GOES-R AWG Product Validation Tool Development

Hydrology Application Team

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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°
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 (35ºS-35ºN) 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?
• 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)
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