



An Update on NOAA Operational Precipitation Products and NOAA's Contributions to the PMM Science Team

Ralph Ferraro¹ and Pingping Xie²

¹NOAA/NESDIS/STAR; ²NOAA/NWS/NCEP/CPC

College Park, MD

Includes contributions by other PI's and affiliates on the NOAA PMM Science Team



Outline

- Status of NOAA Satellites
- Status of NESDIS Operational Products, including use of GPM
- Example uses (Hurricane Dorian) & validation
- NOAA contributions to PMM Science Team
- Other topics of interest
- Summary

NOAA
SATELLITES



Update on Satellites - JPSS

- S-NPP

- ATMS has sporadic scan motor issues, not impacting SDR or EDR quality

- JPSS-1 launched on 11/18/17 (NOAA-20)

- Orbit ~30 min after S-NPP

- Opportunities for synergies

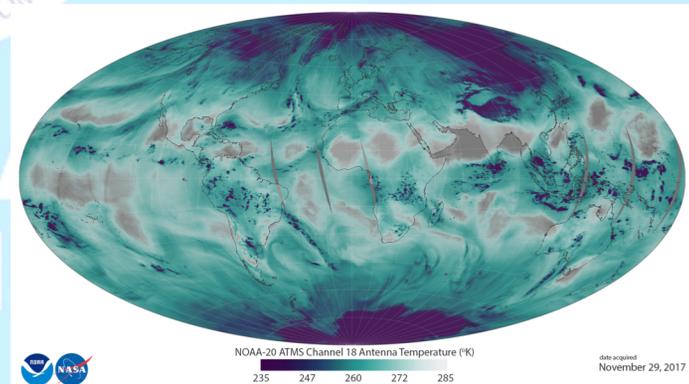
- SDR's and EDR's have reached full maturity

- JPSS-2 launch ~Jan 2022

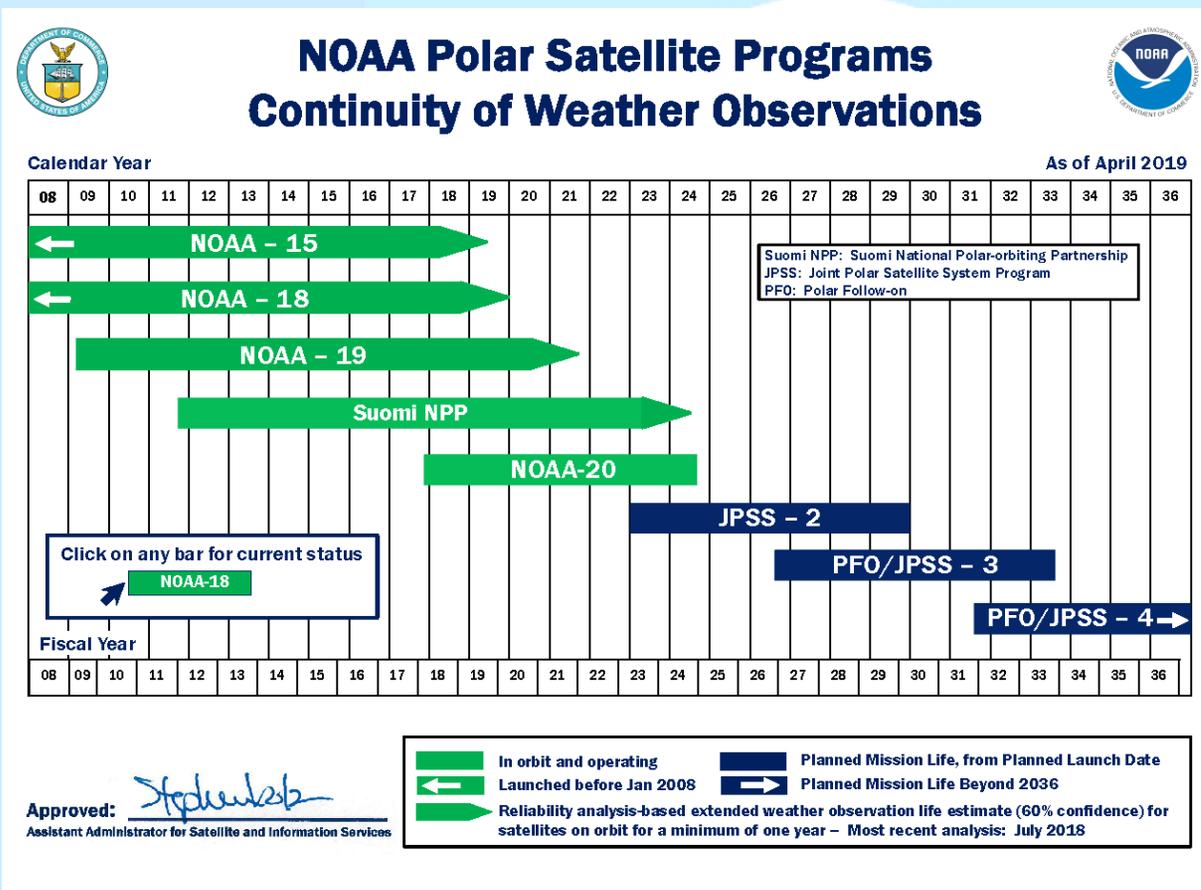
- Could be some reconfigurations for JPSS-3 and -4

- Future NOAA architecture under evaluation

- Likely to be different than it is today....



LEO Satellites



We also exploit MetOp; DMSP; GPM; GCOM-W1

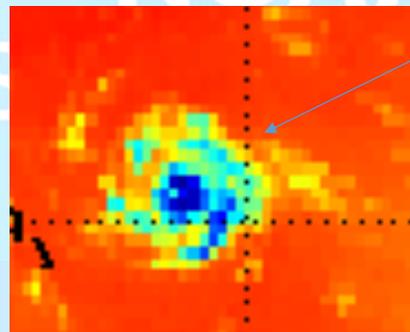
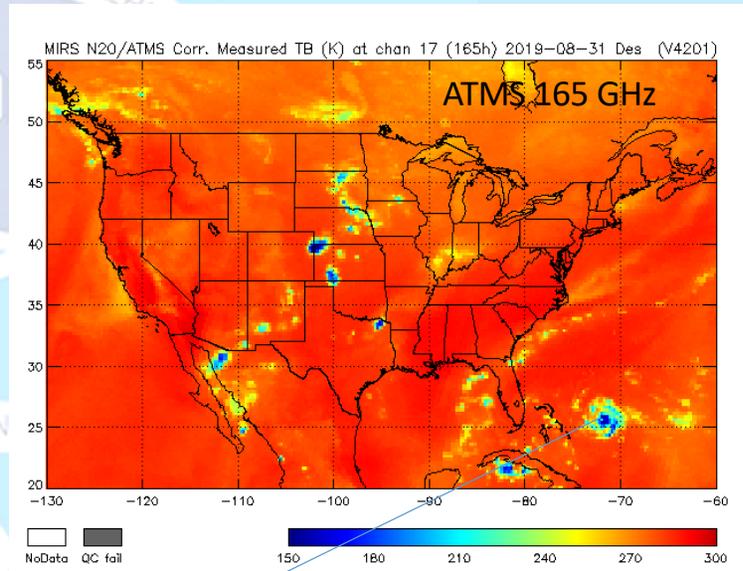
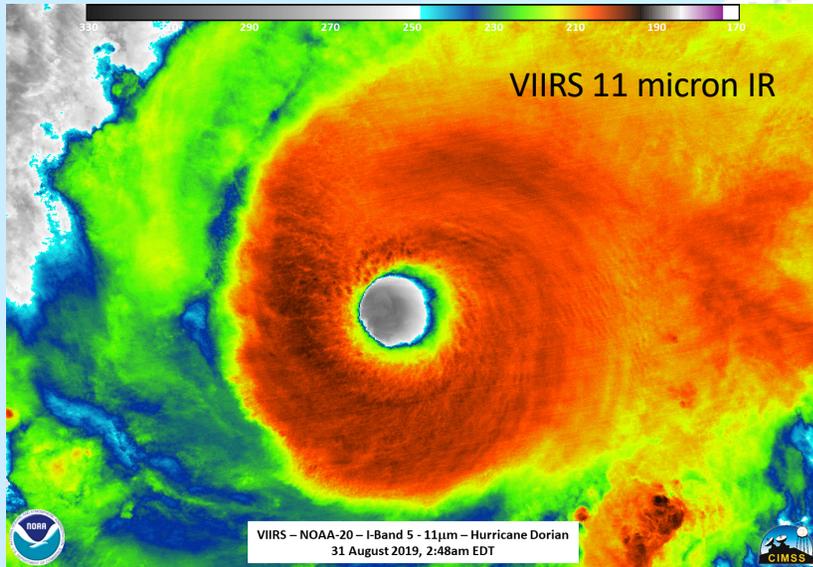
LTAN for precip useable satellites:

- N19: 1700
- S-NPP: 1330
- N20: 1330
- MOB: 2130
- MOC: 2130
- DMSP – not exactly sure of status...



Hurricane Dorian from NOAA-20

August 31, 2019



4-8 November 2019

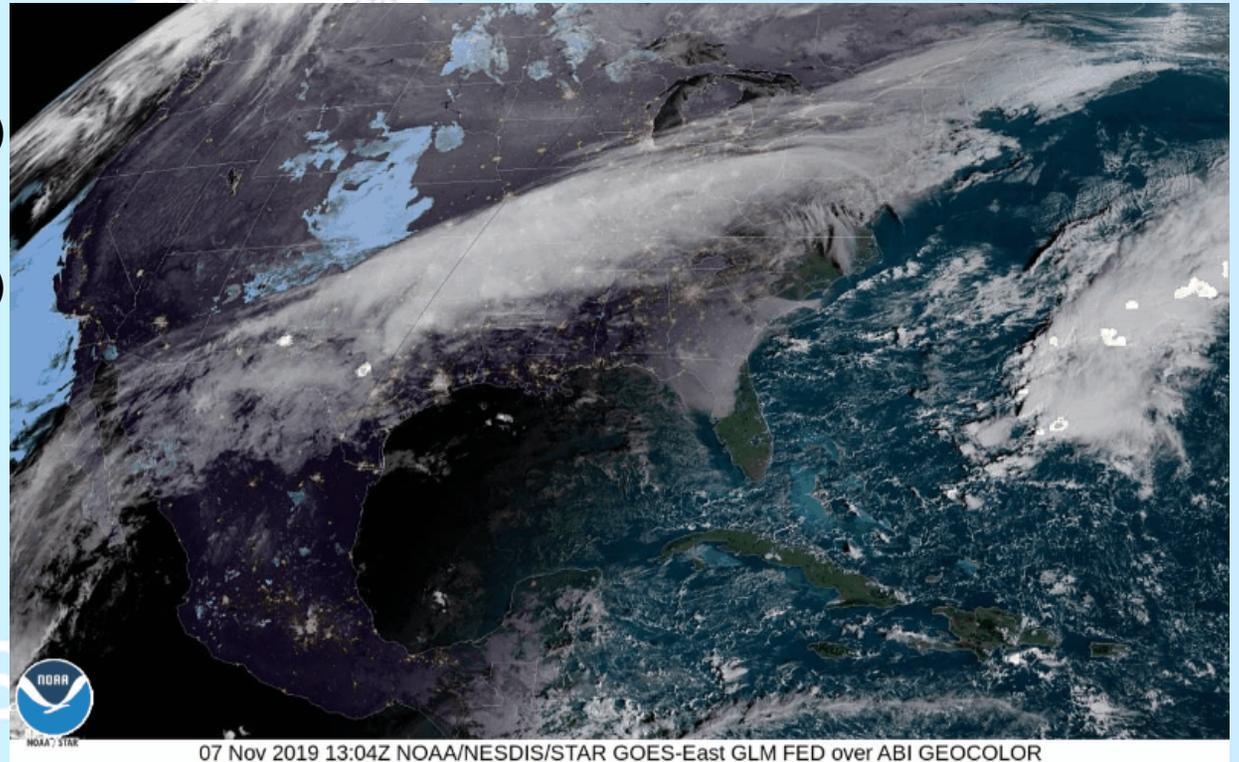
Indianapolis, IN

5

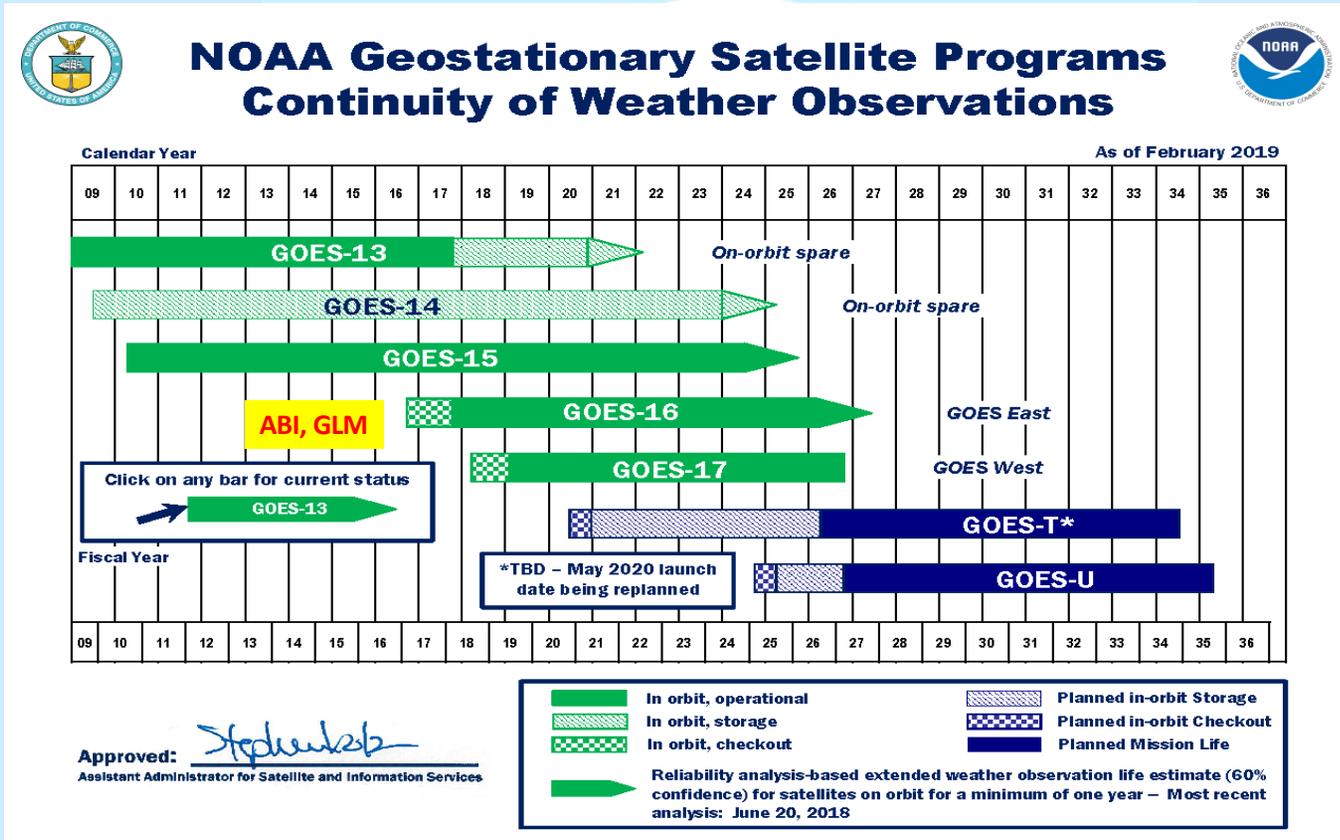


Update on Satellites - GOES

- GOES-16 (GOES-E @75.2 W)
 - ABI and GLM Sensors performing to specifications
- GOES-17 (GOES-W @137 W)
 - Launched 3/1/18
 - ABI sensor having loop heat pipe issues
 - Mainly impacts near-IR channels and when out of sun
 - Mitigation processes have been implemented
- GOES-T (May 2021)



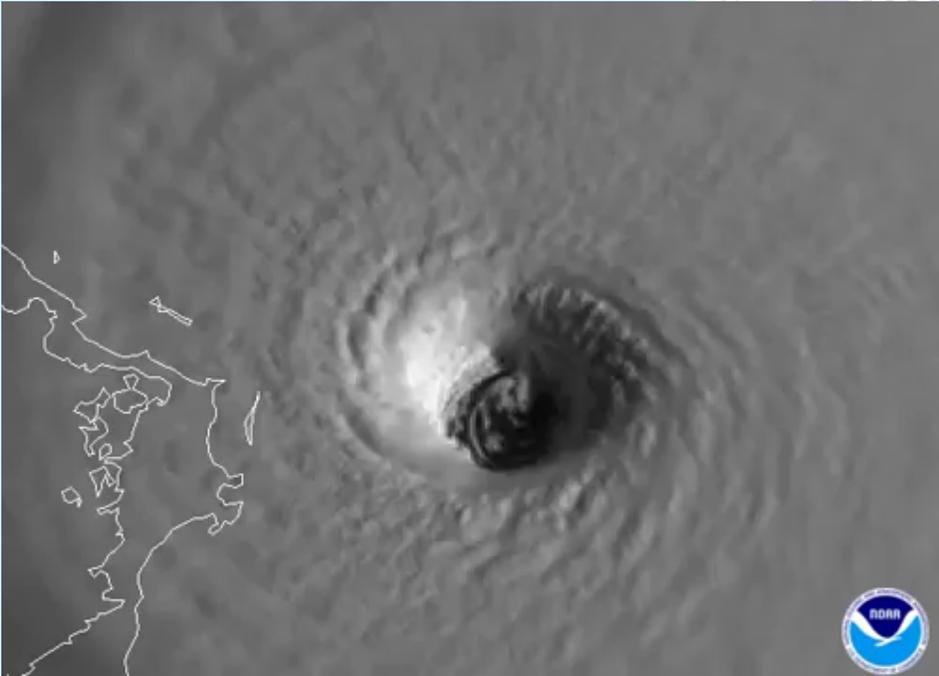
GEO Satellites



Hurricane Dorian from GOES-16 – September 1, 2019

ABI 1 minute imagery

ABI and GLM imagery



Primary Operational Product Systems

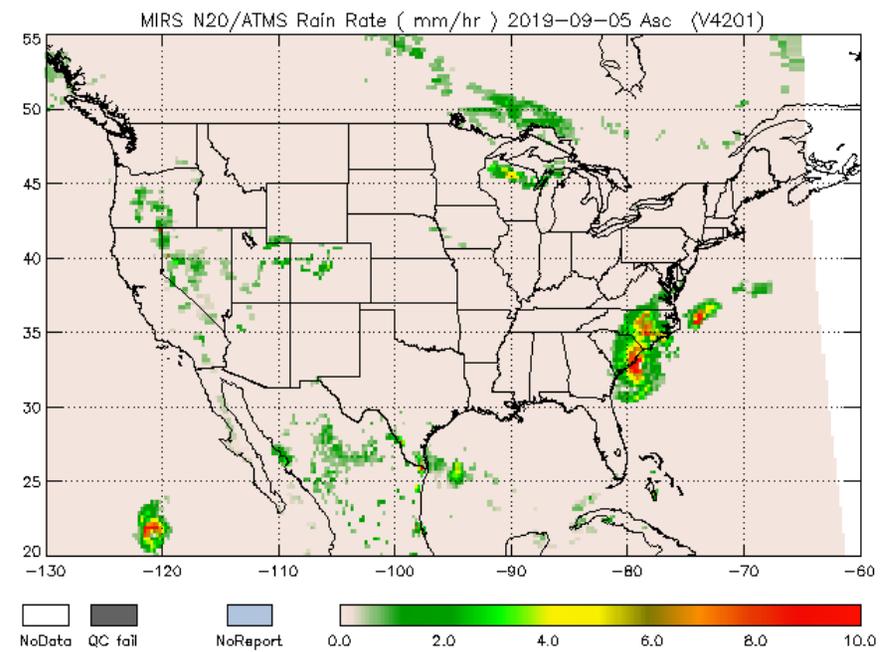
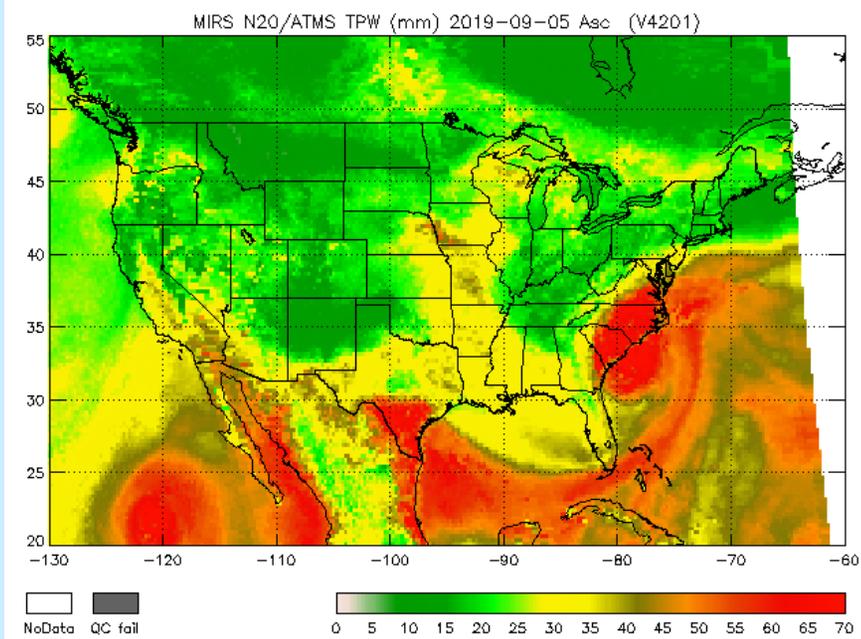
(Support S-NPP, NOAA-20, GPM, GCOM, POES, DMSP, MetOp satellites)

- Microwave Integrated Retrieval System (MiRS)
 - <http://www.ospo.noaa.gov/Products/atmosphere/mirs/index.html>
- Microwave Snowfall Rate (SFR)
 - <http://www.ospo.noaa.gov/Products/atmosphere/mirs/index.html>
- NOAA Operational GCOM-W1 AMSR2 Products System (NOGAPS)
 - <http://www.ospo.noaa.gov/Products/atmosphere/gpds/>
- NESDIS Operational Soil Moisture Products (SMOPS)
 - <http://www.ospo.noaa.gov/Products/land/smops/index.html>
- Blended TPW/RR (bTPW/bRR)
 - <http://www.ospo.noaa.gov/Products/atmosphere/brr/>
- Ensemble Tropical Rainfall Prediction (eTRaP)
 - <http://www.ssd.noaa.gov/PS/TROP/etrap.html>



Hurricane Dorian from NOAA-20 – MiRS Products

September 5, 2019



N20 MiRS Rain Rates

Chris Grassotti, Univ. MD/CISESS

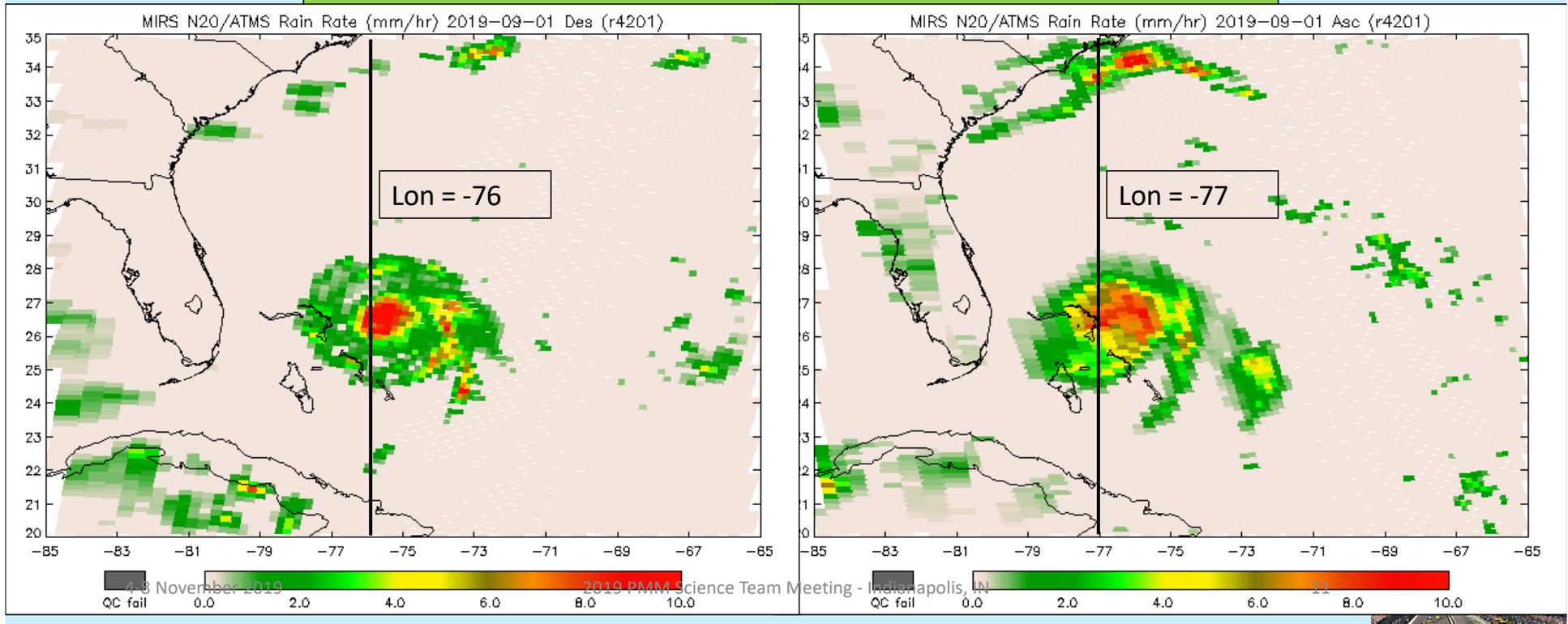
Hurricane Dorian, 2019-09-01

MiRS NOAA-20/ATMS Example of Retrieved TC Warm Core Anomaly

TC Center Location:

Ascending: 26.5°N, 77.1°W

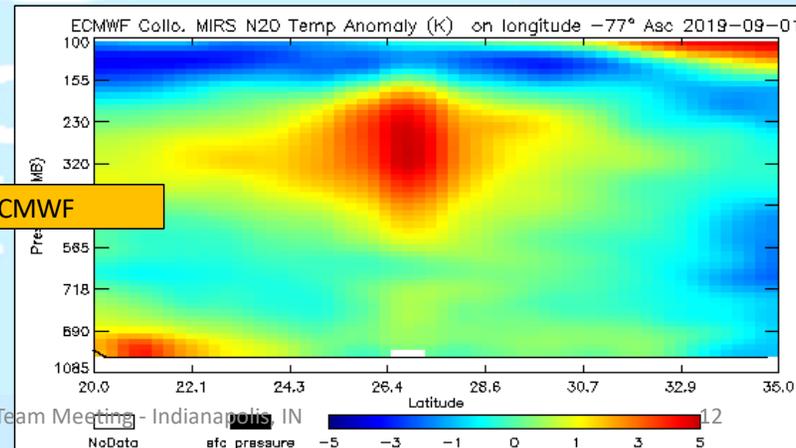
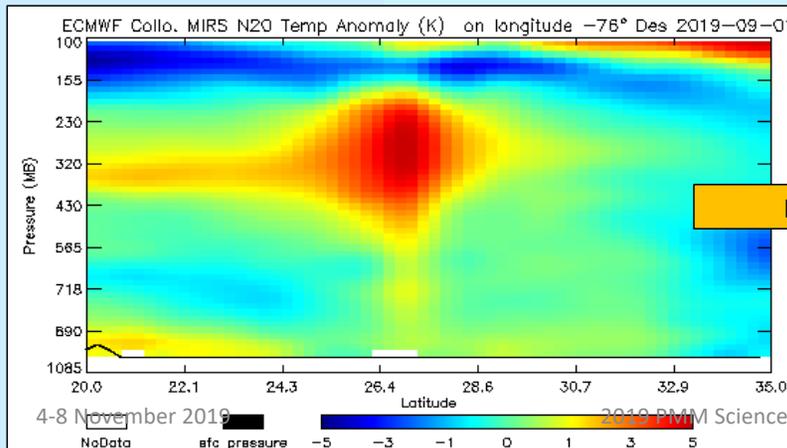
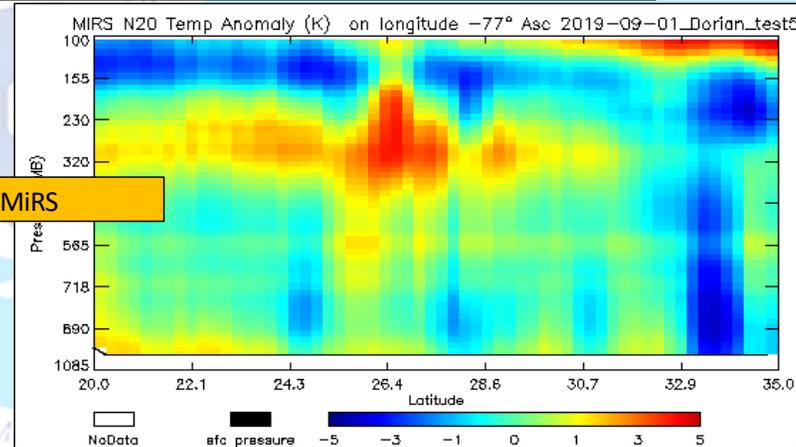
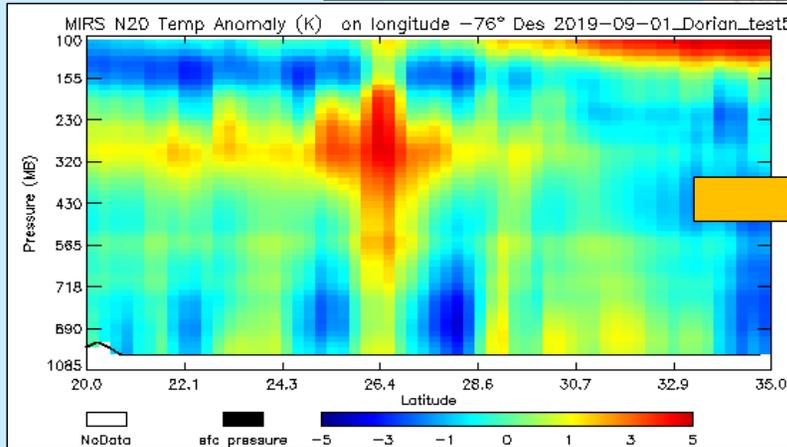
Descending: 26.3°N, 75.6°W



MiRS Warm Core Anomalies

Chris Grassotti, Univ. MD/CISESS

Demonstrates synergistic use of complete set of MW sounding channels



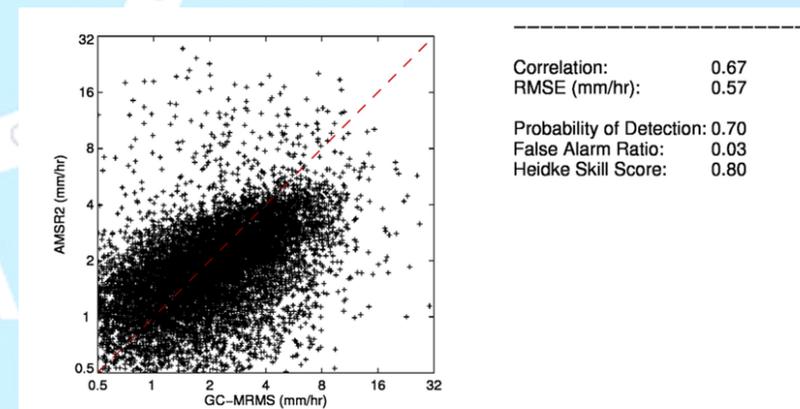
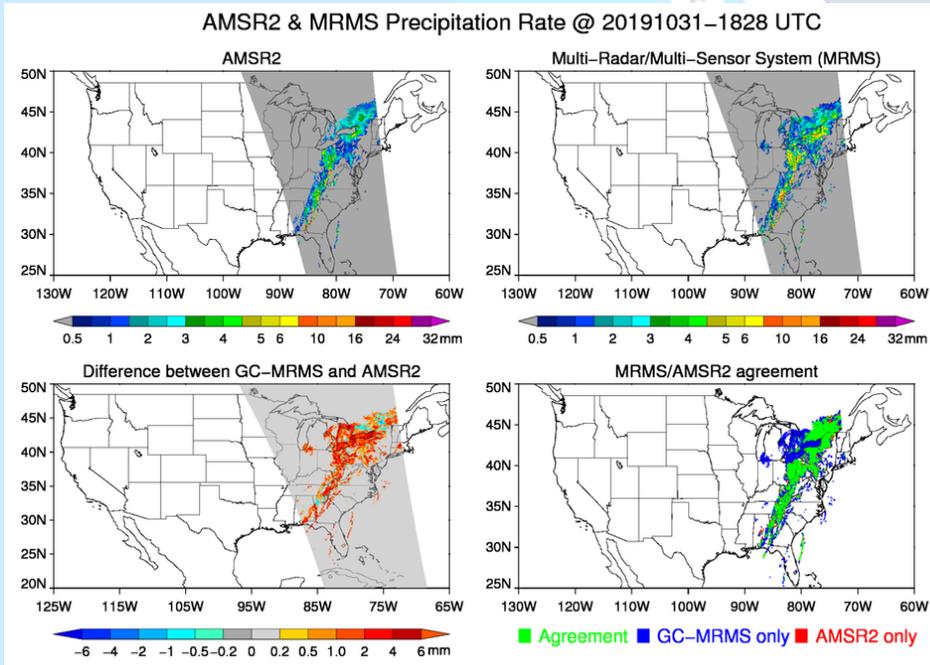
4-8 November 2019

2019 BMM Science Team Meeting - Indianapolis, IN



NOAA GPROF2010V3 for AMSR-2

V3 recently implemented – reduces false alarms in light rain situations, descending (nite) node



Evaluation of GPROF2017 for NOAA AMSR-2

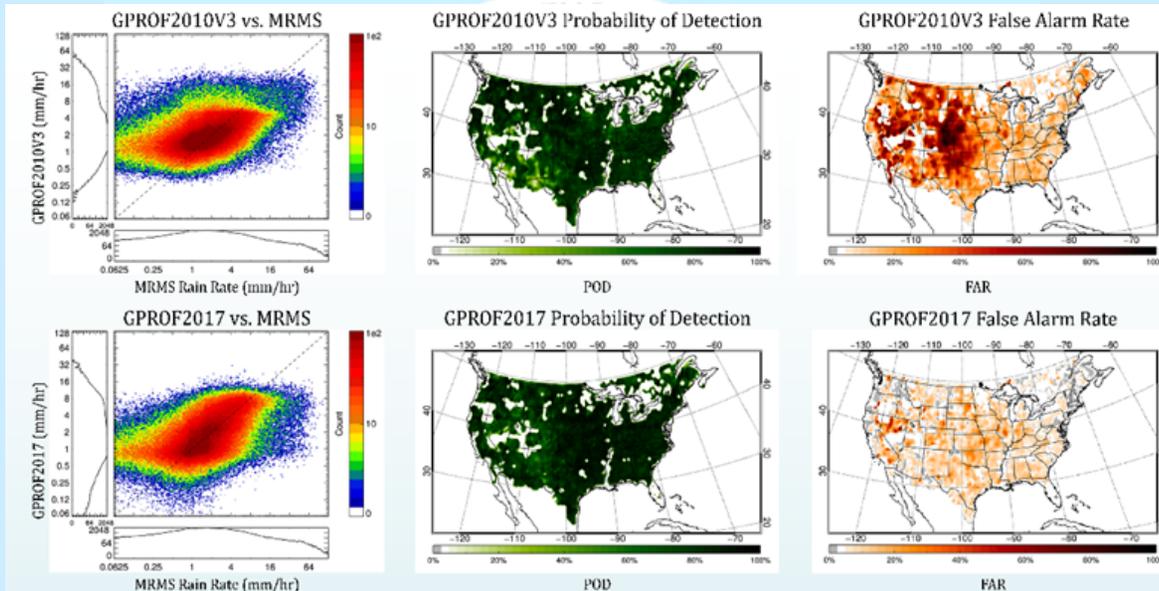


Figure 4: Comparisons of GPROF2010V3 (top) and GPROF2017 (bottom) relative to MRMS rain rates over a 1-yr period. Rain detection is superior for GPROF2017.

Algorithm	RMSD	POD	FAR
GPROF2010V2	6.55 mm h ⁻¹	73.1%	38.1%
GPROF2010V3	6.23 mm h ⁻¹	72.2%	27.9%
GPROF2017	6.86 mm h ⁻¹	85.6%	9.8%

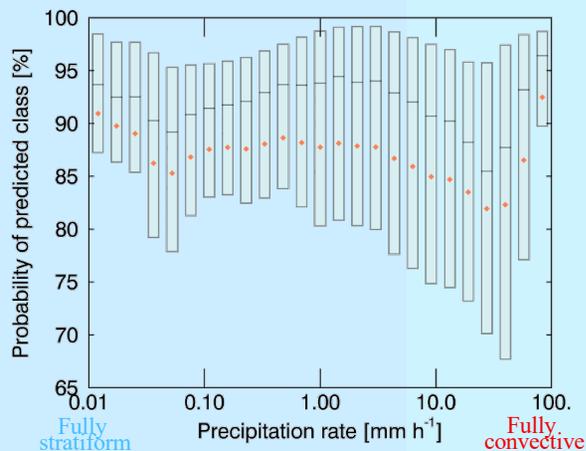
Table 1: Accuracy and detection metrics for GPROF2010 and GPROF2017 relative to MRMS over CONUS for a 1-year period.



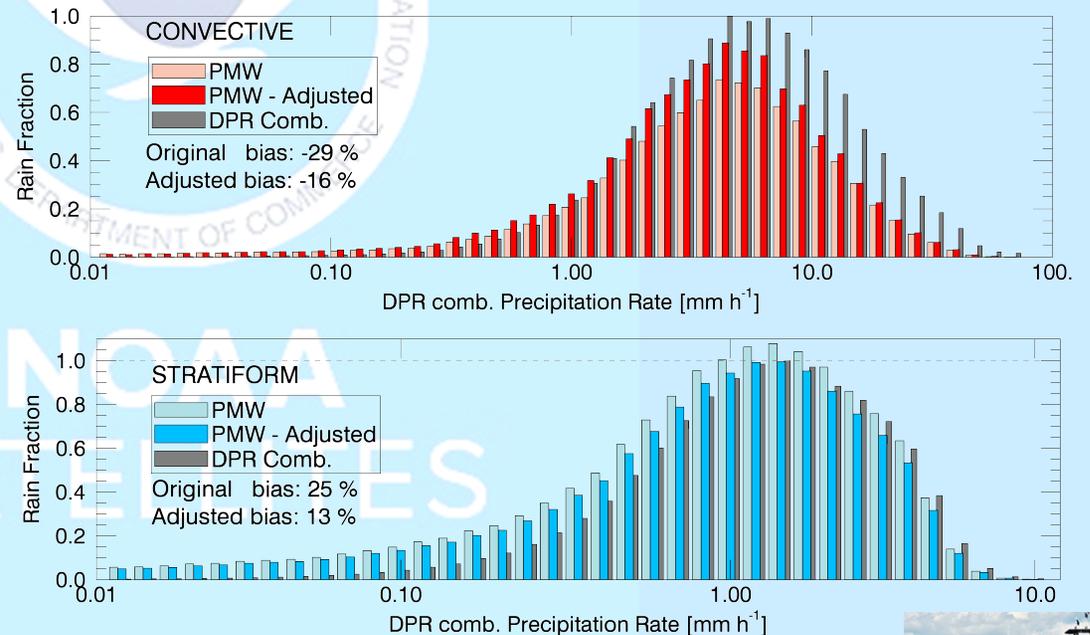
Upgrading convective fraction scheme for use with AMSR-2

- Current AMSR2 GPROF convective index is used only over land
- An upgrade to include Bayesian algorithm and new convective fraction module is scheduled for spring 2020

Convective scheme consistency



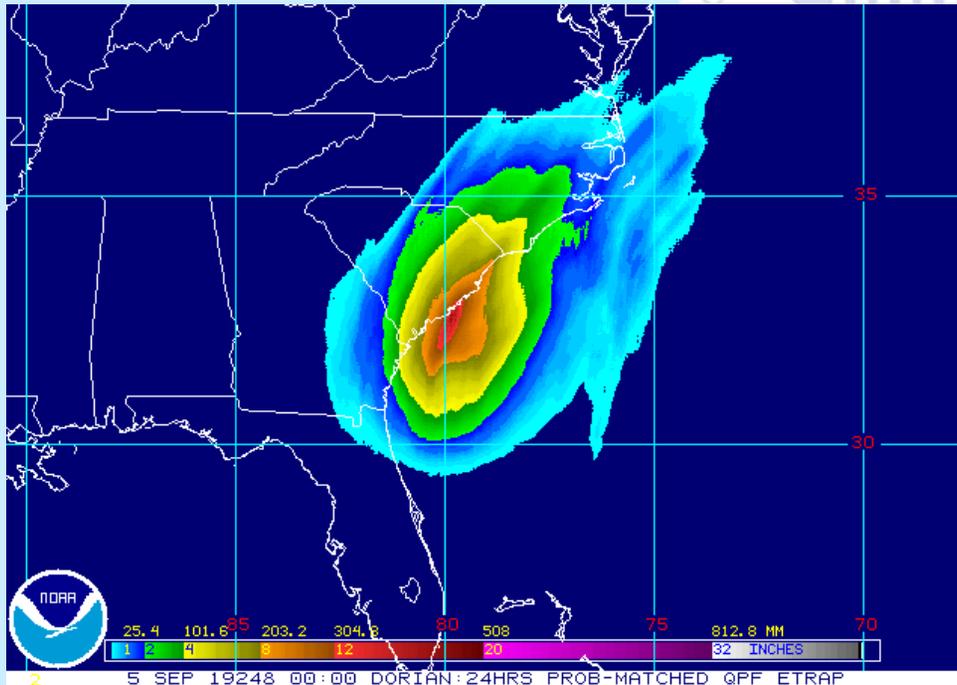
Mean global annual bias reduction over land



Accuracy [%]				
By volume		By count		
Conv	Stra	Conv	Stra	
55	79	14	56	GPROF-2010
67	98	39	98	New scheme



Ensemble Tropical Rainfall Potential (eTRaP) – Dorian Landfall



Individual rain estimates used –
16 in total (including a GMI/MiRS retrieval)

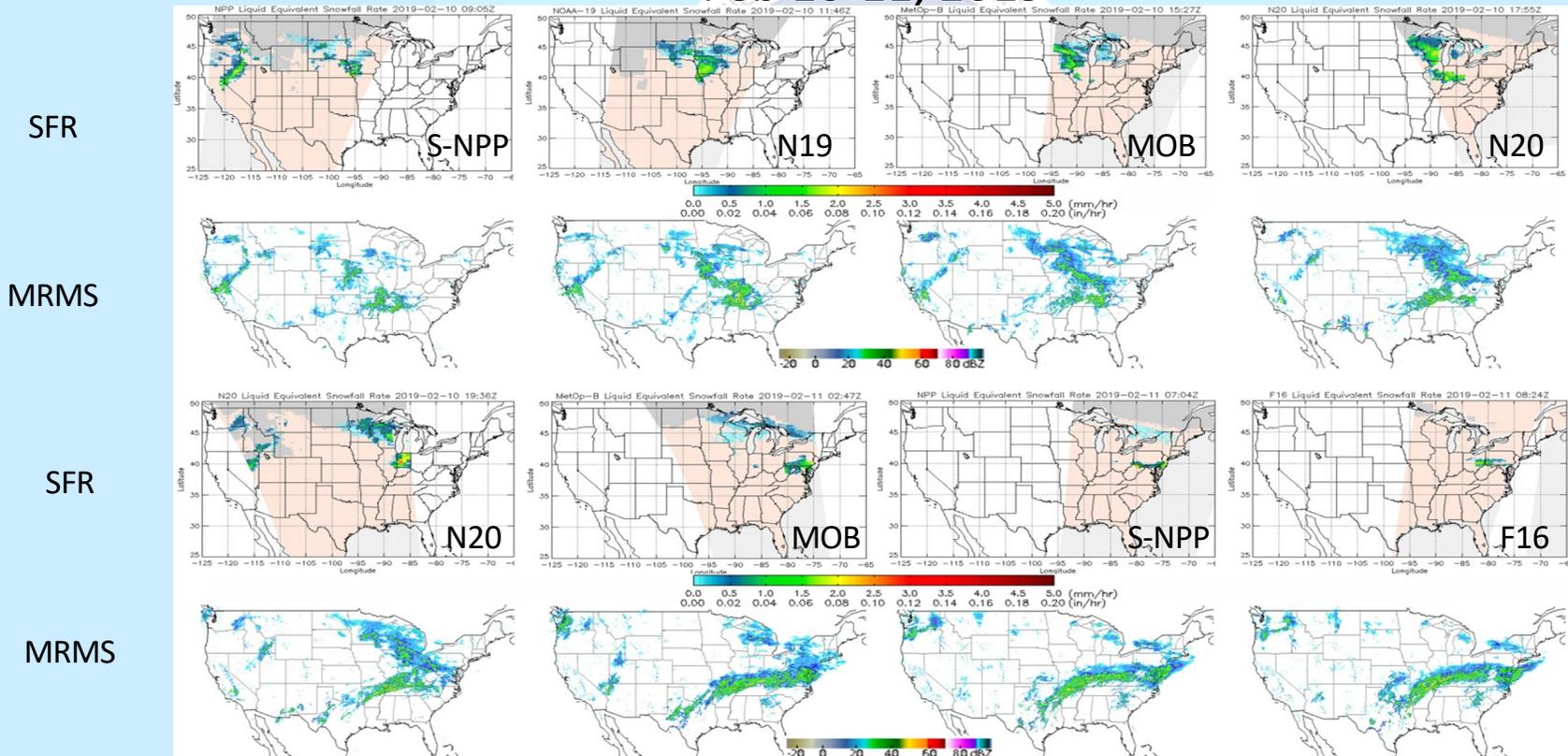
```

/data/Petrap/2019/DORIAN/2019DORIAN.WTNT25.KNHC.040800.RCLIPER.09040800
/data/Petrap/2019/DORIAN/2019DORIAN.WTNT25.KNHC.040854.N20_RAIN.09040712
/data/Petrap/2019/DORIAN/2019DORIAN.WTNT25.KNHC.040854.RRH_AMSR.09040735
/data/Petrap/2019/DORIAN/2019DORIAN.WTNT25.KNHC.041400.RCLIPER.09041400
/data/Petrap/2019/DORIAN/2019DORIAN.WTNT25.KNHC.041456.AMSUM2.09041452
/data/Petrap/2019/DORIAN/2019DORIAN.WTNT25.KNHC.041456.AMSUNP.09041022
/data/Petrap/2019/DORIAN/2019DORIAN.WTNT25.KNHC.041456.RRH_GPM.09041037
/data/Petrap/2019/DORIAN/2019DORIAN.WTNT25.KNHC.041456.SSMISB.09041214
/data/Petrap/2019/DORIAN/2019DORIAN.WTNT25.KNHC.042000.RCLIPER.09042000
/data/Petrap/2019/DORIAN/2019DORIAN.WTNT25.KNHC.042055.RRH_AMSR.09041858
/data/Petrap/2019/DORIAN/2019DORIAN.WTNT25.KNHC.042055.RRH_GPM.09042020
/data/Petrap/2019/DORIAN/2019DORIAN.WTNT25.KNHC.050200.RCLIPER.09050200
/data/Petrap/2019/DORIAN/2019DORIAN.WTNT25.KNHC.050254.AMSUM2.09050209
/data/Petrap/2019/DORIAN/2019DORIAN.WTNT25.KNHC.050254.AMSUNP.09042143
/data/Petrap/2019/DORIAN/2019DORIAN.WTNT25.KNHC.050254.SSMISB.09042333
/data/Petrap/2019/DORIAN/2019DORIAN.WTNT25.KNHC.050254.SSMISC.09042241
Grid information: nc,nr,clat,clon: 800 800 32.30 78.90
Total independent TRaPs used: 16
Ensemble members before cull to 200 : 5 x 8 x 13 x 16 = 8320
Total Ensemble TRaP members: 200
    
```



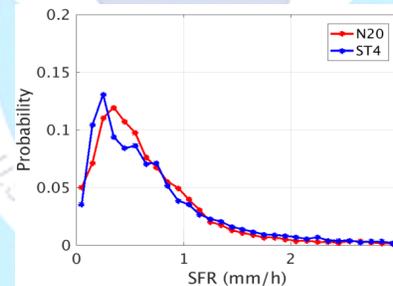
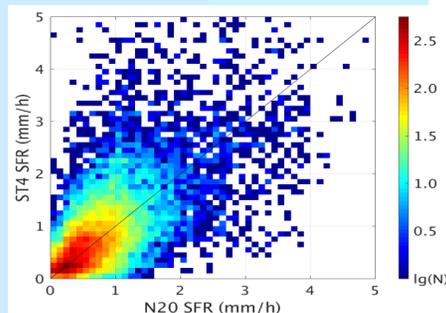
NESDIS Operational SFR vs. MRMS

Feb 10-11, 2019



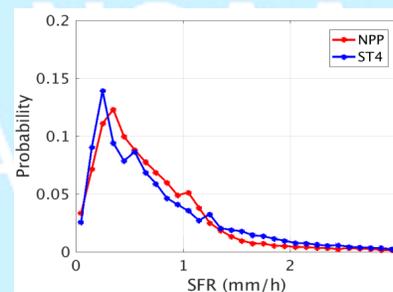
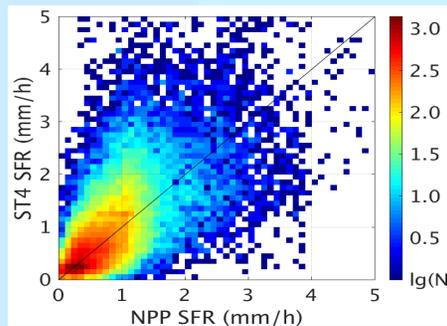
SFR Validation – Latest Algorithm

- Validation data: hourly Stage IV radar and gauge combined precipitation analyses



Corre. Coeff.	0.66
Bias (mm/hr)	-0.07
RMS (mm/hr)	0.57

S-NPP

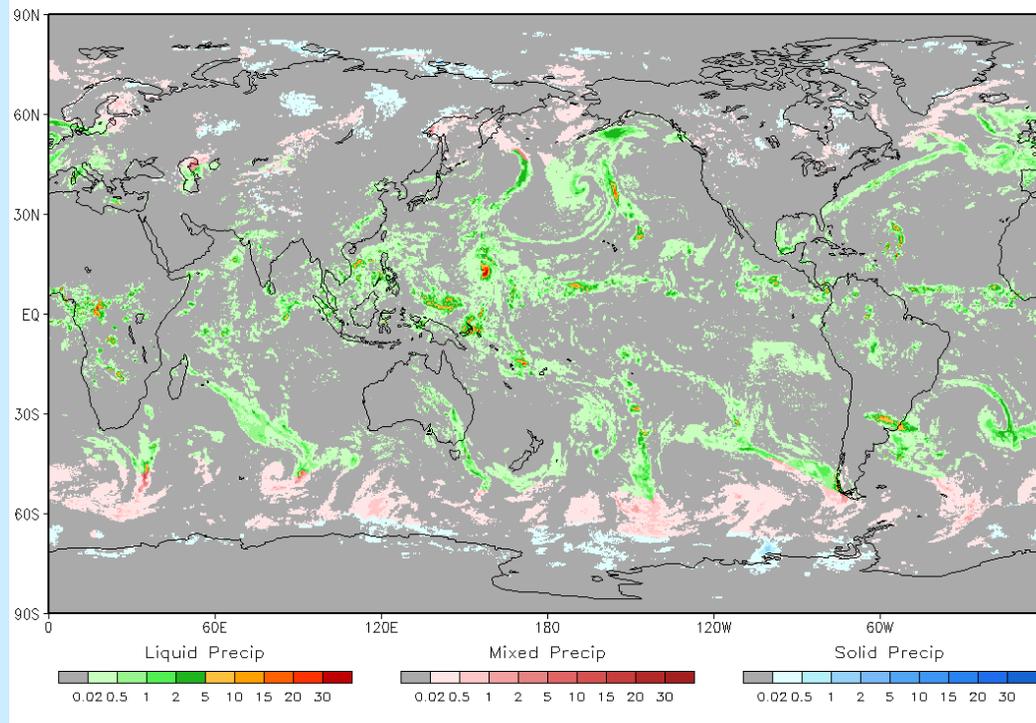


Corre. Coeff.	0.67
Bias (mm/hr)	-0.10
RMS (mm/hr)	0.56

CMORPH2 Covers the Entire Globe with Improved Performance Especially for Snowfall

Pingping Xie, Bob Joyce, NOAA/NWS

CMORPH-2 Precip Rate @ 2019.11.02 14:00Z (mm/hr)



“NOAA PMM Omnibus” Project – Primary Efforts

Support from NOAA programs to NASA

- 1. GPROF usage by NOAA to support operational GCOM AMSR-2 products**
 - Transition GPROF2017 into NESDIS operations
 - Customize if needed
 - Assess performance
- 2. Operational NOAA snowfall rates and use by NWS**
 - Continued comparison between NESDIS SFR and GPM GPROF SFR
 - NWS assessments
 - Use of SFR in NCEP/WPC Winter Weather Experiments
 - Exploit low latency/direct broadcast data streams
- 3. Comparisons of GPM observations with GOES-16/17 ABI and GLM**
 - Exploiting AWIPS system, examine co-incident observations of GMI, ABI and GLM
 - Is there any advantage to using GLM to help constrain GPROF databases?
 - Joint NASA/NOAA ROSES call on GOES-R
- 4. Improvement to CMORPH – Pole to Pole Precipitation CMORPH2**
 - Establishing a sub-system as a part of the CMORPH2 to perform evaluation of L2 retrievals for all PMW sensors generated by NASA/GPM and NESDIS/STAR on a real-time basis;
 - Exploring optimal strategy to quantify precipitation of solid and mixed phases with L2 inputs from various sources
 - Optimize real-time production schedule

Poster 236

Poster 225



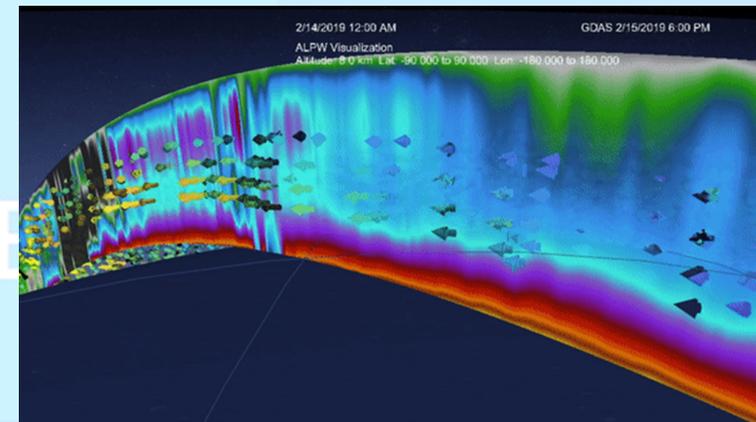
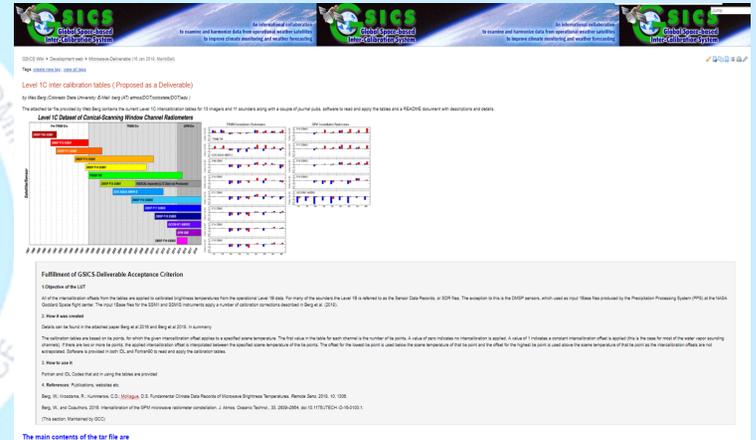
NASA-NOAA MOU on GPM Activities Include....

1. **NESDIS and NWS Satellite Data Sets to PPS**
2. **OSSE's related to DA of GPM data**
3. **NESDIS Autosnow Product for TMPA reprocessing**
4. **MRMS GV Data Sets**
5. **Specialized data sets and engagement on GPM GV programs**
6. **Lake effect snow (Mark Kulie now a NESDIS/STAR employee)**



Other Topics of Interest

- WMO/GSICS X-Cal engagement (Berg, Kroodsma)
 - Provided LUT's as GSICS deliverable
- Sustainment of Great Smoke Mountain Rain Gauge Network (Barros, Miller)
 - Vital for orographic precipitation
- Virtual Reality Applications (Rudlosky et al.)
 - New opportunities for forecasters to exploit satellite hydrological products
- L2 Reprocessing
 - TCDR (MSPPS) rainfall (2000 – present)
 - MiRS + SFR (for S-NPP era to start with)



Summary

- GPM data and products continue to be exploited at NOAA
 - NOAA looks forward to continuing its long standing collaboration with NASA, JAXA and other partners
- Future
 - NOAA moving towards sensor agnostic/enterprise approaches rather than mission specific goals
 - More efficient, more opportunities to leverage non-NOAA assets
 - Concepts such as PPS more 'accepted' than before
 - AI solutions being embraced by current leadership
 - Data explosion
 - Computational efficiency
 - Adaptability
 - GOES-R joint NOI

