Fusing GPM and Ground Observations for Hydrologic and Climate Applications

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Operational Fusion Frameworks

• OHD
  o Multisensor Precipitation Estimator (MPE)
  o Blending of gauge, ground radar and IR

• CPC
  o CPC-Morphing (CMORPH)
    o Uses IR for advecting microwave rain rate estimates
  o Augmentation to incorporate ground observations
Need for Data Fusion - NEXRAD coverage

NEXRAD Coverage - summer

NEXRAD Coverage - winter
Comparison of Radar and Model with Gauge - Regional Performance
Multisensor Precipitation Estimator

- **Mechanisms**
  - Mean-field and local bias correction
    - Based on time and distance-weighted precip/ amounts
    - Local bias correction used for satellite QPEs
  - Multisensor blending
    - Variations of co-kriging

- **Products**
  - Gauge-only (interpolated gauge data)
  - Bias corrected radar and satellite
  - Blended radar-satellite, and radar-satellite-gauge products
**Existing MPE Satellite-Radar-Gauge mechanism**

**Highlights:**

1. Sat. data at present are from IR-based Hydro-Estimator

2. Sat. data fills the gaps only

3. SR merged product is blended with gauge data

4. This operation is performed for hourly S, R and G data
Revised Algorithm for SRG mosaic

Highlights:
1. Sat/Gauge/Radar merged in 2 steps via MPE-DOE
2. Beam height and quality index will be used in formulating the covariance matrix
CMORPH Fusion Approach

• Objective:
  o To construct high-resolution regional precipitation analyses over CONUS and its adjacent oceans through blending information from gauge measurements, radar observations, satellite estimates and numerical model forecasts

• Resolution:
  o Starting with Hourly / 4km (HRAP)

• Inputs being tested:
  o Hourly gauge reports from NCDC (will include MESONETS data)
  o NCEP Stage IV radar (will be replaced by Q2 in the future)
  o CMORPH (will be using regional CMORPH)
  o NAM (will check other possibilities)
Individual Processes and Current Status

• QC for gauge reports
  o Based on CPC QC system for daily precip
  o A very preliminary system tested
  o Need extensive work for complete development

• Gauge interpolation
  o Developed based on Xie et al. (2007)

• Bias correction for radar, satellite and model precip
  o Developed based on Xie and Xiong (2011)

• OI blending
  o Developed based on Xie and Xiong (2011)

• Model precip repositioning and downscaling
  o In preliminary tests
Science Infusion and Assessments

• **Synergy needed to test methodologies**
  o Identify the best approaches from MPE and CMORPH for bias correction and multisensor fusion
  o Incremental benefit of fusing model predicted precip

• **Determine the impacts on hydrologic predictions**
  o Effectiveness in capturing heavy/extreme floods at different scales
  o Stability of the bias across spatial and temporal settings
Science Infusion and Assessments

SCaMPR without (P) or with (T) TRMM

Challenge: How to move the points below the dotted line? For what regions/watersheds can superior performance from fused QPE be achieved?