Global Energy and Water Cycle Experiment

GEWEX NEWS

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Changes in Leadership of the GEWEX Scientific Steering Group

Thomas P. Ackerman

After many years as a member of the GEWEX Scientific Steering Group, Prof. Thomas Ackerman has assumed leadership of this important advisory group. GEWEX welcomes him as the new SSG Chairman (see page 3).

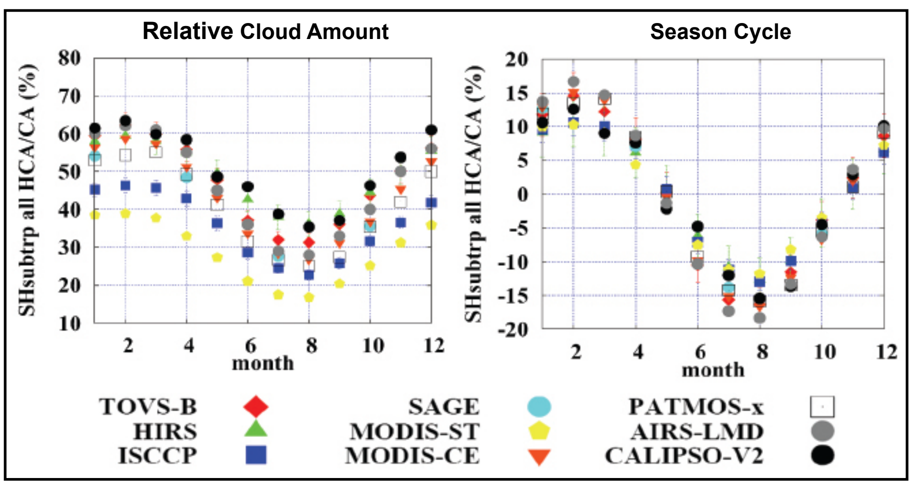
After 9 years as Chairman of the GEWEX Scientific Steering Group, Prof. Soroosh Sorooshian has stepped down. Two former IGPO Directors give tribute to the man whose exceptional leadership and guidance have shaped the science and direction of GEWEX (see pages 4 and 5).

Soroosh Sorooshian

GEWEX Radiation Panel Providing Key Contributions for Improving Models and Climate Prediction

Evaluation of Global Cloud Data Products (see figure below and article on page 6)

Intercomparisons of GCM Radiative Transfer Codes (see page 8)



Climatological monthly averages of high cloud amount are given for the latitude band 0° to 30°S. Whereas the absolute values depend on instrument sensitivity (as well as retrieval method), the seasonal cycles are very similar. The large seasonal cycle can be explained by the shift of the Inter-Tropical Convergence Zone. The seasonal cycle is smallest in the southern hemisphere mid-latitudes. See article by C. Stubenrauch et al. on page 6.

Water in a Changing Climate: Progress in Land-Atmosphere Interactions and Energy/Water Cycle Research

Deadline for Submitting Abstracts Extended (See Website)

http://gewex.org/2009gewex_ileaps_conf.html

Global Energy and Water Cycle Experiment GEWEX WCRP

6th International Scientific Conference on the Global Energy and Water Cycle

24-28 August 2009 Melbourne, Australia

iLEAPS

2nd Integrated Land Ecosystem-Atmosphere Processes Study Science Conference

iLEAPS/GEWEX Early Career Scientist Workshop (ECSW) 20—22 August

See page 17 for details about ECSW and Conferences

Commentary

Reviewing Accomplishments and Planning for the Future

Peter J. van Oevelen
Director, International GEWEX Project Office

This year started with a big change for GEWEX, as Prof. Soroosh Sorooshian stepped down as Chairman of the GEWEX Scientific Steering Group (SSG) and gave the reigns to Prof. Thomas Ackerman. We thank Soroosh for his leadership over the last 9 years and hope that he will stay involved with GEWEX and the World Climate Research Programme (WCRP), where he will be extremely valuable due to his expertise, demeanor and professional network. We look forward to working with Tom, as he has been supportive to and active within GEWEX for many years.

Stimulated by the Joint Scientific Committee (JSC) meeting of last year and by the joint GEWEX-Climate Variability and Predictability Project (CLIVAR) Executive meeting last August, we have begun working on a document that highlights the successes of GEWEX over the past 10 years. Given the breadth of GEWEX activities and its many worthwhile products and results, it will not be easy to truly capture the accomplishments from all of our contributors, but we will do our best with your help to present this. I thank those who have contributed to this effort already: your input truly shows the remarkable progress made.

This brings me to what I believe is going to be an extremely important topic this year: the future direction of WCRP and its core projects. The projects have been asked to prioritize their activities and to indicate which areas should or could be downscaled. With these imminent changes underway, it is important that we realize what our heritage is, what has been achieved under the GEWEX umbrella and, most importantly, how we can make these both stronger and better. These activities are all founded upon voluntary contributions, based on a clear interest from individuals and numerous groups of scientists to work in an international setting on a number of topics, ranging from producing data products and enhancing model parameterizations to establishing global measurement networks. It is at this level, often buried deep within the organizational hierarchy, where true progress is made.

It is my belief that JSC discussions should focus at the macro scale on where WCRP would like to see additional or improved activities and international collaboration. The large number of activities within WCRP should encourage greater flexibility in responding to arising societal needs, to safeguarding activities that are difficult to fund (for example, *in situ* observations) and to making new alliances between international organizations. We have seen many of the current activities that naturally formed under the umbrella of a core project move on to a different entity in order to better prosper, thanks to this flexibility. By focusing on the big picture, rather than limiting activities on a small scale, we can better enable each project to reach its ultimate goals as we plan for the future of GEWEX and WCRP. In such a process it is a challenge to strike the right chord with each of the communities involved and at the same time find the right balance between progress made and the change that is needed for the future; such a conservation of progress and vision has always, however, been part of GEWEX and will continue to be one of its greatest strengths.

It is important at this juncture to thank our sponsors—not only those organizations and programs who have directly supported the International GEWEX Project Office but also those that have contributed and funded essential work taking place under the umbrella of WCRP and GEWEX. We often make fun of the great abundance of acronyms that we deal with, but this over-abundance shows the organic growth of our activities, a widespread acknowledgment of the importance of our work, and a high level of support by a diverse group of organizations and countries.

One forum where we are really excited to showcase our science efforts this year is with our International Geosphere-Biosphere Programme counterpart, the Integrated Land Ecosystem-Atmospheric Processes Study, at the jointly organized science conferences to be held 24–28 August in Melbourne, Australia. Both organizations have done an excellent job in putting together an attractive package of science presentations, working group and panel meetings and an early career scientist workshop that will enable a greater level of collaboration in water, energy, and biogeochemical sciences. Please join us there.

Contents

GEWEX Welcomes a New Scientific Steering Group Chairman

The transfer of the GEWEX Scientific Steering Group (SSG) chairmanship from Prof. Soroosh Sorooshian to Prof. Thomas P. Ackerman was endorsed at the 29th Session of the Joint Scientific Committee of the World Climate Research Programme in March 2008.

Prof. Ackerman is the Director of the Joint Institute for the Study of the Atmosphere and Ocean (JISAO), a National Oceanic and Atmospheric Administration and University of Washington (UW) cooperative institute dedicated to understanding climate and its effects. In addition, he is a Professor of Atmospheric Sciences at UW and formerly a Battelle Fellow at the Pacific Northwest National Laboratory (PNL) in Richland, Washington. While at PNL (1999–2006), Prof. Ackerman served as Chief Scientist for the Atmospheric Radiation Measurement Program, the largest global change research program supported by the U.S. Department of Energy. He was Professor of Meteorology at Pennsylvania State University from 1988 to 1999, as well as Associate Director of the Earth System Science Center. Earlier, he was a staff research scientist at the National Aeronautics and Space Administration (NASA) Ames Research Center in California.

Prof. Ackerman received his Ph.D. in Atmospheric Science in 1976 from UW and has extensive experience in climate research including both observational and modelling studies. He has authored or co-authored nearly 200 journal articles, which include studies of the climate influence of volcanic eruptions and asteroid collisions, the impact of clouds on earth climate, and the use of ground-based and satellite observations to study clouds and climate. He pioneered the use of millimeter wavelength radar for cloud studies and serves on the science teams of two NASA satellite observing systems.

Prof. Ackerman has been a member of the GEWEX SSG since 2001. He is the recipient of the NASA Distinguished Public Service Medal and the Leo Szilard Award for Science in the Public Interest, awarded by the American Physical Society. He is a fellow of the American Association for the Advancement of Science and has also received several awards for his research papers, including one from the World Meteorological Association.

New GEWEX Scientific Steering Group Members

Dr. William K.-M. Lau is Chief of the Laboratory for Atmospheres at the National Aeronautics and Space Administration Goddard Space Flight Center in Greenbelt, Maryland, USA. His areas of interest are monsoon climate and variability, aerosol and atmospheric water cycle interaction, and climate variability and change.

Prof. Howard S. Wheater is a Professor of Hydrology and the Director of the Imperial College Environment Forum at the Department of Civil and Environmental Engineering of the Imperial College in London. His areas of interest are hydrological processes; hydrological and precipitation modelling; flood risk, water resources and water quality management; and arid zone hydrology.

ESA/GEWEX Water Cycle Project Kickoff Conference in November 2009

The Water Cycle Multimission Observation Strategy (WACMOS) is a collaborative project of the European Space Agency (ESA) and GEWEX to establish a sound scientific basis for the development of novel observations and products for the water cycle that exploit the new capabilities in Earth observations offered by ESA missions. WACMOS will focus on four aspects of the water cycle: evapotranspiration, water vapor, clouds and soil moisture.

To kickoff WACMOS ESA, GEWEX, the European Geophysical Union, and the International Society for Photogrammetry and Remote Sensing are organizing the conference, "Earth Observations and Water Cycle Science: Towards a Water Cycle Multi-Mission Observation Strategy," to be held in Frascati, Italy on 18–20 November 2009. Abstracts are due 30 April 2009. For more information about the conference, see: *http://dup.esrin.esa.int/STSE/news/news159.asp*.

Gridded Precipitation Data Sets for Asia

The Asian Precipitation—Highly Resolved Observational Data Integration Towards Evaluation of Water Resources (APHRODITE) Project creates state-of-the-art daily precipitation data sets (0.5° × 0.5° and 0.25° × 0.25°) for all of Asia. Data are collected from between 4,000 and 10,000 rain gauge stations (depending on the time of year) across Asia, representing 2.5 to 5.5 times as much data as are available through the Global Telecommunication System network. Products have been released for 1980–2001 for East Asia and Russia, and 1979–2001 for the Middle East.

The next version, which will have rain gauge data for 1961–2004 over the domains of Monsoon Asia (extended from East Asia), Russia and the Middle East, is scheduled for release in early 2009. These data sets are available free of charge for scientific research. For more information, see: *http://www.chikyu.ac.jp/precip*.

Tribute to Prof. Soroosh Sorooshian, Chair, GEWEX SSG 1999 – 2008

Lasting Legacy for GEWEX and Interdisciplinary Science

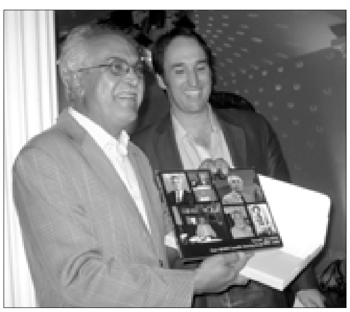
Paul D. Try
International GEWEX Project Office

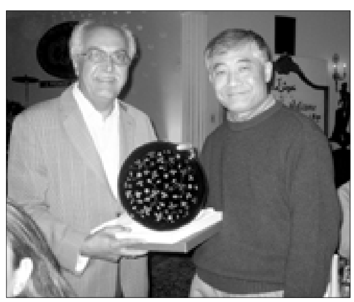
In general, the GEWEX community expects the Chairman of the GEWEX Scientific Steering Group to provide broad scientific guidance and promote our research efforts to the upper levels of organizations with related scientific interests. Prof. Soroosh Sorooshian successfully delivered this, as well as an unexpected exceptionally high level of involved, concerned, insightful, connected, and well-grounded continuous attention that has kept GEWEX moving ahead on all levels and in all aspects of its scientific responsibilities.

Soroosh's finesse and remarkable diplomatic skills are well known, but his ability to perceptively cut across the complex and interrelated scientific disciplines, agency objectives, and international interests to produce a way forward has been of major benefit to every GEWEX component. While to some our scientific achievements seem to develop at a snail's pace to some, to many others of us the interdisciplinary aspects of the movements that Soroosh has championed have moved foward at a rapid pace, and indeed have been of the greatest benefit to achieving our overall objectives. While quietly moving us forward, Soroosh was always there to remind us of the need to show, apply and deliver the societal benefit of our efforts (i.e., how can/will our results be applied to a societal need). Soroosh had a knack for sifting through voluminous research results or international/interagency report conclusions and picking out key areas where not enough had been done or where the main difficulties were to be found in the conclusions, and then raising the issues to the highest levels within the community and governmental organizations. Many of you are aware of Soroosh's continuing reminders to all levels of administration (e.g., the Intergovernmental Panel on Climate Change) of the fundamental problem of climate change research and results not providing significant consideration of the observation and prediction of precipitation and related water resource applications.

While keeping us all well grounded in considering the results of our progress, Soroosh was always addressing the larger issues of how we achieve better interdisciplinary cooperation. His significant behind-the-scene efforts throughout numerous activities of the American Meteorological Society (AMS) almost singlehandedly brought hydrology to the forefront of many of the AMS activities, resulting in the implementation of the new Journal of Hydrometeorology and a significant increase in the number of hydrologists being elected as a Fellow of the AMS.

With all of the diverse activities in which Soroosh was deeply involved, I am always amazed at how he is able to maintain such a personal involvement with his colleagues and their families. Soroosh makes everyone feel they are part of his own extended family and a friend for life. Wishing the best for Soroosh in his future endeavors is wishing the best for Society as a whole. Soroosh may be moving on by title or position, but I believe he will always be a part of GEWEX.





The three chairs of the GEWEX SSG. Left to right: Soroosh Sorooshian (1999–2008), Moustafa Chahine (1989–1998), Thomas Ackerman (2009–present).

Photos of Soroosh Sorooshian taken during the week of the February 2009 GEWEX-SSG Meeting held in Irvine, California and during his tenure as Chairman.

Tribute to Prof. Soroosh Sorooshian, Chair, GEWEX SSG 1999–2008

The Super-Colleague: A New GEWEX Innovation

Richard Lawford
International GEWEX Project Office

Super-cells, super-parameterizations, and supercomputers have all played important roles at GEWEX. However, during the past decade GEWEX added an even more critical contribution to its inventory of super-phenomena—the super-colleague. The paragraphs that follow describe the features of this new phenomenon and the features that were used to identify it and validate its reality.

The super-colleague has a number of features that make him stand out from regular or even highly esteemed colleagues. While the criteria are inevitably subjective, the presence of all these features support the broad assessment of an individual in this category. Virtues that are expected in a super-colleague are commitment, judgment, diplomacy, insight, respect and empathy, to name some of the obvious ones. In my mind, Prof. Soroosh Sorooshian, the recently retired chair of the GEWEX Scientific Steering Committee (SSG), fully meets these criteria and deserves recognition as a super-colleague.

Given that this designation is new, it is necessary to provide examples to validate this claim. The evidence presented here is primarily empirical but very representative and repeatable nevertheless. My involvement with Soroosh as a member of the GEWEX community extends back over one and a half decades. When I first met Soroosh he was a Principal Investigator for a project in the GEWEX Continental-scale International Project (GCIP). Shortly afterwards, he became Chair of the National Academy of Sciences GEWEX Panel. In these two settings we played different roles: I was the GCIP project manager who had to pass along budget cuts to his GCIP project, and shortly after he was the Chair of an Academy Panel that was reviewing GCIP. In both cases, through his commitment to GEWEX first, he showed that science was the priority for him, and not funding or personal recognition. This commitment carried over to his 9 years as Chair of the GEWEX SSG, a service to the community in which he nobly bore the GEWEX cause from the winter cold in Hamburg to the heat of Zanzibar.

In terms of fair judgment, Soroosh has been exemplary. When situations became blurry and people proposed several versions of reality of the future, Soroosh would pursue the facts before he would develop a position. Then he would convincingly argue his case or negotiate a resolution with finesse and remarkable diplomatic skills. His skills served GEWEX well through the years. He gave GEWEX influence because he personally cultivated the art of influencing. Soroosh was welcome in every science manager's office in Washington, DC, regardless of their level. He made a point of meeting important players and making sure the important players would remember who he was and why they needed to hear his views.

Soroosh had excellent intuition about scientific questions and about people and situations. Although he was a hydrologist who found himself as the lone voice in a midst of meteorologists and oceanographers, he understood the central commonalities between the sciences and could promote collaboration or identify alternative approaches in problem solving because of his experience and his holistic view of problems and processes. In fact, the World Climate Research Programme looked to Soroosh to introduce more hydrological science and water resource applications into its program. The Hydrologic Applications Project and the Hydrological Ensemble Prediction Experiment are two hydrology-related projects that emerged while Soroosh was SSG Chair.

Soroosh had remarkable success in building and maintaining rapport with his colleagues, using respect and hospitality to achieve this goal. In working with Soroosh over the years, I noted that it didn't matter if it were a first-year student or a President of a university, Soroosh would show that person respect. His hospitality is legend, a product of an eastern heritage that we in North America never have effectively learned. Of course his wife Shirin has played a critical role in his effectiveness here—Soroosh always was excellent in coordinating team work and his family is a tribute to his success in this area.

When problems arose, one could always count on Soroosh to be empathetic. It is not clear to me how many hundreds of people feel the same way. I cannot recall all of the cities where his cell phone rang during a walk after a long day of meetings, and after sympathizing with the person on the phone for a number of blocks, giving the impression that his best friend is in horrible trouble, the call has ended and Soroosh explains that a colleague's child is sick, or a student has had visa problems and has been unable to get back into the U.S., or some other unfortunate incident has happened. These people all look to Soroosh not only as a leader but as a personal friend who will understand their problems and help them if it is humanly possible. And Soroosh does listen and always tries to help.

GEWEX has accomplished a lot under Soroosh's leadership. Some actions, such as the merger of the Coordinated Enhanced Observing Period and the GEWEX Hydrometeorology Panel into the Coordinated Energy and Water-cycle Observations Project (CEOP), probably would not have happened if Soroosh had not applied his diplomacy, insight and persistence to make them happen. Other successes, such as CEOP, were the efforts of a number of people who worked together under his leadership to make things happen. While a number of other activities would likely have happened without the special touch of Soroosh, they would not have taken place with such smoothness, finesse and success. Not only did he provide oversight and leadership but he would make sacrifices to do jobs that no one else was available to do.

It has been my pleasure to work with Soroosh very closely, especially during my years as Director of the International GEWEX Project Office, and I have enjoyed the experience. Soroosh is a super-colleague by my estimate at least, and I wish him and Shirin much happiness, health and continued success in the coming years.

Assessment of Global Cloud Climatologies

Claudia Stubenrauch[1], Stefan Kinne[2], and the GEWEX Cloud Assessment Team
[1]Centre National de la Recherche Scientifique (CNRS)/Institut Pierre Simon Laplace (IPSL), Laboratoire de Météorologie Dynamique (LMD), Palaiseau, France; [2]Max Planck Institute for Meteorology, Hamburg, Germany

Only satellite observations provide a continuous survey of the state of the atmosphere over the globe at the space-time scales at which cloud processes occur and their record length now exceeds more than 25 years. To resolve the diurnal cycle of clouds, the GEWEX International Satellite Cloud Climatology Project (ISCCP) uses data from a combination of polar orbiting and geostationary satellite radiometers. During the past decade, other global cloud climatologies have been established from various instruments. In order to be useful for climate studies and the evaluation of general circulation models, it is necessary to determine the accuracy and error sources of these cloud products. The GEWEX Cloud Assessment Project was thus initiated by the GEWEX Radiation Panel in 2005 to evaluate the reliability of available global long-term cloud data products, with a special emphasis on the GEWEX cloud products from ISCCP.

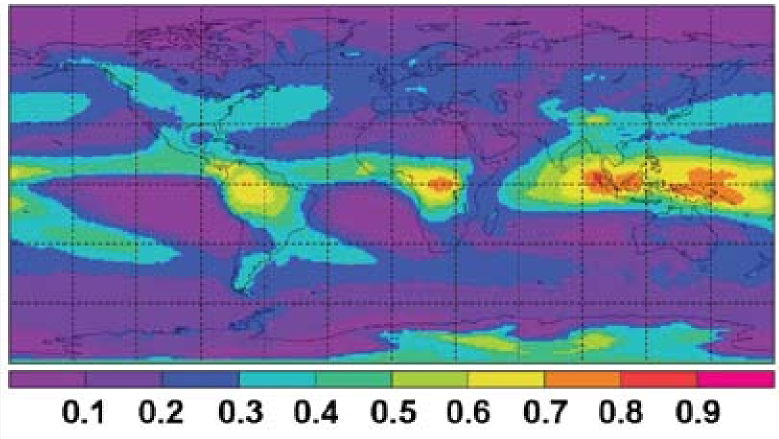
In 2007, the global cloud climatologies participating in the Cloud Assessment included ISCCP (W. Rossow, City University of New York), AVHRR Pathfinder Atmospheres—Extended (PATMOS-x) [(A. Heidinger, National Oceanic and Atmospheric Administration (NOAA)], High Resolution Infrared Radiation Sounder (HIRS)-NOAA (D. Wylie, University of Wisconsin), Television and Infrared Observation Satellite (TIROS) Operational Vertical Sounder (TOVS) Path-B (C. Stubenrauch, CNRS/IPSL LMD) and the Stratospheric Aerosols and Gas Experiment (SAGE; P.-H. Wang, Science and Technology Corporation). Global cloud climatologies obtained from the new generation of instruments aboard the National Aeronautics and Space Administration (NASA) Earth Observing System platforms and the A-Train satellite also participated in the assessment, including the Moderate Resolution Imaging Spectroradiometer (MODIS) Science Team (S. Ackerman, the Cooperative Institute for Meteorological Satellite Studies (CIMSS); S. Platnick, NASA Goddard Space Flight Center) and the MODIS Clouds and the Earth's Radiant Energy System (CERES) Team (P. Minnis, NASA Langley Research Center (LaRC)), as well as the Atmospheric Infrared Sounder (AIRS)-LMD (C. Stubenrauch, CNRS/IPSL LMD) and Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) Mission (D. Winker, NASA LaRC). Surface observations were also made available by S. Warren (University of Washington). Monthly averages of total cloud amount and the cloud amount of high, mid-level and low-level clouds (for which cloud top pressure is needed) and their seasonal cycles were also studied.

In 2008, the assessment was extended to other essential cloud properties such as cloud temperature, optical depth, emissivity and bulk microphysical properties. Four additional teams joined the assessment: the Multi-angle Imaging SpectroRadiometer (MISR – DiGirolamo, University of Illinois), the POLarization and Directionality of the Earth's Reflectances sensor (POLDER – J. Riedi, CNRS Laboratoire d'Optique Atmospherique), the Along-Track Scanning Radiometer-2 (ATSR2 – C. Poulsen, Rutherford Appleton Laboratory) and CloudSat (G. Mace, University of Utah).

One outcome of the assessment was finding that the different data sets compared better when high, mid-level and low-level cloud amount was scaled by total cloud amount (see figure on page 1). This approach may also be useful for comparisons with climate models, although it should be noted that passive remote sensing gives only information on the uppermost cloud layer. About 40% of all clouds are high clouds [with cloud pressure smaller than 440 hectopascals (hPa) and about 40% are single-layer low-level clouds (with a cloud pressure larger than 680 hPa)]. Differences in relative high cloud amount (scaled by total cloud amount) are related to different instrument sensitivities (e.g., active lidar CALIPSO as well as limb-sounding SAGE are the most sensitive instruments to very thin cirrus clouds). The relatively high spectral resolution of infrared (IR) sounders (TOVS/HIRS and AIRS) makes these the passive instruments most sensitive to cirrus—the sounders only miss 10% and 5% of all high clouds in the tropics and mid-latitudes, respectively (being subvisible cirrus). ISCCP misses an additional 15% and 10% of high clouds in the tropics and mid-latitudes, respectively. Thin cirrus (often above lower clouds) are often misidentified as mid-level clouds. The MODIS Science Team algorithm misidentifies some thin cirrus as low-level clouds. The seasonal cycles of the different cloud properties, however, agree very well. Active instruments CALIPSO and CloudSat give insight to the vertical structure of clouds and help to evaluate the cloud properties determined from passive remote sensing. For further progress in climate research, the synergy of different data products and data sets becomes very important.


Participants of the Third GEWEX Cloud Assessment Meeting, 21–23 July 2008.

First comparisons were presented at the Third GEWEX Cloud Assessment Meeting, held 21–23 July 2008 in New York. Key results presented at the meeting include the following:

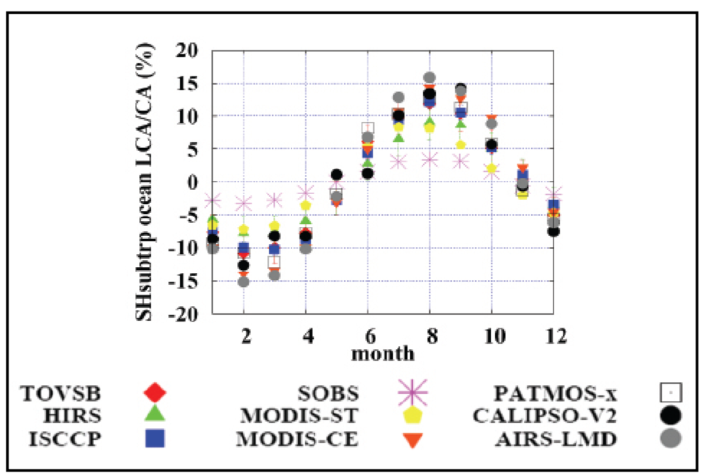


Geographical map of high cloud amount (averaged over 6 years from AIRS-LMD). In general, geographical cloud structures of the different data sets agree quite well, with a maximum of high clouds in the Inter-Tropical Convergence Zone.

- Global average total cloud amount is about 70% (± 5%) with 5%–15% more clouds over ocean than over land.
- Seasonal cycles agree very well. The seasonal cycle of single-layer low-level cloud amount over ocean is largest in the latitude band 0°–30°S, linked to the stratocumulus regions off the western coasts of the continents. Surface observations suggest that the seasonal cycle of all low-level clouds is small.
- In general, geographical cloud structures agree well, with a maximum of high clouds in the Inter-Tropical Convergence Zone (up to 80%).
- Combined information from space-borne lidar and radar provides a reference for passive remote sensing; however, the sampling is much sparser.
- There are few single-layer mid-level clouds in the tropics (about 5%).
- Differences in relative high cloud amount (scaled by total cloud amount) can be mostly understood by different instrument sensitivities.
- Average high cloud temperature depends on the instrument sensitivity to thin cirrus.
- The seasonal cycle of temperature of single-layer low-level and of high clouds decreases from the polar regions towards the tropics. Detection thresholds also affect cloud optical depth, as more sensitive retrievals contribute with a higher frequency to small optical depths. Furthermore, the type of averaging (linear or logarithmic) has an impact. Comparisons should thus focus on histograms and detection thresholds because information on cloud optical depth associated with cloud amount is more meaningful than cloud amount alone.
- With the exception of optically thick clouds, Liquid Water Path retrieved from reflectance and microwave methods agrees generally well between 60°N and 60°S, especially for overcast stratus. There is also reasonable agreement for the diurnal cycle. Cloud microphysical retrievals refer to cloud particles near the cloud top when using visible (VIS)/near-IR techniques. Retrieved droplet sizes depend slightly on the selected near-IR channel. Nevertheless, it was shown that effective droplet size of water clouds is smaller over land than over ocean. Effective ice crystal size retrieval based on spectral differences of IR emissivity provides an average over the cloud depth of semi-transparent cirrus. Therefore, averages are slightly larger than those obtained from methods using VIS/near-IR techniques. Absolute values also depend on assumptions on particle shape and size distributions.

In summary, climatological monthly averages as well as seasonal variabilities of the different cloud properties should help to evaluate climate models. The analysis of correlation between cloud properties and atmospheric properties is important; however, the analysis of trends has to be handled carefully because diurnal drifts, sensor degradation and the switch to different satellite platforms can complicate the detection of trends in long-term records. Apparent trends may be an artifact or well within natural variability. Therefore, it is necessary to stratify the results by land and water and climate regime.

To further the understanding of the differences it was concluded that in addition to the monthly averages, variabilities as well as distributions of the cloud properties are needed. Level 3 1 x 1 degree monthly cloud data (statistics, histograms and joint histograms) in a common format (netCDF) are currently requested from all participating teams. These data sets will be made available via the Cloud Assessment web site at *http://climserv.ipsl.polytechnique.fr/gewexca* for easy access to the science community once the necessary evaluation and documentation are finalized. The report of the Cloud Assessment, to be completed by the end of 2009, will state the strengths and limitations of individual data sets and the ISCCP cloud climatology record.



The seasonal cycle of single-layer low cloud amount over ocean is largest in the latitude band 0° – 30°S, linked to the stratocumulus regions off the Western coasts of the continents. Surface observations suggest that the seasonal cycle of all low clouds (including multi-layer situations) is small.

CIRC to Provide Key Intercomparisons of GCM Radiative Transfer Codes Prior to Next IPCC Assessment

Lazaros Oreopoulos[1] and Eli Mlawer[2]
[1]NASA Goddard Space Flight Center, Greenbelt, MD, USA; [2]Atmospheric & Environmental Research, Lexington, MA, USA

The Continual Intercomparison of Radiation Codes (CIRC) Project was initiated to evaluate the performance of radiative transfer (RT) codes used in global climate models (GCMs). Such an undertaking has not been attempted on a systematic scale since the GRP Intercomparison of Radiation Codes in Climate Models (ICRCCM; Ellingson and Fouquart, 1991) that took place over 15 years ago. The motivation for CIRC is the current routine availability of radiation data measured simultaneously with important radiative properties of the atmosphere like temperature and humidity by the U.S. Department of Energy Atmospheric Radiation Measurement (ARM) Program and similiar initiatives, such as Europe's Cloudnet Project. The significance of continuous measuring programs for improving RT parameterizations has been advocated for many years (Ellingson and Wiscombe, 1996), but the necessary level of maturity in understanding instrument capabilities, retrieval algorithms and analysis techniques needed to take full advantage of the wealth of data produced by these programs has only recently become a reality.

The use of ARM data for the intercomparison of radiation codes is especially attractive due to the availability of the Broadband Heating Rate Profile (BBHRP) Evaluation Product, which has generated time series of calculated atmospheric radiative flux and heating rate profiles for two ARM sites using specifications of atmospheric and surface properties by instruments deployed at the sites. The centerpiece of BBHRP is the suite of radiometric measurements associated with these sites. Comparison of flux calculations and measurements allows refinement of the methodology used for the calculations, resulting in improved quality of the calculated radiation profiles. BBHRP utilizes the RRTM correlated-k RT algorithms (one for the solar and one for the thermal part of the spectrum) developed at Atmospheric and Environmental Research, Inc. (AER) under ARM support. These algorithms are capable of accurately reproducing the fluxes computed by high-resolution (but much slower) line-by-line (LBL) calculations. Since the output quality of BBHRP's RT calculations has been evaluated and refined using radiometric observations at the surface and the top of the atmosphere (TOA), GRP postulated that a subset of BBHRP cases with good radiative flux closure could be used as a reference for evaluating GCM RT algorithms.

Given the designs and capabilities of the RT models to be evaluated and the assumptions built within the BBHRP algorithm, two essential criteria were set for identifying optimal CIRC cases: (1) atmospheric conditions must be homogeneous, and (2) flux closure for four radiative components must be achieved, namely reasonable agreement among measured and calculated shortwave (SW) and longwave (LW) fluxes at the surface and the TOA. The spectral information of the RRTM codes is insufficient for identifying and addressing discrepancies emerging in the calculations of the participating codes. Because of this, selected cases are rerun with the more exact and spectrally detailed LBL codes. An additional benefit of this approach is that, at least for the thermal portion of the spectrum, spectral closure could be assessed using radiance measurements by ARM's surface-based atmospheric emitted radiance interferometer (AERI). Achieving LW spectral closure enhances confidence in the quality of the input since it confirms the realism of the input temperature, humidity and ozone profiles. Selecting ice or mixed phase cloud cases appropriate for the intercomparison has challenges; while the single-scattering properties of liquid cloud droplets are largely well-defined, the corresponding properties of ice crystals are not, and require assumptions about the shape and habit of the crystals. BBHRP flux closure for ice cloud cases can therefore be entirely due to a particular ice crystal optical property parameterization in the RRTM codes being fortuitously appropriate for those cases. Due to this, ice cloud cases were shelved for a later phase of CIRC.

Given the above factors the cases for CIRC's first phase were selected to represent the least demanding scenarios a GCM RT code could encounter: conditions as horizontally homogeneous as possible (as indicated by a low temporal variability in measured surface radiative fluxes), and with the least ambiguous optical properties for atmospheric scatterers. For cloudy cases these conditions translate to contiguous overcast cloud layers of low horizontal cloud water variability with no ice crystals anywhere in the cloud (note that deficiencies of GCM RT codes for complex cloud structures were already documented by Barker et al., 2003). A consequence of introducing LBL calculations as the reference standard was the need to develop a more detailed specification of spectral surface albedo, but this was an effort already underway for other ARM projects. Such an albedo also provides the added flexibility for participating codes to adjust the spectral breakdown of their surface albedo in accordance with the band structure of their models.

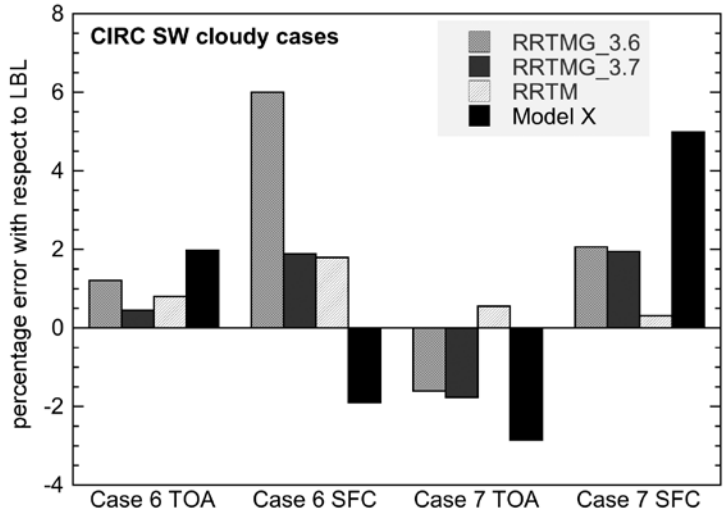
The effort to carefully screen the BBHRP data set for CIRC-appropriate cases culminated in the selection of five cases representing very dry (ARM Alaska site), dry, moderately humid, and very humid conditions (ARM Oklahoma site), and one mid-latitude (ARM Oklahoma site) overcast liquid cloud of relatively high optical thickness (~60 in the visible). A spin-off case was created by doubling the CO_2 concentration of the arctic case, as it was deemed important to evaluate model-produced CO_2 forcings under very dry conditions given the significant spectral overlap of CO_2 and water vapor absorption. The search within BBHRP for another cloud case of more modest optical thickness that would satisfy the CIRC criteria was not fruitful. Following the suggestion of ARM colleagues, such a case was eventually identified in measurements taken by the ARM Mobile Facility deployment in Pt. Reyes, California, which included most of the types of measurements used by the BBHRP effort.

The CIRC web site (*http://circ.gsfc.nasa.gov*) contains all the necessary input fields and instructions on how to run the cases, output from the reference LBL calculations (TOA and surface spectral fluxes, broadband flux profiles and heating rates) and sample code to ingest the data. The web site also contains information on the goals and modus operandi of the project and will soon add documentation on participating codes and the analysis of submissions by registered CIRC participants. Currently, 17 scientists representing seven countries (Australia, Brazil, Finland, France, Russia, the United Kingdom and the United States) have registered as participants and several submissions have been received and are being analyzed. With the recent endorsement of the project by the International Radiation Commission, further expansion of the project's reach is expected.

CIRC seeks to provide standards against which radiation code performance will be documented in scientific publications, in coordinated joint modelling activities such as GCM intercomparisons, and in important international undertakings such as the radiative forcing calculations for the assessment reports of the Intergovernmental Panel for Climate Change. It may prove especially valuable to global modelling groups wishing to intercompare versions of current and future candidate schemes. An example where CIRC is used in this context is when the current Community Atmospheric Model (CAM3) GCM SW and LW RT schemes are compared with with RRTMG-SW and RRTMG-LW, which are faster versions of their RRTM siblings and candidates for future versions of CAM. As can be seen in the figure at the top of page 20, the RRTMG schemes perform better overall for the CIRC cases than the current CAM schemes.

An interesting aspect of this example is that the version of RRTMG-SW initially used for the comparison gave substantial errors for CIRC's thick cloud case (Case 6). Following a rigorous investigation with full flux and heating rate profiles involving several models, it was discovered that the culprit responsible for the disagreement was the relatively low threshold of droplet single scattering albedo for triggering an approximation with no absorption. Setting this threshold to a higher value immediately improved results (see figure on this page, comparing both versions of RRTMG-SW). Remaining discrepancies (as in Case 7) are believed to be due to inadequacies of the two-stream approximations that do not affect RRTM-SW with its multi-stream capability. The obvious advantage of performing such an intercomparison exercise through CIRC is the availability of additional RT models that share common fundamental features with the model under consideration to facilitate error analysis.

While it is understood that the CIRC reference calculations reflect current spectroscopic knowledge and may themselves be imperfect, the intent is to update them whenever algorithmic or database improvements become available. Contributions of alternate LBL calculations by participants are especially welcome and may help to identify overlooked issues or to fill gaps in our reference data set. Already LBL SW submissions that provide full flux profiles have been received, output that the CIRC LBL code (CHARTS) currently cannot produce on a single run.



Above is the percentage of errors with respect to LBL calculations for the two CIRC Phase I cloudy cases of upwelling TOA and downwelling surface shortwave (SW) fluxes for the version of RRTMG-SW initially tested (3.6) and after modification (3.7). Errors are also shown for RRTM-SW and for another two-stream (as RRTMG-SW) RT code that participates in CIRC, but is not identified (Model X). Negative errors indicate higher LBL flux values.

The first order goal of CIRC is to document the performance of participating models relative to reference standards. Ultimately, model performance will be critically evaluated in terms of the accuracy needed to address operational GCM requirements for current and future climate simulations and comparisons with observations. Feedback and contributions from participants and users of the data set and atmospheric radiation practitioners will be essential toward enhancing and enriching the CIRC portfolio of cases and supporting the continuous nature of the CIRC effort.

For more information on CIRC, please contact *Lazaros.Oraiopoulos@nasa.gov* or *emlawer@aer.com*.

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A New Pathway for Absorbing Aerosols' Influence on the Interannual Variability of the South Asian Monsoon

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Aerosol forcing remains the dominant uncertainty and a challenging problem in climate change scenarios. While it is widely documented that anthropogenic activities have significantly contributed to raising the global aerosol concentration in the troposphere, quantification of the influence of tropospheric aerosols on climate has proved difficult because of the large spatial and temporal variability of aerosols, their short lifetimes, their diverse physical and chemical properties, and complex interactions that take place with radiation and microphysical processes. Aerosol particles can influence clouds and the water and energy cycles by directly affecting the radiation balance (the "direct" effect) and by impacting the microphysics of clouds and precipitation (the "indirect" effect). A "semi-direct" effect is also known, consisting of the evaporation of the cloud layer from aerosol absorption of solar radiation, with consequent increase in the amount of solar radiation reaching the surface.

Heavy loadings of aerosols are found in many regions of the globe (e.g., the northern tropical Atlantic, the Amazon, the eastern United States, northern China and the Pacific, and South Asia). Over polluted regions, aerosols can induce a forcing in the atmosphere and at the surface that is up to an order of magnitude larger than that from anthropogenic greenhouse gases, as it is the case for the Indo-Asian haze. Rapid urbanization and population growth in the Indo-Asia-Pacific region has resulted in higher demand of energy and mobility, and thus larger emissions of pollutants. Understanding the effects of aerosols on the spatial distribution and/or duration of summer monsoon rainfall (which accounts for nearly three-quarters of the yearly precipitation over many regions) is important for the health and food security of more than 60% of the world's population.

During the last few years, field experiments [e.g., the Indian-Ocean Experiment (INDOEX), the Aerosol Characterization Experiment (ACE-Asia), the Atmospheric Brown Cloud (ABC) Project] and observational studies, together with new data sources [e.g., remote sensing data, the Aerosol Robotic Network (AERONET) surface-based sun-photometers] have led to a reasonable characterization of the composition [above all, its large black carbon (BC) content] and properties of South Asian aerosols.

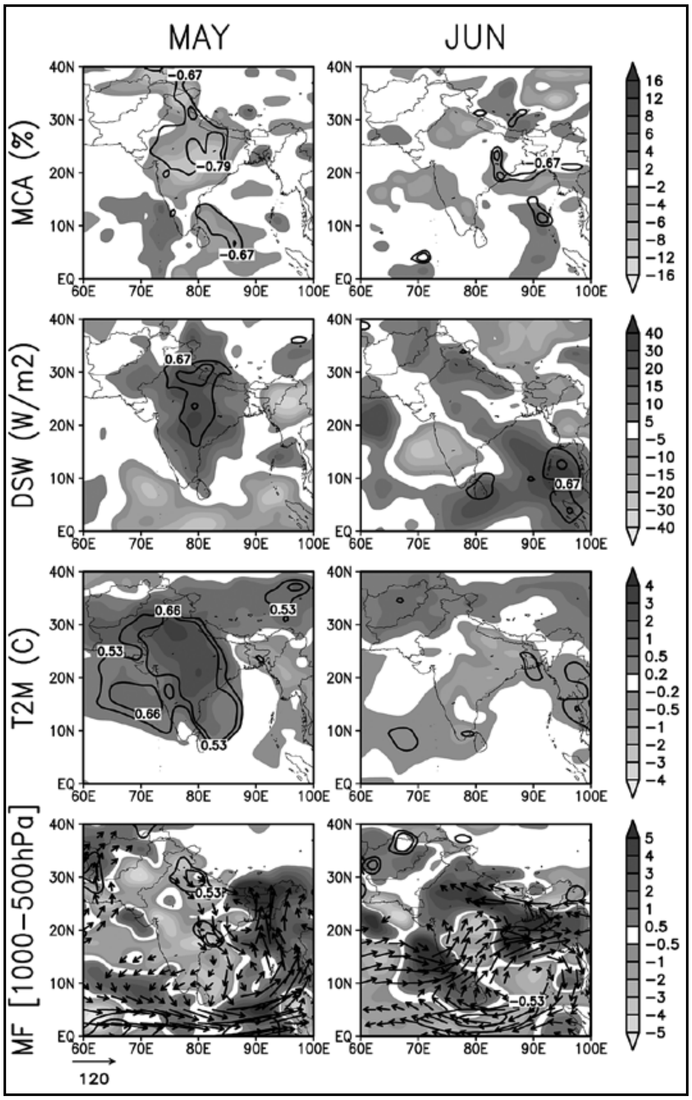
Atmospheric and ocean-atmosphere general circulation models have also been used with quasi-realistic aerosol distributions to investigate the impact of aerosols on the South Asian monsoon, mostly, the climatological rainfall distribution. Several mechanisms have been proposed, including:

- Anomalous heating of air due to shortwave absorption by BC aerosols, which enhances regional ascending motions and thus precipitation in atmospheric general circulation models (Menon et al., 2002).
- Modulation of the summertime meridional sea-surface temperature (SST) gradient from reduced incidence of shortwave radiation over the northern Indian Ocean in preceding winter/spring. Ramanathan et al. (2005) and Chung and Ramanathan (2006) showed that aerosol-induced weakening of the SST gradient (leading to weaker summer monsoon rainfall) more than offset the increase in summertime rainfall resulting from the "heating of air" effect in a coupled ocean-atmosphere model, leading to a net decrease of summer monsoon rainfall. Meehl et al. (2008) recent analysis, also with a coupled climate model but with more comprehensive treatment of the aerosol-radiation interaction, supports findings on the effect of BC aerosols on the Indian summer monsoon rainfall.
- Modulation of the summertime meridional tropospheric temperature gradient from anomalous accumulation of absorbing aerosols against the southern slopes of the Himalayas. The elevated diabatic heating anomaly ("elevated heat-pump," Lau et al., 2006) over the Tibetan plateau in April and May would reinforce the climatological meridional temperature gradient and lead to monsoon intensification in June and July.

It is interesting that none of the proposed mechanisms concern aerosol effects on cloudiness. The aforementioned studies moreover rely heavily on models, many of which are unable to produce realistic spatiotemporal distributions of cloudiness. Climate system models are clearly a valuable tool for investigating the mechanisms underlying aerosol-monsoon interaction, but some caution is necessary as these models are known to have significant, and in many cases, unacceptably large biases in quantities as basic and relevant as the monsoon rainfall distribution and onset. Many of these models also exhibit spurious air-sea interaction over the Indian Ocean in coupled settings (Bollasina and Nigam, 2008).

Our analysis (Bollasina et al., 2008) is complementary to most earlier studies in view of its focus on the interannual variability of aerosol concentration and related monsoon rainfall variations (rather than long-term trend), and because it is observationally rooted. The focus is on the transition period between late spring, when aerosol concentration reaches a peak, and summer, when the monsoon develops. Regional variations of the response are highlighted. The Nimbus-7 Total Ozone Mapping Spectrometer (TOMS) Aerosol Index (AI) provided a measure of monthly averaged aerosol loading for the period 1979–1992.

Excessive aerosols in May over the Indo-Gangetic Plain (IGP) lead to reduced cloud amount and precipitation, increased surface shortwave radiation, and land-surface warming. These relationships are supported by the structure of related vertical motion, diabatic heating and outgoing long-



Regressions on Nimbus-7 TOMS Aerosol Index (blue line in (a) in the figure at the bottom of page 20) during May (left) and June (right) above for (top to bottom): International Satellite Cloud Climatology Project D2 middle cloud amount (MCA, percentage); GEWEX Surface Radiation Budget Project surface downward shortwave radiation (Wm^{-2}, DSW); and ERA-40 m^{2} air temperature (T2M, °C); ERA-40 moisture flux (MF, Kg m^{-1} s^{-1}; vectors) and its convergence (Kg m^{-2} s^{-1}; shaded, convergence is positive) vertically integrated between 1000 and 500 hPa. (a) and (b) in the figure at the bottom of page 20 are for the period 1984–1992. The ±0.53 (±0.67) and ±0.66 (±0.79) contour lines show 95% and 99% confidence levels, respectively.

wave radiation (OLR) anomalies. The June (and July) monsoon anomaly associated with excessive May aerosols is of opposite sign over much of the subcontinent (although with a different pattern). The monsoon circulation strengthens and precipitation increases (see figure above and at the bottom of page 20). The following physical picture is suggested: absorbing aerosols are responsible in May for a decrease of cloudiness over India, which leads, above all, to reduced precipitation, increased shortwave radiation at the surface, and heating of the dry ground. The changes may be attributed to the evaporation of the cloud layer (i.e., the semi-direct effect). Indeed, studies have shown that the resulting decrease in cloud cover and albedo can lead to a warming of the surface whose magnitude can be comparable to the cooling from the direct effect (Ackerman et al., 2000). As the season progresses the monsoon intensifies, and although we have not conducted a modelling analysis to connect the anomalous heating of the land-surface in May to increased monsoon rainfall in June and July over both local and remote regions, we argue that the enhancement of the monsoon results from the increased thermal contrast (originating in May), as in the basic monsoon mechanism. Our analysis also shows that the aerosol impact and operative processes over central and western India are quite different, if not opposite, to those over the eastern subcontinent.

The results described suggest that although anomalously high aerosols are associated with deficient precipitation over India in early spring, internal atmosphere–land-surface feedback actually strengthens the monsoon in subsequent summer months. Land-surface processes, once triggered by anomalous aerosol concentration and induced low cloudiness and precipitation, are important mediators in monsoon evolution and hydroclimate. The finding of the significant role of the land-surface in the realization of the aerosol impact is somewhat novel, as best as we can tell, as only heating of the lower troposphere and solar dimming effects on both land and oceans have hitherto been emphasized. Observations at weekly resolution are currently being analyzed at various lead/lag intervals to identify the sequence of physical processes generating the aerosol influence.

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Highlights of the 21st Session of the GEWEX Scientific Steering Group

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International GEWEX Project Office, Silver Spring, MD, USA

This session of the GEWEX Scientific Steering Group (SSG) was hosted by Prof. Soroosh Sorooshian, Director of the Center of Hydrometeorology and Remote Sensing at the University of California, Irvine (UCI) on 19–23 January 2009. The meeting was chaired by the new SSG Chair, Prof. Thomas Ackerman, Director of the Joint Institute for the Study of the Atmosphere and Ocean at the University of Washington.

We thank Prof. Sorooshian and his staff, in particular his assistant Diane Hohnbaum, for the generous support they provided in organizing the meeting. Furthermore, we thank the following organizations for graciously sponsoring this meeting: Northrop Grumman Space Technology, UCI's Office of the Vice Chancellor for Research, UCI Henry Samueli School of Engineering, and the Institute for Geophysics and Planetary Physics at UCI.

The meeting was opened by Dr. Rafael Bras, Dean of UCI, followed by Dr. Ghassem Asrar, Director of the World Climate Research Programme (WCRP), who thanked Prof. Sorooshian for his 9 years of exemplary service as Chair of the GEWEX SSG. Dr. Asrar then presented him with a letter of appreciation from Michel Jarraud, the Secretary-General of the World Meteorological Organization.

Special presentations given include: The Effects of Dust and Soot Aerosols on Snow and Climate (Charles Zender, Department of Earth System Science, UCI), Innovative Remote Sensing Satellite Development for Earth and Space Science Observations (Brian Baldauf, Northrop Grumman Corp.), and GEWEX-related Research on High-Resolution Precipitation and Regional-Scale Modelling (Xiaogang Gao, Kuolin Hsu, and Bisher Imam, Center for Hydrometeorology and Remote Sensing, UCI).

Participants at the GEWEX SSG Meeting.

In addition to the review of project status, the meeting focused on WCRP Joint Scientific Committee recommendations and action items relevant to GEWEX, most importantly GEWEX program development from Phase II (present) to its sunset date of 2013 and beyond. These recommendations include cross-panel and cross-WCRP project coordination on WCRP cross-cuts (e.g., extremes and monsoons); greater integration of the activities of the three GEWEX panels [the GEWEX Radiation Panel (GRP), the GEWEX Modelling and Prediction Panel (GMPP), and the Coordinated Energy and water-cycle Observations Project (CEOP)]; ensuring the promotion of GEWEX data sets in the next Intergovernmental Panel on Climate Change assessment; continuing GEWEX work on parameterizations and cloud modelling; focusing on hydrological applications for climate science while addressing societal benefits; building data sets for the validation of climate models; and fostering linkages with organizations such as the International Geosphere-Biosphere Project, the International Global Atmospheric Chemistry Program and the Earth System Science Partnership projects.

As part of the High Elevations Project, CEOP has begun planning for a global high elevation watch period. Links between the CEOP Cold Regions Study and several Regional Hydroclimate Projects have now been clearly identified; this work is being coordinated with the WCRP Climate and Cryosphere Project. CEOP Extremes studies have begun focusing on drought, heavy precipitation, floods and low flows and the ways in which these events intermesh. As such, this activity directly contributes to the WCRP Extremes cross-cut.

The first meeting of the newly restructured Working Group on Numerical Experimentation (WGNE) took place November 2008 in Montreal, Canada. In the new set-up, the GMPP chair and the three chairs of the study group are automatically ex-officio members of WGNE. The current GMPP chair (and co-chair of WGNE) has particular responsibility for coordination of the parameterization effort within WGNE. Discussed at length during the meeting was the perception that some parameterizations, most notably those of deep convection, will soon be obsolete due to the emergence of convection-permitting global models. It is the firm opinion of WGNE that the use of such models in global operational numerical weather prediction (NWP) is at least a decade away. Furthermore, the use of parameterizations in operational, seasonal and climate prediction is not likely to occur for an additional decade after that. WGNE therefore strongly urges a reinvigoration and increase in activities related to parameterization research for global models.

SSG members agreed that a further restructuring of GMPP is desirable and suggested that the GEWEX Atmospheric Boundary Layer Study, being a relatively small effort, become part of either the GEWEX Cloud System Study (GCSS) or the Global Land Atmosphere System Study (GLASS). GMPP will remain a strong and essential part of GEWEX that is responsible for modelling development, and is asked to better integrate with CEOP and GRP activities for further model activities.

GCSS, the Atmospheric Radiation Measurement (ARM) Program and the Stratospheric Processes And their Role in Climate (SPARC) Project are collaborating on a new initiative: tropical convection during monsoons as observed in the Tropical Warm Pool—International Cloud Experiment (TWP-ICE). The initiative will focus on differentiating between the physical processes that control the amount of moisture transported to the tropical upper troposphere during monsoon events. GLASS reviewed the success of GMPP in improving parameterization at operational NWP and climate modelling centers and is in the process of writing a synthesis paper.

Under GRP, the Global Precipitation Assessment (WCRP-128) was published in May 2008; the Cloud Assessment is expected to be published at the end of 2009 (see "Assessment of Global Cloud Climatologies" article on page 6). Version 1.0 of the sea surface temperature and version 0.5 of the latent and sensible heat fluxes are available for testing, while SeaFlux plans to finish Version 1 by spring of 2009. The International Satellite Cloud Climatology Project is almost ready to release a new cloud particle size climatology, covering July 1983 – September 2001. All GRP products are preparing for the reprocessing cycle to begin in 2010—key activities within each project are geared towards that goal.

Once the SeaFlux and LandFlux products are in production, GRP will focus on creating composite global water and energy products that combine the various individual products into a consistent product containing all the water and energy states and fluxes. This composite product is envisioned to usher in a new era of interaction between GRP and the modelling community, as well as the satellite providers.

The next session of the GEWEX SSG will be held in New Delhi, India on 25–29 January 2010.

Meeting/Workshop Reports

GEWEX Radiation Panel Meeting

Cheju Island, South Korea
14–17 October 2008

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The 19th Session of the GEWEX Radiation Panel (GRP) was hosted by Byung-Ju Sohn of the School of Earth and Environmental Sciences at Seoul National University (SNU), Korea, and chaired by Chris Kummerow. The meeting was sponsored by the Korean Meteorological Society and the National Institute of Meteorological Research, Korea.

At the 2008 meeting of the GEWEX Scientific Steering Group (SSG), the members approved the following new Terms of Reference for GRP: "The GRP guides GEWEX radiation projects in determining global water and energy fluxes in the atmosphere and the surface, as an element of seasonal-to-interannual climate variability, and the response of the climate system on decadal-to-interannual time scales to changes in anthropogenic forcing." The SSG also supported the new GRP goal to produce data products that can be used for climate trend analysis and developing a global hourly precipitation product. This goal in particular requires GRP to pay closer attention to satellite radiance calibration issues.

GRP is currently focused on reprocessing all products beginning in 2010. This reprocessing will focus not only upon improvements within individual products, but also upon the use of common ancillary data across all products and a new integrated water and energy cycle product that combines basic elements from each of its stand-alone products. The integrated data should be useful to process studies.

The host country institutions gave six science presentations. B.-J. Sohn gave a talk on the impact of water vapor on measured longwave cloud radiative forcing. S.-C. Yoon (School of Earth and Environmental Sciences, SNU) gave a presentation about the Atmospheric Brown Clouds (ABC) East Asia Regional Experiment with emphasis on the Gosan super observatory, as well as the unmanned aerospace vehicles campaigns in Cheju (the Cheju ABC Plume Monsoon Experiment). K.-L. Kim [Korea Meteorological Administration (KMA)] presented the status of the Korean geostationary Communication, Ocean and Meteorological Satellite (COMS) that is scheduled to be launched in June 2009. Data from COMS will be available 6–9 months after launch to authorized users of the research community via the KMA Internet home page. H.-S. Lee (the National Institute of Meteorological Research, South

Participants at the GEWEX Radiation Panel Meeting in South Korea.

Korea) gave an overview of the Predictability and Observations Experiment to assess the suitability of using the Weather Research and Forecasting model as the operational KMA forecast model. Mi-Lim Ou (KMA) presented the validation activities planned for the Global Precipitation Mission.

Reports were given from the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), the Japan Aerospace Exploration Agency (JAXA), the Japan Meteorological Agency, the Instituto Nacional de Pesquisas Espaciais (INPE) and the U.S. National Oceanic and Atmospheric Administration (NOAA). J. Schmetz (EUMETSAT) noted that the rapid scanning capabilities (10–15 min. full disk) of Meteosat Second Generation and Third Generation systems will provide data needed for GRP process studies. JAXA's presentation summarized the Earth Observations Missions that it is currently developing, while INPE reported that they have taken over the collection of the Geostationary Operational Environmental Satellite-10 data from NOAA; they are working on providing these data to the International Satellite Cloud Climatology Project (ISCCP). In the NOAA report, GRP received positive news about the restoration of the Clouds and the Earth's Radiant Energy System (CERES) and the Total and Spectral Irradiance Sensor to the National Polar-orbiting Operational Environmental Satellite System mission. These, together with acknowledgment of concrete funding for starting the Climate Data Records at the National Climatic Data Center (NCDC), were all perceived as positive steps.

Project reports started with ISCCP, which celebrated its 25th anniversary of data processing on 1 July 2008. A symposium was held at the National Aeronautics and Space Administration (NASA) Goddard Institute for Space Studies (GISS) on 23–25 July to mark the occasion, to review the status of knowledge about clouds and their role in the climate's radiation and water cycles, and to discuss future satellite cloud measurements and analyses. The data now span the period of July 1983 – June 2007. A primary focus of ISCCP has been to convert to the higher space time resolution (B1 data) and transition to operational data processing. Over the next few years, ISCCP code will be updated to provide an operational and more standardized data set. ISCCP is looking into the reprocessing of sounder data versus the possible use of the Modern Era Retrospective-analysis for Research and Applications (MERRA) reanalysis as the source temperature/humidity structure for the next version of the product.

The Global Precipitation Climatology Project (GPCP) continues to process data routinely with research products being delivered about three months after observation time. While processing is on temporary hold until new gauge analysis is incorporated, products are generally available through May/June 2008. Consistency among the GPCP and Tropical Rainfall Measuring Mission satellite products was shown. Routine production of monthly and pentad GPCP products is now reaching 29 years and there are over 900 journal publications making use of the GPCP data sets. The Global Precipitation Assessment was published in May 2008 as a WCRP report. GPCP is planning to replace the current algorithm with one that produces the instantaneous rainfall products needed as GPCP strives for higher space and time resolution products. A 3-hr, 0.25° spatial resolution product is planned for the next reprocessing cycle. While not directly supported by the GPCC daily rain gauge data, GPCP will ensure that the higher space and time resolution products always add up to the monthly 5° grids that constitute the basis for the GPCP product.

The Surface Radiation Budget (SRB) Version 3 is being processed now and the shortwave (SW) product is complete; the longwave (LW) product will be processed next. Much of the SRB effort has gone into validation, specifically against the Baseline Surface Radiation Network (BSRN) sites. Agreement among products is quite good. Future efforts continue to focus on validation and assessment of the flux products. Algorithm upgrade activities include:

- Developing improved parameterizations for the conversion of narrow-band radiance to flux in the GEWEX SW model using new CERES information in collaboration with Rachel Pinker of the University of Maryland.
- Assessing new temperature and humidity meteorology for processing in collaboration with NASA GISS. A new High-Resolution Infrared Radiation Sounder-based data set and MERRA will be evaluated to improve the homogeneity between ISCCP and SRB products.
- Improving aerosol treatment in SW and LW codes in collaboration with NASA Goddard Space Flight Center and GISS, with assessments relative to GISS, the Global Aerosol Climatology Project (GACP) and the Global Ozone Chemistry Aerosol Radiation Transport.

Ellsworth Dutton reported that five new sites have recently been proposed for BSRN: two in Spain and one each in Portugal, Canada and Kenya. Unfortunately, there are also three sites in jeopardy, Saudi Arabia, Nigeria and South Africa. Scientifically, BSRN sites have seen a 5 W/m^{-2} per decade increase in surface downwelling long-wave radiation, generally in good agreement with models. The transition of the BSRN archive from Swiss Federal Institute of Technology, Zurich to the Alfred Wegener Institute (AWI) is complete. G.-K. Langlo (AWI) gave an overview of the PANGAEA software used that offers a Google-like interface for searching and distributing BSRN data via the Web.

GACP has been relatively inactive but received funding in 2008 to re-energize both the program itself (led by M. Mischenko) and the product assessment (led by S. Christopher). In particular the Multi-angle Imaging SpectroRadiometer (MISR), Moderate Resolution Imaging Spectroradiometer (MODIS) Advanced Very High Resolution Radiometer (AVHRR), and Polarization and Directionality of the Earth's Reflectances (POLDER) products are to be compared. They do not currently agree very well with respect to Aerosol Optical Depth.

The SeaFlux intercomparison is expected to be complete in mid-2009. Version 1.0 of the sea surface temperature and version 0.5 of the latent and sensible heat fluxes are available for testing. Much of 2008 was spent comparing available products against one another and against very limited *in situ* data. A novel aspect of the current validation strategy is that each input into the flux products is assessed independently so that parameters like wind and humidity can be evaluated separately.

LandFlux activities continued during the past year with two topical workshops, one on the retrieval of land surface skin and air temperatures (7–9 April 2008, Asheville, North Carolina) and one on retrieval of land surface properties from microwaves, including soil moisture and flooding extent (20–22 October 2008, Oxnard, California). Both workshops are being followed up with comparisons of products and investigations into their differences. The next event will be a 1-day workshop held in conjunction with the GEWEX–Integrated Land Ecosystem-Atmospheric Processes Study (iLEAPS) Scientific Conference in August 2009 (see page 17), where an inventory of available global surface latent and sensible heat flux products will be made, including observationally based (*in situ* and satellite), model-based and mixed observation-model.

In addition to the established projects, the International Soil Moisture Working Group (ISMWG) began reporting to GRP. With the folding of Integrated Global Observing Strategy–Partners into the Group on Earth Observations—hence the disappearance of the Integrated Global Water Cycle Observations—a new home was needed for ISMWG. GEWEX was suggested with three distinct objectives for the working group: (1) the development of a global *in situ* soil moisture network and data sets to support the validation of satellite soil moisture retrieval and assimilation; (2) the assimilation of soil moisture and satellite data (both active and passive) into numerical weather prediction and hydrological modelling for forecasting as well as process studies; and (3) data fusion activities, or the development of long-term consistent global soil moisture products and their derivatives.

The Cloud Assessment Project (see page 6) is working on its final report, due at the end of 2009. The Continual Intercomparison of Radiation Codes Project is a new GRP activity that uses observationally based input from Atmospheric Radiation Measurement flux closure studies (see page 8).

A number of activities currently being encouraged; the first is to revisit the GEWEX Global Water Vapor Project to assess the quality of purely observational vapor products relative to those produced by the data assimilation systems. GRP is exploring this issue and may hold a joint workshop with the International Television and Infrared Observation Satellite (TIROS) Operational Vertical Sounder (TOVS) Working Group. At the same time, the NASA MERRA reanalysis is being assessed as a consistent source of vapor for the next reprocessing of all GRP products.

GRP continues to foster the Cloud, Aerosol, Precipitation Initiative. While not independent of the modelling activity, GRP sees potential in collecting simultaneous global-scale data on aerosols, clouds and precipitation in order to provide global-scale observations to what otherwise tends to be a very case-oriented analysis of data.

A. Schweiger (Applied Physics Lab/Polar Science Center, University of Washington) gave the first of the new member science presentations on the relationship between Arctic Sea ice variability and clouds, in particular how clouds and radiation figured into the record sea ice anomaly of 2007. Ice thickness is quite sensitive to radiation, with a 10 W/m^{-2} increase in LW flux causing up to 50 cm reduction in ice thickness. SW is not as effective at melting ice because of the high albedo; lost sea ice aligns better with the downwelling long-wave anomaly. National Centers for Environmental Prediction forcing confirms that it was really LW forcing, and not the cloud-free (i.e., SW) forcing at all. Furthermore, it appears the reduction in sea ice thickness was not extraordinary, as the large areal extent of the sea ice loss was due primarily to the already thin ice in the anomalous LW flux region. Wind also played a role in thickness reduction.

S. Van Den Heever (Colorado State University, Ft. Collins, Colorado), a new GRP member, described her research related to Cloud Condensation Nuclei (CCN) versus Giant CCN. Whereas enhanced CCN tends to lead to greater numbers of small drops with a narrow drop spectrum, reduce the collision and coalescence processes and thus reduce the event of warm rain, giant CCN tends to widen the cloud drop size distribution, enhance collision and coalescence processes and thus enhance warm rain processes. The main findings suggest that CCN has the greatest impact on the initial stages of the convection but that giant CCN and ice nuclei had a greater impact in the mature states.

New member M. McCabe (School of Civil and Environmental Engineering, University of New South Wales, Sydney, Australia) showed how hydrologic consistency tests can be used as an alternative method to improve independent water and energy variables through knowledge of the coupled system. Research includes work with isotopes, which can be used to identify source regions of groundwater recharge; calculating relative contributions of surface runoff and groundwater discharge to streamflow; and discriminating soil evaporation from plant transpiration in water vapor return to the atmosphere.

S. Seneviratne (ETH Zurich), another new GRP member, gave a presentation on soil moisture-atmosphere interactions in a changing climate. Strong coupling between precipitation and vegetation is clearly evident in the transition zones between wet and dry climates. An indirect measure of the coupling between soil moisture and land surface temperature is the correlation between summer evapotranspiration and temperature. A negative correlation implies a strong soil moisture-temperature coupling (i.e., high temperature as a result of low or no evapotranspiration). The opposite is true for positive correlations. Correlation maps show high coupling between soil moisture and interannual variability of temperature in transition zones.

The next GRP meeting will be held 13–16 October 2009 in Bonn, Germany.

International Precipitation Working Group Workshop on Space-based Snowfall Measurements

Steamboat Springs, Colorado, USA
31 March – 4 April 2008

Ralph Ferraro[1], Ralf Bennartz[2], and Gregory Tripoli[2]
[1]NOAA/NESDIS Center for Satellite Applications and Research, Cooperative Institute for Climate Studies, College Park, MD, USA; [2]Department of Atmospheric and Oceanic Sciences, University of Wisconsin, Madison, WI, USA

The Second International Precipitation Working Group (IPWG) Workshop on Space-based Snowfall Measurement was hosted by the Storm Peak Laboratory of the Desert Research Institute and was attended by over 40 scientists from seven nations, including the United States, Canada, Japan, Finland, Poland, Germany and Italy. The primary goal of the workshop was to assess the state of the science and measurement technology of measuring snowfall from space using active and passive microwave sensors, and to recommend future directions in research and technology development.

The workshop was focused around five main topical areas/working groups (chair in parenthesis): (1) Applications (D. Lettenmaier, University of Washington); (2) Global and Regional Detection and Estimation (C. Kummerow, Colorado State University); (3) Modelling of Snow and its Radiative Properties (G. Petty, Purdue University); (4) New Technologies (S. Tanelli, Jet Propulsion Laboratory and T. Iguchi, National Institute of Information and Communications Technology, Japan); and (5) Validation (D. Hudak, Canadian Space Agency and J. Koistinen, Finnish Meteorological Institute). The following high priority recommendations emerged from the workshop.

- Encourage the generation of community Cloud Resolving Model/Numerical Weather Prediction model profile databases that represent natural variability. A parallel effort for data bases from observations or combined model simulations and observations is also encouraged.
- Use "modelling chains" as a basic research tool to develop an understanding of the relationship between snowfall and radiative transfer.
- Recognize "data assimilation" as a necessary component of snow analysis from space-based measurements.
- Community efforts led by the International TIROS Operational Vertical Sounder Working Group have successfully led to the emissivity data bases and inventories. Continuing community efforts to study and develop high-latitude surface emissivity products (10–200 GHz) including error estimates are strongly recommended.
- The use of combined active and passive satellite data for snowfall detection/retrieval is recommended.
- Future space-borne measurement platforms must have high sensitivity and be able to detect reflectivity down to within 100–200 m of the surface and with a sensitivity of –20 to –30 dBz.
- New passive microwave instruments and new channel combinations need to be studied.
- High level coordination of international ground validation programs for snowfall should be enhanced to advance the current state of snowfall retrievals.
- With several new and emerging technological advances, routine validation specific to falling snow is achievable and should be pursued.

Since the first workshop held in 2005, much progress was noted on several of the actions from that meeting, and many of these have been carried forward in the recommendations noted above. In addition, there is much closer collaboration between the various disciplines involved in this area of remote sensing, namely, a much more synergistic relationship between instrument, validation, cloud modelling, radiative transfer modelling and algorithm retrieval scientists. In addition, close synergy between IPWG, GEWEX and the Global Precipitation Mission is expected. The complete workshop report is available at: *http://www.isac.cnr.it/~ipwg/IPWG.html*.

Participants at the Second International Precipitation Working Group Workshop on Space-based Snowfall Measurements.

Water in a Changing Climate

Progress in Land-Atmosphere Interactions and Energy/Water Cycle Research

Parallel Science Conferences with Joint Sessions

24–28 August 2009 – Melbourne, Australia

Deadline for Submitting Abstracts Extended (see website for details)

http://www.gewex.org/2009gewex_ileaps_conf.html

The **Sixth International Scientific Conference on the Global Energy and Water Cycle** and the **Second Integrated Land Ecosystem-Atmosphere Processes Study (iLEAPS) Science Conference** are being held in conjunction in Melbourne, Australia on 24–28 August 2009. The conferences will hold joint sessions on three common themes with keynote talks, oral and poster presentations.

This venue provides an exciting platform for presenting and discussing the latest scientific developments in the area of water, energy, and biogeochemical cycles. It also provides an opportunity for cross-fertilization between the sciences represented by both GEWEX, as part of the World Climate Research Programme (WCRP), and iLEAPS, as part of the International Geosphere-Biosphere Programme (IGBP), in addressing present and future climate and global change challenges.

A **Joint iLEAPS/GEWEX Early Career Scientists Workshop** is being hosted by the University of Melbourne, prior to the GEWEX/iLEAPS conferences, on 20–22 August 2009. Early career scientists are encouraged to participate in this event to interact with other students, scientists and expert senior scientists. The workshop is open to all students and early career scientists working within the scope of the Conferences themes. The event will include state-of-the-art keynote talks, training, discussions, and social activities. See *http://ileaps.org/ecsw/* for more details.

VENUE:

The conferences will be held at the Sofitel Melbourne hotel, located in the heart of the Melbourne's shopping, dining and theatre district. The conference dinner will be held at the National Gallery of Victoria.

LODGING:

There are many reasonably priced options for lodging near the Sofitel Melbourne. Please see the conference website for options and links to hotels in Melbourne.

See Page 18 for the Preliminary Program of the GEWEX and iLEAPS Conferences and Joint Sessions.

IMPORTANT DATES

31 March 2009	Financial Assistance Application Deadline
1 May 2009	Financial Assistance Notification
1 May 2009	Oral/Poster Acceptance Notification
1 June 2009	Deadline for Early Registration

REGISTRATION DETAILS

Amounts in USD are approximate and may change depending on daily currency conversion rates

Registration Category:	Early Bird *paid before 1 June 2009*	Standard
GEWEX/iLEAPS Full Delegate 5-days (includes all sessions, materials, morning/afternoon breaks, welcome reception, conference dinner)	700 AUD (~450 USD)	800 AUD (~520 USD)
Student Rate* 5-day (includes all sessions, materials, morning/afternoon breaks, welcome reception, conference dinner)	450 AUD (~290 USD)	550 AUD (~350 USD)
1-Day Rate *Must indicate which day: 24th, 25th, 26th, 27th, or 28th* Welcome reception and dinner is not included in this rate.	400 AUD (~260 USD)	500 AUD (~320 USD)

**Students must supply a letter from their advisor stating that they are currently enrolled at a university.*

Preliminary Program
GEWEX and iLEAPS Sciences Conferences with Joint Sessions

MONDAY, 24 AUGUST 2009
GEWEX/iLEAPS Plenary Session

Keynote Speakers
– *Dr. Piers J. Sellers* (NASA, Lyndon B. Johnson Space Center, USA)
– *Prof. John Thwaites* (Monash Sustainability Institute, Australia)
– *Prof. Paulo Artaxo* (University of São Paulo, Brazil)
– *Prof. Roger R. Pielke, Jr.* (Center for Science and Technology Policy Research, USA)

GEWEX/iLEAPS Parallel Sessions Begin

iLEAPS Session 1: Surface Exchange Processes from Leaf Level to Earth System Scale
(Co-Chairs: *A. Arneth,* Lund University, Sweden; *S. Harrison,* University of Bristol, UK)

Invited Speakers:
– *J. Beringer* (Monash University, Australia)
– *G. Bonan* (NCAR, USA)
– *B. Medlyn* (Macquarie University, Australia)

GEWEX Session 1: Regional Forecasting and Predictions for Hydrological Applications in Arid Zones
(Co-Chairs: *S. Sorooshian,* UCI, USA; *A. Lipponen,* UNESCO, Kazakhstan)

GEWEX Session 2: Rainfall Variability and Drought in Australia
(Co-Chairs: *A. Pitman,* UNSW, Australia; *N. Nicholls,* Monash University, Australia)

TUESDAY, 25 AUGUST 2009
iLEAPS Session 2: Progress in Land-Atmosphere Interactions and Climate Change
(Co-Chairs: *S. I. Seneviratne,* ETH, Switzerland; *P. Friedlingstein,* LSCE, France; *G. Farquhar,* Australian National University; *P. Canadell,* CSIRO, Australia)

Invited Speakers:
– *D. Lawrence* (NCAR, USA)
– *Y. Malhi* (University of Oxford, UK)
– *C. Prentice* (University of Bristol, UK)

TUESDAY, 25 AUGUST 2009
John Roads Memorial Symposium: Prediction, Reanalyses and Regional Downscaling (Chair: *M. Kanamitsu,* UCSD, USA)

GEWEX Session 3: Modern ERA Reanalyses
(Chair: *M. Bosilovich,* NASA/GSFC, USA)

GEWEX Session 4: Climate Prediction Systems
(Chair: *S. Schubert,* NASA/GSFC, USA)

GEWEX Session 5: Regional Downscaling
(Co-Chairs: *B. Rockel,* GKSS, Germany; *L. Mearns,* NCAR, USA)

Invited Speaker:
A. Nunes (UCSD, San Diego, USA)

GEWEX Session 6: Regional Hydroclimate Projects and Studies
(Co-Chairs: *J. Huang,* NOAA/CPPA, USA; *R. Stewart,* Univ. of Manitoba, Canada)

WEDNESDAY, 26 AUGUST 2009
Joint GEWEX And iLEAPS Sessions

Session A: Land in the Climate System
GEWEX Co-Chairs: *J. Kim,* Yonsei University, Korea; *B. van den Hurk,* KNMI, The Netherlands
iLEAPS Co-Chairs: *N. de Noblet,* LSCE, France; *A. Pitman,* University of New South Wales, Australia

Invited Speakers:
– *D. Baldocchi* (University of California, Berkeley, USA)
– *P. Dirmeyer* (COLA, USA)
– *R. Valentini* (University of Tuscia, Italy)

Session B: Aerosol, Cloud, Precipitation and Climate Interactions
GEWEX Co-Chairs: *W. Lau,* NASA/GSFC, USA; *T. Ackerman,* JISAO, USA
iLEAPS Co-Chairs: *A. Andreae,* Max Planck Institute for Chemistry, Germany; *M. Kulmala,* University of Helsinki, Finland

Invited Speakers:
– *T. Nakajima* (University of Tokyo, Japan)
– *D. Rosenfeld* (The Hebrew University, Israel)
– *L. Rotstayn* (CSIRO, Australia)
– *B. Stevens* (Max Planck Institute for Meteorology, Germany)

Session C: Future Generation of Integrated Observation and Modelling Systems
GEWEX Co-Chairs: *M. Miller,* ECMWF, UK; *K. Trenberth,* NCAR, USA
iLEAPS Co-Chairs: *G. Brasseur,* NCAR, USA; *J. Finnigan,* CSIRO, Australia; *H. Dolman,* VU University, The Netherlands

Invited Speakers:
– *P. Rayner* (LSCE, France)
– *A. Simmons* (ECMWF, UK)
– *K. Trenberth* (NCAR, USA)

THURSDAY, 27 AUGUST 2009
iLEAPS Session 3: The Role of Atmospheric Boundary Layer Processes in Modulating Surface Exchanges
(Co-Chairs: *L. Ganzeveld,* Wageningen University, The Netherlands; *B. Holtslag,* Wageningen University, The Netherlands

Invited Speakers:
– *H. Jonker* (Delft University of Technology, The Netherlands)
– *T. Karl* (NCAR, USA)
– *T. Vesala* (University of Helsinki, Finland)

GEWEX Session 7: Observing Surface Fluxes: From Local to Global Scales
(Co-Chairs: *J. Finnigan,* CSIRO, Australia; *C. A. Clayson,* FSU, USA)

Invited Speaker:
– *W. Rossow* (CREST, The City College of New York, USA)

GEWEX Session 8: Multiscale Properties of the Tropical Energy and Water Cycles: From Thunderstorms to Monsoons
(Co-Chairs: *H. Hendon,* CAWCR, Australia; *T. Yasunari,* HyARC, Japan)

GEWEX Session 9: Advances in the Representation of the Energy and Water Cycle in Models
(Co-Chairs: *D. Randall,* CSU, USA; *G. Feingold,* NOAA/ESRL, USA)

GEWEX Session 10: Cloud Climate Feedbacks
(Co-Chairs: *W. Rossow,* CREST, The City College of New York, USA; *R. Colman,* BMRC, Australia)

FRIDAY, 28 AUGUST 2009
iLEAPS Session 4: Aerosols from the Land Surface and their Interactions with the Climate System
(Co-Chairs: *P. Artaxo,* University of Sao Paulo, Brazil; *G. Feingold,* NOAA, USA; *V.-M. Kerminen,* Finnish Meteorological Institute, Finland)

Invited Speakers:
– *A. Andreae* (Max Planck Institute for Chemistry, Germany)
– *H. Coe* (University of Manchester, UK)
– *S. Martin* (Harvard University, USA)

GEWEX Session 11: The Role of Integrated Observing Systems in Closing Regional and Global Water and Energy Budgets
(Co-Chairs: *T. Koike,* University of Tokyo, Japan; *P. Ingmann,* ESA-ESTEC, The Netherlands)

Invited Speakers:
– *J. Kaye* (NASA Headquarters, USA)
– *G. Stephens* (Colorado State University, USA)

GEWEX Session 12: Climate Change and Global Precipitation
(Co-Chairs: *P. Siebesma,* KNMI, Netherlands; *C. Kummerow,* CSU, USA)

GEWEX Poster Sessions To Be Announced

GEWEX/WCRP Meetings Calendar

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

6–9 April 2009—**30th Session of the WCRP Joint Scientific Committee**—College Park, Maryland, USA.

19–24 April 2009—**European Geosciences Union 2009 Meeting**—Vienna, Austria.

21–23 April 2009—**30th Session of the IPCC**—Antalya, Turkey.

25–30 April 2009—**XIV Brazilian Remote Sensing Symposium**—City of Natal, Rio Grande do Norte, Brazil.

26–30 April 2009—**7th International Science Conference on the Human Dimensions of Global Environmental Change, "Social Challenges of Global Change"**—Bonn, Germany.

30 April – 1 May 2009—**DRI Precipitation and Drought Indices Workshop**—Canada Met. Service HQS, Toronto, Ontario.

4–8 May 2009—**2nd Lund Regional-Scale Climate Modelling Workshop: 21st Century Challenges in Regional Climate Modelling**—Lund, Sweden.

24–27 May 2009—**2009 AGU Joint Assembly: The Meeting of the Americas**—Toronto, Ontario, Canada.

25–28 May 2009—**International Conference on Climate Change: The Environmental and Socio-economic Response in the Southern Baltic Region**—Szczecin, Poland.

27–28 May 2009—**Mountains: Energy, Water and Food for Life. The Share Project: Understanding the Impacts of Climate Change**—Milan, Italy.

10–12 June 2009—**EarthCARE Workshop**—Kyoto, Japan.

15–17 June 2009—**EU-FP7 Workshop on Drought and the Natural System**—Noordwijkerhout, The Netherlands.

15–19 June 2009—**AGU Chapman Conference on Abrupt Climate Change**—Columbus, Ohio, USA.

22–24 June 2009—**GEWEX/Global Land/Atmosphere System Study (GLASS)/QUEST Workshop**—Exeter, United Kingdom.

22–26 June 2009—**Weather Research and Forecasting Users Workshop**—Boulder, Colorado, USA.

26–27 June 2009— GEWEX Atmospheric Boundary Layer Study (**GABLS) Workshop**—Boulder, Colorado, USA.

5–10 July 2009—**2009 Gordon Research Conference on Radiation and Climate**—New London, New Hampshire, USA.

7–11 July 2009—**IGARSS 2009**—Cape Town, South Africa.

13–15 July 2009—**WCRP/WWRP-THORPEX Year of Tropical Convection ImplementationWorkshop**—Honolulu, Hawaii, USA.

19–29 July 2009—**IAMAS/IAPSO/IACS 2009 Joint Assembly (MOCA-09) on Our Warming Planet**—Montreal, Canada.

20–24 July 2009—**3rd International AMMA Conference**—Ouagadougou, Burkina Faso.

16–22 August 2009—**2009 World Water Week in Stockholm**—Stockholm, Sweden.

19–21 August 2009—**Third GEWEX Coordinated Energy and Water Cycle Observations Project (CEOP) Meeting**—Melbourne, Australia.

20–22 August 2009—**iLEAPS/GEWEX Early Career Scientists Workshop**—Melbourne, Australia.

22 August 2009—**GEWEX/Global Land/Atmosphere System Study (GLASS) Meeting**—Melbourne, Australia.

23 August 2009—**GEWEX/iLEAPS Workshop on Landflux**—Melbourne, Australia.

24–28 August 2009—**6th International Scientific Conference on the Global Energy and Water Cycle and 2nd iLEAPS Science Conference**—Melbourne, Australia.

6–11 September 2009—**European Aerosol Conference**—Karlsruhe, Germany.

9–15 September 2009—**International Workshop on the Northern Eurasia Mountain Ecosystems and Regional (High Elevations) NEESPI Science Team Workshop**—Bishkek, Kyrgyz Republic.

15–20 September 2009—**Joint NASA-LCLUC Science Team Meeting and GOFC-GOLD/NERIN, NEESPI, and MAIRS Workshop: Monitoring land cover, land use, and fire in agricultural and arid regions of Northern Eurasia**—Almaty, Kazakhstan.

16–18 September 2009—**GEWEX/GRP Working Group on Data Management and Analysis**—College Park, Maryland, USA.

24–28 September 2009—**13th Session of the Working Group on Coupled Modelling**—San Francisco, California, USA.

13–16 October 2009—**GEWEX Radiation Panel Meeting**—Bonn, Germany.

3–7 November 2009—**24th Session of the Working Group on Numerical Experimentation (WGNE) to be held with the 10th Session of the GEWEX Modelling and Prediction Panel (GMPP)**—Montreal, Canada.

9–12 November 2009—ECMWF/GLASS Workshop on Land Surface Modelling and Data Assimilation and the Implications for Predictability—ECMWF, Shinfield Park, Reading, United Kingdom.

18–20 November 2009—**ESA/EGU/ISPRS/GEWEX Conference on Earth Observation and Water Cycle Science: Towards a Water Cycle Multi-Mission Observation Strategy**—ESRIN, Frascati, Italy.

GEWEX NEWS

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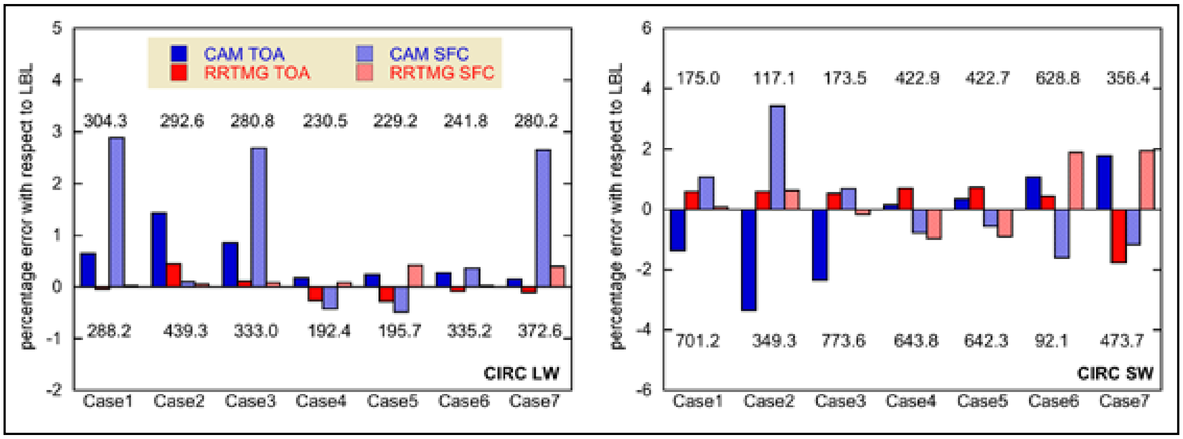
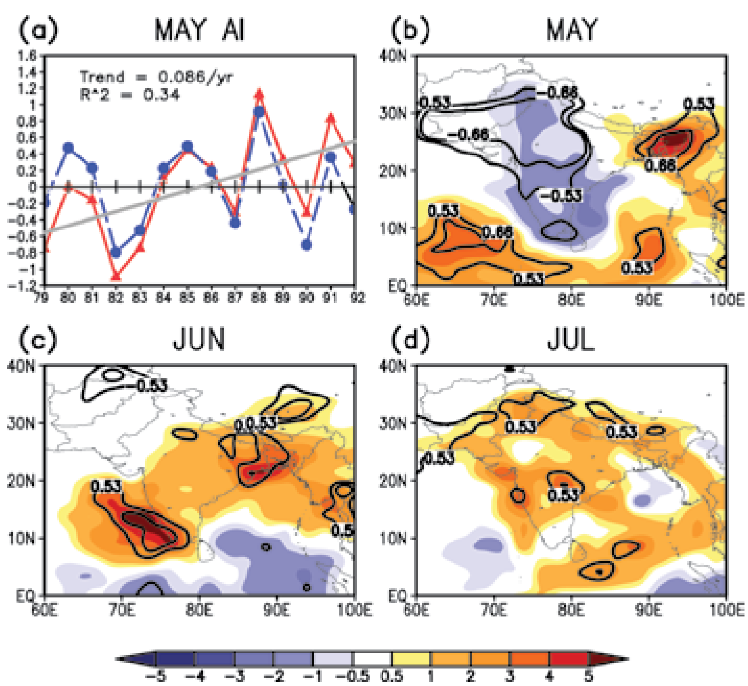
Continual Intercomparison of Radiation Codes (CIRC) Project Improving GCM Radiative Transfer Codes



For the seven CIRC Phase I cases, percentage errors are given with respect to line-by-line (LBL) calculations of the current Community Atmospheric Model (CAM) RT schemes and the shortwave (SW) and longwave (LW) rapid RT for GCMs (RRTMG) codes. Negative errors indicate higher LBL flux values. Top values are for upwelling flux at top of the atmosphere and bottom values are for downwelling flux at the surface. See article by L. Oreopoulos and and E. Miawer on page 8.

High Spring Indian Aerosol Concentration and Associated Low Precipitation Leads to Strengthened Summer Monsoon



RRTMG schemes perform better overall for the CIRC cases than the current CAM schemes. (a): Time series of May Aerosol Index (AI) anomalies over the Indo-Gangotic Plain (red line: original data; blue line: original data after removing trend; grey line: least square fit to original data). The trend is 0.086 yr^{-1} (significant at the 95% confidence level), with $R^2 = 0.34$. (b) – (d): GEWEX Global Precipitation Climatology Project precipitation (mm day^{-1}, shaded) regressed on the May AI time series [blue line in (a)] for: (b) May, (c) June, and (d) July. The ±0.53 and ±0.66 contour lines show the 95% and 99% confidence levels, respectively. See article by M. A. Bollasina and S. Nigam on page 10.