Progress in GPROF V7

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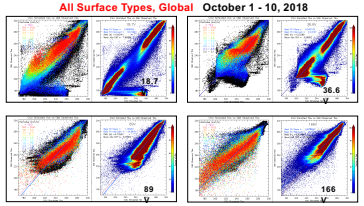
GPROF 2017: aka GMI Version 5

- Over oceans, uses "Combined V04" rainfall + additional hydrometeor adjustments to get better Tb match at higher GMI frequencies.
- Uses GMI to extend rain rates to lower thresholds than detectable by DPR. Cloud Water is converted to drizzle to match CloudSat rain occurrence.
- Over land, uses "DPR Ku V04" rainfall + additional hydrometeor adjustments to get better Tb match at higher GMI frequencies.
- Over snow covered surfaces, uses "MRMS matchups with individual satellites" for a-priori databases
- Sets precipitation threshold to match rain occurrence in a-priori database. i.e. in each TPW and Water vapor bin, probability of rain is the same as Combined.

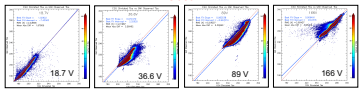
GPROF 2021: aka GMI V7

- Use GPM CMB to create a-priori database.
- Transition database generation to be more operational
  - Use only standard product
  - Develop a documented methodology for creating database profiles
  - Develop a documented methodology for constellation databases
- Continue to work on well-known issues (Snow, orographic precipitation, and Convective/stratiform biases)
- Support parallel algorithm development efforts

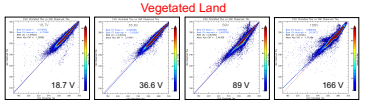
GMI Simulated vs. GMI Observed Tb Using Combined Product Only
All Surface Types, Global October 1 - 10, 2018



Using MIRS for Non-precipitating Pixels
Ocean



Vegetated Land

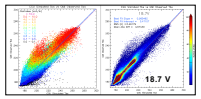


A first step in creating the a-priori databases checks to see if Tbs computed from the CMB profiles and accompanying surface properties match the observed GMI brightness temperatures a the pixels scale (top panel). Large discrepancies are visible but non-raining pixels come from NOAA's operational MIRS products + radiative transfer simulations (bottom panel). These match pretty well.

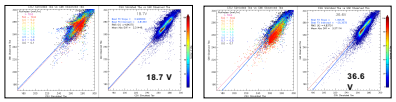
V7 A-Priori Database Creation

GMI Simulated vs. Observed Tbs
Using Only CMB for Precipitating Pixels October 1-10, 2018

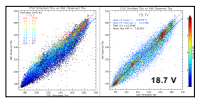
OCEAN



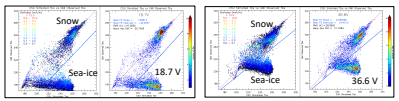
Vegetated Land



Coastlines



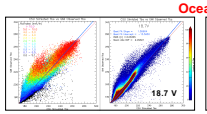
Snow Covered and Sea-Ice



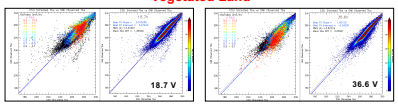
CMB derived profiles and radiative transfer simulations also agree pretty well for precipitating profiles, except for sea ice (which specifies ocean emissivities in the CMB product)

GMI Simulated vs. Observed Tbs Using MIRS (non-precipitating) and CMB (precipitating) Pixels
October 1-10, 2018

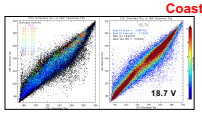
Ocean



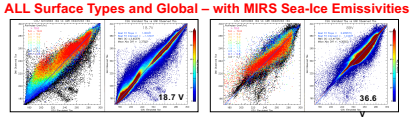
Vegetated Land



Coastlines



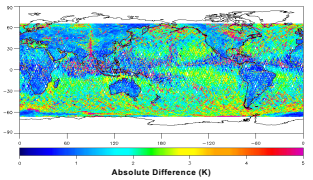
ALL Surface Types and Global – with MIRS Sea-Ice Emissivities



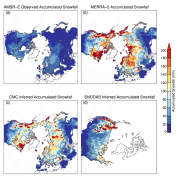
Results look reasonable when CMB is used for raining profiles, MIRS is used for non-raining profiles and MIRS surface emissivities are inserted in the case of CMB precipitation over sea ice.

Other Improvements

Residual Tb Differneces
October 1-10, 2018

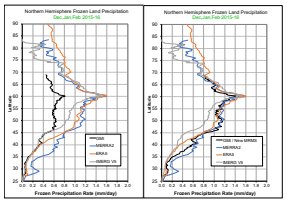


Snowfall and Orographic Precipitation



Outliers are being examined to assess if they can be eliminated without skewing the overall rainfall statistics.

Expected Snowfall Zonal Means



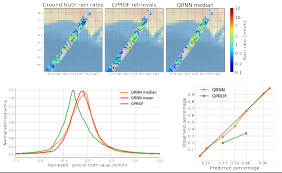
Orographic Rain Index

Moisture transport and Slope
$ORI = TPW * Wind_{850mb} \bullet \nabla Hgt$

Snowfall and orographic precipitation (both rain and snow) are being examined. An orographic index in the form of ORI will be implemented. Instead of TPW, ORI will be used to subset the a-priori databases.

Metric Learning from A. Ebtehaj

QRNN from Erikkson/Norrestad/Freundshuh



We continue to support alternate strategies, including Machine Learning methods, including quartile regression neural networks that are showing remarkable early success

Summary

Working towards codifying database creation using standard, agency supported products.

Currently examining Tb outliers. Can eliminate if random

Tackling orographic enhancement with Bayesian scheme

Supporting various AI efforts