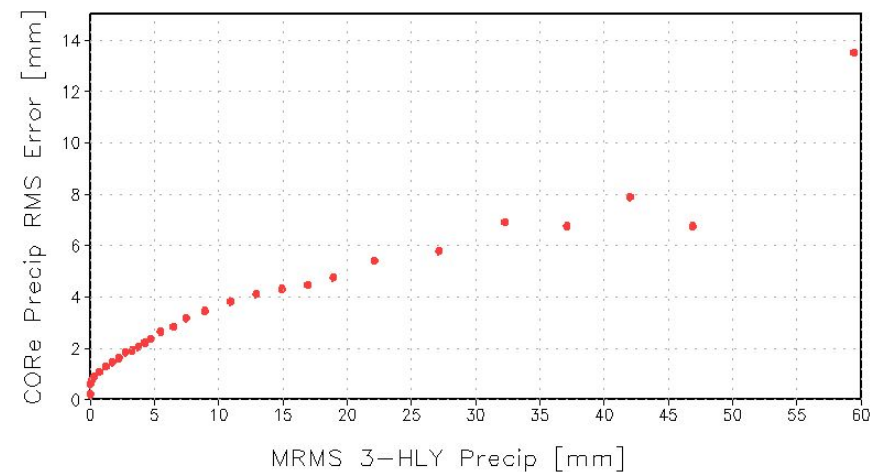
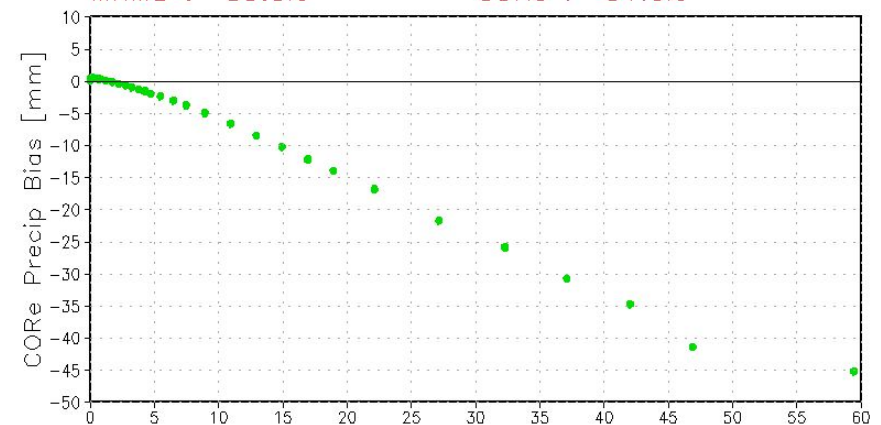
CORR : 0.596
BIAS : 0.012 mm



CORe 3-Hly Precip Error
a Function of Precip Intensity in MRMS

[2021.01. - 2021.12. / ALL SEASONS]

Frequency of Precipitating Grids :
MRMS : 39.0% CORe : 51.6%



Summary

- Overall, CORE performs quite well in capturing the temporal / spatial variations of precipitation at its native resolution;
- Performance is better for precipitation over eastern CONUS and for cold season and degraded for precipitation over the western mountainous regions and during summer;
- Diurnal cycle of precipitation caused by the propagation of convective systems over the central CONUS and by the land-sea contrasts over the eastern regions is captured reasonably well but with reduced magnitude;
- CORE tends to generate wider raining areas, under-/over-estimate the heavy / light precipitations compared to the observations;
- This work will be re-conducted when the CORE data are available for 2022;