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GEWEX Annual Report

(Submitted by Professor Tom Ackerman and Mr Peter van Oevelen)

RECOMMENDATIONS AND ACTION ITEMS

From the 21st Session of the GEWEX Scientific Steering Group (SSG)
January 19–23, 2009, Irvine, California

Recommendations to GEWEX Panels:

1. It was recommended that GEWEX Radiation Panel (GRP) expand the tools developed within the project for a broader use. An example of this is the International Satellite Cloud Climatology Project (ISCCP) simulator, which has been very successful in linking models and observations.
2. It is recommended that the leaders of monsoon studies develop common themes to be studied and that the Coordinated Energy and Water Cycle Observations Project (CEOP) organize a meeting concerning this.
3. It was agreed that the current focus of the Hydrologic Applications Project (HAP) primarily addresses seasonal forecasting. There are a number of other priority areas for linking meteorological and hydrological science under GEWEX to facilitate hydrological applications. In particular the user community urgently requires scientific guidance to support the management of hydrological extremes (floods and droughts) under scenarios of climate change. Extremes of precipitation and drought persistence are two relatively undeveloped areas. It is recommended that HAP broadens its focus to include the aforementioned issues.
4. It is recommended that the Global Land/Atmosphere System Study (GLASS) (in parallel to or along with HAP) collaborate with the Climate and Cryosphere (CliC) Project on cold processes studies.
5. It is recommended that, in the current era of new and improved sensors, relatively easy algorithm implementation and data processing, the definition of a GRP product needs to be clearly articulated. The following description is endorsed and accepted by the SSG: *A GRP product should be endorsed by GEWEX/GRP to conform to a high standard of production and documentation. It consists of a blend of available satellite and in situ observations and is continuously evaluated against other products in an open and transparent fashion.*
6. It is recommended that GEWEX Modelling and Prediction Panel (GMPP) develop a modified organizational plan that incorporates GEWEX Atmospheric Boundary Layer Study (GABLS) into the GCSS organization, rather than maintaining GABLS as an independent working group.

Recommendations to the WCRP Joint Scientific Committee (JSC):

1. While we appreciate the significant efforts regarding the development of new structures that address the monsoon cross-cut, we think that these are inconsistent and undesirable with the joint GEWEX/CLIVAR approach of analyses and priority setting, exemplified by the commendable research efforts currently being carried out by CEOP. We request the advice of the JSC on how the CLIVAR/GEWEX group should continue to manage this cross-cut.
2. Recommendations adopted in 2008 by the GEWEX SSG and JSC regarding the co-chair of WGNE and the status of the GMPP left several issues unresolved. We ask the JSC to endorse the following plan to clarify this situation.
    - GMPP will continue to report primarily to and take direction from the GEWEX SSG; it will report secondarily to WGNE.
    - The GMPP chair will be appointed by GEWEX from among the co-chairs of the GEWEX Cloud System Study (GCSS) and the Global Land/Atmosphere System Study (GLASS) for a two-year term renewable for another two years.
    - The GMPP chair will co-chair WGNE on a rotational basis.
    - The GLASS and GCSS co-chairs and the GEWEX Atmospheric Boundary Layer Study (GABLS) chair will be ex officio members of WGNE.
    - It was also suggested that CEOP could contribute to WGNE and work more closely with GMPP through ex-officio status on WGNE. This would allow more visibility into global and regional modeling and algorithm development work in CEOP that could contribute more directly to GMPP and WGNE objectives.
    - The structure of GMPP will be as follows:

1. GMPP will consist of three equal working groups, GEWEX Cloud System Study (GCSS), GEWEX Land Atmosphere System Studies (GLASS), and GEWEX Atmospheric Boundary Layer Studies (GABLS).
2. GCSS, GABLS and GLASS will each be led by two co-chairs, approved by GEWEX. A co-chair from each working group will be expected each year to attend the GEWEX SSG meeting, the WGNE meeting and the PAN-GEWEX meeting.

3. Based on the encouraging results of the completed Task Force on Seasonal Prediction, we request that the JSC name GEWEX and CLIVAR as co-leaders for the Working Group on Seasonal-interannual Prediction (WGSIP) to address coupling across land-atmosphere-ocean and predictability of seasonal to interannual scale.

Action Items

A. General

1. Represent GEWEX at an Intergovernmental Panel on Climate Change (IPCC) workshop to be scheduled in 2009 with past lead authors of IPCC. (Action: K. Trenberth)
2. Organize a workshop under the GEWEX/Global Water System Project (GWSP) umbrella to assess existing GEWEX activities and provide suggestions for future regional GEWEX initiatives specifically targeted on water availability problems. (Action: E. Wood, IGPO, ??)
3. GRP and CEOP to participate in the World Climate Research Programme (WCRP) and World Weather Research Program (WWRP) 2009 workshop on the first Year of Tropical Convection (YOTC). (Action: C. Kummerow/T. Koike)
4. GEWEX and the Climate and Cryosphere (CLIC) Project will co-sponsor two workshops, the first on solid and high latitude precipitation and the second on high latitude and cold region hydrology and land surface models. (Action: C. Steffen, E. Wood, IGPO, M. Best and T. Prowse)

B. GEWEX Radiation Panel

1. In an effort to revive the GEWEX Water Vapor Project, GRP will investigate holding a joint workshop with the International Television and Infrared Observation Satellite (TIROS) Operational Vertical Sounder Working Group (ITWG), CLIVAR, and Stratospheric Processes And their Role in Climate (SPARC) to assess existing water vapor products. (Action: J Schultz, C. Kummerow)
2. The SSG agreed with the GRP request to find a new name for this panel that more accurately represents its activities. GRP to suggest alternatives for its name at the next SSG meeting. (Action: C. Kummerow)
3. Draft a letter to the Director of WCRP requesting support for travel for Baseline Surface Radiation Network (BSRN) activities within the GRP context. (Action: C. Kummerow, IGPO)
4. Coordination is to be improved between GRP and CLiC for hydrologic studies in northern latitudes.
5. Increase the visibility of CIRC among the climate modeling community by encouraging presentations at climate modeling meetings and at the WGNE meeting.

C. CEOP

1. CEOP to clarify the relationship between CEOP activities and African and Asian water studies in terms of management, roles and responsibilities. This will help clarify the role of GEWEX in the oversight of these activities. (Action: T. Koike)
2. Given that the National Oceanic and Atmospheric Administration (NOAA) Climate Prediction Program for the Americas (CPPA) financial support for CEOP data collection activities at the University Corporation for Atmospheric Research (UCAR) has decreased by 50 percent, letters will be sent to the National Aeronautics and Space Administration (NASA), the NOAA National Climatic Data Center (NCDC), the National Science Foundation (NSF), and the U.S. Department of Energy (DOE) to endorse this activity by designating additional support. Note: UCAR has been doing the data quality control for CPPA and all the other CEOP data. (Action: IGPO, T. Koike, S. Williams, V. Detemmerman)
3. CEOP to prioritize its objectives to ensure that the needs of the hydrological community are met by CEOP. (Action: T. Koike)

4. In response to concerns expressed at the SSG that HAP has insufficient membership to carry out its responsibilities, the membership of HAP will be increased and appropriate action will be taken to make HAP more accessible to the hydrologic community. Specifically, HAP is requested to collaborate with the GEWEX Radiation Panel, the World Meteorological Organization (WMO) hydrology department, The Observing System Research and Predictability Experiment (Thorpex) and the United Nations Educational, Scientific, and Cultural Organization (UNESCO) International Hydrology Programme (IHP) and Water and Development Information for Arid Lands — A Global Network (G-WADI). (E. Wood, T. Koike, IGPO, S. Sorooshian)
5. CEOP is encouraged to actively pursue collaboration with the African Monsoon Multidisciplinary Analysis Project (AMMA), including having representation at the upcoming 3rd International AMMA Conference in Ouagadougou, Burkina Faso (July 2009). AMMA is also encouraged to participate in the next CEOP meeting being held in Melbourne, Australia in August 2009.
6. GEWEX data collected under CEOP activities should be interactively linked with GWSP data on water availability and reservoir storage to allow for a more effective use of GEWEX data in a wide spectrum of applications. (Action: T. Koike)
7. CEOP and GLASS to coordinate with CliC on cold region studies.

D. GMPP

1. GLASS to extend its panel membership to include the National Centers for Environmental Prediction (NCEP)/NOAA and others. SSG will need to approve the restructure. It is recommended that Mike Ek (replacement for Ken Mitchell) be involved in this group. (Action: M. Best)

1. Introduction and Overview

This report summarizes the main developments in GEWEX during the year 2008 and includes the main items and recommendations from the 21st Session of the GEWEX Scientific Steering Group (SSG), held at the University of California, Irvine (UCI) in Irvine, California on 19–23 January 2009. The meeting was hosted by Prof. Soroosh Sorooshian, Director of the UCI Center of Hydrometeorology and Remote Sensing. The following organizations provided sponsorship for the meeting: Northrop Grumman Space Technology, UCI's Office of the Vice Chancellor for Research, UCI Henry Samueli School of Engineering, and the Institute for Geophysics and Planetary Physics at UCI.

Special presentations given during the meeting include: The Effects of Dust and Soot Aerosols on Snow and Climate (Charles Zender, Department of Earth System Science, UCI), Innovative Remote Sensing Satellite Development for Earth and Space Science Observations (Brian Baldauf, Northrop Grumman Corp.), and GEWEX-related Research on High-Resolution Precipitation and Regional-Scale Modelling (Xiaogang Gao, Kuo-lin Hsu, and Bisher Imam, Center for Hydrometeorology and Remote Sensing, UCI).

The meeting was opened by Dr. Rafael Bras, Dean of UCI, followed by Dr. Ghassem Asrar, Director of the World Climate Research Programme (WCRP), who thanked Prof. Sorooshian for his 9 years of exemplary service as Chairman of the GEWEX SSG. Dr. Asrar then presented him with a letter of appreciation from Michel Jarraud, the Secretary-General of the World Meteorological Organization (WMO). The meeting was chaired by the new SSG Chair, Prof. Thomas Ackerman of the Joint Institute for the Study of the Atmosphere and Ocean at the University of Washington. Peter van Oevelen attended the meeting in his new capacity as Director of the International GEWEX Project Office.

In addition to the review of project status, the meeting focused on WCRP Joint Scientific Committee (JSC) recommendations and action items relevant to GEWEX, most importantly GEWEX program development from Phase II (present) to its sunset date of 2013 and beyond. These recommendations include cross-panel and cross-WCRP project coordination on WCRP cross-cuts (e.g., extremes and monsoons), greater integration of the activities of the three GEWEX panels [the GEWEX Radiation Panel (GRP), the GEWEX Modelling and Prediction Panel (GMPP), and the Coordinated Energy and Water-Cycle Observations Project (CEOP)], ensuring the promotion of GEWEX data sets in the next Intergovernmental Panel on Climate Change (IPCC) assessment, continuing GEWEX work on parameterizations and cloud modelling, focusing on

hydrological applications for climate science while addressing societal benefits, and building data sets for the validation of climate models.

1.1 Major Activities and Achievements in 2008:

As part of the High Elevations Project, CEOP has begun planning for a global high elevation watch period. Links between the CEOP Cold Regions Study and several Regional Hydroclimate Projects have now been clearly identified; this work is being coordinated with the WCRP Climate and Cryosphere Project (CliC). CEOP Extremes studies have begun focusing on drought, heavy precipitation, floods and low flows and the ways in which these events intermesh. As such, this activity directly contributes to the WCRP Extremes cross-cut.

The first meeting of the newly restructured Working Group on Numerical Experimentation (WGNE) took place November 2008 in Montreal, Canada. In the new set-up, the GMPP chair and the three chairs of the study group are automatically ex-officio members of WGNE. The current GMPP chair (and co-chair of WGNE) has responsibility for coordination of the parameterization effort within WGNE. Discussed at length during the meeting was the perception that some parameterizations, most notably those of deep convection, will soon be obsolete due to the emergence of convection-permitting global models. It is the firm opinion of WGNE that the use of such models in global operational numerical weather prediction (NWP) is at least a decade away. Furthermore, the use of parameterizations in operational, seasonal, and climate prediction is not likely to occur for an additional decade after that. WGNE therefore strongly urges a reinvigoration and increase in activities related to parameterization research for global models.

The GEWEX Cloud System Study (GCSS), the Atmospheric Radiation Measurement (ARM) Program and the Stratospheric Processes And their Role in Climate (SPARC) Project are collaborating on a new initiative: tropical convection during monsoons as observed in the Tropical Warm Pool—International Cloud Experiment (TWP-ICE). The initiative will focus on differentiating between the physical processes that control the amount of moisture transported to the tropical upper troposphere during monsoon events. GLASS reviewed the success of GMPP in improving parameterization at operational NWP and climate modelling centers and is in the process of writing a synthesis paper.

Under GRP, the Global Precipitation Assessment (WCRP-128) was published in May 2008; the Cloud Assessment is expected to be published at the end of 2009. Version 1.0 of the sea surface temperature and Version 0.5 of the latent and sensible heat fluxes are available for testing, while SeaFlux plans to finish Version 1 by the end of 2009. The International Satellite Cloud Climatology Project (ISCCP) celebrated its 25th anniversary of data processing on 1 July 2008. A 2.5-day symposium was held at the National Aeronautics and Space Administration (NASA) Goddard Institute for Space Studies on 23–25 July to mark the occasion, to review the status of knowledge about clouds and their role in the climate's radiation and water cycles, and to discuss future satellite cloud measurements and analyses. ISCCP is almost ready to release a new cloud particle size climatology, covering July 1983–September 2001. All GRP products are preparing for the reprocessing cycle to begin in 2010–key activities within each project are geared towards that goal. All projects are detecting trends in climate data and are being used in publications related to climate change.

Once the SeaFlux and LandFlux products are in production, GRP will focus on creating composite global water and energy products that combine the various individual products into a consistent product containing all the water, energy states, and fluxes. This composite product is envisioned to usher in a new era of interaction between GRP and the modelling community, as well as the satellite providers.

1.2 Goals and Plans for Major Activities for 2009 into 2010:

The GEWEX and CLIVAR Task Force on Climate Extremes will develop the scope, focus, and deliverables for this crosscut. IGPO will coordinate an assessment of GEWEX accomplishments for Phase II.

Programmatically, IGPO is assisting GEWEX efforts to make its research related to climate change more visible. It is particularly addressing JSC recommendations on the research directions WCRP should take both in the short- and midterm, as well as in the long-term where the Coordinated Observation and Prediction of the Earth System (COPES) Strategic Framework is central. GEWEX is also exploring how to best address ways in which to improve links to the applications field.

CEOP will place a great deal of emphasis during the coming year on advancing scientific work in monsoon studies, high elevations initiatives, and extremes. The CEOP High Elevations (HE) will

create a database of HE stations worldwide and begin producing high-quality data sets in line with CEOP data policy. CEOP Monsoon Studies will contribute to a synthesis paper(s) providing input to the next Intergovernmental Panel on Climate Change (IPCC) assessment.

CEOP Extremes has a number of specific steps currently underway for the coming year, including assessing current definitions of extremes and determining whether further definitions are needed; assessing existing extreme event catalogues (heat waves, floods, droughts on a global basis from 1948–present) and incorporating this into the Extremes information base as appropriate; pulling together at least one comprehensive, continental-scale data set on multi-year drought; and providing a "recipe book" for others to follow in terms of conducting comprehensive drought studies.

All GRP projects have begun preparations for coordinated reprocessing to begin in 2010 in order to address smaller space/time issues as well as the Extremes focus identified by GEWEX. The Cloud Assessment Project is working on the final World Meteorological Organization (WMO) report (in one or two parts) that should be finished at the end of 2009. It discusses the existing long-term climatologies and also comparisons with climatologies from improved instruments aboard the NASA Earth Observing Satellite (EOS) and the A-Train. Climatology averages as well as their regional, seasonal, and diurnal variations will be presented, and differences between results from the various data sets will be discussed. Once the SeaFlux and LandFlux products are in production, GRP will focus on creating composite Global Water and Energy products that combine the various individual products into a consistent product containing all the water and energy states and fluxes. This composite product is envisioned as ushering in a new era of interaction between GRP and the modelling community as well as other satellite providers *vis à vis* closure of the water and energy budgets at both global and regional scales.

1.3 Interactions (Especially with WCRP Sponsors and Partners):

Following the GEWEX Executive Meeting, which was held 25-26 August 2008, a 2-day joint GEWEX/CLIVAR meeting was held to discuss current and future collaboration between the two programs and their roles within WCRP for the next 2 to 5 years.

IGPO is working together with the International Geosphere-Biosphere Programme (IGBP) Integrated Land Ecosystem-Atmospheric Processes Study (iLEAPS) and Monash University in planning the 6th International Scientific Conference on the Global Energy and Water Cycle and the 2nd International iLEAPS Science Conference with joint science sessions, to be held in Melbourne, Australia on 24–28 August 2009. The majority of invited speakers have accepted, including Prof. Roger R. Pielke, Jr., from the Center for Science and Technology Policy Research and Prof. John Thwaites, from the Monash Sustainability Institute. A flyer and brochure announcing the conference has been widely distributed. The conference has been announced in EOS has been advertised in the calendars of a number of web sites. IGPO developed the conference web site at http://gewex.org/2009gewex_ileaps_conf.html. UCAR is handling the abstract submissions. Monash University events planners, with oversight by Christian Jakob, have made the arrangements for the venue and have responsibility for logistics and registration. Funding commitments for the meeting have been obtained from NASA, NOAA, and WCRP. Other organizations have been approached but have not yet committed or the procedure is still on-going.

GEWEX represents WCRP on the Executive of the Integrated Global Water Cycle Observations (IGWCO) theme [formerly a theme under the Integrated Global Observing Strategy – Partners (IGOS-P)] and serves on several Group on Earth (GEO) committees. GEWEX scientists also lead several GEO tasks. Through the extensive collaboration CEOP has with the Committee on Earth Observation Satellites (CEOS), GEWEX and WCRP have had better opportunities to influence and benefit from the Earth Observation community. In addition, GEWEX has established links at the national level with many funding agencies, programs, data services, research groups, and environmental organizations; for example, the Regional Hydroclimate Projects (RHPs) have connections with both national and international programs and funding agencies such as the Global Environmental Facility.

In 2008 the European Space Agency (ESA) in collaboration with GEWEX launched the Water Cycle Multi-mission Observation Strategy (WACMOS) Project, which contributes to international scientific efforts led by GEWEX to improve the understanding, monitoring, and forecasting of the different water cycle components and their impacts on human activities. In particular, WACMOS aims at developing and validating novel and enhanced geo-information products exploiting the existing multi-mission capacity and covering four thematic priorities for the GEWEX scientific

agenda: (1) evapotranspiration, (2) soil moisture, (3) water vapor, and (4) clouds. In 2009 ESA and GEWEX plan to organize a one-day Scientific Consultation Workshop on WACMOS and towards the end of 2009 a week long conference on WACMOS is planned by ESA in collaboration with GEWEX, the European Geophysical Union, and the International Society for Photogrammetry and Remote Sensing (ISPRS) in Frascati, Italy on 18-20 November 2009.

1.4 GEWEX Roadmap:

During the past few years and continuing into the next year, GEWEX under the leadership of IGPO has worked toward developing a roadmap that defines the direction for GEWEX research over the next 7 years. The purposes of the roadmap are to focus the use of the intellectual and financial resources available to GEWEX and to provide a basis for communicating the coherent nature of GEWEX plans to funding agencies and the science community at large. GEWEX plans to achieve these objectives in the context of specific science questions critical to the WCRP Strategic Plan. IGPO will be coordinating these efforts and reporting on its milestones to build upon the research results, models, and data products developed during the first phase of GEWEX. After discussion on the future directions of WCRP and its Core Activities, the roadmap will be updated accordingly.

1.5 Publications and Other Projects:

The International GEWEX Project Office (IGPO) publishes a quarterly GEWEX Newsletter. Representation of GEWEX at numerous national and international conferences, meetings, and workshops has resulted in various publications, including proceedings, peer-reviewed literature, and more. This year the IGPO prepared four newsletters, the Report of the 20th Meeting of GEWEX SSG, Buenos Aires, Argentina, January 2008 and the Report of the 10th BSRN Scientific Review and Workshop, July 2008. GRP Published *WCRP-128 Global Precipitation Assessment: A Project of the GEWEX Radiation Panel*.

CEOP Publications include:

- Collini, E. A., E. H. Berbery, V. Barros, and M. Pyle, 2008: How does soil moisture influence the early stages of the South American monsoon? *J. Climate*, 21, 195–213.
- Ueno K., and R. Aryal, 2008: Impact of tropical convective activity on monthly temperature variability during non-monsoon season in the Nepal Himalayas. *Journal of Geophysical Research – Atmospheres* (accepted).
- Lu, H., T. Koike, H. Tsutsui, D. Kuria, T. Graf, K. Yang, and X. Li 2008: A long term field experiment for radiative transfer model development and land surface processes remote sensing. *Annual Journal of Hydraulic Engineering, JSCE*, 52, 13–18.

1.6 Outreach and Capacity-Building Activites:

Peter van Oevelen served as a Chairperson for a session on *Adaptation and Mitigation Under Climate Change and Uncertainty* at the Fall Meeting of the American Geophysical Union in San Francisco, California.

Scientific sessions at the European Geophysical Union ??? , AMS ???

IGPO continues to serve on the Executive Board of the IGWCO and support the IGWCO Science Committee that currently takes responsibility for input to the water task under GEO.

IGPO continues to serve as a link to GEO activities through representation on various GEO committees, including Capacity Building (Dr. van Oevelen) and the User Interface Committee (Dr. Lawford).

2. GEWEX Panel Statues Reports

2.1 Coordinated Energy and Water-Cycle Observations Project (CEOP)

Reporting Period: 2008

URL: http://www.ceop.net

Chair(s) and Term Dates: Co-Chairs Drs. Toshio Koike and Ron Stewart. Two-year terms beginning in 2007 renewable for an additional 2 years and set to coincide with the regular annual CEOP International Planning Meetings that take place in August or September of each year.

Overview

***Objectives*:**

CEOP's goal is **to understand and predict continental to local-scale hydroclimates for hydrologic applications**. To achieve this goal, the strategic objectives of CEOP include:

Objective 1: Producing consistent research-quality data sets complete with error descriptions of the Earth's energy budget and water cycle and their variability and trends on interannual to decadal time scales, for use in climate system analysis and model development and evaluation.

Objective 2: Enhancing the understanding of and quantification of the ways in which energy and water cycle processes contribute to climate feedbacks.
Objective 3: Improving the predictive capability of key water and energy cycle variables and feedbacks through improved parameterizations to better represent hydrometeorological processes, and determine the geographical and seasonal characteristics of their predictability over land areas.
Objective 4: Undertaking joint activities with operational hydrometeorological services, related Earth System Science Partnership Program (ESSP) projects like the Global Water System Project (GWSP) and hydrological research programs to demonstrate the value of GEWEX research, data sets, and tools for assessing the consequences of climate predictions and global change for water resources.
Some technical issues that are being addressed as part of the CEOP objectives are:
1. Applying an integrated hydroclimate data set to address a variety of scientific topics, which must be advanced in order for the Project to meet its objectives.
2. Developing the capability to handle and disseminate a large amount of data from diverse sources.
3. Analyzing and comparing with model simulations diverse data to understand the underlying mechanisms and model deficiencies.
4. Assimilating and integrating data with newly-developed models.
5. Transferring CEOP methodologies to other regions, sectors, and applications.

Status:

- The CEOP community began working as a unified research group following the merger of the Coordinated Enhanced Observing Period with the GEWEX Hydrometeorology Panel (GHP), which was endorsed by the GEWEX Scientific Steering Group (SSG) in early 2007. The first Coordinated Energy and water-cycle Observations Project (CEOP) Annual Meeting was subsequently held in September 2007, in Bali, Indonesia. In September of 2008, CEOP held its second Annual Meeting in Geneva, Switzerland.
- Worldwide in situ CEOP reference site data sets, CEOP satellite products, and Model Location Time Series continue to be delivered and applied in ways that have shown strengths and weaknesses of the models at each Modelling Center that participates in CEOP.
- CEOP has developed metadata and distributed and centralized data integration systems, and is continuing to evolve and be applied to useful initiatives being undertaken by both operational and research groups.
- CEOP has accepted a new role in undertaking unique scientific studies and promoting research on the use of model prediction ensembles and associated statistics by comparing them with observations, and making these results available to other researchers for further analysis.
- CEOP has devoted considerable effort and resources to assembling and making available sustained regional reference observations of key meteorological and radiation parameters, together with analysis tools and methods and standards for archiving, distributing, analyzing and visualizing these observations for scientists around the world.
- CEOP has focused its efforts over the past year on contributions to GEWEX that support World Climate Research Programme (WCRP) mission objectives as established in the WCRP Strategic Framework 2005–2015, to "support climate-related decision making and planning adaptation to climate change by developing science required to improve climate predictions and the understanding of human influence on climate, and use this scientific knowledge in an increasing range of practical applications of direct relevance, benefit, and value to society." This work has led to the reduction of uncertainties associated with the climatically sensitive and key hydrological processes in regions where CEOP is active, and ensured their proper representation in climate system models.

Key Results and Accomplishments

Science Foci Key Results:

- The scope of CEOP science activities has expanded; in addition to the Regional Hydroclimate Projects (RHPs), CEOP includes groups focused on studies in high elevations, monsoon, extremes, cold regions, and semi-arid regions.

- The CEOP Monsoons Study has been shown through a special session at the CEOP Second Annual Meeting to be synergistic with the overall WCRP Monsoon crosscut initiative.
- A CEOP High Elevation study special session at the CEOP Second Annual Meeting resulted in plans to organize a global high elevation watch period.
- CEOP Extremes studies have begun focusing on drought, heavy precipitation, floods, and low flows and the ways in which these events intermesh.
- Links between the CEOP Cold Regions Study and several RHPs have now been clearly identified. This work is also being coordinated with the WCRP Climate and Cryosphere (CliC) Project.
- The CEOP Semi-arid Regions study has recently shown progress on meeting the goals created for it as an element of CEOP, particularly by the establishment of a joint U.S.- and China-based semi-arid region study.
- CEOP science continues to provide a traditional focus for Water and Energy Budget Studies (WEBS), which will now extend efforts to understand average conditions to conditions throughout the entire CEOP period.
- Other CEOP science efforts related to water and energy budget studies have been expanded, including a study of the influence of aerosols and of water isotopes.
- CEOP modelling efforts now include explicit global, regional, land surface, and Hydrologic Applications Project (HAP) efforts. All of these groups have now begun to look at an ensemble of international models in regions focused on CEOP reference sites.
- A CEOP satellite data set is now being populated with data from instruments flown on spacecraft from the Japan Aerospace Exploration Agency (JAXA), the European Space Agency (ESA), and the National Aeronautics and Space Administration (NASA) and tools for handling historical data, which have been provided by the National Oceanic and Atmospheric Administration (NOAA). This work is being carried out as part of the CEOP Data Management component.

Integrated Data Set Key Results:

CEOP has fulfilled its most ambitious goals to address a number of key scientific issues through comprehensive improvement in access to integrated observational (in situ and satellite) and model data. Data Management, a focal point of the Coordinated Enhanced Observing Period, has now successfully implemented a data policy allowing the sharing of in situ reference site data, model output data, and satellite data, and has set up archival centers of this data at the National Center for Atmospheric Research (NCAR) and the Max Planck Institute (MPI). Satellite data has gone online at the University of Tokyo (UT), and along with other data has been moved to a central data archive where it can be accessed and distributed to interested users.

The CEOP Data Management web page was revised in August 2008 and is available directly at http://www.eol.ucar.edu/projects/ceop/dm, with improved links to all CEOP RHP (and related data provider) data archives.

Completed in situ data are now available from 28 of 32 reference sites (including data from 12 sites that contain full annual cycles for both Enhanced Observing Periods (EOP) 3 and 4).

The CEOP Model Output Center (located at the World Climate Data Center, Max Planck Institute for Meteorology, Germany) continues to maintain the archives and Model Output Gateway at http://www.mad.zmaw.de/projects-at-md/ceop. To date, 5.6 terabytes of data have been submitted and are available online. Metadata from the 11 Numerical Weather Prediction (NWP) Centers participating in CEOP continues to be updated at http://www.eol.ucar.edu/projects/ceop/dm/model/model_table.html. Periodic conference calls are conducted between these various Centers to coordinate data submission and data formatting issues.

The CEOP Satellite Data Center (UT, Japan) continues to add EOP3/4 satellite data to its archives. A new Satellite Data Gateway web page has been developed and is available at http://monsoon.t.u-tokyo.ac.jp/ceop2/satellite. This page provides current data policy, format, inventory, and access information. Data access is also available through the CEOP Centralized Data Integration System at http://monsoon.t.u-tokyo.ac.jp/ceop-dc/ceop-dc_top.htm.

An unprecedented international effort resulted in the specialized data integration function developed by CEOP, which has in turn has begun to add value to work in both the meteorological

and climate science and operational communities, especially the numerical weather prediction centers involved in CEOP.

An improvement of models has been achieved based on insights developed through CEOP validation studies and intercomparisons, as well as the provision of new capabilities and tools for integrating the model products with satellite and in situ data.

Plans for 2009

Science Foci Plans for CEOP in the Coming Year:

While each element of CEOP has made progress toward meeting its goals and has presented its status and plans in detail at the Second Annual CEOP Meeting in Geneva, Switzerland (17–19 September 2008), CEOP will place a great deal of emphasis during the coming year on advancing scientific work in monsoon studies, high elevations initiatives, and extremes. Each of these topics was the subject of a special session at the CEOP Second Annual Meeting. The outcome of these special sessions was used in breakout sessions that resulted in points to be addressed within the CEOP scientific framework and that specified the data needed to carry out the science plans.

All of the presentation material provided by the participants at the meeting, including abstracts of talks and posters, is available through the CEOP home page at http://www.ceop.net.

CEOP High Elevations (HE) will address the following activities in the coming year:

- Collecting information on key high elevation monitoring sites where physical and dynamic processes are being studied, and inviting site managers to become part of the CEOP-HE network
- Creating a database of HE stations worldwide
- Developing CEOP-approved installation procedures and long-term maintenance guidelines for HE sites and quality assurance/quality control policies for data acquisition
- Producing high-quality data sets in line with CEOP data policy

CEOP Monsoon Studies' plans for the coming year include attempts to improve understanding, modelling, and prediction of heating, circulation, and rain components of the monsoon system by:

- Dealing with data concerning continental forcing including trends, as well as inter-decadal and inter-annual variability
- Identifying Large-scale Orographic forcing, particularly over the Tibetan Plateau on time scales including inter-decadal, inter-annual, and low-frequency *variability* (LFV)
- Detecting the land/sea breeze, inter-decadal, inter-annual, LFV, and diurnal variability
- Contributing to a synthesis paper(s) providing input to the next Intergovernmental Panel on Climate Change (IPCC) assessment
- Improving predictions of seasonal march, intraseasonal variations, and extreme events in the monsoon systems, using cloud resolving models (CRMs)

CEOP Extremes has a number of specific steps currently underway for the coming year. These include:

- Assessing current definitions of extremes and determining whether further definitions are needed
- Assessing existing extreme event catalogues (heat waves, floods, droughts on a global basis from 1948–present) and incorporate this into the Extremes information base as appropriate
- Producing a high-resolution data set on global precipitation
- Pulling together at least one comprehensive, continental-scale data set on multi-year drought
- Assessing whether re-analyses are capable of detecting and determining the trend of extremes events over the last 30 years
- Providing a “recipe book” for others to follow in terms of conducting comprehensive drought studies
- Assessing whether a review article on extremes is warranted

Data Set Development Plans for CEOP in the Coming Year:

It has been concluded that a systematic effort is needed to match the expanded CEOP science framework with new and better specialized data sets and data integration tools. This has led to a number of points associated with the need for:

1. Better data sets and data integration tools with increased focus on defining and generating new multi-sensor, multi-scale integrated data sets;

2. CEOP to coordinate RHP efforts in the provision and integration of the new data types necessary to achieve CEOP science objectives; and
3. Cooperation with other groups within WCRP and GEWEX who are producing specialized data sets that are necessary to meet CEOP data set requirements.

New Directions:

By 2013, CEOP will have developed a functioning CEOP data center that be used by all of the CEOP science groups. It should be noted that CEOP data is already open to outside groups; CEOP data management is in the process of developing links to a number of associated groups, such as the Global Runoff Data Centre and Global Precipitation Climatology Centre.

CEOP is contributing to the Group On Earth Observations (GEO) water activities Water Task WA-06-02 (Droughts, Floods and Water Resource Management) and Water Task WA-08-01 (Integrated Products for Water Resource Management and Research) in the near term (2009-2011). CEOP will meet its commitments to GEO by maintaining its continued efforts to improve models and enhance the quality and integration of important hydroclimate data sets. Additionally, CEOP will make a lasting contribution to the GEO Portal, a web-based interface for searching and accessing the data, information, imagery, services, and applications.

CEOP will expand on the unique collaborative arrangement between itself, the international group of numerical weather prediction centers, and the broader climate research community represented by the World Meteorological Organization (WMO), WCRP, and GEWEX as they all move toward the implementation of the Global Earth Observation System of Systems (GEOSS). In this context, the GEOSS 10-Year Implementation Plan Reference Document states that CEOP should be considered as a prototype of GEOSS. This may be recognized in the future as the ultimate achievement of CEOP.

Issues

Recommendations/Issues for the SSG:

1. CEOP needs the support of the SSG to aggressively pursue the fulfillment of commitments made by international participants in CEOP to provide, validate, archive, and stage the complete baseline data set prescribed in the initial CEOP requirements.
2. CEOP must have the support of the SSG to maintain its relationship with data archive centers at NCAR, the Max-Planck Institute, JAXA, and the University of Tokyo. In particular, NOAA funding to NCAR for support of the in situ data archive and the oversight of CEOP data management activities may be in jeopardy beyond FY2009.
3. The CEOP Co-Chairs need the assistance of the SSG to ensure that space agencies—including the Committee on Earth Observation Satellites (CEOS)—are encouraged to actively support the CEOP implementation process through funding support and contributions to CEOP data needs.
4. The CEOP Co-Chairs may need the approval and endorsement of the GEWEX SSG to reclassify one or more RHPs as only affiliate activities. CEOP recently reported to the GEWEX SSG that a few GHPs have evolved or begun work along courses of development that have made them unable or at least limited by external factors such as funding constraints to continue to meet the scientific and technical criteria they had initially committed to abide by in order to become GEWEX/CEOP experiments. The SSG needs to address this situation.

Contributions to WCRP Strategic Themes:

In the future, CEOP must continue to focus on contributions to GEWEX that support WCRP mission objectives to "support climate-related decision making and planning adaptation to climate change by developing science required to improve:

- climate predictions;
- understanding of human influence on climate; and
- use this scientific knowledge in an increasing range of practical applications of direct relevance, benefit, and value to society" (WCRP Strategic Framework 2005-2015)."

In this way, CEOP can maintain its role in the process that WCRP-sponsored scientists and programs/projects have undertaken to make seminal contributions to international environmental assessments such as the IPCC.

Summary

The Coordinated Energy and water cycle Observations Project (CEOP) is a merger of the previous WCRP GEWEX Hydrometeorology Panel (GHP) and the Coordinated Enhanced Observing

Period, which was an element of WCRP initiated by GEWEX. This formal merger into the new CEOP was meant to enhance the efforts of both GHP and the Coordinated Enhanced Observing Period. The merger was accomplished without losing sight of any GHP or Coordinated Enhanced Observing Period strategic goals or any of their ongoing science work. It did, however, necessitate a refocusing of some activities toward the new CEOP goal and objectives. With this in mind, CEOP developed a new Strategic Implementation Plan (SIP). Through the process of a thorough review of the initial SIP draft by the GEWEX SSG in 2008 and by addressing all of the SSG's comments and concerns in a final draft of the SIP, CEOP has now reconciled its implementation plans with all of the other elements of GEWEX and WCRP. This process has provided the basis for CEOP to make its unique and separate but equal contributions to the success of the overall objectives of the broader International Climate Research community represented by GEWEX and WCRP and to extend its influence into the future as a part of GEOSS. The latest version of the SIP can be found at http://www.ceop.net.

List of Key Publications

References to technical work that have been citied in reports to CEOP and GEWEX by members of the CEOP science community.

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Saito, M., and J. Asanuma, 2008: Eddy covariance calculation revisited with wavelet cospectra. *SOLA*, 49, 49–52, doi:10.2151/sola.2008-013.

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Coordinated Energy and Water-cycle Observations Project (CEOP) Strategic Implementation Plan: October 2008.

List of Meetings, Workshops in 2008

4–5 January, Executive meeting in San Diego
2–4 February, GEWEX SSG Buenos Aires, Argentina
May, CEOP Extremes Workshop
2 September, CEOP Annual Meeting, Geneva, Switzerland

List of Planned Meetings, Workshops

The **CEOP Third Annual Meeting** will be held in Melbourne, Australia from 19–21 August 2009, just ahead of the joint GEWEX/iLEAPS Science Conference scheduled for 24–28 August 2009.
Other elements of CEOP will hold small topical meetings and workshops but these are usually planned within a few months of the time of the meeting; announcements will be forthcoming in due course. Other more mature CEOP initiatives plan larger meetings that can be known in advance such as BALTEX and Regional Modelling.
BALTEX: Four major events are planned and organized or co-organized by BALTEX that will focus on issues for future study, including:

- 2nd International Workshop on "21st Century Challenges in Regional Climate Modelling" in Lund, Sweden, 4–8 May 2009
- International conference on "Climate Change - The environmental and socio-economic response in the Southern Baltic Region" in Szezecin, Poland, 25–29 May 2009
- BALTEX Summer School on "Ecosystems of the Baltic Sea basin under climate change" in Bornholm, 24 August—4 September 2009 (tentative title, venue and time window)

- 6th Study Conference on BALTEX in Miedzyzdroie, Wolin, Poland, 2010 (dates still to be defined)

Regional Modelling

- 4–8 May 2009, The 2nd Lund Regional-scale Climate Modeling Workshop: 21st Century Challenges in Regional Climate Modelling, Lund, Sweden
- 18–20 March 2009, The International Conference on Land Surface Radiation and Energy Budgets: Observations, Modelilng, and Analysis, Beijing, China

List of Members

The list below is current; all leaders are in place for two more of three-year terms, which will be reviewed at the fourth CEOP Annual Meeting in August/September 2010. Renewals or changes at that time will be made at the end of the CEOP Annual Meeting in August/September 2013, the current horizon for GEWEX/CEOP.

Function	**Web Site**	**Representative**	Email address
CEOP co-chair	http://monsoon.t.u-tokyo.ac.jp/ceop/	Toshio Koike	tkoike@hydra.t.u-tokyo.ac.jp
CEOP co-chair	http://www.drinetwork.ca/extremes/	Ron Stewart	ronald.e.stewart@gmail.com
International Coordinator	http://www.gewex.org/	Sam Benedict	sam.benedict@gewex.org, gewex@gewex.org
RHPs			
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co-chair		Berbery	
Monsoon co-chair		William Lau	lau@climate.gsfc.nasa.gov
SAS		Congbin Fu	fcb@mail.tea.ac.cn
Cross Cutting Studies			
WEBS	http://www.itpcas.ac.cn/users/webs/	Kun Yang	yangk@itpcas.ac.cn
Extremes	http://www.drinetwork.ca/extremes/	Ron Stewart	ronald.e.stewart@gmail.com
Aerosols		Bill Lau	
Isotope co-chair		David Noone	dcn@Colorado.EDU
Isotope co-chair		Kei Yoshimura	k1yoshimura@ucsd.edu
Models			
Global (MAC)		Mike Bosilovich	Michael.Bosilovich@nasa.gov
Regional			
ICTS	http://icts.gkss.de	Burkhardt Rockel	Burkhardt.Rockel@gkss.de
SIEVE		Ray Arritt	rwarritt@bruce.agron.iastate.edu
LSM		Matt Rodell	Matthew.Rodell@nasa.gov
HAP		Eric Wood	efwood@princeton.edu
Data Management	http://www.eol.ucar.edu/projects/ceop/dm/		
Reference Sites/Basins	http://www.eol.ucar.edu/projects/ceop/dm/	Steve Williams	sfw@ucar.edu
Model Output	http://www.eol.ucar.edu/projects/ceop/dm/model/	Michael Lautenschlager	Michael.Lautenschlager@zmaw.de
Satellite Data	http://monsoon.t.u-tokyo.ac.jp/camp-i/doc/sat_info/index.htm	Toshio Koike	tkoike@hydra.t.u-tokyo.ac.jp
Data Integration & Dissemination	http://jaxa.ceos.org/wtf_ceop/	TBD	
Central Data Integration	http://monsoon.t.u-tokyo.ac.jp/ceop-dc/ceop-dc_top.htm	Kenji Taniguchi	taniguti@hydra.t.u-tokyo.ac.jp

Associated Global Data Centers	http://www.ngdc.noaa.gov/wdc/		
GRDC	http://grdc.bafg.de/	Ulrich Looser	Looser@bafg.de
GPCC	http://gpcc.dwd.de	Tobias Fuchs*	Tobias.Fuchs@dwd.de

2.2 GEWEX Radiation Panel (GRP)
Reporting Period: 2008
URL: http://www.gewex.org/projects-GRP.htm and http://rain.atmos.colostate.edu/GRP/index.html
Chair and Term Dates: Christian Kummerow (2008–2010)

Overview:

Within the World Climate Research Programme (WCRP) Global Energy and Water Cycle Experiment (GEWEX), the GEWEX Radiation Panel is organized to review theoretical and experimental knowledge of radiative processes in and for the study of the climate system. These processes are central to the climate's energy cycle: climate is determined by the imbalances of solar radiative heating and longwave radiative cooling. The circulation of the atmosphere and ocean, the environment on land, and the biosphere are all driven by local radiative imbalances. Changes in climate can be caused by alterations of the radiation budget at the top of the atmosphere or at the surface, such as those induced by changing amounts of greenhouse gases or aerosols in the atmosphere or by changing land surface properties. The sensitivity of the climate response to a change in radiative forcing is determined by many feedback processes that alter the radiation budget, especially those involving clouds and water vapor.

The main source of global information about the climate system comes from the analysis of satellite remote sensing data which requires detailed models of the interaction of radiation with the atmosphere and the ocean-land-ice surfaces, including the effects of vegetation, as a function of wavelength, polarization state and observing geometry. Water is unique in its role on Earth. Not only does it provide the necessary sustenance to support life, it also acts as an energy storage and transport mechanism as it changes phase from solid to liquid and vapor. Together with water vapor in the atmosphere, the reservoirs of water are continually exchanging mass. Water evaporates from the ocean and land surfaces, is transported by the atmosphere, forms clouds and returns to the surface as precipitation. Rainfall on land can return to the sea via rivers or be stored in lakes and aquifers. Snowfall on land can melt into rivers or build up into ice sheets, which can melt into rivers later. The cycle of water is thus inextricably linked with the cycle of energy by clouds, water vapor, and precipitation, so it makes sense to study these water processes together with radiation processes.

The GPR focuses on answering the following specific questions:

- How can we better measure and characterize the state and variations of climate using satellite observations?
- What are the changes in radiative forcing that cause climate change?
- How do the interactions of radiation with changes of the internal state of the climate (radiative feedbacks) affect the climate's sensitivity?
- How do the internal water exchange and transport processes in the climate (water feedbacks) affect the climate's sensitivity?

Status:

International Satellite Cloud Climatology Project

The International Satellite Cloud Climatology Project (ISCCP) celebrated its 25th anniversary of data processing on 1 July 2008. A 2.5-day symposium was held at the National Aeronautics and Space Administration (NASA) Goddard Institute for Space Studies on 23–25 July to mark the occasion, to review the status of knowledge about clouds and their role in the climate's radiation and water cycles, and to discuss future satellite cloud measurements and analyses.

The calibration of visible and infrared satellite radiances proceeded routinely over the past year: at the time of the GRP meeting, normalization of geostationary to polar orbiting radiometers was complete through May 2008 and the absolute calibration of the polar orbiters had been extended through December 2007. The main reduced resolution radiance data set (Stage B3) has been delivered to the archives for the period July 1983–June 2007.

The primary set of cloud data products (DX, D1, and D2) and the two ancillary data products (atmospheric temperature and humidity, snow/ice cover) have been delivered for the period July 1983–June 2007. The radiative flux product produced by ISCCP (called FD) is available for the period July 1983–December 2006. Other specialized products (mesoscale convective tracking; tropical, low latitude and midlatitude weather states analysis; cyclone tracking) are currently being extended beyond 2004 through 2006. A new cloud particle size climatology, covering July 1983-September 2001, will be released in early 2009.

All ISCCP data processing center funding is in place; however, Canada decided to withdraw from further participation as of October 2008. Fortunately the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC) was already preparing to take over processing of the Geostationary Operational Environmental Satellite (GOES) in early 2009; this move also ends the participation of Colorado State University. Brazil is still working to supply GOES-10 data.

The extension of funding for the Global Processing Center has been approved. The first grant supporting continuing operations also specifically supports switching the cloud products from B3 radiance data (with 30 km spatial sampling) to the B1U radiance data product (with 10 km sampling). The second grant funds the re-engineering of the ISCCP processing system so that it can become "operational;" NOAA NCDC has agreed to take over the Global Processing Center role for the future. This re-engineering effort will be used as a pilot project to define and document the necessary features of a data processing system for producing climate data records.

Cloud Assessment

The GEWEX Cloud Assessment was initiated by GRP in 2005 to evaluate the reliability of available global, long-term cloud data products. In 2008, monthly averages of cloud temperature, cloud emissivity, and optical thickness, as well as water path and effective particle size, were made available to all assessment participants via the web site. With ten teams participating, the comparisons were presented at the GEWEX cloud assessment meeting held in July 2008 in New York, USA, hosted by W. B. Rossow (program available at http://climserv.ipsl.polytechnique.fr/gewexca/). The general seasonal cycles of different cloud properties agree well among the participating groups. Varying instrument sensitivities and spatial resolutions explain differences in absolute values of cloud amount, especially of thin cirrus. To move forward in the understanding of such differences, it was concluded that variability as well as distributions of the cloud properties are needed in addition to the monthly averages. At present the participating teams are preparing data sets in a common format (netCDF) with all this information. The data sets will be made available for all participants to continue the comparisons, and later to the public.

Surface Radiation Budget

The Surface Radiation Budget project (SRB) has completed the following since October of 2007:

- Processed ISCCP DX for all codes from July 2005–June 2007
- Extended ozone profiles from July 2005–June 2007 with NOAA Stratosphere Monitoring Ozone Blended Analysis products
- Improved algorithms accordingly:
    1. GEWEX Shortwave (SW): added new background aerosol that limits effective optical depth over ice surfaces to more realistic values [i.e., the algorithm retrieves effective optical depth to match clear-sky top-of-atmosphere (TOA) albedo on a 3-hourly basis]; other improvements were made related to products
    2. SW Quality Check (QC) algorithm: improved surface albedo and background aerosol representations
    3. LW QC algorithm: improved surface skin-temperature/near-surface discontinuity issues causing spurious fluxes over hot surfaces
    4. GEWEX Longwave (LW): upgraded trace gas histories and surface emissivities and evaluated new ice treatments and day/night cloud assumptions
- Produced and archived a 23-year SRB Release 3.0 data set spanning July 1983–June 2007 for the GEWEX SW, SW Quality Check (QC), and LW QC flux algorithms. 3-hourly, monthly averaged 3-hourly, daily averaged, and monthly averaged data sets are now available at the NASA Langley Atmospheric Sciences Center (ASDC)
- Delivered data sets to numerous users and contributed to several scientific papers, the most notable of which supported the GEWEX Seaflux project

- Implemented procedures to reproduce *Swiss Federal Institute of Technology*, Zurich data quality flags for Baseline Surface Radiation Network (BSRN) measurements and other networks. Used the paper by Long and Shi (2008) and extended the method for fluxes < 50 W m-2. This action was required since new BSRN data do not have such quality control
    1. Re-ran all validation using new procedures.
- Compared latest gridded flux products to the Center for Environmental Remote Sensing (CERES), ISCCP-Flux Data Set (FD) TOA, and other surface radiative fluxes provides for GEWEX Radiative Flux Assessment (RFA)
- Completed long-term analysis relative to surface measurements and submitted as a paper

Global Precipitation Climatology Project

The Global Precipitation Climatology Project (GPCP) continues to process data smoothly with research products approximately coming out 3 months after observation time. While processing is on temporary hold until new gauge analysis is incorporated, products are generally available through May/June 2008.

Monthly = Jan. 1979–June 2008
Pentad = Jan. 1979–May 2008
Daily = Oct. 1996–June 2008

Some of the significant accomplishments of GPCP include:

- Published Precipitation Assessment report. WCRP-128 Global Precipitation Assessment: A Project of the GEWEX Radiation Panel. Available from http://wcrp.wmo.int/documents/AssessmentGlobalPrecipitationReport.pdf
- Reached 29 years of records with the monthly and pentad products
- Daily product reached 11 years (Oct. 1996 – present)
- Successfully continued the routine collection of satellite data and the production of analysis products in a timely manner
- Discussions continued at the Working Group on Data Management and Analysis **(**WGDMA) and elsewhere on refining the plan for GPCP Version 3 re-processing
- Examined possible procedures for a “quick-look” GPCP monthly product (to occur a week or so after the end of the month). A remaining roadblock has been identified as ocean/microwave processing with an “early” version of RSS SSM/I Tb’s producing different results—still investigating
- GPCP products are cited in over 900 journal papers. Citation list is available at: ftp://precip.gsfc.nasa.gov/pub/gpcp-v2/doc/gpcp_citation_list.pdf

LandFlux

LandFlux activities continued during the past year with two topical workshops, one on the retrieval of land surface skin and air temperatures (7–9 April, Asheville, NC, USA) and one on retrieval of land surface properties from microwaves, including soil moisture and flooding extent (20–22 October, Oxnard, CA, USA). Both workshops are being followed up with comparisons of products and investigations into their differences. The next event will be a one-day workshop held in conjunction with the GEWEX-iLEAPS Scientific Conference in August 2009, where an inventory of available global surface latent and sensible heat flux products will be made—including observationally-based (in situ and satellite), model-based, and mixed observation-model—and plans for systematic comparisons initiated. The idea is to conduct these comparisons and investigate causes of differences over the coming year, leading up to the production of revised products and preparation for the systematic processing of long-term global products.

Continuous Intercomparison of Radiation Codes

The Continuous Intercomparison of Radiation Codes (CIRC) effort was advanced in several important ways in 2008, including: (1) calculations for Phase I cases were finalized; (2) the CIRC web site (http://circ.gsfc.nasa.gov) was created; (3) Phase I was launched and the first submissions received; (4) CIRC-themed talks were given at various meetings, such as the Atmospheric Radiation Measurement (ARM) annual Science Team Meeting and working group meetings and the International Radiation Symposium (IRS) 2008; (5) a short paper intended to advertise the effort was submitted to the Bulletin of the American Meteorological Society (BAMS); and (6) a CIRC working group was established within the International Radiation Commission (IRC) and is being considered as a potential successor to the Intercomparison of Radiation Codes used in Climate Models (ICRCCM). A brief summary on those advances was given at the annual GRP Meeting held on Jeju Island, South Korea.

The CIRC web site is a focal point of the project and is the central repository from which data involving the validation of radiative transfer models can be obtained. We are currently hosting the data and description of Phase I cases, as well as general information about the scope and modus operandi of the effort. On 4 June 2008, the announcement of the web site and an invitation to participate in CIRC was sent via e-mail to 100+ radiative transfer modelers. Requests for registration and submissions followed soon thereafter; so far we have received 15 requests for registration and submissions from five participants. Preliminary results with our own test codes and the first submissions were presented in ARM meetings and IRS'08. An extended abstract will appear in the proceedings of the latter. Our initial analysis has focused on the effects of the exact specification of spectral surface albedo and its subsequent spectral degradation, and the behavior of radiation models when carbon dioxide is doubled under dry conditions. These issues are also discussed to some extent in the BAMS article. But the main thrust of the article is to make a convincing case for the necessity of a community-oriented project such as CIRC and the expected benefits to radiation modelling. It is not entirely clear how the suggestion by IRC leadership that CIRC absorb ICRCCM will materialize, especially since a phase of ICRCCM focusing on thermal infrared effects of cloud inhomogeneity (somewhat outside the scope of CIRC at this point) is currently active. The suggestion seems to draw from the original purview of ICRCCM to compare approximate global climate Model (GCM) radiation schemes with accurate line-by-line algorithms for simple synthetic atmospheres, which may be also included in the roster of our future cases.

Global Aerosol Climatology Project

The Global Aerosol Climatology Project (GACP) has been relatively inactive but received funding in 2008 to re-energize both the program itself (led by Michael Mischenko) and the product assessment (led by Sundar Christopher).

SeaFlux

SeaFlux intercomparisons were essentially completed in 2008. Version 1.0 of the sea surface temperature and version 0.5 of the latent and sensible heat fluxes are available for testing. Much of 2008 was spent on comparing available products against one another and against very limited in situ data. A novel aspect of the current validation strategy is that each input into the flux products is being assessed independently so that parameters such as wind and humidity can be evaluated separately.

Key Results:

- All data generation and assessment projects are currently funded to continue.
- CIRC has completed Phase I; intercomparsions against real data collected at the ARM site are now possible.
- GRP products continue to set the standard for quality products and independent assessment activities. GPCP alone has over 900 references in journal publications to date.
- All projects have begun preparations for coordinated reprocessing to begin in 2010 in order to address smaller space/time issues as well as the Extremes focus identified by GEWEX.
- All projects are detecting trends in climate data and are being used in publications related to climate change.

Plans for 2009:

All GRP products are preparing for the reprocessing cycle to begin in 2010. Key activities within each project are geared towards that goal.

ISCCP will focus on: (1) obtaining a "Moderate Resolution Imaging Spectroradiometer (MODIS) anchor" for the radiance calibration; (2) improving polar cloud detection by testing against Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO); (3) refining optical thickness retrieval for ice clouds to make it more precise; (4) installing a treatment of land surface bi-directional reflection and non-unit infrared emissivity; (5) accounting for aerosols in the retrieval; and (6) removing or reducing interannual artifacts in the ancillary data sets used. Current open issues that will be addressed in 2009 include: (1) incorporating Chinese and Brazilian data into the products; (2) investigating anomalies in the new series of Advanced Very High Resolution Radiometers (AVHRR), including scan-angle effects, bi-linear VIS response, and non-linear infrared calibration; (3) finding an adequate atmospheric temperature and humidity dataset to replace the operational TOVS product (required to provide coverage of whole ISCCP time period and continue into the future, to provide adequate daily coverage, at least, of the globe, at least as accurate as the original TOVS and more homogeneous over the whole record than TOVS); and (4) finding an adequate description of the geographic and temporal variations of aerosols.

The Cloud Assessment Project is working on the final World Meteorological Organization (WMO) report (in one or two parts) that should be finished at the end of 2009. It discusses the existing long-term climatologies and also comparisons with climatologies from improved instruments aboard the NASA Earth Observing Satellite (EOS) and the A-Train. Climatology averages as well as their regional, seasonal, and diurnal variations will be presented, and differences between results from the various data sets will be discussed.

SRB plans to complete the processing and archival of V3.0 LW and cloud/ancillary 3-hourly data sets containing inputs to SRB processing codes through June 2007, as well as update the archive as ISCCP continues processing. Algorithm upgrade activities include:

- Develop improved parameterizations for the conversion of narrow-band radiance to flux in GEWEX SW model using new CERES information in collaboration with Dr. Rachel Pinker of University of Maryland.
- Assess and select new temperature and humidity meteorology for processing in collaboration with NASA Goddard Institute for Space Studies (GISS). A new High Resolution Infrared Radiation Sounder (HIRS)-based data set and the Modern Era Retrospective-analysis for Research and Applications (MERRA) will be evaluated. This will improve the homogeneity between ISCCP and SRB products.
- Improve aerosol treatment in SW and LW codes in collaboration with NASA Goddard Space Flight Center (GSFC) and GISS; assess relative to GISS, GACP and the Global Ozone Chemistry Aerosol Radiation Transport (GOCART).
- Improve various cloud and boundary layer assumptions in the GEWEX LW code.

Intercomparison of surface and top-of-atmosphere (TOA) flux estimates continue against satellite and surface measurements. The plan is to extend intercomparsions between other surface and TOA flux data sets such as the CERES Surface and Atmospheric Radiation Budget (SARB)/Surface-Only Flux Algorithms (SOFA) and ISCCP-FD as required for the GEWEX-RFA report. Surface analysis to direct, diffuse, and photosynthetically active radiation fluxes with an emphasis on validation under various sky conditions will also be extended. An enhanced error and sensitivity analysis will be performed to better characterize uncertainties. SRB will also continue time series analysis relative to surface measurement time series of the Global Energy Balance Archive (GEBA) and BSRN, and a new emphasis on polar fluxes validation will be made. The Radiation Flux Assessment activity will focus on analyzing long-term variability in relation to estimates of other meteorological and cloud parameters to assess characteristics of variability in relation to large-scale atmospheric processes.

GPCP's plans, aside from continuing to process data on a timely manner, include the following:

- Complete plans for Version 3 of GPCP products with a 3-hour or fine scale incorporating the Tropical Rainfall Measuring Mission, the Advanced Microwave Scanning Radiometer and others, and begin calculating alternate procedures for a test period (~1 year). Reprocessing will hopefully start during 2010.
- Test using B1 geo-infrared data to extend daily (or 3-hour) product before October 1996. Test on the same 1-year test period.
- Incorporate the Global Precipitation Climatology Centre 50-year gauge analysis into merged analysis, replacing monitoring and other gauge products.

SeaFlux plans to finish Version 1 by spring of 2009. Version 1 is to include more satellites in order to improve the diurnal cycle of sea surface temperature, improve the determination of q and Ta and use better intercalibrated Special Sensor Microwave Imager (SSMI) brightness temperatures than the current Tracking and Data Relay (TDR) satellites. There is a reluctance to use the commercially available RSS data set, as it is expensive and not well documented.

CIRC intents to hold a workshop within the year and is currently considering dates and location options. One possibility is to hold the meeting just before the Gordon Conference on Radiation and Climate (New London, NH) in a nearby location such as Boston in early July. The rationale is to attract some of the international participants that may otherwise be reluctant to travel to the U.S. for a CIRC workshop. Efforts will be extended to establish a closer working relationship with the radiation modellers of Intergovernmental Panel on Climate Change (IPCC)-participating GCMs. In addition to analysis of Phase I submissions, we will start exploring the appropriate ARM data sets for possible Phase II cases that can offer new insights on the performance of the radiation algorithms.

Science Highlights:

Some of the scientific highlights in this reporting period come from the Cloud Assessment activity that has benefited from the recent launch of CloudSat/CALIPSO. Climatological averages as well as seasonal variabilities among products reveal relatively uniform results across platforms.

- 70 percent (±5%) clouds: ~40 percent high clouds and ~40 percent single-layer low clouds. In general, geographical cloud structures agree quite well:
- Maximum of high clouds in Inter-Tropical Convergence Zone (up to 60%)
- Few single-layer midlevel clouds in the tropics (5%), most in Northern Hemisphere midlatitude winter (15%); CALIPSO data confirm this
- Infrared sounders [TOVS/HIRS, the Atmospheric Infrared Sounder (AISR), the Infrared Atmospheric Sounding Interferometer (IASI)] are passive instruments most sensitive to cirrus; they only miss 10 percent/5 percent subvisible cirrus in the tropics/midlatitudes. ISCCP misses further 15 percent/10 percent in the tropics / midlatitudes.
- Pathfinder-Atmosphere (PATMOS-X) and MODIS are still in the validation process, but will miss more thin cirrus than the infrared sounders.
- Active instruments CALIPSO and CLOUDSAT give insight to the vertical structure of clouds and help to evaluate the cloud properties determined from passive remote sensing. For further progress in climate research, the synergy of different variables and data sets is very important.
- Microphysical cloud properties:
    1. Effective droplet size of water clouds is smaller over land than over ocean.
    2. Effective ice crystal size of cirrus is slightly larger when obtained from infrared than from NIR-VIS observations.

New Directions:

GRP is best known for its global long-term products and this focus will be maintained. However, it can be enhanced. Once the SeaFlux and LandFlux products are in production, GRP will focus on creating composite Global Water and Energy products that combine the various individual products into a consistent product containing all the water and energy states and fluxes. This composite product is envisioned to usher in a new era of interaction between GRP and the modelling community as well as other satellite providers *vis à vis* closure of the water and energy budgets at both global and regional scales.

In preparation, there are a number of activities being encouraged: the first is to revisit the GEWEX water vapor project the Global Water Vapor Project (GVaP). It is not clear at this time whether such a product can or should exist separate from the data assimilation community that has so successfully brought in diverse data sets into a coherent framework. GRP is exploring this issue and may hold a joint workshop with the International TOVS Working Group. At the same time, the NASA MERRA reanalysis is also being assessed as a consistent source of vapor for the next reprocessing of all GRP products.

Related to the unification of water and energy variables, GRP continues to foster the Cloud, Aerosol, Precipitation Initiative (ACPC). While not independent of the modelling activity, GRP sees potential in collecting simultaneous global scale data on aerosols, clouds and precipitation in order to provide global scale observations to what otherwise tends to be a very case-oriented analysis.

Finally, GRP feels that it should get involved in the data stewardships activities that are springing up, as a consistent, high-quality data set is critical for the long-term products being produced by GRP. Unfortunately, each calibration/intercalibration and stewardship activity has its own objectives that only sometimes fit GRP needs. As a panel, we want to encourage communities to use GRP algorithms to assess the stability of their long-term data products.

Recommendations and Issues for Attention of the SSG:

GRP in general, but GPCP in particular, needs a closer working relationship with the Climate and Cryosphere (CliC) Project for joint evaluation of products in high latitudes.

Data stewardship activities—particularly calibration and intercalibration—are springing up everywhere under different acronyms. Coordinating these activities seems critical.

New members of GRP feel that at some point, the GRP name itself should be revisited as global water and energy flux products have eclipsed radiation as the key activity within GRP.

Contributions to WCRP Strategic Themes:

The production of global data sets is a strategic theme that GRP addresses directly.

Summary:

GRP projects have all been funded and are making plans for a reprocessing cycle starting in 2010. This reprocessing will focus not only upon improvements within individual products, but also upon using common ancillary data across all products in order to bring uniformity to the data. Aside from using common ancillary data, GRP will also begin to produce an integrated water and energy cycle product that combines basic elements from each of its stand-alone products. The integrated data should be useful for process studies. Details regarding exact space/time resolution, time span and data fields are still being worked out in the panel.
The radiation code intercomparison activity is up and accessible through the web. Unlike previous efforts, the current CLiC activity uses actual observations from the ARM site and LBL calculations as a reference. It is available to all participants including IPCC modellers if they wish to avail themselves of this opportunity.

Planned Meetings in 2009:

- LandFlux workshop with GEWEX/iLEAPS conference in August.
- Potential Water Vapor Workshop with the International TIROS Operational Vertical Sounder Working Group
- CiRC Workshop around July
- WGDMA meeting in Americas; typically September
- GRP meeting, Oct. 13–16, Bonn, Germany

GRP Members: Term:

David Barber (University of Manitoba, Canada) 2006–2009
Toshiro Iguchi (CRL, Japan) 2002–2008
Norm Loeb (NASA Langley Research Center, USA) 2005–2008
Luiz Machado (CPTEC, INPE, Brazil) 2005–2008
Matthew McCabe (UNSW, Australia) 2008–2011
Catherine Prigent (Paris Observatory, France) 2003–2008
Joerg Schulz (Deutcher Wetterdienst, Germany) 2006–2009
Axel Schweiger (Polar Science Center, Washington) 2008–2011
Sonia I. Seneviratne (ETH Zurich, Switzerland) 2008–2011
BJ Sohn (Seoul Nationa University, Korea) 2007–2010
Claudia Stubenrauch (LMD, France) 2007–2010
Sue Van Den Heever (CSU, Colorado) 2008–2011
Fengsheng Zhao (CMA, China) 2006–2009

Project and Working Group Chairs:

Robert Adler (U. Maryland, USA) GPCP
Robert Cahalan (NASA GSFC, USA) I3RC
Carol Anne Clayson (Florida State U, USA) SeaFlux
Ellsworth Dutton (NOAA, USA) BSRN
Tobias Fuchs (Deutcher Wetterdienst, Germany) GPCC
Lazaros Oreopolus (NASA GSFC, USA) CIRC
Vencenzo Levizzani (ISAC, Italy) WGPRN
Michael Mishchenko (NASA GISS, USA) GACP
William Rossow (CCNY, USA) ISCCP (WGDMA Chair)
Jacqui Russell (Imperial College, UK) Liaison to GERB
Paul Stackhouse (NASA LARC, USA) SRB
Graeme Stephens (Colorado State U, USA) Liaison to CloudSat
Taneil Uttal (NOAA, USA) Liaison to IPY
Bruce Wielicki (NASA LARC, USA) Liaison to CERES
David Winker (NASA LARC, USA) Liaison to Calipso

2.3 GEWEX Modelling and Prediction Panel (GMPP)
Reporting Period: 2008
URL: http://www.gewex.org/projects-GMPP.htm
Chair: Prof. Christian Jakob

Objective(s):

GMPP's role is to coordinate the activities within GEWEX which aim at improving the representation of the global water and energy cycle within Earth system models. Furthermore it coordinates collaboration with modelling and related observational activities within and beyond

GEWEX. Particular focus areas of the work of GMPP are cloud systems, land-surface processes, and the atmospheric boundary layer (ABL). To address these difficult areas of parametrization adequately, GMPP is organized into three activities:

1. The GEWEX Cloud System Study: GCSS
2. The Global Land/Atmosphere System Studies: GLASS
3. The GEWEX Atmospheric Boundary Layer Study: GABLS

Progress report:

The main activities of GMPP take place in the three study groups mentioned above and are summarized in the progress reports of those groups.

The main activity at the GMPP-coordination level this year was to establish the enhanced collaboration with the newly formed parameterization expert group within the Working Group on Numerical Experimentation (WGNE). This effort was proposed last year and was discussed at the SSG in January 2008. A recent GEWEX Newsletter article describing the effort can be found at http://www.gewex.org/Nov2008.pdf. Both WCRP and CAS endorsed the formation of the expert group within WGNE as well as the admission of the GMPP, GCSS, GLASS, and GABLS chairs as members of WGNE. The first meeting of the newly structured WGNE took place in November 2008 in Montreal. Christian Jakob was appointed the new co-chair of WGNE with particular responsibility for coordination of the parameterization effort. The meeting was exceedingly successful and the GEWEX efforts in parameterization development are very clearly at the core of the new expert group. It is a testament to the fantastic work done in all the study groups over the past decade that the community has fully embraced these efforts and that they form the foundation for the plans of enhancing parameterization research within WMO.

As a consequence of the new parameterization effort the WGNE meeting addressed a large number of parameterization-related issues, all of which are intrinsically GMPP issues as well. The following is an excerpt from the forthcoming WGNE meeting report:

“The meeting discussed at length the perception that some parameterizations, most notably that of deep convection, will soon be obsolete due to the emergence of convection-permitting global models. It is the firm opinion of WGNE that the use of such models in global operational NWP is at least a decade away. Furthermore, its use in operational seasonal and climate prediction is not likely to occur for an additional decade after that. WGNE therefore strongly urges a reinvigoration and increase in activities related to parameterization research for global models.”

The meeting received reports from all three GEWEX parameterization efforts, namely the GEWEX Cloud System Study (GCSS), the GEWEX Land-Atmosphere System Study (GLASS), and the GEWEX Atmospheric Boundary Layer Study (GABLS). WGNE congratulated the studies on their achievements in 2008 and encouraged all of them to continue along the plans they presented. In particular, WGNE encouraged GABLS to maintain its major efforts to improve the representation of the stable boundary layer in models and to withstand the temptation to move on to potentially easier problems.

A specific topic of the discussion was how to best move work forward on the representation of microphysics. It is recognized that the importance of this representation is increasing in all areas of modelling especially in convection-permitting models as well as models that include cloud-aerosol interactions. It was decided to focus research efforts through the recently created GCSS working group on microphysics. WGNE encourages its members and the wider research community to make best use of this effort by participating in existing activities of the group and by suggesting new projects for it to take on. In particular WGNE suggests building on the existing efforts in GCSS and expanding to include the increasing number of operational convection-permitting models in the GEWEX model evaluation and development activities.

The new co-chair presented a number of proposals to enhance the parameterization effort and to engage a broader community in its activities. Three initiatives in particular were discussed and supported by WGNE. First the co-chair has been tasked to conduct an audit on (1) existing parameterization activities in the broader WMO community and (2) on the problems ascribed to parameterization issues throughout the application communities including NWP and data assimilation, seasonal prediction, and climate simulation and projection. Results of an initial survey are encouraging in its response. A second initiative, led by Dr. Joao Teixeira (JPL), is to organize a conference/workshop on the representation of physical processes in Climate System Models. WGNE agreed to support such a meeting subject to a more detailed plan being submitted to

members and discussed by e-mail. It is likely that the conference, rather than focusing on model components, will discuss parameterization issues in various applications and geographic regions, including issues of coupling. WGNE also supported a proposal to write a white paper on parameterization issues. It was decided to tie the publication of the paper to the conference and to request the conference organizers to seek broad community input and support for the conclusions of the paper." GMPP and in particular the three studies will play a central role in all the activities proposed by WGNE.

Plans for 2009:

The GMPP study groups will continue their efforts as outlined in their individual reports. At the GMPP coordination level much of the work will focus on the collaboration with the WGNE effort, as GMPP is the core of that effort.

With my appointment to co-chair of WGNE I will be unable to continue in my role as GMPP chair. I am therefore seeking to resign from that role at a time in 2009 that allows for sensible succession planning and implementation. I would like to take the opportunity to thank all my friends and colleagues in GEWEX and beyond. In particular I would like to thank the chairs of the study groups who made my life as GMPP chair very easy. I would also like to give special thanks to the GEWEX IPO for their support over the years. It has been great fun to working with all of you.

New directions:

With the establishment of the WGNE parameterization expert group, which integrates the GMPP study groups into a larger WMO effort on parameterization, it is worthwhile to rethink the GMPP structure within GEWEX. From my own experience as GCSS and GMPP chair over the last 5 years I would suggest maintaining GMPP, but to have it co-chaired by two of the co-chairs of GCSS, GLASS, and GABLS, instead of appointing a separate chair. As all the actual work is carried out in the three study groups, their chairs are best placed to coordinate efforts and to identify potential areas for collaboration both amongst the GMPP groups and with the wider community. The recent successes in such collaboration, such as the GCSS-CFMIP and ACPC initiatives as well as the GLACE project, were all initiated from within the study groups. The study group chairs are also best placed to represent GEWEX in the wider community, as is evident from their recent appointment as WGNE members.

Recommendations and issues for attention of the SSG:

- To note the successful implementation of a parameterization expert group under the auspices of WGNE, with automatic membership for the GMPP and study group chairs.
- To congratulate the GMPP study groups on their continued success in supporting the community's efforts in parameterization development and endorse their plans for 2009.
- To endorse the participation of the GMPP study groups in the proposed activities of the WGNE parameterization effort as outlined in this report.
- To accept the resignation of Christian Jakob as Chair of GMPP at a time in 2009 that is convenient for succession planning and implementation.
- To note and discuss the proposal for future GMPP leadership outlined in this report.

Summary

In 2008 GMPP has been at the heart of the implementation of a new parameterization initiative that resulted in a new expert group on parameterization within WMO under the auspices of WGNE. The role of this group is to advise all WMO activities in the area of parameterization and to set the agenda for parameterization development activities. The existing GMPP study groups form the core of this new activity. Through the GMPP groups GEWEX continues to drive progress in this very important area of research.

List of meetings, workshops

November 2008, WGNE-24, Montreal, Canada

Planned meetings, workshops

November 2009, WGNE-25, Frankfurt, Germany