MW-IR Data Fusion-- NOAA/NESDIS Perspective

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The IR-MW Data Fusion Problem

- Even with enhancements in spatial resolution, sampling, and latency in the GPM era, MW-based rainfall data will still not be ideally suited for weather and hydrologic applications where high resolution, frequent sampling, and low latency are critical.
- IR data will thus continue to have an important role for the foreseeable future, combined with MW data to take advantage of its higher accuracy.

Two IR-MW Fusion Approaches

- Two basic approaches to MW-IR data blending:
  - "Eulerian"—fit the IR data to MW rain rates
  - "Lagrangian"—use the IR data to interpolate the MW rain rates in time and space
- Eulerian techniques can more effectively capture variations of rainfall between MW overpasses than Lagrangian approaches.
- However, Eulerian techniques' efforts to fit IR data to MW rain rates results in loss of information content and hence accuracy, whereas Lagrangian methods preserve information content—at least near overpass time.

The SCaMPR Approach

- Self-Calibrating Multivariate Precipitation Retrieval
- An Eulerian framework for downscaling GPM data for weather and hydrologic applications
- Retrieves rain rates from IR data, but uses a calibration based on matches with MW rain rates
- Updates calibration whenever MW rain rates become available
- Selects both best predictors and calibration coefficients (as opposed to most single-channel approaches); thus, predictors used can change in time or space
- Flexible; can use any inputs or target data

Potential SCaMPR Roles in GPM

- Key role: using IR data to downscale GPM data for weather forecasting and hydrologic applications.
- Some possible roles of the SCaMPR framework in a blended NOAA GPM product:
  - Provide a more robust IR-only retrieval in a GPM multi-sensor framework like MPE or CMORPH
  - Calibrate against radar to fill gaps in the surface radar network as part of a blended GPM product for the CONUS

GPM Data Fusion: Bigger Picture

- Idea: what about a WRF equivalent for GPM—a modular rainfall rate algorithm with multiple available components for each part of the rain rate solution problem?
  - MW rain rate retrieval
  - Blending with IR data
    - Eulerian module (e.g., SCaMPR, MPE, PERSIANN)
    - Lagrangian module (e.g,. CMORPH)
    - Fixed calibration when MW data are limited (e.g., shallow orographic rainfall)
  - Blending with radar data
    - MPE
    - QPE-SUMS
- This approach would enable us to derive an optimal algorithm and advance the science through rigorous, controlled intercomparison of approaches!

Questions?