P1.7

NOAA Satellite and Information Service
National Environmental Satellite, Data, and Information Service (NESDIS)

University of North Carolina Asheville | Duke University | cics-md Cooperative Institute for Climate & Satellites, University of Maryland

Validation of Satellite Precipitation Estimates over the Continental United States using Unique Rain Gauge Data Sets

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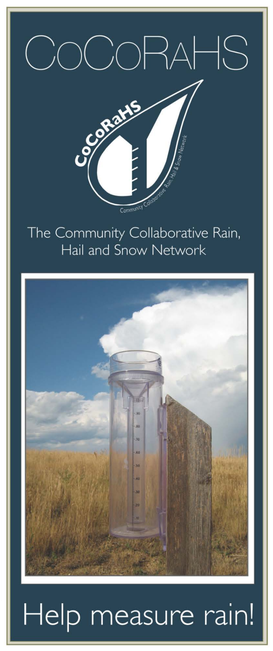
1. Introduction

Validation of satellite precipitation estimates is an ongoing challenge. Exploitation of 'specialized' data sets can provide a first order evaluation of algorithm performance in regions where conventional data is limited or even non-existent. In this study, we examine some initial use of two such data sets over the continental United States (CONUS).

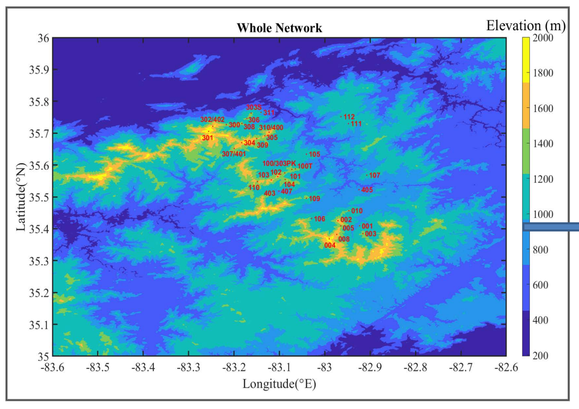
2. Gauge Data #1 – CoCoRaHS[1]

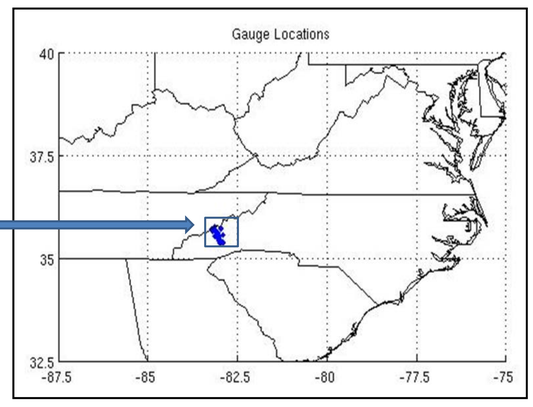
The Community Collaborative Rain, Hail and Snow Network (CoCoRaHS) is a non-profit, community based, network of volunteers who measure and report rain, hail and snow in their backyards. Individuals and family volunteers of all ages and all walks of life are the foundation of the CoCoRaHS network! Many students also participate through their schools. CoCoRaHS reports 24-hr precipitation totals, typically from 7 am – 7 am each day. The only requirement is the purchase of a low cost (~$20 USD) rain gauge. On-line training is provided; each region also has volunteer coordinators who can also offer on-site set up and training. The data are available on-line.



3. Gauge Data #2- GSMNP[2]

The Great Smoky Mountains and Pigeon Basis (GSMNP) high-resolution rain gauge network, developed by Duke University and maintained by the UNC-Asheville, includes 44 tipping bucket rain gauges deployed during 2007-2009 at mid to high elevations (from 1150m to 1920 m) along exposed ridges in the western part of the state of North Carolina in the Southern Appalachians in locations where no previous rainfall observations were ever made, and where complementary existing observations are available at low elevations. This is a region of orographic rain and periodic severe flooding. Every rain gauge is visited every two-three months for regular maintenance, data collection and scheduled recalibration. Quality control of collected data is performed for each rain gauge, where flags are added to any questionable data.





4. Satellite and Radar Rainfall Data

24 hour satellite rainfall data sets were obtained from Bob Kuligowski (NESDIS/STAR) and the CICS-MD IPWG Validation Web Site[3]. The data sets analyzed included:

- **SCaMPR[4]** – Self-Calibrating Multivariate Precipitation Retrieval
- **CMORPH[5]** - CPC Morphing technique
- **MRMS[6]** – Multi-Radar/Multi-Sensor System

Simple co-location methods (e.g., nearest satellite observations to gauge locations) were employed.

References

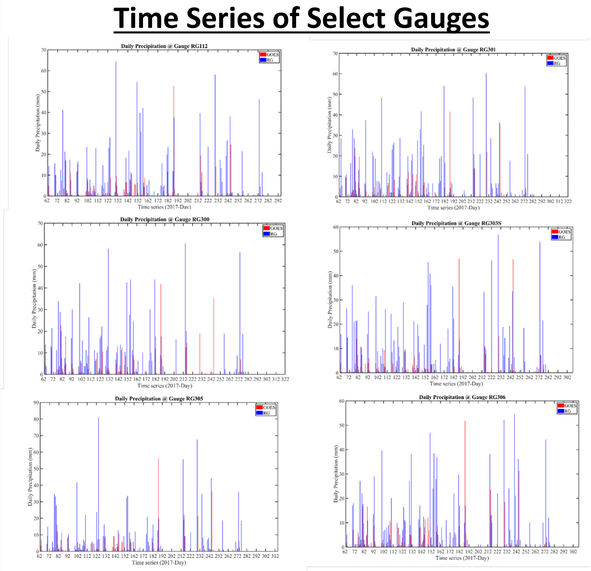
[1]https://www.cocorahs.org/
[2]https://iphex.pratt.duke.edu/study%20area
[3]http://cics.umd.edu/ipwg/
[4]https://www.star.nesdis.noaa.gov/smcd/emb/ff/SCaMPR.php
[5]http://www.cpc.ncep.noaa.gov/products/janowiak/cmorph_description.html
[6]https://www.nssl.noaa.gov/projects/mrms/

5. Results – GSMNP and SCaMPR

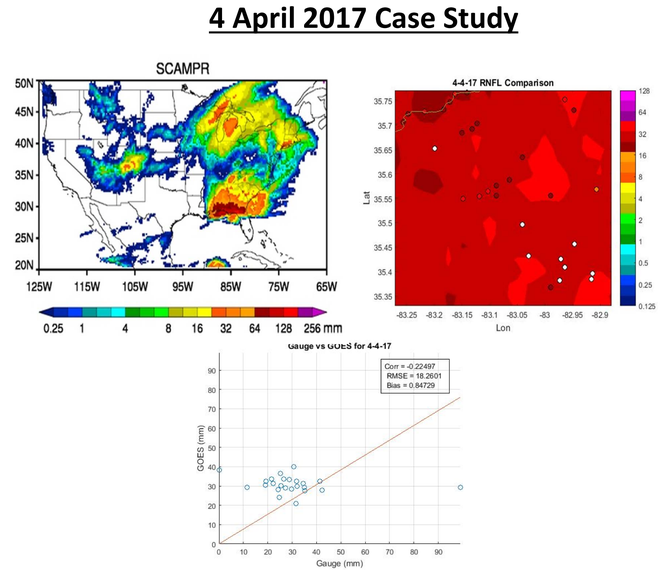
The SCaMPR rainfall estimates were evaluated over the GSMNP domain for GOES-16 for 24-hour periods during seven months during 2017. Some general findings include:

- The performance of SCaMPR varies from region to region (W, C and E)
- Missed precipitation by SCaMPR are most likely associated with warm rain processes
- Overestimation by SCaMPR are most likely due to persistent cold cloud tops

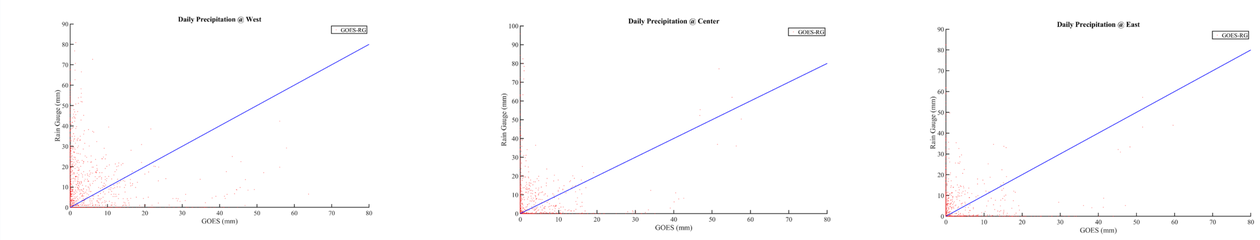
Time Series of Select Gauges



4 April 2017 Case Study



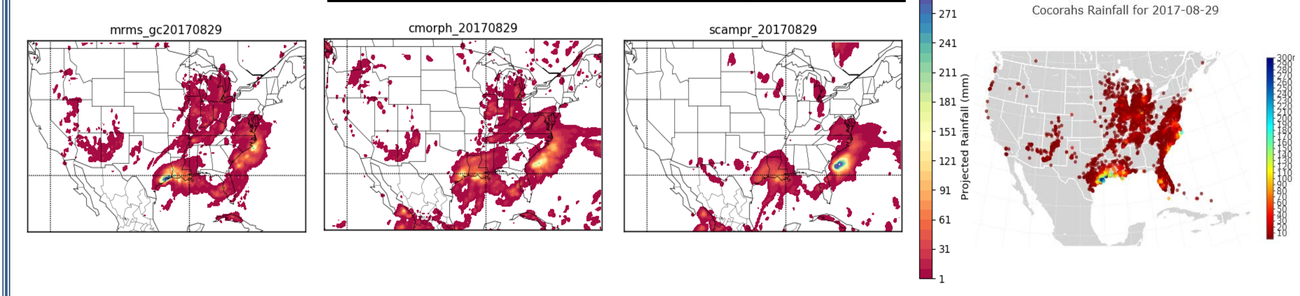
Performance By Region



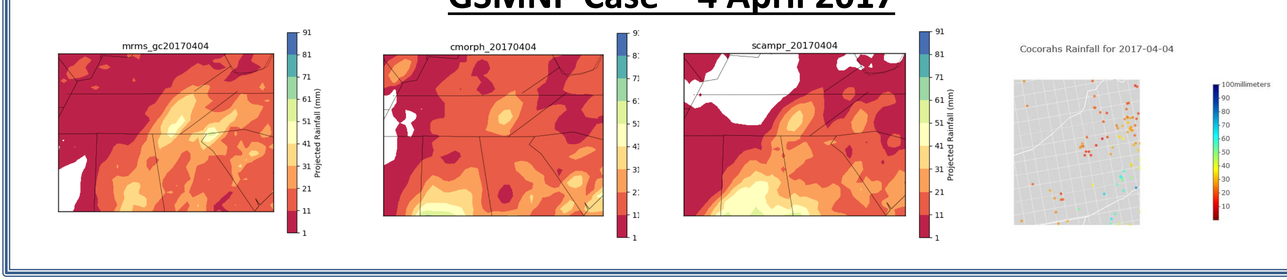
6. Results –Radar, Satellite and CoCoRaHS

- The CoCoRaHS and MRMS fields are in general agreement
- CMORPH and SCaMPR vary considerably
  - In many instances, CMORPH agrees better with surface reports

Hurricane Harvey – 29 August 2017



GSMNP Case – 4 April 2017



7. Summary & Future Plans

This pilot (and ongoing study) is exploiting 'specialized' surface rain gauge data sets over the CONUS to validate satellite-based precipitation products. Preliminary results suggest that these surface data sets can provide "another piece of information" to algorithm developers and product users. In the next phase of the activity, which is centered around students as a form of outreach, education, and training, will focus on quantitative evaluation, using the IPWG validation protocol tools.

Acknowledgements – We would like the GOES-R3 Program and Center for Satellite Applications and Research (STAR) of NOAA/NESDIS for supporting this activity. Additionally, we want to thank the University of Maryland/CICS-M, University of North Carolina - Asheville, and Duke University for their contributions to the analysis and maintaining the GSMNP network and providing the data sets for this study.