Coordinated Enhanced Observing Period

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

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CEOP Phase I successes must be sustained through a CEOP Phase II effort for climate research and Earth observations: A view by the Director of the World Climate Research Programme (WCRP) International Global Energy and Water Cycle Experiment (GEWEX) Project Office and Executive Chair of the Integrated Global Water Cycle Observations (IGWCO) theme of the Integrated Global Observing Strategy Partnership (IGOS-P)

Richard Lawford, Director, International GEWEX Project Office (IGPO), MD, USA


Richard (Rick) Lawford

It is a privilege to have an opportunity to offer a perspective on CEOP at this critical point as it transitions from Phase I to Phase II. The first phase of CEOP has made important steps towards the realization of its long-term scientific 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. I am sure that those who are close to CEOP, however, would be the first to recognize that there is a great deal more that needs to be done.

CEOP has made remarkable progress since it was initiated by the Global Energy and Water Cycle Experiment (GEWEX) within the framework of the World Climate Research Programme (WCRP) in 2001. As Director of the International GEWEX Project Office (IGPO), I have closely followed the progress of CEOP because its scientific and technical goals are synergistic with those of GEWEX. Not only has CEOP been successful in developing comprehensive composited datasets, it also has stimulated a number of research projects that continue to advance our understanding of processes important for climate prediction. In addition, CEOP reports indicate that a number of milestones have been reached in each of the main CEOP science focal areas.

CEOP's synergy with GEWEX goals is evident through its primary science focuses including land surface processes and monsoons. For example, the Water and Energy Simulation and Prediction (WESP) Working Group has been using enhanced observations to diagnose, simulate, and predict water and energy fluxes and reservoirs over land on diurnal to annual temporal scales as well as to apply these predictions for water resource applications. In addressing this goal, which interacts very effectively with the GEWEX Water and Energy Budget studies, the CEOP Monsoon Systems Working Group has taken steps to document the seasonal march of the monsoon systems, assess their driving mechanisms, and investigate the possible connections between monsoonal systems in different regions. The CEOP Inter-monsoon Model Study (CIMS), which has spurred the organization of a Pan-WCRP Monsoon Studies Workshop, is unifying studies of these important climate phenomena that occur in different regions of the world.

In my recent role as the co-chair of the writing team for the IGWCO and my present role as the Executive Chair of the Implementation team, I have come to appreciate CEOP's contributions to IGWCO and plans for new approaches to Earth observations based on paradigms such as interoperability, integration, and timeliness. CEOP's success in bringing together space agencies, the research community, tower operators, and Numerical Weather Prediction and Data assimilation centers has provided a model for addressing complex scientific and observational issues. As IGOS-P and the Committee of Earth Observing Satellites (CEOS) have witnessed CEOP's ability to build a community and to harness the energies of diverse groups including research scientists and operational forecasters, they have gained confidence in the water cycle science community and its ability to achieve the ambitious plans that relate to the IGWCO implementation plans and the targets described for the water sector in the Global Earth Observation System of Systems (GEOSS) Ten-Year Implementation plan. Given CEOP continuing

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leadership in data intergration, it is fully understandable that IGOS-P has endorsed CEOP II as a central IGWCO activity.

The decision to extend CEOP into a Phase II (2005-2010), which was made by the CEOP Advisory and Oversight Committee (AOC) and CEOP Science Steering (SSC) Committee, has also been endorsed by the GEWEX Scientific Steering Group (SSG) and the Joint Steering Committee of the World Climate Research Programme (WCRP). This transition is timely because GEWEX and CEOP are both contributing to the establishment of the WCRP Coordinated Observation and Prediction of the Earth System (COPES) strategy as a unifying and integrating strategic framework for making more effective use of the capabilities of the climate research community and the growing capabilities of observation, data assimilation, and prediction systems.

The programmatic, technical, and scientific infrastructure that has evolved in CEOP over its initial observation period is a very positive contribution to the overall context of water and energy cycle research in climate studies. It is important to research communities of WCRP and GEWEX, and to Earth observation communities in IGOS-P and CEOS that CEOP remains a stable, well-funded activity so that its participants can focus on its scientific and system development goals. While all space agencies are to be commended for their support the Japanese Aerospace Exploration Agency (JAXA) and the National Aeronautical Space Agency (NASA) have been exemplatory in this respect. I would also be remiss without recognizing a few of the central individuals, such as the Chief CEOP scientists, the International CEOP coordinator, the CEOP Secretariat and the leads of the Scientific and Data Working Groups, that have made CEOP a success through their unselfish commitment to its objectives. The commitment of past experts as well as new participants is welcome and indeed is essential for the success of Phase II of CEOP.

Summary of Discussions at the American Monsoons System Workshop (Montevideo, Uruguay, 17-18 September 2004): Held as the Third In a Series of CEOP Inter-monsoon Model Study (CIMS) Monsoon Science Meetings

Jose Marengo, CPTEC/INPE, Sao Paulo, Brazil

The Third CEOP Workshop on Monsoon Systems associated with CEOP Inter-monsoon Model Study (CIMS) was organized in cooperation with the World Climate Research Programme (WCRP) and Global Energy and Water Cycle Experiment (GEWEX) Hydrometeorology Panel. Local support was received from the Universidad de la Republica from Montevideo, Uruguay. The meeting was organized by Dr. Jose A. Marengo, from the Centro de Previsão de Tempo e Estudos Climáticos (CPTEC) from Sao Paulo, Brazil, who co-chaired the proceedings with Dr. Roberto Mechoso from the University of California-Los Angeles (UCLA), at California, USA.

The main objective of the meeting, which the participants agreed was successfully accomplished, was to provide better understanding of fundamental physical processes underpinning the diurnal and annual cycles, and intraseasonal oscillations in monsoon land and adjacent oceanic regions especially of the Americas, and also of Africa, Asia, and Australia; as well as to share experiences and ideas on studies of processes and variability in the American, Asian (Indian and Australian) and African monsoons. Progress was made toward the accomplishment of each of a number of specific issues, which motivated the organization of the meeting, including to:

- identify individuals and institutions working on different aspects of monsoon studies in the Americas;
- encourage the use of data from field experiments and reference sites for observational and modeling studies for both North American Monsoon Systems (NAMS) and South American Monsoon Systems (SAMS);
- encourage collaboration among scientists on monsoon issues, relevant to the objectives of other international monsoon activities such as the WCRP Climate Variability and Predictability (CLIVAR) Project, Variability of American Monsoon Systems (VAMOS) initiative; the CLIVAR Asian-Australian Monsoon Panel; WCRP Global Energy and Water Cycle Experiment (GEWEX) monsoon related studies and CEOP Monsoon Working Group research.

Over 25 presentations were made by a large International Group of multi-displinary researchers. The focus was on processes, studies on model physics improvement, simulations, and cross-validation of global and regional model outputs with talks on detailed observational analyses using in-situ observations and gridded CEOP model datasets. Assessments of model capabilities in simulating physical processes in the America's monsoon and inter-comparisons with the Asian monsoon were also presented. Observational studies were described that had been undertaken to understand the intraseasonal, interannual and decadal time scale variability of the monsoon in the Americas. Other talks covered issues related to the water and energy balances, diurnal cycle, predictability, teleconnections and regional forcing in monsoon regions. New research that included aerosol interactions with monsoon systems were also presented. Recent studies done as part of the GEWEX Large-scale Biosphere-Atmosphere Experiment in Amazonia (LBA) have linked the concentration of aerosols due to biomass burning in the Amazon with rainfall and the onset of the rainy season in southern Amazonia.

Summary of the CEOP International Metadata Meeting (Tokyo, Japan 1 - 2 November 2004)

Sam Benedict, CEOP International Coordination Function, CA, USA

A meeting was held in Tokyo in early November 2004 that focused on the establishment of a unified CEOP Metadata format. The International specialists at the meeting agreed that a CEOP metadata design was necessary for integrating CEOP satellite imagery, reference site data and simulation result data. This effort is necessary for CEOP to meet its commitments to the CEOS IGOS-P, IGWCO, to WCRP COPES and ultimately to the implementation of GEOSS, by enabling interoperability of multiple systems (beyond those currently defined as part of CEOP) and by developing metadata services incorporating international standards as one of the main activities of CEOP.

The participants agreed that the role of metadata in CEOP will be to:

- Provide data producers with appropriate/consistent information/requirements.
- Facilitate organization and management of the CEOP datasets.
- Enable users to apply geographic data.
- Facilitate data discovery, retrieval and reuse.
- Enable users to determine whether geographic data in a holding will be of use to them.

Because there are existing standards for metadata, such as ISO 19115, for geographic Information the main task is to harmonize the CEOP metadata with the ISO metadata. This requires that a metadata standard/design must be devised for CEOP satellite, reference site, GRIB Model output and MOLTS model output data types. Presentations at the meeting showed that work has already begun on this task and metadata designs have been prototyped for each CEOP data type. For the satellite data, the AMSR-E instrument was chosen as an illustrative example for the metadata structure. The AMSR-E product consists of a header and a data part and the header includes the core metadata and the product metadata. As an example, one part of the metadata standard format for CEOP satellite data (specifically for the AMSR-E, instrument) was shown at the meeting (see Figure 1.). Other similar examples already exist for the CEOP in-situ and model data types.

The CEOP Lead Scientist noted that the plans for implementation of a CEOP metadata standard established by the participants require endorsement by CEOS and commitments by space agencies, especially JAXA and NASA, to be achieved. Strategies are being developed to obtain the required support.

Header information of data and their mapping to ISO metadata (1)

Index	CEOP header data item description	ISO metadata package	Class	Attribute	Data type	Explanations
1	Filename	Identification Information	MD_Identification	citation	CI_Citation	Filename can be title (an attribute of CI_Citation class). See 19115_No.360
2	Sensor		MD_Sensor			If MD_Sensor class suggested in 19115-2 is not applied, this will be handled as "title".
3	Product		MD_DataIdentification	topicCategory	Class	High-level geographic data thematic classification to assist in the grouping and search of available geographic data sets. Can be used to group keywords as well. Listed examples are not exhaustive. "imageryBaseMapsEarthCover"seems to be the most appropriated among the examples given. But, "CEOP_Satellite_Imagery" is suggested as a better term.
			or MD_Keywords	keywords	CharacterString	Keywords can be used.
4	Observation Date and Time	Extent information	EX_TemporalExtent	Class	TM_Primitive	Date and time for the content of the dataset
5	Image Size	Spatial representation information	MD_GridSpatialRepresentation			Spatio grid dimension
				numberOfDimensions	Integer	
				axisDimensionProperties	Sequence<MD_Dimension>	Row, column, vertical etc. see B.5.14 MD_DimensionNameTypeCode <<CodeList>> Resolution of Grid is also represented here
				cellGeometry	class (MD_CellGeometryCode)	Point or area
		Content information	MD_RangeDimension	sequenceIdentifier	MemberName	Number of spectral/frequency bands
6	Data Type	Content information	MD_Band	cellValueType		e.g. £≤byte Integer Proposed in 19115-2: mandatory (if applicable) bit representation of data value in raster cell
7	Data Unit	Content information	MD_CoverageDescription	attributeDescription	record type (see. 19103)	Unit of physical measurement Def. Record type (see. 19103): "A Record is used as an implementation representation for features, by keeping a list of (name, value) pairs in a dictionary. This represents a generic storage structure for features."

Figure 1. CEOP Satellite Metadata Standard (AMSR-E, instrument) first 13 of 21 total fields

Summary of CEOP Issues Presented at the Joint Meeting of the WCRP Working Group on Numerical Experimentation (WGNE) and the GEWEX Modeling and Prediction Panel (GMPP) at Exeter, UK from 11-15 October 2004.

Michael G. Bosilovich, Global Modeling and Assimilation Office, NASA/GSFC, MD, USA

Dr. Michael G. Bosilovich, Co-Chair for the CEOP Modeling Working Group, represented CEOP at the WGNE/GMPP joint meeting and reported on the status of the CEOP data collection process, current scientific activities, connections to other international observational and research efforts and future plans.

The Working Group on Numerical Experimentation (WGNE) was jointly established by the Joint Scientific Committee (JSC) on the WCRP and the WMO Commission for Atmospheric Sciences (CAS) while the GEWEX Modeling and Prediction Panel (GMPP) was established by the GEWEX Scientific Steering Group and endorsed by the JSC. The functions of these groups that make their work synergistic with CEOP include their joint responsibility in WCRP/GEWEX of fostering the development of atmospheric circulation models for use in weather prediction and climate studies on all time scales and diagnosing shortcomings and for promoting coordinated numerical experimentation for validating model results, observed atmospheric properties, exploring the natural and forced variability and predictability of the atmosphere.

The participants were informed that many modeling groups are utilizing CEOP data in research and development activities. Specific examples of CEOP analyses were presented including a study being undertaken by the Global Land Data Assimilation Systems, Land Information Systems (GLDAS/LIS) Group at the Goddard Space Flight Center (GSFC). Results were shown of testing of 1km spatial resolution offline land models, using 1km vegetation and leaf area index (LAI) from the NASA Moderate Resolution Imaging Spectroradiometer (MODIS) satellite instrument, compared to 25km resolution, over CEOP sites that show that better representation of the vegetation nearer a site, improves the land model results. It was also noted that as participants in the model output component of CEOP, several major Numerical Weather Prediction and Data Assimilation Centers are validating their grid space surface energy fluxes with CEOP reference site data. The Global Modeling and Assimilation Office (GMAO) at GSFC is also using the CEOP reference site data as independent validation for testing remotely sensed skin surface temperature assimilation impact on the energy and water fluxes. In addition, presentations from Yoshiaki Takeuchi (JMA) and Sean Miller (UKMO) demonstrated their respective offices use of CEOP data for internal validation studies. The Groups were advised that the key attribute of the existing CEOP data set for Model applications, which includes data from sites that is accessible from other databases, is that the CEOP data has undergone additional quality control measures (including visual inspection of all data), and the format of the data is uniform across all providers.

Proposed CEOP Model Inter-Comparison Experiment Framework

Michael G. Bosilovich, Global Modeling and Assimilation Office, NASA/GSFC, MD, USA

The data collection and science efforts defined in the CEOP implementation plan (Phase I) encouraged the contribution of many analysis centers (operational and research) data products. This would effectively coordinate many different data assimilation products with in-situ and remotely sensed observations. How then can we exploit the synergy afforded by CEOP for the improvement of models and data assimilation? In November 2004, the National Aeronautics and Space Administration (NASA) accepted proposals to the Model, Analysis and Prediction program. This note describes our response to that program. Here, we summarize the framework of initial experiments to alert the broader international community of this activity and to solicit additional comment and participation in the process.

The proposed project will specifically focus on the ability of current global data assimilation systems, individually and in ensemble, to reproduce all of the components of the water and energy cycles (precipitation, evaporation, transports, water and energy content, and radiation). The team expects to take advantage of many new EOS platforms to provide independent global data for cross comparison of the analysis systems. Processes will be investigated that relate to the diurnal cycle and seasonal progression (e.g. monsoons). Previous studies with 2 or 3 analysis systems have shown that, despite the analysis of observations, the analysis output, especially output related to the models' physical processes, can differ greatly from each other. There will be an inter-comparison of many available centers' analyses, including NASA's next generation systems, to be used for operational analyses in support of NASA research instrument teams and also for satellite era retrospective-analysis. The inter-comparison of so many different analyses should reveal the uncertainty of current data assimilation systems, and will contribute to the improvement of operational and retrospective analyses (and also contribute toward improved climate, seasonal and weather predictions, and the representation of climate variability in reanalysis).

The main data period that will be the focus of this effort consists of CEOP's two annual cycles (EOP3 and EOP4, October 1, 2002 – December 31, 2004). The large number of centers involved show that there has been a recognition that this timeframe will provide a superior time period to conduct model and analysis research and development owing to the richness of the CEOP data collection (including both in-situ and remotely sensed observations, and many other data analysis products). The proposed activity will take advantage of the extensive CEOP collection in order to better understand and quantify the uncertainty of analyses. This proposed analysis inter-comparison project will also implement tools developed by the Program for Climate Model Diagnosis and Inter-comparison (PCMDI) for analysis of multiple general circulation models. The Climate and Forecasting data standard will also be applied across the different analyses. This is the accepted standard for the next International Panel on Climate Change (IPCC) model experiments, so this standard should facilitate collaboration among scientific research groups.

The data and diagnostics developed in this project will provide a benchmark for future developments models and analysis systems, as well as a resource for the international scientific community. A central scientific priority of CEOP focuses on the measurement, understanding and modeling of the water and energy cycles in the Earth system and the relationships of monsoon systems. In particular, the Water and Energy Simulation and Prediction (WESP) working group is concerned with understanding the gaps in measurements and the deficiencies of models, and ultimately to define and improve the skill in predicting hydro-climatological water and energy budgets. The NASA Land Information System (LIS) will contribute fine resolution offline land data for comparison and analysis of the systems. Therefore, this initial project brings focus to three main CEOP science objectives (water and energy cycles, land atmosphere interactions and monsoon connections) while addressing the principal needs of the NASA Modeling, Analysis and Prediction (MAP) program.

Another way this proposal connects to CEOP is through issues that relate to monsoon life cycles. Model inter-comparison studies have shown simulations of monsoon climate variability by state-of-the-art models lack fundamental characteristics (e.g. the diurnal cycle), and that uncertainties in model predictions ultimately can be traced back to inadequate model performance in simulation of the climatology. The implementation of this activity will follow the CEOP Inter-monsoon Modeling Study (CIMS) strategy to document the variations of the diurnal and seasonal cycles around the world, using the data developed in the proposal and with CEOP data.

An important synergistic aspect of this project and CEOP is that the EOS research satellites are producing critical data for validation and assimilation, especially the water and energy budgets and CEOP has agreements to obtain such data. Each parameter is in a different state of maturity. For example, many MODIS (Moderate-resolution Imaging Spectroradiometer) data products are only recently becoming more accessible. It has been partly through the endorsement of CEOP by the Committee on Earth Observation Satellite (CEOS) that space agencies have agreed to make such data and products available for use within a fully integrated CEOP database system.

The first objective of the project will be direct inter-comparisons of key water and energy cycle parameters. The contributing centers are providing Model Output Location Time Series (MOLTS). These are high temporal resolution point output for the nearest CEOP reference site locations. The small size of these subsets of data, with high temporal resolution (1-3 hours), facilitates investigation of the diurnal and seasonal cycles (without a great concern about modifying gridded data). However, we will quickly move to intercomparing the key water and energy cycle data on a common spatial grid structure. This will facilitate a quantitative analysis of the uncertainty of all analyses, as well as the development of an ensemble of analyses. A first attempt will be simply a linear ensemble of the available data. This should be a reasonable starting point, as the analyses are all linked through similar observing systems, and differences will occur due to the analysis methodology and the model physics. Eventually, more advanced methods will also be examined, for example, a weighting scheme based on independent observations (such as TRMM rain rate).

The PCMDI utilities are linked to DODS and Live Access servers that allow dissemination of data and diagnostics. The data on the server will include the available centers CEOP data subsetted to key parameters, ensemble of the analyses, and available EOS data. It is envisioned that this will ultimately be a resource for the international CEOP participants and the community in general.

The research team consists of M. Bosilovich (NASA), J. Roads (SIO), C. Peters-Lidard (NASA), and W. K.-M. Lau (NASA), with P. Glecker (PCMDI) and S. Benedict (CEOP/GEWEX) collaborating. For more details, contact Michael.Bosilovich@nasa.gov.

Inter-comparisons of seasonal changes between East Asian and South American monsoons:

Preliminary results from the CEOP Inter-Monsoon Studies (CIMS)

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1. Introduction

Traditionally, monsoon climate is thought to exist only in the Asian-Australian-Indian Ocean-African sector based on the seasonal wind reversal phenomena, and the South American Continent has been regarded as'monsoonless'(Ramage, 1971). However, some recent studies indicate that the South American Continent is also monsoonal (e.g., Zhou and Lau, 1997, Chen, 2004).

On the other hand, the East Asian monsoon has been recognized as a monsoon system, although the main components include the Baiu/Mei-yu frontal zone (BFZ) of mid-latitude origin, which distinguishes it from the South Asian tropical monsoon system (e.g. Tao and Chen, 1987, Ninomiya and Murakami, 1987). In South America, the cloud band called the South Atlantic Convergence Zone (SACZ) has an influence on its rainy conditions of the monsoon (Kodama, 1992). Here, based on a paper presented at the CEOP Inter-Monsoon Studies (CIMS) Workshop held at Montevideo, Uruguay (See Page 2), the authors attempt to depict a comparative view of the seasonal changes between East Asian and South American monsoons.

2. Data

The data utilized in the present study are; wind, temperature and specific humidity data at 850hPa based on NCEP/NCAR reanalysis (Kalnay et al., 1996) and precipitation data derived from CMAP (Xie and Arkin, 1997) for the 22-year period from 1979 to 2000. To reveal the minute seasonal transitions, pentad mean data are utilized.

3. The monsoon circulation

Figure 1 depicts the distribution of seasonal differences of 850 hPa wind and precipitation between winter and summer in both Asian and South American regions. In East Asian sector (Fig. 1a), two separate regions are identified in the Mei-yu/Baiu frontal band (MBFZ) in the central China-Japan area and in the ITCZ cloud band over the western North Pacific as distinct seasonal rainfall contrast. For circulation fields, the former is accompanied with pronounced weakening of northwesterly in summer, while, the latter with strengthened southwesterly wind. Over the Asian continent, cyclonic circulation feature surrounding the Tibetan Plateau is clearly seen.

Over South America (Fig. 1b), continental-scale precipitation changes are also recognized between the equator and 25ºS with enhanced westerly wind between 5ºS and 25ºS, which may be identified as low level monsoonal circulation. The latter circulation will be related to the development of surface heat low over the continent locally known as Chaco Low, and the eastward retreat of the subtropical high on the South Atlantic. However, the large difference between these two monsoons is contrasted by the existence/absence of a strong winter monsoon from the continent in East Asia/South America.

4. Seasonal changes of wind and precipitation

Figure 2 depicts the time-latitude sections of 850hPa wind and precipitation along 110-120ºE and 50-60ºW as a representative longitude of the continental part of the East Asian and South American monsoons, respectively. Over East Asia (Fig. 2a), two precipitation maxima are located at 0-20ºN and 20-35ºN, corresponding to the ITCZ and frontal band. An abrupt onset of westerly wind at Pentad 28 (late May) accompanied by a sudden increase of precipitation over the South China Sea is a conspicuous feature of summer monsoon onset. After that, two precipitation belts seem to come close together and then the northern band suddenly shifts northward at Pentad 32 (mid-June) accompanied by the onset of Mei-yu season in the Yangze valley. Southwesterly flow along the MBFZ also migrates northward to 40ºN at pentad 42 (late July). At Pentad 45 (mid- August), a sudden change from westerly to easterly wind occurs in the 20-30ºN zone. After that the MBFZ precipitation gradually decreases.

Over South America (Fig. 2b), two precipitation zones are also basically recognizable at 0-20ºS and 25-35ºS. The former band migrates southward as the season progresses from winter to summer, while the latter is rather stable in location and a somewhat northward shift can be found at about Pentad 65 (late November). Rainfall amount in the former region tends to be more abundant after Pentad 70 (mid December). In the wind field, albeit not as distinct either temporally or spatially, a wind shift from easterly to westerly also occurs rather abruptly at about Pentad 66. This maybe regarded as the summer monsoon onset over South America in the low-level circulation.

5. Temperature and moisture conditions

Temperature and moisture conditions are also analyzed. In East Asia, the MBFZ is characterized by the weak temperature and strong moisture gradient along the frontal zone (Ninomiya, 1984) and the decrease of temperature gradient occurs in mid-May in an abrupt manner (Kato, 1985). In Fig. 3a, such features are also recognized. Over South America (Fig. 3b), of course, the temperature is higher in summer, but the seasonal change amplitude is much smaller than that over East Asia. However, if we look at the conditions near the rain-belt at 30ºS, the north-south temperature gradient is also weakened in summer, similar to the situation over East Asia.

Moisture fields over East Asia (Fig. 3a) also exhibit conspicuous seasonal changes. The increase in moisture content in summer and the northward intrusion of the moist region after Pentad 35 (late June) and up to Pentad 50 (early September) are one of the prominent features. Over South America (Fig. 3b), although wet air invades also into the southern region in summer, its extent is limited to north of 30ºS and the moisture amount itself is much smaller.

6. Conclusions

In this study, comparisons of seasonal changes between East Asian and South American monsoons are attempted using the wind, temperature and moisture fields as basic information that will be utilized in future CIMS studies. Although, both monsoon systems exhibit more or less seasonal contrasts between winter and summer, more vigorous changes are, in general, observed in East Asian monsoon. However, also found is the abrupt wind shift at the onset of South American monsoon in late November. Further studies using CEOP data are needed for the more comprehensive comparisons of the two monsoon systems.

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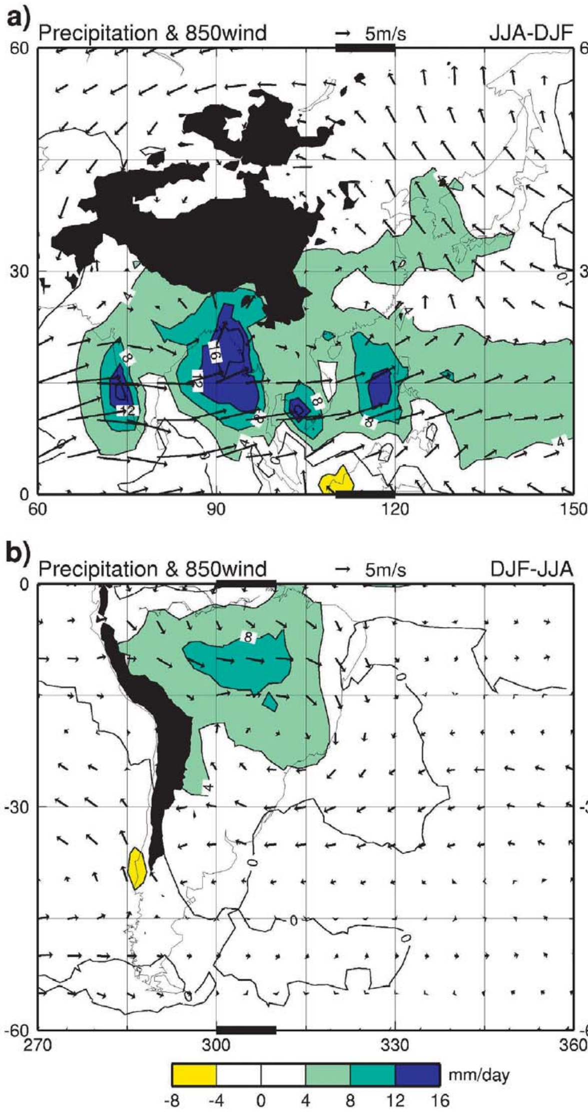


Figure 1 Spatial distribution of seasonal differences of precipitation and 850hPa wind between summer and winter around (a) East Asia and (b) South America. Solid bars at the top and bottom of each figure indicate the meridional zones in Figures 2 and 3.

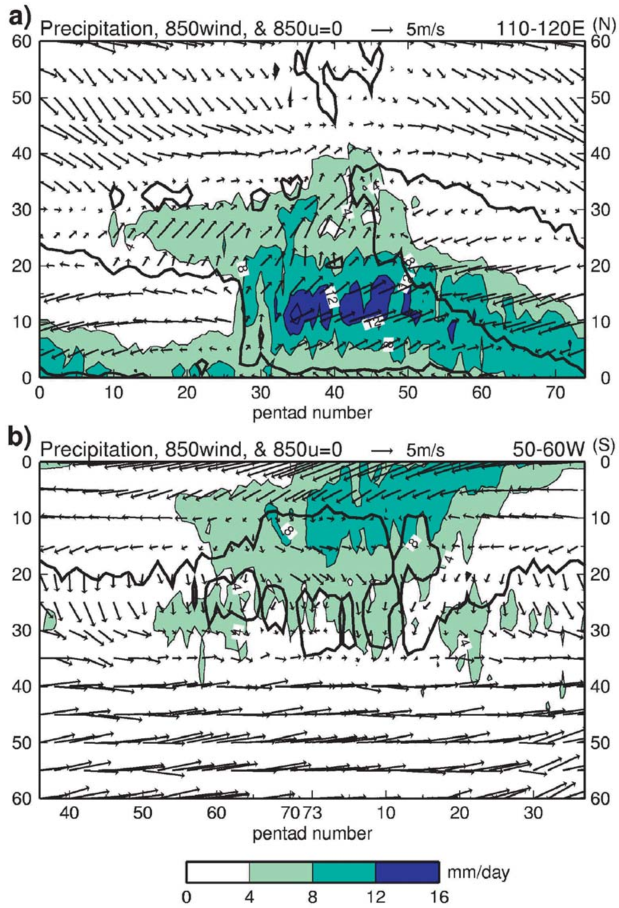


Figure 2 Time-latitude sections of precipitation and 850hPa wind along (a) 110-120ºE and (b) 50-60ºW. Thick solid line indicates 0m/s contour line of 850hPa zonal wind.

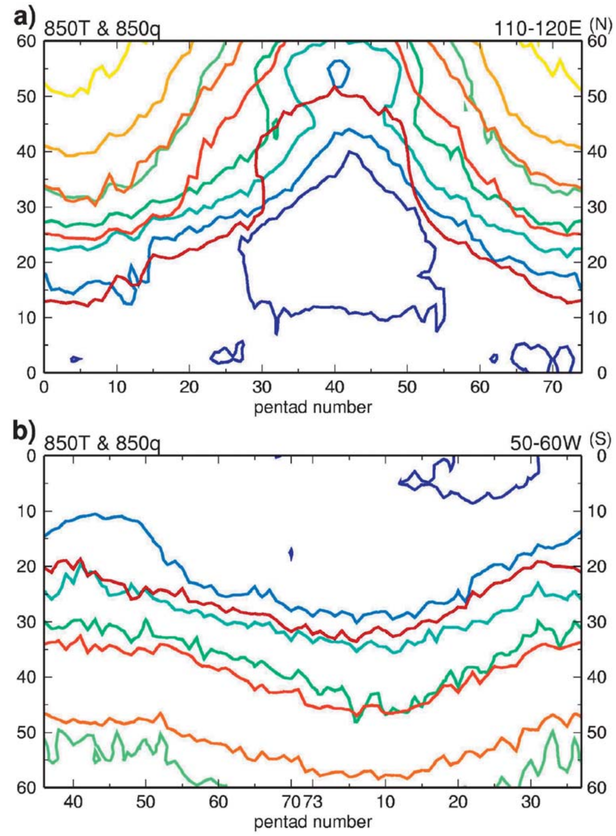


Figure 3 Same as Figure 2, but for 850hPa temperature (T) and specific humidity (q). Warm-color lines are T for 260 (red), 252, 244, 236, and 228 (yellow) K. Cold-color lines are q for 10 (deep blue), 8, 6, 4, and 2 (light green) g/kg.

Contribution of the CATCH* project to the CEOP and Its relations with the AMMA** international project over West Africa

***Couplage de l'Atmosphère Tropicale et du Cycle Hydrologique ** African Monsoon Multidisciplinary Analysis**

Thierry Lebel and **Christian Depraetere**, CATCH Project, Grenoble, France

The CATCH observing system is one element of the French component of the AMMA project. CATCH focuses on the long term monitoring of the water cycle and vegetation dynamics on three mesoscale sites spanning the West African eco-climatic gradient. It operates thanks to the financial support given by the French Ministry of Research and by the French Institute for Development (IRD).

One mesoscale site (the area containing the Niamey, Niger, sahelian bioclimate) has been in operation since 1990; the second site (upper Ouémé valley, Benin, soudanian bioclimate) started in 1999; the third site is located in the Malian Gourma (Mali, sub-desertic bioclimate). National operational services(meteorology and hydrology) are associated with the project.

These mesoscale CATCH sites (MS1, MS2 and MS3) play a pivotal role within the overall AMMA experimental setting (figure 1). Hydrometeorological monitoring is a key priority for these sites, which will be operational until the end of the AMMA/LOP in 2010.

Hydrometeorological data of the Ouémé reference site for the years 2001-2003 (figure 2) were transmitted to the CEOP data centre as a contribution to ongoing studies on monsoon inter comparison all over the world.

Following the building phase initiated in 2002, the AMMA/EOP will start in 2005 and last till 2007 (figure 3).

AMMA site	Code	Period	Location
Niamey Square degree	MS1	1990 onward	2°E to 3°E 13°N to 14°N
Oueme bassin	MS2	1999 onward	1.5°E to 2.8°E 8.9°N to 10.2°N
Malian Gourma	MS3	from 2005 onward	2°W to 1°W 14.5°N to 17.5°N

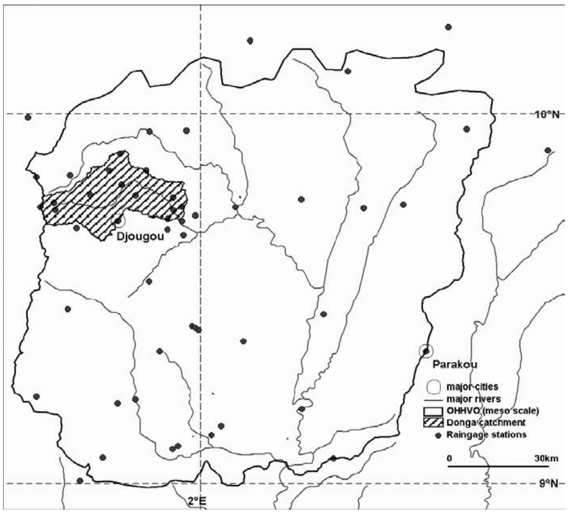


Figure 2 List of CATCH sites and rain gauges network on the Upper Ouémé bassin (MS2)

	2001	2004	2003	2004	2005	2006	2007	2008	2009	2010
LOP										
EOP		building phase								
SOP										

Figure 3 Phases of the AMMA international project

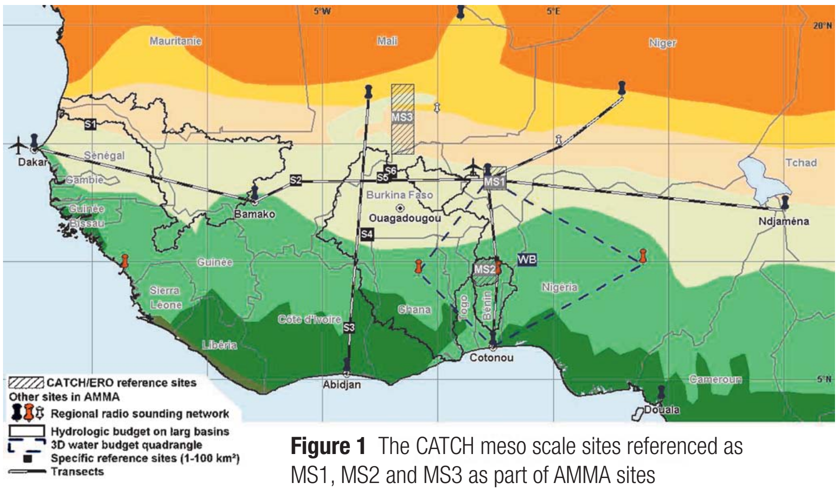
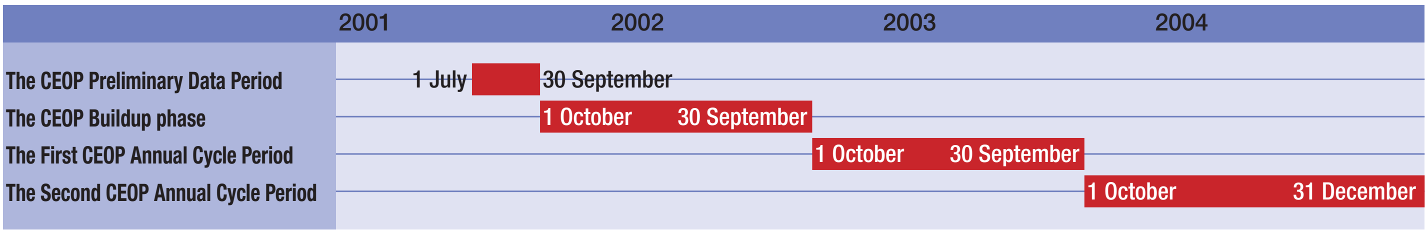


Figure 1 The CATCH meso scale sites referenced as MS1, MS2 and MS3 as part of AMMA sites

Schedule of CEOP



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