Evaluating Satellite Precipitation Products over Complex Terrain: Preliminary Results from IPHEX and HyMeX Observations

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Improving Satellite Precipitation Estimates over Mountainous Terrain

Objectives
- Apply a technique to adjust high-resolution satellite-retrieved rainfall fields (CMORPH) over complex terrain using NWP predicted precipitation datasets (Zhang et al. 2013).
- Evaluate the satellite adjustment technique using independent rainfall fields from gauge-adjusted (Stage IV) WSR-88D estimates focusing on heavy-precipitation storm events over the IPHEX domain.

Study Domain
- IPHEX GV field campaign domain: Centered in the Southern Appalachians and spanning into the Piedmont and Coastal Plain regions of North Carolina.

Data: Seven Storm Events
- A storm event in IPHEX experiment: 2014-05-15
- Six historical hurricane events:
  - Bill: 2003-07-01
  - Gaston: 2004-08-29
  - Frances: 2004-09-07
  - Ivan: 2004-09-16
  - Cindy: 2005-07-06
  - Fay: 2008-08-26

Methodology

Y = a * X^b

Bias Score

Heidke Skill Score

Scatter plot of acc. rain
[7 Events * 5 basins]

Summary
- CMORPH provides similar rainfall pattern to the radar data, while WRF is good at rainfall magnitude prediction.
- WRF-adjusted CMORPH rain rates exhibit improved error statistics against independent radar-rainfall estimates. The adjustment reduced the underestimation of high rain rates thus moderating the strong rainfall magnitude dependence of CMORPH rainfall bias.

Evaluating Satellite Precipitation Products over Complex Terrain in Streamflow Simulation

Study Domain
- HyMEX: Upper Adige river basin in the Eastern Italian Alps

Data
- 9-year (2002-2010) precipitation

Satellite products:
- 1. TRMM 3B42-RT [TR]
- 2. TRMM 3B42-V7 [aTR]
- 3. CMORPH [CM]
- 4. gauge-adjusted CMORPH [aCM]
- 5. PERSIANN [PE]
- 6. bias-adjusted PERSIANN [aPE]

Rain-gauge network
Simulated hydrograph

Results
- Basin scales: Medium Scale, Large Scale
- Seasons: May - Aug, Sep - Nov

Error Analysis of Precipitation and Runoff

Bias, RMSE, Correlation Coefficient

Detection of precipitation is not an important issue (except for 3B42RT).

Bias in basin-average precip. depends on:
- a) product, b) basin area, c) basin elevation and d) season.

Satellite-based simulations, estimated total runoff within ~ 25% bias (except for 3B42RT).

Correlation and CSI of high flow values is low.

Which scales? Results show >10% improvement from smallest to highest scales examined.

Summary
- Which products? Performance varied among products but overall......adjusted CMORPH is the authors' choice!