CCPA Precipitation Analysis: Data Set, Cross Validation and Evaluation

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A High Resolution Precipitation Dataset over CONUS: Climatology-Calibrated Precipitation Analysis (CCPA)

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What is CCPA?
(Climatology-Calibrated Precipitation Analysis)

- A new dataset of precipitation analysis, over CONUS at 6h, ~4km resolution
- Statistical adjustment of Stage IV data toward CPC analysis
- Simple linear regression at 0.125 degree and 24h accumulation
- Spatial interpolation and temporal smoothing to regression coefficients
- Keep the fine scale structures of Stage IV
- Closer to CPC Unified Precipitation Analysis, in the sense of climatology
- Provide a proxy of truth for precipitation forecast calibration and downscaling

Status and Availability of CCPA data sets

- Operational implementation at NCEP on July 13, 2010
  - Real time generation of CCPA after STAGE IV
  - Generate at noon and update in the evening
- Generate the historical data set of CCPA for 2002-2010
- Product grids:
  - HRAP (primary)
  - NDGD, 0.125, 0.5 and 1.0 degree resolutions (byproducts)
- Contact information: Yan.Luo@noaa.gov
- CCPA website:

http://www.emc.ncep.noaa.gov/gmb/yzhu/html/imp/201007_imp.html

Establish Statistical Relationship

1. Historical data sets

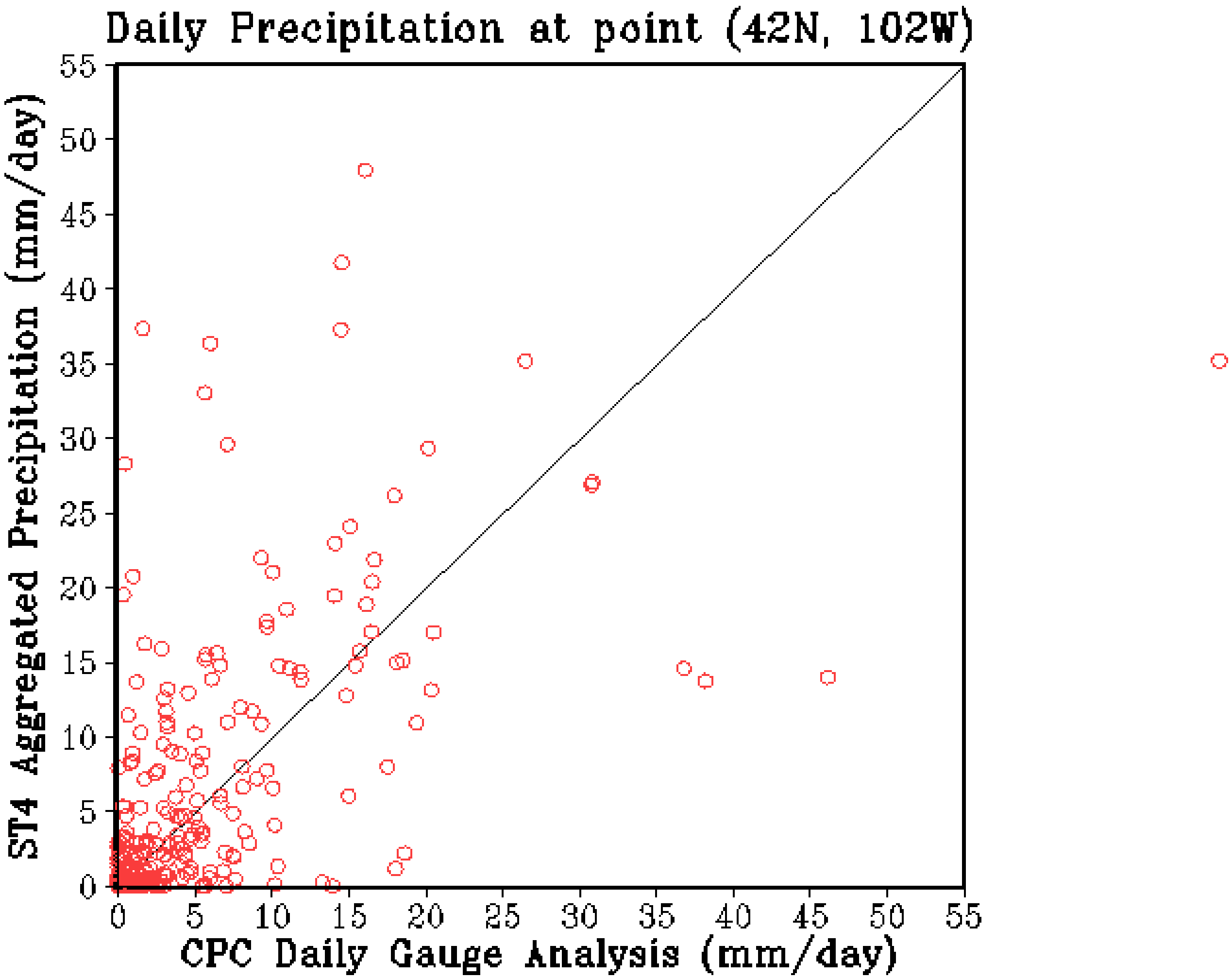
   June 1 2002 to July 31 2009 For CPC and STAGE IV

2. Match resolutions
   a. Accumulate RFC over 24 hours
   b. Interpolate to ⅛° (copygb w/ volume preservation)

3. Collect precip samples
   a. For each day of the year and at each grid point, collect all precip within 61 day window centered around that day, over all 7 years (max ~427 data points)
   b. Use only data points with ST4 > 0

4. Linear regression
   a. $CPC = a \cdot ST4 + b$

- End Result
  – Linear relationship (a & b) on ⅛° grid for each day of the year

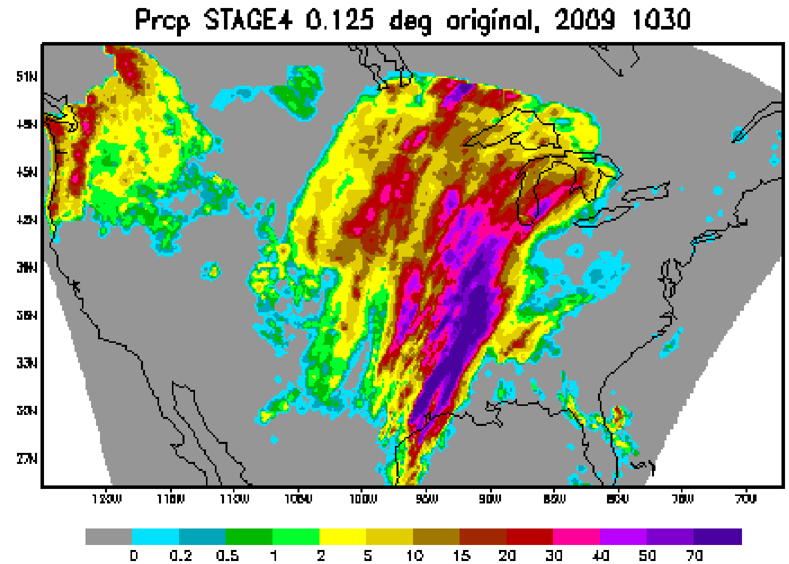


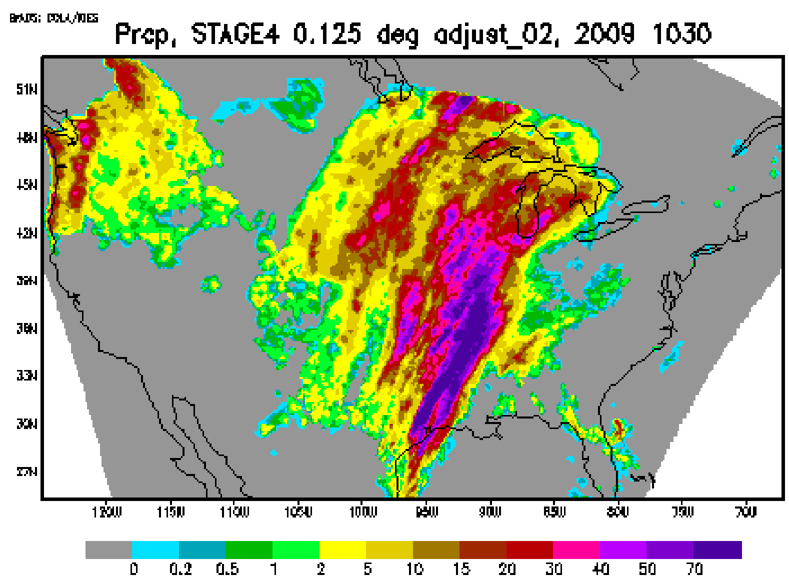
Scatter plots of Stage IV against CPC. All data pairs here are sampled to estimate regression coefficients at point (42N,102W) for day July 1st (Julian day 182).

- Different sample size for the lower and higher precipitation ranges
- Small size for heavy precipitation
- A "linear" regression likely dominated by the lower precipitation points.

Adjustment with regression coeff and intercept:

$$ST4^* = a \cdot ST4 + b$$





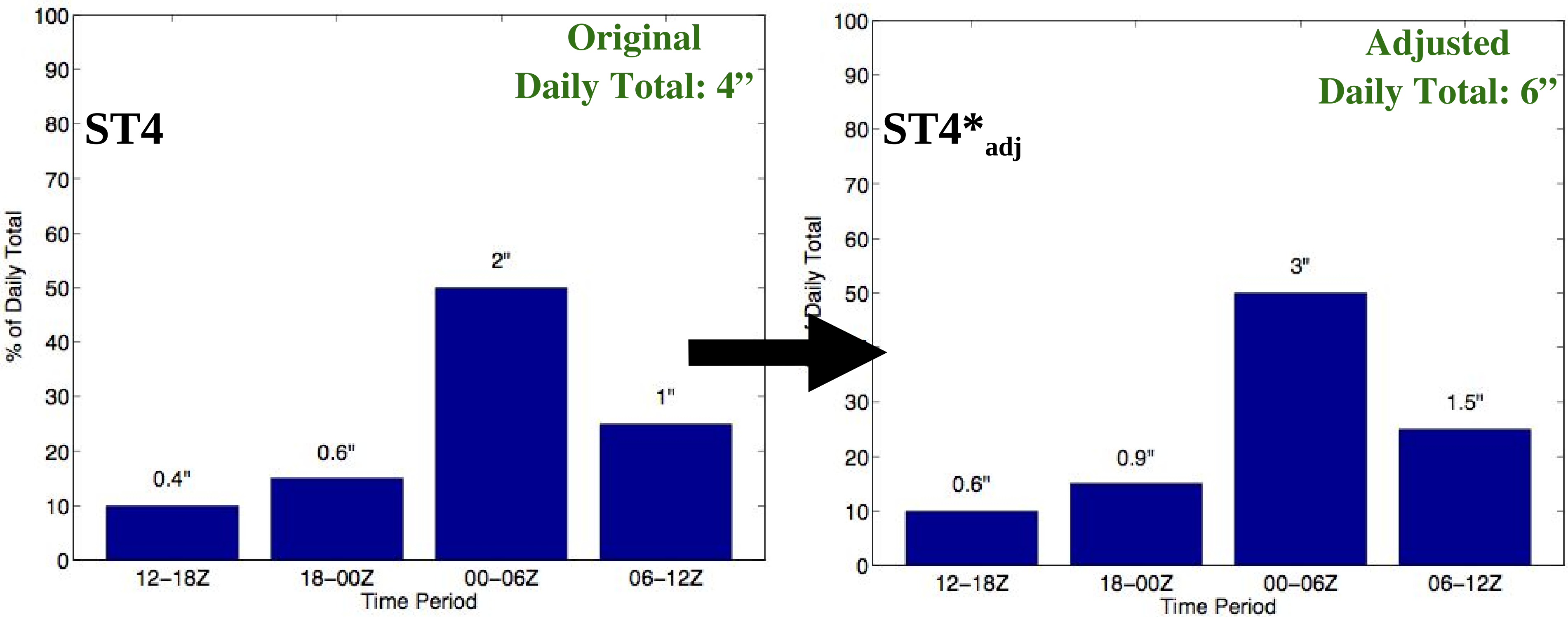
Recovering Original RFC Resolutions

Temporal Disaggregation

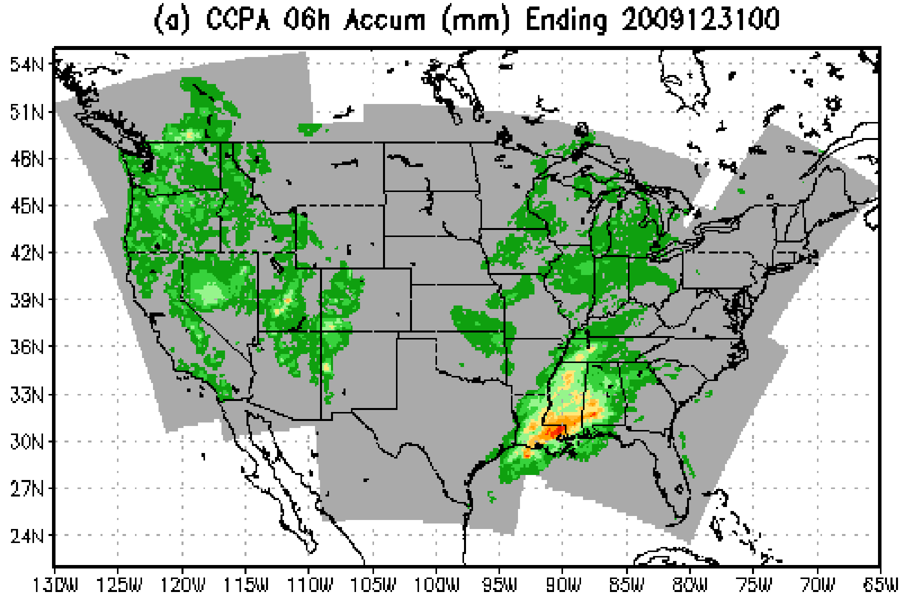
1. Determine percentage of daily total precipitation in each 6-hour period in original ST4

1. Divide 24 hour ST4* into four 6-hour precip amounts using the percentages from original ST4

Percent of daily total in each 6-hourly period

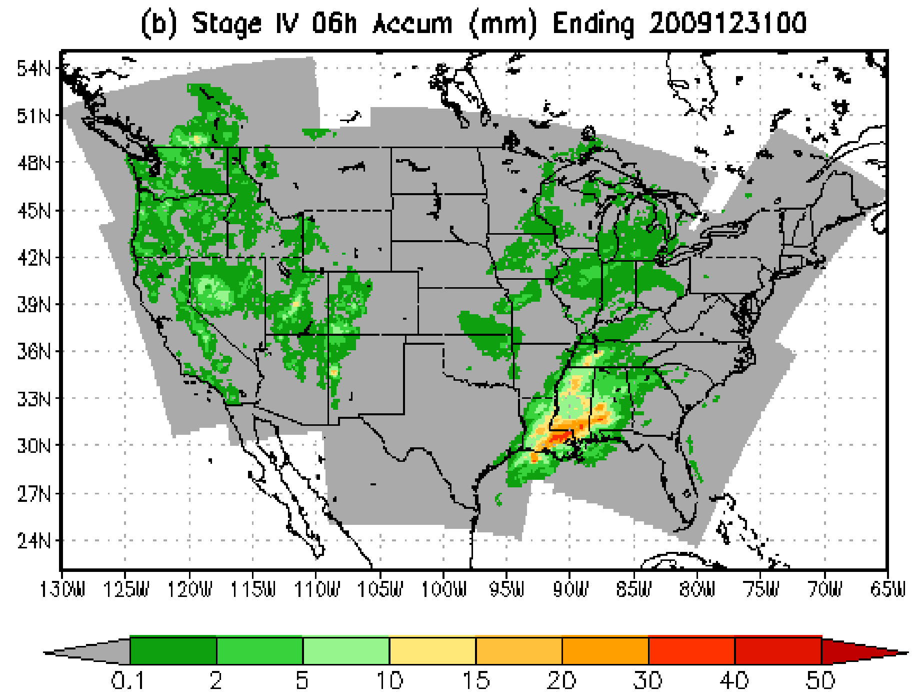


Comparison of CCPA and Stage IV

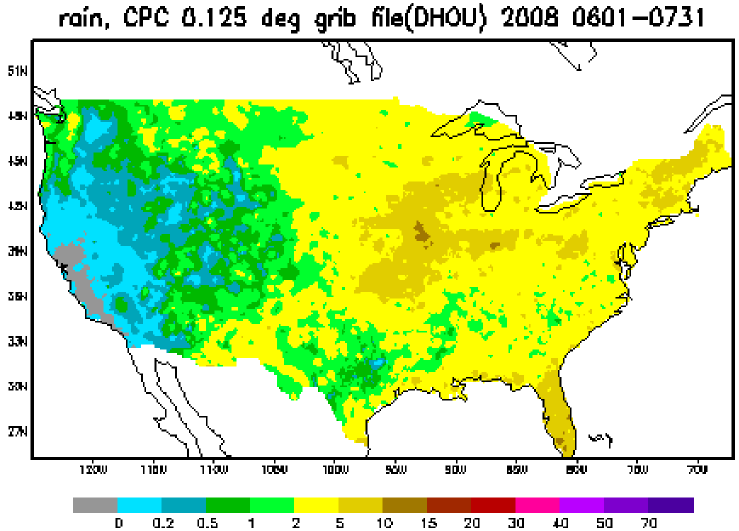


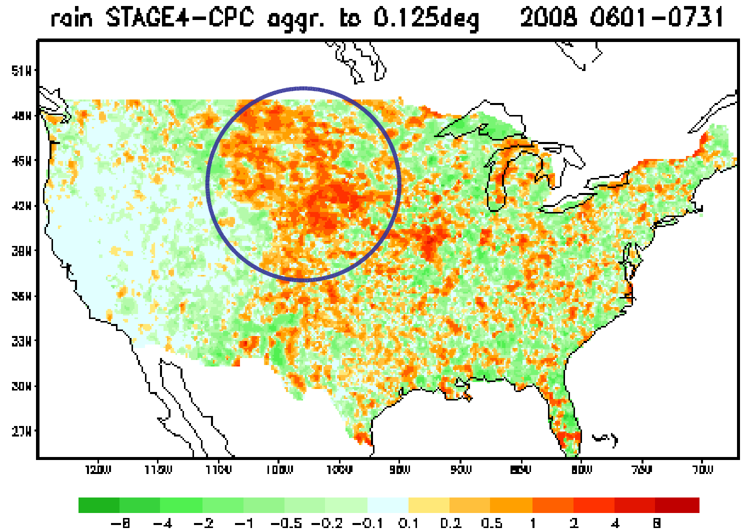
6-h accumulation
(18Z , 30th to 00Z 31st, December 2009)
4km HRAP

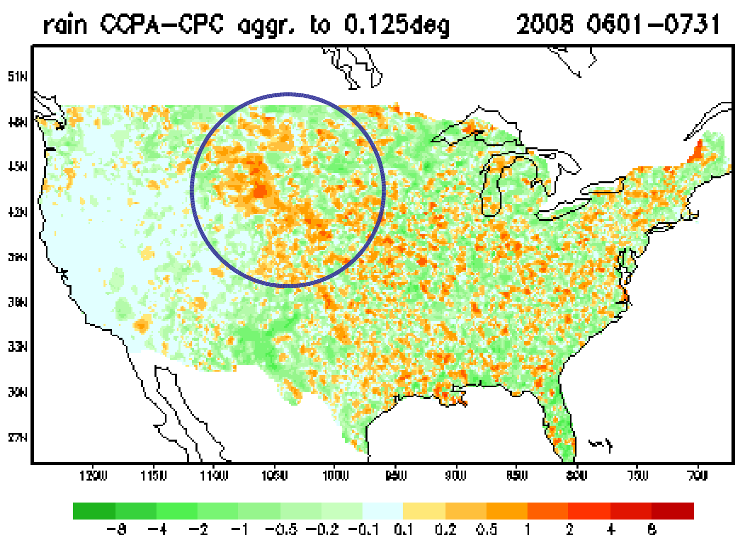
Spatial pattern correlation coefficient
= 0.990016



Comparison of Stage IV and CCPA Wrt. CPC



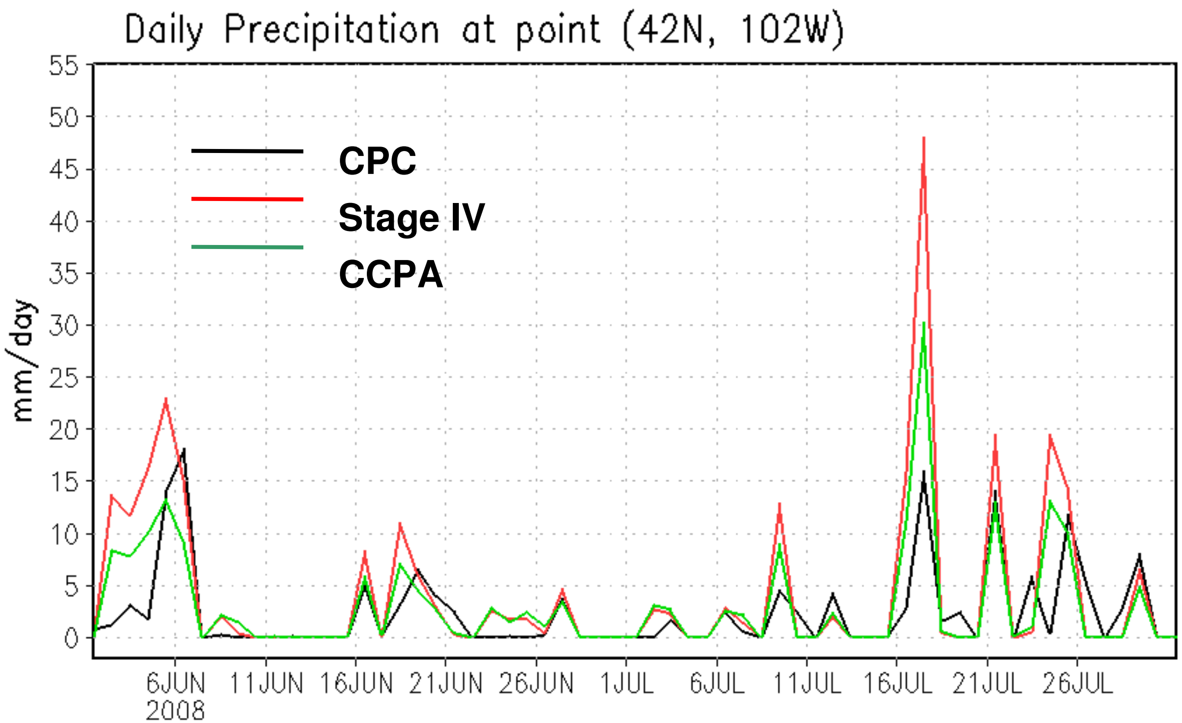




-Two Month Mean (June 1 – July 31, 2008)

For Stage IV and CCPA
- Aggregated from HRAP to 0.125 deg
- Aggregated from 6-hourly to daily

Comparison of time series of CPC, Stage IV and CCPA

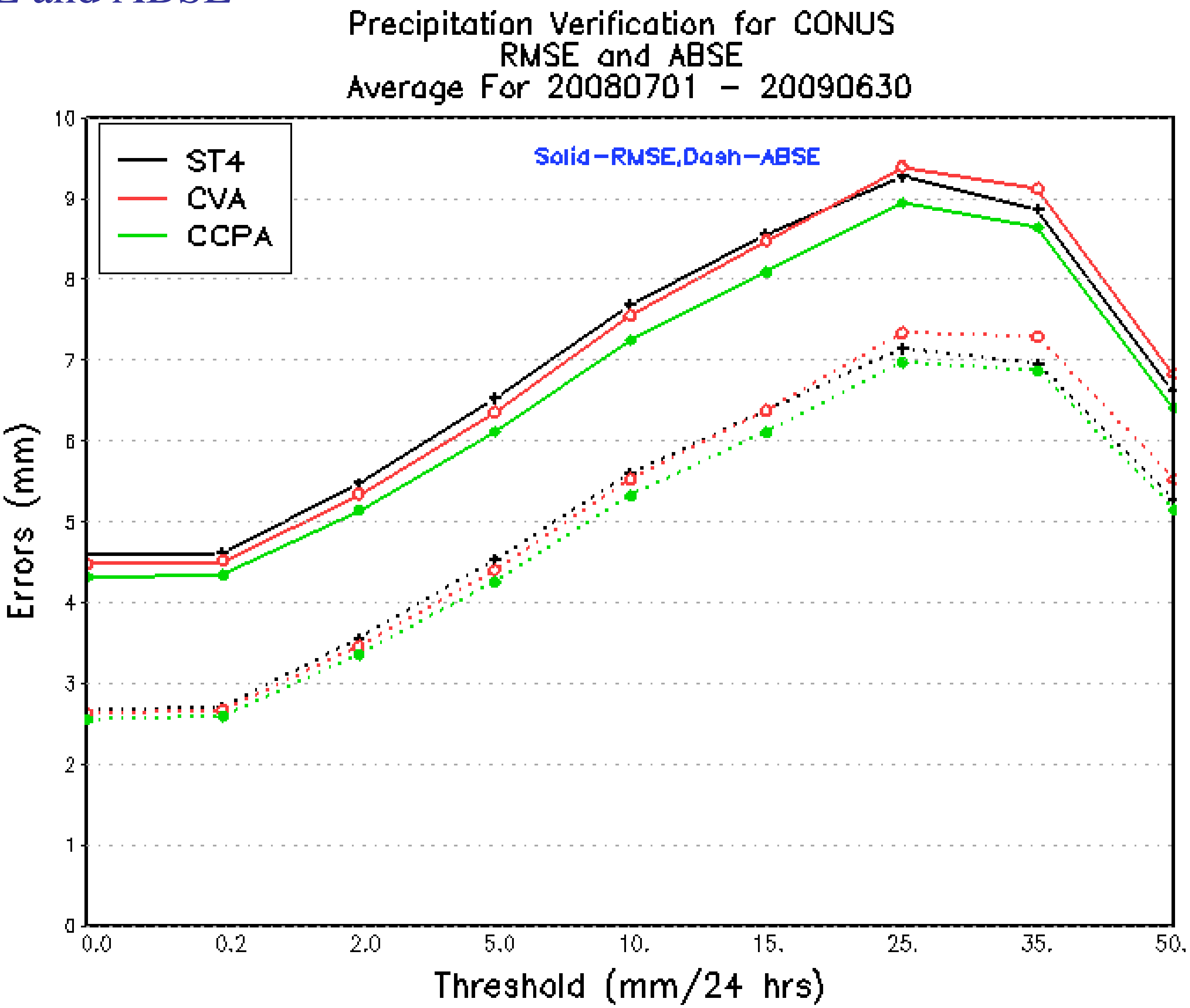


- Example: A Point (42N, 102W) near Ashby, NE
- Selected from 0.125 deg datasets for June 1 – July 31 2008

Verification against RFC-gauge network

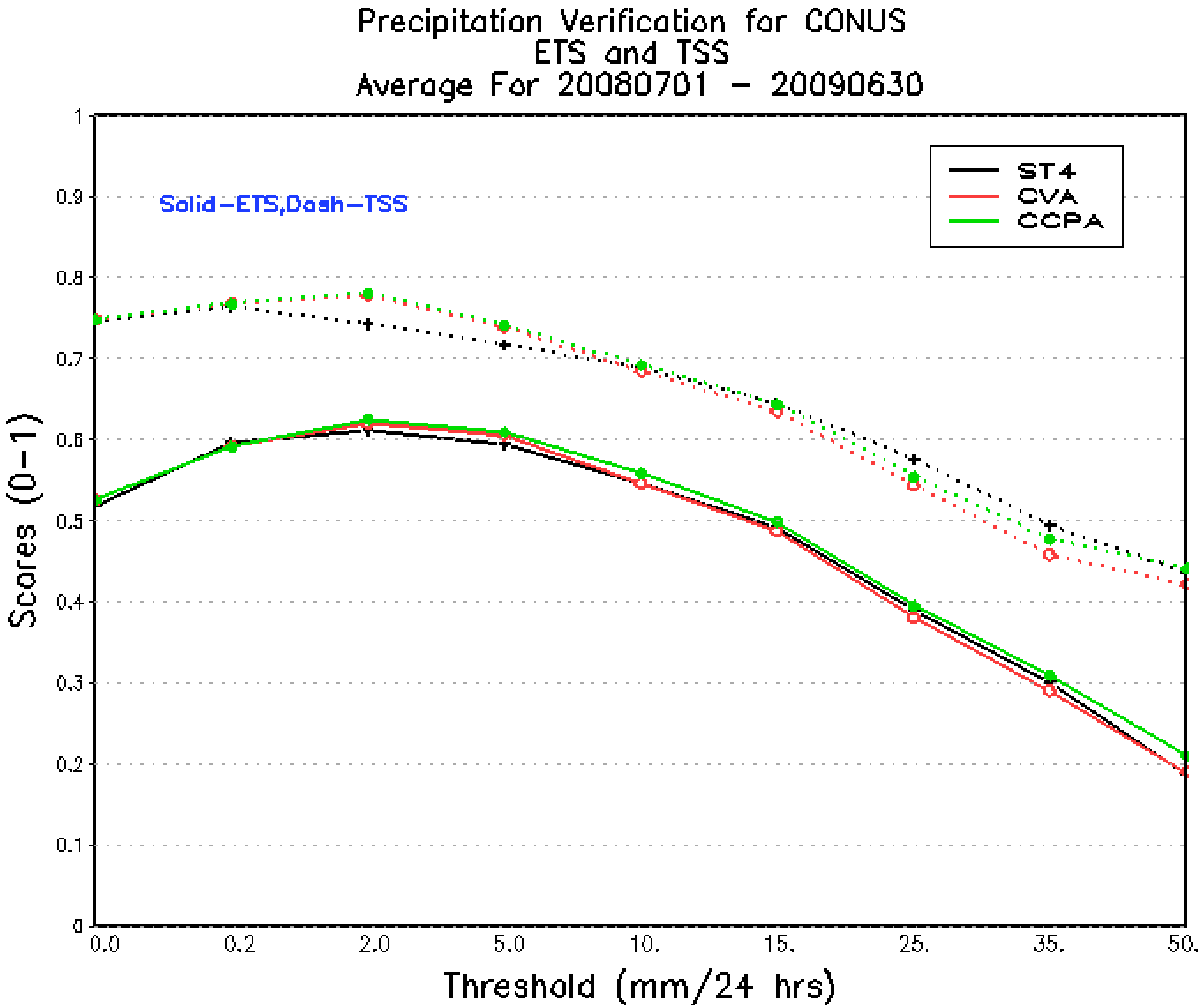
Results – RMSE and ABSE

CVA: cross validation analysis



Verification against RFC-gauge network

Results – ETS and TSS



Conclusion

- CCPA methodology is robust; this is supported by the fact that cross validation analysis is fairly close to CCPA.
- Non-uniform quality control as one shortcoming of Stage IV is (at least partially) corrected.
- CCPA retains spatial and temporal patterns of Stage IV data set.
- CCPA long term average is closer to that of CPC analysis than Stage IV.
- The improvement is more significant with lower and medium daily precipitation amounts.

Limitations and Future Work

- Limitations
  - Inadequate sample of high amount precipitation
  - Validity of the simple linear regression model

- Future Work:
  - Perform annual updating of the regression coefficients with increased sample size
  - Employ more realistic non-linear regression models
  - Other calibration methods