



GOES-R AWG Product Validation Tool Development

Hydrology Application Team

Bob Kuligowski (STAR)



Outline



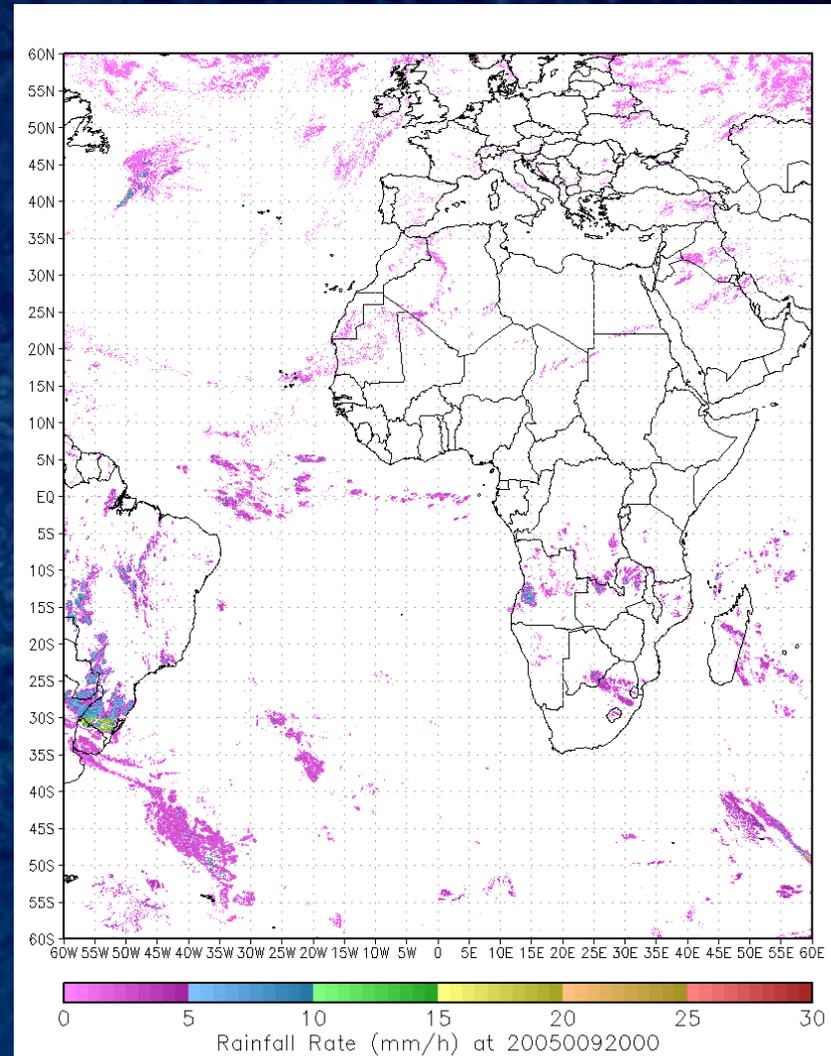
- **Products**
- **Validation Strategies**
- **Routine Validation Tools**
- **“Deep-Dive” Validation Tools**
- **Ideas for the Further Enhancement and Utility of Validation Tools**
- **Summary**



Products



- Rainfall Rate / QPE
 - 4-km resolution
 - every 15 min
 - FD equatorward of 60° and with a $LZA < 70^\circ$

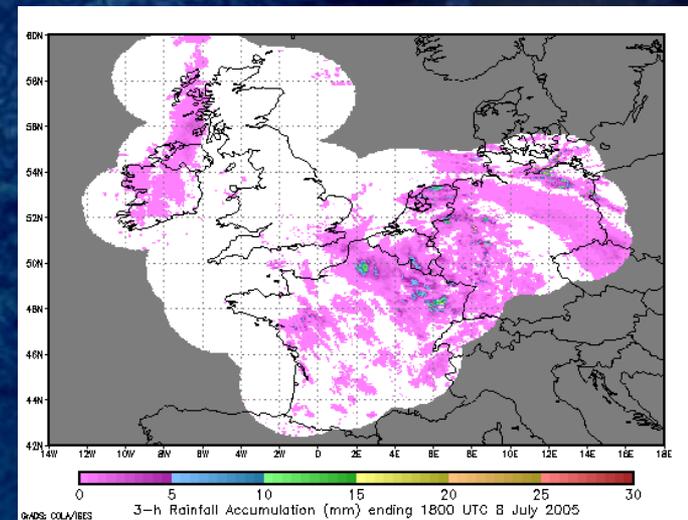
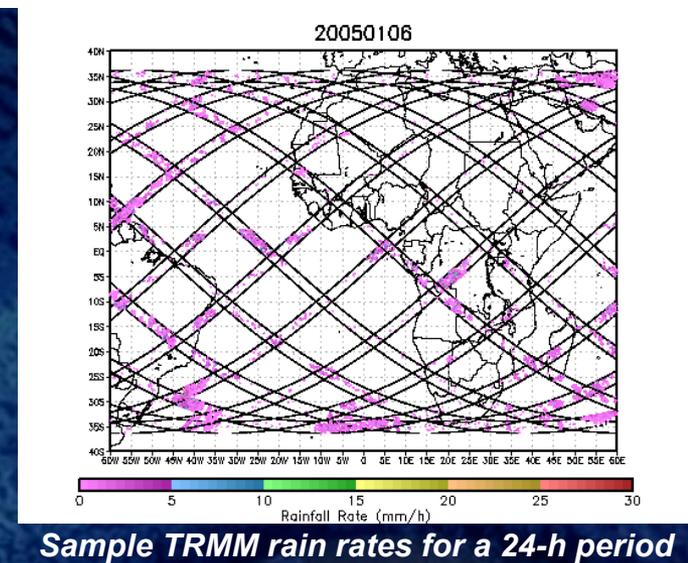




Validation Strategies: Overview



- Twofold validation strategy:
 - Determine performance of the algorithm against spec
 - Identify systematic biases / weaknesses in the algorithm
- Ground validation datasets:
 - TRMM Precipitation Radar (35°S-35°N) from NASA
 - Nimrod radar composite (western Europe) from the British Atmospheric Data Centre





Validation Strategies



- Routine validation tools:
 - Time series of accuracy and precision
 - Is the algorithm meeting spec on a consistent basis?
 - Are there any trends in performance that might need to be addressed even if the algorithm is still meeting spec at this time?
 - Spatial plots of rainfall rates vs. ground validation
 - Are the rainfall rate fields physically reasonable?
 - Do the rainfall rate fields compare reasonably well with ground truth?
 - Scatterplots vs. ground validation
 - Are there any anomalous features in the scatterplots that could indicate errors not revealed by the spatial plots?



Validation Strategies



- Deep-dive validation tools:
 - Comparing calibration MW data with ground truth
 - How much of the error is due to the calibration data rather than the calibration process?
 - Divide data by algorithm class and analyze
 - Are errors in the algorithm associated with a particular geographic region or cloud type?
 - Spatially distributed statistics
 - Does the algorithm display any spatial biases (e.g., latitudinal, land vs. ocean) that need to be addressed?
 - Analyze the rainfall rate equations for particular cases
 - Are there particular predictors or calibration equations associated with errors?



Routine Validation Tools



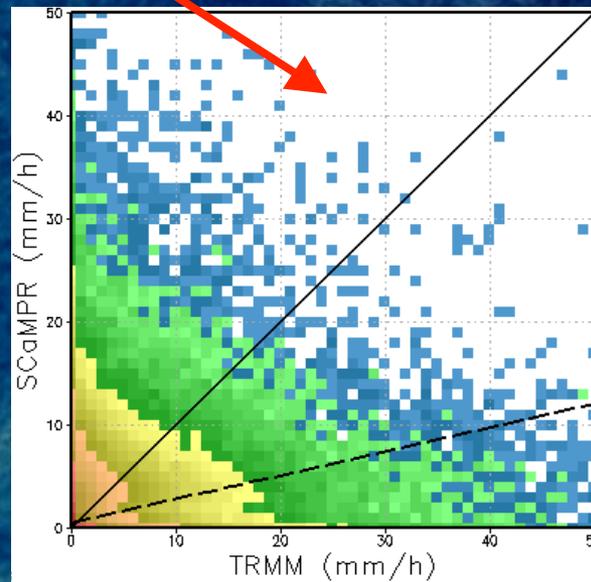
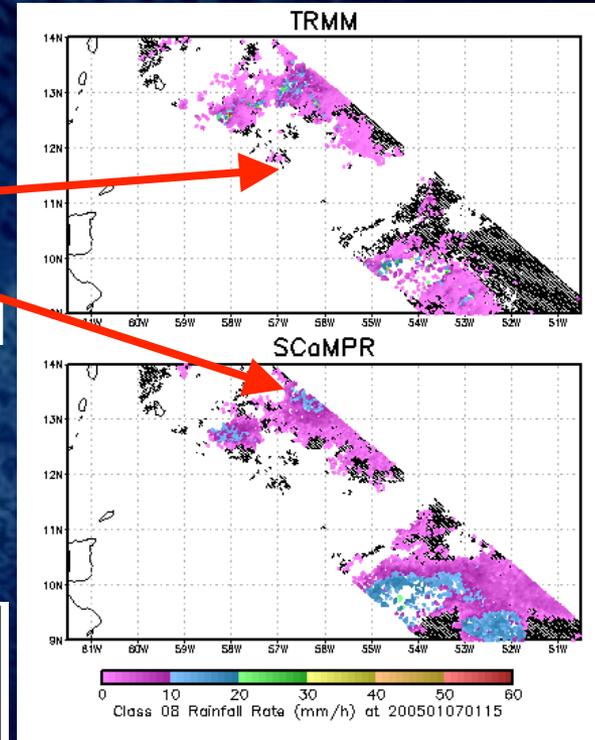
- Capabilities:
 - Match Rainfall Rate with ground data (TRMM and Nimrod radar pre-launch; GPM and Stage IV / MPE post-launch)
 - Compute accuracy, precision
 - Compute basic validation statistics (volume bias, correlation, and threshold-dependent POD, FAR, area bias, and HSS)
 - Create joint distribution files



Routine Validation Tools



- Use GrADS for all visualization:
 - Spatial plots of Rainfall Rate and ground-truth data
 - Plots of POD, FAR, area bias, and HSS vs. threshold
 - Rainfall Rate / ground-truth data joint distribution





“Deep-Dive” Validation Tools



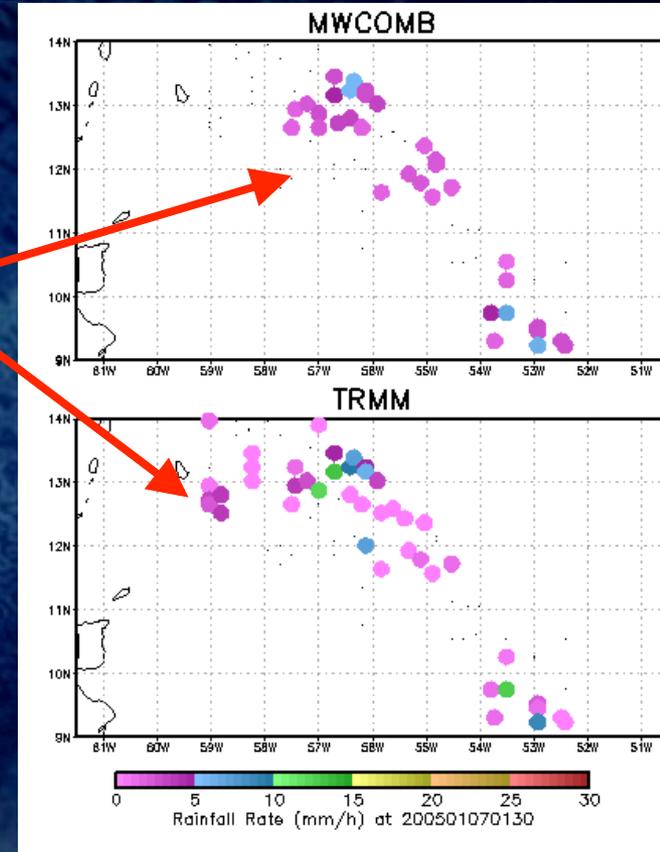
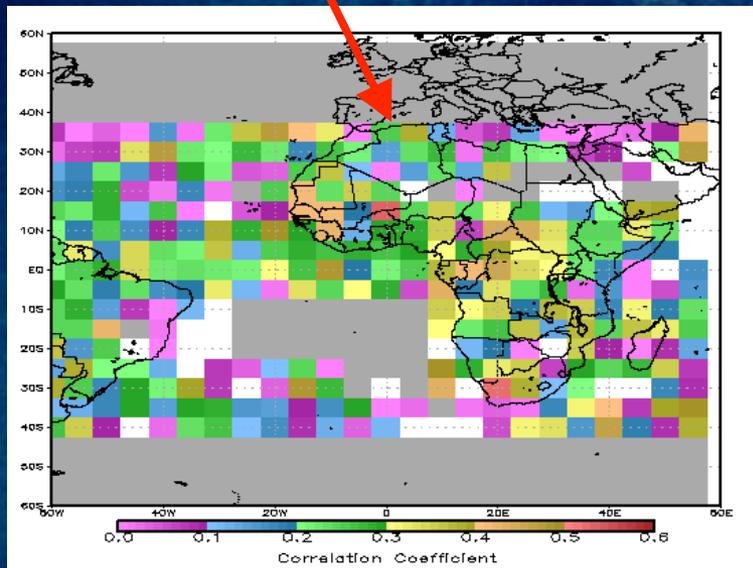
- Capabilities:
 - Match Rainfall Rate with ground data (TRMM and Nimrod radar pre-launch; GPM and Stage IV / MPE post-launch)
 - Match calibration MW rainfall rates with ground data
 - Divide matched Rainfall Rate and ground data by algorithm class
 - Divide matched Rainfall Rate and ground data by location
 - Compute performance statistics by algorithm class and location
 - Extract rain/no rain and rate equations and distribution adjustment LUTs



“Deep-Dive” Validation Tools



- Use GrADS for all visualization:
 - Spatial plots and joint distribution plots of both calibration MW rain rates and of GOES-R Rainfall Rates vs. ground data
 - Spatial plots of performance statistics

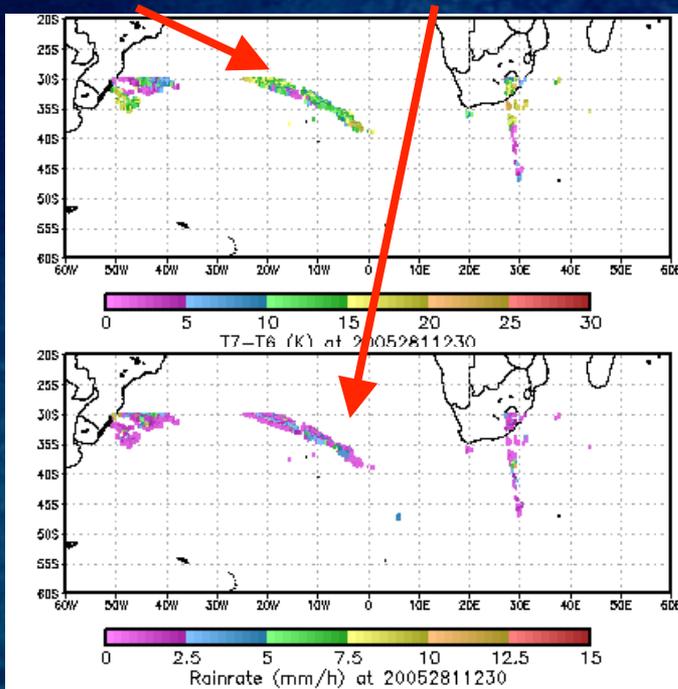
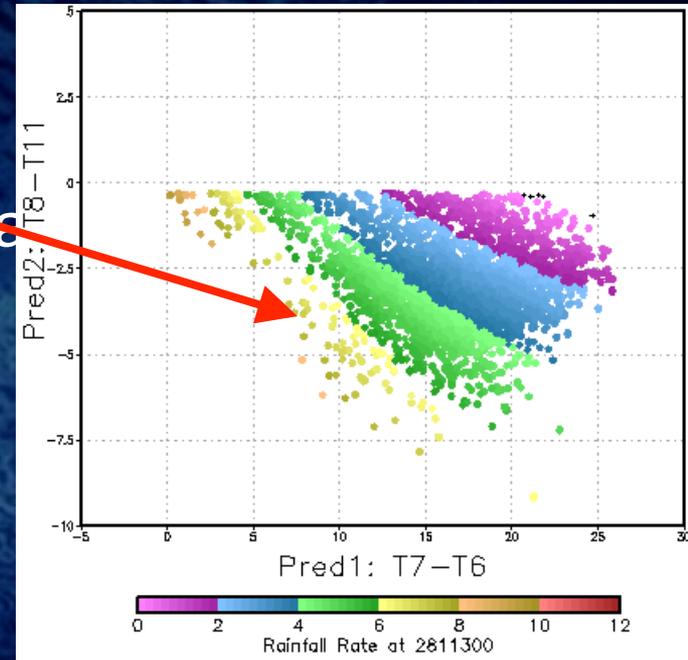




“Deep-Dive” Validation Tools

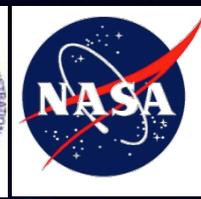


- Use GrADS for all visualization:
 - 2-D plots of rain/no rain and rate values as a function of predictor values
 - Spatial plots of the training data (predictors & targets)





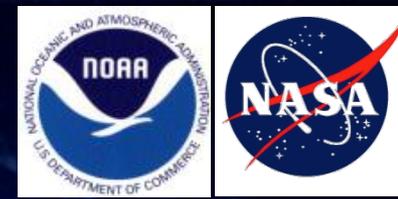
Ideas for the Further Enhancement and Utility of Validation Tools



- A handy tool would be a GUI that would allow the user to select a portion of a Rainfall Rate field and automatically create regional plots of:
 - Performance statistics vs. ground validation and available calibration data
 - Joint distribution
 - Predictor fields
 - Rain / no rain and rain rate equations and distribution adjustment LUTs
 - etc.



Summary



- The GOES-R Rainfall Rate algorithm will be validated against TRMM and Nimrod radar pre-launch and GPM and Stage IV / MPE post-launch
- Validation will focus on evaluating performance and identifying areas for potential improvement
 - Routine validation will focus on the former using time series of statistics, spatial plots and joint distribution plots
 - Deep-dive validation will focus on the latter by examining the predictor and target data along with the calibration to determine the reasons for any anomalies in performance