

# A Plan for CEOS WTF for CEOP and CEOP Satellite Data Integration Implementation

## 1 Background

The Coordinated Enhanced Observing Period (CEOP) was initially motivated by the World Climate Research Programme (WCRP) Global Energy and Water Cycle Experiment (GEWEX) international efforts focusing on the measurement, understanding and modeling of water and energy cycles within the climate system. The requirements of GEWEX, the Climate Variability and Predictability (CLIVAR) initiative, the Climate and Cryosphere (CliC) Project and the other WCRP core projects as well as the climate research community at large have been taken fully into account in planning the assembly of a co-ordinated data set that will serve numerical modeling and analyses needs. Plans are for CEOP to assist research into the global atmospheric circulation and changes in water resources. CEOP has gained the interest of other international organizations outside of the WCRP community, as evidenced by the proposal for an Integrated Global Water Cycle Observations (IGWCO) theme within the framework of the International Global Observing Strategy Partnership (IGOS-P), which has re-affirmed CEOP as 'the first element of the IGWCO'. IGOS is a component of the Committee on Earth Observation Satellites (CEOS).

Professor T. Koike, the Lead Scientist for CEOP, on behalf of Dr David Carson, Director of WCRP and Dr Soroosh Sorooshian, Chairman of the GEWEX Scientific Steering Committee (SSG), arranged for the initial launching meeting of the formal CEOP implementation process to be held at the Earth Observation Research Center (EORC) of the National Space Development Agency (NASDA), in Tokyo, Japan, from 6-8 March 2002. Dr T. Ogawa, Director of EORC, hosted the meeting. More specifics about CEOP and the Kick-off meeting can be found through the CEOP Internet site: <http://monsoon.t.u-tokyo.ac.jp/ceop/>.

The lead organization representing the CEOS agencies in the Working Group on Information Systems and Services (WGISS) Test Facility (WTF) for CEOP is proposed to be MEXT/NASDA, with possible support from other CEOS members and CEOS affiliates.

The WTF for CEOP will include data and information systems supported by CEOS agencies and affiliates and two CEOP Satellite Data Integration Centers (CSDICs), one at the University of Tokyo (UT) under the cooperation with NASDA and the other at NASA's Goddard Space Flight Center (GSFC). The WTF for CEOP will handle Earth observation satellite data, in-situ data, numerical model output, and four-dimensional data assimilation for atmospheric profiles over land and ocean, land and ocean surface and land sub-surface. For the WTF for CEOP, OpenGIS technology and visualization tools will be utilized.

The CEOS agencies data systems as WTF for CEOP will provide catalogue services for level 1 –3 products and also provide subsetted (edited) level 1b & level 2 for CEOP validation sites ("CEOP customized product") and standard level 3 Earth observation satellite data.

The CSDIC at UT will receive CEOP customized level 1b & level 2 and standard level 3 Earth observation satellite data from CEOS agencies' data systems and information systems and archive them. CSDIC at UT will distribute integrated CEOP products to users. Under the WTF for CEOP collaboration, the CSDIC at UT will develop catalogue interoperability with CEOS agencies' systems by using CEOS developed protocols. In addition, the CSDIC at UT will exchange data and information with CEOS agencies and affiliates as well as users through networks. Integrated CEOP products overlaid with other EO satellite, in-situ and model output will be delivered to users by Web Mapping Technology and other visual technologies through networks.

NASA has developed a Global Land Data Assimilation System (GLDAS) that uses various new satellite and ground based observation systems within a land data assimilation framework to produce optimal output fields of land surface states and fluxes. GLDAS includes four components implemented globally at ¼ degree resolution (higher resolutions are planned) in near real time: land modeling, land surface observation, land surface data assimilation and calibration and validation. The core advantage of GLDAS is its use of satellite-derived observations (including precipitation, solar radiation, snow cover, surface temperature, and soil moisture) to realistically constrain the system dynamics. This allows it to avoid the biases that exist in

near-surface atmosphere fields produced by atmospheric forecast models, minimize the impact of simplified land parameterizations, and to identify and mitigate errors satellite observations used in data assimilation procedures. These value-added GLDAS data will improve land surface, weather, and climate predictions by providing global fields of land surface energy and moisture stores for initialization. GLDAS is a natural and important tool for CEOP because in a globally consistent manner, it will integrate the information from multiple models and observation platforms to provide the best available assessment of the current state of the land surface. CEOP has requested that NASA further develop GLDAS as another CSDIC.

## 2 Team Member List

### 2.1 WGISS

Organization	Staff	Role
NASDA	Shinichi Sobue	WGISS POC
	Osamu Ochiai	WGISS POC
	Tomomi Nio	WGISS POC
NASA (TBC)	Kenneth McDonald	WGISS POC
	Jared K. Entin	WGISS POC

### 2.2 CEOP

Organization	Staff	Role
UT	Toshio Koike	CEOP lead
	Masaru Kitsuregawa	CEOP data integration
	Ryosuke Shibazaki	CEOP data integration
	Yoshifumi Yasuoka	CEOP data integration
NASDA	Naoto Matsuura	NASDA lead
	Shuji Shimizu	NASDA data provider
	Misako Kachi	NASDA data provider
NASA	Paul Houser	NASA co-leads
	Michael Bosilovich	NASA co-leads

## 3 Documents

### 3.1 Applicable document

[A1] Coordination Enhanced Observing Period (CEOP) Implementation Plan (IGPO Publication Series No. 36)

### 3.2 Reference document

[R1] Proposed WTF/CEOP (February 12, 2002 CEOS/WGISS Tokyo)

[R2] Report of Issues/Actions/Recommendations from the Coordinated Enhanced Observing Period (CEOP) Implementation Planning Kick-off Meeting (6-8 March 2001, Tokyo, Japan Rev-1, 4 April 2002)

[R3] Remarks for inclusion in a letter to the CEOS SIT Meeting (18-19 April 2002, Pasadena CA,

## 4 Purpose of this document

This document proposes a Work Plan for the CEOP WGISS Test Facility. It is primarily based the Proposed WTF/CEOP material (3.2 [R1]) presented to CEOS/WGISS in Tokyo at February 2002. It is organized as follow:

- Section 5 describes the high level technical objectives of the WTF/CEOP. There are three items for prototyping and its evaluation. Also, three phased activities concept for satellite data integration is described.
- Section 6 identifies the workpackages for each phase, provides the planned schedule of activities and identifies the main deliverables and milestones.
- Section 7 gives the management plan for the WTF/CEOP project.

## 5 WTF/CEOP objectives

### 5.1 Three Prototyping and Evaluation activities for the WTF/CEOP satellite data Integration

The satellite data integration project has been designed to evolve in steps over the period from October 2002 up to the end of September 2004. In the initial prototyping and evaluation period, data will be required to be sent from the satellite data archives of CEOS/WGISS member organizations to CSDIC at UT. The CSDIC will integrate satellite 4D product with in-situ and model data validation. The 4D visualization prototype will then be undertaken and finally an evaluation of the application and value of the 4D products will be initiated along with the data access capability.

- 1) Data delivery from Satellite Archives (from WGISS organizations) to CSDIC at UT. [see “#1” in fig. 1]
- 2) Satellite-based data product and full 4D product visualization prototyping (by using OGC, GML, VRML, etc) [see “#2” in fig. 1]
- 3) Evaluate the need for 4D product interoperability, data access capabilities, catalog interoperability, etc. [see “#3” in fig. 2]

### 5.2 GLDAS, as CSDIC at NASA, is requested the following function in cooperation with CSDIC at UT

- A testbed for evaluating multiple land surface models.
- Linking and inclusion of reference site observations with globally consistent observation and modeling to enable GEWEX-CSE land transferability studies.
- Land initialization for seasonal-to-interannual coupled predictions.
- Evaluation of NWP and climate predictions for land.
- Integrate remote sensing land observations in land/atmospheric modeling for use in CEOP and higher level understanding.
- Produce a quality control check on observations.
- To produce 4DDA “value-added” GLDAS-CEOP datasets
- The production of GLDAS Model Locate Time Series (MOLTS).
- The expansion of GLDAS to include selected atmosphere and ocean observations
- The development of a long-term archive function.

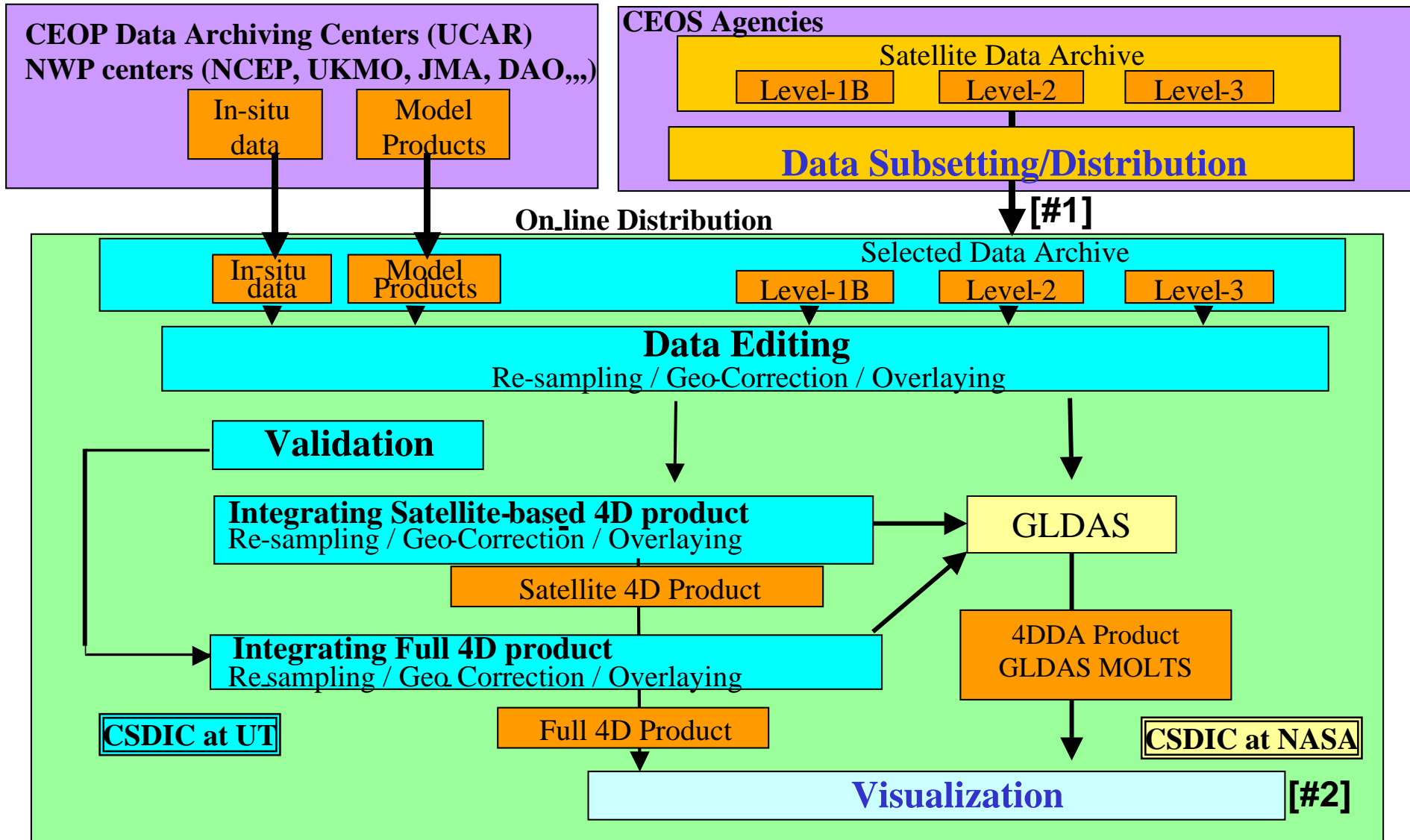
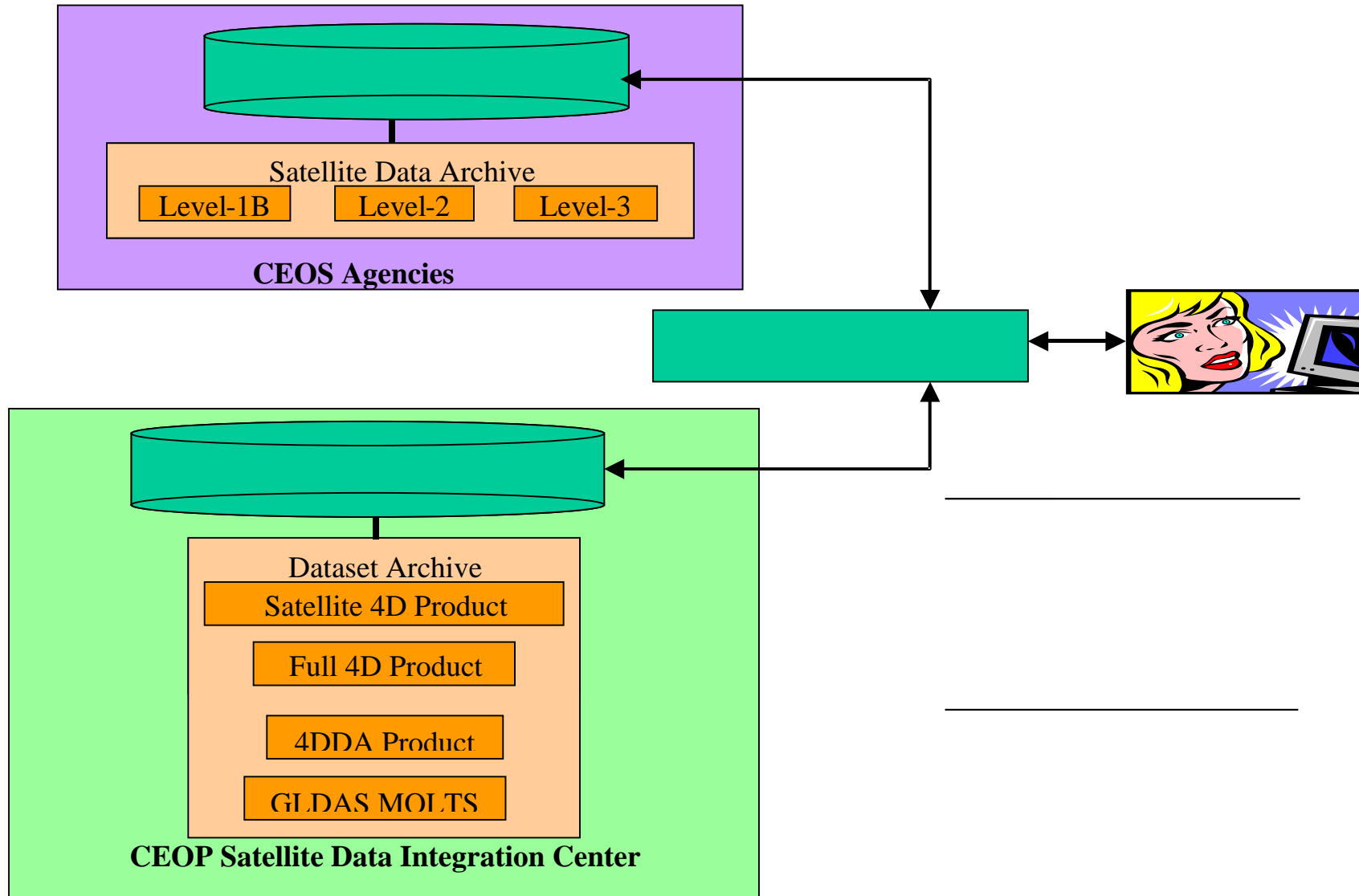


Fig.1 CEOP data flow overview

Fig.2 CEOP data interoperability overview



## 6 Work plan

### 6.1 Three Phased Activities for Satellite Data Integration

- 1) Phase 1 (a, b, c): CEOP Reference Sites (RS)/Global Prototyping
- 2) Phase 2 (a, b): Regional area (Monsoon) Prototyping
- 3) Phase 3: Operational

<b>Phase 1a</b>	
Work Period	June 2002 – Nov. 2002
Participants	NASDA, UT, EUMESAT(TBD)
Data Period	July – Sept. 2001
Data & Area	<ul style="list-style-type: none"> <li>■ TRMM/TMI, PR (NASDA) and DMSP/SSM-I (UT) for the all CEOP Reference Sites (CRSs).</li> <li>■ GMS(UT), GOES(TBD), Meteosat(EUMESAT(TBD)), ancillary (other data centers) for the all CRSs.</li> <li>■ Terra/MODIS, NOAA/AVHRR (UT) for the CRS in Asia</li> </ul>
Prototyping	<p>[#1] NASDA and UT to deliver the satellite subsetting data to CSDIC</p> <p>[#2] NASDA and CSDIC will prototype 4D product visualization</p> <p>[#3] NASDA and CSDIC will evaluate the need for 4D product interoperability, data access capabilities, catalog interoperability.</p>
Evaluation	WGISS SG/EOGEO (dry run), WGISS, CEOS Plenary GEWEX SSG, WCRP JSC
<b>Phase 1b</b>	
Period	Dec. 2002 – May 2003
Participants	NASDA, UT, EUMESAT(TBD), NASA(TBD), ESA(TBD) or other WGISS members
Data Period	July – Sept. 2001 and Oct. 2002 – Mar. 2003
Data & Area	<ul style="list-style-type: none"> <li>■ TRMM/TMI, PR, Aqua/AMSR-E (NASDA) and DMSP/SSM-I (UT) for the all CRSs.</li> <li>■ GMS(UT), GOES(TBD), Meteosat(EUMESAT(TBD)), ancillary (other data centers) for the all CRSs.</li> <li>■ Terra/MODIS, NOAA/AVHRR (UT) for the CRS in Asia</li> <li>■ ENVISAT/ASAR (ESA) and Terra/MODIS, CERES, MISR, ASTER, Aqua/MODIS, CERES, AIRS (NASA) for the all CRSs.</li> </ul>
Prototyping	<p>[#1] NASDA, ESA, NASA and UT to deliver the satellite subsetting data to CSDIC</p> <p>[#2] NASDA, ESA, NASA and CSDIC will prototype 4D product visualization</p> <p>[#3] NASDA, ESA, NASA and CSDIC will evaluate the need for 4D product interoperability, data access capabilities, catalog interoperability.</p>
Evaluation	WGISS SG/EOGEO (dry run), WGISS, IGOS-P10 GEWEX Hydro-meteorology Panel (GHP)

<b>Phase 1c</b>	
Period	Jun. 2003 – Sept 2005
Participants	NASDA, UT, EUMESAT(TBD), NASA(TBD), ESA(TBD) or other WGISS members
Data Period	July – Sept. 2001 and Oct. 2002 – Sept. 2004
Data & Area	<p>For the all CRSs</p> <ul style="list-style-type: none"> <li>■ TRMM/TMI, PR, Aqua/AMSR-E, ADEOS-II/GLI, AMSR(NASDA)</li> <li>■ GMS(UT), GOES(TBD), Meteosat(EUMESAT(TBD)), ancillary (other data centers)</li> <li>■ DMSP/SSM-I, NOAA/AVHRR (UT)</li> <li>■ ENVISAT/ASAR (ESA)</li> <li>■ Terra/MODIS, CERES, MISR, ASTER, Aqua/MODIS, CERES, AIRS (NASA)</li> </ul> <p>For the global coverage</p> <ul style="list-style-type: none"> <li>■ The level 3 products of the above sensors</li> </ul>
Prototyping	<p>[#1] NASDA, ESA, NASA and UT to deliver the satellite subsetting data to CSDIC</p> <p>[#2] NASDA, ESA, NASA and CSDIC will prototype 4D product visualization</p> <p>[#3] After evaluation, if necessary, NASDA ESA, NASA and CSDIC will prototype 4D product interoperability, data access capabilities, catalog interoperability.</p>
Evaluation	WGISS SG/EOGEO (dry run), WGISS, CEOS Plenary, IGOS-P10 WCRP JSC, GEWEX SSG, GHP

<b>Phase 2a</b>	
Period	Jun. 2003 – May 2004
Participants	NASDA, UT, EUMESAT(TBD), NASA(TBD), ESA(TBD) or other WGISS members
Data Period	July – Sept. 2001 and Oct. 2002 – Mar. 2003
Data	<p>For the Asia – Australia Monsoon Region</p> <ul style="list-style-type: none"> <li>■ TRMM/TMI, PR, Aqua/AMSR-E, ADEOS-II/GLI, AMSR(NASDA)</li> <li>■ GMS(UT), GOES(TBD), Meteosat(EUMESAT(TBD)), ancillary (other data centers)</li> <li>■ DMSP/SSM-I, NOAA/AVHRR (UT)</li> <li>■ ENVISAT/ASAR (ESA)</li> <li>■ Terra/MODIS, CERES, MISR, ASTER, Aqua/MODIS, CERES, AIRS (NASA)</li> </ul>
Prototyping	<p>[#1] NASDA, ESA, NASA and UT to deliver the satellite subsetting data to CSDIC</p> <p>[#2] NASDA, ESA, NASA and CSDIC will prototype 4D product visualization</p> <p>[#3] After evaluation, if necessary, NASDA ESA, NASA and CSDIC will prototype 4D product interoperability, data access capabilities, catalog interoperability.</p>
Evaluation	WGISS SG/EOGEO (dry run), WGISS, CEOS Plenary, IGOS-P10 WCRP JSC, GEWEX SSG, GHP

<b>Phase 2b</b>	
Period	Jun. 2004 – Sept 2005
Participants	NASDA, UT, EUMESAT(TBD), NASA(TBD), ESA(TBD) or other WGISS members
Data Period	July – Sept. 2001 and Oct. 2002 – Sept. 2004
Data	For the four Monsoon Regions <ul style="list-style-type: none"> <li>■ TRMM/TMI, PR, Aqua/AMSR-E, ADEOS-II/GLI, AMSR(NASDA)</li> <li>■ GMS(UT), GOES(TBD), Meteosat(EUMESAT(TBD)), ancillary (other data centers)</li> <li>■ DMSP/SSM-I, NOAA/AVHRR (UT)</li> <li>■ ENVISAT/ASAR (ESA)</li> <li>■ Terra/MODIS, CERES, MISR, ASTER, Aqua/MODIS, CERES, AIRS (NASA)</li> </ul>
Prototyping	[#1] NASDA, ESA, NASA and UT to deliver the satellite subsetting data to CSDIC [#2] NASDA, ESA, NASA and CSDIC will prototype 4D product visualization [#3] After evaluation, if necessary, NASDA ESA, NASA and CSDIC will prototype 4D product interoperability, data access capabilities, catalog interoperability.
Evaluation	WGISS SG/EOGEO (dry run), WGISS, CEOS Plenary, IGOS-P10 WCRP JSC, GEWEX SSG, GHP

<b>Phase 3(TBD)</b>	
Period	Sept 2005-
Participants	NASDA, Univ. of Tokyo, Possibly NASA, ESA (or other WGISS members) and other operational organization??
Data area	TBD (Global?)
Data	TBD (Operational Satellite?)
Prototyping	N/A (Movement prototyping system to operational system)
Evaluation	N/A (Evaluation of operation)

## 6.2 Two Phased Activities for Global Land Data Assimilation

The GLDAS proposes the following timeline:

- Data Integration Period (2002-2005)
  - Compile the forcing data (obs and analyses) and assimilation data
    - Including radiance observations (level 1), high-level satellite data products, in-situ observations, and NWP land analyses.
  - Long term archive (Goddard DAAC, NCAR, Japan)
  - MLDAS (Molts LDAS)
    - Reconfigure GLDAS to run only MOLTS points
    - Access the global forcing for flexibility in point definition
    - Smaller computing requirements, easier turnaround time. Good for R&D, land model intercomparison
    - Link to CSE reference sites
- Reanalysis Period (2006-2007 work activity)
  - 1/8 degree resolution; global land, CEOP time domain
  - Land model products (NOAH, CLM, VIC, others)



- Data assimilated value-added analysis

## 7 Management

### 7.1 Definition of responsibilities

The project will have two co-chairs of CEOP and the WGISS team, respectively. The co-chairs of the CEOP satellite data integration working group, Dr. Toshio Koike, UT, and Dr. Paul Houser, NASA GSFC, will represent CEOP. On the WGISS team, the co-chairs will be Mr. Naoto Matsuura, NASDA and a representative of the other space agency.

The CEOP will be responsible for:

- o Specify WTF/CEOP user requirements
- o Establish a point of contact for each data set or data centre who will facilitate access to the data providing in particular visibility on existing interfaces and support server integration when relevant.
- o Possibly participate in the development effort.
- o Test the servers that will be deployed at the scientific institutes
- o Participate to the WTF/CEOP System Test
- o Promote WTF/CEOP within oceanographic community
- o Participate in elaboration and run WTF/CEOP demos at CEOS plenary (in collaboration with a WGISS member)
- o Provide Feedback

The WGISS Team will be responsible for:

- o Analysing Scientific User Requirements
- o Securing the necessary resources
- o Develop the prototype
- o Maintain appropriate and regular communication with the Science Team. Including: organization of teleconferences and distribution of progress reports.
- o Keeping project schedule up-to-date
- o Briefing WGISS on the status of the WTF/CEOP
- o Participate in elaboration and run WTF/CEOP demos at CEOS plenary (in collaboration with a Science Team member)

### 7.2 Communication

Regular communication will be maintained between the WTF/CEOP Team Members relying in particular on :

- o Monthly teleconferences. Minutes from the teleconferences will be distributed to all members within two working days.
- o An WTF/CEOP web site will be put in place and serve as a focal point for all WTF/CEOP activities. It will provide in particular access to all WTF/CEOP reference documents, minutes of meetings and teleconferences, status reports, threaded discussion group (?) future events and provide list of contact points and links to the various participating sites as well as to the WTF/CEOP demo site itself.
- o Monthly progress reports. WTF/CEOP members will provide monthly reports on the status of their activities. These reports will be compiled and be distributed to all members by an email distribution list. They will also be available on the WTF/CEOP web site.

Other communication means fax, one to one phone calls and outstanding teleconferences will also support

day-to-day work and will be organized as needed.