Worldwide Monsoons in 2008-09

Song Yang, Wei Shi, Viviane Silva, Wassila Thiaw, Muthuvel Chelliah, and Qin Zhang

NOAA Climate Prediction Center, Camp Springs, Maryland

Acknowledgement:
CPC Global Monsoons Team
1. Global monsoon features
   • Australian monsoon
   • South American monsoon
   • North American monsoon
   • African monsoon
   • Asian monsoon

2. N. China winter drought (E. Asian winter monsoon)

3. Weak Indian summer monsoon
1. Global Monsoon Features
(Oct 2008 – Sept 2009)

OLR Anomalies (Wm$^{-2}$) 31 May 2009 to 28 Aug 2009

JJA OLR Anomalies

200-hPa Ave. Velocity Potential ($10^4$ m$^2$ s$^{-1}$) & Div. Wind Anomalies 03 Jun 2009–31 Aug 2009

JJA 200-mb Vel Pot Anomalies
Australian Monsoon (Winter 2008-09)
Strong monsoon & link to La Nina condition

Data Source: NCEP/CDAS - Climatology (1979–1995)
(Wind speed > 1 ms⁻¹ shaded)
Apparent Intraseasonal Variability
The monsoon was weak during the onset phase of rainy season over southern Amazon and central-southeastern Brazil, with large rainfall deficits (>150 mm) in many areas.
Rainfall was below average over central-southern Brazil and most of Argentina but above average over the northern Amazon Basin, features consistent with the La Niña conditions in the tropical Pacific.
• Much above-average rainfall was observed over northeastern Brazil (consistent with the La Niña conditions in the tropical Pacific), contributing to an intensification and southward displacement of the Atlantic ITCZ.

• Another factor contributing to the rainfall anomalies in Northeast Brazil was the active MJO.
North American Monsoon (Summer 2009)
Weak monsoon, in spite of an early onset

Driest Months:
Aug in SW U.S.
Jul & Aug in Mexico

Wettest Month:
September
Mexican National Rainfall

CLIMATOLOGÍA, PRECIPITACIÓN MENSUAL 2009 Y PRONÓSTICO CLIMATOLÓGICO

DATOS AL 06/10/2009

Pronóstico en base a la analogía de los años 1957, 1997, 2002 y 2004

From Art Douglas
2009 NAME Forecast Forum Zone 2
Accumulated Precipitation

Accum. Precip. (mm)

Date

Jun 16-Jun 1-Jul 16-Jul 31-Jul 15-Aug 30-Aug 14-Sep 29-Sep

Clim
CFS T382
2009

Obs
URD Clim 79–95
URD Clim 81–95
CFS,IC=MAR09
CFS,IC=MAR
CFS,IC=APR09
CFS,IC=APR
GSFC,IC=MAR09
GSFC,IC=MAR
GSFC,IC=APR09
GSFC,IC=APR
ECPC-RSM,IC=MAR
ECPC-RSM,IC=APR
CFS382,IC=APR09
CFS382,CLIM,IC=APR
Weak relationship with ENSO
The rainfall over Sahel was consistent with the upward tendency of the past years.
Asian Summer Monsoon
Weak monsoon over India
Weak large-scale monsoon circulation

Philippines constantly received above-normal monsoon rainfall.
Weak Large-scale Asian Summer Monsoon Circulation in Years
(Webster-Yang Index)

(a) Total JJA WY Index

(b) Normalized JJA WY Index

(c) Total MJJAS WY Index

(d) Normalized MJJAS WY Index

Webster and Yang (1992): \([U_{rea} - U_{rea}] (0-20N, 40-110E)\)
2. Winter Drought in N. China

Strong winter monsoon

- No precipitation over Beijing for 111 days since October 2008
- Most serious in 5 decades in some locations
- Disastrous damage to China’s main areas for crops
- 10 million hectares of crops affected, and more than 4 million people short of drinking water

Reference:
Gao and Yang (2009, JGR)
Drought Categories (Oct 2008 – Jan 2009)
Severe drought mainly in Dec 2008 & Jan 2009
Relationship with Pacific SST
La Nina condition

Dec-Jan correlation: core drought domain and grid-point SST

SST anomalies in Dec-Jan 2008-09
Relationship with the Tibetan Plateau
Less extensive snow & warming

Anomalies of 700-mb winds and T (700-200 mb) in Dec-Jan 2008-09

Opposite condition of Tibetan Plateau was linked to snow storms affecting China in Jan 2008 (Wen et al. 2009; MWR)
3. Weak Indian Summer Monsoon

77% of JJAS normal & worst in the northwest

O. P. Singh:
Worst since 1973
5th worst in record (since 1871): 67% in 1877, 71% in 1899, 75% in 1918, 76% in 1972, & 77% in 2009

Monsoon appeared early (23 May), but propagated northwestward too slowly during 8-20 June.
Worst in June: 53% of Normal
July (96%), August (73%), & Sept (79%)

From IMD
• ENSO: Weak Indian summer monsoon after La Nina winter and before El Nino winter (Nino3.4 SST anomalies: -1.4 in DJF 2008-09 and +??? in DJF 2009-2010; 0.7 in JJA 2009)

• Biennial feature: Weak Indian summer monsoon after strong Australian winter monsoon (strong Australian monsoon in DJF 2008-09)

• Subtropical-extratropical influence: Strong upper tropospheric westerlies unfavorable for strong monsoon (Webster and Yang 1992)

• MJO? Indian Ocean SST? And others?
1. Global monsoon features
   - Strong Australian monsoon (La Nina condition)
   - Weak South American monsoon (delayed onset?)
   - Weak North American summer monsoon (early onset)
   - Strong African summer monsoon (also long-term change)
   - Weak Asian summer monsoon (apparent regional features)

2. Northern China winter drought
   Influences of ENSO, Tibetan Plateau, etc.

3. Weak Indian summer monsoon
   ENSO impact, biennial feature, subtropical-extratropical influence, …