Accounting for Surface Ice and Snow in the Goddard Profiling Algorithm Rain Rate Retrievals

Patrick Meyers¹, Ralph Ferraro²

(1) ESSIC, University of Maryland, College Park, Maryland, USA.
(2) Center for Satellite Applications and Research, NESDIS, NOAA, College Park, Maryland, USA.

CoRP Symposium 2015
September 16, 2015
NOAA GCOM-W/AMSR2 Rain Retrievals GPROF2010V2

- GPROF2010V2 (Gopalan et al. 2010; Meyers et al. 2015) adapted for use with AMSR2
- Brightness temperature (Tb) correction addresses nonlinearity of Tb calibration
- For more NOAA GCOM-W contributions see: An overview of NOAA’s GCOM-W1/AMSR2 Product Processing and Utilization – Friday 14:30

Source: JAXA
AMSR2 GPROF2010V2 Structure

- Updated screening procedures to address snow/semi-arid surface (Meyers et al. 2015)
AMSR2 Precipitation Validation

AMSR2 vs TMI Rain: Over Land

AMSR2 vs TMI Rain: Over Ocean

GPCP – June 2013

GPROF AMSR2 – June 2013
Routine Validation

AMSR2 & MRMS Precipitation Rate – 20150627–1758UTC

Reference Statistics

- RMSD : 6.51 mm/hr
- r : 0.31
- POD : 64.7%
- FAR : 27.8%
Similar Signals, Different Realities

- No Precip / No Surface Snow
- No Precip / Surface Snow Present
- Precipitation Present

Legend:
- Snow Possible / Snow Unlikely
- Rain Unlikely / Rain Possible
Low-End Noise in Overnight Rain
Stratiform Precipitation
Spatial Variability of T89-GHz

- Brightness temperature at 89-GHz is more sensitive to ice aloft
  \[ \sqrt{n^2 \sum T_{89H}^2 - \left( \sum T_{89H} \right)^2 \over n^2 - 1} \]

- Rain is spatially non-uniform, hence \( \sigma(T89) \)

- Snow/frozen surfaces expected to be much more uniform

- Not necessarily the case…
Flagging Frequency and False Flagging

Semi-Arid Screen Frequency

Rain Frequency when Scattering Observed

Spatial Variability of T89 Screen Frequency

Rain Frequency when Scattering Observed
Changes to Screening: Conditional Approach

- Automatically screen where:
  1. IMS monthly snow climatology indicates snow is likely
  2. Over IGBP desert scenes
Probability of Detection / False Alarms

- Poor detection in winter areas
- Lack of scattering of light precipitation
Future Work
Summary

• GPROF2010V2 is operational for AMSR2 and meets NOAA’s accuracy and latency requirements

• Empirical Tb relationships are insufficient in identifying light precipitation

• Geographic thresholds needed

• GPROF2014 employs a fully-parametric approach over all surface types (Kummerow et al. 2015)