GEWEX NEWS
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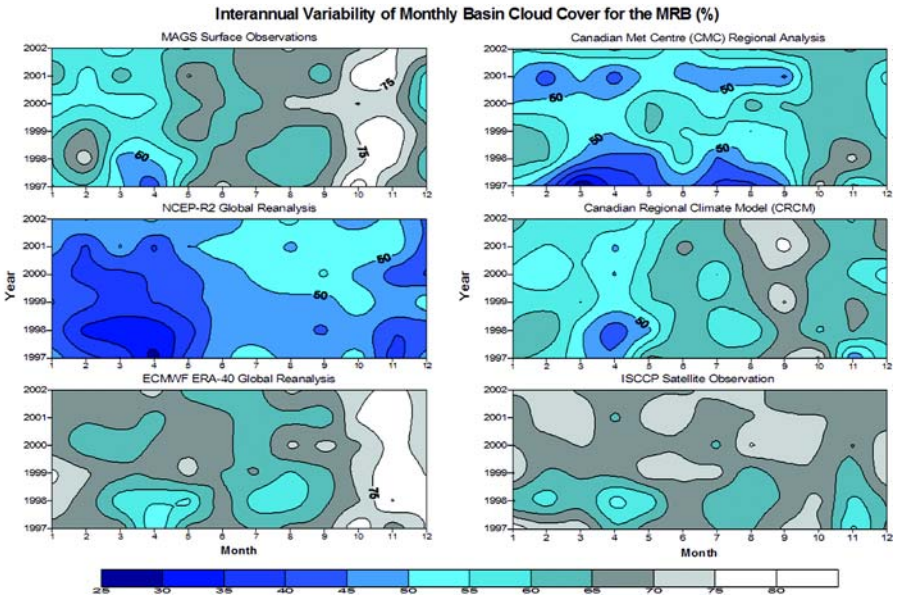
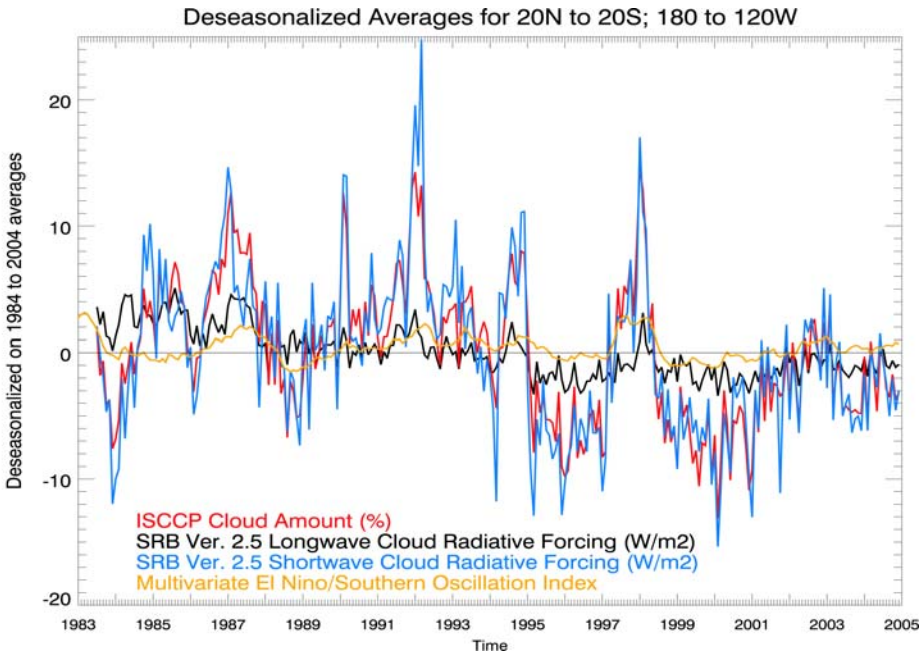
GEWEX DATA SETS ISSUE: COMPREHENSIVE GLOBAL AND REGIONAL DATA SETS PROVE VALUABLE FOR MODEL VALIDATION AND CLIMATE PROCESS UNDERSTANDING

MACKENZIE GEWEX STUDY CLOUD COVER OBSERVATIONS USED TO ASSESS CLOUD COVER BIAS AT HIGH LATITUDES



Intercomparison of monthly basin-average cloud covers for the Mackenzie River Basin in various regional and global data sets. *See article on page 8.*



21.5-YEAR GEWEX CLOUD AND RADIATION DATA SETS SHOW EL NIÑO EFFECT

Illustration of the role of El Niño in determining the long-term anomalies in the shortwave (SW) and longwave (LW) radiative forcing for the western Pacific region (20N to 20S and 180W to 120E). Shown are the anomalies relative to the 21.5-year mean of the cloud fraction from the International Satellite Cloud Climatology Project (ISCCP) and the Surface Radiation Budget (SRB) Project SW and LW cloud radiative forcing. The El Niño/Southern Oscillation index is shown for comparison. *See article on page 12.*

COMMENTARY

GEWEX DATA SETS FOR CLIMATE ASSESSMENT ACTIVITIES

Richard Lawford, Director
International GEWEX Project Office

Since its outset GEWEX has been developing global and regional data sets that can be used to address climate change questions. This issue describes many of these data sets and provides guidance on how to access them.

The World Climate Research Programme (WCRP) is placing a greater priority on contributions to climate assessment activities, including those of the Intergovernmental Panel on Climate Change (IPCC). This strengthened emphasis will provide support and guidance for the GEWEX research agenda. For example, the IPCC process has identified various water cycle processes (e.g., water vapor, clouds, land surface processes) as major knowledge gaps in the most recent assessment. These topics are all central science issues for GEWEX.

Programmatically, GEWEX activities in the climate change area can be broadly classified as: 1) studying climate processes and feedbacks that account for changes in climate; 2) developing and distributing data sets to facilitate the identification of variability and trends in water cycle variables, and to improve process representation in global and regional climate models; and 3) carrying out model studies to assess the relative importance of factors that could contribute to climate change.

Discussions about anthropogenic climate effects frequently focus on the influence of greenhouse gases such as carbon dioxide and methane on the radiative properties of the atmosphere. The provision of tools to facilitate assessments of the effects of the increasing atmospheric concentrations of these gases on the radiative balance have been a research focus for GEWEX. Projections of temperature changes are only as reliable as the radiation codes used in the climate models under both cloud free and cloudy conditions. Through its Continuous Intercomparison of Radiation Codes (CIRC) Project, GEWEX is establishing a database using detailed cases from the Atmospheric Radiation Measurement (ARM) Program Cloud and Atmospheric Radiation Testbed (CART) site in Oklahoma to provide a benchmark against which GCM developers can compare their model codes for cloud-free, liquid cloud and ice cloud conditions. GEWEX also undertakes process and modelling studies to improve land surface, cloud, boundary layer and hydrology parameterizations in climate models. These studies are facilitated by the development of a number of long-term global data sets based on operational satellite data. The value of these data sets would be further enhanced by a product reprocessing initiative that GEWEX is proposing.

GEWEX also addresses other anthropogenic effects influencing climate change whose impacts are less well known. Aerosols not only affect human health and infrastructure, but it is postulated that they affect precipitation patterns and regional climates. Another feedback process involves the influence of land use change on surface fluxes. Over the past two centuries the land surface has been extensively altered by man through the construction of reservoirs and the clearing of forests for agricultural use. Through its Global Land-Atmosphere System Study, GEWEX is planning an intercomparison of GCMs to see how they handle the land use change observed over the past century and to identify if any of the recent temperature trends can be attributed to this factor.

Readers are encouraged to make use of these data sets and, where appropriate, contribute to our understanding of the role of the energy and water cycle to change and variability in the climate system.

Contents

RECENT NEWS OF RELEVANCE TO GEWEX

WESTERN PACIFIC GEOPHYSICS MEETING

The WPGM was held in Beijing, China on 24–27 July 2006. One of the main conference themes, "sustainable natural resources and the environment" featured a number of hydrology sessions, including one on "the Earth's energy and water cycle." Prof. Soroosh Sorooshian gave a Frontier lecture entitled "Status of the Water Resources Worldwide and Recent Developments in Hydrometeorologic Forecasting." Rick Lawford gave a presentation on GEWEX contributions to climate science at both the WPGM and the Chinese Meteorological Administration.

EUROPEAN COMMISSION APPROVES WATCH PROJECT

WATCH will bring together the hydrological, water resources and climate communities to analyze, quantify and predict the components of the current and future global water cycles and related water resources states, evaluate their uncertainties, and clarify the overall vulnerability of global water resources related to the main societal and economic sectors. As such there will be active cooperation between GEWEX and its activities and WATCH.

GEWEX NEWS

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DATA SETS FROM THE CONTINENTAL-SCALE EXPERIMENTS

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For more than 10 years GEWEX has coordinated the activities of the Continental-Scale Experiments (CSEs) and other land-surface research through the GEWEX Hydrometeorology Panel (GHP). In almost all of the CSEs, reference sites were established where high precision *in situ* measurements were collected for use in validating models and remote sensing algorithms. In addition to the GHP reference sites, each CSE had its own active data collection and management program which focused primarily on priority regional scientific issues, but taken together, provided new global water cycle research data. The GHP Data Management Working Group began developing common protocols for data collection, exchanges, and data policy in 1998. This effort was galvanized by the Coordinated Enhanced Observing Period (CEOP), which is developing common protocols for *in situ* data and using these for model output products (model analyses and reanalyses) and remote sensing (satellite) based data. Many of the CSE data sets are not yet available for use in CEOP products. In order to ensure that these intrinsically regional data sets with global implications receive full consideration, we asked the CSEs to provide us with background information that includes the data holdings in their archives, a description of how their data are prepared for dissemination (quality control), their data policy, an example of the use of the data, and lessons learned for the future.

BALTEX DATA SETS

Four dedicated Baltic Sea Experiment (BALTEX) data centers are currently operating as the support infrastructure for BALTEX researchers. The Baltic Sea Basin includes the territories of 14 countries and the task of these centers is to facilitate exchange of observational data for both data users and data providers.

The **BALTEX Meteorological Data Centre** *(http://www.baltex-research.eu/data/bmcd.html)* is operated by the World Data Centre for Climate at the Max-Plank-Institute for Meteorology in Hamburg, Germany. The Centre archives include basic meteorological surface observations, as well as additional variables such as evaporation, soil temperature and moisture, and snow from the Baltic Sea Basin. Also worth noting is the successful archival of non-GTS precipitation observations (e.g., from climate stations) which increased the data density of precipitation observations by an order of magnitude. The key target period is 1994 until present and data providers are national services.

The **BALTEX Hydrological Data Centre** *(http://www.smhi.se/sgn0102/bhdc/index.htm)* is operated by the Swedish Meteorological and Hydrological Institute (SHMI) in Norrköping, Sweden. This Centre holds monthly and daily runoff data from BALTEX stations. Some of the monthly station records cover more than 100 years. A monthly record for the entire basin was established covering 1920 to the present. The daily data are limited to several years since 1990 and do not cover the entire basin. The Centre also archives hydrological, meteorological and ancillary data needed for hydrological modelling in specific BALTEX study basins and a gridded meteorological surface data set for the entire BALTEX region.

The **BALTEX Oceanographic Data Centre** *(http://www.smhi.se/sgn0102/nodc/datahost/datahost.html#BALTEX)* is operated by SMHI in Göteborg, Sweden. The Centre houses hydrographical standard observations, sea level and sea ice data products. The priority target period is 1999 to 2004, which covers the BALTEX BRIDGE (extended observing periods) and the Coordinated Enhanced Observing Period (CEOP). The Centre also functions as a metadata centre, identifying links to other oceanographic databases relevant to BALTEX.

The **BALTEX Radar Data Centre** *(http://www.smhi.se/brdc)* is operated by SMHI in Norrköping, Sweden. The Centre has radar data products developed from the Baltic network (BALTRAD) of operational weather radars. These products include radar reflectivities, accumulated precipitation, and weather radar wind profiles. The target period is 1999 until present.

Satellite data are processed and made available by several organizations contributing to BALTEX, including the Free University of Berlin, Germany; University of Bonn, Germany; Max-Planck-Institute for Meteorology, Germany; SMHI, Sweden; and Chalmers University of Sweden. All BALTEX Data Centres may be accessed via the BALTEX web site at *http://www.baltex-research.eu*.

BALTEX data are only available to registered BALTEX users. BALTEX data users are approved by members of the BALTEX Scientific Steering Group. More than 85 institutions and research groups have been registered as BALTEX data users.

BALTEX data centres have been defined and implemented based on BALTEX Phase I objectives and requirements. A recently established BALTEX Working Group on Data Management is reviewing the data requirements related to BALTEX Phase II objectives, which may result in a reorganization of the centres.

GAME DATA SETS

The GEWEX Asian Monsoon Experiment (GAME) began in 1996 and ended in March 2005. During this period a great deal of data was produced through observational activities represented by the four sub-regional field experiments (GAME-Tropics, GAME-Tibet, GAME-Hubex, GAME-Siberia) and the assimilated data production in both the global and regional scales based on observational data from the GAME Intensive Observation Period in the summer of 1998.

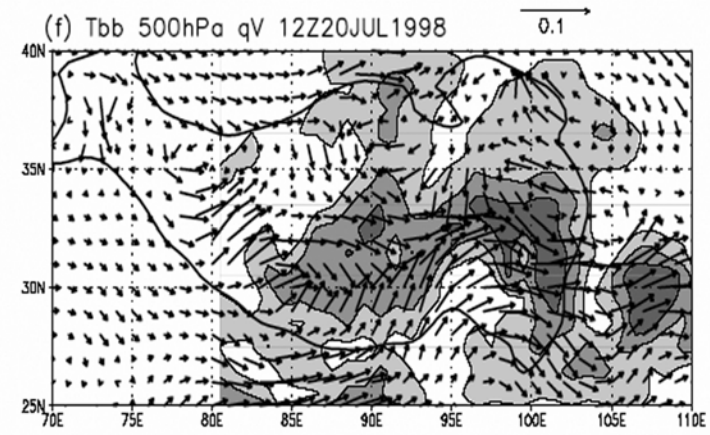
There are two categories for data, GAME–international data resources and institutional holdings. The former is available freely for scientific purposes. The latter is subject to the policy of each institute. Commercial use is prohibited.

Data are archived in the GAME distributed archiving system. Each observation/research group established a web/ftp site to provide the data to

research communities via online access. The portal site for the GAME data is the GAME Archive Information Network (GAIN)-hub site *(http://gain-hub.mri-jma.go.jp/index.html)*. CDs have also been produced to provide GAME data to researchers who have restricted access to the internet. The CD images are available from *http://erc3.suiri.tsukuba.ac.jp/~game/cdroms/CD-ROM.html*.

The GAME Asia Automatic Weather Stations (AWS) Network (AAN) group produced a DVD that contains up to 9 years of flux, meteorology, and hydrology data obtained for 2005. These data sets were obtained from AAN's 14 surface automatic weather stations deployed over the GAME study areas and covering a wide range of climatic regions from Thailand to the northern tip of Siberia.

GAME data have been used for many research activities, and their achievements can be reviewed in the list of published papers at *http://erc3.suiri.tsukuba.ac.jp/~game/literature/lists/pubs.htm*. One of achievements using the GAME observation data is the production of the GAME reanalysis data set. Recently, the Japan Meteorological Agency completed a 26-year reanalysis (JRA-25) for the period of 1979 to 2004 *(http://jra.kishou.go.jp)*. GAME observation data for the summer of 1998 are also included. JRA-25 includes a revised version of the GAME reanalysis for that period. Many scientific papers have already been published using the GAME reanalysis data. Yasunari and Miwa (2006) used these data to explore the spatial structure of convection and circulation over the Tibetan Plateau during the summer monsoon of 1998. They found a zonally oriented convergence zone which varied diurnally and sometimes developed into vortex systems at the eastern edge of the plateau (as shown in the figure below) which manifest themselves as a mesoscale precipitation system embedded in the Meiyu/Baiu frontal system over east Asia.



Water vapor flux (at 500 hPa) and equivalent black body temperature (TBB) horizontal distribution over the Tibetan plateau at 12Z20 JUL 1998. The regions with TBB below 250 K are shaded. Contour interval is 20 K.

In the future, a new framework for data exchange and dissemination for the GAME follow-on activity, the Monsoon Asian Hydro-Atmospheric Science Research and prediction Initiative (MAHASRI), will be established on the basis of the GAME data management activity and database.

References

Yasunari, T., and T. Miwa, 2006. Convective cloud systems over the Tibetan Plateau and their impact on mesoscale disturbances in the Meiyu/Baiu frontal zone. A case study in 1998. *J. Meteorol. Soc. Japan*, in press.

GAPP DATA SETS

The GEWEX Americas Prediction Project (GAPP) is a National Oceanic and Atmospheric Administration (NOAA) and National Aeronautics and Space Administration (NASA) funded initiative to develop an improved capability to make seasonal to annual forecasts through better land surface and hydrologic modelling *(http://www.ogp.noaa.gov/mpe/gapp)*. The geographical focus for GAPP is the 48 contiguous states of the U.S.A. and Northern Mexico. The accomplishment of the GAPP scientific objectives requires the development of a comprehensive and accessible database for the GAPP study areas that permits observations and analyses to be extended spatially within GAPP or applied globally. These data sets consist primarily of relevant data from existing *in situ*, remote sensing, and model output sources, but also include special (surface, upper air, and satellite) meteorological and hydrological observations with increased spatial and temporal resolution (e.g., field projects and process studies). Retrospective data sets previously collected for the GEWEX Continental-scale International Project (GCIP) are also climatologically important to GAPP and many were extended to support GAPP objectives.

The GAPP data management strategy takes advantage of the capabilities of several existing data centers to implement a distributed data management system. The Earth Observing Laboratory (EOL) has the overall responsibility for hosting the GAPP Data Center at the National Center for Atmospheric Research (NCAR) and to ensure the collection, processing, quality assurance,

archival, and dissemination of GAPP (and related) data sets from a variety of sources. In many cases, data sets are archived at NCAR. EOL does not duplicate archives available at other distributed data centers, but redirects users to the archives holding the desired data sets. EOL also makes arrangements for any "orphan" data sets that are not normally archived or readily available to the GAPP community. EOL also provides value added data sets including data "composites" and data from a variety of networks all in a common format with uniform quality control.

GAPP Data Management oversight is provided by the GAPP Data Management Committee (DMC) *(http://www.eol.ucar.edu/projects/gapp/dm/dmc/)* whose purpose is to coordinate with the GAPP scientific community and establish and document GAPP data requirements. The DMC is composed of members representing the various GAPP scientific interests and data sources/types participating in GAPP.

The World Meteorological Organization (WMO) Resolutions 40 and 25 (adopted by the Twelfth WMO Congress 1995 [CG-XII] and the Thirteenth WMO Congress 1999 [CG-XIII], respectively) comprise the basis for the GAPP data policy/protocol adopted and practiced by each of the GAPP distributed Data Centers: *"As a fundamental principle of the WMO, and in consonance with the expanding requirements for its scientific and technical expertise, the WMO commits itself to broadening and enhancing the free and unrestricted international exchange of meteorological, hydrological, and related data and products."* In general, users have free and open access to all the GAPP data subject to procedures in place at the various distributed data centers involved (e.g., data reproduction fees). The costs for data management, including data reproduction costs, are kept to a minimum, primarily through the use of existing distributed data centers. Users are requested to acknowledge the data provider(s) in publications and documents.

Data access and supporting information on the complete GAPP project archives are available at: *http://www.eol.ucar.edu/projects/gapp/dm/*. These pages provide links to GAPP data sets, documentation, and other relevant supporting and associated program or field project archives. Current GAPP/GCIP data holdings include *in situ* (surface and upper air meteorological, flux, radiation, hydrology), land characterization, model output, and remote sensing (satellite and radar) from 1992 to the present. A master table providing a list and access to all GAPP data sets and documentation (sorted by data category) is located at: *http://www.eol.ucar.edu/projects/gapp/dm/archive/*.

GAPP/GCIP data have been widely used by research communities and by NOAA operations. One good example is the application of a multitude of GAPP/GCIP data for the development of a National Land Data Assimilation System (NLDAS). The main objective of NLDAS is to generate real time and retroactive land states and land surface fluxes using land surface models with observed forcings. NLDAS provides the best available initial states over land for weather and climate prediction and has been implemented operationally in the NOAA National Centers for Environmental Prediction (NCEP). Of the 20 data products applied in NLDAS 18 (90%) received funding from GAPP. Examples of these data are daily gauge-only precipitation analysis, hourly 4 km radar precipitation analysis, and the Surface Radiation Monitoring Network (SURFRAD) of surface solar insolation observations. These data are used in NLDAS to produce NLDAS surface forcing, to validate NLDAS surface forcing and land model output, to provide NLDAS land surface characteristics, and to improve land/hydrology models. Besides NLDAS applications, GCIP/GAPP data are used routinely in NCEP operations to validate NCEP global and regional models, and to provide daily input for snow cover analysis to operational models.

GAPP also funded and supported the North American Monsoon Experiment (NAME) in 2004. This effort resulted in the collection and archival of 266 data sets. This archive provides researchers with one-stop shopping and quality-controlled data sets for North American monsoon studies.

LBA DATA SETS

The Large-Scale Biosphere-Atmosphere Experiment in Amazonia (LBA) is the largest cooperative international scientific project ever to study the interaction between the Amazon Forest and the regional and global atmospheres. Led by Brazil, LBA involves several nations, many institutions and more than 1,000 scientists. The main objective is to improve the understanding of the Amazonian ecosystem and its response to land use and climate change

through multidisciplinary and integrated research. Data are held in a Distributed Information System (DIS) located in the Center for Weather Forecasts and Climate Studies (CPTEC) in Brazil.

The data holdings in the archive include research in seven areas: physical climate, carbon storage and exchange, biochemistry, atmospheric chemistry, land surface hydrology and water chemistry, land use and land cover change, and human dimensions. The LBA data holdings support LBA objectives to address two fundamental questions: (1) How does the Amazon currently function as a regional natural system in relation to cycles of water, carbon, trace gases and nutrients? (2) How will changes in land use and climate effect the biological, chemical and physical functions of Amazonia, including the sustainability of development in the region and its influence on the global climate.

Quality control of LBA data is the responsibility of the originator who is most knowledgeable with the individual data sets. Guidelines for data documentation have been developed which include metadata files that describe the characteristics (e.g., geographic locations, parameter names, dates) of the various data sets, as well as providing links to the data.

Under the LBA Data Access Policy data originators have up to 1 year to quality control their data and make them available to other researchers. After a year of availability within the LBA community the data are made accessible to the public.

An Internet-based approach for data and information management has been created for sharing scientific data within LBA which consists of LBA investigator web sites, the LBA project and module web sites, the data archives at Instituto Nacional de Pesquisas Espaciais (INPE)/CPTEC and the Beija-flor retrieval system. Additionally, the National Aeronautics and Space Administration (NASA) has agreed to archive and distribute LBA data at the NASA Distributed Active Archive Center (DAAC) at the Oak Ridge National Laboratory (ORNL) using the Beija-flor system. Beija-flor, which means "flower kisser," is represented by a hummingbird (Brazil's national bird) that travels from flower to flower gathering nectar, much like Beija-flor travels from web site to web site gathering data. LBA data sets can be accessed on-line via the Beija-flor system at *http://lba.cptec.inpe.br/beija-flor/* or by requesting CDs at *http://lba.cptec.inpe.br/lba/lbadis/cd/lba_cd.php*.

LPB DATA SETS

The La Plata Basin (LPB) is the fifth largest basin in the world and second only to the Amazon Basin in South America. The La Plata Basin presents a large diversity of challenges, from its vulnerability to notable positive trends in precipitation and streamflow, to the management of hydropower production. The fundamental issues to be addressed by the LPB Continental-Scale Experiment can be summarized by three questions: (1) What climatological and hydrological factors determine the frequency of occurrence and spatial extent of floods and droughts? (2) How predictable is the regional weather and climate variability and its impact on hydrological, agricultural and social systems of the basin? (3) What are the impacts of global climate change and land use change on regional weather, climate, hydrology and agriculture? Can their impacts be predicted, at least in part?

Several activities have been underway for the last 4–5 years that may be considered a pre-LPB phase, the most important being the South American Low Level Jet Experiment (SALLJEX)–presented in Vera et al. (2006). The operational and experimental data of the SALLJEX may be found at *http://www.eol.ucar.edu/projects/salljex/*. The LPB Project, however, is in its implementation phase, and the main field activities are still a couple of years in the future. Nevertheless, as an operational center that is supporting the LPB activities, the Center for Weather Forecasts and Climate Studies (CPTEC) in Brazil, has started to develop the necessary tools to be the LPB major data center and distributor. At present, the homepage *http://www.cptec.inpe.br/lpb* points to different numerical weather prediction, seasonal climate forecasts and monitoring products that are related to the LPB. CPTEC has a free access data policy for all the data sets and products that are generated by CPTEC or are in the operational networks and follow a no-restriction principle whereby there are no financial implications for data exchange.

LPB experimental data are only delivered to users for scientific studies designed to meet LPB objectives. Commercial use and exploitation is prohibited, unless specific permission, in writing, has been obtained from the LPB investigators. The timing of experimental data release will be balanced between the interests of the data user who wishes to obtain the data as soon as possible and the data provider who wishes to ensure the highest attainable quality of the data. Data will be ready for

general release after an agreed upon time interval following its acquisition. A 6-month lag has been considered as the appropriate length for this data turn-around period.

CPTEC, as the LPB data center, will provide access to LPB-related operational data through an internet interface (under construction—to be released in November 2006) to a real time and historical database already available internally at CPTEC. The database includes meteorological data, satellite images and products, and gridded analysis and forecasts. The funds for the extension of this database to include the experimental LPB data are included in the proposed LPB campaign budget. In any case, the Earth Observing Laboratory's Data Management System at NCAR *(http://data.eol.ucar.edu)* will serve as an alternative to the LPB data center with all the functionality already used for the SALLJEX.

Reference

Vera, C., J. Baez, M. Douglas, C. B. Emmanuel, J. Marengo, J. Meitin, M. Nicolini, J. Nogues-Paegle, J. Paegle, O. Penalba, P. Salio, C. Saulo, M. A. Silva Dias, P. Silva Dias, and E. Zipser, 2006. The South American Low Level Jet Experiment (SALLJEX), *Bull. Amer. Met. Soc.*, pp. 64–77.

MAGS DATA SETS

The Mackenzie GEWEX Study (MAGS) ended December 31, 2005. Considerable effort has been focused on wrap-up activities to synthesize the results of 10 years of scientific research, to establish a data legacy, and to engage communities and policy-makers in using the scientific outcomes.

The data holdings in the archive include physical data for the Mackenzie River Basin, observations from small research basins and extended field projects, model and analysis data sets, and various operational/climatological data sets for the region. A partial list of available data sets is given in the Table on this page.

Quality control of MAGS data was primarily the responsibility of the data providers. Some bulk quality control checks were made on the MAGS specific surface observation site data. Both the modified and quality-controlled data, and unmodified data are available through the MAGS archive. MAGS Guidelines for Data Documentation were also developed to provide a basis for documenting the wide range of MAGS data sets sufficiently to facilitate their use in future research, while minimizing the workload of originating data providers in producing them.

Mackenzie GEWEX Study Data Compilations

Series	Volume	Title
Series I Physical Properties	1	Vertical Profiles through Precipitation Clouds
	2	Mackenzie Basin DEMs
	3	Mackenzie Basin Land Cover
	4	1 km Resolution Surface Data Set
Observations	5	Water Vapour Diurnal Cycle in MAGS
	6	IPIX Radar Observations
	7	MAGS Enhanced Surface Observations
	8	Discharge Measurements During the 1999 Breakup Period
	9	MAGS Satellite Observations
Research Basins	10	Research Basin: Trail Valley Creek
	11	Research Basin: Havipak Creek
	12	Research Basin: Wolf Creek
Series II Case Studies	1	BASE Observations September 30, 1994
	2	CAGES Case Study Observations
Series III Water Years	1	1994-1995
	2	1998-1999
Compilations	1	Water and Energy Budget Study
	2	MAGS Database Archive
Documents	1	1995-2000 Worshop Proceedings and Other Documents
	2	2001-2005 Workshop Proceedings and Other Documents

MAGS data sets have been used in numerous case and process studies, model validation, water and energy budget studies (WEBS), and model parameterization development. The results shown in the figure at the top of page 1 illustrate how MAGS cloud cover observations can be used as a reference to assess the cloud cover bias at high latitudes in either regional or global data sets. Many more of these kind of comparisons can be found on the MAGS WEBS CD-ROM. The figure on page 9 shows an example application of MAGS data in a water-year case study of record low discharge in the MRB (Stewart *et al.*, 2002). Other examples of MAGS data applications can be found in Rouse *et al.* (2003) and on the MAGS website *(http://www.usask.ca/geography/MAGS/)*.

The large diversity of temporal and spatial scales and data formats associated with the MAGS data sets has made it difficult to develop tools that allow interactive and real time online access to the data. It also made combining data from various sources into specific theme data sets difficult. This has

hampered, for example, the production of a consolidated surface forcing data set for use in model intercomparison exercises for the basin. Some recent efforts have sought to address this deficiency, but with the end of MAGS the outcome of this work is uncertain.

MAGS data are available in a series of CD-ROM/DVD archives (see the table on page 8). Data are also available in the MAGS data set archive which is a compilation of many of the MAGS data sets, supplemented by other data on the MRB. It encompasses a two DVD set with over 10 GB of data accessible by simple browsing or a MySQL database query system. This system will also be available through the MAGS website for online browsing and access. The CD-ROMs, DVDs and additional data stored off-line, primarily satellite and radar imagery, are available to researchers by request. Although MAGS has concluded, access to the MAGS data sets can still be facilitated through the Information Manager, Bob Crawford (e-mail: Robert.Crawford@ec.gc.ca).

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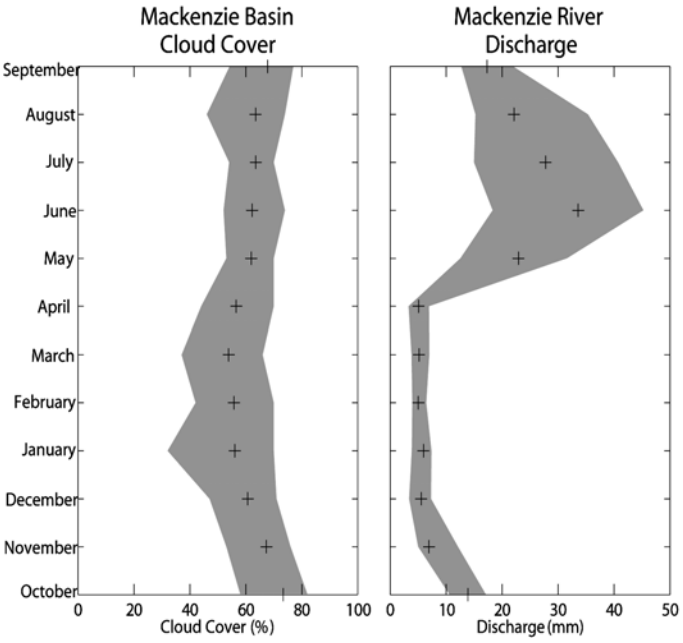
Rouse, *et al.*, 2003. Energy and water cycles in a high latitude, north-flowing river system: summary of results from the Mackenzie GEWEX Study – Phase 1. *Bull. Amer. Met. Soc.* 84: 73–87.

Stewart, R. E., *et al.*, 2002. Hydrometeorological features of the Mackenzie basin climate system during the 1994/1995 water year: a period of record low discharge. *Atmosphere-Ocean*, 40: 257–278.



MAGS data used in a water-year case study of record low discharge in the Mackenzie River Basin.

CEOP DATA SETS

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University of Tokyo, Japan

The Coordinated Enhanced Observing Period (CEOP) provides a unique approach to the integration of different types of observations including *in situ* and satellite, and in combination with numerical weather prediction model outputs. Enhanced observation and model output generation were carried out during the first pilot Enhanced Observing Period (EOP-1) [July–September 2001], EOP-3 [October 2002–September 2003], and EOP-4 [October 2003–December 2004]. The result is an integrated global data set of the overall water cycle with spatially and temporally continuous coverage in a form that is freely available and easily accessible to a broad international community.

The **CEOP *in situ* element** was developed under the leadership of Drs. Steve Williams and Hans-Jörg Isemer with assistance from Dr. Scot Loehrer. The observation network consists of 35 globally distributed reference sites, most of which are associated with the GEWEX Continental-Scale Experiments, and provide enhanced observations of subsurface (soil profiles), surface (standard meteorological and radiation), near-surface (flux tower), and atmospheric profiles (rawinsonde and profiler), as well as ancillary data sets (radar, special observations). The collecting, standardizing, quality assurance, archiving, and dissemination of *in situ* data is conducted by the Central Data Archive (CDA) at the National Center for Atmospheric Research (NCAR) Earth Observing Laboratory (EOL) *(http://www.eol.ucar.edu/projects/ceop/dm/).*

Initially, a prototype composite reference site data set was developed by NCAR/EOL for the preliminary period EOP-1. Two types of data sets at an hourly resolution were developed: a surface meteorology, flux and radiation data set and a soil heat flux, moisture and temperature data set. Based on the evaluation of these pilot data sets, improvements were made for the EOP-3 and EOP-4 and the most recent metadata formats and requirements were summarized in the Reference Site Data Set Procedures Report *(http://www.eol.ucar.edu/projects/ceop/dm/documents/refdata_report/).*

In contrast to the pilot data sets, the annual cycle data are compiled into four 30-minute resolution data sets, which include the following measurements: surface meteorology and radiation;

meteorological tower; soil temperature and moisture; and surface flux. Sounding data in the native format are also made available. Submissions of these data sets began in October 2003. The CSE data centers and site managers coordinate the format conversion and initial quality check. Data then are submitted to EOL for a follow-up quality assurance procedure. Automated checks are conducted on the data formats and values are assessed for reasonableness for their location. Time series plots are manually examined to detect unusual values. Finally, consistency between the submitted data and documentation are manually checked. The data (see table below) are available at *http://www.eol.ucar.edu/projects/ceop/dm/archive/*.

Drs. Toshio Koike and Paul Houser coordinate the **CEOP satellite data element.** The satellite data provided by the Committee on Earth Observation Satellites (CEOS) agencies to CEOP is managed and archived by the CEOP Satellite Data Integration Center (CSDIC) at the University of Tokyo (UT), which is jointly administered by the Japan Aerospace Exploration Agency, the Japan Meteorological Agency and UT. The data sets include water cycle parameters and are geo-coded and generated at three scales, 250 km^2, monsoon regional and global scales, which are associated with three product levels: (i) Radiance products with full resolution at the reference sites (Level-1b); (ii) Geophysical products at the same resolution as the sites and monsoon regions (Level-2); and (iii) Statistical geophysical products in space and/or time at the sites, monsoon regions and global scale (Level-3).

Summary of the Data Available at the CEOP Central Data Archive

CSE	Reference Site	FLX	SFC	STM	TWR	SONDE
BALTEX	Cabauw	EOP-3 and -4	EOP-3 and -4	EOP-3 and -4	EOP-3 and -4	EOP-3 and -4
	Lindenberg	EOP-3 and -4	EOP-3 and -4	EOP-3 and -4	EOP-3 and -4	EOP-3 and -4
	Norunda	Data Not Yet Available	EOP-3	Data Not Yet Available	Data Not Yet Available	Data Not Yet Available
	Sodankyla	Data Not Yet Available	Not Collected	Data Not Yet Available	Data Not Yet Available	Data Not Yet Available
CAMP	Cahao-Phraya	Data Not Yet Available	EOP-3	EOP-3	EOP-3	Data Not Yet Available
	Equatorial Island	Not Collected	EOP-3	Not Collected	Not Collected	EOP-3
	Himalayas	EOP-3 and -4	EOP-3	EOP-3 and -4	Not Collected	Not Collected
	Korean Haenam	EOP-3	EOP-3	EOP-3	Not Collected	Not Collected
	Korean Penninsula	Not Collected	First Half of EOP-3 Available	First Half of EOP-3 Available	First Half of EOP-3 Available	Not Collected
	Mongolia	EOP-3	EOP-3	EOP-3	Not Collected	Not Collected
	Northeast Thailand	First Half of EOP-3 Available	First Half of EOP-3 Available	First Half of EOP-3 Available	First Half of EOP-3 Available	Not Collected
	N. South China Sea	Not Collected	EOP-3 and -4	EOP-3 and -4	Not Collected	Not Collected
	Siberia Taiga	EOP-3	EOP-3	EOP-3	EOP-3	Not Collected
	Siberia Tundra	Complete EOP-3 + First Half EOP-4	Complete EOP-3 + First Half EOP-4	Complete EOP-3 + First Half EOP-4	Complete EOP-3 + First Half EOP-4	Not Collected
	Tibet	Data Not Yet Available	Data Not Yet Available	Data Not Yet Available	Data Not Yet Available	Not Collected
	Tongyu	EOP-3	EOP-3	EOP-3	EOP-3	Not Collected
	Western Pacific Ocean	Not Collected	Complete EOP-3 + First Half EOP-4	Not Collected	Not Collected	Not Collected
GAPP	Bondville	EOP-3 and -4	EOP-3 and -4	EOP-3 and -4	Not Collected	EOP-3 and -4
	Ft. Peck	First Half of EOP-3 Available	First Half of EOP-3 Available	First Half of EOP-3 Available	Not Collected	EOP-3 and -4
	Oak Ridge	First Half of EOP-3 Available	First Half of EOP-3 Available	First Half of EOP-3 Available	Not Collected	EOP-3 and -4
	SGP	EOP-3 and -4	EOP-3 and -4	EOP-3 and -4	EOP-3 and -4	EOP-3 and -4
LBA	Brasilia	Data Not Yet Available	Data Not Yet Available	EOP-3 and -4	Not Collected	Data Not Yet Available
	Manaus	EOP-3 and -4	EOP-3 and -4	Data Not Yet Available	Data Not Yet Available	Data Not Yet Available
	Pantanal	Data Not Yet Available	First Half of EOP-3 Available	Data Not Yet Available	Data Not Yet Available	Data Not Yet Available
	Santarem	EOP-3	EOP-3	EOP-3	First Half of EOP-3 Available	Data Not Yet Available
Other	ARM NSA	Not Collected	EOP-3 and -4	Not Collected	EOP-3 and -4	EOP-3 and -4
	ARM TWP	Not Collected	EOP-3 and -4	Not Collected	Not Collected	EOP-3 and -4

EOP-3 and -4 — First Half of EOP-3 Available
EOP-3 — Complete EOP-3 + First Half EOP-4
Not Collected — Data Not Yet Available

The CSDIC databases include complete Phase 1 data sets for all three levels from the following sensors: Advanced Earth Observation Satellite (ADEOS-II) Global Imager and Advanced Microwave Scanning Radiometer (AMSR), Aqua AMSR-EOS, Defense Meteorological Satellite Program Special Sensor Microwave Imager, and the Tropical Rainfall Measuring Mission Imager and Precipitation Radar. The regional data sets in Asia for all three levels for the Geostationary Meteorological Satellite (GMS-5) Visible Infrared Spin-Scan Radiometer (VISSR), Geostationary Operational Environmental Satellite (GOES-9) VISSR, Terra and Aqua Moderate Resolution Imaging Spectroradiometer and National Oceanic and Atmospheric Administration (NOAA) Advanced Very High Resolution Radiometer were also archived. Additional data sets are being processed and will be added to the CEOP database in the near future.

The CEOP model data element has been developed under the leadership of Drs. Michael Lautenschlager and Michael Bosilovich, with expert assistance from Drs. Hans Luthardt and Frank Toussaint. The International Council of Scientific Unions (ICSU) World Data Center for Climate (WDCC) in Hamburg, Germany, which is administered by the Model and Data Group at the Max-Planck-Institute for Meteorology (MPI-M) and the German Climate Computing Center (DKRZ), serves as the CEOP model output archive center *(http://www.mad.zmaw.de/projects-at-md/ceop/)*. Ten operational NWP and two data assimilation centers are currently contributing their model output to CEOP. The model output is grouped into two types, including 4-D globally gridded model output, which is stored on a global basis and 1-D Model Output Location Time Series (MOLTS) is extracted for each variable at each model data grid square.

Gridded data are disseminated in the standard Gridded Binary (GRIB) format but different data structures and code tables are used. The data have different storage structures (e.g., vertical coordinate system, order of dimensions) and consequently, homogenization of the data structure poses a greater challenge than the large data volumes.

MOLTS data are archived in three different formats. First, the original data blocks are stored in their native formats as provided by the CEOP partners. Most of these data are accessible from WDCC.

Second, the data are converted to the netCDF-CF standard format. These data sets are currently being processed and will be added later to the WDCC database. Finally, the data are directly filed into database tables as standard real numbers, where they are accessible via the Internet. Most CEOP Phase 1 data have already been uploaded to the WDCC archive (see the timeline at the bottom of page 20).

To facilitate data accessibility, international information sharing and dissemination is compliant with the International Organization for Standardization (ISO) and other appropriate technologies. A Centralized Data Integration System administered by UT and a Distributed Data Integration System developed through a collaborative effort between UT, the Japan Aerospace Exploration Agency and the Committee on Earth Observation Satellites Working Group on Information Systems and Services (WGISS) enable users to easily access, browse and analyze the CEOP data. They are accessible at the websites: *http://jaxa.ceos.org/wtf_ceop/* and *http://monsoon.t.u-tokyo.ac.jp/ceop-dc/ceop-dc_top.htm.* Dr. Koike has led the data integration element with exceptional technical assistance from Dr. Masaru Kitsuregawa and Dr. Ben Burford in development of the centralized and distributed systems, respectively. Dr. Kenneth McDonald and his colleagues are developing a satellite data server prototype for the WTF-CEOP that is based on the OGC Web Coverage Server and the OPeNDAP technologies. The prototype allows remote processing and intelligent subsetting of the data, reduces the amount of data transferred over the network, and enables access and overlay of global model output and the satellite data.

Studies based on EOP data have been presented in CEOP newsletters *(http://monsoon.t.u-tokyo.ac.jp/ceop/NewsLett.html),* refereed journals, and at scientific meetings. These studies demonstrate the potential of CEOP data for advancing research into the global energy and water cycle, evaluating weather and climate model physics, developing and validating advanced satellite algorithms and developing downscaling techniques. A CEOP special issue dedicated to Phase 1 achievements will be published in February 2007 by the *Journal of Meteorological Society of Japan*.

CEOP will continue to build up its integrated data set during Phase 2 (2005–2010). Besides the Phase 1 data providers, new Reference Sites will be included based on the needs of the CEOP science initiatives.

GSWP-2 INTERCOMPARISON AND DATA DISTRIBUTION CENTER

Taikan Oki[1], Naota Hanasaki[2], Eiji Ikoma[3], Masaki Yasukawa[1], Masaru Kitsuregawa[1], and Paul A. Dirmeyer[4]

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Under the Global Land/Atmosphere Study (GLASS), Phase 2 of the Global Soil Wetness Project (GSWP-2) produced the first global (excluding Antarctica) 1x1 degree Multi-Model Analysis (MMA) of land-surface variables and fluxes for the 10-year period of 1986–1995 at the daily time scale. Thirteen land-surface models (LSMs) were driven by the best possible forcing data of the atmospheric conditions, such as precipitation, downward radiation, wind speed, air humidity and air temperature with temporal resolution of 3-hourly or higher. For more information about the MMA see *http://www.gewex.org/GSWP2_data_product_4-2006.pdf* or *http://www.iges.org/gswp/.*

In general, the MMA product has been found to be superior to the products of any of the individual models and is as good as or better than the best model at each place and time validated by *in situ* soil moisture observations (Dirmeyer et al., 2006). Analyses of the product indicate that the interannual range of the annual mean hydrological quantities on the global scale is smaller than the intermodel range as illustrated in the figure on page 20. This suggests that the uncertainties in the products by individual models may be higher than the natural variations of these quantities.

As was done for GSWP-1, a data server at the Institute of Industrial Science, University of Tokyo collected and redistributed the data products among the participating research groups of GSWP-2. Data from the GSWP-2 Inter-Comparison Center (ICC) and the Data Distribution Center (DDC) are accessible by commonly used web browsers, such as Firefox and Internet Explorer. The ICC has three major functions to assist participating researchers in finding and viewing the data: (1) Data Visualization on Scratch Pad; (2) Time Sequential Comparison; and (3) Model Intercomparison Workbench.

Users can set the quantity of data to be displayed, the LSM to be used, the set of forcing data and boundary conditions used for the off-line simulation, the layer if the quantity is defined as multi-layer, the time, and the spatial domain. The spatial distribution of the quantity is then displayed by the Data Visualization on Scratch Pad. Temporal resolution can be set to daily, monthly or annual mean. Time series of a quantity at a grid box are displayed by the Time Sequential Comparison with a similar setting, and multiple quantities can be overlaid on the time sequence. Users can zoom in and out with the pointer operation of their browser on the graph.

Currently 52 output quantities from LSMs, such as net radiation, sensible and latent heat flux, soil moisture, canopy and soil temperature, snow water equivalent, surface and sub-surface runoff, and intercepted water storage associated with the forcing data are stored and accessible through the GSWP-2 ICC/DDC. The MMA product is freely accessible to all users. All other data are available only to registered users, but anyone can register by e-mail. More intercomparison and validation studies are welcome. The GSWP-2 ICC/DDC is accessible at: *http://gswp2.tkl.iis.u-tokyo.ac.jp/gswp2/.*

Reference

Dirmeyer, P. A., X. Gao, M. Zhao, Z. Guo, T. Oki, and N. Hanasaki, 2006: The Second Global Soil Wetness Project (GSWP-2): Multi-model analysis and implications for our perception of the land surface. *Bull. Amer. Met. Soc.* (in press).

FORMER GEWEX SCIENTIST NOW A VETERAN SPACEWALKER

During the successful 13-day space shuttle mission (STS-121), which ended on 17 July 2006, Piers Sellers and fellow astronaut Michael Fossum conducted three spacewalks to repair the International Space Station and test shuttle patching techniques.

ATMOSPHERIC SCIENCE DATA CENTER AT NASA LANGLEY RESEARCH CENTER

Charlene H. Welch, Nancy A. Ritchey, and Paul W. Stackhouse

NASA Langley Research Center

The Atmospheric Science Data Center (ASDC) at the National Aeronautics and Space Administration (NASA) Langley Research Center (LaRC) is responsible for the processing, archival, and distribution of NASA Earth science data in the areas of radiation budget, clouds, aerosols, and tropospheric chemistry. ASDC was established in 1993 and is one of the nine Distributed Active Archive Centers sponsored by NASA. It currently supports over 1700 archived data sets from more than 40 projects and has an archive volume of almost 2 Petabytes. The data volume includes the satellite observations needed for producing higher-level data products, and aircraft and surface measurements provided by scientists.

ASDC provides open access to the GEWEX-related data shown in the table on page 13. Of these data sets, the International Satellite Cloud Climatology Project (ISCCP), the NASA Water Vapor Project (NVAP) and the Surface Radiation Budget (SRB) Project are GEWEX projects under the auspices of the GEWEX Radiation Panel (GRP). Also, as commissioned by the GRP, ASDC has an active collaboration with the GEWEX Radiative Flux Assessment (RFA) team to develop and host the project web site providing for the submission and access to participant provided data products. ASDC is serving as the official archive site for the assessment of radiation products. The goal of the GEWEX-RFA project is to provide a forum for consistent analysis of long-term radiative flux products, primarily top-of-atmosphere (TOA) and surface fluxes, to establish a foundation for better analysis of the climate system and its variability in terms of the energy and water cycle. Long-term variations of these quantities help characterize the changing climate.

In addition to the GEWEX specific data sets, the Clouds and the Earth's Radiant Energy System (CERES) and the Multi-angle Imaging SpectroRadiometer (MISR) Project data products contain information about the Earth's radiation balance, clouds, and aerosols related to GEWEX goals. Future related products will include cloud and aerosol data

from the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) Mission.

The ASDC data holdings have been used for a number of noteworthy results, including significant advances in understanding the spread of aerosols from major volcanic eruptions, improving our ability to separate real variations in the solar constant from instrument artifacts, and identifying unforeseen anomalies in the Earth's radiation budget and in the influence of clouds on that budget. The figure at the bottom of page 1 shows how ISCCP and SRB data have been used in analyses of El Niño.

All ASDC data are publicly available via FTP and on media and prepackaged CDs and videos. Some of the data products, including the GEWEX-RFA data, have web interfaces that allow direct access to the data holdings for immediate downloading. Detailed information about the data products, including documentation, data ordering interfaces, and tools for working with the data, is available for each project from the ASDC web site: *http://eosweb.larc.nasa.gov*.

GEWEX Related Data Products Available from the NASA LaRC Atmospheric Science Data Center

Data Type	Products	Data Availability
Cloud, Water Vapor, Ozone	ISCCP B3, DX, D1, D2, TOVS	1983-2005
Water Vapor	NVap	1988-2001
Surface Radiation	SRB Release 2, 2.5/2.7*	1983-2004
Surface Radiation for Renewable Energy Applications	SSE	1983-1993
Radiance, Aerosol	SCAR-B	1995
Cloud, Water Vapor Radiance	CLAMS (CERES, MAS, AirMISR, MODIS) field campaign	2001
Cloud, Water Vapor, Radiance	FIRE field campaigns	1986-1998
Aerosol, Tropospheric Chemistry	GTE (TRACE-P, PEM Tropics, ACE Asia)	1983-2001
Total Solar Irradiance	ACRIM II & III	1991-present
TOA Radiation	ERBE	1984-present
TOA, Surface & Atmospheric Radiation, Cloud	CERES (TRMM, Terra, Aqua)	1997-present
Cloud, Surface Reflectance, Aerosol, TOA Radiance	MISR	2000-present
Stratospheric Aerosol, Cloud, Ozone	SAM II	1978-1993
Stratospheric Aerosol, Cloud, Ozone	SAGE I, II, III	1979-present
Stratospheric Aerosol, Ozone	POAM II, III	1993-2005

** As of this writing the SRB Project is in the process of releasing their latest data products expected to be available at the time of printing.*

GEWEX AND RELATED DATA SETS ARCHIVED AT NCDC

John J. Bates
NOAA National Climatic Data Center

The U.S. National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC–*http://www.ncdc.noaa.gov*) is the world's largest active archive of weather and climate data. NCDC produces numerous climate publications and responds to data requests from all over the world. NCDC operates the World Data Center for Meteorology which is co-located at NCDC in Asheville, North Carolina, and the World Data Center for Paleoclimatology which is located in Boulder, Colorado. NCDC was established in 1951 as the official agency records center for atmospheric data for the United States. Total data holdings exceed one petabyte, access to on-line data is free and open, and data served to customers have exceeded 20 terabytes per month over the past 6 months.

In response to increased customer requests for remotely sensed climate products and services, and in anticipation of the large volumes of remote sensing data projected in the near future, in 2002 NCDC established a Remote Sensing Applications Division that is responsible for the scientific stewardship of the satellite and radar data sets at NCDC to enable and facilitate use of these data for societal benefit.

NCDC provides archive and access services that may be of interest to GEWEX scientists, including, raw data produced by NOAA and a number of GEWEX-produced data sets. NCDC also actively participates in the development of new GEWEX products. The access methods for obtaining data vary. Raw satellite and NEXRAD weather radar data sets are generally available through interactive web browsers with data orders then sent out to an ftp site for user pickup. Subscription services are also available for these data sets. Large volume GEWEX product data sets are generally available via ftp direct file level access. Smaller volume GEWEX product research data sets are generally available through client-server systems (Live Access Server – LAS and Thematic Real-time Environmental Distributed Data Services) that also allow for additional subsetting, visualization, and analysis capabilities.

Two historical *in situ* data sets that may be of particular interest to GEWEX investigators are: (1) the Global Historical Climatology Network, com-

prised of quality-controlled surface observations of temperature, precipitation, and pressure from the 1930s (although some records date farther back) to the present; and (2) the Hydrometeorological Automated Data System data set, which contains more than 5500 precipitation (and some stream gauge) observations at high temporal resolution.

As part of a larger NOAA effort, NCDC is working on a long-term plan for an integrated data environment that will provide a more uniform mechanism for customers to access all our data holdings. In the interim, we are committed to providing as much data online as possible for free and easy access by customers. We look forward to continuing to work with the GEWEX user community to provide continued support for archive and access to GEWEX and related data sets. Please e-mail your comments or questions to *ncdc.satorder@noaa.gov*.

The table on page 15 briefly summarizes observational data sets of particular interest to GEWEX investigators. In addition to these observational data sets, NCDC now also provides archive and access to most of the numerical weather prediction input and output data sets from NOAA's National Centers for Environmental Prediction through the National Operational Model Archive and Distribution System *(http://nomads.ncdc.noaa.gov)*.

BALTEX SSG CHANGES

Following Prof. Hartmut Grassl's resignation, the GEWEX Baltic Sea Experiment (BALTEX) Scientific Steering Group (SSG) at its May 2006 meeting, elected Dr. Joakim Langner, Swedish Meteorological and Hydrological Institute in Norrköping, Sweden, as the new chair. Both Dr. Timo Vihma, senior research scientist at the Finnish Meteorological Institute, Helsinki, Finland, and Prof. Anders Omstedt, Professor for Oceanography at Göteborg University, Earth Science Centre, Göteborg, Sweden, will serve as vice-chairs.

Left to right: Lennart Bengtsson, BALTEX SSG chair 1994–1999, Mikko Alestalo, member of the SSG, Hartmut Grassl, BALTEX SSG chair 1999–2006, and Joakim Langner, current BALTEX SSG chair.

4th INTERNATIONAL SYMPOSIUM ON TERRESTRIAL AND CLIMATE CHANGE IN MONGOLIA

26–29 July 2005
Ulaanbaatar, Mongolia

Tetsuo Ohata
Institute of Observational Research for Global Change, Japan Agency for Marine-Earth Science and Technology

Over 130 researchers from six countries participated in the Symposium organized by the Advanced Earth Observing System (ADEOS- II) the Mongolian Plateau Experiment for Ground Truth, the Institute of Observational Research for Global Change (IORGC), the Japan Marine Science and Technology Center (JAMSTEC), and the Rangelands Atmospheric-Hydrosphere-Biosphere Interaction Study Experiment in Northeastern Asia (RAISE), in cooperation with the Mongolian Institute of Meteorology and Hydrology (IMH) and the National Agency for Meteorology, Hydrology and Environmental Monitoring.

Papers presented during the first two sessions focused on the changing climate, hydrology and ecology in Mongolia. Except for autumn, the temperature has significantly increased over the past 40 years for all seasons in the area surrounding Lake Hovsgol, the largest lake in Mongolia. Increases in precipitation were also observed, but statistically these signals were not very strong, although the estimated evapotranspiration increased significantly. A group from the Frontier Research Center for Global Change of JAMSTEC, using a fine resolution coupled global circulation model (GCM), predicted an increase in the total summer precipitation and frequency of extreme precipitation events in East Asia under the global warming scenario. A team from the RAISE Project downscaled a GCM warming scenario using a regional climate model that suggested a general decrease in summer precipitation, but with different magnitudes depending on the area. Reconciling these models for East Asia is a major research challenge.

A study by a group from the Center for Environmental Remote Sensing (CEReS) showed that the frequency of Asian dust outbreaks is dependent upon the weather surface conditions. Studies from the Environmental Education and Research Institute, and the Desertification Early Warning System

(Continued on page 16)

NATIONAL CLIMATIC DATA CENTER OBSERVATIONAL DATA SETS					
NAME	**RESOLUTION**		**COVERAGE**		**ACCESS (LAS, FTP, HTTP, THREDDS) OR CONTACT: NCDC.SATORDER@NOAA.GOV**
	SPATIAL	**TEMPORAL**	**SPATIAL**	**TEMPORAL**	
ISCCP (Raw Satellite Data)					
GOES Historical Raw Data	1 or 4 km		W. Hemi	9/1994 - Present	http://www.class.noaa.gov
Global AVHRR GAC Data	4 km	4x Daily	Global	11/1978 - Present	http://www.class.noaa.gov
ISCCP (Sampled Satellite Data)					
ISCCP B1 (GEO based)	10 km	3-Hourly	Global	7/1983 - Present	Contact: ncdc.satorder@noaa.gov
ISCCP B2 (AVHRR Based)	30 km	2x Daily	Global	7/1983 - Present	Contact: ncdc.satorder@noaa.gov
ISCCP Products					
ISCCP DX	30 km	3-Hourly	Global	7/1983 - 7/2005	ftp://eclipse.ncdc.noaa.gov/pub/isccp/dx
ISCCP D1	2.5°	3-Hourly	Global	7/1983 - 7/2005	Contact: ncdc.satorder@noaa.gov
ISCCP D2	2.5°	Monthly	Global	7/1983 - 7/2005	http://eclipse.ncdc.noaa.gov;9090/thredds/catalog/isccp/catalog.html
ISCCP (HIRS Clear Sky Radiance)					
Cloud-cleared HIRS	~20 km	2x Daily	Global	11/1978 - 12/2005	ftp://eclipse.ncdc.noaa.gov/pub/hirslc http://eclipse.ncdc.noaa.gov;9090/thredds/hirs/catalog.html
GPCP					
1 Degree Daily (1DD) Precipitation Estimate	1°	Global	Daily	1/1997 - Present	http://www1.ncdc.noaa.gov/pub.data/gpcp/1dd/data
GPCP Version 2 Combined Precipitation Data Set	2.5°	Global	Monthly	1/1979 - Present	http://www1.ncdc.noaa.gov/pub/data/gpcp/v2/sat_gauge_precip
Experimental GPCP Pentad (5-Day) Precipitation	2.5°	Global	5-Day	10/1979 - Present	http://www1.ncdc.noaa.gov/pub/data/gpcp/pentad/data
Merged Histogram Data Set	2.5°	Global 40N - 40S	Pentad	1/1986 - 12/1990	Contact: ncdc.satorder@noaa.gov
SEAFLUX					
Sea Winds (Ver 1.0)	0.25°	6-Hourly, Daily	Global Ocean	7/1987 - Present	http://las.pfeg.noaa.gov/las6_5/servlets/dataset?catitem=8 ftp://eclipse.ncdc.noaa.gov/pub/seawinds/ http://eclipse.ncdc.noaa.gov:9090thredds/OceanWinds.html
Sea Surface Temp: AVHRR+AMSR-E based	0.25°	Daily	Global Ocean	6/2002 - Present	ftp://eclipse.ncdc.noaa.gov/pub/OI-daily/
Ta/Qa: AMSU based	0.5°	6-Hourly	Global Ocean	1999 - Present	In Progress
LANDFLUX					
SSMI	70x45 ~ 16x14 km	2x Daily	Global Land	1993 - Present	http://www.class.noaa.gov or Contact: ncdc.satorder@noaa.gov
SSMI (F-8)	70x45 ~ 16x14 km	2x Daily	Global Land	1987 - 1992	In Progress
Emissivity Product: SSMI + GOES			Regional Domain		In Progress
PRECIPITATION DATA SETS					
NEXRAD Level II	1° x 1 km	5 Minute	CONUS	1995 - Present	http://www.ncdc.noaa.gov/oa/radar/radarresources.html
NEXRAD Level III	4 km	5 Minute - Hourly	CONUS	1995 - Present	http://www.ncdc.noaa.gov/oa/radar/radarresources.html
HADS Precipitation	Stations	15 Minute - Hourly	CONUS	7/1996 - Present	Contact: ncdc.satorder@noaa.gov
Multisensor Precipitation Reanalysis Product	4 km	Hourly	Regional Domain	1996 - Present	http://eclipse.ncdc.noaa.gov:909/thredds/catalog.html
Global Historical Climatology Network (GHCN) Precipitation	Stations	Daily & Monthly	Global	1930s - Present	http://www.ncdc.noaa.gov

Project showed that an early warning system could be constructed by using vegetation species as indicators of ongoing desertification in this area. The concept of common pool resources (CPR) was advocated by a researcher at the Institute for Global Environmental Strategies for pastureland management. He also proposed to study CPR elements (e.g., physical infrastructure, market) in several areas in Mongolia.

Scientists from the Institute of Geography, Mongolia Academy of Sciences, described recent increases in the active layer depth and the permafrost temperature by 3–30 cm and by 0.1–0.3 degrees per decade, respectively, at well measured sites. Two presentations by RAISE and CEReS researchers showed that the evapotranspiration estimates by satellites are not sufficiently accurate for water management needs or for regional scale applications. Moderate correlations between radar-based precipitation estimates and ground-based measurements were presented by an IMH scientist. It was noted that there is a need for further calibration and validation using more rain gauge data. The U.S. National Oceanic and Atmospheric Administration Normalized Difference Vegetation Index data analysis (1982–2004) and ground-based observations in the eastern steppe zone of Mongolia have been used by Mongolian researchers to assess pastureland changes. Vegetation cover changed differently, spatially and temporally due to both climate change and human factors. In order to clarify their interactions, further studies of the water cycle were recommended focusing on ecological system and human activities in order to clarify the mechanism of interaction between them.

IMH reported that a decrease in water temperature along with an increase in groundwater from glacial melt water was likely related to a decrease in evaporation for the Uvs Lake from 1963 to 2003. RAISE scientists demonstrated the effectiveness of groundwater recharge studies and the environmental tracer method for studying groundwater regime in arid/semi-arid regions, and described comparative overland flow and generation observation results in different basins. IORGC described activities of its water cycle study in northern Mongolia and future plans. Participants were encouraged to strengthen the linkages of their water cycle studies in Mongolia to related activites within GEWEX, the Integrated Global Water Cycle Observation Theme and the Global Earth Observation System of Systems. It was recommended that another symposium be held in 2007 or 2008.

U.S.-AMMA WORKSHOP

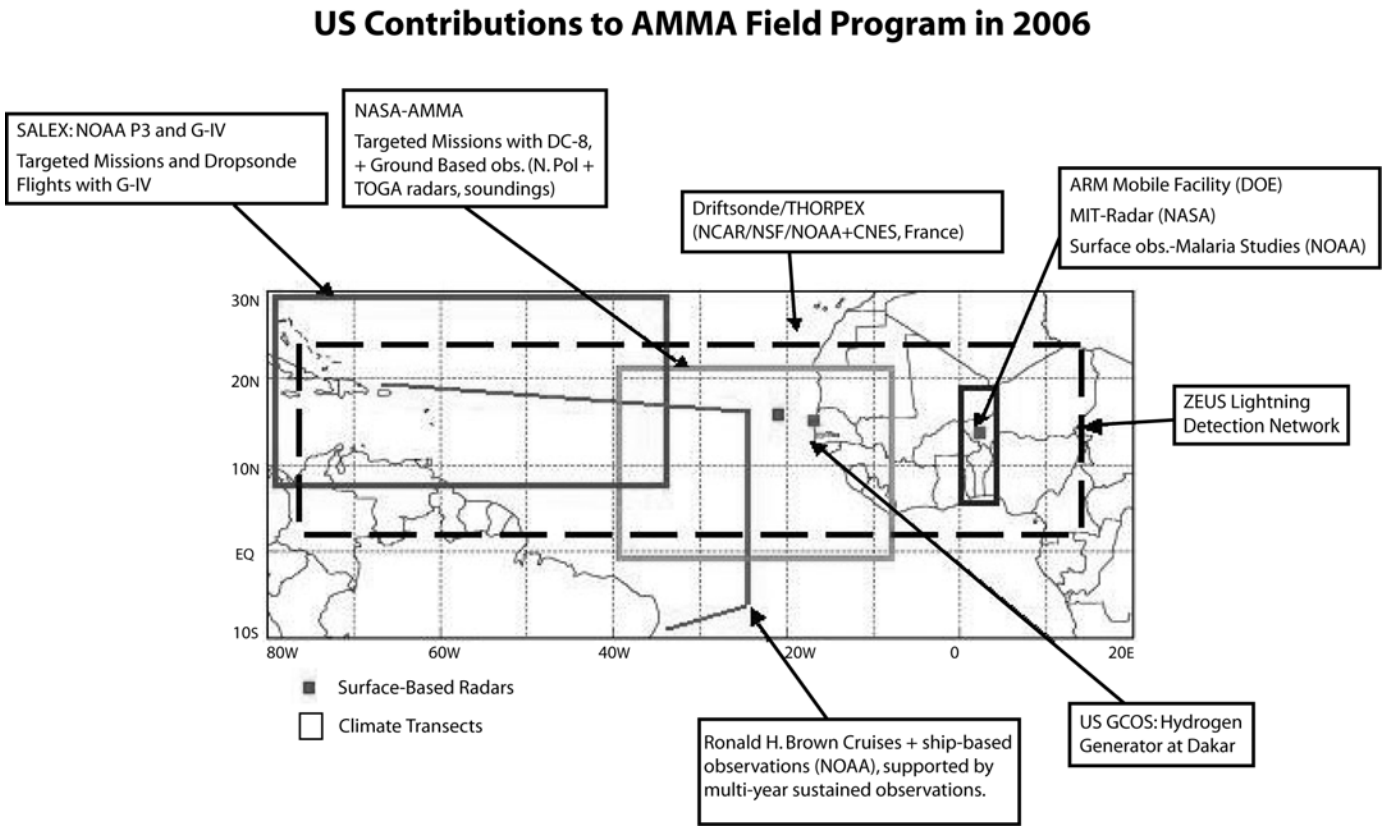
4–5 May 2006
Silver Spring, Maryland U.S.A.

Chris Thorncroft
University at Albany, SUNY

The United States is making significant contributions to the field campaign component of the African Monsoon Multidisciplinary Analysis (AMMA) Project. In addition to the observing platforms (see figure on page 17), the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Prediction (NCEP) is making important contributions to forecasting efforts. More than 80 scientists from the U.S., Europe, and Africa attended the U.S.-AMMA Workshop, which was supported by the U.S. Department of Energy, National Aeronautics and Space Administration (NASA), NOAA, and National Science Foundation, with substantial organizational support from the University Corporation for Atmospheric Research. A major outcome of this workshop was the establishment of an AMMA-U.S. Science Team organized around U.S. contributions to the five international working groups (WGs) described below.

WG 1: West African Monsoon and Global Climate, Water Cycle. U.S. objectives are directed at the regional climate impacts and the two-way interactions between the West African Monsoon (WAM) and the tropical Atlantic at time scales ranging from seasonal/interannual to decadal. Scientific priorites include: (i) monsoon processes; (ii) variability and predictability of the West African Monsoon; (iii) global impacts of the WAM (emphasizing tropical cyclone variability); and (iv) aerosol-radiation issues, including their impact on the WAM. A key WG1 cross-cutting activity is the U.S.-led WAM Model Evaluation (WAMME) Project being carried out in collaboration with the Coordinated Enhanced Observing Period (CEOP) Inter-Monsoon Model Study in the WAM region. Models will be evaluated for diurnal, intraseasonal, interannual, intradecadal timescales for the onset and withdrawal of the monsoon rains.

WG2: Water Cycle. Major research foci for this group are: (i) Determine and predict the interactions between mesoscale, synoptic and monsoon systems by identifying scaling structures and process connections; and (ii) Routine monitoring and prediction of local-scale hydrologic connections and interactions with mesoscale and monsoon processes in order to im-



prove resource allocation and outcomes in climate sensitive sectors.

WG3: Surface-Atmosphere Feedbacks. U.S. contributions to land-surface feedbacks, which focus on more integrated large scale factors, will be undertaken collaboratively with European efforts that focus more on the hydrologic/boundary layer processes (at smaller space-time scales), particularly upscaling process scales to synoptic scales. A 2-year modelling study is being planned to look at century scale modelling of dynamic vegetation and its impact on climate variability. Intercomparison studies of vegetation dynamics (seasonal and interannual) will be emphasized.

WG4: Prediction of Climate Impacts. AMMA will leave a significant legacy if it provides a better understanding and prediction of how climate variability translates into more efficient climate risk management in climate-sensitive sectors, such as food security, health and water resources management. The International Research Institute has volunteered to organize an international workshop focused on downscaling for West Africa to better define cross-cutting activities that would lead to new products for use in climate risk management activities.

WG 5: High Impact Weather Prediction and Predictability. WG5 is concerned with high impact weather over West Africa (e.g., wet/dry spells, onset), the tropical Atlantic (e.g., tropical cyclones) and extratropics (e.g., extratropical transition of tropical cyclones, Rossby wave trains). United States investigators are making significant contributions to all three areas of this joint AMMA/THe Observing System Research and Predictability Experiment (THORPEX) activity involving basic research, tailoring of forecast products in tropical regions, and data impact and predictability studies. A major emphasis for the United States is tropical cyclogenesis downstream of West Africa, recently highlighted by support provided by NASA for the NASA-AMMA (NAMMA) Project.

The next steps for the AMMA-US science team will be to identify funding resources for areas that currently have none and for an AMMA-US data center to coordinate access to U.S. and international data sets. For more information about the Workshop and AMMA-US, see *http://www.eol.ucar.edu/projects/amma-us/*.

Acknowledgement. Based on a French initiative, AMMA was built by an international scientific group.

MONSOON REGION CLIMATE APPLICATION WORKSHOP

May 8–11, 2006
Guaymas, Sonora, Mexico

Andrea Ray[1] and Gregg Garfin[2]
[1]NOAA/Earth Systems Research Laboratory
[2]University of Arizona

Over 60 climate and social scientists, resource managers, and policymakers met at the Workshop, which was held at the *Instituto Tecnológico de Sonora*. The Workshop was designed to integrate climate science with applications efforts in ecosystems and sustainability, water management, and drought and natural hazards in the monsoon region, including northwestern Mexico, the United States-Mexico border, and monsoon-influenced areas in the western United States. The workshop built on the progress of National Oceanic and Atmospheric Administration (NOAA) funded climate and social science research, including the North American Monsoon Experiment (NAME), an internationally coordinated Climate Variability and Predictability Project (CLIVAR)–GEWEX process study. Invited talks described climatic and societal contexts of the region, climate applications efforts, and recent advances in climate science. Theme sessions addressed issues related to water management, ecosystems and sustainability, and drought and natural hazards.

Key workshop findings include: (1) Stakeholders in the monsoon region were identified; (2) A regional integrated science assessment is needed to improve multidisciplinary interactions and integration between basic and applied science; (3) Meetings should be held every 18–24 months to discuss progress and next steps; (4) An email listserv, web page and special sessions of appropriate society meetings to foster communication are needed; (5) Experts should be developed as applications and extensions specialists, and managers should learn specific skills for use in resource management. (e.g., geographic information system).

Two specific proposals supported by the workshop are: (1) A regional climate center for northwest Mexico and the border region is needed to facilitate access to data and products, and to develop products that transcend the border for the many stakeholders with transboundary interests; (2) A binational, bilingual climate information product is needed that could help develop scientific literacy for regional climate and forecasts. For more information, presentations from the workshop, and to join a listserv on applications activities in the region, see: *http://www.ispe.arizona.edu/climas/conferences/monsoon2006*.

9th BSRN SCIENTIFIC REVIEW AND WORKSHOP

29 May–2 June 2006
Lindenberg, Germany

Ellsworth Dutton
National Oceanic & Atmospheric Administration

The 9th biennial Baseline Surface Radiation Network (BSRN) Scientific Review and Workshop was hosted by the German Weather Service (DWD) at the Richard Assmann Observatory. Over 60 experts committed to BSRN's goal of promoting and extending high quality surface radiation budget measurements over a globally and climatically diverse coordinated set of ground-based stations were in attendance. After welcoming remarks by Prof. Gerhard Adrian (DWD) and an overview of scientific work at the Assmann Observatory by Dr. Franz Berger, the observatory director, more than 40 scientific talks were given and 25 posters presented. Many are available at *http://www.gewex.org/bsrn.html*. Topics covered included the future of the BSRN archive, the extensive use and application of BSRN data to issues in climate research, progress in advances in radiation measurement technology, and reports from the working groups.

Prof. Atsumu Ohmura, who created the BSRN archive over 15 years ago and maintained it at the World Radiation Monitoring Centre in Zurich, Switzerland, is retiring. In addition to overseeing the archive, Prof. Ohmura has conducted extensive research using BSRN data. The challenge of supporting and transitioning the BSRN archive through its subsequent growth was ably met by Prof. Atsumu and his colleagues. Today, the archive has data from 36 BSRN sites and a holding of over 3400 station months of data. Prof. Ohmura's successor will have a large impact on the future of this archive.

Dr. Hans Teunissen, Global Climate Observing System (GCOS) Secretariat, invited BSRN contributions to the development of the global surface radiation products identified as "Essential Climate Variables" defined in the *Second Report on the Adequacy of the Global Observing Systems for Climate in Support of the United Nations Framework Convention on Climate Change*. He noted the importance of expanding the network to full global coverage and the participation of dedicated analysis centers to ensure generation of the needed climate products on a continuing basis.

The GEWEX Radiative Flux Assessment (RFA), has been launched to provide a forum for consistent analysis of long-term radiative flux products, primarily top-of-atmosphere (TOA) and surface fluxes as a foundation for better global radiation budget analysis. Dr. Paul Stackhouse, Surface Radiation Budget (SRB) Project Manager, described the project and requested BSRN assistance in assessing uncertainties in satellite data filling and in the estimation of long-term variability.

Dr. Ellsworth Dutton, BSRN Project Manager, described how BSRN addresses the combined efforts of the surface radiation components of the climate modeling and satellite observations communities. Highlights of the BSRN accomplishments include the growing institutional affiliations and support along with the expanding operations network and resulting data records. Accomplishments also include the many improvements that the group has facilitated for the entire ground-based broadband radiation measurement community. Progress was also noted in Network improvements to the function of the Network and its data archive, ongoing investigations in area measurement capabilities are not yet fully part of BSRN standards, such as ultraviolet (UV) and Photosynthetically Active Radiation (PAR). Examples of highly visible BSRN data applications include satellite algorithm and model validation and comparisons, and the analysis of the BSRN and related ground-based observations to provide independent and stand-alone information on local and regional radiation climatologies.

Updates were given on two stations that were approved at the 2004 BSRN meeting, Plataforma Solar de Almeria and Dome C (Antarctica), were given by Drs. Bella Espinar-Frias and Vito Vitale, respectively. Presentations on some promising new BSRN observing stations in Brazil, Suriname, Antarctica and the Czech Republic were given by Drs. Enio Bueno Pereira, Wouter Knap, Vito Vitale and Jiri Pokorny, respectively. These stations have been designated as prospective candidate sites, pending demonstration of their capability to produce sustained surface radiation budget data from systems meeting BSRN specifications and the delivery of data to the central BSRN archive for review and subsequent distribution.

A number of data application and research presentations were given, including Dr. Taipang Zhang's demonstration of the good agreement between SRB and BSRN data and Dr. Rainer Hollman's (Germany) discussion of the use of BSRN data in the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) surface radiation observational project

Dr. Chuck Long strongly recommended that in addition to downwelling radiation, BSRN sites should strive to include surface meteorological and upwelling radiation measurements as well. His estimates of continuous clear sky upwelling shortwave (SW) and longwave (LW) radiation showed that the clear-sky upwelling SW methodology now accounts well for extreme changes in surface albedo and that the methodology developed for clear-sky LW shows good agreement with the corresponding clear-sky measurements. He used this technique along with BSRN data to show that the flux analysis methodology significantly increases the value of BSRN-style surface radiation and meteorological measurements over the value of the measurements themselves.

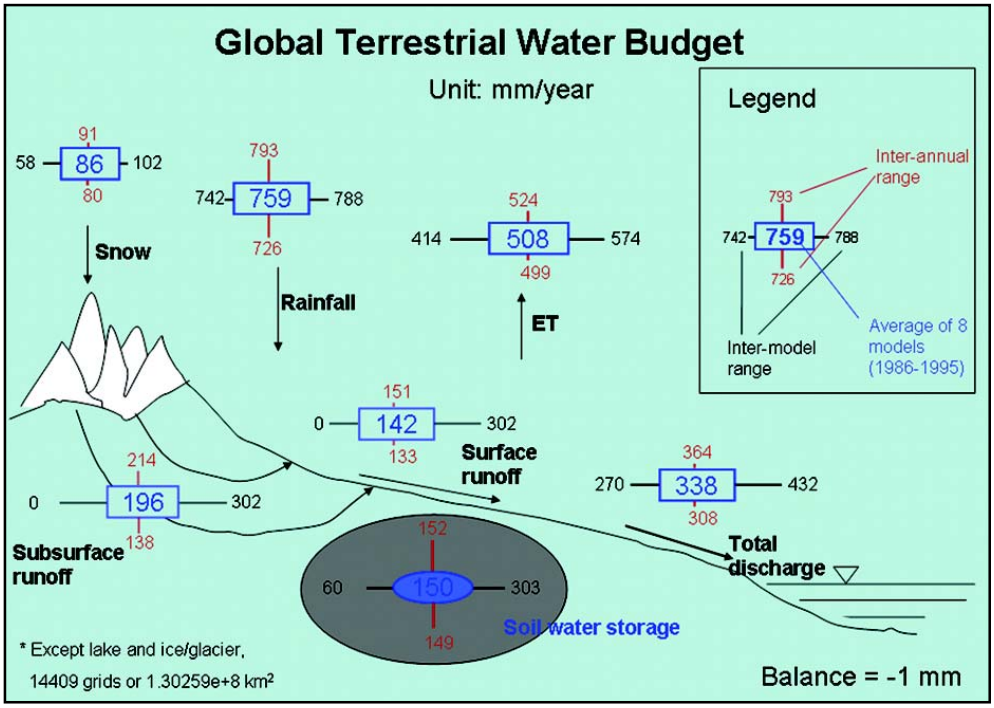
Talks were also given on the directional response on Precision Infrared Radiometer (PIR) pyrgeometers (Dr. Julian Groebner), the status of spectral and broadband UV (by Drs. Guenther Seckmeyer and Laurent Vuilleumier), a novel and promising method for the on-site, on-line, ongoing calibration checks for global pyranometers (Dr. Davis Halliwell), and the results of some pioneering investigations into the ambient thermal effects on Normal Incidence Pyrheliometers (NIPs) (Dr. Tom Stoffel). Two interesting presentations on Chinese radiation observations and analyses were given, one on historical records by Dr. Tadhiro Hayasaka and the other on the early first data being produced by the new Chinese BSRN station by Dr. Xiangao Xia. Many other interesting and valuable presentations including Dr. Christian Ruckstuhl were given on the many aspects of the BSRN data collection and related analysis and applications.

Attendees enjoyed a guided tour of the Lindenberg observatory facilities and greatly appreciated the exceptional hospitality and meeting accommodations provided to them during the course of their stay by the staff and management of the Lindenberg Observatory.

GEWEX/WCRP MEETINGS CALENDAR

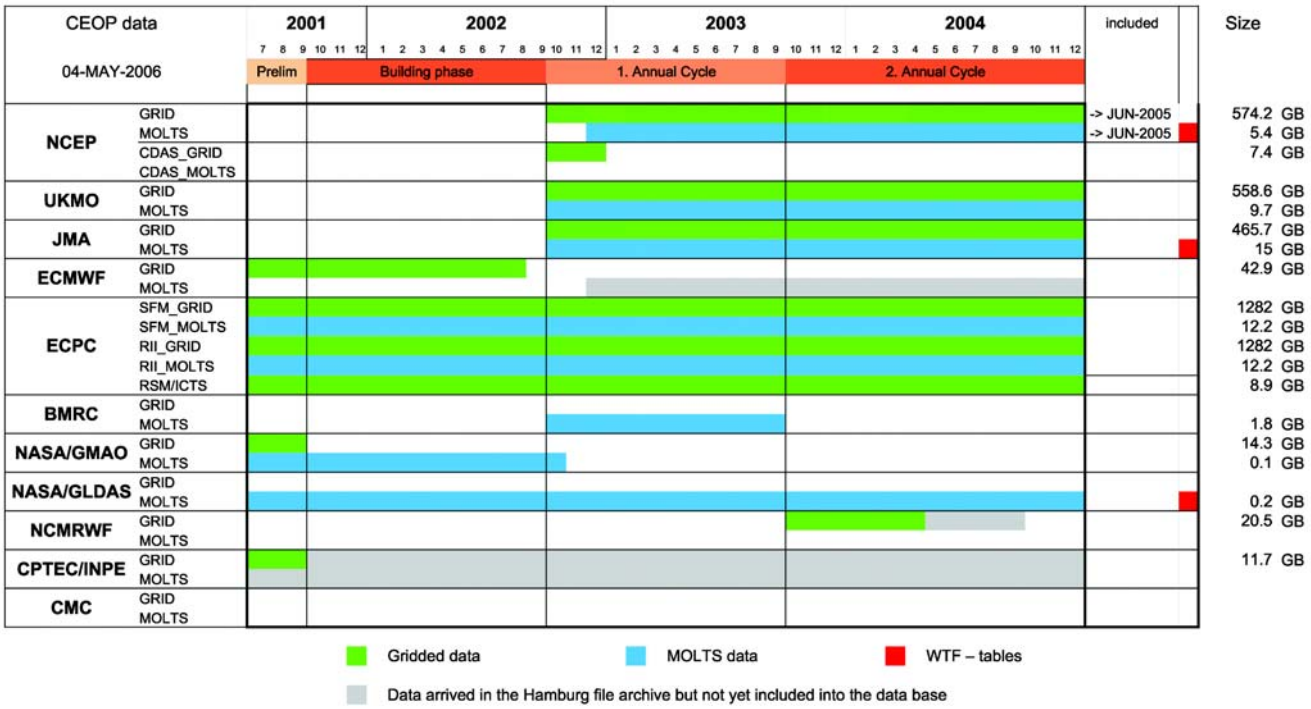
For a complete listing of meetings, see the GEWEX web site: http://www.gewex.org

TEN-YEAR GSWP-2 MULTI-MODEL ANALYSES SHOW LARGE MODEL DIFFERENCES



Components of the surface hydrologic balances estimated by eight land surface models from the Global Soil Wetness Project (GSWP-2) with the ranges of interannual variation (vertical bar) and intermodel discrepancies (horizontal bar) show that the global interannual range of annual mean hydrological quantities is smaller than the intermodel range. See article on page 11.

STATUS OF CEOP PHASE I DATA ARCHIVAL AT WDCC



Time line for CEOP data stored at the World Data Centre Climate Archive. See article on page 9.