
World Climate Research Programme—WCRP

THE GEWEX CONTINENTAL SCALE INTERNATIONAL PROJECT (GCIP)

**Dr. John C. Schaake, Jr., Chairman,
GCIP Science Panel**

At its second session in Paris in January 1990, the International GEWEX Scientific Steering Group (SSG) proposed a continental scale project as a major new effort to be undertaken during the first phase of GEWEX. This project would test both atmospheric and hydrological components of future climate models over selected river basins on a long-term basis (minimum of 5 years). It would provide the opportunity to intercompare the detailed performances of different models under realistic time-dependent conditions, to ascertain their sensitivity to various possible estimates of forcing fluxes, and to determine the degree of similarity with observed hydrological quantities (e.g., river runoff data). A continental scale project could also facilitate the early development of global algorithms by acquiring, in more limited areas, many of the global data sets that will be produced by the future Earth Observing System.

A continental scale data set could be widely distributed to encourage development of algorithms at many centres throughout the world. These algorithms should have general validity and be capable of being applied globally when global data become available. It is essential that such data and model results collected internationally be made freely available to encourage the exploitation and international development of GEWEX. Participants and beneficiaries will not be limited to countries in which the field measurements are taking place.

GOAL OF THE GCIP

The goal of the GCIP is to bridge the gap between those scales significant for modelling discrete processes of the hydrologic and energy cycles over land and those scales that are practical for modelling the global climate system and predicting the regional impacts of climate change.

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GLOBAL PRECIPITATION CLIMATOLOGY PROJECT

**Dr. Phillip Arkin, International Project
Manager, GPCP**

The Global Precipitation Climatology Project (GPCP) was established in 1987 by the World Climate Research Programme (WCRP) to provide global fields of area-time-averaged precipitation for the period 1986-95. Specifically, global precipitation data are needed for the following reasons:

- (i) Validation of atmospheric general circulation and climate models
- (ii) Determination of the budgets of land surface moisture and runoff, ocean fresh-water, and atmospheric water vapor
- (iii) Initialization of climate models
- (iv) Understanding of the relationship of precipitation to the tropical atmosphere's principal periodic or quasi-periodic forcings (e.g., 40-60-day waves, the El Niño Southern Oscillation, and the quasi-biennial oscillation)

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COMMENTARY

**Dr. Moustafa T. Chahine, Chairman
GEWEX Science Steering Group**

The Payload Panel for NASA's Earth Observing System (EOS), responding to direction from the EOS Engineering Review Committee (September 1991) and the United States Congress, has proposed a restructuring of the EOS payload to address high priority science and environmental policy issues in the Earth System science. NASA is expected to announce the payload selection in early 1992. Priorities were established based upon recommendations from the Intergovernmental Panel on Climate Change (IPCC) and the Committee on Earth and Environmental Sciences (CEES) as follows:

- (i) **Water and Energy Cycles**
(cloud formation, dissipation, and radiative properties, which influence the response of the atmosphere to greenhouse forcing)
- (ii) **Oceans**
(exchange of energy, water, and chemicals between the ocean and atmosphere and between upper layers of ocean and deep ocean)
- (iii) **Chemistry of the Troposphere and Lower Stratosphere**
(links to the hydrologic cycle and ecosystems, transformations of greenhouse gases in the atmosphere, and interactions with climate change)
- (iv) **Land Surface Hydrology and Ecosystem Processes**
(improved estimates of runoff over the surface and into the oceans; sources and sinks of greenhouse gases; exchange of moisture and energy between the land surface and the atmosphere; changes in land cover)
- (v) **Glaciers and Polar Ice Sheets**
(predictions of sea level and global water balance)
- (vi) **Chemistry of the Middle and Upper Stratosphere**
- (vii) **Solid Earth**

The ultimate success of GEWEX has always been dependent on the deployment of a new generation of sensors on the international earth observing platforms of NASA, ESA, and NASDA. The restructuring of the EOS payload means that the implementation of the EOS Program is now even more closely coupled with the goals and objectives of the GEWEX Programme. The GEWEX Programme will continue to advocate for the development and deployment of all crucial instruments with the international space agencies.

GEWEX Continental Scale International Project *(continued from page 1)*

OBJECTIVE OF THE GCIP

The objectives of the GEWEX Continental Scale International Project are

- (i) To determine the time-space variability of the hydrologic and energy budgets over a continental scale
- (ii) To develop and validate macroscale hydrological models, related high resolution atmospheric models, and coupled hydrologic-atmospheric models
- (iii) To develop and validate information retrieval schemes incorporating existing and future satellite observations coupled with enhanced ground-based observations
- (iv) To provide a capability to translate the effects of a future climate change into impacts on water resources and temperature on a regional basis

GCIP STUDY AREA

The river basin on which such a project would focus must meet the following criteria:

- Encompass a sizable number of horizontal grid squares within global climate models of the current generation
- Be of a practical size to enable assembling an adequately comprehensive database using current and incipient observing technologies

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GEWEX Continental Scale International Project *(continued from page 2)*

- Encompass a wide range of climate, soil moisture conditions, vegetation types, and surface topographies
- Have adequate ground based observing and data systems, as well as historical records

A large catchment scale study covering all or a large fraction of the Mississippi River basin could satisfy these requirements. The watershed area of the Mississippi River basin ($3.224 \times 10^9 \text{ km}^2$) is third largest of the 16 rivers in the world with individual flow rates of more than $10^4 \text{ m}^3/\text{sec}$ and the largest of any Northern Hemisphere river providing flow to the oceans. This is a significant point in the study of continental impact on the global water cycle as the Northern Hemisphere land comprises approximately 40 percent of the surface whereas the Southern Hemisphere land is only about 23 percent of the surface. The Mississippi River basin is a region of widely varying land use, vegetation, soil conditions, ground water characteristics, and topography. These diverse geophysical characteristics and the extensive North American hydrological and meteorological observational networks provide scientists with an excellent opportunity to study clouds, precipitation, and runoff.

The meteorological and hydrological networks covering the continental United States includes new Doppler radars, wind profilers, and automatic weather stations being implemented as part of the upgrade of the U.S. operational meteorological network. These enhancements to the observing networks will provide the best opportunity for obtaining data sets essential for (1) the determination of precipitation, wind fields, and other climate parameters and (2) the validation of estimations based on remote sensing. Equivalent data sets are not likely to be available in other continental areas within the same timeframe.

Despite the broad suitability of the Mississippi River basin for staging the GCIP, it is recognized that not all of the hydrological processes important to GEWEX occur there. Consequently, it will be essential for the GCIP to validate and ensure the transferability of the results obtained for the Mississippi to other parts of the world. Also, it

is important that the scientific results of parallel efforts conducted in other areas such as the Amazon, Mackenzie, Murray/Darling, or Northern Europe river basins are applied to improve models for the principal project area. Specific studies of areas outside the Mississippi River basin that are essential to meet the overall objectives of GEWEX will be included in the GCIP Implementation Plan.

For this reason, it is important that countries other than the United States be involved in the project, especially in the analysis of meteorological fields, the development of models, and the conduct of process studies outside of the Mississippi River basin, as well as in the exploitation of GCIP data for the assessment of impacts on water resources within a wider context.

GCIP Science Strategy

The pivotal components of the GCIP are (1) the development of a comprehensive database for the Mississippi River basin and (2) the establishment of a structured program of model development. Each component will draw heavily on existing infrastructures. In the case of the GCIP database, there are many potential sources of meteorological and geophysical data for the study area, and in the case of the modelling program, there is a suite of atmospheric and hydrological models that GCIP investigators can build upon to study all or parts of the region. A series of research and technical activities addressing algorithm development, quality assurance issues, and water and energy budget studies will link these pivotal components, as shown in Fig 1. Supporting these components and activities will be a series of field and analytical studies that may address problems specific to the primary GCIP study area, generic to the GCIP objectives, or concerned with transferring the results obtained for the Mississippi River basin to other regions around the globe.

STRATEGY FOR INTERNATIONAL COLLABORATION

Many but not all of the data required for the GCIP will pertain to the mainland United States. The principal U.S. government agencies responsible for the collection and management of those data will be called upon to fund the development of the data

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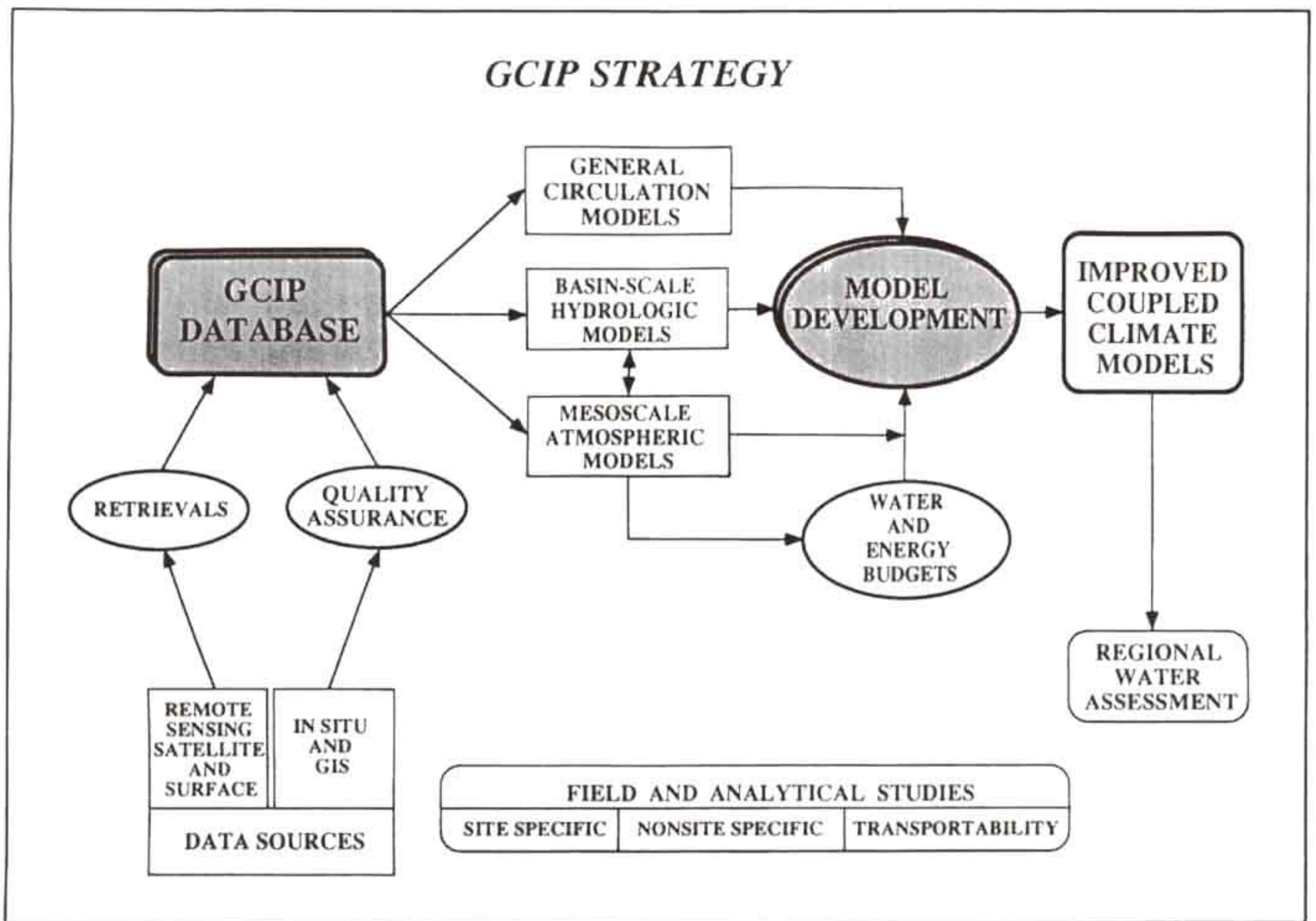


Figure 1. The research and technical activities linking the pivotal components of GCIP.

GEWEX Continental Scale International Project
Project (continued from page 3)

management and distribution system to support all relevant scientific investigations. The essence of all GCIP data management policy is to make data readily available to all participating scientists, worldwide.

The GCIP is an international project in which U.S. and non-U.S. scientists will be invited to participate. Opportunities for international contributions to the GCIP will lie in areas of data analysis, modelling, and process studies by use of GCIP data. It is expected also that further studies will be needed in areas outside of the Mississippi River basin, such as

Validation of the transfer of GCIP results and model formulations to other areas and to the

global domain: Other, possibly less detailed, regional studies are involved.

Assessments of the impact of climate change on water resources: Regional studies may be needed to understand how to use GCIP results worldwide.

Field Studies: At other locations where significantly different water and energy (atmosphere and land) processes occur (e.g., tropical rain forest, subarctic region).

It is also planned that the GCIP data management system shall receive data from relevant studies outside of the Mississippi River basin and distribute such data internationally to participating scientists.

Global Precipitation Climatology Project

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The GPCP will obtain global estimates of area averaged monthly precipitation totals through the improved utilization of rain gauge observations and innovative use of existing satellite data rather than rely on the implementation of any new observing or measurement programmes. Over most continental areas of the world, the GPCP hopes to obtain adequate statistics from the existing rain gauge network through more stringent control on quality and improved collection and processing. Over the ocean, on the other hand, reliance must be placed on remote observations from satellites.

DESCRIPTION OF THE PROJECT

Raw satellite infrared image data for the area within $\pm 40^\circ$ latitude and $\pm 50^\circ$ longitude of the geostationary subsatellite point are collected every 3 hours of the day (nominally, 00, 03, 06, 09, 12, 15, 18 and 21 UT) by three *geostationary satellite data processing centres (GSDPCs)*: EUMETSAT for METEOSAT, Japan for GMS, and the United States for GOES-West and GOES-East (INSAT data not available to the project). For each image, the picture elements (pixels) are assigned to 2.5° latitude x 2.5° longitude "boxes," and the following statistics are computed for each "box": 16 cases histograms, mean value, and spatial variance. For each 5-day period, the statistical information area is aggregated to produce the following quantities for each three-hourly time period of the day: sums of the histogram classes, averages of the means, and averages of the variances. The 5-day aggregates are accumulated on magnetic tape for 18 consecutive pentads.

The *Geostationary Satellite Precipitation Data Centre (GSPDC)* in the United States collects the aggregated statistical information from the GSDPCs, as well as available ground truth observations and microwave measurements, and produces estimates of area averaged monthly precipitation totals, using a project-approved algorithm. The monthly rainfall estimates are accumulated on magnetic tape for three consecutive months. Copies of these tapes are sent to the Global Precipitation Climatology Centre (GPCC).

The *Polar Satellite Data Processing Centre (PSDPC)* in the United States acquires calibrated,

earth-located microwave radiance data from the U.S. Defense Meteorological Satellite Program (DMSP) satellite's Special Sensor Microwave Imager (SSMI) instrument for all channels and polarizations and for all available orbits. The raw data are converted to brightness temperatures and accumulated on magnetic tape for monthly periods.

The *Polar Satellite Precipitation Data Centre (PSPDC)* in the United States acquires the SSMI data from the PSDPC, as well as available ground truth observations, and produces estimates of area averaged (2.5° latitude x 2.5° longitude) monthly rainfall over the entire globe, using a project-approved algorithm (initially, estimates will cover ocean areas only; global estimates will be made when improved algorithms have been developed and tested). The monthly estimates are accumulated on magnetic tape for 3-month periods, and copies are sent to the GPCC and the GSPDC.

The *Global Precipitation Climatology Centre (GPCC)* in the Federal Republic of Germany collects rain gauge precipitation information, contained in SYNOP and CLIMAT reports exchanged over the World Weather Watch Global Telecommunication System, and also acquires information not available over the system but provided directly by cooperating countries. In addition, the GPCC collects the three-monthly accumulations of rainfall estimates from the GSPDC and PSPDC. The various types of precipitation information are merged into a consistent monthly global analysis on a 2.5° latitude x 2.5° longitude grid using a project approved merging procedure. The monthly analysis fields are accumulated on magnetic tape for 6-month periods and copies of these tapes are sent to the World Data Centres for Meteorology.

DESCRIPTION OF ARCHIVE PRODUCTS

The World Data Centres for Meteorology archive the monthly rainfall fields produced by the GPCC. The monthly rainfall fields are stored in a 2.5° latitude x 2.5° longitude grid in the WMO GRIB Code, on nine track, 1600 bpi magnetic tapes. Each tape contains information for a 6-month period. Information, providing an indication of the quality of each grid point value, is appended to each analysis value.

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Global Precipitation Climatology Project

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SUMMARY

The GPCP continues to make sure progress since its inception in the mid-eighties. Its goals of creating global precipitation data sets are being realized. These data sets can only set the stage for the next generation of global and regional remote sensing devices and instruments in the nineties. They should provide even greater data volumes with improved spatial and temporal coverage, all of which will aid in developing new and improved precipitation models. This work is especially important as we face the prospect of global climate change.

RATIONALE FOR A GEWEX CONTINENTAL SCALE INTERNATIONAL PROJECT

**Dr. Michael Coughlan, Manager
GCIP**

In the following paragraphs I will describe the important underlying scientific reasons for a GCIP. The hydrologic cycle is at the core of Earth System science since the Earth is essentially a water-driven planet. Therefore, the water and energy budgets of the atmosphere and surface are fundamental components of the climate system. A GCIP, the first phase of GEWEX, can be thought of as the primary land surface component of that climate system.

An understanding of the processes determining Earth's water and energy budgets and an ability to model them are prerequisites to credible predictions of climate change. While the energy budget is characterized by large radiative exchanges between Earth and space, the Earth is a closed system with regard to water. Yet it is not possible to treat these budgets independently since the global hydrological cycle plays a dominant role in the energy budget and evaporation is driven and largely controlled by the availability of solar energy.

Present uncertainties in geographical and temporal distributions of the components of the hydrological cycle are very large. It has not been possible so far, for example, to measure precipitation or evaporation on ocean basins, or soil moisture storage on a continental scale. Published

budgets for net precipitation minus evaporation averaged over whole continents may differ by a factor of 2 or more. One-third of the total continental runoff may be occurring in small, ungauged rivers and streams. There are even ambiguities in the sign of area-averaged fluxes of water and energy computed for large regions of the Earth.

Developing macroscale hydrological models and improved precipitation models for GEWEX is a major undertaking that will require the cooperative efforts of hydrologists and other geoscientists throughout the world. Processes that occur on the subgrid scales of atmospheric general circulation models must be accounted for internally in the hydrological models. Sufficient data do not exist, however, to calibrate macroscale hydrological models in the same way that hydrologists usually calibrate catchment-scale models. Therefore, the required macroscale models must account for the water balance of "ungauged areas," and model parameters must be estimated a priori using limited climate, soil, and vegetation information. Parallel investigations of precipitation from atmospheric models are needed to develop information required by the macroscale hydrologic models, take advantage of additional information that will be produced by the macroscale hydrologic models about surface conditions, and to facilitate linking new macroscale hydrologic models with general circulation models.

Formulations of land surface processes now in use in general circulation models lack calibration or verification. This is also true of precipitation forecasts, especially in the mountains and for short time periods. Researchers are only beginning to understand how to blend data from a variety of sources in numerical models as computers become more powerful and capable of addressing such complex problems. But at present, the *global* data sets needed to test more detailed surface and macroscale hydrology algorithms are inadequate and will remain so until the launch of the next generation of environmental satellites. In the interim, and in preparation for this new stage in global environmental data collection, we must extract the maximum amount of information from in situ, predominantly land based observing systems, linking it with information from the current generation of environmental satellites.

UNITED KINGDOM GEWEX PROGRAMME

Dr. Keith Browning, Chairman

The purpose of this article, which has been edited from a much broader document, is to present outline proposals for U.K. contributions to GEWEX. International programmes of this kind depend on national inputs. The United Kingdom, with its expertise and facilities in a number of relevant areas, is particularly well placed to contribute to the GEWEX Programme. The primary U.K. research related to GEWEX is briefly described in this article. Some aspects of the research are already underway, but most of the work is as yet unfunded and constitutes proposed U.K. contributions to GEWEX.

PROPOSED U.K. CONTRIBUTIONS

Proposal 1. Radar Observations of Clouds and Rain from Space

This is a proposal for a major U.K. contribution to the science and technology of observations from space of rainfall and clouds in the troposphere. In particular, the ability to monitor cloud structures globally is central to the GEWEX objectives relating to energy and water transport within the atmosphere, because, for example, quite modest changes in total cloud amount or type can lead to changes in global heat balance comparable to those attributed to predicted anthropogenic changes in atmospheric composition. Improved cloud observations, which should lead to improved modelling capability, are therefore of vital importance.

The programme would have two main thrusts. The first of these would be to seek a comprehensive involvement in the scientific support and exploitation programmes for the U.S.–Japan Tropical Rainfall Measuring Mission (TRMM) due for launch in 1997, whose objectives are well aligned with those of the GEWEX Programme. Also, where relevant, possibilities will be explored for participation in other ongoing spaceborne radar programmes. The second thrust would be to undertake an intensive study of the feasibility of developing a millimetre-wave spaceborne radar system to observe the 3-D structure of clouds as distinct from rain.

In all important aspects of this programme, the U.K. research community can provide substantial

expertise, facilities, and experience. The areas of expertise include interaction of electromagnetic waves with hydrometers, interpretation of radar echoes, modelling of cloud and rainfall structures in the atmosphere, and, of course, the exploitation of data through data-assimilation and other means of analysis. These are complemented by substantial expertise in the relevant aspects of space instrument development.

The scientific benefits from these areas of expertise will be in the area of improved monitoring of the 3-D structure of rain and clouds, derived from a better understanding and validation of data from TRMM. Although limited in coverage, TRMM is the only planned space mission that is likely to provide data of this kind in the present decade. The proposal will also lead to a clearer view of the potential of spaceborne radar for the monitoring of cloud structure and motions and may lead naturally to a major programme proposal for an instrument development programme.

Proposal 2. Cloud Systems and Their Parameterizations

Cloud systems have a dominant influence on the effect of solar heating and radiative transfer within the atmosphere. The formation and evaporation of precipitation within cloud systems produce large latent heating effects. These systems also determine the actual surface precipitation and considerably influence the surface fluxes of heat, moisture, and momentum. All of these effects occur on a scale too small to be represented explicitly in climate and weather forecast models, and they must be parameterized. Within climate models this parameterization process probably constitutes the greatest source of uncertainty, and whilst weather forecasts are not so severely influenced there is still a large impact from inadequate cloud parameterization. A key objective of GEWEX is to derive improved parameterizations of cloud systems within these large-scale models. This research is focussed within an international programme known as the GEWEX Cloud System Study (GCSS).

Observations from special field experiments (see footnote at end of article) are clearly needed to allow a description and understanding of cloud systems, but they alone cannot be expected to provide either the required detail over large areas or

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U.K. GEWEX Programme

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to be carried out in the full variety of circumstances that occurs. An opportunity exists, however, to complement these observational studies by exploiting recent advances in numerical flow modelling (large eddy simulation) to produce computer simulations of these cloud systems. The very small scale physical processes (on scales less than 100 m) will still have to be parameterized within such simulations. It is proposed that the United Kingdom should establish a cloud scale model and join in the international effort to undertake observations and their analysis with a view to improving cloud scale modelling. The cloud model will provide simulations of flow, clouds, and precipitation, over areas comparable with climate model mesh spacings. These simulations are necessary for the development of required parameterizations in numerical weather and climate prediction models.

Proposal 3. Role of Water Vapour in the Atmosphere Through Diagnosis of Assimilated Data

With the advent of new observations, particularly global observations associated with GEWEX, and with the increasing complexity and accuracy of the models used in the assimilation procedure, it is necessary to consider many more variables. Indeed full value is only obtained from observations of, for example, cloud and rain if they are made consistent with observations of other variables at other places and other times. The Meteorological Office has developed a data assimilation system that has worked well in the context of numerical weather prediction. Recently it has tested a new unified climate and numerical weather prediction model, which represents more of the physical processes (e.g., cloud, the upper atmosphere, and the ocean) important to climate. It is proposed to use this unified model in the numerical weather prediction assimilation, making use of the many remotely sensed data (e.g., TRMM) of the climate system. The archived analyses from these assimilations, with quantified uncertainties from misfit to observations, will provide a consistent basis for studies of climate processes.

Climate diagnostics play a vital role in generating and testing hypotheses, comparing models with each other and with observations, and evalu-

ating new observational requirements. The United Kingdom has been prominent in the development of diagnostics of the atmospheric general circulation and their application both routinely and to particular situations. It is proposed that general circulation diagnostics be developed and applied to climate models. The United Kingdom is uniquely situated to play a dominant role leading to an increased understanding of the role of water in climate and climate change.

Proposal 4. Linked Atmospheric-Hydrological Models at Large Basin Scale

The hydrological processes at the land surface are not well represented in the present generation of regional or global atmospheric models. For example, subgrid scale, hydrological variability catchment storages; routing of surface water flow between cells; groundwater flows; and discharges to the ocean are neglected. These shortcomings have been recognized by GEWEX, which has proposed a continental scale international project (GCIP) to develop and validate mesoscale and macroscale models and to couple these to atmospheric models. These integrated models will improve greatly the capability to predict climate change and, in particular, its impact on water resources and temperature on a regional scale. The GEWEX Scientific Steering Committee assessed the suitability of a number of possible basins and selected the Mississippi as best meeting the above requirements. The U.K. hydrologists have been fully involved in the international meetings where the GCIP has been formulated, and they have contributed to the GCIP Science Plan.

The long-term goal of the GCIP is to produce models that are applicable worldwide and can be based on the characteristics of a catchment without the need for a long time series of hydrological data. The river basin on which the GCIP will focus initially has hydrological and meteorological historical data and new observational tools to facilitate developing and validating models. The need will also exist to encompass a wide range of climate, soils, vegetation, and surface features, and the basin will be of a size to include a large number of grid scales as used in the current generation of global climate models.

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U.K. GEWEX Programme

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The United Kingdom is a world leader in the development and application of physically based, distributed hydrological models; the simulation of spatially-variable input data into models; and the development of links between atmospheric and hydrological models. The U.K. scientists would therefore aid in the selection of the test regions within the Mississippi, participate in the building and validation of appropriate hydrological models, develop methods for linking these with the atmospheric models, and run climate change scenarios for water resource models within the selected areas.

The United Kingdom has a long established international reputation in the measurement and modelling of hydrological processes. It is a leader in distributed hydrological modelling and mesoscale meteorological modelling, with internationally respected expertise in ecology, plant physiology, and terrestrial remote sensing.

Participation in land-atmospheric experiments will be drawn from the multi-disciplinary research community presently being created under the Terrestrial Initiative in Global Environmental Research (TIGER). The United Kingdom will also draw on expertise from the meteorological modelling community and its aircraft measurement facilities.

The U.K. proposals are nested in the overall relationships of the international GEWEX Programme. Proposal 1 has links to the Global Precipitation Climatology Project (GPCP). Proposal 2 is closely linked to the GEWEX Cloud System Study (GCSS). Proposal 3 is important to activities of the Working Group on Numerical Experimentation (WGNE) of the WMO Commission for Atmospheric Sciences/Joint Scientific Committee (CAS/JSC). Proposal 4 is closely linked to the GEWEX Continental Scale International Project (GCIP).

FOOTNOTE: The first field study of GCSS has been proposed to take place within the GCIP study area during the summer of 1994. The aim is to obtain mesoscale data for developing and validating cloud system parameterization in a hierarchy of models, with special attention to scale interaction. The site and time were selected to capitalize on the

observational capability of two major U.S. programmes. The U.S. funded efforts are (1) the National Oceanic and Atmospheric Administration (NOAA) Stormscale Operational and Research Meteorology (STORM) Program and (2) the Department of Energy (DoE) Atmospheric Radiation Measurement (ARM) Program. The U.K. researchers have discussed with STORM and ARM researchers the common science for the advancement of cloud parameterization by collaborative efforts optimizing the resources available in the summer of 1994. This GCSS field study will contribute to the science goals of the GCIP and provide early experience with the handling and utilization of STORM and ARM data.

GCIP SCIENCE PANEL—Fall 1991

The GCIP Science Panel is chaired by Dr. John E. Schaake, NOAA. The membership is as follows:

HYDROLOGIC MODELLING

G. Schultz (GERMANY)
R. Bras (U.S.A.)
R. Gurney (U.K.)
R. Lawford (CANADA)
E. Engman (U.S.A.)

ATMOSPHERIC MODELLING

P. Rowntree (U.K.)
A. Henderson-Sellers (Australia)
K. Lavall (FRANCE)
J. Shukla (U.S.A.)
L. Dumenil (GERMANY)

PROCESS STUDIES

P. Sellers (U.S.A.)
J.C. Andre (FRANCE)
T. Takeda (JAPAN)
S. Sorooshian (U.S.A.)
R. Dickinson (U.S.A.)
E. Raschke (GERMANY)

DATA ANALYSIS

J. Schaake (Chair), (U.S.A.)
T. Charlock (U.S.A.)
A. Ohmura (SWITZERLAND)
E. Rasmussen (U.S.A.)
A. Hollingsworth (U.K.)
E. Kalnay (U.S.A.)

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DATA COLLECTION AND MANAGEMENT

J. Smith (U.S.A.)
E. Njoku (U.S.A.)
D. Renne (U.S.A.)
A. Gruber (U.S.A.)
G. Leavesley (U.S.A.)

EX OFFICIO

J. Theon (U.S.A.)
M. Coughlan (U.S.A.)
P. Try (U.S.A.)
H. Bolle (GERMANY)
H. Lins (U.S.A.)
D. Vane (U.S.A.)
S. Benedict (WMO-WCRP)
P. Stephens (U.S.A.)

WCRP/GEWEX MEETINGS CALENDAR

27 - 31 January 1992—THE FOURTH SESSION OF THE GEWEX SCIENTIFIC STEERING GROUP will be held in TOKYO, JAPAN. By invitation only. Contact S. Benedict, WMO (WCRP) 41, Avenue Giuseppe Motta, 1211 Geneva 2, Switzerland. PHONE: 41-22-730-8247; FAX: 41-22-734-0357; EMAIL: OMNET/S. Benedict

23 - 28 March 1992—THE THIRTEENTH SESSION OF THE JOINT SCIENTIFIC COMMITTEE (JSC) will be held in Victoria, B.C., Canada. By invitation only. Contact S. Benedict, WMO (WCRP) 41, Avenue Giuseppe Motta, 1211 Geneva 2, Switzerland. PHONE: 41-22-730-8247; FAX: 41-22-734-0357; EMAIL: OMNET/S. Benedict

Tentative 5 - 8 May 1992—GEWEX CONTINENTAL-SCALE INTERNATIONAL PROJECT (GCIP) WORKSHOP ON DATA ISSUES will be held in SASKATOON, SASKATCHEWAN, CANADA. This workshop will be directed towards resolving major data issues involved in implementing the GCIP. Such issues include the consolidation of data from different sources and effectively incorporating them into continental scale water and energy budget analyses and real-time data assimilation systems for modelling studies. Specific issues that have been identified to date are (1) the ability of existing data collection systems to provide real-time data from different sources (e.g., climatological and hydrological networks) to a central point and (2) the lack of observations of key parameters such as soil moisture, difficulties in measuring precipitation, and the accuracy implications of different types of meteorological instrumentation such as those used in Canada and the United States. The role of remote sensing in satisfying GCIP data needs must also be explored. Persons interested in contributing papers or attending the workshop should contact

Dr. R. Lawford, Chief, Hydrometeorology Research Div., Canadian Climate Centre (AES), National Hydrology Research Centre, 11 Innovation Blvd., Saskatoon, Saskatchewan, S7N 3H5, Canada, PHONE: 306-975-5775; FAX: 306-975-5143; EMAIL: OMNET/R. Lawford. NHRI

15 - 19 June 1992—AN INTERNATIONAL SYMPOSIUM ON ACTIVE SENSORS AND NON-SYNCHRONOUS MISSIONS DEDICATED TO GEWEX will be held in PARIS, FRANCE. By invitation only. This symposium is sponsored by the Centre National d'Etudes Spatiales (CNES) in concert with the World Climate Research Programme (WCRP), the European Space Agency (ESA), the National Aeronautics and Space Administration (NASA), and the National Agency for Space Development of Japan (NASDA). The objectives of this symposium are (1) to provide an opportunity to discuss the rapidly evolving design strategy for the Earth Observing System series of satellites and its impact on GEWEX and (2) to provide a forum for discussion of satellite requirements and international availability of other planned satellites to meet the goals and objectives of GEWEX. For further information contact C. Salmon, Centre National d'Etudes Spatiales (CNES), 2 pl. Maurice Quentin, 75039 Paris, France. PHONE: 45 08 75 00; FAX: 45 08 76 76

22 June 1992—THE JOINT SCIENTIFIC COMMITTEE (JSC) WORKING GROUP ON LAND SURFACE EXPERIMENTS (WCRP/IGBP) will meet in WASHINGTON, DC. By invitation only. For further information contact Dr. Jean-Claude Andre, Meteo-France, Etablissement d'Etudes Recherches Meteorologiques (EERM), Centre National de Recherches Meteorologiques, 42, Avenue Coriolis, 31057 Toulouse Cedex, France. PHONE: (33)-61-07-93-70; FAX: (33)-61-07-96-00; EMAIL: OMENT/J.Andre

23 - 26 June 1992—THE INTERNATIONAL SATELLITE LAND SURFACE CLIMATOLOGY PROJECT (ISLSCP) (Americas) will meet in WASHINGTON, DC, in conjunction with the JSC Working Group on Land Surface Experiments (WCRP/IGBP) meeting (see above announcement). For further information contact Dr. Piers Sellers, COLA (Center for Ocean-Land-Atmosphere Interactions), Department of Meteorology, University of Maryland, College Park, MD 20742-2425, U.S.A. PHONE: 301-286-4173; FAX: 301-286-9200

28 - 30 October 1992—A JOINT GEWEX/JSC WORKING GROUP ON NUMERICAL EXPERIMENTATION (WGNE) will hold a workshop ON GLOBAL ANALYSES AND SIMULATION OF PRECIPITATION in WASHINGTON, DC. By invitation only. The purpose of this special workshop is to review the quality and reliability of precipitation observations (including ground and remotely sensed), precipitation forecasts (including those from data assimilation systems and short-range forecasts), model simulations, and available climatologies. Abstracts may be submitted to and further information obtained from the Chair of the Workshop, Dr. P. Arkin, National Meteorological Center, W/NMCx1, WWB, Room 204, Washington, DC 20033. PHONE: 301-763-8317; FAX: 301-423-9181; EMAIL: OMNET/P. Arkin

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WCRP/GEWEX MEETINGS CALENDAR

(continued from page 10)

10 - 13 November 1992—THE SECOND ANNUAL GCIP SCIENCE PANEL MEETING, tentatively scheduled to be held in VICKSBURG, MISSISSIPPI. By invitation only. Further information as to exact location will be provided as received, or contact the IGPO.

To announce a GEWEX meeting or workshop in *GEWEX NEWS*, send details via OMNET: INTLGEWEX or FAX: 202-488-5364.

GEWEX REPORTS/DOCUMENTS

SCIENTIFIC PLAN FOR THE GLOBAL ENERGY AND WATER CYCLE EXPERIMENT—WCRP-40, AUGUST 1990 (WMO/TD - No. 376).

This document is now available. (See note in box, column 2.)

GEWEX CONTINENTAL SCALE INTERNATIONAL PROJECT (GCIP), REPORT OF THE FIRST GCIP PLANNING WORKSHOP, RESTON, VA., U.S.A., 8-10 OCTOBER 1990 (IGPO Pub. 1).

This document is now available. (See note in box, column 2.)

GLOBAL ENERGY and WATER CYCLE EXPERIMENT (GEWEX), REPORT OF THE FIRST GEWEX TEMPERATURE/HUMIDITY RETRIEVAL WORKSHOP, GREENBELT, MD, U.S.A., 23-26 OCTOBER, 1990.

The workshop summary report is in press. Distribution information will follow.

THE ROLE OF WATER VAPOR IN CLIMATE, A STRATEGIC RESEARCH PLAN FOR THE PROPOSED GEWEX WATER VAPOR PROJECT (GVAP), REPORT OF WORKSHOP, EASTON, MD, U.S.A., 30 OCTOBER - 1 NOVEMBER 1991, NASA Conf. Pub. 3120).

This document is now available. (See note in box, column 2.)

GLOBAL ENERGY AND WATER CYCLE EXPERIMENT (GEWEX), REPORT OF THE THIRD SESSION OF THE JSC SCIENTIFIC STEERING GROUP, BERMUDA, 21-25 JANUARY 1991—WCRP-57 (WMO/TD-No. 413).

This document is now available. (See note in box, column 2.)

GLOBAL CLIMATE CHANGE — A SCIENTIFIC REVIEW PRESENTED BY THE WORLD CLIMATE RESEARCH PROGRAMME (WCRP) JANUARY 1990.

The WCRP is the international scientific programme chartered jointly by the International Council of Scientific Unions and the World Meteorological Organization to provide a quantitative understanding of climate and predictions of global and regional climate changes on all time scales. The document is a review of global climate change as of 1990. This document is now available. (See note in box below.)

SCIENTIFIC PLAN FOR THE GEWEX CONTINENTAL SCALE INTERNATIONAL PROJECT (GCIP), REPORT OF THE FIRST GCIP SCIENCE PANEL MEETING, WASHINGTON, DC, U.S.A., 17 - 19 JULY 1991.

The document is in press and will be available in early 1992.

GEWEX NEWS

Published by the International GEWEX Project Office (IGPO), Dr. Paul D. Try, Director, Suite 203, 409 Third Street SW, Washington, DC 20024, U.S.A.

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