Bias-Corrected CMORPH: A 13-Year Analysis of High-Resolution Global Precipitation

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2011.04.05.

Objective:

- To develop a high-resolution global precipitation analysis through adjusting the CMORPH satellite estimates against a daily gauge analysis

  - Up to 8kmx8km over the globe (60^oS-60^oN)
  - 30-min from Jan.1998, updated real time

Global Daily Gauge Analysis

- Interpolation of gauge reports from ~30K stations

- Optimal Interpolation (OI) with orographic correction (Xie et al. 2007)

- Interpolated on 0.125^o lat/lon, then averaged on 0.5^o/0.25^o lat/lon grid over global land / CONUS for release

- Global fields from 1979 to present updated daily on a real-time basis

- CONUS analysis from 1948

- Example for July 1, 2003
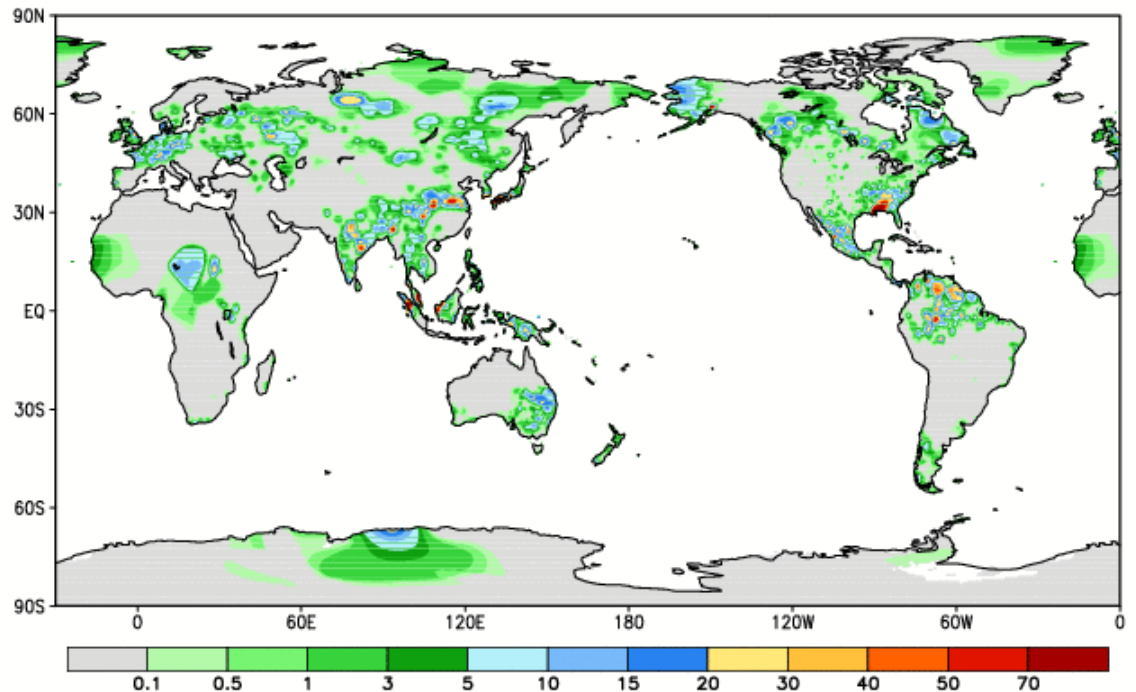
CMORPH Satellite Estimates

- CMORPH : CPC Morphing technique (Joyce et al. 2004)
  - Combined use of satellite PMW and IR data
  - 8kmx8km / 60°S-60°N;
 - 30-min interval / from January1998 / Real-time

  - **CMORPH back-extended to 1998 to cover the entire TRMM Era**
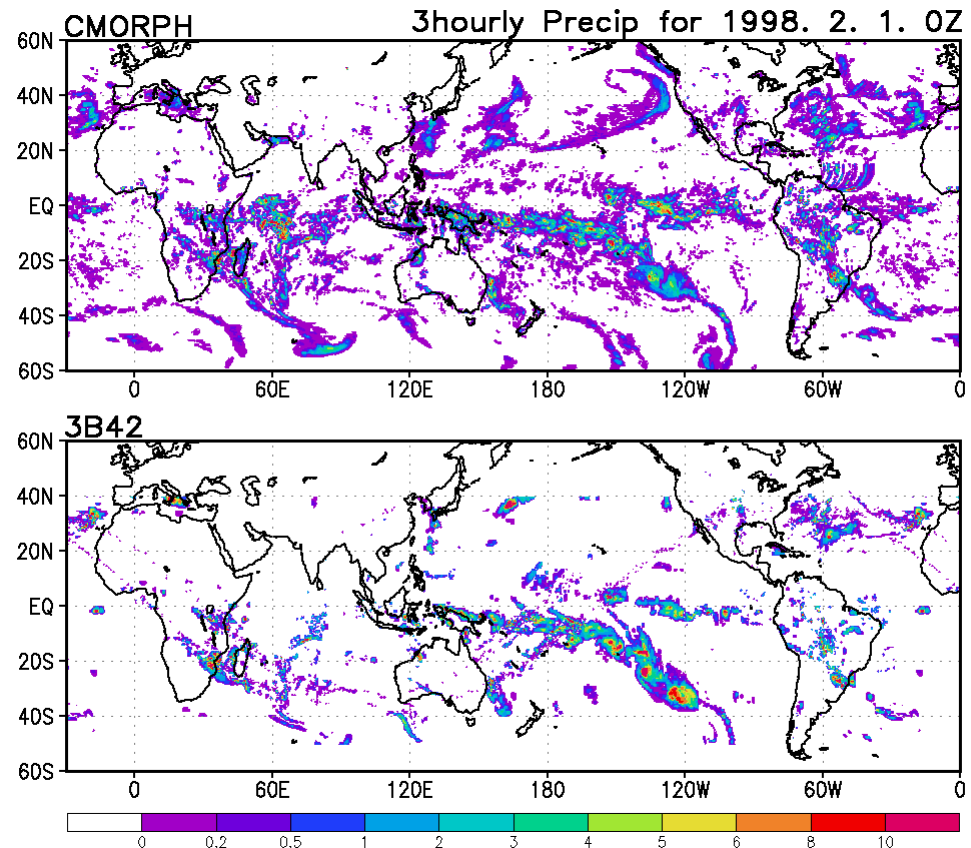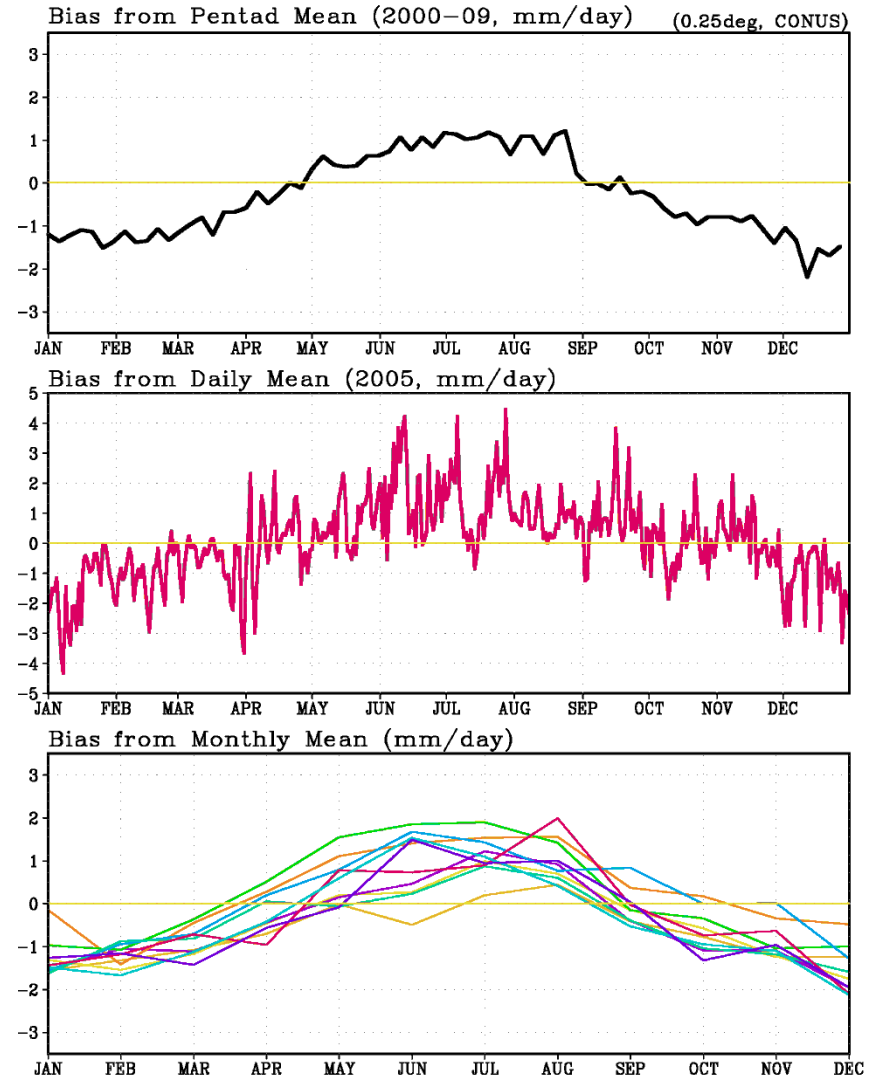
CMORPH Bias [1]

Global Distribution

- 2000-2009 10-yr annual mean precip

- CMORPH captures the spatial distribution patterns very well

- BIAS exists
  - Over-estimates over tropical / sub-tropical areas
  - Under-estimates over mid- and hi-latitudes

CMORPH and GAUGE Daily (ANN 2000-09)
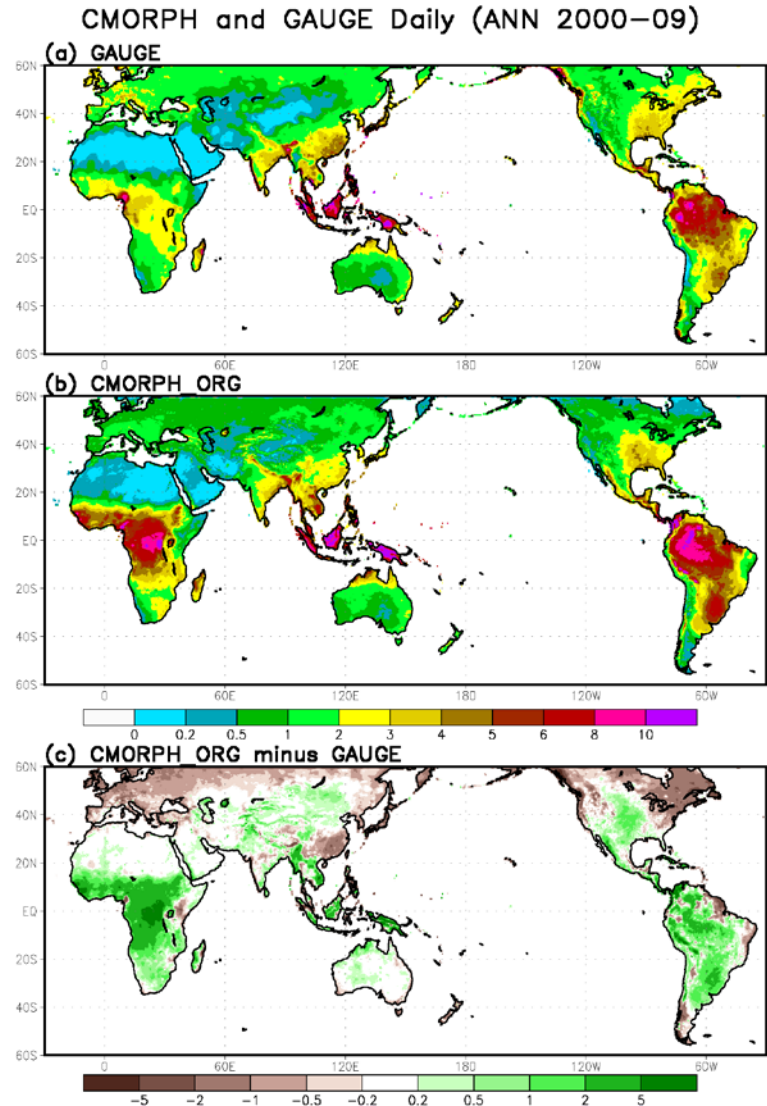
CMORPH Bias [2]
Time Scales of the Bias

- Bias over CONUS

- Bias presents substantial variations of

  – *seasonal (top),*

  – *sub-monthly (middle), and*

  – *year-to-year (bottom) time scales*

Bias from Pentad Mean (2000-09, mm/day)   (0.25deg, CONUS)

Bias from Daily Mean (2005, mm/day)

Bias from Monthly Mean (mm/day)

CMORPH Bias [3]
Range Dependence

- Bias as a function of gauge Rainfall Intensity over CONUS

- Bias exhibits strong range dependence

Bias of CMORPH Daily over CONUS (2000-09, 0.25deg)
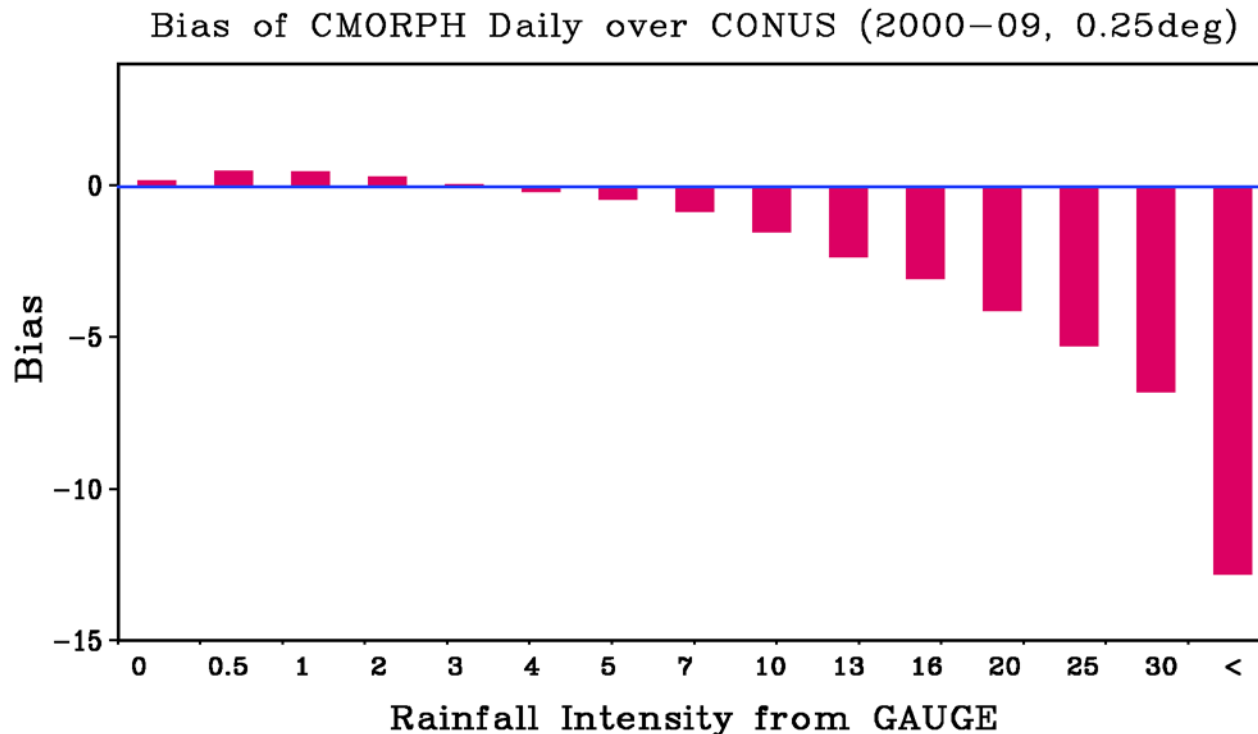
Bias Correction [1]
General Strategy

❑   *Over Land:*

   PDF matching against daily gauge data

❑   *Over Ocean:*

   Adjusting against a relatively homogeneous long-term record (pentad GPCP)

Bias Correction [2]
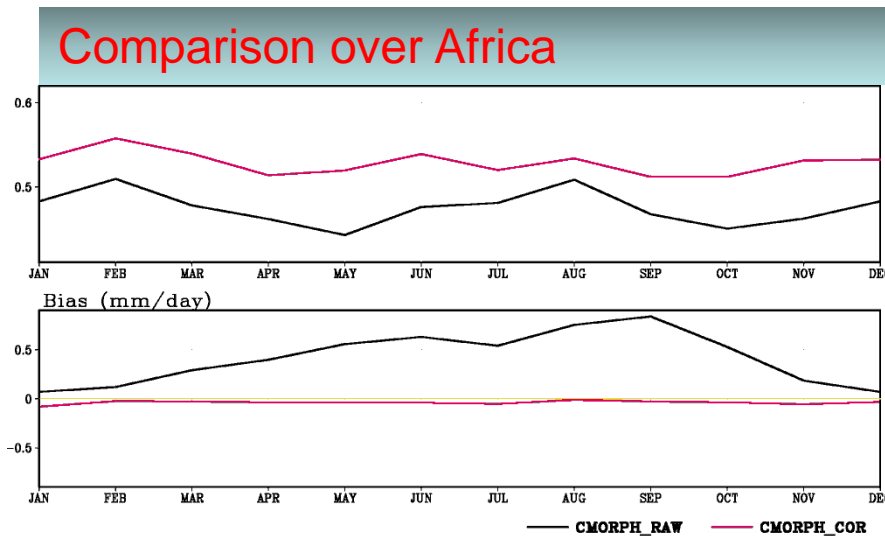## *Global Implementation Strategy*

- Step 1:   Correction using Historical Data
    - Establish PDF matching tables
        - using historical data
        - for each 0.25^olat/lon grid
        - for each calendar date
        - using data over nearby regions and
        - over a period of +/- 15 days centering at the target date
    - At least 500 pairs of non-zero data pairs
    - to ensure the PDF tables are created using data over a small space domain

- Step 2:   Correction using Real-Time Data
    - Perform PDF matching using data over a 30-day period ending at the target date
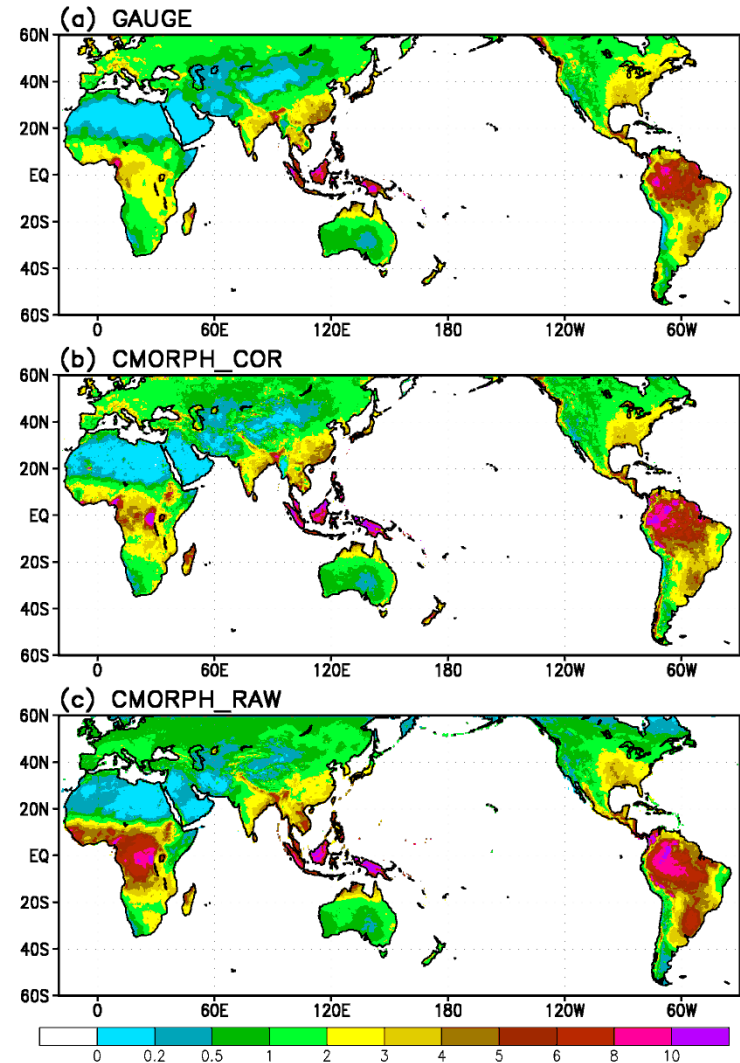   - To account for year-to-year variations in the bias

Bias Correction [3]
Results over Global Land
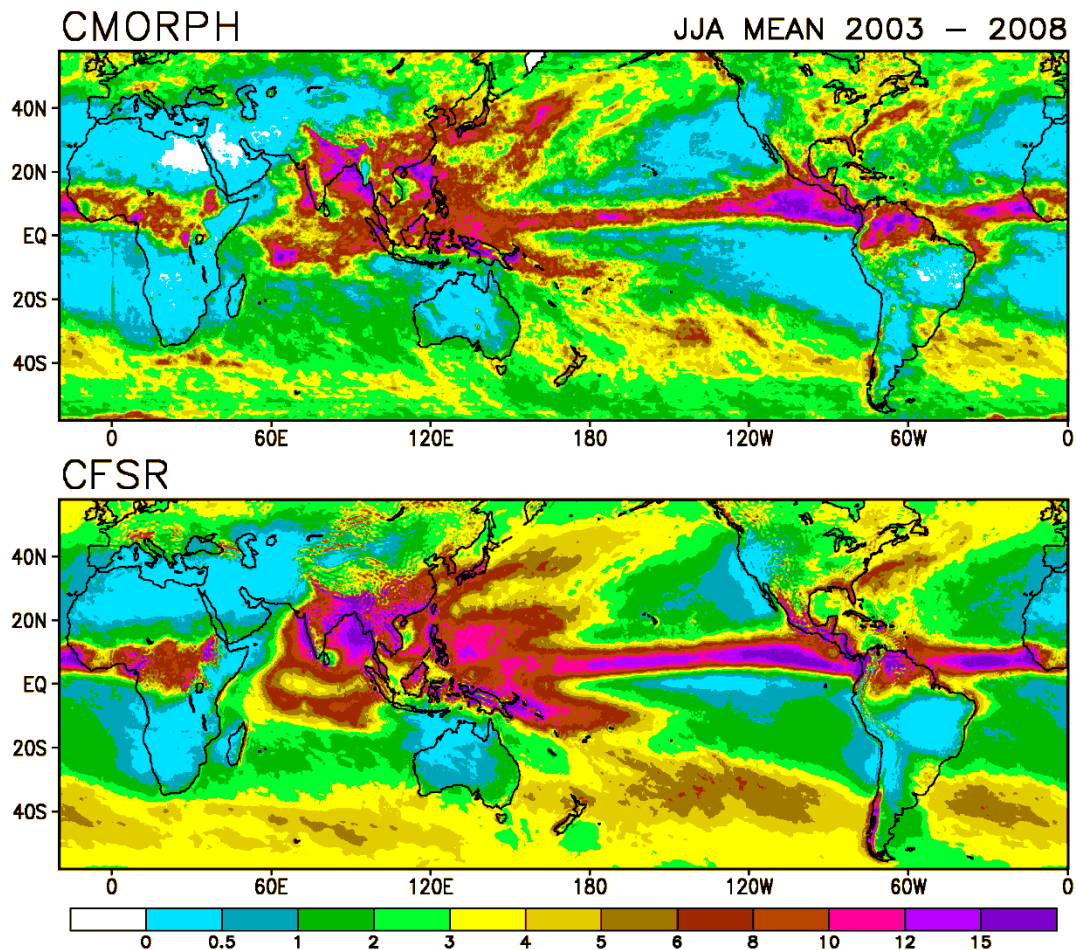
- 2000-2009 annual mean

- Large-scale bias corrected

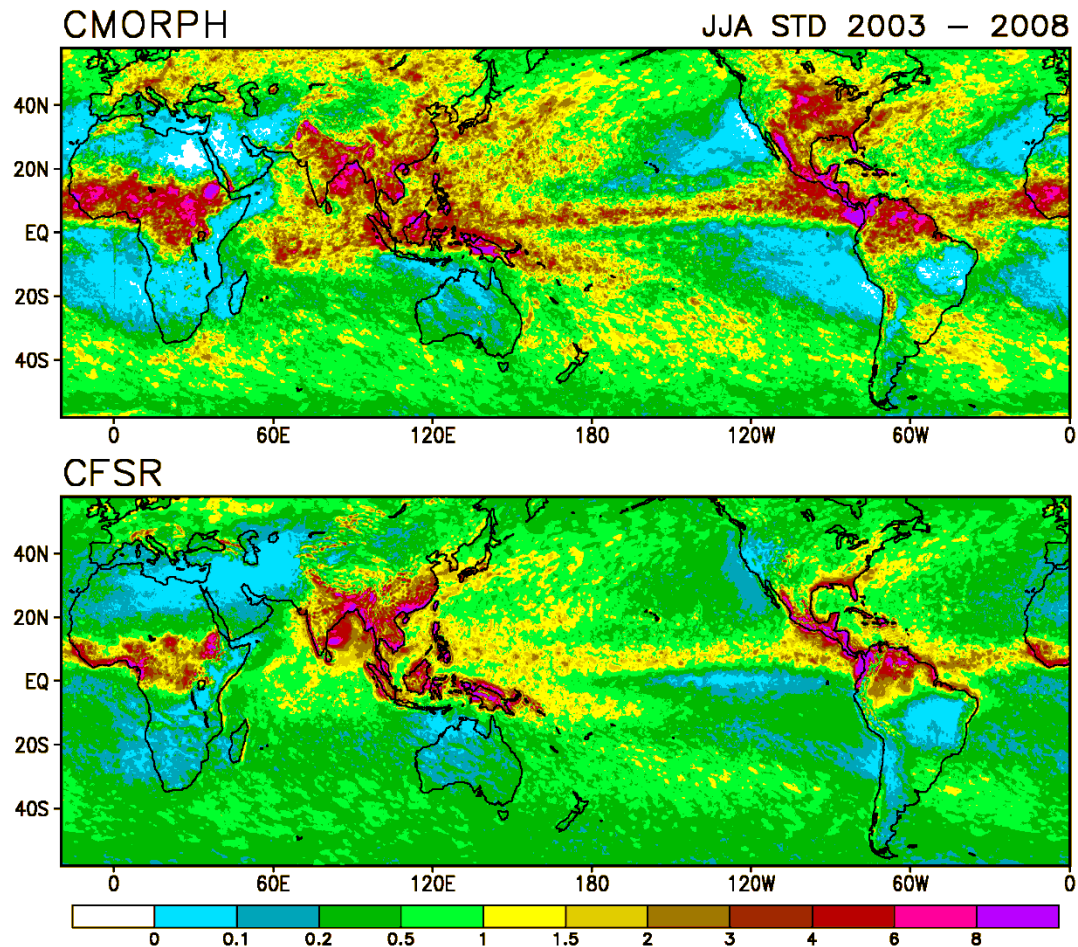Mean of CMORPH and GAUGE Daily (2000-09)
(a) GAUGE
(b) CMORPH_COR
(c) CMORPH_RAW

Comparison over Africa

Bias (mm/day)

CMORPH_RAW   CMORPH_COR

Applications [1]
Evaluation of CFSR JJA Precip.

Applications [2]
Precipitation Diurnal Cycle

Summary

- A set of procedures have been developed to remove the bias in the CMORPH satellite estimates though PDF matching against daily gauge data

- We are in final stage of constructing bias-corrected CMORPH for a 13-year period from 1998 to the present

- The data set will be available around Summer 2011

Applications [3]
Precipitation Diurnal Cycle over Oceans