# Ground Truth for Radar-Estimated Precipitation Algorithms for MRMS

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*WERA 1012 Meeting – In the Field Updates*

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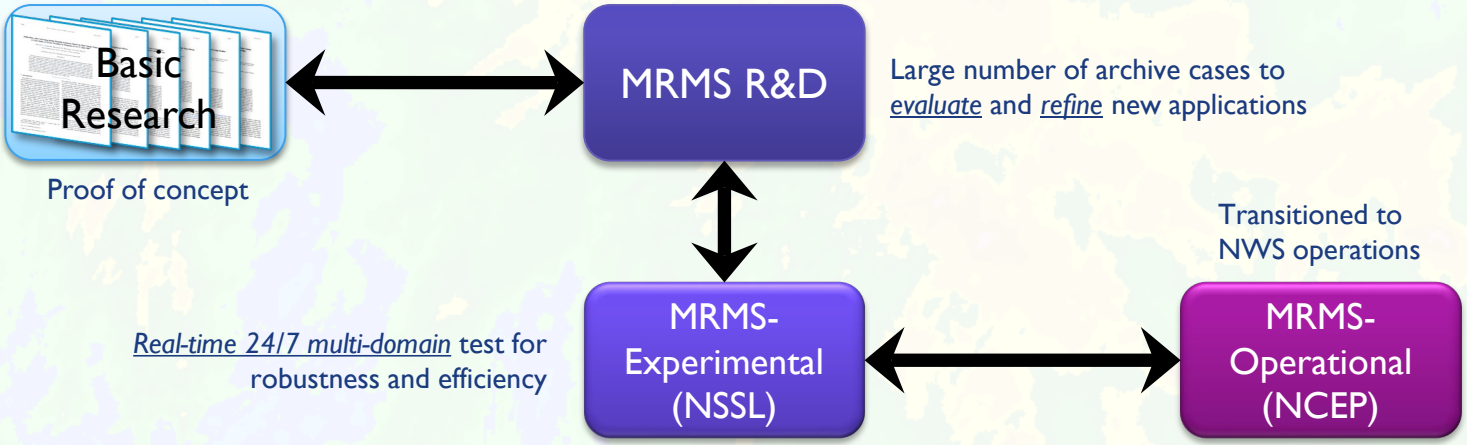
# MRMS: What is it?

- An operational system for the integration of **Multi-Radar Multi-Sensor** data and creation of high-resolution (1-km, 2-min) severe weather and hydrometeorological products
- A research platform for evaluations and refinements of new applications and to facilitate their transition into operations



# MRMS Precipitation Product Development

- Series of QPE products based on seamlessly mosaicked radars, hourly gauge observations, PRISM climatologies, and model data/forecasts
- Need an independent dataset to analyze the performance of the MRMS products

| Product Name | Data Sources | Resolution | Update Cycle | Latency |
|---|---|---|---|---|
| **Dual-Pol Synthetic Rate** | Radar, Model | 1 km Cartesian | 2 min | ~90 s |
| **Dual-Pol Synthetic QPE (1 h)** | Radar, Model | 1 km Cartesian | 2 min | ~90 s |
| **Dual-Pol Synthetic QPE (3-72 h)** | Radar, Model | 1 km Cartesian | 60 min | ~90 s |
| **Multi-Sensor QPE** | Radar, Model, Gauges, PRISM | 1 km Cartesian | 60 min | Pass 1: 20 min; Pass 2: 60 min |

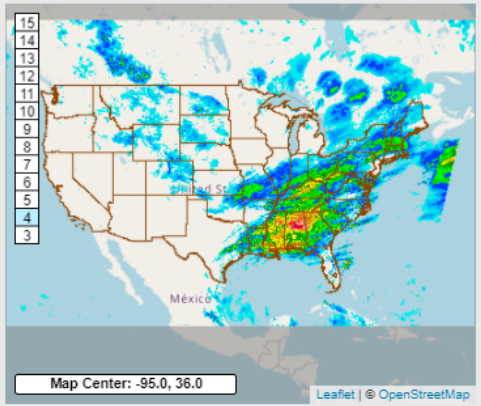
# CoCoRaHS for Independent Verification

- Internal QPE Verification System (QVS) that utilizes independent CoCoRaHS daily gauges observations to evaluate the operational and experimental QPE products
- Allows us to make comparisons with external precipitation products outside of MRMS (e.g., NWS Stage IV, satellite-derived QPEs, and model QPFs)
- Ingest CoCoRaHS once a day in early afternoon and visualize within the QVS web interface

# Gauge vs QPE Comparison

METOP Analysis Tools

### Zoom/Pan Map




Reset Region | Overlays | Base Map Layer

### QPE Product Selection

- CONUS Q3 Radar
- CONUS Q3 Gauge
- CONUS External QPE
- ALASKA Q3 Suite
- CARIB Q3 Suite
- CARIB External QPE
- HAWAII Q3 Suite
- HAWAII External QPE

Gauge Adj (Pass 2)
Gauge Adj (Pass 1)
Gauge Adj (Legacy)
Mountain Mapper (Pass 2)
Mountain Mapper (Pass 1)
Mountain Mapper (legacy)
Multi-Sensor (Pass 2)
Multi-Sensor (Pass 1)
Multi-Sensor (Legacy)

### Date/Time

2021 May 5 12:00 UTC

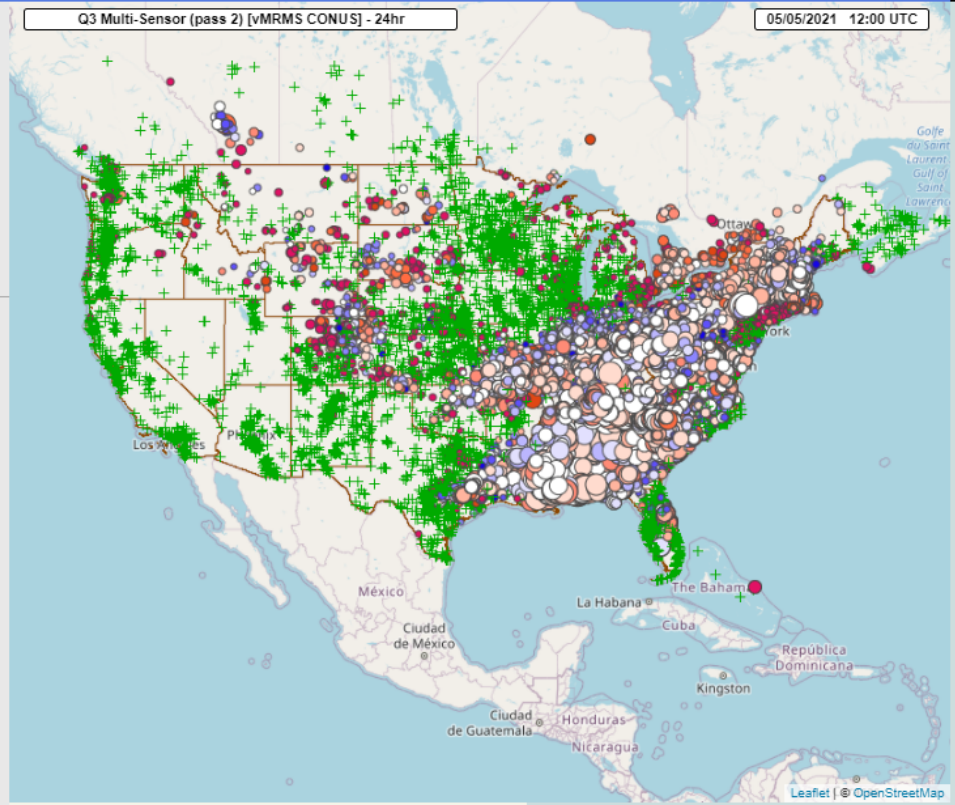
| | | | | | | |
|---|---|---|---|---|---|---|
| 00: | 01: | 02: | 03: | 04: | 05: | 1 hr / 3 hr / 6 hr |
| 06: | 07: | 08: | 09: | 10: | 11: | 12 hr / 1 dy |
| 12: | 13: | 14: | 15: | 16: | 17: | 2 dy |
| 18: | 19: | 20: | 21: | 22: | 23: | 5 dy |

### Time Series Duration

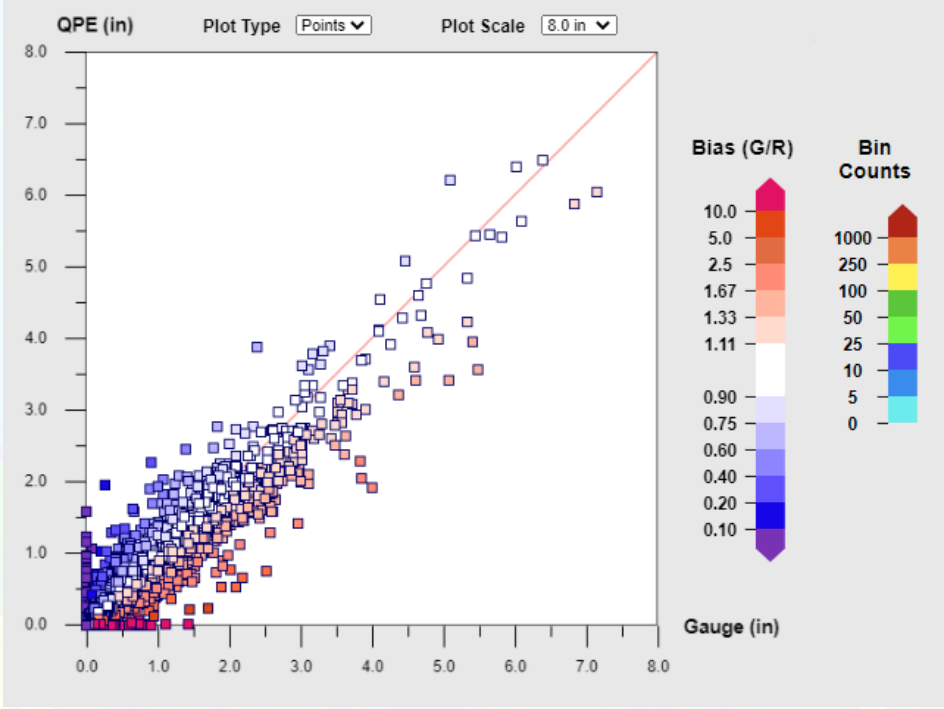
24 hr

### Map Data Management

- QPE Product — Palette: 0 - 12.0 in
- Opacity: 0% 100%
- Hourly Gauges (MADIS via MRMS) — Status:
- Daily Gauges (CoCoRaHS) — Status: 14209 Loaded
- CoCoRaHS Snow Reports — Status:
- MPING Reports



# ➢ Multiple viewing options with statistics and scatterplots




**Quality Filters**

| | |
|---|---|
| Max # Bad QC Flags | 24 hr (No Limit) |
| Max # Missing Reports | 24 hr (No Limit) |
| Max Report Time Shift | 4 hr |

**Radar Range Filters**

| | |
|---|---|
| Min Radar Range | 0 mi (No Limit) |
| Max Radar Range | No Limit |

**Amount/Bias Filters**

| | |
|---|---|
| Min Gauge | 0" (No Limit) |
| Max Gauge | 20" |
| Min QPE | 0" (No Limit) |
| Max QPE | No Limit |
| Allowed Bias | No Limit |

Filter Gauge/QPE Text Output

Full Gauge/QPE Text Output

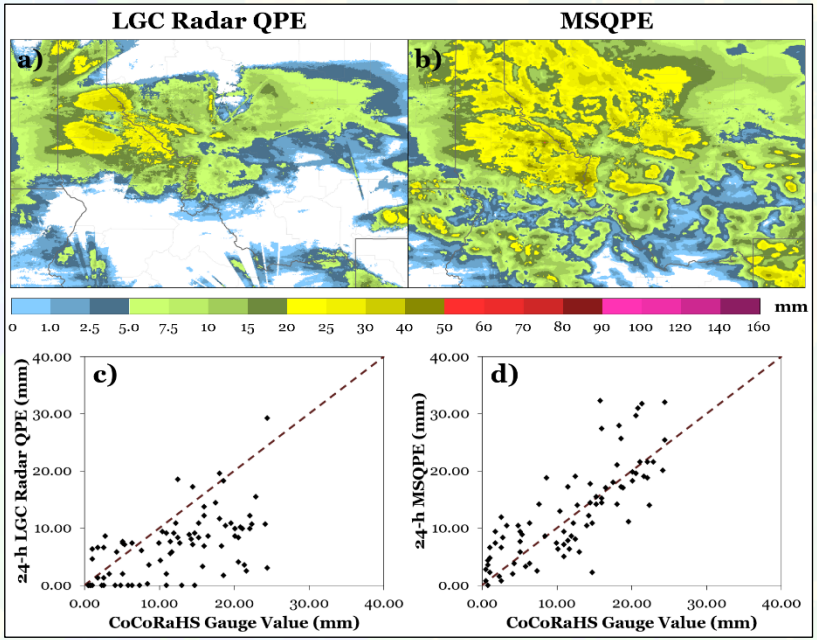
Total Gauges Loaded: 14209
Gauges Passing All Filters/Used In Stats: 14208

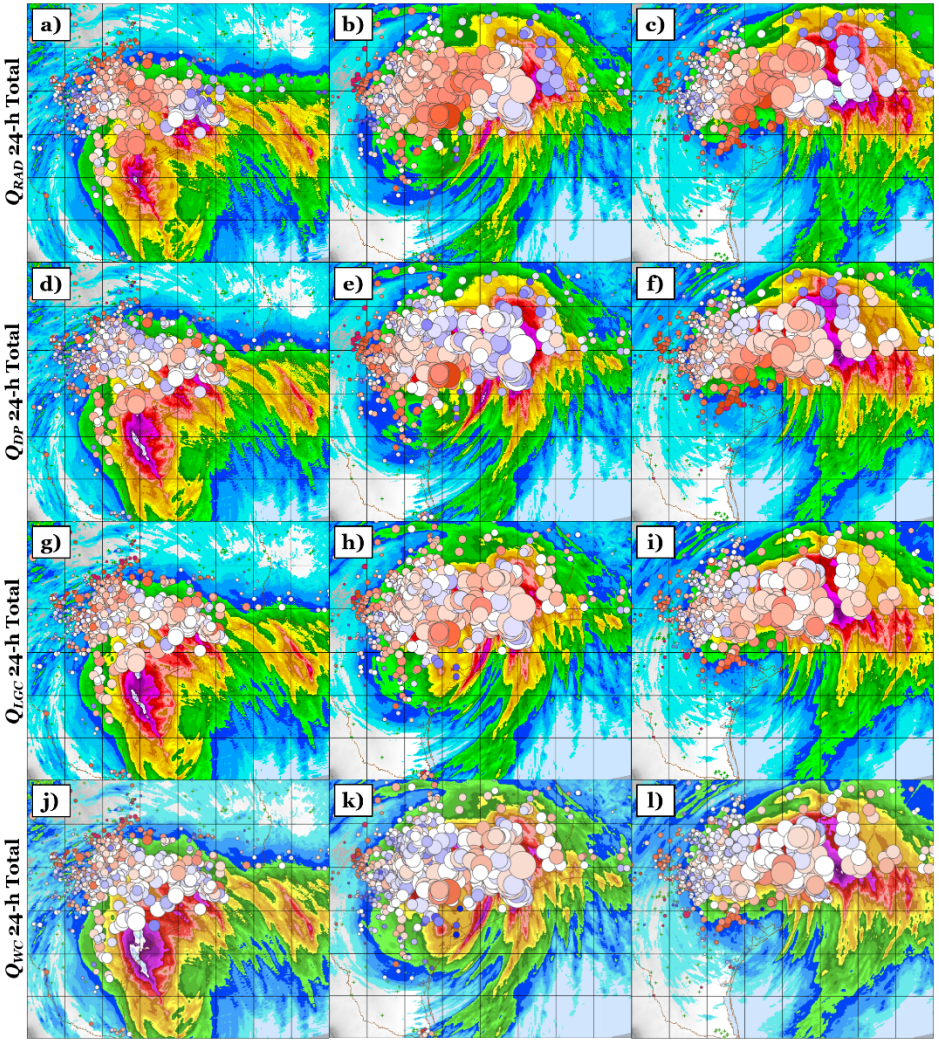
| | Gauges: | QPE: |
|---|---|---|
| Min | 0.00 | 0.00 |
| Avg | 0.24 | 0.23 |
| Max | 7.14 | 6.50 |

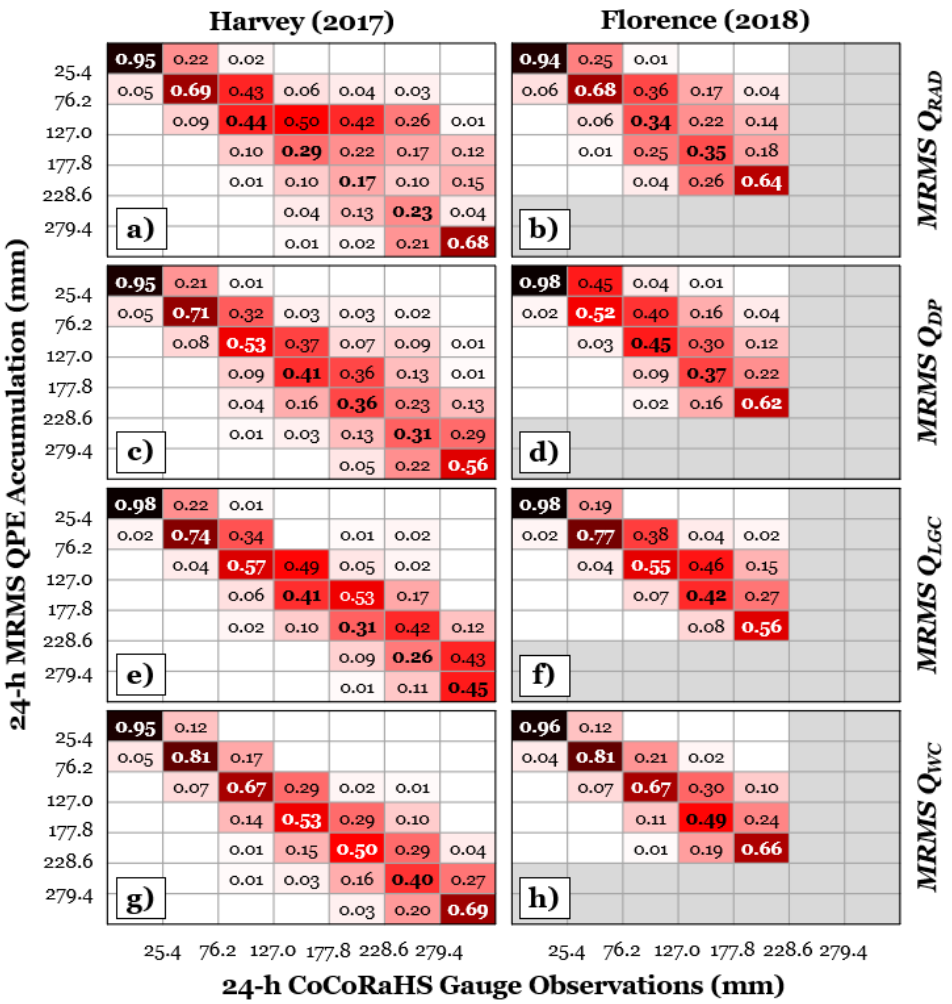
| | | | |
|---|---|---|---|
| Mean Bias(G/R): | 1.045 | G-R Err Std Dev: | 0.060 |
| Add Bias (G-R): | 149.73 | Corr Coeff: | 0.962 |
| Mean Err (G-R)/N: | 0.011 | Fract Bias: | 0.043 |
| Mean Abs Error: | 0.060 | Fract RMSE: | 0.602 |
| RMSE: | 0.147 | Fract Std Dev: | 0.601 |

# CoCoRaHS Featured in Published Work

- Radar-based QPE evaluations
- Winter precipitation analysis
- Multi-sensor QPE analysis





1200 UTC 26 August 2017
1200 UTC 27 August 2017
1200 UTC 28 August 2017
a)
b)
c)
d)
e)
f)
g)
h)
i)
j)
k)
l)
$Q_{RAD}$ 24-h Total
$Q_{DP}$ 24-h Total
$Q_{LGC}$ 24-h Total
$Q_{WC}$ 24-h Total


Harvey (2017)
Florence (2018)
24-h MRMS QPE Accumulation (mm)
25.4 76.2 127.0 177.8 228.6 279.4
a) 0.95 0.22 0.02
0.05 0.69 0.43 0.06 0.04 0.03
0.09 0.44 0.50 0.42 0.26 0.01
0.10 0.29 0.22 0.17 0.12
0.01 0.10 0.17 0.10 0.15
0.04 0.13 0.23 0.04
0.01 0.02 0.21 0.68
b) 0.94 0.25 0.01
0.06 0.68 0.36 0.17 0.04
0.06 0.34 0.22 0.14
0.01 0.25 0.35 0.18
0.04 0.26 0.64
c) 0.95 0.21 0.01
0.05 0.71 0.32 0.03 0.03 0.02
0.08 0.53 0.37 0.07 0.09 0.01
0.09 0.41 0.36 0.13 0.01
0.04 0.16 0.36 0.23 0.13
0.01 0.03 0.13 0.31 0.29
0.05 0.22 0.56
d) 0.98 0.45 0.04 0.01
0.02 0.52 0.40 0.16 0.04
0.03 0.45 0.30 0.12
0.09 0.37 0.22
0.02 0.16 0.62
e) 0.98 0.22 0.01
0.02 0.74 0.34 0.01 0.02
0.04 0.57 0.49 0.05 0.02
0.06 0.41 0.53 0.17
0.02 0.10 0.31 0.42 0.12
0.09 0.26 0.43
0.01 0.11 0.45
f) 0.98 0.19
0.02 0.77 0.38 0.04 0.02
0.04 0.55 0.46 0.15
0.07 0.42 0.27
0.08 0.56
g) 0.95 0.12
0.05 0.81 0.17
0.07 0.67 0.29 0.02 0.01
0.14 0.53 0.29 0.10
0.01 0.15 0.50 0.29 0.04
0.01 0.03 0.16 0.40 0.27
0.03 0.20 0.69
h) 0.96 0.12
0.04 0.81 0.21 0.02
0.07 0.67 0.30 0.10
0.11 0.49 0.24
0.01 0.19 0.66
MRMS $Q_{RAD}$
MRMS $Q_{DP}$
MRMS $Q_{LGC}$
MRMS $Q_{WC}$
24-h CoCoRaHS Gauge Observations (mm)

# Future MRMS Work with CoCoRaHS

- Developing a new Analysis of Record (AoR) that incorporates CoCoRaHS gauges into QPE development
- New ingest of CoCoRaHS gauges in real-time
- Includes a new quality control of CoCoRaHS gauges and then downscale them for use on hourly scale

# Contact Information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# Web Information

Public-Facing MRMS Operational Product Page:
https://mrms.nssl.noaa.gov/
Public-Facing MRMS QVS Page:
https://mrms.nssl.noaa.gov/qvs/gauge_vs_qpe/


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