Introduction to the CEOP Data Integration System

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Abstract

Under the frame work of Coordinated Enhanced Observation Period (CEOP), the in-situ, satellite, and model output observation data, will be obtained during the period of Oct 2002 through Dec 2004. In this research, I am going to introduce how to integrate all the CEOP data that have a wide diversity and vast numbers. Specifically, this integration system will be showing on the Web Interface, equipped with some basic analysis functions such as data display, overlay, cross-section drawing, averaging and so on.

Keyword: Data Integration, in-situ data, satellite data, model output, CEOP.

1. Introduction

The Coordinated Enhanced Observing Period (CEOP), which is an element of the World Climate Research Programme (WCRP) initiated by Global Energy and Water Cycle Experiment (GEWEX), was proposed in 1997 as an initial step for establishing an integrated observation system for the global water cycle. Its guiding goal states as follows:

> *"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."*

Toward the guiding goal, CEOP represents a unique opportunity to improve the scientific basis needed to achieve overall water cycle documentation and prediction goals, based on the coordination among the WCRP/GEWEX Continental Scale Experiments (CSEs), the Committee on Earth Observation Satellites (CEOS) space agencies and the numerical weather prediction (NWP) centers affiliated to the World Meteorological Organization (WMO). CSEs organized the 36 reference sites, which cover the global climate variation and are collecting the in-situ data and making the composite data sets. CEOS space agencies and Working Group on Information Systems and Services (WGISS) are providing the satellite products and integration functions. The 11 NWP centers are providing the Model Located Time Series (MOLTS) at the CEOP reference sites, the global gridded outputs, and the reanalysis products.

2. Data Management Strategy

The essential task of CEOP is to assemble relevant data sets and develop a data management system to support the scientific program. Data collected for CEOP will include the in-situ and satellite measurements with model output on key energy and water cycle budget quantities of the land surface and overlying atmosphere. The CEOP Data Management System will provide a single-point access to relevant data, regardless of its location, using a central information center for user access and in-situ data, one or more satellite data integration centers for 4D merged satellite data products, and several distributed Numerical Weather Prediction (NWP) centers for model output.

2.1 Data Archive

As shown in **Figure1**, the data sets and products from the reference sites, the satellites and the NWP models are archived by the University Cooperation for Atmospheric Research (UCAR) of the USA, the University of Tokyo and Japan Aerospace Exploration Agency (JAXA) of Japan, and the Max-Planck Institute (MPI) for Meteorology of Germany, respectively. The value-added Land Data Assimilation products from both regional and global scale processing systems with emphasis on the Global Land Data Assimilation System (GLDAS) are being developed in the USA (NASA/GSFC and NCEP) as a contribution to CEOP.

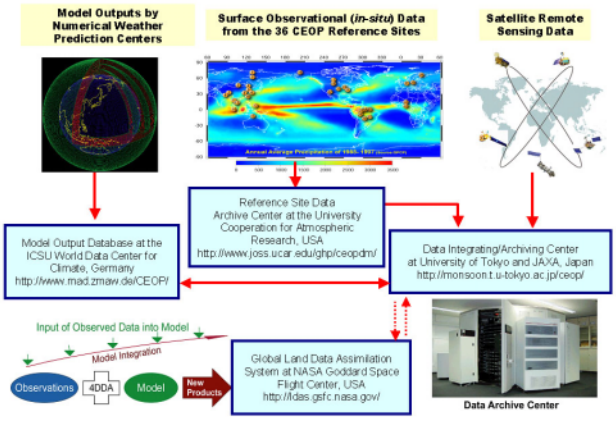


Figure1: The first global integrated data sets of the water cycle.

2.1.1 In-situ

The in-situ observation data are collected at 36 different reference sites in the world, classified in sub-surface (soil profile), surface (standard meteorological and radiation), and upper-air(by rawin sonde and profiler). All the data are now archived at the Data Archiving Center in the UCAR, US.

2.1.2 Satellite

As for the satellite data, JAXA, NASA, NOAA and ESA provide passive and active microwave, visible and near-infrared, and sounder data. The University of Tokyo, Japan has been doing this archiving work.

2.1.3 Model Output

Regarding Model output data, the world eleven numerical weather prediction centers (NCEP, UKMO, NASA(GMAO,GLDAS), JMA, BMRC, ECMWF, NCMRWF, ECPC and CPTEC/INPE) provide global grid data by six hours, and the one-hour high time resolution point data called MOLTS (MOdel Location of Time Series). These data are archived at Max Planck Institute of Meteorology in Germany.

2.2 Available Data sets

Table1 and **Table2** show the currently available data sets of In-situ, Satellite and Model output data for CEOP 36 reference sites. CEOP full data will be available January 2006.

Table 1: Available Data list for EOP-1 (July to Sep. 2001)

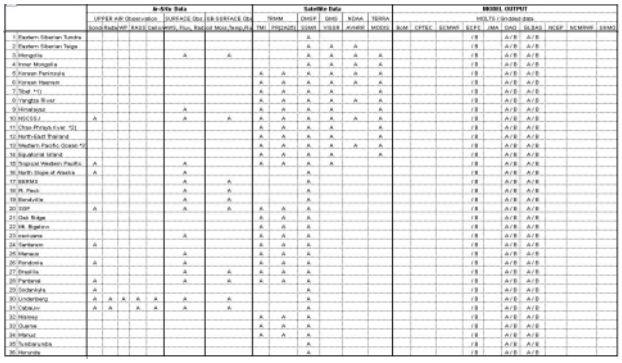
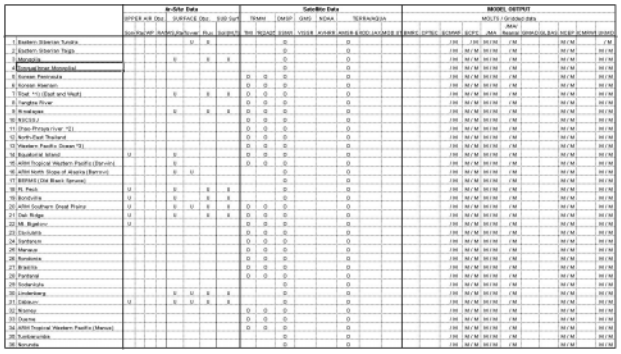


Table 2: Available Data list for First Half EOP-3 (Oct. 2002 to Mar. 2003)



3. System architecture

As shown in **Figure2**, archived data are managed by Data Base Management System (DBMS). The communication between client and server is carried out by the Hyper Text Transfer Protocol (HTTP).
The user can use this system without any special software or hard ware. But the only JAVA runtime environment is required.

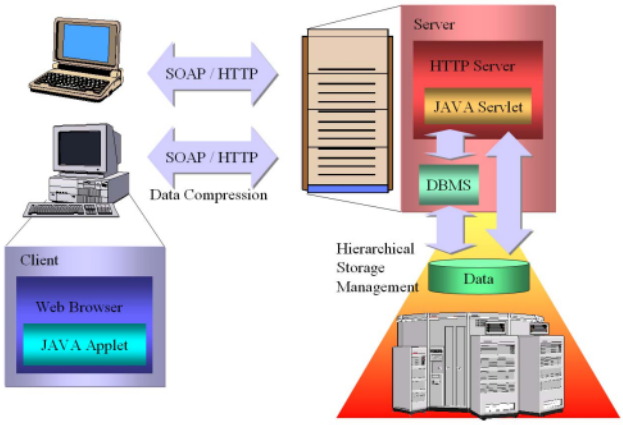


Figure2: Architecture of Data Integration System.

4. Data Integration Interface

This system was designed under the basic concept of;

- User friendly
- Hiding complicated tasks from users
- Supporting various computer environments
- No special hardware or software to use

Figure3 shows the image of data selection. Users can select the In-situ, Satellite and Model data respectively. And they can specify any particular time.

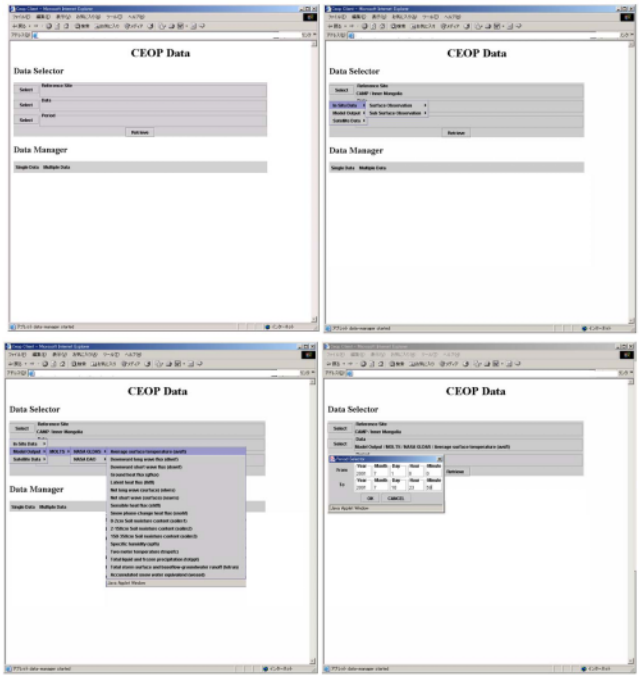


Figure 3: Data Selection Window.

By selecting In-situ and Model output data, users can compare each data shown as in **Figure 4**. The left figure shows the time series of averaged surface temperature of NASA GLDAS MOLTS and In-situ observation at Inner Mongolia site, during 1 to 10 July, 2001. The right figure is the scatter diagram of them.

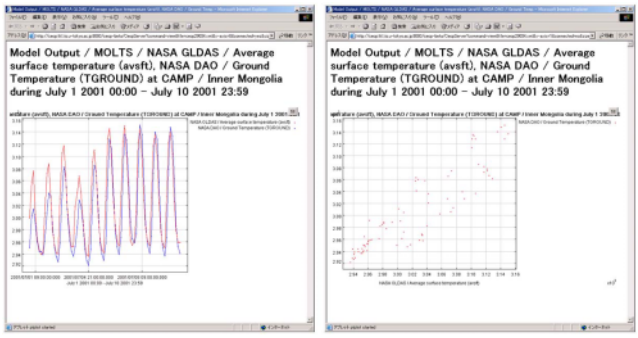


Figure 4: Data Comparison at Inner Mongolia reference site (Left: time series, Right: scatter chart).

Next is another example of the typhoon at CEOP North South China Sea – Southern Japan (NSCSSJ-Taiwan) Reference site in September 2001. (See **Figure 5**). The upper figure shows the list of selected data. Selected data are TRMM/PR, GMS/IR-1, in-situ/Surface Air Pressure and in-situ/Surface Precipitation. The middle figure shows the comparison between in-situ surface pressure and precipitation. You can see the heavy rain fall accompanying rapid decrease of air pressure. The bottom figure shows the image of GMS/IR-1 and TRMM/PR. You can see the spatial distribution of IR-1 and PR, and cross-section distribution of PR.

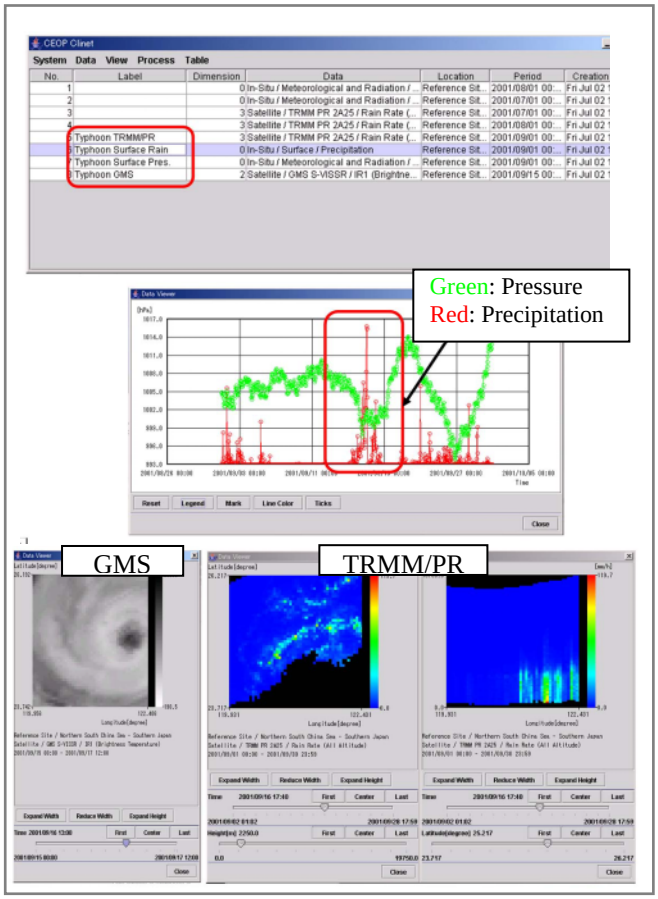


Figure 5: Data Comparison at NSCSSJ-Taiwan reference site(Upper: selected data, Middle: comparison of in-situ data, Bottom: comparison of satellite data)

5. Conclusion

The goal of our CEOP Project is to establish an international framework for operating a sustained observational scheme of the global water cycle that makes maximum use of the valuable information gained for the benefit of society. And for this purpose, it is necessary to establish information systems and services that can integrate the observational, model and socio-economic data and products: interpret the integrated data sets, and provide for sharing the data, products and information internationally. To achieve this goal, the prototype of CEOP Data Integration System is designed and will be developed into a further advanced level in the future.

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References

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