THE GOES-R RAINFALL POTENTIAL ALGORITHM

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Background

Requirements

- The GOES-R Algorithm Working Group (AWG) Hydrology Algorithm Team (AT) has been tasked with providing a recommended, demonstrated, and validated algorithm for retrieving 0-3 h rainfall potential from GOES-R data meeting the following requirements:
  - Cover the region 60°S to 60°N within 70° LZA at the full resolution of the ABI (2 km at nadir);
  - Update every 5 min, day and night;
  - Possess an accuracy and precision of 5 mm for 3-h rainfall totals, with a range of values of 0-100 mm.
- Note that this is a Future Capabilities algorithm.

Algorithm Selection

- The AT selected as candidates six nowcasting algorithms that were deemed sufficiently mature for consideration.
- The final selection by the AT was the K-Means algorithm developed at NOAA / OAR / NSSL (Lahskmanan et al. 2003, 2009a, 2009b).
- However, incorporating the K-Means code into the Algorithm Integration Team (AIT) framework at STAR proved to be extremely difficult, so the algorithm was re-coded from scratch using information from NSSL.
- In the process, modifications were made to the algorithm that improved performance.

References

Lakshmanan, V., K. Hondl, and R. Rabin. 2009a: An efficient, general-purpose technique for identifying storm cells in geospatial images. *J. Ocean. Atmos. Tech.*, **26**, 523-537.
-----, R. Rabin, and V. DeBrunner, 2003: Multiscale storm identification and forecast. *J. Atmos. Res.*, **67**, 367-380.
-----, and T. Smith, 2009b: Data mining storm attributes from spatial grids. *J. Ocean. Atmos. Tech*, in Press.

DISCLAIMER: The contents of this poster are solely the opinions of the authors and do not constitute a statement of policy, decision, or position on behalf of the GOES-R Program Office, NOAA, or the U.S. Government.

Ackonowledgment: This work was supported by the GOES-R Program Office.

Theoretical Basis

Inputs and Outputs

- Input: the current and immediately previous Rainfall Rate products
- Outputs: a field of predicted rainfall accumulations for the subsequent 3 h plus a field of error flags.
- Special outputs on a 4400x4400 lat / lon grid for use by the GOES-R Probability of Rainfall algorithm:
  - Predicted 3-h rainfall accumulation on the lat / lon grid
  - Twelve fields of predicted rainfall rates at 15-min intervals from t+15 min to t+180 min

Assumptions and Limitations

- Assumes the current and previous Rainfall Rate fields are available and accurate.
- Steady-state assumption for rainfall; i.e., does not account for the initiation, growth, or decay of rainfall.
- Assumes the development region (Europe and Africa) is sufficiently representative to be applicable to GOES-R in the Western Hemisphere.
- Note that data are reprojected to a 4400x4400 lat / lon grid for processing to avoid distortions from the satellite pixel spacing on the limb.

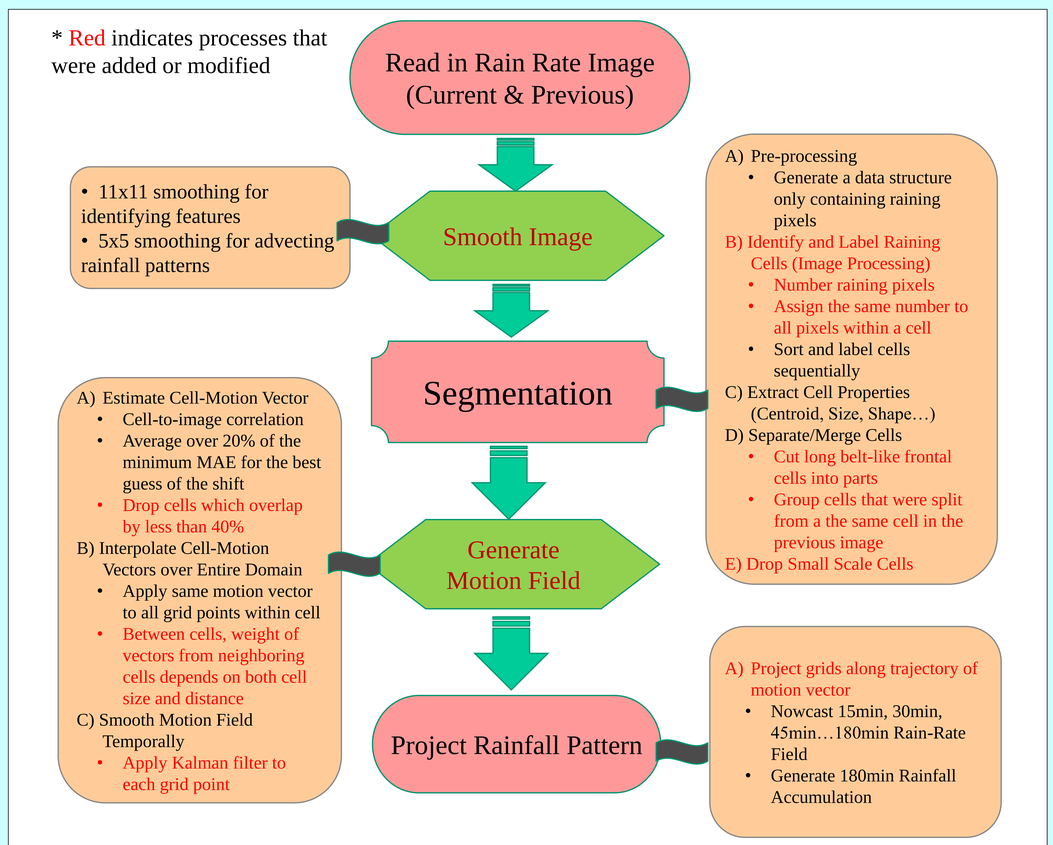

Figure 1. The Rainfall Potential process flowchart.

Validation and Future Work

Comparison with K-Means

- Figure 2 illustrates performance statistics against SCaMPR rainfall rates for 7 July 2005, comparing to both K-Means and persistence (i.e., maintain the initialization time rain rate for 3 h).

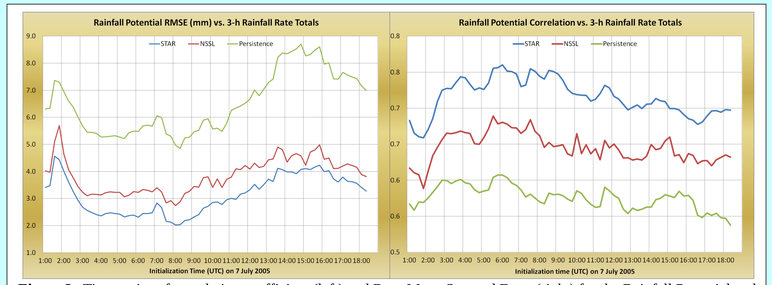

Figure 3. Time series of correlation coefficient (left) and Root Mean Squared Error (right) for the Rainfall Potential and original K-Means algorithms and persistence versus the corresponding Rainfall Rate totals for 7 July 2005.

Validation against Nimrod

- Due to the scarcity of 3-h gauge data, the algorithm has been evaluated against 3-h totals from the Nimrod radar network in Western Europe (Fig. 4). Note how any biases in the Rainfall Rate algorithm will be reflected in the Rainfall Potential totals.
- Table 1 shows statistics for the 6th-9th of April, July, and October 2005. Algorithm performance is well within spec.

	Accuracy (mm/h)	Precision (mm/h)
vs. Nimrod	2.3	4.1
F&PS Spec	5.0	5.0

Table 1. Validation of the GOES-R Rainfall Potential algorithm against Nimrod radar data over Western Europe for 6-9 April, July, and October 2005 for only pixels with observed or predicted rainfall > 1 mm.

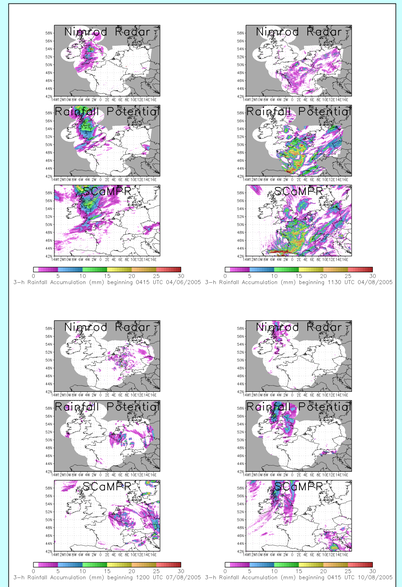

Figure 4. Comparison of Rainfall Potential with corresponding Nimrod totals.

Future Work

- Additional validation on 4 months of data.
- Carefully QC the Nimrod data for artifacts.
- Turn in version 5 code and documentation in September.