TABLE OF CONTENTS

Page No.

ACTIONS AND RECOMMENDATIONS FROM SSG-15

REPORT

1. INTRODUCTION 1

2. OVERVIEW AND MAIN RECOMMENDATIONS FROM SSG 1

2.1 Evaluation of GEWEX phase II advances 1
2.2 Recommendations of GEWEX SSG 3

3. HYDRO-METEOROLOGY 4

3.1 Overview 4
3.2 Continental scale experiments 5
3.3 Specific projects and activities 7
3.4 Co-ordinated Enhanced Observing Period (CEOP) 8

4. RADIATION PANEL AND GLOBAL DATA SETS 9

4.1 Overview 9
4.2 Global data sets and satellite projects 10
4.3 Specific study projects and working groups 11

5. MODELLING AND PREDICTION 12

5.1 Overview 12
5.2 GEWEX Cloud System Study (GCSS) 12
5.3 GEWEX Global Land-Atmosphere Study (GLASS) 13
5.4 GEWEX Atmospheric Boundary Layer Study (GABLS) 13

APPENDICES

A. List of participants
B. Final agenda
C. List of scheduled meetings
D. Publications and reports 2002-2003
E. Reports from SSG-15
- SSG-15 Members Provide Phase I Assessment And Phase II Direction
- Summary of GEWEX SSG-15
- The role of GEWEX studies in environmental policy decisions
F. Reports to JSC
- GEWEX Support Reaffirmed at Recent WCRP/JSC Meeting
Soroosh Sorooshian
- GEWEX Progress reported to WCRP Joint Scientific Committee
Robert Schiffer
G. Reports from specific GEWEX projects
- African Monsoon Multidisciplinary Analysis (AMMA)/
Couplage de l'Atmosphère Tropicale et du Cycle Hydrologique (CATCH)
Thierry Lebel
- Report on GEWEX Baseline Surface Radiation Network (BSRN) Activities
Ellsworth G. Dutton

- International Satellite Cloud Climatology Project (ISCCP) Activities in 2002
  William Rossow
- GCSS report from the Kananaskis meeting, May 2002
  Steven K. Krueger

H. Reports from specific workshops

- GABLS Initiates Intercomparison for Stable Boundary Layer Case
  Albert A.M. Holtslag
- CEOP status session at GHP-8
  Sam Benedict
- GSWP-2 Kickoff Workshop
  Paul Dirmeyer, Taikan Oki, and Xiang Gao
- Workshop on climate system feedbacks
  William B. Rossow

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ACTIONS AND RECOMMENDATIONS FROM SSG-15

1/ Completion of review paper highlighting achievements of GEWEX phase 1.

2/ Development of a "roadmap" of activities focused on meeting the objectives of GEWEX phase 2.

3/ Establishment of two cross cutting activities across GRP, GMPP and GHP:

a) Precipitation: to address critical issues in reducing errors in retrievals and mapping of global precipitation (including solid precipitation), and to improve the representation of precipitating processes, with in view a better simulation and forecast of precipitation in NWP and climate models.

b) Global Water Cycle and Energy Budget (G-WEBS) Estimations: to provide a structured process for determining the variations and changes in the global energy and water cycles, in order to meet the first objective of GEWEX, and to determine our ability to close the energy and water budgets on various scales.

4/ Revision of the guidance and objectives for WRAP, in order to provide broader interactions with the hydrology community (IAHS, PUB, HELP, etc.,), to include:

a) The further development of a joint project with IAHS/PUB,

b) A "catalog" of applications type projects that are related to the CSEs and involve interested users,

c) The development of mountain area activities that may cross-cut with the precipitation activities throughout GEWEX.

5/ Orientation of ISLSCP initiative 3 with a stronger focus on land surface global data sets (e.g., surface albedo, land skin temperature, evapotranspiration, vegetation indices and classes, etc.) and possible intercomparisons of potential methods (e.g., NDVI, FASIR, GVI, etc.,) to better specify errors/accuracies. ISLSCP should be co-ordinated with other global data sets as part of GRP and a new scientific committee should be established.

6/ Encouragement to continue research on "climate feedbacks" in collaboration with WGCM and in interaction with the space platform instrument teams.

7/ Approval of the recommendations of the Satellite WG with a special effort to ensure closer relations with space agencies at the project and at the working level.

8/ Encouragement to pursue the reflection undertaken by GRP and GHP on data management and encouragement to develop a more collaborative relationship by joint or overlapping meetings.

9/ Appointment of Paul Dirmeyer as new Chair for GLASS and GEWEX representative for IGBP/iLEAPS.

10/ Recommendations for CEOP:

a) readdress the transfer to 3rd party restrictions within their Data Policy to ensure the developed CEOP data sets are not restricted from dissemination,

b) request formally that GRDC update the CEOP basin data sets,

c) define the CEOP and CLIVAR monsoon activities in a more collaborative role,

d) readdress the CSE emphasis on real time GTS or internet access for RAOB and met data,

e) develop a resource plan and proposals for planned data management activities,

f) consider appropriate letters of appreciation for reference site contributions.

11/ Recommendation to support AMMA as a GEWEX GHP "affiliated" project.

12/ Recommendation to GHP to revisit criteria for CSE acceptance, with the addition of a new criterion on scientific representativity and complementarity of selected basins.

13/ Establishment within GHP of a working group on the use of isotopic data to assist in determining the water cycle variability.

14/ Organisation of a workshop on climate research for arid and semi-arid regions, jointly with CLIVAR.

15/ Pursuit of the reflection on ways to institutionalise the BSRN network and incorporating it as an element of GCOS.

16/ Recommendation of a larger involvement of the GEWEX community in IGOS-P reflection and use of the IGOS P process for the development of future projects.

17/ Organisation of a GEWEX management retreat (GRP/GHP/GMPP/IGPO/SSG Chair).

18/ Confirmation of a date and location for the 5th International Scientific Conference on the Global Energy and Water Cycle.

19/ Encouragement to develop a more systematic representation of SSG members by areas of interest for potential assistance in attending international meetings on behalf of GEWEX.

20/ The usefulness of Read Ahead books is appreciated and it is recommended that the future ones contain background organisational material for reference.

21/ Extension of SSG member appointments for U. Schumann and R. Atlas. Redaction by SSG Chair of a letter of appreciation for Tony Hollingsworth and his long term of special service to GEWEX. Pursuit of activities to propose a new member at JSC. (A. BELJAARS has been subsequently nominated as a new SSG member).

1. INTRODUCTION

This report summarises the main developments in GEWEX during the past year, including the main items and recommendations from the fifteenth session of the GEWEX Scientific Steering Group kindly hosted by UNESCAP in Bangkok, 20-24 January 2003, with great support from D. Jezeph and his staff.

2002 was indeed the first full year of GEWEX Phase II and most projects underwent orientation changes following guidelines established by JSC-22. This resulted in an increased interaction between the various projects for a more global and a more interdisciplinary approach. In order to assess this evolution and to provide guidance for future actions, SSG members were specifically asked to evaluate progress made relative to the five guiding goals of GEWEX Phase II.

GEWEX Milestones worth noting for 2002 are:

- The beginning of the build-up phase of CEOP, with the joint commitment of the continental scale experiment, the space agencies and the global modelling community.
- Advances in closing regional water budgets.
- The reorganisation of global data sets under a common umbrella.
- The start of new modelling activities in close co-ordination with the GCM community.

Increased communication between GEWEX projects and panels has taken place as part of the preparation of "cross-cutting" activities in several areas: observation, modelling and forecast of precipitation, closure of the energy and water budgets at various scales, data management, and as part of reflections undertaken to contribute to WCRP "banner" and observation strategy.

Several initiatives demonstrate efforts for a closer interaction between GEWEX and the other WCRP components; this is the case in the areas of monsoon observation and modelling as part of CEOP, radiation-climate feedbacks, and the various modelling projects of GEWEX closely linked with WGNE. The positioning of GEWEX with programmes outside WCRP was also considered as a major item at the SSG. This was particularly the case for WWRP and the Thorpex experiment, with which a continuing dialogue is felt to be necessary, and for the other ESSP programmes where the involvement of the GEWEX community should probably be further encouraged, especially with respect to the joint water system project.

There is a continuing effort to keep close relationship with space agencies programmes, with the participation at SSG of ESA, NASA, NASDA and NOAA, the leading role of GEWEX in the IGOS-Partners water theme and the reflection undertaken within the satellite-working group. Relationship with main modelling centres is maintained on a continuous basis (several workshops organised in 2002) and with the participation of ECMWF and NASA/DAO at the SSG.

2. OVERVIEW AND MAIN RECOMMENDATIONS FROM SSG

2.1 Evaluation of GEWEX phase II advances

A preliminary evaluation of advances in GEWEX phase II was carried out with the contribution of SSG members acting as "rapporteurs". Main conclusions can be summarised as follows:

- **Objective 1:** production of consistent descriptions of the Earth's energy budget and water cycle and their variability and trends, and data sets for the validation of models

This has been a primary goal of GEWEX since the beginning and significant progress has been achieved. The land surface water budgets are now successfully characterised across a range of climatic regions and closed to about 20% in the best instrumented regions; progress being under way in the other ones. Global surface water budget is closed to about 10%. With respect to energy budget, only TOA fluxes and surface energy fluxes are available yet. Significant progress is expected from the CEOP data set and the use of global reanalyses, among them the ECMWF ERA-40 presented at the SSG. Further work is clearly needed in a combined approach of the global energy and water budget and in the associated GCM formulation and assimilation techniques.

With respect to global data sets, 12 to over 20-year records are now available for most pertinent observable parameters at a time and space resolution suitable for GCM validation. Regional variability can be properly assessed but the accuracy of those data sets is still marginal for climate trend detection. An integrated observational analysis strategy has been proposed for further advances in this area.

- **Objective 2:** enhancing the understanding of how energy and water cycle processes contribute to climate feedbacks.

Progress in this domain requires a strong interaction between observations and model approaches, including detailed process models and GCM studies. The three GEWEX panels contribute to this objective but there are divergent opinions concerning an overall strategy. Progress has been made in understanding the main issues related to radiative climate feedbacks, as part of the November 2002 Atlanta workshop and further work is planned on this subject in coordination with WGCM. A second workshop is envisioned in about 18 months, but it was felt that this topic needs to be given more attention throughout WCRP, with the help of a specific task group composed of modellers and data analysts.

- **Objective 3:** developing improved parameterisations encapsulating these processes and feedbacks for atmospheric circulation models

GMPP is the main contributor to this objective and achievements are noticeable in the validation of existing parameterisations for cloud and land surface processes. In addition field observations and process simulations (column and three-dimensional large-eddy models) concur to the development of new schemes in global modelling centres. A good cross-fertilisation between experimentalists, process and GCM modellers is seen as a common feature of workshops organised by the three components of GMPP, including the new GABLS project. It is proposed to address this question more specifically at the next SSG.

- **Objective 4:** interacting with the wider WCRP community in determining the predictability of energy and water cycles

Apart from the radiative climate feedback mentioned above, GEWEX/CLIVAR interaction is important in the general domain of monsoon studies, from the observational and modelling point of view. Quantification of the components of regional water cycles over continents is necessary for understanding monsoon dynamics and reciprocally the forecast of monsoon systems is essential to forecast precipitation variability. Most Continental Scale Experiments are involved in studies which are directly relevant to CLIVAR projects and GEWEX/CLIVAR cooperation is underlying the second main objective of CEOP (Monsoon systems studies). If one considers the various regional experiments, GAPP is a partner in the North American Monsoon Experiment NAME; the Plata Basin experiment in preparation can be considered as a future joint GEWEX/CLIVAR experiment; a CEOP Asian-Australian Monsoon Project (CAMP) has been jointly established between GEWEX and CLIVAR communities. The AMMA (African Monsoon Multi-disciplinary analysis) project in preparation and already supported by GEWEX SSG will also be submitted to CLIVAR SSG and is an example of a comprehensive approach involving the expertise of both communities for the understanding of an important regional component of the climate system.

CliC's newly defined scientific strategy takes into account GEWEX objectives and complements the GEWEX approach in areas where cryospheric processes are important. CliC complements GEWEX in relevant Continental Scale Experiments (MAGS, BALTEX, GAME Siberia and Tibet) and in the CEOP observational network. Frozen precipitation was the object of a joint workshop in June 2002 and will remain a focus of interest, from the observational and modelling points of view, with the prospect of a joint working group. CliC-GEWEX cooperation is continuing in the area of the observation of ungauged basins and is also important as part of GMPP activities, for the modelling of cloud systems and land-surface processes.

The interaction with SPARC is significant in the domains of water vapor transport at the troposphere-stratosphere interface and of the radiative effects of stratospheric aerosols, joint activities on the Pinatubo event and the radiative effect of cirrus clouds are being explored.

- **Objective 5:** interacting with the water resource and applications communities to ensure the usefulness of GEWEX results

This objective is carried out by the water resources and applications (WRAP) project, which organises a series of workshops with hydrologists (two in 2002, another one planned for July 2003). However, SSG has recommended a revision of guidance and objectives for WRAP in order to provide a broader interaction with the hydrology community. This would involve a "catalogue" of application projects related to the Continental Scale Experiments, jointly planned with users, as well as tighter links with IAHS and the PUB (Prediction of Ungauged Basins) project.

2.2 Recommendations of GEWEX SSG

GEWEX SSG main recommendations include the completion of a review paper highlighting achievements of GEWEX phase I and the development of a "roadmap" of activities focused on meeting the objectives of GEWEX phase II, along the lines described above.

In addition, emphasis has been put on the development of two cross-cutting activities, namely the general question of precipitation measurement and modelling, and the problem of data management.

With respect to precipitation, several actions are under way in order to address critical issues in reducing errors in retrievals and mapping of global precipitation (including solid precipitation in collaboration with CliC), and to improve the representation of precipitating processes in NWP and climate models. The objective analysis and merging of precipitation data is the object of a specialised workshop in March 2003. Reviewing the experiences that GPCP and TRMM have had in trying to validate satellite- and ground radar-derived precipitation highlighted the need for consistent formulations between the different precipitation measurement communities, for adequate validation data sets especially over oceans, and for advances in measurement systems. The idea of an intensive "precipitation year" was discussed,, however, this concept will most likely be delayed until planned future precipitation missions are launched.

Another “cross-cutting” issue concerns data management, which is being dealt with as one of the major CEOP items and by GRP, with one workshop being planned on this subject in May 2003. It is recommended that these initiatives be followed by joint or overlapping meetings open to the wider WCRP community. As a first step, it is felt that there is a need for a parallel data management group within CLIVAR, or at least a point of contact, that can provide information on data sets being collected and exchange ideas on studies of mutual interest. The same suggestion would probably be also valid for CLIC and SPARC.

Two other recommendations are sufficiently broad to deserve JSC’s attention: (1) the evolution of BSRN, and (2) the use of the new experimental satellite sensors.

The success of BSRN is widely recognised but relies upon the continuity of financial support to individual stations and to the archiving centre. In order to achieve this, a procedure has to be defined jointly with GCOS in order to prepare a transition from a research network into a long term observing system. This question raises the general problem of how to progressively convert well-established research systems into operational systems.

The GEWEX position with respect to the use of newly available satellite sensors is well reflected in the conclusions of the satellite working group, and the proposal for a co-ordinated, integrated observational analysis strategy provided as input to the reflection on WCRP banner. Important messages relate to the need for a concerted plan with space agencies for cross-calibration of the new experimental sensors and inter-comparison of derived products, as well as a plan for a co-ordinated analysis and re-analysis of all global observations pertinent to climate research.

More specific recommendations and information relevant to the various panels and projects are outlined below.

3. HYDRO-METEOROLOGY

3.1 Overview

The hydrometeorology activity is coordinated by the GEWEX Hydrometeorology Panel (GHP), which held its 8th annual meeting at the International Research Institute in Palisades, New York, September, 2002. Its mission, currently expressed as: "to improve the capability to predict variations in water resources and soil moisture on time scales of seasonal and annual as an element of WCRP's prediction goals for the climate system", is key to the goals of GEWEX phase II.

A crucial aspect of the overall strategy for GHP has been to carry out a number of regional research activities as a first step towards global application. In this regard, six continental-scale experiments (LBA, GCIP/GAPP, GAME, BALTEX, MAGS and MDB) as well as one affiliate experiment (AMMA/CATCH) have been initiated. Two projects with strong ties to CLIVAR are also in the planning stages, NAME (part of GAPP), and the La Plata Basin Study.

This activity collectively brings together an international group of about 500 researchers to address water and energy fluxes and reservoirs over various land areas. In each regional experiment, efforts have been mounted to acquire the necessary observations to characterize water and energy fluxes and reservoirs and to simulate these with appropriate atmospheric, land surface and hydrological models, as described below.

Carrying out the overall strategy for GHP has also led to the establishment of specific overarching projects and the development of several critical activities currently being carried out in a more ad-hoc manner, as described below.

In addition GHP was a driving force in the initiation and preparation of CEOP, described below, which entered its implementation phase in October 2002.

The annual assessment of GHP status reflects progress in the closure of the water and energy balance for several basins, in the development of atmospheric coupled and uncoupled hydrological models at regional scale, and in the dialogue with the water resource community. The beginning of the implementation phase of CEOP was a milestone in the global coordination of efforts developed earlier at the regional level. One should also note the release of ISLSCP initiative 2 data set which is almost complete at the time of this report, as well as substantial progress made by the two global data centres GRDC and GPCC.

It is expected that the hydrometeorology community within GEWEX will 'evolve' considerably in the future given factors such as:

- The continued development of its initial continental-scale experiments as they individually mature, and as the interaction between the research teams is reinforced by CEOP and the thematic working groups.

- The evolution of new continental-scale experiments. Although it was formally approved as a continental-scale experiment only a year ago, the Murray-Darling basin (MDB) project of Australia is already making significant progress towards addressing this region's water and energy processes, including the role of groundwater.

- The development of new initiatives over other regions including the AMMA project in west Africa and the PLATIN in South America which is expected to apply for the status of continental-scale experiment next year.

- The development of new overarching issues and interactions within GEWEX, and with CLIVAR and CliC. There is also considerable room for linkage with WWRP, the ESSP joint projects (water, carbon and food) and the IGOS water cycle theme. Through isotope research, there may also be a good opportunity for collaboration with IAEA.

3.2 Continental scale experiments

1) The Baltic Sea Experiment (BALTEX)

The Baltic Sea Experiment (BALTEX) was established in 1992 to measure and model the energy and water cycles over the Baltic Sea and its catchment. Its purpose is to provide an improved understanding of the processes controlling the fluxes of water and energy into and out of the entire basin and to use such knowledge for establishing and improving coupled atmospheric, hydrological and ocean models for better weather forecasting, climate studies and climate prediction.

Phase I of BALTEX, now finalised (1993-2002), brought an improved understanding of the energy and water cycle in the Baltic Sea Basin. Two fully coupled model systems are currently being finalized and used for BALTEX purposes. An ongoing data assimilation project is focusing on parts of the BALTEX/*BRIDGE* period 1999 to 2002, and several BALTEX projects are ongoing in different countries funded by both national and European sources. Two special peer-reviewed volumes of *Boreal Environmental Research* have been published including presentations given at the 3rd Study Conference on BALTEX held July 2002 in Mariehamn, Finland. Four dedicated BALTEX data centres for meteorological, hydrological, oceanographic and radar data are being operated by the Swedish and German national weather services.

At its 14th meeting in Lund, Sweden, 20 November 2002, the BALTEX SSG approved the general objectives for Phase II of BALTEX and a revised science plan is being drafted covering the period 2003 to 2010. The primary focus of BALTEX will be maintained and enlarged to regional climate variability, water management, air and water quality, global change impact assessment and international outreach.

2) GEWEX Asian Monsoon Experiment (GAME)

Phase I of GAME has now been finalised and scientific results, particularly from GAME-Tropics and GAME-Tibet were reported in the special issue of *Journal of the Meteorological Society* of Japan (Yasunari, ed., 2001). GAME entered in its Phase II, which includes further research and data analysis, some additional process studies, and modeling needed for the synthesis of the overall GAME objectives. Key research issues for the energy and water cycle of monsoonal Asia include the understanding of cloud and precipitation processes and their interaction with large-scale atmospheric circulation, and the interaction between the cloud/precipitation system and the land surface conditions, including topography and land use/land cover conditions.

Also, to fully understand the seasonal cycle and interannual variation of the Asian monsoon, GAME will include the large-scale atmosphere-ocean processes and their interaction with land surface processes. GAME modeling activity includes these processes using atmospheric GCMs and coupled atmosphere-ocean GCMs.

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

GAPP, a follow-on to the GEWEX Continental-scale International Project (GCIP), is being supported to "demonstrate the capability to predict changes in water cycle variables (e.g., precipitation, soil moisture) on times scales up to seasonal and interannual through better understanding and model representation of land surface and boundary layer processes." The geographical area of study is the United States (the lower 48 states) with a focus on the western USA. Funded by NOAA and NASA, GAPP relies on a mix of observational, modeling and diagnostic studies to understand processes and build better prediction systems.

GAPP was launched at a large conference in New Orleans in May 2002, which was also the occasion to review the achievements of GCIP, to be published in a special issue of JGR.

GAPP will serve as a key component of CEOP, with the contribution of four reference sites, the development of an operational land surface assimilation scheme, and studies of transferability of regional coupled atmospheric-hydrology models. GAPP will also contribute to the study of the monsoonal circulation and the carbon cycle.

4) Large-scale Biosphere-Atmosphere Experiment in Amazonia (LBA)

After a phase of implementation of field activities and the initiation of research and training activities, new developments include the implementation of several levels of climate and hydrological modelling, making use of the CPTEC Global model at 70 km resolution and the Eta/CPTEC regional model at 20 km. resolution. Future activities on this subject include the downscaling of climate change scenarios from IPCC (using the Eta/CPTEC model nested on the HadCM3 model from the Hadley Centre) and the preparation of long-term climate runs, on the newly acquired NEC-SX6 supercomputer.

On the observational side, the involvement of LBA in CEOP, and the implementation and planning of field experiments in Amazonia from 2002 to 2005 guarantee the availability of high resolution time-space data. The closure of the water budget over the Amazon basin remains a priority. With respect to new developments, one should note the field experiment on the South American Low Level Jet planned jointly with CLIVAR for summer 2003, which will allow a better knowledge of the moisture transport between Amazonia and the La Plata river basin. Currently, there are 102 projects going on in LBA, funded either by Brazilian or international founding institutions.

A special issue of JGR with the major findings of the first LBA conference has been published in 2002 and the second international LBA Conference was held in July 2002 in Manaus.

5) The Mackenzie River GEWEX study (MAGS)

The initiation of MAGS Phase-2 in 2001 brought a shift in the focus of the research program, from data acquisition and experimentation to modelling and prediction. The major objectives of MAGS-2 are:

- to integrate knowledge of atmospheric and hydrological cycles into a unified system
- to develop hierarchy of models for a range of spatial and temporal scales
- to apply improved predictive ability to environmental and social issues

MAGS research in the second year of Phase-2 has focused on achieving the first two objectives. Some process models (e.g. lake models, frost models, blowing snow models etc.) have been improved and parameterizations based on those are under development for integration into coupled models. The development of intermediate-level coupled models (e.g. coupled atmosphere-land surface and coupled land surface-hydrologic models) has been completed and preliminary results are very encouraging. In addition, major projects initiated in Phase-1 have been completed and activities addressing the third objective have started.

6) The Murray-Darling Basin Water Balance Project (MDBWP)

The objectives of the MDBWP are:

- to enhance the capability of the operational systems of the Bureau of Meteorology to provide accurate and reliable estimates of the real-time surface water budget across the MDB;
- to measure the spatial and temporal variability of soil moisture and temperature across one part of the basin (the Murrumbidgee River basin);
- to identify and reduce key limitations in the representation of soil moisture and temperature in BMRC atmospheric model;
- to develop products for water authorities in the MDB.

These objectives are being achieved through a programme of combined observation and modelling studies, based on the hydrology and modelling expertise at the University of Melbourne and the meteorological modelling expertise in BMRC. Two CSIRO laboratories have joined the project, with expertise in land surface and land atmosphere interaction, as well as Macquarie University model for surface scheme intercomparison studies and ANSTO (Australian Nuclear Science and Technology Organization) for isotopic studies.

7) African Monsoon Multi-disciplinary Analysis (AMMA)

AMMA is a multidisciplinary and international project, building on projects such as CATCH (GEWEX CSA) and WAMP (West African Monsoon Project, a European modelling project). It aims at a global study of the West African Monsoon in order to:

- improve our understanding of the coupling between the atmosphere, the land surface and the ocean over a spectrum of scales ranging from regional down to local,
- evaluate the impact of the variability of this climate system on the water resources, food sustainability and health of one of the most vulnerable regions on earth,
- improve the predictive capability of dynamical models, especially for seasonal rainfall prediction and for the production of hydro-climatic scenarios for this century,
- provide an array of adequate in situ measurements for satellite validation and,
- strengthen the partnership between African, American and European scientists.

AMMA is built around four main components: observing system, modelling activities, satellite component, training program.

Currently the main effort is on organising the EOP and the related modelling and satellite activities. One major issue in this respect is to secure the operation of the existing radio sounding network over West Africa and, possibly, to reinforce it where needed, especially around the LOP window.

One major issue for AMMA is to obtain an official WCRP/WMO label that will help in obtaining the support of national meteorological services and international agencies (funding agencies, space agencies, etc.) This support is needed for maintaining and upgrading the radio-sounding network as well as for getting access to satellite data at a reasonable cost. AMMA has been approved by the GEWEX SSG as an affiliated project.

3.3 Specific projects and activities

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

Following a wide distribution of the Initiative I data set, the Initiative II collection, consisting of a 10-year core global data collection spanning the years 1987 to 1995 with improved spatial and temporal resolution (one-quarter to one-degree) and including a larger range of products, is being finalized. This data collection includes carbon data sets designed to support global carbon cycling studies, and GCM data.

An Initiative III data set is planned that would expand the physical and biophysical near-surface global compilation to over 25 years (1982-2007) and would focus on exploiting the data from the new satellite sensors becoming available, as well as the carbon/biophysical data needed for addressing the broad climate change issues. A major change from Initiative II to III is the increased focus on validation and cross-validation of surface exchange parameters. Two successful workshops were held in 2002. It is intended that the scientific plan of Initiative III will be refined during 2003, with a closer link with GRP activities, a stronger focus on land-surface data sets and a wider opening to international participations.

- **Water and Energy Balance Study:** WEBS aims to quantify and characterise the water and energy fluxes and reservoirs over the GHP continental-scale experiments as well as other regions. Progress has been made to assess our capability to "close" the water and energy balance with global and regional models. Several workshops have been held and an article using NCEP re-analysis data over all of the CSE regions has been completed, WEBS-related efforts are ongoing within the individual CSEs, making use of global products covering the period 1987-2001. Two workshops will be held in 2003 at AGU/EGS/EGU in April and IUGG in July.

- **Water Resources Applications Project:** WRAP is designed to structure the dialogue between the users of hydro-meteorological forecasts, and the researchers within GHP who are involved in the development of datasets and models on a global basis. A second workshop has been held in July 2002 in Dresden, opening a dialogue between GEWEX scientists and water resource managers. This dialogue will be pursued at a new workshop scheduled as part of IUGG in July 2003.

This effort is duly appreciated by the hydrology community, but there is a need and demand to effectively start specific application projects.

- **Data Management Working Group:** This group is concerned with improving the access to and distribution of various data sets. For example, each of the continental-scale experiments has produced a variety of special datasets. To help improve the use of these, this working group has summarized the various data listings and access guidelines of participating groups within GHP, and it is currently concerned with pulling together its first collective dataset on precipitation. This group is also playing a major role in the preparations for CEOP.

- **Large scale hydrological modelling:** These studies are being carried out in the continental-scale experiments. In some cases, these are using fully coupled atmosphere/land-surface models. As well, and in cooperation with GMPP and CliC, an inter-comparison activity has been carried out within the BALTEX region.

- **Transferability and validation:** The transferability of regional models between regions and/or the validation of global models over continental-scale experimental regions and other regions is being addressed on a case by case basis. To move this effort along, BALTEX has volunteered that the 1995 PIDCAP period can act as the basis for an inter-comparison of regional (and global) models. Under CEOP, specific tests of transferability and evaluation are being planned.

- **Prediction and Predictability:** Prediction and predictability studies are underway within each of the continental-scale experiments. These are generally aimed at establishing our capabilities and weaknesses to predict water-related parameters over these regions on time scales ranging up to interannual. At the September 2002 GHP meeting, further discussions were held in regards to moving this effort along in a more comprehensive manner.

In addition to the above topics, research examining "Water Sources" as well as "Extreme Water-Cycle Events" is being pursued to various degrees within the continental-scale experiments. Initial discussions have been held regarding whether more coordinated actions are needed or justified but final decisions have not yet been made. If it moves ahead, it is expected that the "Water Sources" issue will be pursued jointly with IAEA. Other topics under consideration include carbon and orographic hydrometeorology.

3.4 Co-ordinated Enhanced Observing Period (CEOP)

The overall goal of the Co-ordinated Enhanced Observing Period (CEOP) is to understand and model the influence of continental hydro-climate processes on the predictability of global atmospheric circulation and changes in water resources, with a particular focus on the heat source and sink regions that drive and modify the climate system and anomalies. To this end, a co-ordinated effort has been undertaken to put together the observations being taken by the CSEs, data sets derived from environmental satellites including the newer ones and data sets from global models. The primary objectives of CEOP are to:

- Document, better understand, and improve the simulation and prediction of water and energy fluxes and reservoirs over land for water resource applications
- Document the seasonal march of the monsoon systems and better understand their physical driving mechanisms and their possible connection.

CEOP has had two major milestones this year: 1) The CEOP Implementation Planning Meeting, 6-8 March 2002 in Tokyo, Japan; and 2) a CEOP status session that was held on 13 September 2002, in conjunction with the GEWEX Hydrometeorology Panel (GHP) meeting.

Since March, CEOP has been focussing on the development of an initial enhanced observing period (EOP-1) data set, which covers the period from July through September 2001, and on the initiation of the build-up observation phase which started on 1 October 2002.

The build-up phase of CEOP is on schedule. Progress has been made according to the CEOP Implementation Plan on the CEOP Data Management, Satellite Data Integration, Model Output Production, Water and Energy Simulation and Prediction (WESP) and Monsoon Systems Studies activities.

There are 36 reference sites reporting around the globe, most of them belonging to the existing network of the Continental Scale Experiments; data are being archived at the CEOP Central Archive at UCAR under the responsibility of the Data Management Working Group. A high degree of involvement of the GEWEX hydrology community in CEOP has been achieved since the kick-off of CEOP implementation, backed by multi-national commitments involving the main reference site operators.

Model output requirements have now been standardized and most major modelling centers are delivering their model products. Those are being centralised and handled by the Max Planck Institute for Meteorology in Hamburg, in view of integrating them into a World Data Center.

The Water and Energy Simulations and Predictions (WESP) Working Group has defined the methodology to document and simulate water and energy fluxes and reservoirs, and to predict them up to the seasonal timescale for water resource applications. The plan is to develop this skill at regional scale, and to transfer it progressively to global scales.

The Monsoon System Working Group has developed its plan to validate and assess the capability of climate models to represent physical processes which are pertinent in the simulation of monsoons. Its work will be further discussed at a workshop to be held in April 2003 in Milan.

Satellite data are handled by two integration centers at the University of Tokyo and at NASA Goddard with a strong support of NASDA and NASA and assistance of the CEOS Working Group of Information Systems and Services (WGISS). Data from most satellite sensors available are progressively included in an impressive archiving system.

GEWEX SSG has endorsed advances in the various aspects of CEOP implementation, including the work of the scientific coordination and the programme of the next CEOP implementation meeting to be held in Berlin, 2-4 April 2003. It supports the efforts of the CEOP organizational structure to formalise current agreements and recommends the prompt finalization of the Advisory and Oversight Committee which should help in securing resources from the various participating organizations.

4. RADIATION PANEL AND GOBAL DATA SETS

4.1 Overview

The GEWEX radiation panel (GRP) leads studies on radiative processes, particularly in association with clouds and aerosols, and the development of global data sets making use to a large extent of satellite observations.

One of the primary goals of the global data projects has been to create or foster the systematic collection of the global, long-term, atmospheric and surface property satellite derived data-sets needed to diagnose the joint variability of the global energy and water budgets and to improve understanding of the climate processes that determine its natural variability and sensitivity to changes.

In order to facilitate better connections among the GRP satellite projects and with other data analysis activities within GEWEX, all of the GRP data activities will be organized into a single Working Group on Data Management and Analysis (WGDMA). The first tasks of WGDMA will be to undertake some common statistical analysis tasks, possibly including the creation of a merged collection of data, for all of the GRP global satellite projects (ISCCP, GACP, GPCP, SRB, SeaFlux) and to make plans for the exploitation of new satellite observations. This new group will also liaise with the GEWEX Cloud System Study (GCSS)/Data Intergration for Model Evaluation (DIME), the Global Land Atmosphere System (GLASS)/Assistance for Land-Surface Modelling Activities (ALMA), the International Satellite Land-Surface Climatology Project (ISLSCP), as well as the GRP Data Management Working Group. The first meeting of this group is planned for May 2003 in Asheville, North Carolina, hosted by NOAA's National Climatic Data Center.

In order to foster development of integrative data analysis methods, the GRP held jointly with WGCM a Workshop on Climate Feedbacks on 18-20 November 2002 in Atlanta, Georgia, USA. A Workshop on Objective Analysis of Precipitation is being organized by GPCP to be held 11–13 March 2003 at the European Centre for Medium-Range Weather Forecasts, UK.

The global satellite analyses are supported by a number of studies to help evaluate their accuracy, a major one being the BSRN to support the SRB project. The ARM site in Oklahoma is also used as a key reference site for satellite measurements.

The activity of the radiation panel is central to the continued interaction between the GEWEX community and satellite operators. This panel made a major input in producing the report of the satellite working group presented separately to JSC. It has recommended among other things that WCRP emphasise the importance of the continuity of measurements from operational and polar orbiting satellites, and increase communication with all space agencies at the management, project and working levels.

GRP has stressed the risks of potential gaps in the continuity of the measurement of the components of the earth radiative budget and of precipitation by space radar. It has also emphasised the benefit expected from the GPM programme and from global soil moisture observations by the still not confirmed SMOS and Aquarius missions. A general plea is also made to space agencies to increase their financial participation and their coordination effort for the preparation of global climate data sets making use of all available sensors.

An increasing interaction with the hydrometeorology community has been recommended and is taking place as part of CEOP. Interaction with other communities is improving as the scope of global data sets evolves to meet some of climate scientific challenges. Major topics where specific effort is needed include radiative feedbacks in the climate system, which remains an open research area, the use of cloud-resolving models in the development and validation of retrieval schemes, the coordination of global data sets with GCM requirements, and the coordination of land flux activities which will be the object of a specific workshop in spring 2003. Further reflection on the last topic should also provide input for the evolution of the ISLSCP programme, which GEWEX SSG recommended to join the GRP community.

4.2 Global data sets and satellite projects

- **International Satellite Cloud Climatology Project** (ISCCP): ISCCP produced a new 18-year (1983–2001) global radiative flux data product which provides physically consistent surface and top-of-atmosphere (TOA), as well as in-atmosphere profiles of shortwave and longwave fluxes for all-sky and clear-sky conditions. Flux values are provided at 3-hour intervals for the whole record and mapped on the 2.5 degree ISCCP grid. Preliminary examination of the global monthly mean shortwave (SW) and longwave (LW) flux anomalies at the surface, in the atmosphere and at TAO over this 18-year period show several notable features:

    - a decrease of the net SW at the surface and TOA, as well as in the atmosphere produced by the Mt. Pinatubo volcanic aerosols in 1991–92;
    - an overall increase of the net SW at TOA and the surface, but not in the atmosphere, from the 1980s to 1990s associated with a decrease in low-latitude cloud cover;
    - three (possibly four) decreases in net LW at the surface and increases in the atmosphere, but not at TOA; and
    - a small decrease of net LW at TOA and in the atmosphere and a larger increase of net LW at the surface occurring in the late 1990s.

  Many new satellite instruments have been or will soon be launched that sense clouds at a new set of wavelengths and/or employ novel measurement techniques. These will progressively be acquired and integrated in the ISCCP approach.

- **GEWEX Global Aerosol Climatology Project** (GACP): Extensive theoretical studies supported the development of a two-wavelength aerosol retrieval method to be applied to AVHRR radiances; subsequent validation studies confirmed that the uncertainty in the retrieved aerosol optical thickness is much reduced compared with a single-wavelength analysis. This new method was applied to the ISCCP cloud product covering 18 years (1983-2001).

- **Surface Radiation Budget** (SRB): The available data record now covers 1983-1995 (12 years) (various products with resolutions from 100 km, 3 hr to 100 km, monthly). Production will resume later this year to extend the record to 2002. Another radiative flux product has also been produced by the ISCCP team covering 1983-2001. Surface shortwave flux variations are consistent with cloud cover changes; surface longwave flux variations suggest significant "slow" exchanges of energy between the atmosphere and ocean.

- **Earth Radiation Budget** (ERB): Analyses of top-of-atmosphere radiative fluxes from Nimbus-7, the Earth Radiation Budget Experiment (ERBE), the Scanner for Radiation Budget (ScaRaB) and the Clouds and Earth's Radiant Energy System (CERES) now cover 23 years of data (1979-2002). They show not only features associated with ENSO events and the El Chichon and Mt. Pinatubo eruptions, but also inter-decadal changes that appear to be associated with changes in clouds found in the ISCCP data set and upper atmosphere water vapor found in the analysis of High resolution Infrared Radiation Sounder (HIRS) data.

- **Global Precipitation Climatology Project** (GPCP): There is now a 23-yr precipitation data record (pentad and monthly mean, 300 km) and a 5-yr record (daily, 100 km resolution); the development of a 3-hour product is being planned. TRMM data have provided a very useful input for the validation and improvement of algorithms. New developments are expected in microwave algorithms and procedures for using simultaneous data from several satellites; the elaboration of a “snowfall” product is being considered. There appears to be a notable decrease in global mean precipitation during the Pinatubo event but no other significant global variations. The issue of inter-annual variability and global change of precipitation will be further examined.

- **GEWEX Water Vapour Project** (GVAP): The NVAP pilot study produced a 11-yr water vapour record (daily, monthly at 100-km resolution) and a new 3-hourly data set is being undertaken. The NOAA operational sounder analysis provides a 300 km-daily record for the last 23 years. A validation of retrieval techniques has been achieved with ARM data. GVAP will continue to carry out comparisons of existing water vapour data sets, together with newer methods/data to come.

- **Baseline Surface Radiation Network** (BSRN): a comprehensive BSRN review took place in May 2002 in Regina (Canada). It confirmed the maturity of the project and its usefulness as a reference network for satellite-based observations and a validation data set for modelling activities. There are now over 35 active stations participating and sending their observations to the central archiving centre at ETH Zürich. Some sites have more than 10 years of data available, the average being of the order of 4 years. Specific working groups are co-ordinating their efforts in order to improve measurement capabilities and methodologies in most major research domains, namely diffuse and direct solar, as well as thermal, irradiance, albedo, aerosol optical depth, and observations in the UV and photosynthetically active part of the spectrum. The success of BSRN is widely recognised but relies upon the continuity of financial support to existing and prospective stations, as well as to the archiving centre.

4.3 Specific study projects and working groups

GRP has organised several specific study projects to examine particular problems and to foster work towards their solutions. The following activities are on-going:

- **ICRCCM-SW:** A study comparing available parameterisations for treating cloud variability effects on short wave scattering to full 3-D calculations has been published. Results show that treatments that represent small-scale variability as an "independent column approximation" and calculate fluxes for horizontally varying layers provide fairly accurate results. Information about and representations of the radiative transfer of ice clouds remains a significant problem. A test kit containing specifications of inputs and outputs from 3-D and other radiative transfer models is being prepared.

- **ICRCCM-LW:** After completing the clear case, a more extensive set of test cases is being prepared for a large range of water vapour abundance and cloudy sky intercomparisons of climate model calculations.

- **I3RC:** This study has shown that all of the various methods currently used to calculate 3-D radiation agree quite well. A test kit for checking new methods is on-line. A new working group is now being organized under the auspices of the International Radiation Commission to examine how radiation couples to the atmosphere (boundary layer dynamics) and the surface at the scales where the radiation is 3-D. The GRP endorsed this activity and highlighted the role that GCSS/GABLS/GLASS could play in this study. A survey of recent changes to global circulation model RT codes, to be published soon, showed that there has been rapid progress lately to improve the physical detail of these codes.

- **SeaFlux:** The on-line database of ship case studies now encompasses over 300 data months, along with a complete collection of collocated satellite products. Several comparison activities are underway: retrievals of skin SST and air temperature/humidity, turbulent surface flux formulations and global flux products. This group is also interacting with others including the GODAE-SST group to compare retrievals of sea surface winds, especially from scatterometers, and precipitation over oceans. A workshop takes place in February 2003 to review progress of the intercomparison projects.

A new working group, the Column Profiling WG, has been established to encourage cooperation among the several sites now producing long-term, if not continuous, atmospheric profile data-sets. The primary emphasis is on cloud profiling by radar and lidar, but efforts will be made to include and/or combine this with profiling of water vapour and winds where possible. The objectives are to discuss common issues, particularly regarding analysis methods, and to establish some common practices and data formats so that the rest of the research community can more easily use these data sets.

5. MODELLING AND PREDICTION

5.1 Overview

The GEWEX Modelling and Prediction Panel (GMPP) has the objective of developing and evaluating improved interactive model formulations of atmospheric and land-surface processes that regulate the global hydrological and energy cycle. During 2002, GMPP initiated its third major component, the GEWEX Atmospheric Boundary Layer Study (GABLS), which is directed by Prof. Bert Holtslag of Wageningen University in the Netherlands. In March 2002, GABLS held a very successful workshop at ECMWF. An additional meeting was held at Wageningen University in July 2002. These meetings refined the working plan, focussing on the stable boundary layer over land.

GCSS held a major workshop in May 2002, the GCSS-ARM Workshop on the Representation of Cloud Systems in Large-Scale Models, which was held in Kananaskis Village, Alberta, Canada, and involved all five GCSS Working Groups. The Workshop was well attended by the global modeling community, and included a special breakout session focused on global modeling issues.

Finally, GLASS is pursuing its series of off-line local intercomparison of land-surface schemes and is addressing the new approaches defined in its implementation plan, with a local-coupled study, the development of a global land-surface data set, the Global Soil Wetness Project (GSWP), and the initiation of a study of the role of land-surface on the variability of the climate system.

As it is now usual, GMPP met jointly with WGNE in November 2002 in Toulouse, reinforcing the links between "process" and "global circulation" modellers. One of the important issues was the larger involvement of GMPP in the evaluation of present AMIP experiments and in the planning of new ones.

5.2 GEWEX Cloud System Study (GCSS)

The goal of GCSS is to improve the parameterization of cloud systems in GCMs (global climate models) and NWP (numerical weather prediction) models through improved physical understanding of cloud system processes. The main tool of GCSS is the cloud-resolving model (CRM), which is a numerical model that resolves cloud-scale (and mesoscale) circulations in either two or three spatial dimensions. The large-eddy simulation (LES) model is closely related to the 3D CRM, but resolves the large turbulent eddies. The primary approach of GCSS is to use single-column models (SCMs), which contain the physics parameterizations of GCMs and NWP models, in conjunction with CRMs, LES models, and observations, to evaluate and improve cloud system parameterization.

GCSS is composed of five working groups, relating to boundary-layer cloud systems, cirrus cloud systems, extratropical layer cloud systems, precipitating convective cloud systems, polar cloud systems. C. Bretherton and P. Brown began serving as WG chairs during 2002, respectively for the boundary-layer and the cirrus groups.

The GCSS workshop held at Kananaskis in May 2002 reflected the increasing interest of the GCM community in GCSS activities and the increasing interaction of GCSS with the radiation, microphysics, aerosol, and cloud-remote sensing communities. The following scientific advances are expected in the GCSS WGs during the next several years:

- rapid progress on the representation of sub-grid scale cloud overlap and inhomogeniety due to the combination of CRMs, cloud radar observations, and faster methods of calculating radiative fluxes for arbitary cloud configurations;

- steady progress in the understanding and representation of cloud microphysical, formation, and dissipation processes due to integrated use of LES (large-eddy simulations) models, CRMs, SCMs, GCMs, and cloud-scale observations, plus insights from recent and upcoming field experiments; and

- use of super-parameterizations (i.e., CRMs used as parameterizations) in some GCMs will provide more physically realistic representations of cloud processes, to increase knowledge and understanding of interactions between cloud processes and large-scale processes (including cloud feedbacks), and to help improve conventional parameterizations.

5.3 GEWEX Global Land-Atmosphere Study (GLASS)

The GLASS project is progressing through the various actions which were defined in the implementation plan. Under PILPS (Project for Intercomparison of Land Surface Parameterization Schemes), a set of simulations at the local and regional level was finalised over the Rhône basin, a new local study including carbon fluxes was initiated over a forested land in the Netherlands, and a third off-line intercomparison of land surface models is starting for the first time in a semi-arid region (San Pedro catchment in the southwestern U.S.).

The Global Soil Wetness Project 2 (GSWP-2) will start in early 2003 and first results should be available by the end of the year. Its goals are to:

- Produce state-of-the-art global data sets of surface fluxes, of soil wetness and related hydrologic quantities.

- Develop and test large-scale validation, calibration, and assimilation techniques over land.

- Provide a large-scale validation and quality check of the ISLSCP data sets.

- Compare Land Surface Schemes and conduct sensitivity studies of specific parameterizations which should aid future model development.

A major product of GSWP-2 will be a multi-model land surface analysis for the ISLSCP II period.

In order to assess our knowledge on the role surface moisture and temperature states play in the evolution of weather and the generation of precipitation, a new study called GLACÉ will address the problem of the relative role of land-surfaces in the variability of the climate system. This will be based on a series of GCM experiments using coupled free and forced land-surface schemes.

5.4 GEWEX Atmospheric Boundary Layer Study (GABLS)

The objective of GABLS is to improve the representation of the atmospheric boundary layer in regional and large-scale models. The first focus of GABLS is on stable boundary layers (SBL) over land. Much of the warming predicted by climate models is during stable conditions over land (either in winter or at night), while at the same time the understanding and parameterization of the SBL is still very poor. GABLS aims to provide a platform in which scientists working on boundary layers at different scales will interact.

A GABLS workshop on Stable Boundary Layers was held at the European Center for Medium-Range Weather Forecasting (ECMWF) in Reading, UK, on March 25-27, 2002 with a balanced participation of process modellers, observation specialists and GCM modellers.

Three task groups were defined on the following topics: the analysis of existing observations, in order to provide data sets to validate LES results and to help scope out the parameterization problem, large eddy simulations to help guide and evaluate proposed parameterizations, and GCM studies to provide feedback on updated parameterizations.

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SCIENTIFIC STEERING GROUP
OF THE GLOBAL ENERGY AND WATER CYCLE EXPERIMENT (GEWEX -SSG)
FIFTEENTH SESSION, BANGKOK, THAILAND, 20-24 JANUARY 2003

Monday, 20 January 2003:

9.00 am: **OPENING CEREMONY**
(Chaired by Mr. R. Sawhney, Director
Environmental and Sustainable Development Division)

WELCOMING ADDRESSES BY:

Mr. Kim Hak Su, UNESCAP Executive Secretary
D. Carson
S. Sorooshian

9.45 am: **1. OVERVIEW OF ACTIVITIES AND PLANS**

1.1: Introductory remarks (D. Carson)
1.2: Chairman's report (S. Sorooshian)
1.3: International GEWEX Project Office report (P. Try)

10.30 am: **BREAK** (Breaks at mid-morning and afternoon will be 30 minutes)

11.00 am: **2. RELATION WITH SPACE AND CLIMATE RESEARCH FUNDING AGENCIES**

2.1: ESA (A.-E. Herland) includes report on ADM and WALES (U. Schumann)
2.2: NASA (J. Entin)

Unless specifically stated, oral presentations should be limited to 20 minutes in order to allow for discussions.

Monday, 20 January 2003: (Continued)

12.00 noon: **LUNCH** (Lunch will be taken for a nominal 1½ hour period)

1.30 pm: **2. RELATION WITH SPACE AND CLIMATE RESEARCH FUNDING AGENCIES - CONTINUED**

2.3: NOAA/US climate research initiative (R. Lawford)
2.4: NASDA (N. Shoichi)

2.45 pm: **Presentations by UNESCAP**

- Mr. Pak Sum Low
  Environmental and Sustainable Development Division
  "Update of Kyoto Convention"
- Mr. Il Chyun Kwak
  Environmental and Sustainable Development Division
  "Climate change activities"
- Mr. David Hastings
- Information, Communications and Space Technology Division

"Applications of Geographic Information Systems and Satellite Technology"

3.30 pm: **BREAK**

4.00 pm: **3. RELATIONS WITH PARTNER PROGRAMMES**

3.1: WGNE (K. Puri)
3.2: WWRP, THORPEX (T. Keenan)
3.3: IGOS Water Theme (R. Lawford)
3.4: ESSP/JWP/IGBP/ILEAPS (D. Carson/G. Sommeria/J. Polcher)

General discussion

6.00 pm: **WELCOME COCKTAIL RECEPTION BY UNESCAP**

Tuesday, 21 January 2003:

8.30 am: **4. ENERGY AND WATER CYCLE IN ASIA**

Deforestation and Its Consequences on the Environment in Thailand
(Professor N. Tangtham, Kasetsart University, Bangkok)
Rainmaking Activities Related to Atmospheric Study in Thailand
(Dr. W. Khantiyanan, Ministry of agriculture and cooperatives)

Tuesday, 21 January 2003: (Continued)

9.30 am: **5. GEWEX MODELLING AND PREDICTION PANEL (GMPP)**

Overall report and planning (J. Polcher)
Proposed contribution of AMIP to GMPP and GEWEX (J. Polcher)
GCSS activities, interactions between GCSS experiments and GCM modelling (S. Krueger)
GLASS activities (J. Polcher)
GSWP2, a key project of GLASS (T. Oki)
GABLS (J. Polcher)
Conclusions on advances of GMPP with respect to GEWEX Phase II objectives and actions needed from SSG

10.30 am: **BREAK**

11.00 am: **5. GMPP - CONTINUED**

12.00 noon: **LUNCH**

1.30 pm: **5. GMPP - CONTINUED**

2.30 pm: **6. GEWEX HYDROMETEOROLOGY PANEL (GHP)**

Status report: CSEs, ITP, WEBS, WRAP, transferability, data management, GRDC, GPCC, IAHS (R. Stewart)

Prospective aspects: data policy, new CSEs, carbon, isotopes, prediction, water resources, extremes, others (R. Stewart)

GAME science update (T. Yasunari)

Coupled modelling for MAGS (K. Szeto)

CATCH/AMMA (J. Polcher)

Water and Energy Budget Study (J. Roads)

Water Resources Applications Project (R. Lawford)

Status of ISLSCP (P. Try)

Status of "Prediction of Ungauged Basins" (PUB), IAHS initiative (K. Takeuchi)

Conclusions on advances of GHP with respect to GEWEX Phase II objectives and actions needed from SSG (J. Roads)

Action plan of new Chair (J. Roads)

3.30 pm: **BREAK**

Tuesday, 21 January 2003: (Continued)

4.00 pm: **6. GHP - CONTINUED**

6.30 pm: **ADJOURN**

Wednesday, 22 January 2003:

8.30 am: **7. CEOP STATUS REPORT**

Overview and main science issues (T. Koike)
Monsoon systems study (T. Yasunari)
CEOP data integration:

- Reference site data management/EOP-1 (S. Williams)
- Global hydrology reference sites
- Data integration overview (T. Koike)
- WESP report (J. Roads)

General discussion:

- Hydrological data/sites (E. Wood)

Conclusions on advances of CEOP with respect to GEWEX Phase II objectives and actions needed from SSG (T. Koike)

10.30 am: **BREAK**

11.00 **7. CEOP (Continued)**

12.00 noon: **AFTERNOON FREE/EXCURSION**

Thursday, 23 January 2002:

8.30 am: **FIRST EXECUTIVE SESSION**

IGPO management and budget, committee membership, general issues relevant to SSG. Reports from SSG members.

10.30 am: **BREAK**

Thursday, 23 January 2002: (Continued)

11.00 am: **8. GEWEX RADIATION PANEL (GRP)**

Status of projects (W. Rossow)
Organization of Working Group on Data Management and Analysis
LandFlux Activity
Report on Joint GRP/WGCM Workshop on Feedbacks Issues
Report on INCA project, aerosol impact on cirrus cloudiness (U. Schumann)
Use of ERA-40 (M. Miller)
Conclusions on advances of GRP with respect to GEWEX Phase II objectives and actions needed from SSG (W. Rossow)

12.00 noon: **LUNCH**

1.30 pm: **8. (GRP) (Continued)**

3.30 pm: **BREAK**

4.00 pm: **9. HORIZONTAL ACTIVITIES**

9.1: Interaction with other WCRP core projects (CliC, CLIVAR, SPARC) (B. Goodison, A. Busalacchi, W. Rossow)
9.2 Data Management (W. Rossow, S. Williams)
9.3: Satellite requirements (G. Sommeria, W. Rossow)

6.00-6.30 pm **Presentation by P. Webster: 25-day rainfall forecasts: a new green revolution?**

6.30 pm: **ADJOURN**

Friday, 24 January 2003:

8.30 am: **9. HORIZONTAL ACTIVITIES (Continued)**

9.4: Cross-cutting activities on precipitation, proposal for precipitation year (W. Rossow, P. Try)

9.30 am: **10. GENERAL GEWEX ORIENTATIONS:**

WCRP banner, possible global climate experiment, long-term GEWEX strategy

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10.30 am: **BREAK**

Friday, 24 January 2003: (Continued)

11:00 am: **SECOND EXECUTIVE SESSION:**

Report by SSG members, conclusions on advances of GEWEX Phase II, review of action items for each panel, finalization of SSG decisions, preparation of messages to JSC

12.00 noon: **LUNCH**

1.30 pm: **SECOND EXECUTIVE SESSION (Continued)**

4.00 pm: **ADJOURN**

APPENDIX C

LIST OF SCHEDULED MEETINGS

2003

9-11 Jan	IGOS Water Cycle Theme Workshop	Bethesda, MD, USA
20-25 Jan	15th Session of the GEWEX SSG	Bangkok, Thailand
9-13 Feb	83rd AMS Annual Meeting. Theme: Water Cycle Variability and Impacts	Long Beach, CA, USA
12-13 Feb	SEAFLUX Working Group Meeting	Long Beach, CA, USA
19 Feb	Briefing on HELP	National Academy of Sciences, Washington, DC
25-27 Feb	5th CLIVAR Asian-Australian Monsoon Panel Meeting	Georgia Institute of Technology, Atlanta, GA, USA
4-6 March	2nd International Workshop on Regional Climate Modeling for Monsoon Systems	IGCR (JAMSTEC), Yokohama, Japan
5-7 March	IGOS Water Cycle Theme Workshop	ESTEC, The Netherlands
11-13 March	GEWEX Workshop on Objective Analysis of Precipitation	ECMWF, Reading, UK
14 March	IGOS Water Cycle Theme Workshop at the Awaji Symposium and Workshops	Awaji Island, Japan
16-23 March	Third World Water Forum	Kyoto, Japan
17-21 March	24th session of the Joint Scientific Committee for WCRP	University of Reading, UK
19-21 March	CarboEurope Conference "The Continental Carbon Cycle"	Lisbon, Portugal
24-28 March	Conference on Monsoon Environments: Agricultural and Hydrological Impacts of Seasonal Variability and Climate Change	Trieste, Italy
31 March - 1 April	CEOP Reference Site Managers Meeting	Berlin, Germany
31 March - 3 April	International Symposium on Climate Change (ISCC)	Beijing, China
2-4 April	2nd CEOP International Implementation Planning Meeting	Berlin, Germany
6-11 April	EGS-AGU-EUG Joint Assembly	Nice, France
7-8 April	CEOP Workshop on the Role of the Himalayas and the Tibetan Plateau within the Asian Monsoon	Epson Meteo Centre, Milan, Italy
7-10 April	International Conference on Hydrology of the Mediterranean and Semi-Arid Regions	Montpellier, France

2003 (Continued)	GRP Working Group on Data Management and Analysis	NCDC, Asheville, NC, USA
12-16 May		
19-23 May	IAEA's 11th Isotope Hydrology Symposium	Vienna, Austria
28-31 May	International Congress on Water Resources and Environment	University of San Carlos, Cebu City, Philippines
3-6 June	Workshop on Improved Quantification of Global Carbon Cycle Fluxes	Sheffield, UK
17-18 June	MAGS Scientist-User Workshop	Edmonton, Alberta, Canada
19-24 June	Third IGBP Congress	Banff, Canada
24-26 June	3rd Global Precipitation Measurement Mission Workshop	ESA/ESTEC, The Netherlands
30 June - 11 July	Workshop on Isotope Tracers in Water Cycle Models at IAHS/IUGG	Sapporo, Japan
3-4 July	2nd WRAP Workshop on Water Resources Applications at the XXIII General Assembly of the IUGG	Sapporo, Japan
21-24 July	GAPP PIs Meeting	Seattle, WA, USA
25-27 Aug	GLASS Meeting	Tucson, AZ, USA
27-29 Aug	PILPS San Pedro-Sevilleta Experiment Workshop	Tucson, AZ, USA
15-19 Sept	International Conference on Earth System Modelling	Max Planck Institute for Meteorology, Hamburg, Germany
22-25 Sept	GABLS Workshop on Model Intercomparison and Future Direction	University of the Balearic Islands, Mallorca, Spain
22-26 Sept	9th Meeting of the GEWEX Hydrometeorology Panel	GKSS, Geesthacht, Germany
29 Sept - 1 Oct	Workshop on Hydrology from Space	Toulouse, France
29 Sept - 3 Oct	ILEAPS Open Science Conference	Helsinki, Finland
7-9 Oct	Global Water Systems Project Open Science Conference	Portsmouth, NH, USA
15-17 Oct	WCRP Satellite Working Group	Geneva, Switzerland
27-31 Oct	GCSS SSG Meeting and GCSS Working Groups 1, 3 and 4 Workshops	Broomfield, CO, USA
10-13 Nov	14th Session of the GEWEX Radiation Panel	Victoria, British Columbia, Canada

2003 (Continued)	19th session of the CAS/JSC WGNE/ 7th session of the GMPP	Salvador, Brazil
10-14 Nov		
11-14 Nov	ACSYS Final Science Conference	AARI, St. Petersburg, Russia
12-14 Nov	MAGS Annual Meeting #9	Montréal, Canada
13-14 Nov	Workshop on Problems with Clouds and 3 -D Radiative Transfer	Victoria, British Columbia, Canada
8-12 Dec	AGU 2003 Fall Meeting	San Francisco, CA, USA
2004		
10-15 Jan	84th AMS Annual Meeting	Seattle, WA, USA
26-30 Jan	16th Session of the GEWEX SSG	Marrakesh, Morocco
2-4 Feb	Workshop on Semi-Arid Regions	Marrakesh, Morocco
1-6 March	25th session of the WCRP Joint Scientific Committee	Moscow, Russian Federation
10-12 March	Third CEOP Implementation Planning Meeting	Irvine, CA, USA
26-30 April	European Geophysical Society (EGS) XXIX General Assembly	Nice, France
17-21 May	AGU 2004 Spring Meeting	Montréal, Canada
24-28 May	Fourth Study Conference on BALTEX	Island of Bornholm, Denmark
21-25 June	1st International CLIVAR Science Conference	Baltimore, MD, USA
1-6 Aug	3rd SPARC General Assembly 2004	Victoria, British Columbia, Canada
13-17 Dec	AGU Fall Meeting	San Francisco, CA, USA

APPENDIX D

PUBLICATIONS AND REPORTS 2002-2003

2002

Informal Reports

3/2002	Report of the 12th session of the GEWEX Radiation Panel (GRP) (Fort Collins, CO, USA, 12-14 November 2001)
10/2002	Report of the seventh session of the GEWEX Hydrometeorology Panel (GHP) (Paris, France, 6-7 September 2001)
12/2002	Report of Issues/Actions/Recommendations from the Coordinated Enhanced Observing Period (CEOP) Implementation Planning Kick-off Meeting (Tokyo, Japan, 6-8 March 2002)
18/2002	Report of the seventh session of the BSRN Science and Review Workshop (Regina, Canada, 28-31 May 2002)

2003

Informal Reports

1/2003	Report of the thirteenth session of the GEWEX Radiation Panel (GRP) (Zurich, Switzerland, 31 July-2 August 2002)
3/2003	Report of the eighth session of the GEWEX Hydrometeorology Panel (GHP) (Palisades, NY, USA, 10-12 September 2002)
4/2003	Report of the fourteenth session of the GEWEX Scientific Steering Group (Reading, UK, 28 January-1 February 2002)

APPENDIX E

SSG-15 SUMMARY REPORTS

Extracted from the February 2003 issue

of the GEWEX Newsletter

SSG-15 Members Provide Phase I Assessment And Phase II Direction

Soroosh Sorooshian
Chairman, GEWEX Scientific Steering Group

At the recent GEWEX SSG-15 meeting in Bangkok, Thailand, January 20-24, 2003, the SSG members were asked to provide a snapshot assessment based on background summaries and presentations provided during the week long meeting. While not a comprehensive, in-depth review, the broad background and senior level experience of the members was clearly sufficient to provide the guidance needed to develop appropriate mid-course corrections to our GEWEX Phase II implementation planning.

There was agreement that the overall objectives remain appropriate and necessary for guiding GEWEX, along with the science questions and implementing objectives modified by the WCRP Joint Scientific Committee (JSC) for Phase II; however, the members believed there was a need for some mid-course changes in the focus of our implementation planning. There was little disagreement with an initial assessment from the outgoing Director of the IGPO on how far along we have come in achieving the basic GEWEX objectives, but significant discussion followed and direction provided on how we continue on in implementing Phase II.

The initial subjective assessment indicated that we have made significant progress in Phase I in attaining nearly 20 years in global 1x1 daily degree data sets for the major variables; however, the lack of global analyses and perspective on the energy and water cycles and the need for improved accuracy in some parameter descriptions leaves us with an estimate of 60% for meeting our first objective of determining the global hydrological cycle and energy fluxes. The second objective of modelling the global hydrological cycle may be estimated to be only 40% achieved based on the good progress in achieving major upgrades to all regional and global model land surface parameterizations, but slow progress in providing adequate cloud and precipitation. It then follows that achieving the third objective for prediction of the hydrological cycles necessary for water resources use trails further at about 30% since precipitation prediction remains a major problem for both weather and climate models. We see a higher accomplishment estimate of 50% in the last objective of fostering new observational capabilities and assimilation techniques with the development of the new series of global satellite observations in clouds, aerosols, water vapor and precipitation arriving, but still having difficulties with the assimilation of the full set of data streams as they become available. This means that we have a strong need for continued focus on the GEWEX objectives and continuing to focus on the WCRP/JSC philosophy and direction that established and continues the GEWEX concept for achieving these overall objectives.

The SSG members followed up their assessments with recommendations for Phase II implementation planning. Central to these was the need to provide for more focus on global and combined analyses of the water and energy budgets, their coupling and representation in the global models. Also, while keeping our attention on the acquisition of the two types of data sets: a) global, long term sets for relationships and trends, as well as b) detailed sets of measurements that can be used to diagnose and compare to model processes, we must increasingly focus on the water cycle, particularly precipitation, which is probably our largest uncertainty in the feedback process. Connection between large scale forcing, cloud microphysics (aerosol), and resulting precipitation is not well enough specified and is critically needed. The development of a more structured “roadmap” to achieve our objectives was also recommended to assist in the implementation process for Phase II. See page 3 for further results from SSG meeting.

The participation and contributions of the GEWEX SSG members has been extremely helpful in guiding our planning and we are looking forward to continued assistance from all of our dedicated SSG members.

SUMMARY OF GEWEX SSG-15

Dawn Erlich
International GEWEX Project Office

The 15th Session of the GEWEX SSG was held on January 20-24 at the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) in Bangkok, Thailand. During the opening remarks, the economic and social value of the accurate prediction and modeling of the hydrological cycle was emphasized and the importance of GEWEX research towards accomplishing this task.

In his opening statement, Mr. Kim Hak-Su, Executive Secretary of UNESCAP, noted that by 2025 about 60% of the world population is expected to be living in water stressed countries. As the largest regional economic and social commission of the United Nations, with members extending from Europe to the Pacific, UNESCAP serves a region that represents some 60% of the world's population (3.8 billion) and 75% of the poor in the world. Mr. Hak-Su stressed the importance for policy makers of knowing how climate change scenarios will impact the regional hydrological cycle for the next 20, 50 and 100 years. For example, millions of Asians are displaced by monsoon flooding each year. Operational flood forecasting could alleviate this problem.

The following activities of the GEWEX Hydrometeorology, Radiation and Modelling and Prediction Panels were reviewed during the meeting.

In 2001 the Coordinated Enhanced Observing Period (CEOP) was confirmed as the first element of the Integrated Global Water Cycle Observations theme at the 8th session of the Integrated Global Observing System Partners (IGOS-P). This year, a series of workshops are being held to draft the report on this theme, of which GEWEX is a key contributor. It is hoped that this involvement by GEWEX will facilitate the development of new initiatives that could assist us in achieving our goals and provide GEWEX with an opportunity to "broadcast" its need for observational data, services and infrastructure.

The GEWEX Asian Monsoon Experiment (GAME) and the Mackenzie GEWEX Study (MAGS), both in their intensive analysis phases after earlier observational efforts, are producing results.

At a joint GEWEX-International Association of Hydrological Sciences (IAHS) Workshop on the Application of GEWEX Scientific Research to Water Resources Management, the participants noted that GEWEX goals are not well understood in the water resource community. Water managers see the integration of hydrological and climate models by GEWEX as most applicable to their needs. The SSG agreed that the guidance and objectives of Water Resources Application Project (WRAP) should be revised to provide broader interactions with the hydrology community. These interactions would include: further development of a joint project with IAHS such as the Decade of Prediction in Ungaged Basins (PUB); a "catalog" of applications type projects that are related to the Continental Scale Experiments (CSEs), and re-emphasizing mountain area activities that may cross-cut with the precipitation activities throughout GEWEX.

Couplage de l'Atmosphère Tropicale et du Cycle Hydrologique (CATCH) activities have been folded into the African Monsoon Multidisciplinary Analysis (AMMA), which is becoming a major international effort focusing on the African monsoon. The SSG agreed that AMMA may assume the status from CATCH as a GEWEX Hydrometeorology Panel (GHP) "affiliated" project and is encouraged to continue along its path to develop into a more complete CSE type experiment.

The SSG recognized the growing importance of isotope studies to better characterize continental scale water balance and encouraged the GHP to consider forming a new working group on the use of isotopic data to assist in determining the water cycle variability.

The comparison of the Tropical Rainfall Measuring Mission (TRMM) precipitation estimates with the Global Precipitation Climatology Project (GPCP) data is becoming the baseline for both incorporating TRMM data into the GPCP product and extending the understanding provided by TRMM back for 20 plus years (GEWEX News, November 2002).

The International Satellite Cloud Climatology Project (ISCCP) has produced an 18-year global radiative flux data product, which provides consistent surface and top-of-atmosphere (TOA) radiative fluxes by showing the global monthly mean net shortwave and net longwave anomalies at the surface, in the atmosphere and at the TOA over the whole time period (GEWEX News, November 2002). In 2003 the review of Global Circulation Model (GCM) radiative transfer code features and metrics for testing clouds and radiation in GCMs will be completed and a workshop on polar clouds and precipitation will be organized jointly with the Climate and Cryosphere (CliC) Study.

Scientific advances by the GEWEX Cloud System Study (GCSS) working groups that are expected during the next several years include rapid progress on the representation of sub-grid scale cloud overlap and inhomogeneity due to the combination of Cloud Resolving Models (CRMs), cloud radar observations, and faster methods of calculating radiative fluxes for arbitrary cloud configurations; and progress in the understanding and representation of cloud microphysical, formation, and dissipation processes due to integrated use of Large-Eddy Simulations (LES) models, CRMs, Single Column Models (SCMs), GCMs, and cloud-scale observations, plus insights from recent and upcoming field experiments.

Under the Global Land-Atmosphere System Study (GLASS), the Rhone-AGGregation experiment was successfully completed this year. This experiment was an intermediate step leading up to the next phase of the Global Soil Wetness Project Phase (GSWP) II for which there will be a broader investigation of the aggregation between global scales (GSWP-1) and the river scales.

In March 2002, the GEWEX Atmospheric Boundary Layer (GABLS) held a very successful workshop at the European Centre for Medium-range Forecasting. An additional meeting was held at Wageningen University in July 2002. The outcome of these meetings is that the initial focus of GABLS is the stable boundary layer over land.

The SSG acknowledged the importance of cross-cutting activities and encouraged the establishment of the following two activities across the GEWEX Radiation Panel (GRP), the GEWEX Modeling and Prediction Panel (GCSS and GSWP) and GHP:

(1) Precipitation – address critical issues in reducing errors in retrievals and representations of global precipitation (including solid precipitation), and improve model precipitation process representations to improve climate and weather model predictions of precipitation.

(2) Global Water Cycle and Energy Budget (G-WEBS) Estimations – provide a structured process for determining the variations and changes in the global energy and water cycles (to estimate our ability to meet this first objective for GEWEX) and to determine our ability to close the energy and water budgets on various scales.

THE ROLE OF GEWEX STUDIES IN ENVIRONMENTAL POLICY DECISIONS

Mr. Kim Hak-Su

Executive Secretary, United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP)

The following text was excerpted from the opening statement given by Mr. Kim Hak-Su at the Fifteen Session of the GEWEX Scientific Steering Group .

Climate change is very much on the top of the global political agenda these days, as reflected by the intensive on-going international negotiations of the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol. Science is the basis for the political agreements of the UNFCCC and the Kyoto Protocol. Based on the Third Assessment Report (2001) of the Intergovernmental Panel on Climate Change (IPCC) we know that: the Earth's surface temperature is projected to increase 1.4 to 5.8°C by the end of this century and sea level is projected to rise by 9 to 88 cm; precipitation patterns have changed and are projected to change further spatially and temporally; extreme weather events are projected to increase; and the frequency, persistence and magnitude of El Niño events have increased in the last 20 years and this trend is projected to continue.

I am sure that there are many scientific uncertainties in the IPCC Assessment that need to be further reduced. Nevertheless, it seems that climate change will bring more adverse than beneficial impacts on our ecological and socio-economic systems. Developing and least-developed countries are expected to suffer the most because of their limited capability to adapt to climate change.

The research of the World Climate Research Programme (WCRP), including GEWEX, has been most valuable for the IPCC Assessment. Your studies of atmospheric and thermodynamic processes that determine the global hydrological cycle and water budget, and their response to global changes, such as the increase in greenhouse gases, are very important to our scientific understanding in climate variability and climate change. Of particular interest to UNESCAP, are the results of the GEWEX Asian Monsoon Experiment (GAME).

As the largest regional economic and social commission of the United Nations, we are particularly interested in finding the socio-economic impacts of climate variability and climate change for our region and subregions. For example, it is noted that by 2025 about 60% of the world population is expected to be living in water-stressed countries. What will be the implications for the availability of water resources in the Asia-Pacific region and its associated impacts on other socio-economic sectors, such as agriculture, forestry, industry, human health and biodiversity? This means that we would need the further refinement of General Circulation Models and the development of Regional Circulation Models that are capable of simulating weather events that give rise to floods and hydrological droughts, as well as the future improvement of regional integrated assessment models. Clearly, more reliable predictions of extreme climatic events would have enormous socio-economic benefits.

The above mentioned activities fall within the mandates of GEWEX, which within the framework of WCRP, are to observe and model the hydrologic cycle and energy fluxes in the atmosphere and at the land and ocean surface. GEWEX is an integrated program of research, observations, and science activities ultimately leading to the prediction of global and regional climate change.

I hope that WCRP, including GEWEX, together with other international research programs will provide us with a comprehensive regional assessment. I believe that UNESCAP will be in a better position to assist our member states in formulating relevant socio-economic policies in response to climate variability and climate change based on the results of your scientific research.

SUMMARY REPORTS

ON GEWEX PRESENTATIONS TO JSC

Extracted from the May 2003 issue

of the GEWEX Newsletter

GEWEX Support Reaffirmed at Recent WCRP/JSC Meeting

Soroosh Sorooshian
Chairman, GEWEX Scientific Steering Group

At the March 2003 meeting of the WCRP Joint Scientific Committee (JSC) in Reading, UK, we presented the results from the January GEWEX SSG review and assessment of recent GEWEX accomplishments, along with the plans for our ongoing and new initiatives. GEWEX received strong support from the JSC, as well as guidance for future activities.

I was joined by Bob Schiffer, Jan Polcher and John Roads in making the GEWEX presentation. We also participated in the JSC discussions concerning a proposed "Banner" activity of the WCRP for the next 10-20 years to focus the aims and objectives of the WCRP. The central theme would address "to what extent climate can be predicted" and build up to a Global Climate and Weather Experiment beginning around 2010.

While a summary of the meeting appears on Page 3, let me mention here some of the JSC comments and recommendations.

a) In view of the importance of the key GEWEX observationally based global data sets, the plans for analyzing the internal consistency and providing comparisons with reanalyses were considered most important.

b) Considering the new series of Earth observation satellites, the JSC recommended that GEWEX work with the Space Agencies to develop a plan for cross-calibration of new experimental sensors and the intercomparison of derived products.

c) As a follow-up to the Workshop on Climate System Feedbacks organized jointly by the GEWEX Radiation Panel (GRP) and the JSC/CLIVAR Working Group on Coupled Models in November 2002, the JSC recommended that GRP continue its efforts and provide a status report on plans for making progress on cloud-radiation feedback.

d) Recognizing the need for model validation against precipitation, the JSC recommended that GEWEX take measures to ensure that its expertise on the water cycle be taken into account by the Intergovernmental Panel on Climate Change in planning for its next report.

e) The JSC recommended support for the involvement of GEWEX in the Atmospheric Model Intercomparison Project and the Global Land-Atmosphere Coupling Experiment (co-sponsored by the GEWEX/Global Land/Atmosphere System Study and the CLIVAR/Working Group on Seasonal-to-Interannual Prediction) projects designed to assess the importance of land surface fluxes in climate simulations.

f) In response to the needs of the climate modelers, the JSC encouraged support for extending the International Satellite Land-Surface Climatology Project towards producing a 25-year data set for determining boundary conditions for seasonal prediction and longer climate runs.

g) The new WCRP Satellite Working Group, strongly supported by GEWEX, recommended: (1) final approval of the new space missions under study, focusing on the water cycle and cloud radiative processes and on ocean salinity and soil moisture; (2) increased resources for a more effective exploitation of current and planned satellite observations; and (3) a reinforcement of the interaction between WCRP and space agencies. The JSC endorsed these recommendations of the working group which should, during 2003, extend its consultations and propose a general strategy for the development, benchmarking and use of climate research products.

h) Considering the importance of the science understanding of the physical water cycle in the analysis of broader global water issues, the JSC supported the WCRP participation in the joint International Human Dimensions Programme, WCRP, International Geosphere-Biosphere Program and Diversitas Global Water System Project (GWSP) to ensure that GEWEX expertise and achievements are taken into account. The GEWEX Hydrometeorology Panel (GHP) Water Resource Applications Panel (WRAP) will have increasing involvement in the GWSP.

i) The JSC endorsed GEWEX plans to coordinate studies with the Stratospheric Processes and their Role in Climate (SPARC) Project on tropospheric chemistry and aerosols of importance to radiative forcing.

As you can see, GEWEX activities and interests span a wide range of the energy and water cycle initiatives cross-cutting many disciplines and organizations. This is often the most challenging area for our project and we sincerely appreciate the understanding and strong support we receive from many of the participating scientists in assisting in the broad international coordination of the wide-ranging GEWEX and WCRP initiatives. Keeping in mind, that as we improve our understanding and make significant advances in our ability to observe, model and predict the Earth system, we must continue and find new ways to address these complex interdisciplinary relationships that drive our environment.

GEWEX PROGRESS REPORTED TO WCRP JOINT SCIENTIFIC COMMITTEE

Robert Schiffer
Director, International GEWEX Project Office

The January 2003 meeting of the GEWEX Scientific Steering Group (SSG) in Bangkok, Thailand, provided the opportunity to review and assess recent GEWEX accomplishments and examine the plans for continuing support of ongoing and new initiatives. This review and assessment was presented to the JSC in March 2003.

GEWEX presentations at the JSC were made by Soroosh Sorooshian, Robert Schiffer, Jan Polcher, and John Roads on GEWEX accomplishments, plans, and institutional arrangements. In addition, Gilles Sommeria, WCRP, reported on the conclusions of a satellite working group, several of which are relevant to GEWEX activities. A more complete report on the presentations can be found at www.gewex.org/reports.htm.

Soroosh Sorooshian presented the SSG's assessment of Phase I, their review of the recently completed first year of Phase II, and their guidance for continuing Phase II activities. GEWEX milestones for 2002 included: (1) The beginning of the build-up phase for the Coordinated Enhanced Observing Period (CEOP), with the joint commitments of the Continental-Scale Experiments (CSEs), the space agencies and the global modeling community; (2) advances in closing regional water budgets; (3) the reorganization of global data sets under a common umbrella; and (4) the start of new modeling activities in close coordination with the GCM community.

Key overarching SSG recommendations included: (1) completion of a review paper highlighting achievements of GEWEX Phase I and the development of a "roadmap" of activities focused on meeting the objectives of GEWEX Phase II; (2) development of cross-cutting activities relating to precipitation measurement and modeling, and data management; and (3) assisting the space agencies in planning for cross-calibration of new experimental sensors and intercomparison of derived products.

Robert Schiffer outlined the organizational structure of GEWEX, emphasizing the new cross-cutting activities that place emphasis on completing the key global data sets, and improving the understanding of precipitation processes for prediction. The JSC questioned plans for verifying the internal consistency of GEWEX global data sets and in particular, the potential role of reanalysis. He then reported on GEWEX Radiation Panel (GRP) matters on behalf of William Rossow. The JSC was reminded that the sensitivity of climate depends mainly on couplings and feedbacks operating in the water and energy cycles, particularly those involving clouds, water vapor and snow/ice albedo. Resolving inconsistencies in relating the top of the atmosphere radiative fluxes with the precipitation record thus requires an improved description of surface fluxes. The main points made were: (1) The climate feedback issue is broader than the aspect addressed by the GRP and needs the attention of the entire WCRP community. GRP plans to define and apply a "standard" set of statistical and diagnostic analyses to all GEWEX global data products, to characterize the variability of all the measured quantities in one common manner as a prelude to a joint analysis. (2) Attention needs to be focused on the transitioning of key research observations into an operational long-term observing system; specifically, GEWEX was encouraged to work with Global Climate Observing System (GCOS) to ensure continuity of support for the Baseline Surface Radiation Network (BSRN) and its transition towards an operational system. (3) There is a concern that there is a general lack of plans to cross-calibrate new experimental sensors on TERRA, AQUA, ENVISAT, and ADEOS-2, and cross-compare data products. (4) A need exists for data management groups (or points of contact) within the Climate Variability and Predictability (CLIVAR) Programme and the Climate and Cryosphere (CliC) Project to collaborate with GRP satellite data projects for exchange of data sets and for conducting joint studies. Finally, GRP plans include a joint activity with the Stratospheric Processes and their Role in Climate (SPARC) Project on aerosols (Pinatubo), upper atmosphere water vapor and radiation, as well as proposing a joint workshop on polar clouds and precipitation with CliC.

Jan Polcher provided an update of activities of the GEWEX Modeling and Prediction Panel (GMPP). The goal of GMPP is to develop and validate models used to represent the water and energy exchange processes in the atmosphere and on continents. There is no closed theory of these processes at the macroscopic scale, although they are well understood at the microscopic scale. As a result, GMPP has had to deal with conceptual models (parameterizations). This research is coordinated through the GEWEX Cloud System Study (GCSS), the Global Land/Atmosphere Study (GLASS), and the GEWEX Atmospheric

Boundary Layer Study (GABLS). GMPP will have achieved success if it leads to an improved representation of the water cycle in global models through better understanding of the interactions between the surface, the Planetary Boundary Layer (PBL) and the clouds. For example, Jan Polcher highlighted the cross-cutting Global Soil Wetness Project (GSWP-2), a multi-model investigation into the variability and predictability of the global water and energy cycles, intended to produce a model-based estimate of the global continental water fluxes with estimates for the errors linked to the modeling and the forcing fields. The major product of GSWP-2 will be a multi-model land-surface analysis for the International Satellite Land-Surface Climatology Project (ISLSCP) Initiative II period (1987–1995). For 2003, the GCSS will emphasize studies of tropical convection with a focus on the diurnal cycle. GLASS will examine the intensity of surface/atmosphere coupling in coupled models (GLACE) and continue the evaluation of the Project for Intercomparison of Land-Surface Schemes (PILPS). GABLS will focus on an arctic case. This will lead to a better understanding of the interactions between the land-surface, the PBL and clouds. The diurnal cycle was adopted as a theme for all GMPP elements.

John Roads reported on the accomplishments and research plans of the GEWEX Hydrometeorology Panel (GHP) and its components. The GHP represents the largest group of researchers working on GEWEX related activities, focused mainly upon GEWEX studies in the six individual Continental Scale Experiment (CSE) regions: the Baltic Sea Experiment (BALTEX), the GEWEX Asian Monsoon Experiment (GAME), the GEWEX Americas Prediction Project (GAPP), the Large-Scale Biosphere-Atmosphere Experiment in Amazonia (LBA), the Mackenzie GEWEX Study (MAGS), the Murray-Darling Basin water budget project (MDB), and developing experiments in Africa (AMMA/CATCH) and South America (La Plata River Basin). The GHP also includes the ISLSCP effort, which is being used to drive the GMPP and GSWP models, and the Global Runoff Data Centre (GRDC), which provides an archive of global streamflow. Now that the CSEs and various GEWEX efforts are maturing, it is finally becoming more feasible to begin to develop more global cross-cutting activities. For example, the GHP Water and Energy Budget Studies (WEBS) addresses one of the major objectives of the CSEs, namely, to study the accuracy to which continental-scale water and energy budgets can be characterized and closed. WEBS has begun in all of the individual CSEs and plans are now underway to develop a GHP WEBS synthesis, which could provide a transition to more focused CEOP Water and Energy Simulations Prediction (WESP) activities described below.

The associated WESP element of CEOP is conducting a pilot 3.5 year synoptic climatological case study of regional and global water and energy budgets as a guide to the interpretation of longer term past and future analysis and observations. Starting with the current efforts to close simplified vertically integrated water and energy budgets with observations and models within the GHP WEBS activity, CEOP will begin to focus more on the global scale, including its vertical and diurnal land-atmosphere-ocean hydroclimatological characteristics. A brief report was presented on the Global Water System Project (GWSP) on behalf of Charles Vorosmarty and Dennis Lettenmaier and on the GHP Water Resources Application Project (WRAP) as well.

Gilles Sommeria summarized the conclusions of the WCRP Satellite Working Group set up during 2002 in order to update space mission requirements for WCRP, a large part of them emanating from the GEWEX community. The working group recommended that joint efforts of space agencies and research organizations should be made to integrate separate sensor/satellite data into high-quality, globally integrated climate products, building upon the experience acquired through GEWEX global data sets.

In summary, the JSC provided a timely opportunity to showcase recent GEWEX accomplishments and plans, which were favorably received. The Commentary on Page 2 summarizes the specific resulting JSC recommendations.

REPORTS FROM SPECIFIC GEWEX PROJECTS

African Monsoon Multidisciplinary Analysis (AMMA)/ Couplage de l'Atmosphère Tropicale et du Cycle Hydrologique (CATCH)

Thierry Lebel, LTHE

1. Current Status

AMMA is a multidisciplinary and international project born in 2001, building on projects such as CATCH (GEWEX CSA), WAMP (West African Monsoon Project, a European modelling project), and other ongoing observing systems (IDAF, AERONET-PHOTONS) or global studies of the coupling between land surfaces and the atmosphere in West Africa (IMPETUS). The project aims at a global study of the West African Monsoon in order to:

i) improve our understanding of the coupling between the atmosphere, the land surface and the ocean over a spectrum of scales ranging from regional down to local,
ii) evaluate the impact of the variability of this climate system on the water resources, food sustainability and health of one of the most vulnerable region on earth,
iii) improve the predictive capability of dynamical models, especially for seasonal rainfall prediction and for the production of hydro-climatic scenarios for this century,
iv) provide an array of adequate in situ measurements for satellite validation and,
v) strengthen the partnership between African, American and European scientists.

AMMA is built around four main components: observing system, modelling activities, satellite component, training program.

The observations started in 2001 by organising a Long term Observing Period (LOP) due to last for 10 years. This LOP pulls together the measurements carried out in already existing projects such as CATCH, IDAF, IMPETUS and AERONET-PHOTONS. The LOP will also be associated with the collection of operational data by national services. Even though the LOP is interested in monitoring the variability of the monsoon system over the whole of West Africa, its main activities are concentrated on a window spanning the South-to-North climatic transect that is a major characteristic of the region (see Figure on last page). The observing system will evolve into an Enhanced Observing Period setup (EOP) in 2004, due to last for 3 years (2004-2006). A Special Observing Period will be organised in 2005.

Currently the main effort is on organising the EOP and the related modelling and satellite activities. One major issue in this respect is to secure the operation of the existing radio sounding network over West Africa and, possibly, to reinforce it where needed, especially around the LOP window.

2. Last year's significant accomplishments

Since West-Africa was recognized as a region of interest by the GHP when it granted CATCH a CSA status at its 5th session in Hamburg (1999), a major accomplishment of the scientific community involved in climate and environmental research in this region of the world was its ability to build an internationally coordinated effort in order to promote a global study of the West African monsoon system.

The science rationale and major scientific questions motivating such an effort were exposed in detail in a white book published in 2001. An International Science Plan is presently being written where the articulation between the scientific rationale, the observation and modelling strategies and the application component of the program will be detailed.

To foster the collaboration between African, American and European scientists a series of meeting were organised in West Africa (Niamey, February 2002) and in the US (Boulder, November 2001 and Baltimore, November 2002). This led to establish a network of African scientists involved in AMMA (AMMA_Net) and an US AMMA committee.

Expanding from pre-existing projects, a multi-scale observing system was built. The initial CATCH window (6°N-15°N ; 0°-5°E) was enlarged to include driest regions to the North of 15°N and different eco-systems to the West (see Figure). Three main mesoscale sites are now composing the backbone of a dense network of observations aiming at documenting simultaneously:

- the intraseasonal to interannual variability of the continental water cycle;
- the intraseasonal to interannual variability of the vegetation for various eco-systems;
- the associated variability of the carbon and nitrogen cycles;
- the associated atmospheric conditions, especially the life cycle of the convective systems that generate most of the rainfall over the region.

Each mesoscale site is organised around a super-site (Hombori, Mali, 15.2°N; Banizoumbou, Niger, 13.5°N; Djougou, Bénin, 9.7°N) that could evolve into a CEOP-standard supersite during the 2005 SOP and the following 2006 EOP year.

The upper Ouémé catchment (14200 km²) in Bénin remains the target site for studying/quantifying the coupling between the continental and the atmospheric water cycles. In 2002 a sub-catchment (Donga, 600 km²) was densely equipped with recording raingauges (14), streamflow gauging stations (5) and aquifer level gauging stations (6), as well a with an automatic meteorological station. The Donga catchment will serve as a test bed for continental water balance studies.

Another major step of the last two years was to include in the project a strong atmospheric chemistry component. The IDAF observations will become fully coordinated with the CATCH observations in 2003, especially on the three super-sites listed above. This will provide a unique opportunity to study the interactions between the water, carbon and nitrogen cycles at the meso to the regional scales.

Last but not least, a strong application and training program is currently being developed within AMMA. Links with water resources, agriculture and health communities are built and a training program directed towards young African scientists will start in 2003.

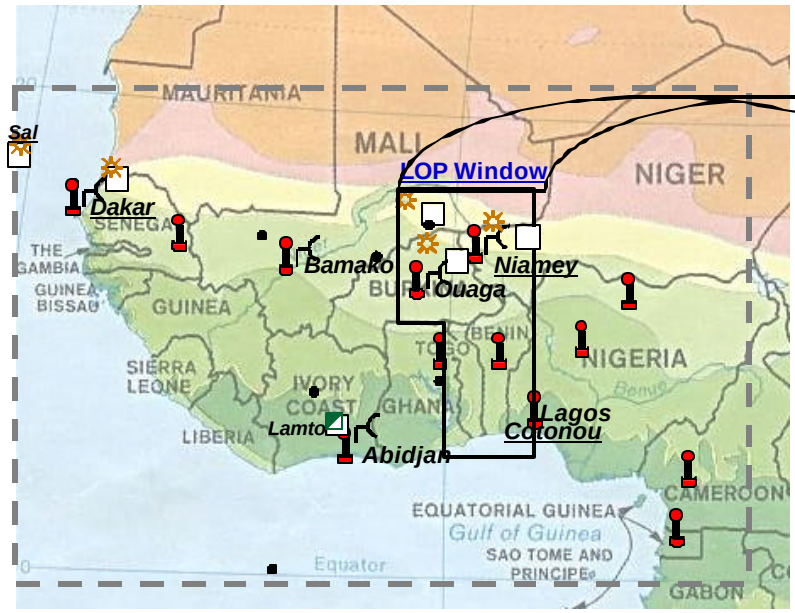
3. Planned accomplishments for next year

While various research groups will continue their diagnostic and modelling studies throughout 2003, the main objectives for next year will be to:

- homogenise the observations carried out on the three mesoscale sites;
- prepare the radio sounding network that will be used during the EOP;
- start the development of a data base of spatial fields derived from the combination of various satellite products;
- organise a summer training school for the young African scientists;
- secure the funding necessary for the SOP in 2005;
- publish the AMMA ISP.

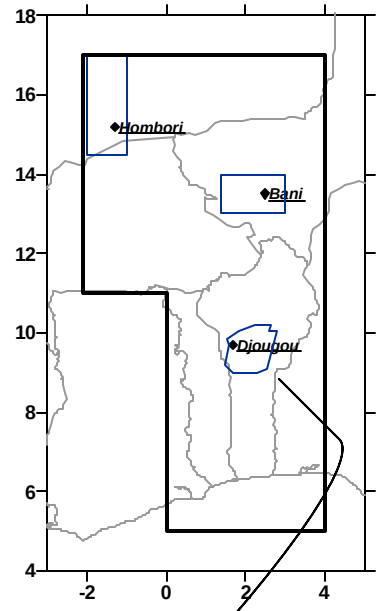
4. AMMA issues to be considered at the GEWEX SSG meeting

One major issue for AMMA is to obtain an official WCRP/WMO label that will help in obtaining the support of national meteorological services and international agencies (funding agencies, space agencies, etc.) This support is needed for maintaining and upgrading the radio-sounding network as well as for getting access to satellite data at a reasonable cost. Since AMMA is a project supported by CLIVAR (though its African Panel, VACS) and GEWEX (though the GHP), it is asked that both the GEWEX SSG and the CLIVAR SSG recommend WCRP to provide an official label to AMMA. Also it is important that WCRP helps the AMMA community in dealing in a coordinated and rationale way with the various WMO services that can help with the observing and training programs of AMMA.



Radio-sounding Weather Radar

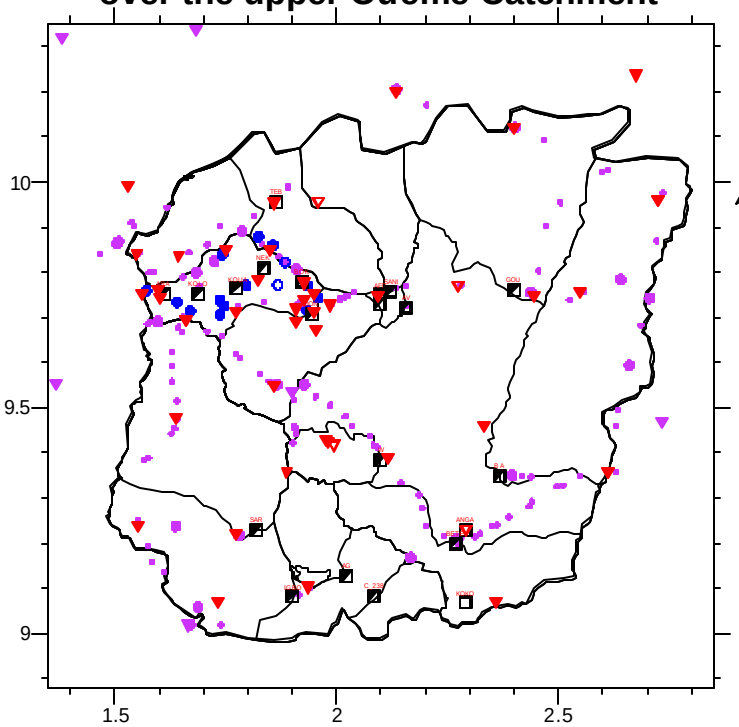
Photometer *Niamey* Aircraft operations



: mesoscale AMMA sites

◆ *Bani* : super-sites

The AMMA- CATCH observing system over the upper Ouémé Catchment



	2002	not operating in 2002
- Raingauge		
recording	▼	▽
daily reading	▼	
- Streamflow	◪	□
- Aquifer		
recording	●	○
daily reading	⬢	
annual reading	▪	
Watershed Boundary		

0 10 20 30 40 50 km

Carte mise à jour le / / par S. Galle
sur fond de carte IGNBénin, , /

Report on GEWEX Baseline Surface Radiation Network (BSRN) Activities

Ellsworth G. Dutton, BSRN International Project Manager
19 December 2002

I. Background and Status

The BSRN was established to provide the best possible surface-based broadband solar and thermal irradiance observations for climate research applications. These applications include general circulation model comparisons, satellite algorithm development and validation, detailed radiative transfer computational comparisons, local and regional radiation climatology definition, and investigation of land surface radiative interactions. Prior to the establishment of BSRN, substantial deficiencies existed in available surface irradiance data. Those deficiencies were addressed by BSRN and included the lack of surface-based atmospheric radiation measurements in specific regions, the quality of measurements that were being made, the representativeness and completeness of the data for climate applications, and the lack of coordination for international measurement reference standards and specifications.

Currently, BSRN consists of more than 35 functioning field sites independently funded by host countries, a group of about 40 active radiation scientists from 19 countries, a central data archive in Zurich contributed by the Swiss government, NOAA and NASA supported project management, and a representative from WCRP/GEWEX Joint Planning Staff. Many of the involved scientists are considered leading experts and are responsible for the acquisition of data at field sites that fulfil the requirements of the BSRN. Through efforts of BSRN, the measurement uncertainties in primary field quantities have been reduced to the level necessary for many of the intended areas of application. The BSRN data have been used in many model and satellite comparisons in which the surface-based data provide accurate and independent information on fundamental climatic forcing and response quantities. Additional projects within BSRN include establishment of international consensus reference standards for thermal infrared and diffuse solar irradiance, adding field sites in under-represented regions, streamlining data ingestion and screening at the archive, and extension of the measurements to include ancillary quantities which contribute to model interpretation of the observed irradiance data. All participants continue to identify funding sources to keep their project viable.

In addition to providing valuable and reliable observational data, the BSRN organization has become a focal point for the surface irradiance measurement community by providing a highly desirable forum and stimulus for ongoing measurement development and improvement. The BSRN participants have inspired and pursued significant advances in instrumentation and measurement strategies that specifically relate to the applicability of the acquired data to climate research needs. The BSRN works with the WMO through the WCRP Joint Planning Staff on administrative and mutual organizational needs and has close contact with the major international commercial instrument manufacturers. BSRN is directly responsible to the GEWEX Radiation Panel and is considered by many as an outstanding example of a WCRP project that is highly accomplished in field measurement capability.

II. Last Year's Significant Accomplishments

- A subset of BSRN data and the research of several BSRN participants continue to contribute to ongoing efforts to close the comparison between measured surface irradiance and theoretical model calculations. Further definition of the requirements for atmospheric inputs to the model calculations has been highlighted by the comparisons, as well as the impact of improved irradiance measurements in radiative transfer parameterizations.

- Work has continued on the development of international measurement reference standards that have not previously been perpetuated in the radiation or climate communities. Analysis and publication of the results of multiple related projects, involving both solar diffuse and total thermal infrared, were completed.

- Four additional field sites have begun submitting data to the BSRN archive. Emphasis in the past few years has been on acquiring new sites in under-represented climatological regions. Additional sites in similarly identified regions are still being recruited by the project. Other stations in more populous regions continue to seek endorsed participation in BSRN because of the status that BSRN has obtained.

- The BSRN Data Archive has, in response to user's requests, revised a portion of its operation to provide data in more versatile formats and including additional supporting data that had not previously been readily available via the network access. Initial steps to insure the longevity of the archive beyond the typical international science research project lifetimes have begun with the hopes that a stable, nationally-sponsored archive will emerge as has with a few other long-term measurement programs, e.g., ozone with a World Archive in Canada.

- A major accomplishment, and for every year with a project like BSRN, is the sustained observational activities where nearly 35 station-years of new surface irradiance data were acquired and are progressing to the archive.

- BSRN activities have been further integrated with those of other organizations where a mutual interests and benefits exist, such as the US/NASA AERONET and US/DOE ARM programs. Related cooperative programs exist a several of the BSRN sites.

- The bi-annual general meeting of the BSRN was organized and held in Regina Canada where the status of the network and related endeavors were discussed and evaluated with needed enhancements and modifications to procedures, plans, and goals were identified.

III. Summary of Significant Accomplishments since Project Inception (in approximate chronological order, oldest first)

- An evaluation of the state-of-the-art of routine surface irradiance observations and a statement of current and achievable measurement accuracies was carried out.

- The network was organized and institutional commitments from a core group of international experts to purse the long-term goals of the project were obtained.

- A strong alliance between the BSRN and the WMO World Radiation Center (WRC) in Davos, Switzerland, was established and is maintained today. Many intellectual contributions to development and maintenance of BSRN have come from WRC.

- An extensive and valuable operations manual detailing the specifications for basic measurement practices of the network was produced and widely distributed.

- Sustained network data collection and archival was initiated.

- The network grew from the original nine field sites that reported data in the first year (1992), passing the original target number of sites (17 or 18) to the current number of reporting sites (35) with at least 5 additional prospective sites in the system. (The expansion of the number of sites beyond the original number was primarily in response to the scientific need for greater diversity in climatological and regional representativeness of the network.)

- BSRN has provided measurement specifications and guidelines to other projects, GEWEX [BALTEX, GAME, and GAPP (formerly GCIP?)] and non-GEWEX projects (ARM, NREL, SURFRAD, CMDL, CERES and various other national and regional programs.)

- Data from BSRN were successfully used by GEWEX and other groups for the purposes originally intended, including; 1) verification of the Surface Radiation Budget (SRB) project's satellite derived surface radiation quantities, 2) comparisons between complete and parameterized radiative transfer calculations, 3) operational use by the European Centre's (ECMWF) general circulation model to evaluate modifications and overall capabilities, 4) comparison to the radiative quantities generated by the NOAA Geophysical Fluid Dynamics Laboratory's GCM, and 5) the initiation of local and regional surface radiation climatological records which will have many potential applications.

- A complete set of observational and data processing specifications for adding aerosol optical depth measurements to the BSRN project were developed.

- Extensive calibration and instrument intercomparisons were completed for the purpose of refined evaluation of measurement accuracies, promotion of further instrument development, and to progress towards eventual acceptance of an international consensus measurement reference standards for diffuse solar and infrared irradiance.

- The uncertainties in field measurements have been reduced as the BSRN program, in cooperation with other groups have been reduced by the systematic pursuit and development of field reference standards.

- Numerous refereed publications and reports have resulted form the developing and mature BSRN with a summary list given at http://bsrn.ethz.ch/ under "Publications".

IV. Expected Accomplishment for Coming Year

- The capacity of the BSRN organization to address the observational needs for extended time-frame (decades to century) climate observing systems will begin to be evaluated, both internally and by the larger community that is slowly growing aware of the need and application for such fundamental measurements

- Several new BSRN sites are under development in under-represented regions and could produce additional data for the network by the end of the year.

- BSRN will continue to promote its role as an aggregate organization in which different local, regional, national, international and global surface irradiance observing efforts benefit from sharing common inspiration, guidance, goals, resources, and products.

- With the completion of defining and conducting the necessary instrument intercomparisons, efforts to elevate tentative measurement reference standards to a higher and broader level of acceptance will be pursued, with the desire to further narrow verifiable measurement uncertainty.

- The BSRN Data Archive will continue to undergo internal evaluation of the manner and methods by which it serves the organization with emphasis on its resources and the eventual sustainable disposition of the archive and its duties.

- Training sessions will be held for new BSRN participants to help insure continuity and consistency of the network.

- Revisions of the BSRN Operations Manual will be made and distributed reflecting the advances in technology and capability over the past few years.

- BSRN management will continue to be diligent in identifying new applications of surface radiation data in climate research and in identifying areas of needed measurement improvements.

- The unique problems in securing sustainable funding for these extended research observations will continue to be addressed, with the identification of national commitments to such efforts being given high priority, as in the past.

V. Issues for SSG at This Meeting.

It is hoped that the SSG will also recognize the value of the sustained observational program of BSRN; not only the value expounded on in the above listed accomplishments, but also the potential and inherent value. These observations define an important segment of nature on a time scale exceeding typical fiscal and investigative realms. The program has been maintained with the pride and dedication of people determined to provide worthy information to the climate research community. The difficulty of this endeavor is emphasized by the fact many earlier attempts at this task have not succeeded. The associated needs of the climate community have been demonstrated to be long-term and ongoing as the actual climate continues to evolve in undefined and unpredictable ways.

There is a desire initiate and sustain BSRN observational programs in the under represented regions of the earth surface. A recent map of BSRN sites is given at http://bsrn.ethz.ch/. Assistance and support in addressing the political and cultural reality of that requirement is needed. Resource-capable and motivated individuals and programs similar to those involved in BSRN should be encouraged by SSG to participate in BSRN.

Contributions to, and support for, BSRN come from many countries and individuals. It is of particular note to acknowledge the extensive and disproportionally high number and quality of contributions from the Swiss government, without whose support the BSRN organization would not have succeeded. While the enthusiastic participation of several other countries is also notable, members of the SSG can help by encouraging their fellow countrymen who are already involved in BSRN, and/or others who could contribute to, and benefit from, an association with the organization.

International Satellite Cloud Climatology Project (ISCCP) Activities in 2002

William Rossow

Status and Accomplishments

ISCCP completed its 19th year of data collection on 30 June 2002. Radiances from all operating meteorological satellites, with the exception of INSAT and FY-2B, are being routinely collected by the cognizant Sector Processing Centers (SPC) and delivered to the Global Processing Center (GPC) in accordance with project requirements. All project data sets are now being delivered via Internet except for the DX product. Currently operating satellites are NOAA-16, NOAA-17, GOES-8, GOES-10, GMS-5, METEOSAT-5 and METEOSAT-7 with METEOSAT-6, GOES-9, GOES-11 and GOES-12 in reserve. NOAA-17 was launched on 24 June 2002 to replace NOAA-15 in the morning orbit; however, the equator crossing time for this and subsequent satellites will be later in the morning at about 1000 local time. Plans call for METEOSAT-5 to continue operating over the Asian sector until the end of 2003. If the launch of MSG-1 to replace METEOSAT-7 is successful and either METEOSAT-6 or 7 is still healthy, then one of these satellites will be moved to replace METEOSAT-5 by the end of 2003. METOP-1 launch is now planned for 2005. The launch of the first MTSAT to replace GMS-5 failed. Actions have been taken to extend the life of GMS-5 until launch of MTSAT-1R, now planned for mid-2003: as of July 2001 the frequency of whole-Earth images has been reduced to avoid scan-motor jamming, but this reduced imaging schedule has not affect the images collected for ISCCP. Nevertheless, GOES-9 will be moved to provide coverage of this sector until MTSAT-1R is launched. MTSAT-2 launch is planned for 2004. China successfully launched FY-1D (polar orbiter) in 2002.

The Satellite Calibration Center (SCC) in Lannion, France, provides monthly satellite-to-satellite radiance normalization for four wavelength channels, nominally at 0.6, 6.7, 11 and 12 mm. Normalization data are complete through March 2002, except for the water vapor channel (6.7 mm).

The GPC monitors the calibration of the polar orbiting radiometers (AVHRR) that serve as the reference standard for the radiance data. Monitoring results are complete through October 2001. Up-to-date calibration information is posted on the ISCCP Web site (http://isccp.giss.nasa.gov).

Routine archival of Stage B3 data is complete through September 2001 (18.25 years). Further deliveries will be delayed until sufficient statistics are developed for the new calibration standard. Since parallel collection of NOAA-16 data began in March 2001, deliveries of Stage B3 data may resume near the end of 2002. However, the newer satellites have more than five wavelength channels, so the ISCCP Stage B3 format will have to be re-designed. Also, the split-response of the new AVHRR solar wavelength channels may make calibration much more challenging.

Atmospheric temperature and humidity profiles and sea ice and snow correlative data sets are complete through September 2001.

Stage DX, D1 and D2 data have been completed for July 1983 through September 2001 (18.25 years). Two CDs of D2 data have been released covering the period 1983 - 1988 and 1989 - 1993; a third CD of D2 is planned to cover the period 1994-1998. All D2 data are now on-line on the ISCCP Web site. Processing of D data beyond September 2001 will be delayed until the calibration standard is re-established at the end of 2002.

Since sampled AVHRR data were obtained back to the beginning of the life of NOAA-7 in August 1981, these data will be processed to provide partial coverage of the El Nino in 1982-83 and the El Chichon eruption. A special polar-orbiter-only climatology will be prepared (with an adjustment for limited diurnal sampling) to produce a 20-yr record of ENSO anomalies.

Complete data sets currently available at the ICA are:

Stage B3 and BT:	July 1983	—	September 2001
Atmospheric data:	July 1983	—	September 2001
Sea ice and snow data:	July 1983	—	September 2001
Stage DX, D1 and D2:	July 1983	—	September 2001

ISCCP produced a new 18-year (1983–2000) global radiative flux data product called ISCCP FD, which provides physically consistent surface and top-of-atmosphere (TOA) radiative fluxes by showing the global monthly mean net shortwave (SW) and net longwave (LW) anomalies at the surface, in the atmosphere and at the TOA over the whole time period. Notable features are:

(1) a decrease of the net SW at the surface and TOA, as well as in the atmosphere produced by the Mt. Pinatubo volcanic aerosols in 1991–92;
(2) an overall increase of the net SW at TOA and the surface, but not in the atmosphere, from the 1980s to 1990s associated with a decrease in low-latitude cloud cover;
(3) three (possibly four) decreases in net LW at the surface and increases in the atmosphere, but not at TOA; and
(4) a small decrease of net LW at TOA and in the atmosphere and a larger increase of net LW at the surface occurring in the late 1990s. Another unique feature of the flux profile product is that it provides, for the first time, a comprehensive determination of the synoptic scale variations of the vertical profiles of radiative diabatic heating, albeit with crude vertical resolution, but sufficient to represent radiative heating in the lower, middle or upper troposphere and the stratosphere.

The contents of the ISCCP Web site (http://isccp.giss.nasa.gov) have been significantly expanded to include: (1) an expanded set of links to other extensive cloud data sets from satellites, radars and lidars, (2) complete D2 data set which can be downloaded, (3) a climatology of small-scale cloud optical thickness and top temperature spatial variability that can be used in GCM radiative transfer models, (4) complete radiance calibrations for all weather satellites used by ISCCP from July 1983 to September 2001, (5) a graphical illustration of the results of an extensive climatological analysis of the ISCCP data set (which will be expanded soon to present cloud-type results), (6) links to several other climate data analyses including radiation budget and surface temperatures, (7) several more satellite-based, global data sets and (8) expanded links to related projects, data centers and web sites.

A separate Home page for the GEWEX Cloud System Study - Data Integration for Model Evaluation (GCSS - DIME) can be found at: http://gcss-dime.giss.nasa.gov. This site contains four categories of data for all of the GEWEX Cloud System Study cases: data for model initialization, large-scale satellite observations, selected field study observations and climatological composites to used to generalize results. Overall, about 6 Gbytes of data can be obtained from this site, comprising 10 different kinds of data for the 21 cases (664 days of data) defined by the five GCSS Working Groups.

Four diagnostic products are being worked on:

(1) a survey of midlatitude cyclone-anticyclone cloudiness produced by combining the NCEP and ECMWF re-analyses with ISCCP,
(2) a survey of tropical mesoscale convection produced by identifying and tracking the motions of all high-cloud clusters that contain convective clouds at some stage,
(3) a climatology of cloud particle sizes, both for liquid and ice clouds, and
(4) a complete analysis of radiative flux profiles at mesoscale resolution.

Cyclones are identified by negative anomalies in the surface pressure and tracked through time; the collocated clouds are combined with other meteorological information to describe these cloud systems (Tselioudis, G., Y-C. Zhang and W.B. Rossow, 2000: Cloud and radiation variations associated with northern midlatitude low and high sea level pressure regimes. *J. Climate*, **13**, 312-327). This survey has been completed and the data set is being prepared for release. Deep convection is identified as cold (i.e., high altitude) cloud tops with very high optical thicknesses; the analysis identifies and tracks the motions and evolution of each system (Machado, L.A.T., W.B. Rossow, R.L. Guedes, and A.W. Walker, 1998: Life cycle variations of mesoscale convective systems over the Americas. *Mon. Wea. Rev.*, **126**, 1630-1654). These data will provide statistics regarding the formation, maturation and decay of individual systems as functions of size, shape and location. This survey is underway and should be completed by early 2003. Still being prepared is an analysis of cloud particle sizes to complement the GACP aerosols product for study of the so-called indirect effect (Han, Q., W.B. Rossow, J. Chou and R.M. Welch, 2000: Near-global survey of cloud column susceptibilities using ISCCP data. *Geophys. Res. Lett.*, **27**, 3221-3224). The fourth product contains complete radiative flux profiles (Chen, T., Y-C. Zhang and W.B. Rossow, 2000: Sensitivity of radiative heating rate profiles to variations of cloud layer overlap. *J. Climate*, **13**, 2941-2959) based on the ISCCP D1 (3 hr, 280 km) dataset and a climatology of cloud layer structure from rawinsondes (Wang, J., W.B. Rossow and Y-C. Zhang, 2000: Cloud vertical structure and its variations from a 20-year global rawinsonde dataset. *J. Climate*, **13**, 3041-3056). This product is now being produced. All of these products will cover the whole ISCCP time period.

New scientific results based on the ISCCP data sets are reported in:

Hahn, C.J., W.B. Rossow and S.G. Warren, 2001: ISCCP cloud properties associated with standard cloud types identified in individual surface observations. *J. Climate* , **14**, 11-28.

Han, Q., W.B. Rossow, J. Zeng and R. Welch, 2002: Three different behaviors of liquid water path of water clouds in aerosol-cloud interactions. *J. Atmos. Sci.* , **59**, 726-735.

Rossow, W.B., C. Delo and B. Cairns, 2002: Implications of the observed mesoscale variations of clouds for Earth's radiation budget. *J. Climate*, **15**, 557-585.

Luo, Z., W.B. Rossow, T.Inoue and C.J. Stubenrauch, 2002: Did the eruption of the Mt. Pinatubo volcano affect cirrus properties? *J. Climate*, (in press).

Funding Status

All ISCCP data processing centers are now funded as part of satellite operations with the exception of the Global Processing Center funded by NASA. Currently approved funding for the GPC ends this year. A renewal proposal for five more years of funding will be submitted in the next two months.

Plans for Exploitation of New Satellites

Many new satellite instruments have been or will soon be launched that sense clouds at a new set of wavelengths and/or employ novel measurement techniques. Among the latter are MISR (which multi-angle measurements at solar wavelengths) on TERRA and POLDER (which makes multi-angle and polarimetric measurements at solar wavelengths). Among the former are spectrometers, such as SCIAMACHY, AIRS and GLI. The most similar style instruments are the new multi-wavelength imagers, MODIS on TERRA and AQUA and MERIS on Envisat. Efforts have begun at the GPC to acquire and process MODIS data with the ISCCP (2-wavelength) analysis procedure to facilitate pixel-level comparisons with the results obtained using many more wavelengths. These data will also be used to compare calibrations at common wavelengths.

Joint Diagnostic Studies

Recent publications have shown that, in addition to anomalies in the top-of-atmosphere radiative fluxes in the tropics and subtropics induced by volcanic events and ENSO events, there appears to also be a "slow" change between the 1980's and 1990's. These changes appear to be related to changes in clouds and upper tropospheric water vapor that are consistent with changes in the tropical-subtropical mean circulation. However, all of the data sets being used for this analysis have several problems that cast doubt on the reality of such small changes. If the changes are real, then it would also be important to diagnose the related changes in the surface radiation budget and precipitation to see how the atmosphere, land and ocean exchanged energy and water over this two-decade period. To do this requires: (1) that all the relevant data sets be re-examined to remove any sources of inhomogeneity by comparisons and consistency checks and (2) that the statistics of these data sets be analyzed, together, in a consistent fashion and extended to include, at least, surface radiation and precipitation. As one example, note that the current ISCCP and SRB products have not made use of the GACP aerosol product, so that these are not consistent. As another example, current upper tropospheric water vapor and precipitation data sets have not employed the available cloud data sets to remove cloud effects, so that these are also not consistent. Given the current maturity of these various data sets, such an integrated, consistent analysis could be performed.

SUMMARY OF PROGRESS AND MAIN ACTIONS/RECOMMENDATIONS FROM THE TENTH MEETING OF THE GEWEX CLOUD SYSTEM STUDY (GCSS) SCIENCE TEAM

24 May 2002
Kananaskis, Alberta, Canada

Steven K. Krueger

GCSS Main Objective and Current Framework

The GEWEX Scientific Steering Group (SSG) has continued to endorse the main objective of GCSS to develop refined parameterizations of cloud systems within Global Models, including both climate and numerical weather prediction models (NWP/GCMs), through the improvement of the understanding of the coupled physical processes within different types of cloud systems. Because the Cloud Resolving Models (CRMs) and Single Column Models (SCMs) being exploited by GCSS are the scientific link between cloud process studies and GCMs, they represent an important connection between GEWEX and its "user" community. The success of GCSS has been achieved by applying specialized computing techniques and resources, which have recently become available, with better validation datasets. GCSS has developed a unique Working Group organizational structure that has facilitated the collection and application of test cases in focused research and analysis exercises that have led to improvements in models. Each one of the five working groups, associated with analyses of boundary layer, cirrus, extra-tropical layer, precipitating convective, and polar cloud types, respectively, has been making progress in mobilizing the CRM community to provide observational/model datasets for many phenomena/processes of importance to GCM development. The current activity within the GCSS has been undertaken within the following framework:

- Boundary-layer cloud systems (Chair: C. Bretherton)
- Cirrus cloud systems (Chair: P. Brown)
- Extratropical layer cloud systems (Chair: G. Tselioudis)
- Precipitating convective cloud systems (Chair: W. Grabowski)
- Polar cloud systems (Chair: J. Curry)

C. Bretherton and P. Brown began serving as WG chairs during 2002.

GCSS Strategy

Rather than try to isolate the individual cloud processes and study them separately, the GCSS approach is to apply SCMs, CRMs and mesoscale models to study the processes as a coupled system. This strategy considers that the two main issues in realistically representing cloud systems in GCMs are process coupling and scale interaction. These produce phenomena that span a broader range of scales than does any individual process. CRMs are used as experimental testbeds to develop improved understanding of the processes and to provide realizations of cloud systems (4-dimensional datasets). These datasets in turn are used to derive and evaluate parameterization schemes for the large-scale models. The CRMs are developed and validated in GCSS through the use of observations from regional field experiments.

GCSS-ARM Workshop on the Representation of Cloud Systems in Large-Scale Models

(20-24 May 2002, Kananaskis, Alberta, Canada)

Immediately prior to the meeting of the GCSS Science Team, a Workshop organized by GCSS was held that brought together a diverse group of over 70 scientists from 9 countries. This group included global modelers with an interest in cloud parameterization, mesoscale and microscale cloud modelers and observationalists, radiative transfer specialists, cloud microphysics/aerosol specialists, and remote sensing specialists. Representatives from many global modeling and NWP centers were present. The workshop agenda is included in the appendix of this report.

In addition to plenary sessions devoted to activities of each of the five GCSS Working Groups, there were sessions on the representations of clouds and radiation in GCMs, general observations of clouds and radiation, and on modeling cloud microphysics, chemistry, aerosols, and radiation. In comparison to the 1998 Workshop, the talks reflected the increasing interaction of GCSS with the radiation, microphysics, aerosol, and cloud-remote sensing communities.

Based on the talks presented at the workshop, the following scientific advances are expected in the GCSS WGs during the next several years:

(1) rapid progress on the representation of sub-grid scale cloud overlap and inhomogeneity due to the combination of CRMs, cloud radar observations, and faster methods of calculating radiative fluxes for arbitrary cloud configurations;

(2) steady progress in the understanding and representation of cloud microphysical, formation, and dissipation processes due to integrated use of LES (large-eddy simulations) models, CRMs, SCMs, GCMs, and cloud-scale observations, plus insights from recent and upcoming field experiments; and

(3) that super-parameterizations (i.e., CRMs used as parameterizations) will be used in some GCMs to provide more physically realistic representations of cloud processes, to increase knowledge and understanding of interactions between cloud processes and large-scale processes (including cloud feedbacks), and to help improve conventional parameterizations.

Key scientific issues

WG 1:
Entrainment in stratocumulus and shallow cumulus clouds. Roles of microphysics/precipitation/aerosols.

WG 2:
What level of microphysical complexity is required for adequate treatment of cirrus clouds in large-scale models?
Is it appropriate to model cirrus produced by deep convection the same as cirrus formed by large-scale ascent?

WG 3:
Is it necessary to parameterize subgrid-scale cloud structure and cloud layering in extra-tropical cloud systems?
What level of microphysical complexity is required for adequate treatment of extra-tropical cloud systems in large-scale models?

WG 4:
The diurnal cycle over land, and other interactions with the boundary layer.
The production of upper tropospheric stratiform clouds by deep convection. (This includes the issue of microphysical complexity.)
Parameterized versus resolved motions as horizontal resolution increases. (This is an issue now for mesoscale NWP models and for future global NWP models and GCMs.)

WG 5:
Microphysics of mixed-phase clouds. Radiative transfer in a cloudy atmosphere.
Formation and dissipation of boundary layer clouds. Stable boundary layer.

Highlights of recent and planned WG activities

- In coordination with the EUROpean Cloud Systems (EUROCS) project, WG 1 is also undertaking a survey of how well large-scale models represent boundary layer clouds over the northeast Pacific in a cross section from California southwest to the Inter-Tropical Convergence Zone (ITCZ)

- WG 1 has recently completed a model intercomparison project (MIP) on the diurnal cycle of shallow cumulus over land and another (led by EUROCS) on the diurnal cycle of marine stratocumulus.

- An important step toward WG 1's goal of a trade cumulus experiment occurred during 2002 as WG 1 participated in the collaborative preparation of the scientific overview document for RICO (Rain In Cumulus over the Ocean) Experiment (http://rico.atmos.uiuc.edu). RICO should take place in the Caribbean Sea in December 2004.

- WG 1 (Boundary-Layer Cloud Systems) is planning a series of intercomparisons on both stratocumulus and shallow cumulus clouds. Their initi al focus will be on the nocturnal stratocumulus-capped mixed layers observed in DYCOMS (Dynamics and Chemistry of Marine Stratocumulus)-II. DYCOMS-II was planned to be the basis of WG 1 modeling studies by a member of WG 1 (B. Stevens). Margreet van Zanten of UCLA will organize a MIP based on two DYCOMS-II cases: the first nonprecipitating and the second heavily drizzling. Future cases will be based on EPIC (Eastern Pacific Investigations of Climate) 2001 (S.E. Pacific stratocumulus) and RICO (trade cumulus). The next WG 1 meeting will be 29-31 October 2003 in Broomfield, Colorado, USA.

- WG 2 (Cirrus Cloud Systems) has completed two idealized MIPs, one for cirrus parcel models and another for cirrus CRMs. The next MIP will be based on cirrus from Hurricane Nora as observed at the ARM (DOE Atmospheric Radiation Measurement program) Southern Great Plains (SGP) site.

- The current MIP for WG3 (Extratropical layer cloud systems) is based on the March 2000 Intensive Observation Period (IOP) at the U. S. DOE Atmospheric Radiation Measurement program (ARM) Southern Great Plains site (SGP). In addition to ground-based and satellite remote-sensing measurements of clouds, there were many obtained from aircraft. WG 3 is also undertaking a survey of cloud properties in large-scale models for a climatological March using March 2000 surface boundary conditions. Model results are to be submitted by the end of April 2003. Analysis of the results will be presented at a Fall 2003 meeting (27-29 October 2003 in Broomfield, Colorado, USA).

- WG 4 (Precipitating Convective Cloud Systems) is continuing analyses of Case 3, a MIP based on the summer 1997 IOP at the ARM SGP site. The current MIP is an idealized case based on the observed diurnal transition from shallow to deep convection over the Amazon. The next WG 4 meeting will be 28-30 Oct 2003 in Broomfield, Colorado, USA.

- WG 5 (Polar Cloud Systems) current activities include participation in the Arctic Regional Model Climate Model Intercomparison Project, a Radiation Model Intercomparison Project, and a Stable Boundary Layer Model Intercomparison Project.

- An Ad Hoc activity called the Data Integration for Model Evaluation (DIME) has the goal is to provide "test kits" for model evaluation based on the GCSS MIPs, including detailed results from the participating CRMs. DIME (chair: W. Rossow) has a website at http://gcss-dime.giss.nasa.gov.

- The revised GCSS Science Plan (http://www.gewex.org/gcss_sciplan.pdf) is described in this article: Randall, D.A., and 10 coauthors, 2003: Confronting Models With Data: The GEWEX Cloud Systems Study. Bulletin of the American Meteorological Society, 84: 455-469. http://ams.allenpress.com/pdfserv/i1520-0477-084-04-0455.pdf

  The highlight is a new strategy that includes a more active role for the large-scale modeling community, and an explicit recognition of the importance of data integration.

- Interactions with Allied Scientific Communities (Radiative transfer) GCSS WGs provided simulated 3D cloud fields for an extensive intercomparison of GCM solar radiative transfer codes. Radiative transfer community provides radiation codes to GCSS; helps GCSS use satellite and ground-based remote sensing to evaluate cloud parameterizations. (Land surface) GLASS plans to provide GCSS with a land-surface model appropriate for use in CRMs. (Aerosol) The aerosol community would like to collaborate with GCSS to improve parameterizations of the interactions of aerosols and clouds in climate models.

Actions/Recommendations

Actions which GCSS will address or which each Working Group has agreed they would implement included:

- S. Krueger will present GCSS interest in CCPP-ARM-GCM analysis tendency errors (CAGATE) analysis at the next WGNE/GMPP meeting (in Oct 2002). It was recommended that GCSS should

participate in the definition of experiments and make suggestions for specific outputs. An issue to be worked out is the interaction between GCSS WG 3 and the AMIP and CAGATE projects.

- S. Krueger is to submit WG 4 Case 2 results (TOGA-COARE) for publication ASAP.

- Christian Jakob is to contact the Large-Scale Biosphere Atmosphere Experiment in Amazonia (LBA) for observational data related to WG 4's MIP.

- GCSS will review and monitor links between Arctic Regional Climate Model Intercomparison Project (ARCMIP) and GCSS.

- Next GCSS SSG: The recommendation was made and accepted to hold the next meeting in 2003 in conjunction with one of the GCSS working group meetings. (It will be held 29-31 Oct 2003 in Broomfield, Colorado, USA, in conjunction with meetings of WGs 1, 3, and 4.)

- DIME (Data Integration form Model Evaluation) lead by W. Rossow, is an effort to collect, catalogue, critique, and disseminate GCSS case study data sets. The following are DIME-related actions for all WGs:

    1) Redesign WG home pages to focus on content, structure and links. ISCCP will prepare a template home page for the WGs to follow in reformatting their web pages.

    2) Complete case data documentation to include version numbers, etc. WGs are to send or point W. Rossow to relevant references for all previous cases.

    3) Collect other relevant data sets on DIME page.

    4) Provide summary of publications.

Suggestions for future DIME developments:

    1) Consider the definition of statistical composites of large-scale observations for each case study

    2) Prepare model evaluation "kits."

    3) Get model results on-line, including GCM information and CRM simulations, in a standard data format.

Recommendations:

- A science issue that needs to be addressed by WG 5 with WG2 is heteorogeneous ice nucleation. The validation of GCMs in polar regions should also be considered among the priorities of WG 5.

- WG 1 survey of large-scale model northeast Pacific cross sections: An interaction with the GEWEX Coordinated Enhanced Observing Program (CEOP) may be useful on this matter.

- The ARM site should continue to be considered as a privileged validation site for GCMs and forecast models.

- W. Rossow is organizing a cloud radiation interaction workshop, scheduled for November 2002 in Atlanta, Georgia, which may be relevant to GCSS activities.

- Accuracy and quality of data that GCSS is using is an important issue. It was recommended that instead of forming a new "Measurements WG", that the WGs indicate areas where there is a problem. WGs are also to encourage the participation of "observational people" in each WG. These experts could give presentations on the pros and cons of the data.

- Quality of NWP analyses for large-scale forcing: When are they good? How can GCSS use them? GCSS needs to promote further study of NWP analyses, especially for the March 2000 IOP.

- A specific request from WCRP is that the WGs provide recommendations on the availability and use of satellite data (current and future missions). This information is collected for a general report on WCRP requirements with respect to satellite missions and satellite data to be prepared for the end of the year 2002.

APPENDIX H

REPORTS FROM SPECIFIC WORKSHOPS

GABLS Initiates Intercomparison for Stable Boundary Layer Case

25-27 March 2002
Reading, UK

Albert A.M. Holtslag
Meteorology and Air Quality Section, Wageningen University, The Netherlands

The overall objective of the GEWEX Atmospheric Boundary Layer Study (GABLS) is to improve the understanding and the representation of the atmospheric boundary layer in regional and large-scale climate models. GABLS aims to provide a platform in which scientists working on boundary layers at different scales will interact. Such activity is important in itself and also very relevant for other activities in GEWEX, and more generally for the activities within WCRP and the International Geosphere-Biosphere Program (Holtslag and Randall, 2001).

The first focus of GABLS is on the representation of the stable atmospheric boundary layer (SBL). It appears that much of the warming predicted by climate models occurs during stable conditions over land (either in winter or at night). This is documented in the latest Intergovernmental Panel on Climate Change report (see for example figure 9.10, pages 546–548 in Cubasch and Meehl, 2001). At the same time, it is realized that the understanding and parameterization of the SBL is still poor (e.g., Beljaars and Holtslag, 1991). As an example, the figure on the bottom of Page 1 shows the difference in the temperature at a height of 2 meters for January 1996 as calculated from two model runs with the same forcings, but with (slightly) different stability functions in the mixing scheme of the ECMWF model in stable conditions (after Viterbo et al., 1999). The scheme with more mixing leads to higher temperatures over continental areas in winter. To obtain the same synoptic evolution in the two simulations, gentle relaxation towards the analysis is applied above 500 m above the surface. Also, the same prescribed values for the sea surface temperature are used (see Viterbo et al., 1999 for more details). Notice that the differences in the mean temperatures over the land areas can take values up to 10K!

To review our understanding and to discuss future directions on stable boundary layers, a workshop was held at the European Center for Medium-Range Weather Forecasting (ECMWF) in Reading, UK, on March 25–27, 2002. The workshop agenda covered the following topics: Modeling and parameterization experiences at the large-scale modeling centers; progress in theory and understanding of SBLs; Large-Eddy Simulation (LES); and observational data sets (Cabauw, CASES, ARM, Lindenberg, and others). Discussion sessions were held on each of the above topics, and a planning session concluded the meeting. In total about 20 presentations were given by leading scientists and about 30 people attended the workshop.

At the ECMWF-workshop many questions were raised, such as: Why do (most) models like enhanced mixing in stable cases? What is the role of the atmosphere-land surface coupling for SBLs (see also Van de Wiel et al., 2002a, b)? How do models compare with the new data available (such as from CASES-99; see Poulos et al., 2002)? How important is model vertical resolution? Subsequently, the GABLS plans were presented at a meeting during the AMS 15th Symposium on Boundary Layers and Turbulence in Wageningen, the Netherlands. About 80 conference participants joined that meeting and overall very positive feedback was received.

Initially a case study of a night in the CASES-99 data set (Poulos et al., 2002) was prepared for a benchmark study of one dimensional column and LES models over land (prepared by staff members at the Meteorology and Air Quality Section of Wageningen University, NL). However, it became clear that a benchmark case for a stable boundary layer over land is rather complex to start with and to compare the skills of LES and single column models. Therefore, it has been decided to first focus on a case for a SBL with less complexity. This case is based on the results presented in a study by Kosovic and Curry (2000). As such the boundary layer is driven by an imposed, uniform geostrophic wind, with a specified surface-cooling rate, which attains a quasi-steady state SBL. The case for the LES intercomparison is prepared and convened by Malcolm MacVean (Meteorological Office, UK). In addition, Joan Cuxart Rodamilans (University of the Balearic Islands at Mallorca) convenes the intercomparison of the single-column models for this case.

The selected case has already been distributed for a LES intercomparison, where the basic aim is to contribute towards a quantification of the reliability of stable boundary layers in LES. About 10 groups have already agreed to participate in this exercise. The purpose of this single-column intercomparison is to check the performance of any turbulence or vertical diffusion scheme for this shear-driven stably stratified case. The basic philosophy of this exercise is to make a run with every single-column model at exactly the same conditions as the LES, including physical setup and vertical resolution. This will make the comparison to the LES outputs more trustable. Single-column versions of operational models (either weather forecast or climate studies) are very welcome to participate.

The outcome of the model intercomparison study will be presented at a the GABLS Workshop on Model Intercomparison and Future Direction in Mallorca, Spain, 22–25 September 2003 (hosted by the University of the Balearic Islands). We strongly encourage the large-scale modeling centers to take part in the 1D model intercomparisons studies, as well as motivate their scientists to contribute and take part in the proposed activities.

In the future we hope that GABLS may also present an important opportunity for the set up of adequate data sets to be collected and for the consistent analysis of existing data for the improvement of stable atmosphere parameterizations in various conditions. Such improvements are of utmost importance to the study of regional and global climate change scenarios, among other important modeling uses. This issue will also be addressed in the upcoming workshop.

If you would like to participate in the model intercomparisons and/or in the workshop please send an e-mail to Bert Holtslag (Bert.Holtslag@wur.nl) for general information, to Joan Cuxart Rodamilans (joan.cuxart@uib.es) for the single-column model study, or to Malcolm MacVean (malcolm.macvean@metoffice.com) for the LES intercomparison. Please also consult http://www.gewex.org/gabls.htm for updates on GABLS activities in the near future.

Acknowledgments

This is a community effort, which needs the activity and creativity of many people to make real progress! In this respect, I thank all participants at the various meetings for their inputs and comments. In particular, I would like to acknowledge Ric Cederwall, Anton Beljaars, Malcolm MacVean, Joan Cuxart Rodamilans, Greg Poulos, and my staff members at the Meteorology and Air Quality Section of Wageningen University for their help and comments.

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CEOP STATUS SESSION AT GHP-8

13 September 2002
Palisades, New York, USA

Sam Benedict
CEOP International Coordinator

A Coordinated Enhanced Observing Period (CEOP) status session was held in conjunction with the Eighth Meeting of the GEWEX Hydrometeorology Panel (GHP). Dr. Toshio Koike, lead scientist for CEOP, confirmed that the build-up phase of CEOP is on schedule and that CEOP is focusing on the development of an initial enhanced observing period (EOP-1) data set, which covers the period July through September 2001. The implementation of two other enhanced observing periods covering annual cycles will be undertaken using data collected from October 2002 to December 2004. In response to a key action item for the CEOP Data Management Working Group, a File Transfer Protocol (FTP) for delivery of data from the CEOP Reference Sites to the CEOP Central Archive has been established.

A number of reports were given at the meeting from representatives of the GEWEX Continental Scale Experiments (CSE) that highlighted the existence of multinational commitments that have been coordinated and maintained in handling interactions among the operators of the CEOP reference sites. Channels of communication between the reference site operators and the CEOP data managers have been established to ensure that data will be provided for the purpose of improving the collective contribution of the CSEs to the global requirements of CEOP. As a result of these reports and the discussions at the meeting, a large amount of information about the characteristics of the CEOP reference sites has been provided by the CSEs and placed in the CEOP Reference Site Table at: http://www.joss.ucar.edu/ghp/ceopdm/rsite.html. The CEOP Central Archive at the University Corporation for Atmospheric Research continues to receive data for the EOP-1 from the CSEs.

As a result of an action to standardize the CEOP Model Output requirements, a document has been produced that provides guidance for CEOP model output generation at numerical weather prediction centers, meteorological agencies and data assimilation centers. Commitments have been obtained for the provision of CEOP model products from major national and multinational centers including the Japan Meteorological Agency, National Oceanic and Atmospheric Administration, National Centers for Environmental Prediction, National Aeronautics and Space Administration/Goddard Space Flight Center Data Assimilation Office, the European Centre for Medium-Range Weather Forecasting, the United Kingdom Met Office, the Center for Weather Forecasting and Climate Research of the Brazilian Agency for Space Research and the Australian Bureau of Meteorology Research Center. It was announced at the meeting that the Max Planck Institute for Meteorology (MPIM) at Hamburg, Germany would contribute support to CEOP by assisting with the centralized handling and retention of the CEOP model output data being generated by the various contributing centers. Work is underway to integrate CEOP data into a World Data Center on Climate database scheme at MPIM. The most efficient input, storage and access structure is currently being defined. Mirror sites for some or all of the CEOP model output data products may be established in Asia and the USA.

Presentations by the CEOP Water and Energy Simulations and Prediction (WESP) Working Group clarified the methodology that CEOP will use in applying enhanced observations to better document and simulate water and energy fluxes and reservoirs over land on diurnal to annual temporal scales and to better predict these on temporal scales up to seasonal for water resource applications. The CEOP WESP Working Group strategy, as accepted at the meeting, is to build on work by the GHP related to closing simplified vertically integrated water and energy budgets with observations and analyses, and beginning efforts to simulate these budgets regionally. WESP plans to transfer this knowledge to global scales; include more land, water and energy cycle processes, and begin to examine the vertical structure in the atmosphere.

The CEOP Monsoon Systems Working Group, held its first implementation planning workshop, in parallel with the GHP meeting from 10 to 11 September 2002. Results of the workshop were reported during the CEOP status session and it was reconfirmed that this working group will address the implementation of one of the main CEOP aims associated with the documenting of the seasonal march of the monsoon systems, assessing the monsoon systems driving mechanisms, and investigating the possible physical connections between such systems. It was recommended that the Working Group proceed with a CEOP Inter-monsoon Model Study (CIMS) as developed during the Workshop. CIMS will be an international

research project to validate and assess the capabilities of climate models in simulating physical processes in monsoon regions around the world. For CIMS, a major effort will be devoted to defining the data requirements, and modeling strategy for validating model physics. Validation data will be derived from CEOP reference sites, which include the GEWEX CSEs and planned Climate Variability and Predictability (CLIVAR) field campaign sites. Numerical experiments will be designed to target the simulation of fundamental physical processes that are likely to uncover limitations in model physics. A draft report of the workshop findings with the versions of the presentations made at the meeting have since been put on the internet at: http://monsoon.t.u-tokyo.ac.jp/ceop/meeting/CEOP-MSS/index.html.

The CEOP Satellite Data Integration Working Group reported that a data integration, storage and access scheme under development by the National Space Development Agency of Japan (NASDA) and the University of Tokyo (UT) has been demonstrated as an integral part of the satellite integration process in CEOP. It was reconfirmed that this 500 tera-byte data integration and archival system at UT will be available for the CEOP satellite data products work. The scheme that utilizes the NASDA/UT capability for production and archiving of satellite data products for CEOP reference sites has been presented as a three-phased process. The new schedule shows that the first phase (June 2002 to November 2002) will focus on data received from NASDA and the University of Tokyo related to all of the CEOP Reference Sites. Specifically this will be for the DMSP Special Sensor Microwave/Imager and Tropical Rainfall Measuring Mission Microwave Imager and Precipitation Radar data. It was announced that NASDA and the UT would host a CEOP Satellite Data Integration Issues Workshop from 9 to 10 October 2002 in Tokyo, Japan. The proposed agenda included a discussion of details associated with a NASDA proposal for a CEOP Committee on Earth Observation Satellites Working Group on Information Systems and Services Test Facility (CEOP-WTF) that would be developed to assist with the derivation of CEOP special products from each satellite sensor. The CEOP WTF proposal, which now includes a Satellite Data Integration Center in Japan and, possibly, one in the USA, has already been accepted for further implementation with the support of the Integrated Global Observing Strategy Partnership (IGOS-P), including Space Agencies.

The CEOP Science Steering Committee reported that a number of important issues related to the efficient organization and management of CEOP to achieve the main science objectives have been addressed by the Committee. These actions have included finalizing the CEOP Data Policy statement; setting minimum standards for temporal sampling of CEOP Reference Site parameters, maximizing the science and technology benefits from CEOP, especially associated with setting a goal for delivery of a CEOP seasonal data product (EOP-1); and providing inputs on CEOP publications including the CEOP Brochure (see the CEOP web site at http://www.ceop.net). It was also confirmed that the CEOP Advisory and Oversight Committee would be activated by the end of 2002 under the co-chairmanship of Drs. A. Sumi (NASDA) and J. Kaye (NASA).

CEOP held its initial implementation planning meeting at the Earth Observation Research Center of NASDA in Tokyo, Japan, from 6–8 March 2002. More specifics about CEOP and the Kick-off Meeting can be found at: http://monsoon.t.u-tokyo.ac.jp/ceop/. All of the main actions and recommendations in CEOP are being undertaken in reference to the goals and objectives contained in the CEOP Implementation Plan. The Plan, which was finalized following recommendations formulated at a CEOP Implementation Workshop held at the GSFC in March 2001, was published in May 2001 and can be found at: http://www.gewex.com/ceop/ceop_ip.pdf.

CEOP has gained the interest of other international organizations outside of the WCRP community, as evidenced by the proposal for an Integrated Global Water Cycle Observations (IGWCO) theme within the framework of the IGOS-P, which has reaffirmed CEOP as "the first element of the IGWCO." The next implementation planning meeting will be held in Berlin, Germany from 2-4 April, 2003. Presentations associated with preliminary results from the application of the available site data in the EOP-1 data set will be part of the agenda.

GSWP-2 Kickoff Workshop

30 September – 1 October 2002
Calverton, Maryland, USA

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The Center for Ocean-Land-Atmosphere Studies (COLA), with support from the National Aeronautics and Space Administration (NASA) Program on Terrestrial Hydrology hosted the kickoff workshop of the Second Global Soil Wetness Project (GSWP-2). The project is the principal element of the large-scale uncoupled land surface modeling action in the Global Land-Atmosphere System Study (GLASS; Polcher et al., 2000) and a major element of the International Satellite Land-Surface Climatology Project (ISLSCP), both contributing projects of GEWEX. The overarching goal of the GSWP is to produce as a community effort the best model estimates of the global land-surface water and energy cycles (Dirmeyer et al., 1999). This will entail an evaluation of the uncertainties linked to the land surface schemes (LSS), their parameters and the forcing variables that drive them.

GSWP-2 will take advantage of the 10-year (1986–1995) ISLSCP Initiative II data set (http://islscp2.sesda.com) and LSS simulations will be conducted at a spatial resolution of 1-degree, sans Antarctica. The project will also adhere to the Assistance for Land-Surface Modeling Activities (ALMA) data standards developed in GLASS.

The main goal of the kickoff workshop was to discuss details of the project planning with members of the scientific community who would be participating in GSWP-2, address unresolved issues and complete the draft Science and Implementation Plan for the project. Specifically, the workshop provided a forum to resolve uncertainties and requirements for input data to the various LSSs; address more general modeling group issues; introduce the GSWP-2 Inter-Comparison Center (ICC), housed at the University of Tokyo, and the data submission process; solidify the new remote sensing element of GSWP-2; outline the validation program; narrow options for model sensitivity studies; and discuss other science that can leverage off of GSWP-2. The workshop also established participants and leadership for elements of the project, and demonstrated the data server and software tools that should make model participation and data access much easier than for past experiments.

Execution of GSWP-2 will follow in three streams—data, modeling and evaluation—given in the figure on page 16. COLA is processing the 3-hourly meteorological forcing and complete boundary condition data for GSWP-2, including an extension of the data back in time to 1982. LSS integrations will begin at July 1982, and loop through the first 12 months of forcing data until the modeler is satisfied that soil moisture has spun up and sufficiently equilibrated. A lesson from the GSWP pilot project was that this spin-up process overly amplifies the impact of climate anomalies from that year on the land surface state variables. Therefore, the models will then proceed with their integrations forward from June 1983 – December 1985 so as to converge to a realistic "land climate" at the start of the evaluation period. The 10-year baseline integration, which will be evaluated within the group of GSWP participants and later released to the community at large, covers the period from January 1986 to December 1995. Daily global output will be reported from all models during this period. In addition, for the last year (1995) there will be an "intensive model output period" where model results will be reported at a 3-hour interval, but likely with a reduced set of variables. These data will be especially useful for validation and remote sensing applications. We may also specify a subset of points for full 10-year histories at 3-hour output. The data server system will make such limited re-integrations simple for the models to perform.

A major product of GSWP-2 will be a multi-model land surface analysis for the 1986–1995 period. This will be a land surface analog to the atmospheric reanalyses. There will be a climatological annual cycle data set, and a larger data set for the entire series. Compiling the results of multiple LSSs to produce a single analysis will provide a model-independent result. Of particular value, uncertainty estimates can be put on all of the fields, based on inter-model spread. Additional uncertainties regarding forcing data can be quantified, based on the results of the sensitivity studies. The act of constructing an ideal multi-model

analysis is a research topic in itself, and much can be learned from the experience of multi-model ensembling in the atmospheric and oceanic modeling communities. There will be three main modes of in situ validation of participating LSSs:

Field campaigns. The GSWP-2 period overlaps a number of relevant field campaigns, including older GEWEX experiments, which can provide validation data. Comparison of measured meteorological variables from these campaigns with the reanalysis-based forcing data will also provide an evaluation of those products.

Observational networks and long-term monitoring. There are also long-term monitoring networks of soil moisture, carbon, radiative and turbulent fluxes that can provide local or regional validation for LSSs. These will be predominantly available for the latter years of the period.

Streamflow. Runoff fluxes from all participating LSSs will be routed with common river routing schemes to compare with streamflow measurements across a large portion of the globe, as an assessment of the simulation of annual, seasonal, and interannual variations in surface hydrology. Similarly, large basin comparison of model water storage change with observed atmospheric moisture flux convergence minus discharge may also uncover problems in the forcing data and models at basin scales.

It is recognized that discrepancies exist between the observed meteorology and land surface conditions at the validation sites, and the 1-degree gridded data that drive the models, and that those differences can contribute to errors at least as much as the shortcomings in the various models. Representativeness of gridded data at the plot scale can also be evaluated in these locations. PILPS, in its Phase 2, has conducted and continues to craft local land surface modeling experiments built around nearly complete sets of forcing and validation data at a single location (Henderson-Sellers et al., 2002). It is not the intent of this in situ validation program to duplicate that effort. Rather, using the global forcing data sets, local validation may be performed when and where such data are available.

One of the new thrusts for GSWP-2 is a stronger connection to applications in remote sensing. The principal goal of the effort in remote sensing applications is to expand validation beyond those few areas where in situ data on land surface state variables are readily available. In addition to the classical attempts to validate the typical land-surface state variables using satellite retrievals, GSWP-2 also intends to expand the capabilities of current LSSs. This is to be done by the application of algorithms by which LSSs can directly report brightness temperatures, like those sensed by instruments in orbit. These may be applied as forward algorithms for infrared/skin temperature and microwave/soil wetness (and vegetation index for LSSs that predict vegetation phenology).

Modeling sensitivity studies will involve re-integrating the LSSs over part or all of the global 10-year domain to test the response of the models to changes in forcing data and surface parameters. Each participant will be encouraged to take part in some or all of the proposed studies. The sensitivity studies are still being defined, but will likely include sensitivity to choices in meteorological forcing data, such as choice of near-surface reanalysis product (NCEP/DOE Reanalysis versus ECMWF ERA-40), impact of hybrid forcing data (combining observed and reanalysis products for precipitation and air temperature), and an assessment of the impact of rain gauge under-catch. There are also multiple land surface parameter data sets available in ISLSCP Initiative II, such as three choices of global vegetation maps. GSWP-2 will also investigate sensitivity to basic choices of surface vegetation data, as well as the impact of inclusion/exclusion of sub-grid information (for LSSs that include surface tile schemes).

Forcing data and model results will be made available to participants as data sets accessible from three Distributed Oceanographic Data System (DODS) servers (http://www.unidata.ucar.edu/packages/dods/; http://grads.iges.org/grads/gds/) in the United States, Europe, and Japan. Using the ALMA data exchange standards (http://www.lmd.jussieu.fr/ALMA/), and DODS data subsetting capabilities, individual LSSs will be able to run globally each time step, each grid point from start to finish, or in any other sequence of integration, accessing the data directly over the Internet without the need to download or otherwise a priori process the complete data set on their local system. Software tools and source code to aid in access and production of ALMA-standard data, DODS client software libraries, PILPS consistency checks of model results, and interpolation of 3-hourly forcing data to shorter time intervals will also be provided to the community. Additionally, standard and customizable browse images will be made available to the public via the web.

Release of all forcing and boundary condition data to the modeling groups is scheduled for February 2003, with baseline simulations due to the GSWP Inter-Comparison Center (ICC) in August 2003 (see figure on page 16). Complete descriptions and current information concerning this evolving project are available at: http://www.iges.org/gswp/ and anyone interested in participating in land surface modeling, validation or other scientific participation should contact the project at gswp@cola.iges.org.

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WORKSHOP ON CLIMATE SYSTEM FEEDBACKS

18-20 November 2002
Atlanta, Georgia, USA

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The Workshop on Climate System Feedbacks was organized by the GEWEX Radiation Panel and the JSC/CLIVAR Working Group on Coupled Models. The term "feedback" looms important in many WCRP (and Intergovernmental Panel on Climate Change [IPCC]) documents and is used to motivate many WCRP programs and projects. We all have some sense of what the feedback concept means in the climate system in that a perturbation of the climate system is either amplified or diminished by a feedback process. Linear control theory (from engineering) has been used since the late 1970s to assess radiation-climate feedbacks in terms of simple energy balance models using the top-of-atmosphere (TOA) radiative fluxes as the dependent variable and global mean surface temperature as the independent variable. This type of analysis has led to discussion of a whole host of feedbacks on surface temperature: water vapor feedback, ice/snow albedo feedback, and many different cloud feedbacks, including those associated with changes in total cloud cover, cloud top temperature (and/or infrared emissivity) or height, cloud optical thickness (or solar albedo), cloud droplet size, and boundary layer or cirrus cloud cover. Many other feedbacks that do not involve radiation directly have also been described, notably ones that alter water exchanges. The continuation of attempts to isolate and describe more climate feedbacks and to quantify those already mentioned in this same way has become very confusing and misleading because application of this simple linear control theory to the complex, non-linear climate system composed of many coupled sub-systems is simply not appropriate. In particular, in observations of the variations of the real climate, many feedback processes act simultaneously so that their intrinsic magnitude cannot be estimated. The most obvious demonstration of the flaw in such an analysis approach comes from studies that show that the magnitude of "feedback factors" determined from climate model experiments depends on the order in which they are evaluated — this expresses the fact that most feedbacks are coupled to others. In particular, most feedbacks are coupled to cloud feedbacks because the climate can only be altered by changing its energy and water cycles, which are really one cycle involving clouds. Considering the derivation of the mathematical expressions commonly used to determine feedback factors shows that several very strong assumptions are required, none of which is true of the real climate or even of climate Global Circulation Models (GCMs). Moreover, even if the feedback concept is useful in summarizing the overall sensitivity of a climate model to changes of forcing, the way in which these quantities are evaluated in practice can not be reproduced with observations: in other words, this way of describing a climate model's sensitivity can never be verified.

Although the notion of climate feedback is useful for evaluating sensitivity of a climate model to forced changes and the roles of different physical processes in determining the model sensitivity when they are isolated in special experiments, we need a more appropriate, yet still practical way of analyzing climate model feedbacks that can be verified from a similar analysis of observations. To explore useful ways of addressing the feedback problem and to evaluate alternate analysis approaches, the GEWEX Radiation Panel and the Joint Steering Committee (JSC)/CLIVAR Working Group on Coupled Models (WGCM) sponsored a workshop in Atlanta, Georgia, USA on 18-20 November 2002 to discuss:

(1) Advanced analysis methods for complex, nonlinear dynamical systems; and
(2) Better applications of the concept of feedbacks for understanding, evaluating and improving climate models.

The desired outcome of the meeting was suggestions for new lines of research to develop better analysis approaches to be applied to both climate observations and climate model outputs and assessments of possible metrics for evaluating climate model feedbacks and sensitivities.

About 30 scientists attended the 3-day workshop. The first two days of the meeting had papers and discussion sessions arranged around consideration of two topics:

(1) Analysis of Multi-Variate, Non-Linear Dynamical Systems Like Climate, Their Behavior and Their Predictability,
(2) Advanced Methods of Model-Data Comparison and Parameterization Testing

The last day of the meeting was composed of two parallel break-out meetings and a final plenary session to formulate some suggestions and recommendations in response to three questions:

(1) How do we evaluate the usefulness of new analysis methods?
(2) How do we diagnose climate and climate model behavior more effectively?
(3) How do we better compare observations and models?

A number of interesting proposals for different ways to analyze non-linear dynamical systems, like climate and climate models, were presented; but very few of the talks actually concerned climate feedbacks directly. Some of these methods have been applied to climate models in informative ways but they could not be applied to observations of the real climate in practice. In particular, it was noted that the common modeling practice of evaluating climate model feedbacks by finite differences between the state variables of two "equilibrium runs" of the model could not be verified against observations. A number of other aspects of model sensitivity testing were also discussed and some specific suggestions for the design of such activities were made and incorporated into the WGCM plan for a "cloud feedback" experiment. Also, several aspects of model-data comparisons were discussed, leading to a specific decision to employ the "International Satellite Cloud Climatology Project (ISCCP) simulator" (http://gcss-dime.nasa.gov/simulator.html), which converts model cloud output into a form that allows for direct comparison of the space-time distributions of cloud top pressure and optical thicknesses as seen by satellites in the ISCCP data set, in the WGCM cloud feedback exercise.

Very interesting discussions occurred, covering a wide range of topics, and some useful suggestions for improved analysis were made; but the basic questions of how to make progress on quantifying climate feedbacks and verifying models of them remained unanswered. The participants believe that this fact indicates the depth of the feedback problem, that there is a general lack of understanding by the climate research community of the issues involved in the feedback problem, and that what the climate research community is mostly working on is not what really needs to be worked on. A tentative conclusion was that the whole feedback approach may not be viable, when applied to such a complicated system as the climate, but that a focus on a more general diagnosis of the dynamic relationships among variables in the system, using methods capable of handling non-linear, multi-variate relationships, would be useful. Another conclusion was that, whatever advanced analysis techniques were to be developed, they would have to determine quantities from models that can also be determined from observations.

Although not well defined, the next steps would seem to include the formulation of a small set of analysis tasks that all of the proposed analysis methods could be applied to, using the same data sets and the outputs from a hierarchy of climate models of varying complexity. The purpose would be to compare and evaluate the results obtained by the different analysis methods to learn what aspects of the dynamical system they are describing and to examine how the results depend on the complexity of the system being considered. Also, this comparison of different diagnostics when applied to different kinds of climate models could help determine what information about the model's feedback processes can be extracted in practice. The participants agreed to continue discussions towards more definite plans for such coordinated studies, possibly leading to another workshop in about 18 months.