

# WCRP REPORT

World Climate Research Programme



ICSU  
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**REPORT OF THE EIGHTEENTH SESSION OF THE GEWEX**

**SCIENTIFIC STEERING GROUP**

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## **DECISIONS AND ACTIONS FROM THE 18<sup>th</sup> MEETING OF THE GEWEX SSG**

### **DECISIONS:**

1. The GEWEX SSG agreed that it was premature to proceed at this time with recommending the formation of a "COPEs" Monsoon Panel. GEWEX will first work on its internal coordination of monsoon activities and its relationships with CLIVAR in the monsoon area. To this end it was agreed that GHP would establish a monsoon coordination function for all of GEWEX. The GHP Chair will identify a lead in consultation with the GEWEX SSG Chair.
2. The GEWEX SSG approved the LandFlux Project as proposed by GRP. In order to ensure that this new project maintains continuity with past activities (e.g. ISLSCP) the SSG requested the establishment of an advisory group with representation from GHP, GMPP, CEOP, iLEAPS and any other relevant programs to provide advice and continuity. The advisory (Bill Rossow, Rick Lawford) will look at options for a broader data collection activity possibly under the ESSP.
3. The GEWEX SSG approved the GRP plans for aerosol work but recommended that issues related to GCOS be undertaken by the team reviewing GEWEX observational requirements (Bill Rossow/Tom Ackerman and representatives from CEOP and GHP).
4. The GEWEX SSG endorsed in principal, the plan for the GAME follow-on project, called MAHASRI, subject to a thorough review and approval by the GHP. The SSG also requests that the MAHASRI science plan be submitted to the CLIVAR SSG for review and feedback.
5. The GEWEX SSG supports the implementation of the Hydrologic Applications Project (HAP) and recommends that a more complete written plan be prepared for review at the GHP meeting.
6. The GEWEX SSG approves the restructuring of GMPP with Chairs and Vice-Chairs.
7. The GEWEX SSG feels that more discussion and thought is needed on the critical aspects of convection before recommending a WCRP Task Force on Convection. This subject could be considered for scientific lectures at the GEWEX SSG-19 meeting and a future JSC meeting.
8. In order to expedite the implementation of Phase II, the GEWEX SSG endorses the CEOP Phase II plan in principal, but has some reservations about the extent of some of the proposed activities.

### **ACTION ITEMS:**

#### **A. GEWEX:**

- A.1. GEWEX Panels will identify existing and potential new links with CLIVAR. An analysis of the results should be completed and presented by Soroosh to the CLIVAR SSG in April 2006. (ACTION: Peter van Oevelen, Toshio Koike, Bill Rossow, Jan Polcher, John Roads)
- A.2. Establish a small working group to assess feasibility of a data project that would address issues and needs raised by iLEAPS and GWSP at the SSG meeting. (ACTION: Yann Kerr to lead. Other participants: Pavel Kabat, Charles Vorosmarty, Eric Wood, Bill Rossow and Rick Lawford)
- A.3. Finalize the draft GEWEX roadmap and develop an implementation plan based on inputs from the pan-GEWEX meeting. (ACTION: Rick Lawford)
- A.4. CEOP should provide input to milestones for roadmap (ACTION: Toshio Koike)
- A.5. Invite SSG members to the Pan-GEWEX Meeting in October (ACTION: IGPO).
- A.6. Panel Chairs are invited to advise IGPO and the SSG Chair of any additional issues not addressed by the 1<sup>st</sup> Pan-WCRP Monsoon Workshop before the CLIVAR SSG meeting in April. (ACTION: John Roads, Bill Rossow, Jan Polcher, Toshio Koike)
- A.7. Working with CLIVAR, determine a suitable date for a 2<sup>nd</sup> Pan-WCRP monsoon workshop. (ACTION: Tetsuzo Yasunari)

- A.8. GHP will take the lead for coordinating monsoon activities within GEWEX. This will require coordination with the leads of monsoon related CSE projects and CEOP (CIMS) to develop a strategy for presentation at the pan-GEWEX meeting. (ACTION: John Roads with IGPO and Toshio Koike in consultation with Soroosh Sorooshian)
- A.9. The GEWEX Chair will invite Phil Arkin to lead the precipitation cross-cut (ACTION: Soroosh Sorooshian)
- A.10. Panels will review the comments of GEWEX SSG members made during the executive session at the SSG meeting and act on them appropriately. (ACTION: John Roads, Bill Rossow, Jan Polcher, Toshio Koike)
- A.11. As requested by CLIVAR, GEWEX will provide comments on the VAMOS Science Plan by the CLIVAR SSG. (ACTION: John Roads)
- A.12. If determined that it would be useful, GEWEX will prepare a letter for the Director of WCRP to sign regarding support for the EGPM mission. (ACTION: Peter van Oevelen will explore the utility of such a letter and appropriate routing. IGPO will prepare the draft letter with inputs from appropriate experts.)

**B. GRP - Specific:**

- B.1. BSRN Archiving centre: as a follow up to the letters sent last year by the WMO SG to the PR of Switzerland and jointly by GCOS and WCRP Directors to the President of ETHZ, a new joint GCOS-WCRP letter will be sent to the new President of ETHZ to reiterate the recommendation of both programmes concerning the importance of maintaining the BSRN archiving centre (ACTION: Gilles Sommeria)
- B.2. The GRP aerosol plan was approved. It was noted that the enhancement of networks should be done in the context of an on-going review of observational systems. (ACTION: Bill Rossow).
- B.3. The GRP proposal for LandFlux was approved on condition that it sets up an advisory group with representation by land surface flux experts from each GEWEX Panel and possibly iLEAPS and CEOP. A progress report on the project will be given at the next GEWEX SSG meeting. (ACTION: Bill Rossow)
- B.4. Conduct an inventory of current land surface data sets useful for land-surface fluxes assimilation. (ACTION: Jan Polcher, Martin Miller)
- B.5. Draft a letter to EUMETSAT (and ESA, if appropriate) for WCRP signature that requests European support for research and other activities involved in preparation of the GPM mission. (ACTION: Bob Adler, Gilles Sommeria).
- B.6. Use the Pan-GEWEX meeting to facilitate the development of a plan to be presented to GEO for improving institute networks to provide necessary surface observations to accomplish research objectives. A draft of this plan will be developed and circulated before the pan-GEWEX meeting. (ACTION: Bill Rossow/Tom Ackerman).

**C. GHP - Specific:**

- C.1. AMMA to develop a data policy and circulate for comment to GHP, GLASS and other related research groups before the pan-GEWEX meeting. (ACTION: Jan Polcher, John Roads).
- C.2. Invite Africa UNESCO FRIEND to participative in AMMA activities (ACTION: Jan Polcher).
- C.3. Develop a listing of all the regional precipitation data sets on the NCAR data management web site with a specific link to the GEWEX home page. (ACTION: Steve Williams)
- C.4. In view of MAHASRI's tentative approval by the SSG, Panel Chairs are to review the plan and provide comments to Jun Matsumoto by May 1. In particular, GHP should review the plan to ensure that it satisfies the criteria for a CSE. (ACTION: John Roads, Bill Rossow, Jan Polcher).
- C.5. The MAHASRI plan will be circulated to CLIVAR SSG for comment (ACTION: Jun Matsumoto).

- C.6. A plan for a redefined WRAP Project called HAP (including a proposed membership list) will be developed and presented at the pan-GEWEX meeting in October 2006 (ACTION: Eric Wood, John Roads)
- C.7. GEWEX will comment on CPPA priorities for 2007 (ACTION: John Roads, Soroosh Sorooshian, IGPO) (DONE)
- C.8. Investigate obtaining WMO support for African AMMA infrastructure (e.g., enhanced observation sites, etc. The requirements for infrastructure need to be determined and options need to be explored. (ACTION: Jan Polcher, Gilles Sommeria)

**D. GMPP - Specific:**

- D.1. GCSS will advise iLEAPS on the possible use of models for studying aerosols. (ACTION: Christian Jakob)
- D.2. WGNE and GMPP will conduct an inventory of data sources for inputs to land data assimilation (ACTION: Jan Polcher).
- D.3. The proposed GMPP reorganization was approved and will be implemented. (ACTION: Jan Polcher)
- D.4. Identify and present at the next SSG a paper on the possible linkages between GMPP and THORPEX. For example, THORPEX is well focused at looking at initial conditions which provides a natural overlap with GMPP. (ACTION: Jan Polcher, Christian Jakob, John Roads, Rick Lawford, Jim Caughey)
- D.5. GMPP should consider developing a proposal for a task force on convection for the next JSC. (ACTION: Christian Jakob, Jan Polcher)

**E. CEOP - Specific:**

- E.1. Although the CEOP II Plan was approved in principal, it was agreed that changes may be needed. Reviews should be conducted and transmitted to Toshio Koike by April 15. (ACTION: GEWEX SSG members, John Roads)

**F. GENERAL:**

- F.1: Panel meeting reports will be distributed by publishing them on the web and sending notice to all SSG members and Panel members (ACTION: Gilles Sommeria, Dawn Erlich).
- F.2: IGPO should develop a plan for making GEWEX and WCRP more visible (in response to a request from the Director of WCRP) (ACTION: IGPO)
- F.3. Comments will be prepared in response to the invitation by WMO Hydrology and Water Resources Division to give guidance on their priorities and issues (ACTION: Soroosh Sorooshian, Rick Lawford, John Roads, Eric Wood)

**G. PAN-GEWEX MEETING - Specific:**

- G.1 An agenda item on SWING and iPILPS will be held at the pan-GEWEX meeting. (ACTION: John Roads and Jan Polcher)

## 1. INTRODUCTION AND OVERVIEW

This report summarizes the main developments in GEWEX during the year 2005 and includes the main items and recommendations from the 18<sup>th</sup> Session of the GEWEX Scientific Steering Group (SSG), which was held in Dakar, Senegal from 9-13 January 2006. The meeting was hosted by the Université Cheikh Anta Diop with exemplary support from Dr. Amadou Gaye and his colleagues from the Ecole Supérieure Polytechnique. The meeting was opened by the Directeur de la Météorologie Nationale du Sénégal and the President de l'Assemblée de l'Université Cheik Anta Diop.

A special session was held on hydro-climatology research in Africa and on the African Monsoon Multidisciplinary Analysis (AMMA) Project. Dr. Daniel Rosenfeld from the Hebrew University of Jerusalem gave a scientific presentation on his recent research related to the thermodynamic responses to precipitation changes induced by surface and aerosol impacts on cloud processes.

In addition to the annual review of GEWEX activities, this SSG provided an opportunity to review linkages with other WCRP projects, including: the Climate Variability and Predictability (CLIVAR) Project, the Climate and Cryosphere (CliC) Project, and the Working Group on Numerical Experimentation (WGNE); as well as with other international communities including: the International Geosphere-Biosphere Project (IGBP)/international Land Ecosystem-Atmospheric Processes Study (iLEAPS); the Global Earth Observation System of Systems (GEOSS); Integrated Global Water Cycle Observations (IGWCO) theme of the Integrated Global Observing Strategy-Partnership (IGOS-P); The Observing System Research and Predictability Experiment (THORPEX); the Global Water System Project (GWSP); the UNESCO International Hydrological Programme and the Water And Development Information for Arid Lands–A Global Network (G-WADI); and the Hydrology and Water Resources (HWR) Programme of the World Meteorological Organization.

All GEWEX panels and most subprojects held meetings or workshops during the past year. In addition to the annual SSG meeting, the GEWEX Executive held a summer meeting at the NASA Goddard Institute for Space Studies in August.

A number of scientific sessions were held at science conferences. These included sessions at American Meteorological Society and American Geophysical Union conferences, and a side session at the European Geophysical Union Conference.

A few GEWEX Milestones worth highlighting for GEWEX in 2005 are:

- Nearly 300 scientists from 23 countries attended the 5th International Scientific Conference on the Global Energy and Water Cycle, which was held 20-24 June 2005 in Costa Mesa, California. The 158 oral presentations and 170 poster presentations presented at the Conference showed the significant progress made in GEWEX related research since the last conference in 2001. Approximately 22 papers on results presented at this Conference will be published in a special issue of the *Journal of Hydrometeorology*.
- A Pan-WCRP Monsoon Workshop was held at the University of California, Irvine immediately preceding the GEWEX Conference from 15-17 June 2005. The science committee co-chairs, Tetsuzo Yasunari and Ken Sperber will publish a related article in BAMS.
- The International GEWEX Project Office (IGPO) produced a GEWEX Phase I Accomplishments Brochure that was published by the European Space Agency in June 2005. The Brochure consists of 36 pages of text and graphics illustrating GEWEX's results and accomplishments during Phase I.
- A Chinese GEWEX Coordinator, Dr. Yuping Yan, funded by the Chinese Meteorological Agency, was appointed in January 2006 to work on the development and coordination of GEWEX activities in China.
- An operational center was established for the African Monsoon Multidisciplinary Analysis (AMMA) Project. 250 participants (90 from Africa) attended the first international AMMA conference held in Dakar on 28 November – 4 December 2005.
- The GEWEX Asian Monsoon Experiment ended in March 2005. A science plan for a proposed follow-on project called the Monsoon Asian Hydro-Atmospheric Science Research and prediction Initiative (MAHASRI) was presented and received approval in principal, subject to approval by the GEWEX Hydrometeorology Panel (GHP) at its next meeting.

- In response to a request to WMO from the United Arab League, a special workshop was held to examine the applicability of climate research and information for water resource management in semi-arid and arid regions. The workshop, which was held in Cairo, Egypt in April 2005, was hosted by WCRP and UNESCO, and organized by the Dr. Lawrence Martz of the GEWEX Water Resources Applications Project (WRAP).
- GSWP-2 has completed model simulations and produced a multi-model analysis (DVD and online) that provides a demonstrably superior simulation of land surface states compared to any other global model product.

GRP reported that all of the global data products (except SeaFlux) are available through 2004, providing more than two decades of global determinations of clouds, precipitation, aerosols (ocean only) and surface and top-of-atmosphere radiation. Formal international assessments of the products from ISCCP, GPCP, GACP and SRB were initiated in 2005 to provide a critique of them, as well as any other alternatives that provide similar long records. Three of the four Assessments are well underway, having completed at least one workshop and planning for another in 2006. A GRP led LandFlux activity is being developed to derive land-surface fluxes from satellite data. When combined with SeaFlux products, these fluxes could be used to address the entire global water and energy budget.

GHP reported that the Transferability Working Group (TWG) is facilitating the development of regional models and climate simulations. The Inter-CSE Transferability Study (ICTS), a joint project under TWG and CEOP will study the performance of regional climate models over all of the CSEs. The role of the Water Resources Application Project has been redefined as the Hydrologic Applications Project (HAP). Examples of initiatives with promising links to HAP include the Hydrological Ensemble Prediction Experiment, the Project for Ungauged Basins, and THORPEX.

GMPP reported that on the basis of the first GABLS benchmark case, eight articles have been compiled and submitted to a special issue on GABLS in the *Journal of Boundary Layer Meteorology* (February 2006). GCSS has had a very active and productive year culminating in the 3rd Pan-GCSS meeting held in Athens, Greece in May 2005. The meeting supported several major new GCSS activities. These include new efforts on cloud microphysics, moist process metrics in climate models and a new collaboration with Stratospheric Processes And their Role in Climate (SPARC) on issues related to the Tropical Tropopause Layer. GLACE analysis has been extended beyond the "hot-spot" map to show why different GCMs exhibit such different coupling behavior, and to compare the GCMs to observations, showing poor local representation of observed flux-state variable relationships, but better large-scale climate behavior.

CEOP has now embarked on Phase II, which will run from 1 January 2005 to 31 December 2010. Most of the data sets from Phase I will be completed in 2006. A draft version of the CEOP Phase II Implementation Plan was presented and received preliminary approval. CEOP Phase II will have two stages that run from 1 January to 31 December 2010. The diurnal cycle was adopted as one of the scientific themes.

## **2. GEWEX INTERACTIONS WITH OTHER GROUPS**

GEWEX plays a central role in the interaction of WCRP with the various international entities or initiatives dealing with climate observations. This role is channelled through its project office, through the WCRP Observation and Assimilation Panel (WOAP) and through other channels that GEWEX has developed through its projects.

As part of WCRP's input to the GEO 10-year Implementation Plan, GEWEX is leading in the development of plans for the global data reprocessing effort and on the observation strategy and serves as a demonstration project of future climate observational networks in GEOSS. GEWEX is also taking the lead on three tasks in the Water section of the 2006 Work Plan.

GEWEX has been interacting with the Global Water System Project (GWSP) on several levels. Dennis Lettenmaier, Taikan Oki and Jose Marengo represent GEWEX on the GWSP Science Committee. In addition, the project offices frequently interact on issues related to Integrated Global Water Cycle Observations (IGWCO) Theme and planning joint activities at the World Water Forum. Most GWSP initiatives remain in the planning stages; hence the commitment of scientists to project implementation has not been large. As a result GEWEX data sets are viewed as a significant potential contribution to the GWSP electronic atlas and the data assessment projects.

iLEAPS has a strong interest in GEWEX activities related to atmospheric boundary layers (ABL) and land-atmosphere interactions (GLASS). iLEAPS is planning a joint activity with GABLS that could extend the

current GABLS case studies. A new case study will include tracer transport for tracers such as CO<sub>2</sub>. iLEAPS cooperation with GLASS will focus on land-atmosphere interactions in the global hotspots. Other areas of co-operation might be within the area of LandFlux. GEWEX expertise in providing physical descriptions of hydrometeorological and climatic processes is of value to iLEAPS while iLEAPS's focus on the carbon-cycle is of potential use to the GEWEX community

The International GEWEX Project Office (IGPO) has continued to provide leadership for the IGOS Global Water Cycle Observations (IGWCO) Theme and a number of GEWEX priorities benefit from interactions with this Theme. These include the development of an Intercomparison Project for Precipitation products that will serve as a contribution to an emerging precipitation cross-cut activity in GEWEX. Other linkages between IGWCO and GEWEX include work related to the use of GEWEX products in GWSP, the development of soil moisture products, and work related to capacity building. CEOP also plays an important role in providing data services for IGWCO activities.

### **3. REVISION OF GEWEX OBJECTIVES AND PLANS IN RELATION TO COPES**

The main contribution of GEWEX to the WCRP/COPES strategic framework is the revision of the objectives of GEWEX Phase II and their use as guidelines for the GEWEX roadmap which is intended to lead GEWEX activities for the next 7 years. GEWEX projects can be presented as contributions to those objectives, with some activities responding more directly to COPES priorities than others.

#### *Objective 1. Produce consistent research quality data sets.*

This objective directly responds to the main aim of COPES, and provides input to the required "analysis of Earth System variability and change" for all variables related to the water and energy cycle. The results already achieved for clouds, precipitation, aerosols (over the oceans), surface and top of the atmosphere radiation are recognized as being the reference for climate analyses. This work will be pursued and complemented by data sets for turbulent fluxes over sea and land.

#### *Objective. Better understand climate feedbacks.*

This is a basis for expected improvements in climate models and for advances in climate prediction and climate change scenarios. Studies undertaken for this objective include the main physical climate processes, which are still not properly formulated in GCMs, clouds, radiative processes, surface turbulent fluxes, and aerosols. They will make use of a number of new satellite missions expected in this domain and aim at an increasing interaction with the climate modelling community.

#### *Objective 3. Address the predictability of the water and energy cycle.*

This is a direct contribution of GEWEX to the climate prediction objective of COPES. It will allow model improvements on one side, taking into account the representation of land surface processes primarily in seasonal forecasts, and to develop on the other side the use of regional models to refine climate forecasts and climate change scenarios. The Global Land Atmosphere Coupling Experiment (GLACE-2) will make a major contribution to the COPES predictability goals.

#### *Objective 4. Improve parameterization schemes.*

This objective builds on results of predictability studies in Objective 3 as well as process studies that lead to better process parameterizations in climate models, with a view to improving both seasonal predictions of events related to the water cycle, such as monsoon characteristics, as well as wet and dry extreme events, and of global change scenarios

#### *Objective 5. Contribute to societal benefits – (the main goal of COPES).*

GEWEX will contribute to societal benefits of climate research by developing practical applications of water cycle research for society, with respect to the management of water resources, both at the seasonal, intraseasonal and interannual timescales with a primary focus on benefits for operational hydrometeorological services.

In summary, the main contributions of GEWEX to COPES can be summarized as follows:

- To the observational component of COPES, with the provision of climate records, and of guidance on the improvements of the climate monitoring strategy and the development of observation systems.
- To climate modelling with regional models, with research on process studies and modelling leading to improvements in parameterizations.
- To contribute to the main COPES objective regarding contributions to society, by playing a lead role in the development of applications focused on water resources.
- CEOP provides a framework for a pan-WCRP demonstration experiment in preparation for future advanced climate observation networks.



#### **4. COORDINATED ENHANCED OBSERVING PERIOD (CEOP)**

CEOP has now embarked on Phase II, which will run from 1 January 2005 to 31 December 2010. Most of the data sets from Phase I will be completed in 2006. The GEWEX SSG endorsed the CEOP Phase II Implementation/Science Plan in principle. CEOP Phase II will extend existing data and observation systems and place greater emphasis on the use of these data in its research activities. The data management and coordination components will contribute to the Committee on Earth Observation Satellites (CEOS)/IGOS-P Water Theme, COPES and Global Earth Observation System of Systems (GEOSS). Three new areas of research are being added for Phase II. Under the Water and Energy Simulation and Prediction Working Group new activities will be established to deal with semi-arid river basins and with cold region hydroclimate processes (together with the Climate and Cryosphere (CliC) Program). To this end CEOP has submitted a pre-proposal for a CEOP Polar Observations Project to be undertaken jointly with CliC and the International Polar Year (IPY) 2007-2008 in Part 2 of CEOP Phase II. The CEOP Monsoon research activities will be expanded to deal with the contributions of aerosols to monsoon circulations. Phase II plans also call for a small set of hydrological reference sites, possibly chosen from the existing CEOP reference sites, which could have dual roles as validation sites for the land-surface parameterizations in coupled land-atmosphere-ocean models, essentially at a point or small area scale, and as "tie points" or ground truth reference sites for remote sensing products. In its review of the CEOP Phase II Plan the GEWEX SSG pointed out that there is a need to ensure that these activities are harmonized with other activities in GEWEX and within WCRP.

Key agreements were reinitiated to maintain continuity in the collection of *in situ* data from 35 of the globally distributed "reference" stations. All nine of the operational numerical weather prediction centers and two data assimilation centers currently are supporting CEOP Phase I have agreed to continue at least at their current level of commitment through 2010. The Max-Planck-Institute for Meteorology with the ICSU World Data Center for Climate (WDCC) in Hamburg, Germany, which earlier served as the CEOP model output archive center, has agreed to continue in this capacity through CEOP Phase II.

Recognizing the overwhelming amount of data collected in CEOP Phase I (around 300 terabytes) and the need for data management systems for the collection, sharing and provision of the data in formats familiar to the science community, the University of Tokyo, the Japan Aerospace Exploration Agency (JAXA), and the Committee on Earth Observation Satellites (CEOS) have begun working together to create a distributed "data mining" system for the CEOP data archive.

Not surprisingly, given the overlap in science communities, there are similarities between the work being undertaken in GHP and in CEOP. CEOP was able to take advantage of the GHP/Data Management Working Group (DMWG) and other GHP activities to launch its globally coordinated effort. Many of these GHP activities have an ongoing connection with CEOP in that they are using CEOP data and are active in planning CEOP Phase II activities.

#### **5. HYDROMETEOROLOGY**

##### **5.1 Overview**

GHP coordinates the regional Continental-Scale Experiments (CSEs) and other relevant global hydrometeorological projects and is a contributor to the Global Runoff Data Centre (GRDC), the International Satellite Land Surface Climatology Project (ISLSCP), the Global Precipitation Climatology Project (GPCP) and the Coordinated Enhanced Observing Period (CEOP). GHP also has activities that are closely linked to the International Association of Hydrologic Sciences (IAHS). The International Atomic Energy's Water Resources Department is a relatively new global contributor that is helping with the Stable Water Isotope Intercomparison Group (SWING) activities described below. The Hydrologic Ensemble Prediction Experiment (HEPEX) is also planning to become a global contributor to the emerging GHP Hydrologic Applications Project (HAP).

GHP held its annual meeting in September at the Bureau of Meteorology Research Centre in Melbourne, Australia. The meeting reviewed the previous year's progress and aligned the GHP objectives with the revised GEWEX Phase II objectives and, by association, with the Coordinated Observation and Prediction of the Earth System (COPES) strategy. Future GHP activities are being increasingly focused on developing a regional to global hydrometeorological analysis and predictive capability, and developing applications of GEWEX science for operational hydrology.

The GEWEX Asian Monsoon Experiment (GAME) and Mackenzie GEWEX Study (MAGS) ended in 2005. A follow-on project for GAME, named MAHASRI, is being planned for 2006-2012 with the objective to improve the prediction of the Asian monsoon and its hydrological cycle. If the Northern Eurasian Earth

Science Partnership Initiative (NEESPI) can meet the Continental Scale Experiment (CSE) criteria, it may be proposed at the next GHP meeting as the newest CSE. Both the Baltic Sea Experiment (BALTEX) and the Large-scale Biosphere Atmosphere Experiment in Amazonia (LBA) have now completed their first Phase and have begun Phase II activities. The La Plata Basin (LPB) Project and the Murray Darling Basin (MDB) Project have submitted implementation plans. The GEWEX Americas Prediction Project (GAPP) plans to continue its participation in GHP as part of the Coupled Prediction Project for the Americas (CPPA). Through GAPP, numerous operational model upgrades have improved the Environmental Modelling Center global forecast system, resulting in reductions to the model's high precipitation bias. An operational center has been established for the African Monsoon Multidisciplinary Analysis (AMMA) Project and the field campaign will be launched in the summer of 2006. The AMMA Implementation Plan was presented at the highly successful First International AMMA Conference on the West African Monsoon held in Dakar, Senegal in November 2005. AMMA represents the new breed of CSEs which are expected to address a broader range of issues and have stronger links with CLIVAR and CliC as well as ESSP projects.

The GHP Data Management Working Group (DMWG) is continuing to focus on CEOP by gathering station data from the CSEs during the CEOP time frame. The Water and Energy Budget Study (WEBS) is assessing the uncertainties in observing and simulating water and energy budgets over the CSEs in particular, and global land in general, using model output and GEWEX global data sets. The Worldwide Integrated Study of Extremes (WISE) Working Group is determining the extent to which processes responsible for extremes are similar in different regions in order to understand the processes that link extremes in different regions, and to assess how they may be changing. One of the first tasks for WISE is to develop a database of extreme events starting with the CEOP time period and extending back in time using the WEBS data set. The Stable Water Isotope Intercomparison Group (SWING) has almost completed its analysis of the first common SWING simulations under present-day boundary conditions using three different state-of-the-art isotope global circulation models. The Transferability Working Group (TWG) is facilitating the development of regional models and climate simulations. Of particular note, is the Inter-CSE Transferability Study (ICTS), a joint project under TWG and CEOP, which will study the performance of regional climate models over all of the CSEs. The TWG agreed at the last GHP meeting to participate in the ongoing GCSS Pacific Cloud Transect Study. Applications work in GHP is being refocused as new initiatives such as HEPEX provide ways to strengthen the links between research and the operational hydrologic community, thereby enabling GEWEX to implement projects with more meaningful contributions to society. The Water Resources Application Project (WRAP) has been redefined as the Hydrologic Applications Project (HAP). Examples of initiatives with promising links to HAP include HEPEX, the Project for Ungauged Basins (PUB), and The Observing system Research and Predictability EXperiment (THORPEX).

## **5.2 GHP Projects and CSEs**

### **Continental Scale Experiments**

#### *African Monsoon Multi-disciplinary Analysis (AMMA)*

The West African monsoon (WAM) is a coupled land-ocean-atmosphere system characterized by summer rainfall over the continent and winter drought. The processes that couple the land, ocean and atmosphere take place in association with multiple interacting space and timescales. Many of the key scientific questions that relate to these scale interactions cannot be answered using routinely available observations and reanalysis data sets. This is due to a combination of the scarcity of the routine observing network, the need for specialized observations and the known deficiencies of GCMs used for weather and climate prediction and necessary for producing reanalyses. AMMA facilitates the multidisciplinary research required to provide improved predictions of the WAM and its impacts.

Special observations during AMMA will concentrate on the sampling of statistically representative events at specific locations. From these data, it will be possible to evaluate the different terms of the water budget for different aspects of the WAM on ocean, land surface and atmosphere. Integrated analyses with routine observations, satellite remote sensing measurements and numerical modelling should help to generalize the local results to the regional scale.

The field program of AMMA is organized in three imbedded periods: LOP (Long Observing Period) (2001-2010), EOP (Enhanced Observing Period) (2005-2007), SOP (Special Observing Period) (2006). The implementation involves the following steps: i) initial set-up of the long-term monitoring program; ii) definition of a detailed strategy for the EOP and the SOP; iii) deployment of the EOP and SOP instruments; and iv) compiling a database, training and capacity building actions.

The AMMA implementation plan was presented at the 1st International AMMA Conference on the West African Monsoon in Dakar, Senegal on 28 November – 2 December 2005. An operational center has been established for AMMA.

#### *The Baltic Sea Experiment (BALTEX)*

BALTEX has completed its Phase I. Major activities in 2005 included summarizing Phase I achievements and results, as well as planning for Phase II. In this context, the following highlights of 2005 include:

- DEKLIM final symposium
- BALTEX Phase I State of the art report published
- BALTEX Phase II implementation document in preparation
- BACC initiative running on schedule
- BALTIC GRID Pilot Study being set up

The German Climate Research Funding Programme DEKLIM (2001–2006) was concluded in 2005 with a final symposium conducted in Leipzig, Germany, in May 2005. DEKLIM includes a funding line “Regional process studies in the Baltic Sea area” which is a direct contribution to BALTEX. Major results contributing to BALTEX objectives were obtained related to the following 8 topics:

1. Development and validation of a coupled model system in the Baltic Region,
2. Regional evaporation over heterogeneous terrain at gridpoint/pixel scale,
3. More accurate aerial precipitation measurements over land and sea,
4. Influence of the Baltic Sea and its annual ice coverage on the water and energy budget of the BALTEX area,
5. Integrated Baltic Sea Environmental Study: Analysis and Simulation of Hydrological and Ecological Variability in the last 1000 years,
6. Influence of carbon and nitrogen fluxes on the water and energy budget of the terrestrial biosphere in the Baltic Sea drainage basin,
7. Soil frost and snow metamorphism simulations for the BALTEX-region with a complex hydro-thermodynamic soil-vegetation scheme,
8. Hyperspectral satellite data analysis over land surfaces for climate modelling applications.

An important BALTEX milestone was met by the recent publication of the state of the art report of BALTEX Phase I achievements. The report is divided into 14 chapters addressing major research fields and their results conducted within BALTEX Phase I. More than 20 chapter authors contributed to the report and the latter makes reference to more than 220 peer-reviewed BALTEX journal articles and numerous additional publications

The *BALTEX Assessment of Climate Change for the Baltic Sea Basin* (BACC) is an initiative contributing to Objective 2 of BALTEX Phase II. In September 2004, a group of climate and environmental researchers initiated BACC

to provide an assessment of ongoing climate change in the Baltic Sea Basin by reviewing existent literature on the subject and publishing an assessment book by 2006. At a meeting of representatives of BALTEX, BACC and HELCOM, held January 2005 in Copenhagen, Denmark, a joint BALTEX-HELCOM Climate Assessment Project was approved, with the following three organisations or groups being involved: 1) HELCOM, 2) BALTEX, as a major European science programme, and 3) the BACC group. The plan foresees HELCOM to use the material on climate change assessment, which is currently being compiled by the BACC group, for dedicated HELCOM Thematic Assessment Reports, to be published in 2007.

#### *GEWEX Asian Monsoon Experiment (GAME)*

GAME ended in 2005 and a follow-on project, the Monsoon Asian Hydro-Atmospheric Science Research and prediction Initiative (MAHASRI), is being planned for 2006-2012 with the objective to improve the prediction of the Asian monsoon and its hydrological cycle. The First International Post-GAME Planning Workshop was held in August 2005 in Kyoto, Japan. MAHASRI will aim to improve the prediction of the Asian monsoon and its hydrological cycle, focusing on establishing a scientific basis for predicting the monsoon system with a special emphasis on intraseasonal to seasonal time-scale, including developing prediction systems for droughts and flood conditions in regional river basins and similar areas in Asia. It will target processes in the Asian summer and winter monsoon. Its spatial coverage will include the tropics from the maritime continent to South and Southeast Asia, Tibet/Himalaya, East Asia, and Northeast Asia. More emphasis will be placed on the air-land-ocean interactions, the role of aerosols on monsoons, monsoon predictability, and flood/drought predictions.

### *GEWEX Continental-scale Experiment (GCIP)/GEWEX Americas Prediction Project (GAPP)*

Within NOAA, the GAPP program has been integrated with the CLIVAR/PACS program into a new Climate Prediction Program for the Americas (CPPA) program. The overall CPPA goal is to improve operational intraseasonal to interannual climate prediction and the water resource applications. CPPA will continue to support GEWEX Phase-II objectives, but will go beyond GAPP's current focus on land-surface/hydrology and water resource components, and will address ocean-land-atmosphere interaction issues, cloud-boundary layer interaction and some COPEs scientific questions.

Currently the NOAA Climate Program Office is funding approximately 50 GAPP projects in one or more of seven possible areas: 1) predictability in land surface processes, 2) hydrometeorology of orographic systems, 3) predictability in monsoon systems, 4) integration of predictability into prediction systems, 5) testing of models in special climate regimes, 6) data and studies for model development (CEOP), and 7) use of prediction for water resource management.

The GAPP Core Project that aims at transferring GAPP research into NOAA operations has been reviewed by an external group and will continue for the next 5 years.

GAPP supported CEOP by managing 35 CEOP reference sites' data, providing data (*in situ*, remote sensing, and model output) in GAPP region, data analysis, demonstrating the utility of satellite data in research and climate prediction and evaluating the performance of global and regional models across climate regimes and time scales.

### *Large-scale Biosphere Experiment in Amazonia (LBA)*

LBA has completed its first Phase and has initiated its Phase II activities.

LBA contributions to GEWEX and GHP and main issues in LBA Phase 1 include:

- Prediction and predictability of the water balance including simulations and model validation, and predictability assessments and studies in South America using global and regional models.
- Studies on the closure of the water and energy cycles in Amazonia including an assessment of uncertainties and sensitivity of the water balance to different rainfall data sets.
- Results from LBA WET AMC, DRY to WET, CLAIRE show that clouds in the Amazon are modulated by land cover and influenced by land cover change. River vs. forest contrast also modulate convection and rainfall.
- Results from SALLJEX show moisture transport from Amazonia into La Plata basin. Model development and data assimilation of data from field campaigns will improve climate and weather predictability.
- A future field experiment called LBA-BARCA (carbon balance in Amazonia) is being planned.
- Applications of LBA research to society include hydrological prediction for electric generation and risk of fire prediction.
- Implementation of LBA-DIS.

The major science goals for Phase II include:

- How does Amazonia currently function as a regional entity?
- How will changes in land use and climate affect the biological, chemical and physical functions of Amazonia including its sustainability?
- How will these changes in the Amazon influence the global climate?

### *La Plata Basin (LPB)*

LPB is finalizing its implementation plan and will present it at the next GHP meeting. The implementation plan envisions two main activities: (i) monitoring of hydroclimate variables and (ii) a field experiment to develop a set of unique data that will (a) help understand the land surface-atmosphere processes that may lead to persistent events, and (b) to calibrate and improve parameterizations in regional and global models employed for forecasting and prediction up to seasons. The two activities will be complemented with modelling and diagnostics of the coupled system. Plans are to hold a preliminary science panel meeting during the Southern Hemisphere Conference of Meteorology and Oceanography to be held in Foz do Iguaçu, Brazil, in April 2006

### *The Mackenzie River GEWEX study (MAGS)*

The MAGS project funding under the Natural Science and Engineering Research Council (Canada) Research Network Grant program ended Dec 31, 2005.

Considerable effort has been focussed 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. Specific activities include:

- Development of a data DVD and the establishment of a distribution system that will extend beyond MAGS
- Convening of a major scientific workshop in the national capital to present and synthesize the results of the MAGS program (22-25 November 2005, Ottawa)
- A series of press releases on major findings
- Publication of a book on cold regions hydro-climate science based on MAGS research
- The development of future research directions and programs.

Several follow-up research projects have already arisen from the MAGS initiative and several others are in development. Some recent changes in the Natural Science and Engineering Research Council (Canada) Research Network Grant program under which MAGS was supported mean that it is not currently possible to initiate a new research network in support of GEWEX goals. However, there is a need to build on the scientific findings of MAGS and to address new issues. Toward this end, MAGS is supporting the development of a Canadian GEWEX coordinating committee and secretariat to support new research to improve understanding of the global water and energy cycle.

#### *Murray Darling Basin (MDB)*

The MDB CSE is working on the completion of its implementation plan. A MDB website is currently being set-up and a multi-agency project to achieve the MDB objectives is being developed and expected to be finalized in 2005.

#### Future Plans:

- Developing links to ACCESS, a new initiative to develop an Australian community climate and weather model.
- Work on techniques to present uncertainty in hydrometeorological forecasts to end-users.

#### Key Results

- Algorithm for estimating land surface evaporation from MODIS remote sensing (see Cleugh et al., 2005)
- Differing responses of evaporation and net ecosystem exchange to drought in the MDB (see Leuning et al., 2005)
- Use of stable isotope measurements at the Tumbarumba site to constrain isotopically-enabled land surface schemes

### **5.3 GHP Projects and Working Groups**

#### *Water and Energy Balance Studies (WEBS)*

The goal of WEBS is to develop the "best available" global and regional synthesis of water and energy variables and processes from global and regional observations and analyses for the 1996-2000-time period. The initial steps are to define the CSE regions, gather the available global and regional data, and to then develop global and regional data sets. Gridded as well as station data will be gathered for this comparison. Our goal is to define global and regional means similar to what was previously done for GCIP WEBS (Roads et al. 2002, 2003). Parallel WEBS activities are also taking place in the other panels (GRP and GMPP) and GHP WEBS will eventually be coordinated with these other panels.

John Roads has now been funded by the NASA Energy and Water Study (NEWS) and will be devoting more time to this effort. It is anticipated that this effort will be merged with the GRP WEBS effort in the future. The overall WEBS activity also will include the GMPP Global Soil Wetness Project (GSWP) products making WEBS a complete GEWEX crosscut activity.

#### **2003-2005:**

Gather together the observation, atmospheric reanalysis, and LDAS data for the period 1986-1995. Begin comparisons of various parameters on annual time scales. Begin comparison of seasonal variations.

#### **2005-2006:**

Continue comparison of various water and energy cycle variables to interannual time scales. Begin to extend this short period analysis (1986-1995) to present in order to examine interannual variations. Draft publication describing water and energy budgets over the various CSEs and ask for input from CSE WEBS representatives to discuss water and energy cycles over their respective CSE.

**2006-2007:**

Submit papers for publication describing the global and regional land comparisons. Begin to extend this land-focused analysis to ocean analyses and begin to develop a more global analysis in collaboration with CLIVAR.

*Water Resources Applications Project (WRAP)*

In response to a request to WMO from the United Arab League, GEWEX/WRAP worked with UNESCO (and WCRP) to organize a workshop on the Application of Climate Research for Water Resource Management in Semi-arid and Arid Regions, which was held in Cairo, Egypt during April 2005.

WRAP has been very successful in opening a dialogue with the water resource community through a series of workshops. However, it has not been as effective in meeting other aspects of its mandate, particularly, in demonstrating the application of GEWEX knowledge, models and data to water resource problems. Therefore, WRAP has been redefined as the Hydrologic Applications Project (HAP). Eric Wood will develop and present a white paper on HAP at the next GHP meeting. Examples of initiatives with promising links to HAP include HEPEX, the Project for Ungauged Basins (PUB), and The Observing system Research and Predictability EXperiment (THORPEX).

*Stable Water Isotope Intercomparison Group (SWING)*

SWING has almost completed its analysis of the first common SWING simulations under present-day boundary conditions using three different state-of-the-art isotope global circulation models. In the near future, SWING will prepare a summary of Phase I results, evaluate new global circulation model results and determine the focus for Phase II. The isotopes in the Project for Intercomparison of Land-surface Parameterization Schemes have strong linkages with SWING and MDB.

*Worldwide Integrated Study of Extremes (WISE) Working Group*

WISE is determining the extent to which processes responsible for extremes are similar in different regions, to understand the processes that link extremes across regions, and to assess how they may be changing. One of the first tasks of WISE is to develop a database of extreme events starting with the CEOP time period and extending back in time using the WEBS data set.

*Transferability Working Group (TWG)*

TWG is facilitating the development of regional models and climate simulations. Of particular note, is the Inter-CSE Transferability Study (ICTS), a joint project under TWG and CEOP, to study the performance of regional climate models over all of the CSEs. The TWG is also participating in the ongoing GCSS Pacific Cloud Transect Study.

*Global Runoff Data Center (GRDC)*

GRDC helps the CSEs by gathering stream flow data. It also helps to provide data quality control and quantification of observation and analysis errors.

*Global Precipitation Climatology Centre (GPCC)*

The GPCC (DWD, Offenbach) continues to collect rain gauge data from three sources to produce the monthly, merged, global monitoring precipitation product (available globally at 1° and 2.5° resolution for the period 1986 to present): monthly totals calculated at the GPCC from the SYNOP reports, monthly CLIMAT reports and monthly totals calculated at CPC/NCEP from the SYNOP reports received at NCEP. The total number of SYNOP reports received has increased from about 6,000 to 7,000 since the 1980's. Nevertheless, the GPCC continues efforts to collect even more data: so far 173 countries have supplied additional data on a voluntary basis to bring the full database to more than 50,000 stations. Following the example of BSRN, it may make sense for GPCC to become the surface-based reference component for precipitation within GCOS.

*International Satellite Land-Surface Climatology Project (ISLSCP)*

The ISLSCP Initiative II data collection is now complete and can be accessed at <http://islscp2.sesda.com>. The ISLSCP Initiative II data collection contains 50 global time series spanning the 10-year period 1986 to 1995 (selected data sets span even longer periods) considered by members of the GEWEX community as required to support investigations of the global carbon, water and energy cycle. The ISLSCP Initiative II beta collection is complete. 50 sets of 4 DVD's have been distributed for evaluation. The entire collection is available on line. The final product will be published on DVDs.

A proposal was tabled to reinvent ISLSCP as a GRP LandFlux activity, making the primary goal for its next phase the development of global data products for the turbulent fluxes of energy and water over land. As practical steps towards this goal, LandFlux would follow a course parallel to SeaFlux, including "cleaning up" the radiances to be used for remote sensing of the main relevant land parameters (albedo, skin temperature, fire occurrence, vegetation index, soil wetness index), producing an extensive compilation of in-situ land-surface flux measurements, evaluating available satellite-based products, and developing methodologies for inferring these fluxes. A working group will be formed to help develop plans for this GRP-led LandFlux activity. In addition a small group will be formed to assess the feasibility of a broader data collection activity under the Earth System Science Partnership (ESSP)

#### *International Association of Hydrological Sciences (IAHS)*

IAHS provides a venue for GHP hydrologic science efforts to interact with the broader science community. In that regard, IAHS has been encouraging various groups to become involved in its Prediction of Ungauged Basins (PUB) 10-year initiative and interacts with the Water Resource Applications Project to better utilize GEWEX products for various applications. Following endorsement of WMO's Operational Hydrology Programme at the recent Commission for Hydrology meeting for support of GEWEX and the Hydrological Ensemble Prediction Experiment (HEPEX), use of WMO's direct links to operational hydrological agencies will assist in the application of GEWEX products to water resources. The IAHS is also interested in helping CEOP to become more relevant to various catchments.

#### *International Atomic Energy Agency (IAEA)*

The IAEA has an isotope hydrology program that not only provides the international standards for making isotope measurements, but also collects and analyzes global isotope measurements in precipitation and stream-flow. The IAEA is working with and helping to coordinate SWING efforts to develop models capable of simulating and predicting these isotope measurements.

## **6. RADIATION**

### **6.1 Overview**

All of GRP's global data products (except SeaFlux and LandFlux) are available through 2004, providing more than two decades of global determinations of clouds, precipitation, aerosols (ocean only) and surface and top-of-atmosphere radiation. Formal international assessments of the products from the International Satellite Cloud Climatology Project (ISCCP), the Global Precipitation Climatology Project (GPCP), the Global Aerosol Climatology Project (GACP) and the Surface Radiation Budget (SRB) Project were started last year. These assessments provide a critique of GEWEX products, as well as any other alternatives that provide similar long records. Three of the four assessments are well underway, having completed at least one workshop and having plans for more workshops in 2006. Funding for the continuation of the global data projects appears to be in place, so the Working Group on Data Management and Analysis (WGDMA) began planning at its most recent meeting for a coordinated reprocessing of all the products to take place in 2007-2008.

The Baseline Surface Radiation Network (BSRN) recently became the GCOS surface radiation reference network. The Continuous Intercomparison of Radiation Codes (CIRC) Project is nearly ready to release a website that will provide both synthetic and observation-based tests for any radiative transfer code calculating broadband fluxes [(like those used in Global Climate Models (GCMs)]. After reviewing current activities, the GRP decided against restarting the Global Water Vapor Project (GVaP) because, with the exception of the development of microwave water vapor profile retrieval methods over land, sufficient activity is already underway to produce new global products within the next few years. New funding and new groups interested in participating have led to the reactivation of SeaFlux, beginning with a workshop in March 2006. LandFlux will assess the feasibility of deriving land surface fluxes from satellite data. When combined with SeaFlux products, it is expected that LandFlux will allow GEWEX to address the global water and energy budget. Precipitation activities include the development of snowfall algorithms (a workshop was held in October 2005) and the formation of a precipitation radar network working group. A GRP plan of action for

aerosols was also adopted at the latest GEWEX SSG meeting. In addition, Dr. Judy Curry, the GEWEX contact for the International Polar Year (IPY) has submitted a proposal dealing with aerosols in northern areas.

The major goal of GRP for the next several years is to complete, analyze, and refine the quantitative description of the global energy and water cycle. This goal involves several interdependent activities. The first is a compilation of the current description from available data products, where the land surface turbulent fluxes must be taken from the model outputs produced by Global Soil Wetness Project-2 (GSWP-2). The second is the completion of the formal data product assessments to identify improvements in preparation for reprocessing. The third is a set of focused activities to bring precipitation, aerosols, and ocean and land surface fluxes up to the same quality level as clouds and radiation. All of this activity is to culminate in a coordinated reprocessing of all products to produce a more complete and improved description of the global energy and water cycle.

By the 2007 JSC meeting, three of the four global data product assessments (precipitation, radiation and clouds) should be nearly complete and the aerosols assessment should be nearing its midpoint. The coordinated reprocessing will also be completed. Plans are for CIRC to have a radiation code test website and hold a workshop to encourage its use. The Working Group on Clouds and Aerosols Profiling (WGCAP) will release a set of common products from continual measurements by cloud radar-lidar at about nine sites for a common time period. The first meetings to start the new SeaFlux and LandFlux activities will be held in 2006, as well as the first meeting of the Working Group of Precipitation Radar Networks (WGPRN).

## **6.2 GRP Projects and Working Groups**

### *Global Precipitation Climatology Project (GPCP)*

The Global Precipitation Climatology Project is in its 21<sup>st</sup> year and has produced global precipitation products covering the period from 1979 to April 2005. Processing beyond April 2005 will be delayed until the processing of infrared sounder data that provides estimates of polar precipitation can resume, but a provisional product without the polar regions will be released to keep current. Analysis of the 26-year record shows a small 0.2%/decade trend in global mean precipitation; but most of this signal arises in the tropics, which exhibits a 0.6% linear increase per decade almost entirely over oceans, with smaller offsetting decreases over tropical and northern mid-latitude land areas. All GPCP centers are currently funded for the next few years at least, but the status of the validation center is uncertain. Some near-term improvements in current version of the product will include changing the gauge product to the new GPCC 50-year analysis (covering the period 1951-2000) and introducing an adjustment as a function of altitude and climate zone. Studies are underway, including a workshop on snow algorithms, to develop improvements for a third version of the products, including a consistent analysis method for all products, a modern microwave analysis method based on Tropical Rainfall Measuring Mission (TRMM) advances and adding an explicit snow discrimination algorithm. The plan is to be ready for a complete re-processing by early 2007.

### *International Satellite Cloud Climatology Project (ISCCP)*

ISCCP is in its 24<sup>th</sup> year and has produced global cloud and radiation products covering the period from 1983 through 2004. New products include a method for analyzing the joint histograms of cloud top pressure and optical thickness to identify distinct weather states, a composite survey of the cloud, radiation and precipitation associated with mid-latitude cyclones and a survey of twice daily retrievals of cloud particle sizes for both liquid and ice clouds. Analysis of the 21.5-year cloud record from ISCCP suggests a near-20-year vacillation in total cloud cover concentrated mostly at lower latitudes. There is no corresponding variation in optical properties. These changes appear to be real.

Work is currently underway to accommodate four new types of satellites, including a NOAA polar orbiter with a new AVHRR, the new EUMETSAT geostationary satellite, MSG-1 (METEOSAT-8), the new Japanese geostationary satellite, MTSAT-1R, and notably, the Chinese geostationary weather satellite (FY-2C). New products that are just being released (completed by the end of this year) include (a) a method for analyzing the joint histograms of cloud top pressure and optical thickness to identify distinct weather states (tropical results have been released), (b) a composite survey of the cloud, radiation and precipitation associated with midlatitude cyclones (including a cluster analysis and composites of cloud vertical structure from radiosonde humidity profiles), and (c) a survey of twice-daily retrievals of cloud particle sizes for both liquid and ice clouds. All centers are funded for the next few years. Work is underway on three improvements of the products: refined cloud detection in the polar regions, reduction of the spurious angle dependence in the retrievals (along with some other refinements of the angle treatment) and substitution of more homogeneous



ancillary data products to remove artifacts caused by changes in these operational products. A complete re-processing of the products is planned for 2007.

#### *GEWEX Global Aerosol Climatology Project (GACP)*

GACP is in its 8<sup>th</sup> year and has produced a monthly mean product over the global oceans providing aerosol optical thickness and Angstrom coefficient for the period from late 1981 through 2004. This record shows the two major volcanic events (El Chichon, Mt. Pinatubo) and a consistently larger optical thickness in the northern than the southern hemisphere. Theoretical analyses have established a hierarchy of the accuracy and information content that can be obtained from various spaceborne instruments, increasing from AVHRR (two-wavelength radiances) through MODIS and MISR (multi-wavelength and multi-angle radiances) to POLDER and the planned APS (multi-wavelength, multi-angle, polarized radiances). The AVHRR-based GACP product has been calibrated against a diverse collection of ship-based measurements. Comparison of the GACP product with the MISR and two MODIS products shows significant disagreement in the mean that are not yet understood. GACP funding is approved through 2006. If this project continues, the newer instruments will be used to calibrate the AVHRR-based analysis more extensively (if the current differences can be resolved) and used to extend the AVHRR-based analysis to land areas. Although a working group was formed, the Aerosol Product Assessment activity did not start, so a new group was constituted. Nevertheless comparisons of products have been made by several individual researchers but much more needs to be done.

#### *Surface Radiation Budget (SRB) Project*

SRB is in its 20<sup>th</sup> year and released all products for 1983-2001 at the end of 2005. The supporting web site for accessing these products has been newly revamped to provide more options and information. Project funding is approved through next year which will allow for product processing to be extended through 2004, providing overlap with CERES products. However, because two different sources of atmospheric temperature and humidity had to be used, the entire product will be re-processed in 2006 using a single source of atmospheric information. Comparisons of downwelling fluxes from SRB and BSRN (as well as the GEBA archive), show shortwave/longwave biases  $< 10 / < 5 \text{ Wm}^{-2}$  and rms differences of about 25/15  $\text{Wm}^{-2}$  for monthly mean values. As evaluations continue, improvements have already been identified for the shortwave, refined aerosol and surface albedo climatologies. The improvements can be implemented along with use of the latest CERES angle dependence models. For the longwave products, improved estimates of cloud base locations (possibly from CloudSat/Calipso analysis) and better treatment of the near-surface atmospheric and surface skin temperatures can be achieved.

#### *Baseline Surface Radiation Network (BSRN)*

BSRN is in its 11<sup>th</sup> year and now is composed of 38 sites (with 12 provisional sites) collecting the full set of radiative flux and meteorological measurements. BSRN has completed its first full year as the radiation reference network for GCOS. Discussions are underway to include some SkyNet sites within BSRN. In the past year a "diffuse" closure study was completed and workshop was held to develop ways to obtain BSRN-quality radiative fluxes over oceans. Proposed expansions of the measurements being considered include aerosol and cloud properties (the former using new instrumentation, the latter analyzing the radiative fluxes themselves), spectral measurements and adding surface turbulent fluxes to provide a complete surface energy budget. The BSRN Archives improved data access by making software available for reading the ftp data products. Funding for the sites appears to be adequate but the Archives are not able to expand to include new products and their future is currently uncertain.

#### *Continuous Intercomparison of Radiation Codes (CIRC)*

The CIRC effort combines with and expands the idea of the Intercomparison of Radiation Codes in Climate Models (ICRCCM) activity to provide the materials needed to test radiative flux codes, including cases based on observations. In addition to a set of synthetic cases, where inputs are specified and outputs are to be compared with state-of-the-art line-by-line codes, another set of cases will be collected where the inputs are determined from measurements together with measurements of the coincident top-of-atmosphere and surface radiative fluxes. These materials are to be made available through an open web site that the ARM project has agreed to host. The initial sets of synthetic and observation-based cases have been identified and are being prepared for posting to the web site; the number and types of cases will be gradually increased over time. The first comparisons using the CIRC cases will be presented at a workshop planned for 2006 as a way of initiating use of and comments on the web site and beginning work to solicit cases from other research observation sites and programs. Of the three organizational possibilities presented, the GRP recommended that CIRC be operated as a hybrid of open cases, where users download the needed

information and conduct their own code tests, and closed cases, where users submit their results without knowing the answers. In all instances, all results of comparisons should be made available with codes identified. The GRP also agreed that, after the first phase of CIRC is completed, a relationship with IPCC should be explored so that the radiation codes in the climate GCMs used for IPCC scenarios are evaluated against the CIRC cases and standards.

#### *Radiation Products Assessment (RFA)*

The RFA Project held its first workshop in Zurich in October 2004 and is planning its second workshop in Virginia, possibly as early as February 2006. A detailed outline of the study report has been completed to guide work. A web site to support the work by providing access to the main data products is also now operational. The basic comparisons of ERBE, early CERES, BSRN, GEBA with SRB and ISCCP-FD have been completed: such basic comparisons indicate excellent agreement on average, with the largest differences occurring in surface longwave fluxes. However, more detailed examinations of all of these products show subtle differences that are still significant to the uses of these products.

#### *SeaFlux*

New funding and new groups interested in participating have led to the re-activation of SeaFlux, starting with a workshop in March 2006. The workshop will resume the planned comparison of all global products in the common year 1999, with an emphasis on comparing those products using “older” instruments (visible, infrared, passive microwave) with products using “newer” instruments (including scatterometers and altimeters). Once the product comparisons are completed, the next phase will be to implement improvements already identified from the previous phase of the project and to work on remaining open questions concerning high-wind regimes and fluxes in coastal and polar waters. It may be that this project will reach a maturity in the next few years allowing the data processing to become operational.

#### *Working Group on Cloud and Aerosol Profiling (WGCAP)*

WGCAP is comprised of operators of “high-end” cloud and aerosol profiling sites (*i.e.*, co-located cloud radar and lidar); the participating sites include the three CloudNet sites plus a Lindenberg site in Europe and the five ARM sites. Discussions are underway to obtain participation from a Japanese site. The US Department of Energy Atmospheric Radiation Measurement program continues with solid funding and support. The most notable event was the first deployment of the ARM Mobile Facility. The next deployment will be next year as part of the AMMA field experiment. The funding status for CloudNet is in question, which is of concern for making progress on problems of aerosol-cloud interaction. The WGCAP is working to provide conversion software to allow for reformatting of data products from all these sites into each other’s formats so as to expand user access to the whole set of sites. Several projects are also underway to cross-implement each other’s analysis methods on each site’s products.

#### *International Radiation Commission’s 3D (I3RC) Working Group*

I3RC is in Phase 3. Web sites have been established to provide the test cases employed to study the 3D effects of solar radiation in clouds; a similar site is being established to support studies of the interactions of radiation with 3D vegetation canopy structure and of radiation scattered between the surface and cloudy atmosphere. A new round of comparisons of 3D calculations is being planned. Another initiative is the release of a “community” Monte Carlo code for calculating 3D radiative fluxes and radiances, the latter being needed to advance remote sensing applications to account for 3D effects in the analysis of measurements by the new generation of instruments. Also an online education resource on this topic is being developed. A brief report on the status of the analysis of data from the SORCE mission indicated that the available spread of absolute values of the solar constant is now 1361 – 1372 Wm<sup>2</sup> but that agreement among different instruments about variability, even at a very detailed level, is excellent. Although a follow-on flight of the TMI on the NASA Glory mission is planned, there are no plans to continue spectrally-resolved measurements, which is of concern.

## **7. MODELLING AND PREDICTION**

### **7.1 Overview**

The GMPP coordinates the activities within GEWEX for improving the representation of the global water and energy cycle processes within Earth System models. The following three groups exist to cover these activities: the GEWEX Cloud System Studies (GCSS) Project, the Global Land/Atmosphere System Study (GLASS), and the GEWEX Atmospheric Boundary Layer Study (GABLS). Furthermore, GMPP maintains a

close link with large scale NWP models in order to ensure that the activities within the studies are relevant to atmospheric models and that the global modelling community is aware and can take advantage of the improvements proposed in cloud, land-surface and Atmospheric Boundary Layer (ABL) conceptual models. The biannual meeting with the Working Group on Numerical Experimentation (WGNE) facilitates this close collaboration with the Numerical Weather Prediction (NWP) community.

GMPP is now turning its focus to the coupling of the systems for which the diurnal cycle was chosen as a theme. It is very likely that the climate offers many situations in which the feedbacks between the surface, ABL and clouds are at least as important as the details of how each of them is reproduced. Furthermore, the role of coupling between these models will be studied. It is anticipated that diurnal cycle research will address some of the strongest interactions between the land-surface, ABL, and clouds. Another major future direction for GMPP involves building stronger links with the general circulation and regional climate modelling communities.

## **7.2 GMPP Projects**

### *GEWEX Cloud System Studies (GCSS)*

GCSS has had a very active and productive year culminating in the 3rd Pan-GCSS meeting held in Athens, Greece in May 2005. The meeting supported several major new GCSS activities. These include new efforts on cloud microphysics, moist process metrics in climate models and a new collaboration with Stratospheric Processes and their Role in Climate (SPARC) on issues related to the Tropical Tropopause Layer (TTL). The new GCSS Pacific Cross-Section Working Group, which evaluates the simulation of tropical and subtropical cloud systems in GCMs, is proving to be a major success. So far more than 10 GCM groups have submitted their contributions to the project and 10 more are expected. Collaboration with WGNE on this project provides a strong GCSS link to the NWP community. Also, with its tighter links to the GCM community and its major new initiatives, GCSS believes that it is in a good position to face the challenges ahead—old and new—to support the development of better representation of clouds in climate and NWP models.

### *GEWEX Global Land-Atmosphere System Study (GLASS)*

GLASS consists of the Project for the Intercomparison of Land-Surface Parameter Schemes (PILPS) (local uncoupled), the Global Soil Wetness Project (GSWP) (global uncoupled), the Local Coupled Project (LoCo) (local coupled), and the Global Land Atmospheric Coupling Experiment (GLACE) (global coupled). PILPS has several active projects; PILPS-C1 which is nearing completion has explored the performance of Land Surface Schemes (LSSs) in representing the carbon cycle and the accumulation of biomass at a forest site; Isotopes in PILPS (iPILPS) has completed preliminary simulations and validation of LSSs that trace stable water isotopes; and PILPS-San Pedro in Arizona is the first validation of LSSs in a semi-arid environment. PILPS-San Pedro has completed the baseline simulations—multi-criteria calibration exercises and tests of spatial transferability of parameters are beginning. The Snow Models Intercomparison Project-2 (SnowMIP-2) is a similar local uncoupled action that tests the ability of snow models to simulate snow accurately under canopies, on canopies and in clearings. GSWP-2 has completed model simulations and produced a multi-model analysis (DVD and online) that provides a demonstrably superior simulation of land surface states compared to any other global model product. Interest in LoCo is growing, as shown in the joint LoCo/GABLS workshop held to kickoff efforts to simulate and understand coupled land-PBL (Planetary Boundary Layer) processes. GLACE analysis has been extended beyond the “hot-spot” map to show why different GCMs exhibit such different coupling behavior, and to compare the GCMs to observations, showing poor local representation of observed flux-state variable relationships, but better large-scale climate behavior.

### *GEWEX Atmospheric Boundary Layer Study (GABLS)*

The first focus of GABLS has been on stable boundary layers (SBLs) over ice and land. On the basis of the first GABLS benchmark case, eight articles have been compiled and submitted to a special issue on GABLS in the journal of *Boundary Layer Meteorology* (February 2006). At present GABLS is focusing on the diurnal cycle of the clear boundary layer over land. As such a new intercomparison case for column models has been set up based on CASES99. At the moment about 40 scientists are actively participating within GABLS, including members of university groups who value the international cooperation which GABLS provides. Given the GABLS findings thus far, there is still a clear need for a better understanding and a more general description of the ABL in particular, under stably stratified conditions in atmospheric models for weather, climate and earth system studies.

The next SSG meeting will be held 22-26 January 2007 at the East West Center in Honolulu, Hawaii.

## APPENDIX A

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## APPENDIX B

### AGENDA FOR THE WORLD CLIMATE RESEARCH PROGRAMME (WCRP) SCIENTIFIC STEERING GROUP

One of the primary purposes of the 18<sup>th</sup> GEWEX SSG meeting is to promote cross-cutting activities within GEWEX. To this end we have developed special sessions on water and energy budgets, precipitation, hydrology, monsoons, soil moisture, and aerosols/cloud systems. Activities of the panels relevant to these topics will be discussed under these themes rather than during the individual panel reports.

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**Monday, 9 January 2006:**  
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08:00-08:30:       **REGISTRATION**

08:30-09:45:       **1.    OPENING PRESENTATIONS AND WELCOMING REMARKS:**

- 1.1: Soroosh Sorooshian (GEWEX)
- 1.2: Gilles Sommeria (WCRP)
- 1.3: Mr Ndiaye, Directeur de la Météorologie Nationale du Sénégal
- 1.4: Mr Le Recteur Sall, Président de l'Assemblée de L'Université Cheik Anta Diop

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10:00-10:15:       **BREAK**  
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10:15-12:30:       **2.    OVERVIEW OF ACTIVITIES AND PLANS**

- 2.1: Introductory Remarks, COPES, WCRP News (Gilles Sommeria)
- 2.2: Chairman's Report (Soroosh Sorooshian)
- 2.3: International GEWEX Project Office Report (Rick Lawford)
- 2.4: European GEWEX Coordination Activities (Peter van Oevelen)
- 2.5: Review of Action Items from the Last JSC and the 17<sup>th</sup> GEWEX SSG meeting (and the summer Executive Meeting)

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13:00               **LUNCH**  
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14:00-15:10:       **3.    AFRICAN HYDROCLIMATOLOGY AND AMMA**

- 3.1: Research on water resources in Africa and its interactions with AMMA (Abou Amani)
- 3.2: Precipitation forecasts on synoptic to seasonal scales in Africa (Andre Kamga)
- 3.3: Possible contributions of the Centre Régional Africain des Sciences et Technologies de l'Espace en Langue Française to GEWEX (Noureddine Filali)
- 3.4: AMMA: The International Project (Jan Polcher)
- 3.5: The African AMMA program (Amadou Gaye)

15:10-15:50:       **4.    RELATIONS WITH SPACE AND CLIMATE RESEARCH AGENCIES**

- 4.1: ESA (Einar-Arne Herland)
- 4.2: JAXA (Riko Oki)



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**Monday, 9 January 2006: (Continued)**

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16:00-18:00:           **4. RELATIONS WITH SPACE AND CLIMATE RESEARCH AGENCIES  
(Continued)**

- 4.3: NASA (Jared Entin)
- 4.4: NOAA including NESDIS plans (Ken Mooney)
- 4.5: CMA (Wenjian Zhang)
- 4.6: Discussion

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18:30:                   **WELCOME COCKTAIL RECEPTION**

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**Tuesday, 10 January 2006:**

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08:30-10:00:           **5. INTERACTIONS WITH OTHER WCRP CORE PROJECTS/COMMITTEES**

- 5.1: CLIVAR (Tony Busalacchi)
- 5.2: CliC (Barry Goodison)
- 5.3: WGNE (Martin Miller)
- 5.4: WOAP (Bill Rossow)
- 5.5: Discussion

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10:00                   **BREAK**

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10:15-12:15:           **6. RELATION WITH OTHER PROGRAMMES**

- 6.1: IGBP/iLEAPS (Pavel Kabat)
- 6.2: GEOSS (José Achache)
- 6.3: CEOS and GCOS Interactions (Gilles Sommeria)
- 6.4: IGOS Global Water Cycle Observations Theme (Rick Lawford)
- 6.5: THORPEX (Jim Caughey)
- 6.6: Discussion on Interface between GEWEX and other Programmes

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13:00-14:00           **LUNCH**

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14:00-16:30           **7. GEWEX, HYDROLOGY AND WATER RESOURCES**

- 7.1: GEWEX's Role in Hydrology and Water Resources (Soroosh Sorooshian)
- 7.2: WRAP and WMO/UNESCO Semi-Arid Workshop (John Roads, Gilles Sommeria)
- 7.3: Global Water System Project (Charles Vorosmarty)
- 7.4: Prediction in Ungauged Basins (Kuniyoshi Takeuchi)
- 7.5: UNESCO's International Hydrological Programme and the G-WADI Network (Annukka Lipponen)
- 7.6: The Hydrology and Water Resources Programme of WMO (Wolfgang Grabs)
- 7.7: A Proposal for a New GEWEX Hydrology Project (Eric Wood)
- 7.8: Rapporteurs Comments on GEWEX and Water Resources
- 7.9: Discussion of the Future Role of GEWEX in Hydrology and Water Resources

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15:45                   **BREAK**

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**Tuesday, 10 January 2006: (Continued)**

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16:00-1800:           **8.   PRECIPITATION ACTIVITIES**

- 8.1: GEWEX Precipitation Climatology Project Activities and the Precipitation Cross-Cut (GPCP, etc) (Bob Adler)
- 8.2: Requirements for Solid Precipitation Information (Barry Goodison)
- 8.3: Update on TRMM and GPM (Bob Adler, Riko Oki)
- 8.4: Summary of GEWEX Regional Precipitation Activities (Steve Williams)
- 8.5: PERSIANN (Soroosh Sorooshian)
- 8.6: Rapporteur Comment on GEWEX Precipitation Activities
- 8.7: Discussion about the Future Role of GEWEX and Precipitation Issues

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**Wednesday, 11 January 2006:**

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08.00-09.30:           **SPECIAL SCIENTIFIC SESSION**

**9.   PRESENTATIONS ON AEROSOLS AND SOIL MOISTURE**

**Aerosols:**

- 08.00-08.30           9.1: Thermodynamic Responses to Precipitation Changes as Induced by Surface and Aerosol Impacts on Cloud Processes: Implications to the Earth's Energy Budget and the Hydrological Cycle. (Daniel Rosenfeld)
- 08.30-08.45           9.2: GRP Aerosol Activities, Data Sets and Analyses (William Rossow)
- 08.45-09.00           9.3: GCSS Aerosol and Cloud Research (Christian Jakob)
- 09.00-09.15           9.4: Discussion on Implications and Recommendations for GEWEX

**Soil Moisture:**

- 09.15-09.30           9.5: SMOS (and HYDROS) and New Soil Moisture Data Sets (Yann Kerr)
- 09.30-09.40           9.6: Comments by Peter van Oevelen and short discussion on soil moisture

09.40-10:45:           **10.   GEWEX RADIATION PANEL (GRP)**

- 10.1: Status of GRP Projects and Assessments (William Rossow)
- 10.2: Actions Needed from the SSG

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10:45-11.00:           **BREAK**

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- 11.00-11:45           10.3 Discussion

**11.   GEWEX MODELLING AND PREDICTION PANEL (GMPP)**

- 11.45-12.10           11.1: Overview of GMPP Activities (Jan Polcher)
- 12.10-12.30           11.2: GLASS (Bart van den Hurk)
- 12.30-12.50           11.3: GCSS Activities (Christian Jakob)
- 12.50-13.00           11.4: Summary and Actions Needed

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13.00-14.00:           **LUNCH**

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**Wednesday, 11 January 2006: (Continued)**

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14.00-14.45                    11.5 Discussion

**12. GLOBAL ENERGY AND WATER BUDGETS AND LAND SURFACE DATA PRODUCTS**

14.45-15.00                    12.1: Global WEBS as a GEWEX Cross-Cut (John Roads)  
15.00-15.15                    12.2: GRP Involvement in GWEBS (William Rossow).  
15.15-15.30                    12.3: CEOP WESP and Connection with GHP (John Roads)  
15.30-15.50                    12.4: ISLSCP II Summary (Pavel Kabat)

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15:50-16.10:                **BREAK**

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16.10-16.30                    12.5: LANDFLUX and ISLSCP Follow On (Bill Rossow)  
16.30-16.50                    12.6: Proposal for Surface Flux/Radiation Sites (Bill Rossow)  
16.50-17.10                    12.7. Discussion of Future Energy and Water Budget Work in GEWEX

**13. MONSOONS**

17.10-17.30                    13.1: Pan-WCRP Monsoon Workshop and Recommendations for JSC (Tetsuzo Yasunari)  
17.30-17.45                    13.2: CEOP Monsoon Activities (CIMS) (Jun Matsumoto)  
17.45-18.00                    13.3: Summary of GHP Monsoon Activities (Jun Matsumoto)  
18.00-18.15                    13.4: CLIVAR Monsoon Activities (Tony Busalacchi)  
18.15-18.30                    13.5: Considerations for a GEWEX/CLIVAR JSC Paper on Monsoons (Rick Lawford)  
18.25-18.45                    13.6: Discussion on GEWEX Monsoon Activities

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**Thursday, 12 January 2006:**

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8.00-09.45:                **14. FIRST EXECUTIVE SESSION**  
(Review of Action Items, Reports by SSG Members)

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09.45-10.15:                **BREAK**

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**15. GEWEX HYDROMETEOROLOGY PANEL (GHP)**

10.15-10.45                    13.1: Overview of the GHP and the CSEs (John Roads)  
10.45-10.55                    13.2: Specific GHP/AMMA issues (Amadou Gaye, Jan Polcher)  
10.55-11.15                    13.3: "MAHASRI" (GAME Follow On) (Jun Matsumoto)  
11.15-11.35                    13.4: Summary and Actions Needed by the SSG  
11.35-12.15                    13.5. Discussion of the GHP Panel activities

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12.15-13.30:                **LUNCH**

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13.30-Evening:              Excursion to the City of Dakar and the Island of Goree, with Dinner Included (Optional)

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**Friday, 13 January 2006:**  
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**16. CEOP**

08.30-09.10: 16.1: CEOP Phase II Overview (Toshio Koike)  
09.10-09.25: 16.2: CEOP Data Issues (Including Hydrologic Data Set Collection)  
(Steve Williams)  
09.25-09.40: 16.3: Proposal for the Management of CEOP in GEWEX (Toshio Koike)  
09.40-10.30: 16.4: Discussion

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10.30-10.45: **BREAK**  
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10.45-11.45: **17. GEWEX FUTURE AND LINKS WITH COPES**

17.1: Overview of the COPES Concept (Gilles Sommeria/Soroosh Sorooshian)  
17.2: Overview of the GEWEX Roadmap (Rick Lawford)  
17.3: Discussion about the Roadmap and GEWEX Contribution to COPES

11.45-12.30 **18. RAPPORTEUR REPORTS AND DISCUSSION**

12.30-13.00: **19. OTHER ISSUES OF RELEVANCE TO GEWEX**

19.1: Succession Planning (Soroosh Sorooshian)  
19.2: Other Issues (All)  
18.3: Chairman's Summary Remarks for General Participants (Soroosh Sorooshian)

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13.00-14.30: **LUNCH**  
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14.30-16.30: **20. SECOND EXECUTIVE SESSION**  
(Review of Actions, Membership, Administrative Issues, etc.)

APPENDIX C

LIST OF MEETINGS CONCERNING GEWEX

Date	Meeting	Location	Attendance
<b>2005</b>			
31 Jan - 4 Feb 2005	GEWEX SSG-17	Kunming, China	By invitation
28 Feb - 4 March 2005	CEOP/IGWCO joint meetings	Tokyo, Japan	By invitation
14-18 March 2005	26th session of the Joint Scientific Committee	Guayaquil, Ecuador	By invitation
18-21 April 2005	Joint WCRP-UNESCO workshop on the Applicability of Climate Research and Information for Water Resource Management in the Semi-Arid Regions	Alexandria, Egypt	By invitation
24-29 April 2005	European Geosciences Union General Assembly	Vienna, Austria	Open
3-5 May 2005	ISLSCP Initiative II Science Workshop	Greenbelt, MD, USA	Open
16-20 May 2005	Pan GCSS meeting	Athens, Greece	Open
24 May 2005	Mid-Year Meeting of CEOS Principals	Geneva, Switzerland	By invitation
26 May 2005	IGOS Partners meeting	Geneva, Switzerland	By invitation
1-3 June 2005	First session of the WCRP Observation and Assimilation Panel	NASA/GISS, New York, NY, USA	By invitation
15-17 June 2005	Pan-WCRP Monsoon Workshop	Irvine, CA, USA	By invitation
<b>20-24 June 2005</b>	<b>5th International Scientific Conference on the Global Energy and Water Cycle</b>	<b>Orange County, CA, USA</b>	<b>Open</b>
2-11 Aug 2005	IAMAS Scientific Assembly	Beijing, China	Open
24-26 Aug 2005	GEWEX Executive Meeting	New York, NY, USA	By invitation
19-21 Sept 2005	Joint GABLS/GLASS Workshop on Local Coupled Land-Atmosphere Modelling	De Bilt, The Netherlands	By invitation
19-23 Sept 2005	LOCO/GABLS workshop	De Bilt, The Netherlands	By invitation
21-23 Sept 2005	6th GLASS Panel meeting	De Bilt, The Netherlands	By invitation
26-30 Sept 2005	11th session of the GEWEX Hydrometeorology Panel	Melbourne, Australia	By invitation
3-6 Oct 2005	16th session of the GEWEX Radiation Panel	Paris, France	By invitation
6-7 Oct 2005	First session of the WCRP Modelling Panel (WMP)	Exeter, UK	By invitation
7-11 Nov 2005	21st session of the CAS/JSC Working Group on Numerical Experimentation (WGNE)/9th session of the GEWEX Modelling and Prediction Panel (GMPP)	St. Petersburg, Russia	By invitation
14-17 Nov 2005	WGDMA meeting	Darmstadt, Germany	By invitation
28 Nov - 2 Dec 2005	AMMA 2005 Dakar-First International AMMA Conference on the West African Monsoon	Dakar, Senegal	Open
5-8 Dec 2005	AGU Fall Meeting	San Francisco, CA, USA	Open
<b>2006</b>			
9-13 Jan 2006	GEWEX SSG-18	Dakar, Senegal	By invitation
21-26 Jan 2006	First iLEAPS Science Conference	Boulder, CO, USA	Open

## APPENDIX D

### PUBLICATIONS AND REPORTS 2005-2006

#### **2005**

U.S. Contributions to CEOP, *Bulletin American Meteorological Society*, 2006.

#### **Informal Reports**

Report of the 11<sup>th</sup> session of the GEWEX Hydrometeorology Panel, Melbourne, Australia, 26-29 September 2005.

Report of the 16<sup>th</sup> session of the GEWEX Radiation Panel, Observatoire de Paris, 3-6 October 2005.

Report of the GEWEX Radiation Panel Working Group on Data Management and Analysis (WGDMA), Darmstadt, Germany, 14-17 November 2005.