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 / 6°S – 6°N
  - Available on a real time basis from January 1999
- CFS Reanalysis
  - Hourly / T382
  - Period: January 1979 – January 2010

Application – Bias Corrected CMORPH vs. CFS Reanalysis

JJA Mean of 2003 - 2008

CMORPH vs. Gauge
CMORPH vs. GPCP

Example

Diurnal Cycle - Magnitude

CMORPH shows similar spatial distributions and magnitudes compared with Gauge and GPCP.

CMORPH vs. Model outputs
(00Z-06Z 1 July 2007)

Diurnal Cycle - Phase

CFSR presents much improved instantaneous rainfall distribution compared to R1/R2

Summary

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 underestimated 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.

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 CMORPH, rainfall amount is over-estimated but the variation of diurnal cycle is weaker than CMORPH