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

Coordinated Enhanced Observing Period

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CEOP Web Site: http://www.ceop.net

UNIQUE OVERSIGHT REQUIRED TO EXPAND EARLY SUCCESSES OF CEOP

Co-Chairs of CEOP Advisory and Oversight Committee:

Prof. Akimasa Sumi, Director of the Center for Climate System Research (CCSR), Tokyo
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Prof. A. Sumi


Dr. J. Kaye

The successful launches of the NASA Terra and AQUA, the NASDA ADEOS-II and the ESA ENVISAT earth observing satellites have started a new era in climate system research. The instruments on board these spacecraft are already adding new content to the flow of data that has begun to arrive from earlier Earth system satellites, e.g. TRMM, GRACE, Jason 1, SAGE III, and the existing suite of operational meteorological satellites. Within the international research framework we have closely co-operated with the World Climate Research Programme (WCRP) in the development of large multi-disciplinary climate research studies such as the Global Energy and Water Cycle Experiment (GEWEX), which is successfully addressing water resources applications issues. Many aspects of our own national priorities parallel those within the international community including the building of new global descriptions of the Earth's environment, upgrading prediction models and improving descriptions of key local and regional processes. The global products and data sets derived through the exploitation of new satellite sensors will be critical to these developments and will significantly extend our current knowledge.

Our own participation in the unique international scientific endeavor of the Coordinated Enhanced Observing Period (CEOP) has been motivated by our desire to promote work that could improve prediction of the climate system by focusing on the measurement, understanding and modeling of water and energy cycles. It is important to ensure that CEOP takes into account the requirements of the climate research community at large in planning the assembly of coordinated data sets that will serve numerical modeling needs and benefit other climate research and analyses interests. CEOP has gained the attention 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'. As you are well aware, IGOS is a partnership between international bodies concerned with global environmental issues, including, among others, all the space agencies belonging to the Committee on Earth Observation Satellites (CEOS).

It is in this context that we have accepted the role of Co-Chairs of the CEOP Advisory and Oversight Committee (AOC). We have agreed that the primary role of the AOC will be to provide constructive feedback to the CEOP Scientific Steering Committee (SSC) and its Working Groups on the relevance of CEOP goals and objectives as well as the importance of the scientific return from CEOP activities to national bodies and organizations that sponsor CEOP and support its contributing scientists. The AOC will work in concert with the CEOP Lead Scientist, Dr Toshio Koike, and with the CEOP SSC, chaired by Dr Hartmut Grassl of the Max Planck Institute, Hamburg, Germany. (Continued in Page2)

Calendar of CEOP Meetings:

- **CEOP Session, 2003 American Geophysical Union(AGU) Fall Meeting:**
  San Francisco, California, USA, 8-12 December 2003
- **The 3rd CEOP Implementation Planning Meeting:**
  Irvine, California, USA 10-12 March 2004
- **CEOP and Asian Monsoon Systems Session, Joint AOGS 1st Annual Meeting & APHW 2nd Conference:**
  Singapore, Singapore, 5-9 July 2004

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In contrast to the CEOP SSC, which focuses on the CEOP science strategy, the AOC's responsibility will be to ensure that the CEOP implementation process takes into account the priorities of the widest possible array of international agencies involved in the study of the water cycle and that those agencies have the opportunity to fully participate in discussions about the direction and implementation of CEOP in order to maximize the alignment between the long-term objectives of CEOP and the concerns of national agencies. Delegates of Agencies and Organizations committed to the support and funding of CEOP are, therefore, being invited to assist us with these important tasks.

In recognition of the success of comprehensive CEOP intercomparisons of *in-situ* data, satellite products and model outputs which are underway, we wish to appeal to heads of all relevant Agencies and Organizations receiving requests to be represented on the CEOP AOC to consider their decision seriously and to commit the necessary intellectual resources to provide the most useful recommendations that will optimize the alignment between goals of CEOS and those of the Agencies and Organizations that sponsor its activities and thus provide for greater stability in the capacity of CEOP to plan for its future. As Co-Chairs of the CEOP AOC we are committed to assisting CEOP achieve its optimum level of performance and return its highest potential scientific benefit in the most efficient manner possible.

Summary of Deliberations at the Second Coordinated Enhanced Observing Period (CEOP) Implementation Planning Meeting 2-4 April 2003, Berlin, Germany
Scientific Report on WESP CEOP Pilot Data Comparisons

Sam Benedict, CEOP International Coordination Function, CA, USA

The Coordinated Enhanced Observing Period (CEOP) is an element of World Climate Research Programme (WCRP) that was motivated by the international efforts of the Global Energy and Water Cycle Experiment (GEWEX) to measure, understand and model the water and energy cycles within the climate system. Dr JÜrgen Fischer, Head of the Institute for Space Sciences at the Free University of Berlin had agreed to host the meeting with support from Dr Einar-Arne Herland and Professor Hartmut Grassl, of the European Space Agency (ESA) and the Max Planck Institute for Meteorology (MPI), respectively. The meeting was hosted by Dr Fischer from 2 to 4 April 2003, at the Harnack House facilities of the Max Planck Society, in Berlin, Germany. Professor T. Koike, the Lead Scientist for CEOP, welcomed the participants on behalf of Dr David Carson, Director of WCRP and Dr Soroosh Sorooshian, Chairman of the GEWEX Scientific Steering Committee (SSG).

Dr H. Grassl, Chairman of the CEOP Scientific Steering Committee (SSC), convened a working session of the CEOP SSC to address a number of issues including establishing a conference call process to address and follow-up on CEOP science issues and actions as they arise; reviewing CEOP science objectives and encouraging a continued re-evaluation and advancement of CEOP science foci; ensuring appropriate representation of CEOP science on WCRP modeling and observational councils; strengthening connections to other elements of WCRP especially GEWEX, CLIVAR and CliC for support of CEOP contributions to improved seasonal predictions that includes broader ocean and cold region sciences issues; outreach to other international groups including an expanded emphasis on international participation and contributions to issues related to sustainable development; and the time and the venue of the next (third) CEOP Implementation Planning Meeting.

The *in-situ* data gathered from the reference sites and reference hydrological basins from the GEWEX Continental Scale Experiments

(CSEs) located around the world were identified as the most fundamental component of the CEOP strategy. Collection of the data from these sites for the initial CEOP period (EOP-1; 1 July to 30 September 2001) has shown that adherence by the Reference Sites to a consistent format is especially important to ensure an efficient continuation of the CEOP dataset development and delivery process. A CEOP reference site managers meeting was therefore held from 31 March to 1 April 2003 at the same venue as the second formal CEOP Implementation Planning meeting. An important part of the discussion included the current status of the Prototype CEOP EOP-1 Reference Site Data Set that was developed by the CEOP Data Archive (CDA) at UCAR/JOSS. The dataset(s) themselves have been placed on the Internet at: http://www.joss.ucar.edu/ghp/ceopdm/archive/eop1_data. The workshop focused on the Reference Site contributions to the assembly and timely delivery of the CEOP annual cycle datasets in the likeness and quality established for EOP-1. The Reference Site representatives agreed at the meeting to collectively assist in defining the final format for future CEOP datasets and to deliver data, which meet the established criteria. One agreement reached at the meeting that directly impacts CEOP's ability to meet its commitment to produce an initial composited annual cycle dataset in line with the CEOP data policy was that EOP-3 data collected during the first half

of annual cycle (October 2002 through March 2003) will be submitted to the CDA, in the agreed format, so that Category 1 data would arrive on or before 1 October 2003 and Category 2 data would follow on or before 1 June 2004. All of the CSE Spokespersons, agreed to meet these submittal dates.

The main issues related to the Satellite Integration element of CEOP that were discussed at the Berlin meeting included: That a proposal to obtain subsetted satellite data from 250 km grids centered at each CEOP reference site would be prepared and presented to ESA and EUMETSAT on behalf of CEOP by the Chair of the CEOP Science Steering Committee, Dr H. Grassl with Jürgen Fischer; that CEOP satellite data requirements encompassed Level 1b (reference site), Level 2 (reference site and for monsoonal regions) and Level 3 (global) data products; that the size of the files (particularly the Level 2 for monsoonal regions) needs to be investigated along with suitable means for transfer of the data to the CEOP Satellite Data Archive Center at the University of Tokyo; and that the data set format and phased release schedule have been agreed upon.

In keeping with efforts to unify and integrate data sets for analysis of the water cycle, composite products of the *in-situ* data at the reference sites, satellite data and model outputs now being generated and analyzed were shown at the meeting.

The CEOP Water and Energy Simulation and Prediction (WESP) activity plan was presented at the meeting. The plan has the details of the main elements of WESP, which includes building on the GEWEX WEBS; adding transferability projects that currently have a direct link to CEOP; focusing on land data assimilation projects; and discussing the nature of the data being requested to achieve the goal of identifying model processes and state variables that can be compared to *in-situ* and satellite measurements and to then develop community intercomparison projects that can help to define and quantify measured and modelled processes. The latest version of the WESP Major Activities Plan (MAP) can be accessed on the Internet through the CEOP Data Management site at: http://www.joss.ucar.edu/ghp/ceopdm/.

It was reported that a targeted workshop on "The Role of the Himalayas and the Tibetan Plateau within the Asian Monsoon System" had been organized on behalf of the CEOP Monsoon Systems Studies Working Group. The workshop was to take place in Milan Italy from 7 to 8 April 2003. The workshop was to be hosted by the Epson Meteo Centre (CEM) with support by the Ev-K2-CNR Project (Gianni Tartari) and WCRP. The outcome of the workshop is to be summarized in a draft report.

More specifics about CEOP and the Implementation meeting can be found through the CEOP Internet site: http://www.ceop.net by clicking on "meetings". Through the assistance of the CEOP Coordination Office in Tokyo, all of the presentations at the meeting, can be accessed directly on the Internet at: http://monsoon.t.u-tokyo.ac.jp/ceop/meeting.html.

It was agreed that the next (Third) CEOP Implementation Planning meeting would take place from March 10-12 2004 at the University of California, Irvine, California, USA.

Brief report on the CEOP/GEWEX Workshop on "The Role of the Himalayas and the Tibetan Plateau within the Asian Monsoon System"

Massimo Bollasina, Epson Meteo Centre, Milan, Italy
Jun Matsumoto, University of Tokyo, Tokyo, Japan
Sam Benedict, CEOP International Coordination Function, CA, USA

The CEOP/GEWEX Workshop on "The Role of the Himalayas and the Tibetan Plateau within the Asian Monsoon System" was held on 7-8 April 2003 at the Epson Meteo Centre, Milan, Italy, hosted by Epson Meteo Centre and the Ev-K2-CNR Committee with support from the World Climate Research Programme (WCRP) Global Energy and Water Cycle Experiment (GEWEX).

In recognition of the profound thermal and dynamical influence exerted by the Himalayas and the Tibetan Plateau on the Asian Monsoon System, it was important to briefly review the current understanding of physical processes occurring on these high-altitude and extended regions, and to examine their relation and influence on the global monsoon circulation at different spatial and temporal scales according to the CIMS (CEOP Inter-Monsoons Model Studies) strategy.

In summary, the following issues and recommendations were highlighted:

1. High altitude research: coordination between the Himalayas Reference Site and Marsyandi River Basin (central Nepal) for EOP-4 was strongly encouraged; key physical processes were addressed.
2. Monsoon understanding and predictability has to be improved following a downscaling strategy with integration and cooperation among reference sites and remote sensing observations and model analysis and simulations. Improvement in model physics is needed.
3. Monsoon issues, especially related to seasonal-scale processes, intra-seasonal oscillations and their relationship with local hydroclimate, were highlighted and it was suggested to proceed through coordinated model integrations from GCMs (General Circulation Models), through RCMs (Regional Climate Models) to CRMs (Cloud Resolving Models) under the CIMS strategy.
4. Coordination with CEOP WESP (Water and Energy Simulation and Prediction), connection with GEWEX/CLIVAR and cooperation with the Asian Brown Cloud (ABC) experiment were recommended.

The presentation slides can be seen by clicking the names in the agenda on the web site: http://news.epson-meteo.org/.

First CEOP EOP-1 Data Comparison

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Toshio Koike, University of Tokyo, Tokyo, Japan
Steve Williams, UCAR/Joint Office for Science Support (JOSS), NCAR, Colorado, USA

In order to understand what components of the global water and energy cycles can be simulated and predicted at regional and global scales, CEOP has undertaken the generation of unified and integrated data sets for the water cycle studies as an essential element of its implementation strategy. The Enhanced Observing Period 1 (EOP-1), from the period from July to September 2001, was designed as the first challenge to CEOP plans for the production of composite data sets. The successful archiving of the *in-situ* data at the reference sites, satellite data, and model outputs, was required for EOP-1, which became the precursor to the annual cycle enhanced observation periods, EOP-3 and EOP-4. The prototype CEOP EOP-1 composite products are available on the Internet at: http://www.joss.ucar.edu/ghp/ceopdm/.

Plate 1 is the first view of the composite products of the CEOP EOP-1 data sets. The figures fringed with red and blue lines show the 10-day averages of net radiation *(Rn)* and sensible heat flux *(H)*, respectively, at the twelve reference sites where *Rn* and/or *H* are available. In the figures, the red and blue bars indicate the data from *in-situ* observations at the reference sites and the Model Location Time Series (MOLTS) output generated by the NASA/Global Model Assimilation Office (GMAO, formerly the DAO), respectively. The observed *Rn* exhibits the latitudinal and seasonal variations at all reference sites except Lindenberg where *Rn* is consistently much smaller than at the other sites even in summer due to local climate conditions. The GMAO/MOLTS *Rn* is in good agreement with the observed *Rn* at many reference sites except at Lindenberg and Rondonia. During EOP-1, there was only a limited amount of sensible heat flux data available. They show apparently that there exists a bigger gap between the observed *H* and the GMAO/MOLTS *H*.

The figures fringed with green lines show the profiles of the atmospheric temperature *(Ta)* and the relative humidity *(RH)* observed at three reference sites and analyzed with the Scripps Experimental Climate Prediction Centre (ECPC) model. The ECPC model *Ta* indicated by the red line corresponds well to the observed *Ta* shown in green, at the reference sites. It is possible to conclude from this that the 4DDA for air temperature is working very well. On the other hand, the ECPC model *RH* misses several important peaks as well as the detailed structures in the observed profiles and shows a big gap in the upper troposphere.

During the on-going EOP-3 from October 2002 to September 2003, CEOP will archive a full complement of observation parameters from 36 different reference sites located around the world, model outputs from 10 numerical weather prediction centers and satellite data will also be collected. More comprehensive and detailed aspects of the global water cycle will be uncovered with the unified and integrated EOP-3 data sets.

Acknowledgments

These analyses would not be possible without the strong support from the CEOP reference site teams in the EOP-1, as well as Drs Michael Bosilovich NASA/GMAO, and John Roads Scripps/ECPC.

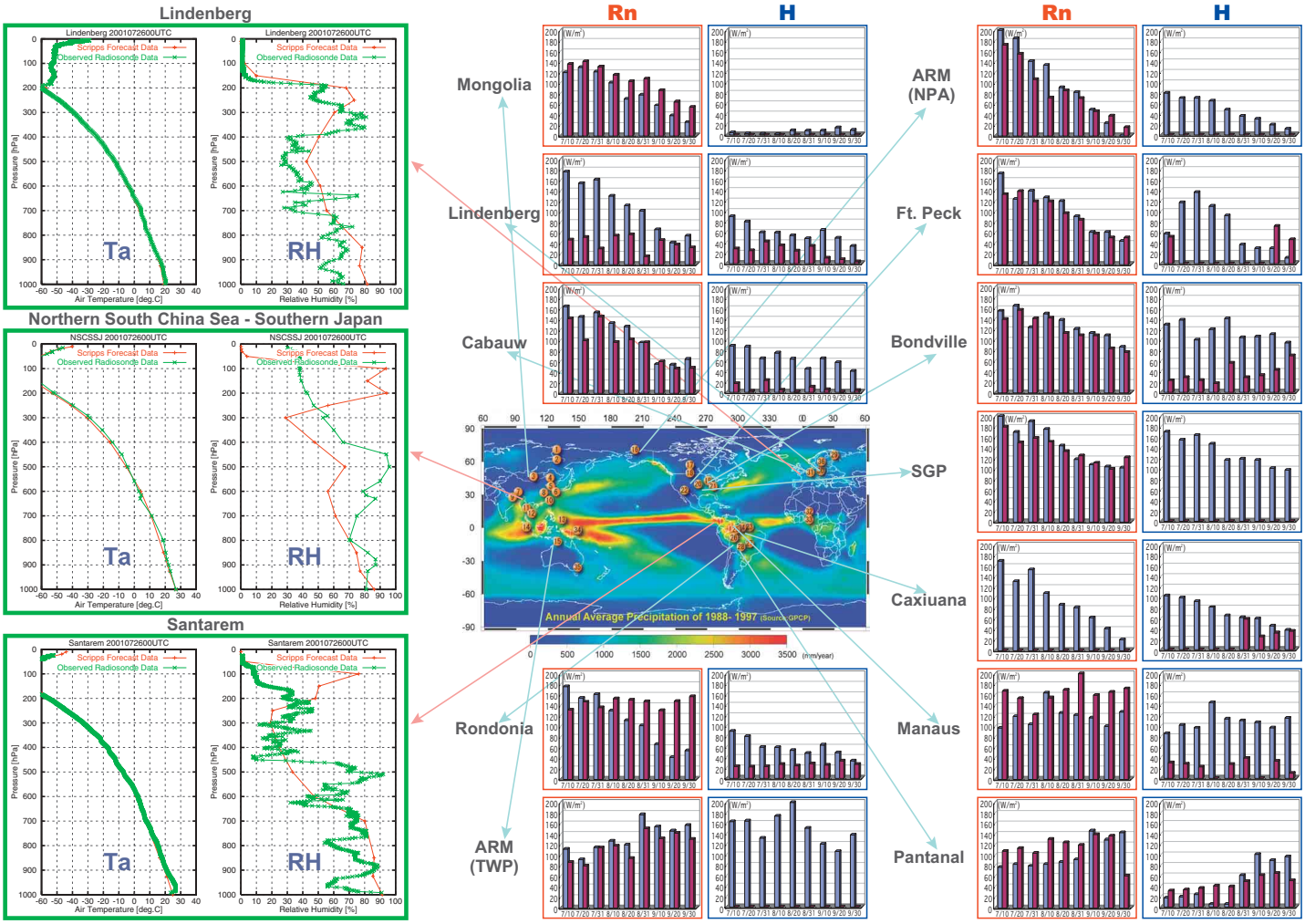

Plate 1 The first view of the composite products of the CEOP EOP-1 data

AMSR-E Soil Moisture Product validated at the CEOP Mongolia Reference Site

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Ichirow Kaihotsu, Hiroshima University, Hiroshima, Japan
Gombo Davaa, Institute of Meteorology and Hydrology, Ulan Bator, Mongolia
Naoto Matsuura, NASDA/Earth Observation Research Center (EORC), Tokyo, Japan

The two advanced microwave radiometers (AMSR-E and AMSR) developed by the National Space Development Agency (NASDA) of Japan were launched on board the NASA Aqua and NASDA Midori2 (ADEOS-II) spacecraft in 2002. The instruments are working well as they continue to provide valuable data for regional and global water cycle studies. In June 2003 NASDA began providing the Aqua/AMSR-E data to the international science community. As a contribution to CEOP, they are also providing the AMSR-E, TRMM and SSM/I products associated with CEOP reference sites.

Both AMSR-E and AMSR have low frequency channels at 6.9 GHz with acceptable spatial resolution, 70 km and 50 km, respectively. For all currently available data, they have the capability to provide soil moisture monitoring for regional and global scale water cycle process studies and modelling. The accuracy of this capability, however, is dependent on how well their soil moisture products can be validated.

As **Figure 1** shows, twelve soil moisture observation stations (yellow circles) were established in the 120 km by 160 km rectangular area of the Mongolia reference site as well as 6 Automatic Weather Stations (red circles). The arrangement of these stations took into account their spatial resolution and the soil moisture heterogeneity of the site. The upper chart in the **Figure 2** is the result of a validation, process, which applied the AMSR soil moisture algorithm developed by the University of Tokyo to the observed soil moisture at 3 cm depth at each ASSH station and the nearest actual AMSR-E instrument data. Due to the large heterogeneity, the results scatter considerably. The lower figure shows the result of the validation using the spatial averages of the *in-situ* and satellite observations. The average relative error is 2% from July to September 2002.

By using the validated algorithm, 10-day average soil moisture maps have been created for Mongolia for the period of July through September 2002 (**Figure 3**). These maps will be validated by the nation-wide operational soil moisture observation data and the results will be reported in due course.

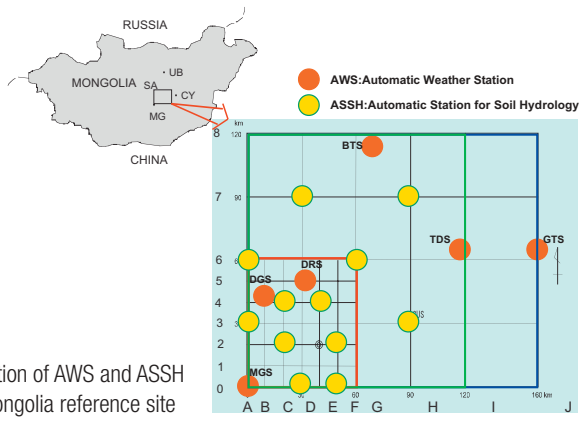


Fig. 1 Location of AWS and ASSH in Mongolia reference site

References

T. Koike, E. Njoku, T. Jackson and S. Palocia, 2000. Soil moisture algorithm development and validation for the ADEOSII/ AMSR. *IGARSS 2000, IEEE,* pp. 1253-1255.

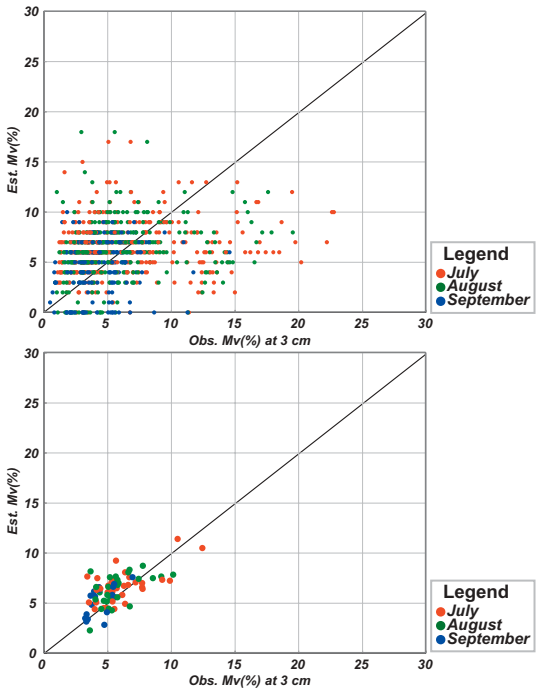


Fig. 2 AMSE-E soil moisture validation by using station-footprint match-up data (upper) and spatially averaged match-up data (lower)

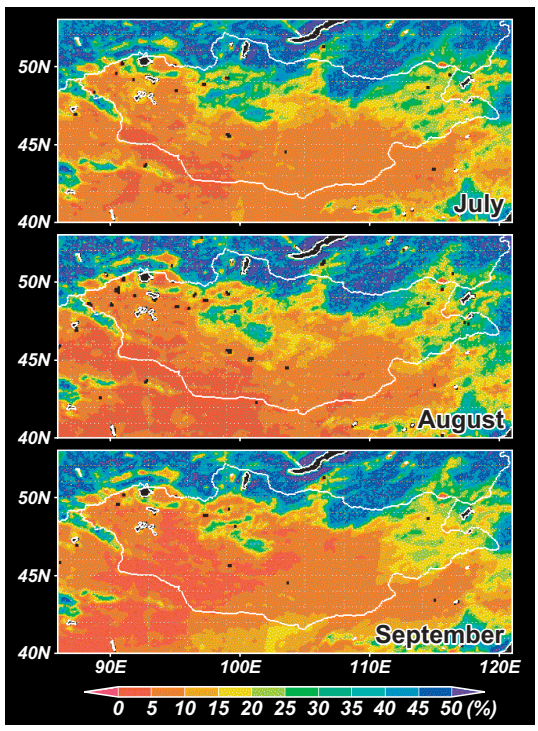


Fig. 3 First ten-day soil moisture average in July (top), August (centre) and September (Bottom) in Mongolia

CEOP reference sites in the LBA Continental Scale Experiment

José A. Marengo, LBA Representative at CEOP, CPTEC/INPE, São Paulo, Brazil
Luiz Horta, LBA DIS Manager, CPTEC/INPE. São Paulo, Brazil

As part of the LBA experiment, several projects funded by NASA, the European Union, and the Brazilian Government (FINEP, FAPESP, CNPq, among other agencies) have implemented experimental sites. These sites are located in various regions across the Amazon basin including the Pantanal and Cerrado (savanna type vegetation) area near Brasilia. Six of these sites have been chosen as CEOP reference sites, and they are operated by multinational group of scientists from institutions and universities located in Brazil, the USA and Europe.

At present, the LBA-CEOP reference sites are: (See **Figure 1**) (a) The **Manaus** site with two towers (K34 and C14) in primary forest; (b) The **Santarém-Flona Tapajós** site with three towers (K67 in primary forest, K83 in selective logging and K77 in pasture); (c) The **Rondônia** reference site, which has two towers on different surface conditions namely the **Reserva Biológica Jaru** (forest site) tower that stopped operating in November 2002, and the **Fazenda Nossa Senhora de Aparecida** (pasture) tower; (d) The **Caxiuana** tower in primary forest; (e) The **Pantanal** tower located on savanna type vegetation, that floods during each wet season; (f) The **Brasilia**-site with towers located on Cerrado (savanna), Campo Sujo (a biennial burn area) and Campo Sujo (a quadrennial burn area).

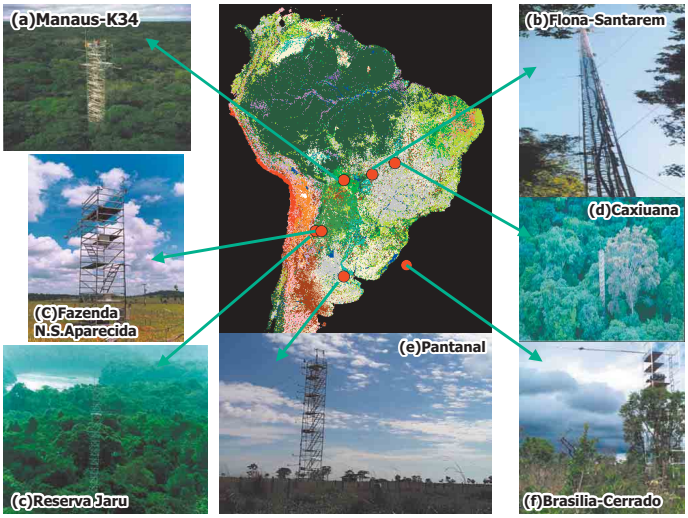


Fig. 1 LBA-CEOP Reference sites

All the sites measure fluxes of carbon and surface energy, vertical profiles of air temperature, CO_2, and water vapour, as well as general surface meteorological variables, with time resolutions as high as 30 minutes so that they can be classified as CEOP 1-D sites. The Manaus K34 and Rondônia sites also measure soil moisture and temperature profiles, continuous soils respiration, and volatile organic carbon. The K34 site also features a tethered balloon and a hydrological catchment that is being discussed for use as a potential LBA CEOP hydrologic reference site.

Figure 2 shows the diurnal variability of CO_2 fluxes in four sites during the dry season.

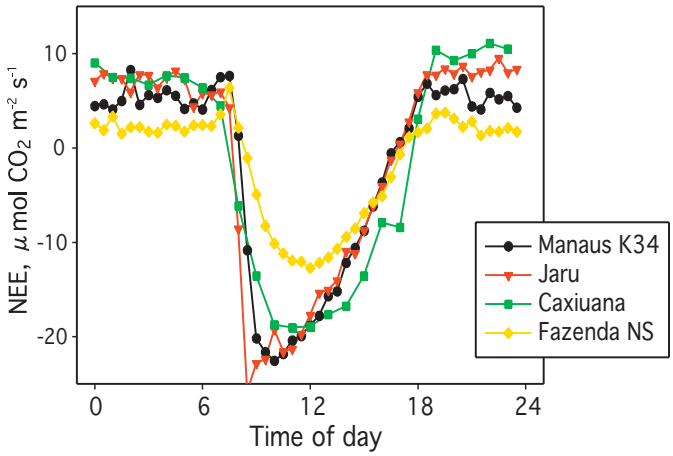
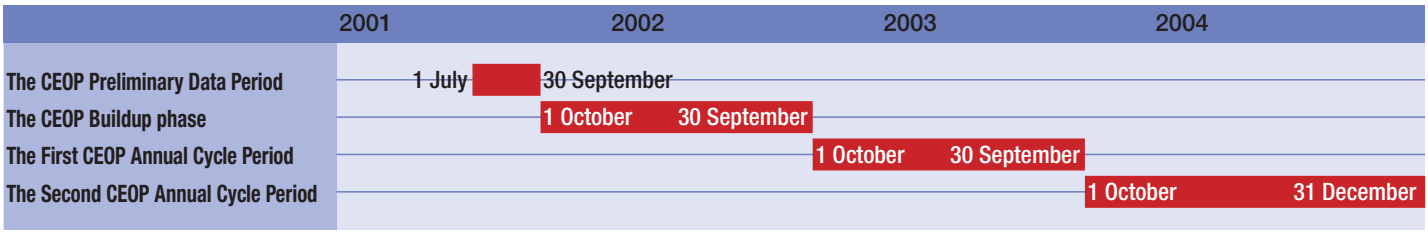


Fig. 2 Averaged diurnal pattern of CO_2 fluxes in 4 sites

Schedule of CEOP



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