# Preparation of the Goddard Profiling 2010 (GPROF2010) Rainfall Algorithm for AMSR2

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1. ESSIC, University of Maryland, College Park, MD.
2. Center for Satellite Applications and Research, NESDIS, NOAA, College Park, MD.
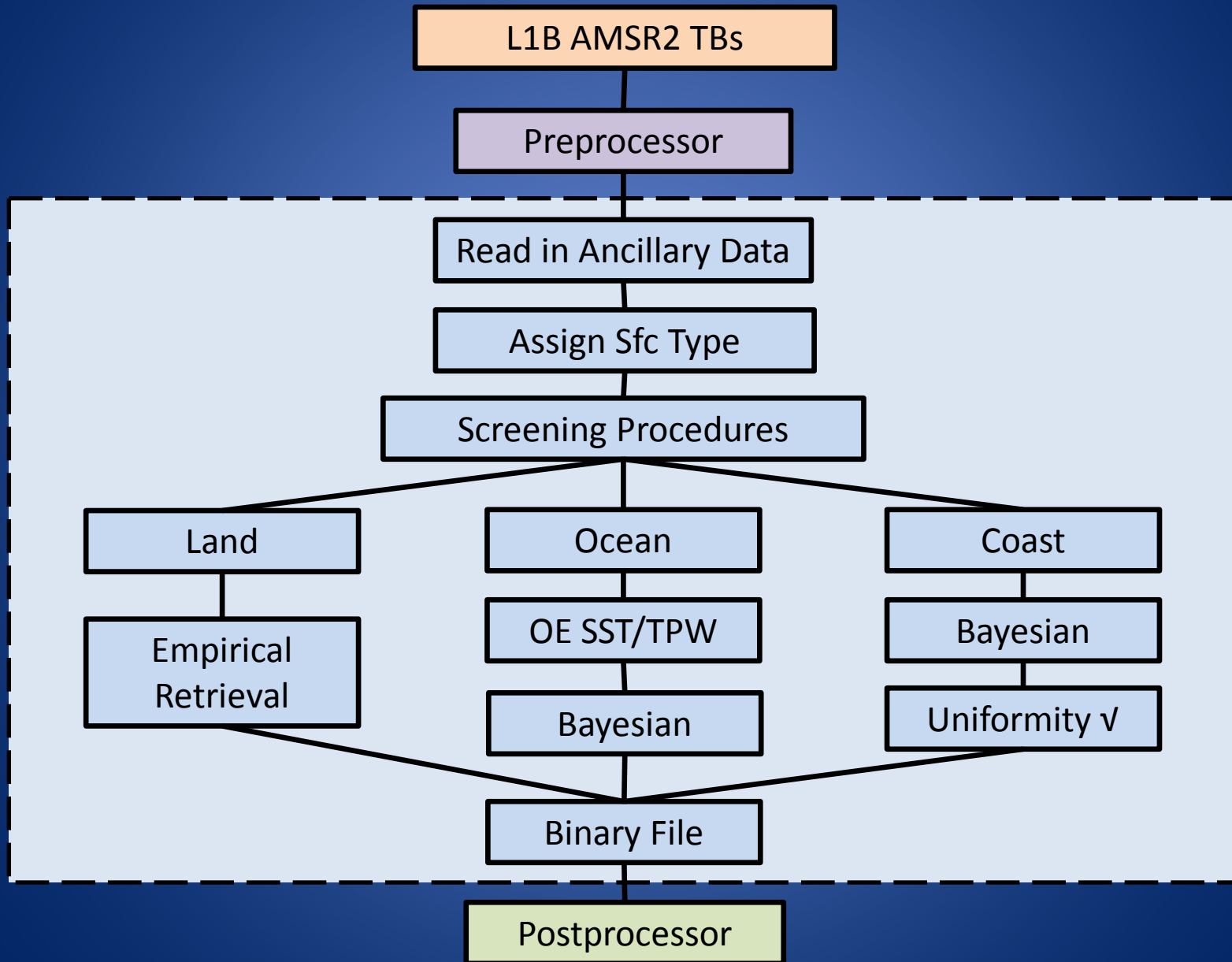3. Department of Atmospheric Science, Colorado State University, Fort Collins, CO.

# AMSR-E & AMSR2

- Advance Microwave Scanning Radiometer aboard Aqua and GCOM-W series satellites
- AMSR2 adds additional RFI channel at 7.3 GHz
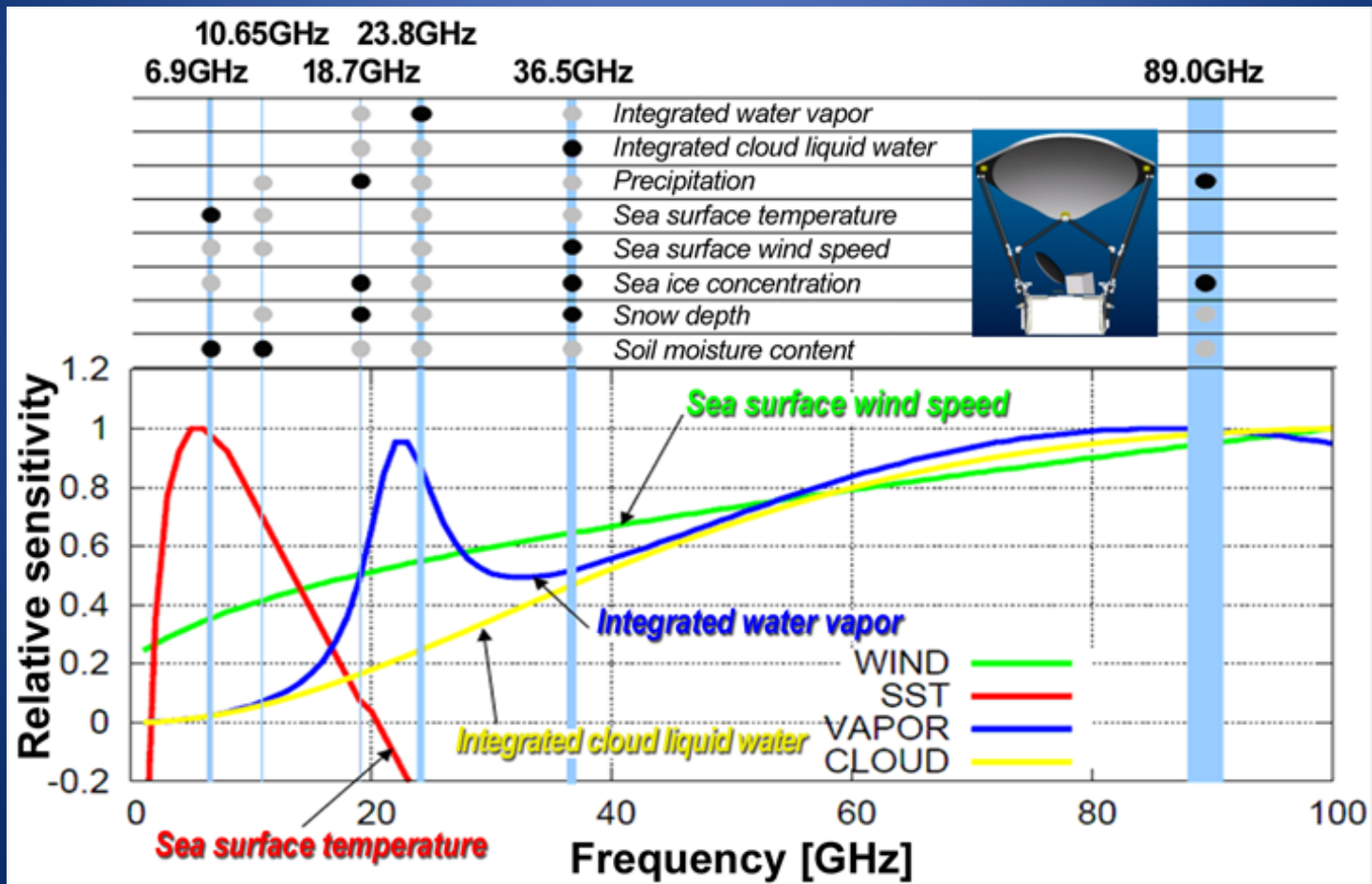


*Source: JAXA - AMSR2 Channel Specification and Products Description*

# GPROF Structure

# Land Segment: Semi-Empirical Calculation

- Developed for TRMM with training dataset from Precipitation Radar (PR) & TMI
  - *Requires adjustment from TMI to AMSR2 frequencies*
- Separated into Convective/Stratiform rain rates

$$RR = RR_{Conv}P(C) + RR_{Strat}[1 - P(C)]$$

- *$RR_{Conv}=(O_3(T89V); RR_{Strat}=O_1(T89V)$*
- *$P(C$[TbV(10, 37, 89), σ(T89V), Minima of T89V, [T89V-T89H]$)$*

# Brightness Temperature Correction
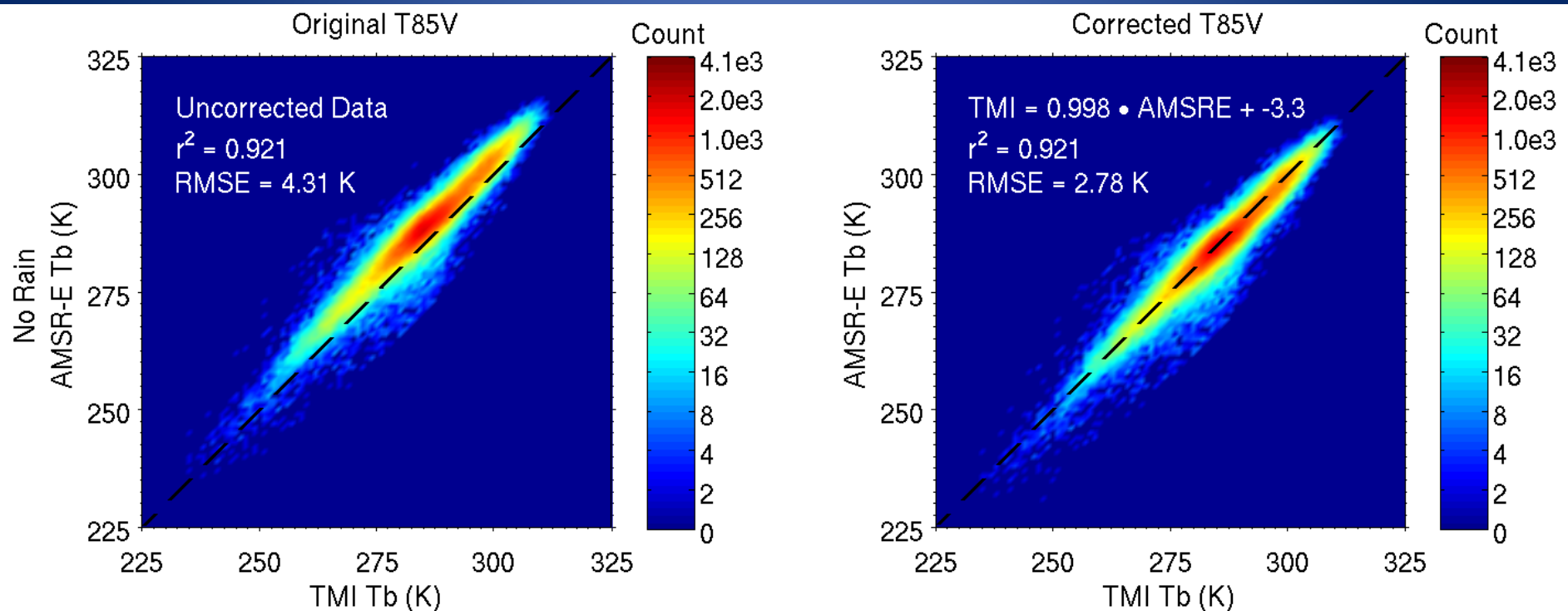


- Collocated TMI & AMSR-E data (1.5 km & 30 minutes)
- Correlation  coefficients computed
- Adjusts  brightness temperatures by over 3.5 K

# Precipitation Screening Over Land

- Precipitation identified as ice scattering
  - *Tb depression at 89-GHz*
- Some surfaces are radiometrically similar to rain signal
  - *Surface ice and snow*
  - *Desert*
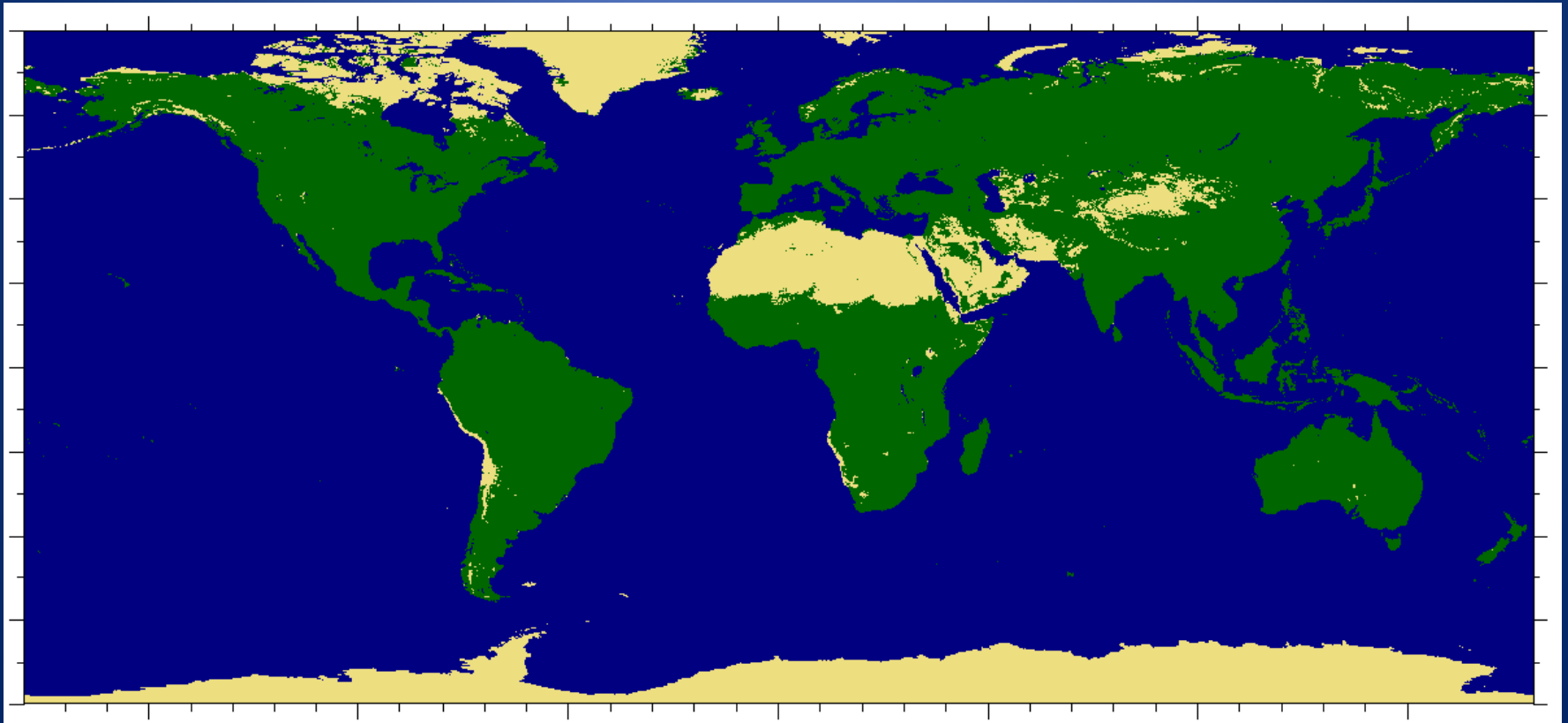- Original GPROF screening was "universal"
  - *No external surface type information*

# Screening Problem



NMQ Rain Rate - 30 April 2010

GPROF Rain Rate - Original Screening
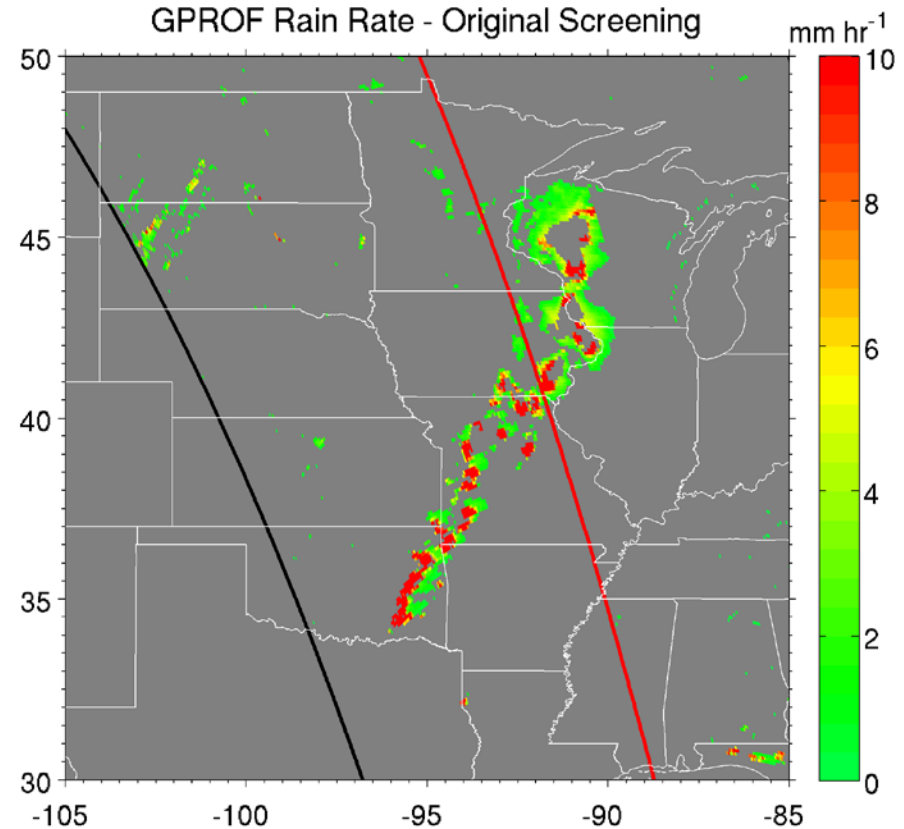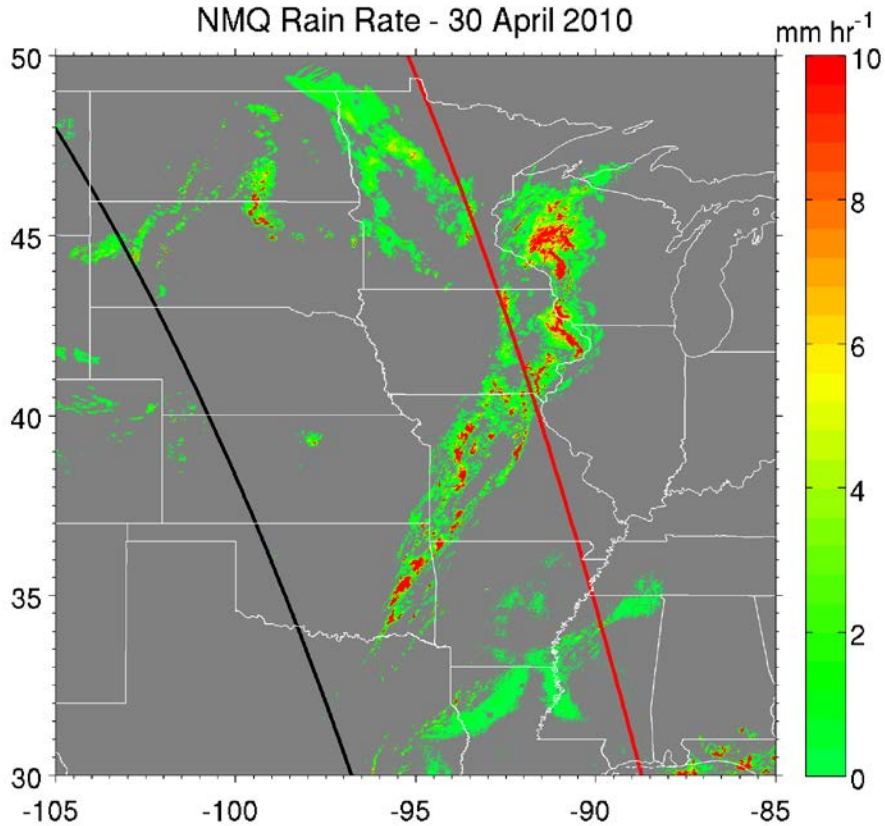
- New plan: Take advantage of ancillary data

# Climatological Desert Screening

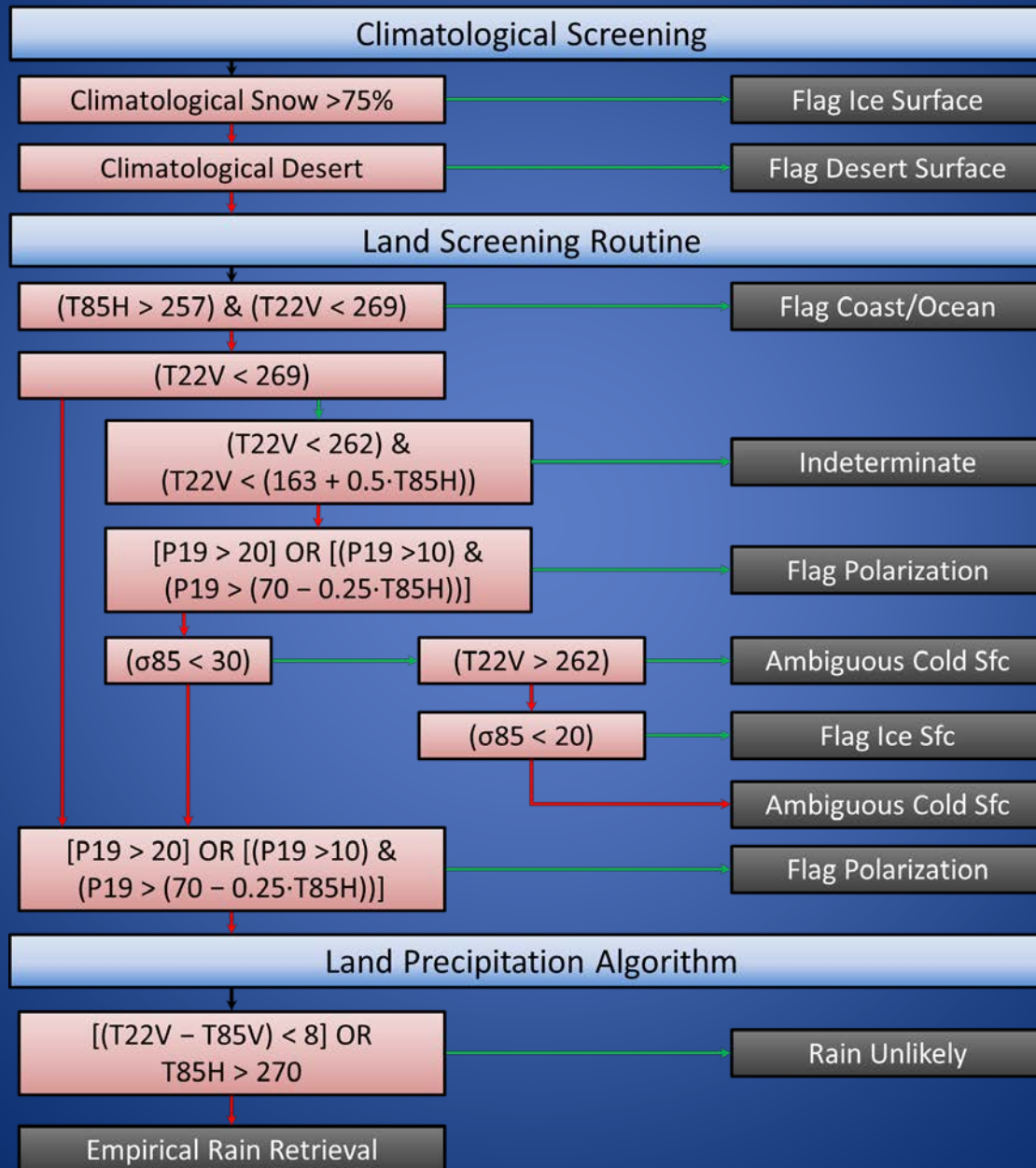– *International Geosphere/Biosphere Programme 1/12° scene types*
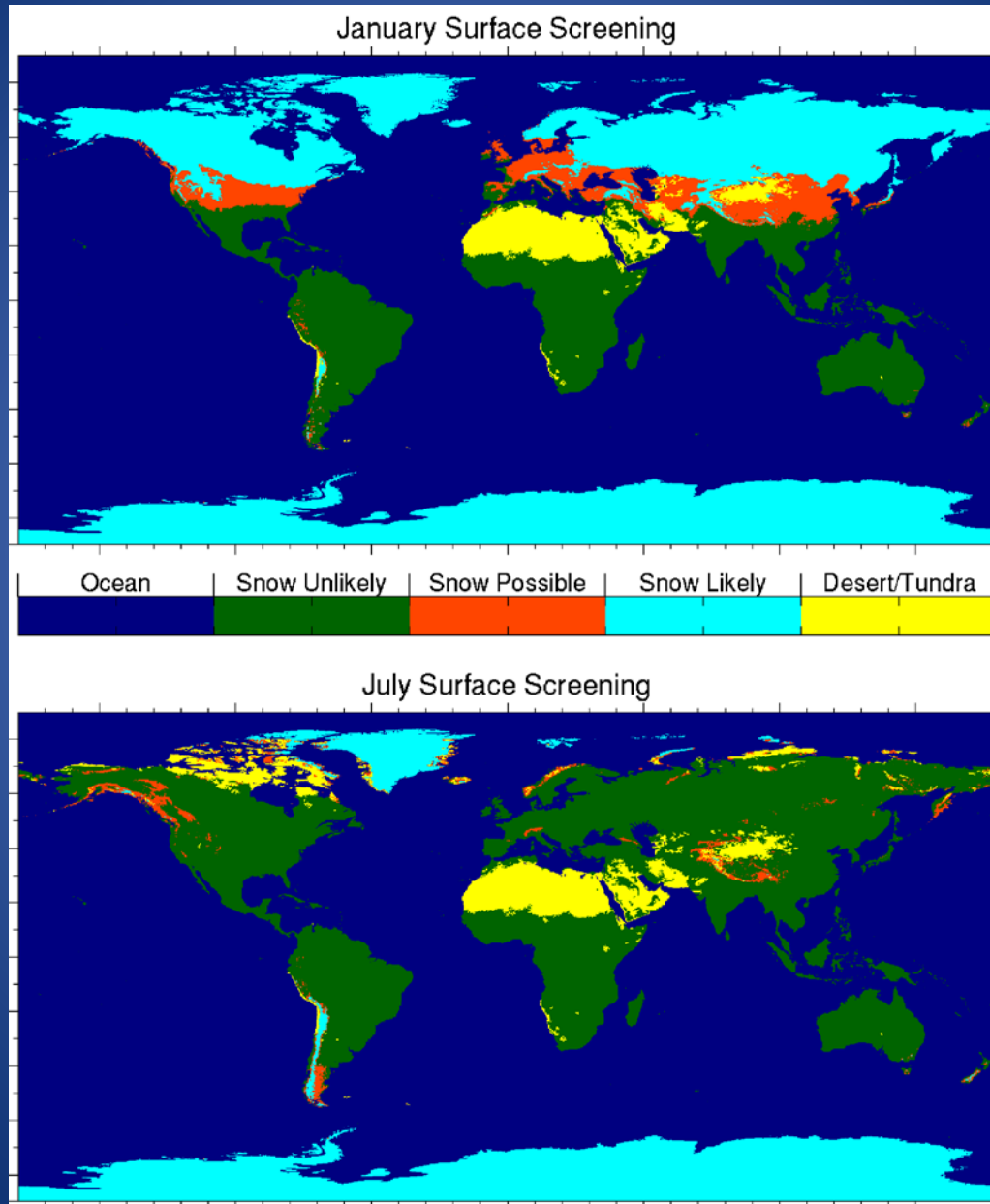
# Climatological Snow Screening

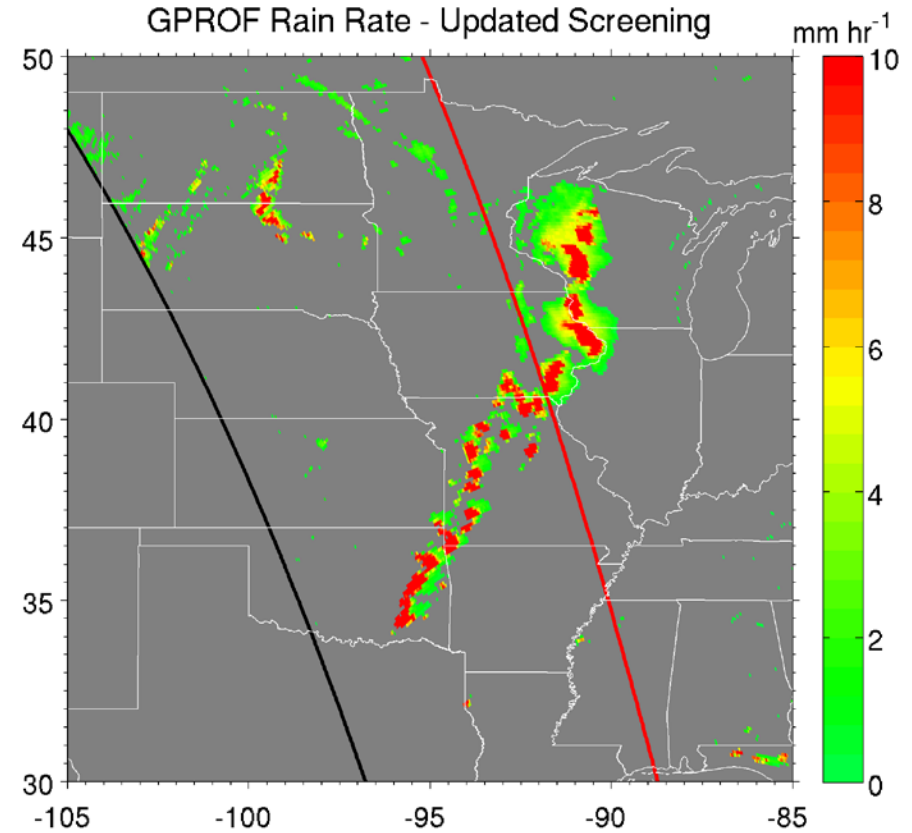– *Interactive Multisensor Snow and Ice Mapping System Monthly & AMSR-E*



Frequency of January Snow Cover
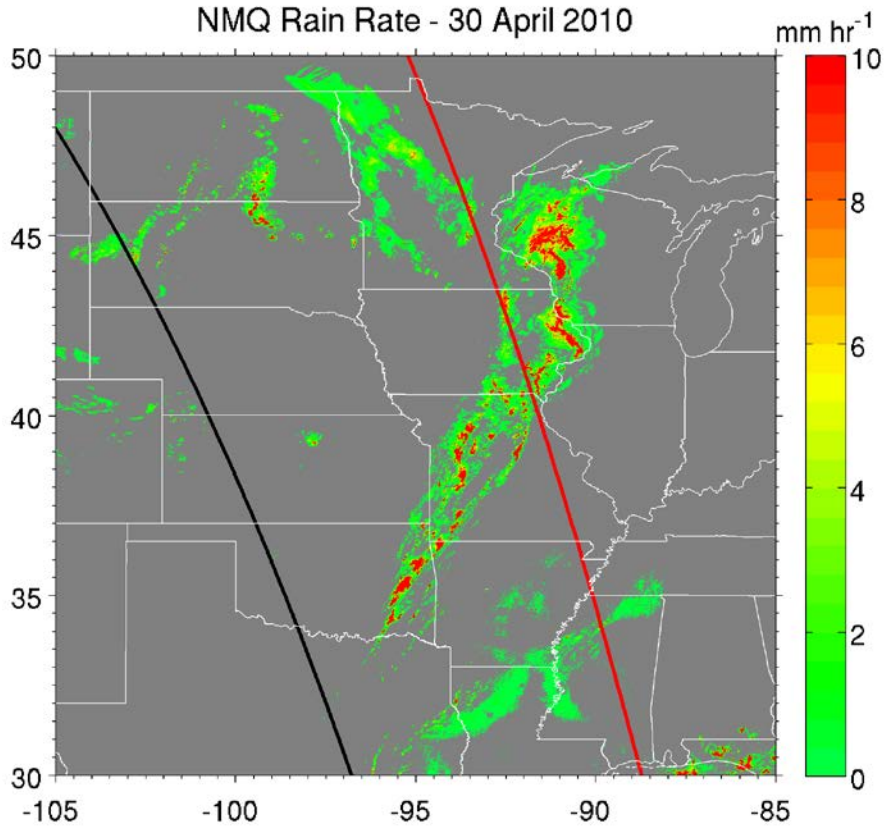
Standard Deviation of Monthly Snow Coverage
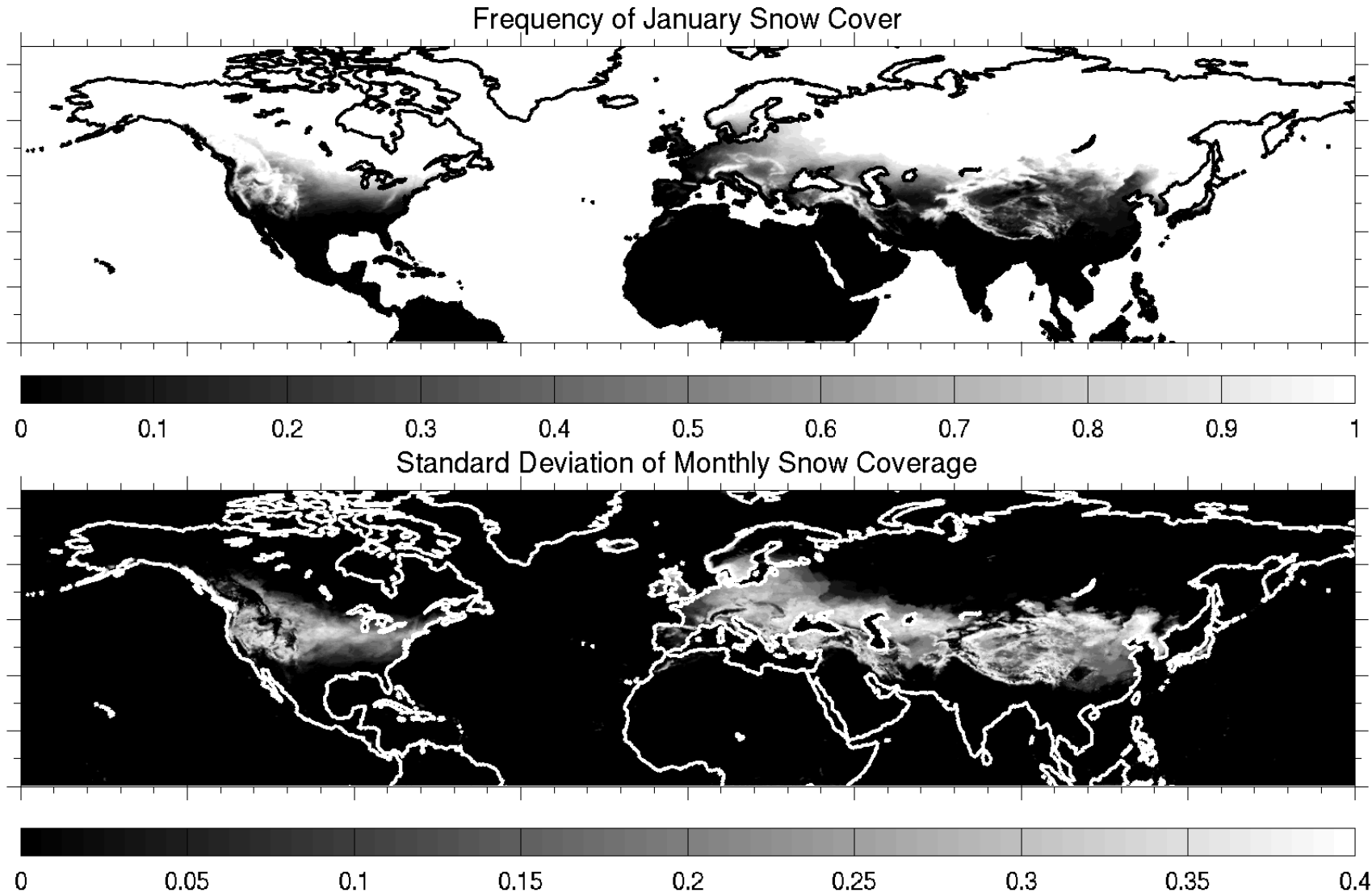
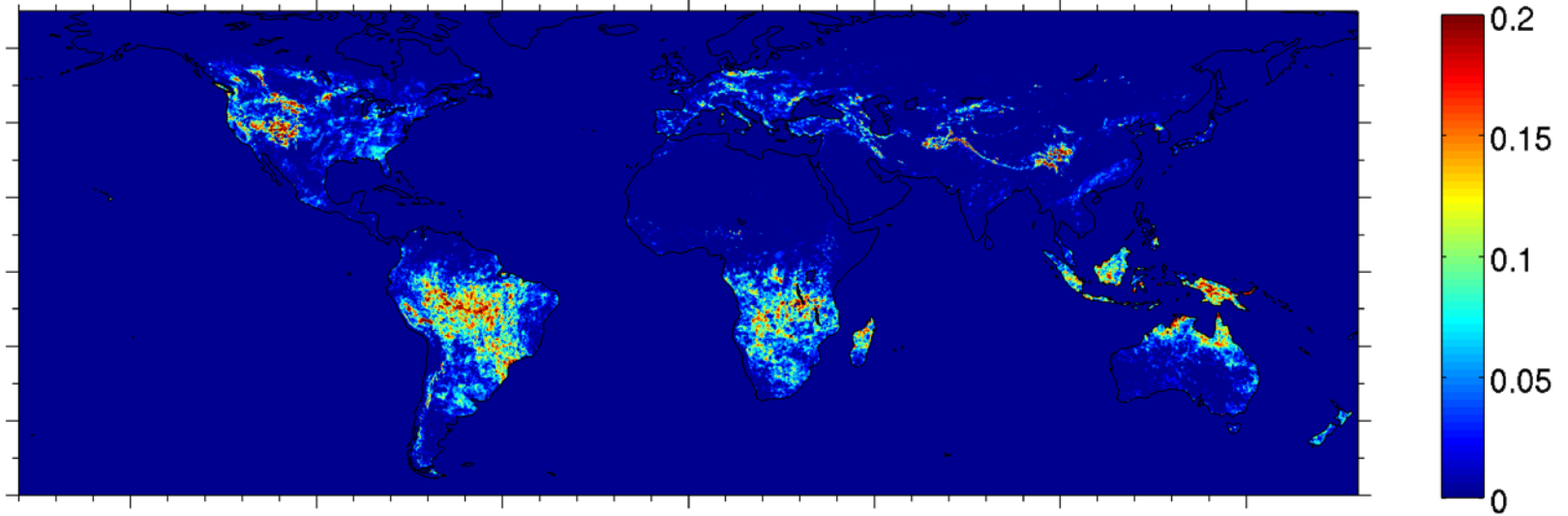# GPROF Land Screening

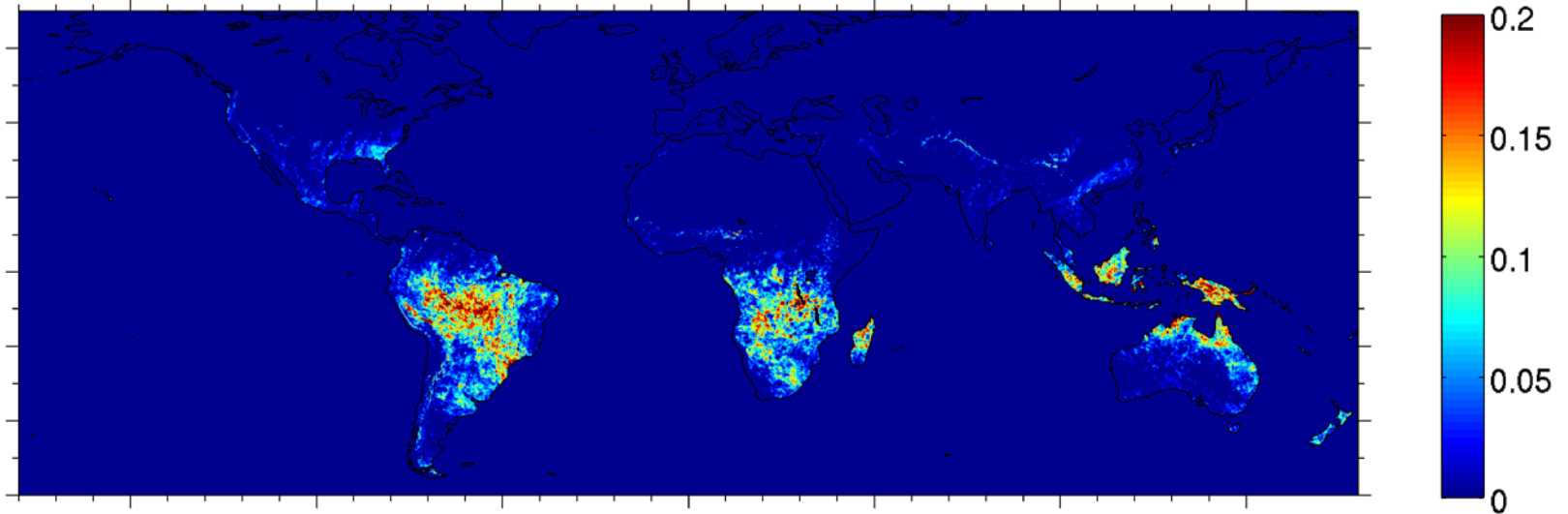# Global Screening Procedures

# Improved Screening

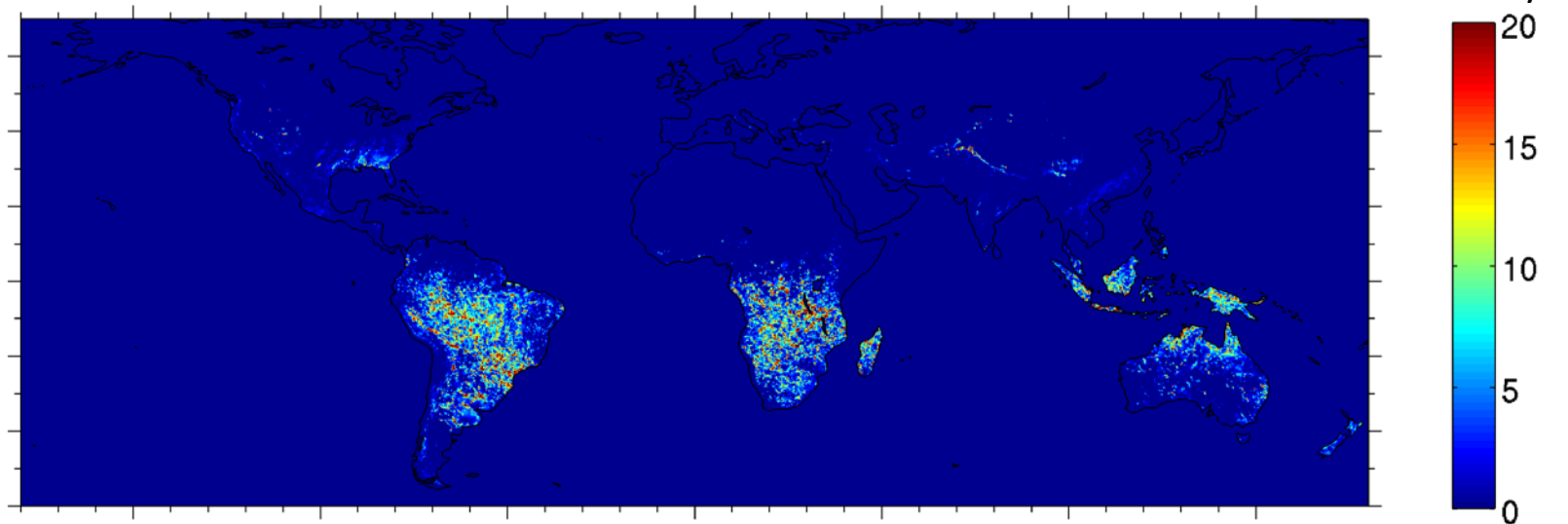# Occurrence of Rain - January



Original AME January Rain Frequency

Updated AME January Rain Frequency

# Rain Rate - January
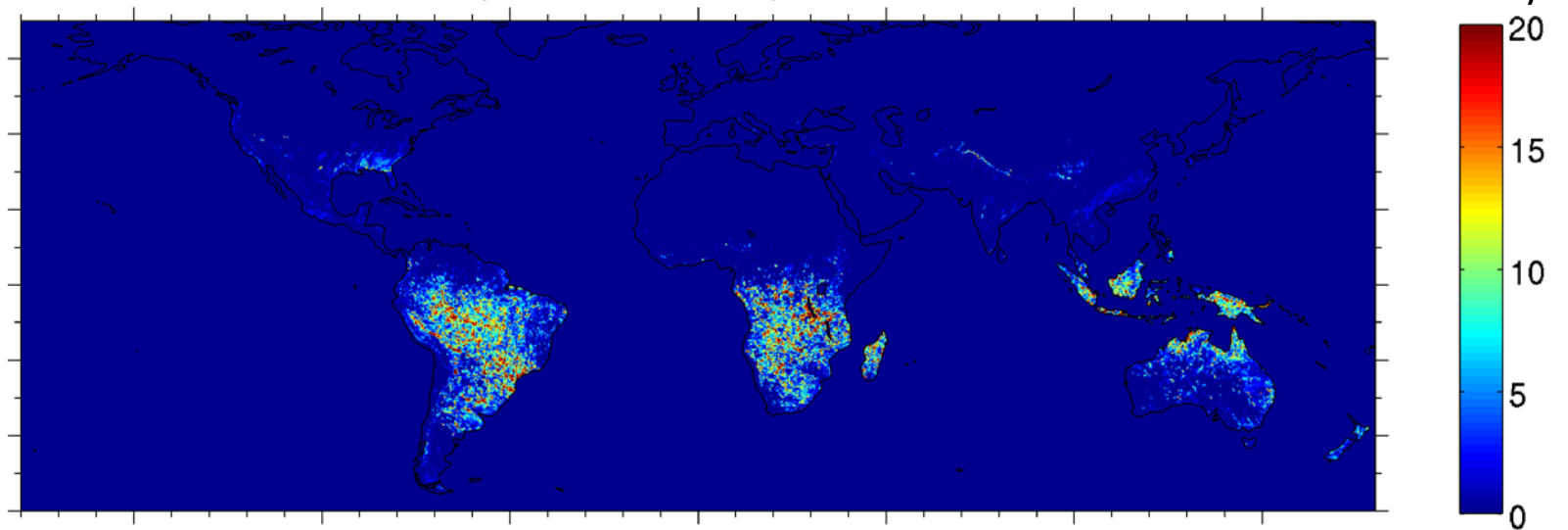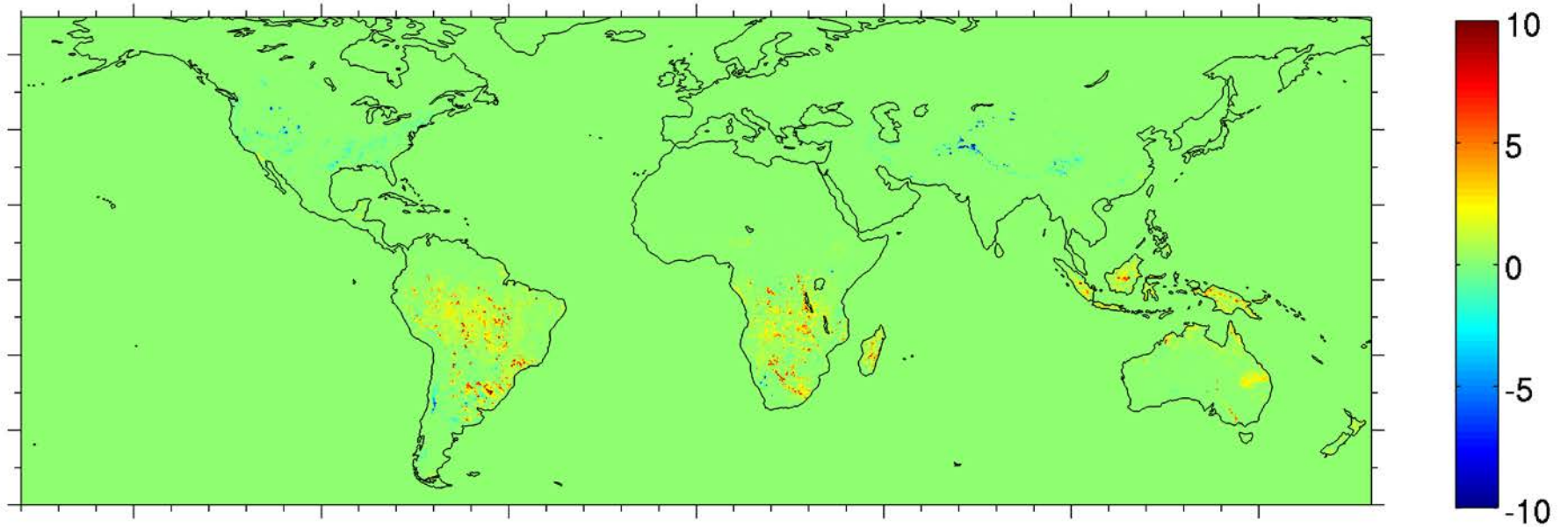


Original AME January Rain Rate — mm·day$^{-1}$

Updated AME January Rain Rate — mm·day$^{-1}$
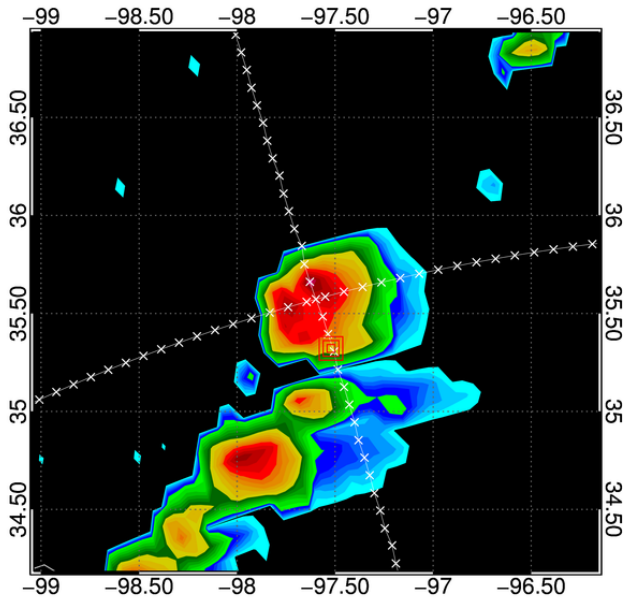
# Rain Rate - January



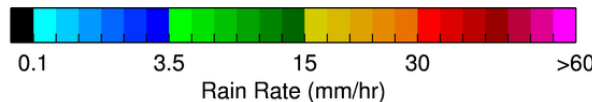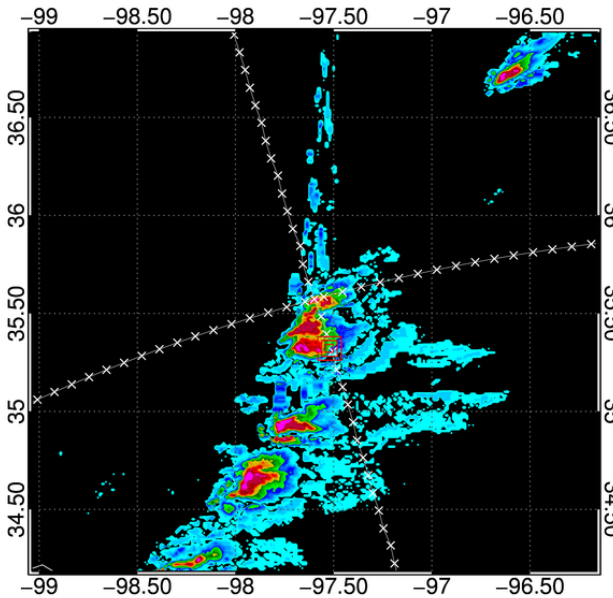[Updated - Original] January Rain Rate — mm·day$^{-1}$

# NMQ-Q2 Validation

- ## National Mosaic & Multi-Sensor QPE
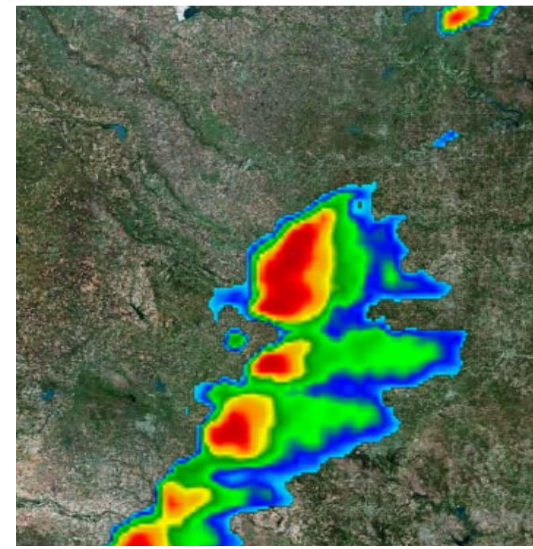  - *3D Blend of radar, satellite, model, and surface obs*



Moore Tornado – GPROF Rain Rates
2013–05–20 19:33
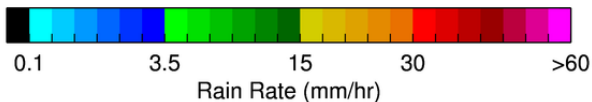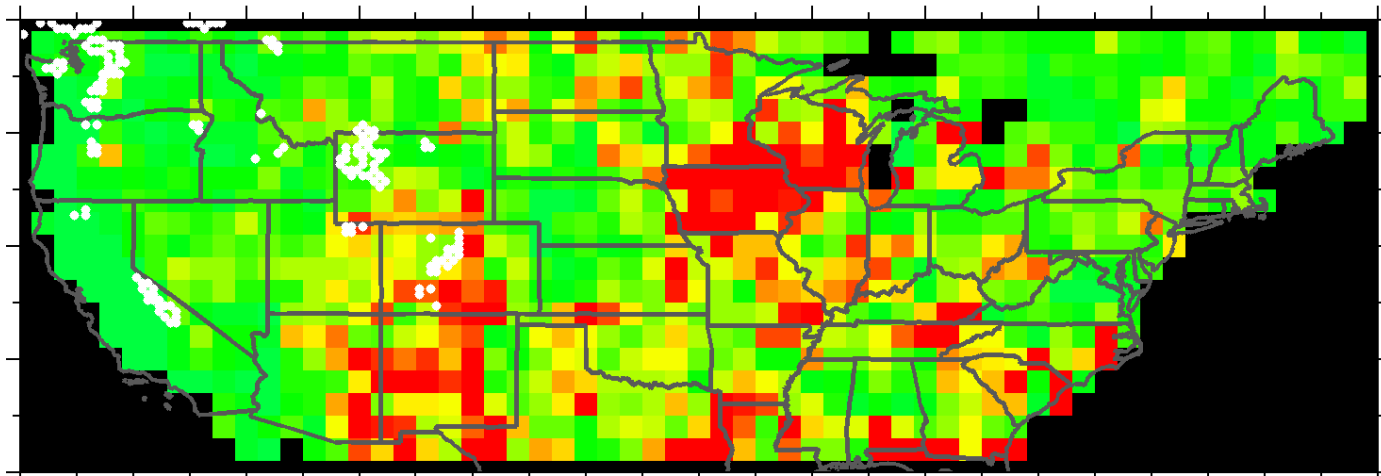
Moore Tornado – NMQ Rain Rates
2013–05–20 19:33
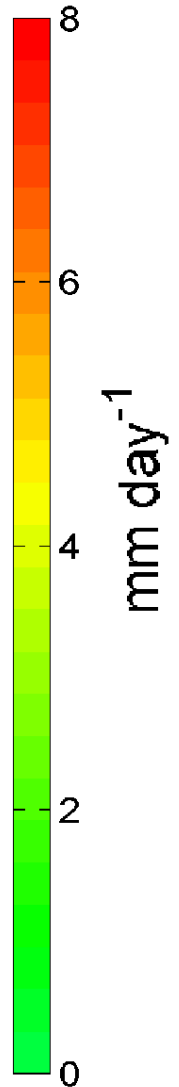
Smoothed Reflectivities
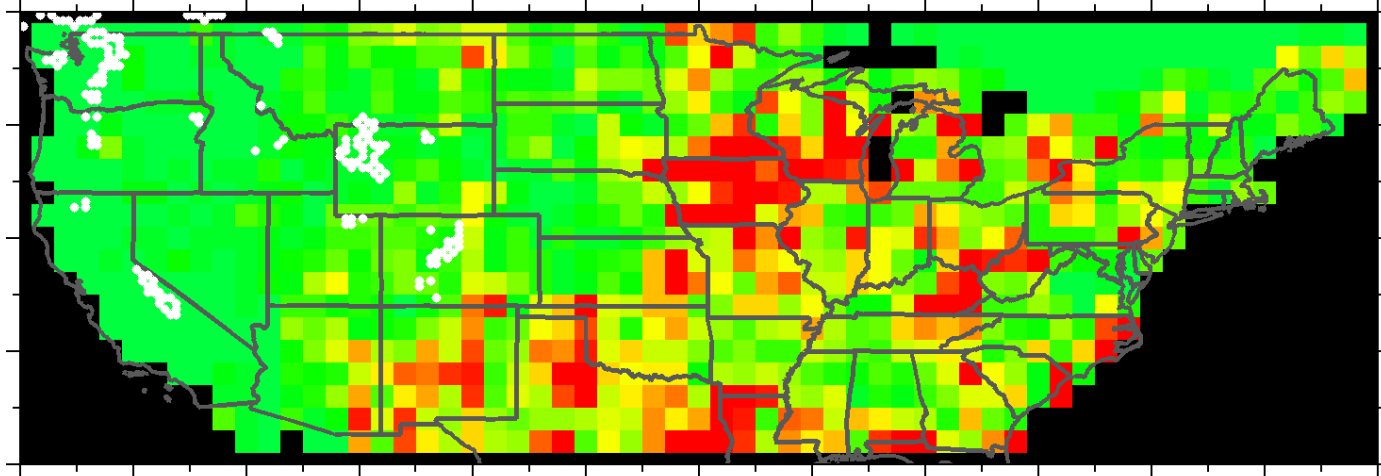
Rain Rate (mm/hr)

# Monthly Average Rain Rate



GPROF Average Rain Rate - July

NMQ Average Rain Rate - July

mm day$^{-1}$

# Conclusion & Future Plan for AMSR2

- Increased rain rate
  - *Getting closer to TMI*
- Removes ambiguous retrievals
- Eliminate Stovepipes
  - *Incorporate latest Ice/Snow EDR*
  - *Feed in SST/TPW data from Ocean EDR*
- GPROF 2014 – in development (Kummerow)
  - *Eliminate empirical RR calculation over land*
  - *Identifies emissivity classes for Bayesian retrieval*