Coordinated Enhanced Observing Period (CEOP)

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

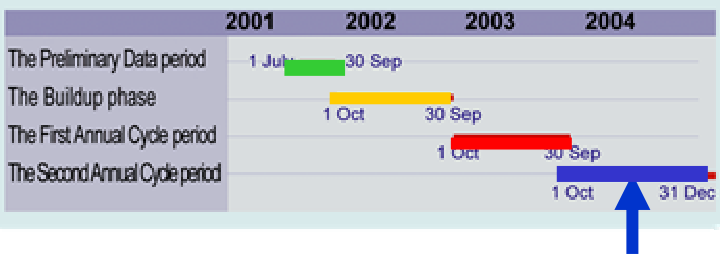
CEOP Objectives:

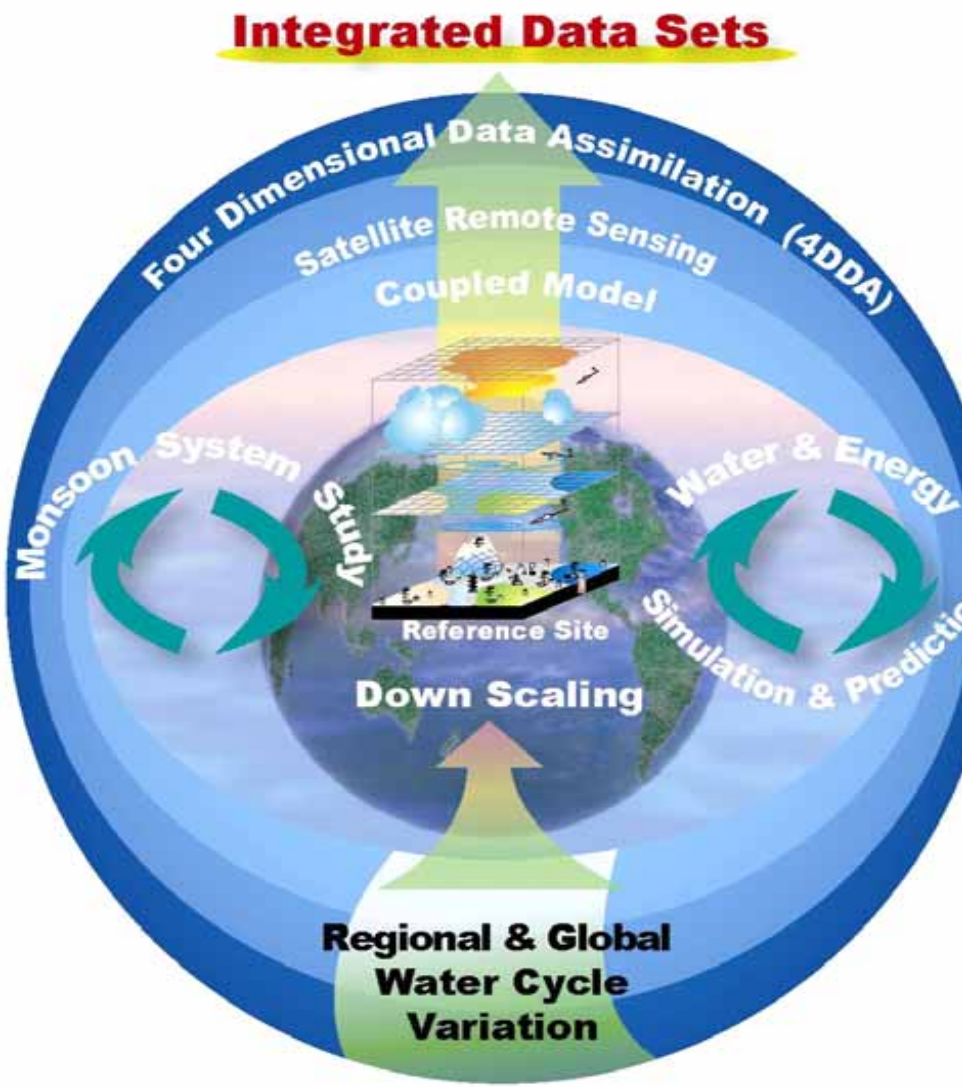
1. Water and Energy-Cycle Simulation and Prediction
2. Monsoon System Studies

CEOP Strategy:

1. The first global integrated data sets of the water cycle with spatial consistency and climate variability, through
   - (i) the ground-based observations from the 36 CEOP reference sites
   - (ii) the satellite observations of the entire water cycle
   - (iii) the simulations of numerical models with physical consistency
2. Challenges to inter-connection of regional water cycles and Down-scaling applications to water resources

CEOP Schedule:





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.

CIMS

CEOP/WESP 3-D Water and Energy Variables and Processes

Atmospheric Water Vapor

$$\frac{\partial \pi q}{\partial t} = -\nabla \bullet \pi v q - \frac{\partial \pi \dot{\sigma} q}{\partial \sigma} + \frac{\partial F_q}{\partial \sigma} - \pi CQ + RSQ'$$

Cloud Water

$$\frac{\partial \pi q_c}{\partial t} = -\nabla \bullet \pi v q_c - \frac{\partial \pi \dot{\sigma} q_c}{\partial \sigma} + \pi CQ - \pi CP$$

Soil Moisture

$$\frac{\partial m}{\partial t} = P - E - N + C_{sm} + RSW'$$

Snow

$$\frac{\partial (s)}{\partial t} = P_s - E_s - C_{sm}$$

Atmospheric Mass

$$\frac{\partial \pi}{\partial t} = -\nabla \bullet v\pi - \frac{\partial \pi \dot{\sigma}}{\partial \sigma}$$

Surface Energy

$$Cv \frac{\partial Ts}{\partial t} = QRS - SH - LE - L_f C_{sm} + QF_s + G'$$

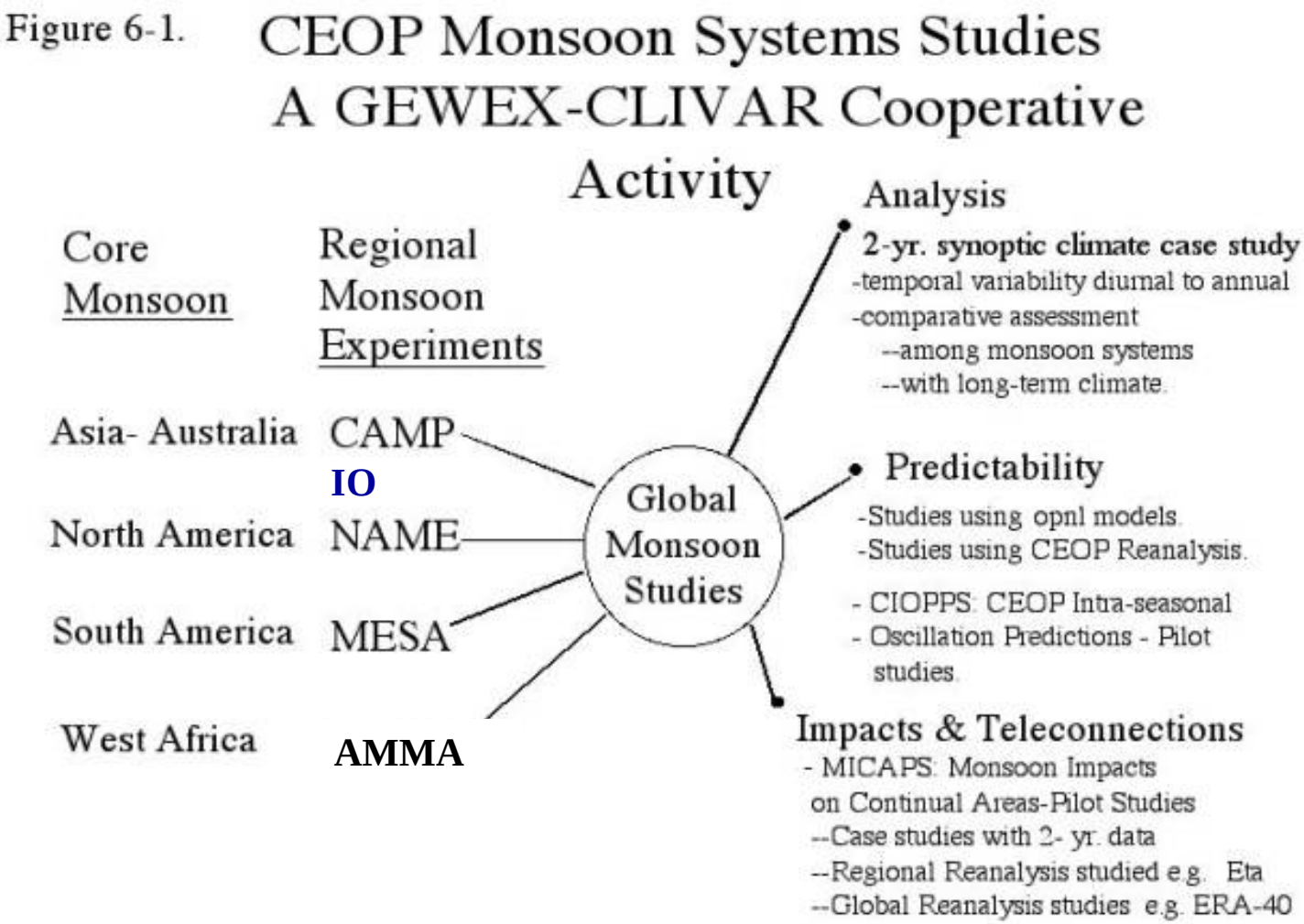
Atmospheric Energy

$$\frac{\partial \pi (C_p T + KE + \phi_s)}{\partial t} = -\nabla \bullet \pi v (C_p T + \phi + KE) - \frac{\partial \pi \dot{\sigma} (C_p T + \phi + KE)}{\partial \sigma}$$

$$+ \frac{\partial F_T}{\partial \sigma} + \pi CT + \frac{\partial F_R}{\partial \sigma} - QF + RST'$$

CEOP Monsoon System Study Framework

The A^4 monsoon: Asian, Australian, American (North and South) and west African



CIMS will focus on the model validation/improvement of fundamental physical processes in monsoon regions: Diurnal cycle, Annual cycle, ISO in relationship to monsoon onsets and breaks; supercloud cluster complex, MCCs, shallow clouds, stratocumulus, LLJs, scale interactions and effects of SST (global regional, and local), soil moisture, vegetation cover, snow and ice cover

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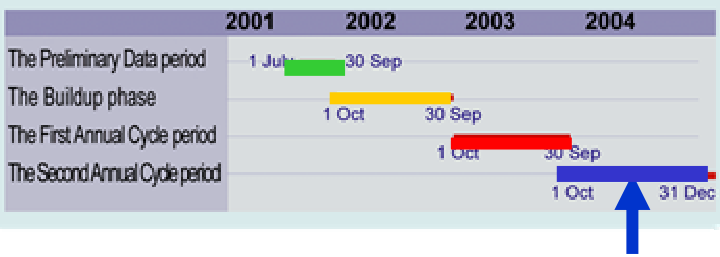
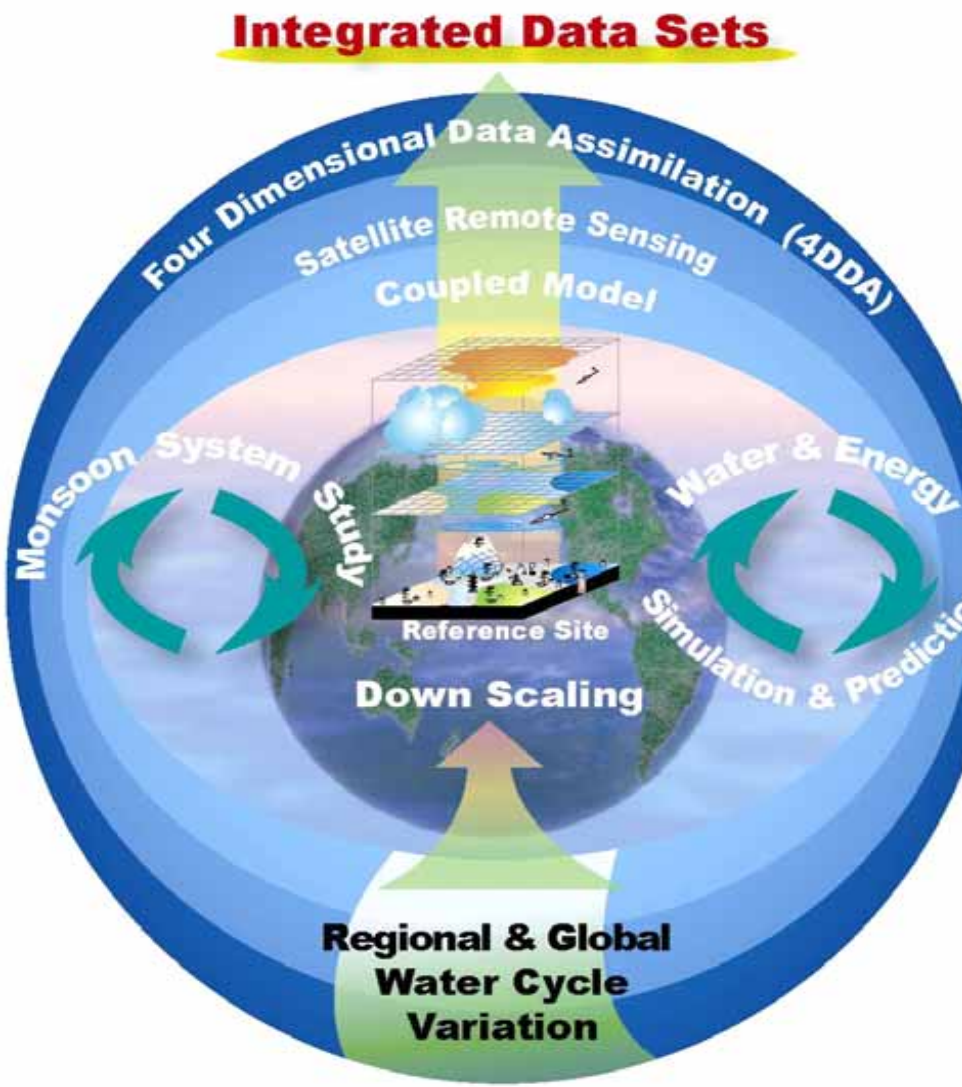
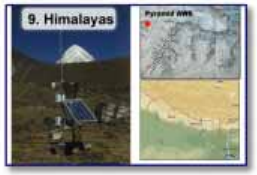
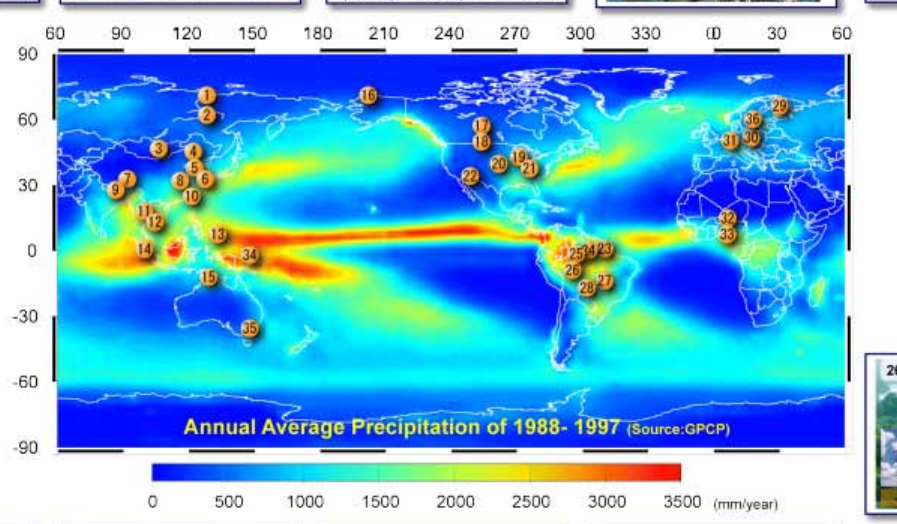
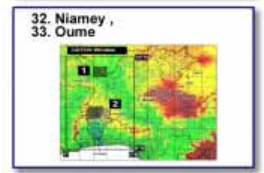


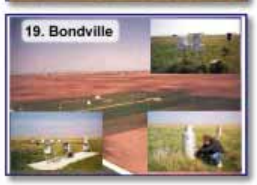


International Cooperation for the Global Coverage

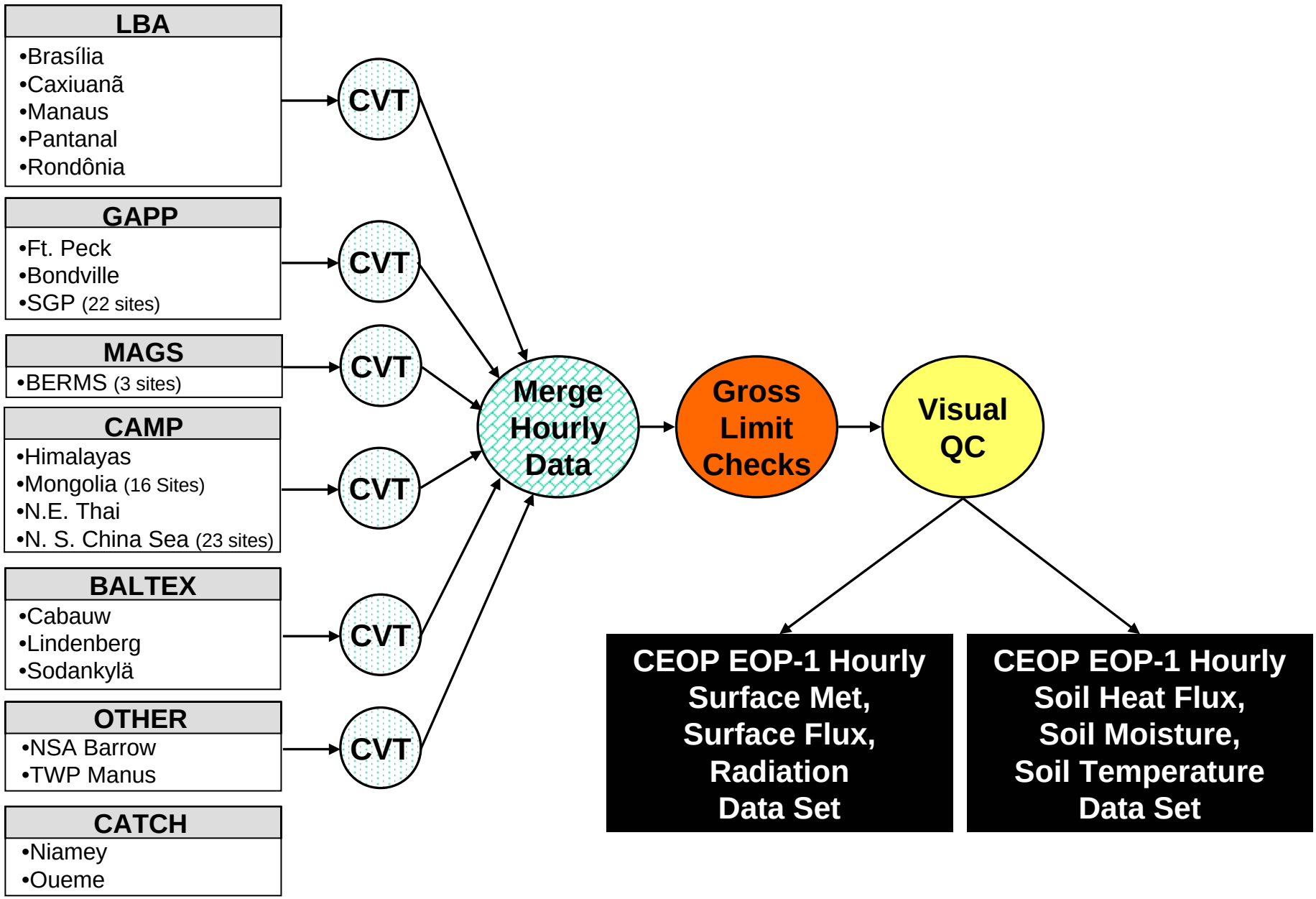




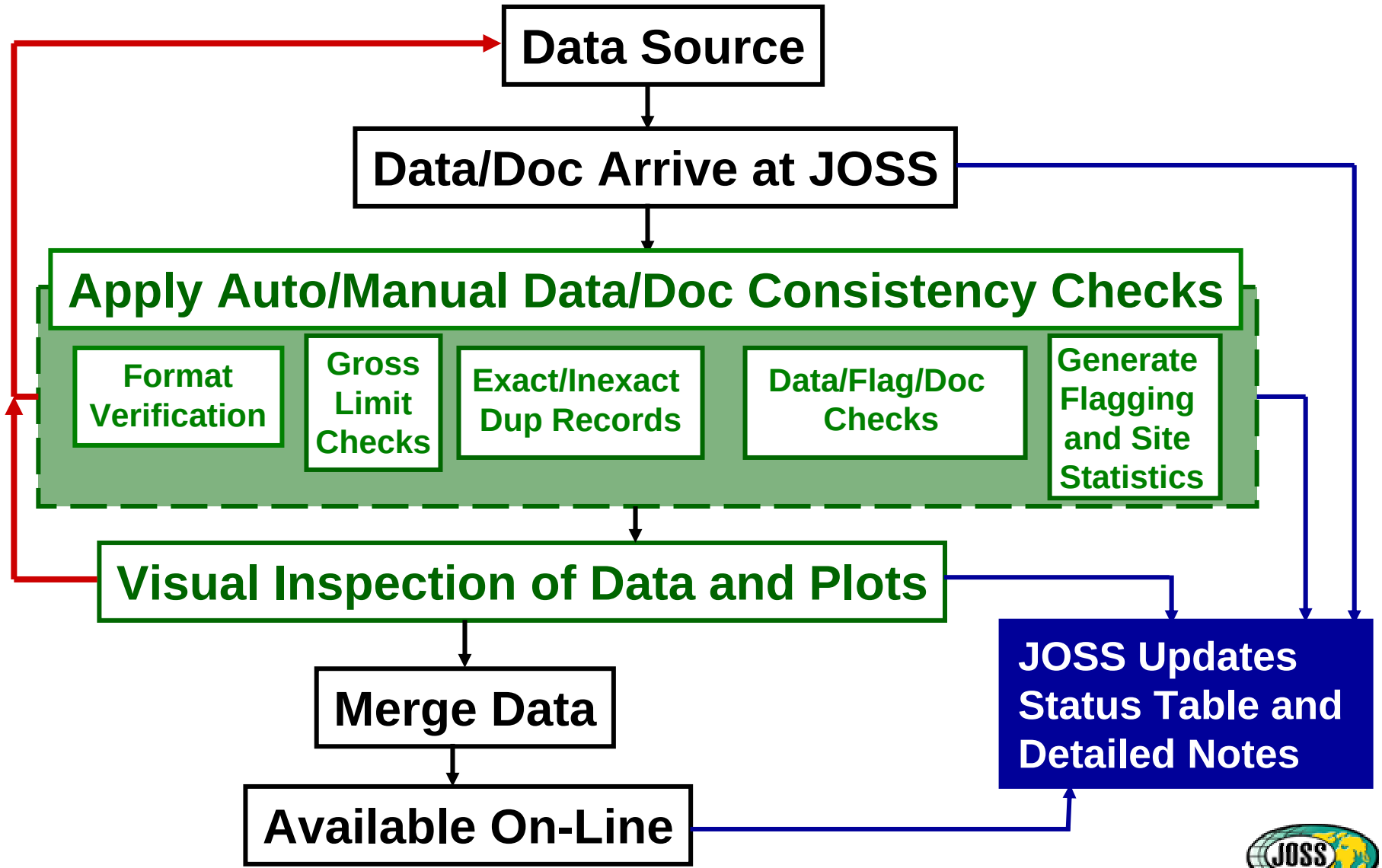




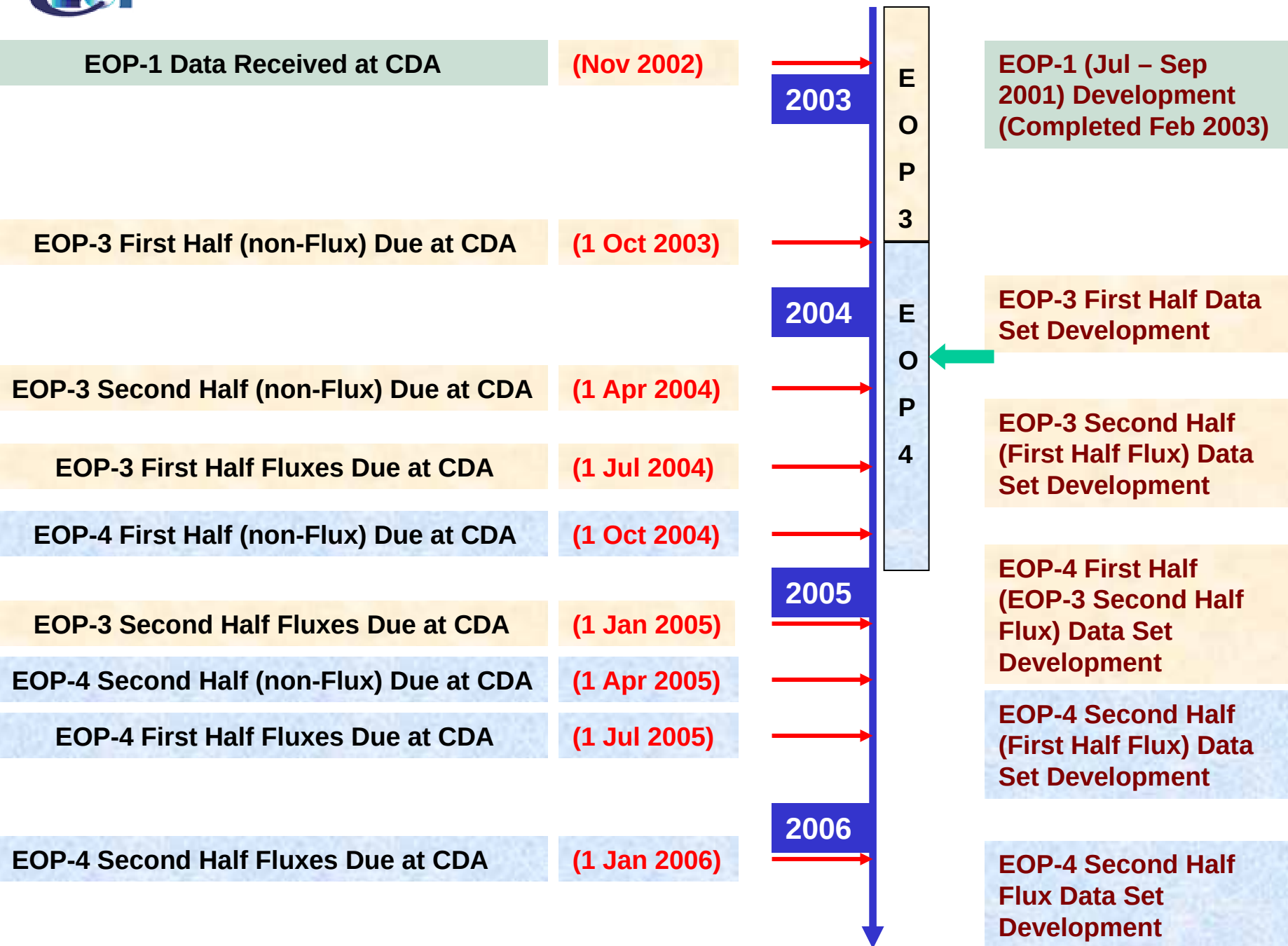
EOP-1 "Composite" Data Set Development



Reference Site EOP-3 Data Flow



Reference Site Data Set Development Timeline



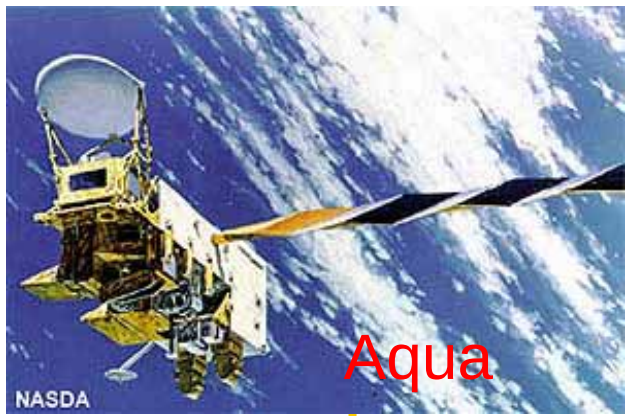
Hydrologic data set collection

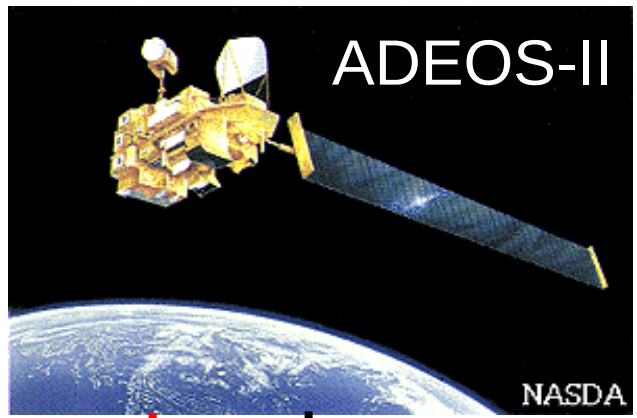
Objectives:

- To serve as validation sites for the land surface parameterizations in coupled land-atmosphere-ocean models, essentially at a point or small area scale;
- To serve as "tie points" or ground truth reference sites for remote sensing products

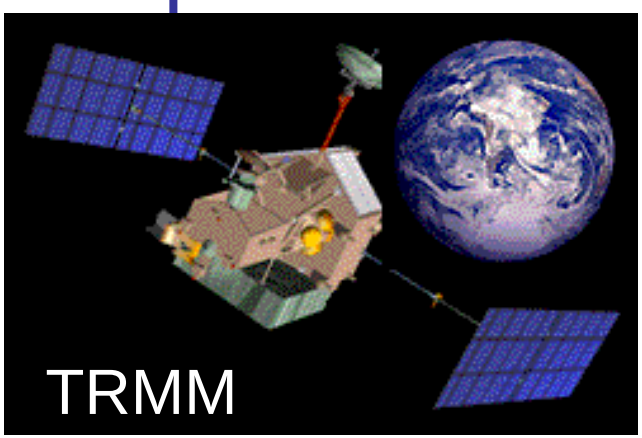
Continent	site names	contact	comments
Africa	Tensift, Morocco	Ghani Chehbouni <irdmar@iam.net.ma>	Research focus is integrated land and water resources management (SudMed project)
Africa	Volta/Nodwua	Nick van de Giesen <nick@uni-bonn.de>	Research focus is drought, agriculture water resources management (www.glowa-volta.de). 20 sq km, soil moistiure, radiation, sensible heat with a scintillometer but no latent. **Note: some info already provided to EFW**
Africa	Volta/Ejura	Nick van de Giesen <nick@uni-bonn.de>	ditto with Volta/Nodwua. Area 15 sq km.
Africa	Volta/Navrongo	Nick van de Giesen <nick@uni-bonn.de>	ditto with Volta/Nodwua. Area 10 sq km.
Africa	Oueme	CEOP (Steve Williams?)	CEOP site. Area of the gauged basin needs to be checked. Seems to be ~35000 sq km.
Australia	Yanco/Cayemba (Murray Darling)	Rodger Grayson	Focus on soil moisture, micromet installed, flux towers pending

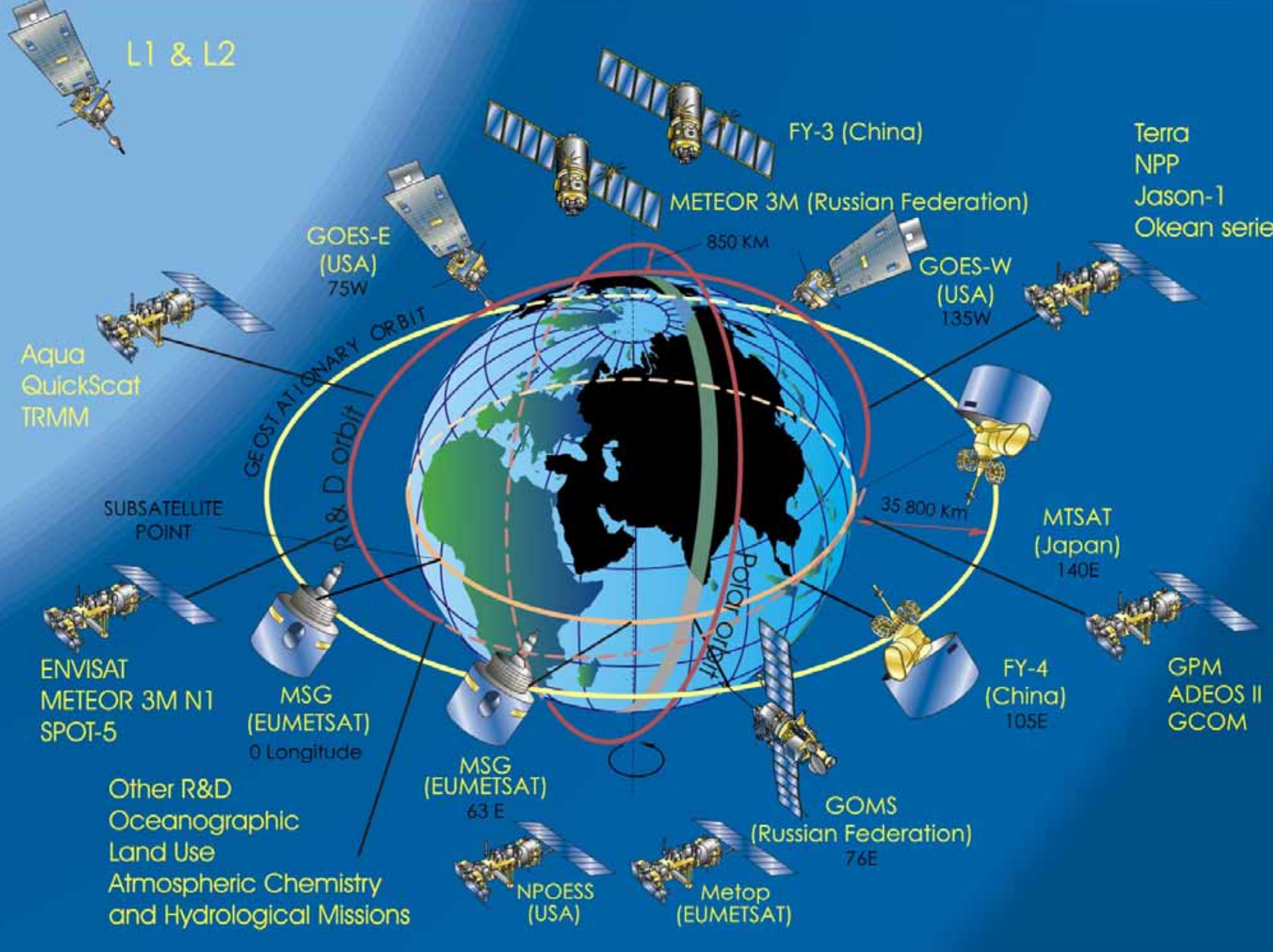
Line-up of the New Generation EO Satellite Data



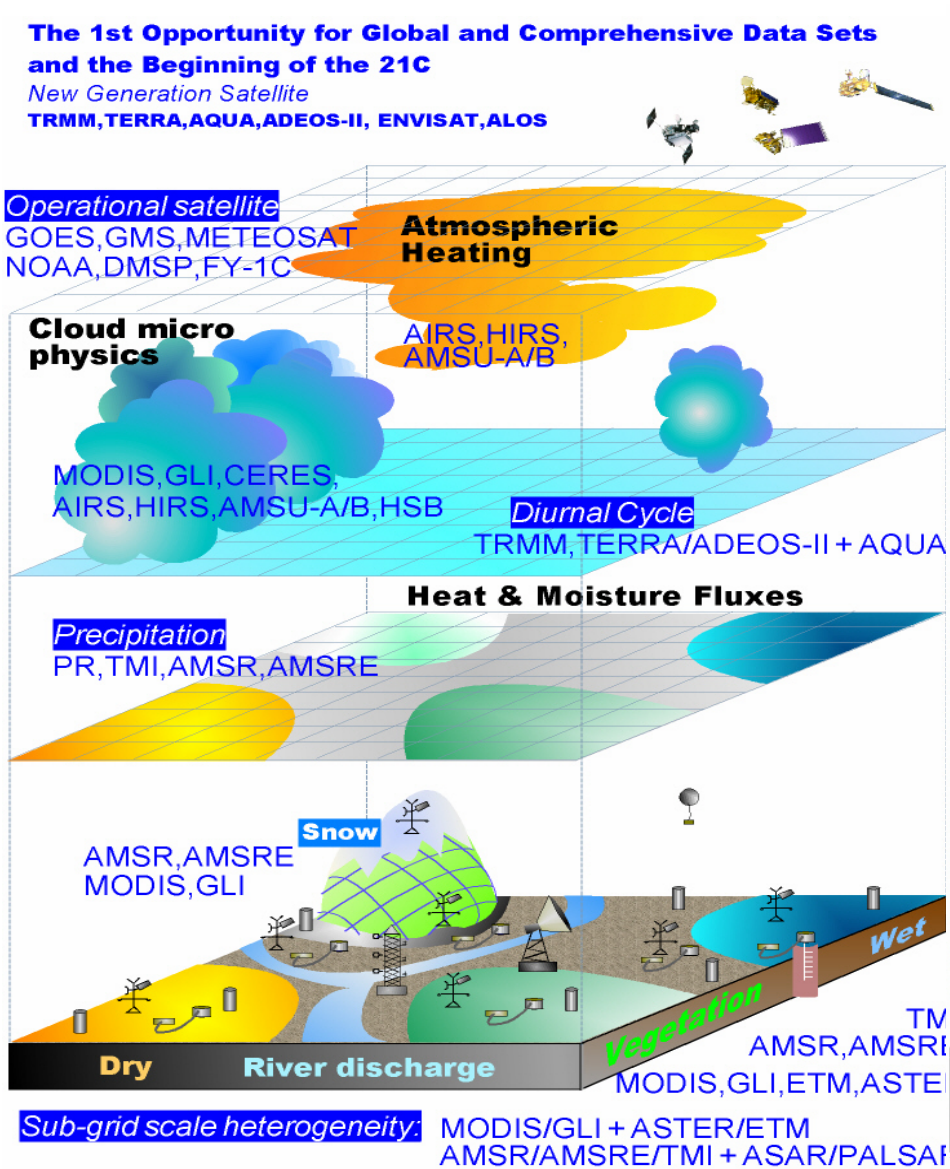


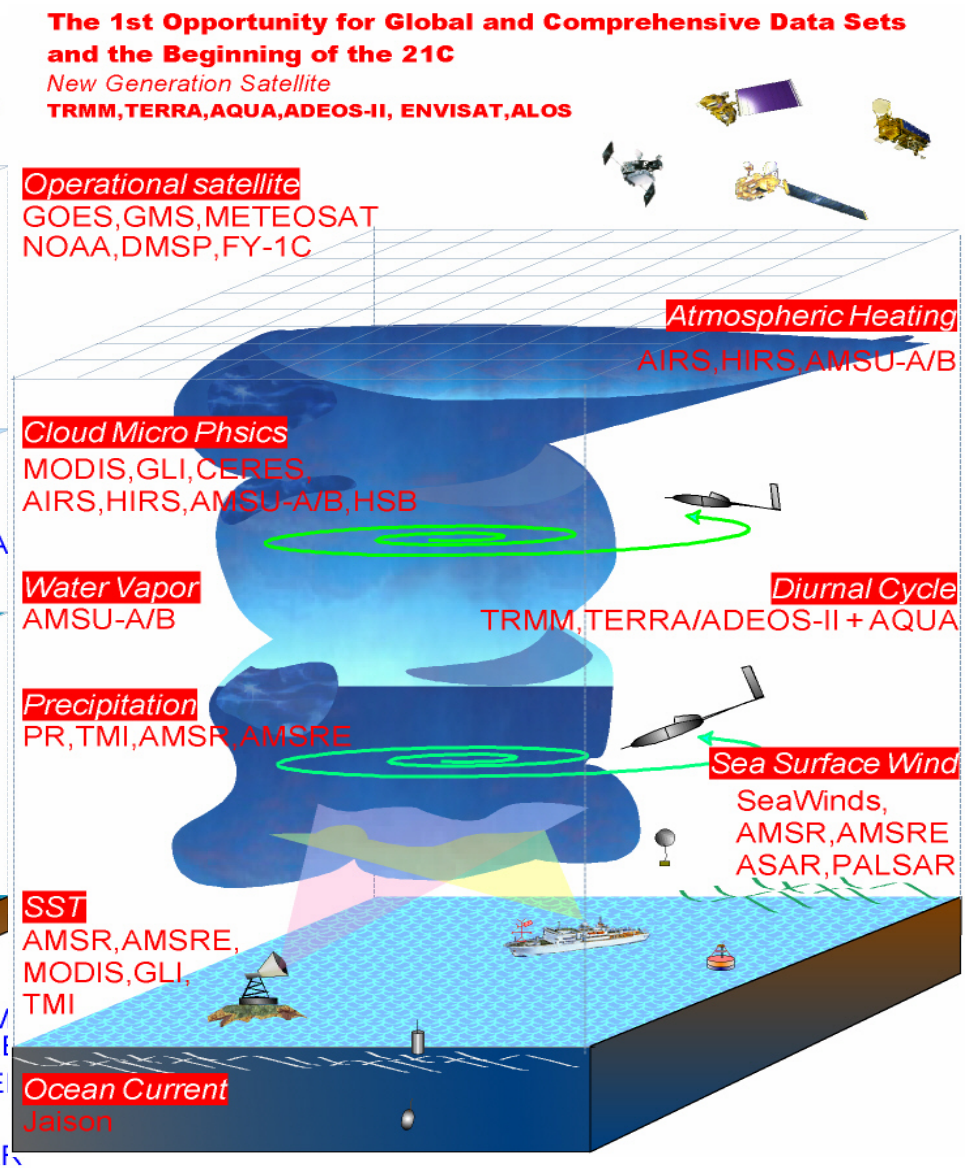
1997 1998 1999 2000 2001 2002 2003 2004 2005



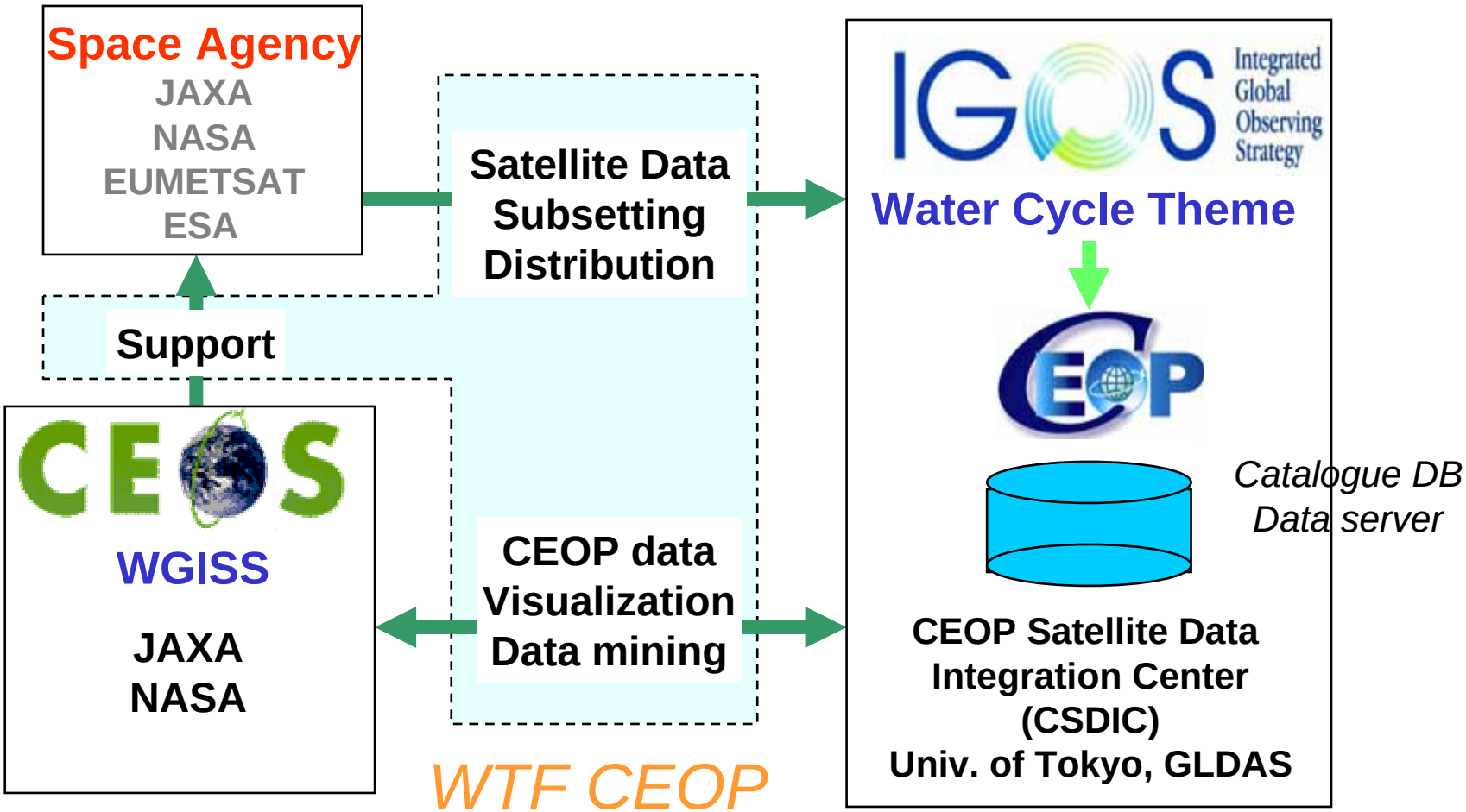

L1 & L2
FY-3 (China)
METEOR 3M (Russian Federation)
Terra
NPP
Jason-1
Okean serie
GOES-E
(USA)
75W
850 KM
GOES-W
(USA)
135W
Aqua
QuickScat
TRMM
GEOSTATIONARY ORBIT
R & D orbit
SUBSATELLITE
POINT
35 800 Km
MTSAT
(Japan)
140E
Polar orbit
ENVISAT
METEOR 3M N1
SPOT-5
MSG
(EUMETSAT)
0 Longitude
FY-4
(China)
105E
GPM
ADEOS II
GCOM
MSG
(EUMETSAT)
63 E
GOMS
(Russian Federation)
76E
Other R&D
Oceanographic
Land Use
Atmospheric Chemistry
and Hydrological Missions
NPOESS
(USA)
Metop
(EUMETSAT)

New Data Sets of the *Overall* Water Cycle by *Integrating* the Satellite Products





CEOS/WGISS Test Facility(WTF) for CEOP



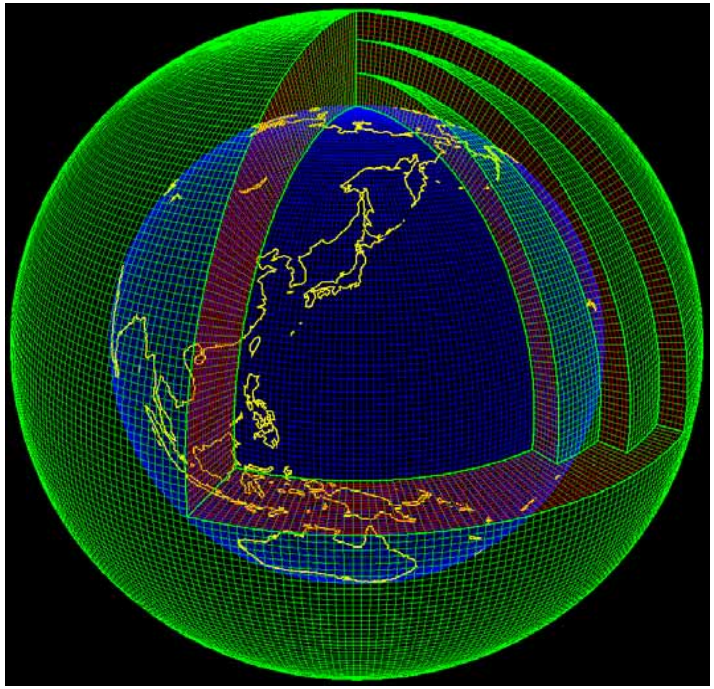
WTF CEOP Approach

- WGISS Test Facility encompasses joint activities of CEOP and WGISS.

- WTF CEOP Project Plan :
  - Identifies how WGISS and CEOP will work together
  - Identifies CEOP points of contact to answer questions and provide science input on WGISS agency developed small prototypes
  - Describes the data services needed by CEOP (e.g. data integration)
  - Identifies potential WGISS Agency tools and utilities that can support some of the data services needed

- WTF Implementation Plans:
  - With CEOP reps input, interested WGISS agencies identify existing tools that can be tailored to prototype a software capability associated with a data integration data service.
  - WGISS agencies develop specific Implementation Plans for the prototypes.
  - Phased approach where cycle can start again with additional Implementation Plans and prototypes

- Status of current WGISS agencies support for CEOP
  - JAXA (Lead WGISS Agency)
  - NASA
  - ESA (considering it)



Eight Numerical Weather Prediction (NWP) Centers, NCEP, ECPC, UKMO, ECMWF, JMA, CPTEC, BoM, NCMWF, and two Data Assimilation Center, NASA/GMAO, NASA/GLDAS provide model outputs to CEOP, and CEOP offers a globally consistent data sets for model validation and calibration.

Three types model outputs are offered by NWP Centers

- Model Output Location Time Series (MOLTS) at the reference sites: high temporal resolution time-series output
- Gridded Output from operational global and regional prediction models
- Output from global and regional reanalysis

CEOP Model Center Documentation

BoM

- None

CPTEC

- CPTEC Contribution to CEOP (10 Dec 2002)

ECMWF

- ECMWF Contribution to CEOP (13 Dec 2002)
- ECMWF CEOP MOLTS locations (13 Dec 2002)

ECPC

- ECPC CEOP Contributions (30 May 2003)
- ECPC Model Characteristics (30 May 2003)
- ECPC Model Output Times (30 May 2003)
- ECPC CEOP Variables and Processes (30 May 2003)
- ECPC SFM/RII MOLTS Characteristics (30 May 2003)

JMA

- JMA Contribution to the CEOP Dataset (17 Dec 2002)
- Additional JMA Comments and Questions on the CEOP Dataset (17 Dec 2002)
- JMA CEOP MOLTS locations (16 Dec 2002)
- Vertical Levels of JMA CEOP Output Data (16 Dec 2002)
- Elements available from JMA Operational 3-DVAR Global Analysis (16 Dec 2002)
- Sample of JMA MOLTS Output (3 Feb 2003)

NASA Global Modeling and Assimilation Office (GMAO; formerly DAO)

- File Specification for the GEOS-DAS Gridded Output (Version 4.3) (4 June 2003)

NASA GLDAS

- None

NCEP Operational

- Output for CEOP from NCEP Global Data Assimilation and Forecast Model (14 Mar 2003)
- NCEP Global Forecast System Implementation (29 Oct 2002)
- NCEP GRIB Table 2 (14 Mar 2003)
- NCEP Output at International CEOP MOLTS Sites (14 Mar 2003)
- NCEP Global Model Characteristics at CEOP MOLTS Reference Sites (14 Mar 2003)
- Vertical Sigma Levels of NCEP Global Model MOLTS Output (14 Mar 2003)
- NCEP data at MPI (28 Mar 2003)
- NCEP CEOP Data CERA Storage (28 Mar 2003)
- Map of proposed NCEP ETA MOLTS locations for NAME
- Map of current NCEP ETA MOLTS locations around the ARM SGP site

NCMRWF

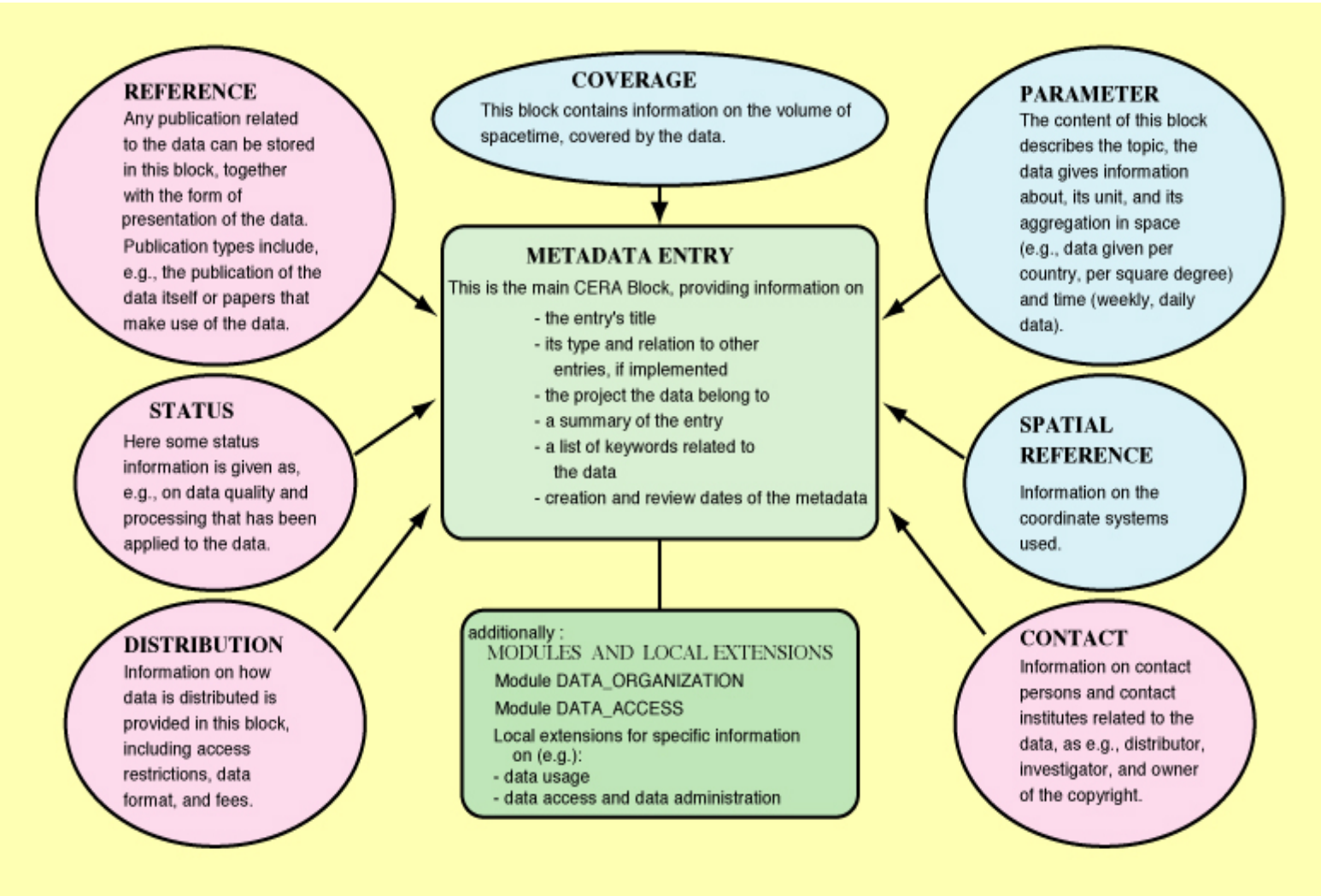
- NCMRWF Notes on Gridded Data (19 Nov 2003)
- NCMRWF CEOP Core Codes (19 Nov 2003)

UKMO

- Met Office Contribution to CEOP (12 Nov 2002)
- UKMO GRIB Table 2 for CEOP Data (28 Mar 2003)
- Model Locations of MOLTS Reference Sites (28 Mar 2003)
- Notes for CEOP MOLTS and Gridded data from UKMO (12 Jun 2003)
- Met Office Scientific Advisory Committee Presentations (28 Mar 2003)

CEOP- Model Output Archive

Metadata



CEOP-data Overview

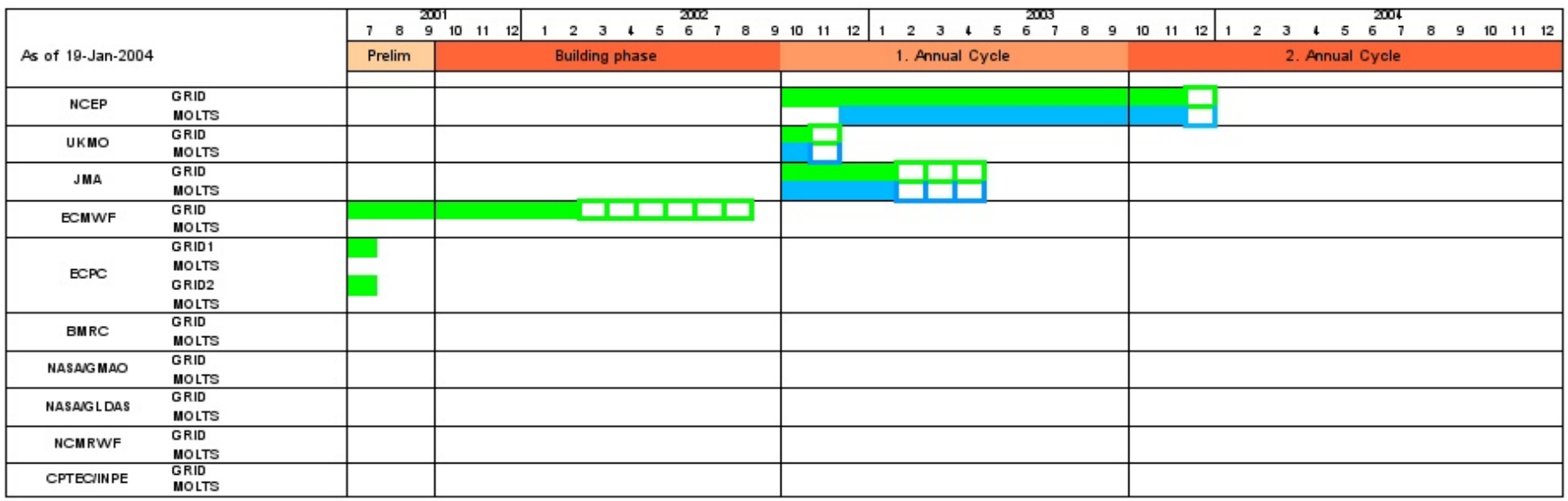
For a complete description of the CEOP-project, data-links and documents please consult the CEOP-homepage

Centre	local documents	MOLTS-data	GRID-data	contact	available programs
NCEP	Description of MOLTS data sets (txt) NCEP Code table 2 (doc)	gzipped binary	grib	Sid Katz	read MOLTS (complete) files (f90) read MOLTS (single station) files (f90)
UKMO	Description of data sets (doc) Code table (doc)	arcs	grib	Paul Earnshaw	
NASA-GMAO		gzipped arcs	grib		
NASA-GLDAS					
JMA	Code table (txt)	arcs	grib	Masayuki Hirai	
BMRC		netCDF		Lawrie Rikus	
ECMWF	Data set documentation (pdf) Parameter/Code Table (txt)		grib	Pedro Viterbo	
NCMRWF					
ECPC					
CPTEC/INPE					

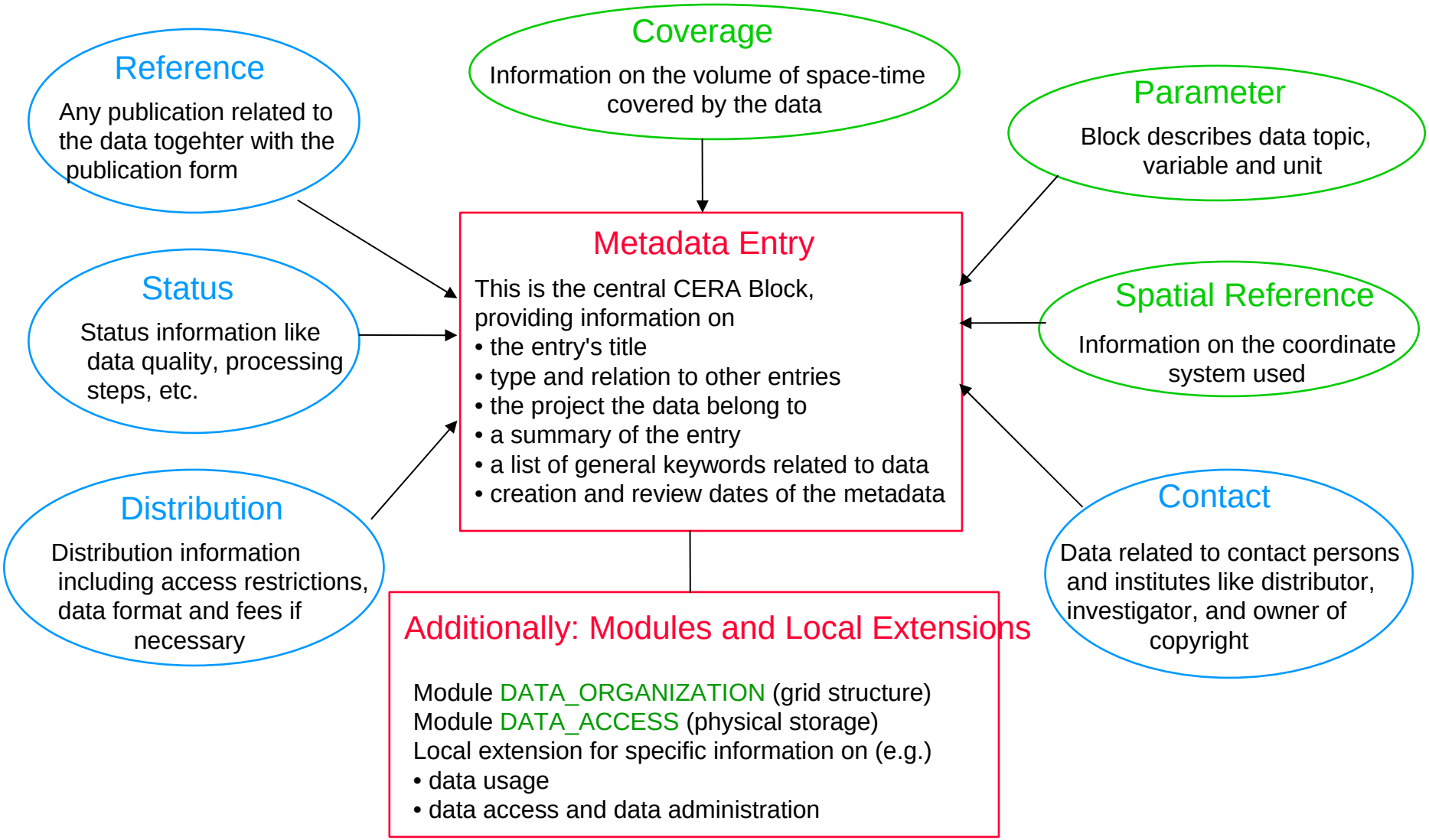
Data sets included into CERA (as of 13/01/2004)

Centre	MOLTS data	GRID data
NCEP	12/01/2002 - 11/30/2003	10/01/2002 - 11/30/2003
UKMO	10/01/2002 - 10/31/2002	10/01/2002 - 10/31/2002
NASA-GMAO	-	-
NASA-GLDAS	-	-
JMA	10/01/2002 - 01/31/2003	10/01/2002 - 01/31/2003
BMRC	-	-
ECMWF	-	07/01/2001-02/28/2002
NCMRWF	-	-
ECPC	-	SFM : 07/01/2001-07/31/2001 RII : 07/01/2001-07/31/2001
CPTEC/INPE	-	-

You may also find a timline presentation of the available data periods.



MPIM CERA-2 Data Model Blocks

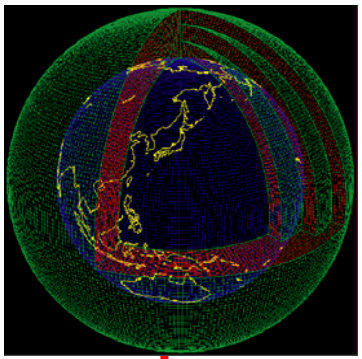


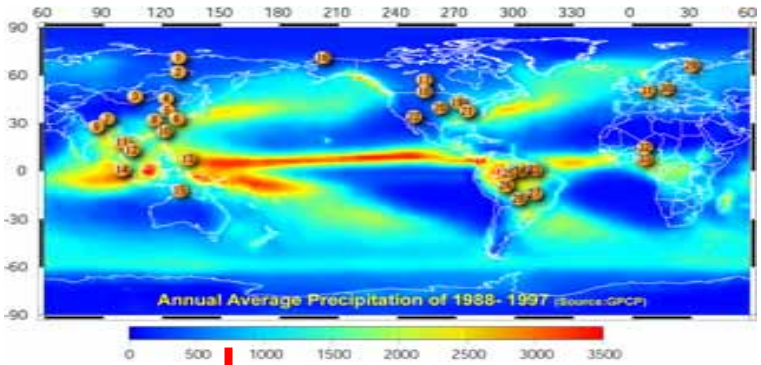
The First Global Integrated Data Sets of the Water Cycle

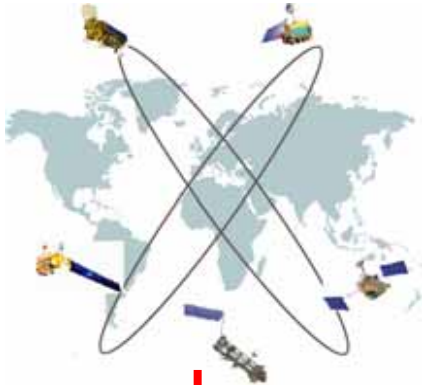
Model Outputs by Numerical Weather Prediction Centers

Surface Observational (*in-situ*) Data from the 36 CEOP Reference Sites

Satellite Remote Sensing Data



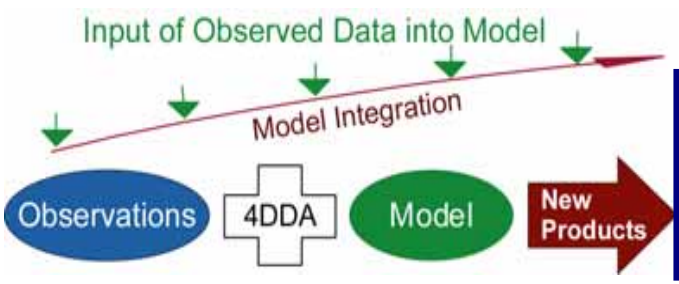




MODEL Output Data Archiving Center at Max-Planck Institute of Germany
http://www.mpg.de/

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

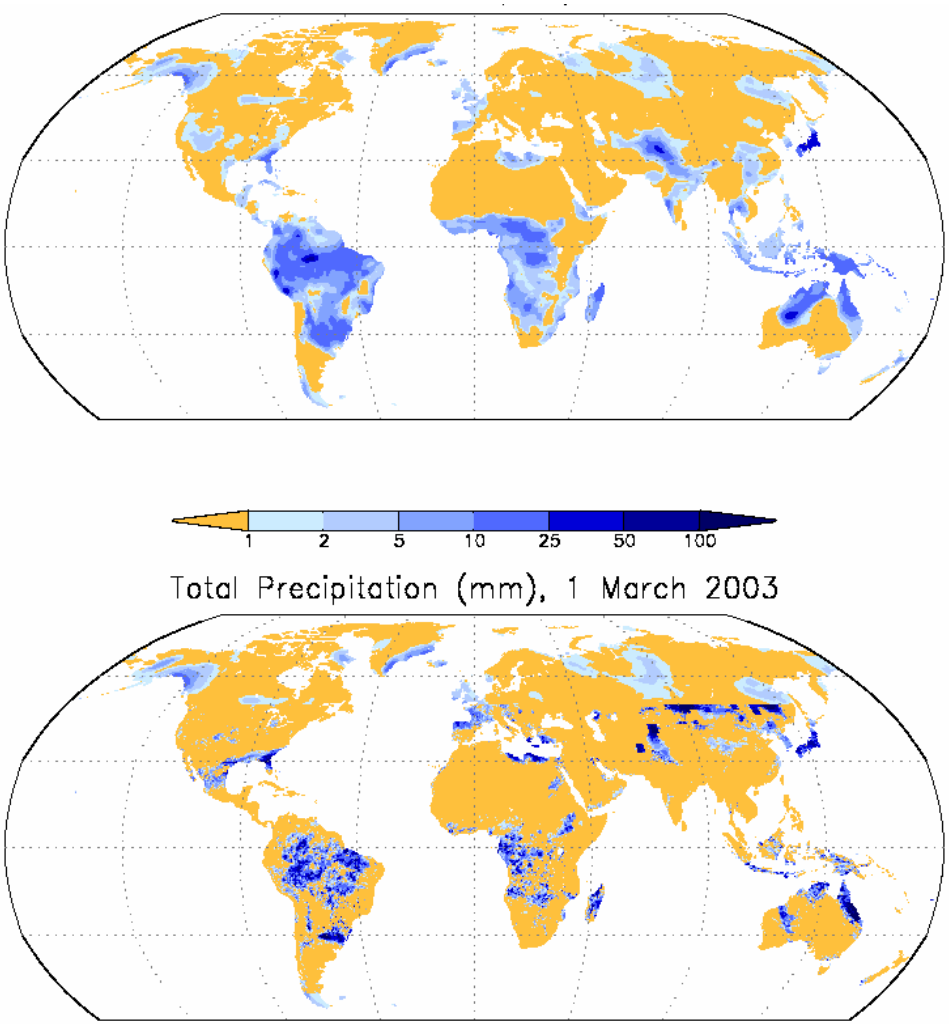
Data Integrating/Archiving Center at University of Tokyo and JAXA of Japan
http://monsoon.t.u-tokyo.ac.jp/ceop/

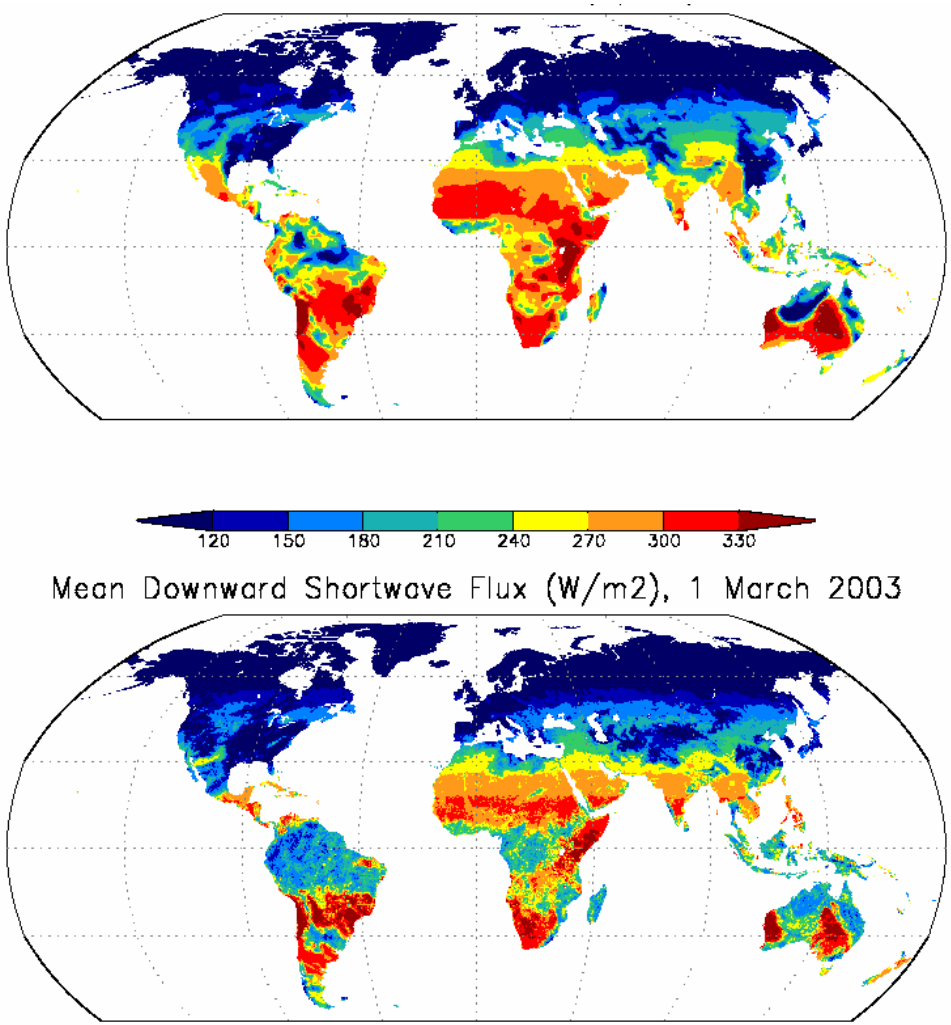


Global Land Data Assimilation System at NASA Goddard Space Flight Center of USA
http://ldas.gsfc.nasa.gov/

Data Archive Center

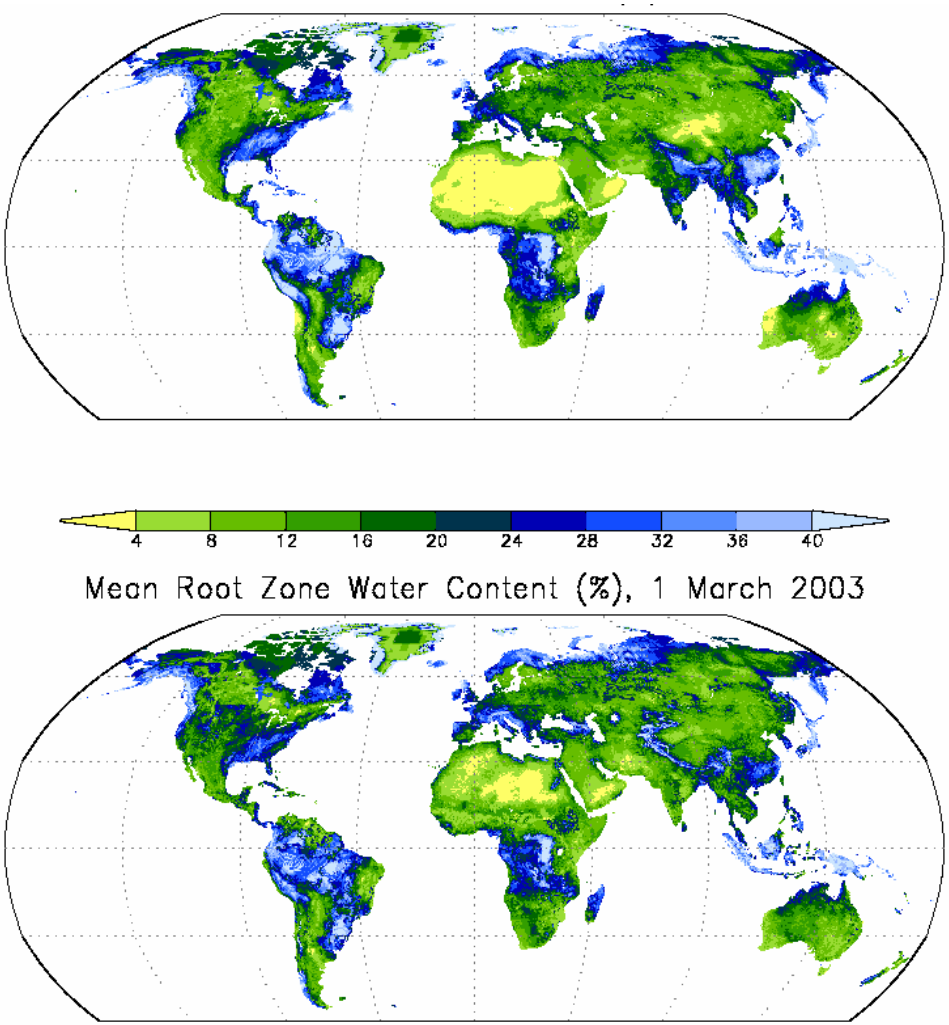
GLDAS Forcing

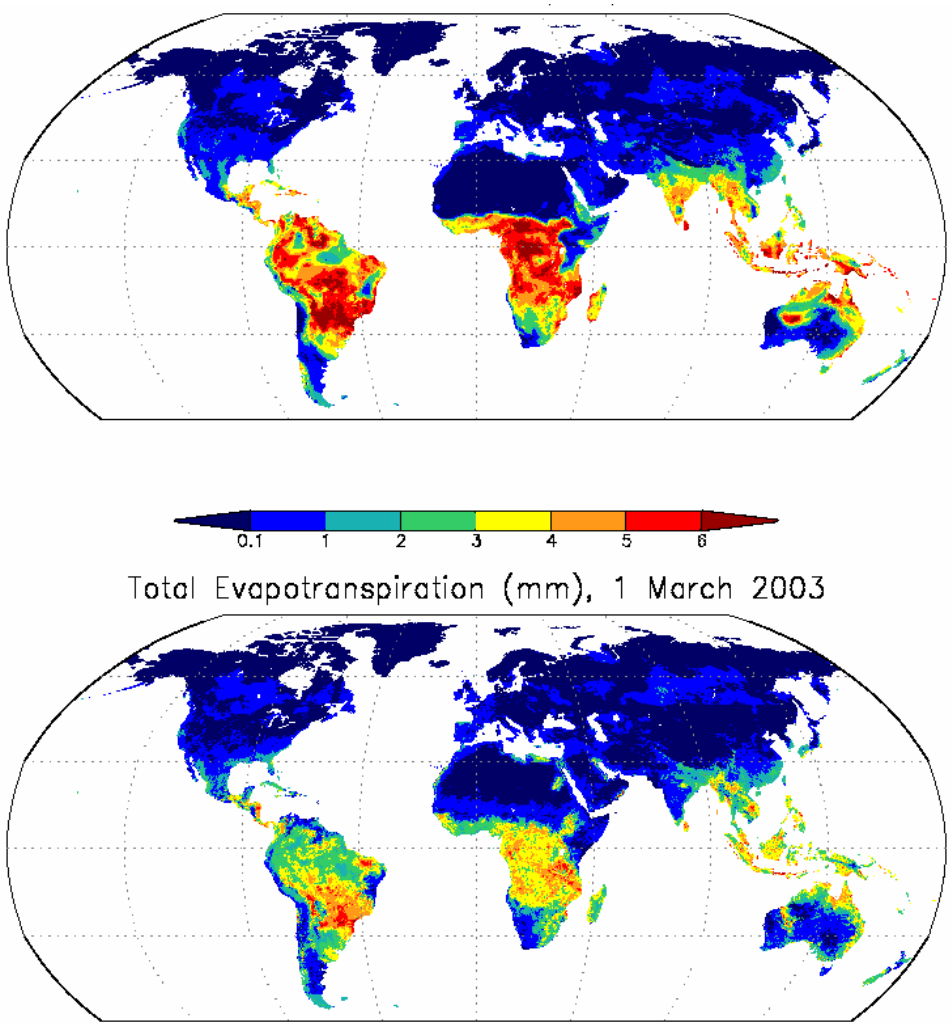




atmospheric data assimilation output (top)
vs.
observation based (bottom)

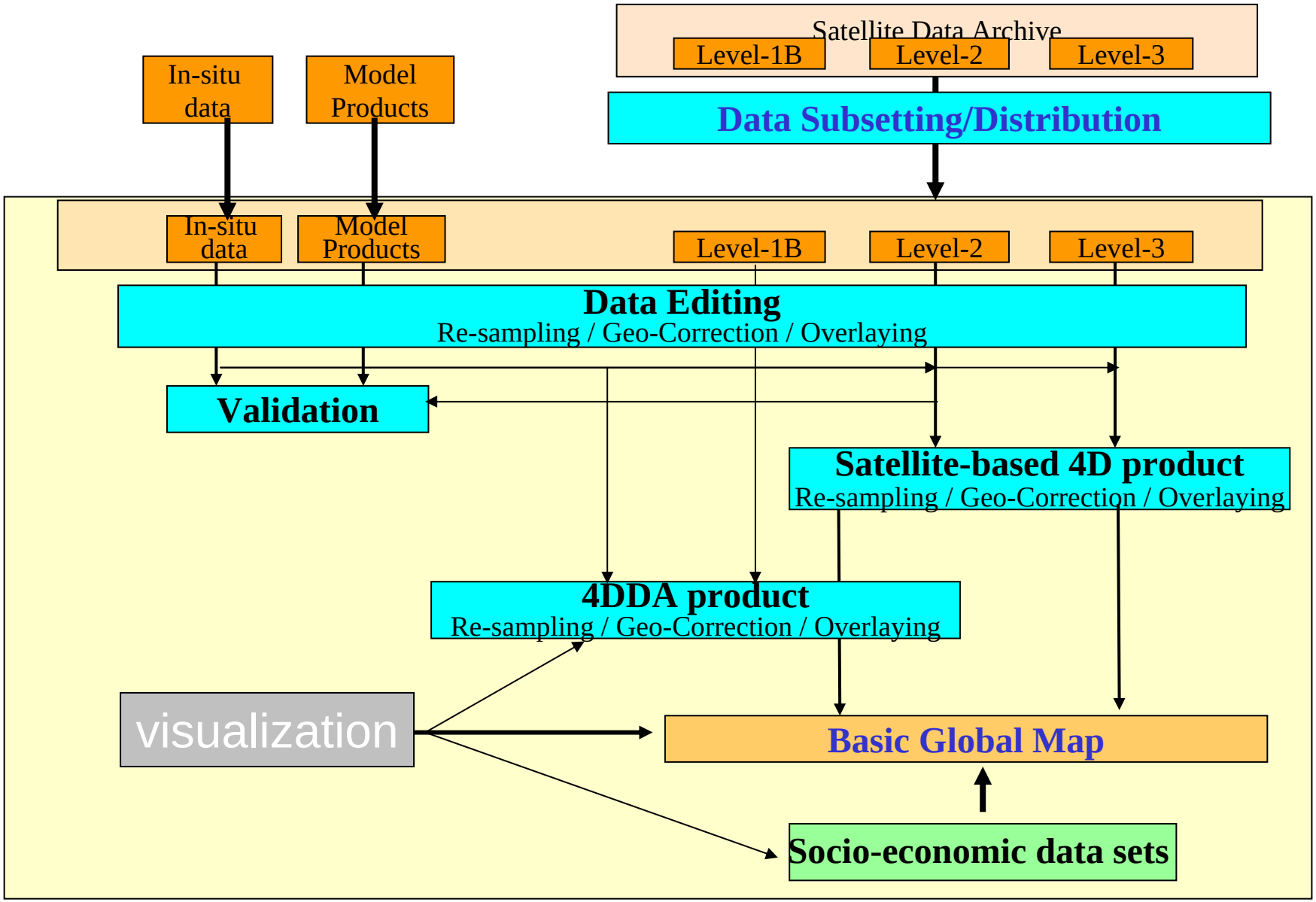
GLDAS Output

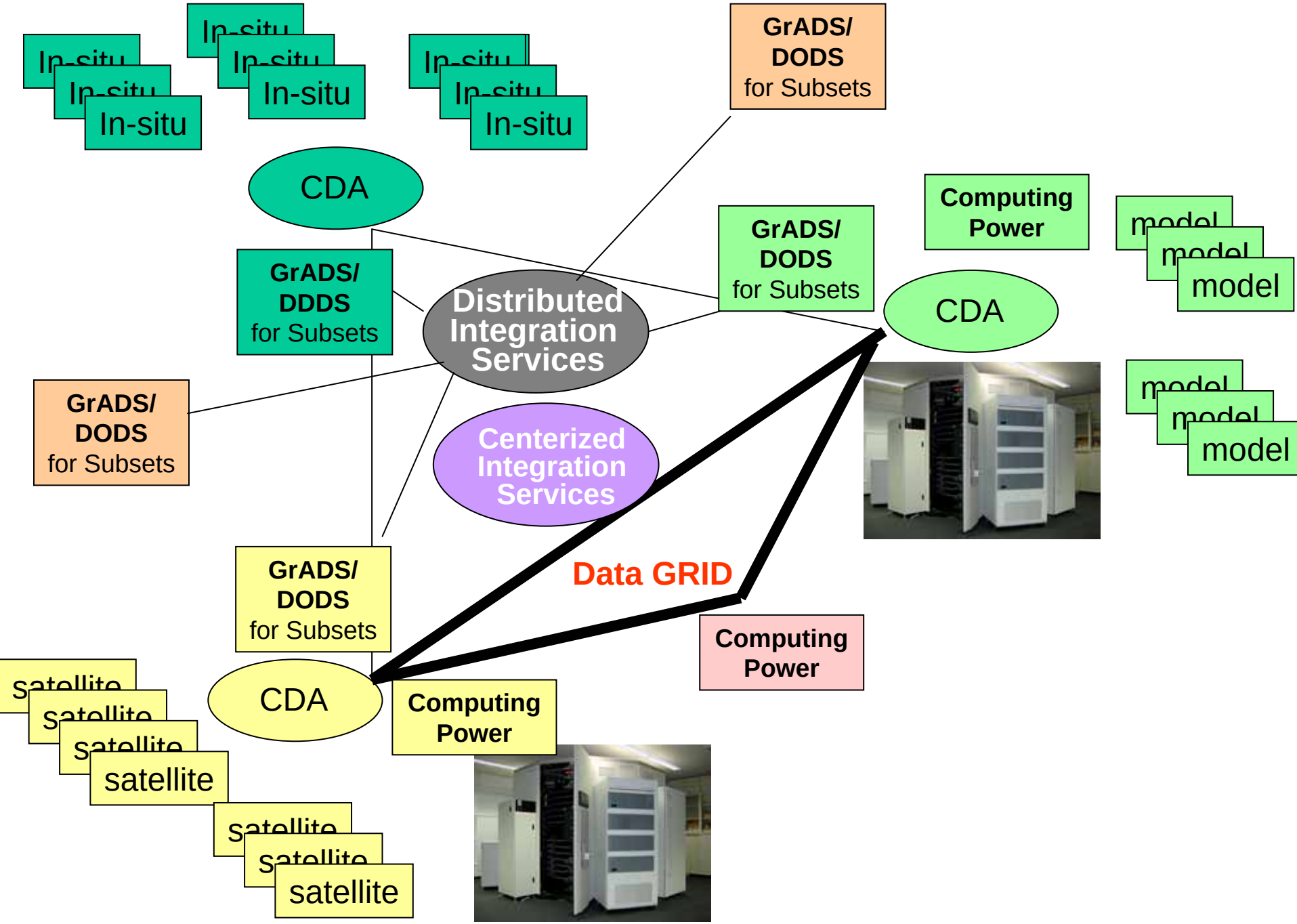




atmospheric data assimilation output forced (top)
vs.
observation forced (bottom)

Data Set Integration

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In-situ
GrADS/ DODS for Subsets
CDA
GrADS/ DDDS for Subsets
Distributed Integration Services
GrADS/ DODS for Subsets
Computing Power
model
model
model
CDA
GrADS/ DODS for Subsets
Centerized Integration Services
model
model
model
Data GRID
GrADS/ DODS for Subsets
Computing Power
satellite
satellite
satellite
satellite
satellite
satellite
CDA
Computing Power

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   - (ii) the satellite observations of the entire water cycle
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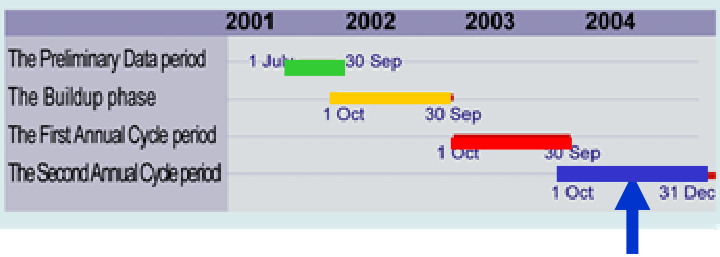
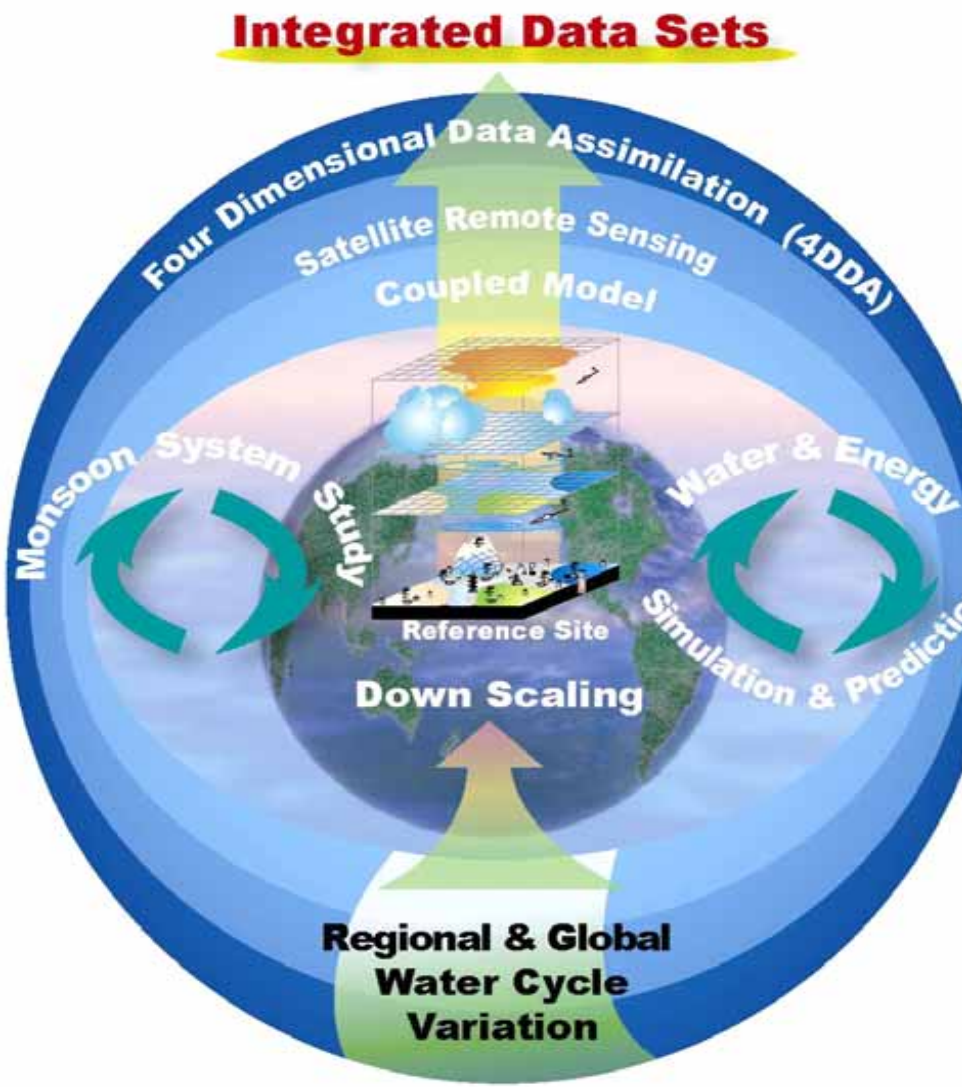
2. Challenges to inter-connection of regional water cycles and Down-scaling applications to water resources

CEOP Schedule:





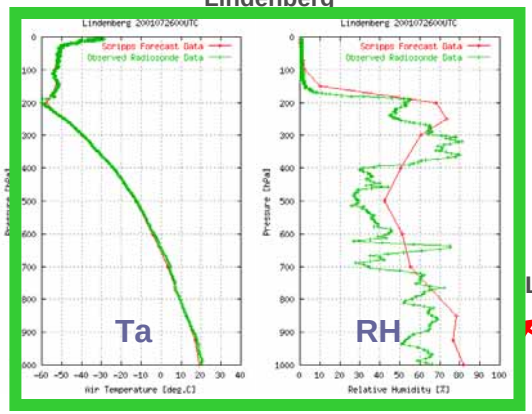
CEOP EOP-1 Dataset Table

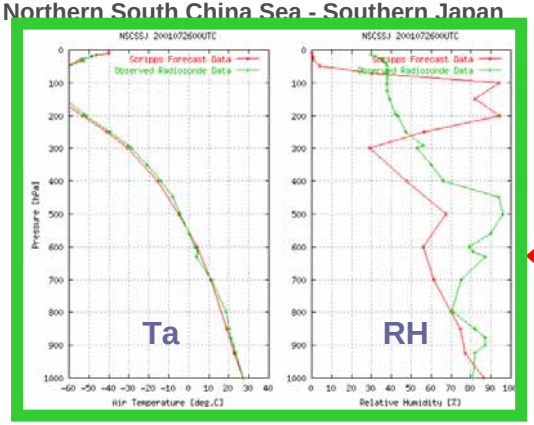
CEOP EOP-1(2001.07 to 09) Data list Ver. 2003.05.16

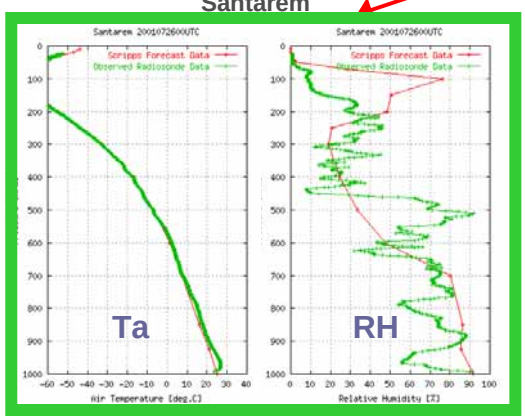
		In-Situ Data							Satellite Data						MODEL OUTPUT									
		UPPER AIR Observation					SURFACE Obs.	SUB-SURFACE Obs.	TRMM		DMSP	GMS	NOAA	TERRA	MOLTS / Gridded data									
		Sond	Radar	WP	RASS	Ceilor	AWS, Flux, Rad.	Soil Mois,Temp,Flu	TMI	PR(2A25)	SSM/I	VISSR	AVHRR	MODIS	BoM	CPTEC	ECMWF	ECPC	JMA	DAO	GLDAS	NCEP	NCMRWF	UKMO
1	Eastern Siberian Tundra						A	A			A							/ B		A / B	A / B			
2	Eastern Siberian Taiga						A	A			A	A	A					/ B		A / B	A / B			
3	Mongolia						A(UF)	A(UF)			A	A	A	X				/ B		A / B	A / B			
4	Inner Mongolia										A	A	A	X				/ B		A / B	A / B			
5	Korean Peninsula								A	A	A	A	A	X				/ B		A / B	A / B			
6	Korean Haenam								A	A	A	A	A	X				/ B		A / B	A / B			
7	Tibet *1)						A	A	A	A	A	A		X				/ B		A / B	A / B			
8	Yangtze River	X	X				X	X	A	A	A	A	A	X				/ B		A / B	A / B			
9	Himalayas						A(UF)	A	A	A	A	A		X				/ B		A / B	A / B			
10	NSCSSJ	A					A(UF)	A(UF)	A	A	A	A	A	X				/ B		A / B	A / B			
11	Chao-Phraya river *2)						X	X	A	A	A	A		X				/ B		A / B	A / B			
12	North-East Thailand						A	A	A	A	A	A		X				/ B		A / B	A / B			
13	Western Pacific Ocean *3)					X	X		A	A	A	A	A	X				/ B		A / B	A / B			
14	Equatorial Island	X	X				X	X	A	A	A	A		X				/ B		A / B	A / B			
15	Tropical Western Pacific	A					A(UF)	A	A	A	A	A						/ B		A / B	A / B			
16	North Slope of Alaska	A					A(UF)	A			A							/ B		A / B	A / B			
17	BERMS						A(UF)	A(UF)			A							/ B		A / B	A / B			
18	Ft. Peck						A(UF)	A(UF)			A							/ B		A / B	A / B			
19	Bondville						A(UF)	A(UF)			A							/ B		A / B	A / B			
20	SGP	A					A(UF)	A(UF)	A	A	A							/ B		A / B	A / B			
21	Oak Ridge						A	A	A	A	A							/ B		A / B	A / B			
22	Mt. Bigelow						A	A	A	A	A							/ B		A / B	A / B			
23	caxiuana						A(UF)		A	A	A							/ B		A / B	A / B			
24	Santarem	A							A	A	A							/ B		A / B	A / B			
25	Manaus						A(UF)	A	A	A	A							/ B		A / B	A / B			
26	Rondonia	A					A(UF)	A	A	A	A							/ B		A / B	A / B			
27	Brasilia						A(UF)	A(UF)	A	A	A							/ B		A / B	A / B			
28	Pantanal						A(UF)	A(UF)	A	A	A							/ B		A / B	A / B			
29	Sodankyla										A							/ B		A / B	A / B			
30	Lindenberg	A	A	A	A	A	A(UF)	A(UF)			A							/ B		A / B	A / B			
31	Cabauw	A	A		A	A	A(UF)	A(UF)			A							/ B		A / B	A / B			
32	Niamey								A	A	A							/ B		A / B	A / B			
33	Oueme								A	A	A							/ B		A / B	A / B			
34	Manus								A	A	A							/ B		A / B	A / B			
35	Tumbarumba										A							/ B		A / B	A / B			
36	Norunda										A							/ B		A / B	A / B			

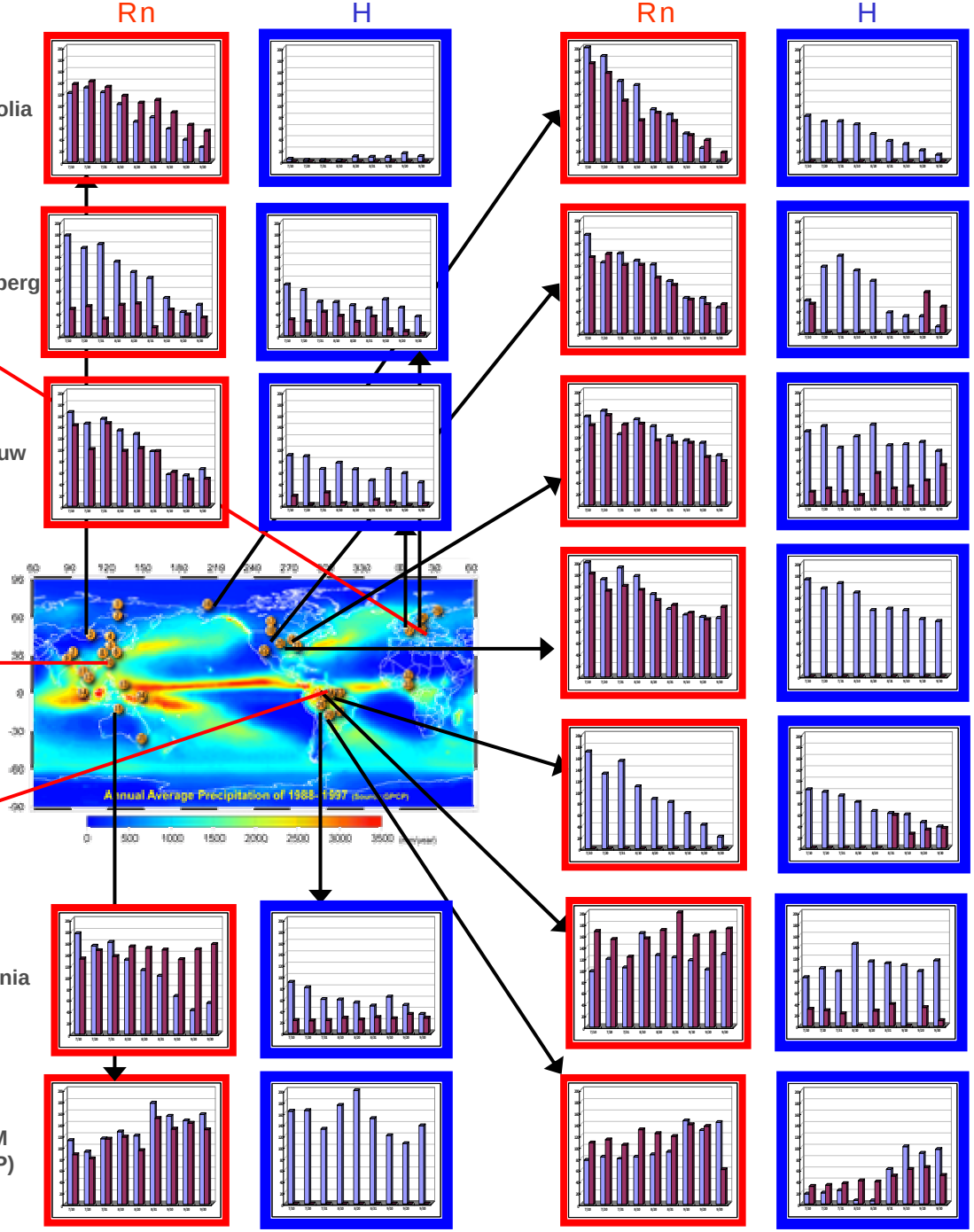
*1) Tibet has Two MODEL OUTPUT Stations
*2) Chao-Phraya river has Four MODEL OUTPUT Stations
*3) Western Pacific Ocean has Two MODEL OUTPUT Stations

A : Data Archived by UCAR
A(UF) : Data Archived by UCAR and Converted to UCAR uniformed Format
B : Will be archived at MPI
X : Will be archived at UCAR
Brank : No data sets during EOP-1









(Tamagawa, Koike, Williams, 2003)

Surface fluxes of GLOBAL MODEL vs CEOP Observations at SGP (top), Pantanal (middle), and Lindenberg (bottom)

Monthly Mean Diurnal Cycle

July 2001

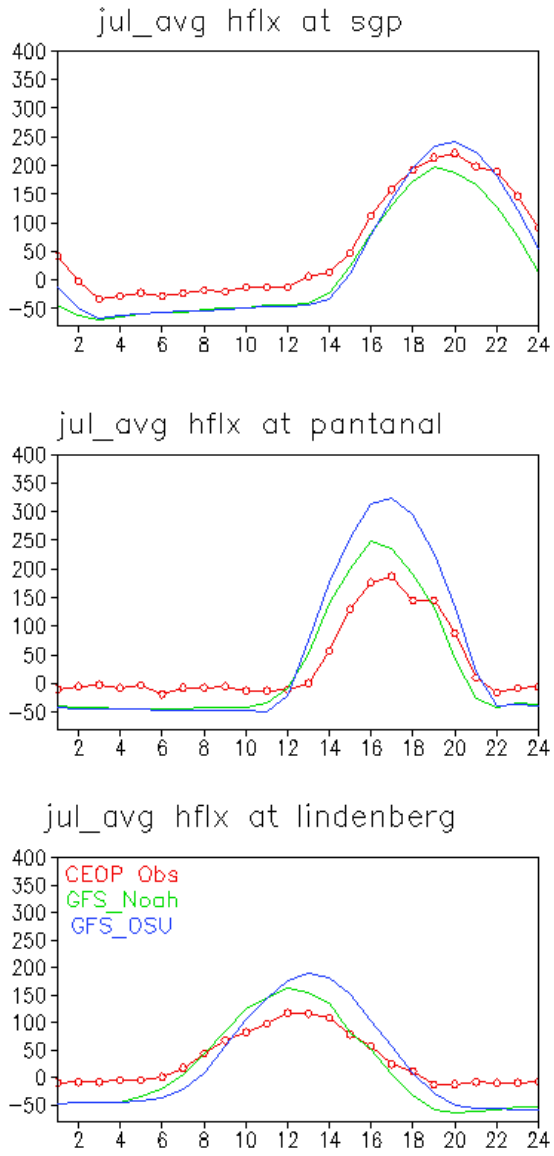
(Lu & Mitchell, 2003)

Red – observations
Blue – using **OSU LSM**
Green – using **Noah LSM**

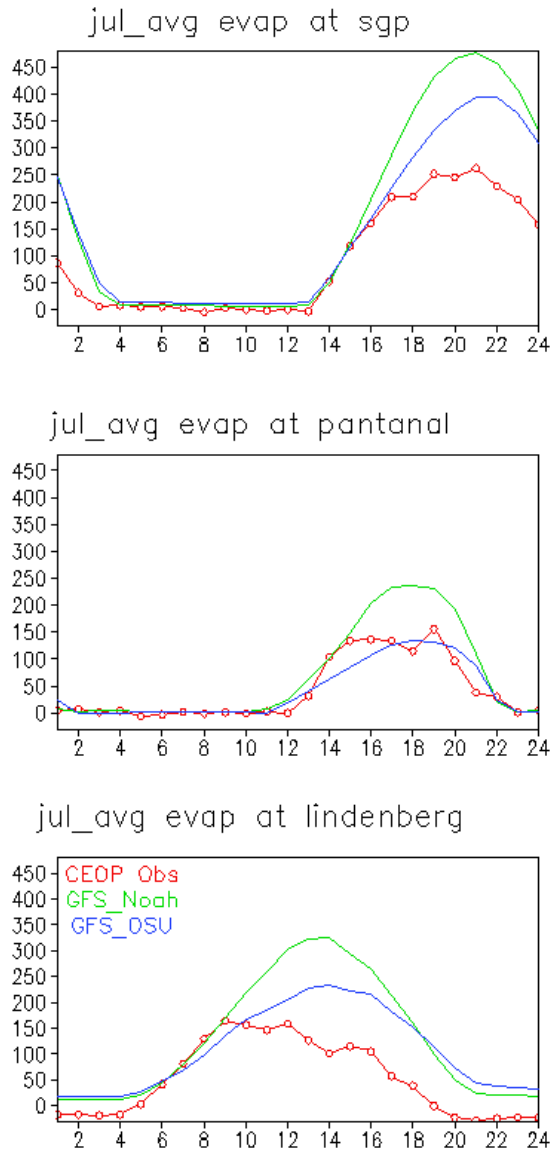
Global model run with newer Noah LSM shows a larger high bias in daytime latent heat flux, though better sensible heat flux.

Forcing biases in parent atmospheric model spur us to consider uncoupled results of Noah LSM in uncoupled NLDAS in slides to follow.

Surface Sensible Heat Flux (W/m2)

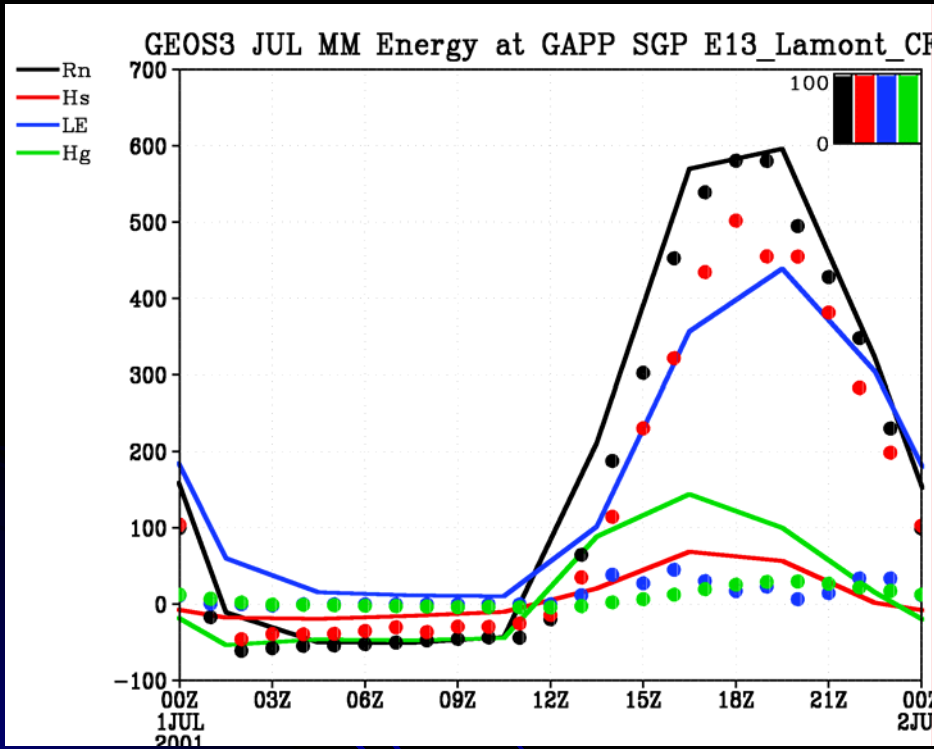


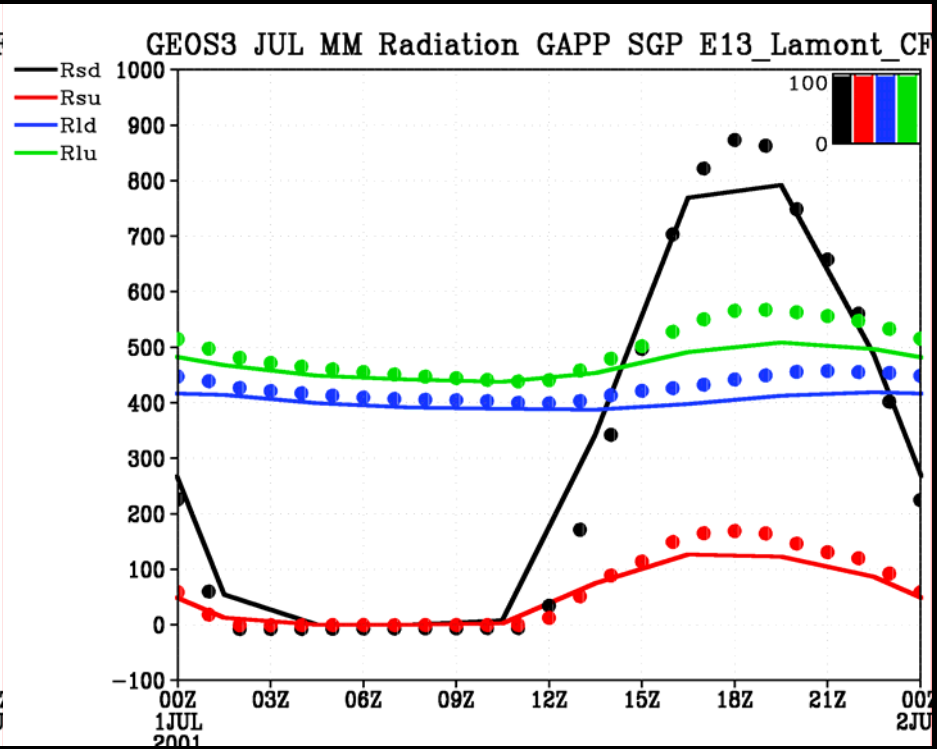
Surface Latent Heat Flux (W/m2)



GEOS3 GAPP SGP Lamont Energy and Radiation Comparison

(Bosilovich,2003)

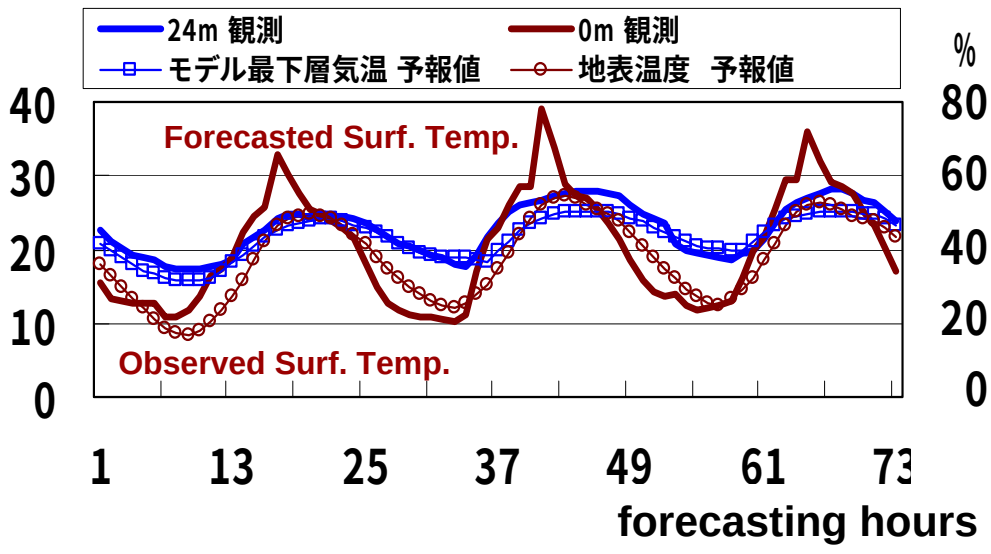


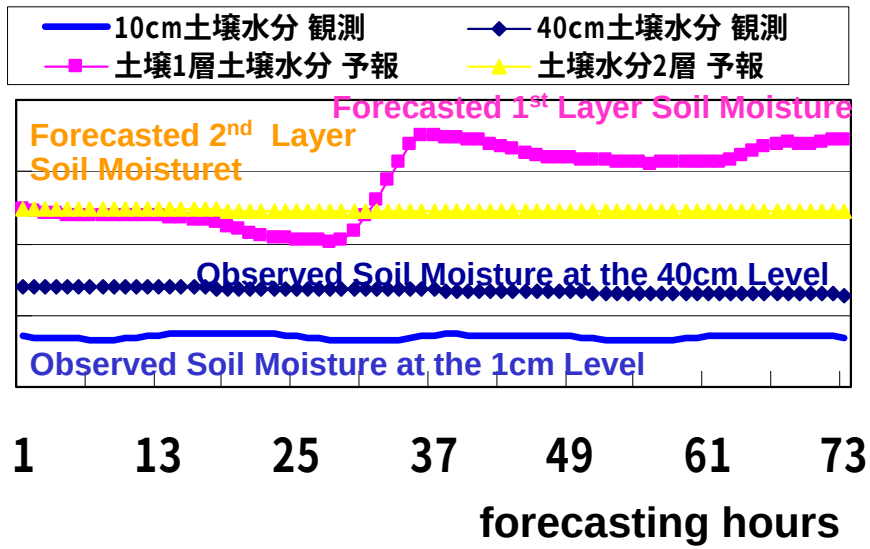


- Too much latent heat in the analysis leads to cold surface temperatures

Inter-comparison of the JMA Operational Forecasting Model Outputs and the EOP-1 at the Siberia Reference Site

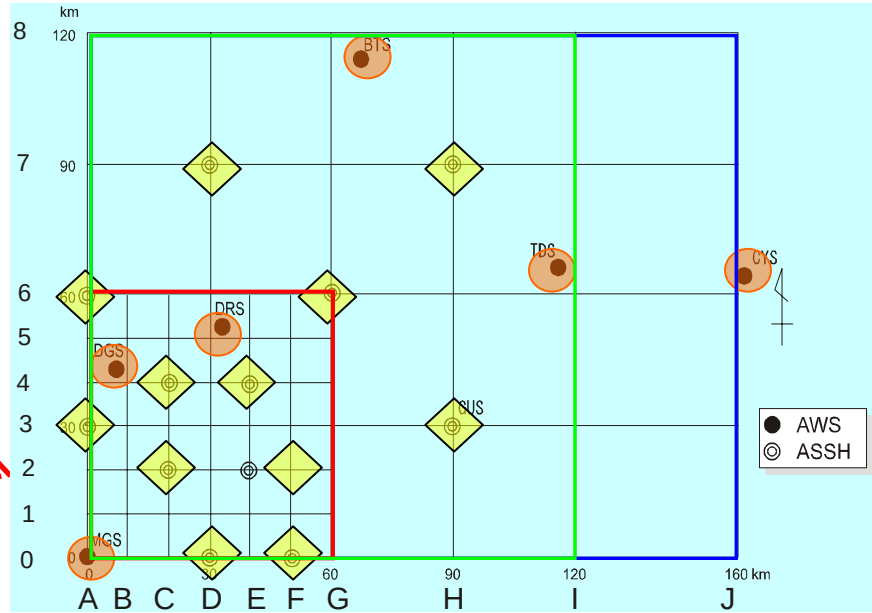
(Nakamura, Matsumura, Hirai, 2003)

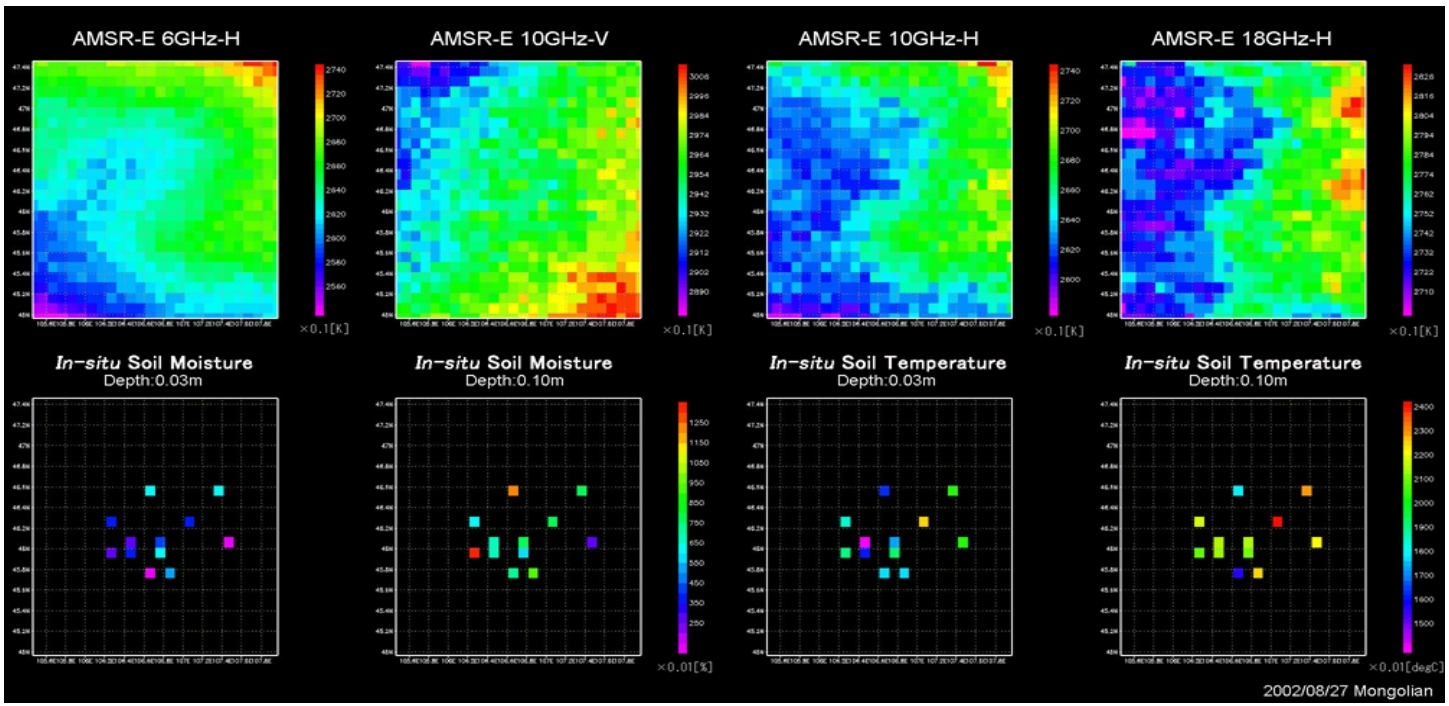




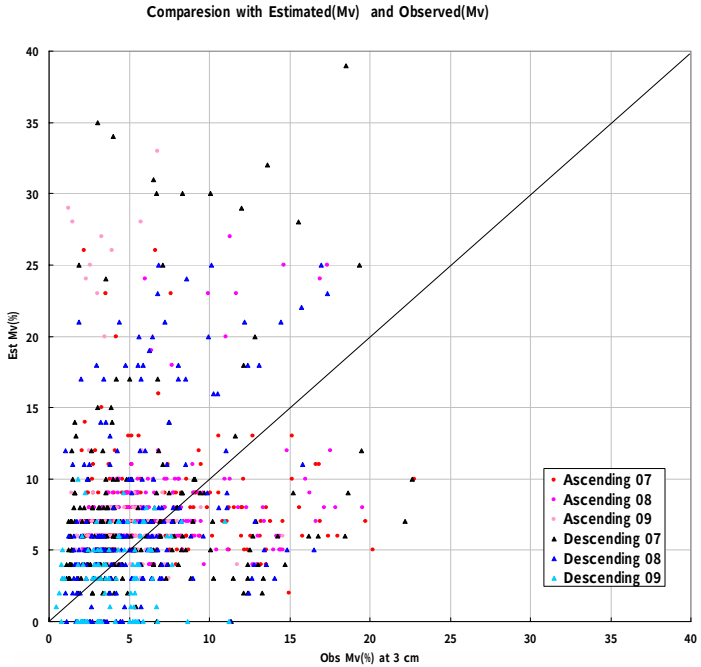
Too much soil moisture in the model leads to the small amplitude of the diurnal cycle of the surface temperature.

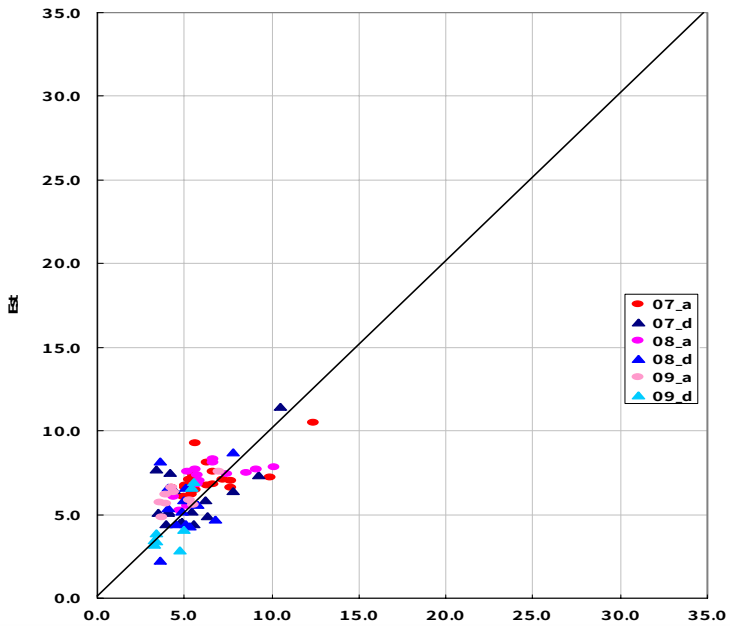
AMSR-E Soil Moisture Validation at the Reference Site in Mongolia

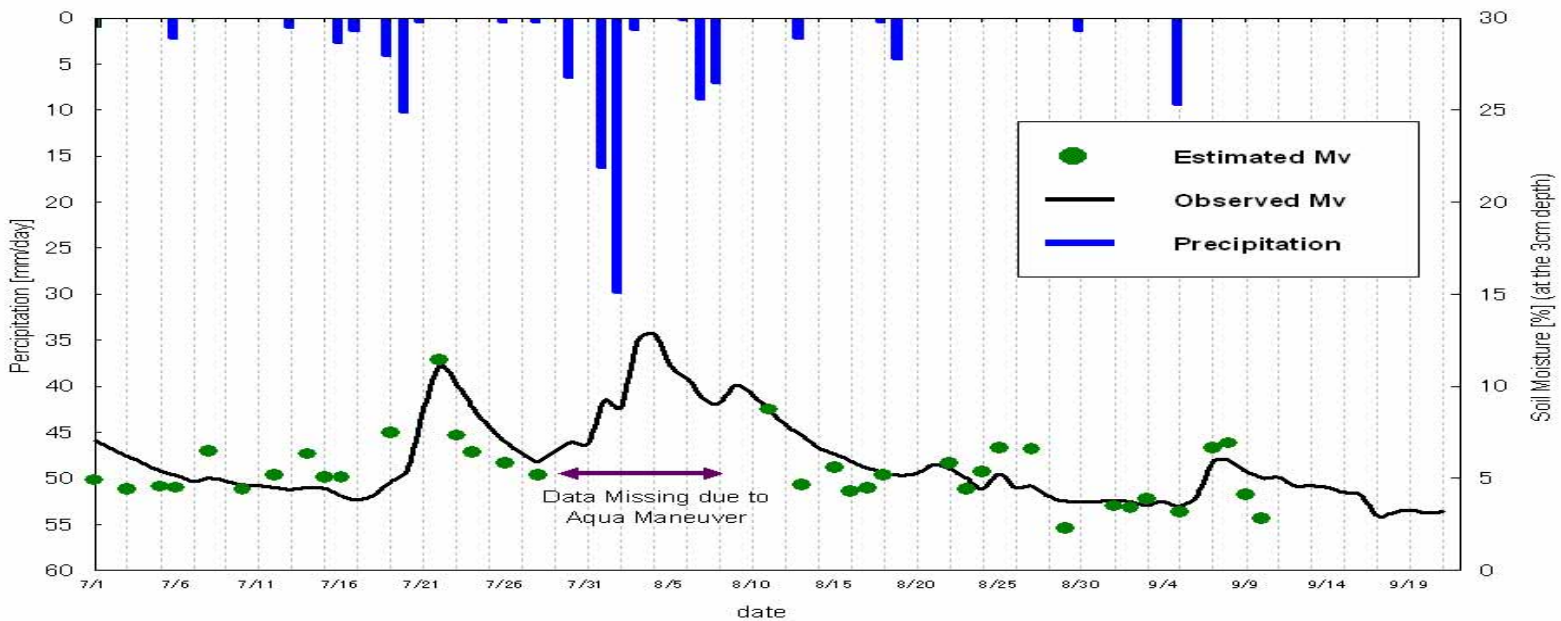




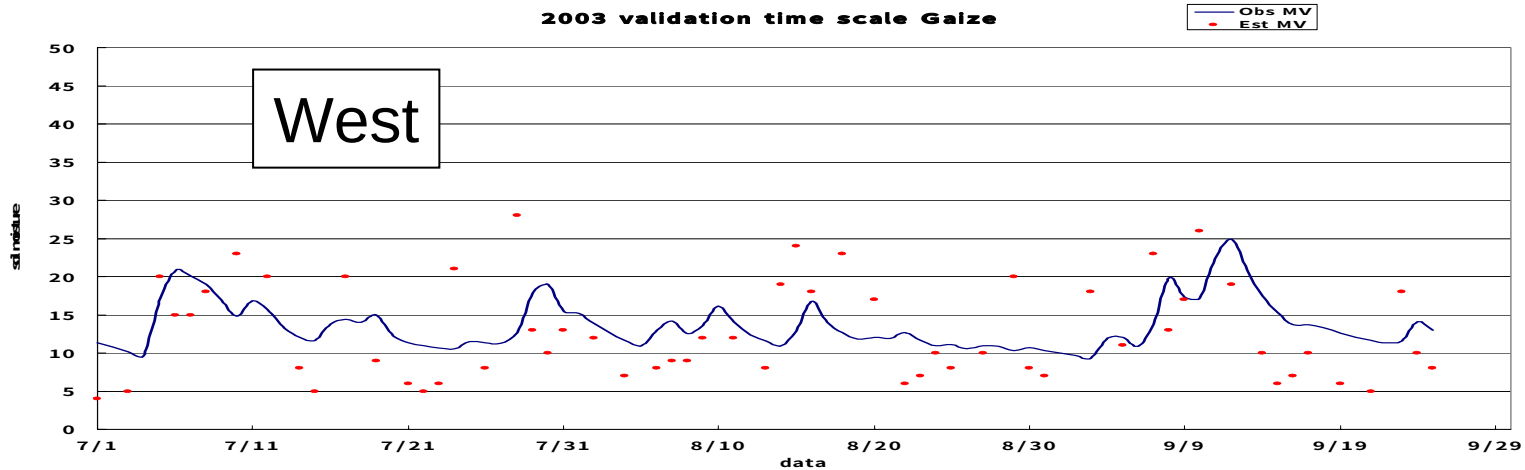
(Koike et al., 2003)





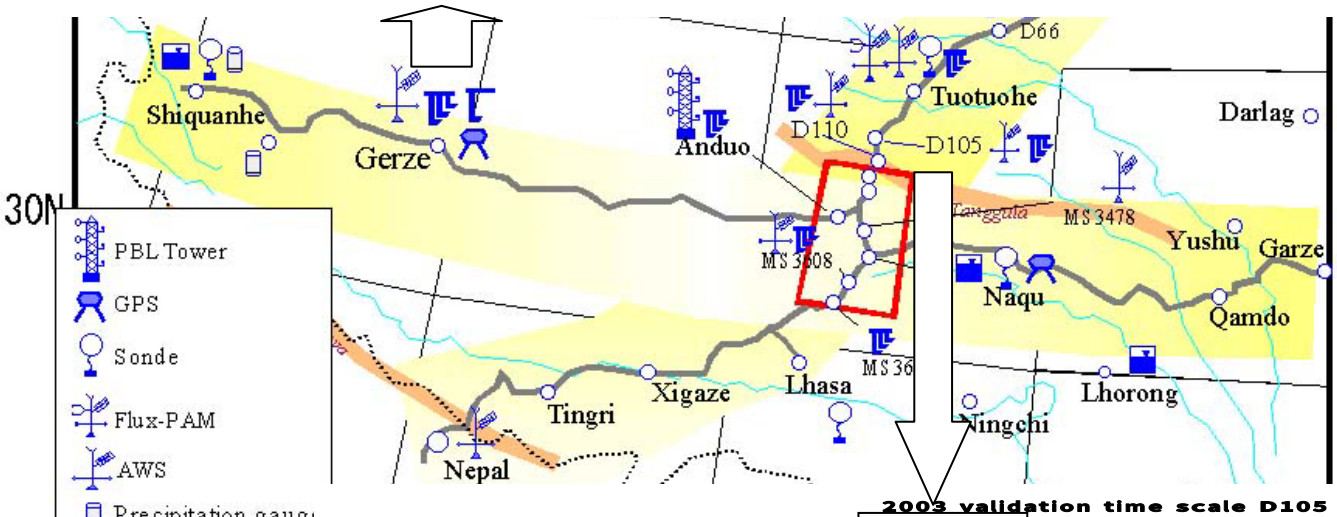


(Koike et al., 2003)

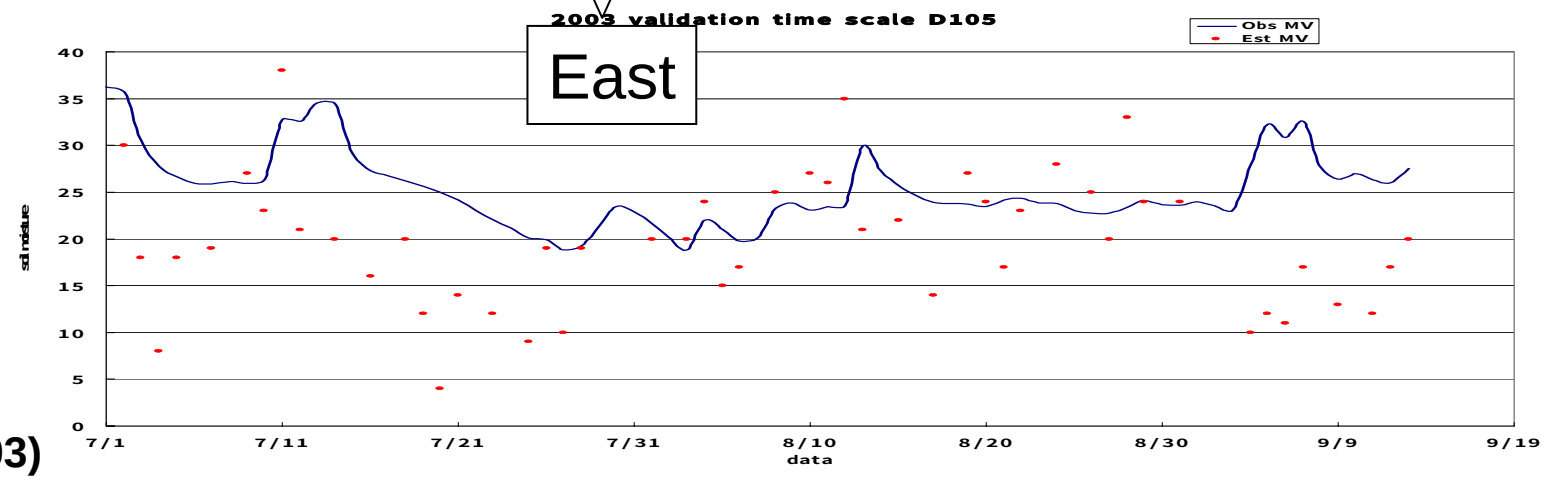


5.7%

average of the absolute errors



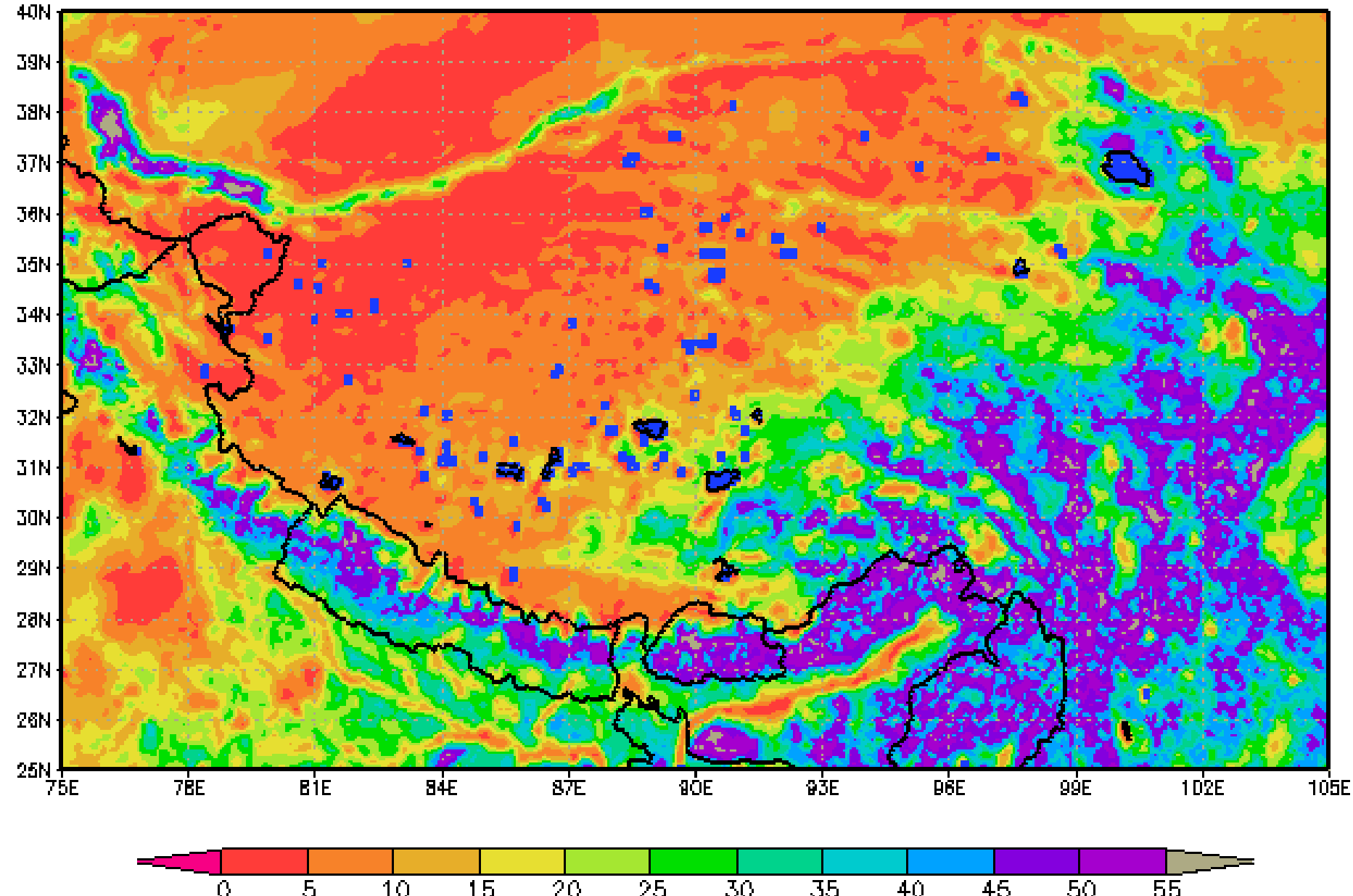
8.1%



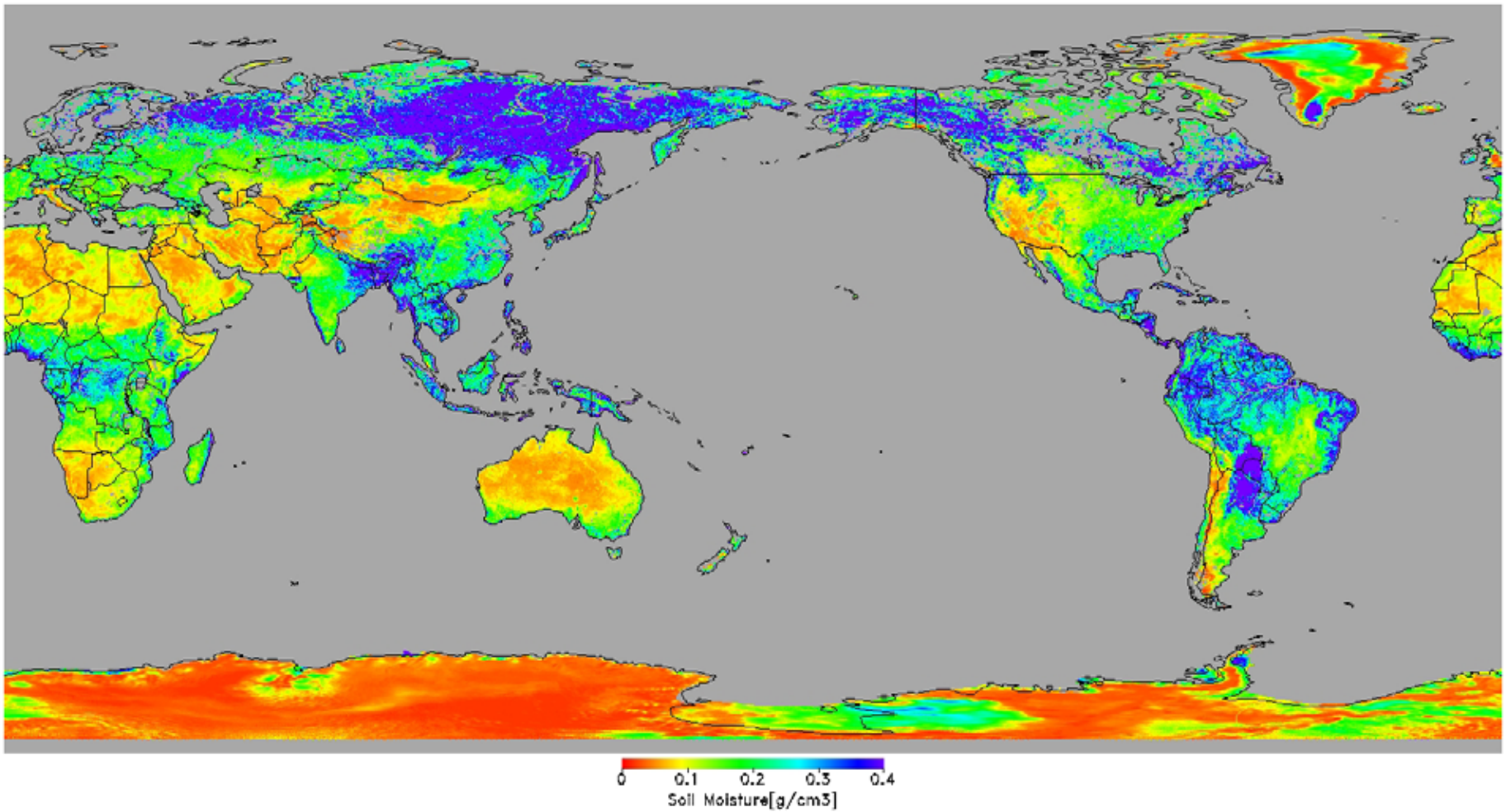
(Koike et al., 2003)

Seasonal Variation of the Soil Moisture in the Tibetan Plateu

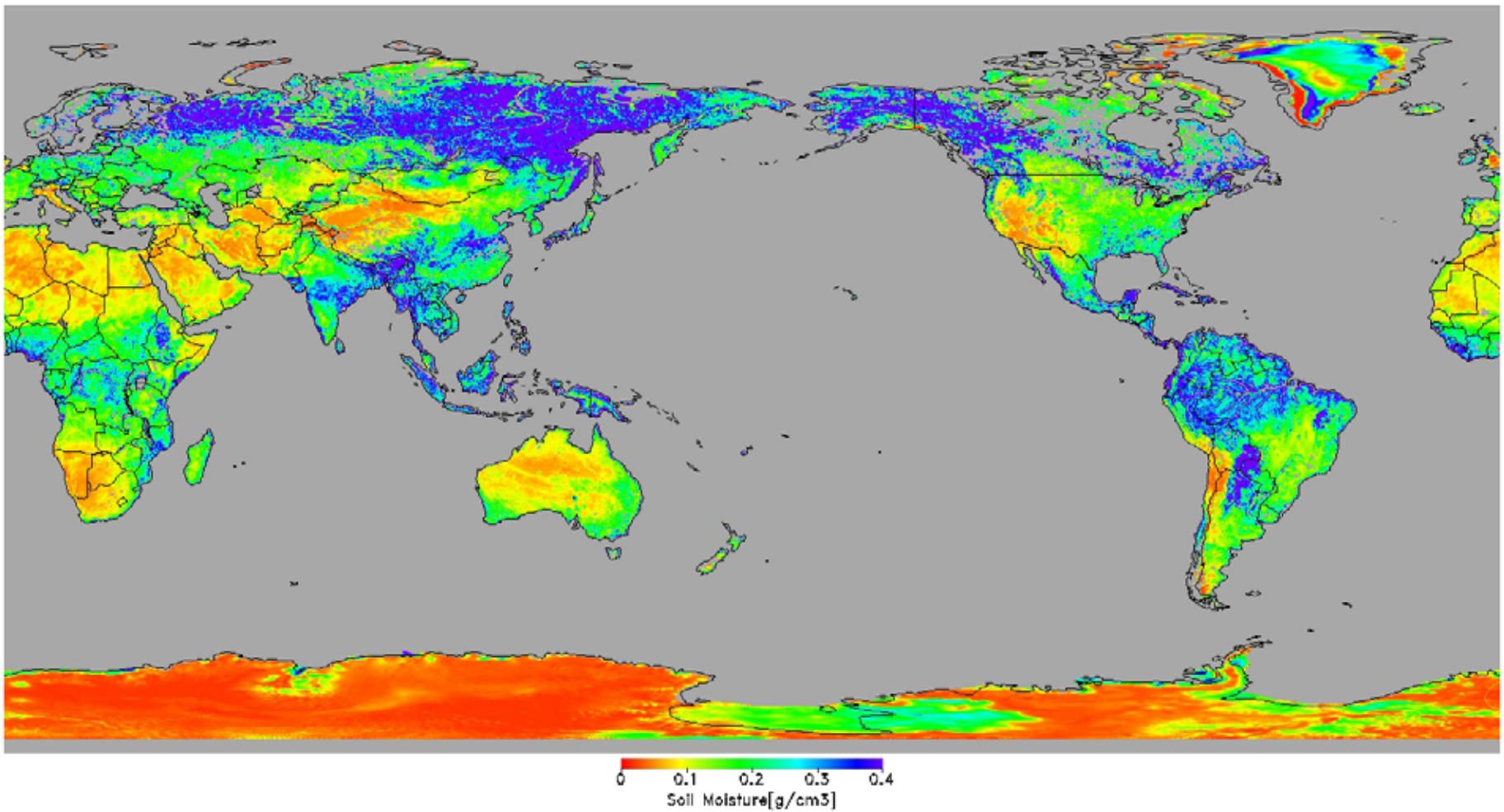
(Koike et al., 2003)

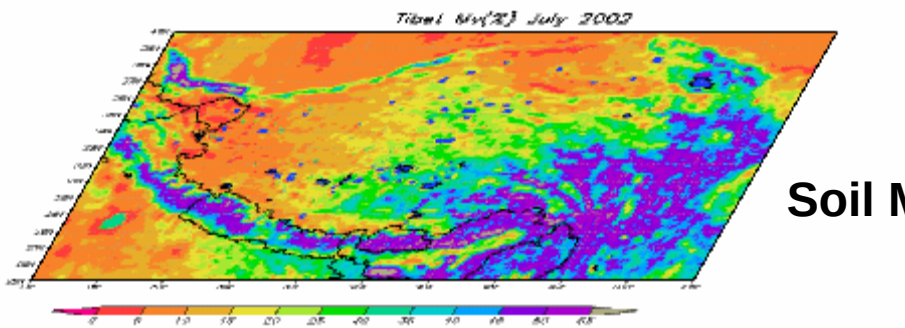


AMSR-E/SM0 5days Mean [Koike 2002/7/1-5 Dec]

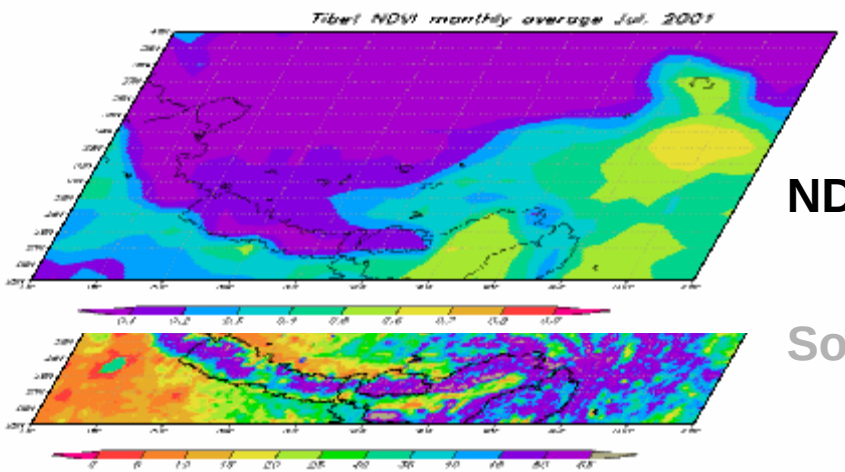


AMSR-E/SM0 5days Mean [Koike 2003/7/1-5 Des]



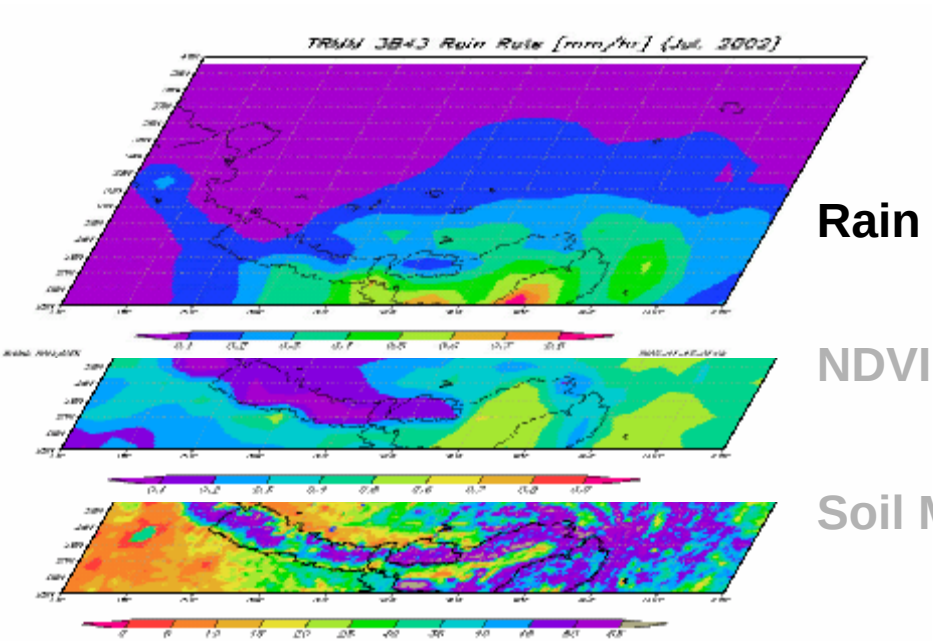


Soil Moisture



NDVI

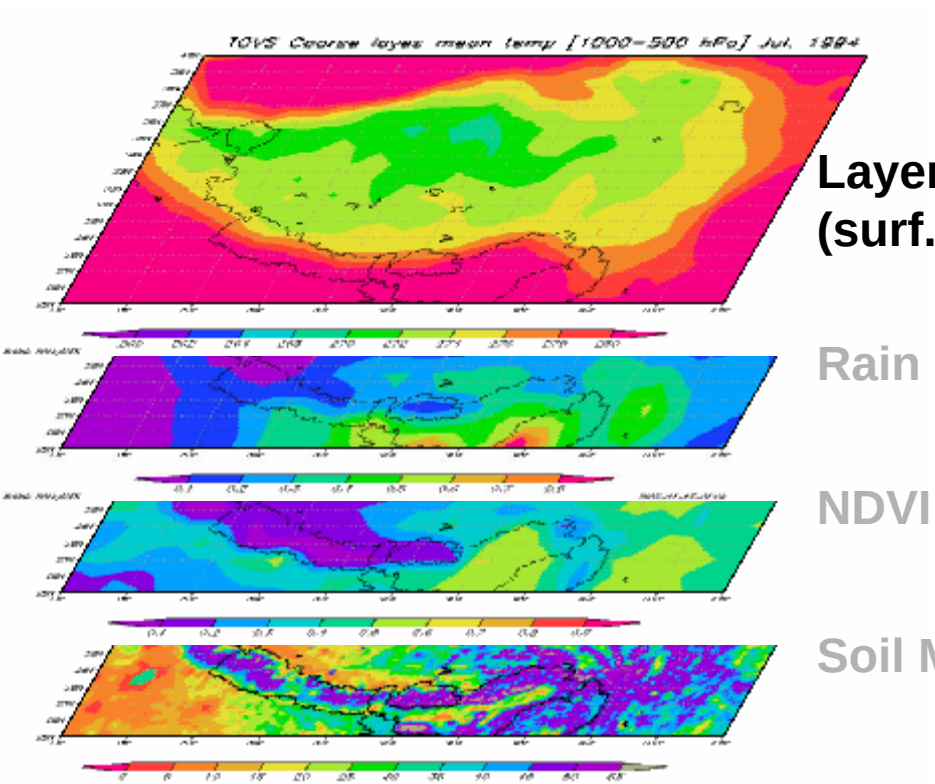
Soil Moisture



Rain Rate

NDVI

Soil Moisture

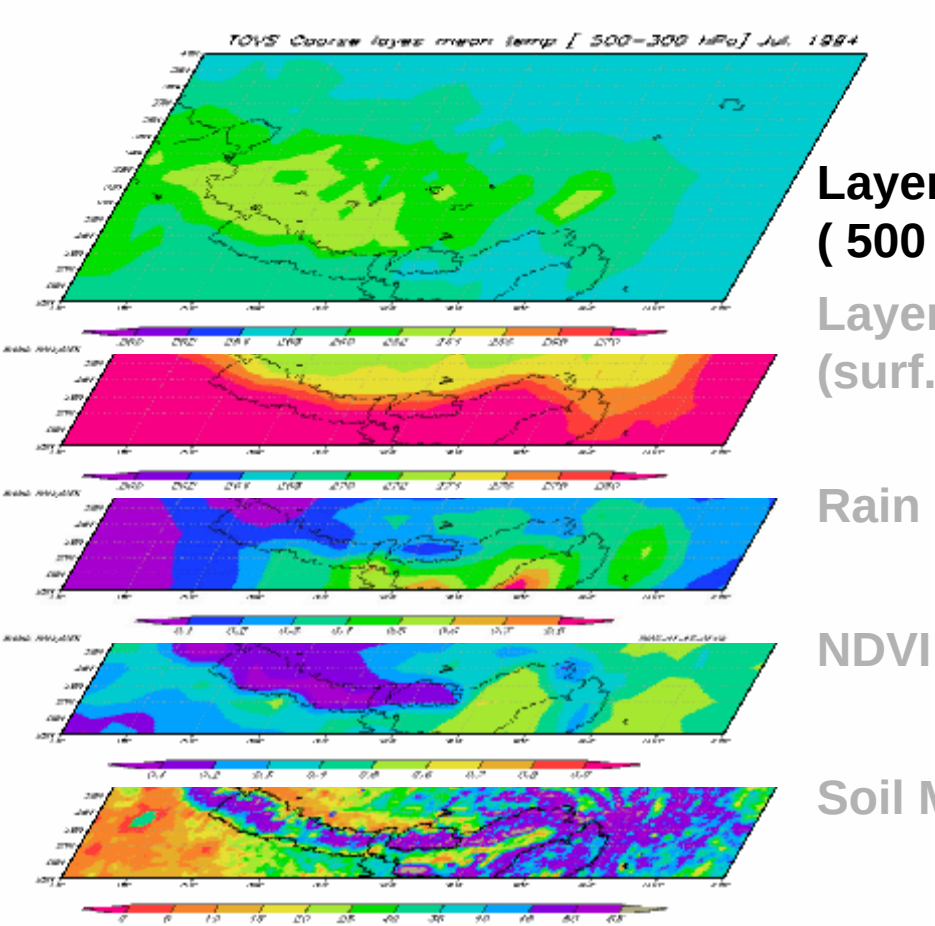


Layer Temp (surf. - 500)

Rain Rate

NDVI

Soil Moisture



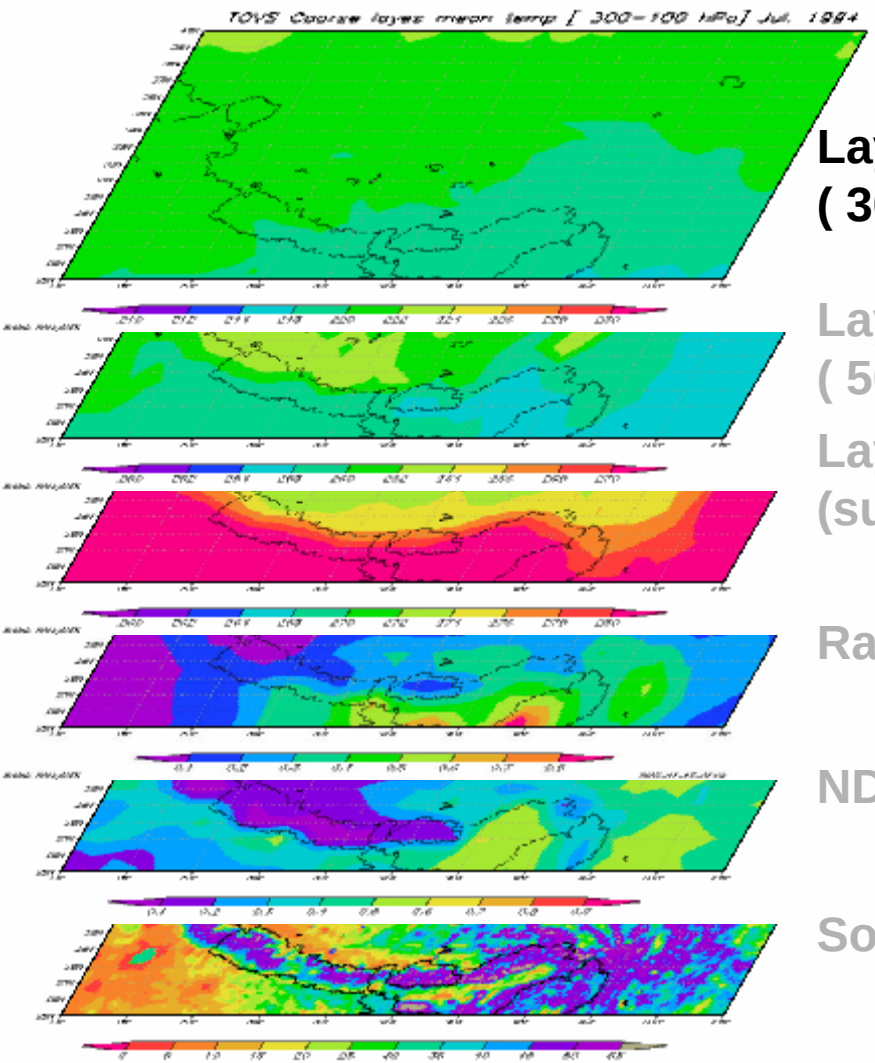
Layer Temp
(500 - 300)

Layer Temp
(surf. - 500)

Rain Rate

NDVI

Soil Moisture



Layer Temp
(300 - 100)

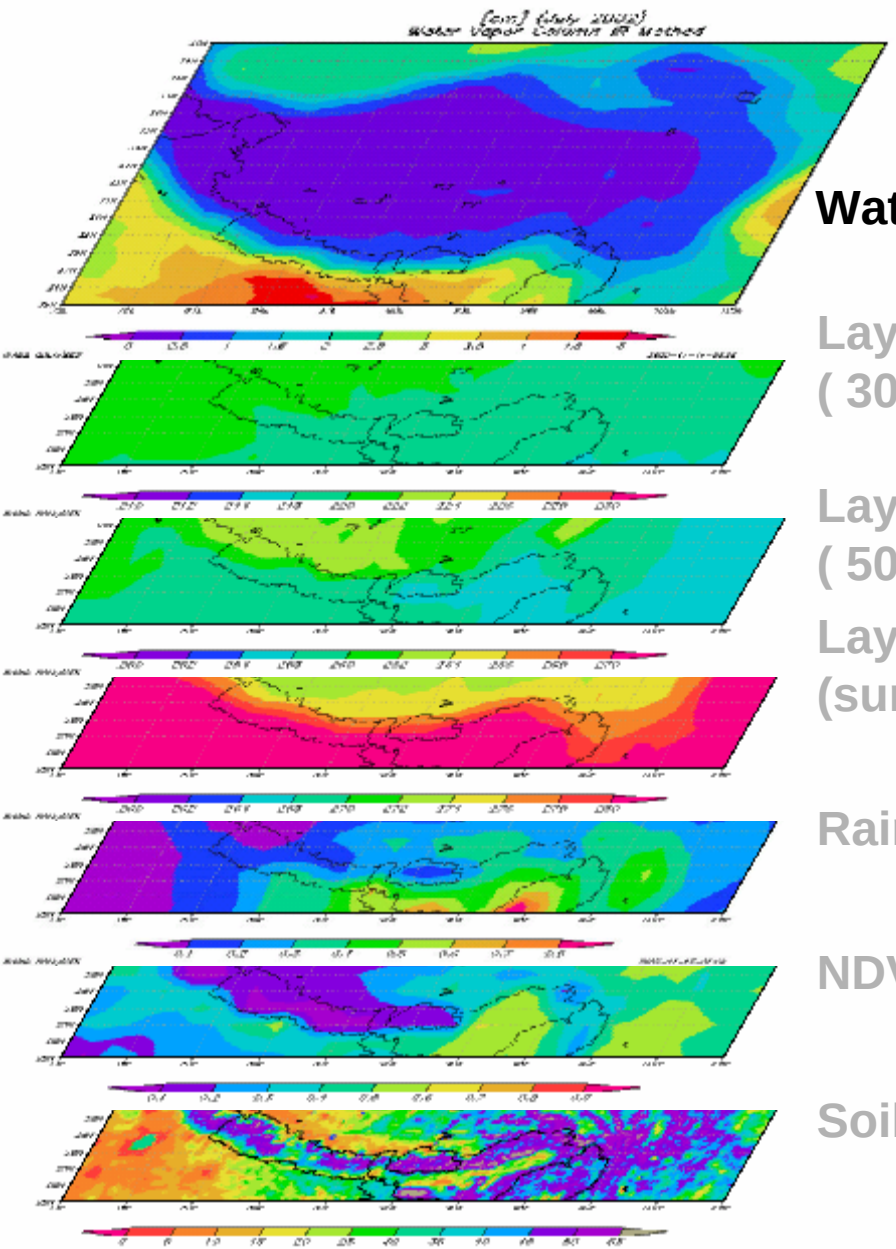
Layer Temp
(500 - 300)

Layer Temp
(surf. - 500)

Rain Rate

NDVI

Soil Moisture



Water Vapor

Layer Temp
(300 - 100)

Layer Temp
(500 - 300)

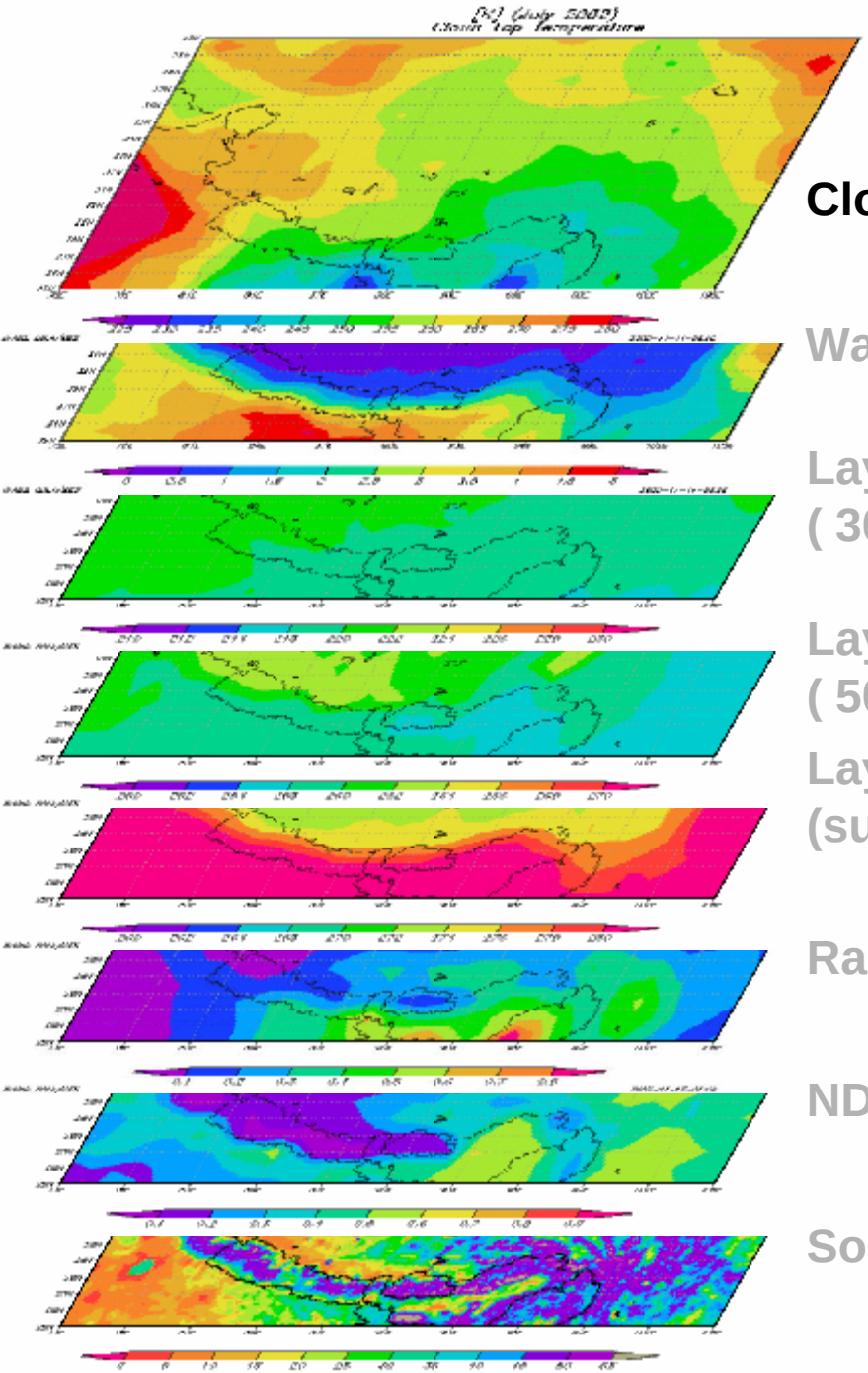
Layer Temp
(surf. - 500)

Rain Rate

NDVI

Soil Moisture

Soil Moisture
Cloud Fraction
NDVI
Water Vapor
Rain Rate



Cloud top Temp.

Water Vapor

Layer Temp
(300 - 100)

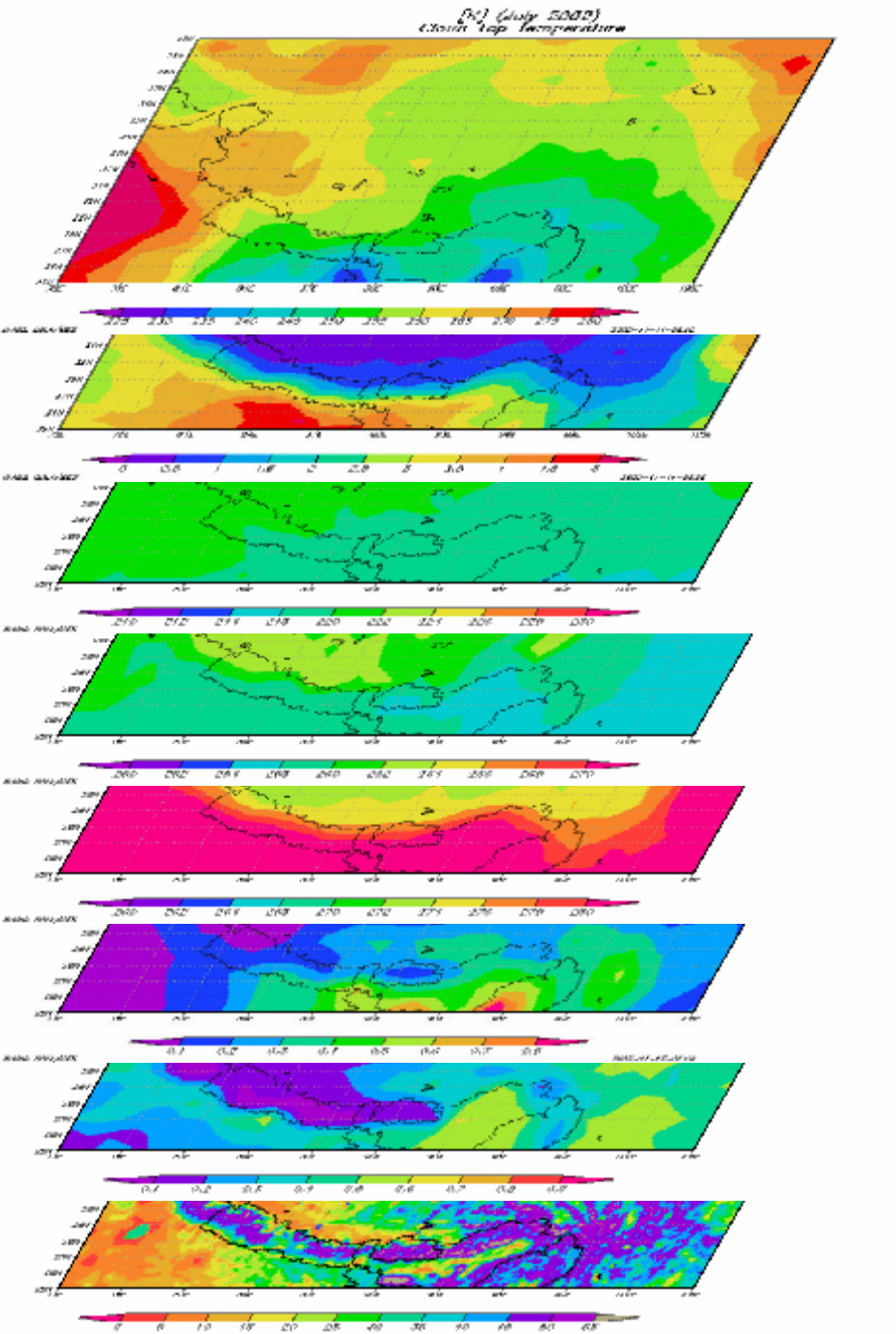
Layer Temp
(500 - 300)

Layer Temp
(surf. - 500)

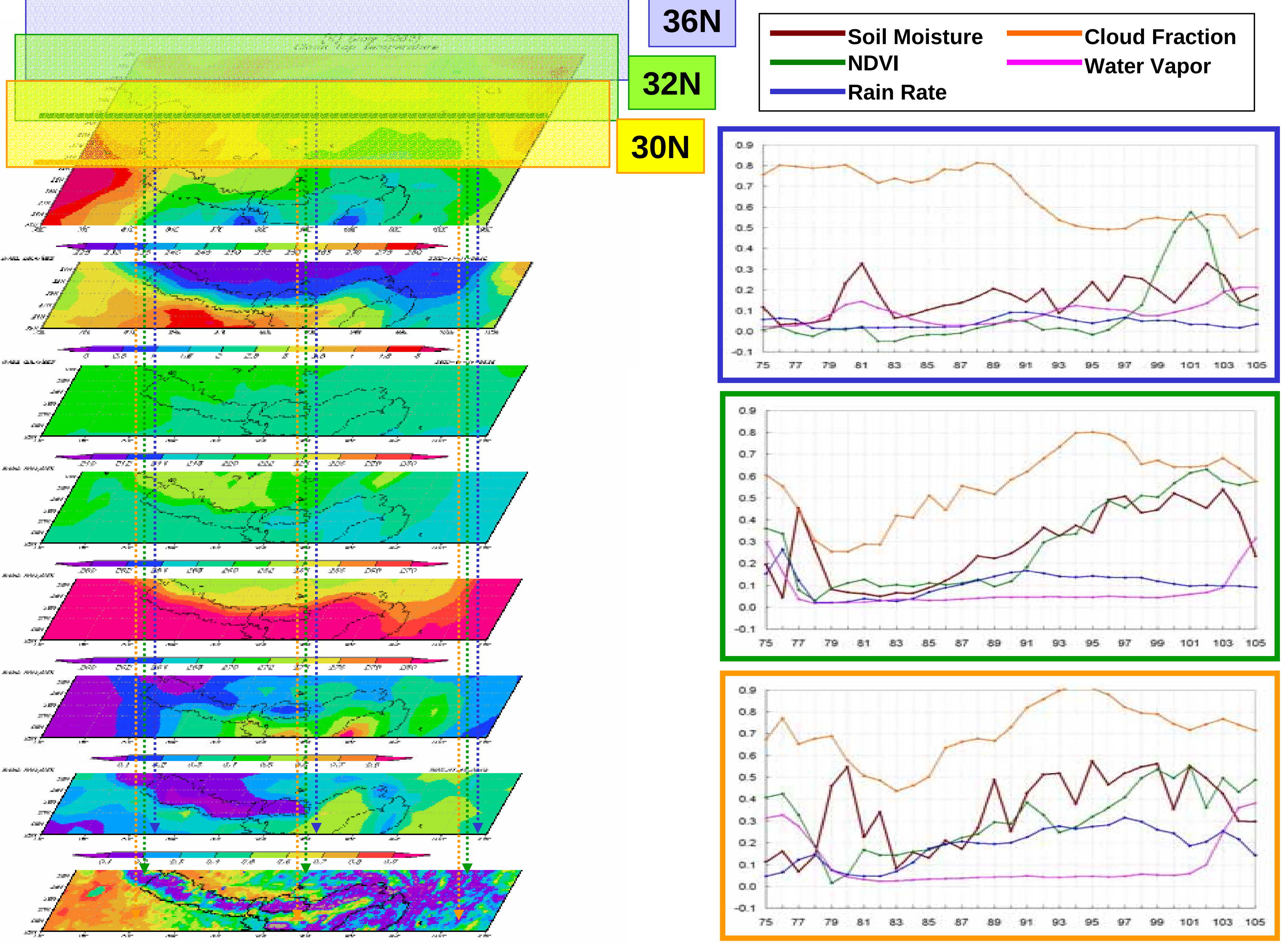
Rain Rate

NDVI

Soil Moisture



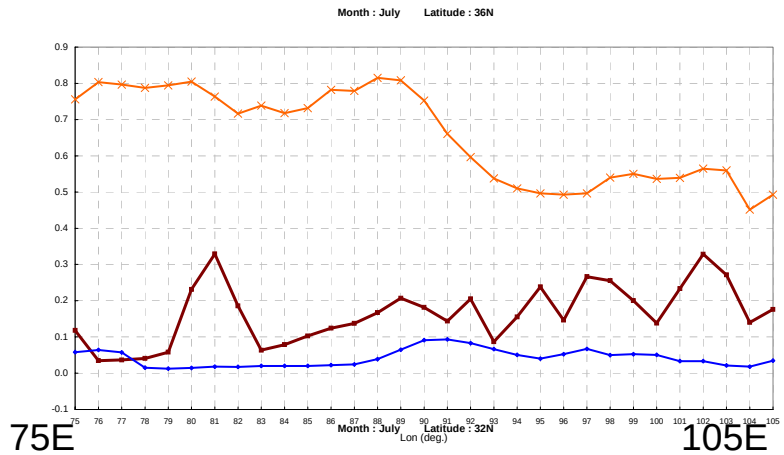
Soil Moisture
Cloud Fraction
NDVI
Water Vapor
Rain Rate

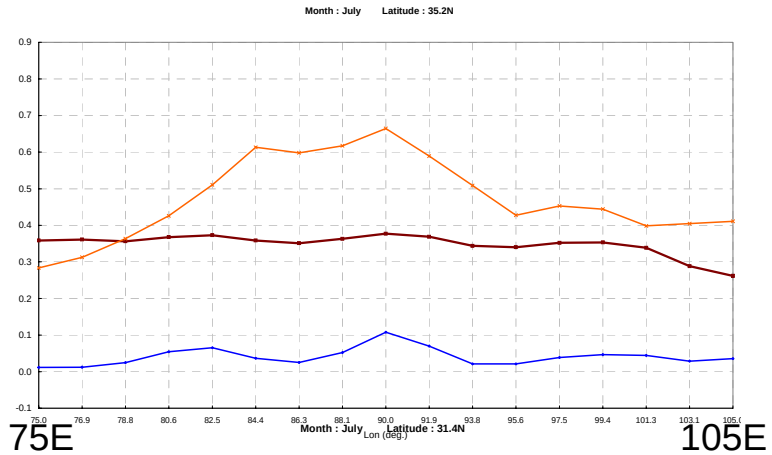


(Koike, Tamagawa, Taniguchi, 2003)

Satellite Product

NCEP/Reanalysis





Soil Moist.

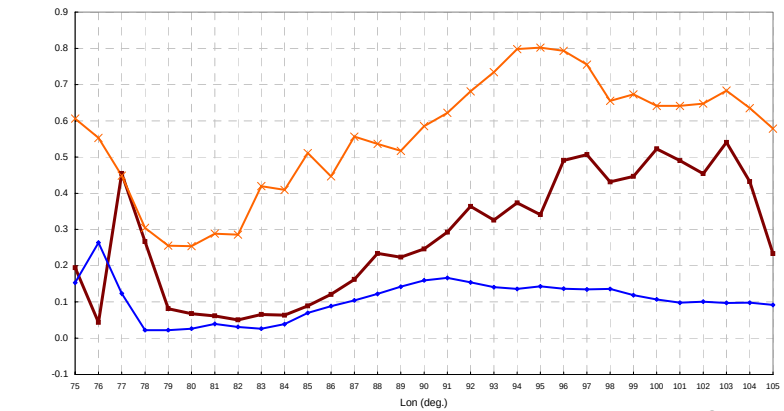
Rain Rate

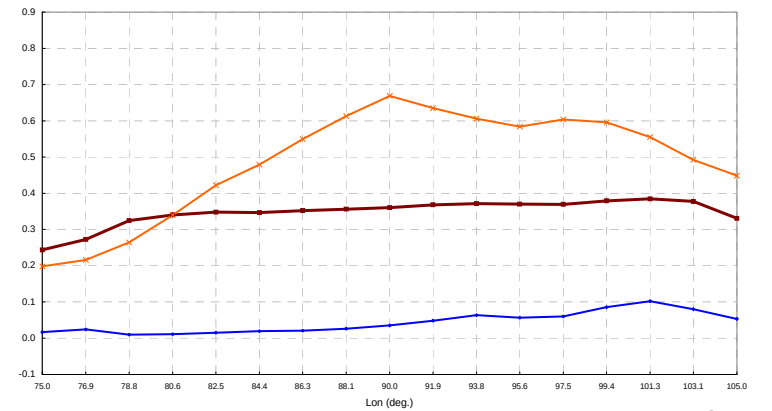
Cloud Frac.

(July, 2002)

36N

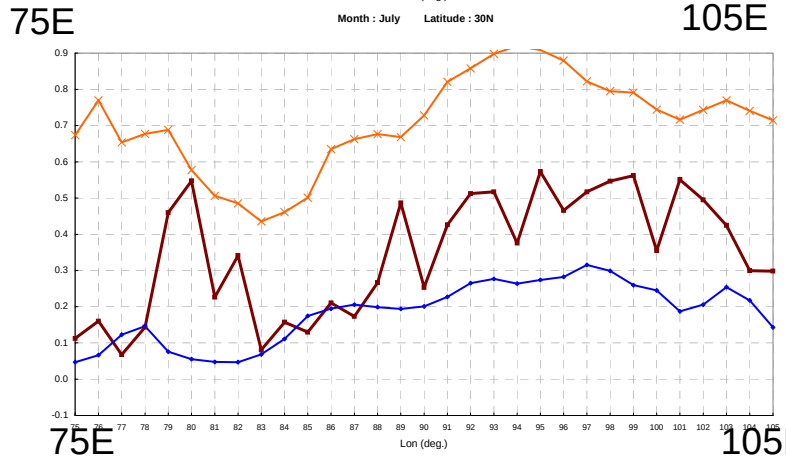
75E 105E 75E 105E

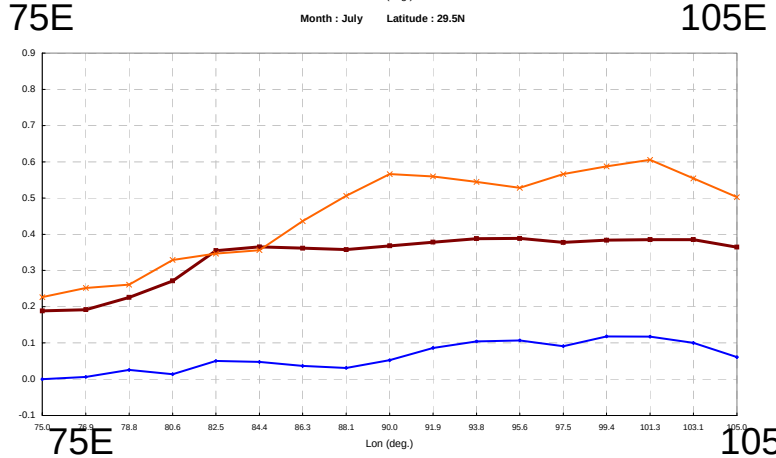




32N

75E 105E 75E 105E





30N

75E 105E 75E 105E

(Koike, Tamagawa, Taniguchi, 2003)

Coordinated Enhanced Observing Period (CEOP)

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

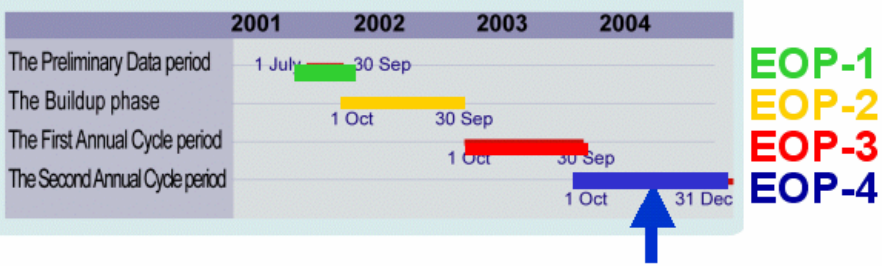
CEOP Objectives:

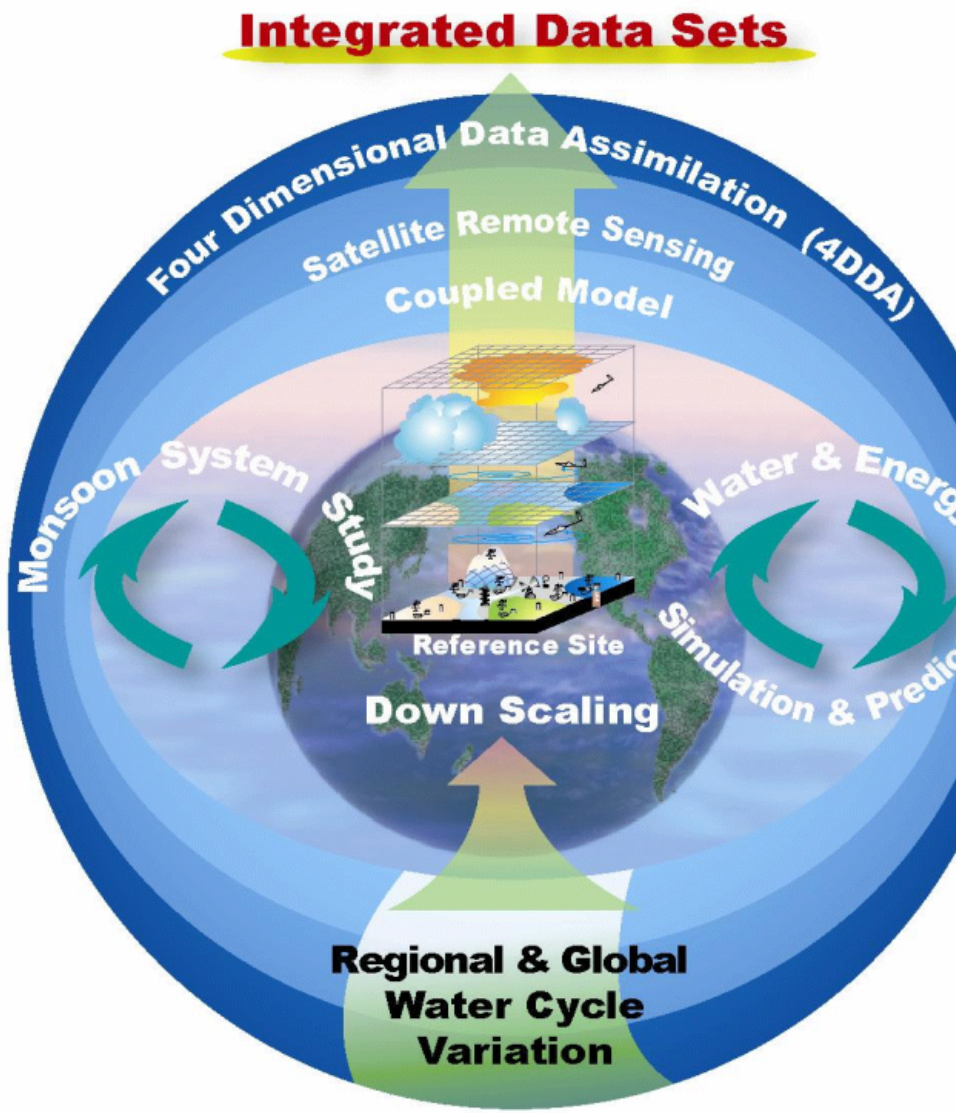
1. Water and Energy-Cycle Simulation and Prediction
2. Monsoon System Studies

CEOP Strategy:

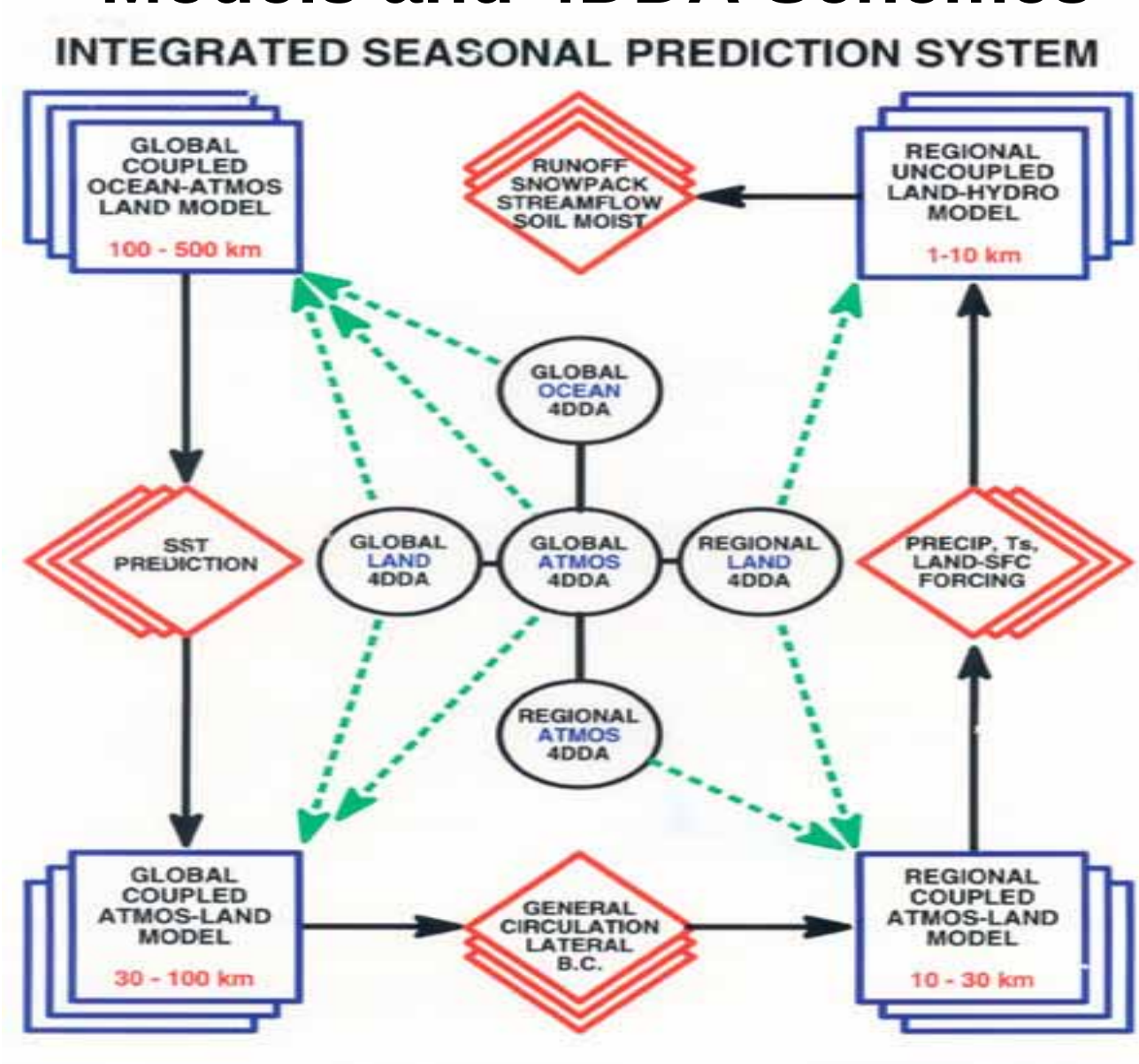
1. The first global integrated data sets of the water cycle with spatial consistency and climate variability, through
   - (i) the ground-based observations from the 36 CEOP reference sites
   - (ii) the satellite observations of the entire water cycle
   - (iii) the simulations of numerical models with physical consistency
2. Challenges to inter-connection of regional water cycles and Down-scaling applications to water resources

CEOP Schedule:





CEOP Down Scaling Strategy by Models and 4DDA Schemes



Mithcell, 2000


CEOS
THE IGOS PARTNERSHIP
WCRP
An agreement among the partners
for the definition, development and
implementation of an integrated global
observing strategy
UNEP
GOS/GAW
GTOS
ICSU
GLOBAL CHANGE
IGFA

The 8th IGOS-Partners

in Kyoto on November 8, 2001

Global water cycle theme

IGOS-P-8 meeting approves the Global Water Cycle Theme

Partners are invited to

(i) support the preparation of a Global Water Cycle theme report on a priority basis;.

(ii) facilitate the development and implementation of this Theme report by:

a) providing necessary support, including the provision of an expert to lead the development of the IGWCO report through consultative meetings and chairing a small writing team;

b) supporting the development of the report and the activities of IGWCO steering committee with the provision of travel support for the participation of their representatives;

Partners endorse CEOP as the first element of the IGWCO

THE PRIMARY CHALLENGE FOR THE WATER CYCLE

October 2002, recognizing the vital importance of the prediction of the WATER CYCLE, WCRP and space agencies will start intensive observations to collect water-cycle related data.

Gained knowledge should be shared worldwide for the maximum social benefits. To achieve this goal, wider support must come from UN organizations and the broader international community.

- ***The earth environment** is formed by the distribution of energy through **the WATER CYCLE.***
- ***Humans and ecosystems** suffer serious damage associated with the variability of **the WATER CYCLE.***
- ***To address floods and draughts,** we must improve understanding and prediction of **the WATER CYCLE.***

The Coordinated Enhanced Observing Period (CEOP)

Global efforts will start for intensive observations of global WATER CYCLE for two full years(2002-2004).

- **The World Climate Research Programme (WCRP)** will support the collection of uniformly formatted ground-based WATER CYCLE data sets from the 33 reference sites with globally consistent coverage for observing climate variability.
- **Space agencies** will provide data sets of all aspects of the WATER CYCLE by contributing products from the newest earth observing satellites e.g., TRMM, ENVISAT, Aqua and ADEOS-II.
- **Numerical weather prediction centers** will provide physically consistent model outputs of the WATER CYCLE on both regional and global scales.
- **CEOP integrated data sets will be open to the international community** for use in understanding the monsoon systems and the temporal and spatial variation of the water budget and for improving numerical prediction models. Successful achievement of CEOP is a first step toward establishing an integrated global WATER CYCLE observation system.

The next step is to support international frameworks for long-term monitoring of the WATER CYCLE and for maximizing the use of new WATER CYCLE information for societal benefit.

- **We need** to establish **an international ground-based observational network** of the WATER CYCLE by engaging a broad group of participants beyond those contributing to CEOP.
- **We need a comprehensive and continuous satellite observing strategy** for the WATER CYCLE, especially for the global rainfall.
- **We need** to establish **information systems and services** for integration of the observational, model and social water/land use data and products, and for international distribution of data for interpreting scientific outputs for actual social applications.
- **We need international administrative expertise and governmental cooperation** from all countries to apply the newly integrated WATER CYCLE information for maximum societal benefit

WSSD Plan of Implementation in Johannesburg in 2002

Paragraph 28

Improve water resource management and scientific understanding of the water cycle through cooperation in joint observation and research, and encourage and promote knowledge sharing, and provide capacity-building and the transfer of technology, as mutually agreed, including remote-sensing and satellite technologies, particularly to developing countries as well as countries with economies in transition, for this purpose.

The 3rd
World Water Forum
March 16-23,2003 in Kyoto.Shiga and Osaka,Japan

Ministerial Declaration

Water Resources Management and Benefit Sharing

We will further encourage scientific research on predicting and monitoring the global water cycle. including the effect of climate change, and develop information systems that enable the sharing of such valuable data worldwide.

Water and Climate Session Recommendations

- Reverse the trend of further deteriorating in-situ data collecting and observational networks
- Develop comprehensive and continuous satellite to ground observing strategy for the WATER CYCLE, especially for the rainfall

2003 G8 Summit Water

…in order to achieve the goals of the Millennium Declaration and the Plan of Implementation of the World Summit on Sustainable Development (WSSD)….. We are committed to playing a more active role in the international efforts towards achieving these goals, on the basis of the Monterrey consensus and building upon the outcomes of the Third World Water Forum and the Ministerial Conference held in Japan in March 2003.

4 Strengthening monitoring, assessment and research
4.1 In collaboration with all stakeholders, we will promote co-ordination of mechanisms for information sharing and monitoring by utilising existing UN and other systems and the network of websites established at the Third World Water Forum Ministerial Conference, and will encourage relevant international organisations to operate them.
4.2 We will support strengthening water monitoring capacity in partner countries to complement existing monitoring efforts.
4.3 We will support the development of mechanisms for collaboration in water-cycle related research, and enhance research efforts in this area.

The 1st Earth Observation Summit
Washington DC, July 31, 2003

Argentina
Australia
Belize
Belgium
Brazil
Canada
China
Cyprus
Denmark
Egypt
European Commission
France
Gabon
Germany
Greece
India
Ireland
Israel
Italy
Japan
Kazakhstan
Mexico
Morocco
Netherlands
New Zealand
Norway
Portugal
Republic of Congo
Republic of Korea
Russian Federation
South Africa
Spain
Sweden
Switzerland
Thailand
Ukraine
United Kingdom
United States

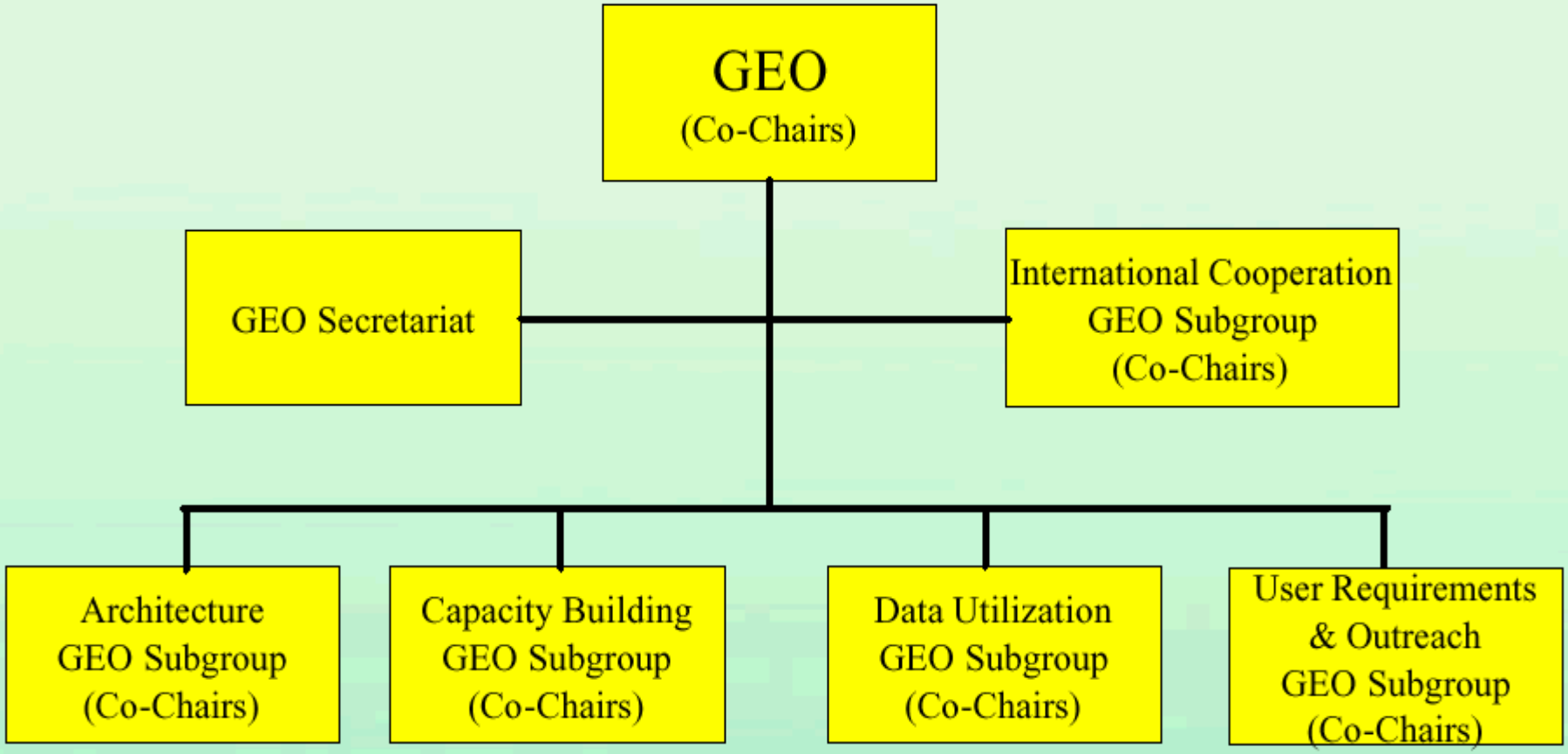
Central American Commission for the Environment and Development (SICA/CCAD) Committee on Earth Observation Satellites (CEOS) European Centre for Medium-Range Weather Forecasts (ECMWF) European Space Agency (ESA) The Network of European Meteorological Services/Composite Observing System (EUMETNET/COS) European Organi-zation for the Exploitation of Meteorological Satellites (EUMETSAT) Global Climate Observing System (GCOS) Global Ocean Observing System (GOOS) Global Terrestrial Observing System (GTOS) Integrated Global Observing Strategy Partnership (IGOS-P) Intergovernmental Oceanographic Commission (IOC) International Agency for the Development of Environmental Information (ADIE) International Council for Science (ICSU) International Geosphere-Biosphere Program (IGBP) International Group of Funding Agencies for Global Change Research (IGFA) Food and Agriculture Organization of the United Nations (FAO) Partnership for Observation of the Global Oceans (POGO) United Nations Educational, Scientific and Cultural Organization (UNESCO) United Nations Environment Programme (UNEP) United Nations Framework Convention on Climate Change (UNFCCC) United Nations Office for Outer Space Affairs (UNOOSA) World Bank (IBRD) World Climate Research Programme (WCRP) World Meteorological Organization (WMO)

DECLARATION OF
THE EARTH OBSERVATION SUMMIT
in Washington DC in July 2003

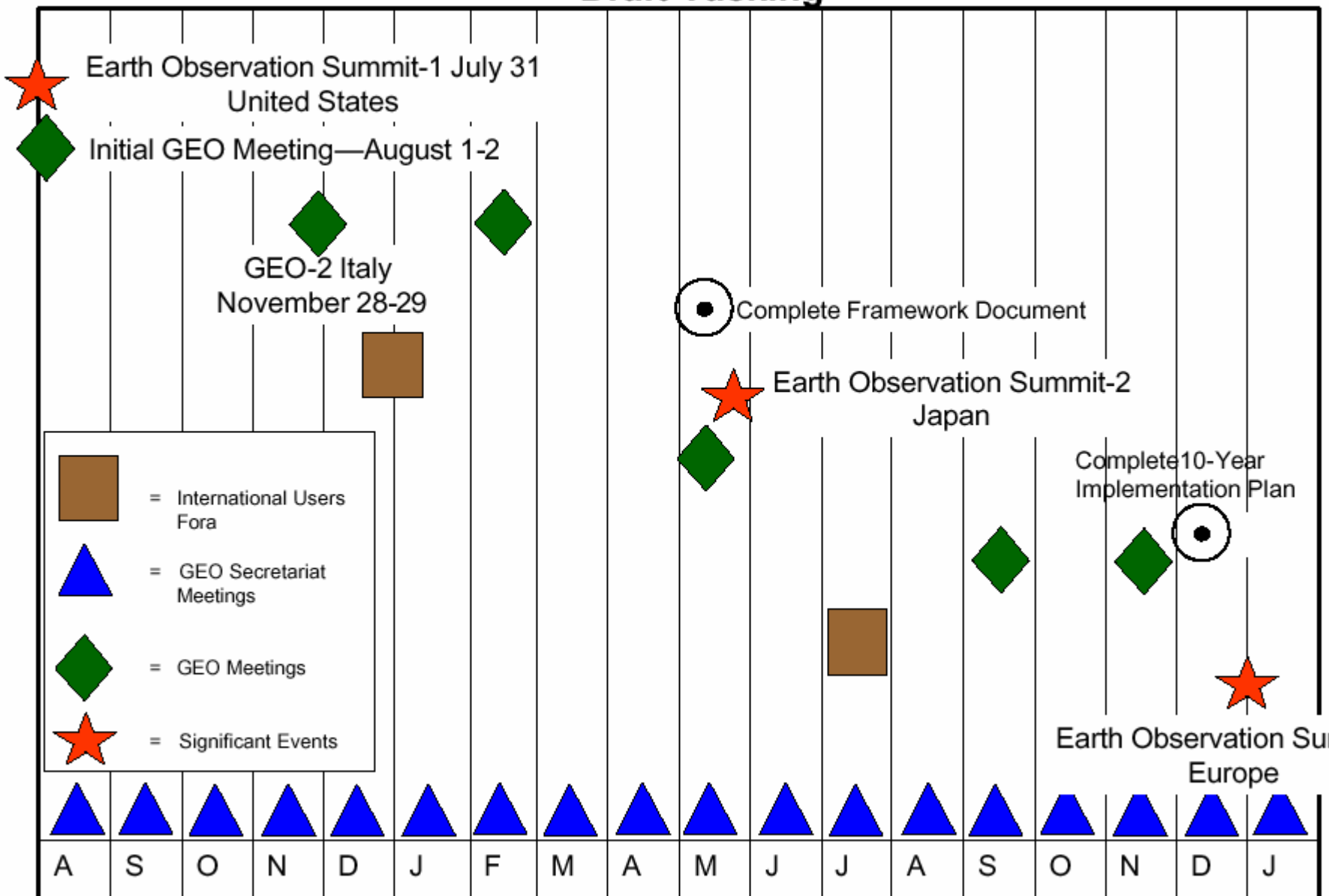
- Affirmed need for timely, quality, long-term, global information as a basis for sound decision making.
- Recognized need to support:
  1) Comprehensive, coordinated, sustained Earth observation system or systems;
  2) Coordinated effort to address capacity-building needs related to Earth observation;
  3) Exchange of observations in a full and open manner with minimum time delay and minimum cost; and
  4) Preparation of a 10-year Implementation Plan, building on existing systems and initiatives
     1) Framework for Tokyo ministerial, April or May 2004
     2) 10-year plan for EU ministerial in late 2004.
- Established *ad hoc* Group on Earth Observations (GEO) to develop Plan
- Invited other governments to join.

Group on Earth Observations

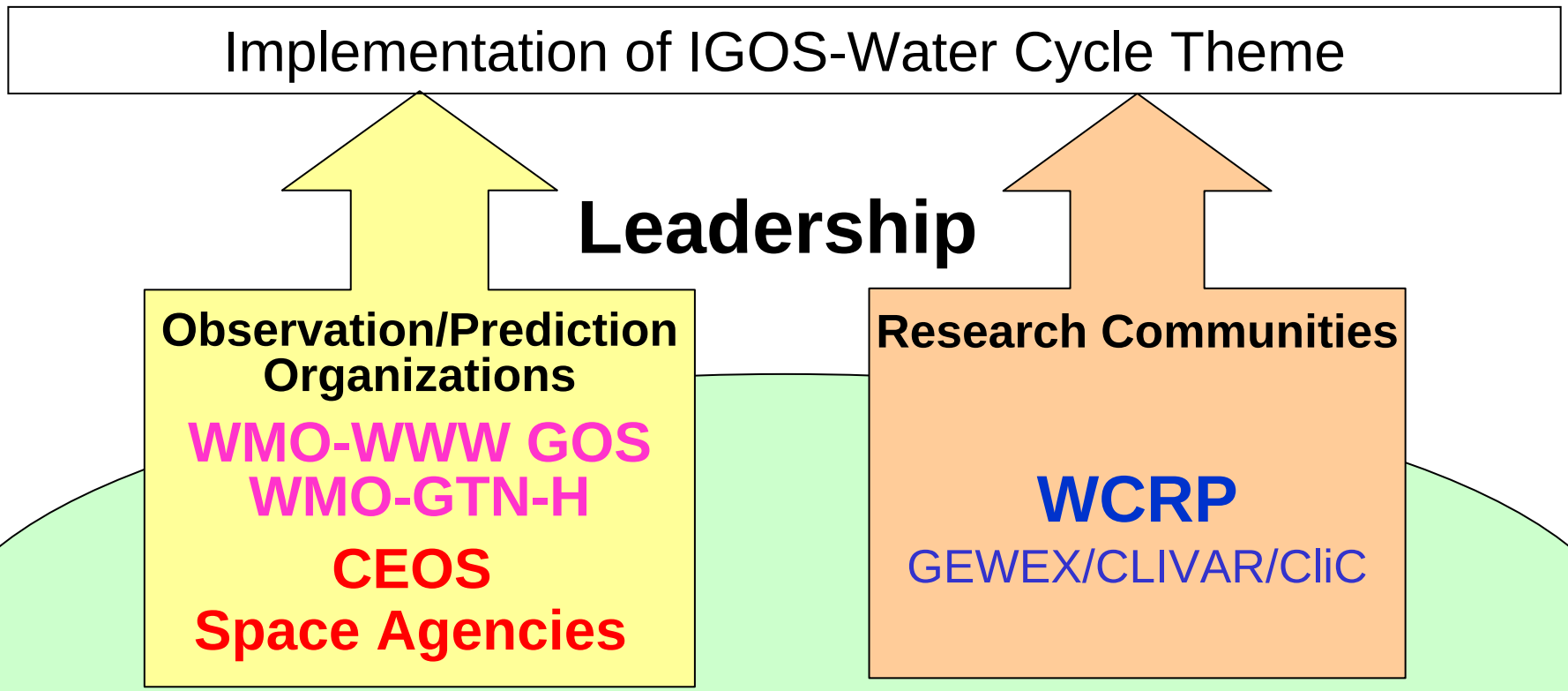
GEO Structure



Ad Hoc Inter-governmental Group on Earth Observation (GEO)
Draft Tasking



CEOP as the First Element of the IGOS Water Cycle Theme
Coordination and Cooperation
WCRP - CEOS Space Agencies - NWPCs Affiliated to WMO



CEOP as the First Element of the IGOS Water Cycle Theme Coordination and Cooperation

WCRP - CEOS Space Agencies - NWPCs Affiliated to WMO

ad hoc Group on Earth Observation

comprehensive, coordinated, and sustained

capacity-building

data exchange in a full and open manner with minimum time delay and minimum cost

10 year implementation plan

close coordination between research communities and obs./prediction organizations

Implementation of IGOS-Water Cycle Theme

Leadership

Observation/Prediction Organizations

WMO-WWW GOS

WMO-GTN-H

CEOS

Space Agencies

Research Communities

WCRP

GEWEX/CLIVAR/CliC

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