

# Verification of CCPA

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# Quantitative Evaluation Method

	Comparison (I)	Comparison (II)	Comparison (III)
Compared QPEs	ST4, CR7,CCPA	ST4,CR7,CCPA, CPC	ST4,CR7,CCPA, CPC
Verifying analysis (Assumed Truth)	CPC (CPC 0.125- deg analysis mapped to grid )	Raw RFC gauge data box averaged to grid	Raw RFC gauge data box averaged to grid
Verifying grids	1/8 deg	1/8 deg	1 deg (copygb3 from 1/8 deg)

- Daily based (12UTC-12UTC, 24 hr accumulation)
- CONUS domain
- One year period (7/1/2008 – 6/30/2009)
- Verification Metrics: RMSE, AMSE, ETS, TSS, and bias score

# Relationships among CPC, ST4, CCPA and CR7

## Linear Regression:

$$\text{CPC}_{8\text{yr}} = a_{8\text{yr}} * \text{ST4}_{8\text{yr}} + b_{8\text{yr}}$$

From 8yr ( **6/1/2002-7/31/2009**) 1/8 deg data pool to get  $a_{8\text{yr}}$  and  $b_{8\text{yr}}$   
Then, compute

$$\text{CCPA} = a_{8\text{yr}} * \text{ST4} + b_{8\text{yr}} \quad \text{for } 7/1/2008-6/30/2009 \rightarrow \text{dependent}$$

## Linear Regression:

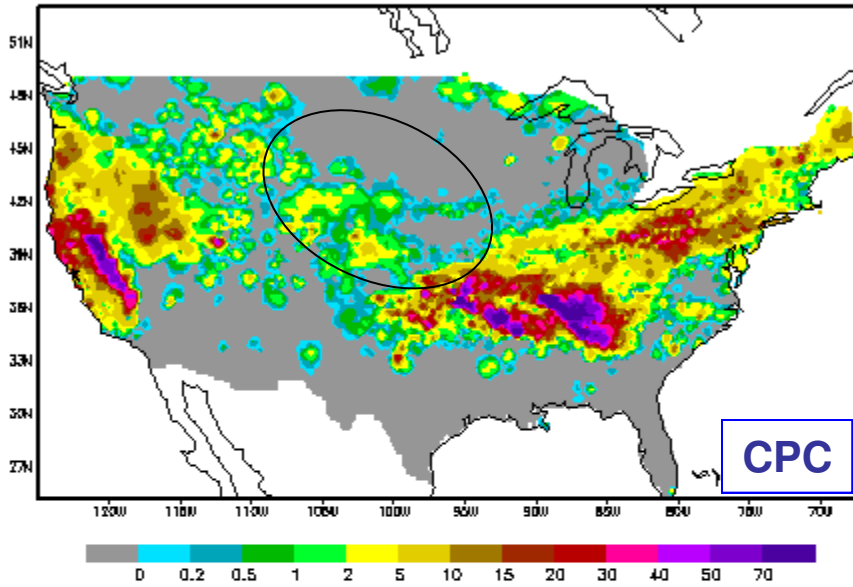
$$\text{CPC}_{7\text{yr}} = a_{7\text{yr}} * \text{ST4}_{7\text{yr}} + b_{7\text{yr}}$$

From 7yr ( **6/1/2002-7/31/2008**) 1/8deg data pool to get  $a_{7\text{yr}}$  and  $b_{7\text{yr}}$   
Then, compute

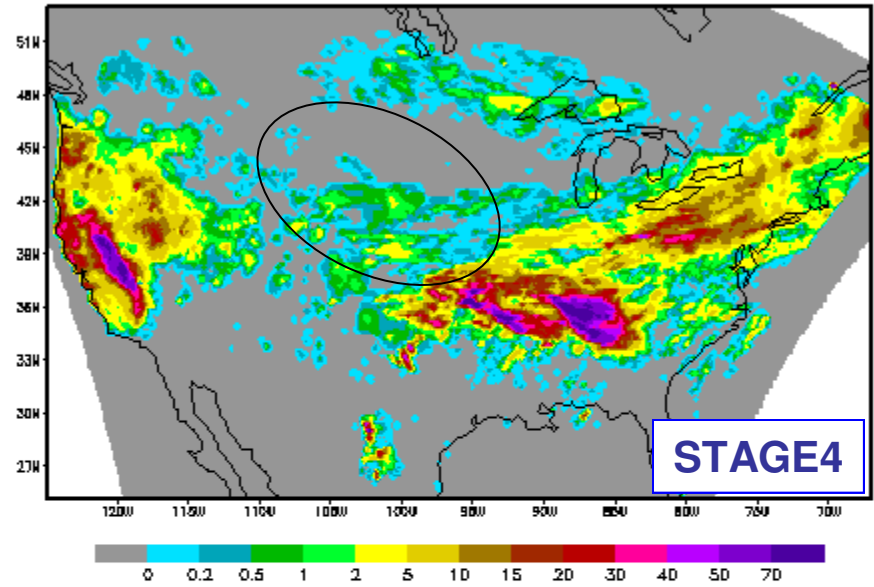
$$\text{CR7} = a_{7\text{yr}} * \text{ST4} + b_{7\text{yr}} \quad \text{for } 7/1/2008-6/30/2009 \rightarrow \text{independent}$$

# Verification against CPC at 1/8 degree

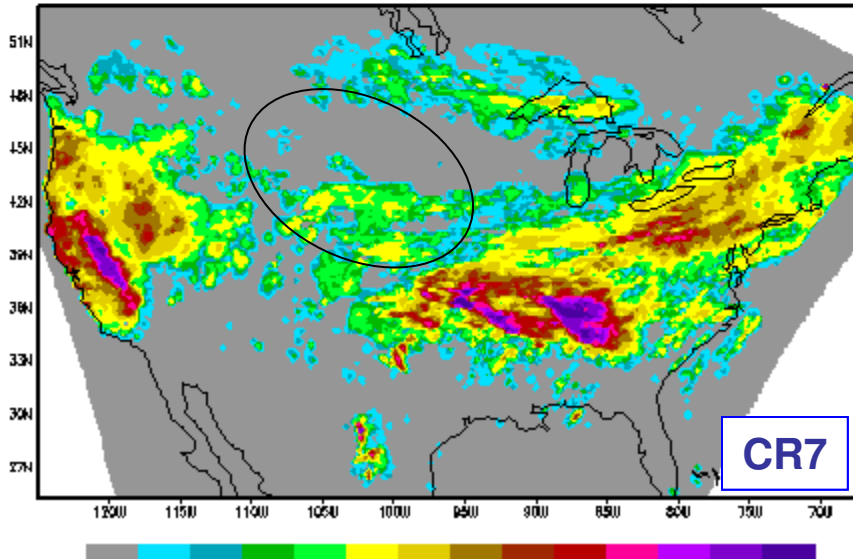
Prpc CPC 0.125 deg daily, 05/02/2009



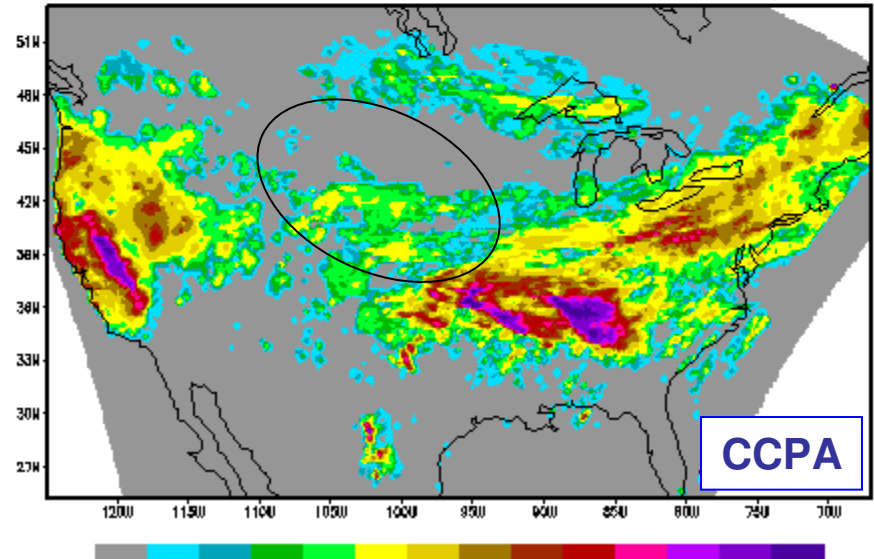
Prpc STAGE4 0.125 deg daily, 05/02/2009



Prpc ST4\_CR7 0.125 deg daily, 05/02/2009

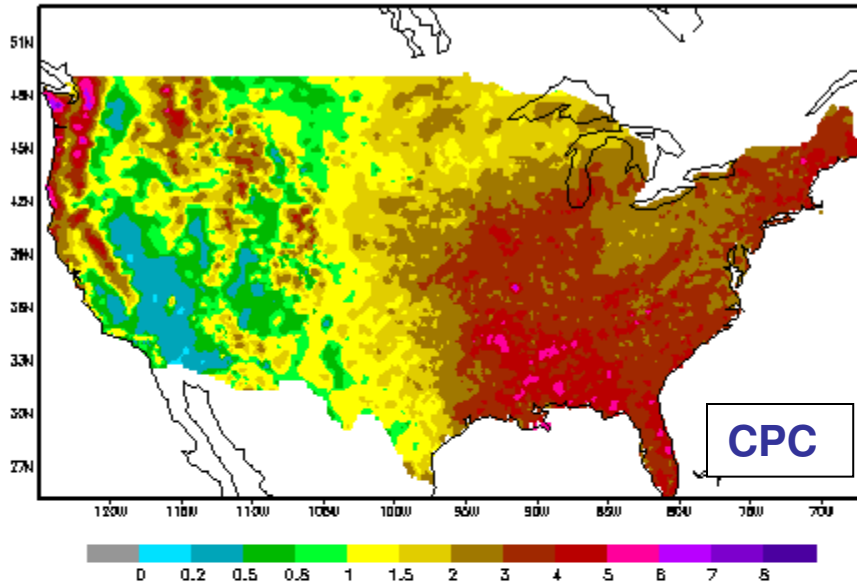


Prpc ST4\_ADJ 0.125 deg daily, 05/02/2009

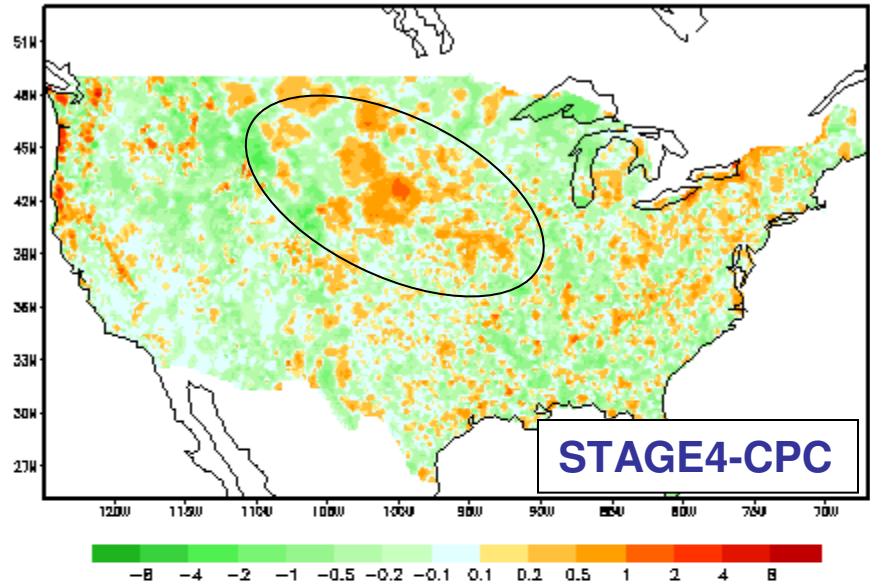


# Verification against CPC at 1/8 degree

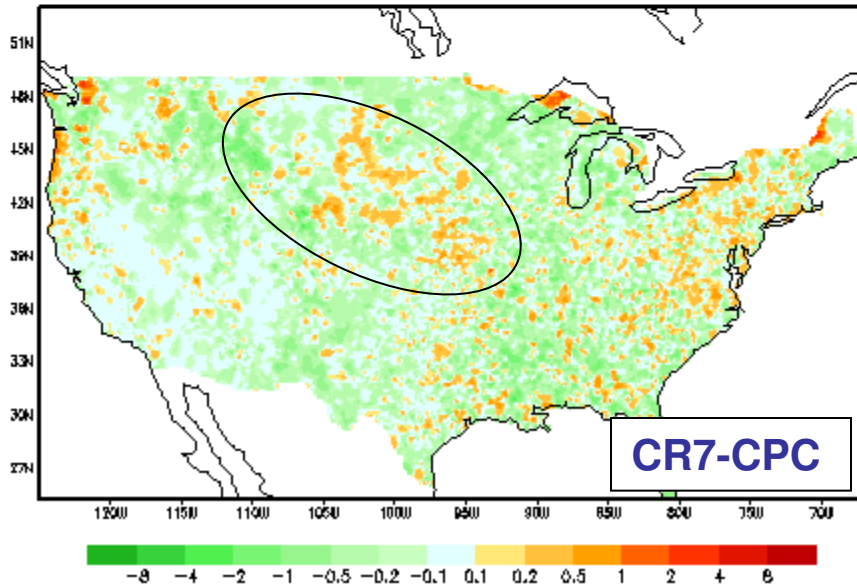
Prpc CPC 0.125 deg daily, Avg for 07/01/08-06/30/09



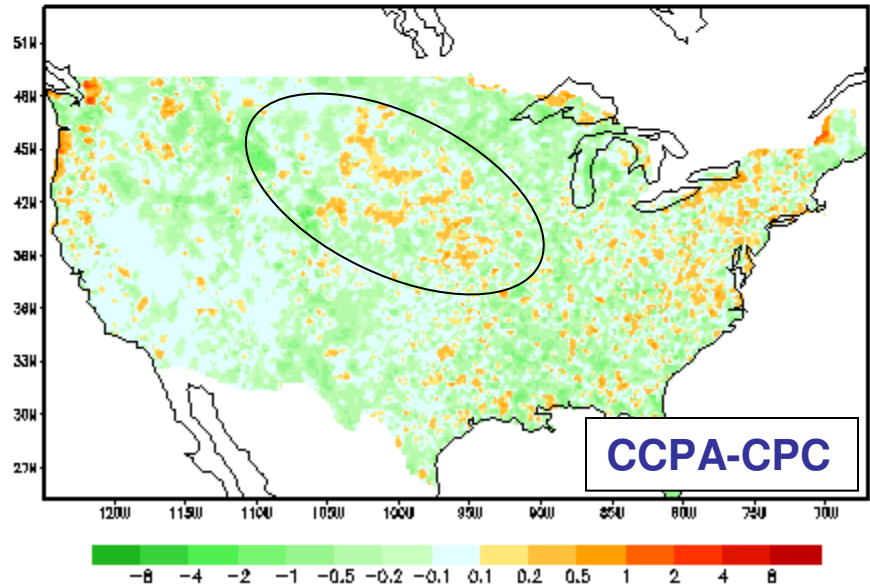
STAGE4 - CPC 0.125 deg daily, Avg for 07/01/08-06/30/09



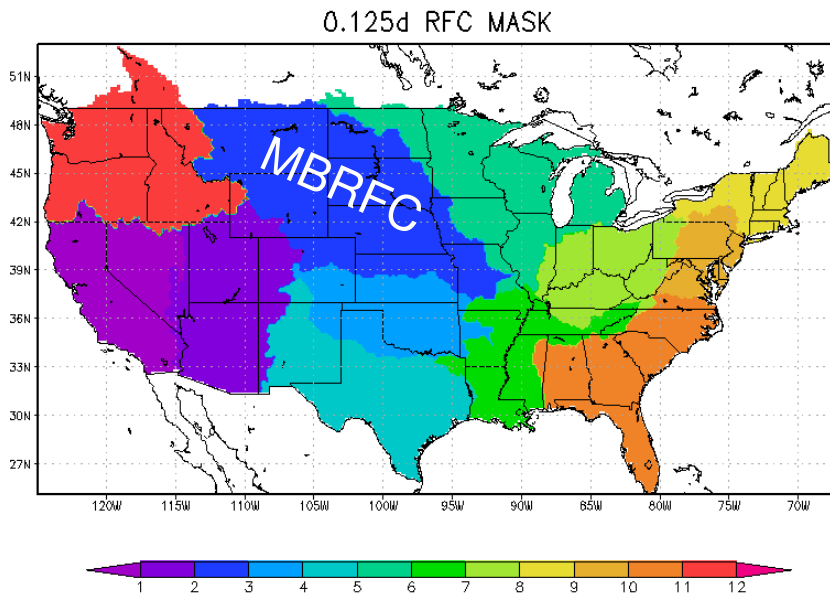
ST4\_CR7 - CPC 0.125 deg daily, Avg for 07/01/08-06/30/09



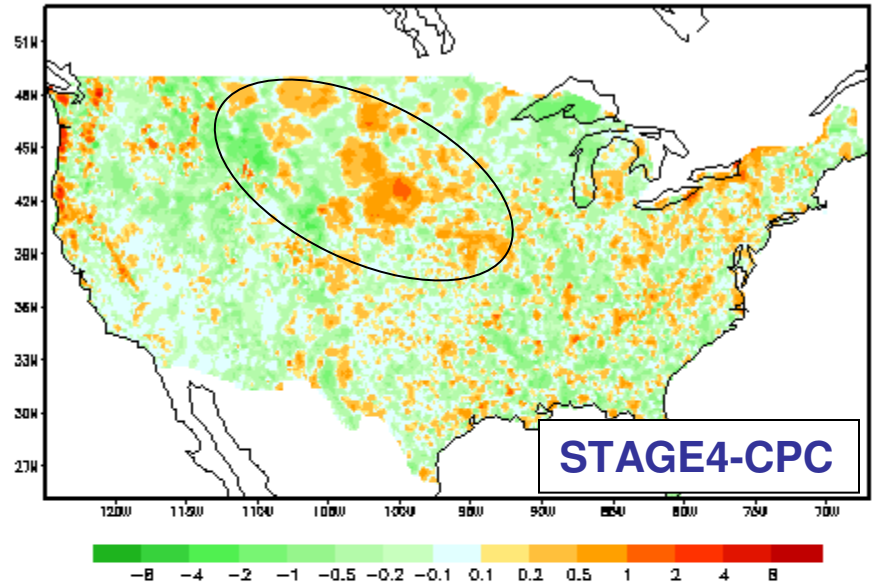
ST4\_ADJ - CPC 0.125 deg daily, Avg for 07/01/08-06/30/09



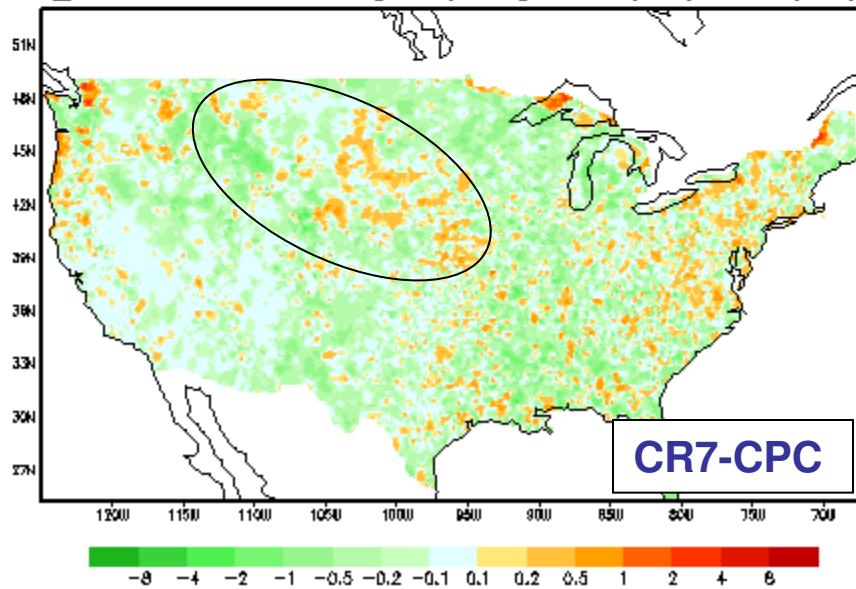
# Verification against CPC at 1/8 degree



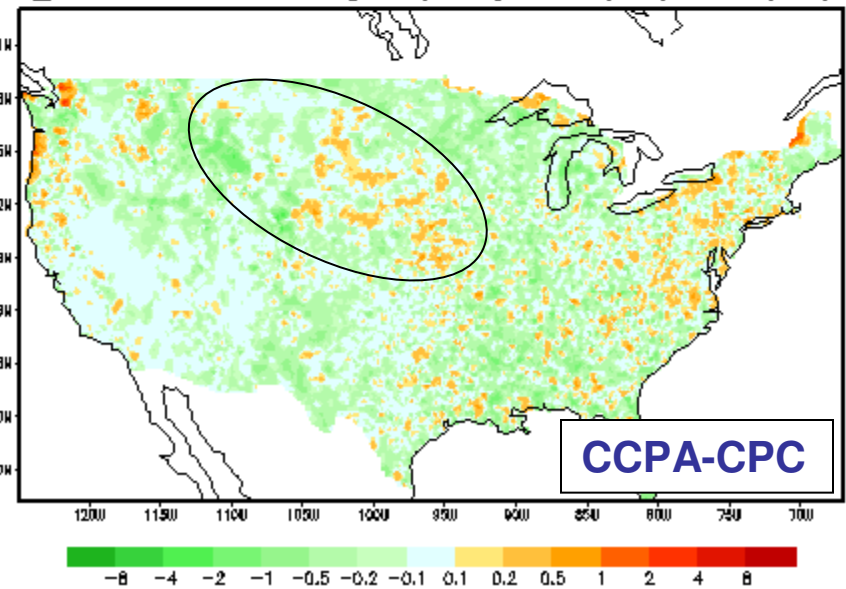
STAGE4 - CPC 0.125 deg daily, Avg for 07/01/08-06/30/09



ST4\_CR7 - CPC 0.125 deg daily, Avg for 07/01/08-06/30/09

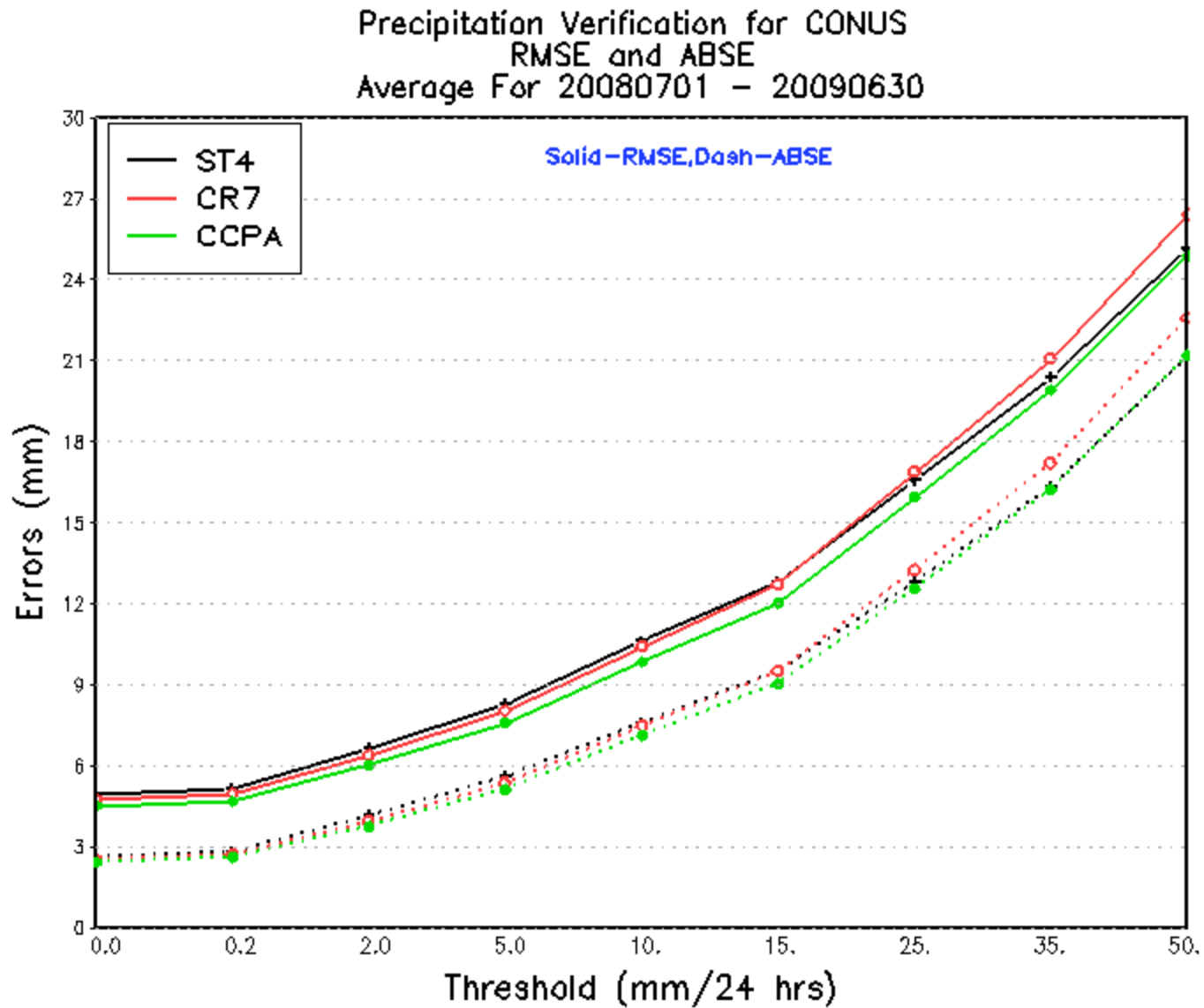


ST4\_ADJ - CPC 0.125 deg daily, Avg for 07/01/08-06/30/09



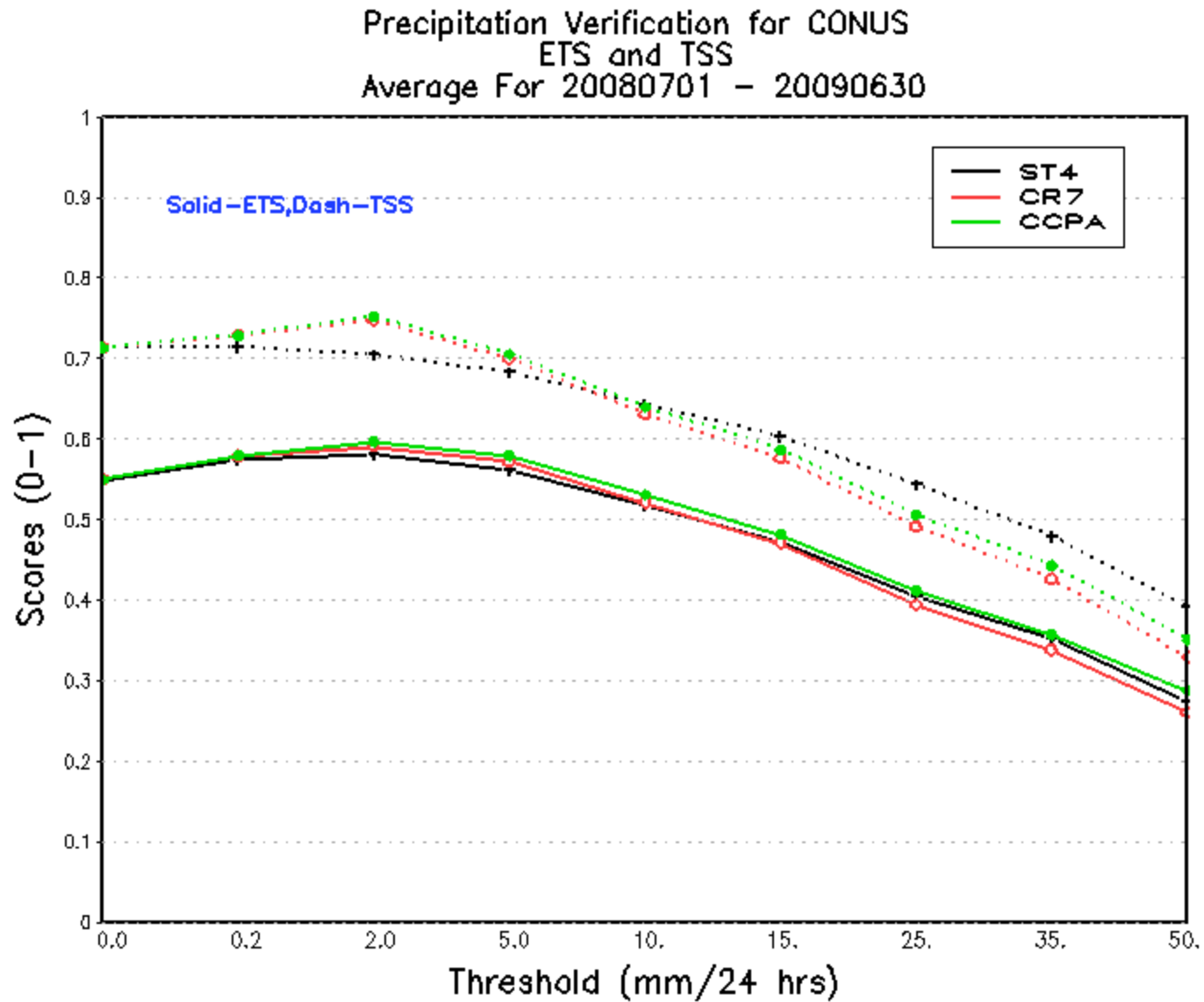
# Verification against CPC at 1/8 degree

## Results – RMSE and ABSE



# Verification against CPC at 1/8 degree

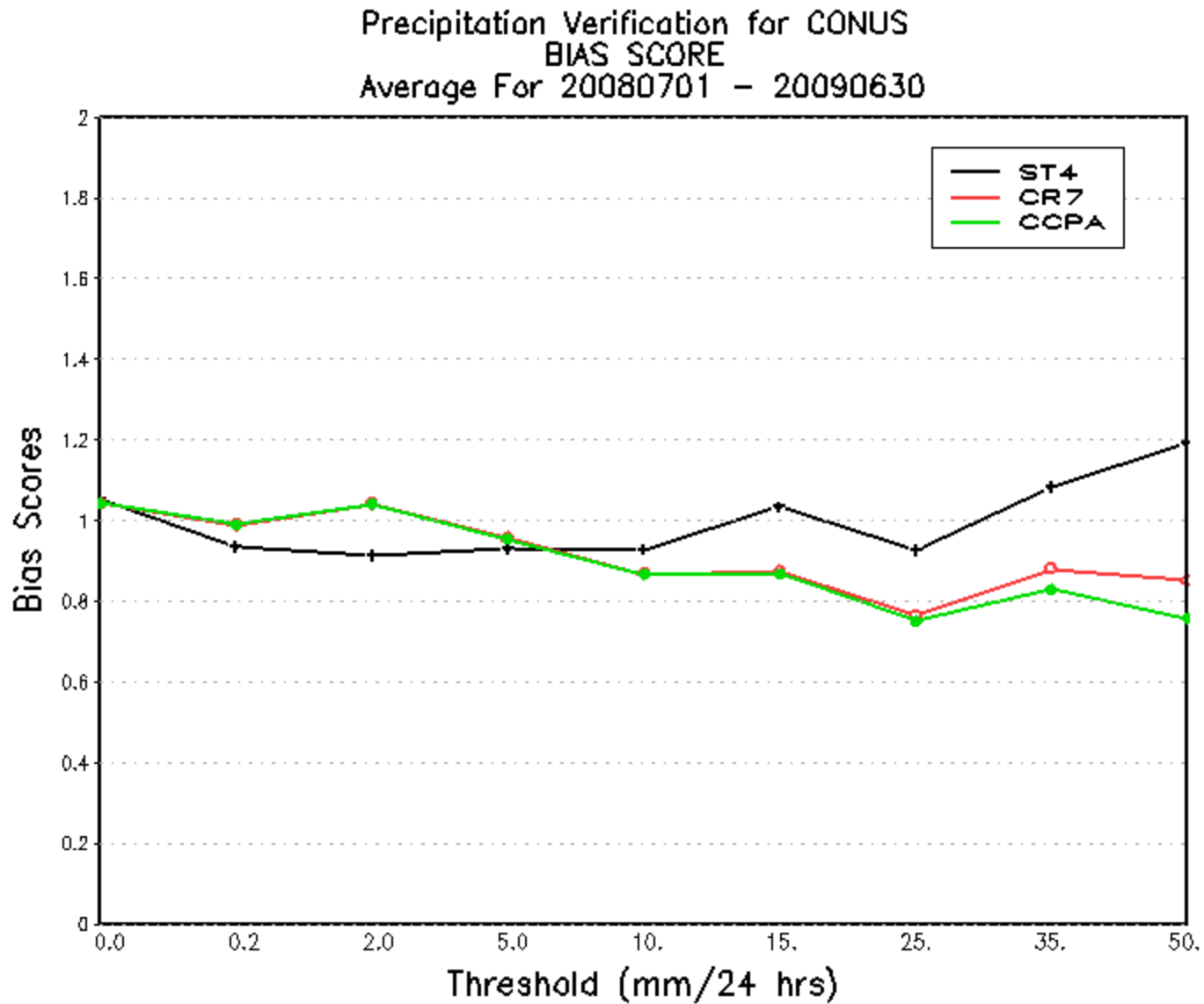
## Results – ETS and TSS



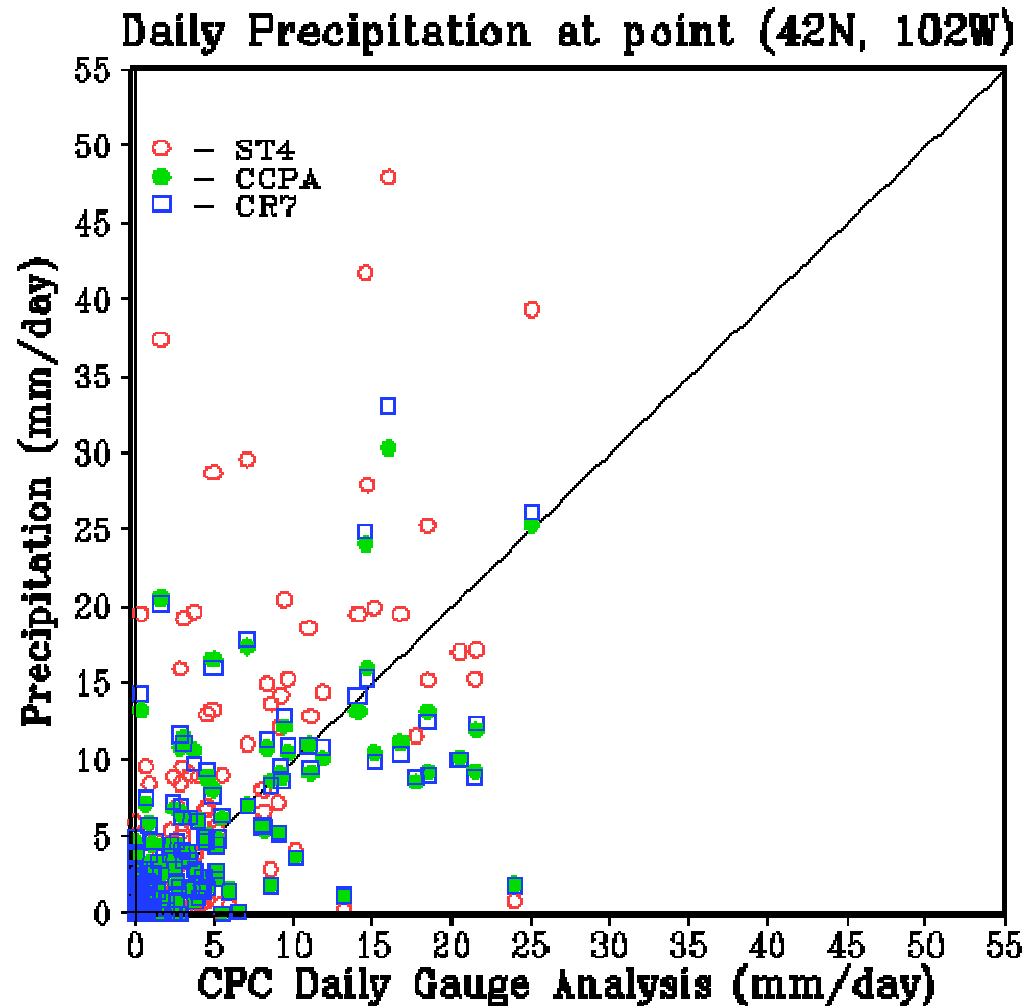


# Verification against CPC at 1/8 degree

## Results – BIAS SCORE



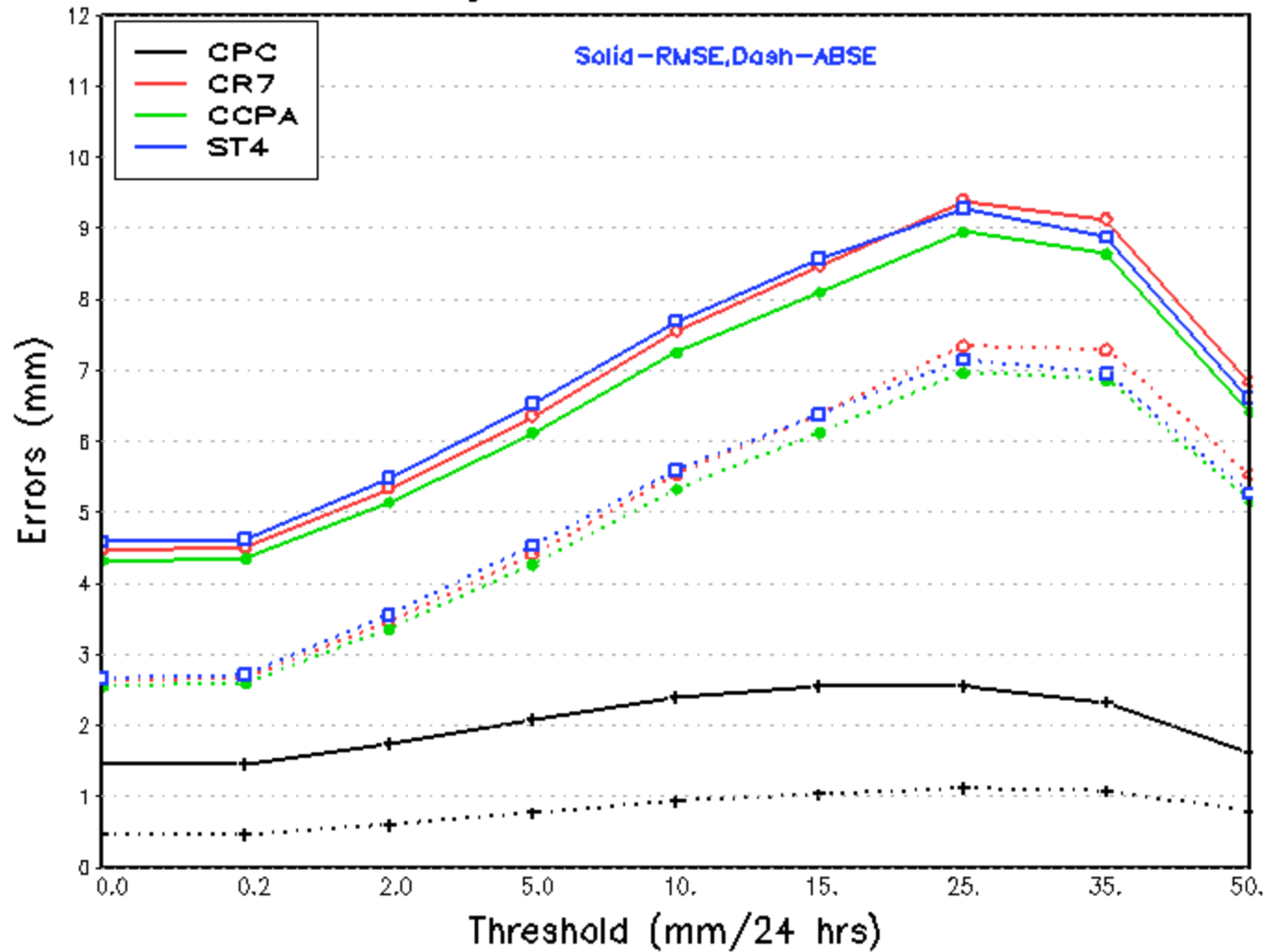
# Verification against CPC at 1/8 degree



# Verification against RFC-gauge network at 1/8 degree

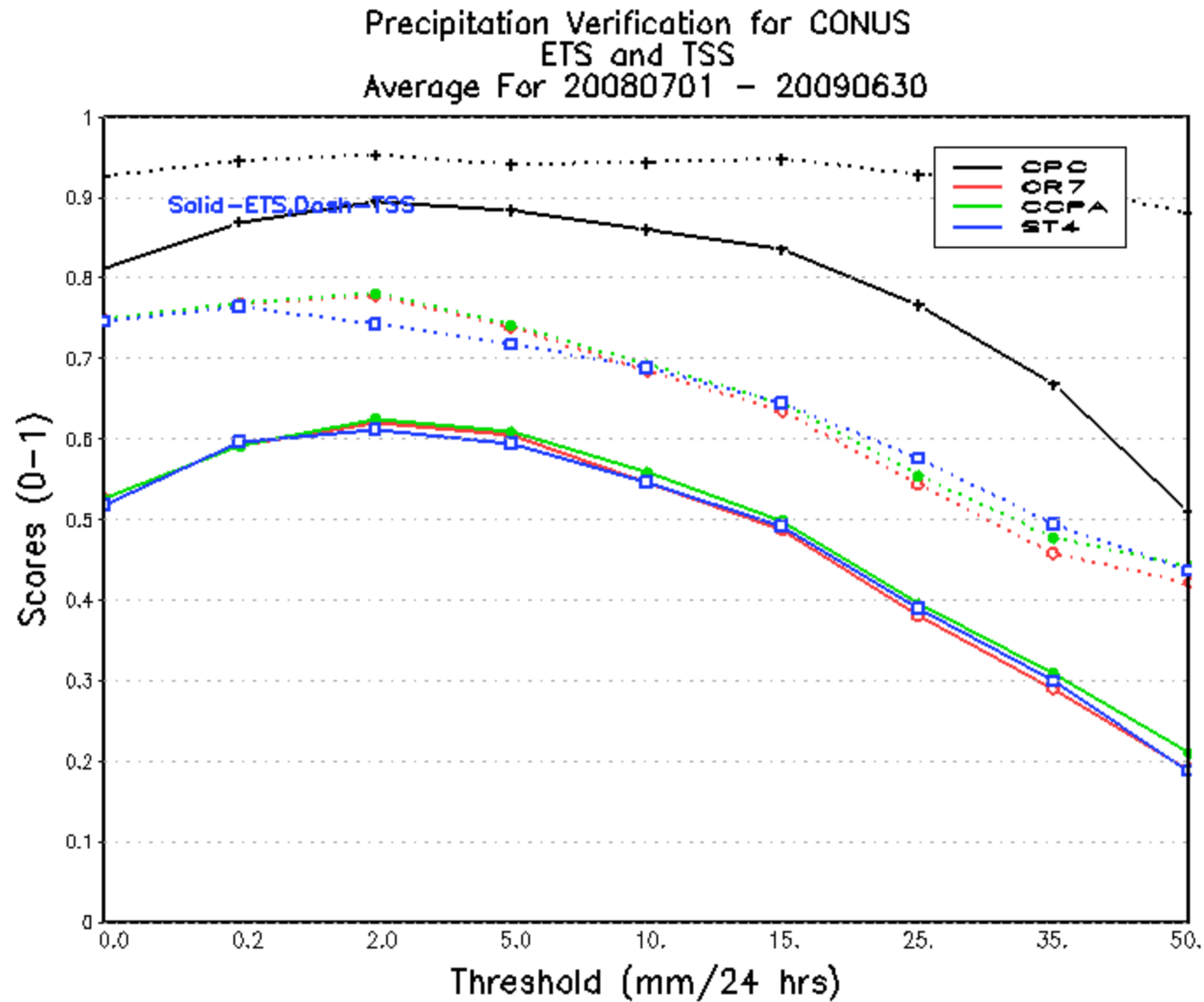
## Results – RMSE and ABSE

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



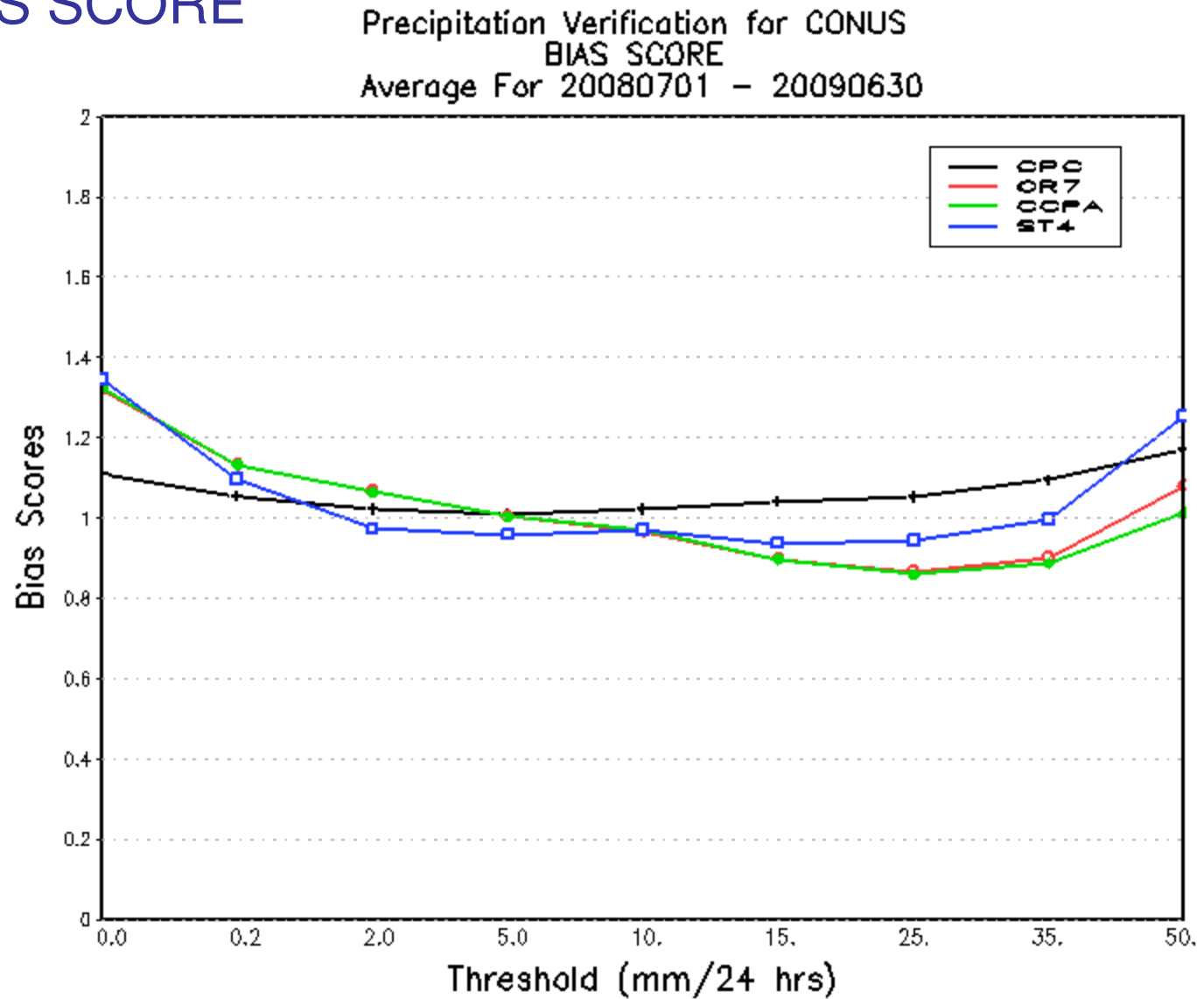
# Verification against RFC-gauge network at 1/8 degree

## Results – ETS and TSS



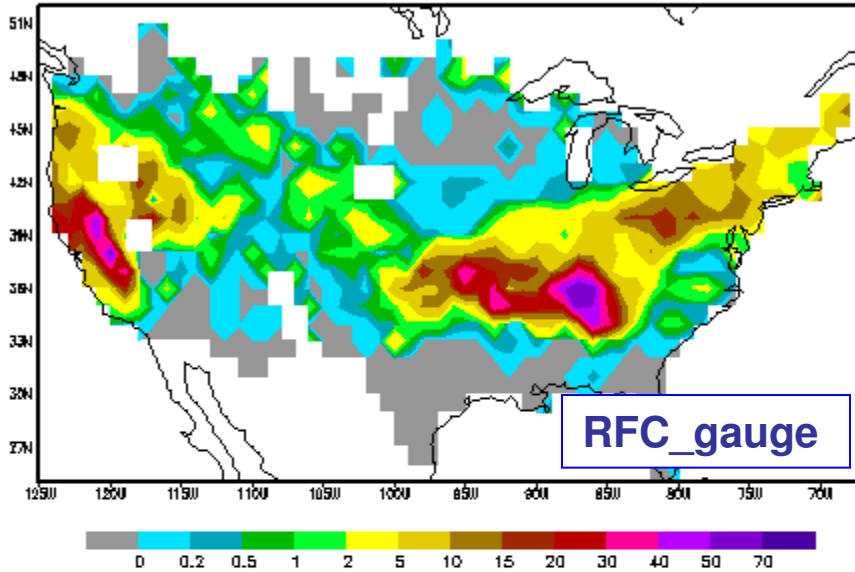
# Verification against RFC-gauge network at 1/8 degree

## Results – BIAS SCORE

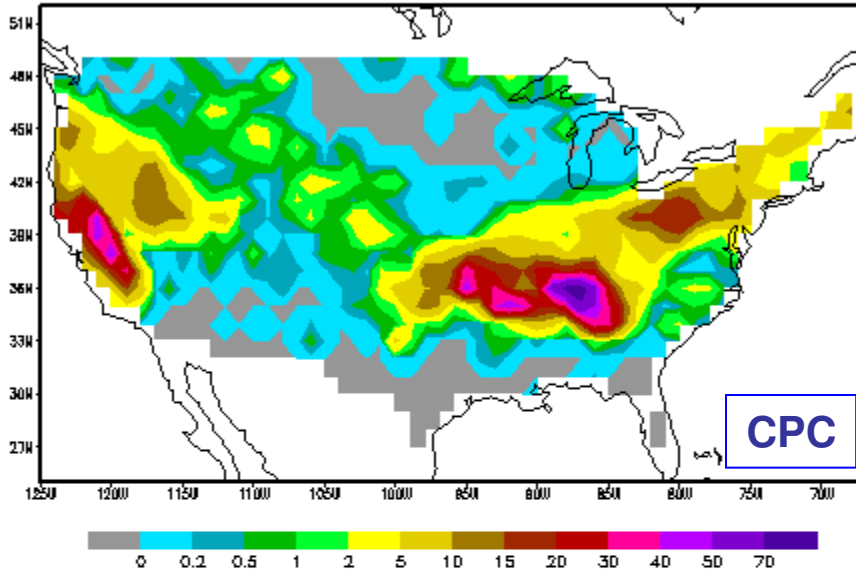


# Verification against RFC-gauge network at 1 degree

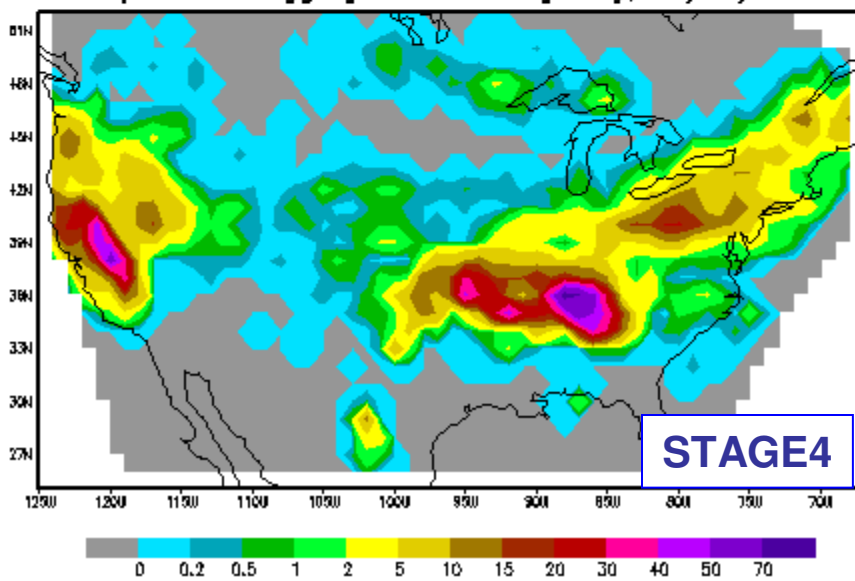
Prcp Gauge box averaged to 1 deg daily, 05/02/2009



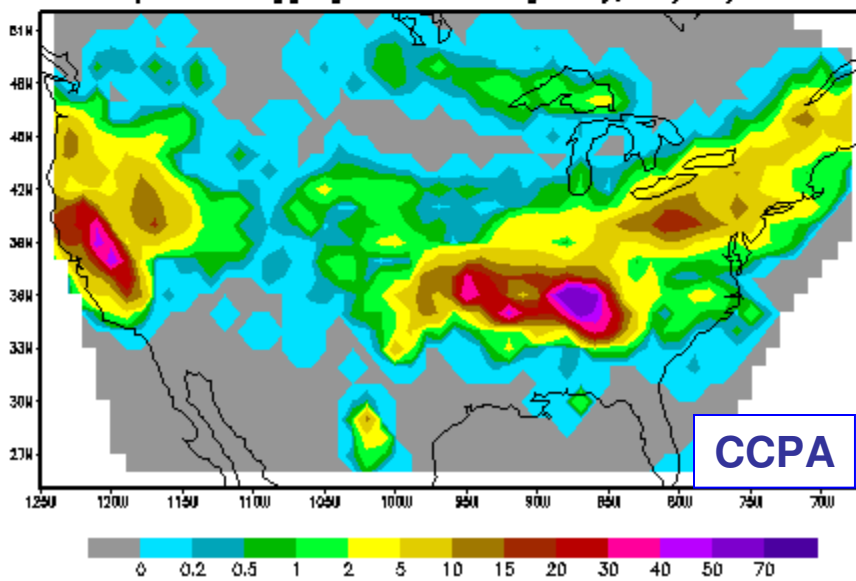
Prcp CPC aggregated to 1 deg daily, 05/02/2009



Prcp STAGE4 aggregated to 1 deg daily, 05/02/2009

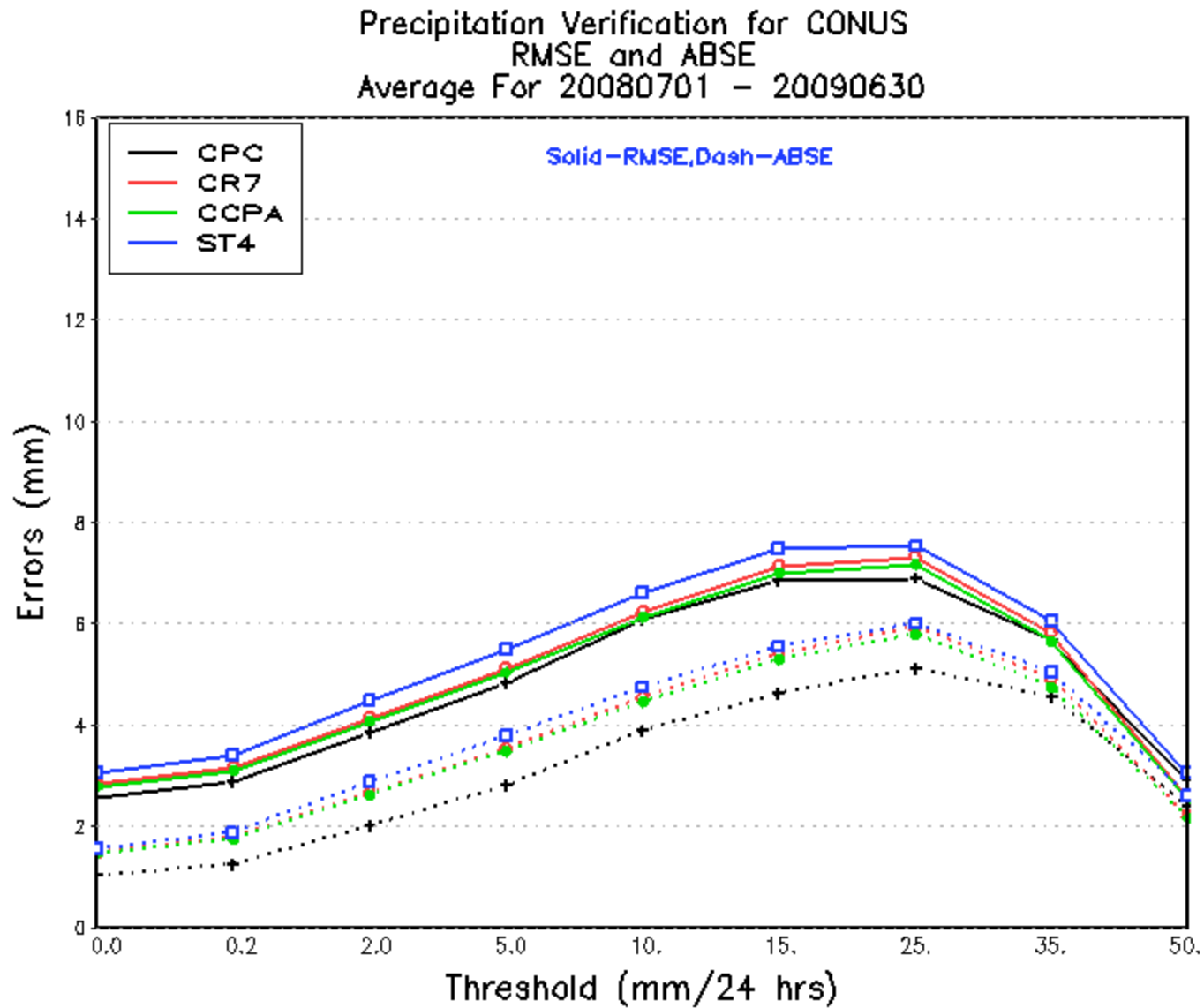


Prcp CCPA aggregated to 1 deg daily, 05/02/2009



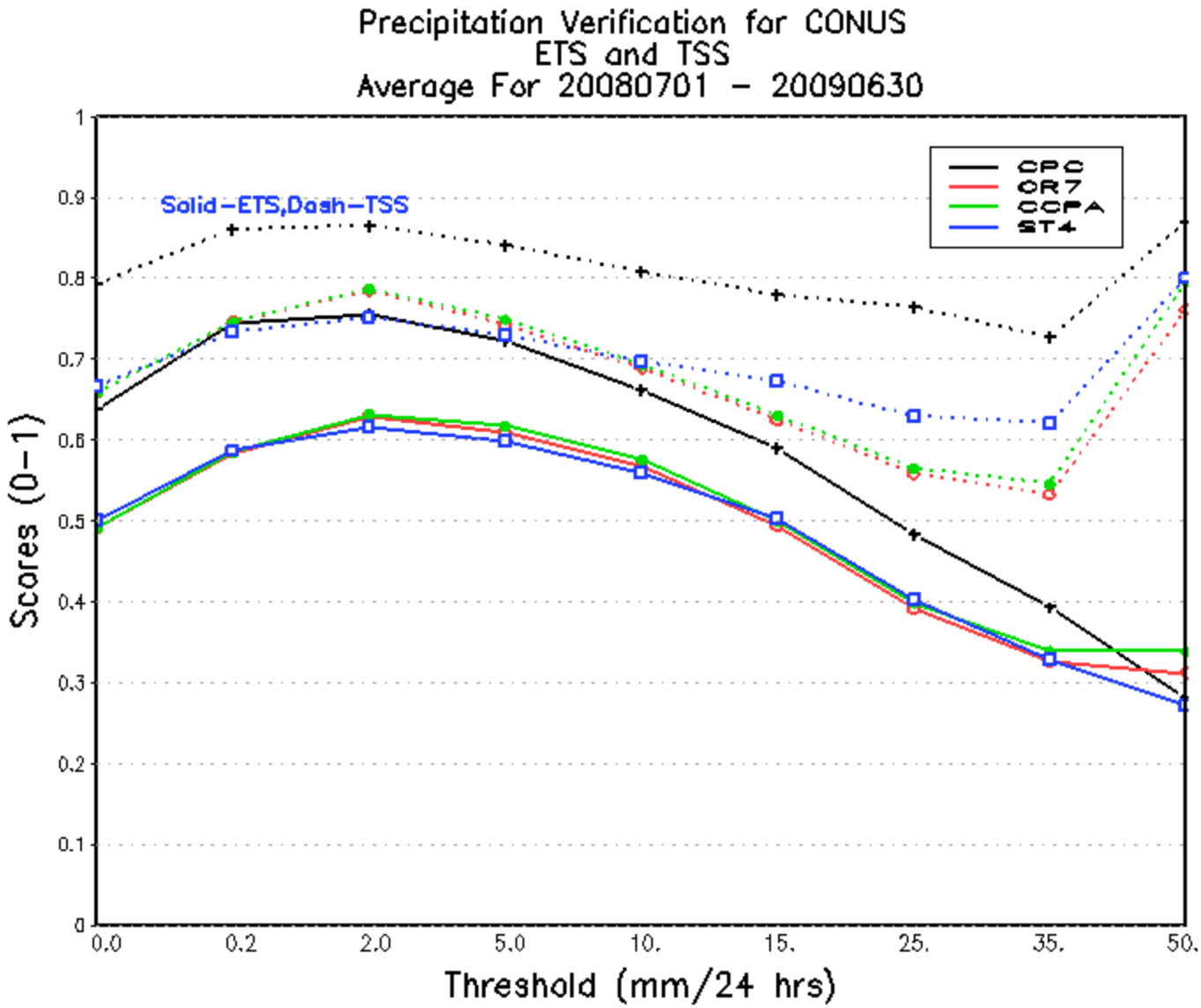
# Verification against RFC-gauge network at 1 degree

## Results – RMSE and ABSE



# Verification against RFC-gauge network at 1 degree

## Results – ETS and TSS





# Conclusion

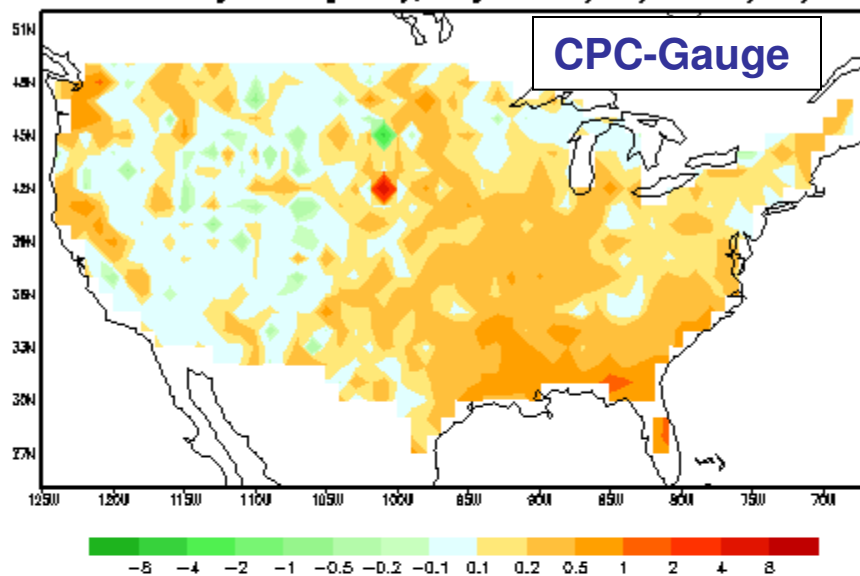
- Comparisons against CPC analysis and gauge observations at different resolutions (1/8 deg, 1deg).
- CCPA improved over STAGE4 mostly on low amount precip (particularly for thresholds <10mm/6hrs; frequently-occurring events).
- The underestimation of large amount precipitation (rarely-occurring events) is also evident. It is likely due to the combination of the linear model assumption and the small sample size of large precip.

# Conclusion (continued)

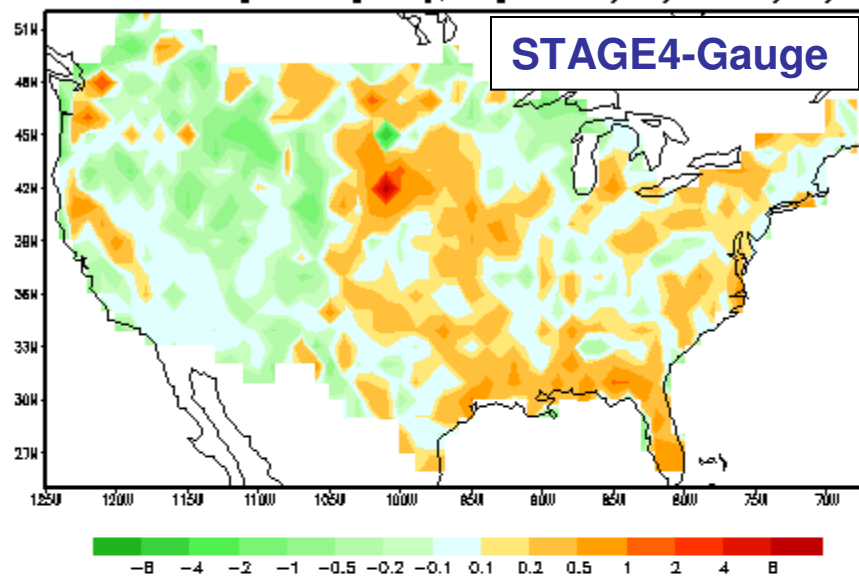
- Conclusions for the 1 deg grid verification are consistent with those for 1/8 deg grid, particularly for RMSE, ABSE, ETS, and TSS.
- Improving CCPA methodology is highly required.

# Verification against RFC-gauge network at 1 degree

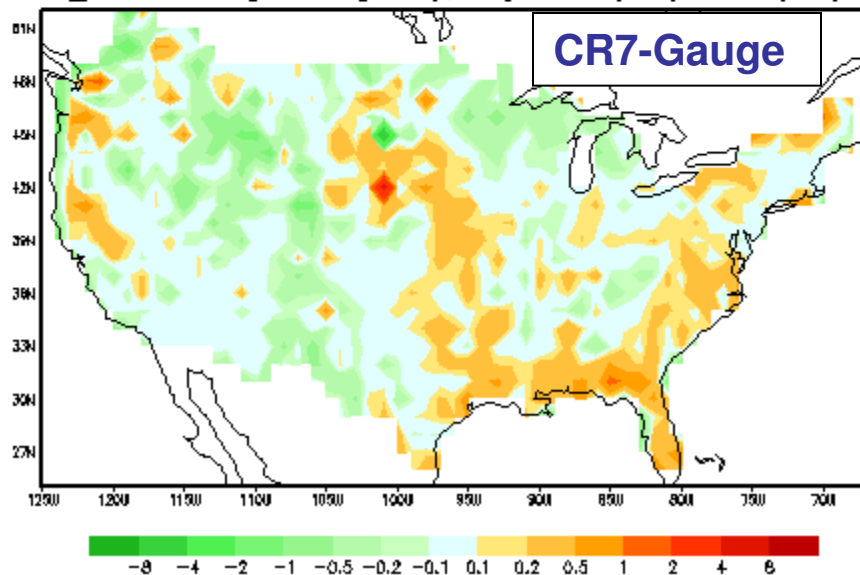
CPC - Gauge 1 deg daily, Avg for 07/01/08-06/30/09



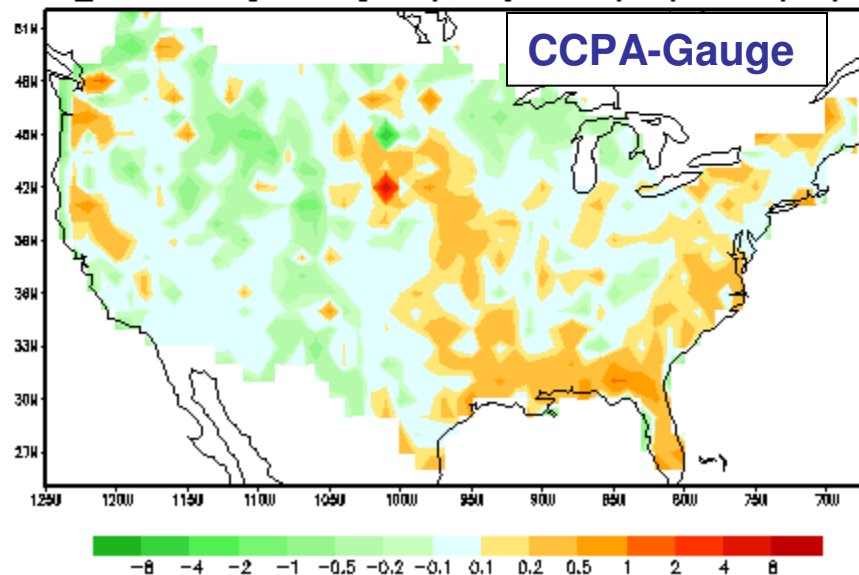
STAGE4 - Gauge 1 deg daily, Avg for 07/01/08-06/30/09



ST4\_CR7 - Gauge 1 deg daily, Avg for 07/01/08-06/30/09



ST4\_ADJ - Gauge 1 deg daily, Avg for 07/01/08-06/30/09



# Verification against RFC-gauge network at 1 degree

## Results – BIAS SCORE

