The Asian Summer Monsoon: An Intercomparison of CMIP-5 vs. CMIP-3 Simulations of the Late 20th Century


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Goal: Develop a Suite of Diagnostics/Metrics to Evaluate Models and Track Improvement

- **Models**
  - Monsoon simulation fidelity varies widely among models
  - IPCC AR4: Climate change projections are uncertain over the Asian-Australian monsoon region

- **Methodology**
  - Evaluate Asian-Australian monsoon on diurnal through interdecadal time scales using proven diagnostics, e.g., climatological cycle, intraseasonal oscillations, monsoon-ENSO relationship, etc.
  - Skill scores for every diagnostic to provide quantitative measure(s) of model performance

- **Outcomes**
  - CMIP-5 more skillful than CMIP-3 for all diagnostics
  - CMIP-3: BCCR BCM2.0, CCCMA CGCM3.1 T47, CCCMA CGCM3.1 T63, CCSM3, CNRM CM3, CSIRO-MK3.0, CSIRO Mk3.5, FGOALS-g1.0, GFDL CM2.0, GFDL CM2.1, GISS AOM, HadCM3, HadGEM1, INGV-MEDEA, INM-CM3.0, IAP-CGCM3.0, IPSL CM4, MIROC 3.2 (hi-res), MIROC 3.2 (med-res), MIUB ECHO-G, MPI ECHAM5-OM, MRI-CGCM3, and CCM3

- **Climatological Mean Performance: JJAS**
  - Observed and simulated results include the two models that show the range of performance as indicated by the pattern correlations with ERA40 [the skill score in (c) is relative to JRA25].
  - The models have substantial biases in representing the time of onset as well as the spatial extent of the monsoon domain.
  - Rainfall and 850hPa Wind
  - Rainfall climatology pattern correlation relative to ERA40 (1981-1990)
  - Rainfall climatology pattern correlation relative to GPCP (1979-2007)
  - Climatological Mean Performance: JJAS

- **Climatological Monsoon Onset, Peak, Withdrawal, and Duration**
  - Climatological Monsoon Onset, Peak, Withdrawal, and Duration
  - Operational tropical disturbances are from the AVHRR OLR Life-cycle
  - The models have substantially better performance in representing the time of onset as well as the spatial extent of the monsoon domain.
  - With the exception of CMIP-3, rainfall anomalies are better represented than in CMIP-3.

- **Intraseasonal Variability: JJAS**
  - The wind anomalies are better represented from the rainfall anomalies.
  - The multi-model mean (MMM) outperforms CMIP-3 multi-model mean.

- **Monsoon simulation fidelity varies widely among models**
  - The wind anomalies are better represented from the rainfall anomalies.
  - In the right column the pattern correlations are with respect to the BSISV OLR life-cycle obtained from Cyclostationary EOF analysis of AVHRR OLR (Annamalai and Sperber, 2005, J. Atmos. Sci., 62, 2729-2746; Sperber and Annamalai, 2008, Clim. Dynam., 31, 345-372)

- **Rainfall Skill**
  - Observed and simulated rainfall anomalies in the monsoon domain

- **East Asian/West Pacific Monsoon: JJA Interannual Variation (con’t)**
  - The wind anomalies are better represented from the rainfall anomalies.
  - In the right column the correlation coefficients are with respect to the BSISV OLR life-cycle obtained from Cyclostationary EOF analysis of AVHRR OLR (Annamalai and Sperber, 2005, J. Atmos. Sci., 62, 2729-2746; Sperber and Annamalai, 2008, Clim. Dynam., 31, 345-372)

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