Factors Affecting the Performance of IMERG

Pixel-Level Evaluation of IMERG by Sensors, Surfaces and Seasons

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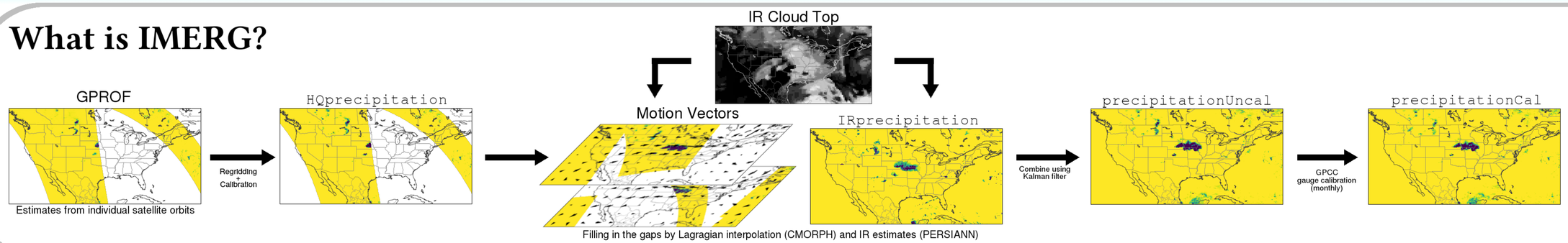
What is IMERG?

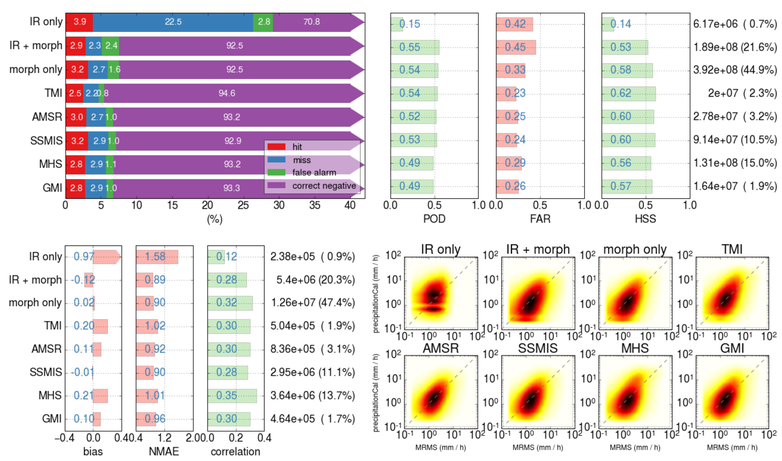


IMERG details
- Integrated MultisatellitE Retrievals for GPM Version 3
- resolution: 0.1°, 30 min
- three runs: Early, Late, and Final

Reference
- Multi-Radar/Multi-Sensor (MRMS) Q3
- WSR-88D network with gauge calibration
- resolution: 0.01°, 30 min
- coverage: CONUS

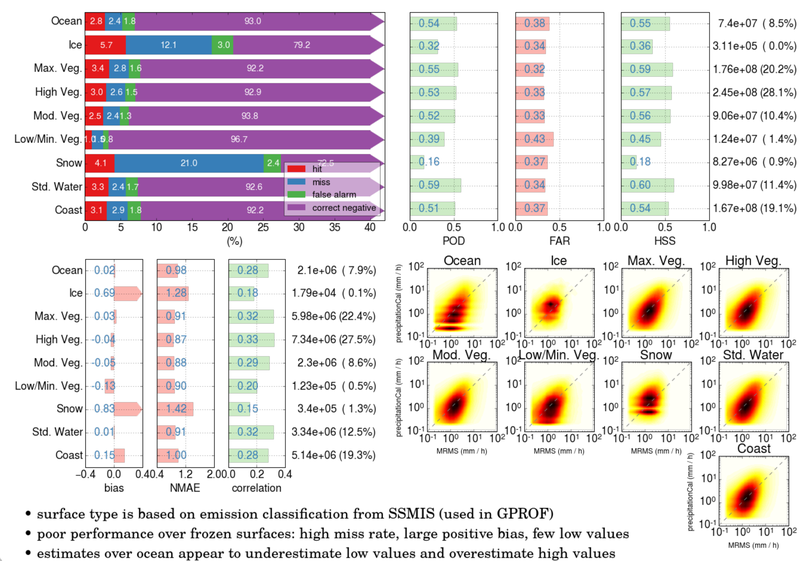
Validation details
- best MRMS liquid precipitation estimates
- rain threshold = 0.2 mm / h
- period = Jun 2014 to May 2015

Performance by Sensor



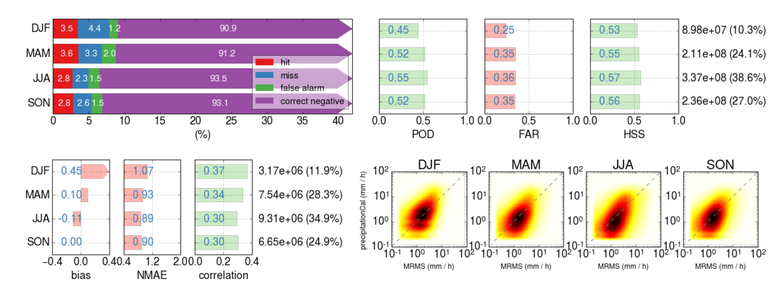
- IR estimates are poor: high miss rate, low skill score, large positive bias, and weak correlation
- average values of non-IR-only estimates: POD ~ 0.5, HSS ~ 0.6, NMAE ~ 0.95, correlation ~ 0.3
- sounders (MHS) have marginally poorer performance than imagers
- ranking of performance: imagers > sounders > morphing > IR only

Performance by Surface



- surface type is based on emission classification from SSMIS (used in GPROF)
- poor performance over frozen surfaces: high miss rate, large positive bias, few low values
- estimates over ocean appear to underestimate low values and overestimate high values

Performance by Season



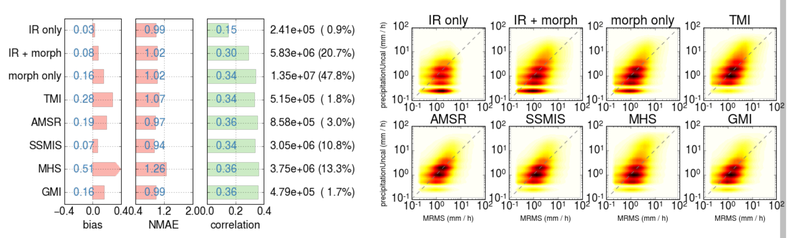
- performance is poorer in winter, consistent with previous studies on other satellite products
- this is not solely due to frozen surfaces: even estimates over frozen surfaces is poorer in DJF

Legend

POD: probability of detection (ideal = 1)
FAR: false alarm rate (ideal = 0)
HSS: Heidke Skill Score (ideal = 1)
NMAE: normalized mean absolute error (ideal = 0)

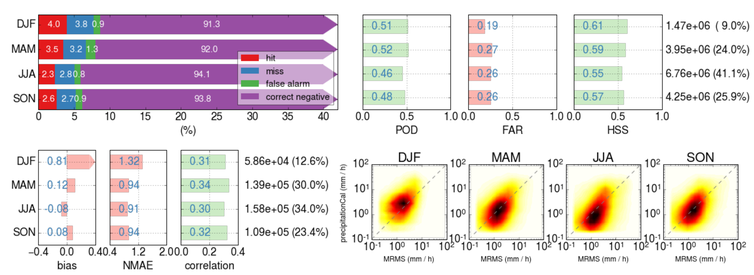
TMI: TRMM Microwave Imager
AMSR: Advanced Microwave Scanning Radiometer
SSMIS: Special Sensor Microwave Imager/Sounder
MHS: Microwave Humidity Sounder
GMI: GPM Microwave Imager

Impact of Gauge Calibration



- gauge calibration generally reduces bias and errors, but also diminishes correlation
- IR estimates are negatively affected by gauge calibration
- note: "waffle" pattern in contour plots is due to discretization at 0.2 mm / h due to lack of gauge adjustment

Performance of GMI



- compared to overall results, GMI is slightly better in rain detection, but slightly poorer in estimating rain rates
- steeper degradation of performance in winter than overall results

Conclusions

- IMERG estimates have: POD ~ 0.5, HSS ~ 0.6, NMAE ~ 0.95, correlation ~ 0.3
- estimates are good when: based on PMW, over vegetation or water, or during warm season
- estimates are poor when: based on IR, over frozen surfaces, or during winter
- GMI is slightly better in rain detection but slightly poorer in estimating rain rates
- gauge calibration reduces biases and errors overall, but also reduces correlation
- results here are at the pixel-level; aggregating over larger areas and longer periods will improve results

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