The GOES-R Rainfall Rate / QPE Algorithm Status

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Presented By: Bob Kuligowski
NOAA/NESDIS/STAR

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Algorithm Description

- The GOES-R Rainfall Rate algorithm produces estimates of instantaneous rain rate every 15 min on the ABI full disk at the IR pixel resolution.
- The rain rates are derived from the ABI IR bands, calibrated against rain rates from MW instruments.
- This allows the rapid refresh and high spatial resolution of IR data from GEO while trying to capture the accuracy of MW rain rates from LEO.
- A rolling-value matched MW-IR dataset with a fixed number of pixels with rates of at least 1 mm/h is maintained; the calibration is updated whenever new MW rain rates become available and then applied to independent ABI data.

Algorithm Summary

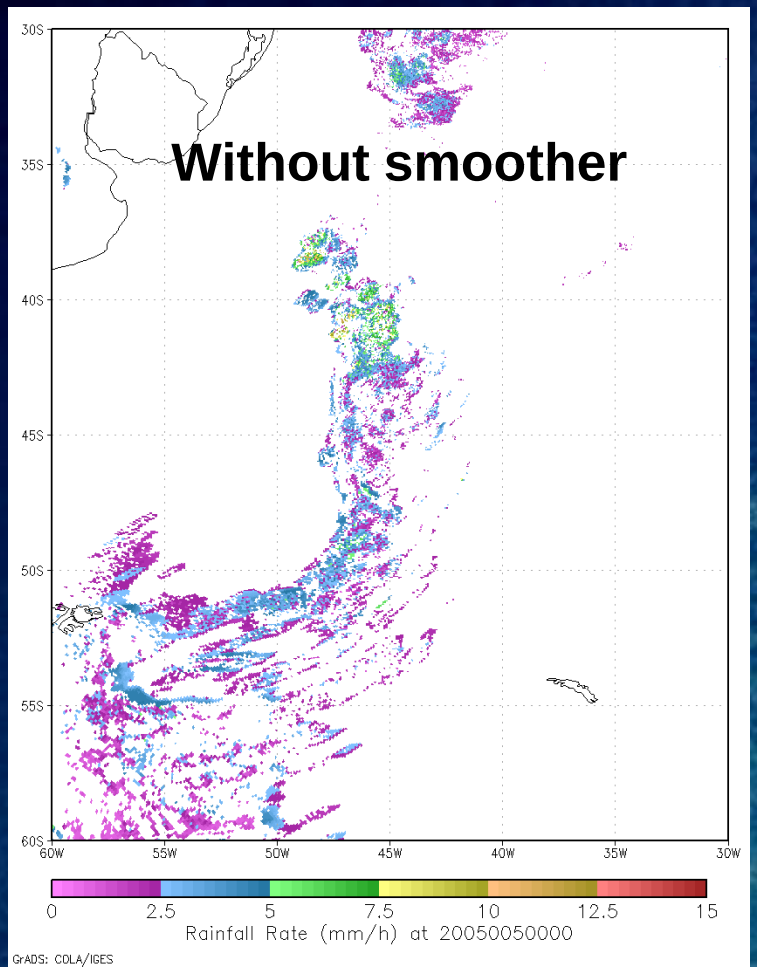
- Calibration / retrieval involves the following steps:
  - Discriminant analysis is used to select the best two rain / no rain predictors and coefficients based on matches with the MW rain rates;
  - Linear regression is used to select the best two rain rate predictors and coefficients (including nonlinear transformations of the predictors) based on matches with the MW rain rates.
  - To correct regression-induced distortions in the distribution, the derived rainfall rates are matched against the training MW rain rates to create a lookup table (LUT) for adjusting the resulting rain rates.
- Separate calibrations are used for each 30º latitude band and 3 different cloud types (determined using BTDs)

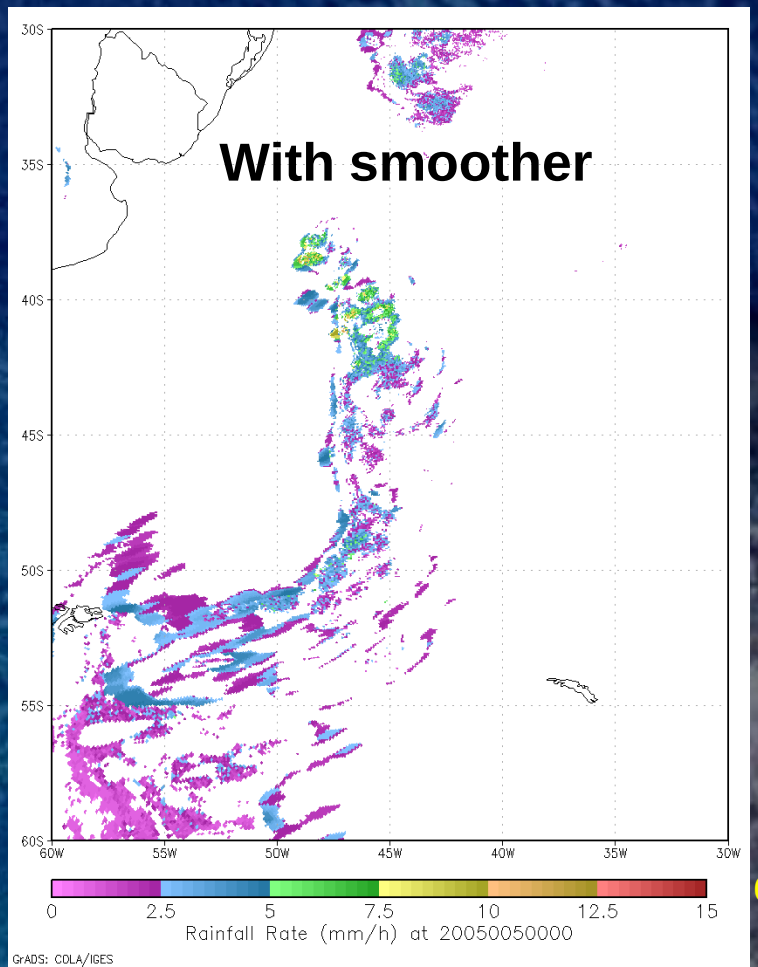
Enhancements since Version 5

- Applied a 9x9 smoother BTD fields for computing rain type
  - Rain type field can contain pixel-sized features when near threshold value; results in non-physical features in rain rate field
- Increased the required amount of training data from 1,000 / 5,000 pixels ≥ 1 mm/h to 15,000 ≥ 2.5 mm/h
  - Addresses occasional instability in rain rate time series due to succession of overfit calibrations
- Rainfall rate calibration now requires a minimum correlation coefficient of 0.15 to update calibration
  - Prevents occasional significant changes in calibration from one time period to the next
- Additional details in the Rainfall Rate poster

Enhancements since Version 5

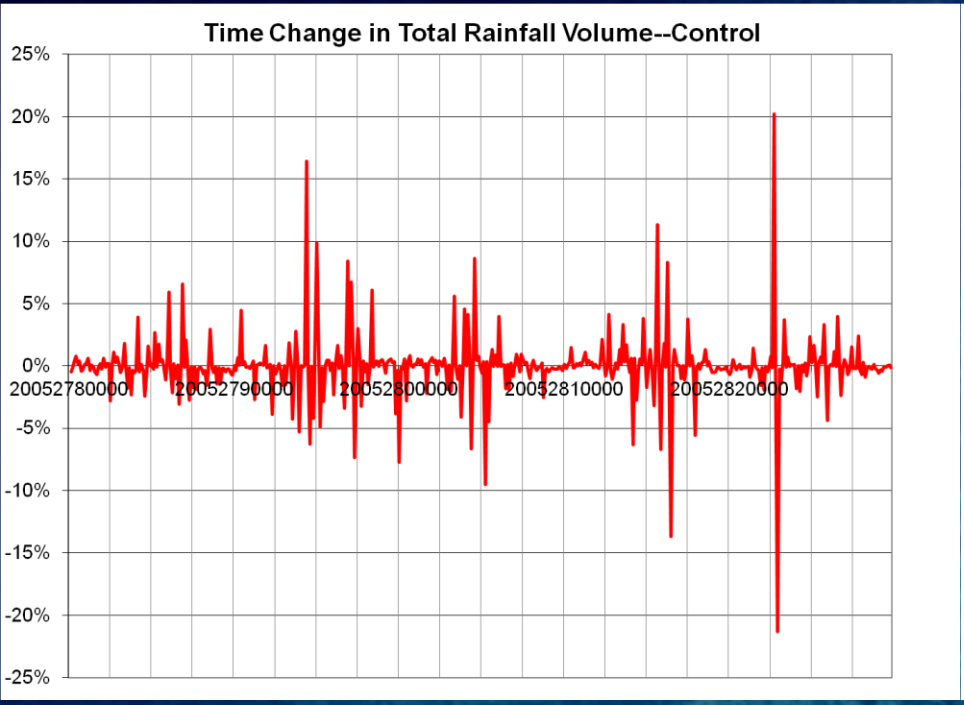
Impact of 9x9 BTD smoother

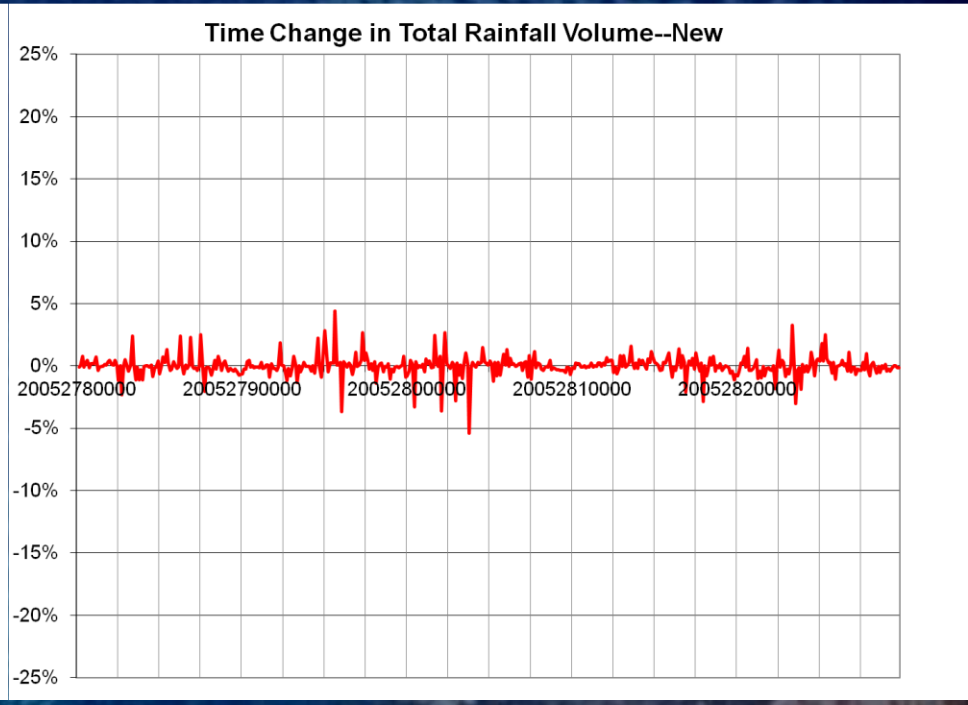




Enhancements since Version 5

Impact of Increased Training Data Requirements





Updated Validation Results

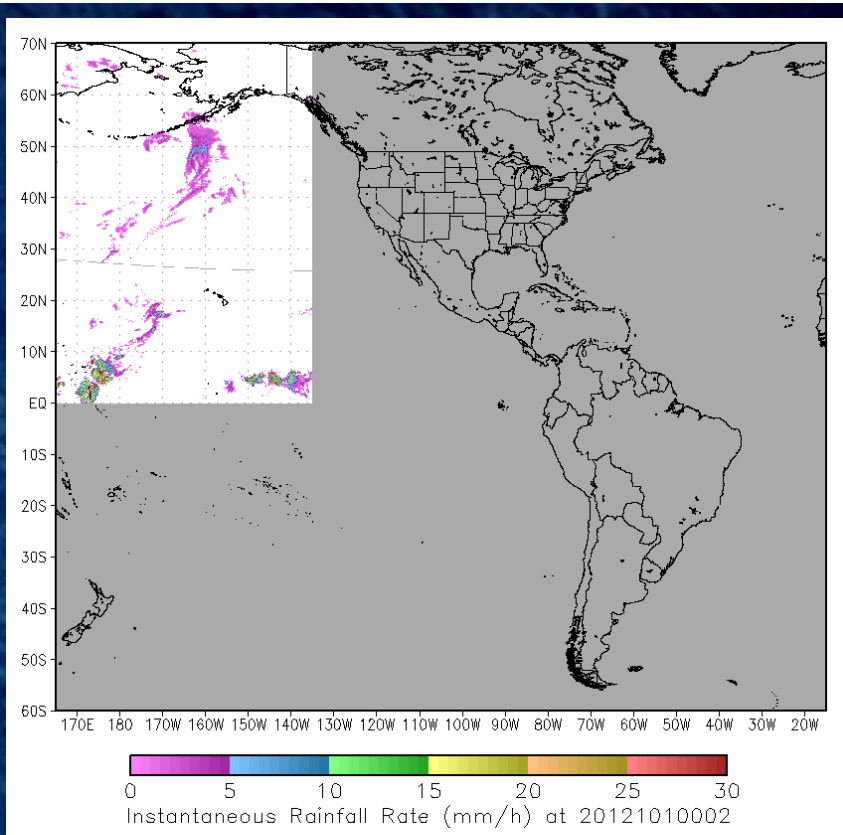
Validation versus TRMM PR (covering 35ºS – 35ºN only) for 20 days of data: 6-9th of January, April, July, and October 2005:

mm/h	F&PS		Version 5		New Version	
	Accuracy	Precision	Accuracy	Precision	Accuracy	Precision
Rainfall Rate	6.0	9.0	4.7	8.6	5.4	9.2

- (Note that these stats use the best match within a 10-km radius to account for spatial displacements of surface rainfall with respect to the cloud tops.)
- Presumed improvements actually degrade performance relative to spec—investigating a bias increase of unknown cause that is probably the reason
- These changes are NOT reflected in the current Harris code!

Proving Ground Support

- A version of the GOES-R Rainfall Rate algorithm without the 8.5- and 12.0-µm bands has been running in real time on GOES-East and –West since October 2011.
- Supports GOES-R Proving Ground activities (via SPoRT) and provides a platform for real-time experimentation with more robust ground validation data than available over Europe and Africa.



Connections with JPSS and GPM

- The MW rain rate data used in the GOES-R Rainfall Rate algorithm come from the operational MWCOMB microwave composite produced by NWS/CPC.
- The MWCOMB product will continue to evolve and improve leading up to and during the GPM era as MW retrieval techniques continue to improve.
- These improvements will likewise improve the GOES-R Rainfall Rate product, though changes to MWCOMB should be transparent from a processing perspective.

Possible Enhancements

- Apply calibration coefficients derived by Zhanqing Li (UMCP) et al. in previous GOES-R Risk Reduction work to real-time GOES cloud property information and evaluate impact on warm-cloud light rainfall which typically IR and MW have difficulty detecting.
- Experiment with a model PW / RH adjustment to rain rates to account for moisture availability and subcloud evaporation of hydrometeors.
- Continue experiments with orographic rainfall modulation.
- Incorporate findings from GOES-R Risk Reduction work by Adler et al., Rabin, Dong and Li, etc.

Summary

- The GOES-R Rainfall Rate algorithm produces estimates of instantaneous rainfall rate at the full IR pixel resolution, using MW rain rates as a calibration standard.
- Enhancements have been made since v5 (but not implemented in the Harris code) to remove non-physical rainfall and calibration features; performance vs. spec actually degraded somewhat and the cause is still being investigated.
- A version of the algorithm without the 8.5- and 12.0-μm bands is running in real time on the GOES imagers to support Proving Ground activities and additional algorithm development.
- Additional possible pre-launch enhancements to the algorithm are being investigated and tested.
- Since the algorithm uses MW rain rates as a calibration source, JPSS and GPM enhancements will improve the Rainfall Rate algorithm while being transparent from a processing perspective.