Coordinated Enhanced Observing Period

An Element of the World Climate Research Programme (WCRP),
initiated by the Global Energy and Water Cycle Experiment (GEWEX)

Schedule of C EOP

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CEOP Science Objectives:

Water and Energy-Cycle Simulation and Prediction

To use enhanced observations 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 resource applications. Starting from the current efforts to close simplified vertically integrated water and energy budgets with observations and analyses and beginning efforts to simulate these budgets regionally, CEOP will begin the effort to transfer this knowledge to the global scales, broaden consideration of water and energy cycle processes, and begin to examine the vertical structure in the atmosphere and land.

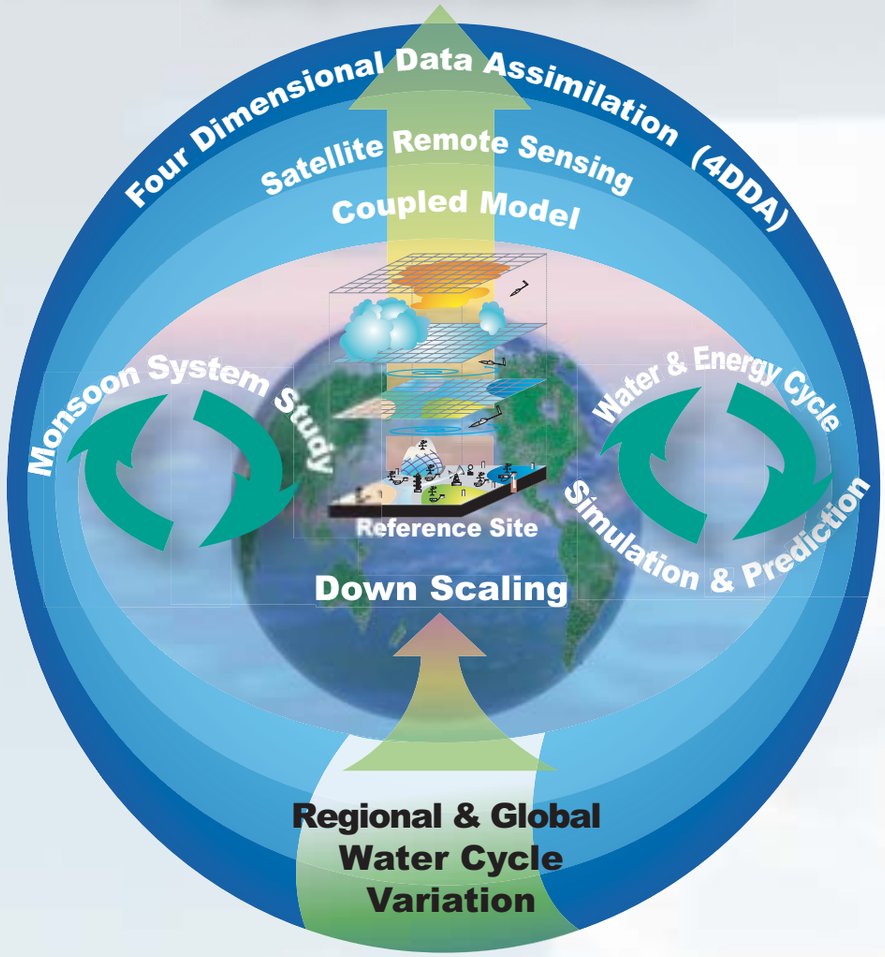
Monsoon System Studies

To document the seasonal march of the monsoon systems, assess their driving mechanisms, and investigate their possible physical connections. CEOP focuses on four of the major monsoon regions around the globe and a regional monsoon experiment is planned for each of them: Asia-Australia Monsoon, North American Monsoon, South American Monsoon and West African Monsoon. These studies will provide an opportunity for a better qualitatively and quantitatively understanding of the multi-scale energy and water cycle processes of the monsoon systems as part of the Earth climate system.

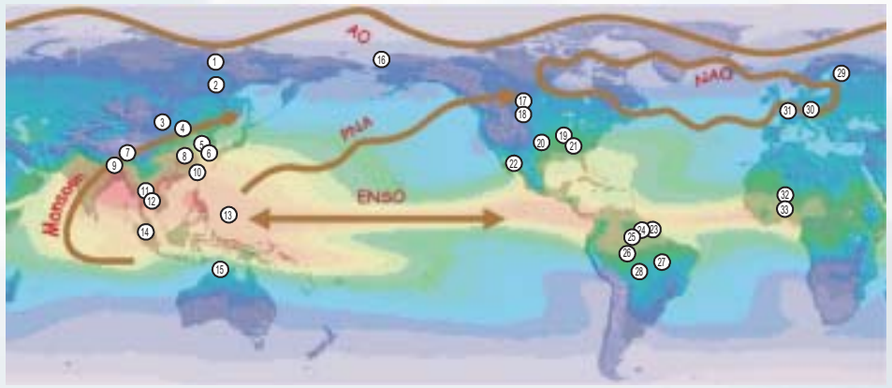
Data Management Strategy:

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 quantitites 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.

Integrated Data Sets



CEOP Reference S ites



1) Eastern Siberian Tundra
2) Eastern Siberian Taiga
3) Mongolian
4) Inner Mongolia
5) Korean Peninsula
6) Korean Jeju
7) Tibet
8) Yangtze River
9) Himalayas
10) Northern South China Sea- Southern Japan
11) Chao-Phraya River
12) North-East Thailand
13) Western Pacific Ocean
14) Equatorial Island
15) TWP
16) NSA
17) BERMS
18) Fort Peck
19) Bondville
20) SGP
21) Oak Ridge
22) AZ
23) Flona
24) Santarem
25) Manaus
26) Rondonia
27) Brasilia
28) Pantanal
29) Sodankyla
30) Lindenberg
31) Cabauw
32) Niamey
33) Oueme

CEOP Comprehensive Data Set:

Satellite Data

In addition to TRMM, Landsat-7, NOAA-K series and geostationary satellites, a new generation of remote sensing satellites will support global observations for CEOP; Terra (USA), Aqua (USA), ENVISAT(ESA) and ADEOS-II (Japan) in the CEOP period. These satellites will provide unprecedented enhancement of observing capabilities to quantify key atmospheric, surface, hydrological and oceanographic parameters in addition to the GEWEX global cloud, surface radiation, precipitation, water vapor and aerosol data sets. CEOP will select relevant portions of this extremely large volume of data and merge these data into 4D products that can be combined with in-situ and model data.

Model Output

CEOP aims to provide a wealth of data to enable extensive testing of atmospheric model parameterizations. NWP and Climate modelling centers are encouraged to consider how to take advantage of the opportunities provided. Several of these centers will provide selected global and regional analyses and model predictions of water and energy cycle processes over the proposed CEOP period. In particular, CEOP data will include:

- high temporal resolution time-series output referred to as Model Output Location Time Series (MOLTS) for specified individual sites; and
- gridded output in both two- and three-dimensional formats processed as synoptic snapshots at a minimum of 6-hourly intervals.

Observational (*in-situ*) Data

Well-instrumented locations of small to intermediate scale areas (10^4 km^2 or less) distributed around the globe in different climate regimes provide the data needed on a mesoscale or smaller scale for research in land area and hydrology processes and model validation. The enhanced observations of sub-surface (soil), surface (raditation and precipitation), near-surface (flux tower), atmospheric soundings (RAOB and profiler), and 3D (radar and aircraft) at the **Reference Sites** provide CEOP with the basic resources necessary to achieve its main scientific objectives. There are at least 33 CEOP geographically distributed **Reference Sites** (see left).

CEOP Under the Framework of IGOS-P

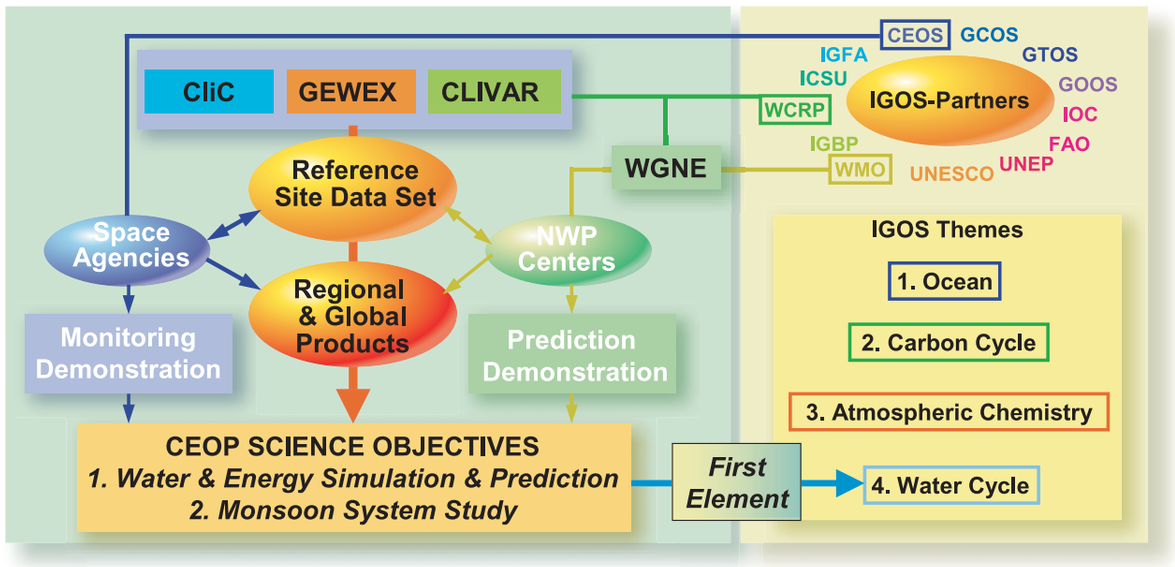
CEOP is Endorsed as the First Element of the IGOS-P Water Cycle Theme

CEOP was confirmed as the first element of the Integrated Global Water Cycle Observations (IGWCO) theme at the the 8th session of the Integrated Global Observing System Partners (IGOS-P) held in Kyoto Japan in November 2001. The goal of IGOS-P is to produce comprehensive global, regional and national data and information to satisfy the environmental information needs of policymakers and to support scientific and operational environmental programmes. IGOS-P is comprised of representation from recognized Global Observing Systems, the international agencies which sponsor these systems, the Committee on Earth Observation Satellites (CEOS), the International Group of Funding Agencies for Global Change Research (IGFA), and international global change research programmes, such as the World Climate Research Programme (WCRP).

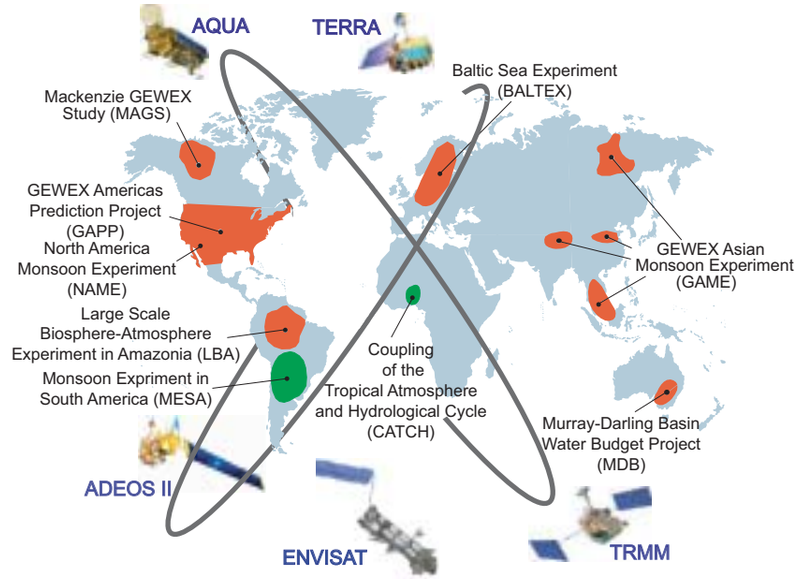
Briefly, the IGWCO objectives are to provide a framework for guiding decisions on priorities and strategies regarding water cycle observations for

- monitoring climate variability and change
- effective water management through the provision of better information
- sustainable development of the world's water resources
- specification of initial conditions for weather and climate forecasts.

Structure of C EOP



CEOP - A Contribution to Improving the Predictability of the Global Water Cycle and Resultant Water Resources



CEOP - initiated mid-2001 and focusing on two annual cycles (2003-2004) - is designed to take advantage of the new E arth observing satellites, the existing suite of operational satellites, and the progress of the GE WEX continental scale experiments and other W CRP activities including CLIVAR (*i.e.* NAME, MESA) and CliC.

The overall objective of the Coordinated Enhanced Observing Period (CEOP) is to achieve a more accurate determination of the water cycle in association with climate variability. The timing of CEOP is coupled to the new series of Earth observing satellites and the GEWEX Continental Scale Experiments (CSEs). The timing is also coupled to other international activities, such as those planned for the Climate Variability and Predictability (CLIVAR) Programme, the Working Group on Numerical Experimentation, and the Climate and Cryosphere (CliC) Project. CEOP objectives are supported by the Integrated Global Observing Strategy Partners (IGOS-P), which includes space agencies and other agencies dealing with global environmental issues.

CEOP will provide a unique database of common measurements for the coordinated observation period. Data from selected Reference Sites closely linked with the GEWEX CSEs, and matching Model Output Location Time Series (MOLTS) and 4DDA analyses from cooperating Numerical Weather Prediction (NWP) centers will be combined with subsets of relevant satellite data into a comprehensive data set. The CEOP global hydroclimatological data set will be used to validate satellite hydrology products and evaluate, develop and eventually predict water and energy cycle processes through global and regional models. Based on the collective data set, studies will be conducted on the regional water and energy budget and both inter-comparison and inter-connectivity studies of the monsoon systems around the world. CEOP will also address defining a path to downscale from global climate to local water resource application as a next step.

CEOP brings together *in-situ*, satellite, and model data (with global coverage over the same time period) to support key science objectives in climate prediction and monsoon system studies.