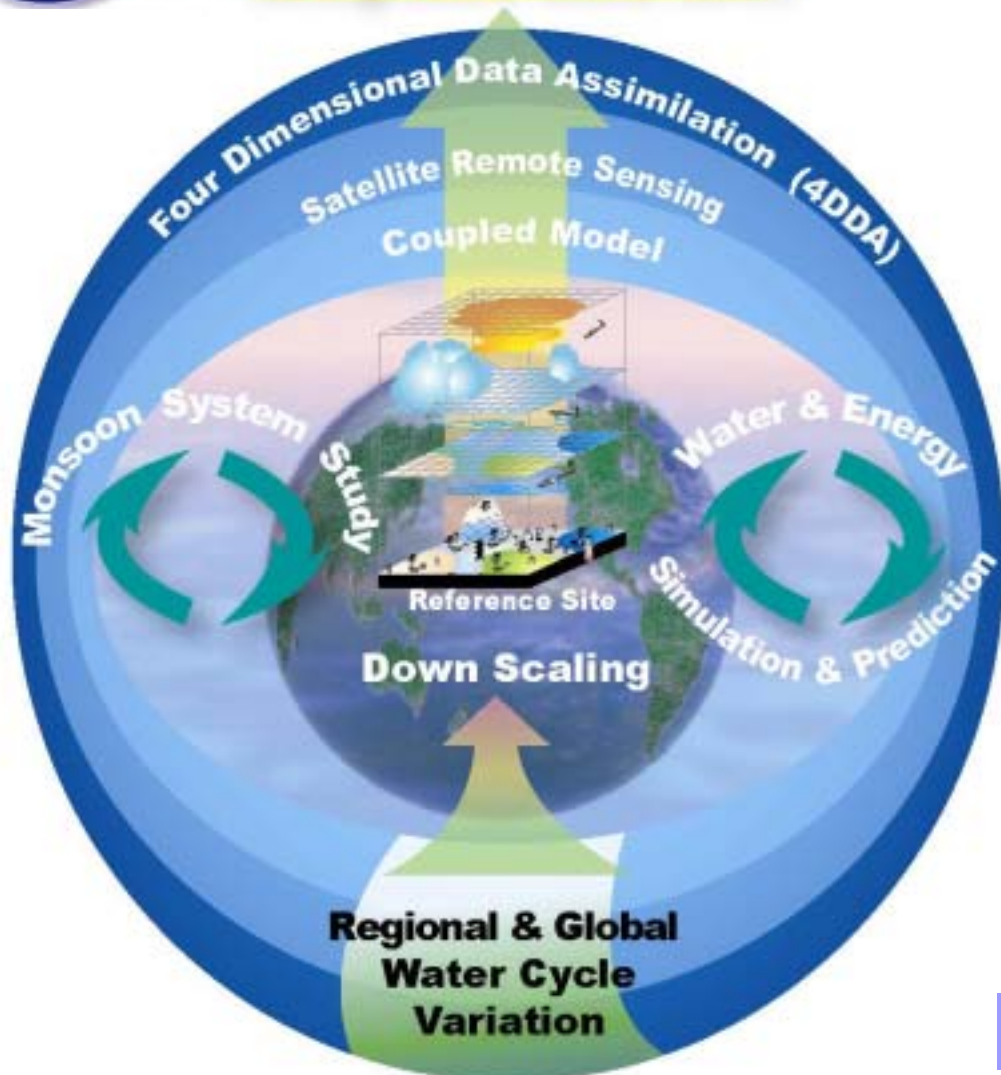


**THE MEETING ON
CEOP
SATELLITE DATA INTERGRATION ISSUES**

**at IIS, Univ. of Tokyo, on October 9, 2002
at EORC, NASDA, on October 10, 2002
Tokyo, Japan**

Coordinated Enhanced Observing Period (CEOP)



CEOP is the first step toward meeting the challenge to provide coordinated observations of the global water cycle.

CEOP will offer the first globally integrated data sets

CEOP will strongly promote study of the water cycle adding to improved accuracy of weather predictions in the near future.

Long-term Guiding Goal and Overall Objectives

Schedule

Organization

CEOP HP : <http://www.ceop.net>

CEOP SCIENTIFIC OBJECTIVES

LONG-TERM GUIDING GOAL

To understand and model the influence of continental hydroclimate processes on the predictability of global atmospheric circulation and changes in water resources, with a particular focus on the heat source and sink regions that drive and modify the climate system and anomalies.

OVERALL OBJECTIVE 1

To better document and simulate water and energy fluxes and reservoirs over land on diurnal to annual temporal scales and to better predict these on temporal scales up to seasonal for water resources application.

WESP

OVERALL OBJECTIVE 2

Document the seasonal march of the monsoon systems, assess their driving mechanisms, and investigate their possible physical connections.

**Monsoon
System Study**



CIMVP:

Model validation/improvement of fundamental

Diurnal cycle, Annual cycle, ISO

in relationship to monsoon onsets and breaks;

Clouds: Super cloud cluster complex
MCCs
Shallow clouds
Stratocumulus

LLJs:

Land Effects: Soil moisture
Vegetation cover
Snow and Ice Cover

Scale Interactions:



CIMVP model physics validation

- **Global** validation: satellite data, gridded CEOP re-analyses
- **Local** validation: reference sites categorize based on MOLTS, and field observations (dynamically adjusted)

Site classification based on data completeness

- I. **Supersites (full 3D coverage)** : ARM-SGP, Tibet, Thailand (Chao-Phraya) basin
- II. **Potential supersites (additional effort required, 2.5 D coverage)** : Radonia/Panatal, Mt. Bigelow (AZ), Darwin, Manus
- III **Important but..(reference sites which require more observations/instrumentation, and better data transmission to be useful)** AMMA, Equatorial Island (Sumatra), Palau

*Site classification should be cross-referenced with similar classification from other groups



Validation Parameters

The 3-D water and energy budget requirements from WESP, add the following:

- Cloud fraction , cloud types, optical depths (clouds and aerosols)
- Subgrid scale turbulent flux of heat, moisture and momentum
- LAI (leaf area index), FPAR (fraction of absorbed photosynthetically active radiation), vegetation types and coverage
- Ground heat flux
- Soil and snow properties: hydraulic and thermal conductivity, porosity, heat capacity
- Snow coverage

*Ground water hydrology parameters, to coordinate with the water resource group



Experimental design: (GCM, RCM, CRM , LSM, column physics models..)

- Stream-1: land/vegetation processes
- Stream-2: physics of clouds, convection (deep, shallow)
- Integration for 2 year, 1 October 2002 –December 31, 2004 with CEOP data as validation
- Allow one-year of spin up for ground hydrology adjustment run embedded RCM , CRM with different domain size over monsoon regions of interests
- Focus detailed physics validation on Category 1 and 2 sites
- Uncover and diagnose model physics errors, and carry out additional experiments ,as needed, to improve model physics

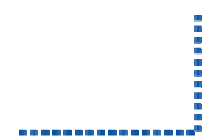
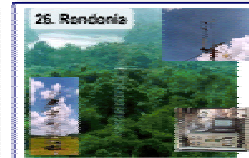
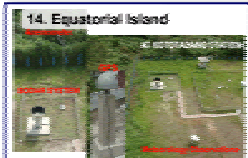
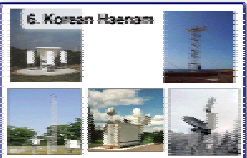
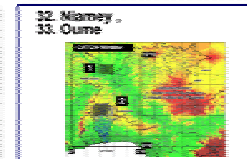
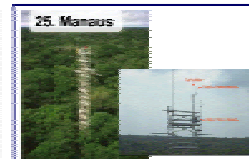
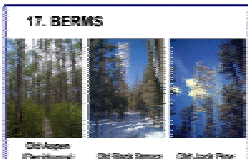
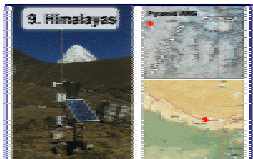
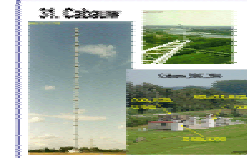
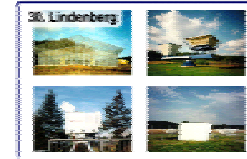
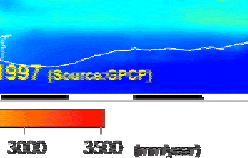
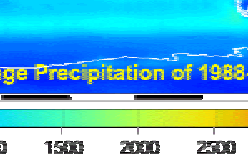
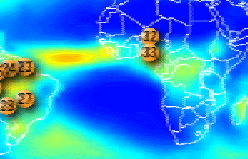
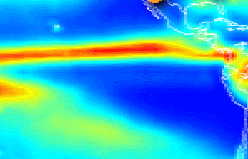
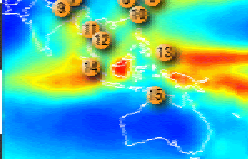
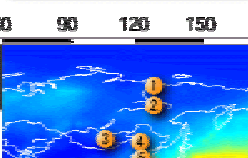
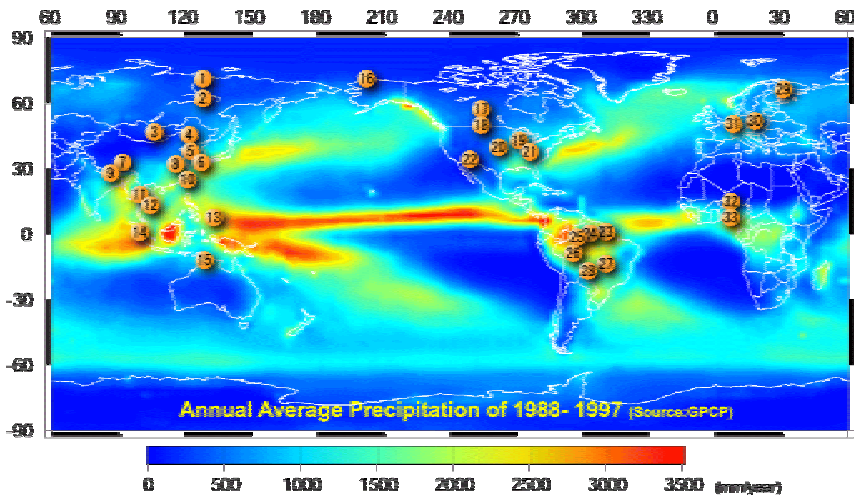
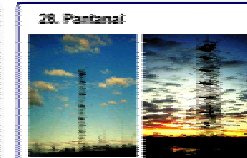
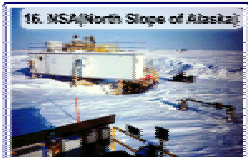
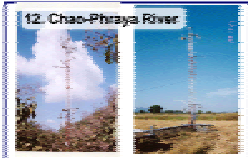
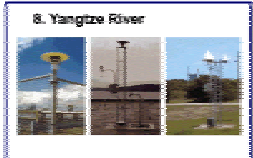
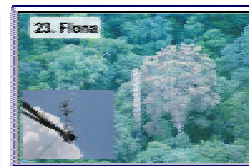
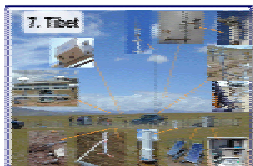
*PCMDI/AMIP may adopt CEOP data period as “IOP” for AMIP-III, and provide some data archive capacity



REFERENCE SITES



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



32. Niamey - 33. Oueme



CEOP EOP-1 METEOROLOGICAL PARAMETERS



Reference Site	Air Temperature	Relative Humidity	Air Pressure	Precipitation	Wind Speed	Wind Direction
LBA						
<u>Brasilia</u>						
<u>Caxiuana</u>	30 min			30 min	30 min	30 min
<u>Manaus</u>	30 min	30 min	30 min	30 min	30 min	30 min
<u>Pantanal</u>	30 min	30 min	30 min	30 min	30 min	30 min
<u>Rondonia</u>	30 min	30 min	30 min	30 min	30 min	30 min
CAMP						
<u>Mongolia</u>	30 min	30 min	30 min	30 min	30 min	30 min
<u>NE Thai</u>	Hourly	Hourly	Hourly	10 min	10 min	Hourly
<u>Northern South China Sea</u>	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
GAPP						
<u>SGP</u>	1 min	1 min	1 min	1 min	1 min	1 min
<u>Ft. Peck</u>	30 min	30 min	30 min	30 min	30 min	30 min
<u>Bondville</u>	30 min	30 min	30 min	30 min	30 min	30 min
BALTEX						
<u>Cabauw</u>	10 min	10 min	10 min	10 min	10 min	10 min
<u>Lindenberg</u>	10 min	10 min	10 min	10 min	10 min	10 min
<u>Sodankyla</u>	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly

NOTES:

- Caxiuana: Air Temperature measured at 16 and 32 m.
Wind Speed and Wind Direction are resultant.
Has additional parameters dry and wet bulb temperature at 53m, standard deviations of dry air temperature, wind speed, and wind direction.
- Mongolia: Four locations measure these parameters.
- SGP: 15 locations measure these parameters.
- Northern South China Sea: 25 locations measure these parameters.
- Cabauw: Pressure is Sea Level Pressure.





MODEL OUTPUTS

- ◆ **High Temporal Resolution Time-series Output Referred to as Model Output Location Time Series (MOLTS) at the Reference Sites**
- ◆ **Gridded Output from Operational Global and Regional Prediction Models and their 4-D Data Assimilation Systems**
- ◆ **Output from Global and Regional Reanalysis**

UKMO, NCEP, JMA, ECMWF, DAO, BOM, ICMWF,,

NCEP CONTRIBUTIONS TO CEOP

(Many of these initiatives substantially supported by GAPP or OGP)

- 1 – Global and Regional 4DDA / forecast output: (coupled atmosphere / land)
 - site-specific time series output (MOLTS) at CEOP reference sites
 - gridded fields output (MORDS)
 - MOLTS and MORDS from:
 - A) from NCEP Global Assimilation and Forecast System
 - B) from NCEP Eta model Regional Assimilation and Forecast System

- 2 - Global and Regional Reanalysis (coupled atmosphere / land)
 - MOLTS and MORDS from:
 - A) Regional Reanalysis (1979-2004), via Eta-model 4DDA (EDAS)
 - 32-km, 3-hrly, assimilates hrly precip, improves soil moisture
 - MORDS only from:
 - B) NCEP/NCAR Global Reanalysis-I and CDAS-I (1948-present)
 - C) NCEP/DOE Global Reanalysis-II and CDAS-II (1979-present)
 - much improved soil moisture via assimilation of global precip

- 3 - Land Data Assimilation System (N-LDAS): Analysis/Reanal (land only)
 - national realtime (Oct 96 to present), hourly, 1/8-th deg
 - national reanalysis (1948-1999), hourly, 1/8-th deg
 - soil moisture and temperature, snowpack, sfc energy and water fluxes
 - MORDS and MOLTS



NCEP CONTRIBUTIONS TO CEOP (Con't)

4- Precipitation Analysis/Reanalysis: national and global

- A) Global, 5-day, 2.5-deg, gage/satellite (1979-present)
- B) U.S. daily, 0.25-deg, gage-only (1948-present)
- C) U.S. hourly, 4-km, radar/gage (1996-present)

5 – NESDIS satellite land-surface products

- A) daily, 23-km, N. Hemisphere snow cover (Jan 97 to present)
- B) hourly, 0.5-degree, U.S. sfc insolation and skin temperature
- C) weekly, global, 0.14-deg NDVI and vegetation greenness

6 - Global SST Analysis/Reanalysis

- weekly, 1-degree (1982 to present), SST

7 - NAME: N. American Monsoon Experiment

- special observations, Mexico and southwest U.S., 2003-2004

8 – Demonstrations of Regional Model Transferability

- executions of NCEP Eta model over S. America (H. Berbery)

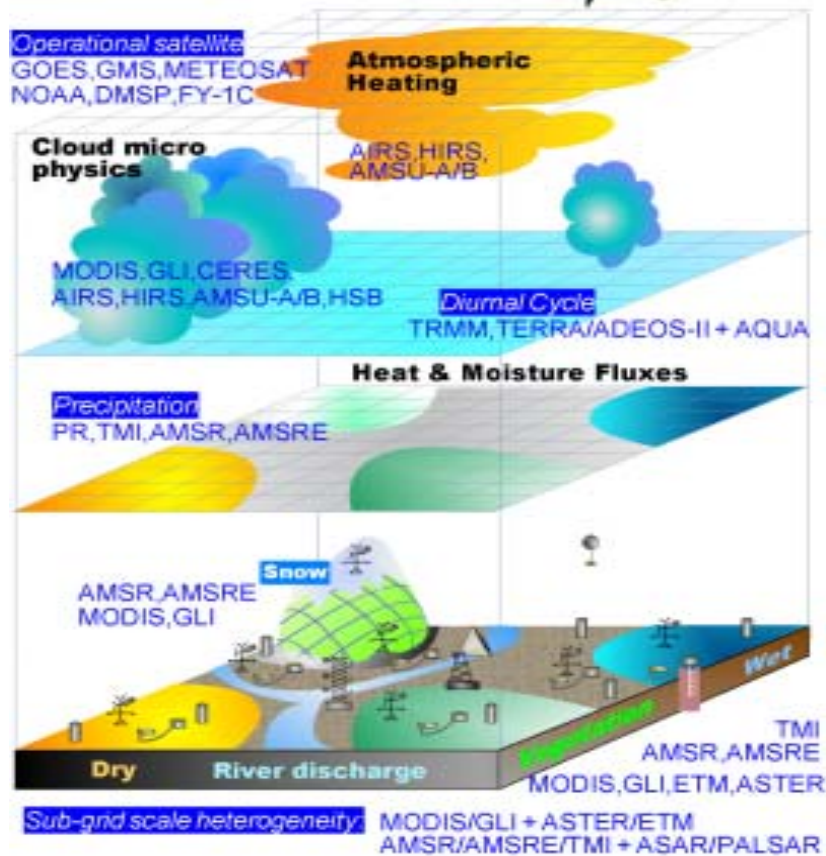
CEOP Scientific Strategy

New Data sets of the **Entire Water Cycle** by **Integrating** the New Generation Satellite Products in Addition to the Operational Ones.

Reference Site	Basin	Monsoon Region	MOLTS	Global
level 1b/2/3	level 1b/2/3	level 2/3	level 2/3	level 3

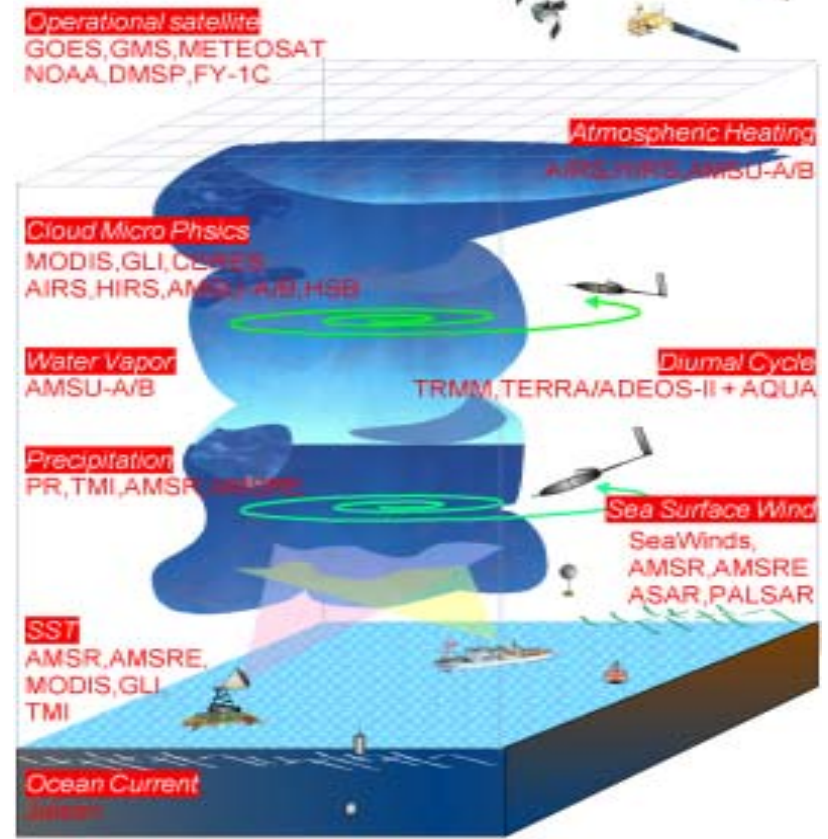
The 1st Opportunity for Global and Comprehensive Data Sets and the Beginning of the 21C

New Generation Satellite
TRMM, TERRA, AQUA, ADEOS-II, ENVISAT, ALOS



The 1st Opportunity for Global and Comprehensive Data Sets and the Beginning of the 21C

New Generation Satellite
TRMM, TERRA, AQUA, ADEOS-II, ENVISAT, ALOS





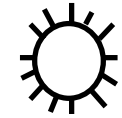
Diurnal Cycle: **TRMM, ADEOSII, Terra+Aqua**

Radiation: **CERES, MODIS, GLI**

Cloud Properties: **MODIS, GLI**

Precipitation Profile:

PR



Atmos. Column Values(WV, CWC, Rain):

AMSR/AMSRE



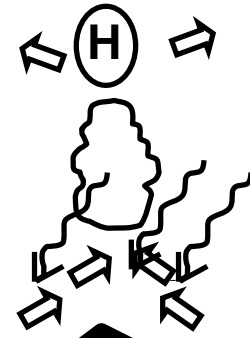
Atmos. Profile:
AIRS, AMSU, MHS

Atmos. Column Values(Precip.):

AMSR/AMSRE



Atmos. Profile:
AIRS



SSW: **QuickSCAT, SeaWinds, ASAR, PALSAR, AMSR/AMSRE**

SST: **MODIS, GLI, AMSR, AMSRE**



Land Surf. Hydrol.
Soil Moist. Snow,
Surf. Temp, VWC.

AMSR/AMSRE

Land Cover: **ETM, ASTER, MODIS, GLI**

Land Surf. Heterogeneity: **ETM, ASTER+MODIS, GLI**

ASAR, PALSAR+AMSR, AMSRE



Equator

Ocean

Land

Himalayas Tibetan Plateau



Land Data Assimilation: Multi-Scale Philosophy

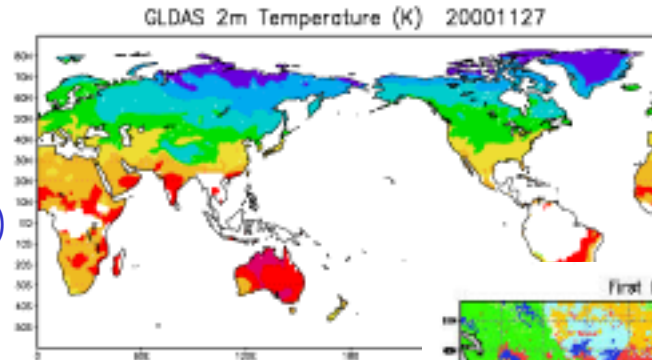
Objective: To develop, evaluate, and validate multi-scale land assimilation in a wide variety of applications.

Global: Off-line Land-surface Global Assimilation (OLGA) system → GLDAS:

Scale: 1/8 to 2 degree global land.

Focus: Land-atmosphere boundary, operational assimilation of remotely-sensed surface observations

Projects: NSIPP, DAO, GLDAS, etc.



Continental: Land Data Assimilation System (LDAS)

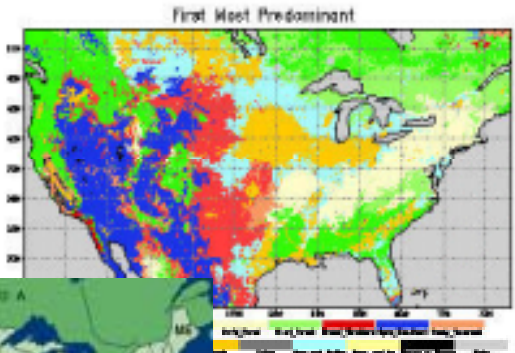
Scale: 1/8 degree, continental, real-time.

Focus: Real-time applications (agriculture, floods), short forecasts, model intercomparisons, TRMM.

Projects: GCIP, LBA, etc.



<http://ldas.gsfc.nasa.gov>



Regional: Monsoon90, Washita 92, SGP97,99,01

Scale: 30 to 1000 m, <10,000 km², watershed focus.

Focus: hydrological controls, assimilation theory, scaling, in-situ observations.

Projects: GSFC-MIT SGP97 Project.

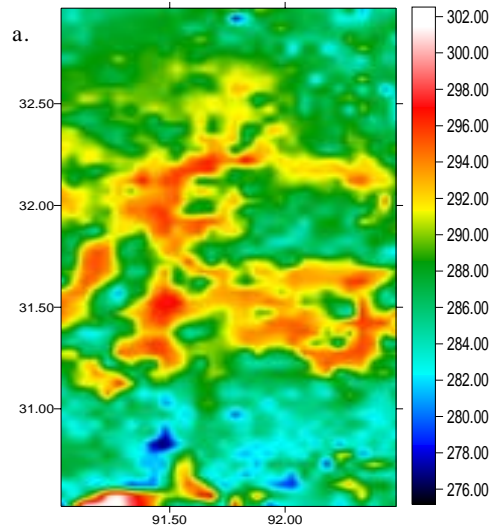


Application of the TMI/SiB2 LDAS

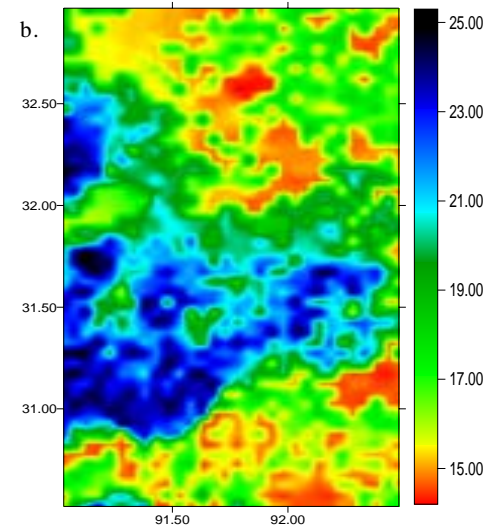


Game-Tibet-Results

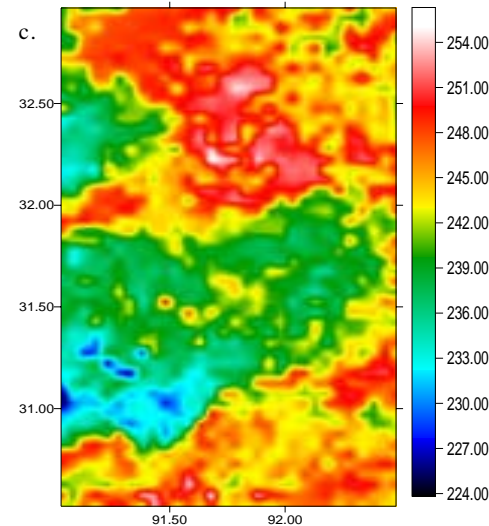
Estimated Surface
Temperature (K)



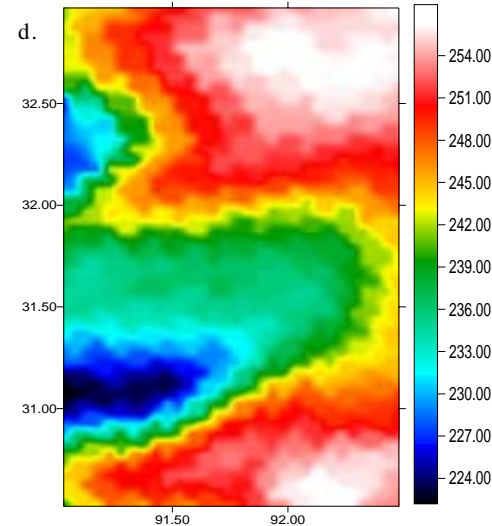
Estimated
Soil Moisture



Estimated
10.65GHz-H



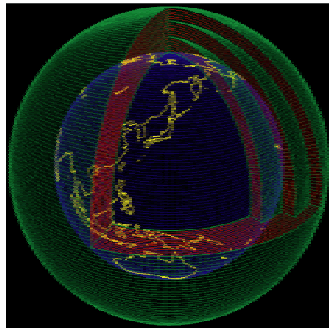
Observed
10.65GHz-H



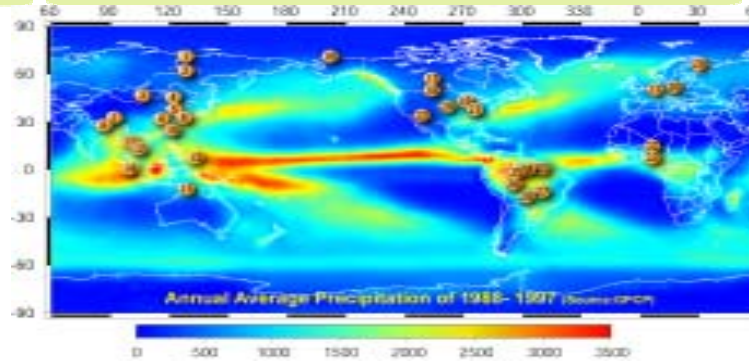
The First Global Integrated Data Sets of Water Cycle



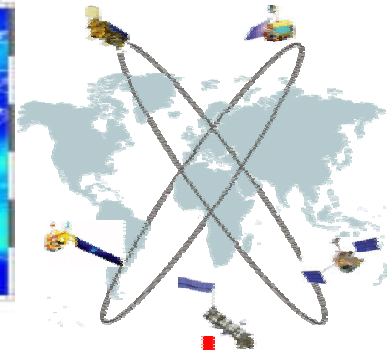
Model Outputs by Numerical Weather Prediction Centers



Surface Observational (*in-situ*) Data from the 33 CEOP Reference Sites



Satellite Remote Sensing Data

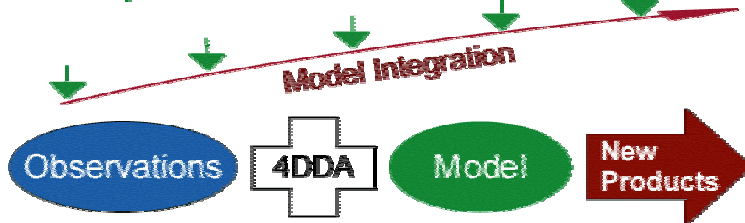


In-Situ Data Archiving Center at UCAR
(Center at University Corporation for
Atmospheric Research) of USA
<http://www.ucar.edu/>

MODEL Output Data
Archiving Center at Max-
Planck Institute of Germany
<http://www.mpg.de/>

Data Integrating/Archiving Center
at University of Tokyo and NASDA
of Japan
<http://monsoon.t.u-tokyo.ac.jp/ceop/>

Input of Observed Data into Model



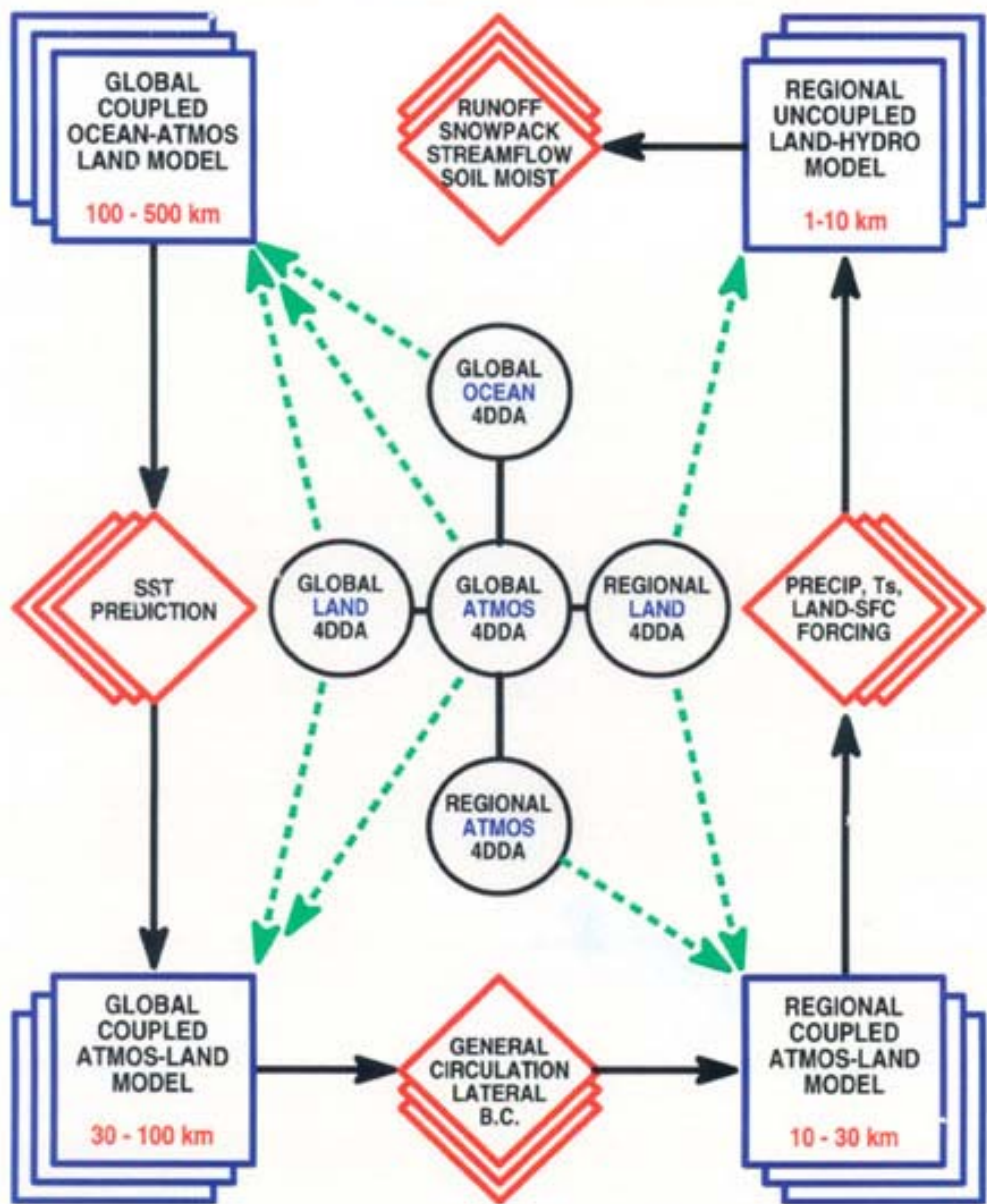
Global Land Data
Assimilation System at
NASA Goddard Space
Flight Center of USA
<http://ldas.gsfc.nasa.gov/>



Data Archive Center

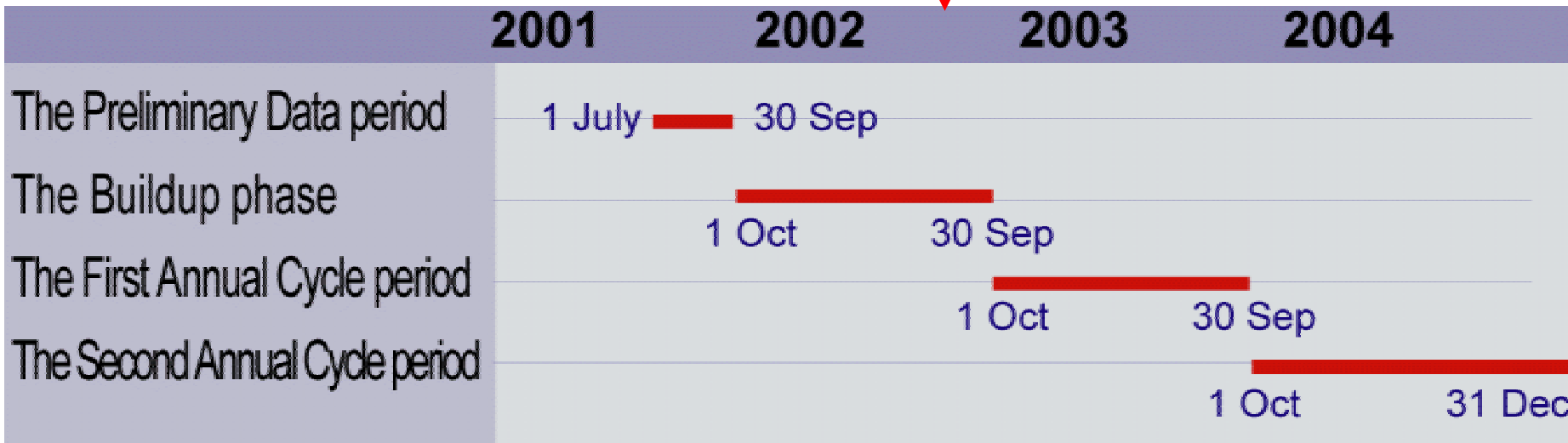
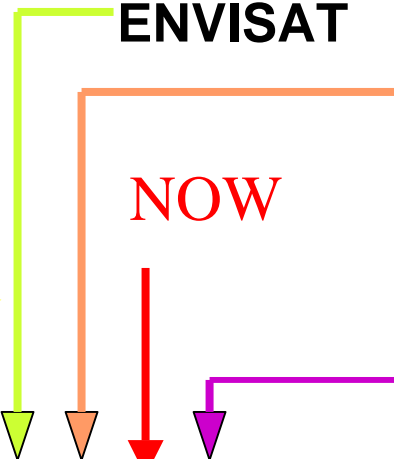
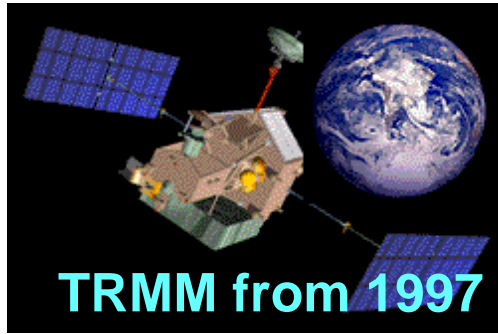


INTEGRATED SEASONAL PREDICTION SYSTEM



Down Scaling

CEOP Schedule



CEOP ORGANIZATION STRUCTURE

Science Steering Committee

- guide the science
- maximize the scientific and technical benefits
- oversee the implementation

WCRP H.Grassl (Chair)
GEWEX: S.Sorooshian
CLIVAR: C.R. Mechoso
CLiC: B. Goodison
WGNE: K. Puri
GHP Chair: R. Stewart
CEOS: (ESA rep)
CEOP Lead Scientist: T.Koike

Advisory Committee

- receivers of scientific ideas for funding and support
- providers of reality checks on funding, infrastructure
- membership criteria (provides data or funds efforts)

Co-chair: J.Kaye(NASA)& A.Sumi(NASDA)
Space Agencies(ESA, CNES, EUMESAT)
NWP's(ECMWF,NCEP,JMA,CPTEC,CMA, DAO)
Other funding agencies GEWEX rep: R. Lawford

Scientific idea

Advise &
opportunity

Implementation report

Scientific guidance

Coordination Body

keep communication flowing: newsletter, web, teleconference, meeting, etc.

International Coordinator: S.Benedict

Implementation Coordination Group: CSE Representatives and S.Williams

News Letter Editorial Board: P.Try, C.R.Mechoso, R.Schiffer

International Coordination Office(Japan):

J.Matsumoto/T.Oki/D.Yang/K.Tamagawa/A.Goda (UT) , N.Mannoji(JMA),
C.Ishida /N.Matsuura(NASDA), A.Hirashima/K.Misawa(RESTEC)

Working Groups

responsible for carrying out the individual components and reporting to Scientific Steering Committee

Water and Energy Simulation & Prediction

Co-chair: J. Roads & J. Marengo

Monsoon Systems

Co-chair: W.Lau & T.Yasunari

Satellite Data Integration

Co-Chair: T.Koike & P.Houser

Data Management

Co-chair: S.Williams & H.Isemer

Water Resource Application(TBD)

Chair: D.Lettenmair(TBC)