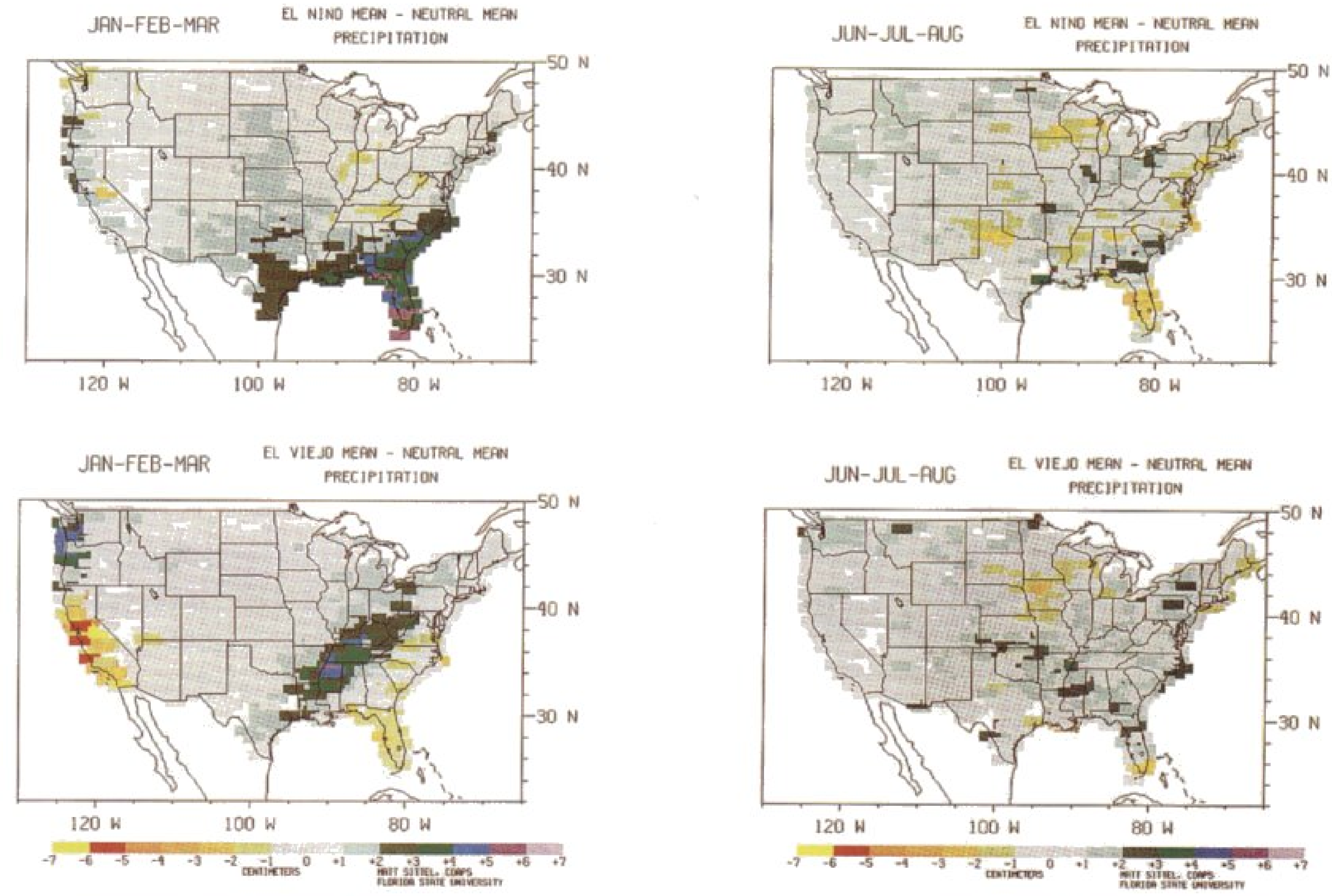
GEWEX WCRP
Global Energy and Water Cycle Experiment
NEWS

Vol. 5, No. 4 November 1995

World Climate Research Programme–WCRP

W I N T E R



S U M M E R

APPARENT ENSO SIGNAL **NO APPARENT ENSO SIGNAL**

Climatology of winter and summer precipitation anomalies over the continental United States in relation to the state of the Southern Oscillation El Niño (warm phase) or El Viejo (cold phase). Summer precipitation anomalies may result from the fast climate processes studied by GEWEX and GCIP. For details see page 12. (Illustration courtesy of Center for Ocean-Atmospheric Prediction Studies, Florida State University.)

COMPARISONS OF EVAPORATION FOR THE RED-ARKANSAS BASIN

Fayez A. Abdulla,[1] Dennis P. Lettenmaier,[1] Eric F. Wood,[2] and James A. Smith[2]

[1]University of Washington
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A primary objective of the GEWEX Continental-Scale International Project (GCIP) is to determine the space-time variability of water and energy fluxes at continental scales. In support of this objective is the development and testing of macroscale land surface hydrological models appropriate for modeling water and energy budgets at the Large Study Area (LSA) scale. One element of the testing for

(Continued on page 6)

The "Anomalous Cloud Absorption" Issue reviewed on page 5 (related article on page 9)

WHAT'S NEW IN GEWEX

- New Focus for GEWEX Regional Experiments
- Initial CAMEX-2 Results Support GVaP
- NPP Shows Effect of Diurnal Cycle of Precipitation
- Germany Increases Global Runoff Data Centre Staff
- ISCCP Marks 12 Years with Special Symposium
- Proceedings on GEWEX in Asia and GAME Issued
- Over 700 ISLSCP CD-ROMs distributed
- Second International GEWEX Scientific Conference Set for 17–21 June 1996, Washington, DC

COMMENTARY

A FOCUSED SCIENTIFIC THRUST FOR THE GEWEX REGIONAL HYDRO-METEOROLOGICAL EXPERIMENTS

Moustafa T. Chahine
Chairman, GEWEX Science Steering Group

At the GEWEX Science Steering Group (SSG) meeting in Melbourne in January 1995, the SSG discussed the need to focus the scientific achievements of GEWEX and project their human and social impacts. It is interesting that this concept was also discussed at the U.S. National Academy of Sciences–National Research Council review of the U.S. Global Change Research Program and NASA's Mission to Planet Earth Program's Earth Observing System held July 19–28, 1995 in LaJolla, California. The review recommended *the use of fundamental science to develop sound predictive schemes that yield products useful to human activities*. GEWEX is now in a strong position to respond to this recommendation.

GEWEX incorporates three main elements of research: (1) Development and production of global data sets of essential climatological parameters; (2) field and theoretical studies on atmospheric radiation processes; and (3) field and theoretical studies on land surface processes. These elements possess the necessary factors to focus on products useful to human activities. The newly formed GEWEX Hydrometeorology Panel (GHP), at its first meeting in September 1995 in Visby, Sweden, has proposed a scientific focus that integrates contributions from all the GEWEX regional continental-scale experiments [i.e., GEWEX Continental-Scale International Project (GCIP), Baltic Sea Experiment (BALTEX), Mackenzie River GEWEX Study (MAGS), GEWEX Asian Monsoon Experiment (GAME), and Large-scale Biosphere-Atmosphere Field Experiment in Amazonia (LBA)].

The GHP focus is *to demonstrate skill in predicting changes in water resources and soil moisture on time scales up to seasonal and annual as an integral part of the climate system.* To make significant progress in this area the regional projects must improve our understanding of the relative influence of local versus nonlocal controls on precipitation over land and how the local controls vary from region to region, as well as determine the feedback mechanisms in the water cycle and to what degree they may affect the persistence of wet and dry spells.

The GHP will coordinate the contributions of the regional projects and will work with water resource agencies to assist in applying the new information. Other scientific foci will be formulated for GEWEX. Each focus will serve to propel the results of GEWEX research and data collection into tangible applications and will provide an essential scientific contribution to WCRP's goals to improve understanding of climate and climate variation.

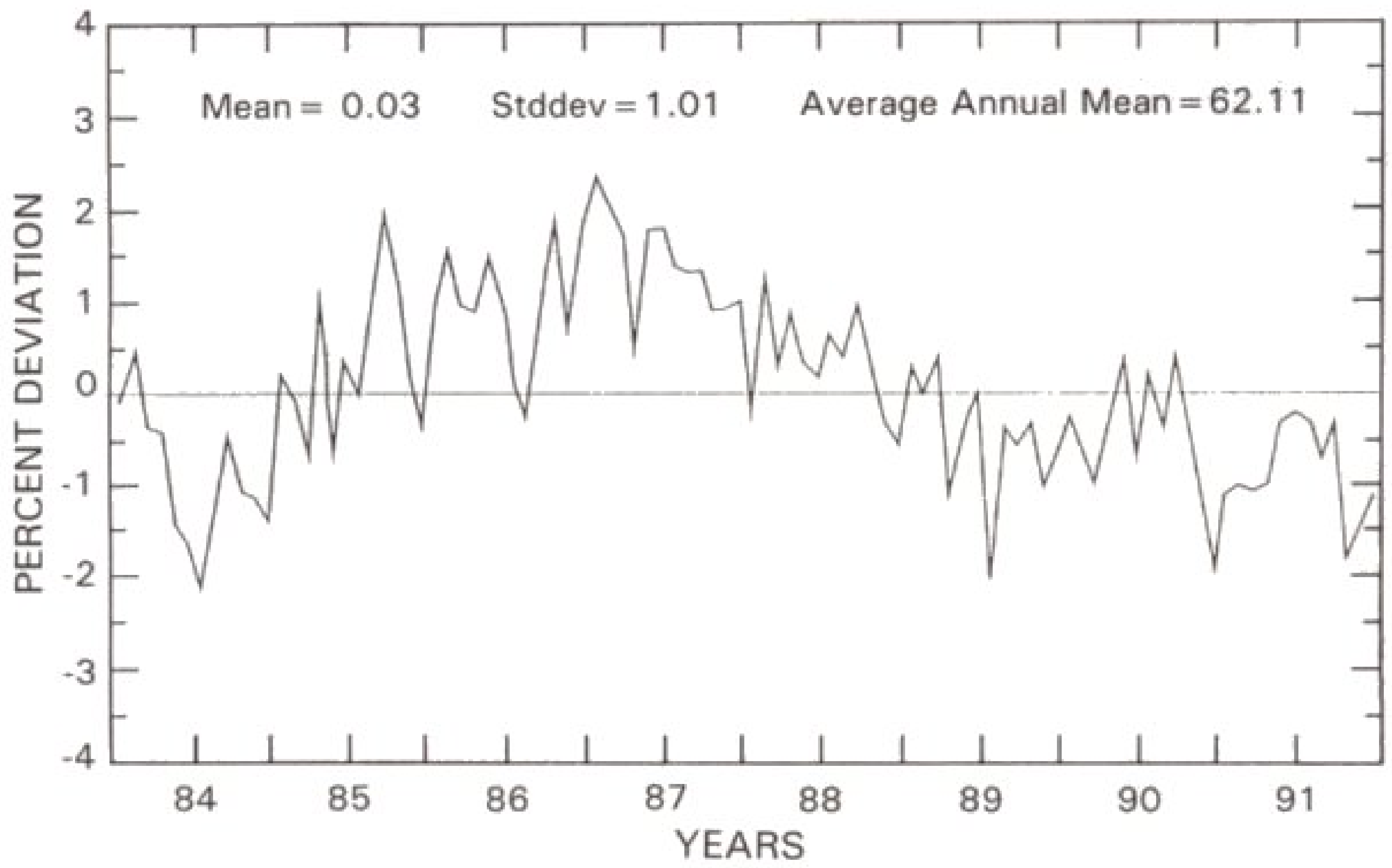
POSITION CHANGES

Michael Coughlan has left his position as the GCIP Project Manager in Washington, DC, to be the Director of the CLIVAR Office in Hamburg, Germany.

Rick Lawford has moved from the National Hydrology Research Centre in Saskatoon, Saskatchewan, Canada to be the Project Manager of GCIP in Washington, DC.

Graeme Stephens has returned to Colorado State University from Australia and is the new chairman of the WCRP Working Group on Radiative Fluxes, GEWEX Radiation Science Panel.

In This Issue



Global monthly mean cloud cover anomaly (relative to mean annual cycle) determined from an analysis of weather satellite observations by the International Satellite Cloud Climatology Project (ISCCP) for the period July 1983 through June 1991. A relationship to El Niño is described below.

12 YEARS: THE INTERNATIONAL SATELLITE CLOUD CLIMATOLOGY PROJECT (ISCCP) AND ITS REGIONAL PROJECTS REPORTED

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A special one-day symposium was held during the recent International Union of Geodesy and Geophysics (IUGG) XXI General Assembly in Boulder, Colorado. This special symposium was to mark the completion of a consistent global ISCCP data set, which covers the period from June 1983 to June 1994, and to summarize the results of the large number of ISCCP Regional Projects and of the various individual research initiatives. Results from regional projects using ISCCP data sets included the First ISCCP Regional Experiment (FIRE), International Cirrus Experiment (ICE), European Cirrus Regional Experiment (EUCREX), and Western Pacific Experiment (WENPEX). There were 29 papers and 9 posters presented at this well attended occasion. Conveners were Ehrhard Raschke, Stephen Cox, and William Rossow. Many more related papers and posters were presented during other sessions of the IUGG.

William Rossow and Qingyuan Han introduced their large data sets, which are now available for everybody, and demonstrated their value for global studies of cloud and related radiation fields and for estimates of particle sizes in upper cloud layers. Results using these data were presented at the special 1-day symposium.

Some investigators reported on using the ISCCP data in combination with other data, for example with microwave data to estimate cloud particle size, radiation data to estimate the absorption of solar radiation in the atmosphere, and on the surface radiation budget. Other oral and poster presentations using these data included arctic radiation climatology studies, rainfall over oceans, convective clouds and land cover, tropospheric wind estimates, sensitivity of budget simulations to mixed phase clouds, and introducing new cloud parameterization in general circulation models.

The figure above is an example of the results presented and shows the summary of the interannual variation—or anomaly—of the global cloud cover from 1983 to 1991 from ISCCP. This period begins just after a major El Niño (warm phase) event in 1982–83 and ends just before an El Niño event in 1991–92; there is also an El Niño in 1986–87 and the only La Niña (cold phase), 1987–88, to occur in the past decade. The long, slow variation of global cloud cover may be associated with these events and indicates the ability of the ISCCP analysis to detect such interannual variations. Whether or not this variation is actually periodic, the fact that a significant variation exists with a time scale of almost a decade shows the need for very long data records (several decades at least) to describe natural climate variations.

COMPARISONS OF RADIOSONDE OBSERVATIONS AND ETA MODEL ANALYSES DURING THE GCIP INTEGRATED SYSTEMS TEST (GIST)

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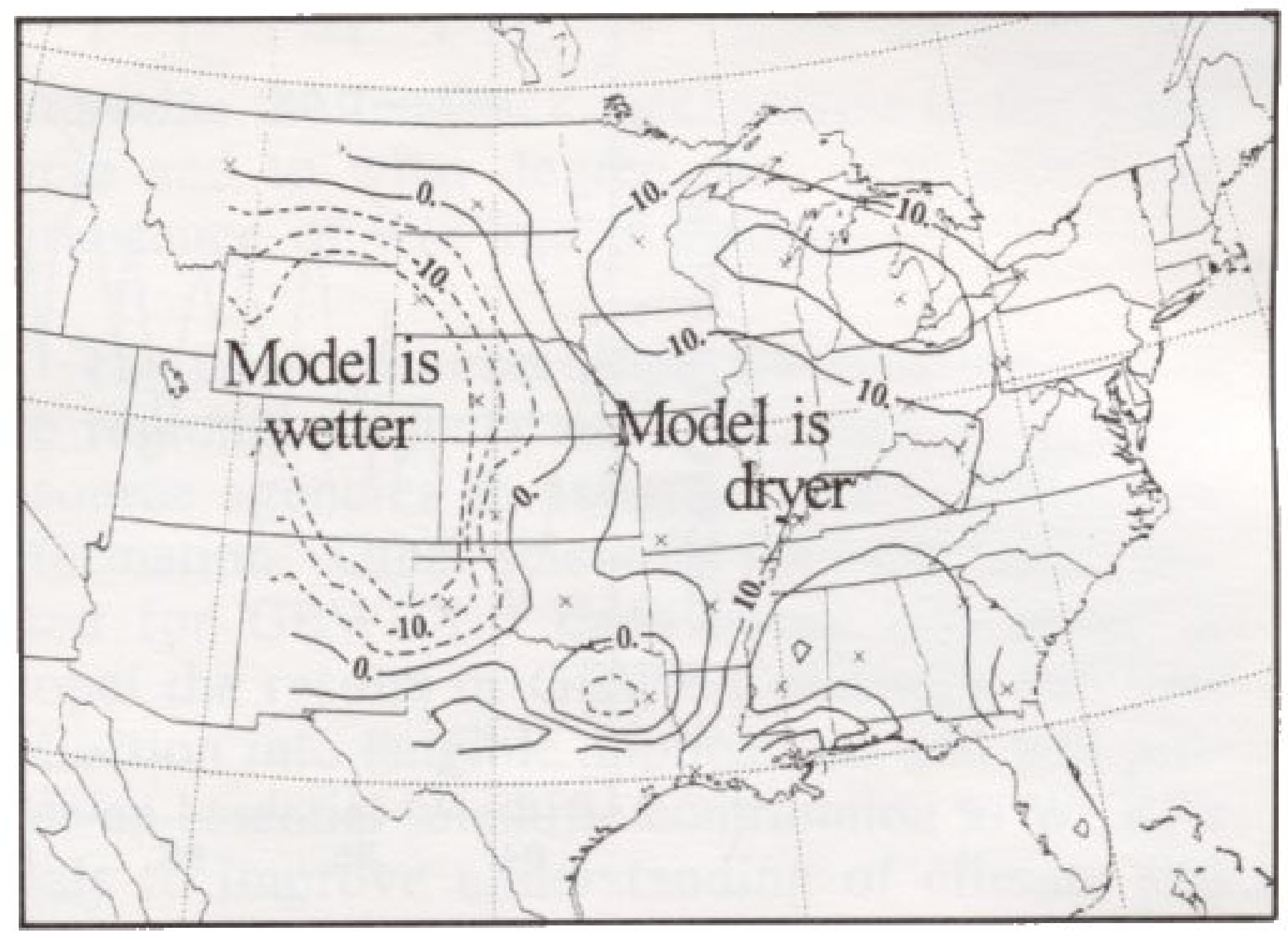
The Global Energy and Water Cycle Experiment's (GEWEX) Continental-Scale International Project (GCIP) will be characterized by a special observational effort over the Mississippi River Basin to better understand the water balance over that domain for the 5 "water years," October through September 1995–2000. In preparation for the full experiment, the GCIP Integrated Systems Test (GIST) took place during July–August 1994, over a year prior to the start of the first GCIP Enhanced Observing Period (EOP). Part of National Meteorological Center's (NMC) participation in GIST was in the production of the MOdel Location Time Series (MOLTS). [On 1 October 1995, NMC was renamed the National Centers for Environmental Prediction.] A subset of MOLTS is composed of vertical profiles of winds, temperature, and humidity, here called "synthetic soundings," generated by the mesoscale Eta model (Black, 1994). During GIST several of these synthetic soundings were co-located with operational radiosonde stations, providing an opportunity to directly compare observations and Eta model analyses and forecasts for these co-located sites. Several GCIP studies will rely on the output from atmospheric water balance (WCRP, 1992). However, there has been little published documentation of the performance of mesoscale models, including the NMC Eta model, with respect to their ability to replicate the atmospheric water budget. A recent study (Yarosh et al., 1995), provides preliminary comparisons of Eta-model-based analyses of humidity, humidity transports, area averaged water content and vertically integrated moisture flux divergence in comparison to estimates of the same quantities from radiosondes during GIST.

An examination of the relative bias in the 850 hPa Eta model analyzed humidity in the figure above shows that the model analysis tends to be dryer than radiosonde observations over most of the GCIP domain with the exception of the mountainous areas in the western reaches (Yarosh et al., 1995). The typical bias values at 850 hPa during GIST were in the order of 10% of the radiosonde daily standard deviations and, generally, are no more than 20%. The absolute humidity bias at 850 hPa was in the order of 0.4 g/kg. Similar patterns in the bias field were typical for all forecast times (3-hr, 12-hr, 24-hr, and 36-hr) and all levels to 300 hPa. The GIST intercomparisons also show good agreement between Eta-model-analyzed and radiosonde-observed zonal transport and meridional humidity transports.



Observed bias between radiosonde observations and Eta-model analysis of specific humidity at 850 hPa during the GCIP Integrated System Test (GIST). The bias is expressed as a percent of the observed daily specific humidity standard deviation.

On a sounding-to-sounding comparison typical root mean square (RMS) errors relative to observed humidity standard deviations were in the order of 0.4–0.5 at all levels between the surface and 300 hPa. The relative RMS humidity errors associated with the forecasts ranged between 0.9 to 1.4 in the lowest 300 hPa for all forecast times examined. The RMS humidity transport errors for the forecasts tend to be somewhat less. Eta model performance for water balance studies appears to be strongly dependent on geographical location—usually the model performance is poorer in regions of changing topography. The Eta-model-derived vertically integrated moisture flux divergence compares favorably with similar estimates based on radiosonde observations alone. In these comparisons, the Eta model estimates of evaporation minus precipitation (E-P) agree with the radiosonde estimates to less than 10% of the mean precipitation over the Mississippi River Basin. The analysis suggests that the Eta model forecasts may be useful for diurnal variability studies over the Mississippi basin. Further, the intercomparison studies suggest that the Eta model analyses will be useful to extend classic radiosonde based analyses, e.g., Rasmusson (1967, 1968), or coarser grid model analysis, e.g., Roads et al., 1994. Details and similar comparisons for the smaller domain of the Red-Arkansas basin can also be found in Yarosh et al., 1995.

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See back page for Conference information.

ANOMALOUS SHORTWAVE ABSORPTION IN CLOUDS

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The seventh session of the WCRP/GEWEX Working Group on Radiative Fluxes (WGRF) was held in Fort Collins, Colorado, from 9–12 July 1995. The WGRF in its role as the GEWEX Radiation Science Panel (GRP), reviewed the issue of anomalous shortwave absorption in clouds as raised in three recent papers published in Science (Cess et al., 1995; Pilewskie and Valero, 1995; and Ramanathan et. al., 1995). **These papers propose absorption values deduced from surface and top of atmosphere (TOA) measurements, which are at variance with results from experiments such as the First International Satellite Cloud Climatology Project (ISCCP) Regional Experiment (FIRE) I and II, and in analyses of related global data sets, such as produced by the ISCCP and Surface-Radiation Budget (SRB) project.**

The following are examples of the issues that the GRP believe were overlooked by the authors:

(1) A wide range of works (e.g., Stephens and Platt, 1987; Nakajima et al., 1990; Twomey and Cocks, 1982; and others) relating to spectral measurements of albedos and reflectances and the general agreement between theory and measurements of particle size, both remotely sensed and confirmed with *in situ* sampling, do not agree with the newly reported results. In addition, slope analyses introduced in the new results imply enhanced absorption can be demonstrated to produce a range of answers depending on the correlation technique applied between surface and TOA data.

(2) Works by Whitlock et al. (1990); Rossow and Lacis (1990); Li et al. (1993); Nemesure et al., (1994), and others relating to analyses of other data sets (SRB, ISCCP, etc.) do not support the newly reported ratio of shortwave forcing in great excess of unity (approximately 1.5) attributable to anomalous absorption.

(3) Works by Ackerman and Cox (1981); King et al. (1990); and others relating to

observational studies show that cloud heterogeneity creates spuriously large absorption when analyzed in the manner presented by the authors of the new reports. Thus, the use of direct aircraft measurements in the new findings to support the conclusions, may not be valid.

The GRP concluded that the fundamental technical problem with the newly published results (Cess et al., 1995; Pilewskie and Valero, 1995; and Ramanathan et al., 1995) is the neglect of the horizontal flux of radiation within clouds and between cloud and clear regions. The results emphasize the two-fold importance of cloud heterogeneity both to interpretation and analyses of data and to the understanding of radiative transfer in clouds and parameterization of this transfer in models. **The consensus was that the results provided no new insight into the issue of anomalous cloud absorption and exposed no unknown problems with the understanding of cloud/radiation interactions.** However, the panel recognized the importance of research on this topic and has asked for a plan outlining an appropriate approach for continued study and oversight by the GRP of progress in this field.

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Comparisons of Evaporation for the Red-Arkansas Basin

(Continued from page 1)

these models is comparisons with water budget estimates derived from atmospheric budget analyses. Some of these comparisons are reported upon here.

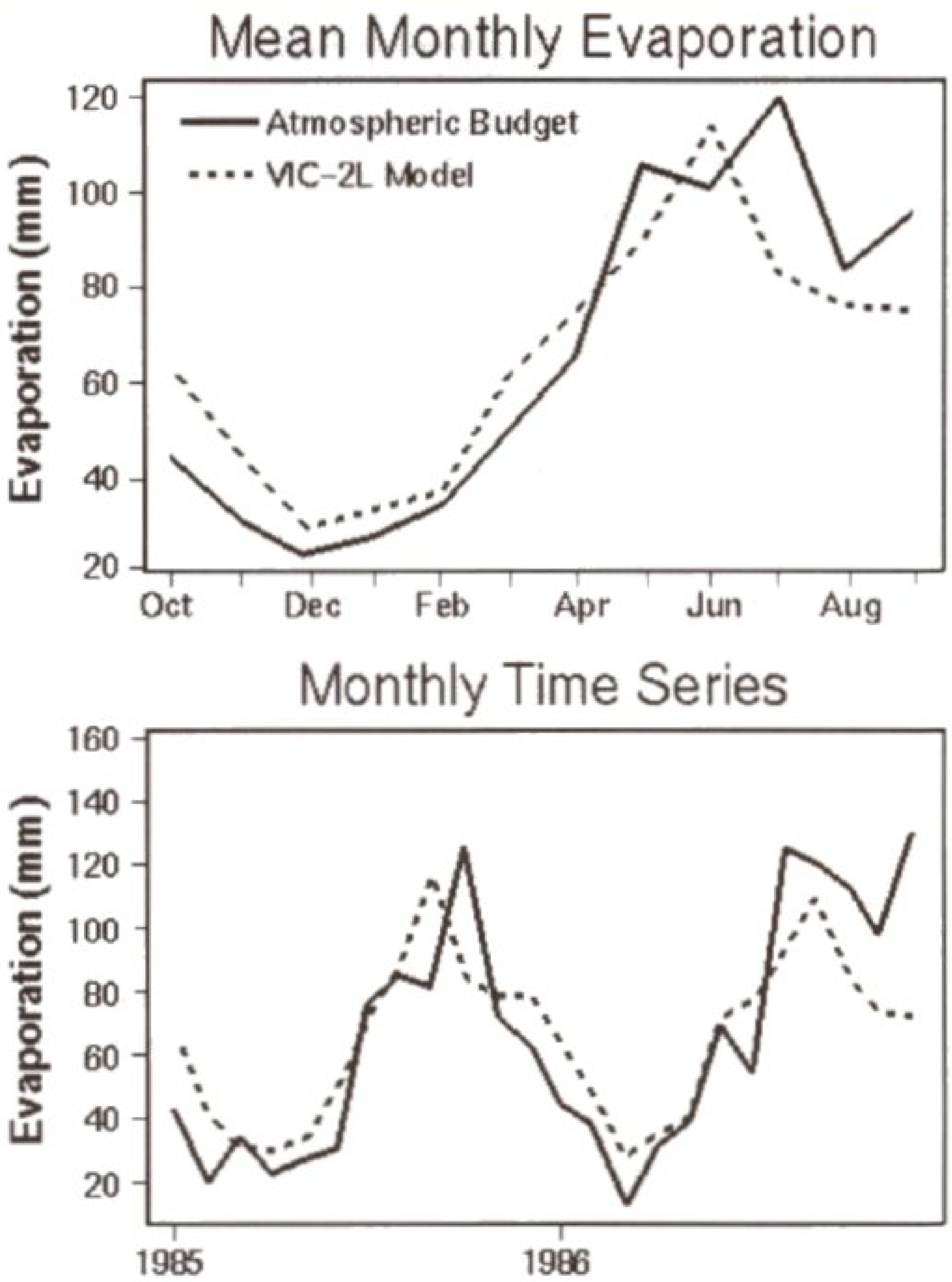
The macroscale hydrological model is based on the two-layer Variable Infiltration Capacity (VIC-2L) model described in Liang et al. (1994). The model is a land surface, water, and energy balance model that is driven by precipitation and incoming solar and down dwelling longwave radiation. Surface meteorological data were obtained from National Climate Data Center cooperative stations. Because of the unavailability of radiation data at the required temporal resolution of 3 hours (the model time step), these inputs were estimated using a clear-sky solar radiation estimate adjusted for cloud cover and a longwave estimate based on the algorithm described in TVA (1972).

Vegetation classes were based on Olson et al. (1983), seasonal Leaf Area Index (LAI) estimated from satellite AVHRR-based monthly 10 minute Normalized Difference Vegetation Index (NDVI) data and vegetation phenology estimated from a variety of sources for the different vegetation classes. Soil data were extracted from the U.S. Department of Agriculture Soil Conservation Service State Soil Geographic database. The model was calibrated on 44 small catchments distributed throughout the Red-Arkansas Basin and is fully described in Abdulla et al. (1995) .

For application of the VIC-2L model at the Red-Arkansas LSA scale, the Red and Arkansas basins were subdivided into 61 1° x 1° grid cells, 16 of which lie in the Red River basin; 45 are cells in the Arkansas River basin. For the results presented here, the model was run at a 3-hourly time step for 2 years. The 3-hourly estimates of the surface water and energy budget terms are then aggregated to monthly (or seasonal) values for further analysis and ease of presentation. The color panels on the back page illustrate the variability in evaporation and runoff across the Red-Arkansas LSA during two seasons (winter and summer).

The hydrological model-generated evaporation for the entire Red-Arkansas basin was compared to evaporation derived from an atmospheric budget for the basin. The moisture storage changes and the water vapor convergence terms for the atmospheric budget were estimated using daily operational radiosonde data that had been interpolated onto a 1° grid within the LSA domain. The moisture storage changes and the water vapor convergence terms were then aggregated to a monthly total for the monthly water budget computation. Monthly precipitation used in the atmospheric budget model was the aggregated daily data used in the hydrological model simulations. Monthly evaporation was then computed as a residual of the atmospheric water budget. The figure panels (above right) show a comparison between the estimated evaporation from the land surface hydrological model and the atmospheric budget model.

Results show that estimates from the VIC-2L land surface hydrological model compare very well with estimates from an atmospheric budget analysis. These results suggest that model-based estimates of evaporation may provide good estimates of the space-time variability of water and energy budget terms at continental scales, thus fulfilling an important GEWEX Continental-Scale International Project (GCIP) objective. Additional comparisons must be made,



Comparison of VIC-2L evaporation with atmospheric budget analysis for Red-Arkansas basin.

both for the Red-Arkansas LSA for longer time periods and for other GCIP-LSAs, to confirm the results presented here.

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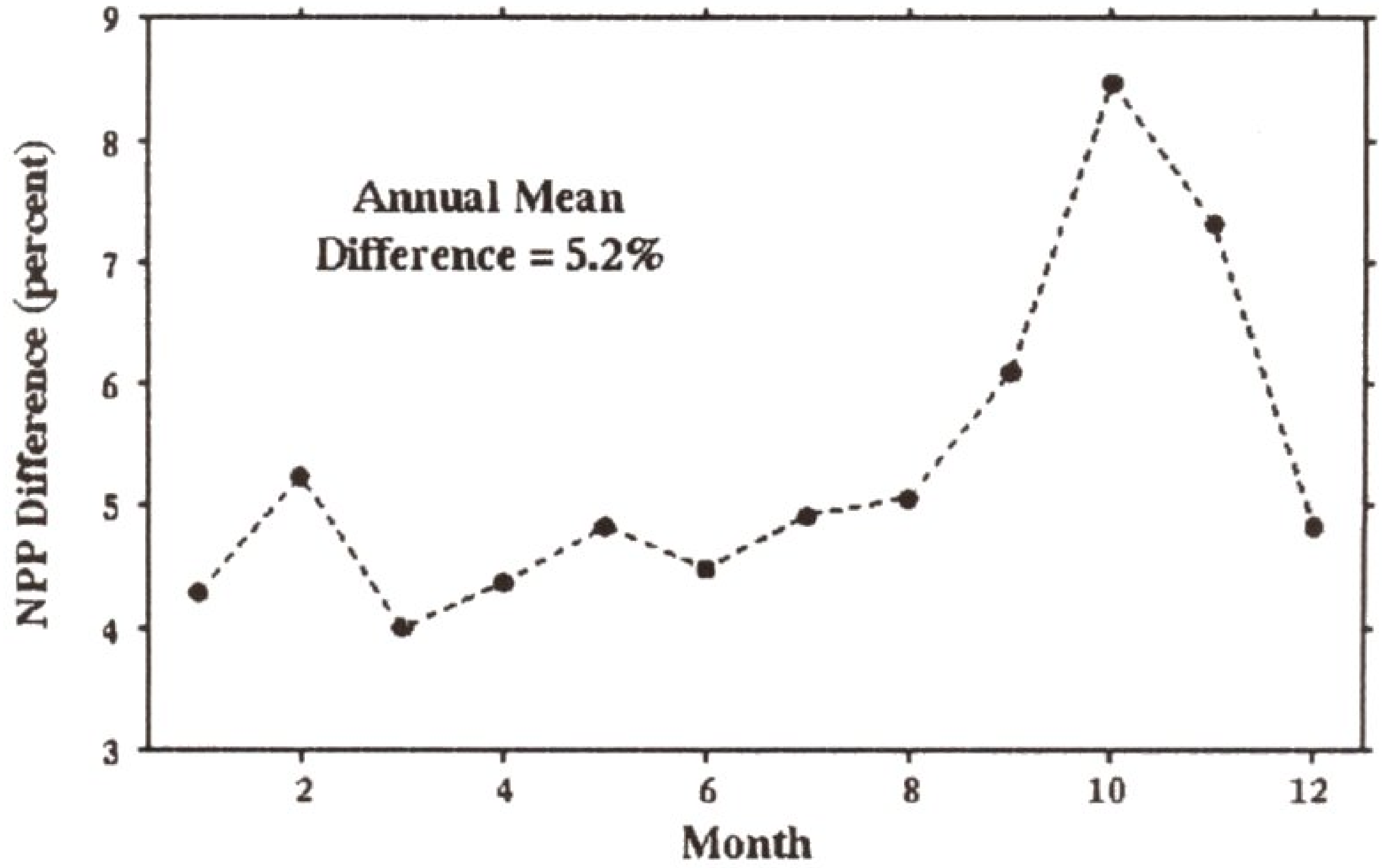

Difference in simulated global monthly net primary production (NPP) between diurnal and nondiurnal precipitation runs of a simple biosphere model as described in the text below.

CHANGES IN SIMULATED NET PRIMARY PRODUCTION IN RESPONSE TO PRECIPITATION DIURNAL CYCLE

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Simulations of both land surface water balance (Sato and Nishimura, 1995) and annual terrestrial net primary production (NPP) (Hubert et al., 1995) have recently been shown to be sensitive to decreases in temporal resolution from daily to monthly means in precipitation data used to force the models. The strong diurnal cycles of biological activity and atmospheric forcings are coupled to one another, suggesting that diurnal variations may also have an impact on annual NPP.

A recently updated version of the Simple Biosphere Model (SiB2; Sellers et al., 1996) was used to evaluate the effect of the diurnal cycle of precipitation on simulated NPP. The monthly mean diurnal cycle of precipitation simulated by a general circulation model (Randall, et al., 1991) was used to interpolate daily observed precipitation data to hourly values, and the model was integrated for 1 year using both the diurnally varying precipitation (DP) and non-diurnally varying precipitation (NDP) forcing data.

The simulated global annual NPP was more than 5% less in the NDP case (48.3 Gt Cyr^{-1}), relative to the DP experiment (50.9 Gt Cyr^{-1}), with the greatest differences occurring in the Northern Hemisphere fall and winter (see figure above). Over most regions, the NDP results show less annual NPP relative to the DP run, with the largest differences in the tropics, suggesting that tropical NPP is most sensitive to the diurnal cycle of precipitation.

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GEWEX DATA SETS FOR ASSESSING THE BUDGET FOR THE ABSORPTION OF SOLAR ENERGY BY THE ATMOSPHERE

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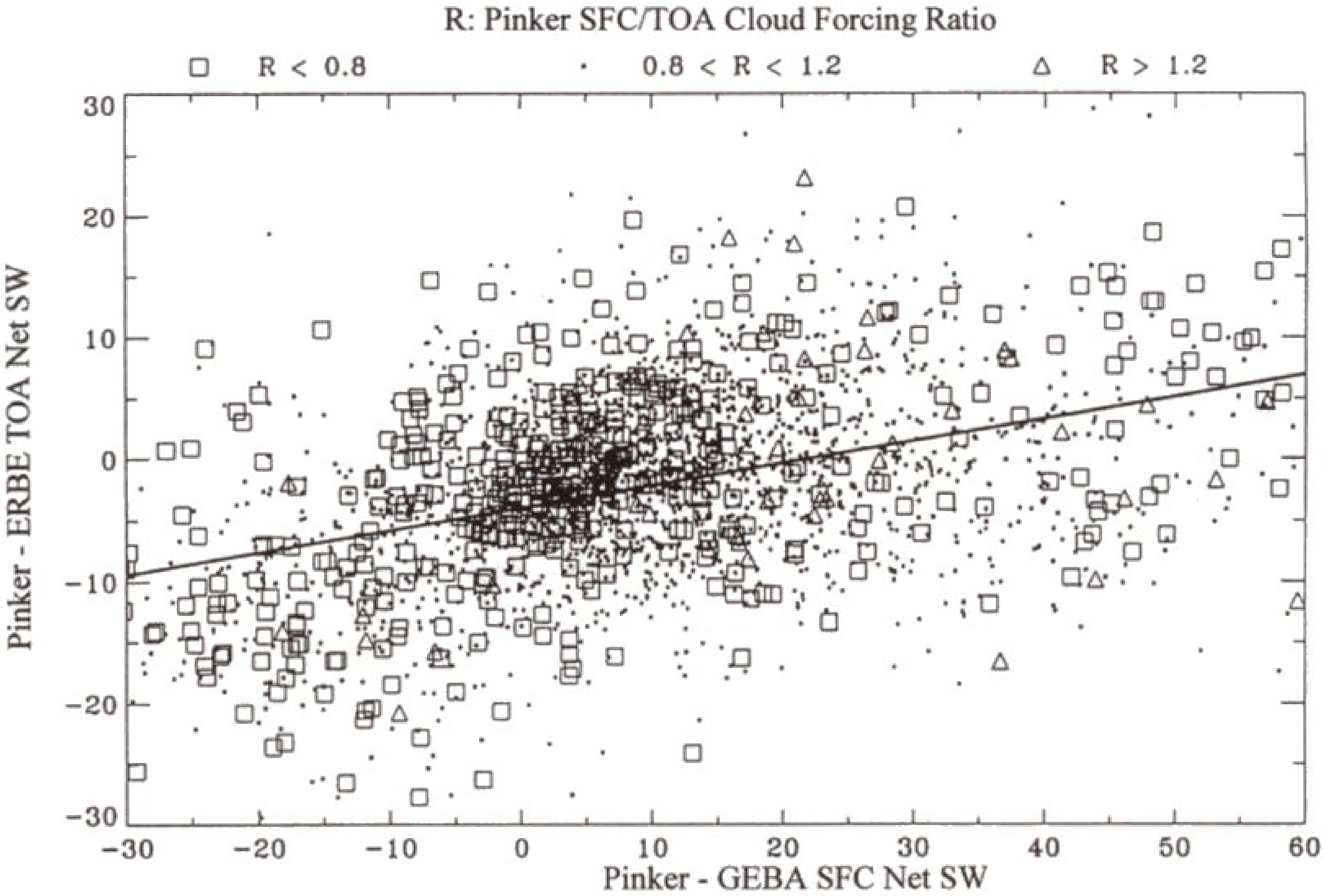
Recent papers by Cess et al. (1995), Ramanathan et al. (1995), and Pilewskie and Valero (1995) have addressed the partitioning of the absorption of shortwave (SW) solar radiation between the surface and atmosphere and the impact of clouds. Cess et al. (1995) maintain that clouds enhance the absorption of SW radiation in the atmosphere by over 25 W/m^2 for the global, annual (24-hour, day and night) average. This cloud absorption suggests an enormous error in our present energy budget for the atmosphere and in radiative transfer theory. At the Oklahoma Cloud and Radiation Testbed (CART) site in October 1995, the Atmospheric Radiation Measurement (ARM) Enhanced SW Experiment (ARESE) (Stokes and Schwartz, 1994) will take extensive measurements and attempt to test the enhanced absorption hypothesis.

Here, we note two GEWEX data sets, the global SW archive of the Surface Radiation Budget (SRB) Project (Whitlock et al., 1995) and the more local Clouds and Earth's Radiant Energy System CERES/ARM/ GEWEX Experiment (CAGEX) at the ARM/CART site, which can be used independently to analyze aspects of the SW budget of the atmosphere. An analysis of 4 years of SRB Project data indicates that the atmospheric absorption inferred from low order radiative transfer theory is indeed too small, but the full-sky (the natural combination of cloudy and clear skies, sometimes called total-sky or all-sky) bias is roughly one half the bias ascribed to clouds by Cess et al. (1995). The magnitude of the bias in atmospheric absorption is approximately the same as the error in surface insolation reported earlier for the SRB Project. Our preliminary analysis of the limited April 1994 CAGEX data set is consistent with the results of the global SRB Project and also indicates that (1) the bias in atmospheric absorption has a strong clear-sky component and (2) the cloud forcing of atmospheric absorption is much weaker than indicated by the above authors.

The SRB Project (Whitlock et al., 1995) uses narrowband operational satellite data from the International Satellite Cloud Climatology Project (ISCCP; Rossow et al., 1991) and the Pinker and Laszlo (1993) algorithm to retrieve the broadband SW fluxes at both the surface and top of the atmosphere (TOA) for the interval 1985–1988, during which the satellite radiometer calibration drift could be well characterized. The SRB Project also uses the Staylor algorithm (Darnell et al., 1992), which produces surface insolation from narrowband ISCCP data and surface albedo from the broadband Earth Radiation Budget Experiment (ERBE) data, as a backup. For some grid boxes, the SRB Project has ground-based measurements of surface insolation from the Global Energy Balance Archive (GEBA) (Ohmura and Gilgen, 1991) as validation. This information from the SRB Project is fully accessible online (http://eosdis.larc.nasa.gov).

We assess the accuracy of the budget for the absorption of SW by the atmosphere by comparing two independent estimates for absorption over a common space and time domain: the SRB Project grid boxes that also have GEBA ground-based measurements. The first estimate for absorption of SW by the atmosphere is obtained from the Pinker and Laszlo (1993) algorithm, which uses operational satellite data. The second estimate for absorption is based more heavily on measurements; absorption is determined as the difference of the net flux at TOA from ERBE (measurement) and the net flux at the surface as the product of the GEBA insolation (measurement) and the Staylor surface albedo (ERBE measurements processed by the Staylor algorithm). The column of values in Table 1 on page 10, compares for SW the TOA net flux, the surface (SFC) net flux, and the atmospheric absorption (the difference of TOA and SFC) for the first and second estimates. At the TOA, the SRB Project result with the Pinker algorithm (244.0 W/m^2) is very close to ERBE finding of (246.3 W/m^2). The SRB Project error is larger in the atmosphere, where the Pinker algorithm infers 11.8 W/m^2 less absorption than the ERBE/GEBA combination. This is a full-sky error and can be expressed as a bias (calculated minus measured) of -11.8 W/m^2.

The scatter plot, above, of the SRB Project bias at TOA (Pinker–ERBE TOA Net SW) versus the bias at the surface indicates that the error is indeed larger at the surface. To compare the SRB



Relation of net shortwave radiation bias (calculated minus measured) at the top of the atmosphere to bias at the surface.

Table 1. Top of atmosphere versus net differences (Pinker, ERBE, GEBA) 1985–1988 data sets excluding snow/ice greater than 10% and mountain sites (the GEBA net inferred using Staylor albedo)

Comparison	Value	
Pinker TOA Net Domain Average:	244.0	Wm^{-1}
ERBE TOA Net Domain Average:	246.3	Wm^{-2}
Pinker SFC Net Domain Average:	165.1	Wm^{-4}
GEBA SFC Net Domain Average (inferred):	155.6	Wm^{-1}
Pinker Atmospheric Absorption:	78.9	Wm^{-1}
ERBE/GEBA Inferred Atmospheric Absorption:	90.7	Wm^{-2}
GEWEX Atmospheric Absorption "Error":	11.8	Wm^{-1}
TOA Difference Std Deviation:	8.4	Wm^{-1}
SFC Difference Std Deviation:	19.6	Wm^{-1}
Mean SFC Albedo:	0.14	

Project results with results noted above, we must note the Cess et al. (1995) cloud forcing ratio R:

R=[(full-sky net SW at surface)-(clear-sky net SW at surface)]/
[(full-sky net SW at TOA)-(clear-sky net SW at TOA)]

=(SW cloud forcing at surface)/
(SW cloud forcing at TOA)

=[(SW cloud forcing at TOA)-(SW cloud forcing in atmos.)]/
(SW cloud forcing at TOA).

Cess et al. (1995), Ramanathan et al. (1995), and Pilewskie and Valero (1995) indicate that R is approximately 1.5, and note that radiative transfer codes produce R values closer to 1.0. As the ERBE (Harrison et al., 1990) global value for SW cloud forcing at TOA is approximately –50 W/m^2, a value of 1.5 for R would imply that the SW cloud forcing at the surface is –75 W/m^2 and that the SW cloud forcing to the atmosphere is +25 W/m^2 (i.e., clouds induce an additional heating of the atmosphere by 25 W/m^2). If the true value for R is 1.5, there would be a significant consequence for a budget analysis like the SRB Project that has an R of approximately 1.0. The bias (calculated-measured) for ONE component of the SW atmospheric budget (the cloud forcing component) would be –25 W/m². In the present analysis, however, we found that the TOTAL bias in the atmospheric budget from the SRB Project is –11.8 W/m² in the ERBE/GEBA domain. The scatter plot also shows no relationship between the R value produced by the Pinker algorithm (note legend for R bins atop the scatter plot) and the bias produced by the Pinker algorithm at the TOA (vertical axis) or surface (horizontal axis). The scatter plot does, however, show a relationship that we anticipate, namely that a bias of excess absorption at the TOA is associated with a bias of excess absorption at the surface.

In sum, the error in atmospheric absorption for the SRB Project appears to be about half the magnitude that would be implied by an R value of 1.5. In the SRB Project, the error in atmospheric absorption is closely approximated by an error of the opposite sign in the surface flux. The magnitude of the bias in atmospheric absorption increases at lower latitudes; –6.9 W/m² poleward of 45 N; –14.7 W/m² between 45 N and 20 N; –18.3 W/m² between 20 N and 20 S; –14.3 W/m² between 20 S and 45 S. In another ERBE-based analysis, Li et al. (1995) report R values quite different from Cess et al. (1995). Li et al. (1995) indicate that R increases at lower latitudes, as does the error in atmospheric absorption in the SRB Project.

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RUNOFF CENTRE INCREASES STAFF

Wolfgang Grabs
Global Runoff Data Center

The Global Runoff and Data Centre (GRDC), at the Federal Institute of Hydrology in Koblenz, Germany, collects and disseminates hydrological data from over 2,500 rivers located in 143 countries. Due to increasing user demands, the GRDC staff level has been increased from two to five full-time employees. The principal tasks of the GRDC staff are:

- Maintain international contacts, policy matters, programme planning and implementation, data acquisition and data product development.
- Scientific data processing, quality control, Geographic Information Systems (GIS) support, statistical analysis of time series.
- Compilation of project databases and use of GIS-based software, response to data requests and data queries from users, generation of data products.
- Administration and development of the Databank Management System, development

of databank tools, update of database, development of programme interfaces.

- Archiving services, public relations, general support.

As a result of resolutions adopted by the Twelfth Congress of the World Meteorological Organization (WMO) in June 1995 and guided by the recommendations of GRDC's International Steering Committee, GRDC has introduced new policy guidelines for the acquisition, dissemination, and costing of data. In addition, the following goals have been identified for GRDC:

- Create a reference time series for global hydrological and climate modelling.
- Establish a data quality group to assist GRDC in developing quality control procedures for hydrological data.
- Conduct studies of streamflow variability in selected rivers.
- Select river stations to monitor the freshwater flux into the world's oceans with the "Runoff Monitor" developed by the GRDC. The Runoff Monitor will use the entire GRDC database for the visual comparative monitoring of station-based observed runoff against selected time series on a regional and global scale.
- Cooperate with identified "Centres of Excellence" in the development of macroscale hydrological models.

PRECIPITATION CLIMATOLOGY PRODUCT FILES AVAILABLE

The Global Precipitation Climatology Centre (GPCC) has created a home page. The URL is:

http://www.wmo.ch/wed/goldis/gpcchome.html

DIFFERENCES OF PRECIPITATION IN THE UNITED STATES AS RELATED TO ENSO EXTREMES

James J. O'Brien and
Matthew C. Sittel
Florida State University

The Center for Ocean-Atmospheric Prediction Studies (COAPS) at Florida State University, has been studying the differences in maximum temperature and precipitation between the extremes of the El Niño Southern Oscillation (ENSO) (i.e., El Niño, warm phase and El Viejo, cold phase) and the neutral phase of the ENSO cycle across the continental United States. The results of this COAPS project complement the GEWEX Continental-Scale International Project (GCIP) efforts to document the time/space variability of the hydrological and energy budgets over the Mississippi River Basin.

The project at COAPS has produced maps illustrating the differences between El Viejo or El Niño years and "neutral" years (Sittel, 1994). The climate data used were from the United States Historical Network (Quinlan et al., 1987) for the period 1948–1987. Each of the 40 years were categorized as either an El Niño, an El Viejo, or neither (a neutral year) based on the Japan Meteorological Agency (JMA) sea surface temperature (SST) data.

The maps illustrate precipitation anomalies that are determined by 3-month running averages of climate data in each of the three ENSO categories for each of the ten 3-month periods in a year. Three criteria were established for the categorization of an ENSO year. First, the 5-month running means of the JMA SST anomalies must be +0.5°C or greater for an El Niño event (–0.5° C or less for an El Viejo event) for at least 6 consecutive months. Second, the first 3 months of the ENSO year must be 3 of the 6 or more months in this "string." Finally, the "string" of 6 or more months must begin before the start of any ENSO year (i.e., before October).

The winter results, illustrated on the first page, show a significant ENSO-related precipitation anomaly; on the other hand, the summer precipitation data show no clear ENSO-related signature. Yet, we know that persistent anomalies do occur during summer, causing either anomalous dry or wet conditions. The 1993 flood of the Missouri/Mississippi Rivers is an example of the consequences of prolonged wet surface during the summer season when local convective storms produce most of the precipitation. Such summer precipitation anomalies are not related to the ENSO cycle but may be triggered by transitions between atmospheric circulation regimes. However, when a dry or wet spell is triggered, the resulting soil wetness (or dryness) and the recycling of rain water within the region is a process that induces considerable persistence of the anomaly. The statistics employed to produce the charts shown are useful for determining the effects at space and time scales of ENSO events and demonstrate the complexity of regional climate variability or shorter time scales.

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CAMEX-2 SUCCESSFUL: PROVIDING GVAP VALIDATION DATA

Robbie Hood

Global Hydrology and Climate Center
NASA Marshall Space Flight Center
Huntsville, Alabama

The National Aeronautics and Space Administration's (NASA) Office of Mission to Planet Earth sponsored the Convection and Moisture Experiment (CAMEX-2), which was successfully carried out 14 August to 3 September 1995 at NASA's Wallops Island Flight Facility located on the Virginia coast. CAMEX-2 combined measurements from satellites and aircraft, radiosonde, and ground-based systems that included microwave, infrared, and lidar instruments provided by Ames Research Center, Marshall Space Flight Center, Goddard Space Flight Center, and the University of Wisconsin.

CAMEX campaigns provided key validation data to support the scientific objectives of the GEWEX Water Vapor Project (GVaP). Examples of CAMEX-2 preliminary results that provide supporting data for GVaP include:

- The first significant Tropical Rainfall Measuring Mission (TRMM) simulation data sets were collected concurrently by TRMM prototype sensors on a single aircraft platform.

- Key information was collected from aircraft radar instruments. These data will be useful in determining the potential to measure the water content in regions of cloud ice from a satellite radar.

- Successful ER-2 missions provided data to investigate water vapor properties on different sides of a frontal system. The aircraft data were collected when radiosonde data were being acquired and a Defense Meteorological Satellite Program platform was overhead providing cloud and sounding data.

- The ground-based Raman lidar data detected rapid bursts of increasing mixing ratio during a dry frontal passage. This unusual phenomenon has been observed only one other time.

- Of particular interest to GVaP scientists was the simultaneous sampling of the water vapor structure performed with aircraft, balloon sounding, and ground-based instrumentation. These data will be significant for studies of upper tropospheric moisture and rawinsonde intercomparisons.

- Also during CAMEX-2, the moisture properties of Tropical Storm Jerry and its remnants were sampled on three different occasions along the Florida and Carolina coastlines.

In summary, CAMEX-2 data will be very useful in GVaP studies now being conducted and those in planning. Publication of a detailed summary of CAMEX-2 results is planned for the next issue of *GEWEX News*.

WCRP/GEWEX MEETINGS CALENDAR

For calendar updates, see the GEWEX Home Page: http://www.cais.com/gewex/gewex.html

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 1985—REGIONAL CONFERENCE ON GLOBAL CHANGE, Sao Paulo, Brazil. For information, contact Ines Iwashita, Instituto de Estudio Avancados, Universidade de Sao Paulo, 05508–900; Tel: (55)–1(11)–818–4442; Fax: (55)–(11)–818–4306; E-mail: iea@cat.cce.usp.br.

6-8 December 1995—GLOBAL PRECIPITATION CLIMATOLOGY PROJECT WORKSHOP ON IDENTIFICATION OF PRECIPITATION RATES, Washington, DC. By invitation only.

11-15 December 1995—GEWEX CLOUD SYSTEM STUDY SCIENCE PANEL, Washington, DC, U.S.A. By invitation only.

11-15 December 1995—AMERICAN GEOPHYSICAL SOCIETY FALL MEETING, San Francisco, California, USA. For information contact AGU, 2000 Florida Avenue, NW. Washington, DC 20009, U.S.A.; Tel: 202–939–3203; Fax: 202–328–0566.

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.

11-16 March 1996—JOINT SCIENTIFIC COMMITTEE FOR THE WCRP, Toulouse, France. By invitation only.

15-19 April 1996—INTERNATIONAL WORKSHOP ON RESEARCH USES OF ISCCP DATA SETS, NASA Goddard Institute for Space Studies, New York, NY, U.S.A. For details contact Dr. William B. Rossow, Goddard Institute for Space Studies, 2880 Broadway, New York, NY 10025; Tel: 212–678–5567; Fax: 212–678–5552; E-mail: clwr@nasagiss. giss.nasa.gov.

6-10 May 1996—EUROPEAN GEOPHYSICAL SOCIETY XXI GENERAL ASSEMBLY, The Hague, The Netherlands. For information contact EGS Office, Postfach 49, Max-Planck-Str. 1, 37189 Katlenburg-Lindau, Germany; Tel: 49–5556–1440; Fax: 49–5556–4709; E-mail: egs@linaxi. dnet.gwdg.de.

15-17 May 1996—INTERNATIONAL WORKSHOP ON MACROSCALE HYDROLOGICAL MODELING, Nanjing, China. One page abstracts due before 30 September 1995. For further information contact Prof. Jold, Water Resources Development and Utilization Laboratory, Hohai University, Nanjing, China; Tel: 86 25 330 4195 (after voice in Chinese dial 0544); Fax: 88 25 33 15375.

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, Wallingsford, Oxfordshire, OX10 8BB, U.K.; Tel: 44-1491-838800; Fax: 44-1491-832256.

17-21 June 1996—SECOND INTERNATIONAL SCIENTIFIC CONFERENCE ON THE GLOBAL ENERGY AND WATER CYCLE, U.S. National Academy of Sciences, Washington, DC. For additional information contact IGPO, 409 Third St. SW, Suite 203, Washington, DC 20024, 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, UMIST, 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.

22-27 September 1996—THIRD USA/CIS JOINT CONFERENCE ON ENVIRONMENTAL HYDROLOGY AND HYDROGEOLOGY, Taahkent, Uzbekistan. For details contact Third USA/CIS Conference, 3416 University Avenue SE, MN 55414–3328 U.S.A.; Tel: 1–612–379–1030; Fax: 1–612–379–0169; E-mail: ALHydro@asl.com.

GEWEX REPORTS AND DOCUMENTS

(Available from IGPO)

REPORT ON INTERNATIONAL GEWEX WORKSHOP ON COLD-SEASON/REGION HYDROMETEOROLOGY, 22–26 May 1995, Banff, Alberta, Canada, IGPO Publication Series No. 15 (in press).

PROCEEDINGS OF THE SECOND INTERNATIONAL STUDY CONFERENCE ON GEWEX IN ASIA AND GAME, 6–10 March 1995, Pattaya, Thailand.

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 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 Series No. 10.

IMPLEMENTATION PLAN FOR GEWEX CONTINENTAL-SCALE PROJECT (GCIP), VOLUME III: Strategic Plan for Data Management. March 1994, IGPO 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.

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 (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.

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GEWEX CONTINENTAL-SCALE INTERNATIONAL PROJECT (GCIP). REPORT OF THE FIRST GCIP PLANNING WORKSHOP, RESTON, VIRGINIA, U.S.A., 8-10 October 1990. April 1991. IGPO Publication Series No.1.

SCIENTIFIC PLAN FOR THE GLOBAL ENERGY AND WATER CYCLE EXPERIMENT—WCRP-30, August 1990. (WMO TD-No. 376).

NOTICE OF CHANGE

The National Space Development Agency of Japan (NASDA) GEWEX Science Project Office has a new telephone number and e-mail address.

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Published by the International GEWEX Project Office (IGPO), Dr. Paul D. Try, Director
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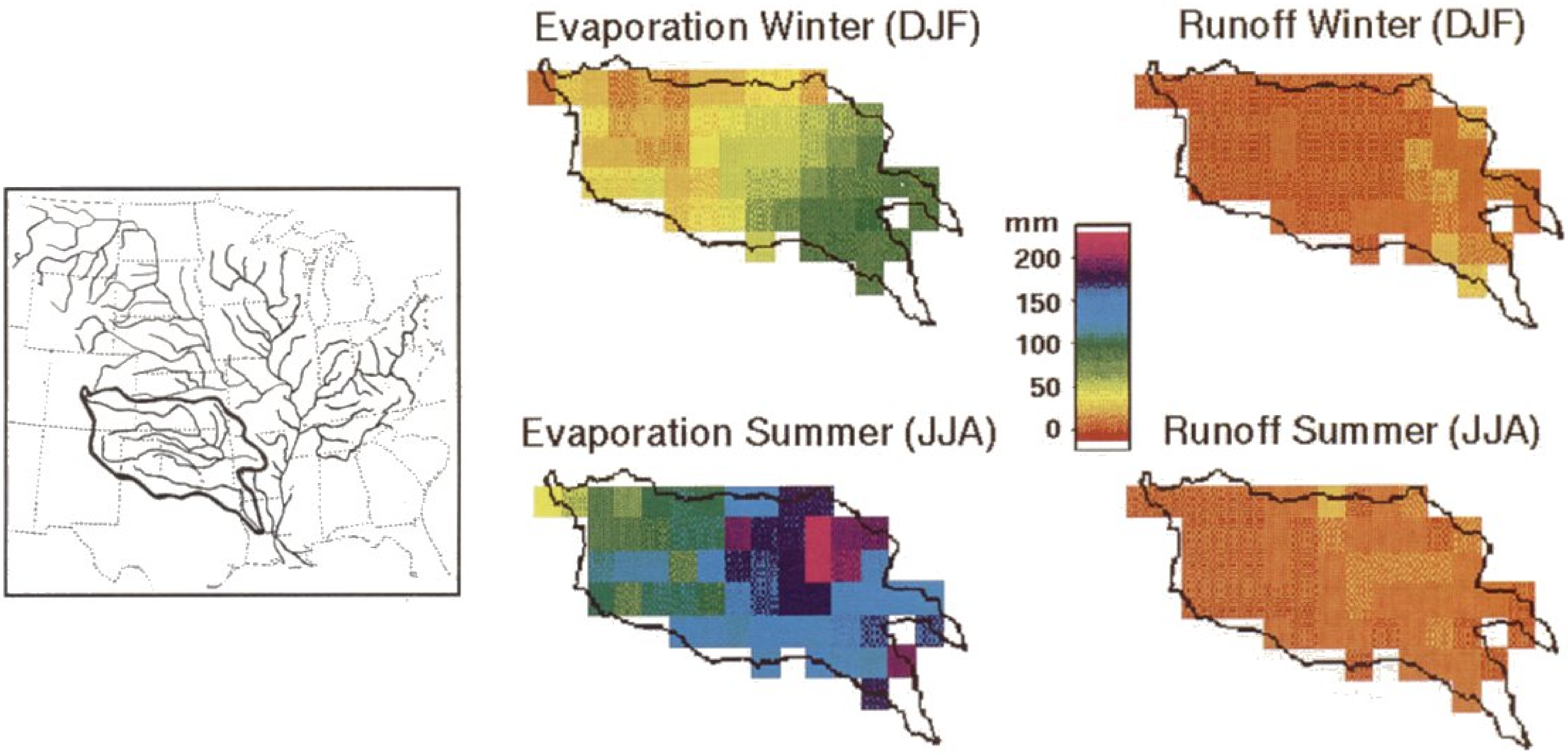

Figure to article beginning on page 1. On the left the Red-Arkansas basin is outlined for reference to the entire Mississippi River Basin. The four color panels on the right illustrate the variability of the mean seasonal evaporation and runoff.

NOTICE

Plan to participate in the Second International Scientific Conference on the Global Energy and Water Cycle, 17–21 June 1996, Washington, DC.

Abstracts	15 November 1995
Early Registration	1 March 1996

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