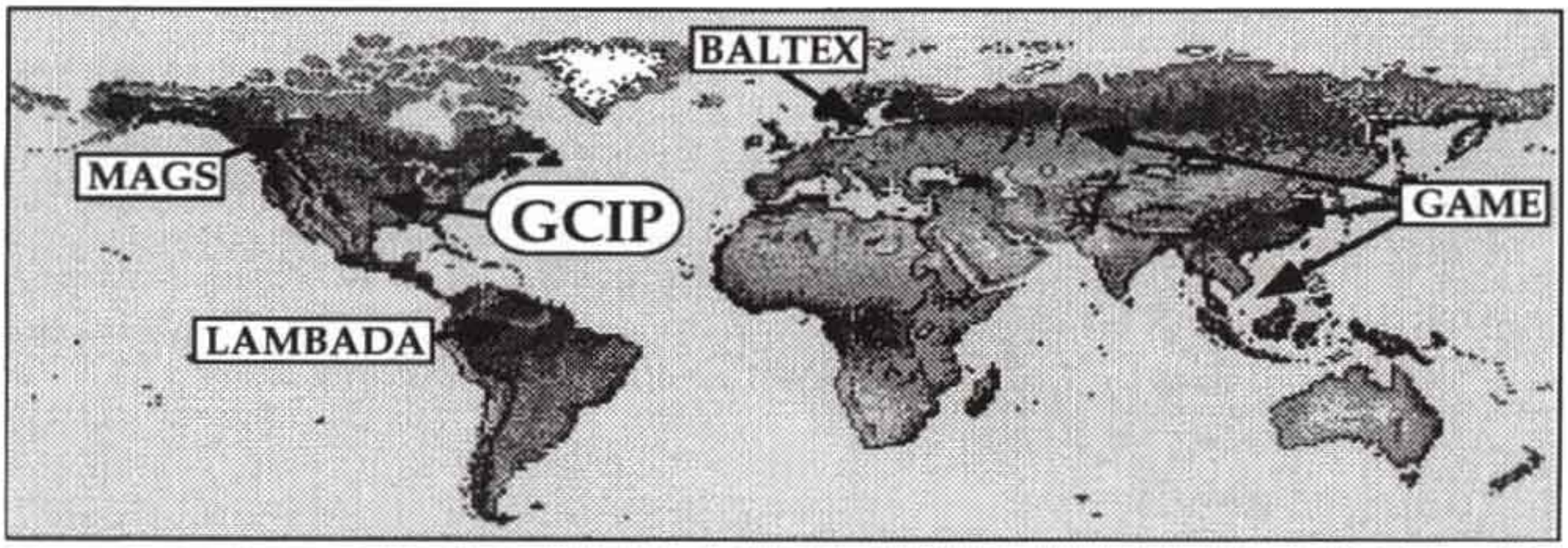
GEWEX WCRP

Global Energy and Water Cycle Experiment

NEWS

Vol. 4, No. 1 February 1994

World Climate Research Programme–WCRP



GEWEX Large-scale Hydrological Projects

GEWEX Scientific Steering Group endorsed four regional GEWEX Continental-scale Projects, BALTEX, GAME, LAMBADA and MAGS; see items pages 2, 3, 11, and 12.

SPACEBORNE MISSION FOR GEWEX

**G. Solari, System Studies Division,
ESTEC, Noordwijk, The Netherlands**

**C. Readings, Earth Sciences Division,
ESA Directorate for Observation of the Earth
and Its Environment
ESTEC, Noordwijk, The Netherlands**

**M. Desbois & R. Sadourny
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Palaiseau, France**

The European Space Agency (ESA) recently completed a study to consider the need for spaceborne measurements to achieve the objectives of GEWEX (Solari et al., 1993). The main purpose of the study was to clarify aspects of GEWEX that could impinge on the long-term plans of ESA. The study team included representations from industry, government, and academic organizations. The science review identified three research areas of fundamental importance to GEWEX requiring a space-borne component.

(Continued on page 10)

WHAT'S NEW IN GEWEX

- NAS GEWEX Panel named
- NMC model upgrade underway for GCIP
- New NASA request for GEWEX proposals
- Canada proposes $4M for GEWEX initiative
- European Commission approves LBE proposal
- SRB CD-ROM issued
- GCSS implementation begins

In This Issue

COMMENTARY
The Contribution of ISLSCP TO GEWEX

Moustafa T. Chahine, Chairman
GEWEX Science Steering Group

At the annual meeting of the GEWEX Scientific Steering Group (SSG), held in Frascati, Italy, 17–22 January 1994, the SSG reviewed the International Satellite Land Surface Climatology Project (ISLSCP) and reaffirmed the important and unique contributions ISLSCP has made, and continues to make, toward improving the representation of land surface processes in climate models. This representation is an essential element of the GEWEX strategy. Research being conducted under ISLSCP is critical to the success of the GEWEX program.

In addition, three recommendations were discussed and approved: (1) that ISLSCP should be responsible for organizing and integrating land surface process studies in the GEWEX Continental-scale International Project (GCIP) in the Mississippi River basin and other continental-scale projects, such as LAMBADA-BATERISTA in the Amazon; (2) that ISLSCP should produce global data sets of key land surface parameters (e.g., soils, land cover, regridded precipitation, and surface radiation); and (3) that ISLSCP should take the leadership in the development of a global soil wetness data set.

Researchers who are interested in obtaining access to the global data sets being produced by ISLSCP are encouraged to contact the International GEWEX Project Office in Washington, DC.

EUROPEAN FUNDS APPROVED FOR LAMBADA-BATERISTA EXPERIMENT (LBE)

Commission of the European Communities (CEC) has approved a four nation proposal involving the Large-scale Atmospheric Moisture Balance of Amazonia (LAMBADA) activity and the Biosphere-Atmosphere Transfer and Ecological Research Studies (BATERISTA) combined experiment known as LBE. The CEC 1994–1995 contribution for LBE is approximately US $600,000 with matching national funds expected. These funds are explicitly for experiment preparation. At a scheduled 18 March 1994 planning meeting in Washington, DC, the European contribution and the technical approach to the experiment design will be presented.

NATIONAL ACADEMY OF SCIENCES GEWEX PANEL ESTABLISHED

The United States National Academy of Sciences, the National Research Council, and the Board on Atmospheric Sciences and Climate jointly announced the formation of the Global Energy and Water Cycle Experiment Panel. The first meeting of this GEWEX Panel will be held at the National Academy of Sciences on 3–4 March 1994. Prof. Soroosh Sorooshian, University of Arizona, is the chairman. Members include

Bruce A. Albrecht
Pennsylvania State University

John J. Bates
Environmental Research Laboratory
National Oceanographic and Atmospheric Administration

Samuel D. Epstein
California Institute of Technology

Lisa J. Graumlich
University of Arizona

Karen S. Humes
Hydrology Laboratory, Agricultural Research Service
U.S. Department of Agriculture

Devendra Lal
Scripps Institution of Oceanography

P.C.D. Milly
U.S. Geological Survey
NOAA/Geophysical Fluid Dynamics Laboratory

Harold D. Orville
South Dakota School of Mines and Technology

John O. Roads
Scripps Institution of Oceanography

David A. Robinson
Rutgers University

James A. Smith
Princeton University

Robert A. Weller
Woods Hole Oceanographic Institute

SUMMARY of SIXTH SESSION OF GEWEX SCIENTIFIC STEERING GROUP, Frascasti, Italy 17–22 January 1994

S. Benedict
World Meteorological Organization

This session of the GEWEX Scientific Steering Group (SSG) began with a review of the major national and international achievements since the group met for its fifth session in San Diego in February 1993. Volume 1 of the Implementation Plan for the GEWEX Continental-scale International Project (GCIP) and a draft of Volume 2 on the GCIP Research Programme have been distributed. Initiation of a National GCIP Project Office within the National Oceanographic and Atmospheric Administration (NOAA) Office of Global Programs was agreed to in principal, and details were put in place for conduct of a GCIP Integrated Systems Test (GIST) in 1994. In addition to GCIP, planning for regional GEWEX continental-scale projects (BALTEX, GAME, LAMBADA, and MAGS) continue to develop within guidelines established by the SSG and endorsed by the Joint Scientific Committee (JSC). Criteria for the National Earth Observing Programmes of the U.S.A., U.K., and Japan have proceeded to move toward the launch of large polar platforms later in the decade. A subpanel of the Working Group on Radiative Fluxes (WGRF) was named to advance plans for a millimeter-wave cloud radar that could fly on a non-sun-synchronous mission with other GEWEX specific instruments. A data set of more than 3 yr of the World Climate Research Programme (WCRP) shortwave radiation parameters was released on compact disc (CD-ROM) media. Progress was achieved at the second meeting of the Science Panel for the GEWEX Cloud System Study (GCSS) and in efforts by WGRF and the International Satellite Land Surface Climatology Project (ISLSCP) as integral parts of GEWEX. Other advances were made in each of the three scientific thrusts of atmospheric radiation processes, cloud system processes and land surface processes, and hydrology that are of major concern to GEWEX in its initial phase.

The objective of this meeting was to review gains critically in each of the GEWEX components focusing

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REPORT of GCIP MEETINGS NORMAN, OKLAHOMA, U.S.A. 18–22 October 1993

Dr. Michael Coughlan
GCIP Project Manager

Two related GEWEX Continental-scale International Project (GCIP) meetings were held in October at the Oklahoma Center for Continuing Education located on the University of Oklahoma campus, Norman, Oklahoma. They were the GIST Meeting and the GCIP Science Panel Meeting.

GCIP Integrated Systems Test (GIST) Meeting

The purpose of the first meeting held 18–19 October was to finalize the design of GIST covering those parts of the Red River and Arkansas River catchments in the United States serviced by the National Weather Service Operational Hydrology Unit in Tulsa, Oklahoma. The GCIP Integrated Systems Test was scheduled to begin in April 1994 as a buildup to the Enhanced Observing Period in 1995. There were over 93 participants at the meeting with representatives from about 20 universities and 20 government research facilities, plus operational meteorologists, hydrologists, water resource managers, and funding agency representatives. The meeting was formally opened by Prof. Jeff Kimpel, Provost of the University of Oklahoma at Norman.

Dr. John Schaake, Chairman of the GCIP Science Panel, in his opening address presented a review of the GCIP scientific objectives and outlined the material that has been assembled for inclusion in the Research Program volume of the GCIP Implementation Plan (Volume 2). Dr. Schaake's address was followed by a status report from the GCIP Program Manager on the overall implementation of the project.

Presentations on the detailed formulation of the GCIP Research Program were given by Dr. Franklin (Pete) Robertson (National Aeronautics and Space Administration Marshall Space Flight Center), Prof. Eric Wood (Princeton University), and Dr. Harry Lins (U.S. Geological Survey). Dr Robertson reviewed the plans for implementing atmospheric research tasks, with particular emphasis on those activities planned for the GIST time period. Prof. Wood reported on the progress the hydrological scientists are making in

the planning of GCIP-Mississippi, again with special emphasis on those activities proposed for GIST. Dr. Lins reported on the longer range plans for GCIP water resources research activities, noting that the scientific and data outputs from GIST and GCIP will provide the basis for the ongoing development of water resource assessment methodologies. The final review presentation was given by Dr. John Leese (International GEWEX Project Office [IGPO]), who reported on the status of GCIP data management activities and planned GCIP user-community services. The meeting then broke into working groups dealing with atmospheric, hydrologic, and water resources issues, the purpose being to discuss, clarify, and update points on the GCIP research approach and strategy presented in the review sessions.

In subsequent sessions, separately constituted working groups convened to address the following specific GIST research and design issues:

- Precipitation, including snow
- Surface and planetary boundary layer coupling
- Four dimensional data assimilation (4DDA)
- Soil moisture
- Runoff and streamflow
- Land surface characteristics

In the final plenary session a representative presented the group's findings. These findings were then summarized in written form by group rapporteurs for consideration during the following GCIP Science Panel meeting.

GCIP Science Panel Meeting

The Fourth GCIP Science Panel Meeting followed the GIST Design Meeting on 20–22 October. The 57 attendees included about two-thirds of the GCIP Science Panel, many of the Science Subpanel members, representatives of funding agencies, and other invited scientists. In the opening session the panel received updates on the following continental-scale projects being planned in other parts of the world:

- Mackenzie GEWEX Study (MAGS)
- LAMBADA-BATERISTA Experiment (LBE)
- Pan American Climate Studies (PACS)
- GEWEX Asian Monsoon Experiment (GAME)

Note was also taken of progress in the development of the Baltic Regional Experiment (BALTEX).

Information was provided to the panel on the status and expected capabilities of the Clouds and Radiation Testbed (CART) site being operated by the U.S. Department of Energy Atmospheric Radiation Measurement (ARM) Program. This site is located within the GIST area, and excellent opportunity exists for collaboration under the joint GEWEX/ARM Memorandum of Participation. It was agreed that a joint ARM/GCIP working group be created to facilitate linkages and to achieve value added science for GCIP and ARM, especially during their respective intensive observing periods.

As part of the overall review agenda, brief presentations were also made on the GCIP Implementation Plan, Volume 1—Data Collection and Model Output. Work is already underway on a number of items listed in Volume 1 including

- Upgrading of the National Meteorological Center Eta (mesoscale) and products
- Enhanced observations, e.g., Commercial Aircraft Sensing of Humidity (CASH) project
- Preparation of GCIP Initial Data Sets (GIDS) on CD-ROM
- Inventory of operational data

The principal task of the panel at this meeting was to approve the overall thrust and content of Volume 2 of the Implementation Plan–GCIP Research Program. Presentations were made by the chairmen of the GCIP Science Subpanels detailing their respective committee's contribution to the draft of Volume 2 and the additional material derived from the preceding GIST meeting. The main issues raised during the discussion related to specific omissions, the clarification of terminology, and the sequencing of activities.

Specific issues identified include

- The need to enhance or clarify concepts and planning on the transferability of GCIP research products, particularly how GCIP validated satellite data retrieval algorithms and GCIP-specific modeling successes might be applied to other continental-scale projects, and, in general, what provisions might be provided for greater international collaboration.
- The need to improve the description of science links to other projects, especially within GEWEX (e.g., the Global Precipitation and Climatology Project, GEWEX Cloud Systems Study, International Satellite Land Surface Climatology Project).
- The need to coordinate GCIP's activity with that of the ARM program in the region,

especially during the planned periods of intensive observations.

- The requirement for comprehensive gauge only precipitation analyses for the entire GCIP region during the enhanced observing period.

On the final day of the meeting detailed briefings on the progress in the implementation of tasks in Volume 1—Data Collection and Model Upgrade were given. Draft copies of Volume 3 on Data Management were available at the meeting and its completion will follow the publication of Volume 2 closely.

The meeting closed with the conclusion that the GCIP program had made substantial progress and had achieved most of its stated goals for 1993. The panel was especially pleased with the interest being shown in GCIP by several government agencies in the United States involved in the U.S. Global Climate Research Program. The panel also expressed its gratitude to the Science Subpanels, especially their chairmen, who had worked hard to bring structure into what was a diverse and complex project. The panel noted too with appreciation the efforts of the IGPO staff in drawing the various pieces together into what was becoming a coherent set of GCIP planning documents. Included in the GCIP goals for 1994 are

(1) Establishment of the GCIP Project Office, which the National Oceanic and Atmospheric Administration has agreed to host

(2) Conduct of the GIST suite of activities

(3) Implementation of initial ETA model upgrades at the National Meteorological Center (NMC)

(4) Development of new precipitation products

(5) Publishing of the GCIP Initial Data Sets (GIDS 1-3)

(6) Publishing of a GCIP Geographical Information System CD-ROM

(7) Preparation of the GCIP Implementation Plan Supplement for 1995–1997

(8) Establishment of a firm funding base for the Enhanced Observing Period.

The dates for the next GCIP Science Panel Meeting were agreed to be 2–4 November 1994. Several sites were considered, and the final recommendation was Boulder, Colorado.

LAND SURFACE MODELING AND ASSIMILATION INITIATIVES FOR GCIP NMC MESOSCALE ETA MODEL

Kenneth Mitchell[1], John Schaake[2], and Hua-Lu Pan[1]

[1]Development Division, National Meteorological Center
[2]National Weather Service Office of Hydrology

At the U.S. National Meteorological Center (NMC), in cooperation with the National Weather Service Office of Hydrology (OH) and the National Environmental Satellite Data and Information Service (NESDIS), several initiatives are underway (Mitchell, 1994) to develop improvements to land surface physics and data assimilation in NMC's newly operational Eta model. These initiatives are in support of Volume 1 of the GEWEX Continental-Scale International Project (GCIP) Implementation Plan (World Climate Research Programme, 1993). Currently operational at 80-km resolution with 38 layers over a North American domain, the Eta model is projected to be executing at 30-km, 50-layer resolution by mid-1994. The initiatives include

(1) Intensive diagnostic energy and water budget studies.

(2) Substantial upgrade of the Eta model land surface physics from a simple slab or bucket model to a multilayer soil model with vegetation. The upgrade will support output of gridded runoff coupled to a streamflow routing model so that discharge measurements can be included in model validation. At present, the NMC is testing the candidate land surface scheme of Pan and Mahrt (1987) against First ISLSCP Field Experiment (FIFE) observations with good results. The Office of Hydrology is studying methods for estimating soil moisture storage capacity parameter values and runoff routing parameters for the southeastern United States.

(3) A specialized, near real-time, continuously cycled Land Surface Data Assimilation System (LDAS) to provide initial surface state variables to the Eta model. Herein, the Eta model's land surface physics will be re-executed in a stand-alone mode on a 12–24-hr delayed

basis with forcing by 1–3 hourly *analyses* of winds, temperature, humidity, and in particular, precipitation, cloud cover, and surface solar insolation.

(4) Composite, high spatial, and temporal resolution precipitation analyses for North America to be developed by NMC using a blend of rain gauge data and WSR-88 (NEXRAD) radar-based estimates, and satellite-based cloud cover and surface solar insolation retrievals to be provided by NESDIS.

(5) Catchment-scale (10^3–10^4 km^2) stand-alone version of the LDAS to permit retrospective analyses using historical surface observations to provide parameter estimates and to assist in model validation.

Land Surface Data Assimilation System

The LDAS of initiative (3) is central to the overall effort, as its primary product will be initial soil moisture and soil temperature fields for the operational Eta model forecasts, including those forecasts used in the Eta-based four-dimensional data assimilation (4-DDA) system. Together, the LDAS and the Eta model 4DDA systems will provide state variable and flux analysis fields required by GCIP. The off-line LDAS analyses should substantially reduce the systematic errors that plague land surface fields generated by traditional 4DDA systems, which rely on forecasts of precipitation, cloud cover, and surface insolation. These three forecast fields are notorious for systematic error in numerical weather prediction models in general.

The catchment-scale version of the LDAS is required so that streamflow data can be used in evaluating alternative land surface parameterizations and for estimating parameter values (coefficients and exponents). Evaluation of modelled water budgets using long periods of historical data is needed to assure that extreme floods and droughts can be simulated and to demonstrate that initial moisture conditions can be estimated at the beginning of storm events.

Water and Energy Budget Diagnostic Studies

Large scale water and energy budget studies will be done by several GCIP researchers to validate atmospheric models and to examine how seasonal and interannual changes in regional precipitation depend on large-scale circulation anomalies versus regional differences in evaporation. To support these studies, the routine operational output of the Eta model is being expanded. These additional outputs focus on surface fluxes, ground processes, and hourly forecasts of vertical profiles ("soundings") at key GCIP sites. Pilot atmospheric diagnostic studies are underway using these expanded Eta model outputs being produced for GCIP.

Pilot monthly surface water budgets for 55 catchments in the southeastern United States are being studied using historical surface observations of precipitation and runoff beginning in 1930. Evaporation pan data are being used to estimate potential evaporation. Different assumptions are made to estimate actual evaporation, depending on soil moisture and potential evaporation. The main purpose of these studies is (1) to illustrate the range of variability of soil moisture over many years; (2) to estimate how soil moisture storage capacity varies in space (and/or with climate); (3) to illustrate, generally, how runoff depends on precipitation and soil moisture; and, (4) to examine, preliminarily, how alternative parameterizations of runoff might perform. An example of the long term seasonal variability of the water budget for Buffalo River, Arkansas, is shown in Fig. 1. An interesting diagnostic tool appears to be a graph of the ratio of average monthly runoff to average monthly precipitation versus specific soil moisture storage, as shown in Fig. 2. A counter-clockwise loop is observed to occur during the year. The basic structure of this loop does not appear to be sensitive to evaporation assumptions, although the exact thickness of the loop is sensitive.

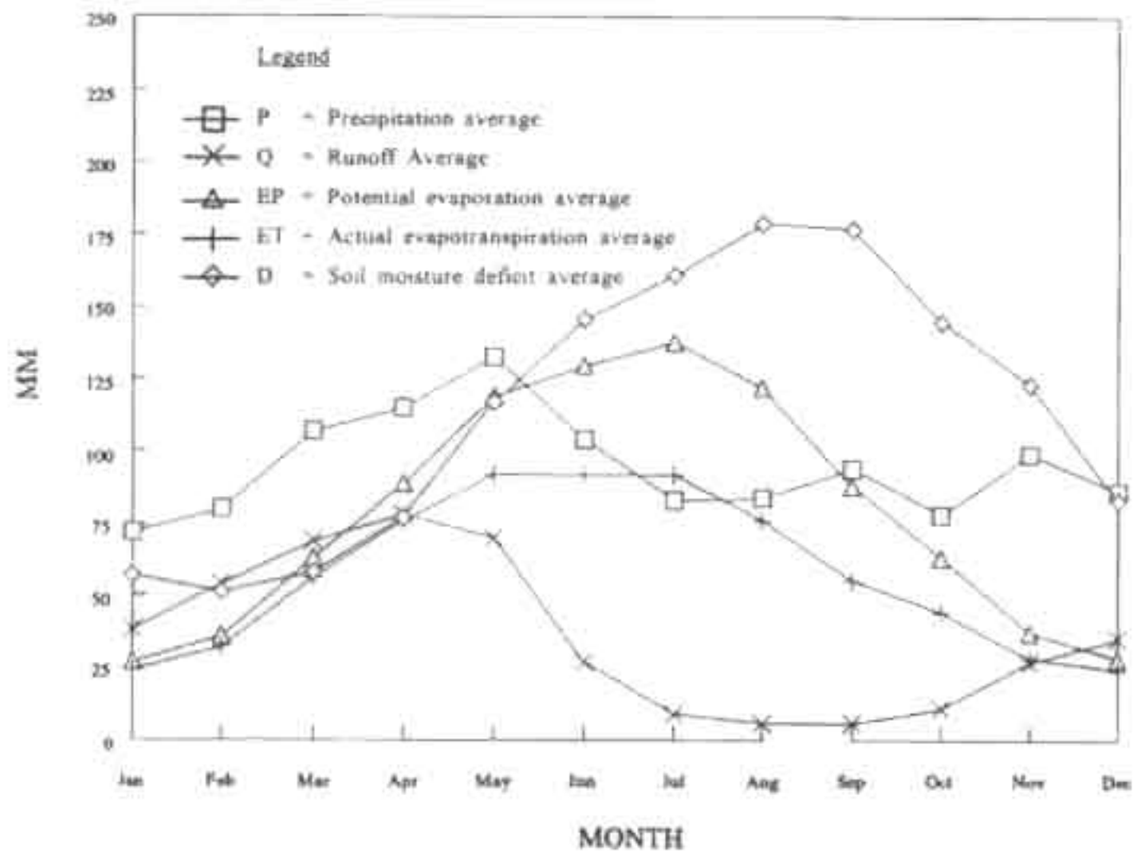

Figure 1. Long term seasonal variability of the Buffalo River water budget near St. Joseph, Arkansas.

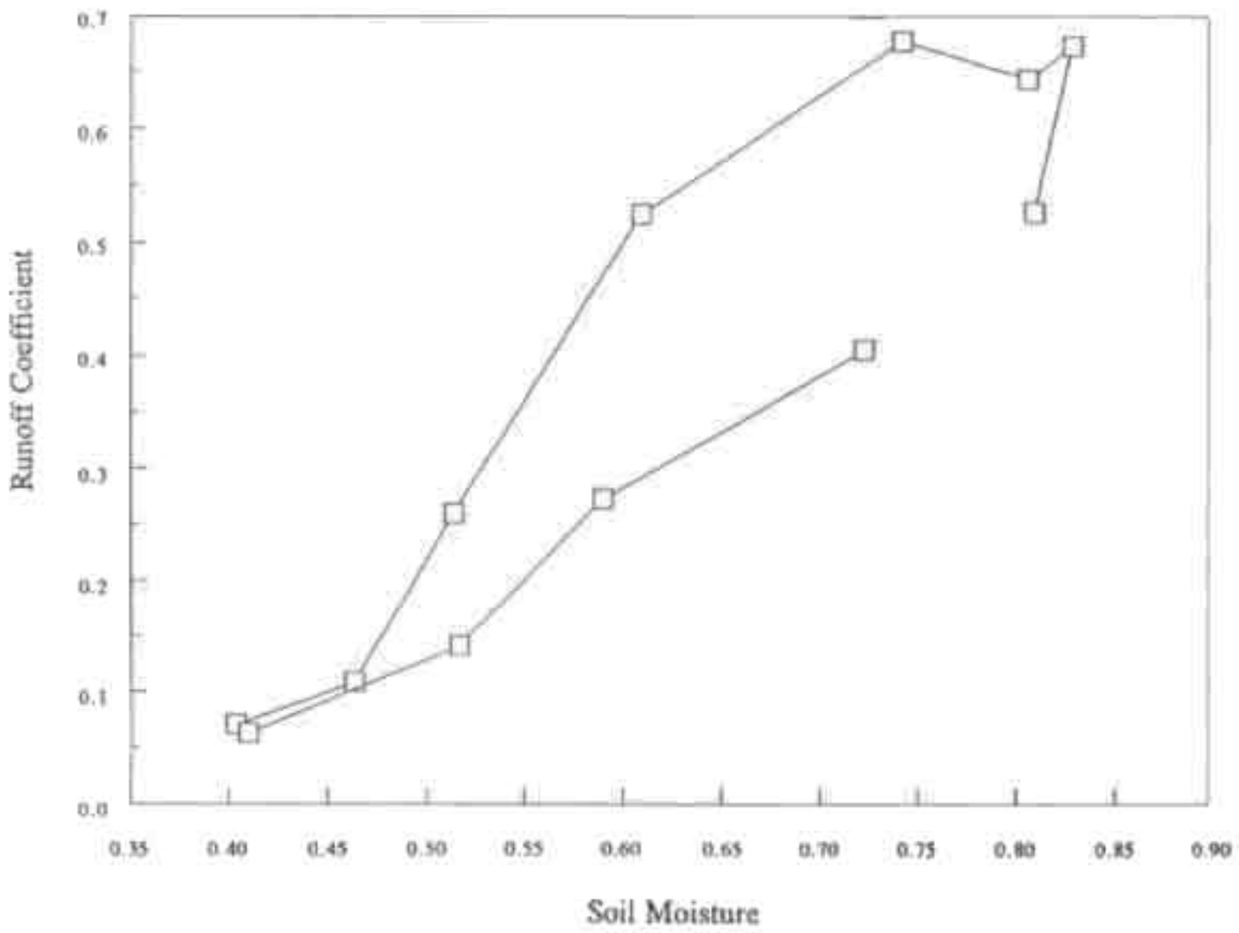

Figure 2. Runoff coefficient as function of soil moisture for Buffalo River, near St. Joseph, Arkansas.

Land Surface Parameterization Issues and Approach

The physical parameterizations in the Eta model are described by Janjic (1990). At present ground thermodynamics is based on the force-restore "slab" approach of Deardorff (1978). The ground hydrology uses a simple bucket (Manabe, 1969). The objective of the Eta model upgrade initiative is to improve this parameterization based on recent experience throughout the scientific community in modelling evapotranspiration and runoff. Ultimately, the improvements must take into account the differences within a grid cell of vegetated areas versus bare soil, the mix of vegetation and soil categories, and the spatial distribution of available water. Improvements in runoff estimation ultimately must consider the spatial distribution of precipitation, snow cover, frozen ground, soil moisture, terrain, and soil characteristics.

A challenge for any improvement is that values of model parameters (coefficients and exponents) must vary spatially and seasonally and must be able to be estimated from available information regarding climate, soils, and vegetation. Availability of such information is much better over some parts of the Eta model domain than others.

The plan is to test two approaches to surface hydrology in the Eta model, one quasi-statistical and one more deterministic. First, the extended bucket method developed by Schaake (1990) will be tested. It is being used successfully with limited data in the Nile River basin. Second, the plan is to test more deterministic land surface models with explicit multilayer soils and vegetation canopies. Two chief candidates are the simplified SiB model of Xue (1991) and the soil and vegetation model of Pan and Mahrt (1987).

The NMC is currently performing site specific validation tests of the Pan and Mahrt model, specifically the highly modular plug compatible version developed and implemented operationally by the U.S. Air Force (Moore et al., 1991). The results of one such test are shown in Figs. 3a and 3b. In Fig. 3a the observed surface fluxes near Manhattan, Kansas, are shown at 30-min intervals for a 48-hr period (with little cloudiness) starting from 0000 GMT, 9 August 1987. Here positive net radiation corresponds to a surface heat source, while positive values of the other fluxes correspond to a surface heat sink. These highly useful observed surface fluxes were assembled, as described by Betts et al. (1993), from averaging multiple surface-flux stations within the 15 x 15 km site of the 1987 FIFE field program. As shown in Fig. 3b, a corresponding simulation of the surface fluxes obtained from the Pan and Mahrt model employs two soil layers (5 cm and 95 cm thick) and three evaporation components (from soil surface, transpiration, and canopy interception). This is a "best case" simulation, wherein all half-hourly downward radiative fluxes and atmospheric state variables, as well as initial-time values of soil moisture and temperature, soil parameters (7), and plant parameters (5) were specified from FIFE observations and site characteristics.

A more significant and stringent test, currently in preparation, is a several month simulation over the entire FIFE–1987 summer season. Herein the plan is to examine the longer term ability of the model to simulate observed surface fluxes, soil moisture, and soil temperature over a period spanning several significant rain events.

In applying such an explicit land surface scheme over a horizontal domain, the plan is to model the subgrid variability of surface and subsurface fluxes by dividing a given model grid cell into several subcells or by representing it in terms of a distribution of point or hillslope elements. These applications would take into account the dominant types of vegetation, soil, and terrain characteristics, the spatial distributions of precipitation and energy forcing, and water and energy storage within the cell. Infiltration and subsurface movement of water will

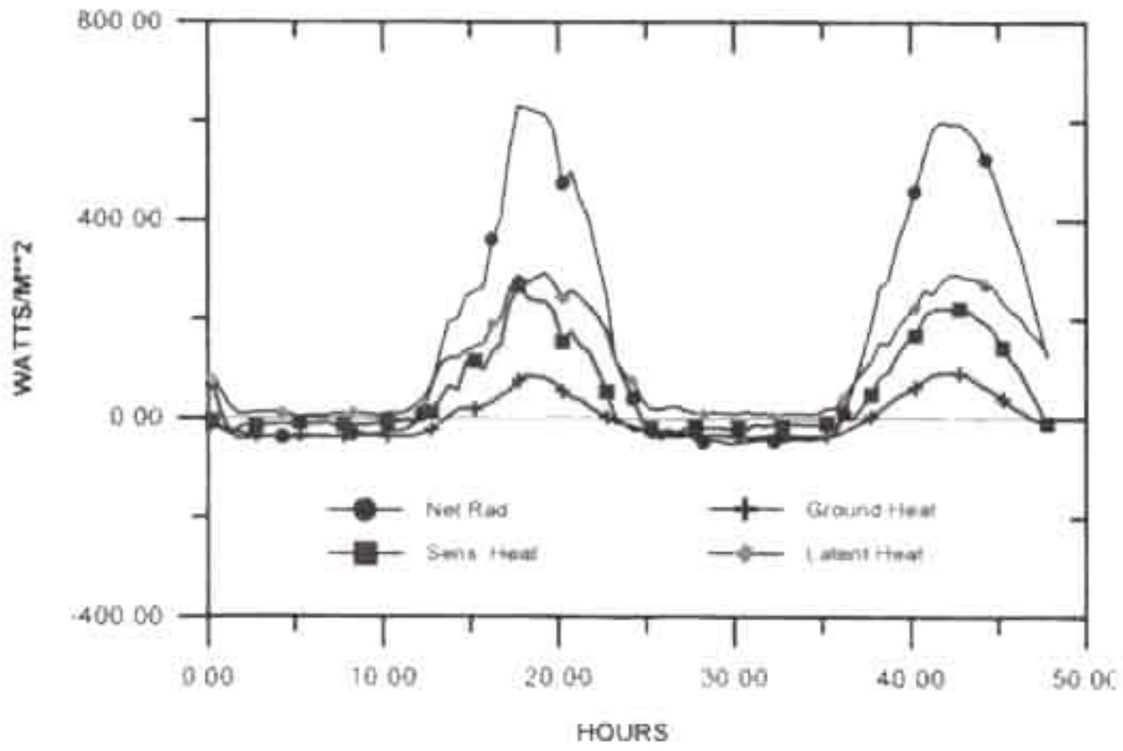

Figure 3a. Observed FIFE surface fluxes near Manhattan Kansas, 9–10 August 1987.

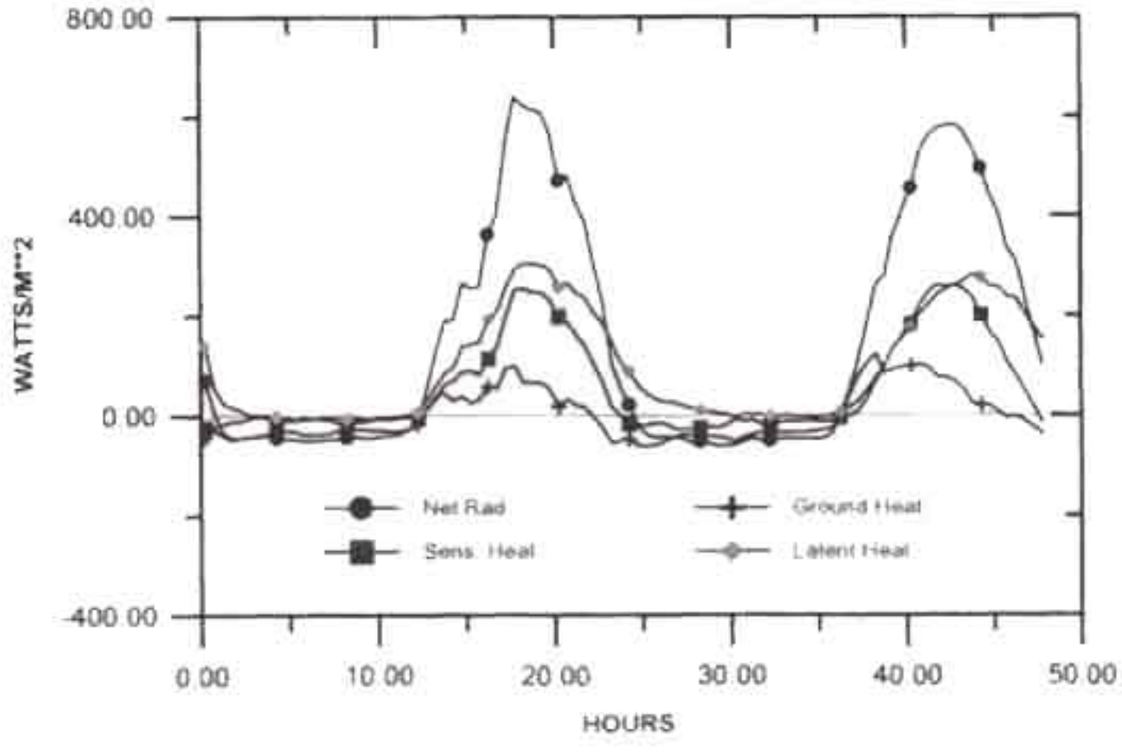

Figure 3b. Simulation of surface fluxes obtained from the Pan and Mahrt model.

be represented differently depending on the spatial scale of the basic computational element.

Model Verification

Verifying land surface parameterizations is difficult because model estimates of areally averaged surface fluxes and storage in the soil of water and heat cannot be measured at grid scale. Therefore, a strategy for model verification is required using measurements and results of data analyses that are available at various scales from different sources. In the following list the first two methods concentrate on using conventional surface measurements directly; the final three include measurements and analyses.

(1) Field experiments such as FIFE and Hydrological Atmospheric Pilot Experiment (HAPEX).

(2) Measurements from the U.S. Department of Energy, Atmospheric Radiation Measurement Project (ARM) such as are being made in Oklahoma and Kansas.

(3) Streamflow and spatially distributed analyses of runoff.

(4) Satellite retrievals of skin temperature (and surface evaporation) by the method of Tarpley (1993).

(5) Large scale atmospheric water budgets as estimated from soundings and 4DDA analyses.

Collaboration With the Scientific Community

The Eta model upgrade and the development of the LDAS is being done in a modular way to encourage and to simplify future collaboration. A research version of the Eta model land-surface physics is being developed to operate on a scientific workstation for small areas up to the size of the CART/ARM complex. It should be a relatively straightforward task to substitute alternative schemes to represent the land-surface processes. In addition, the plan is to test candidate upgrade schemes using the Project for Intercomparison of Land-Surface Parameterization (PILPS) data sets and provide the results to the PILPS project (Henderson-Sellers, 1992). Finally, an attempt will be made to develop additional data sets for PILPS that include real observations together with suggestions on how they may be used to support PILPS objectives.

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EDITOR'S NOTE

GEWEX investigators are encouraged to submit short articles on their findings for consideration in the Newsletter. Concise illustrations summarizing results are requested.

1994 PUBLICATION SCHEDULE

ITEMS DUE	PUBLICATION
10 April	May 1994
10 July	August 1994
10 Oct	November 1994

NEW NASA GEWEX RESEARCH OPPORTUNITIES

Research proposals are being solicited by the recently established National Aeronautics and Space Administration Water Cycle Processes Program. The new program was established by the Office of Mission Planet Earth (MTPE) to reside in the Physical Climate Branch of the MTPE Science Division.

The objective of the Water Cycle Program is:

> To understand the role of water in land-atmosphere interactions by promoting new or improved techniques for measuring hydrologic variables; by developing processes models for describing mesoscale coupling of atmospheric motion and the exchange of water, energy, and momentum at the land surface; and by formulating new theories about the role of land-atmosphere interactions in regional and global climate.

Topics of high priority include

(1) Characterization of the spatial-temporal variability of precipitation soil moisture.

(2) Scaling of the dynamic behavior of the atmospheric boundary layer and surface water and energy balance in both freezing (excluding polar regions) and nonfreezing environments.

(3) Development of coupled meteorological-hydrological models as tools for studying mesoscale interaction, including the means for validating them and the techniques for four-dimensional data assimilation.

Both experimental and analytical work will be supported. The scientific accomplishment anticipated from the work proposed specifically contributing to the objectives of GEWEX, and in particular, the GEWEX Continental-scale International Project (GCIP), should be identified in a brief section at the end of the proposal.

There is no specific deadline for submitting unsolicited proposals; approximately 6 months should be allowed for processing. Grants average US $80–120 thousand

per year and 2–3 years in duration. Pending availability of funds, approximately US $1.25 million is anticipated in FY 1994 for initiating new grants. Scientists planning to submit a proposal for 1994 funds are urged to discuss their interests with Dr. Ming-Ying Wei at 202–358–0771 prior to proposal submission. They are also encouraged to consult with others in the Earth System Modeling and Global Analysis Branch and the Terrestrial Ecology Program in the MTPE Science Division for work on complementary aspects of land surface hydrology.

SPACEBORNE MISSION FOR GEWEX

(Continued from page 1)

They are

(1) Interactions between precipitation and circulation in the tropics

(2) Cloud and radiation interactions

(3) Water and energy exchanges through the surface

From the analysis of the above research areas the study team proposed eight specific GEWEX space missions, as shown in Table 1. Missions A to D address the science objectives associated with interactions involving precipitation systems in the tropics; Missions E and F address cloud and radiation science objectives; the boundary layer and surface flux missions G and H are in the category of long-term surveys.

In order to realize the science objectives for each proposed mission the requirements for specific instruments to observe key parameters were identified. The data needs were determined in terms of precision, resolution, and sampling (space and time).

In the findings of the study reported by Solari et al. (1993), potential instruments were identified in the context of GEWEX data requirements and eight proposed missions were formulated, as listed in Table 1. The GEWEX spaceborne data requirements proved to be rather exacting both in terms of variables to be measured and in terms of sampling (space and time). Furthermore, it was realized that GEWEX science missions could not be carried out independently. Also, there is considerable commonality in data requirements between the eight proposed GEWEX science missions. For example, Missions A and B data requirements are also covered by Missions C and D. In Table 2 (Solari et al., 1993) six space mission scenarios are presented that reflect the aforementioned overlapping data requirements.

TABLE 1
LIST OF PROPOSED GEWEX MISSIONS

MISSION	DESCRIPTION
A	Maintenance of tropical circulation by latent heat release
B	Tropical circulation monitoring
C	Control of convection by humidity convergence
D	Convection monitoring
E	Cloud life cycle and influence of cloud morphology
F	Albedo effect versus greenhouse effect
G	Dynamics and atmospheric boundary
H	Surface fluxes over land and sea

The ESA study has highlighted some GEWEX data requirements obtainable from spaceborne instruments and six specific GEWEX missions proposed to serve as a basis of discussion. The proposed studies have spaceborne data requirements beyond those likely to be provided by established observing systems. Within the category of new instruments are a Doppler wind lidar and a cloud radar. Cloud radars are in the planning stage for ENVISAT-2 (as is ATLID) and the TRMM follow-on. However, no concrete plans have been made to cover the provision of a Doppler wind lidar that is on a critical path for GEWEX. The implications of not having these data available in time for GEWEX require further investigation.

REFERENCE

Solari, G., C. Readings, M. Desbois, and R. Sadourny, 1993: 'GEWEX'—Requirements for Data from Spaceborne Instruments. ESA Bulletin, **75**, August 1993, 26–36.

ACKNOWLEDGMENT

The authors would like to express thanks to their many colleagues in Aerospace, LMD, and ESA for assistance in this study.

TABLE 2. SPACE MISSION FOR GEWEX

	New Missions/Flight Opportunities		Planned Missions/Flight Opportunities	
	Instruments	Orbit	Key Instruments	Missions
Mission A+C	Rain Radar+MIMR+AVHRR	Tropical	MIMR+IASI+ASCATT	METOP (polar)
			MIMR+AIRS	EOS-PM (polar)
	Doppler Wind Lidar	Tropical	Rain Radar+SSM/I+AVHRR	TRMM/2 (tropical)
Mission B+D	Doppler Wind Lidar	Polar	MIMR+IASI+ASCATT	METOP (polar)
			MIMR+AIRS	EOS-PM (polar)
Mission E	ATLID+POLDER+Cloud Radar	Polar	MIMR+IASI+SCARAB+AATSR	METOP (polar)
			MERIS+AATSR	ENVISAT (polar)
			CERES+AIRS+MIMR	EOS-PM (polar)
			CERES+MODIS	EOS-AM (polar)
Mission F	ATLID+Cloud Radar	Polar	As for Mission H	
Mission G	ATLID	Polar	ASCAT	ENVISAT (polar)
Mission H	POLDER	Polar	MERIS+ASCATT+AATSR+SCARAB	ENVISAT (polar)
			MIMR+AATSR	METOP (polar)
			CERES+MIMR+AIRS	EOS-PM (polar)
			CERES+MODIS	EOS-AM (polar)

NOTES

(a) Assuming that data from the operational meteorological instruments are available;
(b) The listed planned mission/flight opportunities are illustrative; others may also be planned;
(c) The TRMM/2 (i.e., TRMM follow-on) is only a partial substitute for a GEWEX precipitation mission.

ACRONYMS

AATSR	Advanced Along-Track Scanning Radiometer
AIRS	Atmospheric Infrared Sounder
ASCATT	Advanced Scatterometer
ATLID	Atmospheric Lidar
AVHRR	Advanced Very High Resolution Radiometer
CERES	Clouds and Earth's Radiant System
EOS AM	Earth Observing System (morning pass)
EOS PM	Earth Observing System (afternoon pass)
IASI	Infra-Red Atmospheric Sounding Instrument
MERS	Medium Resolution Imaging Spectrometer
METOP	Meteorological Operational Satellite
MIMR	Multifrequency Imaging Microwave Radiometer
MODIS	Moderate-Resolution Imaging Spectrometer
POLDER	Polarization and Directionality of Earth's Reflectances
SCARAB	Scanner for Radiation Budget
SSM/I	Special Sensor Microwave/Imager

GEWEX IN ASIA

An International Symposium on GEWEX in Asia will be held on March 3–6, 1994, at Peking University, Beijing, China. This symposium is co-organized by the Chinese Liaison Group of GEWEX and the Japan National Committee for GEWEX. The chairpersons of the international organizing committee are Prof. Zhao Bolin (China), Prof. T. Takeda (Japan), Prof. T. Yasunari (Japan), and Prof. Ding Yihui (China). Peking University will host the meeting. An important aim of this symposium is to discuss strategy of international cooperation related to GEWEX and GAME in Asia and to exchange scientific information between GCIP, GAME, and other continental-scale budget studies in the GEWEX.

For further information on this meeting, contact Dr. Zhang Wenjian, Secretary-General of the Organizing Committee, c/o Dept. of Geophysics, Peking University, Beijing 100871, P.R. China: Tel: 86–10–2501131; Fax: 86–1–2564095.

PROGRESS ON IMPLEMENTING BALTEX

The Baltic Sea Experiment, BALTEX, is developing further into an international cooperative effort. Almost all countries whose rivers drain into the Baltic Sea have either formed national committees or nominated a sectional representative for this project. These are: Belarus, Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia, and Sweden. Several operational agencies declared their readiness to take over responsibility for management and analysis of meteorological data (Deutscher Wetterdienst, Offenbach), hydrological data (Swedish Meteorological and Hydrological Institute, Norrkoping, Sweden), and oceanographic data (Finnish Institute of Marine Research, Helsinki, Finland).

Two major limited area model chains, which are nested in global weather forecast and analysis schemes, will be used for detailed studies of processes that are most effectively affecting energy and water cycles within the system formed by the atmosphere, continental surfaces, and also the Baltic Sea. There are models of the HIRLAM-family (developed primarily by the Nordic countries) and of the Deutscher Wetterdienst; both are providing spatial resolutions of up to 10–20 km.

The BALTEX Steering Group will consist of representatives from all 10 countries but must also ensure a balanced representation of three major scientific disciplines: hydrology, meteorology, and oceanography. Three working groups that were formed to prepare the work for the major research phase (a buildup phase of 2 years) will start in about 1996. During the research phase many process studies with models and field measurements will be carried out to improve the understanding of the branches in energy and water cycles over the various continental surfaces, climate zones, and the Baltic Sea itself. Extensive use of all available satellite data will be made during the research phase.

The BALTEX research is open for all interested research groups and individuals located outside of the BALTEX countries. A major BALTEX conference is planned for the last week of August 1995; it will be held in Visby on the island of Gotland. Inquiries should be directed to Prof. Dr. E. Raschke, c/o BALTEX-Secretariat, GKSS Research Center, D-41502 Geesthacht, Germany. Phone: +49–4152–871834; Fax: +49–4152–871888, E-Mail: raschke@dvmc10.gkss.de.

CANADIAN GEWEX UPDATE

The Canadian GEWEX Programme is planned as an integration of scientific activities in atmospheric science and hydrology, of university and government researchers, and of funding support from several sources. The programme is focusing on the Mackenzie River basin, and the results will be an improved understanding of cold region, high latitude hydrological and meteorological processes, and the role that they play in the global climate system. The research will be mostly conducted as part of the Mackenzie GEWEX Study (MAGS). The scientific aspects of the Canadian GEWEX Programme made significant progress during the 1992/93 fiscal year as a result of government research projects and university studies.

On 30 July 1993 a Collaborative Special Project and Programme (CSPP) proposal was submitted to the Natural Sciences and Engineering Research Council (NSERC) of Canada requesting funding of the university portion of the Canadian GEWEX Programme. The CSPP proposal requests approximately Can $4 million over a 3-yr period for 13 projects (involving 28 investigators representing 10 universities in 5 provinces), as well as infrastructure and data management functions. The collaborative project leader is Prof. Gordon McBean from the University of British Columbia. A decision on the level of funding is expected in early 1994.

The Canadian GEWEX Programme will add complementary scientific activities to enhance understanding of the role of storm-related physical processes in the climate system, during the Beaufort and Arctic Storms Experiment (BASE) planned for the Inuvik area during the fall of 1994. The experiment will have core funding provided by the Canadian Panel on Energy Research and Development (PERD).

For further details and information about the Canadian GEWEX Programme contact Terry Krauss, Canadian GEWEX Secretariat, National Hydrology Research Centre, 11 Innovation Boulevard, Saskatoon, SK, Canada, S7N 3H5. Tel. 306–975–4215, Fax. 306–975–5143.

GCSS SCIENCE PANEL MEETS

The second session of the GEWEX Cloud System Study (GCSS) Science Panel meeting was held 7–10 December 1993 in Reading, U.K. The objective of this meeting was to expand upon the existing draft of the GCSS Implementation Plan by Sam Benedict, World Climate Research Programme (WCRP), and Dr. Paul Try, International GEWEX Project Office (IGPO). Participation in the meeting provided links to other WCRP activities and GEWEX components.

The agenda included presentations by invited speakers and reports by the GCSS Chairman, Dr. Keith Browning, and the chairmen of the working groups contributing to the GCSS Implementation Plan. Dr. Browning reported on the 25 responses from a survey of leading Numerical Weather Prediction and Climate Modelling Centre directors. The purpose of this survey was to improve the definition of GCSS priorities in pursuing its aim to use cloud resolving models to develop better parameterizations of clouds in large-scale climate models. The main survey recommendations were

(1) Improve physical realism in the cloud parameterization schemes used in cloud submodels.

(2) Unify parameterization schemes to take into account coupling between physical processes.

(3) Require better *in situ* and remote sensing measurements to improve cloud resolving models.

(4) Use prognostic cloud water variables within GCMs as a means for implementing improved parameterization.

The working group (WG) structure was reviewed at the meeting resulting in a change to the charter of the precipitating (frontal) cloud group to be expanded and renamed the Working Group on Extra-Tropical Layer Cloud Systems. The activities of each WG were reviewed. Brief summaries of key issues follow.

The Boundary Layer Cloud Systems (WG-1) Chairman, Dr. William Cotton, reported that the proceedings of the Workshop on the Parameterization of the Cloud-topped Boundary Layer held 8–11 June 1993, has been prepared for publication. The general agreement reached by WG-1 is that boundary layer clouds are not well represented in numerical weather precipitation and climate models.

Dr. Erhard Raschke, Chairman of the Working Group in Extra-Tropical Layer Cloud Systems (WG-2), summarized the issues regarding cirrus clouds, noting the importance of quantifying cirrus properties (radiative, microphysical, etc.) versus large-scale forcing parameters provided by numerical weather prediction and climate models. The WG-2 is formulating plans with the European Centre for Medium Range Weather Forecasting (ECMWF) for a November 1994 workshop to extend efforts on characterizing existing models in relation to cirrus and mid-level cloud types.

The WG-3 had an initial narrow focus of precipitating nonconvective layered clouds. Dr. Ronald Stewart, Chairman of WG-3, accepted the expanded responsibility to add extratropical cyclones including polar lows to this working group's responsibility. A 1994 workshop in coordination with WG-2 is planned to develop future modelling strategies for these cloud types.

Precipitating convective cloud systems are the focus of WG-4. The scale interaction of processes including microphysics, surface layer, boundary layer, radiation, and turbulence to mesoscale (up to a few hundred kilometers) convective systems, and ultimately to large-scale cloud mean flow interactions, are all concerns of this working group. An initial phase of the GCSS convective cloud system of activities will be on anvil cirrus-producing cloud systems. In keeping with this decision the WG-4 Chairman, Dr. Mitch Moncrieff, announced an early 1994 meeting will be scheduled to assist those planning the late 1995 Maritime Continent Thunderstorm Experiment to be conducted near Darwin, Australia. Recommendations developed at the GCSS Panel Meeting could be grouped into three general categories: (1) enhance observational and measurement requirements; (2) improve data procedures; and (3) actions to foster collaboration with GEWEX components and other related projects. A stand-alone recommendation is for establishing a new working group to address topography effects on cloud systems.

Sixth Session of GEWEX Scientific Steering Group *(Continued from page 3)*

on an assessment of achievements attained so far, consideration of areas where significant momentum has been built and areas where more effort is required to attain the desired results. In particular, the SSG reviewed plans for related national and international surface and space based observational activities, results of ongoing GEWEX projects, production of validation data sets, and improvements in interactive atmospheric and hydrological models.

The SSG reviewed a statement, submitted by the Director of WCRP, which outlined future orientations for confirmation or redefinition. The group concurred with the appraisal that GEWEX has a major role to play in four specific areas of climate science:

(1) Continuation of the ongoing global climatology projects and expansion of efforts to provide additional data sets for model validation.

(2) Continued critical evaluation of the major space observation programmes and promotion of specific missions to fill gaps in current space agency plans for global observations of energetic and hydrological processes in the earth climate system.

(3) Advancement of the development of interactive atmospheric and macroscale hydrological models and expansion of efforts to gain support and active involvement of the operational environmental services in improving model formulations.

(4) Provision of an international cooperative framework for accomplishment of atmospheric and hydrological process studies that will help improve the parametric representation of these processes in global climate models.

The GCIP presentations provided a comprehensive review of the overall operational aspects of the project. There has been significant progress in the implementation of the NEXRAD Weather Surveillance Radar 1988 Doppler (WSR-88D) network and related hardware systems. A cooperative agreement exists between GEWEX and the Atmospheric Radiation Measurement (ARM) project of the U.S. Department of Energy, and additional agreements may evolve with other agencies. At the same time development of techniques for recording, archiving, and using the data, and distributing and managing the data and products are on schedule.

However, as the GCIP research strategy has evolved, the connection between GEWEX and GCIP and the scientific interest and emphasis on data exploitation through improved model formulations continues as an issue that has not been satisfactorily resolved. To meet this problem, the SSG, prompted by recent results in predicting rainfall one month in advance by linking soil moisture storage to evaporation, runoff, and rain, has restated the central goal of GCIP to be: *To provide the validation data needed for making progress in quantitative predictions of coupled atmospheric and hydrological phenomena.* This statement was shaped from the first two objectives of the project published in the GCIP Scientific Plan, which deal with determining the variability of the hydrological and energy budgets over continental areas and developing and validating coupled hydrological and atmospheric models. Having seen the potential value of improved prediction of precipitation events such as those that occurred in the summer of 1993 in the Mississippi River Valley, this GCIP role is being promoted in the United States at the highest levels of agency management, including the top management of NOAA. To meet these goals and coordinate the involvement of the macroscale hydrological modelling community and the operational centers, the SSG recommended the establishment of a GEWEX Modelling Panel.

STATUS OF GVaP RESEARCH AND OBJECTIVES

Graeme L. Stephens
Colorado State University

The GEWEX Water Vapor Project (GVaP) held a meeting 23–27 August 1993, at Breckenridge, Colorado. GVaP, a GEWEX component, seeks to improve understanding of the role of water vapor in meteorological, hydrological, and climatological processes through improved knowledge of water vapor and its variability on all scales.

A series of four specific activities (subtasks) have been identified for the GVaP pilot phase as follows:

(1) Assessment of global water vapor retrievals from satellites

- Global dataset preparation
- Intercomparison of data from different satellites

(2) Operation of a pilot water vapor reference station

(3) Intercomparison of water vapor sensing instruments

(4) Research and development to improve radiosonde humidity data

During the Breckenridge meeting the focus was on the first of these GVaP research objectives. This workshop was sponsored by the National Oceanographic and Atmospheric Administration (NOAA), the Cooperative Institute for Research in the Atmosphere, and the World Climate Research Programme (WCRP).

The broad goal of this meeting was to identify major sources of global water vapor data and to evaluate the limitations of these data. A number of issues were discussed including

- Status of satellite data and satellite algorithms.
- Applications of these data and their validation, including potential of aircraft work, and radiosonde data.
- Product development—what products can be done now with confidence (e.g., column water), and what is the status with vertical profile information, and what needs to be done to go the next step.

The meeting began with presentations that provided an excellent update of the status of water vapor research on all fronts (including measurements from satellites, surface and radiosondes, as well as, available data sets, calibration and validation of instruments and algorithms, and the application of data to modeling). These set the stage both for significant discussion and for developing a set of recommendations and action items which include

(1) Making available both sensor data records (SDR) from the Special Sensor Microwave/Imager (SSM/I) and environmental data records (EDR). Further coordination between the National Aeronautics and Space Administration (NASA) and NOAA was recommended to ensure that activities continue in a complementary fashion.

(2) Developing under GVaP a water vapor data set, based on radiosonde observations, to help evaluate existing retrieval algorithms and to assist in the development of improved ones.

(3) Using global total column water vapor data sets now being produced for 1987–88 under NASA sponsorship. This is the key first step in meeting the GVaP Subtask 1a requirements. The follow-on efforts involve extraction of vertical profile data. In general, production of global water vapor data sets requires blending or merging or model-driven four dimensional data assimilation (4DDA) techniques. Therefore, preservation of original datasets, including radiance data, must be done in parallel since these merging 4DDA methods are generally irreversible.

(4) Expressing the concerns of the research community to NASA Headquarters on the recent withdrawal of the microwave humidity sensor from the Earth Observing System AM platform. A draft letter was reviewed by the entire group.

(5) It was determined now to be timely for developing an Implementation Plan for Subtask 1b (Intercomparison of Data from Different Platforms). The 2-yr Pathfinder and 4-month Tropical Ocean Global Atmosphere (TOGA) Coupled Ocean Atmospheric Response Experiment (COARE) data should be the primary data to be considered, along with all other available data sets. The TIROS Operational Vertical Sounder versus SSM/I versus Stratospheric Aerosol Gas Experiment issues should be addressed. Also, any other related work required needs to be identified. This remains as an action item for the GVaP satellite working group.

(6) Developing a plan for a water vapor algorithm intercomparison project, complementary to the dataset intercomparison project.

(7) Adding the satellite calibration and validation function to the rationale and subsequent planning for the establishment of the reference stations. (Subtask 2–Reference Stations was developed to begin the acquisition of long term water vapor high resolution time series data.) A second marine site has always been in the GVaP plan; however, the need for a worldwide network of baseline reference water vapor reference stations similar to the Baseline Surface Radiation Network was identified. This network would entail increased international participation since it is envisioned that all but two would be operated and maintained by international partners. A concept implementation plan is needed to outline this potential effort.

SUMMARY OF CLOUD WORKSHOP

S. Benedict
World Meteorological Organization

On 18–20 October 1993 an international cloud workshop was held in Washington, DC, U.S.A. This workshop was organized by the International Association of Meteorology and Atmospheric Physics (IAMAP) Joint Working Group on Clouds and Radiation and was held in association with the World Climate Research Program (WCRP)–GEWEX Working Group on Radiative Fluxes and the WCRP Working Group on Numerical Experimentation and the WCRP–GEWEX Cloud Systems Science Panel.

The aim of the workshop was to bring together representatives of the cloud physics, radiative transfer and climate modelling communities to focus on cloud radiations and their parameterizations. This focused topic has been recognized by the scientific community to have a major effect on the fast component of the climate system. The GEWEX Programme is the WCRP primary effort addressing clouds and radiation effects on the fast component of the climate system. Clouds interact both with solar radiation and with the radiation thermally emitted by the earth and atmosphere. The combined effect of these interactions depends significantly on cloud parameters, the profile of atmospheric temperature, humidity, and aerosols, and surface temperature and optical properties. These processes often occur on scales smaller than the grid spacing of the global numerical models used for climate and weather prediction. The large-scale impact of clouds must, therefore, be parameterized in general circulation models and other large-scale models in terms of the basic variables defined on the model's coarse grid.

The workshop successfully facilitated interaction between participants with emphasis on linkages to and between GEWEX projects. The participants were from different scientific disciplines and widely separated geographic locations. Discussions ranged from new developments in numerical modelling, recent cloud physics findings, and descriptions of cloud programs. Activities discussed include the following:

- The development at the European Centre for Medium Weather Forecasting (ECMWF) of a more unified stratiform and convective cloud-radiation scheme for large-scale models. Results of tests in the ECMWF global forecast model that have been compared to the operational diagnostic cloud scheme show that the new method produces more realistic cloud fields and radiation fields at the top of the atmosphere when correlated with observed values from data derived from the Advanced Very High Resolution Radiometer, Special Sensor Microwave Imager, Earth Radiation Budget Experiment, and High Resolution Infrared Sounder/2.
- Aerosols as an important parameter in studies of cloud-radiation interactions because of their potential to directly and indirectly change the radiative balance of the earth. It was noted that more information is needed on worldwide distribution of anthropogenic aerosols properties to determine their effects on climate adequately.
- The new decade long Japan Cloud-Climate Study (JACCS) program to develop better parameterizations of cloud and radiation processes used in climate models and to promote advanced uses of satellite data in the study of cloud-climate relationships.
- A single shortwave-longwave radiation code for use in a variety of radiative calculations from studies of atmospheric processes and simulations of observations to climate modelling in global circulation models.
- Results from numerical experiments conducted at the Roshydrometcentre in Moscow on the estimation of the effect of cloud-radiation interactions on the predicted patterns of various meteorological fields.

GEWEX SESSIONS AT AMERICAN METEOROLOGICAL SOCIETY ANNUAL MEETING

The full day (27 January 1994) of GEWEX presentations at the annual meeting of the American Meteorological Society in Nashville, Tennessee, was very well attended. The entire agenda for the week can be found in the October 1993 issue of the Bulletin of the American Meteorological Society. Readers of GEWEX News are already well informed on the topics presented by many of the participants. For example, Alan Betts discussed model advances at the European Center for Medium Range Weather Forecasting, Harvey Melfi reviewed the GEWEX Water Vapor Project, Kenneth Mitchell reported on Eta model progress, and Ann Henderson-Sellers reported on Phase 1a of the Project for Intercomparison of Land-Surface Parameterization Schemes results. These GEWEX papers and others are included in the preprint volume of the Fifth Symposium on Global Change Studies, available from the American Meteorological Society, 45 Beacon Street, Boston, Massachusetts 02108.

GEWEX SURFACE RADIATION BUDGET WORKSHOP

Robert Schiffer
NASA Headquarters

On 10–12 November 1993 in Williamsburg, Virginia, U.S.A., the GEWEX Surface Radiation Budget (SRB) Workshop on Algorithms and Data was conducted. This workshop also addressed issues related to the cloud and radiation component of GEWEX. The purpose of this meeting was specifically to review the strategy currently defining the direction of the World Climate Research Project (WCRP) Surface Radiation Budget effort. The workshop addressed the continuation of global processing for shortwave (SW) surface radiation dataset, the initiation of longwave (LW) global processing by the SRB Project, and the selection of algorithms, data sources, and data products for these activities.

The GEWEX SRB Project results were reviewed as background at the workshop for the purpose of providing the guidance for future work. Some of the accomplishments include the following:

- Produced a 4-yr data set of global SW surface radiation retrievals using data from the International Satellite Cloud Climatology Project (ISCCP) and made available both on CD-ROM and electronically through the National Aeronautics and Space Administration (NASA) Langley Distributed Active Archiving Center. Data from each of these formulations have been compared to each other and to the Global Energy Balance Archive (GEBA) at the Swiss Federal Institute of Technology.

- Comparison of net SW results using algorithms developed by outside groups of investigators (with both ISCCP and Earth Radiation Budget Satellite Data) brought out differences and has led to modifications to compensate for the differences.

From the discussions several recommendations emerged. They were

- A single SW climatology data set be made available for use by the multidisciplinary science community based on the Pinker SW retrieval scheme, with other retrieval results made available as quality control data sets for intercomparison.

- A LW surface radiation data set be produced at the same time as the SW data set, recognizing that reducing the remaining uncertainty in the large incoming and outgoing infrared fluxes at the surface remains an outstanding problem.

- The next generation of SRB Project SW and LW fluxes should be based on ISCCP version 2, which is expected to be issued shortly, and also on temperature profiles from the National Meteorological Center or the European Center for Medium Range Weather Forecasting reanalysis, and the microwave-based humidity profiler from the GEWEX Water Vapor Project when they become available.

- The SRB Project should continue with a specific calibration and validation component, but in the future the project should include available high resolution satellite data and interpolated input fields to produce special SRB estimates more nearly coincident with ground sites (including the specification of local surface properties). This action was thought necessary when it became apparent at the workshop that, comparing directly, the SRB estimates on a 2.5° x 2.5° grid to the very few "ground truth" measurements available from existing operational radiation stations or the forthcoming Baseline Surface Radiation Network are not fully satisfactory.

- Comparison of pyrgeometers, spectrometers, and LW calculations in SPECTRE was close enough to regard a very well calibrated and operated pyrgeometer as accurate to within about 5 Wm^2.

The SRB Project global processing is managed by Charles Whitlock at NASA Langley. The science direction is set by the ad hoc SRB Science Working Group, whose chair (Thomas Charlock) called the workshop in consultation with Robert Schiffer (WCRP Radiation Project Office) and Thomas Vonder Haar (Working Group on Radiative Fluxes).

The SRB Project data may be accessed on line through the NASA Langley Distributed Active Archive Center, DAAC (userserv@eosdis.larc.nasa.gov; PHONE: 804–864–8656; FAX: 804–864–8807). Abbreviated monthly averaged results are available by FTP (charloc@sarsun.larc.nasa.gov).

CALL FOR PAPERS

An International GCIP/MAGS Workshop on Scaling in Hydrometeorological/Hydrological Processes and Models will be held 19–23 September 1994, in Victoria, British Columbia, Canada. A special session of this workshop will also be held on GIST (GCIP Integrated Systems Test)—being carried out in Oklahoma during the summer of 1994.

The workshop discussions will center on three main themes:

- Scaling of hydrometeorological processes including cloud systems, synoptic scale systems, precipitation patterns, and land surface features and conditions.

- Techniques and data requirements for scale analysis including the analysis of remote sensing data.

- Scaling in macroscale models and the experiences in scaling up from small watersheds to large basins.

You are invited to submit an abstract for an oral presentation or a poster presentation at this workshop. Your paper should focus on one of the three themes, although other submissions will be considered. An extended abstract of 150–300 words should be submitted by 1 April 1994 to Rick Lawford, (see address below). Authors will be notified of acceptance of their papers by 1 May 1994 or shortly thereafter. There are tentative plans to produce a book from selected presentations at the workshop.

For further information on obtaining abstract forms and costs of the workshop, contact Rick Lawford, Chief, Hydrometeorological Processes Division, National Hydrology Research Centre, 11 Innovation Blvd., Saskatoon, Saskatchewan, Canada S7N 3H5, Telephone: 306–975–5775, Telefax: 306–975–5143.

WCRP/GEWEX MEETINGS CALENDAR

3–6 March 1994—INTERNATIONAL SYMPOSIUM ON GEWEX IN ASIA. For information contact Dr. Zhang Wenjian, Peking University, Beijing 100871, P.R. China. (See notice on p. 11.)

15–18 March 1994—SEVENTH JOINT SCIENTIFIC COMMITTEE/WCRP Meeting, Geneva, Switzerland.

18 March 1994—LAMBADA/BATERISTA EXPERIMENT (LBE) Science Steering Panel Planning Meeting, Goddard Space Flight Center, Greenbelt, Maryland, USA (by invitation only).

21–27 March 1994—SCIENTIFIC STEERING COMMITTEES of both the International Satellite Land-Surface Climatology Project (ISLSCP) and the IGBP Core Project Biological Aspects of the Hydrological Cycle (BAHC) will hold sequential 3-day committee meetings in Tucson, Arizona, USA.

31 May–3 June 1994—CLIMATIC PARAMETERS IN RADIOWAVE PROPAGATION PREDICTION, Moscow. For more information contact Mr. M.P.M. Hall, Rutherford Appleton Laboratory, Chilton, Didcot, Oxon, OX11 OQK, UK. Phone: +44 235 446650, Fax: +44 235 446140, E-Mail: mpmh@ib.rl.ac.uk; Dr. Y.B. Zoubarev, Radio Research Institute, NIIR, 16 Kazokova Str. Moscow 103064, Russia, Phone: +7095 267 0547, Fax: +7095 2610090.

5–8 July 1994—WORKING GROUP ON RADIATION FLUXES (WGRF) Meeting, Luneburg, Germany.

11–14 July 1994—WGDM FOR WCRP RADIATION PROJECTS, Budapest, Hungary.

18–22 July 1994—EUROPEAN CONFERENCE ON THE GLOBAL ENERGY AND WATER CYCLE. For registration information on this conference write The Executive Secretary, Royal Meteorological Society, 104 Oxford Road, Reading, Berkshire RG1 7LJ, UK.

25–29 July 1994—WESTERN PACIFIC GEOPHYSICS MEETING, Hong Kong. For more information contact Dr. X. Gao or Prof. S. Sorooshian, Univ. of Arizona, USA, Fax: 602–621–1422; Japan: Prof. T. Yasunari, Univ. of Tsukuba, Japan, Fax: 81–298–51–9764; Prof. M. Katsumi, Japan, Fax: 81–3–3402–2597.

19–23 September 1994—INTERNATIONAL GCIP/MAGS WORKSHOP ON SCALING IN HYDROMETEOROLOGICAL/HYDROLOGICAL PROCESSES AND MODELS, Victoria British Columbia, Canada. (See Call for Papers, this page.)

28–30 September 1994—EIGHTH SESSION OF THE GPCP WGDM, Offenbach, Germany.

September 1994—BALTEX IMPLEMENTATION PLANNING MEETING.

2–4 November 1994—FIFTH GCIP SCIENCE PANEL MEETING, Boulder, Colorado (by invitation only).

14–17 November 1994—ECMWF/GCSS WORKSHOP ON CLOUD PARAMETERIZATION.

12–14 April 1995—GPCP THIRD ALGORITHM INTERCOMPARISON PROGRAMME (AIP-3) WORKSHOP, Melbourne, Australia (tentative dates).

CORRECTION

In GEWEX News, Volume 3, No. 2, page 8, Table 1, the second column, third row should read **435 mm**.

GEWEX REPORTS/DOCUMENTS
(Available from IGPO)

PROJECT FOR INTERCOMPARISON OF LAND-SURFACE PARAMETERIZATION SCHEMES (PILPS): Results from Off-line Control Simulations (Phase 1A). December 1993, IGPO Publication Series No. 7.

GCIP BROCHURE (trifold glossy).

IMPLEMENTATION PLAN FOR THE GEWEX CONTINENTAL-SCALE INTERNATIONAL PROJECT (GCIP). Volume 1: Data Collection and Operational Model Upgrade. May 1993, IGPO Publication Series No. 6.

A PRELIMINARY SCIENCE PLAN FOR A LARGE-SCALE BIOSPHERE-ATMOSPHERE FIELD EXPERIMENT IN AMAZON BASIN: Report on Workshop convened 18–20 June 1992 at NASA Goddard Space Flight Center, Greenbelt, Maryland, USA.

INTERNATIONAL SATELLITE LAND SURFACE CLIMATOLOGY (ISLSCP) WORKSHOP REPORT, 23–26 June 1992, Columbia, Maryland, USA.

PROJECT FOR INTERCOMPARISON OF LAND-SURFACE PARAMETERIZATION SCHEMES (PILPS): Report on PILPS Workshop, 24–26 June 1992, Columbia, Maryland, USA, and First Science Plan. September 1992, IGPO Publication Series No. 5.

GEWEX CONTINENTAL-SCALE INTERNATIONAL PROJECT (GCIP) DATA WORKSHOP: Summary report on 5–8 May 1992 Workshop. June 1992, IGPO Publication Series No. 4.

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