GLOBAL PRECIPITATION DIURNAL VARIATIONS DEPICTED IN THE OBSERVATION AND THE CFS REANALYSIS

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Objectives

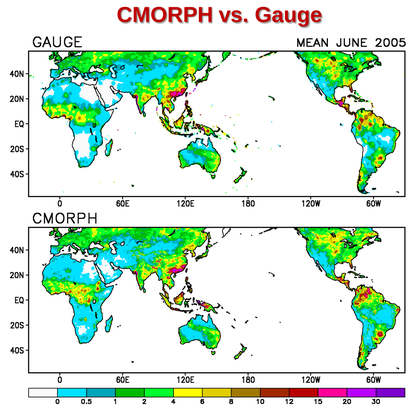
- To examine the diurnal cycle of global precipitation in the CPC's unified precipitation products
- To verify how these features are captured by NCEP / CFS Reanalysis

Data

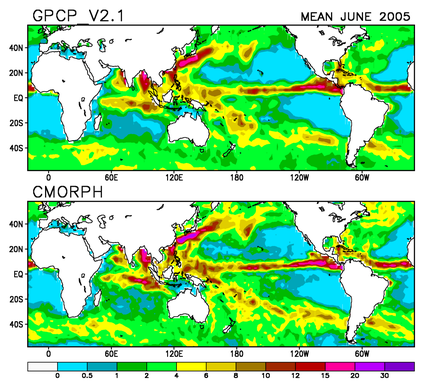
- CPC Unified Precipitation Estimates
  - Bias Corrected CMORPH using Daily Gauge data over land and Pentad GPCP data over ocean
  - 30 min / 8 km / 60oS – 60oN
  - Available on a real time basis from January 1999
  - Regridded into hourly / T382
- CFS Reanalysis
  - Hourly / T382
  - Period : January1979 – January 2010

Example

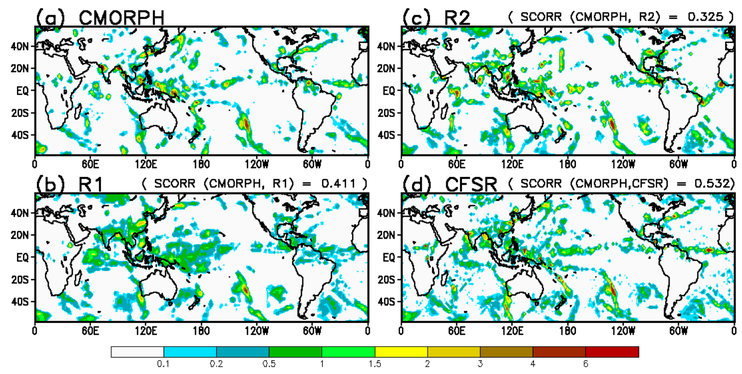
CMORPH vs. Gauge



CMORPH vs. GPCP



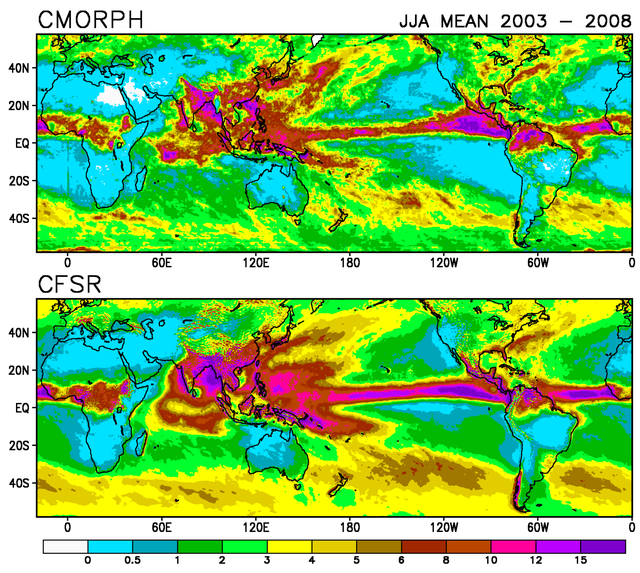
CMORPH vs. Model outputs (00Z-06Z 01 July 2007)



- Large-scale bias has been reasonably corrected and CMORPH shows similar spatial distributions and magnitudes compared with Gauge and GPCP
- CFSR presents much improved instantaneous rainfall distribution compared to R1/R2

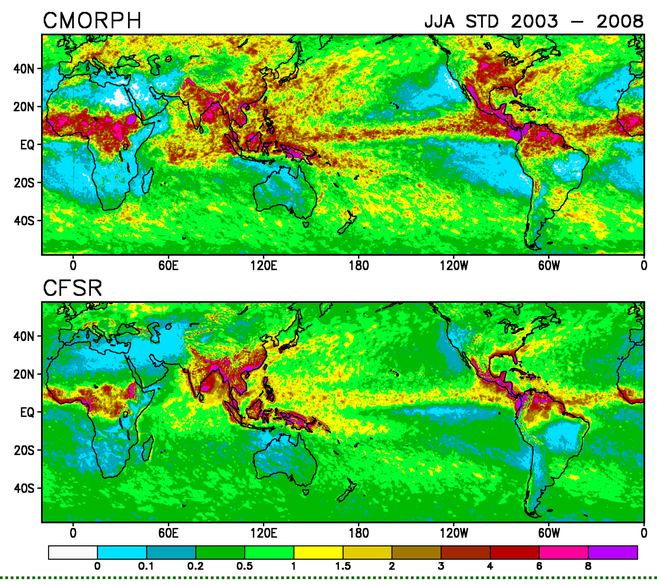
Application – Bias Corrected CMORPH vs. CFS Reanalysis

JJA Mean of 2003 - 2008



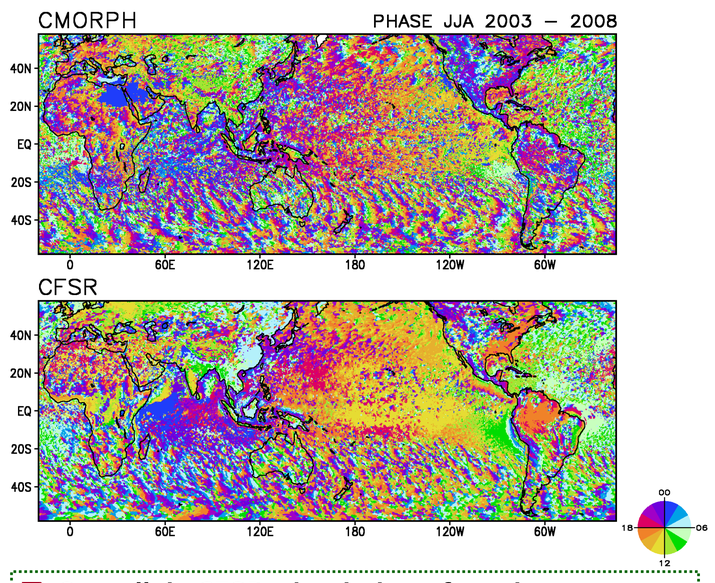
- CFSR captures the spatial distribution pattern of CMORPH well
- Over-estimates over tropical / subtropical area

Diurnal Cycle - Magnitude

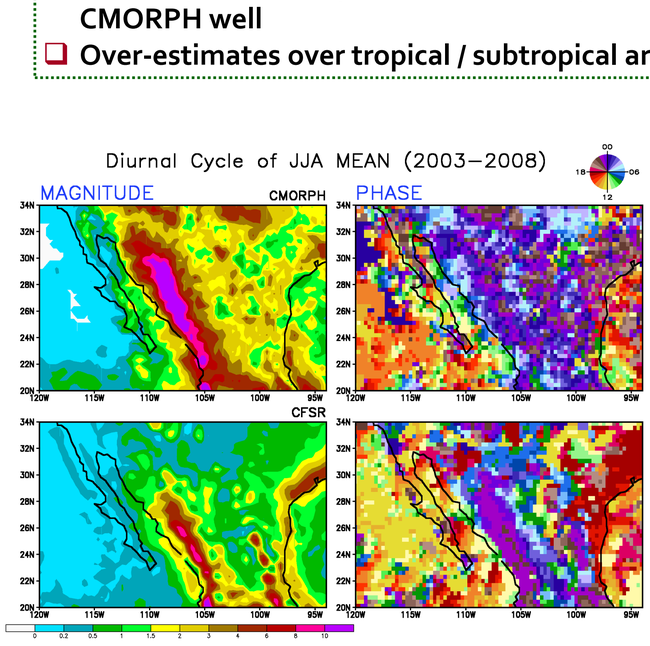


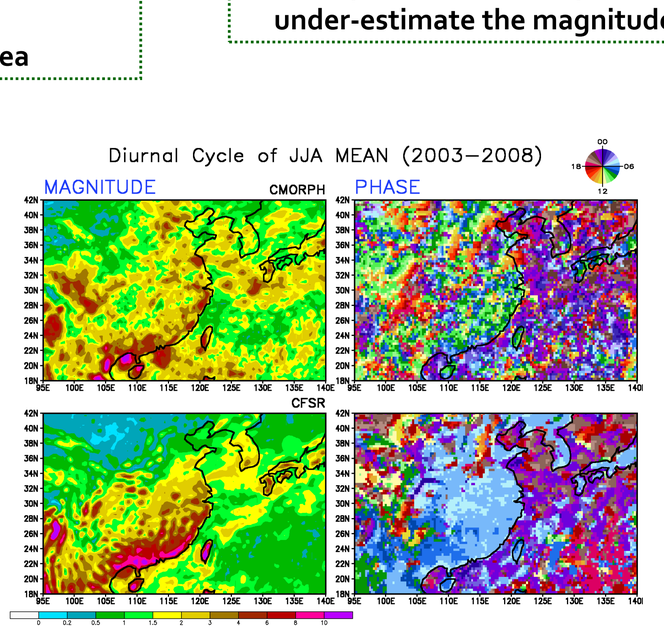
- CFSR presents similar spatial distribution although under-estimate the magnitude of Diurnal Cycle

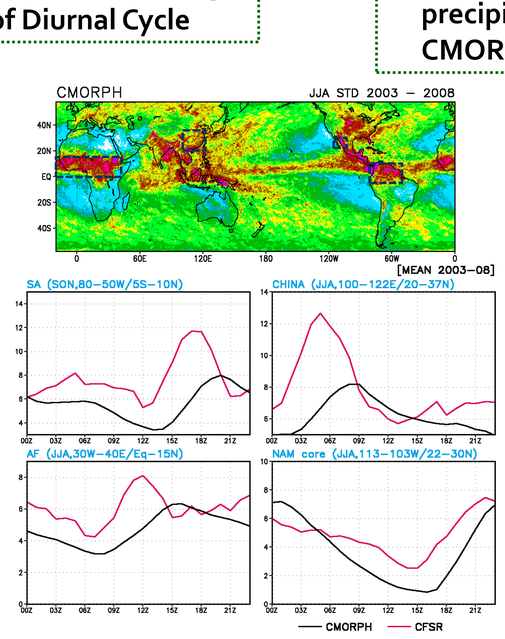
Diurnal Cycle - Phase

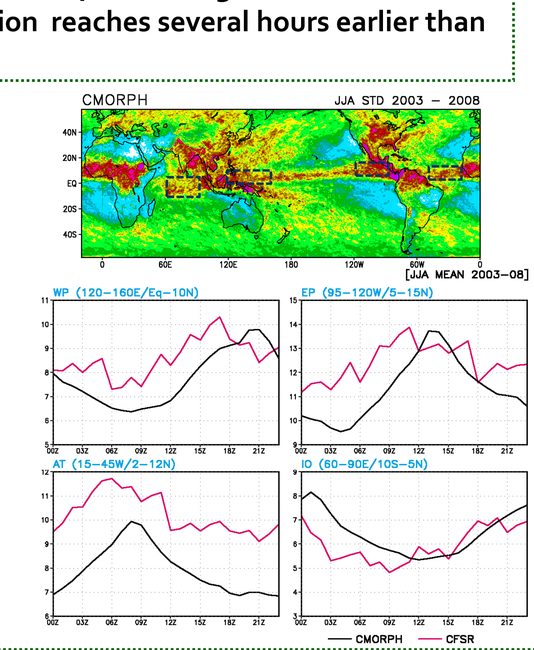


- Overall, in CFSR, the timing of maximum precipitation reaches several hours earlier than CMORPH



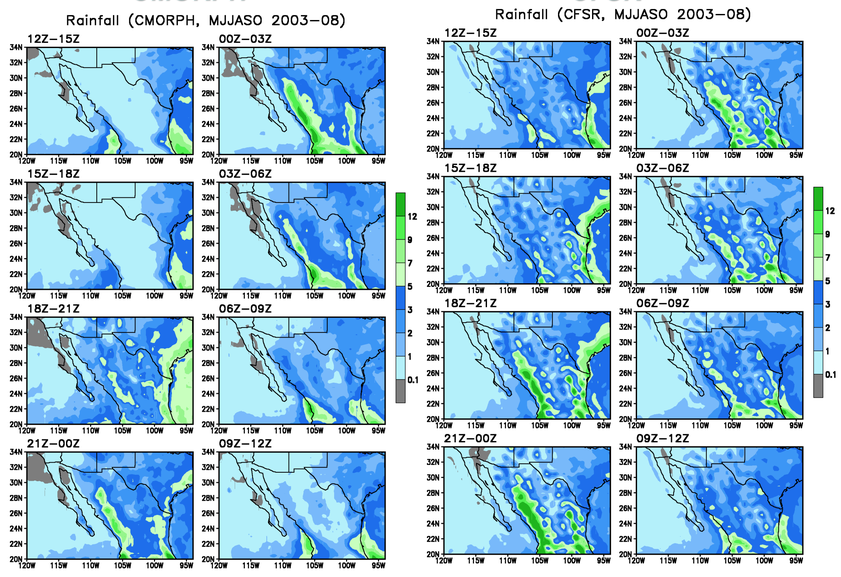




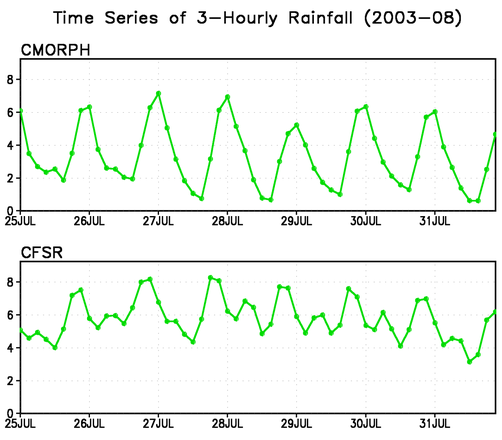


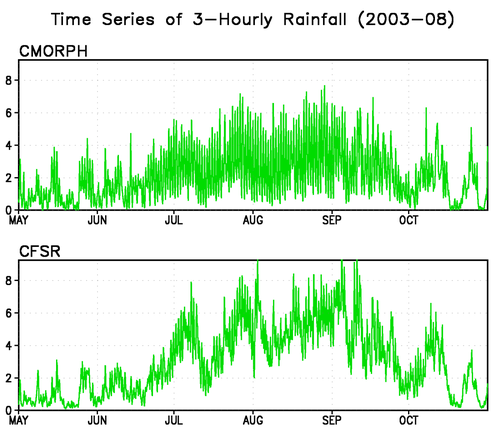
- In CFSR, the phase of diurnal cycle overland is shifted about 3 -4 hour earlier than CMORPH
- In CFSR, the phase of diurnal cycle over ocean is shifted about 3 -4 hour earlier than CMORPH

Diurnal Cycle – North America Monsoon System



- Diurnal cycle over the west and east coasts of Mexico is in phase
- Precipitation reaches maximum in late afternoon in CMORPH
- In CFSR, precipitation starts and reaches maximum earlier than CMORPH





- Phase of diurnal cycle is relatively stable in both CMORPH and CFSR
- Magnitude presents changes of synoptic and intraseasonal time scales
- In CFSR, the peak time appears about 3 hour earlier than CMORPH
- In CFSR, rainfall amount is over-estimated but the variation of diurnal cycle is weaker than CMORPH

Summary

- Diurnal cycle of precipitation is examined using the bias-corrected CMORPH and the CFSR data for a 6-year period from 2003 to 2008:
  1. Overall, CFSR precipitation is capable of capturing the spatial distribution with reasonable quality, while the amount is over-estimated.
  2. The magnitude of diurnal cycle in CFSR is mostly under-estimated over most of the ocean and land, except over-estimated over South and East Asian monsoon regions.
  3. In CFSR, the phase of diurnal cycle over land and ocean is substantially shifted approximately 3 ~ 4 hour earlier than CMORPH.
- Associated with North America Monsoon System (NAMS):
  1. Diurnal cycle is dominant.
  2. The phase of diurnal cycle is relatively stable in both CMORPH and CFSR but the magnitude in CFSR is weaker than in CMORPH.
  3. Maximum of precipitation over NAM region in CFSR appears in the afternoon, which is about 3 hour earlier than CMORPH.