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How accurate are precipitation retrievals from space-borne passive microwave radiometers?

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Abstract

- **Precipitation retrievals from 12 space-borne passive microwave (PMW) radiometers are evaluated against a high-resolution ground radar-based dataset over the continental United States.**
- **Study the error propagation from single sensor precipitation retrievals to the multi-sensor precipitation products benefits both data producers and end users.**
- **PMW radiometers include imagers (TMI, AMSR-E, SSM/I) and sounders (AMSU-B and MHS).**

Study Data

Table 1. Characteristics of passive microwave radiometers and data availability of retrieved precipitation

Satellite Sensor	Channels	Finest Spatial Resolution at nadir (km)	Swath Width (km)	Scan Pattern	Data Period	Equator Cross Time (Designed)
TRMM TMI	9	14	878	Conical	Dec.1997-present	Precessing
EOS Aqua AMSR-E	12	15	1445	Conical	Jun.2002-Oct.2011	1:30 A.M./P.M.
DMSP F13 SSM/I	7	15	1700	Conical	May 1995-Nov.2009	5:42 A.M./P.M.
DMSP F16 SSMIS	24	12.5	1707	Conical	Nov. 2005 - present	8:20 A.M./P.M.
DMSP F17 SSMIS	24	12.5	1707	Conical	Mar. 2008 - present	5:30 A.M./P.M.
DMSP F18 SSMIS	24	12.5	1707	Conical	Mar.2010 - present	7:55A.M./P.M.
NOAA-15 AMSU-B	5	16	2178.8	Cross track	Jan.2000-Sep.2010	7:30A.M./P.M.
NOAA-16 AMSU-B	5	16	2178.8	Cross track	Oct.2000-present	2:00A.M./P.M.
NOAA-17 AMSU-B	5	16	2178.8	Cross track	Jun.2002-Dec.2009	10:00A.M./P.M.
NOAA-18 MHS	5	17	2348	Cross track	May 2005-present	2:00A.M./P.M.
NOAA-19 MHS	5	17	2348	Cross track	Feb.2009-present	2:00A.M./P.M.
MetOp-A MHS	5	17	2348	Cross track	Dec.2006-present	9:00A.M./P.M.

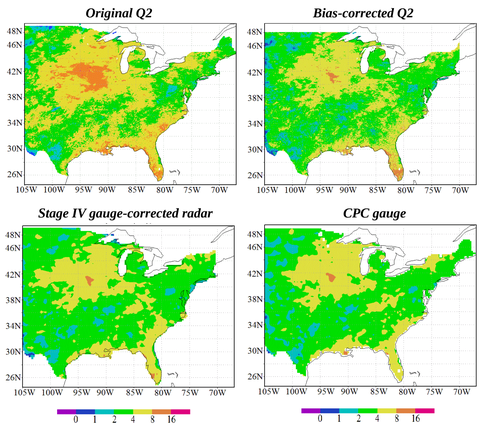
- **Study data are remapped to 0.25 degree grid boxes and 5 minutes time resolution, and coincident with the ground reference.**

Ground Reference

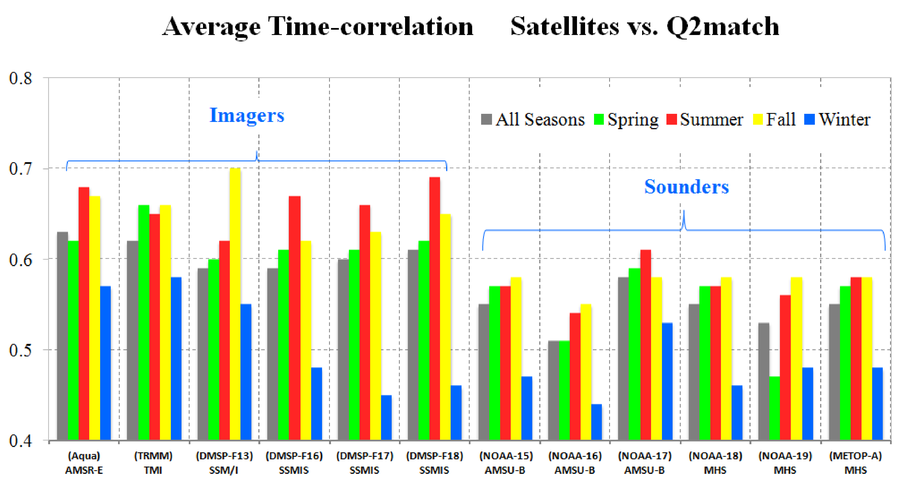
-NOAA National Severe Storms Laboratory's next generation multi-sensor QPE (*Q2*) data over the contiguous US. (*resolution: 5 minutes and 1 km*)

-Q2 data are bias-corrected using radar gauge merged product *NEXRAD Stage IV* data (*resolution: hourly and 4 km*).

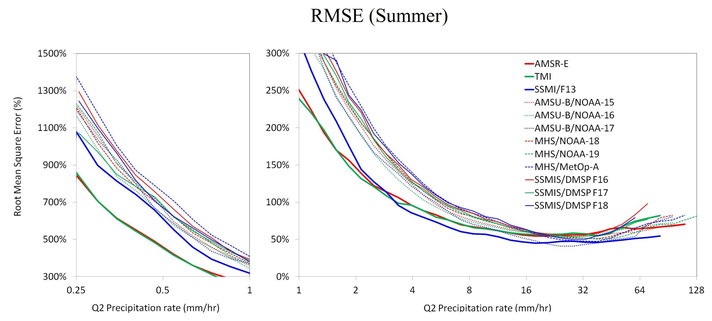
-The original Q2 data show considerable overestimates over the Midwest and Southeast. They are removed after bias correction. (Figure: 06-08/2010 Units: mm/day)

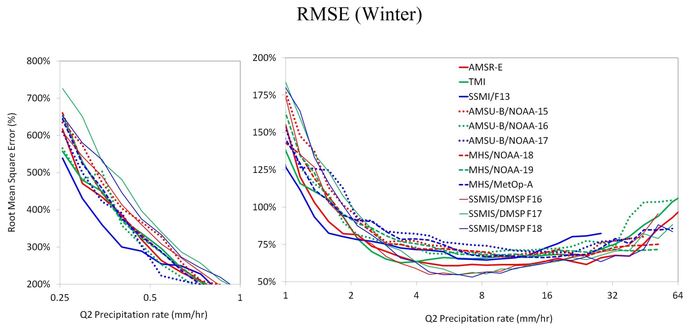


Time Correlation: Imagers better than Sounders

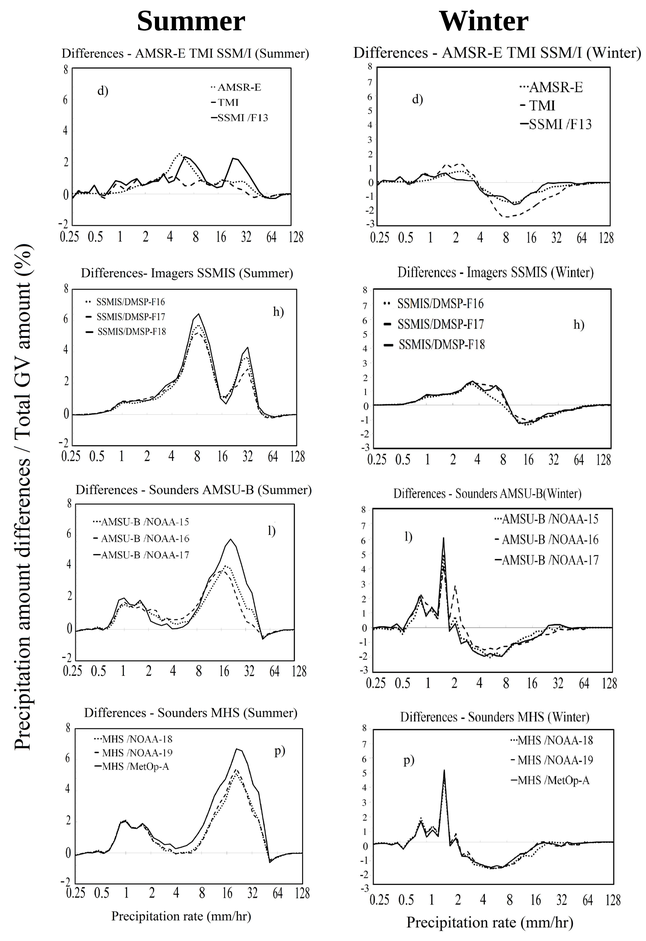


Root Mean Square Error (RMSE): Imagers less than Sounders





$PDF_{Satellite} - PDF_{Q2}$ (PDF Difference): Imagers less than Sounders



Conclusion and Future Work

- **Sensor biases have seasonal and rain intensity dependency: summer – overestimate; winter – underestimate. This feature is also observed in the merged products, suggesting the dominant contribution of the sensor errors to merged products**
- **Retrievals from the microwave imagers have notably better performance than those from the sounders. The latter tend to have a narrower dynamic range, higher biases and random errors.**
- **Future work will focus on investigation of the error decomposition and error modeling of the sensor-level precipitation retrievals, based on [1][2].**

Reference

[1] Tian, Y., C. D. Peters-Lidard, J. B. Eylander, R. J. Joyce, G. J. Huffman, R. F. Adler, K. Hsu, F. J. Turk, M. Garcia, and J. Zeng (2009), Component analysis of errors in satellite-based precipitation estimates. *Journal of Geophysical Research*, *114*(D24), 1–15. doi:10.1029/2009JD011949

[2] Tian, Y., G. J. Huffman, R. F. Adler, L. Tang, M. Sapiano, V. Maggioni, and H. Wu (2013), Modeling errors in daily precipitation measurements: Additive or multiplicative? *Geophysical Research Letters*, *40*(10), 2060–2065. doi:10.1002/grl.50320

[3] Tang, L., Y. Tian, and X. Lin (2014), Validation of precipitation retrievals over land from satellite-based passive microwave sensors, *Journal of Geophysical Research*, doi: 10.1002/2013JD020933.

[4] Tang, L., Y. Tian, F. Yan, and E. Habib (2014), An improved procedure for the validation of satellite-based precipitation estimates, International Precipitation Working Group (IPWG) 6 special issue, *Atmospheric Research, submitted.*

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