CEOP Inter-Monsoon Studies (CIMS)

Objectives:

• To provide better understanding of fundamental physical processes (diurnal cycle, annual cycle, intraseasonal oscillations) in monsoon regions around the world

• To demonstrate the synergy and utility of CEOP data in providing a pathway for model physics evaluation and improvement

WCRP/CEOP: First Element of the Water Cycle theme, within IGOS-P

Integrated Satellite data
Reanalysis

MOLTS
Reference Site Obs

“Telecoping Strategy”

Figure 3.5: From Global, Mesoscale Regional, to Reference Site Local and Plot Scales. Relevant Data Sets will be Collected and Aggregated.
CIMS and related activities

• First CIMS workshop, IRI, Palisade, NY, September 2002
• CEOP/GEWEX workshop on role of Himalayas and Tibetan Plateau on the Asian monsoon System, Milan, Italy, April 2003
• CEOP Special Session in AGU, San Francisco, Dec. 2003
• CEOP newsletter no.5 “Diurnal Variability in monsoon regions: preliminary results from CIMS”
• 3rd Workshop on Regional Climate Modeling, U. of Hawaii, February, 2004
• CLIVAR AAMP, Bangalore, India, Feb. 2004
• CEOP Workshop on American monsoon, Montevideo, Uruguay, Sept. 2004
• Joint CAPT (CCSP- Arm Parameterization Testbed) CEOP session in annual AMS meeting, January 2005
• Joint GEWEX/CLIVAR Monsoon Modeling Workshop, Irvine, CA, June, 2005 (planned).
CEOP Reference Site Status: http://www.joss.ucar.edu/ghp/ceopdm/rsite.html
SGP Monthly Averages (annual cycles)

Courtesy of T. Ackerman
Manus Daily Avgs: Flux

Relative Frequency

Bin Minimum (Wm⁻²)

Courtesy of T. Ackerman
Cloud Property Frequency Distributions at Manus

Courtesy of T. Ackerman
Cloud Property Frequency Distributions at Manus

- Cirrus
- Melting zone
- BL Cu

Graphs showing ARM and CAM-only condensed water content against pressure and logarithmic concentration.
Heating Rates
All Sky-minus-Clear Sky at Manus

Cirrus warming

Boundary Layer clouds, LW warming

Courtesy of T. Ackerman
A conceptual model of diurnal cycles of surface temperature, clouds and rainfall over land Lin et al. (2000)
Histogram for Diurnal (24-hour) Component (40 S - 40 N)

- **CTRL**
- **less strapping**
- **longer relx time**
- **both**
Climatological Annual Cycles in Monsoon Regions

- Slow and fast components of annual cycles:
  - Abrupt onset
  - Break
  - Withdrawal
  - Oceanic ITCZ vs. land convection
  - Phase-locking with ISO
Winds at 925hPa
Longitude-Time cross section of Precipitation (East Asia)
Longitude-Time cross section of Precipitation (India)
Longitude-Time cross section of Precipitation (South America)
Longitude-Time cross section of Precipitation (West Africa)
Longitude-Time cross section of Precipitation (NAME)
Longitude-Time cross section of Precipitation (NAME)
Preliminary Assessments

- Annual and diurnal cycles information from integrated observing platforms (satellite + reference sites + MOLTS) are extremely useful for climate model physics assessments.

- MMF (super-parameterization) produces better CWC structures than CAM; both have problems with vertical radiative heating profiles.

- Coares resolution (2x2 degree) GCMs produce reasonable diurnal cycles, but about 3 hour early;
  - do not produce details of rainfall cycles realistically;
  - have too much drizzles;
  - simulate reasonably well the major monsoons annual cycles of EASM, IM, SASM, and WAM, but not NAME;
  - underestimate strength of ISO, and phase-locking.

- Next step is to pin-point, and correct critical factors in model physics package that causes these biases, and implement missing physics.