GEWEX WCRP
World Climate Research Programme
(A Programme of WMO, ICSU and IOC)

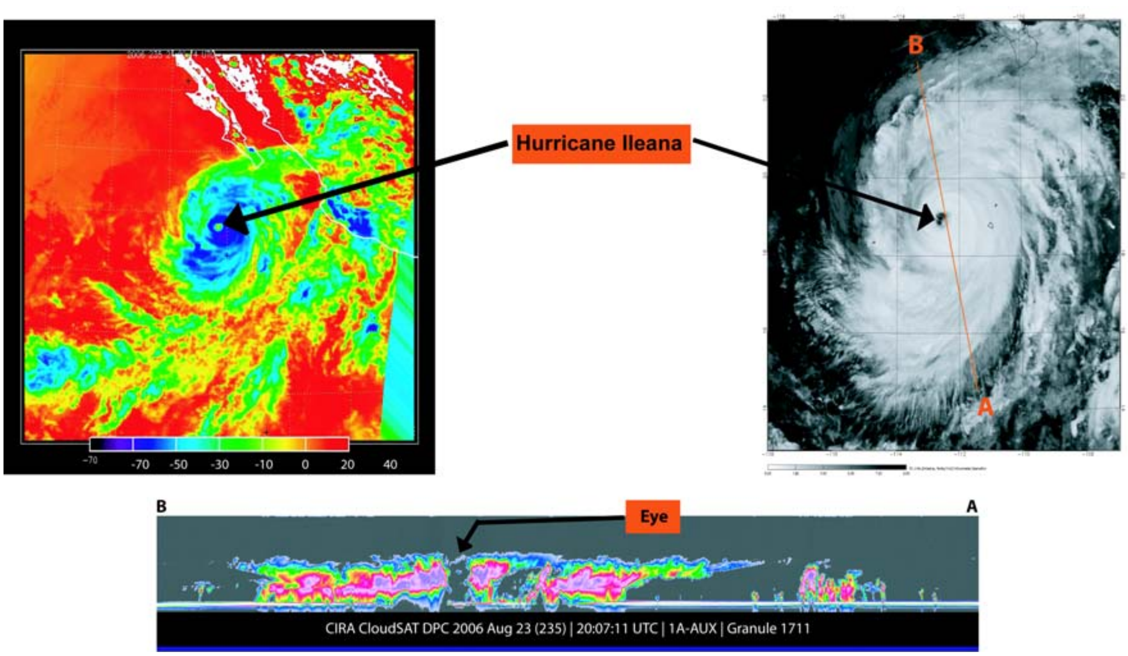
NEWS

Vol. 16, No. 4 | Global Energy and Water Cycle Experiment | November 2006

115 SCIENTISTS MEET TO FINALIZE GEWEX ROADMAP AND COORDINATE RESEARCH AT THE FIRST PAN-GEWEX MEETING

Participants at the First Pan-GEWEX Meeting held in Frascati, Italy, 9–13 October 2006. See articles on pages 8 and 10.

GEWEX STUDIES TO BENEFIT FROM CLOUDSAT AND CALIPSO DATA



CloudSat and CALIPSO data are providing the first view of the full vertical structure of clouds and aerosols over the globe. The CloudSat radar overpass of Hurricane Ileana on 23 August 2006 (bottom panel) is also shown. The bright band at the bottom of the CloudSat image is the ground return. Where this return disappears, the rainfall is so intense (exceeding 10 mm/hr) that the radar is unable to penetrate to the ground. See article by D. Winker et al. on page 4.

Newsletter Contents

COMMENTARY

REVIEWING PAST YEAR HIGHLIGHTS AND POTENTIAL CHALLENGES FOR GEWEX IN 2007

Soroosh Sorooshian, Chairman
GEWEX Scientific Steering Group (SSG)

It has been a very interesting and busy year from not only the perspective of GEWEX, but also the perspectives of the World Climate Research Programme (WCRP) and climate change research, in general. Dr. Ann Henderson-Sellers, who became the director of WCRP in January 2006, has been very busy addressing a number of urgent issues facing WCRP. I am sure some of you have heard about the anticipated diminishing resources to WCRP, which for most part supports the travel expenses of participants to all of WCRP project SSGs and working group meetings. Some of you may have been interviewed by the consulting group retained by WCRP to learn and provide input on how WCRP can overcome its financial challenges and, more importantly, ensure its efforts on behalf of climate research are appreciated and viewed relevant by the international community.

This has prompted a discussion about the future strategy of WCRP in terms of a balance between its scientific impact, relevance, visibility and its stance within a number of other international programs. In this context, a number of cross-cutting issues (i.e., anthropogenic climate change, extreme events, sea-level rise, monsoons, aerosols, seasonal and decadal predictions), have become central to the current discussions within WCRP and will be the main focus of discussions and consideration by the Joint Scientific Committee (of WCRP) in its upcoming meeting in Zanzibar, Tanzania in March 2007. This discussion will certainly lead to such questions as to the future role and relevance of WCRP's four main core projects: GEWEX; Climate Variability and Predictability (CLIVAR); Climate and Crosphere (CliC); and Stratospheric Processes and their Role in Climate (SPARC).

GEWEX held its first week-long Pan-GEWEX meeting involving over 100 members of GEWEX panels and working groups, including the Coordinated Enhanced Observing Period (CEOP), in Frascati, Italy in October 2006 (see article on page 8). The primary objective was to ensure closer contact and communication between our panels in order to further develop and refine GEWEX's Phase II research Roadmap (see article on page 10). While it is a living document and will periodically be updated, it is available on the GEWEX website and I encourage you to review it.

Another important step being taken by GEWEX is the merger of activities of the GEWEX Hydrometeorology Panel (GHP) with CEOP under one umbrella. We hope that the outcome will result in reducing redundant activities and achieve a more effective research strategy in support of GEWEX's overall objectives. This proposal will be presented for approval at the January 2007 GEWEX SSG-19 meeting in Hawaii. Needless to say that any major change (whether in GEWEX or WCRP) will have its critics as well as supporters. As long as we follow a logical and transparent process leading to the eventual decision and there is no push for a "top down" change, I am optimistic that it will yield positive outcomes towards achieving our Phase II goals by the end of our sunset date of 2012.

Finally, a few words about public perceptions about climate change. The general population, internationally speaking, seems to be showing more interest in the potential consequences of climate change in recent months, thanks to more press coverage by the media. The recent documentary movie, *An Inconvenient Truth*, about the Earth's climate crisis featuring former U.S. Vice-President Al Gore, is also helping to bring more awareness to this issue, especially in the United States.

Then, one wonders why WCRP which is the flagship organizing body for international RESEARCH on climate finds itself in a declining financial situation from its main co-sponsoring organizations such as the World Meteorological Organization (WMO), the International Council for Science (ICSU), and the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational Scientific and Cultural Organization (UNESCO). In seeking the symptoms, answer(s) and remedies, it is important to constantly remember and remind people of the significance of the letter "R" in WCRP's acronym. Joining the bandwagon of addressing "trendy" objectives, which are likely to be short-lived, should not influence us to change course in ways that our main mission which is **CLIMATE RESEARCH**, is compromised.

NEW GEWEX SCIENTIFIC STEERING GROUP (SSG) MEMBERS

GEWEX welcomes the following new members to the GEWEX SSG. Their terms begin 1 January 2007. We wish to thank Drs. Maria A. F. Silva Dias, Yann Kerr, and Zurab Kopaliani, whose terms end 31 December 2006, for their contributions to the SSG.

DR. LAURA BERTOLANI

Researcher, Epson Meteo Centre, Research and Development Division, Milan, Italy.

Areas of interest: Atmospheric modelling; verification of numerical weather prediction model forecasts, especially precipitation; and Asian monsoon climate at high altitudes over the Himalayas and the Tibetan Plateau.

PROF. AMADOU GAYE

Associate Professor, Laboratory for Atmospheric and Ocean Physics, University Cheikh Anta Diop, Dakar, Senegal.

Areas of interest: Atmospheric sciences; West African monsoon processes.

DR. JAN POLCHER

Laboratoire de Météorologie Dynamique du Centre National de la Recherche Scientifique, Paris, France.

Areas of interest: Land-surface modelling and the land-surface/atmosphere interactions. Dr. Polcher served as Chair of the GEWEX Modelling and Prediction Panel for the past 4 years.

NEW GMPP AND GCSS CHAIRS

Dr. Christian Jakob, Research Scientist at the Bureau of Meteorology Research Centre, Melbourne, Australia, is Chair of the GEWEX Modelling and Prediction Panel (GMPP). He served as Chair of the GEWEX Cloud System Study (GCSS) for the past 2 years. Dr. A. Pier Siebesma, Meteorological Institute, De Bilt, the Netherlands, now chairs GCSS.

GEWEX CONTACT FOR MONSOONS

Dr. Jun Matsumoto will be representing GEWEX interests in the planning and coordination of monsoon related activities. This includes developing joint GEWEX/CLIVAR programs to address monsoon related issues of mutual interest. Dr. Matsumoto is a member of the GEWEX SSG and chair of the new GEWEX project, the Monsoon Asian Hydro-Atmospheric Science Research and prediction Initiative (MAHASRI). He is also co-chair of the Coordinated Enhanced Observing Period Inter-Monsoon Model Study.

GAME FOUNDER RECEIVES JAPAN SOCIETY OF HYDROLOGY AWARD

Prof. Tetsuzo Yasunari, Program Director, Hydrospheric Atmospheric Research Center, Nagoya University, received the International Award from the Japan Society of Hydrology and Water Resources in August 2006 for his significant contributions to understanding the water and energy cycle processes related to water resources and disasters over the Asian monsoon region, and for his efforts in promoting the development of related modelling studies through the activities of the GEWEX Asian Monsoon Experiment (GAME). Results from GAME, which ended in 2005, have been compiled into 38 project reports, 267 research papers published in international peer-reviewed scientific journals, and nearly 20 data CD-ROMs.

CLOUDSAT AND CALIPSO HERALD IN A NEW ERA OF REMOTE SENSING

Dave Winker[1], Charles Trepte[1], Deborah Vane[2], and Graeme Stephens[3]

[1]NASA/Langley Research Center, [2]Jet Propulsion Laboratory, [3]Colorado State University

Both CloudSat and the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) satellites were launched on 28 April 2006, and are now orbiting the Earth in formation as a part of the "A-Train," a five-member constellation of international satellites in closely matched orbits whose combined data will provide information for improved weather and climate prediction.

CloudSat is flying the first space-borne millimeter wavelength radar, which provides unique views of clouds and precipitation. CALIPSO carries an innovative lidar system as its primary payload, providing complimentary views of thinner clouds (i.e., cirrus) and also the surrounding aerosols. Combined with CloudSat data, CALIPSO provides the first full view of the vertical structure of clouds and aerosols over the globe. Complementing the lidar are the Imaging Infrared Radiometer and the wide-field camera, which provide a large-scale view of the atmosphere surrounding the thin column of air probed by the CALIPSO lidar and a context for interpreting the observations.

Both CloudSat and CALIPSO began operational measurements in early June 2006, and scientists for both missions have been working diligently to evaluate the performance of their respective sensors. In addition to routine onboard calibration, a small CloudSat-CALIPSO validation experiment conducted over the state of Georgia in the United States during July and August further confirmed that both active sensors are operating as expected. The CloudSat "beginning of life" sensitivity is –29.6 dBZ, which surpasses the mission requirement. Early analysis suggests the calibration of the radar also appears to be better than ±2 dBZ requirement.

The figure at the bottom of page 1 shows the CloudSat overpass of Hurricane Ileana in the Pacific Ocean in August 2006. This is a good example of the stunning view of clouds now available from the CloudSat radar, which is approximately five orders of magnitude more sensitive than the radar flown on the Tropical Rainfall Measuring Mission (TRMM). This sensitivity allows joint observations of most of the clouds and precipitation, a capability unique to CloudSat that should lead to substantial improvements in modelling and prediction of weather and climate. For example, improvements in forecasting severe storms and floods will come from improved representation of cloud processes in cloud resolving models or equivalent models. Evidence for this is mounting, with many examples demonstrating the sensitivity of storm prediction to assumptions of cloud physical processes. CloudSat provides the most direct way of determining the important cloud properties (like ice amounts) that are deemed critical to the development of storms.

The CloudSat radar unprecedented view of the vertical structure of cloud and precipitation systems reveals information about the vertical structure of atmospheric heating, which is also critical for predicting the evolution of wide-scale disturbances and the Asian Monsoon.

Global models of the atmosphere are increasing in resolution to the point that current global-scale cloud resolving models (less than 5-km resolution) are feasible. These models represent the future of operational forecast models and eliminate the troublesome problems of parameterizing convective and mesoscale motions, and the artificial situation where clouds and precipitation are largely represented by separate physics modules. Observations from CloudSat provide a powerful source of information that is in step with current model evolution and is forcing a new approach to modelling moist processes in the global atmosphere.

CALIPSO provides new insights into the vertical structure of clouds and aerosols over the globe by observing common atmospheric features, such as thin cirrus clouds and dust clouds, as well as a unique cloud type called the Polar Stratospheric Cloud (PSC). A dramatic example of CALIPSO's capabilities can be seen in the figure at the bottom of page 20. This shows an extensive PSC over Antarctica on 24 July 2006 that extends above 25 km in altitude over a broad region. With its ability to measure the depolarization characteristics of clouds and aerosols, CALIPSO is able to distinguish between the parts of the PSC that contains solid particles (ice crystals) and the parts containing partially solid particles (ice and/or nitrogen trihydrates). These clouds play an essential role in the formation of the ozone hole each year because of chemical reactions between ozone and chemicals activated on the surfaces of different types of PSCs. Because CALIPSO has the unique ability to see where mixed phase particles are located, scientists can better understand how PSCs form and evolve, and how they affect the development of the ozone hole.

CloudSat data products include (all as a function of altitude in 500-m bins from the surface to 20 km): cloud reflectivity, cloud mask, cloud classification, water content, ice content, optical depth, fluxes and heating rates. The CloudSat Data Processing Center (DPC) has completed the reprocessing of 1B-CPR (radiometrically corrected and geo-located reflectivity vs. altitude), 2B-GEOPROF (cloud mask vs. altitude), and 2B-CLDCLASS (cloud classification) products for the first 5 months of the mission. To access this data, use the DPC data ordering system interface found at: *http://cloudsat.cira.colostate.edu/data_dist/OrderData.php*. The "process description documents" for these products are being updated. The on-line specifications are current and are located at: *http://www.cloudsat.cira.colostate.edu/dataSpecs.php*.

CALIPSO data products include lidar attenuated backscatter profiles at 532 and 1064 nm and radiance measurements from its wide field-of-view camera. Lidar browse images are typically posted one week after the satellite overpass. An initial release of data products, including the lidar Level 2 vertical feature mask and cloud and aerosol layer products is planned in December 2006. The browse images and data products will be available through the Atmospheric Science Data Center (ASDC) at NASA Langley Research Center and can be accessed at: *http://eosweb.larc.nasa.gov/PRODOCS/calipso/table_calipso.html.*

With the successful demonstration of CloudSat and CALIPSO, we are embarking on a new age of active remote sensing of clouds, precipitation and aerosols. This new era provides us with the opportunity to move away from the present artificial practices of observing and analyzing clouds and precipitation as separate entities. The more unified approach to observing the properties of clouds and precipitation jointly will greatly advance our understanding of important precipitation-forming processes.

OPPORTUNITIES FOR GEWEX IN ESA's GLOBAL MONITORING FOR ENVIRONMENT AND SECURITY PROJECT

Peter van Oevelen
European GEWEX Coordinator

The European Space Agency (ESA) is the main partner to the European Commission (EC) in the Global Monitoring for Environment and Security (GMES) Project, which is the European Commission's response to the increasing need for geo-spatial information within Europe. The GMES Project will provide autonomous and independent access to information for policy-makers, in particular related to the fields of environment and security. The Project makes extensive use of both *in situ* observations and observations from space, and relies increasingly on assimilation and modelling to obtain relevant and accurate data that can be used to provide useful and up-to-date information. As such, GMES is Europe's contribution to the Global Earth Observation System of Systems (GEOSS).

Since 2001, ESA has supported the establishment of GMES through the development of the space component, which involves a series of satellite missions called Sentinels, as well as pilot services, and ground segment operations. The GMES Services Element is an ESA program dedicated to the delivery of policy-relevant services to end-users, primarily (but not exclusively) from Earth Observation (EO) sources. Currently, several service portfolios are being set up, two of which may be of particular relevance to GEWEX, namely: (1) Land Information Services and (2) Food Security Information.

Within the Land Information Services the Irrigation/Agricultural Water Consumption service area may be of special importance to GEWEX. Currently, EO methods are not being used extensively in this field and much of the potential has not been explored. There is a looming world-wide crisis in water utilization and management, and in many water scarce regions, water use exceeds sustainable levels. In these areas, for example, thermal infrared remote sensing can be used to monitor water resources and provide performance assessments of irrigation projects. EO data can also be used for basin characterization and setting priorities for water resources management, as well as for providing information related to water rights and consumption.

In its Phase II, GEWEX is addressing impacts of the changing water and energy cycle on water resources. Water availability issues are also a primary concern in the GMES service portfolio, Food Security Information. The development of the GMES Sentinels, services and other operations, both within ESA and the European Union, provide an opportunity for the GEWEX community to interact and turn their research and expertise into operationally and routinely used services that will have positive impacts on society and the environment. For more information about GMES, see: *http://www.esa.int/esaLP/LPgmes.html* and *http://www.gmes.info*.

DALTON MEDAL FOR HYDROLOGY RESEARCH AWARDED TO ERIC WOOD

Dr. Eric Wood will receive the 2007 John Dalton Medal at the next General Assembly of the European Geosciences Union in Vienna, Austria (April 2007), where he will also deliver the Dalton Lecture. The medal, established in 1997, is awarded "for distinguished research in hydrology reviewed as an Earth science." Prof. Wood is the head of the Land Surface Hydrology Research Group at Princeton University and chairs the GEWEX Hydrological Application Project.

ISLSCP INITIATIVE II PAPERS IN JGR ATMOSPHERES SPECIAL SECTION

The GEWEX **International Satellite Land-Surface Climatology Project (ISLSCP) Initiative II** was an international effort that produced a global gridded data collection containing 52 3-hourly to monthly data time series supporting water, carbon and energy cycling investigations. The **November 2006 issue** of the ***Journal of Geophysical Research Atmospheres*** contains a special section of ISLSCP Initiative II papers entitled "**Carbon, Water, and Energy Cycle Investigations Using a Common Global Data Set: ISLSCP Initiative II" (Vol. 111, No. D22, 2006)**. For a listing of the papers, see *http://www.agu.org/journals/ss/ISLSCP2/*. The papers should be of great interest to both the carbon and water cycling communities. A limited number of bound copies will be available in January. If you are interested in a copy, please contact Dr. Forrest Hall at *fghall@ltpmail.gsfc. nasa.gov*. The data series is available online at *http://www.daac.ornl.gov*.

ASSESSMENT SHOWS NO TREND IN GLOBAL PRECIPITATION

Arnold Gruber[1] and Vincenzo Levizzani[2]

[1]Earth System Science Interdisciplinary Center, University of Maryland, [2]Italian National Research Council, Bologna, Italy

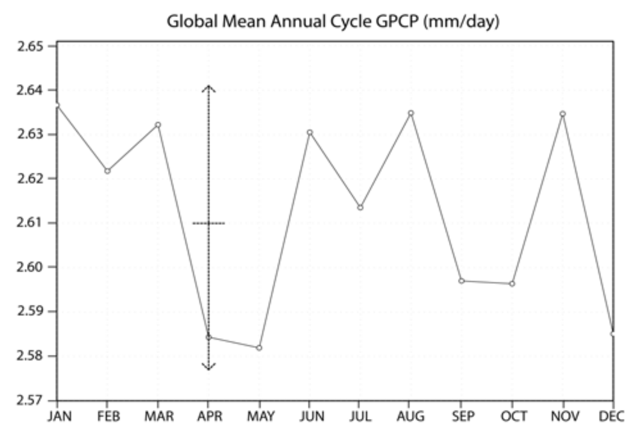
There are a limited number of global precipitation data sets available for possible assessments of climate change as carried out by the Intergovernmental Panel on Climate Change or for studies of the global water cycle as called for by the Integrated Global Observing Strategy Partnership Water Cycle Theme (2000). The Global Precipitation Climatology Project (GPCP) (Huffman et al., 1997; Adler et al., 2003) data are widely available and comparisons of the data have been performed with other global precipitation data (Gruber et al., 2000; Yin et al., 2004). However, GPCP data had not been independently and thoroughly assessed in terms of how reliable they are in representing temporal and spatial variations of precipitation for climate change and water cycle studies. This is crucial since a variety of satellite precipitation estimates are used in this data set as well as new methodologies for merging satellite and gauge data.

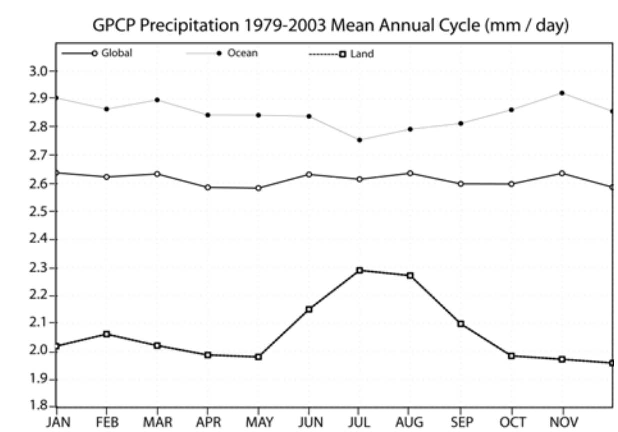
At a planning workshop held in August 2004 at the Cooperative Institute for Climate Studies, University of Maryland, it was decided to conduct such an assessment on the GPCP monthly mean data set with inclusion of other data sets as necessary. GPCP enjoys broad community support—one of the reasons for selecting this data set for assessment. GPCP was developed to improve understanding of seasonal to interannual and longer term variability of the global hydrological cycle, determine the atmospheric latent heating rates needed for weather and climate prediction models, and provide an observational data set for model validation and initialization and other hydrological applications. Its initial goal was to produce a 10-year climatology of monthly global precipitation on a 2.5º × 2.5º latitude/longitude grid. In recognition of the vast areas of the globe that are not sampled by gauges it was clear from the beginning that the GPCP data would rely heavily on satellite estimates of precipitation which would be merged with rain gauges where available. The first version of the GPCP merged satellite and gauge data set was produced in 1997 (Huffman et al., 1997). This version revealed a markedly different view of global precipitation, especially over the oceans, than previously depicted by other climatologies that did not have the benefit of satellite observations (e.g., Jäger, 1976; Legates and

Wilmott, 1990). The initial success of the project led to its continuation and an extension of the precipitation data set back in time to 1979 (Adler et al., 2003), thus providing a relatively long record of global monthly precipitation. Given the length of the GPCP climatology and its global coverage this data set is ideally suited for studying the global water cycle and has the potential for detecting a precipitation-based global climate change signal.

The Precipitation Assessment was conducted by an international group of scientists who are experts in the measurement and analysis of precipitation using remote sensing techniques and *in situ* gauges. Although focused on the GPCP data set, the assessment also reviewed the current state-of-the-art of satellite techniques for estimating precipitation, as well as the variety of long-term gauge data sets. The satellite techniques reviewed include single sensor (e.g., infrared, microwave), as well as multispectral techniques, and timescales that are less than monthly and space scales finer than 2.5 × 2.5 degrees latitude/longitude. Clearly these retrieval algorithms are continuously evolving and we need to emphasize that GPCP, which for the most part uses single sensor techniques that are decades old, will at some point have to consider the impact of new retrieval algorithms, as well as sensors (e.g., Tropical Rainfall Measuring Mission-TRMM). The following briefly summarizes the Assessment, which will be published as a WCRP/GEWEX report and is available online at *http://cics.umd.edu/GPCP*.

Global mean precipitation and its spatial and temporal distribution were reviewed and analyzed based on the period 1979–2003, which exhibited a global mean of 2.61 mm day^{-1} with no evidence of a trend in global precipitation. This analysis is consistent with global energy arguments that a first approximation global precipitation should be more or less constant over the 25-year period. The uncertainty of the mean was estimated at ± .03 mm day^{-1}. **At this level of uncertainty there is no significant mean annual cycle in global precipitation (see figures on this page)**. The mean annual cycle over the oceans and land are examined separately with the land areas showing the largest annual variation. Analysis of the spatial and temporal distribution of precipitation demonstrated that this data set is very capable in capturing the El Niño/Southern Oscillation (ENSO), the major interannual variation in precipitation, most evident in the tropics but also influencing mid-latitude regions (see figure at the top of page 20). However, no relationship was found between global precipitation anomalies and ENSO. The situation is not as clear with regard to longer period variations. As previously stated, there is no significant trend in globally averaged precipitation. However, this does not preclude the existence of regional trends. Analyses were presented that indicate small areas of linear trends over land and the Indian and central to eastern Pacific Oceans. These data seem to suggest that the rainfall shifts between the 1982/83 and 1997/98 ENSO. A similar result was obtained using an empirical orthogonal function analysis which isolated the ENSO regime (Modes 1 and 2) from the lower frequency variations (Mode 3). These trend calculations are very sensitive to the length of the record and it was felt that record length is too short to provide reliable estimates of trends. Based on this analysis we feel that it is crucial to continue this data set. It is clearly useful for studying interannual variability and increasing the length of record would help increase the reliability in the low frequency changes calculated on a regional scale. This would meet the requirements for applications of the data set to global climate analysis.





Top: Mean annual cycle of GPCP precipitation on an expanded scale with an estimate of the uncertainty represented by the vertical arrow. Bottom: Mean annual cycle of precipitation for oceans, global, and land.

Given the increase of new satellite retrieval algorithms and other gauge data sets it seems reasonable to anticipate that a reanalysis of GPCP data would demonstrate an improved accuracy of the global precipitation. One area in particular would use the TRMM precipitation radar data to provide an oceanic reference for ocean precipitation in a similar way that gauges provide for the land areas.

Also identified was the need to determine the snow rate using remotely sensed data and accurate precipitation in a complex terrain, the latter being a problem for remote sensing techniques and gauges. Another possibility in the future is the application of data assimilation methods to observed and modeled precipitation in order to obtain a dynamically, physically and hydrologically consistent field of precipitation. This would require a collaborative research effort among data producers and modelers.

Finally, the most significant future development for global precipitation will be the Global Precipitation Mission (GPM). This mission will consist of a core satellite with an advanced dual-frequency precipitation radar and microwave instruments, and a constellation of polar orbiting satellites whose precipitation estimates can be calibrated against those of the core satellite. It will extend the TRMM mission by providing coverage at higher latitudes at 3-hour intervals over nearly the entire globe**.** The global precipitation community is faced with the challenge to develop methodologies for utilizing these new observations to improve and extend existing data sets such as GPCP, thus providing long-term records for assessing climate change signals.

References

Adler, R. F., G. J. Huffman, and A. Chang, et al., 2003. Version 2 Global Precipitation Climatology Project Monthly Precipitation Analysis (1979–Present). *J. Hydromet.*, 4, 1147–1167.

Gruber, A., X. Su, M. Kanimitsu, and J. Schemm, 2000. The comparison of two merged rain gauge satellite precipitation data sets. *Bull. Amer. Met. Soc.*, 81, 2231–2644.

Huffman, G. J., R. F. Adler, P. A. Arkin, and A. Chang, et al., 1997. The Global Precipitation Climatology Project (GPCP) combined precipitation dataset**.** *Bull. Amer. Met. Soc.*, 78, 5–20.

Jäger, L., 1976. *Monatskarten des Niederschlags für die ganze Erde*, Bericht des Deutschen Wetterdienstes, Vol. 139, Offenbach, 33 pp.

Legates, D. R., and C. J. Willmott, 1990. Mean seasonal and spatial variability in gauge-corrected, global precipitation. *Int. J. Climat.*, 10, 111–127.

Yin, X., A. Gruber, and P. A. Arkin, 2004. Comparison of the GPCP and CMAP merged gauge-satellite monthly precipitation products for the period 1979–2001. *J. Hydromet.*, 5, 1207–1222.

FIRST PAN-GEWEX MEETING A GREAT SUCCESS

Rick Lawford[1], Dawn Erlich[1], William Rossow[2], John Roads[3], Christian Jakob[4], and Sam Benedict[5]

[1]International GEWEX Project Office, [2]City University of New York, [3]University of California at San Diego, [4]Bureau of Meteorology Research Centre, Australia, [5]International Coordinator for CEOP, San Diego

Almost 115 scientists and project managers attended the First Pan-GEWEX Meeting held on 9–13 October 2006 in Frascati, Italy. The meeting was hosted by Dr. Einar-Arne Herland of the European Space Agency. This was the first time that the members of the GEWEX Radiation Panel (GRP), GEWEX Hydrometeorology Panel (GHP), GEWEX Modelling and Prediction Panel (GMPP), and the Coordinated Enhanced Observing Period (CEOP) have met jointly. The meeting provided a forum for the completion of the GEWEX Phase II Roadmap**,** which lays out the direction for the research activities of GEWEX over the next 7 years. The meeting structure allowed all participants to receive overviews of World Climate Research Programme (WCRP) and GEWEX activities, and other related international projects. Individual GEWEX panels also met separately and jointly to review and discuss the GEWEX Roadmap objectives, as well as other issues of mutual interest.

In the opening session, Dr. Ann Henderson-Sellers, Director of WCRP, noted that the two major objectives of WCRP are to determine the extent to which climate can be predicted and the extent of human influence on climate. To achieve these objectives, WCRP has adopted a multi-disciplinary approach, organizing large-scale observational and modelling projects, and facilitating a focus on aspects of climate that are too large and complex to be addressed by any one nation or single scientific discipline. The WCRP Strategic Framework (2005–2015) aims to facilitate analysis and prediction of Earth system variability and change for use in an increasing range of practical applications of direct relevance, benefit, and value to society.

Dr. David Winker gave a special presentation on the recently launched CloudSat and Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) missions (see related article on page 4). Representatives from international space agencies, climate research programs and other international activities presented their plans for research and monitoring missions. Highlights from these presentations included the Climate Variability and Predictability Project's (CLIVAR) interest in working more closely with GEWEX on a number of issues, including monsoon studies. Opportunities exist for GEWEX participation in a "Year of Tropical Convection" that would leverage the new observational data sets and computational resources to better characterize, understand, model and forecast multi-scale convective processes/dynamical interactions in the tropics. Dr. Jagadish Shukla, chair of the WCRP Modelling Panel, noted that GEWEX is in a special position to assess predictability of intraseasonal to seasonal climate.

Rick Lawford reviewed the GEWEX Roadmap, which was discussed in more detail in the breakout sessions. Major changes made to the Roadmap during the meeting include the consolidation of Objective #3 (dealing with predictability studies) and Objective #4 (dealing with prediction systems). In addition, the language clarified in several of the other objectives and the panels recommended a number of new milestones.

Prof. Tetsuzo Yasunari presented some of the initial findings of the WCRP Joint Steering Committee (JSC) review of the GEWEX Roadmap. A more complete report will be presented to the GEWEX Scientific Steering Group (SSG) in January 2007.

GRP, chaired by Dr. William Rossow, reviewed its four active global data projects [International Satellite Cloud Climatology Project (ISCCP), Global Aerosol Climatology Project (GACP), Global Precipitation Climatology Project (GPCP) and the Surface Radiation Budget (SRB) Project, the latter two supported by surface data projects, Global Precipitation Climatology Centre (GPCC) and Baseline Surface Radiation Network (BSRN), respectively] and the four associated data product assessment activities. All projects have made excellent progress on extending the product time records and investigating possible improvements. The four assessment groups are at different stages; for example, the precipitation assessment (in collaboration with the International Precipitation Working Group-IPWG) is complete (see article on page 6) and the aerosol assessment has just begun. Of particular note is that the GPCP and precipitation assessments are now collaborating with the IPWG concerning improved measurements of snowfall, and with a consortium for quantitative precipitation estimation under the THe Observing System Research and Predictability Experiment (THORPEX) activity. The SeaFlux Project is moving towards completion of its analysis method and global product evaluations and may be ready to produce a new global product (ocean surface turbulent fluxes) by early 2008. The similar LandFlux activity, in collaboration with the Global Land-Atmosphere System Study (GLASS)/Global Soil Wetness Project (GSWP), is just being organized, starting with an international workshop to be held in spring 2007 to evaluate the status of available land surface property data products and analysis methodology.

Several other study groups are also making significant progress. The Continuous Intercomparison of Radiation Codes (CIRC) Project is working towards the first release of a web site containing synthetic and observation-based test cases for radiation codes, together with state-of-the-art calculations for the former, and measured fluxes for the latter. The 3D Working Group has combined forces with other working groups to focus attention on the complex problem of 3-dimensional radiation in cloudy atmospheric boundary layers overlying complex vegetation canopies (and other heterogeneous surfaces). Two other groups continue to work to organize world efforts to produce systematic products from surface lidar-cloud radar sites and from precipitation networks. This effort is to provide measurements complementary to CALIPSO, CloudSat and the Tropical Rainfall Measuring Mission. These study efforts continue to build towards a quantitative description of the weather-scale variations of the global energy and water cycle over more than a decade. To foster research using such a data set, GRP has organized a special symposium at the December 2006 American Geophysical Union Meeting in San Francisco.

GHP, chaired by Dr. John Roads, reviewed the past year's progress to meet the GEWEX Phase II objectives. Presentations were made by the Continental Scale Experiment (CSE) representatives and GHP working group chairs and affiliated global projects. A proposal for a ninth CSE, the Northern Eurasia Earth Science Partnership Initiative (NEESPI) is now being developed and will be considered at the next meeting of the GEWEX SSG. The Mackenzie GEWEX Study (MAGS) provided a final report for their 10-year project, which ended in 2005.

CEOP was a special focus for this meeting. GHP and CEOP are now developing plans for a merger that could occur within the next year. Dr. Toshio Koike, CEOP Chairman, presented the results of the CEOP Phase I assessment, which reviewed the degree to which the commitments made by agencies and organizations to CEOP have been fulfilled; and the degree to which CEOP has been able to apply the resources it has been provided to meet its observational and scientific goals. The meeting provided CEOP a specific accounting of the success of CEOP Phase I and an initial set of clearly defined steps that will mark the start of CEOP Phase II implementation.

GHP and CEOP members discussed this potential merger extensively during the meeting. Some of the CSE representatives questioned the status of the CSEs under this merger. Considerable energy was spent in finding a new name for the merged entity that could build on the momentum and good will that has been developed by CEOP. A paper is currently being prepared to bring this planned merger forward at the GEWEX SSG meeting for approval.

A number of exciting research avenues were proposed at the GMPP session chaired by Dr. Christian Jakob. Those include the further study of diurnal cycle issues in the GEWEX Atmospheric Boundary Layer Study (GABLS); the possible extension of the Global Land/Atmosphere Coupling Experiment (GLACE-2) and the use of the results of GLACE to guide process studies in GLASS; and a possible strong collaboration between the Cloud Feedback Model Intercomparison Project, the GCSS Pacific Cross Section Intercomparison (GPCI) and process studies carried out in the GEWEX Cloud System Study (GCSS) Boundary Layer Cloud Working Group to further elucidate the role of low clouds for climate sensitivity.

GMPP sessions also focused on revisions to the GEWEX Roadmap as well as on the identification of possible joint research across GMPP project boundaries. These may include an extension of the GPCI to an area that includes land as well as fully coupled (land–planetary boundary layer–cloud systems) process studies. Using guidance for the choice of a study area from both the GLACE results and recent field studies, the joint research could cover the African Monsoon Multidisciplinary Analysis (AMMA) Project area in West Africa and/or the area around the United States Atmospheric Radiation Measurement Program site in Oklahoma.

The final plenary session focused on ways in which these new initiatives could be consolidated in the GEWEX Roadmap. Following the success of the First Pan-GEWEX Meeting, a second one is being planned for 2008.

HIGHLIGHTS OF THE GEWEX ROADMAP

Rick Lawford
International GEWEX Project Office (IGPO)

Over the past year IGPO has been reviewing GEWEX Phase II goals and deliverables and how these could be summarized in a succinct document or Roadmap. This Roadmap, which is near completion, provides guidance on how GEWEX should focus its research efforts and scarce resources to best achieve the goals for its second phase. Based on an analysis of GEWEX strengths and the gaps in scientific understanding that need to be addressed, the Roadmap sets out a series of actions for each of the GEWEX objectives for the period of 2007 to 2012. In particular, the GEWEX roadmap identifies both interim and final deliverables and milestones that it plans to achieve as GEWEX moves toward the realization of its heritage through scientific insights, analysis tools, models and data products for the benefit of the World Climate Research Programme (WCRP), the agencies that sponsor GEWEX, the global environmental community, and other GEWEX stakeholders.

The most recent version of the Roadmap was reviewed and modified at the October Pan-GEWEX Meeting held in Frascati. The following paragraphs summarize the Roadmap objectives and milestones including changes recommended at that meeting.

Objective 1: Produce consistent research quality data sets complete with error descriptions of the Earth's energy budget and water cycle and their variability and trends on interannual to decadal time scales, for use in climate system analysis and model development and validation.

Work related to this objective builds upon the global products derived primarily from satellite data by the GEWEX Radiation Panel and include water vapor (Global Water Vapor Project), clouds (International Satellite Cloud Climatology Project), precipitation (Global Precipitation Climatology Project), aerosols (Global Aerosols Climatology Project) and radiation (Surface Radiation Budget Experiment). Other Panels have produced global products as well, including the modelled soil wetness under the GEWEX Modelling and Prediction Panel (GMPP) and the International Satellite Land-Surface Climatology Project products (see related announcement on page 6) as part of the GEWEX Hydrometeorology Panel (GHP). These products are of research quality and are reliable when used for their intended use in identifying the causes of variability in the global water and energy system. Also, studies carried out by GHP led to the description of the water and energy budgets at the continental scale. However, to address the closure of the global water and energy budget we must have an extended record of the surface fluxes over the ocean, such as those available for limited intervals through the SeaFlux Project and access to the types of data sets being planned for the LandFlux activity, as well as outputs from the National Aeronautics and Space Administration Global Land Data Assimilation System Project. During the second phase of GEWEX, scientists will rely on data from new satellites and make more extensive use of data assimilation systems. This will require a more coordinated approach to the testing and use of new satellite products and in deriving relationships between the on-going products and new data products from research satellites. As part of this objective GEWEX will place a higher priority on producing reprocessed data sets that will address a broader range of climate analysis.

Objective 2: Enhance the understanding of and quantify how energy and water cycle processes contribute to climate feedbacks.

The second GEWEX objective will be addressed by both process and modelling studies that will target specific problems related to cloud and land surface feedbacks, often in combination with priority cross-cuts such as monsoons and extremes. One of the greatest sources of large uncertainties in current climate scenarios arises from the inability of coarse resolution climate models to simulate clouds and their feedbacks, posing one of the greatest challenges for the modelling community. GEWEX will focus on understanding the contributions of water and energy cycles and their highly coupled nonlinear interactions in regulating feedbacks to the climate system. In addition, GEWEX studies will be directed at understanding and quantifying the diabatic heating of the atmosphere and the surface by radiative, sensible, and latent energy exchanges with accuracies and resolutions sufficient to determine how these processes influence climate and surface conditions on weather to decadal climate time scales.

GEWEX will assess the factors that contribute to different climate phenomena and processes. Included in this list will be the diurnal cycle, precipitation processes, and floods and droughts. In addition, the processes that strengthen, maintain, and weaken monsoons will be understood and simulated under current and projected climate changes.

Objective 3: Improve the predictive capability for key water and energy cycle variables and feedbacks through improved parameterizations to better represent hydrometeorological processes, and determine the geographical and seasonal characteristics of their predictability over land areas.

This objective was revised at the First Pan-GEWEX Meeting and reflects the merging of the original Objectives 3 and 4. GEWEX has worked towards improving seasonal predictions from its inception and is committed to contributing to the improvement of prediction systems by advancing our physical understanding of the underlying processes, developing and testing experimental products, improving parameterizations, and facilitating their transfer to operations.

GMPP has developed improved parameterizations for cloud and land processes that have been incorporated into simulation and prediction models. Intercomparisons have been carried out through the Project for the Intercomparison of Land-Surface Parameter Schemes (PILPS) to assess the need for improving parameterizations and to discover the best ways for improving parameterization schemes. Similar steps have been taken within some of the Continental-Scale Experiments (CSEs). This was facilitated by both the CSEs which were required to develop links with regional Numerical Weather Prediction (NWP) centers and by the Coordinated Enhanced Observing Period (CEOP), which coordinates the production and collection of relevant global outputs from at least 11 NWP and data assimilation centers. The GEWEX Americas Prediction Project/ GEWEX Continental-scale International Project, a core CSE project, has transferred a number of techniques and parameterizations to the National Centers for Environmental Prediction operational systems.

During Phase II, GEWEX plans to study the contributions of land-atmosphere and cloud processes on atmospheric predictability for: (1) precipitation and (2) monsoon intensity. A suite of studies to assess the influence of anomalies on the seasonal predictability of precipitation and on monsoon intensity will be undertaken and used to set priorities for studies directed at improving prediction systems. Results from model studies such as the Global Land Atmospheric Coupling Experiment have suggested that there are critical land areas ("hot spots") where surface wetness has a very significant influence on the predictability of seasonal precipitation at lead times of 1 to 3 months (Koster et al., 2000). GEWEX Predictability studies also address the WCRP objective of determining the predictability of climate.

During Phase I regional models have been used extensively for downscaling and regional process simulation. While regional models produce better results than global models in some areas, there are other regions where regional models are unable to outperform global models in spite of their higher resolution. Studies are needed to determine where the benefits of downscaling and the more precise representation of surface features are greater than the benefits of more accurately representing the regionally dominant forcings. In some cases the evaluation of regional models may require enhanced data collection activities either through CEOP or enhanced field campaigns. The activities of the CEOP Transferability Working Group contribute to these assessments.

Objective 4: Undertake joint activities with operational hydrometeorological services, related Earth System Science Partnership projects such as the Global Water System Project and hydrological research programs to demonstrate the value of GEWEX research, data sets and tools for assessing the consequences of climate predictions and global change.

This is a revised statement of the old objective 5. In addressing this objective, the GEWEX Hydrological Applications Project (HAP) has been developed. It will work with the Project on Ungauged Basins (PUB) and the Hydrologic Ensembles Prediction Experiment (HEPEX) to demonstrate how remote sensing data, land data assimilation products, and hydrological prediction can improve the decisions made by water resource managers. These advances will benefit operations through the development of better prediction systems for hydrological prediction services. These activities will build upon the knowledge gained through the GEWEX Water Resources Applications Project which preceded HAP. GEWEX will also promote strategies to work more closely with the Global Water System Project (GWSP), the World Meteorological Organization's Hydrology and Water Resources Department, operational hydrometeorological services, and UNESCO's International Hydrology Programme (IHP).

The Roadmap will be presented to the GEWEX SSG at their 2007 meeting for ratification. However, the document is intended to be a living plan to be updated on an annual basis or as needed. The complete draft GEWEX Roadmap is available at *http://www.gewex.org*.

Reference

Koster, R. D., M. J. Suarez, and M. Heiser, 2000. Variance and Predictability of Precipitation at seasonal-to-interannual timescales. *J. of Hydrometeor.*, 1, 26–46.

SURFACE RADIATION BUDGET PROJECT COMPLETES 22-YEAR DATA SET

Shashi K. Gupta[1], Paul W. Stackhouse Jr.[2], Stephen J. Cox[1], J. Colleen Mikovitz[1], and Taiping Zhang[1]

[1]Science Systems and Applications, Inc., Hampton, Virginia,
[2]Climate Science Branch, NASA Langley Research Center, Hampton, Virginia

The Surface Radiation Budget (SRB) Project has completed a 22-year (July 1983 to June 2005) data set of surface and top-of-atmosphere (TOA) shortwave (SW) and longwave (LW) radiative fluxes. This data set was produced, archived, and made available to the science community by the National Aeronautics and Space Administration (NASA) Langley Research Center (LaRC) Atmospheric Sciences Data Center (ASDC). It is designated as SRB Release-2.5/2.8 and supercedes the 12-year Release-2.0 data set made public about 3 years ago (Stackhouse et al., 2004). The new data set was produced on a 1.0 x 1.0 degree global grid using satellite-derived cloud parameters and ozone fields, reanalysis meteorology, and a few other ancillary data sets. Both SW and LW surface fluxes were computed with two sets of algorithms: one designated as primary, and the other as a quality-check. TOA fluxes were derived with primary algorithms only. All except the quality-check SW algorithm compute fluxes on a 3-hourly resolution, which are then averaged into daily, monthly, and monthly 3-hourly values. Quality-check SW fluxes are computed on a daily resolution and averaged into monthly values. Surface fluxes from all algorithms were extensively validated with ground-based measurements obtained from the Baseline Surface Radiation Network (BSRN), the Global Energy Balance Archive (GEBA), and other sources.

For the latest SRB version, significant changes to the inputs were made by replacing Goddard Earth Observing System Data Assimilation System (GEOS-1) reanalysis data from the Global Modelling and Assimilation Office (GMAO) with corresponding GEOS-4 products. Column ozone values that were based entirely on Total Ozone Mapping Spectrometer (TOMS) data for Release-2.0 processing are now produced by filling gaps in TOMS fields, including those over unlit polar areas, with data from the Television and Infrared Observation Satellite (TIROS) Operational Vertical Sounder (TOVS) archive. Only minor changes were made to the cloud properties derived from the International Satellite Cloud Climatology Project (ISCCP) pixel-level (DX) data.

The four basic algorithms used to process these inputs are described in Stackhouse et al. (2004). The primary SW algorithm (Pinker and Laszlo, 1992) was incrementally improved by updating the treatment of Rayleigh scatter for elevated terrain and radiative transfer near the the solar terminator. Also, the TOA insolation computation and gap filling in the polar twilight zones has been revised to fully address Raschke et al. (2006). As a result, the products of the primary SW algorithm were designated as Release-2.8. The other three algorithms have undergone only minor modifications and were designated as Release-2.5.

Global annual averages for commonly used SRB parameters for both sets of algorithms are presented in Table 1 below. Present results are compared with corresponding averages from another satellite-based product, the ISCCP-FD data set. The two data sets show very good agreement. Also included in this comparison are a set of GCM-based values and the ground measurement based values from the GEBA database. Higher insolation values in the GCM-based data are characteristic of the overestimation in GCMs of the 1990s. Low values of SW fluxes in the GEBA data set may be partly related to those data being mainly from land based sites. It is noteworthy that land region averages from the present data set are closer to GEBA results (not shown).

Table 1. Global Annual Averages for Commonly Used SRB Parameters

Parameter	Ohmura and Gilgen (1993) GEBA	Kiehl and Trenberth (1997) ERBE/CCM3	Zhang and Rossow (2004) 21-Year Mean	NASA/GEWEX SRB Rel.-2.5/2.8 21-Year Mean; 1984-2004	
				Primary	Quality Check
SW Down	169	198	189.2	186.6	183.7
SW Net	142	168	165.9	165.1	161.0
LW Down	345	324	343.8	343.1	348.7
LW Net	-40	-66	-49.6	-53.0	-50.0
Total Net	102	102	116.3	112.1	111.0
SW CRF	--	--	-53.0	-57.0	-59.2
LW CRF	--	46	29.5	35.3	34.3
Total CRF	--	--	-23.5	-21.7	-24.9

BSRN measurements were used in the validation of the monthly average downward SW and LW fluxes. These measurements, originally made at 1- and 3-minute intervals were averaged over the desired temporal resolution and cover the period from 1992 to 2005. Mean bias for SW fluxes is about –7.5 Wm^2. An examination of individual sites showed that most of this underestimation arose at polar sites, especially those located on the Antarctic coast. Cloud characterization at these sites is generally very difficult and is believed to be the primary reason for these errors. Removing polar points reduced this bias to about –5.4 Wm^{-2}. Corresponding bias for the LW fluxes is only about –2.0 Wm^{-2}. Validation of fluxes of quality-check algorithms provides very similar results. Biases and random errors for all models and at all temporal resolutions are shown in the Table below.

Table 2. Biases and Random Errors for All Models and at All Temporal Resolutions Relative to BSRN Measurements

Model	3-Hourly	Daily	Monthly/ 3-Hourly	Monthly
Primary SW	-12.1 (88.9)	-7.7 (37.2)	-11.4 (44.4)	-7.5 (22.0)
QCSW	----	0.0 (42.9)	----	-0.3 (24.4)
Primary LW	0.2 (32.2)	0.3 (24.2)	0.4 (14.3)	-2.0 (13.2)
QCLW	7.2 (32.8)	7.0 (24.2)	7.4 (18.0)	4.3 (14.8)

It is planned to extend this data set beyond June 2005 as ISCCP data for the later period become available. The current data set is available from the LaRC ASDC at: *http://eosweb.larc.nasa.gov/PRODOCS/srb/table_srb.html.*

References

Pinker, R., and I. Laszlo, 1992. Modeling surface solar irradiance for satellite applications on a global scale. *J. Appl. Meteor*., 31, 194–211.

Raschke, E., S. Bakan, and S. Kinne, 2006. An assessment of radiation budget data by ISCCP and GEWEX-SRB. *Geophys. Res. Lett*., 33, LO7812.

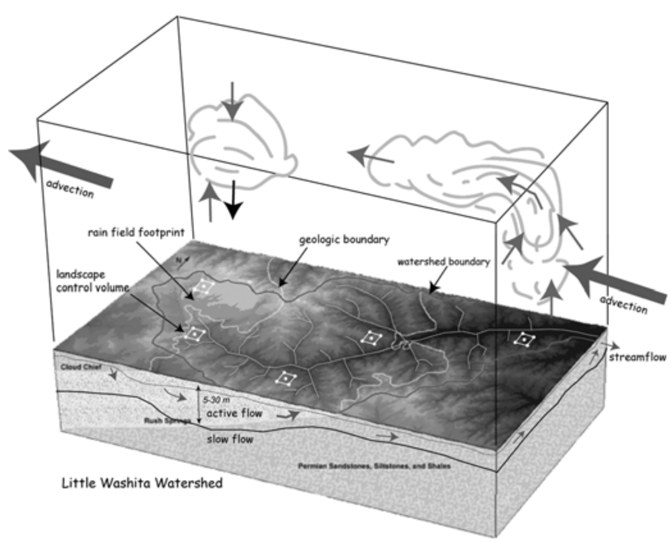
Stackhouse, P. W., S. K. Gupta, S. J. Cox, J. C. Mikovitz, T. Zhang, and M. Chiacchio, 2004. 12-Year Surface Radiation Budget Data Set. *GEWEX News*, Vol. 14, 10–12, November 2004.

A NEW DESIGN FOR AN INTEGRATED OBSERVING PLATFORM FOR THE TERRESTRIAL WATER CYCLE

Science Steering Group of the Interagency Working Group of the CCSP Global Water Cycle Research Element,
Christopher Duffy, Chair

The circulation and exchange of water and energy across the shared boundaries of the atmosphere, continents and oceans defines the global water cycle. Conceptually, these fluxes determine the "state" of the Earth-climate system; however, the domain, function and linkages of significant components of this system are poorly understood, and either unmeasured or only partially measured. The U.S. Climate Change Science Program (CCSP) Water Cycle Research Element has prepared a white paper to address a fundamentally new design for an integrated water cycle observing platform that will revolutionize our way of seeing the hydrologic cycle. To be successful the design concept will require detailed coordination and broad participation across the water cycle research community. Given the importance of seasonal and longer time scales and trends, to the intensity of hydroclimatic events, this effort will need coordination of short-term campaign-style Intensive Operation Periods (IOPs), and place-based, fixed-sensor, long-term monitoring that is typical of watershed investigations. The white paper explores this new arena of integrated measurements as a mechanism for interdisciplinary science and as a bridge to understanding interfacial fluxes across these boundaries. An instrument platform is proposed that emphasizes sensor integration and coordination of data streams within the natural space and time scales of the terrestrial water cycle. The watershed is used as the organizing principle at the regional scale, and the physical properties of the watershed as the basis for sensor deployment (see figure on this page). At the local scale, sensor systems are deployed within a vertical and horizontal domain, which extends from the base of active groundwater circulation, through the soil, vegetation and the top of the atmospheric boundary layer. The design of the instrument array must be able to take advantage of the natural scales of motion for water and energy at the watershed scale, and should be adaptable to any physiographic, ecological and climatic setting.

The surface exchange and transport of water and energy within the watershed domain described above, represents a unique challenge to integrated water cycle research. To this point we have attempted to make the case that the major roadblock to understanding the water cycle at this scale is the lack of coordinated or coherent measurements at the natural scales of the terrestrial water cycle. There should be no illusions about the scope of this effort. It is a significant scientific and institutional challenge. The current limited experiment would require coordinated observations of the atmosphere (e.g., water vapor, winds, thermodynamics, cloud-radiative forcing, and precipitation), the land-surface (e.g., surface exchange fluxes of heat, momentum and moisture, and radiation balances, vegetation dynamics, precipitation, and runoff), and the subsurface (e.g., soil moisture, temperature, pressure profiles, water table and baseflow). The control volume will require geophysical and biophysical characterization. Any site chosen should have a completed (or anticipated) digital watershed survey available for soils, geology, vegetation, high resolution topography, in addition to a hydroclimatic database. To be truly useful, the data products generated will require special care in the data acquisition, quality assurance and in the format of the measurements. In particular, since the control volume of the experiment is place-based (not generic), the location of the environmental sensors and instrumentation relative to the control volume will require precise placement if a truly useful 4-D data set is to emerge. The complete white paper is available for community review and comment at *http://www.usgcrp.gov/usgcrp/Program Elements/water.htm.*



The regional conceptual model, including a limited subsurface region below the land surface where the water table influences both soil moisture and groundwater flow over time scales important to local weather and climate.

LAND SURFACE PROCESS MODEL DEVELOPMENT AT THE BEIJING CLIMATE CENTER

Weiping Li, Xueli Shi, Wenjie Dong, Yong Luo, Tongwen Wu, Jingjun Ji, and Shufen Sun

Beijing Climate Center, China

Several land-surface process models developed by Beijing Climate Center (BCC) scientists are being compared, improved and coupled to the BCC climate system model, which is under development. The Atmosphere-Vegetation Interaction Model (AVIM) is a biogeochemical model involving physical and ecophysiological processes at the land surface. AVIM was developed to account for the feedback mechanism between the plant growth physiological processes and abiotic environment-atmosphere and soil, resulting in plant growth and the changes in morphological and dynamical parameters (e.g., leaf area index-LAI, albedo), which in turn affect the instantaneous physical transfer processes (Ji, 1995; Li and Ji, 2001). AVIM focuses on the modelling of the mature ecosystem and its changes at annual and decadal time scales (Lu and Ji, 2006) and consists of four modules: (1) the Soil-Vegetation-Atmosphere Transfer module, which simulates the radiation, water, heat, and momentum fluxes among the atmosphere-vegetation-soil system; (2) the Vegetation Growth Module, a plant physiological process model involving photosynthesis, respiration, dry matter allocation, and phenological processes, as well as decomposition of litter, which simulates the seasonal and interannual variation of the biomass, net primary productivity and LAI; (3) the Biophysical Feedback Module, in which the surface physical parameters, such as albedo, dynamical roughness, and physiological parameter like canopy stomatal resistance can be derived from plant morphological parameters; and (4) the Soil Carbon Pool Module which consists of active, slow and passive pools, simulating carbon input from litter fall, transfer among pools, and release into the air due to heterogeneous respiration.

A simple multi-layer snow scheme called the Snow-Atmosphere-Soil-Transfer Scheme (SAST) has been developed based on improvements and simplifications of comprehensive snow schemes for Global Circulation Model (GCM) applications (Sun et al., 1999). The scheme includes important physical processes, such as snow compaction, heat conduction, snow grain growth, and snow melting. There are three prognostic variables in the model: specific enthalpy, snow water equivalent, and snow depth. The vapor effects on snow processes have been parameterized in the energy balance calculation. A unique feature of SAST is that it uses enthalpy rather than temperature in the energy balance equation, which greatly simplifies the computation procedure for the phase change calculation in the snow process. SAST consists of at most three layers. The criteria for determining the layer numbers and the thickness of each layer are based on the following considerations: (1) For reasonable simulations of diurnal changes of surface temperature, the surface layer thickness should be thinner than the thermal damping depth of snow and be no more than 2 cm; and (2) The second layer thickness is restricted to less than 20 cm because the diurnal variation of snow pack properties is more pronounced at the top 15–20 cm of the snow pack. There are basically two kinds of parameterization schemes for frozen soil processes. One is based on the fixed freezing point (273.16^{o}K). The other is based on a freezing process that is continuous with an unfixed freezing point, and on the relationship between liquid water content, ice content and soil temperature. A simple frozen soil scheme with an unfixed freezing point has also been developed by Sun et al. (2003, 2004).

Coupling of the frozen soil scheme with the snow scheme-SAST is under way and will replace the one-layer snow scheme in AVIM to develop a new land-surface model. High resolution land cover types are also available. A mosaic nested scheme for land-surface models can be used to simulate the heterogeneities in a GCM box. Each land pixel within a GCM box shares the same atmospheric conditions, while the area-weighted total fluxes from each land pixel go back to the overlying atmosphere.

References

Ji, J., 1995. A climate-vegetation interaction model simulating the physical and biological processes at the surface. *J. Biogeography*. 22, 445–451.

Li, Y., and Ji J., 2001. Model estimates of global carbon flux between vegetation and the atmosphere. *Adv. Atmos. Sci.*, 18, 807–818.

Lu, J., and Ji, J. 2006. A simulation and mechanism analysis of long-term variations at land surface over arid/semi-arid area in north China. *J. Geophys. Res.*, 111, D09306.

Sun, S. F., J. M. Jin, and Y. K. Xue, 1999. A simple snow-atmosphere-soil transfer model. *J. Geophys. Res.*, *104*, 19587-19597.

Sun, S. F., X. Zhang, and G. A. Wei, 2003. A simplified version of the coupled heat and moisture transport model. *Glob. Planet. Change*, *37*(3–4), 265–276.

Sun, S. F., and X. Zhang, 2004. Effect of the lower boundary position of the Fourier equation on the soil energy balance, *Adv. Atmos. Sci.*, *21*(6), 868–878.

WORKSHOP/MEETING SUMMARIES

FIRST MEETING OF THE LPB SCIENCE AND IMPLEMENTATION STEERING GROUP

18–19 September 2006
Guaratinguetá, Brazil

E. Hugo Berbery[1] and
M. Assuncao Silva Dias[2]

[1]University of Maryland, [2]CPTEC

The La Plata Basin (LPB) Project seeks to improve the predictive skill of that basin's hydroclimate system and to establish the possible impacts of regional and global climate change on the water resources of the region. LPB addresses the following science objectives: (1) What climatological and hydrological factors determine the frequency of the occurrence and spatial extent of floods and droughts? (2) How predictable is the regional weather and climate variability and its impact on hydrological, agricultural and social systems of the basin? and (3) What are the impacts of global climate change and land use change on regional weather, climate, hydrology and agriculture? To what extent can their impacts be predicted?

The first planning meeting of the LPB Science and Implementation Steering Group (SISG) was hosted by the Centro de Previsão de Tempo e Estudos Climáticos (CPTEC). The meeting had two purposes: (a) initiate activities that will lead to the LPB monitoring activities and field experiment; and (b) develop synergistic activities through partnerships with other programs and activities that have common interests in the region.

The role of CPTEC as a regional operational center and the availability and development of observing systems was discussed. These discussions included the ongoing effort to integrate Brazil's network of meteorological radars and the availability of flux towers, remote sensing and model products being developed at CPTEC, the hydrological network in Paraguay, and data management practices.

The representatives of the Inter-American Institute for Climate Change Studies and the European Union described the mechanisms by which LPB may seek interactions with groups involved in research in the region.

The SISG worked on defining specific actions to strengthen the LPB Project. Several activities have been advancing in themes related to LPB as a result of research by participating institutions.

Working groups were established to address the following tasks.

1. *Survey of previous data in preparation for the field experiment*. Existing meteorological and hydrological information throughout the region will be identified and collected as the basis for the field experiment.

2. *LPB supersite*. The location of an appropriate site or region where enhanced hydrological and meteorological observations can be obtained will be determined.

3. *Radar integration*. A network of radar systems is being integrated in South-eastern Brazil. Radars from Paraguay and Argentina will be integrated using the same protocols and procedures to be identified for integrated data sets, internet connectivity, real-time communication, and compatability throughout the systems.

4. *Flux towers*. One to three flux towers will be selected to represent the different hydroclimates found in LPB, with the purpose of contributing as reference sites to the Coordinated Enhanced Observing Period.

5. *Soil moisture measurements*. Activities in different basins related to soil moisture observations for model calibration and other agricultural purposes will be surveyed.

The meeting agenda, presentations, and first draft of the Implementation Plan are available at *http://www.eol.ucar.edu/projects/lpb/presentations/meeting.html.*

The second meeting of the SISG is planned for February 2007 in Buenos Aires, Agentina and will focus on monitoring and field experiment plans, and planning for modeling activities and educational outreach. A new draft of the LPB Implementation Plan is expected to be available in early 2007.

GCSS WORKSHOP ON MODEL INTERCOMPARISON STUDIES

18–21 September 2006
New York, USA

A. Pier Siebesma[1] and Joao Teixeira[2]

[1]Meteorological Institute, De Bilt, Netherlands, [2]NATO Undersea Research Centre, La Spezia, Italy

The joint workshop of the GEWEX Cloud System Study (GCSS) Boundary Layer Clouds (BLC) and Pacific Cross-section Intercomparison (GPCI) Working Groups (WGs) was held at the National Aeronautics and Space Administration's Goddard Institute for Space Studies. The purpose of the Workshop was to review and compare the results of several intercomparison studies for Large Eddy Simulation (LES) models, Single Column Models (SCMs), Global Circulation Models (GCMs), and limited area models (LAMs).

In GPCI, data from several weather/climate prediction models and satellites are analyzed along a Pacific Ocean cross section, from California to the equator. The BLC WG aims to improve physical parameterizations of BLC, other bodary layer processes, and their interactions. It conducts intercomparison studies between observational case studies, Single Column Model (SCM) versions of weather/climate prediction models, and 3-dimensional Large Eddy Simulation (LES) models of cloud-topped boundary layers. The joint nature of the Workshop was related to the overlap between the scientific interests of the BLC WG (the cloud-topped boundary layer) and GPCI studies that encompass stratocumulus, cumulus and deep convection.

The current case study of the BLC WG is on precipitating shallow cumulus based on data obtained during the Rain In Cumulus over the Ocean (RICO) field campaign which took place in the vicinity of the Caribbean islands of Antigua and Barbuda from December 2004 to January 2005. Twelve research groups from Europe, the United States, and Japan participated in an intercomparison study for high resolution LES models based on observations taken from the RICO field campaign. This suite of LES model results, along with the observations, forms a test bed for an intercomparison study for SCM versions of a large variety of 13 weather/climate models. The objective of this intercomparison study was to assess how capable the SCMs are of representing moist convection, cloud properties, and especially, precipitation characteristics originating from the observations/LES data set. The presentations that summarize the findings of this quest are available at: *http://www.knmi.nl/samenw/rico/agenda_RICO-GPCI.html*.

The past case of the BLC WG for precipitating stratocumulus, such as observed during the Dynamics and Chemistry of Marine Stratocumulus Experiment (DYCOMS) was discussed during the Workshop. The general feeling with respect to precipitation of both the present RICO shallow cumulus case and the past DYCOMS stratocumulus case is that it is hard to distinguish if the spread in the model precipitation rates is due to the dynamics or because of the microphysics. To sort this out there will be a new GCSS initiative led by Dr. Ulrike Lohmann to design more dynamically constrained model experiments to assess the variability in the modelled precipitation due to microphysics exclusively.

GPCI complements the more traditional GCSS methodology by providing a simple framework for model and data evaluation that includes several important cloud regimes such as stratocumulus, shallow cumulus and deep convection, as well as the transitions between them. Over 20 weather and climate modeling centers worldwide (United States, United Kingdom, France, Japan, Germany, Canada and the Netherlands) are currently participating in GPCI. A comparison of monthly mean properties between models and observations shows that although most models often suffer from similar problems (e.g., negative stratocumulus cloud bias) they also have quite different characteristics (e.g., the depth of the boundary layer evolving from a low to a high sea-surface temperature region). The fact that the data are collected with a 3-hour frequency allows for studies of time variability of cloud properties, including the diurnal cycle of different variables. For example, cloud histograms along the cross section differ from model to model. Some models exhibit a quasi-bimodal structure with low cloud cover being either close to 100 percent or close to zero, while other models show a more continuous transition from high stratocumulus values to low values closer to the equator. For further information on the set of the GPCI Pacific case, refer to the web site: *http://www.igidl.ul.pt/cgul/projects/gpci.html* and for a previous version of a Pacific intercomparison case to: *http://www.knmi.nl/samenw/euroc*s. Presentations on results of GPCI made during the Workshop can also be found at *http://www.knmi.nl/samenw/rico/agenda_RICO-GPCI.html*.

IGWCO/JAXA/GEO CAPACITY BUILDING WORKSHOP

26–28 September 2006
Bangkok, Thailand

Rick Lawford[1] and Chu Isida[2]
[1]International GEWEX Project Office, [2]JAXA

The Integrated Global Water Cycle Observations (IGWCO) Theme, Japan Aerospace Exploration Agency (JAXA), Group on Earth Observations (GEO) Workshop on Capacity Building was the second in a series of workshops hosted by IGWCO and GEO to determine how the needs of underdeveloped countries in different regions of the world can be met using the knowledge, technologies and information services that have been developed in nations with more advanced observational capabilities. The Workshop was well attended with more than 120 participants from 22 countries.

The workshop began with welcoming remarks from the hosts, a review of the objectives of IGWCO Theme and GEO in the area of capacity building, and descriptions about the policy focus and services of a number of regional organizations and programs. GEWEX activities in Asia were also described with presentations on the Coordinated Enhanced Observing Period (Dr. Toshio Koike), and the Monsoon Asian Hydro-Atmospheric Science Research and prediction Initiative (Dr. Jun Matsumoto). Related programs such as the Project for Ungauged Basins, the International Centre for Water Hazard and Risk Management (Japan) and the World Meteorological Organization were also described. During the second day of the workshop each country reviewed its requirements for data, hydrometeorlogical forecasts and models. A number of these needs focused attention on the requirement for better access to information from government agencies and neighboring countries. Although there is considerable interest in accessing and using remote sensing products it also became apparent that many of these countries are unaware of the products that are available. It was gratifying to see that some GEWEX products such as the GEWEX Global Precipitation Climatology Project data sets have become part of the environmental services for some countries. Participants recommended that more of the products derived from remote sensing data should have a “first look” product that is available in near real time.

The needs identified in these discussions went beyond just accessing data and data needs but also addressed requirements for forecasting services at weather and climate time scales. There was a strong interest in the seasonal prediction of drought. It was clear from the discussions about capacity building that there is a need to have capacity building at several different levels: (1) those who produce the information, (2) those who communicate the information to the users, and (3) the users themselves. The requirements for capacity building are likely to be quite different depending on the level where the capacity building is needed. A critical part of past capacity building activities has been the use of demonstration projects from past successful developments to show others how they could benefit.

Three working groups were established to review the region's needs in the domains of floods, droughts, and water quality. The most pressing need identified at the Workshop came in the area of water quality. In many countries in Asia, baseline water quality measurements do not exist except for periodic assessments. This is particularly distressing in countries like Bangladesh where it was reported that a large percentage (approximately 90%) of the population is drinking arsenic-contaminated waters in spite of the Millennium Development Goals. Based on this need, the workshop made a strong recommendation to GEO to initiate demonstration projects and a water quality network in the region. In other areas such as floods and perhaps less widely droughts, where services do exist, the focus was on making these services more effective through the provision of better input data and better scientific understanding to improve the predictive models. In the case of floods, the need for a good flood alert system was emphasized. There is considerable optimism that the Global Precipitation Mission, when it is available, will provide much better flood monitoring in many countries in eastern Asia. Education and awareness-raising were two topics that came up in the discussion groups. Recommendations in these areas are also being considered and will likely become part of the Asian Water Cycle Initiative, a regional study that is gaining momentum in Japan and elsewhere.

The results of this workshop are being submitted to the third GEO plenary in Bonn, Germany and the Committee on Earth Observing Satellites plenary in Buenos Aires, Argentina, both in November 2006. It will also be submitted to the Asian Water Cycle Symposium in January 2007.

GWSP SSC MEETING

7–8 November 2006
Beijing, China

Kendal McGuffie
University of Technology, Sydney

The Institute of Geographical Sciences and Natural Resources Research of the Chinese Academy of Sciences provided the venue for the fourth meeting of the Global Water Systems Project (GWSP) Scientific Steering Committee (SSC), which preceeded the Earth Science System Partnership Open Science Conference. During the meeting, the new Executive Officer (EO), Dr. Lydia Dümenil Gates, was welcomed and the outgoing EO, Dr. Eric Craswell, was thanked for his contributions.

GWSP has several key activities that address the central research question: "How are humans changing the global water cycle, the associated biogeochemical cycles, and the biological components of the global water system, and what are the social feedbacks arising from these changes?" GWSP activities are complementary to GEWEX, which seeks to understand the physical processes taking place in the hydrological and energy cycles. GWSP addresses issues such as the governance of water resources, hydrological data sets, resilience and adaptation, and has a strong focus on capacity building, and an aim for dialogue with stakeholders and policy makers. There is a high degree of complementarity between GWSP and GEWEX and significant potential for interactions to provide a pathway to policy makers for GEWEX science outcomes, which would likely include the effects of land cover changes on the global water system, including such aspects as changes in sediment load and nutrient levels in rivers in response to land use change.

GEWEX NEWS

Published by the International GEWEX Project Office

Richard G. Lawford, Director
Dawn P. Erlich, Editor
Carolyn S. Ehn, Assistant Editor

Mail: International GEWEX Project Office
1010 Wayne Avenue, Suite 450
Silver Spring, MD 20910, USA
Tel: (301) 565-8345
Fax: (301) 565-8279
E-mail: gewex@gewex.org
Web Site: http://www.gewex.org

GEWEX/WCRP MEETINGS CALENDAR

For a complete listing of meetings, see the GEWEX web site: http://www.gewex.org

9–10 January 2007—2ND ASIAN WATER CYCLE SYMPOSIUM, University of Tokyo, Japan.

14–18 January 2007—87TH ANNUAL AMS MEETING, San Antonio, Texas, USA.

22–26 January 2007—GEWEX SSG-19, Honolulu, Hawaii.

5–7 February 2007—WORKSHOP ON MONSOON CLIMATE VARIABILITY AND CHANGE, AND THEIR IMPACTS ON WATER, FOOD, AND HEALTH IN WESTERN INDIA, Ahmedabad, Gujarat, India.

7–8 February 2007—20TH LBA SSC MEETING, Manaus, Brazil.

12–16 February 2007—3RD WGNE WORKSHOP ON SYSTEMATIC ERRORS IN CLIMATE AND NWP MODELS, San Francisco, California, USA.

1–2 March 2007—THE SCIENCE OF CLIMATE CHANGE: A ROYAL SOCIETY SHOWCASE OF THE IPCC 4TH ASSESSMENT WG 1 REPORT, London, United Kingdom.

6–9 March 2007—SOLAS OPEN SCIENCE CONFERENCE, Xiamen, China.

12–17 March 2007—JOINT CEOP/IGWCO PLANNING MEETING, Washington, D.C., USA.

12 March–4 April 2007—WORKSHOP ON INTERDISCIPLINARY SCIENCE OF CLIMATE CHANGES: BASIC ELEMENTS, Buenos Aires, Argentina.

13–15 March 2007—4TH INTERNATIONAL CLIVAR CLIMATE OF THE 20TH CENTURY WORKSHOP, Exeter, United Kingdom.

20–23 March 2007—5TH CLIMATE PREDICTION APPLICATIONS SCIENCE WORKSHOP, Seattle, Washington, USA.

26–30 March 2007—28TH SESSION OF THE WCRP JOINT SCIENTIFIC COMMITTEE, Zanzibar, Tanzania.

15–20 April 2007—EGU GENERAL ASSEMBLY 2007, Vienna, Austria.

21–26 April 2007—13TH BRAZILIAN SYMPOSIUM ON REMOTE SENSING, Florianpolis, Brazil.

23–27 April 2007—ENVISAT SYMPOSIUM 2007, Montreaux, Switzerland.

7–9 May 2007—EARTHCARE WORKSHOP, Noordwijk, The Netherlands.

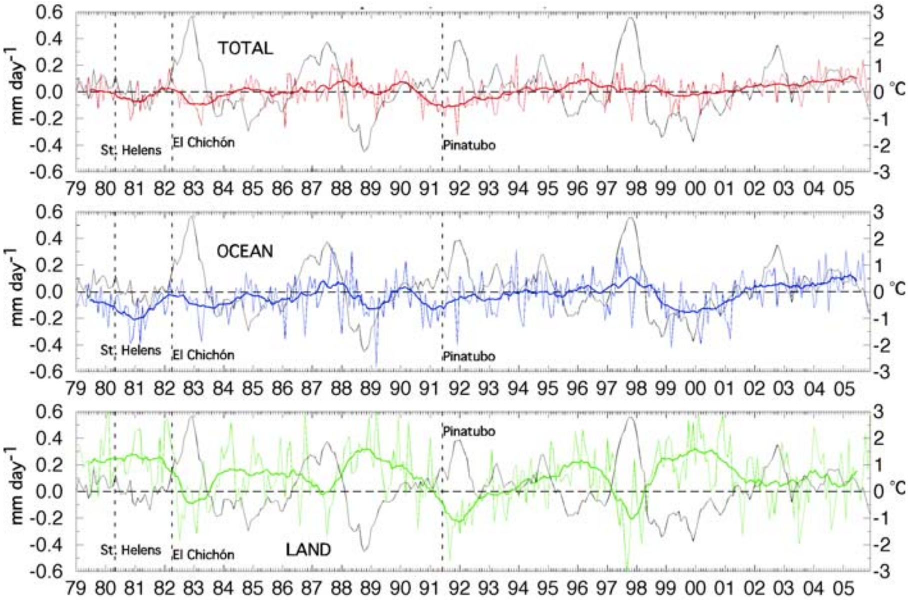
22–25 May 2007—JOINT ASSEMBLY, Acapulco, Mexico.

4–8 June 2007—WCRP WORKSHOP ON SEASONAL PREDICTION, Barcelona, Spain.

4–8 June 2007—5TH STUDY CONFERENCE FOR BALTEX, Island of Saaremaa, Estonia.

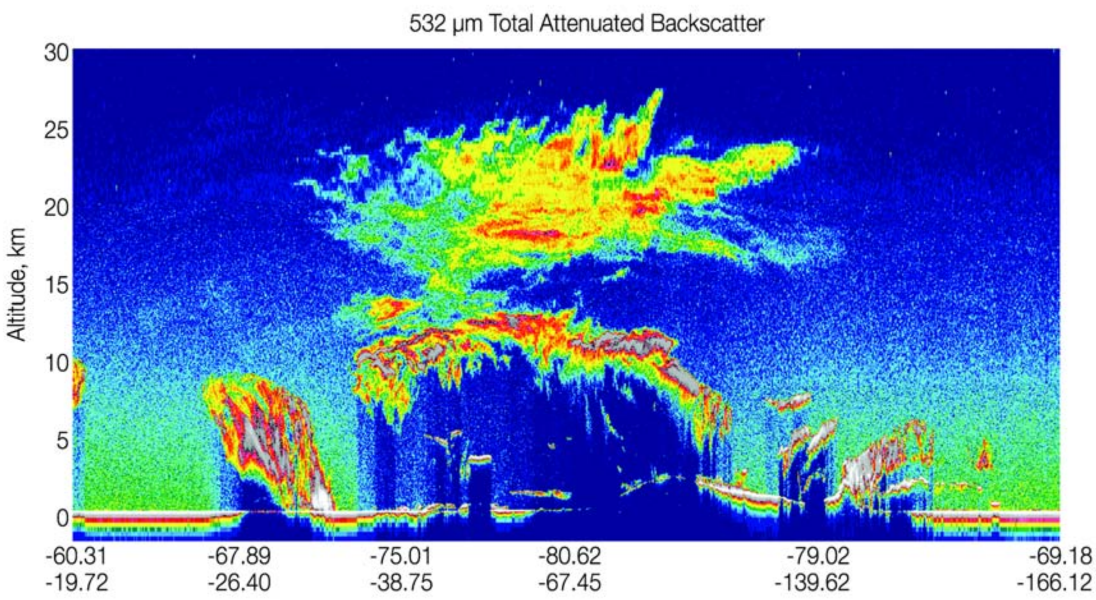
27–29 June 2007—3RD HEPEX WORKSHOP, Stresa, Italy.

PRECIPITATION ASSESSMENT SHOWS LITTLE GLOBAL TREND BUT CAPTURES ENSO



Global Precipitation Climatology Project monthly precipitation anomalies (mm day^{-1}) for total (top), oceans (middle), and land (bottom) for 30°N–30°S (tropical). (Figure is extended to 2005 to include the most recent data available.) Vertical dashed lines indicate the months of significant volcanic eruptions. The thin black curves indicate the El Niño-3.4 Sea Surface Temperature Index (°C). Heavy lines indicate the 12-month running mean. Note that land-only (ocean-only) observations show a clear tendency for dry (wet) conditions in association with ENSO, whereas the total shows little relation to ENSO. See article by A. Gruber and V. Levizzani on page 6.

CALIPSO'S UNIQUE POLAR CLOUD DATA WILL HELP SCIENTISTS LEARN MORE ABOUT THE FORMATION OF THE OZONE HOLE



A dramatic example of CALIPSO's capabilities, the figure shows an extensive Polar Stratospheric Cloud (PSC) over Antarctica on 24 July 2006. PSCs play an essential role in the formation of the ozone hole every year. See article by D. Winker et al. on page 4.