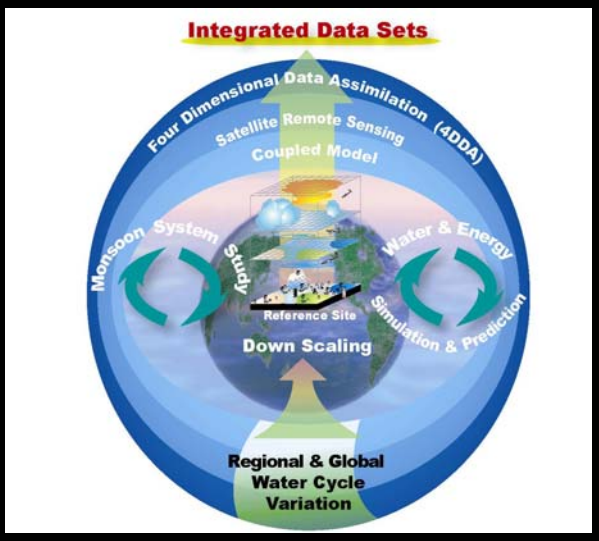
CEOP Inter-Monsoon Studies (CIMS)

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



CIMS Working Group

Co-Chairs: 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, A. Barros…

CIMS and related meetings/workshops

- 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
- 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
- Pan WCRP Monsoon Modeling Workshop, Irvine, CA, June, 2005
- SHARE-Asia workshop "Mountain, witness to Global Change", Rome, Italy, Nov. 17-20, 2005.
- Special session in West Pacific Geophysical Meeting, Beijing, China, July 24-27, 2006
- Workshop on "Effect of elevated aerosol on radiation, hydrology, and atmospheric water cycle in monsoon regions", Xining/Lhasa, China, July 29 - Aug 2, 2006

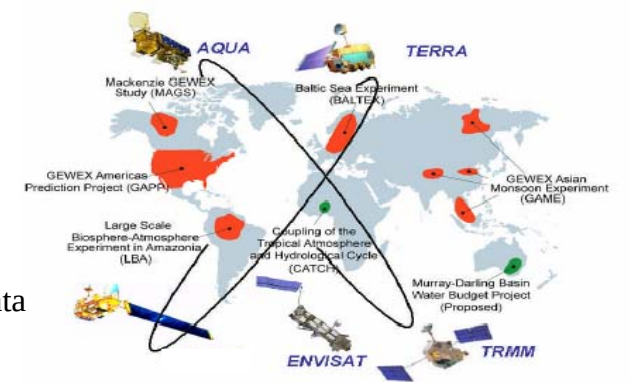
Ongoing and planned CIMS research and coordination activities

Phase-I

- East Asian monsoon region: Regional Atmospheric Inter-Model Evaluation (RAIME) Project for the Diurnal Cycle of Clouds and Precipitation (10 RCM groups, Y. Wang, U. Hawaii)
- Classification of monsoon systems around the world, based on diurnal and seasonal characteristics as part of NASA Energy and Water cycle studies (NEWS, PI: Bosilovich)
- Reference sites development in Himalayas and Karakoram, SHARE-Asia project (Tatari et al, EV-K2-CNR, Italy)
- Newsletter articles: CEOP (2004, 2005), GEWEX 2005; CLIVAR Exchange (2005)
- Two refereed papers on "Elevated Heat Pump " Hypothesis (Lau et al 2006, Lau and Kim 2006)
- 8 papers in monsoon studies in CEOP, JMSJ special issue.

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

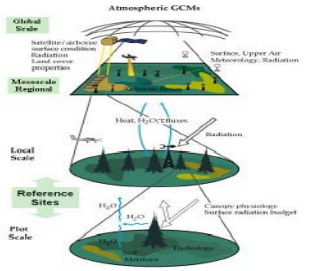
Integrated Satellite data



"Telescoping Strategy"

Global Reanalyses
Regional Reanalyses

MOLTS
Reference Site Obs

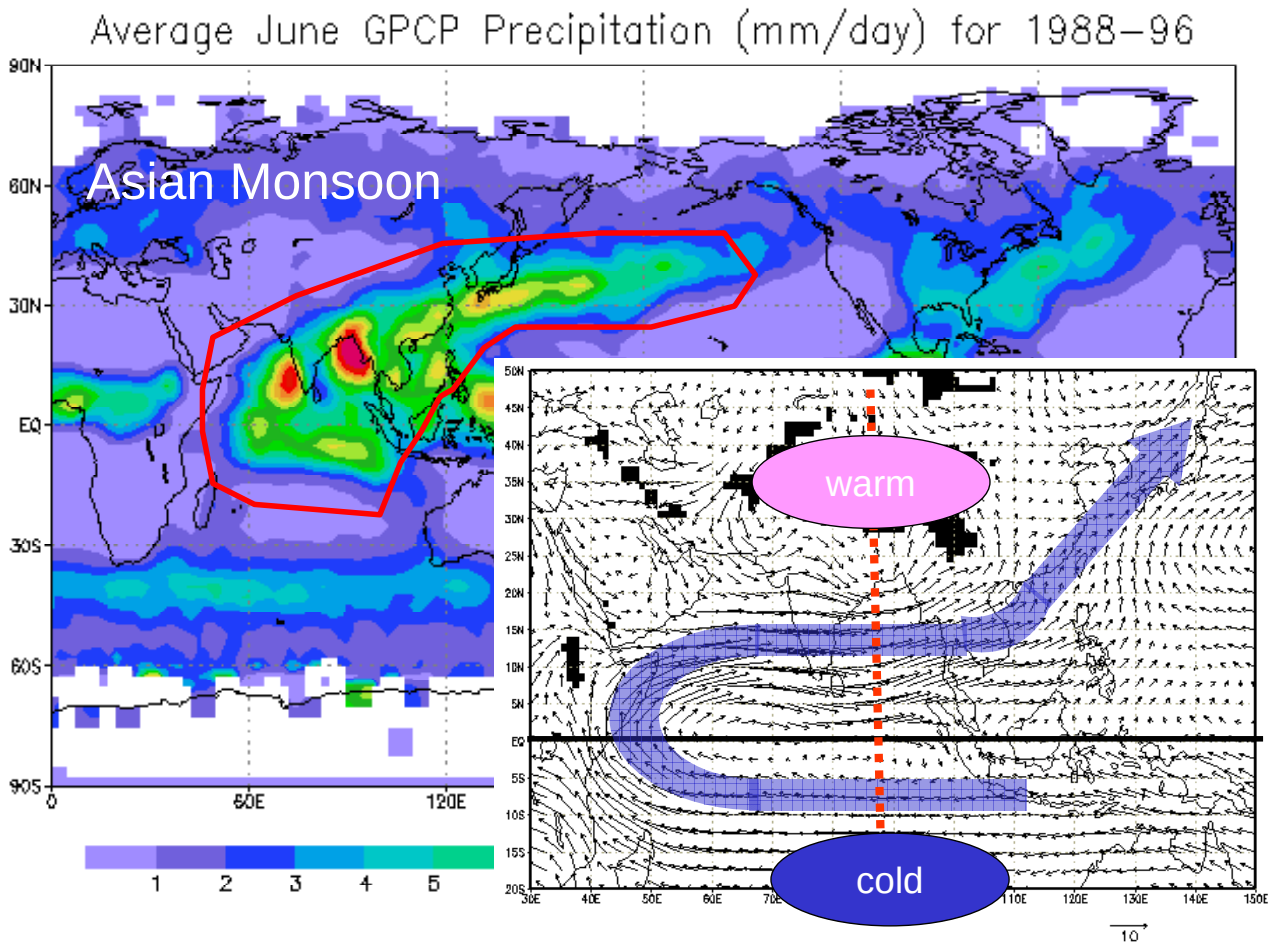


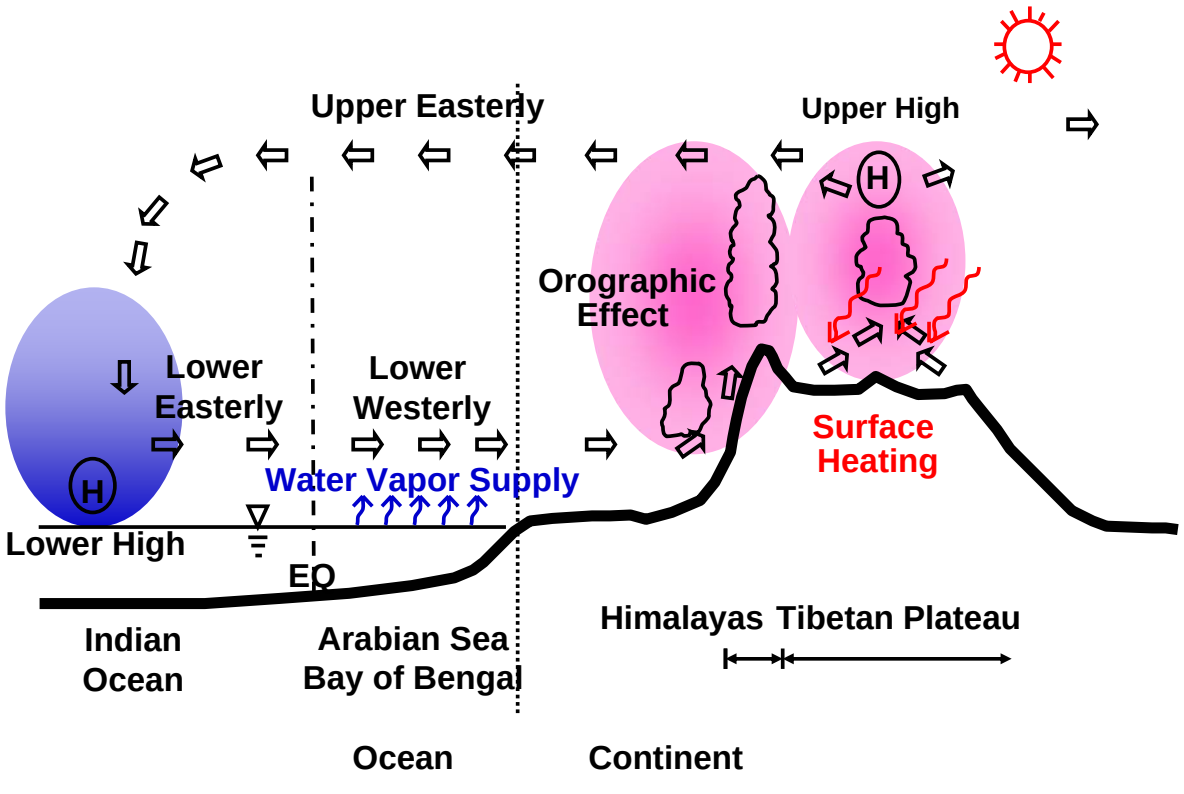
GCM

RCM

CRM/MHM

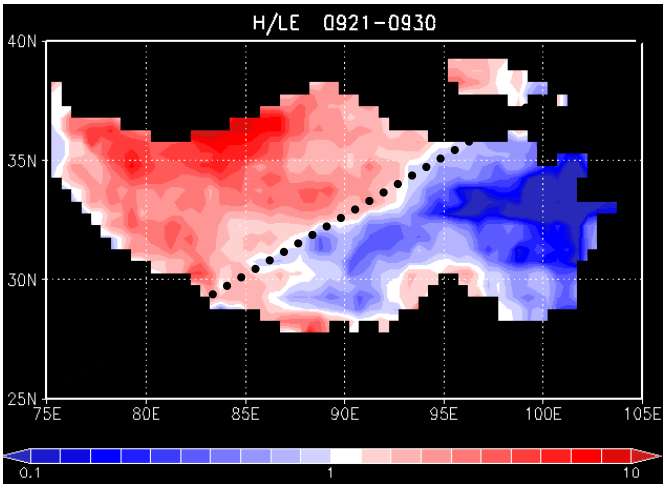
Figure 33: From Global, Mesoscale Regional, to Reference Site Local and Plot Scales, Relevant Data Sets will be Collected and Aggregated.


Average June GPCP Precipitation (mm/day) for 1988–96
Asian Monsoon
warm
cold
90N
60N
30N
EQ
30S
60S
90S
0
60E
120E
1
2
3
4
5

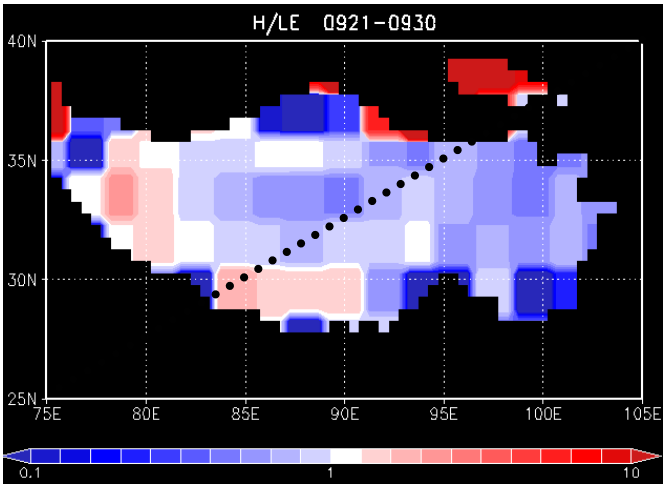

Upper Easterly
Upper High
Orographic Effect
Lower Easterly
Lower Westerly
Surface Heating
Water Vapor Supply
Lower High
EQ
Indian Ocean
Arabian Sea Bay of Bengal
Himalayas Tibetan Plateau
Ocean
Continent

Seasonality of distributed Bowen Ratio: Sensible Heat Flux/Latent Heat Flux

LDASUT



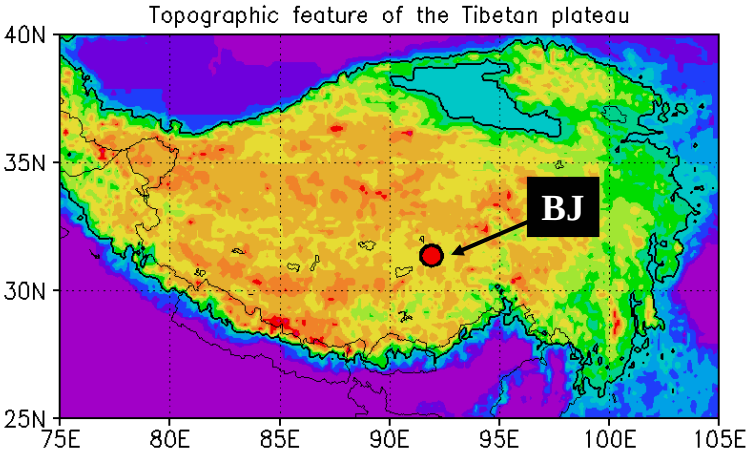
NCEP



LDAS Seasonality: May~Mid June, H > lE; Mid June~Aug; lE>H

LDAS Regionality: H is dominant in N.W. TP, lE is dominant in S.E. TP

Overview of the Enhanced observation over Tibet in pre-monsoon season 2004 (By K. Taniguchi and T. Koike)



Site :

Eastern part of the Tibetan Plateau, Naqu (BJ), 91.8987E, 31.3687E, 4509mASL

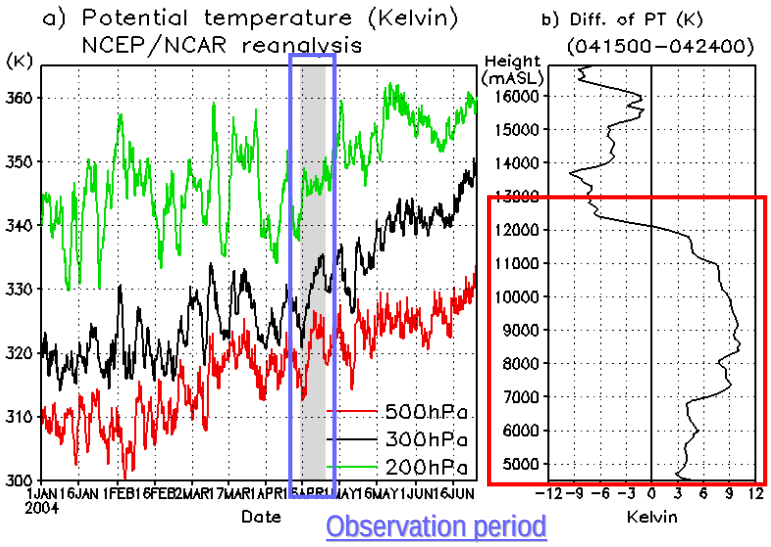
Period :

Apr. 15th – Apr. 24th, 2004

Items :

Radiosonde (every 2 hours, 00UTC-12UTC, 8 times a day),
AWS, LIDAR, Wind profiler

Overview of Atmospheric Temperature Rise during the observation

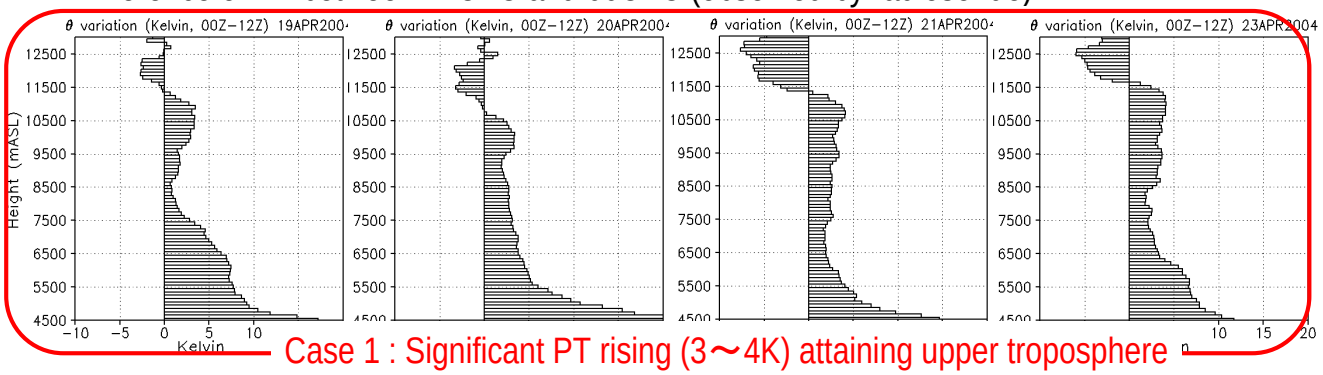


Observation period

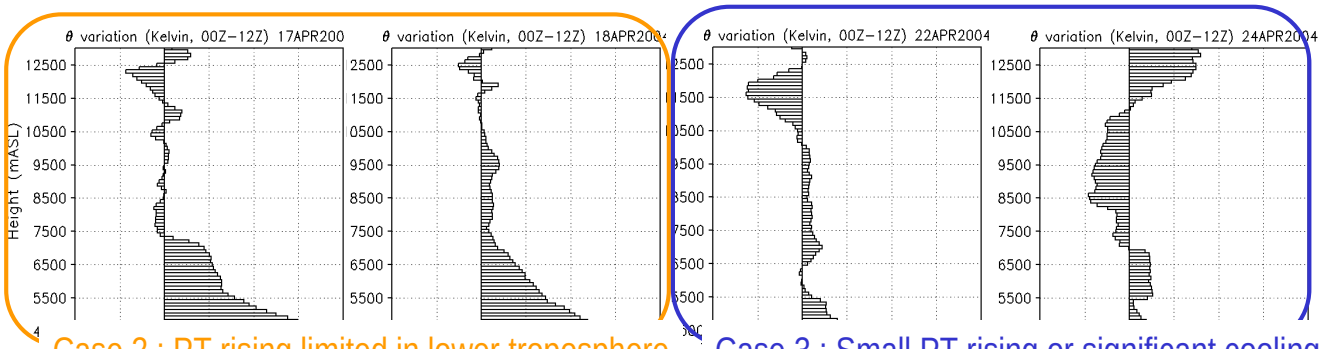
- Potential Temperature (PT) begins rinsing in the beginning of April.
- Increasing of PT is much clear at 300hPa.
- Large PT rise during the observation period (Max. 9K/day)
- Significant cooling in stratosphere during the observation period
  → Effect of general circulation in the upper air (not effect of the plateau)

Increase of PT in daytime during the observation period

Difference of PT between 12UTC and 00UTC (observed by radiosonde)



Case 1 : Significant PT rising (3～4K) attaining upper troposphere



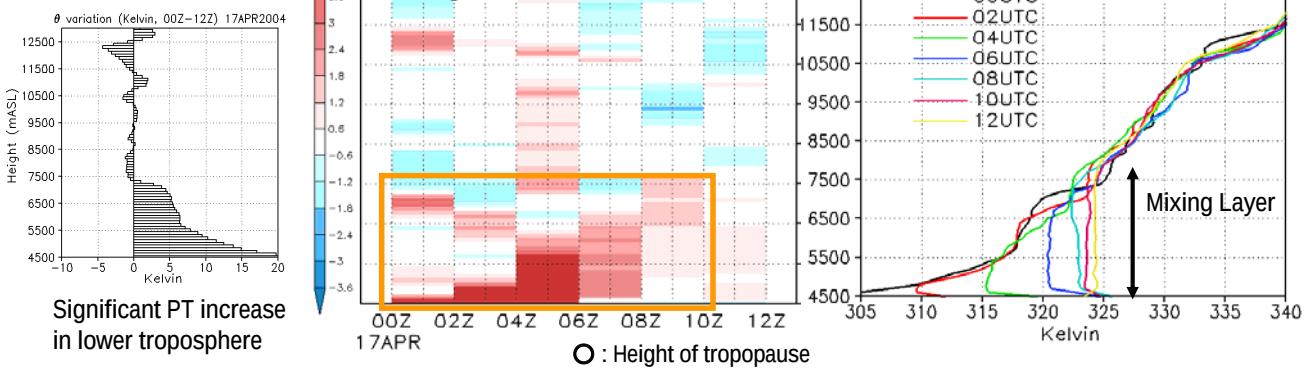
Case 2 : PT rising limited in lower troposphere

Case 3 : Small PT rising or significant cooling

⇨ *What processes cause the difference of daytime PT increasing?*

Diurnal variation of PT (PT rising limited in lower troposphere)

Results of April 17th

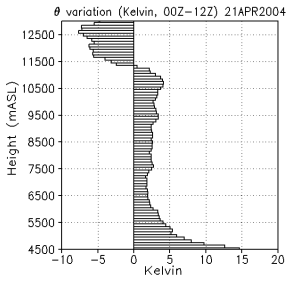


- Large PT rising near the ground surface
- Deep mixing layer developed by surface heating contribute to the PT rising in lower part of troposphere

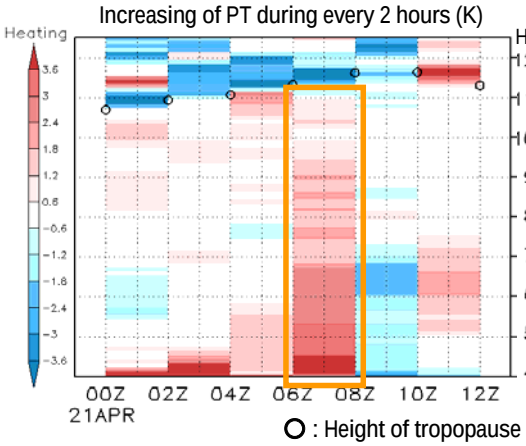
→ Corresponding to the past studies (Li and Yanai (1984), Yanai et al. (1992), etc)

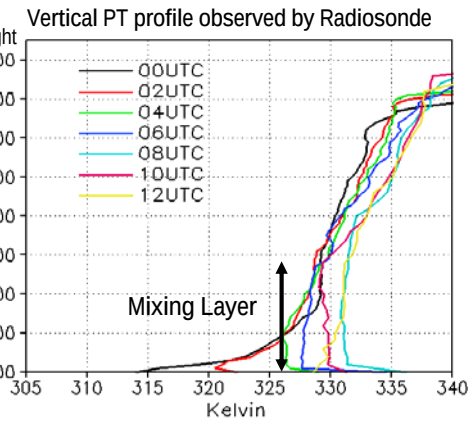
Diurnal variation of PT (Significant PT rise in upper troposphere)

Results of April 21st



Significant PT rising attaining tropopause





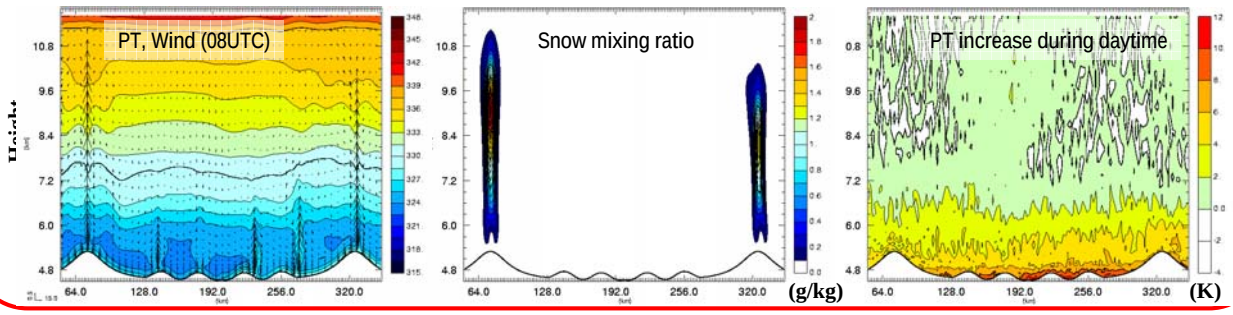
- Large PT rising near the ground surface
- PT rising in lower troposphere by development of mixing layer
- Increasing of PT goes above 10000mASL during 06-08UTC
- Height of mixing layer is 7500mASL at most

⇨ Dry thermal convection (= development of ML) CAN NOT explain the PT rising

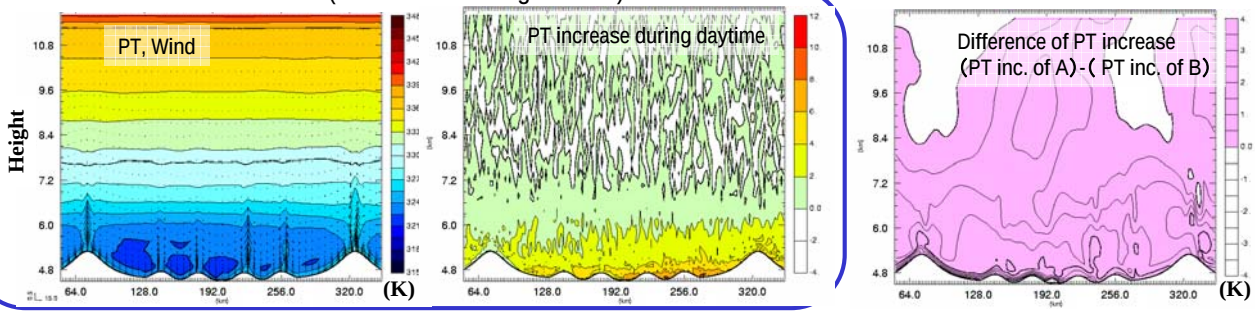
⇨ *What process can make PT rising attaining tropopause?*

Numerical simulations for verification of the effect of convective cloud on atmospheric temperature increase (by ARPS)

A : WITH MOIST PROCESS (Convective cloud generates)



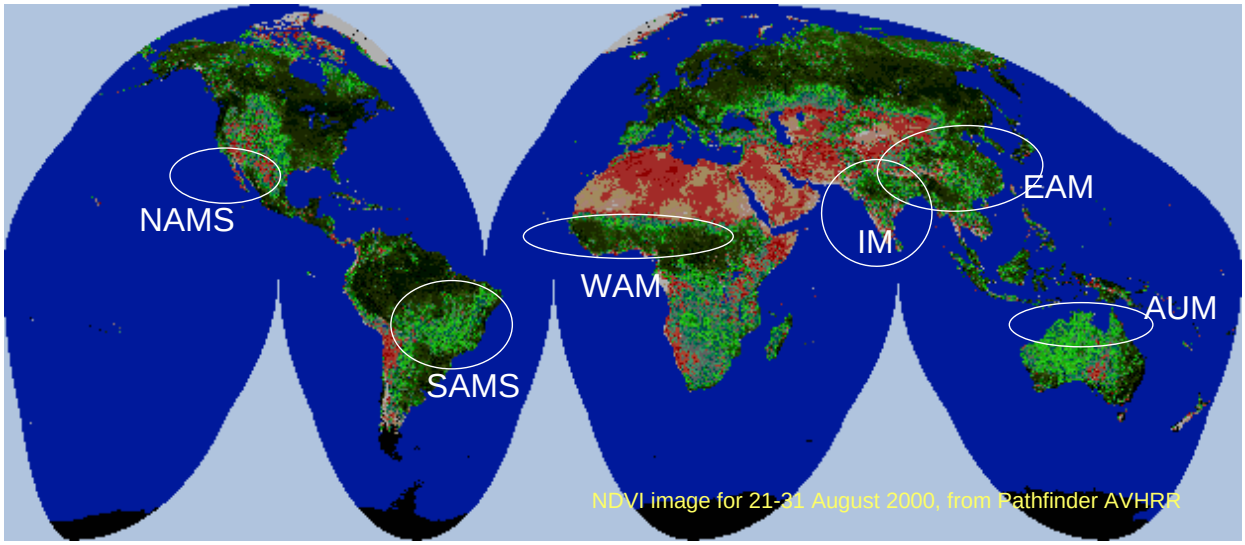
B: WITHOUT MOIST PROCESS (Cloud DOES NOT generates)



- WITH moist process, PT rising occurs in upper troposphere
- Dry thermal convection developed to 7500nASL, no significant PT increase in the upper air

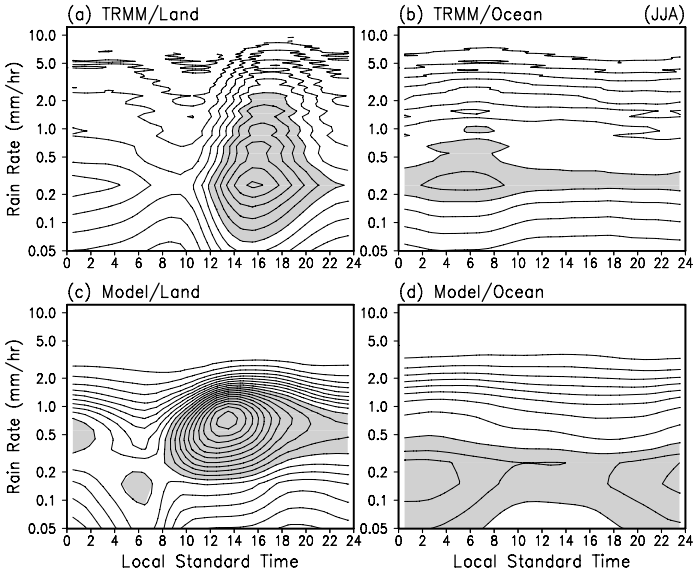
➔ Cloud activity is indispensable for temperature rise in upper troposphere in early spring

Major monsoons systems of the world



NDVI surface vegetation

Diurnal precipitation spectra

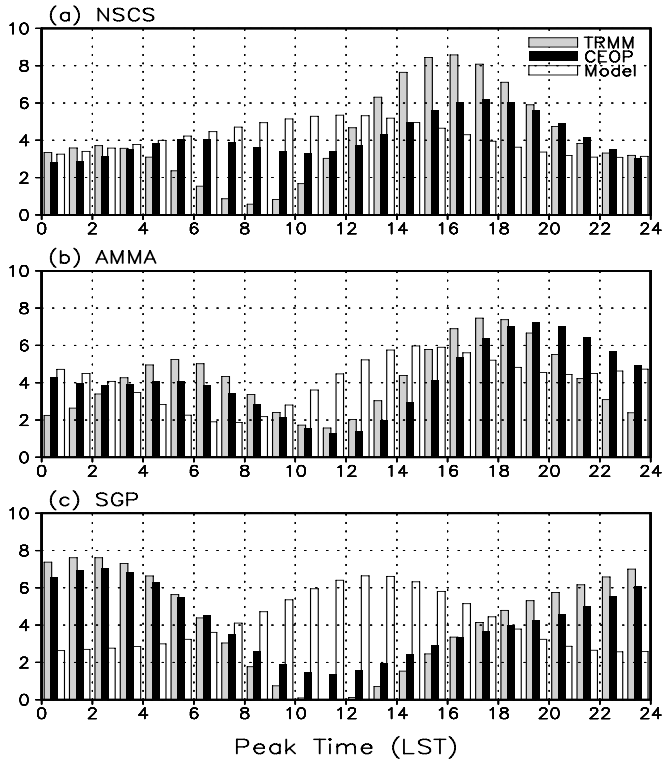


Over land: model produces too early peak. Too narrow spectrum, concentrate on moderate rain

Over ocean: too early peak, too much drizzle, not enough moderate to heavy rain.

→

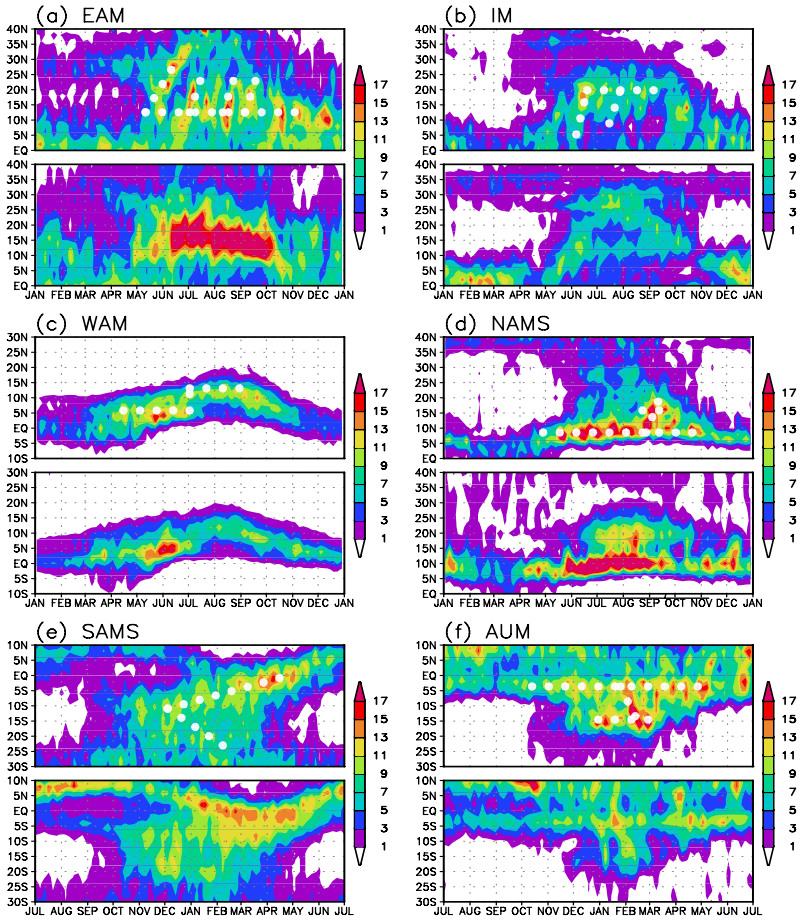
Need better resolution, better representation of shallow, middle raining clouds, boundary layer processes and microphysics of warm, and mixed phase rain



coastal area

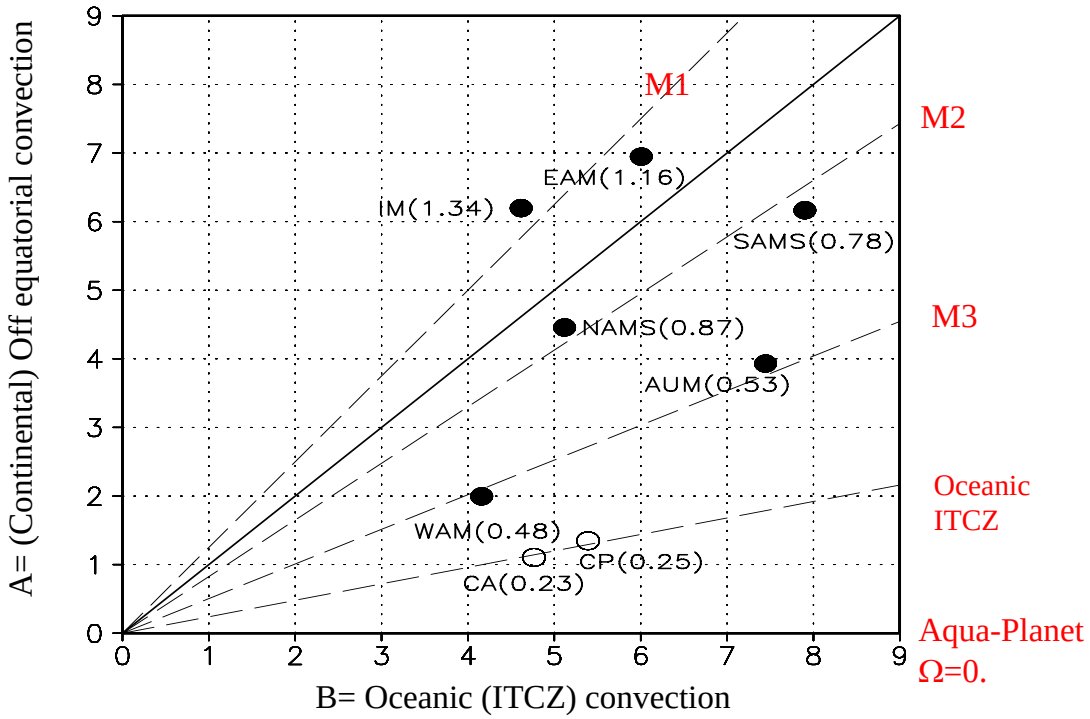
continental region

LLJ region



Obs: Top Panel
Model: Lower Panel

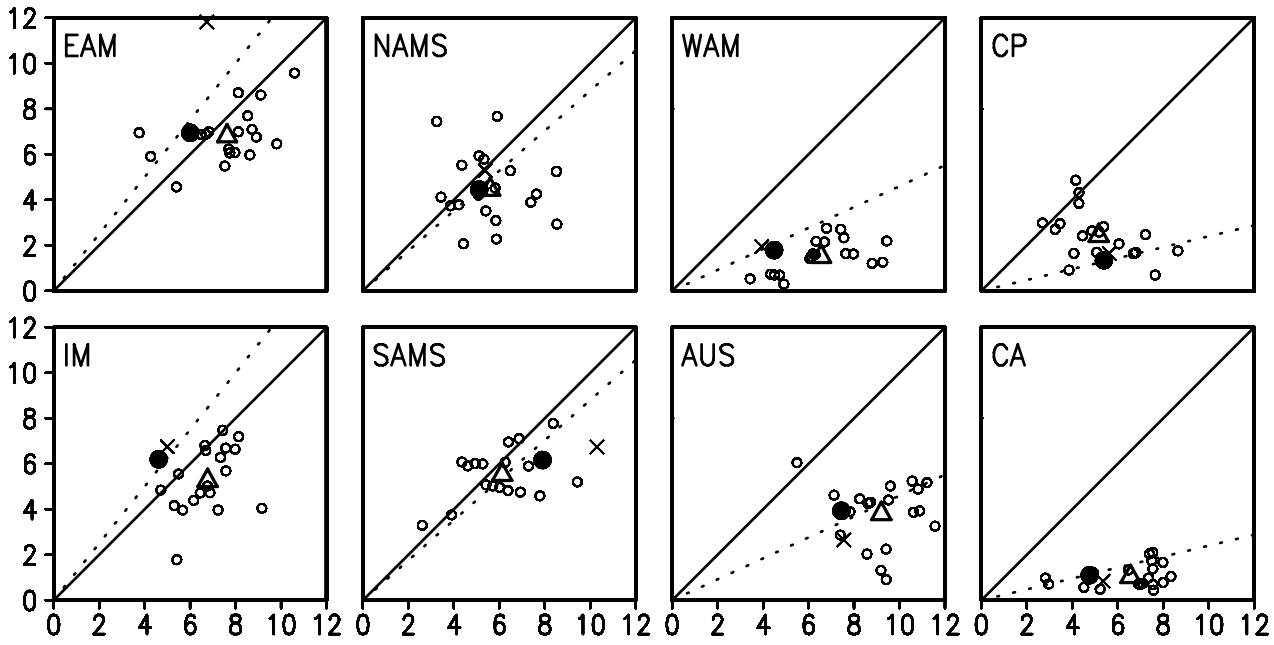
Classification of Monsoon Systems



Continentality, Ω = A/B

In the mean, IPCC coupled models tend to

1) Overestimate oceanic influence in EAM, WAM and AUS
2) Underestimate land influence in IM
3) Do reasonably well in NAMS
4) Underestimate oceanic influence in SAMS



Summary

CEOP has developed a a viable integrated observation/modeling, data management/science system for water and energy cycle studies

- CEOP facilitates model evaluation with multi-platform observations, promoting active participation from operational centers, research institutes, and satellite agencies.
- Increased synergy between satellite, in-situ observations and assimilated data for both regional and global water cycle studies
- Promoted international organization and coordination of water cycle data processes, research through reference site participations and workshops.
- Stimulated and coordinated regional monsoon water cycle field campaigns, model intercomparison studies, regional water and energy cycle studies , e.g. draft of a white paper " Aerosol-water cycle interaction: a new challenge to Monson climate research" based on an CEOP sponsored workshop in Xining, China, July 2006.