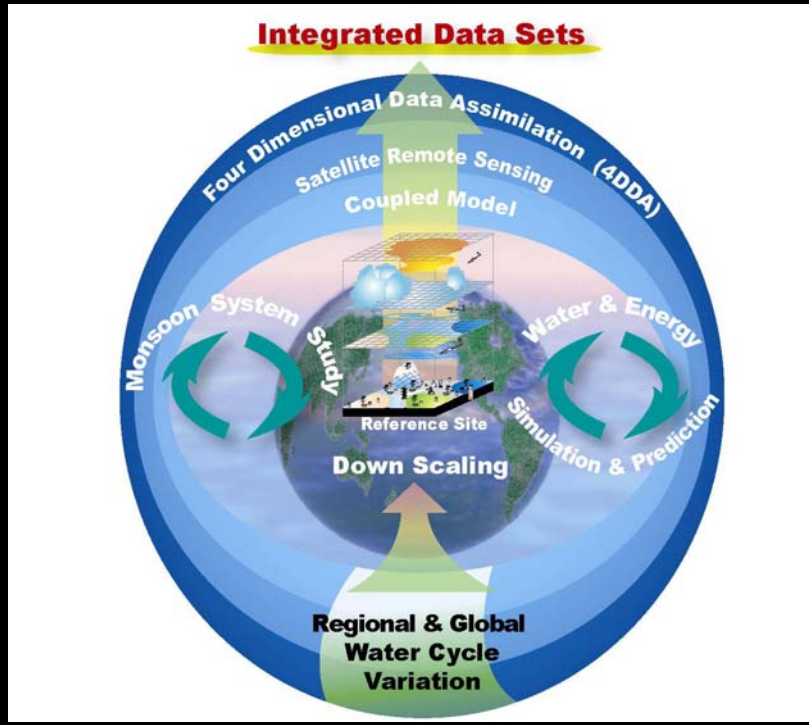
CEOP Inter-Monsoon Studies (CIMS)

Objectives:

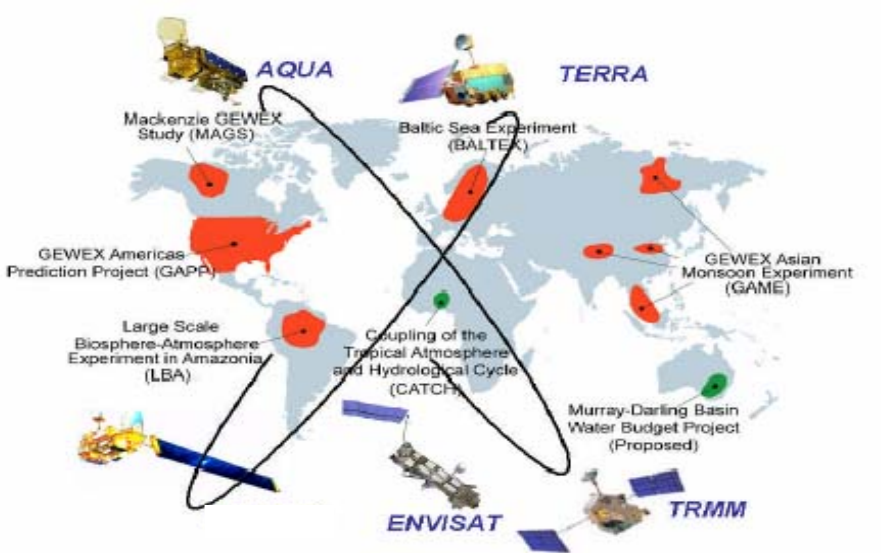
- To provide better understanding of fundamental physical processes (diurnal cycle, annual cycle, intraseasonal oscillations) in monsoon regions around the world
- To demonstrate the synergy and utility of CEOP data in providing a pathway for model physics evaluation and improvement



Ad hoc CIMS working group: W. Lau, J. Masumoto, R. Mechoso, J. Marengo, H. Berbery, M. Bollasina, T. Yasunari, Y. K. Xue, T. Satomura , P. Glecker, Y. Wang, J. Potter, B.K. Basu, B. Burton, …

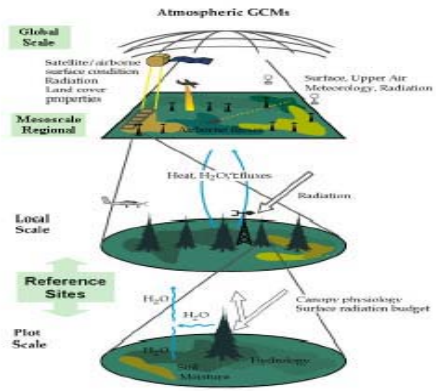
WCRP/CEOP: First Element of the water Cycle theme, within IGOS-P

Integrated Satellite data
Reanalysis



"Telecoping Strategy"

MOLTS
Reference Site Obs



GCM

RCM

CRM/MHM

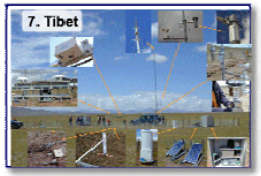
Figure S3: From Global, Mesoscale Regional, to Reference Site Local and Plot Scales, Relevant Data Sets will be Collected and Aggregated.

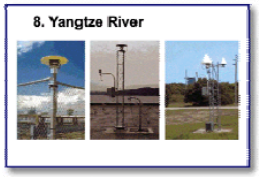
CIMS and related activities

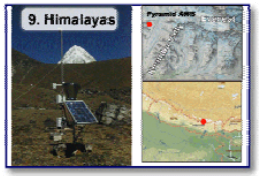
- First CIMS workshop, IRI, Palisade, NY, September 2002
- CEOP/GEWEX workshop on role of Himalayas and Tibetan Plateau on the Asian monsoon System, Milan, Italy, April 2003
- CEOP Special Session in AGU, San Francisco, Dec. 2003
- CEOP newsletter no.5 " Diurnal Variability in monsoon regions: preliminary 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).

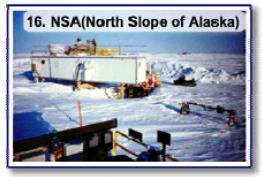
REFERENCE SITES

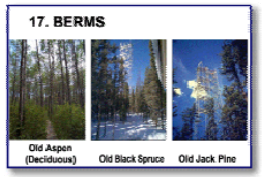
CEOP Reference Site Status: http://www.joss.ucar.edu/ghp/ceopdm/rsite.html

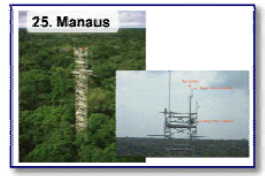


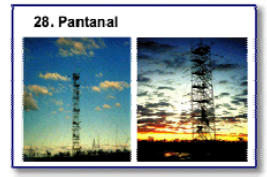


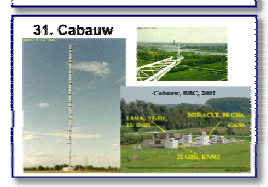


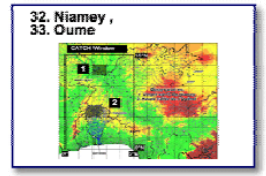


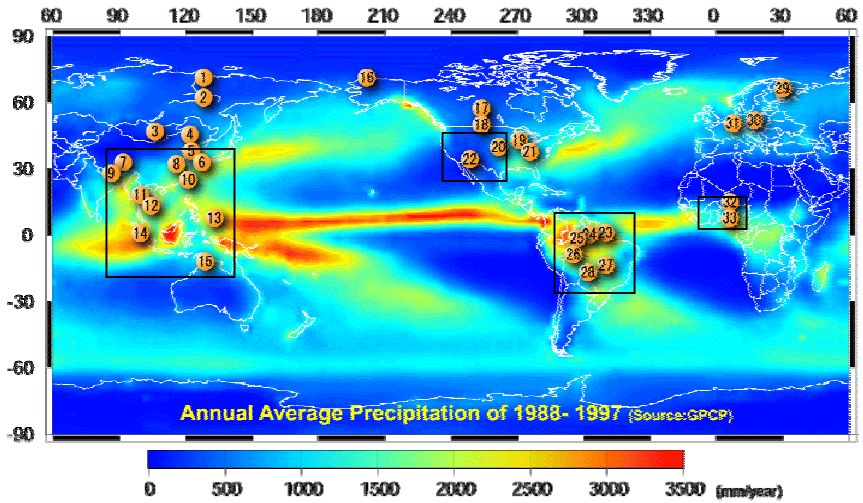




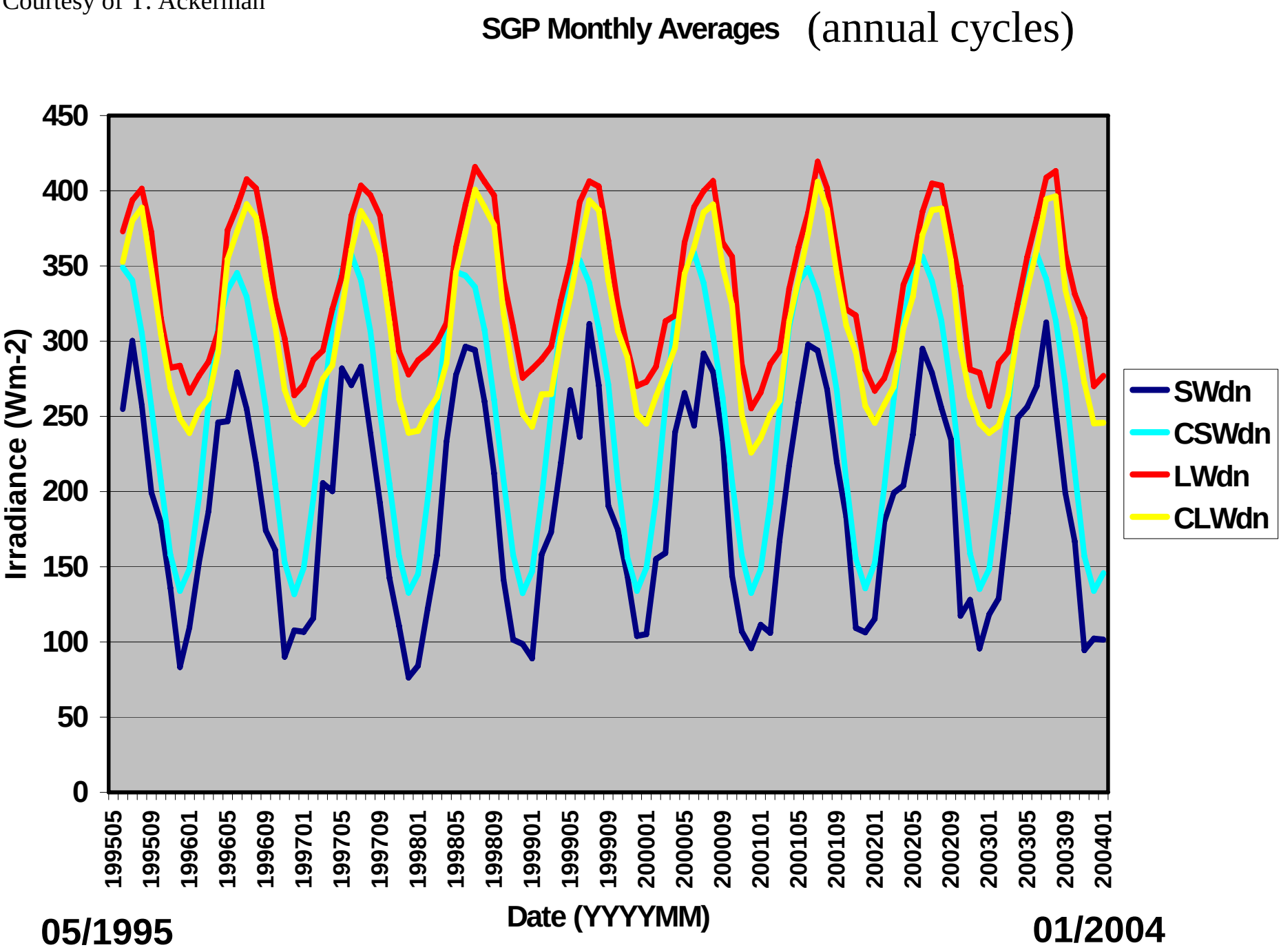








Courtesy of T. Ackerman



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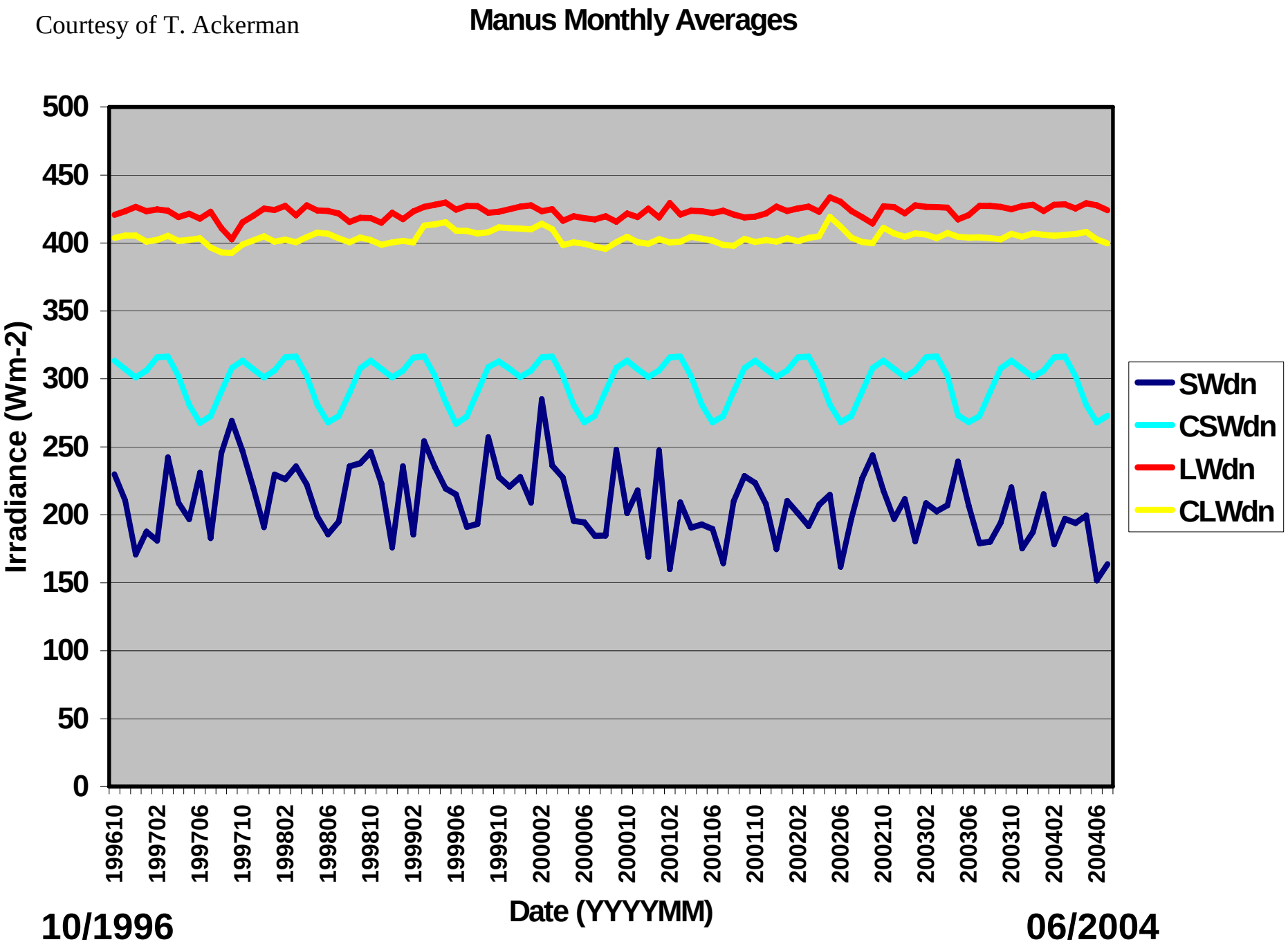
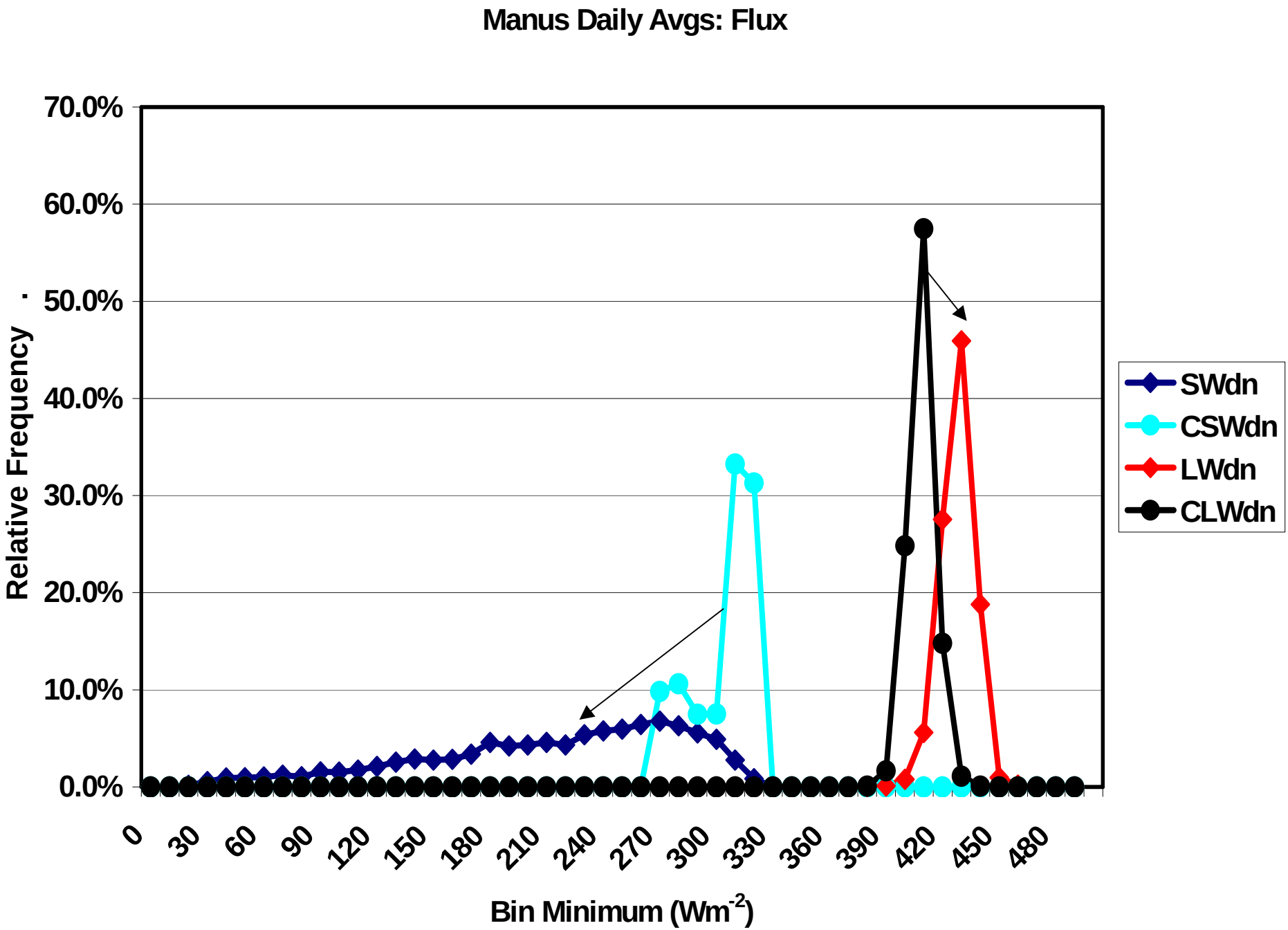
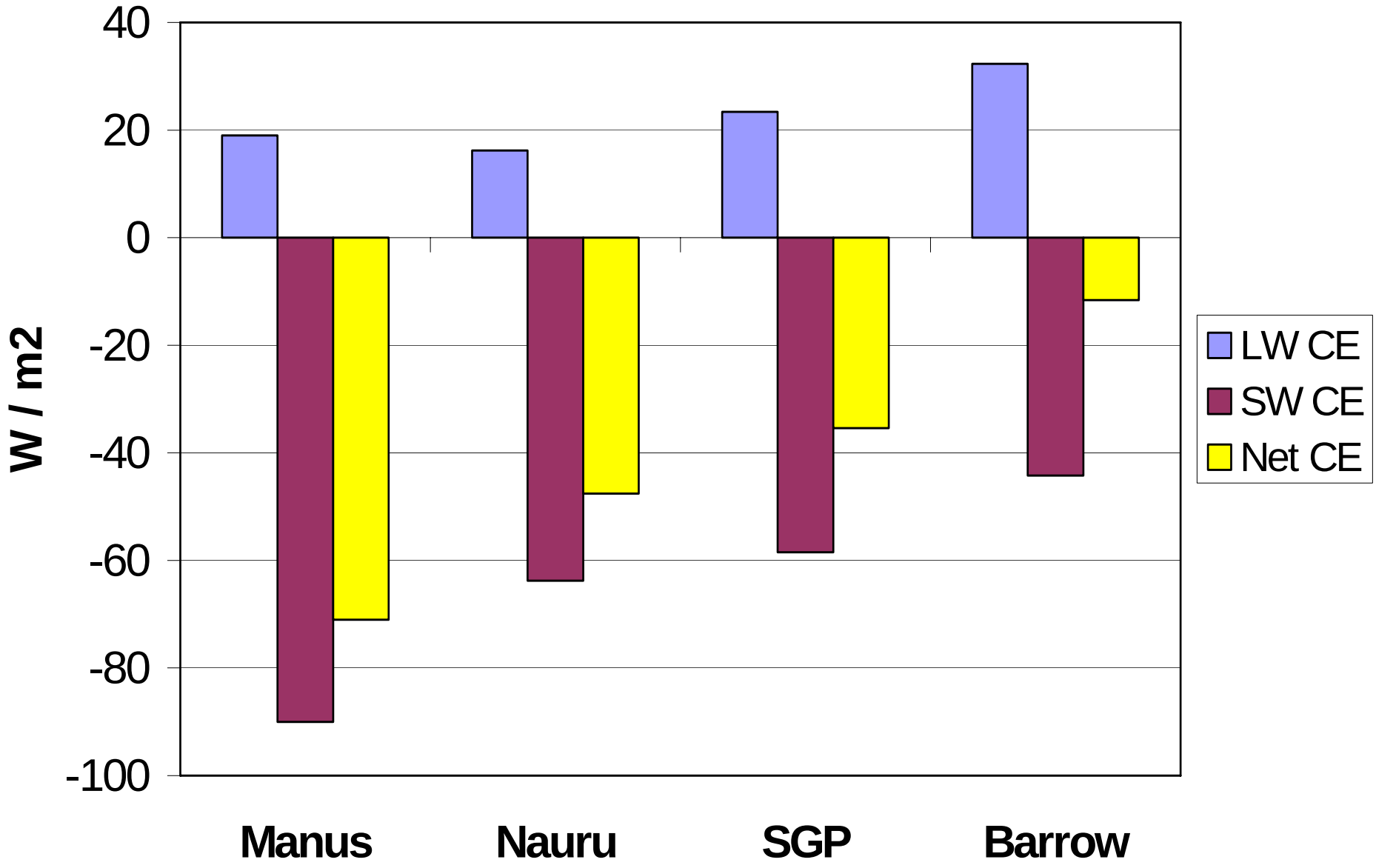




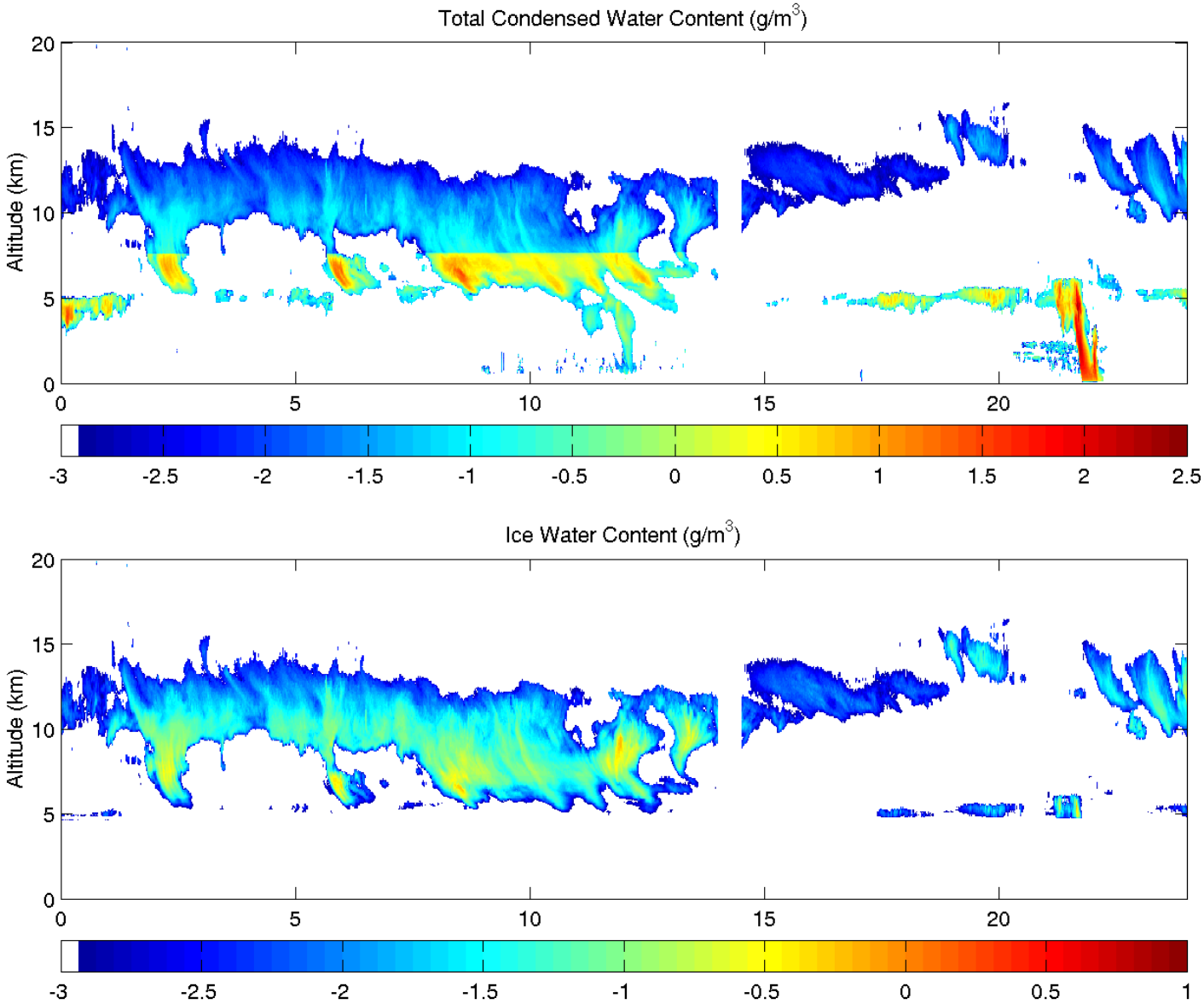
Courtesy of T. Ackerman

Courtesy of T. Ackerman

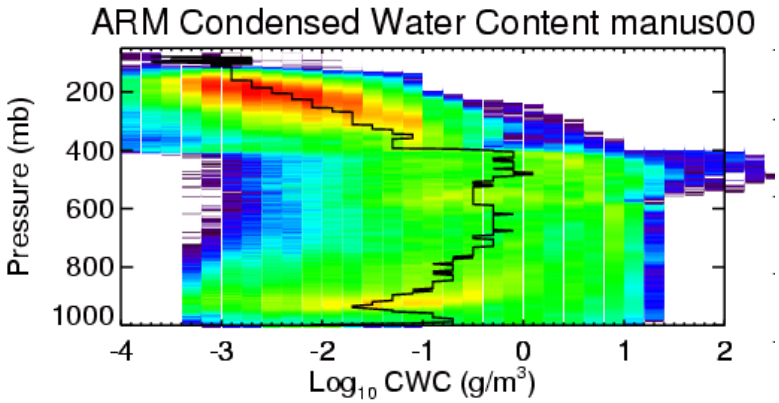
Average Downward Cloud Effect

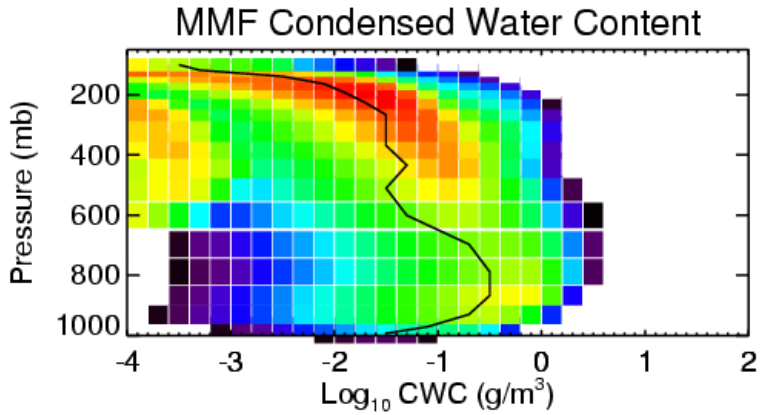


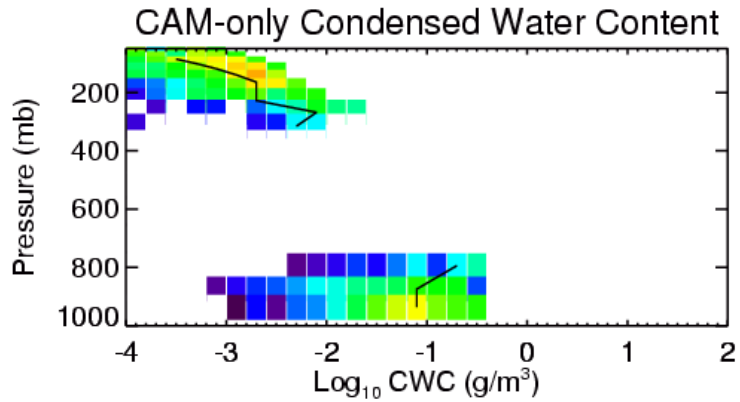
Total water content – Manus, 13 March 2000



Cloud Property Frequency Distributions at Manus

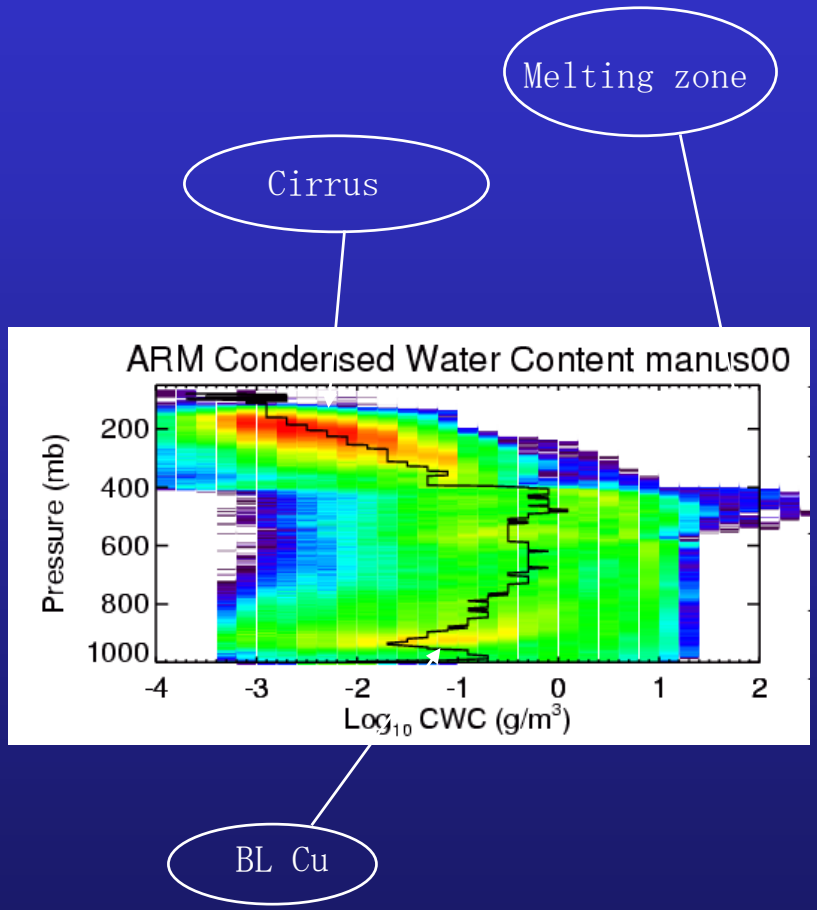


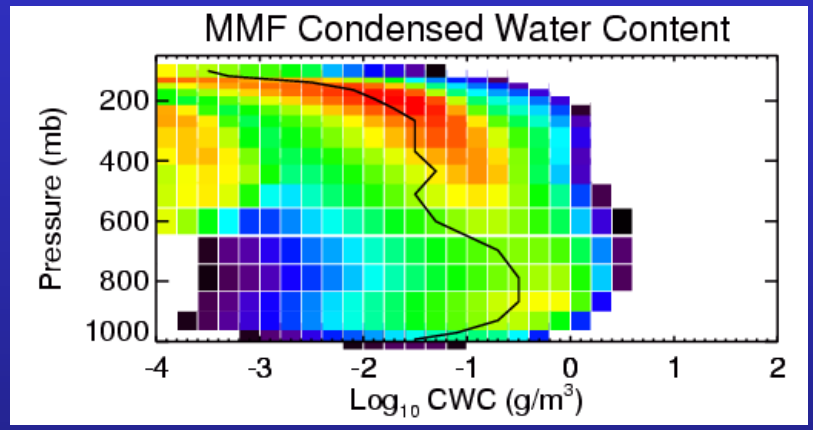


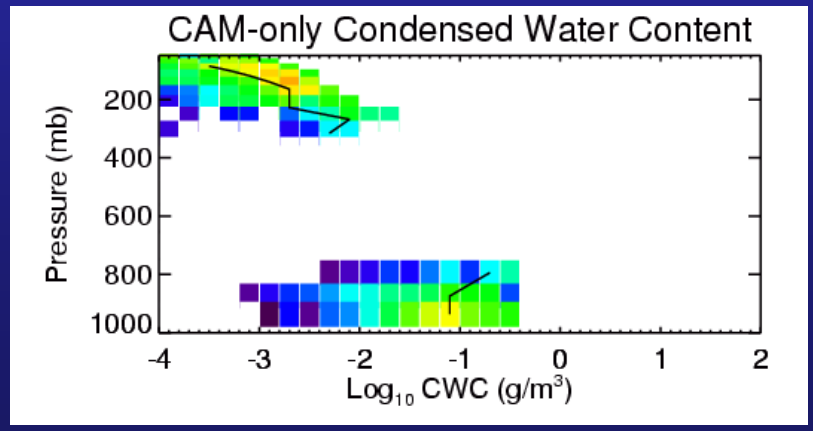


Courtesy of T. Ackerman

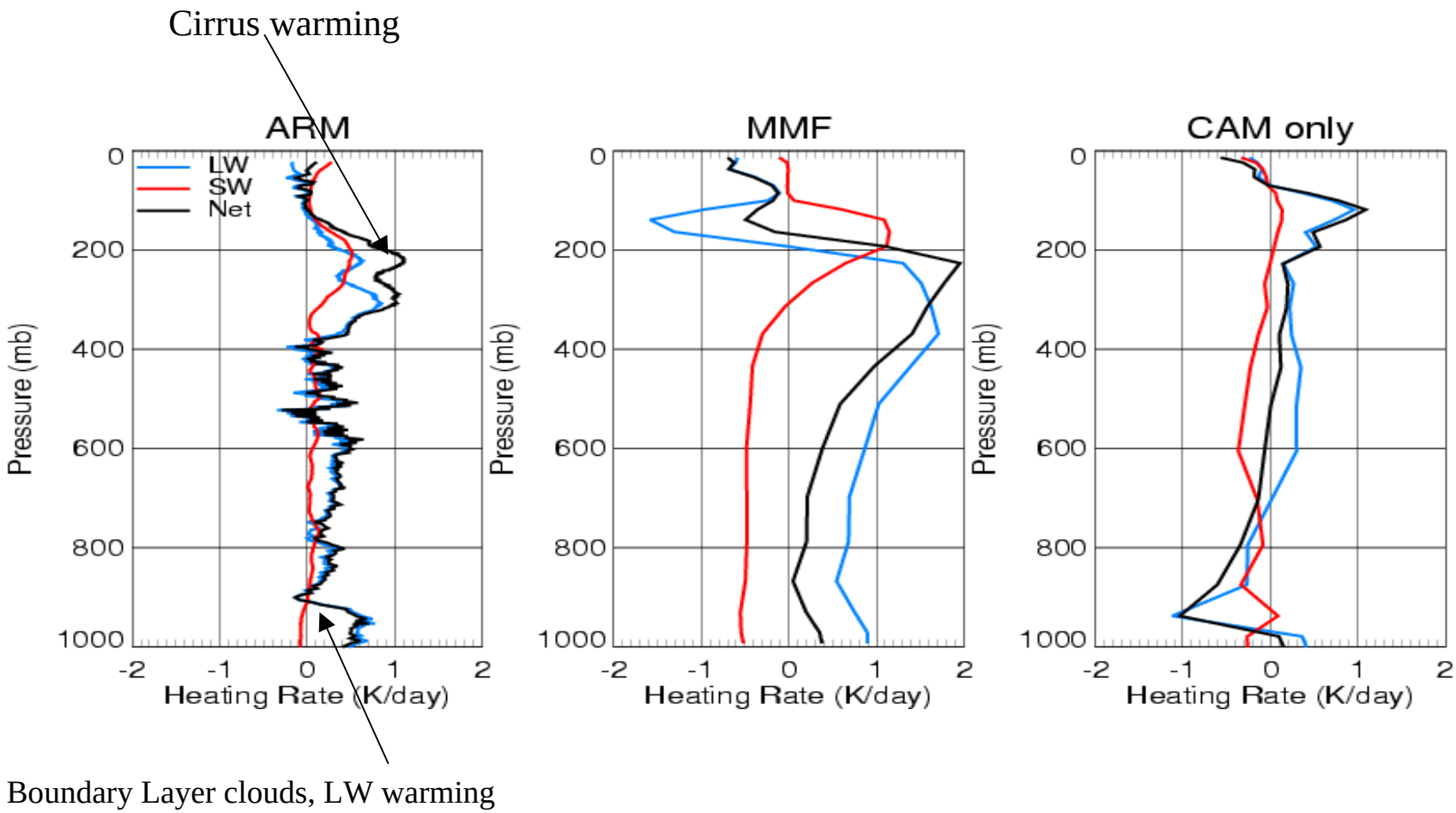
Cloud Property Frequency Distributions at Manus



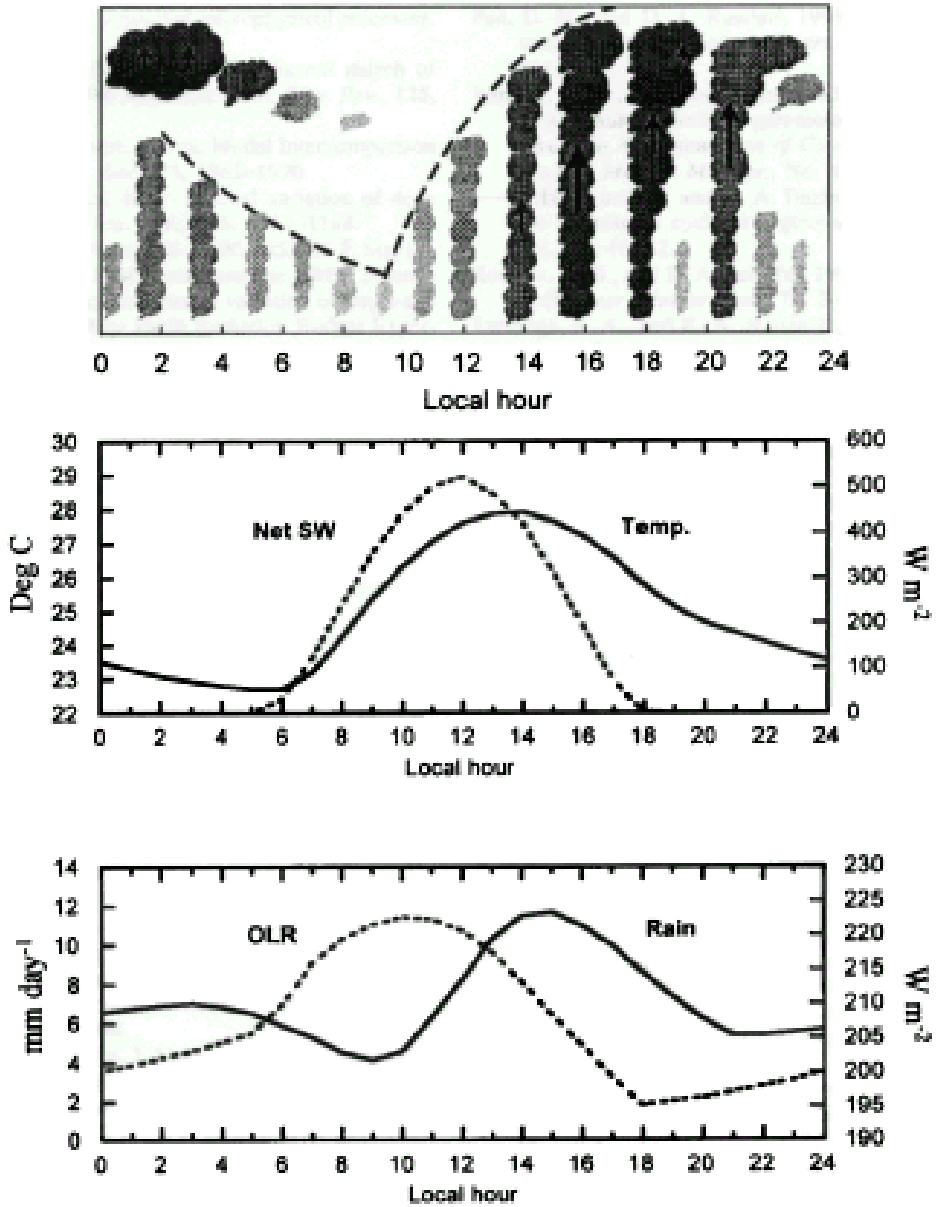




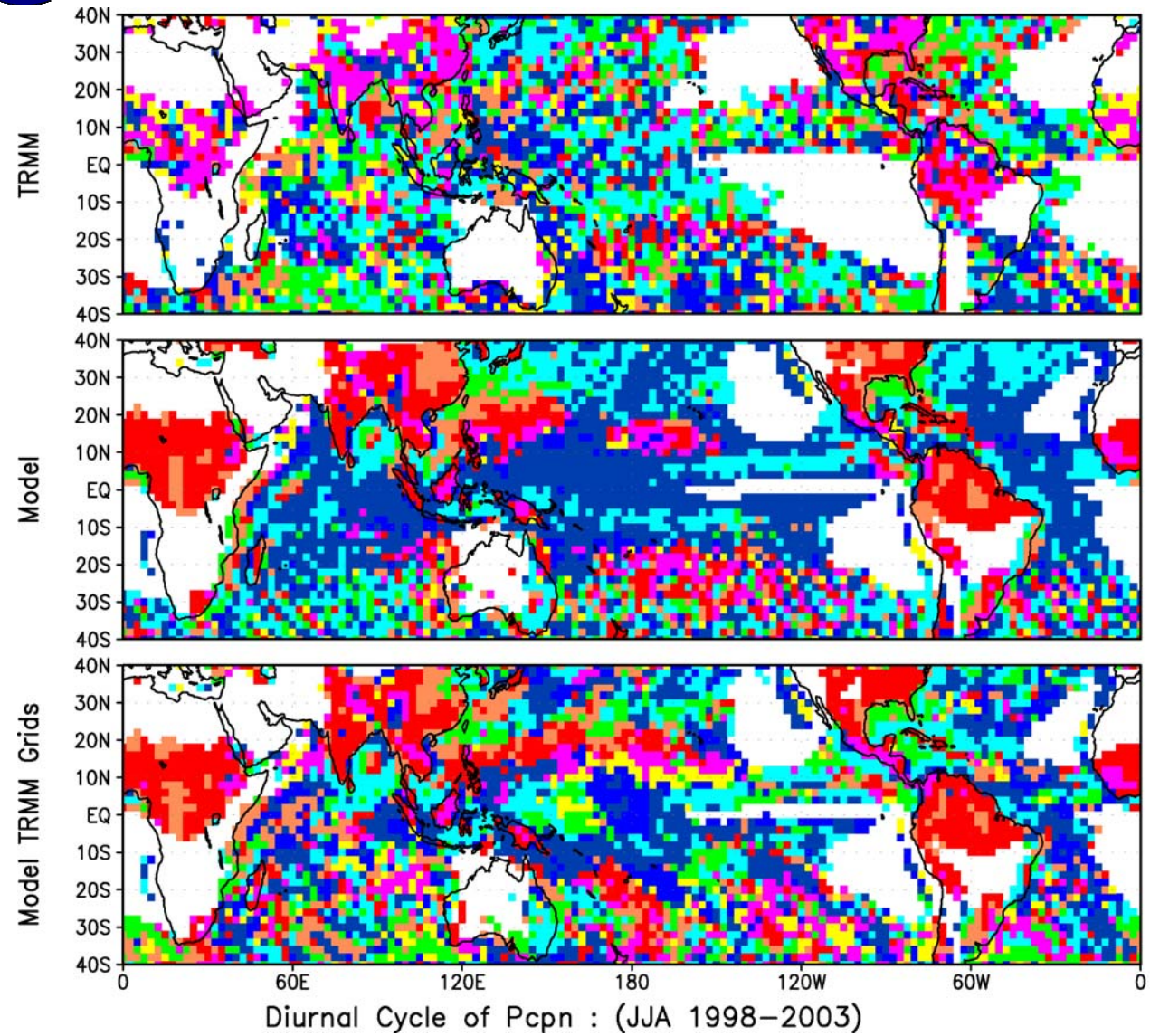
Heating Rates
All Sky-minus- Clear Sky at Manus

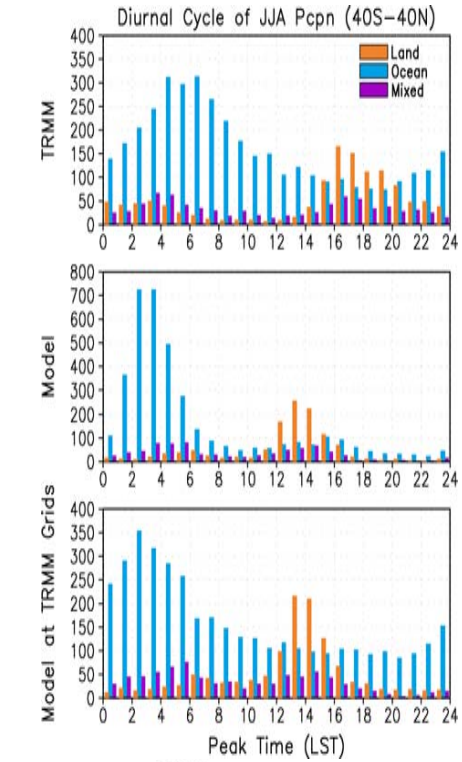


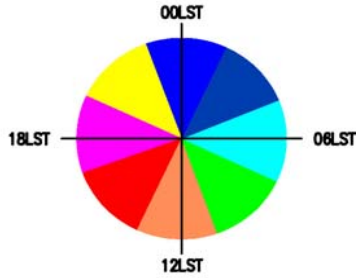
Courtesy of T. Ackerman

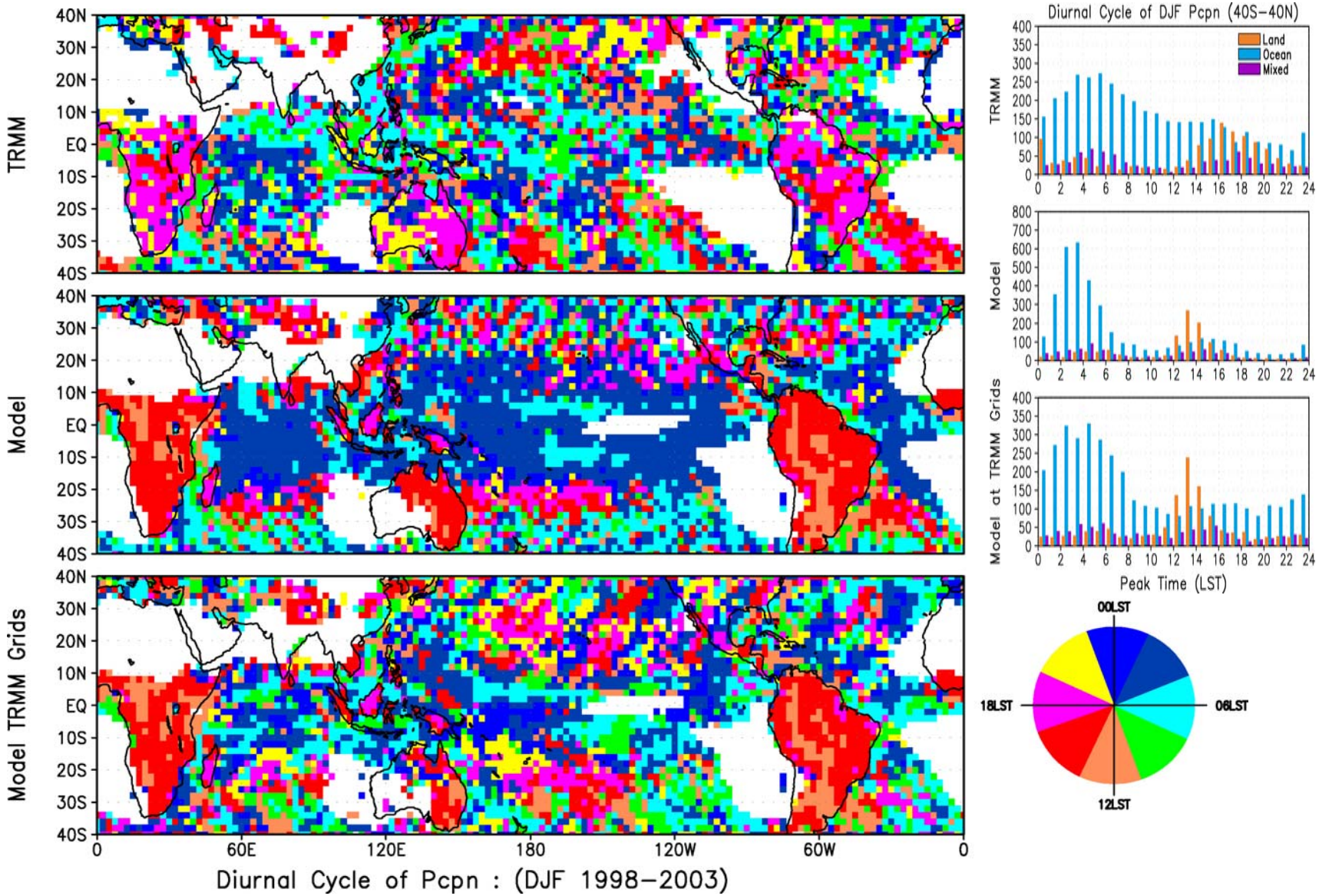


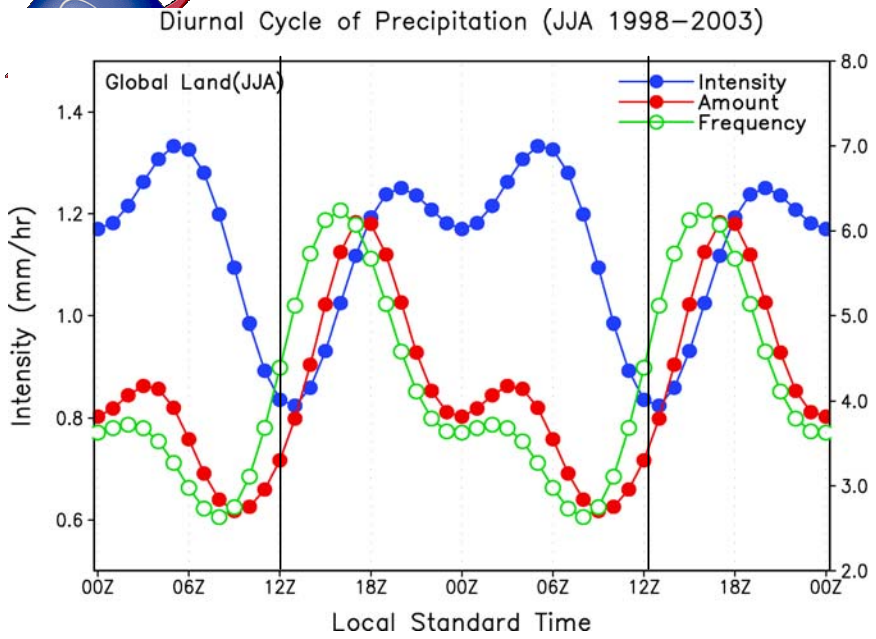
A conceptual model of diurnal cycles of surface temperature, clouds and rainfall over land Lin et al. (2000)

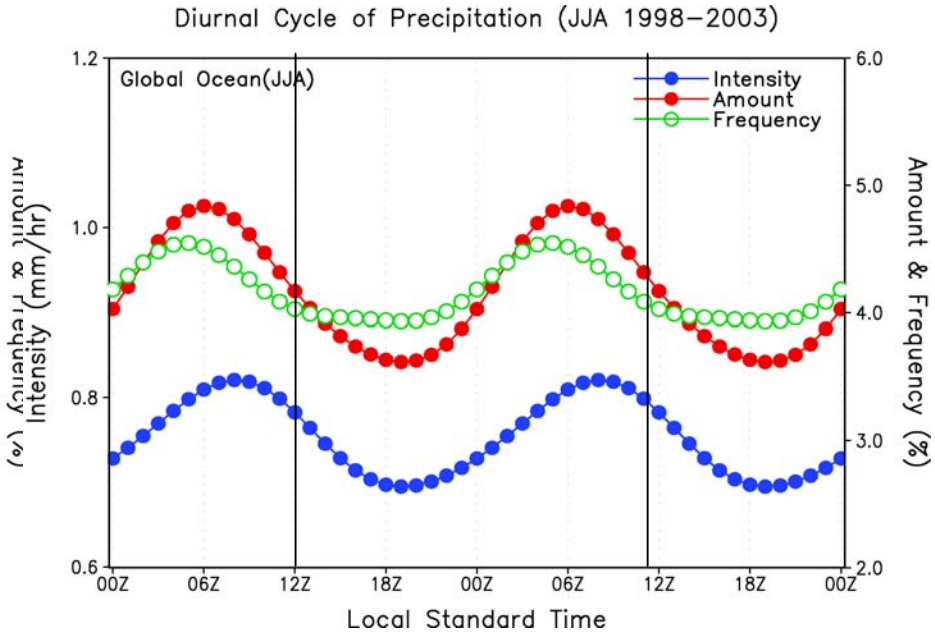

TRMM
Model
Model TRMM Grids
40N
30N
20N
10N
EQ
10S
20S
30S
40S
0
60E
120E
180
120W
60W
0
Diurnal Cycle of Pcpn : (JJA 1998–2003)

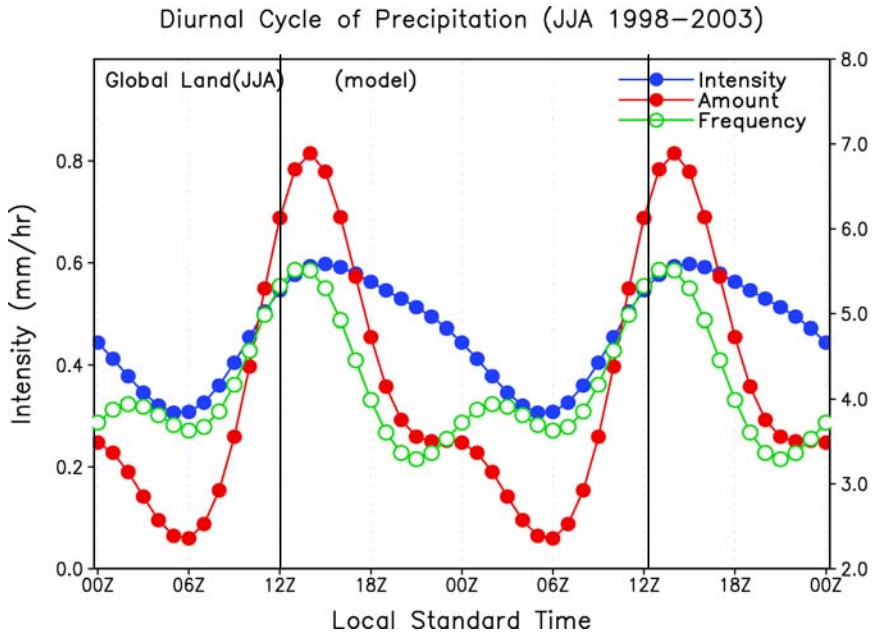

Diurnal Cycle of JJA Pcpn (40S–40N)
Land
Ocean
Mixed
TRMM
Model
Model at TRMM Grids
0 2 4 6 8 10 12 14 16 18 20 22 24
Peak Time (LST)

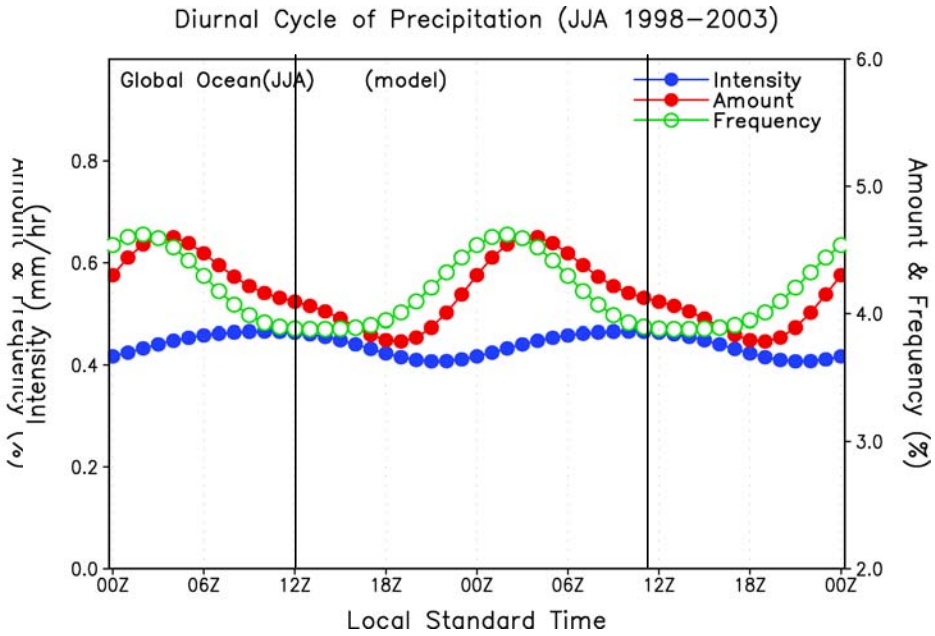

00LST
06LST
12LST
18LST


TRMM
Model
Model TRMM Grids
40N
30N
20N
10N
EQ
10S
20S
30S
40S
0
60E
120E
180
120W
60W
Diurnal Cycle of Pcpn : (DJF 1998–2003)
Diurnal Cycle of DJF Pcpn (40S–40N)
Land
Ocean
Mixed
TRMM
Model
Model at TRMM Grids
Peak Time (LST)
00LST
06LST
12LST
18LST

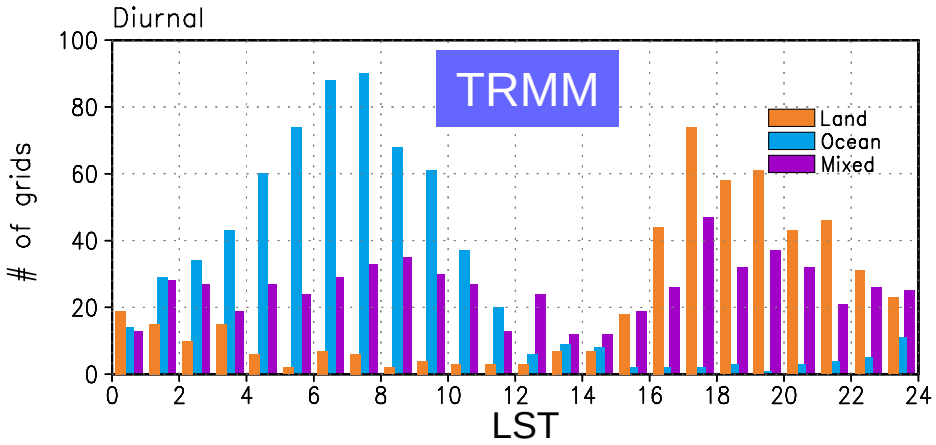

Diurnal Cycle of Precipitation (JJA 1998–2003)
Global Land(JJA)
Intensity
Amount
Frequency
Intensity (mm/hr)
Amount & Frequency (%)
00Z
06Z
12Z
18Z
00Z
06Z
12Z
18Z
00Z
Local Standard Time

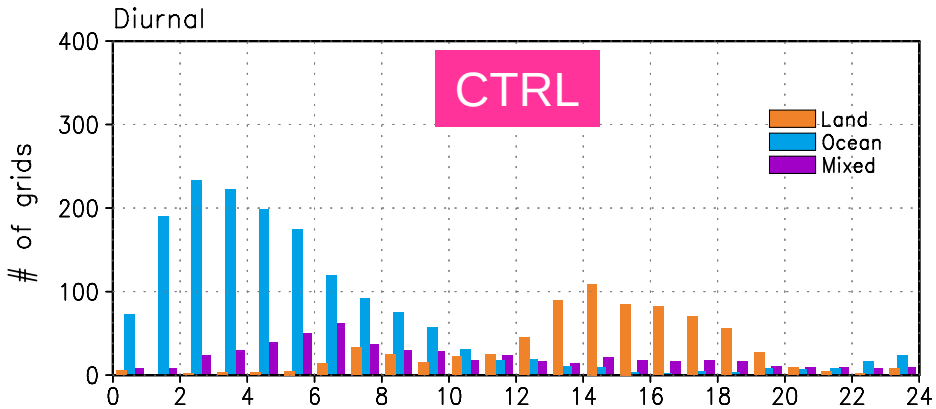

Diurnal Cycle of Precipitation (JJA 1998–2003)
Global Ocean(JJA)
Intensity
Amount
Frequency
Intensity (mm/hr)
Amount & Frequency (%)
00Z
06Z
12Z
18Z
00Z
06Z
12Z
18Z
00Z
Local Standard Time

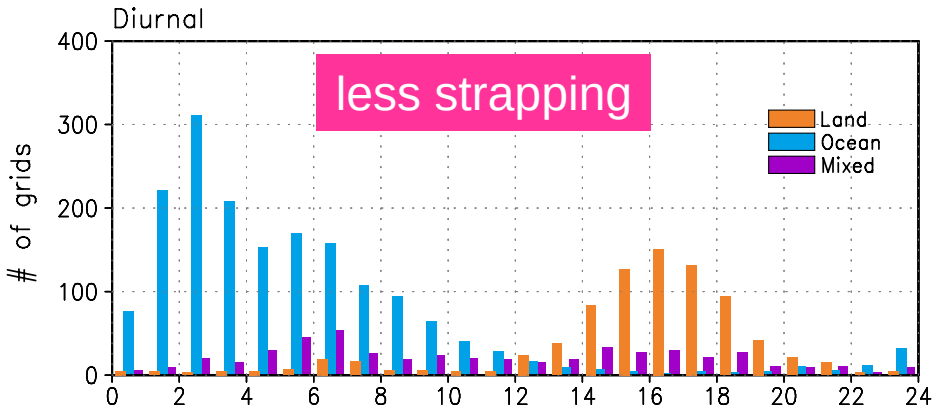

Diurnal Cycle of Precipitation (JJA 1998–2003)
Global Land(JJA)
(model)
Intensity
Amount
Frequency
Intensity (mm/hr)
Amount & Frequency (%)
00Z
06Z
12Z
18Z
00Z
06Z
12Z
18Z
00Z
Local Standard Time

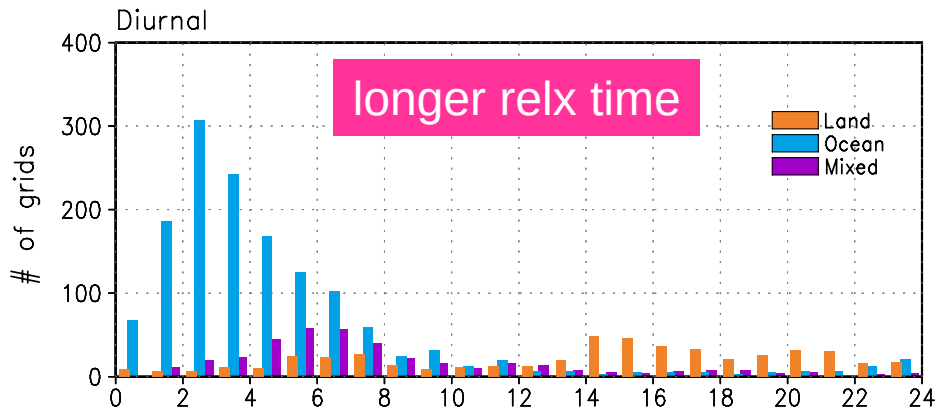

Diurnal Cycle of Precipitation (JJA 1998–2003)
Global Ocean(JJA)
(model)
Intensity
Amount
Frequency
Intensity (mm/hr)
Amount & Frequency (%)
00Z
06Z
12Z
18Z
00Z
06Z
12Z
18Z
00Z
Local Standard Time

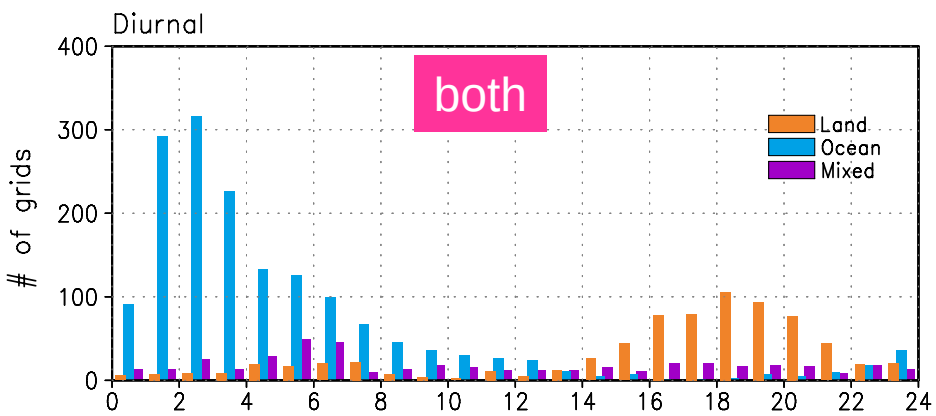
Histogram for Diurnal (24-hour) Component (40 S - 40 N)







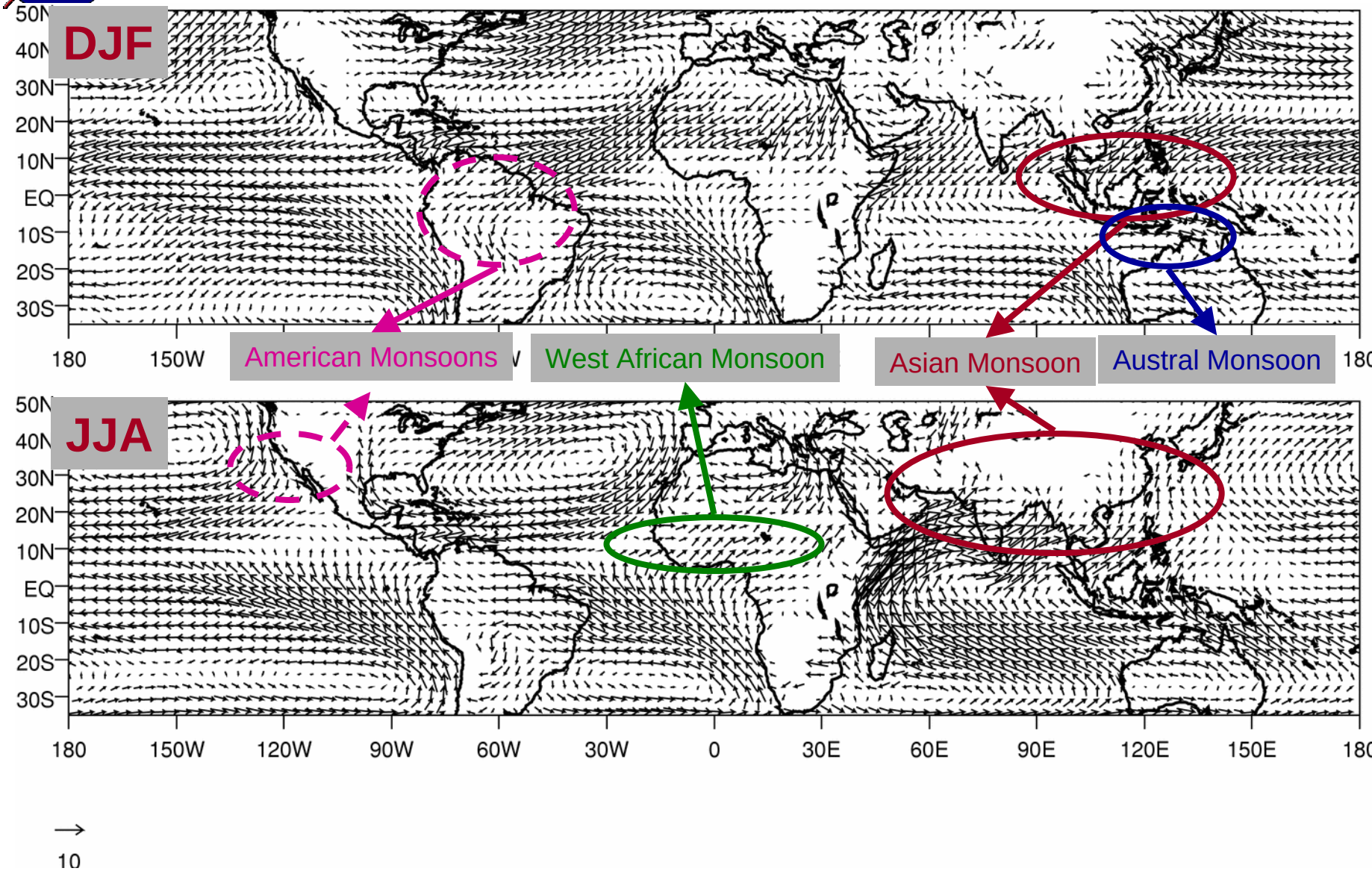




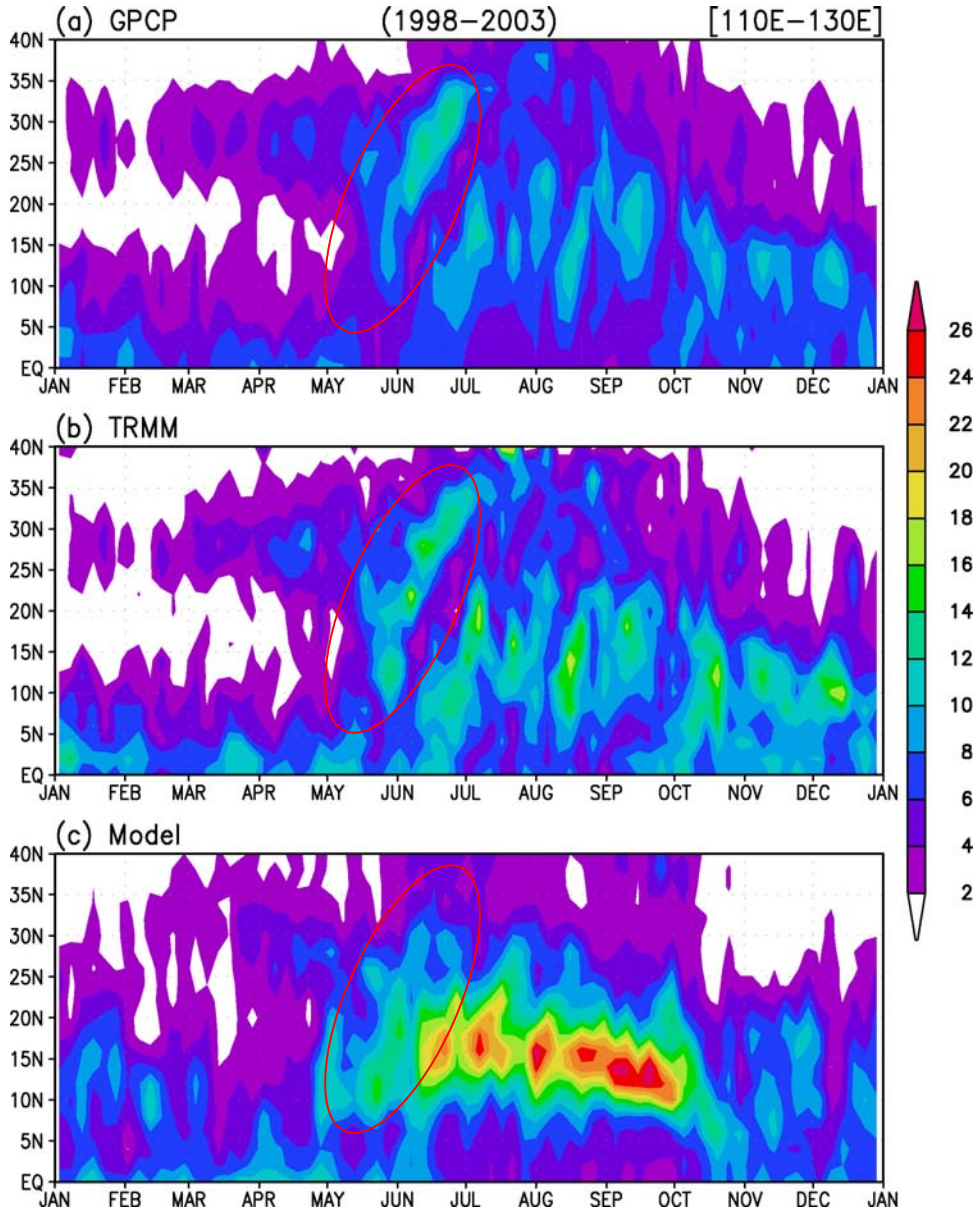
Climatological Annual Cycles in Monsoon Regions

- Slow and fast components of annual cycles:
  - Abrupt onset
  - Break
  - Withdrawl
  - Oceanic ITCZ vs. land convection
  - Phase-locking with ISO

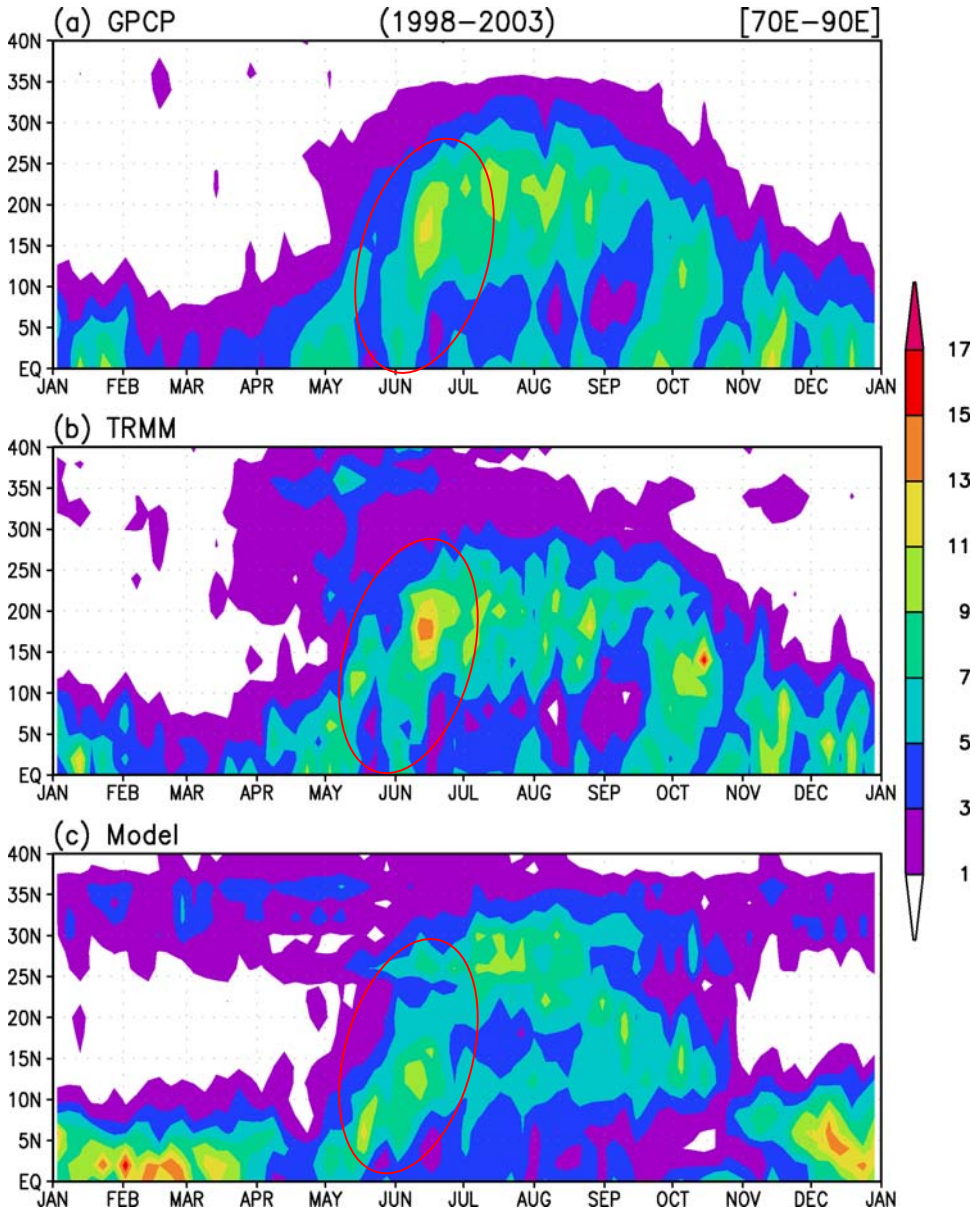
Winds at 925hPa



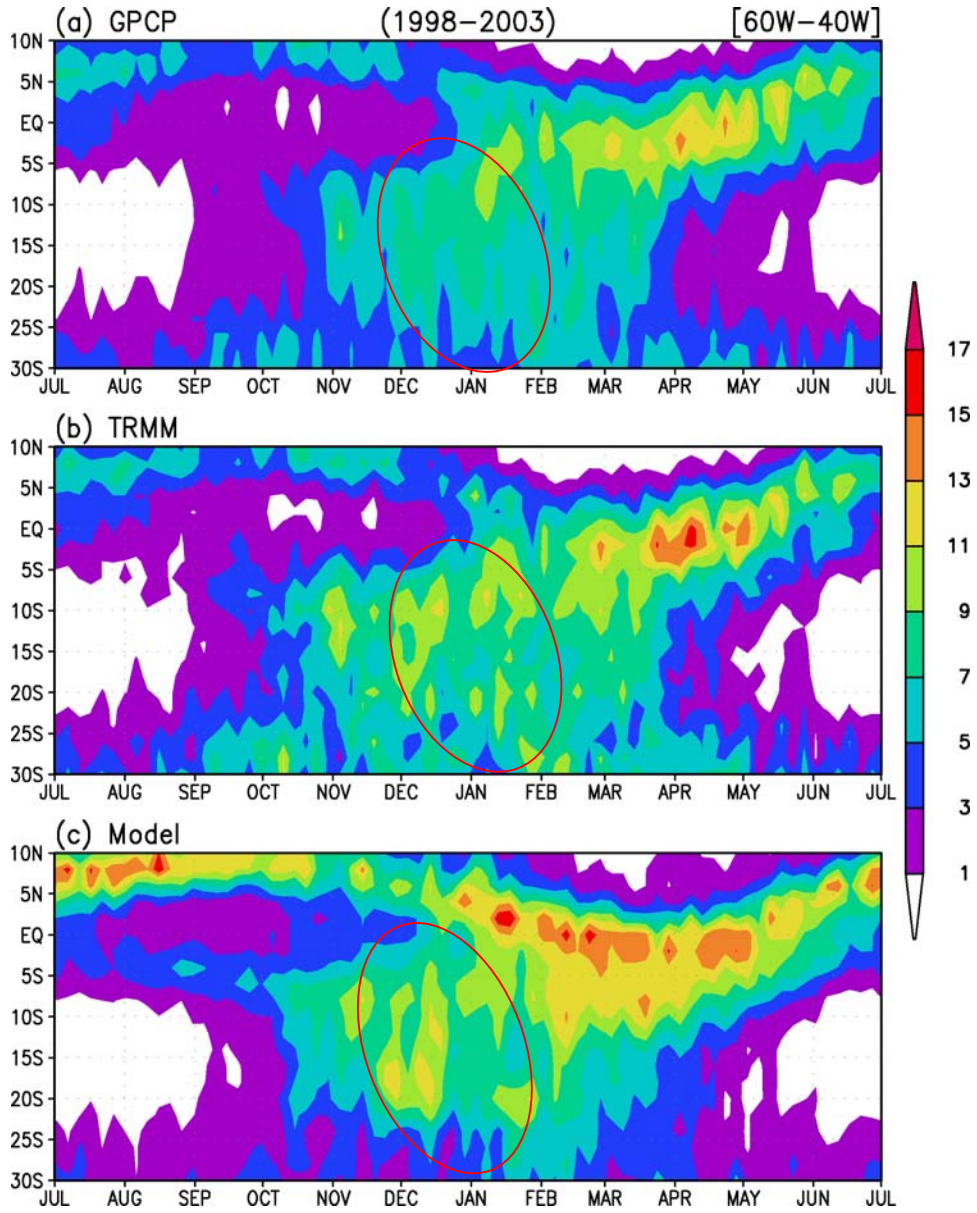
Longitude-Time cross section of Precipitation (East Asia)



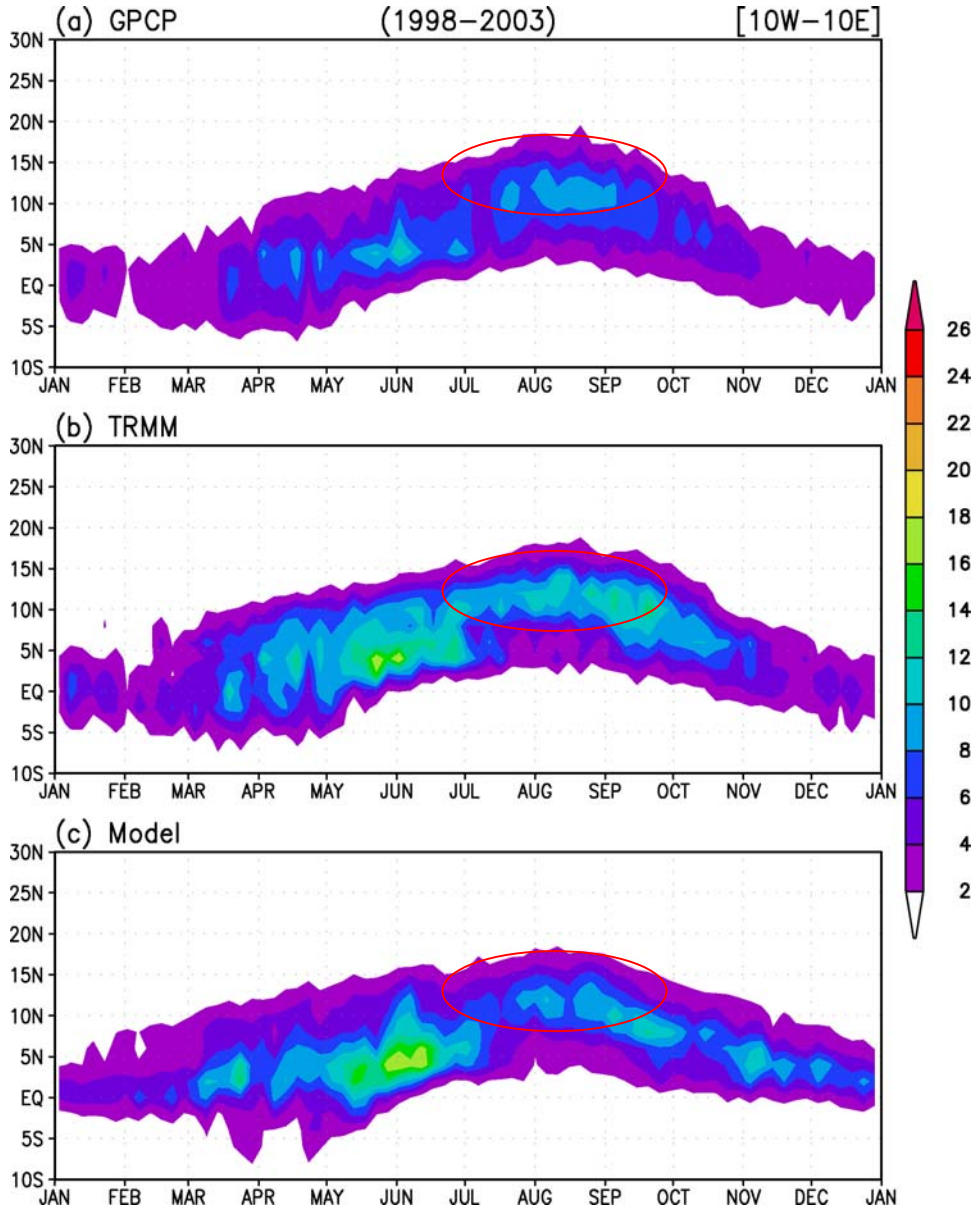
Longitude-Time cross section of Precipitation (India)



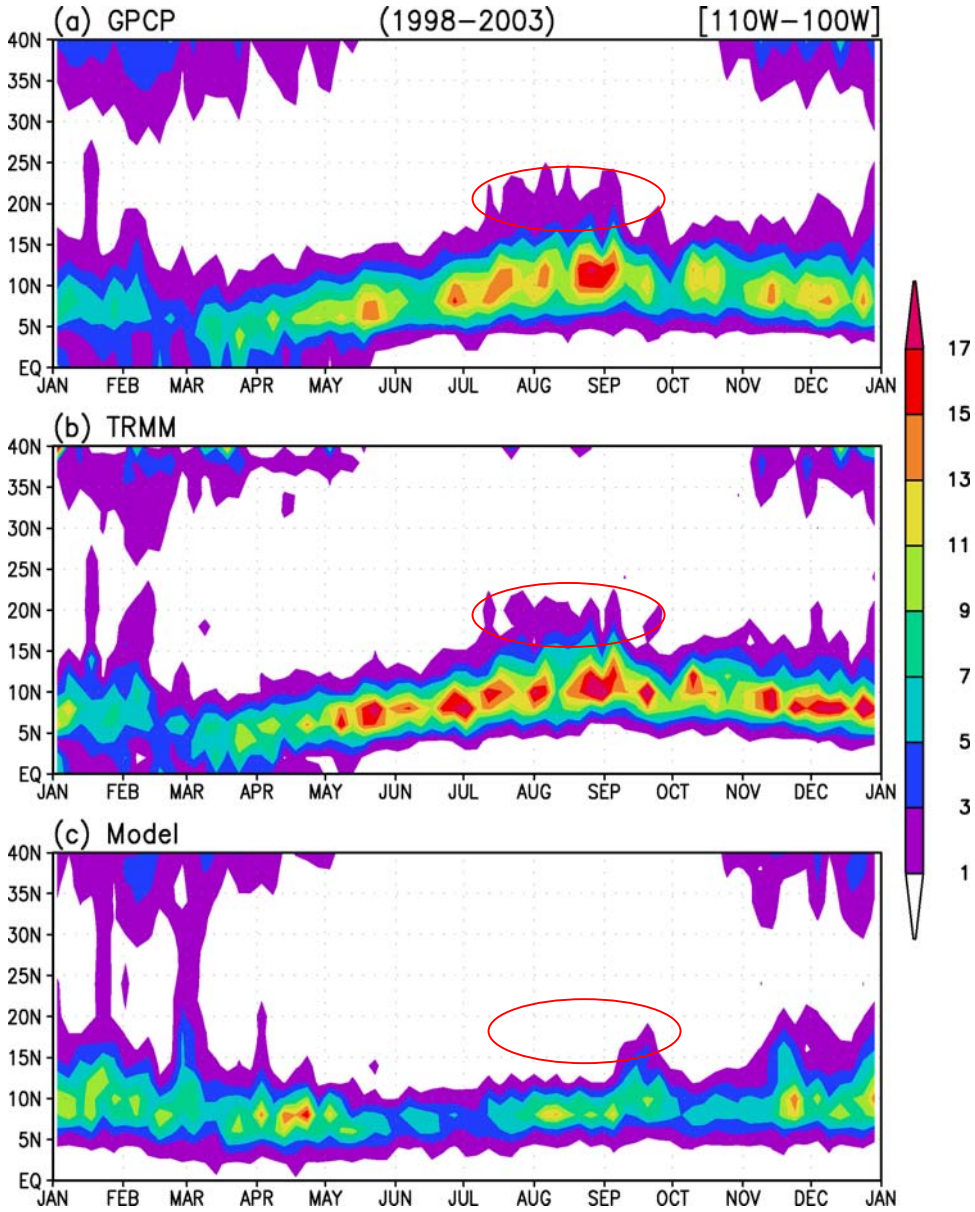
Longitude-Time cross section of Precipitation (South America)



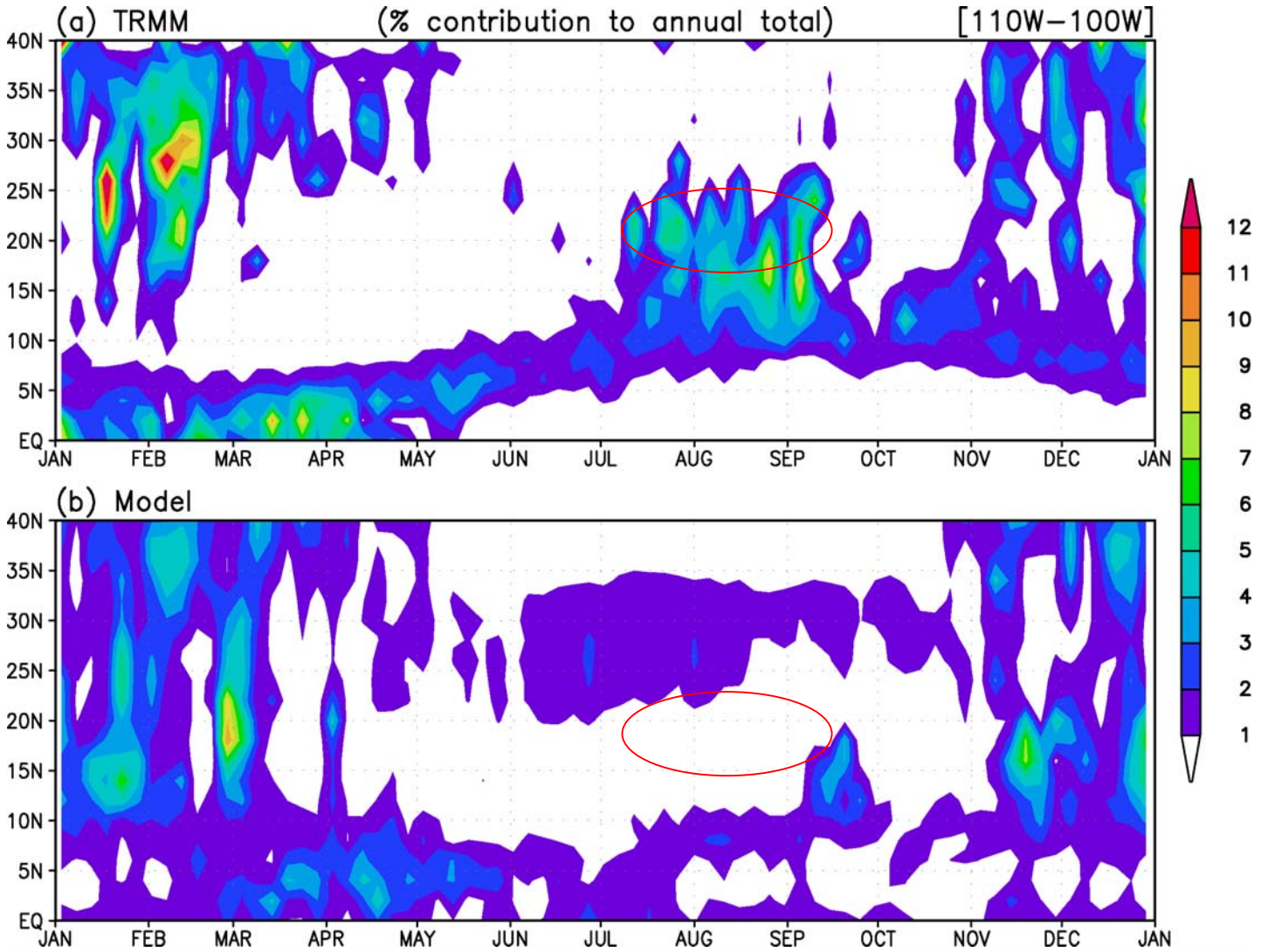
Longitude-Time cross section of Precipitation (West Africa)

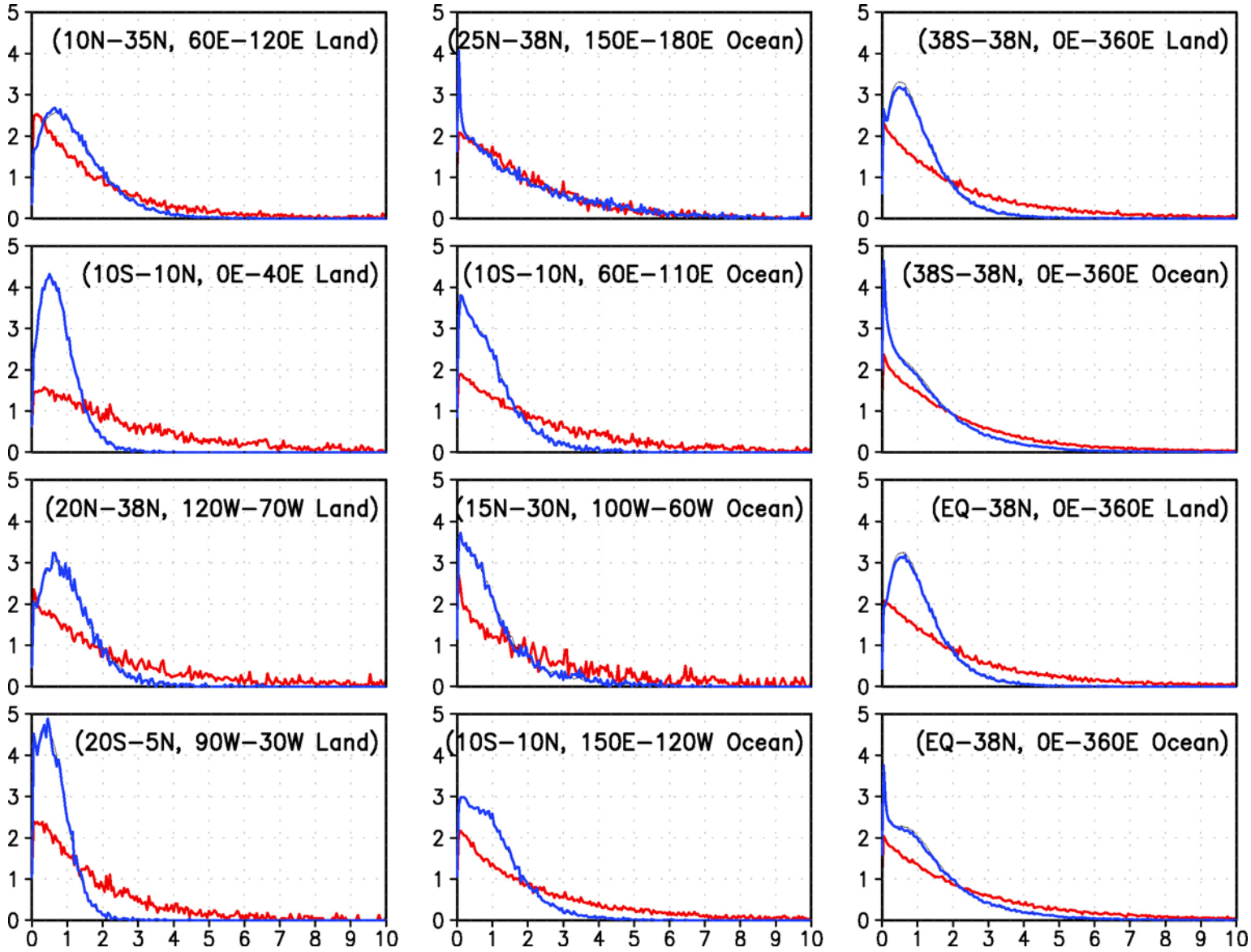


Longitude-Time cross section of Precipitation (NAME)



Longitude-Time cross section of Precipitation (NAME)




(10N–35N, 60E–120E Land)
(25N–38N, 150E–180E Ocean)
(38S–38N, 0E–360E Land)
(10S–10N, 0E–40E Land)
(10S–10N, 60E–110E Ocean)
(38S–38N, 0E–360E Ocean)
(20N–38N, 120W–70W Land)
(15N–30N, 100W–60W Ocean)
(EQ–38N, 0E–360E Land)
(20S–5N, 90W–30W Land)
(10S–10N, 150E–120W Ocean)
(EQ–38N, 0E–360E Ocean)
0 1 2 3 4 5
0 1 2 3 4 5 6 7 8 9 10

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.