Surface Characterization for AMSR2 Precipitation EDR

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I. Introduction

Validation efforts are underway to characterize and validate global rainfall calculations from the Advanced Microwave Scanning Radiometer 2 (AMSR2). AMSR2 was deployed by the Japanese Aerospace Exploration Agency (JAXA) aboard the Global Change Observation Mission – Water 1 (GCOM-W1) in May 2012 as part of the JPSS program. The Goddard Profiling Algorithm 2010 (GPROF2010V2) was updated for global rainfall retrievals.

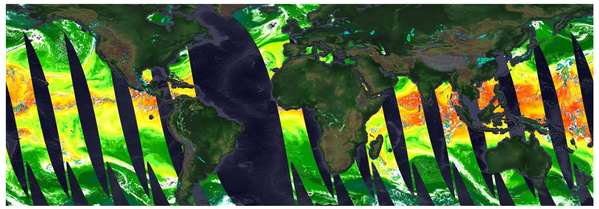


Fig. 1 – Example of Day-1 AMSR2 EDRs. Precipitation and cloud liquid water are overlaid on total precipitable water. Sea surface temperature and ocean wind speed are also produced. Day-2 products include snow water equivalent, sea ice concentration, and soil moisture.

II. GPROF2010V2 Screening Procedures

Identification of precipitation is achieved through a series of screening procedures intended to classify land surfaces. Snow, frozen or wet ground, and semi-arid surfaces can have rain-like radiometric signatures, and are classified using the system below. Note: GPROF2014 determines the presence of rain through a fully parametric retrieval.

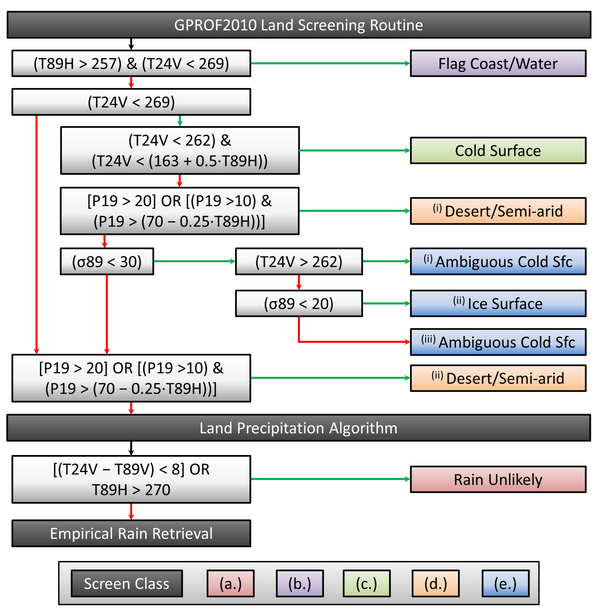


Fig. 2 – Flowchart of GPROF2010V2 surface screening for AMSR2. Scenes where snow is observed for 75% of days in the IMS climatology are automatically flagged. Deserts are also flagged because the algorithm shows low skill separating rain from background noise. Similar screen types are grouped and color-coded.

III. Reaffirming the limitations of empirical screening procedures

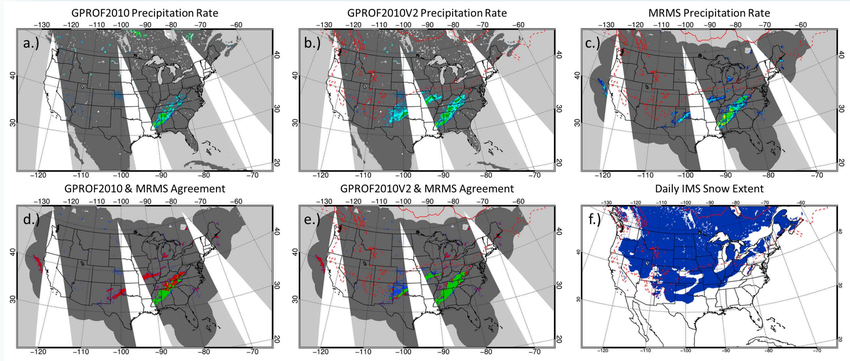
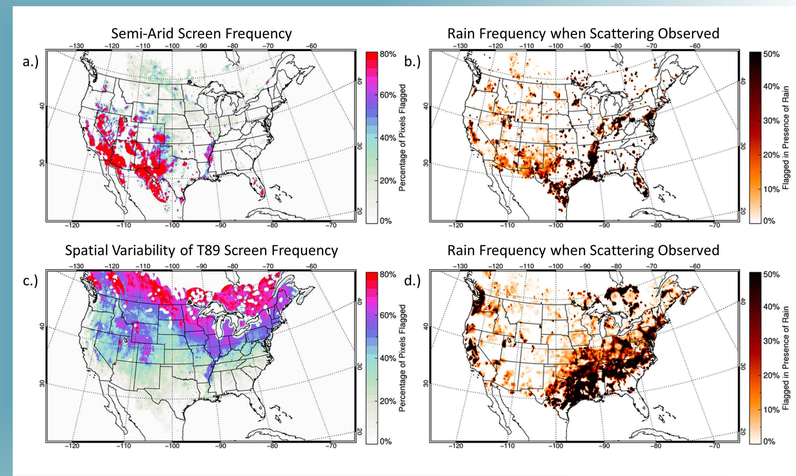
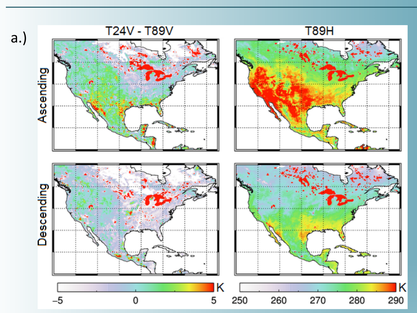
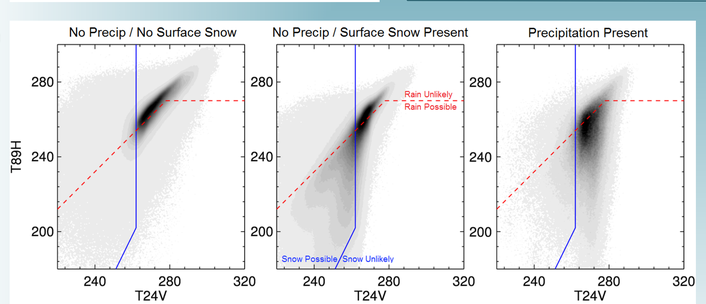


Fig. 3 – Precipitation rates for (a.) GPROF2010, (b.) GPROF2010V2, and (c.) the MRMS radar product on 16 NOV 2014. GPROF2010V2 automatically flags areas where snow is present in 75% of days in the IMS snow record for the given month (solid red line) and only uses snow screening procedures [Fig. 2 (c.) & (e.)] where snow is observed in 5% of the IMS record (dashed red line). Agreement maps show (d.) GPROF2010 misses more areas of precipitation, relative to (e.) GPROF2010V2. The observed IMS snow extent (f.) shows precipitation is still able to be identified over snow surfaces.

Fig. 4 – The screening procedures identify (a.) semi-arid and (c.) cold surfaces, using the screening in Fig. 2 (e.ii) and (c.ii), respectively. In some cases, the scattering indices (Fig. 2 a.) indicate rain is possible and rain is observed by ground radar, but the pixel is incorrectly flagged. For instance, (d.) precipitation is often observed when the flag for uniform cold surfaces is triggered in the southeastern United States.







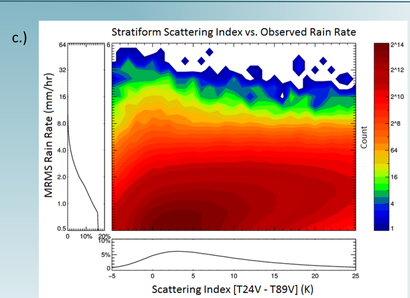
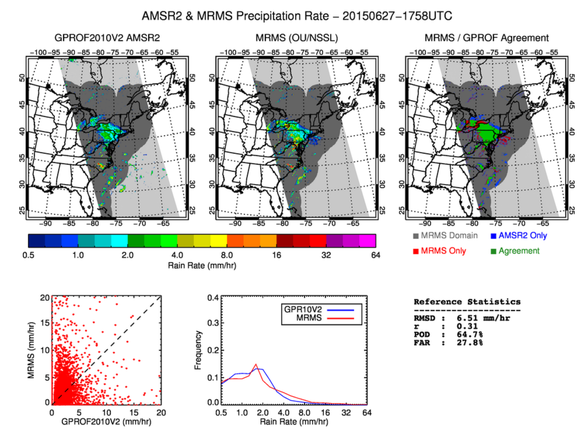


Fig. 5 – (a.) Average value of scattering indices (Fig. 2 a.) separated by ascending (day) and descending (night) orbits. Nighttime AMSR2 retrievals are degraded by patchy precipitation features as a result of cold T89H values. (b.) Frequency of T24V and T89H for different rain and surface snow conditions and the corresponding screens from Fig. 2 a. (red line) and c. (blue line). (c.) Comparison of scattering index and MRMS rain rate for stratiform rain in winter '14-'15. GPROF2010V2 cannot resolve light precipitation by exclusively using the scattering index.

IV. CICS-MD Swath Validation System



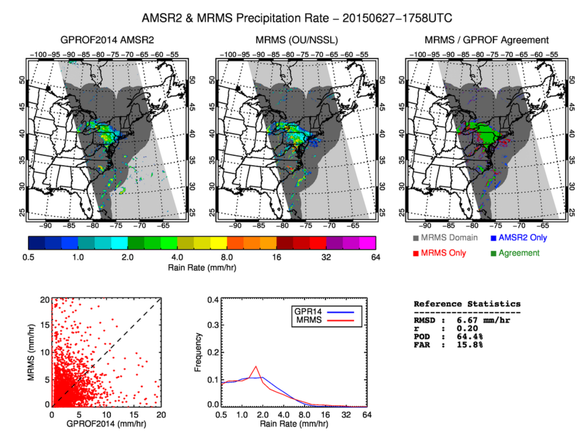


Fig. 6 – Routine monitoring of GPROF2010V2 (top) and GPROF2014 (bottom) for AMSR2 is conducted as part of CICS-MD's IPWG validation system. Instantaneous rain rates measured by AMSR2 are compared to near real time MRMS data.

V. Future Directions

GPROF2014 is being considered to replace GPROF2010V2 as NOAA/STAR's operational algorithm for AMSR2 as the algorithm matures and stabilizes. As part of NOAA's contribution to the GPM program, regionalized precipitation algorithms for the GPM constellation will be developed to support National Weather Service regions outside of the continental United States. These regions have unique climates and surface properties, and are not always well-characterized by global algorithms. In particular, coastal regions will be studied to reduce the frequency of erroneous precipitation retrievals

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