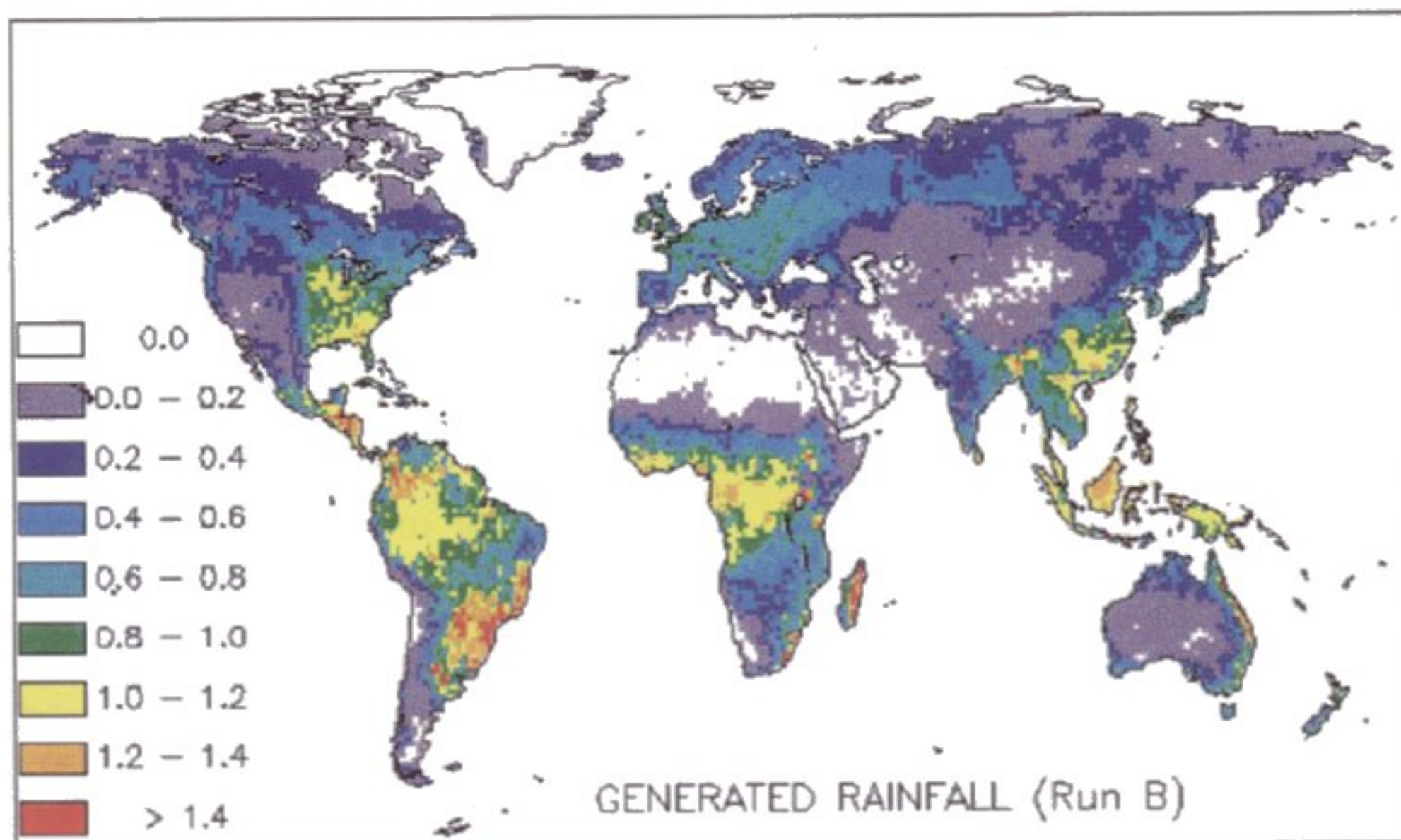


World Climate Research Programme—WCRP

ANNUAL NET PRIMARY PRODUCTIVITY ($\text{kgC m}^{-2} \text{yr}^{-1}$)

TEMPORAL VARIABILITY OF PRECIPITATION MAY CAUSE UP TO 32% UNDERESTIMATION OF GLOBAL NPP



The highly nonlinear processes governing soil hydrology and carbon assimilation in vegetation is illustrated by comparing model results with daily rainfall (Run B), shown above, to results with monthly rainfall, shown on the back page—open flat for comparison. Note the significant overestimation of desert extent in Run A. See page 6 and related article below on climatic forcing sensitivity to the partitioning of rainfall.

GLOBAL SOIL WETNESS PROJECT

SENSITIVITY OF A SIMULATED WATER BUDGET TO TEMPORAL RESOLUTION OF ATMOSPHERIC FORCINGS

Nobuo Sato, Japan Meteorological Agency
N. Nishimura, Center for Climate System Research, University of Tokyo

The goal of the International Satellite Land Surface Climatology Project (ISLSCP) and the GEWEX Numerical Experimentation Panel (GNEP) sponsored Global Soil Wetness Project is to generate global soil wetness fields for use in initializing global circulation models (GCM) and other models. The participants will force the land surface parameterizations in their GCMs using observed or assimilated near-surface meteorological conditions to produce global 1x1 degree fields of surface wetness, snow cover, and surface-atmosphere fluxes

(Continued on page 4)

WHAT'S NEW IN GEWEX

- ISLSCP 1°x1° Land Atmosphere CD-ROM Released
- Second International GEWEX Science Conference set for 17–21 June 1996
- CAGEX Radiation Data Now On-line
- Hydrology/Biogeochemical Linkages Being Emphasized
- PILPS Elevated to GEWEX Component

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COMMENTARY**GEWEX-GOALS PARTNERSHIP****Peter J. Webster, Chairman
CLIVAR/GOALS Panel****and****Moustafa T. Chahine, Chairman
GEWEX Scientific Steering Group**

The Climate Variability and Predictability (CLIVAR)/Global Ocean-Atmosphere-Land Surface (GOALS) program and GEWEX are tied together by the need to understand the global oceans, atmosphere, and land surfaces on different time scales. GEWEX is focussed on understanding the fast climate system incorporating all dynamical and physical processes in the atmosphere and the boundary layer, whereas prediction of seasonal-to-interannual variations of the coupled ocean-atmosphere-land system is the focus of GOALS. Determination of the hydrological cycle in the atmosphere and at the land and ocean surfaces, a key objective of GEWEX, is essential to improving the modelling on both climatological and meteorological time scales. Thus, the development of a collaborative partnership between GEWEX and GOALS is both natural and necessary. The GOALS and GEWEX programs are already working closely together to identify essential contributions from GEWEX in modelling, observations, and process studies.

GOALS will take advantage of GEWEX programs in continental-scale budget studies and of GEWEX modelling studies of land surface processes to improve the representation of the land surface in coupled ocean-atmosphere-land models. Improved characterization of land-surface processes is needed to develop accurate long-range predictions of climate regimes over continental areas.

GEWEX will work closely with GOALS to provide the data that are required for GOALS research. Many of these data sets are already being developed by GEWEX, for example:

- cloud amount, optical depth, and variability (International Satellite Cloud Climatology Project [ISCCP])
- surface radiation budget and surface heat flux (Surface Radiation Budget [SRB] Project)
- surface albedo, roughness, and vegetation type (International Satellite Land Surface Climatology Project [ISLSCP])

- soil wetness (ISLSCP and PILPS)
- water vapor (GEWEX Water Vapor Project [GVaP])
- precipitation (Global Precipitation Climatology Project [GPCP])
- runoff into the oceans (Global Runoff Data Centre [GRDC])
- sea surface temperature (a new joint initiative between GEWEX and GOALS)

GEWEX will benefit from the ocean observation system either in place (e.g., the Tropical Ocean Global Atmosphere-Tropical Atmosphere Ocean [TOGA-TAO] array, expendable bathy-thermography [XBT] system, drifting buoys) or planned that provides *in situ* measurements of ocean-atmosphere variables to allow ocean-atmosphere fluxes of heat, momentum, and moisture to be calculated. In addition, GOALS will provide global estimates of the ocean interface fluxes based on a model-observation mix. Validation and application of this data set and of other satellite observations will require collaborative efforts that will benefit from strong ties between GOALS and GEWEX.

The new Director of WCRP, Prof. Hartmut Grassl, recently stated that "without a successful GEWEX we will not get a successful CLIVAR." The dialogue between GEWEX and GOALS has begun. GEWEX is sending a representative to all major GOALS meetings, and a GOALS representative will be invited to all related GEWEX meetings and workshops. GEWEX and GOALS intend to continue to work closely to ensure the mutual success of the two WCRP programs.

GEWEX NEWS

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**CERES/ARM/GEWEX
EXPERIMENT (CAGEX)
RADIATION DATA AVAILABLE**

**Thomas P. Charlock
NASA Langley Research Center
Timothy L. Alberta, Lockheed
Engineering and Sciences**

The Clouds and the Earth's Radiant Energy System (CERES) program/Atmospheric Radiation Measurement (ARM) program/GEWEX Experiment (CAGEX) is an ongoing campaign that provides calculated radiative fluxes, input data, and validating measurements over the ARM Cloud and Radiation Testbed (CART) site in Oklahoma, U.S.A. CAGEX is the combined effort of the National Aeronautics and Space Administration CERES program, the Department of Energy ARM program, and the GEWEX Continental-scale International Project (GCIP).

The basic driver of climate and global change is the Earth's surface and atmospheric radiation budget—the vertical profile of radiative fluxes from the surface to the top of the atmosphere (TOA). CAGEX is a comprehensive program using *in situ* data and satellite measurements to provide vertical profiles of radiative fluxes for validating global circulation models (GCM) and cloud resolving models, for testing area-averaged satellite-based retrievals, and for use in investigating the role of radiation in hydrological and meteorological processes. CAGEX is a long term and incremental activity to assess the errors and improve the accuracy of vertical profiles of radiative fluxes.

To observe, calculate, and interpret radiative fluxes, CAGEX uses a virtual cage (Figure 1) positioned over the well-instrumented ARM-CART site. Beginning on 5 April 1994, CAGEX collected data at 30-minute intervals for 26 days using a 3x3 grid (0.3 degree on each side) centered at the ARM-CART site. These data (Version 0) are now available and provide the following information:

- (1) Satellite-based cloud properties and atmospheric sounding data that are sufficient for broadband radiative transfer calculations.
- (2) Vertical profiles of radiative fluxes.
- (3) Validating measurements for broadband radiative fluxes and cloud properties.

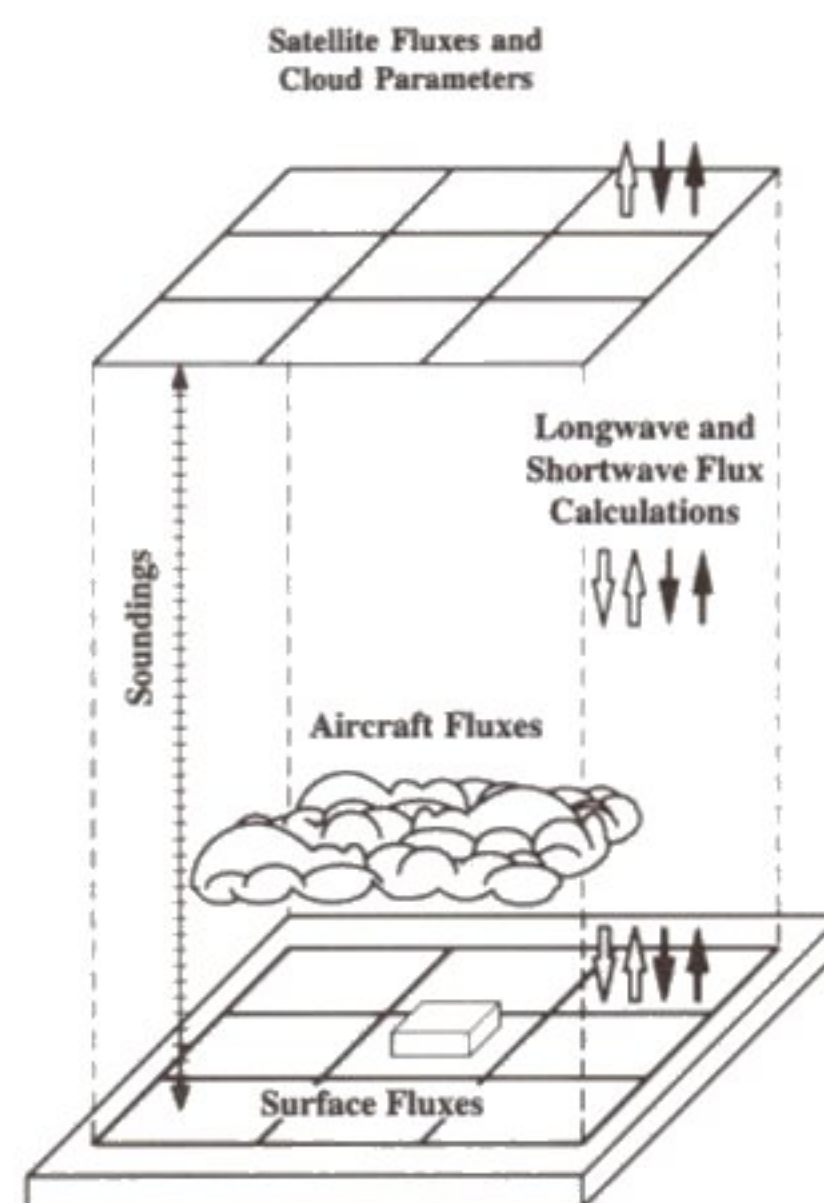


Figure 1. CAGEX virtual cage.

For item (1), CAGEX Version 0 uses the Minnis et al. (1993) Layered Bispectral Threshold Method (LBTM) GOES-based cloud property retrievals and interpolated National Meteorological Center (NMC) soundings. For item (2), CAGEX provides total-sky (all sky or full sky, i.e., with clouds, if present) longwave (LW) fluxes from the Fu and Liou (1993) delta-4-stream code at 48 vertical levels, and some clear sky LOWTRAN7 calculations. For item (3), CAGEX has the ARM surface pyranometer/pyrheliometer (shortwave [SW]) and pyrgeometer (LW) fluxes (DeLuisi, 1991) and micropulse lidar (MPL; Spinhirne, 1993) cloud base heights. Meteorological data from a 60-m tower are included. Estimates of the broadband TOA fluxes based on narrowband GOES radiances are also available, courtesy of Patrick Minnis. Input data (1) and Fu-Liou calculations (2) are provided half-hourly in the 3x3 grid in Oklahoma. Validating measurements (3) are provided half-hourly at one point, the ARM Central Facility.

Subsequent versions of CAGEX data will include increased time intervals and a larger grid area for the April 1994 observation period. This data set will also include SW fluxes, pixel-scale satellite radiances, aerosol data, and validating measurements obtained via aircraft and from the surface.

Currently, CAGEX data are a validation source for the GEWEX Surface Radiation Budget (SRB) experiment (Whitlock et al., 1995) and will become a validation source for the NMC mesoscale Eta model used in GCIP. CAGEX data sets are

also being used to test preliminary versions of algorithms for retrieving radiative fluxes (Charlock et al., 1994) by CERES (Wielicki and Barkstrom, 1991)—to be flown on the Tropical Rainfall Measuring Mission (TRMM) in 1997 and NASA's Earth Observing System (EOS-AM1) satellite in 1998.

CAGEX is a principal research activity in GCIP and is also a tool to extend the application of the complex network of sensors at the ARM-CART site to satellite remote sensing. The integrated space-time cage approach will be useful for interpreting ARM *in situ* measurements. For example, CAGEX can be used to estimate the sampling noise in surface and aircraft radiometric measurements of the SW absorption of clouds (i.e., Stephens and Tsay, 1990). It is planned that CAGEX will cover each ARM intensive observing period (IOP). ARM conducts 3 to 4 IOPs each year.

CAGEX Version 0 data are available via File Transfer Protocol (FTP). Copies of the data may be obtained by sending requests by e-mail to t.p.charlock@larc.nasa.gov or to alberta@snowdog.larc.nasa.gov. Plans to coordinate an intercomparison of CAGEX fluxes with fluxes determined by other researchers are underway.

References

- Charlock, T., F. Rose, T. Alberta, G.L. Smith, D. Rutan, N. Manalo-Smith, T.D. Bess, and P. Minnis, 1994: Retrievals of the surface and atmospheric radiation budget: Tuning parameters with radiative transfer to balance pixel-scale ERBE data. *Eighth Conf. on Atmospheric Radiation*, 23–28 January 1994, Nashville, Tennessee, Amer. Meteor. Soc., Boston, Massachusetts, pp. 435–437.
- DeLuise, J., 1991: *Second Workshop on Implementation of the Baseline Surface Radiation Network*. WCRP-64, WMO/TD No. 453, World Meteorological Organization, Geneva, Switzerland.
- Fu, Q., and K.-N. Liou, 1993: Parameterization of the radiative properties of cirrus clouds. *J. Atmos. Sci.*, **50**, 2008–2025.
- Minnis, P., K.-N. Liou, and Y. Takano, 1993: Inference of cirrus cloud properties using satellite-observed visible and infrared radiances, Part I: Parameterization of radiance fields. *J. Atmos. Sci.*, **50**, 1279–1304.
- Spinhrne, J.D., 1993: Micro Pulse Lidar. *IEEE Transactions on Geoscience Remote Sensing*, **31** (1), 48–55.
- Stephens, G.L., and S.-C. Tsay, 1990: On the cloud absorption anomaly. *Quart. J. Roy. Meteor. Soc.*, **116**, 671–704.
- Whitlock, C.H., T.P. Charlock, W.F. Stayler, R.T. Pinker, I. Laszlo, A. Gilgen, T. Konzelmann, R.C. DiPasquale, C.D. Moats, S.R. LeCroy, and N.A. Ritchey, 1995: First global WCRP surface radiation budget data set. *Bull. Amer. Meteor. Soc.*, in press (June).
- Wielicki, B., and B. Barkstrom, 1991: Clouds and the Earth's Radiant Energy System (CERES): An Earth Observing System Experiment. *Second Symposium on Global Change Studies*, New Orleans, Louisiana, January 14–18, 1991, Amer. Meteor. Soc., Boston, Massachusetts, pp. 11–16.

Global Soil Wetness (Continued from page 1)

and runoff, among other variables. These fields will be compared with selected validation data sets to be prepared by another team in the project.

The objective is to highlight the strengths and weaknesses of the participating land surface parameterization schemes, as well as generating fields that should be useful for model initialization. The period of 1987–1988 was chosen for the pilot study, which allows the early analyses to be based on atmospheric forcings and surface boundary conditions taken from the recently released ISLSCP CD-ROM.

This paper addresses the issue of the need to partition monthly fluxes into hourly values. The atmospheric forcing parameters are precipitation, downward solar and longwave radiation fluxes, surface air temperature, vapor pressure, and wind speed. The last three meteorological parameters are taken from the 6-hourly European Centre for Medium-range Weather Forecasting (ECMWF) analysis. The precipitation is taken from a Global Precipitation Climatology Project (GPCP) product, which is monthly accumulated precipitation on 2.5x2.5 degree grids. The downward surface radiative fluxes are derived from International Satellite Cloud Climatology Project products, which are also monthly mean fluxes in 3-hour time slices on 2.5x2.5 degree grids (diurnal cycle is taken into consideration).

A numerical experimentation was performed in order to investigate the sensitivity of a simulated water balance to the temporal resolution of precipitation and radiative forcings, using a modified version of the Simple Biosphere Model (SiB) (Sellers et al., 1986 and Sato et al., 1995). The atmospheric forcings were taken from hourly observations made at the Sapporo Meteorological Observatory in northern Japan. Time averages of those hourly atmospheric forcings were taken to make monthly averaged ones. A mixed forest was assumed as a vegetation cover in all experiments.

Figure 1 and Figure 2 show the sensitivity of simulated runoff and evapotranspiration to the temporal resolution of radiative fluxes and precipitation in the 2-year simulation. In the case of radiative fluxes, the simulated surface water budget is not

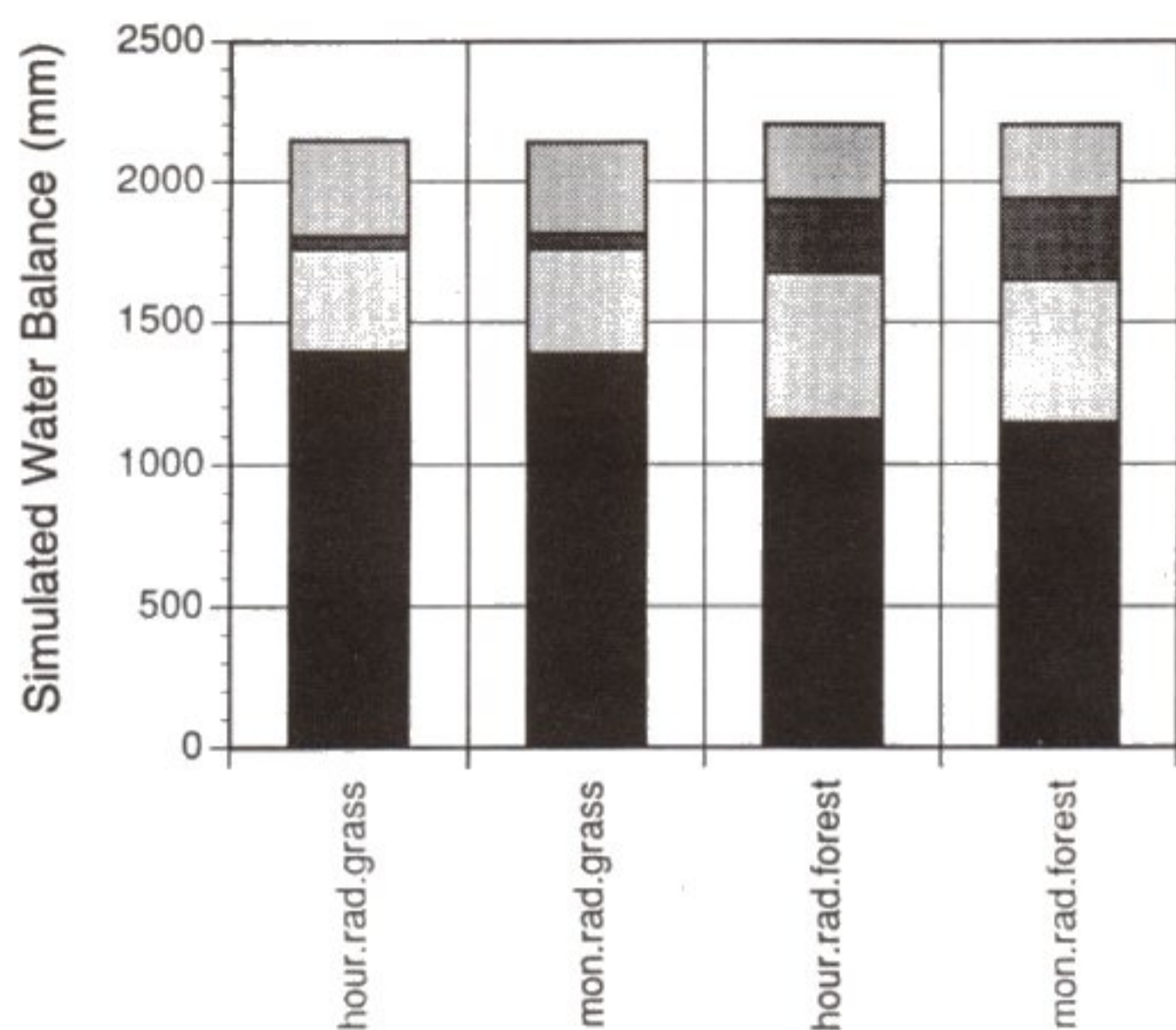


Figure 1. Sensitivity of simulated water balance to temporal resolution of solar and terrestrial radiative fluxes. Simulation was made by forcing the modified SiB under hourly atmospheric observations at Sapporo, Japan, for the 2-year period (May 1985–April 1987). Monthly mean radiative fluxes were generated from hourly observed fluxes. Simulation was performed for two vegetation types: grass cover (two bars on the left) and mixed forest (two bars on the right).

much affected by the temporal resolution. This lack of effect is surprising because surface radiative fluxes are well correlated with precipitation, surface air temperature, and vapor pressure.

The result is quite different in the case of precipitation. The amount of evapotranspiration (the sum of transpiration, soil evaporation, and interception losses) becomes larger as longer time averages are taken and runoff becomes smaller. If longer time averages are taken, the precipitation given as an hourly external forcing becomes smaller. Light precipitation is mostly intercepted by the canopy; it re-evaporates quickly into the atmosphere and does not fall onto the ground. This activity is evident in Figure 2, which shows interception loss is the most affected component of evapotranspiration.

Six-hourly accumulated precipitation from the Japan Meteorological Agency global four-dimensional data assimilation was also compared with precipitation measured by rain gauges. The tim-

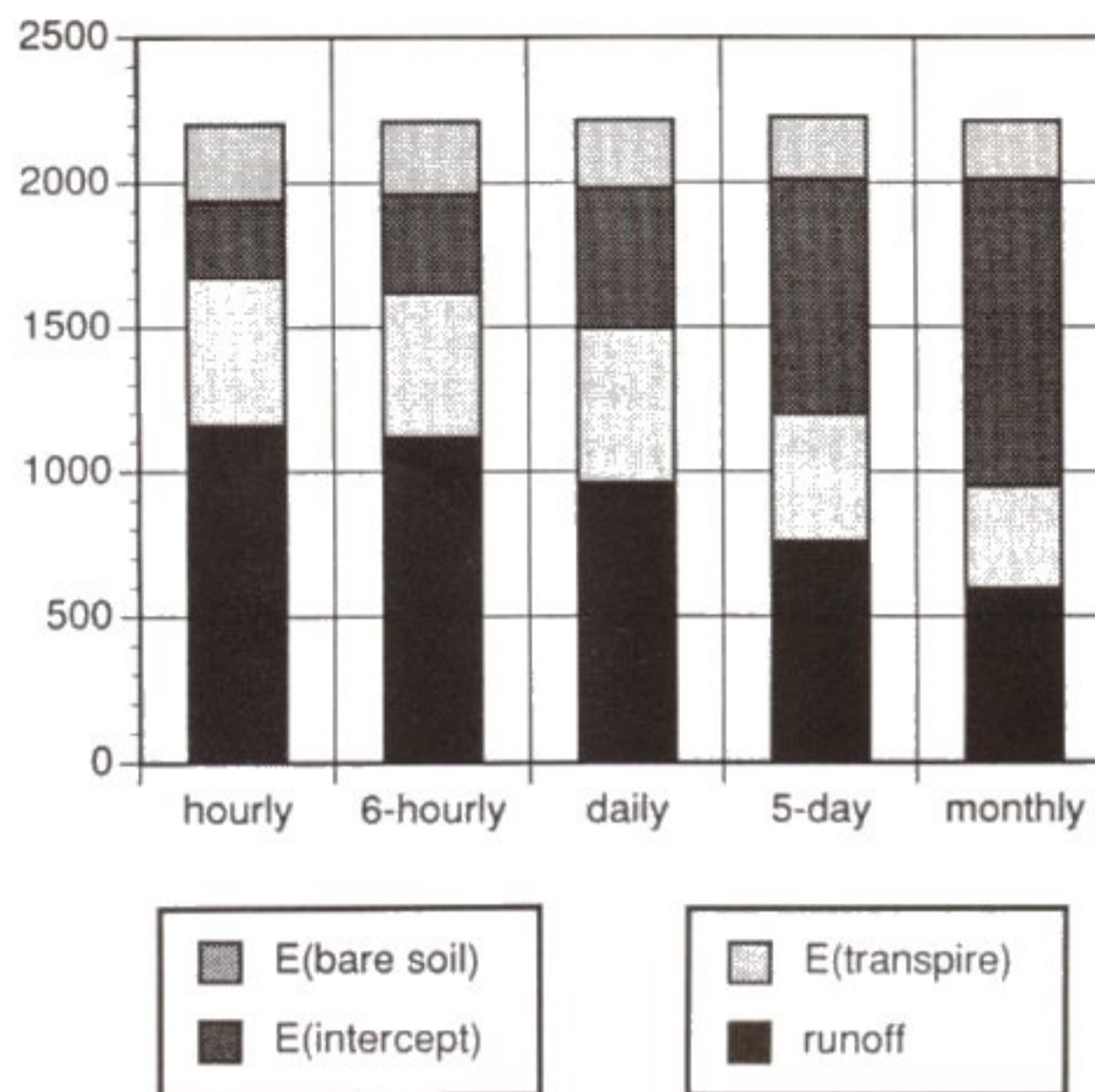


Figure 2. Sensitivity of simulated water balance to temporal resolution of precipitation. Six-hourly, daily, five-day and monthly mean precipitation was generated from observed hourly precipitation. Mixed forest was assumed as a vegetation cover.

ing of model-derived precipitation was found to be correct although its amount was different by a few tens of percent.

As a consequence of this study, the use of 6-hourly accumulated precipitation from the National Meteorological Center (NMC) reanalysis was recommended in order to partition the GPCP monthly precipitation into hourly precipitation.

A report describing the methodologies and data sets to be used by the soil wetness product generation and validation teams will be released this summer.

References

- Sato, N., K. Mabuchi, and P.J. Sellers, 1995: Simulation of snow deposition and melting by modified simple biosphere model (SiB). *J. Meteor. Soc. (Japan)*, submitted.
- Sellers, P.J., Y. Mintz, Y.C. Sud, and A. Dalcher, 1986: A simple biosphere model (SiB) for use within general circulation models. *J. Atmos. Sci.*, **43**, 505–531.

STOCHASTIC GENERATION OF PRECIPITATION AND EFFECT ON VEGETATION NET PRIMARY PRODUCTION

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University of Liège, Belgium

The processes governing soil hydrology and carbon assimilation in vegetation are highly non-linear. Mechanistic models of the continental water and carbon cycles should thus use daily climatic forcings rather than monthly means as is usually done in view of the easy access to monthly climatic databases. The nonlinearity of the soil-vegetation system was tested with the CARAIB (CARbon Assimilation In the Biosphere) model, a global mechanistic model developed at the University of Liège that incorporates parametric representations of soil hydrology and vegetation productivity. The model uses a one-day timestep and is forced with monthly rain data uniformly distributed over the whole period (Run A) and with stochastically generated daily rainfall (Run B). The resulting maps (see cover and back pages) of annual-mean net primary productivity (NPP) show a drastic overestimation of the extent of the major deserts in Case A. The global annual NPP is 40 GtC yr⁻¹ in Case A versus 59 GtC yr⁻¹ in Case B. The global annual runoff volume varies from 22 km³ in Run A to 34 km³ in Run B.

The rain generator is based on a monthly-mean precipitation climatology and probabilities for a rainy or a dry day, to follow a rainy or dry day, in each of the "geoclimatic" divisions of the earth's continents. The division was outlined on the basis of the Koppen classification of climates and landscapes. The feasibilities were determined from 5,200 meteorological stations, stratified according to geoclimatic division.

NOTICE

See page 10 for announcement of the 1996 Conference on Global Energy and Water Cycle.

ISLSCP INITIATIVE I DATA SETS AVAILABLE ON CD-ROM

Piers Sellers
NASA/Goddard Space Flight Center

The International Satellite Land Surface Climatology Project (ISLSCP) has released comprehensive, interdisciplinary data sets on CD-ROM for use by land surface-atmosphere modelers. These Initiative I data sets span the 24-month period of 1987-1988 and are mapped to a common 1x1 degree spatial resolution and grid. A summary of the data is provided in the following table.

The goals of ISLSCP are to improve understanding of the physical and biological processes controlling the exchanges of energy, heat, and mass between the vegetated land surface and the atmosphere by using remote sensing and other techniques to integrate local-scale understanding to regional and global scales. The idea for the CD-ROM began in 1992 at an interdisciplinary earth science workshop, which brought modelers, algorithm developers, and field experiment scientists together to discuss future steps for applying and translating current research finds into useful global data sets for land-atmosphere models. The data sets contained within this CD-ROM set are a direct response to the recommendations of that workshop. [Note: Hybrid 6-hourly partitioning of precipitation and radiation data are provided as recommended by the lead article.]

Planning is now underway for the next ISLSCP CD-ROM, Initiative II, for which the ISLSCP Science Panel is examining the feasibility of providing 3- and 6-hourly data sets at 0.5x0.5 degree spatial resolution for the period of 1987-1994. The tentative release date for the Initiative II CD-ROM is 1997.

ISLSCP Initiative I data sets are available through the Goddard Distributed Active Archive Center.

EOSDIS Distributed Active Archive Center
NASA, Goddard Space Flight Center
Code 902.2
Greenbelt, MD 20771, U.S.A.
Tel: 301/286-3209
Fax: 301/286-1775
E-mail: gsfc@eos.nasa.gov
WWW URL: <http://daac.gsfc.nasa.gov>

**DATA ON ISLSCP CD-ROM RELEASED
MARCH 1995**

**DATA SETS ON THE ISLSCP CD-ROM
Temporal Resolutions Are Given in the Right-Hand Column**

NOTES:

- Data sets span the 24-month period of 1987–1988.
- "Monthly 3-hourly" refers to values that are monthly means of 3-hourly data. Thus, all the OOOOZ values for a month are averaged into a single value, also the O3OOZ values, etc.
- The snow-free albedo data set in Section A is based on NDVI fields and a model calculation, the albedo field in Section D is based on ERBE data, and the fields in Section E originate from a survey of *in situ* work.
- The documentation for the vegetation class data in Section A includes vegetation morphological and physiological parameters associated with each vegetation type in the SiB2 model now in preparation.

A. VEGETATION: LAND COVER AND BIOPHYSICS—(NASA/GSFC, CSU, U. Maryland)

NDVI, FASIR-NDVI.....Monthly	Background (soil/litter) reflectance
FPAR, LAI, GreennessMonthly	(Vis, NIR).....Fixed
Surface roughness, snow-free albedo.....Monthly	Vegetation class.....Fixed

**B. HYDROLOGY AND SOILS
(GPCP, GRDC, U. Arizona, Trent U., NCAR, FAO, NASA/GSFC, NASA/GISS)**

Precipitation (GPCP).....Monthly	Lake, river, marsh cover percentage.....Fixed
River runoff (GRDC; 14 basins).....Monthly	Soil texture, depth, slope.....Fixed

**C. SNOW, ICE, AND OCEANS
(NOAA/NESDIS, Rutgers U., USAF, NOAA/NMC, U.S. Navy, NCAR)**

Snow cover, depth.....Monthly	Land-ocean boundary.....Fixed
Sea Ice, SST.....Monthly	

**D. RADIATION AND CLOUDS
(U. of Maryland, NASA/LaRC, ISCCP, NASA/GISS)**

Surface and TOA incoming and outgoing shortwave.....Monthly 3-hourly	Surface net shortwave, net longwave, net radiation fluxes.....Monthly
Surface incoming PAR fluxes.....Monthly	Cloud amount, cloud top pressure.....Monthly
Surface incoming shortwave and longwave radiation fluxes.....Monthly	Optical thickness, water path.....Monthly
	Clear-sky albedo (ERBE).....Monthly

**E. NEAR-SURFACE METEOROLOGY
(ECMWF, NASA/GSFC, NOAA/NMC, NASA/LaRC, GPCP)**

<p>(i) Prescribed/diagnostic fields</p> <p>Soil Moisture.....Monthly</p> <p>Deep soil temperature and soil wetness.....Monthly</p> <p>Snow depth.....Monthly</p> <p>Albedo, surface roughness.....Fixed</p> <p>(ii) Monthly 6-hourly forcing fields</p> <p>Surface pressure, air temperature, dew point.....Monthly 6-hourly</p> <p>Surface temperature.....Monthly 6-hourly</p> <p>Mean sea level pressure.....Monthly 6-hourly</p> <p>u,v wind speed and stress.....Monthly 6-hourly</p>	<p>Surface sensible and latent heat fluxes.....Monthly 6-hourly</p> <p>Net surface and TOA shortwave, longwave fluxes.....Monthly 6-hourly</p> <p>(iii) Diurnally-resolved (6-hourly) forcing</p> <p>Surface pressure, air temperature, dew point, wind speed.....6-hourly</p> <p>Hybrid longwave and shortwave incoming radiation fluxes.....6-hourly</p> <p>Hybrid total precipitation and convective precipitation.....6-hourly</p>
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MEETINGS AND WORKSHOP SUMMARIES

THIRD SESSION GEWEX CLOUD SYSTEM STUDY

Science Panel Meeting
Victoria, British Columbia, Canada
13-16 December 1994

Keith Browning
University of Reading, U.K.

The goal of the GEWEX Cloud System Study (GCSS) is to improve numerical weather prediction models (NWP), general circulation models (GCM) and climate models through better understanding and parameterization of the coupled physical processes within different types of cloud systems. To achieve this goal the GCSS Science Plan established four working groups to address different cloud systems. Brief summaries of the working groups' accomplishments and plans follow.

The Boundary Layer Cloud Systems Working Group (WG-1) has started a series of workshops. The first was held 16-18 August 1994 in Boulder, Colorado. Ten groups from around the globe gathered to hold an intercomparison of large eddy simulation (LES) models that represent cloud resolving models in the atmosphere's boundary layer. The data for this intercomparison were from the First International Satellite Cloud Climatology Project (ISCCP) Regional Experiment (FIRE). **It was concluded that the scatter in the LES model cloud top heights requires benchmark measurements of entrainment rates for testing and calibrating boundary layer cloud models.** The next intercomparison test will be based on data from the Atlantic Stratocumulus Transition Experiment (ASTEX) Lagrangian cases. That workshop is scheduled for mid to late-1995, to be held in The Netherlands.

The recent activities of the Cirrus Cloud Fields Working Group (WG-2) included participation in a joint European Centre for Medium-range Weather Forecasting (ECMWF) and GCSS workshop held in Reading, U.K., from 31 October to 5 November 1994. Concerns of the WG-2 include atmospheric water vapour profiles and the sensitivity of cirrus to upper tropospheric and stratospheric aerosols. The WG-2 strategy is to parameterize cirrus clouds through the use of cloud-resolving model simulations using observational data. This strategy was advanced at the joint ECMWF/GCSS Workshop. The WG-2 plans include publishing review articles, conducting additional workshops, defining observational requirements, and distributing data sets (model and observational).

The Extra-Tropical Layer Cloud Systems Working Group (WG-3) has identified several issues including precipitation efficiency impact on the hydrological cycle, the role of super-cooled water at the top of some ice clouds, and the diabatic effects on microphysical processes. At the joint ECMWF/GCSS workshop, climate and general circulation modellers interacted with cloud resolving modellers and microphysical observationalists. It was concluded by this diverse group at the workshop that there is a need for well-documented case studies to be simulated. The output resulting from these simulations would include products needed to validate cloud-resolving models and the statistics on vertical velocity, turbulence, moisture, and the ice phase. A specific recommendation addressed the need to examine upper tropospheric moisture.

To address adequately issues of cloud layering relating to large scale forcing, precipitation, and radiation, WG-3 is taking action to influence data acquisition for planned field experiments. As part of that action, WG-3 representatives participated in a Fronts and Atlantic Storm Experiment (FASTEX) planning workshop held in Silver Spring, Maryland, U.S.A., 13-16 March 1995. FASTEX is proposed to be conducted in 1997. In addition to these activities, two survey articles are being prepared for publication in the Bulletin of the American Meteorological Society (BAMS): "A Survey of Frontal Cloud Systems" and "Extra-Tropical Layer Clouds: Their Nature and Climatic Importance."

The Precipitating Convective Cloud Systems Working Group (WG-4) reported progress including the adoption of a strategy to produce prototype cloud resolving models (CRM) to serve as a basis for model intercomparison studies. Experiments in France have been conducted with tropical convection and midlatitude frontal systems. These simulations used data from the Tropical Ocean Global Atmosphere (TOGA)-Coupled Ocean Atmosphere Response Experiment (COARE) and other experiments. For application to the GEWEX Asian Monsoon Experiment (GAME), advances have been made in Japan in parameterizing physical processes that include the microphysical structure and the regional water and energy cycle at the cumulus scale, and their interactions with larger scale cloud systems.

GEWEX Science Steering Group Meeting

Melbourne, Victoria, Australia
30 January-3 February 1995

Sam Benedict
World Meteorological Organization, Geneva

The Seventh Session of the GEWEX Science Steering Group (SSG) met to review the major national and



Participants at Seventh Session of GEWEX Science Steering Group meeting.

international achievements of GEWEX since the sixth session was held in Frascati, Italy, in January 1994. Topics reported that are of major scientific concern in GEWEX include atmospheric radiation, clouds, surface interactions with atmosphere, hydrology, and numerical experimentation. The SSG also considered specific science priorities of GEWEX in relation to ongoing and emerging initiatives within the WCRP and within the entire international framework of global change research.

A number of presentations addressed priorities for production of high quality WCRP data sets used in numerical experimentation and diagnostic studies to improve understanding or identify interactive factors that govern global systems, particularly the crucial energy and water cycle. For example, the International Satellite Cloud Climatology Project (ISCCP) reported on the Phase 2 initiative, which includes new ISCCP data sets that use improved algorithms and calibration procedures to better determine the effects of clouds on the exchanges of radiation (energy) in the climate system and the properties and role of clouds in the hydrological (water) cycle. Also, the need for producing a higher resolution Global Precipitation Climate Project (GPCP) data set was discussed. Producing a self-consistent global data set of clouds, precipitation, and water vapour was also to be considered. Sea surface temperature and aerosol data sets were introduced as future GEWEX products. The International Satellite Land Surface Climatology Project (ISLSCP) conducted a highly successful field project, the Boreal Ecosystem-Atmosphere Study, and made a significant contribution to improving the boundary layer parameterization for global numerical weather prediction modelling.

Progress in conducting regional experiments, the GEWEX Continental-scale International Project (GCIP) and the Mackenzie GEWEX Study (MAGS), were reported. A national project office for GCIP in the Mississippi River basin has been established within the U.S. National Oceanic and Atmospheric Administration (NOAA) Office of Global Programs. "The GCIP Major Activities Plan for 1995, 1996, and Outlook for 1997" was distributed. In addition, plans for other regional experiments were considered; these included the Baltic Sea Experiment (BALTEX), the GEWEX Asian Monsoon Experiment (GAME), and the Large-Scale Atmospheric Moisture Balance of Amazonia Using Data Assimilation (LAMBADA) project. It was concluded that a continental-scale experiments panel was needed to facilitate transfer of results between these regional efforts, and the GEWEX Hydrometeorology Panel (GHP) was formed to do this.

The Project for Intercomparison of Land-Surface Parameterization Schemes (PILPS) was approved as a GEWEX component. Also, proceeding very well were the GEWEX Numerical Experimentation Panel (GNEP) plans and those concerning the development of a GEWEX data management function.

Satellite observing systems, particularly the systems planned by Europe, Japan, and the United States nearly fulfill the primary remote sensing requirements of WCRP and GEWEX. However, measurements that still need to be addressed include the vertical structure of clouds and global winds, as well as accurate atmospheric profiles under cloudy conditions, such as could be provided by the Microwave Humidity Sounder. A cloud diagnostic mission remains the highest scientific priority in addition to those currently planned.

**Second International Study Conference
on GEWEX in Asia and GAME****Pattaya, Thailand
6-10 March 1995****K. Musiaka
University of Tokyo, Japan**

The Japanese National Committee for the GEWEX Asian Monsoon Experiment (GAME) and the National Research Council of Thailand organized this conference to coordinate international cooperation for GAME and review scientific issues related to the water and energy cycles in monsoon Asia and the relationship to the global climate system.

Approximately 200 participants representing over 20 countries made presentations covering topics that included GEWEX experiment strategies in Asia and satellite remote sensing techniques for atmospheric, hydrologic, and oceanographic process studies related to GAME. During the evenings and between sessions, informal meetings were held to discuss the surface radiation network, the GAME Tibetan Plateau Experiment, macro-scale hydrologic modelling, and the GAME Tropics Implementation Plan.

In the final session on planning and implementation of GAME, Prof. T. Yasunari, chairperson of the Conference, proposed the following activities:

- **GAME International Science Panel (GISP):** The tasks of this panel are to steer and coordinate GAME and GAME-related scientific activities and to review the scientific results of GAME. The GISP should be composed of one to three members from each country who can provide continuity to GAME-related activities such as regional experiments, data collection, and modelling.
- **GAME International Secretariat (GIS):** The GAME International Secretariat of Japan is located at the Institute of Hydrospheric-Atmospheric Sciences of Nagoya University. This office will be held concurrently with that of the Earth Observation data analysis and Research Center (EORC) of the National Space Development Agency (NASDA) of Japan.
- **International Monsoon Study Panel (IMSP):** The main function of this panel is to cooperate and coordinate the field-based experiments related to GAME (particularly, the intensive observation period (IOP) with other monsoon projects. Tentatively, this panel will be organized jointly by GISP and the WMO tropical monsoon program committee.

In addition to the above items, the IOP presently scheduled for 1998 and the principles of data management and exchange were discussed.

**MEETING ANNOUNCEMENTS AND
CALL FOR PAPERS****WCRP Workshop on Arctic Climate System
Study Solid Precipitation, 12-15 September 1995,
Reston, Virginia, U.S.A.**

The WCRP Arctic Climate System Study (ACSYS) is scheduled to convene at the U.S. Geological Survey Headquarters Building in Reston, Virginia, on 12-15 September 1995. Workshop topics include (1) *in situ* measurements of solid precipitation in the Arctic region; (2) remote sensing of solid precipitation over the Arctic; (3) model-derived precipitation climatologies for the Arctic; and (4) hydrological modelling of Arctic river runoff.

For additional information, contact: Prof. R. Barry, University of Colorado, Colorado 80309-0449, U.S.A., Tel: +1-303-492-5488; Fax: +1-303-492-2468; E-Mail: rbarry@kryos.colorado.edu.

**Second International Conference on Global Energy and Water Cycle, 17-21 June 1996,
Washington, DC, U.S.A.**

The Second International Conference on the Global Energy and Water Cycle will be held at the U.S. National Academy of Sciences. Following the interdisciplinary science theme of the 1994 Conference at the Royal Society, London, the 1996 Conference will bring together scientists involved in the study of measurements, modelling, and the theory of processes affecting the energy and water cycle from small scale to global scale. In focussing on the GEWEX science areas involving clouds, radiation, hydrologic processes, and modelling, there will be five interrelated sessions:

- Drought and Flood Prediction
- Regional Water Resources and Climate
- Cloud, Water Vapour, Aerosols, and Global Warming
- The Water and Carbon Cycle Connection
- Ocean-Atmosphere-Ice Exchanges

Additional registration and abstract information will be mailed soon. Contact IGPO for further information.

WCRP/GEWEX MEETINGS CALENDAR

*For calendar updates, consult the GEWEX
Home Page [http://www.cais.com/gewex/
gewex.html](http://www.cais.com/gewex/gewex.html)*

11-15 December 1995—GEWEX CLOUD SYSTEM STUDY SCIENCE PANEL meeting in Washington, DC, U.S.A.

15-19 January 1996—GEWEX SCIENTIFIC STEERING GROUP MEETING, U.S. National Academy of Sciences, Irvine, California, U.S.A., by invitation only.

28 January-2 February 1996—GEWEX topics at American Meteorological Society Meeting, Atlanta, Georgia, U.S.A.

10-12 June 1996—SCALING UP HYDROLOGICAL VARIABLES USING REMOTE SENSING, Wallingford, U.K. For information, contact Dr. John Stewart, Institute of Hydrology, Crowmarsh Gifford, Wallingford, Oxfordshire, OX10 8BB, U.K.; Tel: 44-1491-838800; Fax: 44-1491-832256.

17-21 June 1996—SECOND INTERNATIONAL CONFERENCE ON GLOBAL ENERGY AND WATER BALANCE, U.S. National Academy of Sciences, Washington, DC. For additional information, contact IGPO, 409 Third St., SW, Suite 203, Washington, DC., U.S.A., Tel: 1-202-863-1435; Fax: 1-202-488-5364; E-mail: gewex@cais.com.

19-23 August 1996—12TH INTERNATIONAL CONFERENCE ON CLOUDS AND PRECIPITATION, Zurich, Switzerland. For information, contact Prof. P.R. Jonas, Dept. of Pure and Applied Physics, UMIT, P.O. Box 88, Manchester, M60 1QD, U.K.

9-13 September 1996—SEVENTH CONFERENCE ON MESOSCALE PROCESSES, Reading, U.K. For information, contact Bradley Smull, NOAA/NSL, 325 Broadway, Boulder, Colorado, U.S.A.; Tel: 1-303-497-6886; Fax: 1-303-497-6930; E-mail: smull@mrd3.mmm.ucar.edu, or Susan Ballard, Joint Centre for Mesoscale Meteorology, University of Reading, P.O. Box 240, Reading RG6 2FN, U.K.; Tel: 44-734-318794; Fax: 44-734-318791; E-mail: spballard@email.meto.govt.uk.

GEWEX REPORTS AND DOCUMENTS

(Available from IGPO)

PROJECT FOR INTERCOMPARISON OF LAND-SURFACE PARAMETERIZATION SCHEMES (PILPS), Soil Moisture Simulation. December 1994, IGPO Publication Series No. 14.

LAND-SURFACE CLIMATOLOGIES OF AMIP-PILPS MODELS AND IDENTIFICATION OF REGIONS FOR FUTURE INVESTIGATION (PILPS Phase 3A). November 1994, IGPO Publication Series No. 13.

GEWEX CONTINENTAL-SCALE INTERNATIONAL PROJECT (GCIP) Major Activities Plan for 1995, 1996, and Outlook for 1997. December 1994, IGPO Publications Series No. 12.

GEWEX CLOUD SYSTEM STUDY (GCSS) SCIENCE PLAN. May 1994, IGPO Publication Series No. 11.

GEWEX PAMPHLET (fivefold glossy).

UTILITY AND FEASIBILITY OF A CLOUD PROFILING RADAR: Report of the GEWEX Topical Workshop, 29 June-1 July 1993, Pasadena, California. April 1994, IGPO Publication Series No. 10.

IMPLEMENTATION PLAN FOR GEWEX CONTINENTAL-SCALE PROJECT (GCIP), VOLUME III: Strategic Plan for Data Management. March 1994, IGPO Publication Series No. 9.

IMPLEMENTATION PLAN FOR GEWEX CONTINENTAL-SCALE PROJECT (GCIP), VOLUME II: Research. June 1994, IGPO Publication Series No. 8.

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

3-7 July 1995—JOINT IAHS/IAMAS SYMPOSIUM ON CLOUDS CONVECTION AND LAND-SURFACE PROCESSES, At International Union of Geodesy and Geophysics XXI General Assembly, Boulder, Colorado. For additional information, write IUGG XXI General Assembly, c/o American Geophysical Union, 2000 Florida Ave., NW, Washington, DC 20009, U.S.A., Tel: 202-462-6900; Fax: 202-328-0566.

9-11 July 1995—GEWEX RADIATION SCIENCE PANEL, Ft. Collins, Colorado, U.S.A. By invitation only.

28 August-1 September 1995—FIRST STUDY CONFERENCE ON BALTEX, Visby, on the Island of Gotland, Sweden. For further information and submittance of registration, contact Prof. Anders Omstedt, SMHI, S-60176 Norrköping, Sweden, Tel: +46 11 15 80 00; Telex: 64400 smhis.; Fax: +46 11 17 02 07; E-mail: aomstedt@smhi.se.

4-8 September 1995—THIRD INTERNATIONAL CONFERENCE ON MODELLING OF GLOBAL CLIMATE CHANGE AND VARIABILITY, Hamburg, FRG. For information, contact Dr. Lydia Dumenil, Max-Planck-Institut für Meteorologie, Bundesstrasse 55, D-20146 Hamburg, Germany. Tel: 49-40-41173-310; Fax: 49-40-41173-366.

12-15 September 1995—WCRP ARCTIC CLIMATE SYSTEM STUDY SOLID PRECIPITATION CLIMATOLOGY WORKSHOP, Washington, DC. For information, contact Prof. R. Barry, NSIDC/CIRES, University of Colorado, Boulder, Colorado 80309, U.S.A.; Tel: 1-303-492-5488; Fax: 1-303-492-2468; E-mail: rbarry@kryos.colorado.edu.

25-29 September 1995—GAIM SCIENCE CONFERENCE, Garmisch-Partenkirchen, Germany. A GEWEX/WCRP-related session on Global System Integration. For additional information, contact Dr. Dork Sahagian, Institute for the Study of Earth, Oceans and Space, University of New Hampshire, Durham, New Hampshire 03824, U.S.A.; Tel: 1-603-862-3875; Fax: 1-603-862-0188; E-mail: gaim@unh.edu.

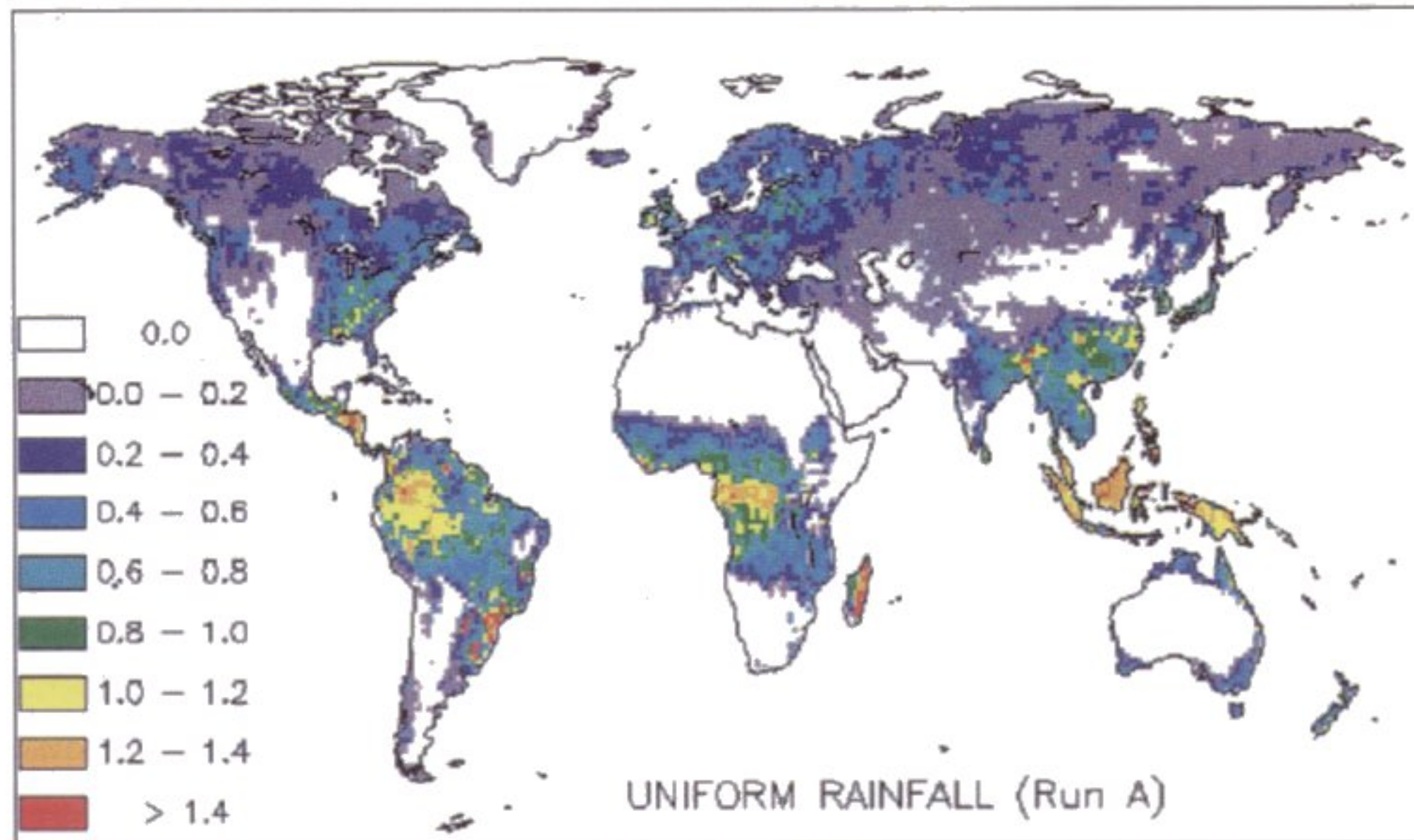
16-19 October 1995—GCIP SCIENCE PANEL MEETING, Minneapolis, Minnesota, U.S.A. For information, contact Blair Gollhur, GCIP Office, 1100 Wayne Avenue, Suite 1225, Silver Spring, Maryland, U.S.A.; Tel: 1-301-427-2080 ext. 511; Fax: 1-301-427-2222; E-mail: gcip@ogp.noaa.gov.

November 1995—LARGE-SCALE BIOSPHERE-ATMOSPHERE EXPERIMENT IN AMAZONIA (LBA), Brazil. For information, contact Dr. Carlos Nobre, CPTEC-INPE, Rod. Presidente Dutra, KM 40, C. Postal 001 12630-000, C. Paulista SP Brazil; Tel: 55-125-612822; Fax: 55-125-612835; E-mail: nobre@cptec.inpe.br.

1-3 November 1995—GEWEX CLOUD SYSTEM STUDY WORKSHOP, Goddard Institute for Space Studies, New York City, New York, U.S.A. For additional information, contact Dr. Ronald Stewart, Tel: 416-739-4122; Fax: 416-739-5700; E-mail: restewart@dow.on.doe.ca.

26 November-1 December 1995—INTERNATIONAL SYMPOSIUM ON SPECTRAL SENSING RESEARCH, Melbourne, Australia. Sessions include Atmospheric, Oceanic, Land Surface Applications, Analysis and Processing Systems, and Data Collection. For information, contact Science and Technology Corporation, Meetings Division, Attn: ISSSR, 101 Research Drive, Hampton, Virginia 23666-1340, U.S.A.; Tel: 1-804-865-7604; Fax: 1-804-865-8721.

4-6 December 1995—REGIONAL CONFERENCE ON GLOBAL CHANGE, São Paulo, Brazil. For information, contact Ines Iwashita, Instituto de Estudos Avancados, Universidade de São Paulo, 05508-900; Tel: (55)-(11)-818-4442; Fax: (55)-(11)-818-4306; E-mail: iea@cat.cce.usp.br.



CARbon Assimilation In Biosphere (CARAIB) model results with average monthly rainfall data. Compare to results shown on page 1.

GCIP PAMPHLET (trifold glossy).

IMPLEMENTATION PLAN FOR THE GEWEX CONTINENTAL-SCALE INTERNATIONAL PROJECT (GCIP), VOLUME I: 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, U.S.A.

INTERNATIONAL SATELLITE LAND SURFACE CLIMATOLOGY PROJECT (ISLSCP) WORKSHOP REPORT, 23-26 June 1992, Columbia, Maryland, U.S.A.

PROJECT FOR INTERCOMPARISON OF LAND-SURFACE PARAMETERIZATION SCHEMES (PILPS): Report on PILPS Workshop, 24-26 June 1992, Columbia, Maryland, 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.

GEWEX CONTINENTAL-SCALE INTERNATIONAL PROJECT (GCIP) ATMOSPHERIC SCIENCE COMPONENT: Report on Atmospheric Subpanel Workshop, 18-19 March 1992. May 1992, IGPO Publication Series No. 3.

IMPLEMENTATION PLAN FOR THE PILOT PHASE OF THE GEWEX WATER VAPOR PROJECT (GVaP). March 1992, IGPO Publication Series No. 2.

SCIENTIFIC PLAN FOR THE GEWEX CONTINENTAL-SCALE INTERNATIONAL PROJECT (GCIP)-WCRP-67, February 1992 (WMO/TD No. 461). (Second printing available)

THE ROLE OF WATER VAPOR IN CLIMATE, A STRATEGIC RESEARCH PLAN FOR THE PROPOSED GEWEX WATER VAPOR PROJECT (GVaP): Report of Workshop, Easton, Maryland, U.S.A., 30 October-1 November 1991. NASA Conf. Pub. 3210.

GLOBAL ENERGY AND WATER CYCLE EXPERIMENT (GEWEX)—REPORT OF THE FIRST GEWEX TEMPERATURE/HUMIDITY RETRIEVAL WORKSHOP, WCRP-XX, Greenbelt, Maryland, U.S.A., 23-26 October 1990.

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