Recent Upgrades to the Climatology-Calibrated Precipitation Analysis (CCPA)

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Background

What is CCPA?

- A dataset of precipitation analysis, over CONUS at 6h, ~5km resolution
- Statistically adjust Stage IV data at CPC analysis grid so their climatology is consistent with the CPC dataset, and then downscale back to the original Stage IV grid.
- Advantages:
  - Higher reliability of the CPC dataset, and
  - Higher spatial and temporal resolution of the Stage IV dataset
- Statistical adjustment — Linear regression: $CPC = a \cdot ST4 + b$
- Products:
  - Operational in July 2010
  - Twice daily
  - Grids: HRAP (primary), and NDGD, 0.125, 0.5 and 1.0 degree resolutions (byproducts)
  - Period:2002~present
- Application: Precipitation forecast calibration and downscaling

CCPA upgrades

- Inclusion of 3 hourly CCPA analysis, in addition to 6 hourly CCPA
  - In need for regional short-range forecast calibration and verification
  - Implemented into operations in July 2011
  - See poster 408 by Luo et al.
- Update of regression coefficients with extended historical data sets from 2002 to 2011
  - Two more years of data added

Update of regression coefficients (a&b)

Establish Statistical Relationship:

1. Historical data sets

   Operational : June 1 2002 to July 31 2009 For CPC and STAGE IV
   Updated: June 1 2002 to July 31 2011 (two more years of data)

2. Match resolutions

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

3. Collect precipitation samples

   a.   For each day of the year and at each grid point, collect all precip
         within 60 day window centered around that day, over all years (max ~
         n x 61 data points)
   b.   Use only data points with ST4 > 0

4. Linear regression

   a.   CPC = a·ST4 + b

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

Regression Aug. 1st

Oper (2002-2009) Update (2002-2011)

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Regression Aug. 1st

Oper (2002-2009)

Update (2002-2011)

Slope (a)
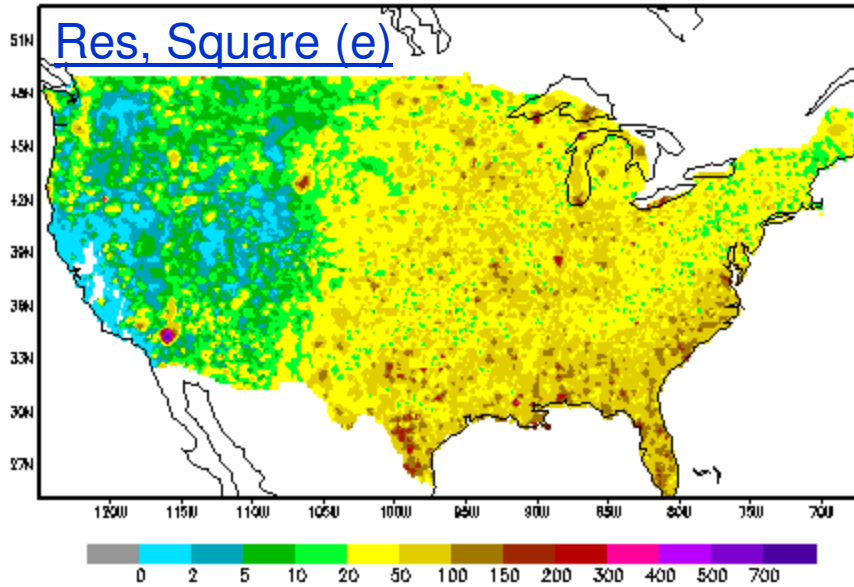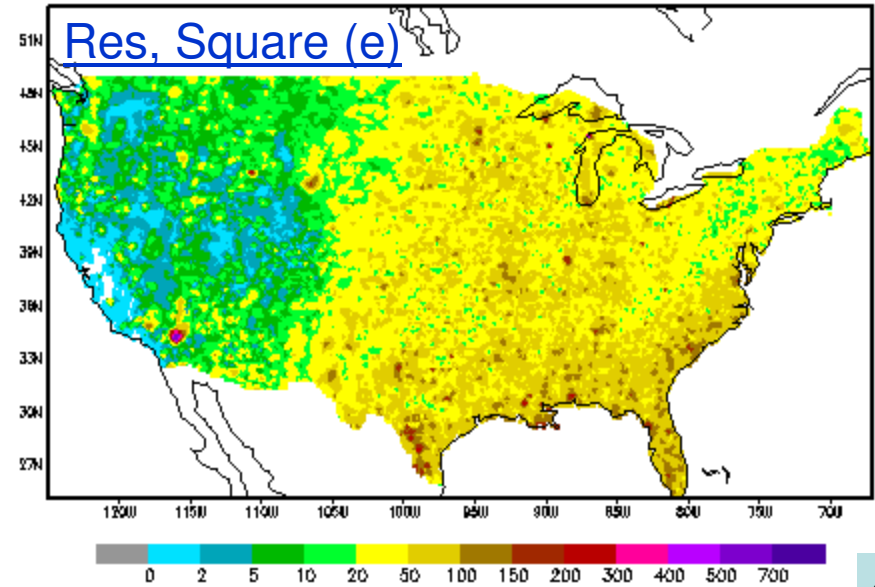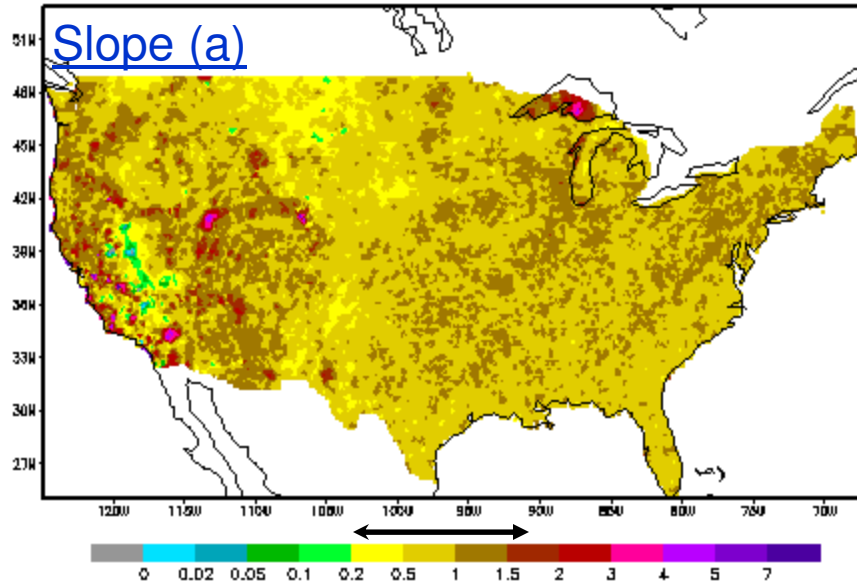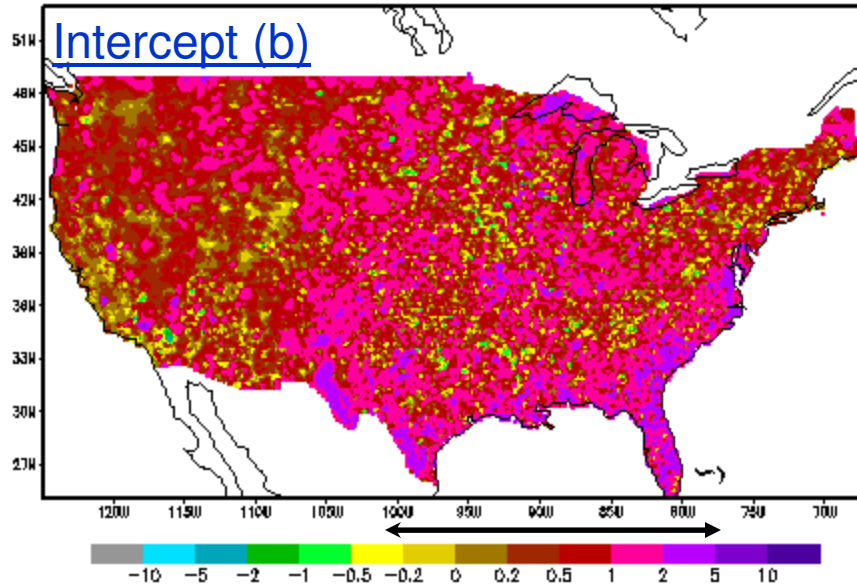
Intercept (b)
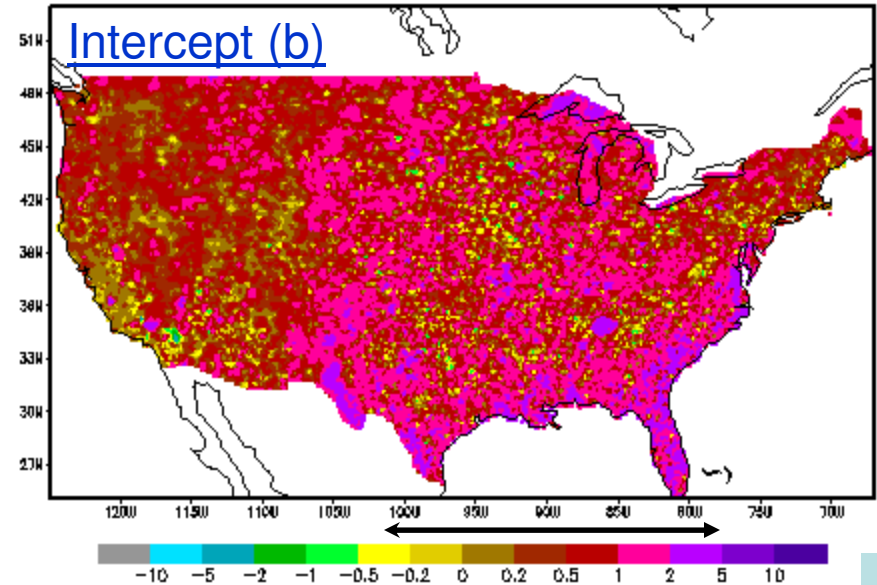
Time series of regression
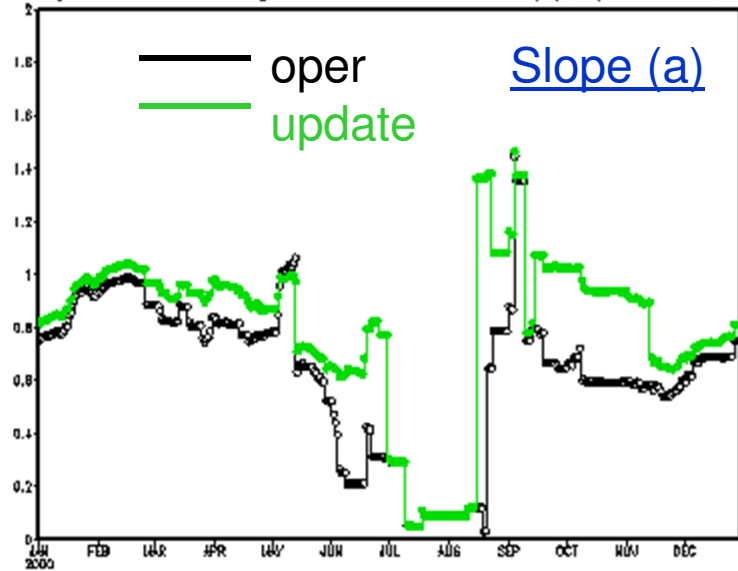
Comparison Wrt. CPC

rain, CPC 0.125 deg daily, 05/02/2009 — CPC

rain STAGE4 aggr. to 0.125deg daily, 05/02/2009 — ST4

rain CCPA (oper) aggr. to 0.125deg daily, 05/02/2009 — CCPA (oper)

rain CCPA (updated) aggr. to 0.125deg daily, 05/02/2009 — CCPA (update)
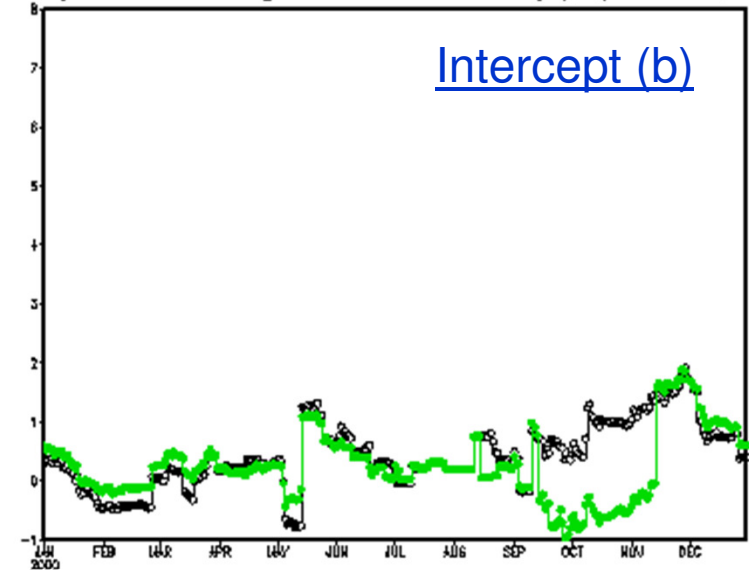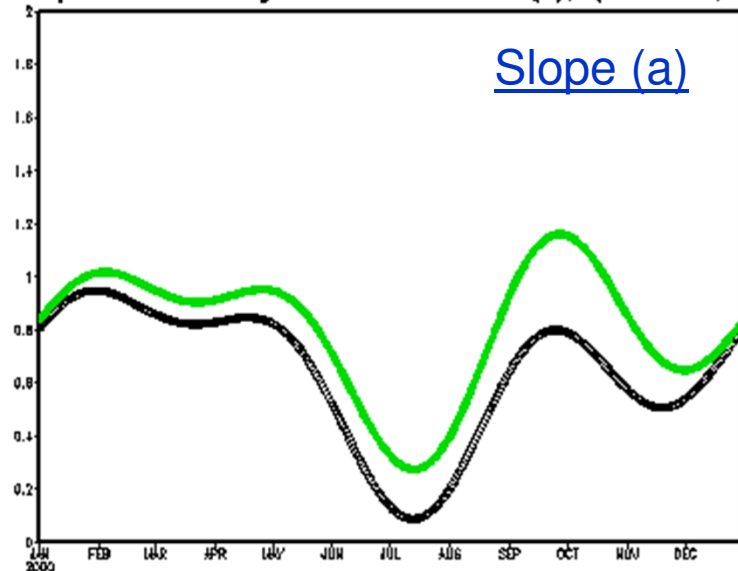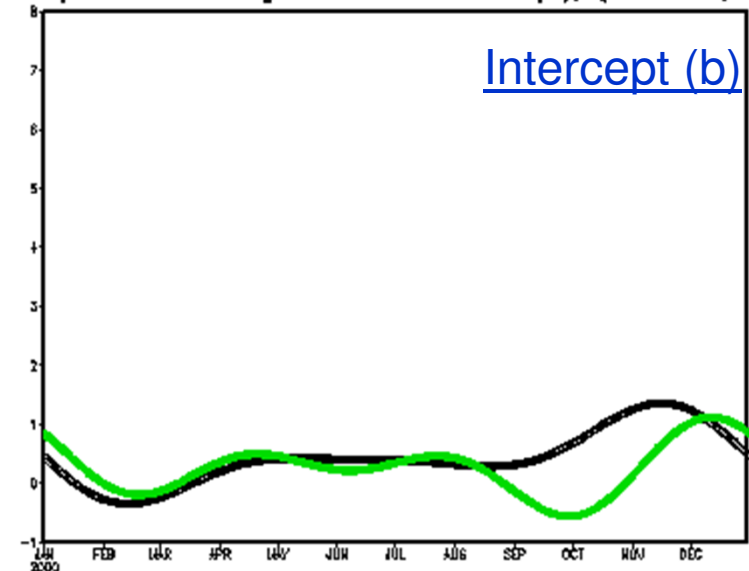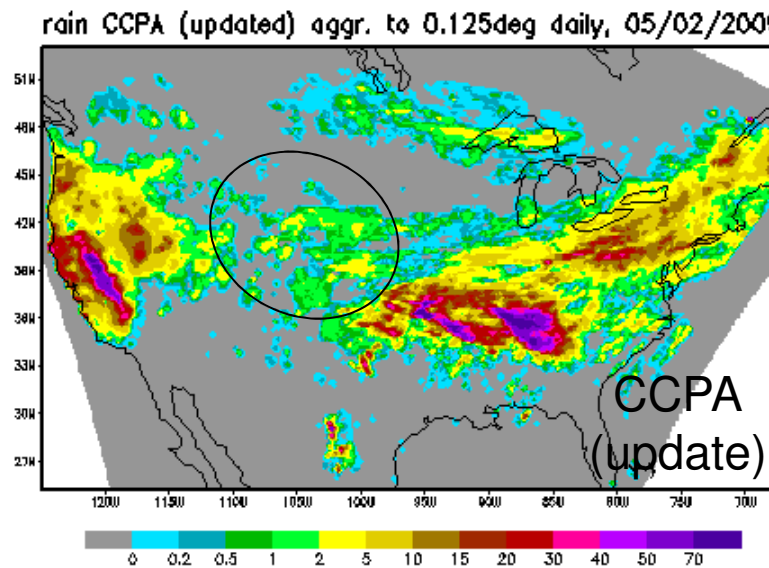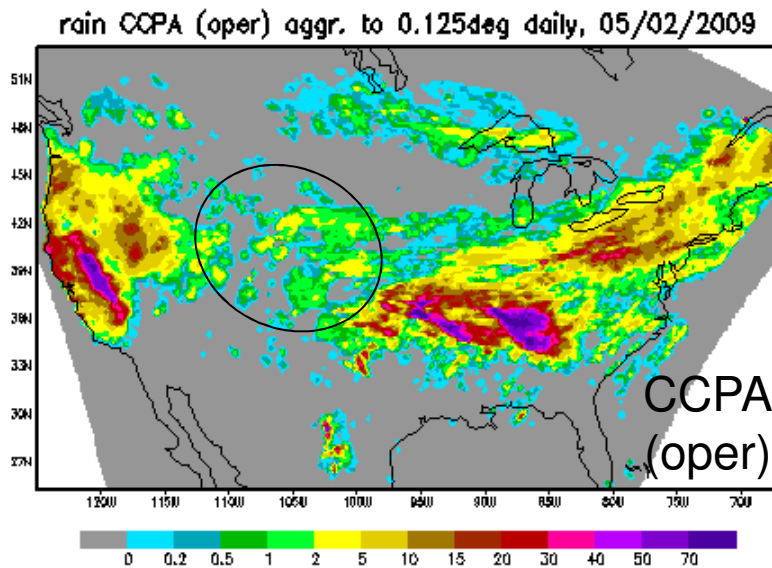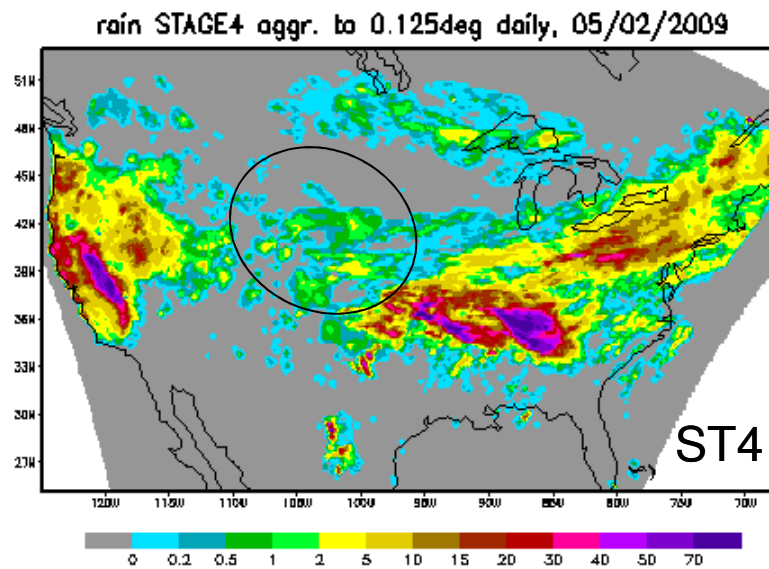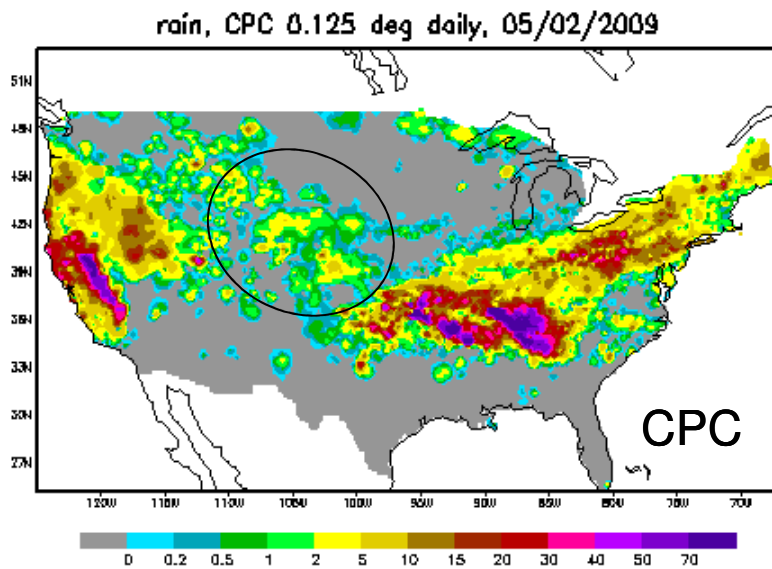
$$CCPA\_oper = a_{7yr} \cdot ST4 + b_{7yr}$$

$$CCPA\_update = a_{9yr} \cdot ST4 + b_{9yr}$$
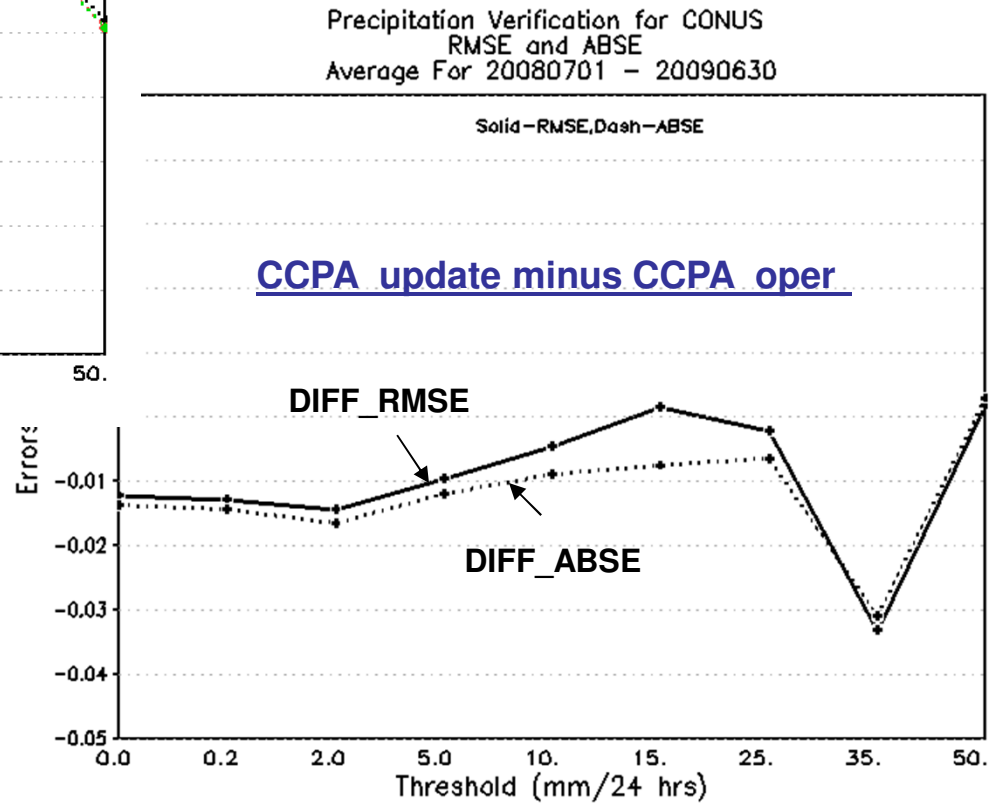
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Difference Wrt. CPC

CPCA _oper= a $_{7yr}$·ST4 + b$_{7yr}$ CCPA_update = a $_{9yr}$·ST4 + b$_{9yr}$

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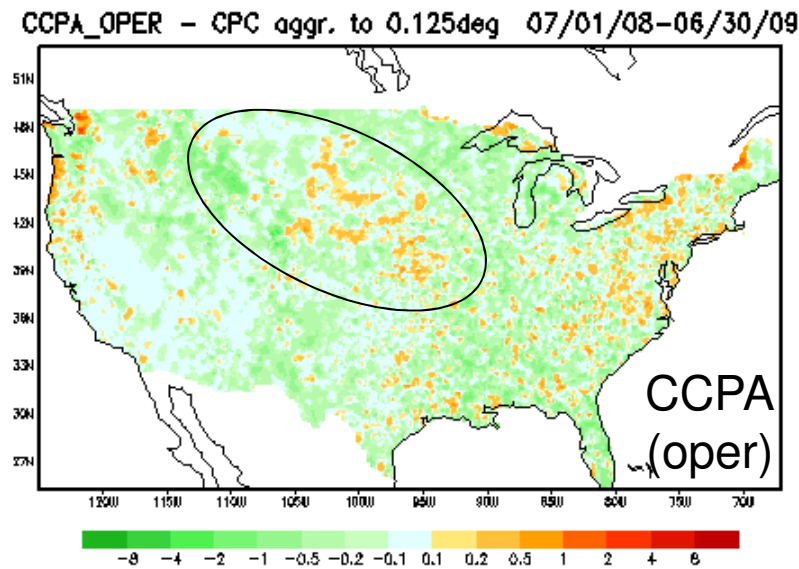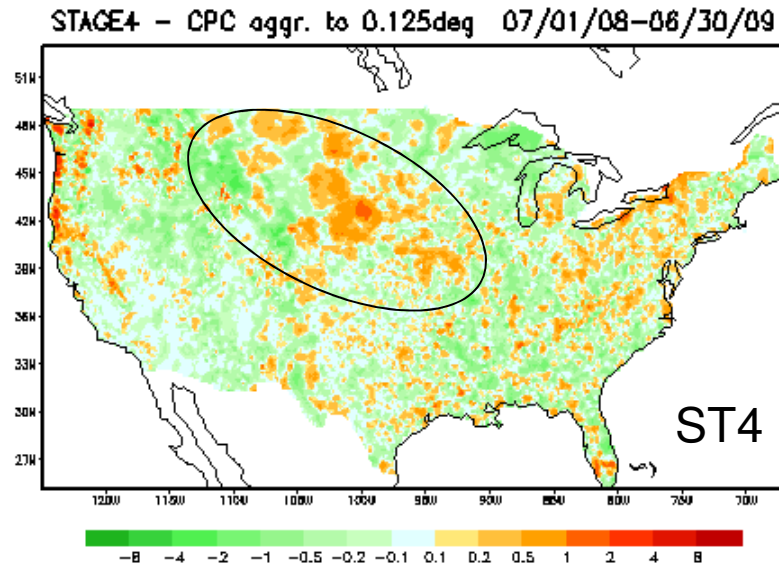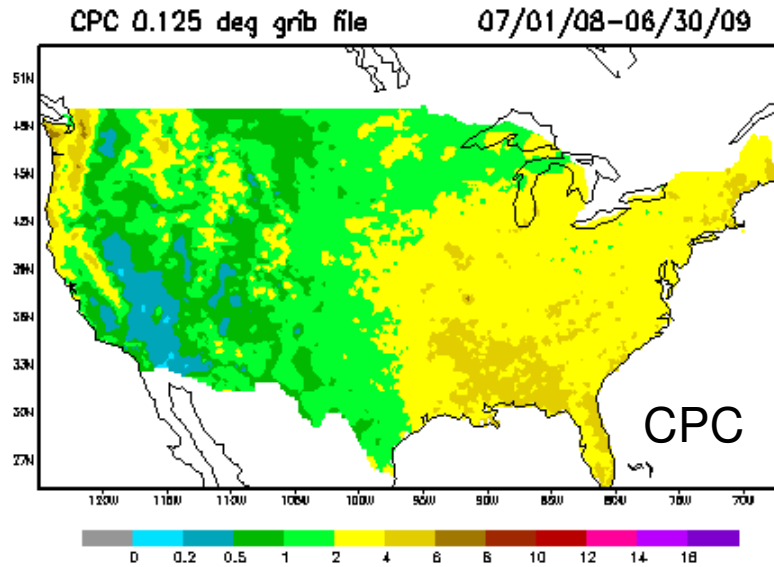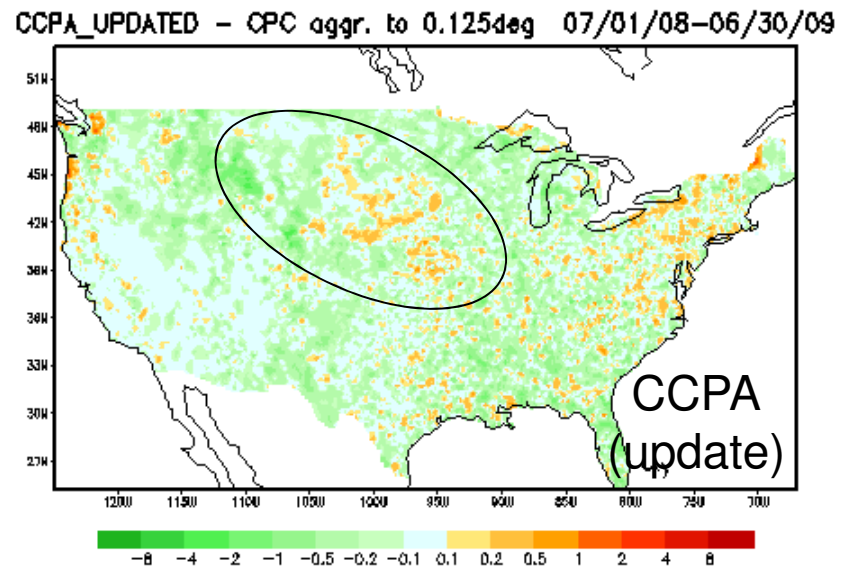
Verification against RFC-gauge network

Precipitation Verification for CONUS
RMSE and ABSE
Average For 20080701 – 20090630

Solid-RMSE,Dash-ABSE

CCPA_update minus CCPA_oper

DIFF_RMSE

DIFF_ABSE
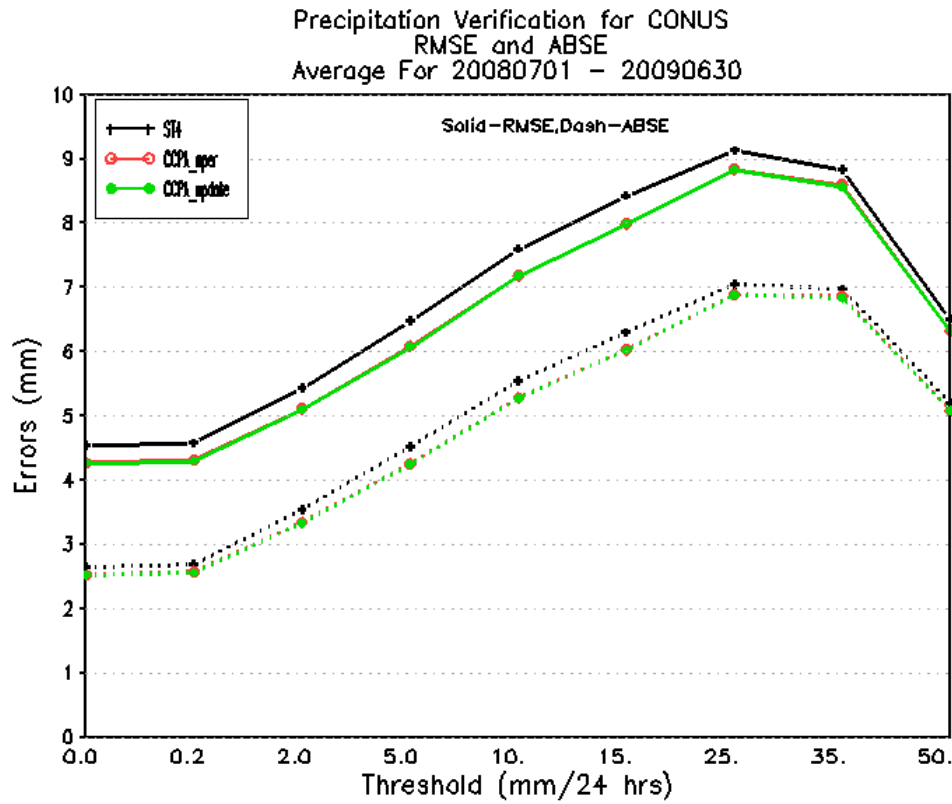
CDF at a point (42N, 102W) for one year (7/1/08-6/30/09)

CCPA_update is even more closer to CPC
between 7-11mm thresholds

CRPS_CCPA_oper

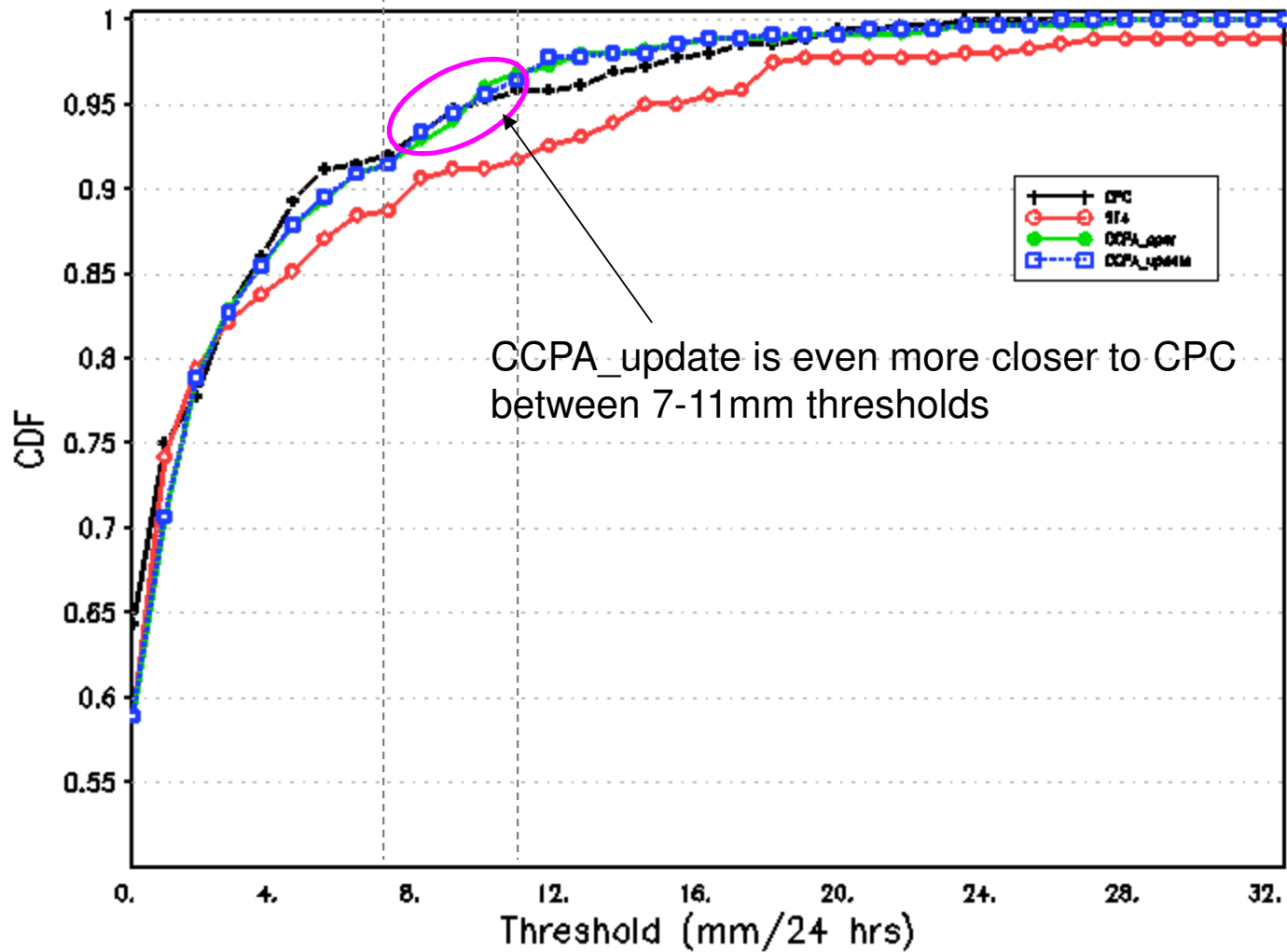CRPS_CCPA_update

0.005 0.01 0.06 0.1 0.3 0.5 0.7 1

0.005 0.01 0.05 0.1 0.3 0.5 0.7 1

DIFF (CRPS_CCPA_update minus CRPS_CCPA_oper)

-0.1 -0.05 -0.01 -0.005 0.005 0.01 0.05 0.1
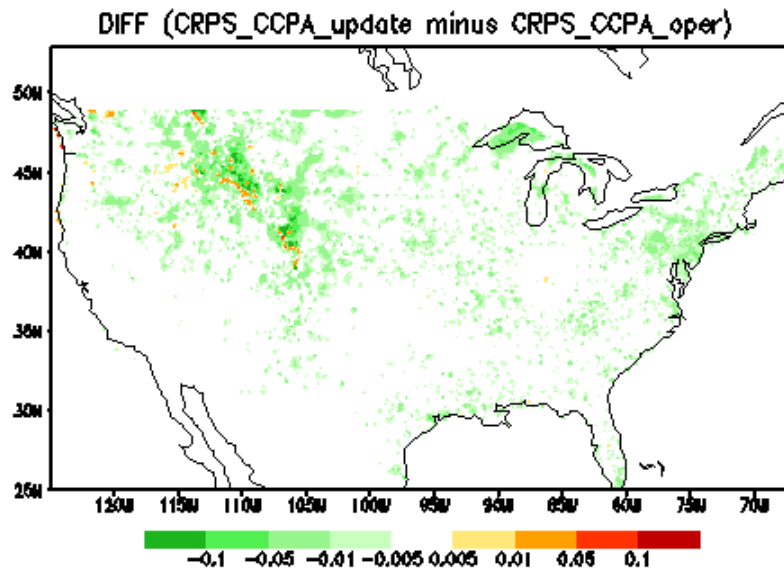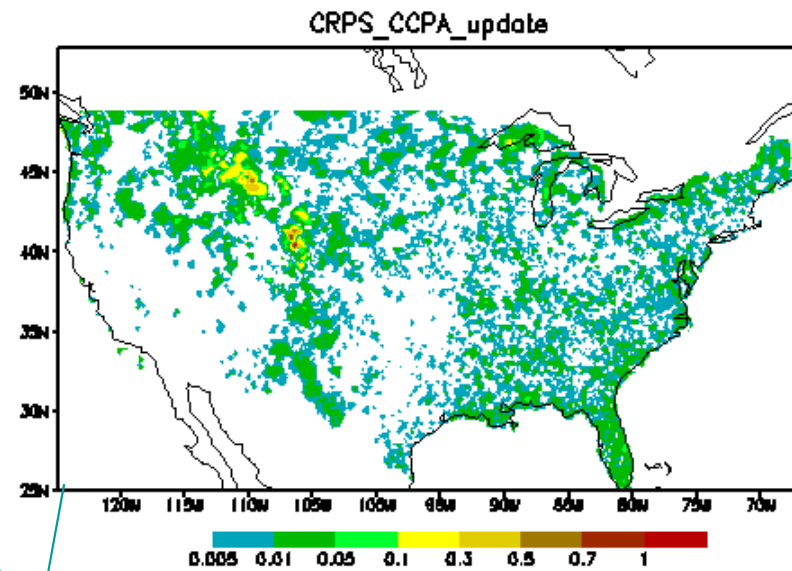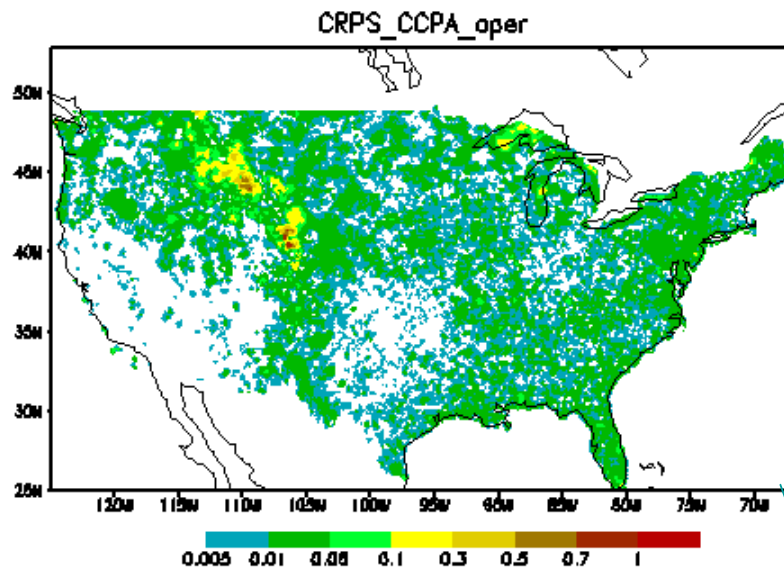
Period: 7/1/2008 – 6/30/2009
Smaller value is better

Period: 7/1/2008 – 6/30/2009
Negative (green) is better

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Summary

1. Updating regression coefficients

- Some slight improvements can be seen in term of RMSE, ABSE, CDF and CRPS.

- No negative impact and degrade were found when regression coefficients were updated and applied to generate new version of CCPA.

- Periodically (annually) upgrading regression coefficients with increasing sample size makes CCPA methodology robust.

2. Future work:

- Nonlinear Regression Models

- Neural Network Method