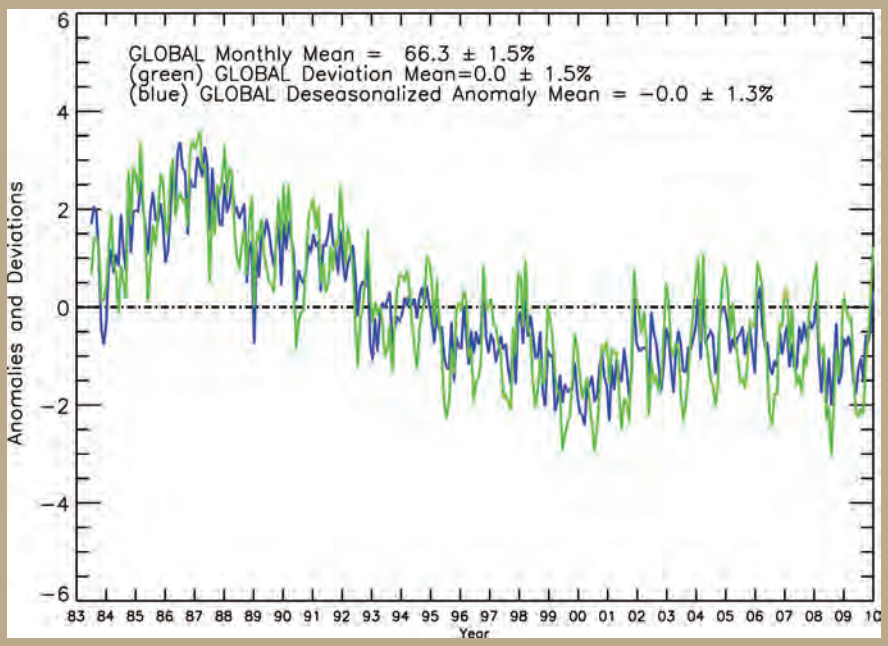
GEWEX WCRP
Global Energy and Water Exchanges
NEWS

Vol. 22, No. 4 | November 2012

# International Satellite Cloud Climatology Project Celebrates 30 Years *(see page 4)*

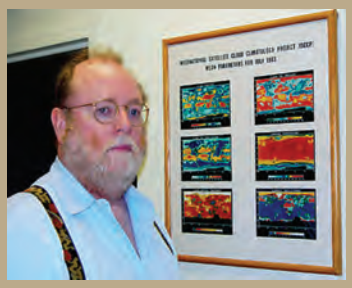
## ISCCP-D2 (198307–200912) Global Monthly Mean Cloud Amount Anomalies (%)




*Deseasonalized anomaly time record for global monthly mean cloud cover amount (%) as determined by ISCCP for the period of July 1983 through December 2009.*

## Scientists Who Guided ISCCP

***Robert A. Schiffer***
***Project Manager (1980–1998)***



***William B. Rossow***
***Project Scientist (1980–1998)***
***Project Manager (1999–2012)***

## *Newsletter Contents*

## Commentary

# Wrapping Up 2012

**Peter J. van Oevelen**
Director, International GEWEX Project Office

The latter part of the year is always a busy time as the GEWEX Panels and Scientific Steering Group (SSG) meet to review past activities and plan for the future (see the meeting reports in this newsletter). The 25th GEWEX SSG Meeting was held in October in Sydney, Australia, and marked the end of a two-plus year period where GEWEX, under the guidance of the World Climate Research Programme (WCRP) Joint Scientific Committee, made changes in both its structure and scientific direction. The results are recorded in two documents: the *GEWEX Imperatives*, which outline a long-term strategy focusing on seven categories of development, and the four *GEWEX Science Questions*, which contribute to the WCRP Grand Challenges. Both of these documents are available at: *http://gewex.org*.

The GEWEX Cloud System Study (GCSS) and the GEWEX Atmospheric Boundary Layer Study (GABLS) were combined into the Global Atmospheric System Studies (GASS) Panel, which serves as the primary group addressing tropospheric modeling within WCRP. GASS held its very successful first Pan-GASS Conference this past September in Boulder, Colorado, attended by over 200 scientists.

The Global Land/Atmosphere System Study (GLASS) did not reorganize structurally, but did initiate some additional exciting new activities such as the Global Soil Wetness Project-3 (GSWP-3). It is also working jointly with the GEWEX Hydroclimatology Panel (GHP) on a land-surface model benchmarking project using FluxNet station data and the Protocol for the Analysis of Land Surface Models (PALS) interface.

The GEWEX Data and Assessments Panel (GDAP; formerly the GEWEX Radiation Panel) has changed significantly over the past 20 years. With an initial focus on the production of global climate data sets, GDAP currently works more on the assessments and the integration of these data sets. Activities that are specifically related to radiation code intercomparisons (Continuous Intercomparison of Radiation Codes project, CIRC) are now undertaken jointly with GASS.

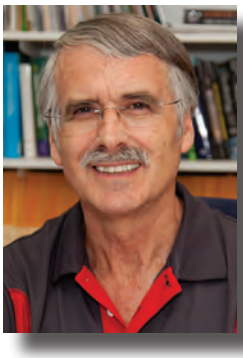
GHP has reorganized itself according to a two-tier approach, in which the Regional Hydroclimate Projects (RHP) form one tier, and a number of limited-duration projects, such as those on extremes and seasonal hydrological forecasting, form the second. In addition, the guidelines and criteria to become an RHP have been reformulated to stimulate cross-RHP collaboration and to promote better adherence to the GEWEX Science Questions and Imperatives.

Several weeks ago, we were reminded of how much GEWEX depends on the efforts of special individuals to accomplish its work in the international arena. The driving force behind the establishment of the Baseline Surface Radiation Network (BSRN), Ellsworth Dutton, died unexpectedly, leaving behind a community shocked that its founder was no longer there to help guide and support it. I have no doubt that the BSRN collaborators will find a way forward to continue Ells' legacy, although it will not be an easy task. As a testimony to Ells' impact on our community, we have dedicated a page on our website to Ells with expressions of sympathy received from the worldwide community. We will all miss him.

For his years of dedication to GEWEX, I acknowledge and thank Rick Lawford, who is stepping down as a senior scientific advisor for GEWEX. Personally, I am very grateful for Rick's guidance and mentorship during my first years with GEWEX. Rick has always been a strong advocate for GEWEX in many capacities, starting with his years as program manager at the National Oceanic and Atmospheric Administration (NOAA), followed by his four years as Director of the International GEWEX Project Office (IGPO). Rick will continue to be involved in GEWEX-related activities in an unofficial capacity, and we look forward to continued collaboration with him.

Finally, I thank everyone for their contributions over the past year and on behalf of all of us at the IGPO, I wish you a very fruitful and happy 2013. As always, please continue to send us any ideas that you may have for news items and articles to publish either in the printed newsletter or our E-Newsletter. We have some exciting new changes planned for 2013, including a redesign of our website and a new logo!

## Kevin Trenberth Wins International Prize for Water



The Chair of the GEWEX Scientific Steering Group, Kevin Trenberth, and his team were awarded the 5th Prince Sultan Bin Abdulaziz Surface Water Prize for groundbreaking work that provides a powerful estimate of the effects of climate change on the global hydrological cycle, with a clear explanation of the global water budget. For more information, see: *http://psipw.org/index.php*.

## *GEWEX Framework for 2013 and Beyond*

The GEWEX Imperatives and Science Questions are available at: *http://gewex.org/*

## Changes in GEWEX Leadership

### New Co-Chair for GEWEX Hydroclimatology Panel (GHP)

*Jason Evans*

Dr. Jason Evans, a scientist at the Climate Change Research Centre at the University of New South Wales in Sydney, Australia, joins Dr. Jan Polcher, as the new co-chair of the GHP. He replaces Dr. Dennis Lettenmaier of the University of Washington in Seattle. Dr. Evans' research interests are regional climate processes and modeling, particularly in relation to the water cycle. He was Chair of the Murray-Darling Basin, a GEWEX Regional Hydroclimate Project, and is currently the coordinator for the Coordinated Regional Climate Downscaling Experiment (CORDEX) Austral Asia domain.

### New Co-Chair for Global Land/Atmosphere System Study (GLASS) Panel

*Aaron Boone*

Dr. Aaron Boone, a research scientist at the Centre National de Recherches Météorologiques (CNES), Météo-France, in Toulouse, France, will join Dr. Joe Santanello in co-chairing the GLASS Panel in January 2013. He replaces Dr. Martin Best of the Joint Centre for Hydro-Meteorological Research at the Met Office in the United Kingdom, who is steping down as GLASS co-chair at the end of this year.

Dr. Boone's research interests include hydrological and land-surface processes, and their interactions with the atmosphere. He is a member of the Surface Externalisée (SURFEX, a land-ocean-atmosphere model coupling platform of Météo-France) steering committee, and has done extensive development work on the Interactions Between the Atmosphere Biosphere (ISBA) land-surface model. He is co-principal investigator of the GLASS-sponsored African Monsoon Multidisciplinary Analysis Project (AMMA) Land-Surface Model Intercomparison Project-Phase 2 (ALMIP-2). Dr. Boone is also a member of the joint US National Aeronautics and Space Administration (NASA)-CNES Surface Water Ocean Topography mission science definition team, specializing in large scale hydrology.

## In Memoriam

### Ellsworth Dutton, Chair of BSRN from 1992–2012

We research colleagues mourn the loss of Ells for the void he leaves in our joint endeavors and our friendships that evolved in meetings around the world. Thus, as our tribute, we recall some of the ways that Ells added to the progress that Earth scientists have made over the past decades in learning how to measure surface radiation better, how to improve global satellite-based determinations of surface radiation, and in being able to determine not only a key component of Earth's climate, namely the net surface radiative heating, but also to quantify the effects on it of atmospheric variability, especially clouds and aerosols. Today's knowledge and capability in these areas exist because of Ells' direct work on making and improving surface radiation measurements and his careful analysis of their significance and meaning.

Through his knowledge and advice, he also helped those of us trying to estimate surface radiation from satellite measurements. But Ells' contributions went beyond being a careful scientist to employing his understanding of people to build a global network of volunteers dedicated to making these state-of-the-art measurements. His steady leadership of the Baseline Surface Radiation Network (BSRN) has been the foundation of major progress in our understanding of surface radiation processes. When BSRN started under the auspices of the World Climate Research Programme, it was planned as the anchor for the global, satellite-based determination of surface radiation by the Surface Radiation Budget (SRB) Project, which, together with the International Satellite Cloud Climatology Project and research on the optical properties of aerosols, formed a comprehensive program to understand the Earth's radiation budget. Ells' skillful leadership of a large and varied group of scientists was instrumental in achieving that goal by: developing and applying a set of common operating procedures and a common absolute calibration that now are the world standard for quality radiation measurements from the surface; producing a common set of data products from all participating sites; enhancing the value of the radiation measurements by including a range of ancillary meteorological observations that better characterize the causes of radiation variations; and expanding our understanding of surface radiation phenomena. Under Ells' leadership, BSRN has become more than that an anchor for SRB; it is now a key component of the Global Climate Observing System, a fitting testament to Ells' work. Because of his achievements, we now have better data, better calibration and smaller uncertainties, and better understanding of what the surface radiation variations mean. We will miss Ells and his collaboration profoundly.

*Signed: Stefan Kinne, Chris Kummerow, Chuck Long, Ehrhard Raschke, William B. Rossow, Paul Stackhouse, Graeme Stephens, Yuanchong Zhang*

# ISCCP at 30: A Historical Perspective of the First WCRP Project

**William B. Rossow[1] and Robert A. Schiffer[2]**

[1]CREST at The City College of New York City, New York, NY, USA; [2]Universities Space Research Association, Columbia, MD, USA

### *Launch of ISCCP as the First Project of WCRP*

The first formal international organizational meeting of the International Satellite Cloud Climatology Project (ISCCP) occurred 30 years ago in August 1982 in Geneva and routine data collection began in July 1983. The launch of this project was the culmination of the research community thinking about how to address one of two key obstacles to understanding climate, namely determining cloud-climate feedbacks. Hence, when the World Climate Research Programme (WCRP) was established in 1980, its first project, ISCCP, had the goal of collecting mesoscale-to-global information about cloud properties and their variations from diurnal to interannual time scales. Soon after, two related projects were launched: the Surface Radiation Budget (SRB) Project in 1985, which determines surface radiation and cloud effects on it [planning also began for the Baseline Surface Radiation Network (BSRN) to support and anchor SRB products], and the Global Precipitation Climatology Project (GPCP) in 1986, which determines the global distribution and variations of precipitation.

Initially, the intention was that ISCCP would collect enough cloud property information to make possible first order evaluations of cloud effects on the Earth's radiation budget and begin studying clouds in the global hydrological cycle; therefore, collection and analysis were envisioned to produce a data product covering about 5–7 years. There was no intention to monitor cloud variations on longer time scales since at that time it was not clear that observing systems were good enough for this purpose. The focus of the first analysis was on quantifying diurnal, weather-scale, and seasonal cloud variations over the entire globe and on obtaining some preliminary information about the magnitude of interannual variations.

To achieve its goals, ISCCP pioneered multi-data set (multivariate) retrievals based on rigorous radiative transfer models to account for all factors affecting the satellite-measured radiances and combining multiple satellite measurements into a comprehensive and homogeneous data product. The latter included developing a radiance calibration standard applied to the whole international constellation of weather satellite imagers, both polar orbiting and geostationary, that today is still the only such calibration available. ISCCP was also one of the earliest satellite-based projects to release all three "levels" of its data, from the calibrated, navigated radiances (Level 1b, first released in 1984), all of which could be read with one software procedure, to the retrieval (pixel) level (Level 2) and the gridded summary statistics (Level 3). The first version of these products was released over the period of 1988–1991.

### *ISCCP Becomes the First GEWEX Project*

Subsequent evolution of WCRP activities led to the formation of GEWEX in 1989–1990, which encompassed ISCCP along with the Global Precipitation Climatology Project (GPCP), SRB, and BSRN. The expansion of the program goals to cover the whole energy and water cycle under GEWEX, together with the occurrence of the Mt. Pinatubo volcanic eruption in 1991, which interrupted the radiance calibration monitoring by ISCCP, led to rethinking the goals of ISCCP and the other projects. Instead of ending ISCCP with an 8-year data product sufficient for the initial goals, the decision was made to continue ISCCP but to revise the analysis procedures to take account of research progress since the mid-1980s, to reprocess the first 8 years of data, and to continue the record to support other GEWEX and WCRP activities. The new (second) version of the ISCCP data products was released in 1996–1997, covering a 12-year period.

### *25th ISCCP Anniversary*

Approaching the 25-year mark, GEWEX began a systematic evaluation of the ISCCP results, including comparison with a number of newer cloud data products produced from more advanced imagers and new types of satellite instruments (sounders, polarimeters, lidar, and radar). Discussion of GEWEX research objectives in the early 2000s led to two important shifts in the goals for the continuing ISCCP. The first shift was to focus on producing a physically consistent collection of data products to quantify the weather-to-climate scale variations of all components of the global energy and water cycle. The second shift was to give more emphasis to the accuracy of the long-term cloud variation record, since it was clear that the only feasible pathway to long-term data records was to use the operational observing system. To achieve these new goals, a third reprocessing of the whole ISCCP record was planned using a revised analysis procedure based on what was learned from the recent GEWEX Cloud Assessment (see page 20) and refined ancillary data products developed in collaboration with the other GEWEX projects.

In parallel to the above events, other programs and concepts were developed, most notably the Global Climate Observing System (GCOS) and the Global Earth Observing System of Systems (GEOSS). These planning and coordinating activities have been considering what is needed to produce climate data records, such as characterizing what these data records should look like and how the observing system must be configured to produce the data records. One crucial realization was that attention must be paid to transitioning data analysis procedures developed as part of research activities into an operational environment (i.e., research-to-operations). ISCCP has served as a prototype of this concept, being one of the earliest examples of a multinational/agency cooperative project involving routine data exchanges that developed procedures for monitoring these exchanges, standardization of calibrations and formats, and for producing a single, merged global product from multiple sources.

### *ISCCP Data Production Moved to NOAA/NCDC*

To complete the reprocessing of ISCCP products with greater physical consistency with the other GEWEX data products and with greater homogeneity of the record, the project is being converted to a fully operational form. After several years of re-engineering and modernizing the production software, revising the radiance calibrations and ancillary data products, and modernizing the data product designs, the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC) will take over the main product production from National Aeronautic and Space Administration (NASA) Goddard Institute for Space Studies (GISS) in early 2013. The new processing code also incorporates some additional scientific revisions based on the GEWEX cloud assessment results.

The first task will be to reprocess all of the current ISCCP data record, July 1983 – December 2009, into the new version. This record will be extended back to 1979. Then NCDC, in partnership with other operational satellite agencies, currently the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), the Japanese Meteorological Agency (JMA), China Meteorological Organization (CMA), and the Instituto Nacional de Pesquisas Espaciais (INPE), will continue processing into the future. If all goes according to plan, the new version of the ISCCP products, covering 1979 through 2012 (34 years), should be available in mid-2013. Documentation of this whole history and transition is being prepared to provide an example of what is needed to produce operational climate data records. Even if improvements of the whole satellite observing system someday warrant creation of a "better" cloud product, the ISCCP record will continue as the longest uniform record of basic cloud properties.

## *Meeting Announcement*

### *ISSCP at 30*

**The City College of New York, NY, USA**
**22–25 April 2013**

The meeting will review and assess what has been learned about the role of cloud processes in weather and climate, and discuss next steps for cloud research.

For more information, contact:
Bill Rossow (*wbrossow@ccny.cuny.edu*)

Website: *http://isccp.giss.nasa.gov/ISCCP30thAnniversaryMeetingAnnouncement.htm*

## Highlights of the 25th Session of the GEWEX Scientific Steering Group

**Peter J. van Oevelen and Dawn P. Erlich**
International GEWEX Project Office, Silver Spring, MD, USA

The 25th Session of the GEWEX Scientific Steering Group (SSG) was hosted by Dr. Jason Evans of the Climate Change Research Centre and Dr. Matthew McCabe of the Water Research Centre at the University of New South Wales (UNSW) in Sydney, Australia on 15–18 October 2012. The meeting was generously sponsored by the Australian Research Council (ARC) Centre of Excellence for Climate System Science and the University of New South Wales School of Civil and Environmental Engineering.

During the meeting, Prof. Andrew Pitman, the Director of the ARC Centre of Excellence for Climate System Science, gave a special in-depth presentation on UNSW research related to GEWEX activities. Dr. Kevin Trenberth, the SSG Chair, was invited by UNSW to give a public lecture on Climate Extremes and Climate Change, which was well attended.

During the agency presentations, Dr. Michael Rast introduced European Space Agency (ESA) programs of relevance to GEWEX research interests, as well as examples of collaborative activities sponsored by ESA, including joint conferences, special publications, and dedicated projects, such as the Water Cycle Multimission Observation Strategy (WACMOS) and GlobVapour. WACMOS II is contributing to the GEWEX LandFlux Project. ESA is also planning a Water Cycle Feasibility Project to explore the potential of Earth observations in addressing key questions about the water cycle at both global and basin scales.

In her presentation on the Japan Aerospace Exploration Agency (JAXA), Dr. Riko Oki noted that the Global Change Observation Mission on Water (GCOM-W1), which launched in May 2012, carries an Advanced Microwave Scanning Radiometer (AMSR2) for observations of water vapor, precipitation, soil moisture, sea-surface temperature, and wind speed. GCOM-C (climate observation) is planned for launch in 2015. GCOM data products are available at: *https://gcom-w1.jaxa.jp*.

Via Skype, Dr. Jared Entin of the National Aeronautics and Space Administration (NASA) reviewed the NASA Earth Science focus areas related to GEWEX activities. Special attention was given to the Modern Era Retrospective-Analysis for Research and Applications (MERRA), highlighting the use of NASA's global data assimilation system to produce a long-term (1979-present) synthesis for state-of-the-art global analyses, with emphasis on improved estimates of the hydrological cycle on a broad range of weather and climate time scales. NASA is also generating groundwater and soil moisture drought indicators each week based on terrestrial water storage observations derived from Gravity Recovery and Climate Experiment (GRACE) satellite data.

Dr. Michael Ek provided an overview of the National Oceanic and Atmospheric Administration (NOAA) Modeling, Analysis, Predictions, and Projections (MAPP) Drought Task Force, a two-year, multi-institutional, interagency-funded activity to improve methodologies for drought monitoring and prediction. Research results from the project will be documented in a special collection of papers on "Advances in Drought Monitoring and Prediction" in the *Journal of Hydrometeorology*.

### *Planning for 2013 and Beyond*

Over the past year, the SSG and the GEWEX science community refined the GEWEX Imperatives and developed four GEWEX Science Questions (GSQs), which are comprised of research efforts that are likely to demonstrate significant progress in the next 5–10 years. These GSQs are complementary to the WCRP Grand Challenges introduced at the last Joint Scientific Committee (JSC) meeting (see the Commentary in the August 2012 issue of *GEWEX News*). The primary objective of one session of the SSG was to review the activities of the GEWEX Panels and their plans for contributing to the GEWEX GSQs, which are stated below.

1. **How can we better understand and predict precipitation variability and changes?**
2. **How do changes in the land-surface and hydrology influence past and future changes in water availability and security?**
3. **How does a warming world affect climate extremes, especially droughts, floods, and heat waves, and how do land area processes contribute in particular?**
4. **How can understanding of the effects and uncertainties of water and energy exchanges in the current and changing climate be improved and conveyed?**

At the recent 33rd JSC meeting, which was held in Beijing, China, GEWEX and the other WCRP Projects were asked to take a fresh look at their regional activities in Africa, as well as in Latin America and the Caribbean. Starting with stakeholder needs in the region, the projects will develop research priorities that are in line with the new research priorities. In particular, the Climate Variability and Predictability Project (CLIVAR) and GEWEX are to take the lead in forming organizing committees for conferences or workshops that will identify future directions for WCRP in these regions. CLIVAR and GEWEX will also coordinate pan-WCRP monsoon activities, with the CLIVAR Asian-Australian Monsoon Panel (AAMP) taking the lead on global monsoons with activities on Africa, Asia, and the Americas.

Activities related to extremes will be guided by the new WCRP Grand Challenge on extremes, and this would necessarily involve a great expansion over what currently exists in the Commission for Climatology (CCI)/CLIVAR/Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) Expert Team (ET) on Climate Change Detection and Indices (ETCCDI). The extremes activity could be centered anywhere, but seems to be a logical fit with land (GEWEX) since it includes drought, ETCCDI, and activities in the GEWEX Regional Hydroclimate Projects (RHPs).

### *GEWEX Data and Assessments Panel (GDAP)*

The SSG reviewed the current and planned activities of the GEWEX Panels, starting with GDAP, which is chaired by Prof. Christian Kummerow and vice-chair Dr. Joerg Schultz. The Panel is divided into three focus areas: (1) Data Products, (2) Product Assessments, and (3) Radiative Transfer Code Assessments. The individual data products for clouds (the International Satellite Cloud Climatology Project, ISCCP), aerosols (the Global Aerosol Climatology Project, GACP), radiation (the Surface Radiation Budget Project, SRB), turbulent fluxes (SeaFlux and LandFlux), and precipitation (the Global Precipitation Climatology Project, GPCP) continue with reasonable support except for GACP, which is currently unfunded. Each of these projects is preparing for a data reprocessing cycle that will result in common ancillary data, assumptions, and space and time grids that will be merged into a single product called the GEWEX Integrated Water and Energy Product. The first year of the integrated product is scheduled for delivery in 2013.

Based upon GDAP data products, the downward shortwave and longwave radiative fluxes at the Earth's surface were calculated to be 166 $Wm^{-2}$ and 344 $Wm^{-2}$ respectively, which is about a 16 $Wm^{-2}$ increase compared to the previous estimation of Trenberth et al. (2009). This makes for a much larger and untenable discrepancy between radiative fluxes and estimated latent and sensible heat fluxes at the surface. The recent publication by Stephens et al. (2012) was discussed and it was noted that the latent heat estimate of 88 $Wm^{-2}$ is well outside the bounds estimated by GPCP (76 $Wm^{-2}$ with a bias error of less than eight percent), highlighting the issue of closure. The integrated GDAP product will further quantify the flux estimates and their uncertainties, and bring closure issues to a head. It was noted that the Global Precipitation Measurement (GPM) mission to be launched in 2014 will resolve most, if not all of the issues related to mean precipitation at the global scale.

The SeaFlux product, a high-resolution satellite-based data set of turbulent surface fluxes over the global oceans, is being developed with input from the CLIVAR ocean flux community. Both SeaFlux and LandFlux data sets will be released in mid-2013 with relatively better quality than reanalysis. Both products have improved agreement with in situ measurements than current reanalyses.

GDAP recently completed assessments of cloud and radiation data products. Journal versions have been submitted in order to make them available to the Intergovernmental Panel on Climate Change (IPCC) assessments. The Radiation Assessment shows some differences between ISCCP, SRB, and the Clouds and the Earth's Radiant Energy System (CERES) products. These differences, however, are often much smaller than among climate models. The cloud assessment focuses significant attention on the question of cloud amount, which

is often used as a metric in climate studies. Although cloud amount is quite inconsistent among data sets, owing to different sensitivity of sensors, the effective cloud amount, which includes the influence of optical depth, is in much better agreement. In addition to these activities, GDAP has initiated two new assessments: a new water vapor assessment that includes new sounders, reference radiosondes, and Global Positioning System (GPS)-based methods, and an assessment of satellite simulators. The latter is intended to document the assumptions made within the simulators that are often not recognized, and it is hoped that this will foster interaction with the modeling community.

***Global Atmospheric System Studies (GASS) Panel***

GASS, which is co-chaired by Drs. Stephen Klein and Jon Petch, supports the community that carries out and uses observations, process studies, and model experiments with a focused goal of developing and improving the representation of the atmosphere in weather and climate models. Close to 220 scientists attended the 1st Pan-GASS Science Conference held in September 2012 (see the meeting report on page 10). GASS has eleven current and planned projects. Newer projects of note include: (i) a joint GASS/Global Land/Atmosphere System Study (GLASS) Panel study on land-atmosphere interactions; (ii) a joint effort with the Working Group on Coupled Modelling (WGCM) and European Union Cloud Intercomparison, Process Study and Evaluation Project (EUCLIPSE) to examine the interactions of moist process parameterizations with large-scale circulation under the weak-temperature gradient approximation; and (iii) the Grey-Zone Intercomparison Project to examine how models parameterize convective processes when the model horizontal resolution only partially permits convective clouds to be simulated (2–10 km range).

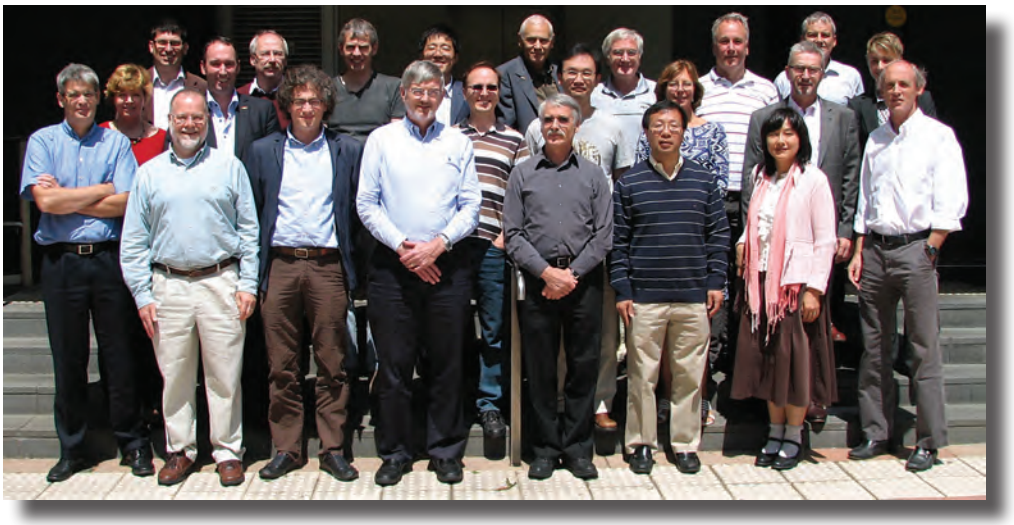
GASS has collaborative activities with many projects. A study on the vertical structure and diabatic heating of the Madden Julian Oscillation (MJO) is a joint project of GASS and the WCRP-World Weather Research Programme (WWRP) MJO Task Force. The GASS Low-Cloud Feedbacks Project is conducted jointly with the Cloud Feedback Model Intercomparison Project of the WGCM. Also, Dr. Gunilla Svensson represents GASS in planning meetings of the new polar project initiatives of WWRP and WCRP, and Dr. Steve Woolnough represents GASS on the joint WWRP/WCRP Subseasonal to Seasonal Prediction Project.

***Global Land/Atmosphere System Study (GLASS) Panel***

GLASS, which is co-chaired by Drs. Joe Santanello and Martin Best, supports the improvement of estimates and representation of land-surface states and fluxes, the interaction with the overlying atmosphere, and maximizing the fraction of inherent predictability in models. An important achievement of GLASS has been the development of easy-to-use, comprehensive evaluation methods for surface models using single site data, based on the Protocol for the Analysis of Land Surface models system (PALS). The PALS capability has been extended beyond traditional validation methods to include a priori benchmarking with the aim of defining the added value that a land-surface model can deliver in comparison with alternative methods (e.g., empirical models). A catalogue of reference sites' flux tower sites has been developed, and progress made in a synthesis of longwave and net radiation methods.

The focus of the GLASS Project for the Intercomparison of Land Data Assimilation Systems' first experiment (PILDAS-1) is on operational weather and seasonal forecasting, soil moisture retrieval, and development of a framework for comparisons. Early experiments have been completed and target dates for full experiments and analyses are August and October 2013 respectively.

The kick-off meeting for the GLASS Global Soil Wetness Project-3 (GSWP-3) is planned for early 2013. The goal of the Project is to develop a comprehensive set of land state data to investigate coupled energy-water-carbon cycles for a long-term period covering the entire 20th and 21st centuries. GSWP-3 activities will include: (1) the comparison of coupled energy-water-carbon cycle models with different configurations of model components (i.e., without a dynamic ecosystem component, with a static carbon cycle component, and with a dynamic carbon cycle component); (2) the comparison of model simulations with time-varying land cover maps and different soil maps (e.g., Harmonized World Soil Map); (3) the validation of models using observations collected from in situ ob-



*Participants at the GEWEX SSG-25 Meeting.*

servations from all over the world; and (4) development of a data portal. As GSWP-3 plans include a global river model, there is considerable potential for collaborative activities with the GEWEX Hydroclimatology Panel (GHP) RHPs. See the GLASS meeting report on page 12.

***GEWEX Hydroclimatology Panel (GHP)***

GHP, which is co-chaired by Drs. Jan Polcher and Jason Evans, has been reorganized around the RHPs and crosscutting projects. Several RHPs have ended and potential new projects have been identified in the U.S., Canada, Australia, and Africa. The Saskatchewan River Basin in Canada received confirmation as an Initiating RHP. A community benchmarking project (PALS) is underway with GLASS, where reference site and model output data sets gathered previously for different regions, seasons, and variables are being used in the validation of land-surface models. GHP is also focused on the SSG challenge to foster collaborations with other groups having common interests in land-surface processes, including the Coordinated Regional climate Downscaling Experiment (CORDEX), GDAP, GLASS, and CLIVAR, to deal with a number of important issues that range from monsoons to extremes and how to help coordinate the multitude of national initiatives in those areas.

Dr. Eric Wood stepped down as the chair for the Hydrologic Applications Project (HAP) and a clear path to maintain this type of activity is needed. HAP members successfully implemented, under the auspices of the United Nations Educational, Scientific, and Cultural Organization (UNESCO), an Experimental African Drought System. This was undertaken and training was conducted at the Centre Regional de Formation et d'Application en Agrométéorologie et Hydrologie Opérationnelle (AGRHYMET) in Niamey, Niger and the IGAD Climate Prediction and Applications Centre (ICPAC) in Nairobi, Kenya. The HAP Seasonal Forecasting Working Group under the leadership of Dr. Albert van Dijk has been very active, with an emphasis on dynamic seasonal forecasts derived from climate models and their propagation through hydrological models.

Joint GHP/GDAP annual meetings that include time for participation by local researchers in related fields are tentatively planned in Rio de Janeiro, Brazil in early September 2013. A CORDEX meeting may also be held during the same period. See the full GHP meeting report on page 18.

It has been a busy year for the International GEWEX Project Office and GEWEX Panels, and that will not change in 2013, judging by the number of meetings already scheduled, including kick-off workshops addressing activities related to the GEWEX Science Questions.

**References**

Trenberth, K. E., J. T. Fasullo, and J. Kiehl, 2009. Earth's global energy budget. *Bull. Amer. Meteor. Soc.,* 90, No. 3, 311–324.

Stephens, Graeme L., et al., 2012. An update on Earth's energy balance in light of the latest global observations. *Nature Geosciences,* 5, 691–696.

## Meeting/Workshop Reports

# CAHMDA-V: Catchments in a Changing Climate

### 8–11 July 2012 Enschede, The Netherlands

**Bob Su, Yijian Zeng, Joris Timmermans, Rogier van der Velde, Suhyb Salama, Christiaan van der Tol, Wim Timmermans, and Marcel van Helvoirt**

Department of Water Resources, Faculty of ITC, University of Twente, Enschede, The Netherlands

The 5th Workshop on Catchment Hydrological Modeling and Data Assimilation (CAHMDA-V) was organized by the Department of Water Resources at the University of Twente. The Workshop brought together the international hydrological science community to begin planning research activities for the upcoming decade. Among the topics discussed were recent advances in modeling, observations, and data assimilation approaches, and how to apply these to understanding, observing, and predicting hydrological processes and changes in catchments. Particular attention was given to the quantification and attribution of climate change impacts. New observing systems, theories, and the use of data assimilation were also reviewed. Presentations from the Workshop are available at: *http://cahmda.itc.nl/.*

Over 45 participants attended the pre-workshop, which was held on 8–9 July to provide advanced training on modeling, data assimilation, and attribution of climate change impacts. Zong-liang Yang, University of Texas at Austin, reviewed the multi-disciplinary development in the Community Land Model (CLM4) and the snow data assimilation algorithm using data from the Gravity Recovery and Climate Experiment (GRACE) and the Moderate-resolution Imaging Spectroradiometer (MODIS). He also reviewed ensemble data assimilation using CLM4 and the Data Assimilation Research Testbed (DART) over the Tibetan Region. Xuebin Zhang, Environment Canada, presented methods for detecting trends in climate change and possible causes. Tim Hoar, US National Center for Atmospheric Research, concluded the first day with a presentation on DART over the Tibetan region. The next day, he led a hands-on demonstration of the DART system.

Over 80 participants attended the main workshop, which included invited keynote speeches, poster presentations, and extensive discussions. Ten keynote speeches were evenly distributed over five thematic sessions and "beyond the state-of-art" views were presented by each of the thematic session chairs.

In the first session, "New Observation Systems—Using Data Assimilation to Understand Model Uncertainty," Matthew

Rodell, National Aeronautics and Space Administration (NASA)/Goddard Space Flight Center (GSFC), presented the importance of managing bias between models and observations by using Cumulative Distribution Function (CDF) matching and dynamic bias correction. He noted that newer and better observations could enable the improvement of models. Gianpaolo Balsamo, European Centre for Medium-Range Weather Forecasts (ECMWF), demonstrated a practical way to identify the needs of parameterizations or data assimilation schemes by separating the time scale in fast and slow land-surface processes. Jeffrey Walker, Monash University, showed how model uncertainty could be improved with more emphasis on multi-variate observations and data assimilation to improve model physics rather than state evolution.

In the session on "Models and Reality—Using Data Assimilation to Understand the Evolution of Catchments," Sally Thompson, University of California Berkeley, revealed how data assimilation could be used to estimate ecohydrological properties using vegetation distribution information. Peter Troch, University of Arizona Hydrology and Water Resources Department, presented the co-evolution of the climate-soil-vegetation properties at the catchment scale.

In the session on "Climate Change Impacts—Detecting Changes in Cold/Arid and High Elevation Catchments/Regions," Chunmiao Zheng, Peking University, presented an ecohydrological experiment in the Heihe River Basin in China that is exploring the principles of ecohydrological processes in an arid environment under the influence of climate change and human activities. Kun Yang, Institute of Tibetan Plateau Research, Chinese Academy of Sciences, reported on the hydrological response of the Tibetan Plateau to climate change, and noted that the limited data availability in high elevation and remote regions could be compensated by using satellite applications, such as data assimilation. Xin Li, Cold and Arid Regions Environment and Engineering Research Institute, Chinese Academy of Sciences, provided a perspective on how to capture the spatial heterogeneity and quantify representative error by using a data assimilation technique.

In the session on "Causes of Hydrological Changes—Attributing Climate and Land Use Change Impacts in Water Cycle Components," Sonia Seneviratne, Swiss Federal Institute of Technology (ETH), gave the status of detected trends in land hydrology, the contributing mechanisms (e.g., forcing, processes, feedbacks) to these trends, and the potential avenues for trend attribution. Xuebin Zhang presented the methods for climate change detection and attribution, evidence of anthropogenic influence on the hydrological cycle, and the expected change in the hydrological cycle on a global scale. Zong-Liang Yang, Land Environment and Atmospheric Dynamics Group, University of Texas-Austin, proposed using global high-resolution modeling, downscaling, and nudging for better model parameterizations and data assimilation to improve understanding, modeling, and prediction at catchment scales.

In the session on "Physics, Parameterizations and Parameters—Testing Model Structure and Process Representation and Inferring Parameters Using Data Assimilation," Michael Ek of the National Oceanic and Atmospheric Administration (NOAA) and the National Centers for Environmental Prediction (NCEP) presented the land data assimilation systems at NCEP and the Environmental Modeling Center, and examples of their applications. Rolf Reichle, NASA/GSFC, discussed the calibration of Radiative Transfer Models in terms of addressing bias for radiance assimilation. Jean-Christophe Calvet of Météo-France gave his perspective on the availability of long-term satellite-derived time series in testing model structure and process representation by using appropriate data assimilation methodologies.

The poster submissions of five of the early career scientists were recognized for outstanding research, and one of these won the best poster award. To share the workshop findings and discussions with the scientific community, a special conference issue of the *Journal of Hydrometeorology* has been initiated by Jeff Walker and Bob Su. All workshop participants are invited to submit their studies and results to this special collection.

*Participants at the 5th Workshop on Catchment Hydrological Modeling and Data Assimilation (CAHMDA-5).*

# 1st Pan-GASS Meeting: Observing, Modeling, and Representing Atmospheric Processes

## 10–14 September 2012 Boulder, Colorado, USA

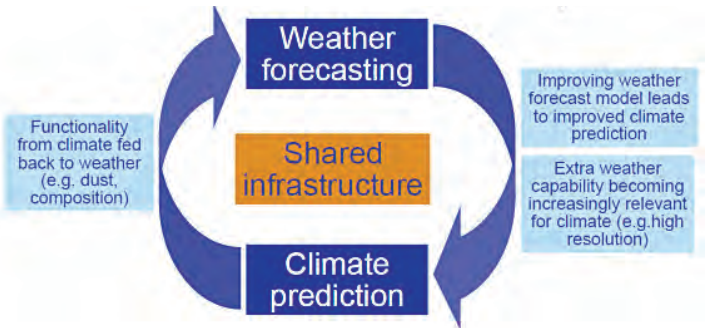
**Jon Petch**[1] **and Steve Klein**[2]

[1]UK Met Office, Exeter, UK; [2]Lawrence Livermore National Laboratory, Livermore, CA, USA

Building upon the tradition and success of past GEWEX Cloud System Study (GCSS) pan-meetings, the 1st Pan-Global Atmospheric System Studies (GASS) Meeting was held, bringing together over 200 scientists involved in GASS activities to review advances in observing, modeling, and parameterizing atmospheric processes. In addition, joint sessions were held with the GEWEX Global Land/Atmosphere System Studies (GLASS) Panel to facilitate collaboration.

From increasing the lead time for the prediction of severe weather events to reducing the uncertainty of future projections of centennial climate change, the need for a better representation of the atmosphere in models remains essential. The GASS community uses observations, process studies, and model experiments to support the improvement of atmospheric models. GASS organizes projects (typically involving the comparison of several models with detailed observations) to bring together scientists involved in all aspects of atmospheric systems or processes. Current and proposed GASS activities discussed at the meeting include:

- Improving the representation of stable boundary layers
- Diagnosing cloud and radiation processes in models to address systematic biases
- Studying convective systems through the weak temperature gradient method
- Evaluating model processes when they are partially resolved (the grey-zone)
- Cloud and precipitation microphysics modeling in a dynamically constrained environment
- Marine boundary layer cloud feedbacks in a warming climate
- Radiative processes in observations and models
- Observing and modeling cirrus clouds
- Modeling tropical convection observed during the Cooperative Indian Ocean Experiment on Intraseasonal Variability (CINDY)/Dynamics of the Madden-Jullian Oscillation (DYNAMO)
- Observing and modeling polar clouds with the Indirect and Semi-Direct Aerosol Campaign (ISDAC)
- Stratocumulus-to-trade cumulus transition
- Vertical structure and diabatic heating of the Madden-Julian Oscillation (MJO)
- Improving land-atmosphere interactions (a joint GASS/GLASS activity)
- Assessing coupling diagnostics using observations at the Atmospheric Radiation Measurement (ARM) Program Southern Great Plains (SGP) site (a GLASS project)

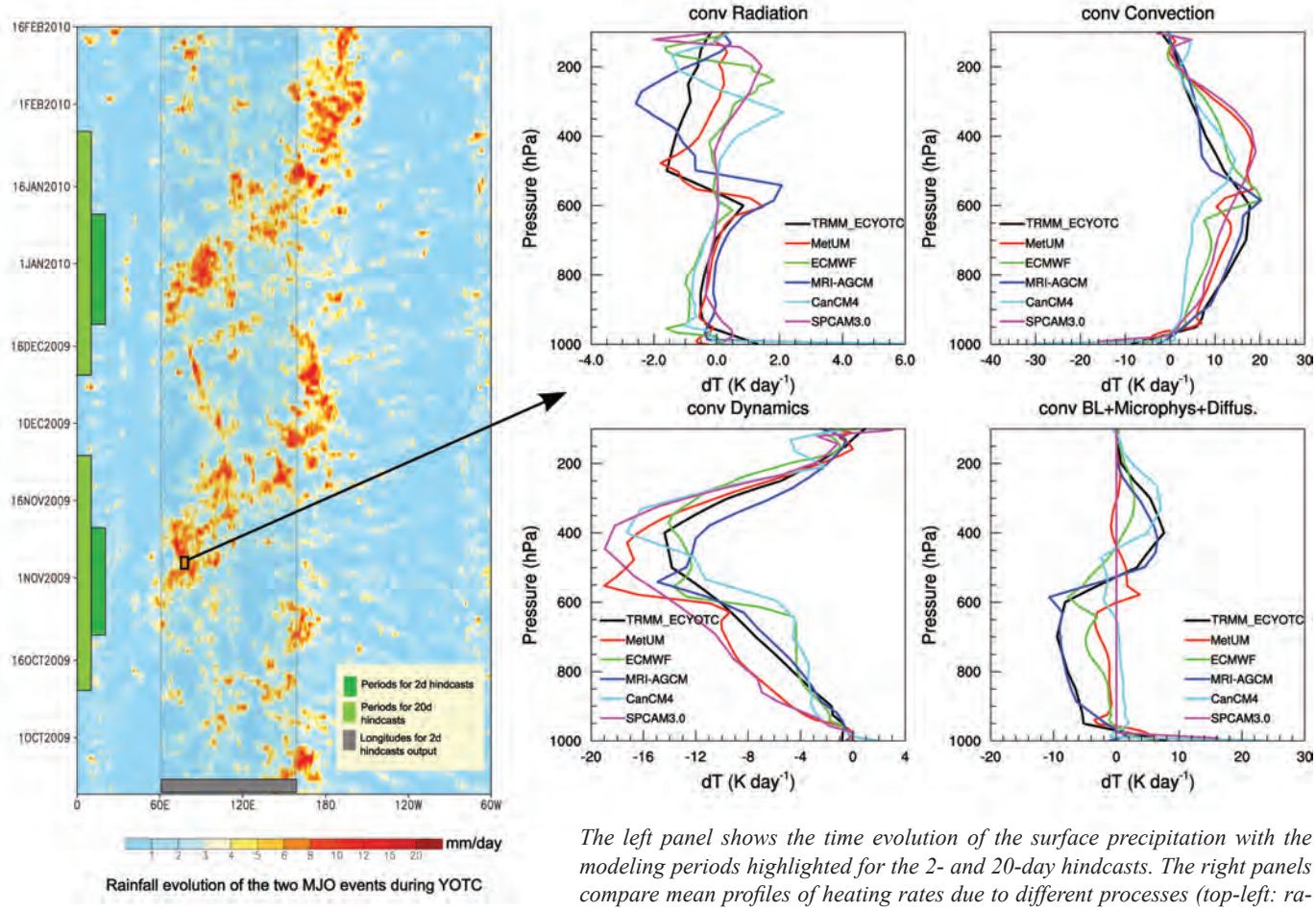



*Benefits of the seamless modeling strategy. Courtesy of Julia Slingo, Met Office, UK.*

Future needs for observations to support model development were addressed and the discussion was complemented by a presentation on the novel use of CloudSat and A-Train satellite observations for model diagnosis of cloud microphysical processes by Kentaroh Suzuki. Satellites, such as the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) satellite and CloudSat, now provide the critical data necessary for the evaluation of atmospheric processes; however, the future of these type of observations is uncertain beyond the Earth Clouds Aerosols and Radiation Explorer (EarthCARE) satellite mission. The importance of field campaigns in making in situ and long-term measurements at supersites like the ARM SGP site were identified as vital to the process of improving models used for weather and climate prediction. The ongoing need for observations as simple as condensate profiles and their spatial distributions was highlighted, as well as the need for associated vertical velocity processes. A report is being prepared to inform the World Climate Research Programme (WCRP) of the needs of the model development community.

Plenary sessions covered many general areas related to atmospheric processes, observations, and modeling. The importance of a seamless approach to weather and climate prediction was noted in several of the talks given, and is fundamental to many of the GASS projects. In particular, Julia Slingo, Met Office, presented the benefits of using seamless and multiscale ap-

## MJO Model Comparison




*The left panel shows the time evolution of the surface precipitation with the modeling periods highlighted for the 2- and 20-day hindcasts. The right panels compare mean profiles of heating rates due to different processes (top-left: radiation; top-right: convection; bottom-left: dynamics; and bottom right: microphysics and boundary layer) from the initial six models submitted to the 2-day hindcast case study. The period and region of average is shown in the blue box.*

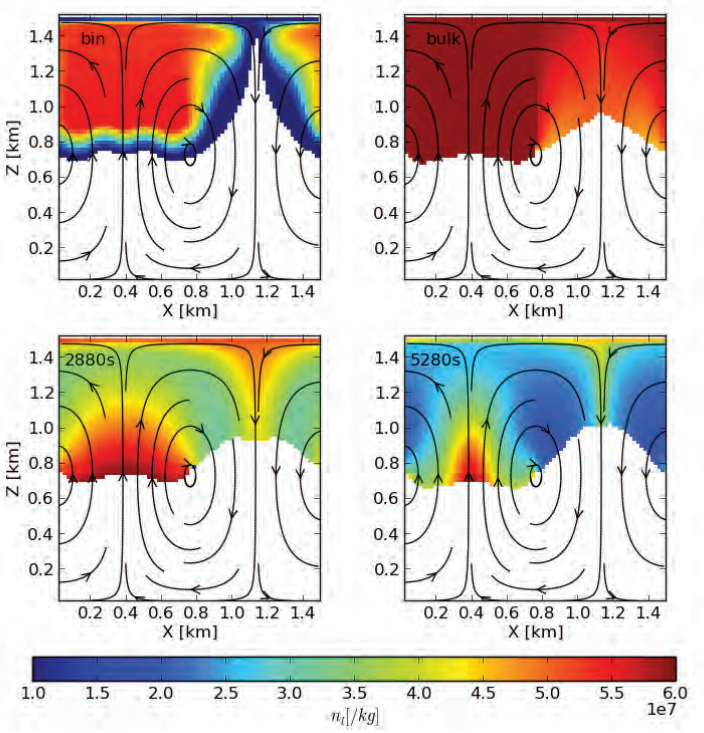
proaches in weather and climate prediction, and how weather prediction models benefit from being tested in climate simulations and vice versa (see the figure on page 10).

A new goal for GASS and a focus of the Pan-GASS Meeting is to entrain more experts in radiative transfer in the GASS community. Many of the presentations by GASS projects highlighted the importance of radiative transfer forcing in the simulation of atmospheric processes. Bill Collins, Lawrence Berkeley National Laboratory, presented the current state of radiative transfer parameterizations in the "best" climate models. His talk showed that in plain parallel situations, with the correct inputs, the errors in radiative transfer are small. However, there remain significant challenges around constraining the key inputs, such as the horizontal and vertical heterogeneity of the atmosphere. He also demonstrated that spectral sampling can be used as a tool in the early detection of anthropogenic climate change. Lazaros Oreopoulos, National Aeronautics and Space Administration Goddard Space Flight Center, gave a presentation on the Continuous Intercomparison of Radiation Codes (CIRC), which is now a joint GASS-GEWEX Data and Assessments Panel (GDAP) activity. This led to useful discussions on how a CIRC component could complement several GASS projects.

Another area of interest for GASS is large-scale tropical moist convection. GASS and the WCRP-World Weather Research Programme (WWRP) MJO Task Force are involved in a joint project to study the diabatic heating and moistening profiles associated with the MJO. This collaborative project (see initial results in the figure above) was reinforced by the strong presence of both communities at the meeting. On a closely related topic, Adam Sobel, Columbia University, presented the weak-temperature gradient methodology to evaluate and develop parameterizations. This methodology showed great promise in isolating the behavior of atmospheric parameterizations in a tropical environment, and a new GASS project based upon these ideas is planned.

There were many talks about the influence of aerosols on clouds and their subsequent impact on radiative forcing of the atmosphere. Graham Feingold, National Center for Atmospheric Research, noted that while aerosols can influence clouds and their production of precipitation, the whole cloud system should be considered, including cloud-scale dynamics. This is necessary to really understand the impacts of the indirect effects of aerosols on the climate system. Without considering the "buffering" role of cloud dynamics the role of aerosols may be poorly estimated. The figure below shows initial results from a GASS project to use a framework to evaluate warm microphysics and aerosol processing in isolation from large-scale dynamics.

The 1st Pan-GASS Meeting was very productive and brought together atmosphere and land model developers, the observational and evaluation community, process modelers, and experts in tropical dynamics. GASS has over ten ongoing projects with several new areas of collaboration suggested at the meeting. The plenary presentations can be found at: *http://www.gewex.org/2012gass_conf.html*. Information about GASS projects and how to participate in them can be found at: *http://www.gewex.org/gass_panel.html* and new projects will be advertised through the GASS mailing list at: *http://lists.gewex.org/mailman/listinfo/gass*).




*Kinematic tests of warm microphysics and aerosol processing, courtesy of Ben Shipway. Arrows show the direction of prescribed flow with colors representing cloud droplet number concentrations. The top panels show equilibrium values comparing a bin model with a bulk model with fixed aerosol. Bottom panels show snapshots at later times when the bulk model continues to run with the nucleation scavenging processes turned on, ultimately resulting in decreased droplet concentrations.*

## GLASS Panel Meeting

### 13–14 September 2012
### Boulder, Colorado, USA

**Joe Santanello[1] and Martin Best[2]**

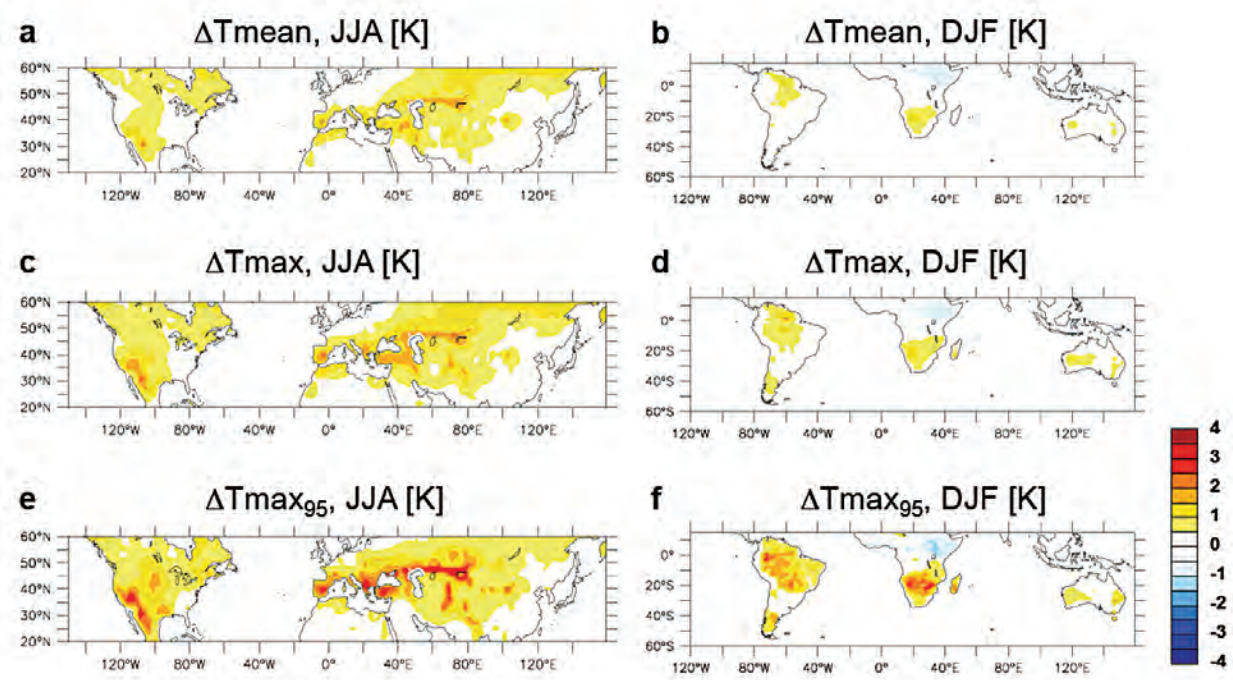
[1]NASA/Goddard Space Flight Center, Greenbelt, MD, USA; [2]Met Office, Exeter, Devon, UK

Twenty-two people attended the Global Land/Atmosphere System Study (GLASS) Meeting, including representatives from current projects, activities and working groups, as well as potential new Panel members. GLASS completed its second year as a stand-alone GEWEX panel for modeling activities with Drs. Martin Best and Joe Santanello serving as co-chairs. Dr. Martin will step down at the end of the year and Dr. Aaron Boone takes his place (see page 3).

The first item of business at the meeting was to present the newly adopted Terms of Reference (TOR) for GLASS Panel membership. These were originally proposed at the 2011 GLASS meeting, subsequently modified according to feedback, and then ratified by the GEWEX Scientific Steering Group. The TOR includes term limits for GLASS co-chairs of 4 years, staggered in 2-year intervals to ensure continuity of leadership. Two main categories of membership were established without term limits: (1) Experienced Scientists (including project leads); and (2) Young Scientists. There is also a protocol for new members of each category, where they may attend a GLASS meeting and present their interests and its relevance to Panel activities. The adoption of the TOR has already improved the expectations of the Panel members, shed inactive members, brought new experienced and young scientists into the fold, and allowed the outside community better access to and understanding of the Panel operations.

GLASS has a representative mix of established and new projects, each of which corresponds to one of the three GLASS themes (Model Data Fusion, Benchmarking, and Land-Atmosphere Coupling). The Panel also has a number of collaborative projects with the GEWEX Hydroclimatology Panel (GHP), is launching projects with the GEWEX Atmospheric Boundary Layer Study (GABLS), and continues to be engaged with the World Climate Research Programme (WCRP) Working Group on Numerical Experimentation (WGNE) on benchmarking and data assimilation activities.

Updates on current and future GLASS activities were presented with a special emphasis on refining plans for three new projects [African Monsoon Multidisciplinary Analysis (AMMA) Land-surface Intercomparison Project-Phase 2 (ALMIP-2); Global Soil Wetness Project-Phase 3 (GSWP-3); and the Project for the Intercomparison of Land-Surface Paramterization Schemes (PILDAS)] that have started or will soon. In addition, discussions were held on current gaps in GLASS membership and activities, and the mapping of GLASS projects to the new WCRP Grand Science Questions and GEWEX Science Ques-




*Impact of 2071–2100 soil moisture conditions vs. 1971–2000 soil moisture fields in CMIP5 projections (ECHAM6, GFDL, and CESM models): Effects on mean daily temperature ($T_{mean}$) (top), mean $T_{max}$ temperature (middle) and 95th percentile $T_{max}$ temperature (bottom) in June-July-August (JJA, left) and December-January-February (DJF, right). The plots are centered on the regions with largest effects, which coincide with those displaying the largest changes in soil moisture in the projections. The effect of mean changes in soil moisture alone account for up to 1–3 degrees warming in the projections, the effect is stronger for extreme midday temperature (95$^{th}$ percentile of $T_{max}$) than mean daily temperature.*

tions. Lastly, two prospective Experienced Scientist members (Nate Brunsell and Lifeng Luo) were invited to the Panel and given an opportunity to share their research interests and connections to GLASS.

### *GLACE-CMIP5*

Benoit Guillod presented results from Phase II of the Global Land/Atmosphere Coupling Experiment (GLACE-2; Sonia Seneviratne). GLACE-2 uses the Coupled Model Intercomparison Project-Phase 5 (CMIP5; Representative Concentration Pathway 8.5) models, and aims to quantify the role of soil moisture-climate feedbacks for climate change projections. Experiments 1A and 1B of GLACE-CMIP5 have been completed, and consist of reruns of climate change projections using a 1971–2000 soil moisture climatology evaluated against a seasonal transient cycle of soil moisture during the 2070–2100 period. The Geophysical Fluid Dynamics Laboratory (GFDL), European Centre for Medium-Range Weather Forecasts (ECMWF) Hamburg model (ECHAM), Community Earth System Model (CESM), and Institut Pierre-Simon Laplace (IPSL) have completed the full analysis and a first article on these results has been submitted. Simulations with the EC-Earth model are currently ongoing.

Results show that the imposed soil moisture anomalies strongly affect the land energy balance and resulting air temperature, and correlate well with study regions projected to experience drought increases (see figure above). In addition, soil moisture changes were identified to affect daily maximum temperature more strongly than minimum temperature, and extreme high temperatures more strongly than average temperatures. Precipitation impacts are less clear, and additional analysis over the next year will be conducted to analyze the feedbacks and water balance effects, including impacts on biogeochemical fluxes, and interactions with land cover change.

### *LoCo*

The Local Land-Atmosphere Coupling (LoCo; Joe Santanello) activity continues as a GLASS Working Group, and is comprised of both Panel and non-Panel member research activities. A breakout session was held earlier in the week at the Pan-Global Atmospheric System Studies (GASS) Meeting, focusing on the proposed "LoCo/US Southern Great Plains (SGP) Testbed Project." The Working Group spent the last year producing and publishing work on the diagnostics of land-atmosphere interactions and coupling using an array of scales and models. For example, a trilogy of papers has been written based on the coupling of NASA's Land Information System (LIS) with the Weather Research and Forecasting (WRF) mesoscale model that includes model coupling behavior evaluation during wet and dry extreme periods over the SGP. Other diagnostics have produced global maps of coupling metrics from global circulation model (GCM) output and reanalysis products such as the North American Regional Reanalysis (NARR) and the Modern-Era Retrospective analysis for Research and Applications (MERRA). Some examples of the diagnostics are the traditional mixing diagrams, two-legged metric, lifting condensation level (LCL) deficit, Findell-Eltahir diagnostics of

triggering of convection, revised relative humidity tendency variables, McNaughton coupling coefficient, and triggering feedback strength (TFS) and amplification feedback strength (AFS). A wide net has been cast in developing coupling metrics and producing maps, but it was recognized that now is the time to reel in these efforts and synthesize them, to get to more science-driven questions of coupling.

**LoCo-SGP Testbed**

The LoCo Working Group is embarking on a testbed project that will allow an array of diagnostics to be consistently applied to the same location in order to understand their hierarchy and to develop a coupling classification system based on metrics. During the Pan-GASS Meeting, Craig Ferguson and Joe Santanello presented the concept of a focused observationally driven testbed for LoCo research centered on the SGP. site. In Phase 1, a consistent 5–10 year data set of all LoCo-related variables would be developed, and compiled and supported by the Atmospheric Radiation Measurement (ARM) Program. A survey on LoCo data needs has been distributed to the community for inputs and these will be reviewed before the ARM data is compiled. From this benchmark data set, the currently disparate models and LoCo diagnostics will be evaluated in a consistant manner across time and spatial scales. The LoCo/SGP Testbed breakout session included a combination of land and Planetary Boundary Layer (PBL) modelers and data measurement experts, and provided excellent feedback on the best way forward, including potential caveats related to PBL data availability and scale issues.

***PALS***

The Protocol for the Analysis of Land Surface (PALS) online land surface model benchmarking system (*http://pals.unsw.edu.au*; Gab Abramowitz) has progressed to a more advanced version that includes gap filling, empirical benchmarks, and automated metrics along with a large suite of FluxNet data. PALS is designed to analyze uploaded single site model simulations with site observations in a standard way. Extensions to other data sets and the creation of benchmarking tests are under development. For example, implementation of the Manabe bucket model and the Priestly-Taylor approach to flux estimation will be performed in order to use as standard benchmarks of the "goodness" of current land-surface models (LSMs). A joint GHP-GLASS project to demonstrate benchmarking through PALS is ramping up as well.

***ALMIP-2***

Phase 2 of the AMMA Land Surface Model Intercomparison Project (ALMIP-2; Aaron Boone) is a 4-year project that began in spring 2012, and includes 22 LSMs, five hydrological models, and one evapotranspiration (ET) model. ALMIP-2 experiments will be performed at the mesoscale (5 km) and local scale to focus on subtle hydrology and vegetation processes (e.g., very large rooting depths; contrasting land use; sloping bedrocks that move water out of the catchment; strong variability in runoff). The forcing data will be derived from a blend of in situ, radar, and satellite data (e.g., Landsat). The goal of the project is to provide recommendations for the parameterization of runoff scaling. As this project has regional hydrological aspects, it is also considered to be an ideal candidate for a collaborative project between GLASS and GHP.

**GSWP-3**

The updated implementation plan for the Global Soil Wetness Project Phase-3 (GSWP-3; Hyungjun Kim) was presented. GSWP-3 will include three experiments, with the first one being a retrospective run (1901–2008) that will serve as a land reanalysis product. This long historical period was designed to entrain the carbon modeling community. In addition to traditional hydrology, possible carbon-related effects will be explored, including changes in ecosystem functioning related to these trends, and uncertainties in forcings (e.g., precipitation) with multiple data sets. Over the past year, a great deal of bias correction has been applied to the Twentieh Century Reanalyses forcing data set (20CR), which uses global dynamical downscaling and Climate Research Unit (CRU) observations for near-surface fields, and a radiation correction is applied using the GEWEX Surface Radiation Budget (SRB) product. A summary of the experimental plan will be distributed to the carbon community to obtain its buy-in before the project begins. This will enable both carbon and water models, and energy cycle LSMs to be included, and simultaneously evaluated in each (e.g., the hydrology of carbon models and vice-versa). A GSWP-3 workshop on first results is planned in Tokyo, Japan in April 2013.

***PILDAS***

The Project for the Intercomparison of Land Data Assimilation Schemes (PILDAS; Rolf Reichle) has completed circulating its experimental plan for feedback and participation. The Project is expected to begin in early 2013. The experimental design is nearly complete, and a pilot study is underway by the project leads to use two LSMs with one data assimilation (DA) algorithm in NASA's Land Information System (LIS). Phase-1 is focused on the operational centers (rather than niche research projects), synthetic observations, and different DA algorithms with different LSMs for a 1/8-degree domain over the U.S. Southern Great Plains. Later phases will focus on coupled DA systems and actual satellite observations from the Soil Moisture Observing System (SMOS) and the Soil Moisture Active Passive (SMAP) satellite. GLASS will present the experimental plan and pilot results to WGNE to engage agencies that are not currently involved.

***LUCID***

The objective of the Land-Use and Climate, IDentification of robust impacts (LUCID; Andy Pitman) Project is to quantify the impacts of land-use-induced land cover changes on the evolution of climate between the pre-industrial epoch and today. Phase 1 is complete and LUCID-2 is underway. Results from LUCID-1 showed the impact of land cover change in the five GCMs that use the Land Use Harmonization (LUH) land cover data set. The Project also demonstrated the need to engage both LSM and land cover change (LCC) data set providers to better determine how to implement LCC in models. Linkages with GSWP-3 and the land cover treatment in the 20C simulations are being investigated.

***Pan-GEWEX and Future Activities***

A number of crosscutting projects were identified at the Pan-GASS and GLASS meeting, and include the following:

- *GLASS/GABLS Diurnal cycle Coupling Experiment (DICE).* This project will run fully coupled single column models (SCMs) during the GABLS-2 CASES 99 study period over the SGP region. The experiments will isolate the impact of surface fluxes (from the land surface models) vs. atmospheric forcing (from the PBL scheme) to determine the impact of land-atmosphere coupling in the SCMs over the full diurnal cycle (stable and unstable PBLs). Martin Best and Bert Holtslag will lead this effort that begins in early 2013.

- *LoCo/SGP Testbed Project.* ARM data providers and the GEWEX community have participated in a data needs survey for land-atmosphere coupling studies. In early 2013, ARM will produce a land best estimate data product for LoCo at the SGP site, which will then be used to establish a benchmark of land-atmosphere coupling based LoCo-derived diagnostics. Craig Ferguson and Joe Santanello are leading this effort.

- *PALS/Benchmarking Study.* Demonstration of the PALS system will be performed using GHP reference site data. Phase 1 will involve the GLASS members' land surface model contribution to PALS from 10–15 sites. The results will be presented during a GLASS-hosted benchmarking session at the American Meteorological Society meeting in January 2013, and is being led by Martin Best.

- *GABLS Stable Boundary Layer Project*. GLASS will assist in assessing the thermal coupling and flux momentum in a polar climate (this has been lacking in GLASS activities and focus).

GLASS is also exploring connections with the GHP Hydrological Cycle in the Mediterranean Experiment (HyMeX) Project. A GLASS representative attended the HyMeX Workshop held in Croatia in May 2012 and a HyMeX representative attends GLASS meetings. There are many "land activities" in HyMeX and the length and design of the study make it essential that GLASS at least monitor the modeling activities. GLASS is also interested in connections with the Coordinated Regional Climate Downscaling Experiment (CORDEX).

GLASS also participates in the new WCRP Modeling Advisory Council (WMAC), and continues its annual representation at WGNE meetings. GLASS is an instrumental part of the GEWEX response to the WCRP Grand Challenges and related workshop activities that will be planned.

GLASS has made good progress this year and is composed of many activities of high relevance to the GEWEX mission. The next GLASS Panel meeting will be held in mid- or late 2013.

## 2nd G-VAP Workshop

### 26-28 September 2012
### Offenbach, Germany

**Marc Schröder[1], Antonia Gambacorta[2], Lei Shi[3], Ralf Bennartz[4], Frank Fell[5], and Jörg Schulz[6]**

[1]Deutscher Wetterdienst and the Satellite Application Facility on Climate Monitoring, Offenbach, Germany; [2]NOAA/NESDIS Center for Satellite Applications and Research, College Park, MD, USA; [3]NOAA/NESDIS National Climatic Data Center, Asheville, NC, USA; [4]University of Wisconsin, Madison, WI, USA; [5]Informus GmbH, Berlin, Germany; [6]EUMETSAT, Darmstadt, Germany

More than 30 participants from research institutes, universities, weather services, ground-based and in situ measurement communities, and space agencies attended the 2nd GEWEX Water Vapor Assessment (G-VAP) Workshop, which was hosted by the Deutscher Wetterdienst (DWD) and the Satellite Application Facility on Climate Monitoring (CM SAF). The primary goal of G-VAP is to quantify state-of-the-art water vapor products for climate applications, thus enabling the GEWEX Data and Assessments Panel (GDAP) to select the most appropriate water vapor products for the construction of a globally consistent water and energy cycle product. G-VAP activities began in 2011 with a workshop on satellite-derived water vapor data records and their quality assessment. The overall goal of this workshop was to finalize the strategy and technical implementation for G-VAP. Presentations are available at: *ftp://ftp-cmsaf.dwd.de/G-VAP/WS2_Sep2012*.

R. Roca, l'Observatoire Midi-Pyrénées (OMP) Laboratoire d'Etudes en Géophysique et Océanographie Spatiales (LEGOS) gave a presentation on satellite water vapor products and their value for climate applications. R. Bennartz, University of Wisconsin, presented lessons learned from assessments of satellite-based cloud and albedo products. T. Peter, Swiss Federal Institute of Technology, talked about a Stratospheric Processes And their Role in Climate (SPARC) Project workshop held on Automated Verification, Analysis, and Synthesis (WAVAS).

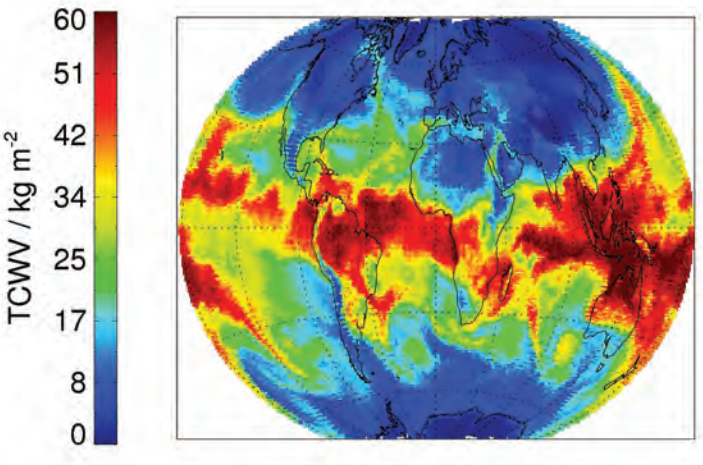
There are many different formats, metadata, parameter definitions, and content in validation data records. The Workshop participants agreed that data providers will be required to upload their data in NetCDF-3 format or include the appropriate software necessary for reading the data. Data providers will also be requested to provide a description of their data using a provided data fact sheet and will be encouraged to submit uncertainty measures with the data records.

The long-term data record analysis will begin by using post-processed data, such as monthly means. A refined analysis using less aggregated data will be conducted at a later stage. Long-term data records are defined as 10 years or more, which is necessary for climatological studies and also increases the number of data records for analysis. Based on this definition, the following preliminary list of instruments was compiled:

- Profiles: High Resolution Infrared Radiation Sounder (HIRS), Advanced Microwave Sounding Unit-A (AMSU-A), AMSU-B, Atmospheric Infrared Sounder
- Upper Tropospheric Humidity (UTH): HIRS, AMSU-B, Meteorological Satellite (METEOSAT)
- Total column water vapor: Special Sensor Microwave Imager (SSM/I), Microwave Radiometer (MWR), Medium-Resolution Imaging Spectrometer (MERIS), Moderate Resolution Imaging Spectroradiometer (MODIS), Global Ozone Monitoring Experiment (GOME)

The scientific approaches to analyzing Level-2 (instantaneous) and Level-3 (spatio-temporally gridded) data records were discussed, and it was agreed that Level-2 validation should go beyond bias and RMS analysis by also considering PDFs, the representativeness error, and averaging kernels whenever available. The assessment of long-term Level-3 data records will focus on stability and homogeneity, and when possible, their value for trend determination. Due to the inherent fundamental differences in the assessments of Level-2 and Level-3 data records, activities related to Level-2 and Level-3 analysis shall start in parallel. The scope, available resources, validation approaches and measures, updated candidate data record lists, the technical implementation, the time line, and rules of play will be summarized in the assessment plan, which will be finalized at the end of 2012.

Currently, DWD/CM SAF is the only participant with significant funding for organizing data hosting, processing, and analyses related to the top priority activities of G-VAP. The Cloud-Aerosol-Water-Radiation-Interactions (ICARE) Thematic Center was proposed as a candidate for data hosting and processing capabilities; however, there was not enough time at the Workshop to work out data and tool ownership issues with ICARE. Most of the Workshop participants concurred that data and software ownership should remain with the provider and that the data records be freely shared within G-VAP internally. This will be included in the data policy, as well as the provision that collocated data and a validation database be made available to the wider community.




*Global daily mean total column water vapor derived from Advanced TIROS Operational Vertical Sounder (ATOVS) for 18 December 2010. The data are available at: http://www.cmsaf.eu.* 

Results from the G-VAP Workshop were presented at the GDAP meeting in Paris, France on 1–3 October 2012, and the following feedback was received from the Panel:

- Atmospheric profiles (specific humidity preferred) are of highest interest to GDAP as they are the input to the GEWEX integrated products.
- The consistency of total column water vapor and UTH should be compared to the profile data.
- Widely used reanalysis products, such as those from the ECMWF ERA-Interim and the Modern Era Retrospective-analysis for Research and Applications (MERRA), should be assessed as they are an alternative source for GEWEX products.
- Linkage to the SPARC Upper Troposphere/Lower Stratosphere water vapor activity is highly appreciated as it is complentary to the G-VAP focus on tropospheric water vapor.

GDAP is interested in assessments of the quality and stability of water vapor products that G-VAP is considering. It is also important that the data record be produced with a unique, single version algorithm. GDAP recommended that long-term Level-3 products be analyzed on different time and space scales to provide an overview of any issues in Level-3 products, which can then be studied in more detail using Level-2 and/or Level-1 data, and by dedicated Level-2 data comparisons employing high quality ground-based observations.

Next steps for G-VAP include:

- Collect and compare the data records with a focus on long-term data records and an initial focus on gridded data records.
- Contact potential data providers for long-term profile data records, including reanalysis products. The primary investigators of the NASA Water Vapor Project-MEaSUREs (NVAP-M) and the long-term HIRS profile data records have been contacted, and downloading these records will begin soon. The download of reanalysis data has begun already.
- Perform comparisons on different time and space scales to determine what issues there may be in the Level-3 products.
- Perform dedicated Level-2 data comparisons employing high quality satellite data records, such as those from the Infrared Atmospheric Sounding Interferometer (IASI) and the Cross-track Infrared Sounder (CrIS), as well as high quality ground-based observations
- Perform, if necessary, studies on the quality of Level-1 data by involving space agencies directly.

First results will be presented at the next G-VAP workshop which is planned in North America in late 2013.

# 4th LandFlux Workshop

## 4–5 October 2012
## Paris, France

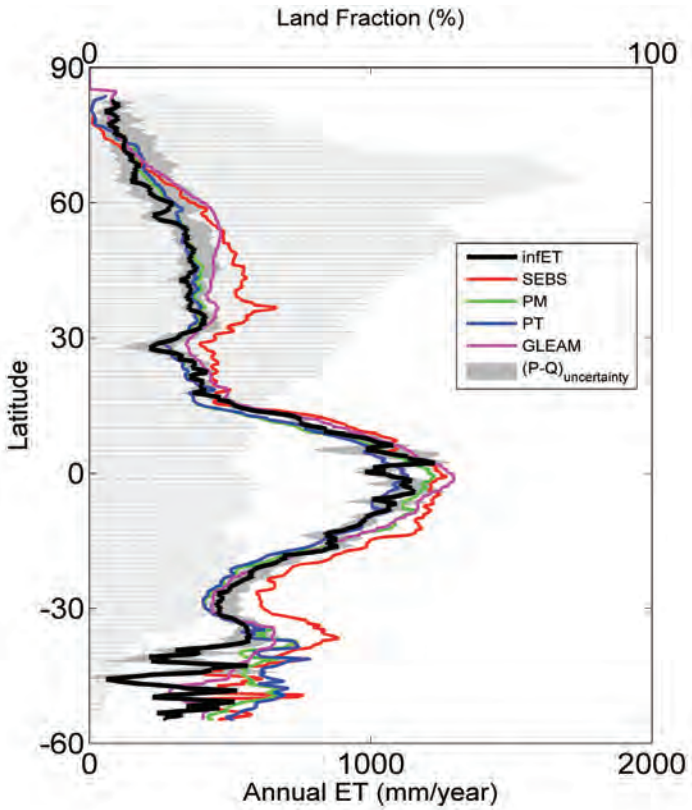
**Carlos Jimenez[1], Matthew McCabe[2], Sonia Seneviratne[3], Eric Wood[4], and William Rossow[5]**

[1]LERMA/CNRS, Observatoire de Paris, France; [2]School of Civil and Environmental Engineering, University of New South Wales, Sydney, Australia; [3]Institute for Atmospheric and Climate Science, ETH, Zürich, Switzerland; [4]Dept. of Civil and Environmental Engineering, Princeton University, USA; [5]NOAA/CREST, City College of New York, NY, USA

LandFlux is an initiative of the GEWEX Global Data Assessment Panel (GDAP) to develop a multi-decadal, global land-based surface heat flux data set that is spatially and temporally compatible with the other GEWEX data products. The Workshop, which was hosted by the Paris Observatory, reviewed the status and plans of the initiative, including evaluations of current products, intercomparisons, and the use of land heat flux products.

The LandFlux Version 0 product uses four different evapotranspiration methodologies (Su, 2002; Mu et al., 2007; Fisher et al., 2008; Miralles et al., 2011) that were run for the period 1984–2007 with a common forcing data set (Vinukollu et al., 2011). Previous intercomparisons have highlighted large differences in the satellite-based heat flux products that exist for particular regions and periods (Jimenez et al., 2011). Identifying the causes and mechanisms that produce these differences is an ongoing exercise, and participants are encouraged to contribute their independent estimates and analysis to this effort. Those interested in contributing to the LandFlux analysis may download the flux estimates and and assess them in the framework of other relevant products. In addition, the forcings may be obtained for running with other methodologies. The estimates from these assessments will be used for comparisons with the other flux simulations. Requests to access the data or to contribute with new estimates and analysis may be directed to the LandFlux Data Coordinator (*carlos.jimenez@obspm.fr*).

A large part of the workshop was dedicated to the initial evaluation of the daily latent flux estimates. Representatives from Princeton University and the University of Bristol presented comparisons with other inferred evaporation estimates and ground measurements from the eddy covariance Flux Tower Network (FluxNet). A comparison with inferred precipitation minus discharge estimates is given in the figure on this page. Although the use of common forcing narrows the differences between the flux estimates, significant differences were evident at a number of locations throughout the simulation time period. A study by the University of New South Wales illustrated the challenges of evaluating model runs against in situ flux data by presenting a comparison of the different flux models using tower-based meteorology. The challenges of producing independent sensible heat flux data (as opposed to calculation via the residual of the surface energy balance, given knowledge




*Comparison of the four global LandFlux V0 ET estimates with ET inferred from P–Q as estimated from a set of five global gridded precipitation data sets and the Global Runoff Data Centre water balance model composite gridded runoff climatology. The gray shading represents the uncertainty in P–Q as quantified by the different precipitation data sets. Horizontal bars show the fraction of land per latitude band.*

of the latent heat flux) and limitations in model choice related to the availability and quality of global forcing (e.g., the air-surface temperature gradient) were also discussed.

The Swiss Federal Institute of Technology (ETH) Zürich is developing a benchmarking data set that provides summary statistics of existing evapotranspiration products. The data set builds upon the earlier analysis by Mueller et al. (2011) and will be available on a monthly time scale for the periods of 1989–1995 and 1989–2005. Statistical and physical constraints were applied to ensure the realism of the derived estimates. The product and a publication documenting this effort are nearly complete and will be made available via the LandFlux-Eval website at: *http://www.iac.ethz.ch/url/Land-Flux-EVAL*. It was also demonstrated how this new product can be used to evaluate the robustness of recent analyses on global evapotranspiration trends, as well as to validate the new Coupled Model Intercomparison Project-Phase 5 (CMIP-5) global climate model simulations.

Efforts by other international groups were reviewed in terms of flux production, evaluations, modeling, and use of existing estimates for scientific analyses. The Water Cycle Multi-mission Observation Strategy (WACMOS)-Evapotranspiration (ET) Project, a European Space Agency initiative, will produce ET

estimates using a range of methodologies. It will focus on flux simulation at continental and regional scales, with a special effort to develop an internally consistent reference input data set that will provide the forcing needed to derive and evaluate these estimates. A high-resolution climate data record of land surface fluxes (referred to as HOLAPS) developed by the Max Planck Institute for Meteorology was presented, including the efforts to evaluate it. An analysis by the Laboratoire des Sciences du Climat et l'Environnement of land-heat flux observations over Europe to constrain regional climate change projections was also presented. The Centre for Ecology and Hydrology is conducting analyses using simple conceptual models to characterize the partitioning of heat flux components for evaluation against the Joint UK Land Environment Simulator (JULES). The Laboratoire d'Océanographie et du Climat-Institut Pierre-Simon Laplace is working on assessing and improving the surface hydrology simulation over the Amazon River Basin in the land surface model ORCHIDEE. The Amazon River Basin is one of the largest contributors to global latent fluxes, and the use of observational ground- and satellite-based products to evaluate the seasonality of the fluxes and the relative contribution of their components (i.e., the partition between interception and transpiration) was discussed.

The next step is for the LandFlux Version 0 product to be merged into the GEWEX Integrated Product. This GDAP-led effort is directed at facilitating an observation-based analysis of the water and energy cycles by offering a suite of products developed using common ancillary data and consistent processing and packaging protocols. For LandFlux, this requires the production of 3-hourly estimates, independent sensible and latent flux estimates, and the adoption of forcing based on common ancillary data sets. To assist in this effort, representatives from the GEWEX SeaFlux Initiative, the Surface Radiation Budget Project, and the International Satellite Cloud Climatology Project provided explanations of the proposed data sets and the necessary adaptations required, based upon previous experience. A joint SeaFlux/LandFlux workshop is being planned during the 2013 EUMETSAT Meteorological Satellite Conference and 19th American Meteorological Society Satellite Meteorology, Oceanography, and Climatology Conference being held in Vienna in September 2013.

**References**


Fisher, J. B., K. Tu, and D. D. Baldocchi, 2008. Global estimates of the land-atmosphere water flux based on monthly AVHRR and ISLSCP-II data, validated at 16 FLUXNET sites. *Remote Sens. Environ.*, 112(3): 901–919.

Jimenez, C., et al., 2011. Global intercomparison of 12 land surface heat flux estimates. *J. Geophys. Res.*, 116(D2), 01.

Miralles, D. G., T. R. H. Holmes, R. A. M. De Jeu, J. H. Gash, A. G. C. Meesters, and A. J. Dolman, 2011. Global land-surface evaporation estimated from satellite-based observations. *Hydrol. Earth Syst. Sc.*, 15(2):453–469.

Mu, Q., F. A. Heinsch, M. Zhao, and S. W. Running, 2007. Development of a global evapotranspiration algorithm based on MODIS and global meteorology data. *Remote Sens. Environ.*, 111:519–536.

Mueller, B., et al., 2011. Evaluation of global observations-based evapotranspiration data sets and IPCC AR4 simulations. *Geophys. Res. Lett.*, 38(L06402).

Su, Z., 2002. The Surface Energy Balance System (SEBS) for estimation of turbulent heat fluxes. *Hydrol. Earth Syst. Sc.*, 6(1):85–99.

Vinukollu, R. K., R. Meynadier, J. Sheffield, and E. F. Wood, 2011. Multi-model, multi-sensor estimates of global evapotranspiration: climatology, uncertain ties and trends. *Hydrol. Process.*, 25.


# GEWEX Hydroclimatology Panel Meeting

## 11–13 October 2012
## Sydney, Australia


**Jan Polcher[1], Jason Evans[2], and Sam Benedict[3]**

[1]Laboratoire de Météorologie Dynamique du CNRS, Paris, France; [2]Climate Change Research Centre, UNSW, Sydney, Australia; [3]International GEWEX Project Office, Silver Spring, MD, USA


The GEWEX Hydroclimatology Panel (GHP) Meeting was held at the University of New South Wales (UNSW) in Sydney, Australia, and was hosted by Drs. Jason Evans and Matt McCabe of the UNSW Centre of Excellence for Climate System Science. The meeting focused on results from the past year, the continued restructuring of GHP science elements, and planning for the GHP contribution to the climate research challenges and questions posed for Phase III of GEWEX.

The organization of GHP has been simplified into two main activities—Regional Hydroclimate Projects (RHPs) and crosscutting projects that are research topic based. Current and proposed crosscutting project topics are: (1) extremes (e.g., drought and high frequency precipitation); (2) water and energy exchanges studies; (3) high elevation science; and (4) seasonal stream flow forecasting.

### *Regional Hydroclimate Projects (RHPs)*

New criteria for defining and evaluating RHPs and their contributions to GEWEX were endorsed by the GEWEX Scientific Steering Group, and provides a framework for GHP to assign the designations of "former, current, or prospective" to the RHPs (see the figure on the next page). Using these criteria, GHP approved the continuation of four regional studies and their proposed end dates: (1) the Baltic Sea Experiment (BALTEX) 2013; (2) the Northern Eurasian Earth Science Partnership Initiative (NEESPI) 2015; (3) the Monsoon Asian Hydro-Atmospheric Science Research and prediction Initiative (MAHASRI) 2015; and (4) the HYdrological cycle in the Mediterranean Experiment (HyMeX) 2016. Of the regional studies designated as "Prospective," the Saskatchewan River Basin Project was shown to be the most mature in its planning and was endorsed by the Panel as an Initiating RHP.

### *GHP Crosscutting Projects*

The goals for GHP crosscutting activities are: (1) to generate interactions between RHPs; (2) maintain links with completed RHPs; (3) advance the GHP contributions to the GEWEX Science Questions (GSQs); and (4) address issues of common concern with the other GEWEX Panels and WCRP projects. Crosscutting projects are limited to a duration of 2–3 years with the possibility of extension. Proposals for these projects follow a prescribed template with specifics related to the GHP science objectives, the relationship of the project to the RHPs, and to the GEWEX Imperatives and GSQs. A desig-

nated project leader will report to the GHP on the progress of the initiative during quarterly phone conferences and at the annual meetings. Once the Panel agrees that a proposal has reached a significant level of momentum, steps may be taken to broaden participation in the project within other GEWEX panels and related communities.

Two new crosscut proposals were submitted during the GHP meeting, one on short time-scale precipitation extremes and the other on droughts. Other potential crosscut projects discussed include: (1) high-elevation precipitation; (2) climate change and water resources; (3) hydrological seasonal forecasting that would have linkages to the Working Group on Seasonal to Interannual Predictions and the Hydrologic Ensemble Prediction EXperiment (HEPEX); (4) regional modeling with linkages with the Coordinated Regional Climate Downscaling Experiment (CORDEX); (5) land surface model validation with linkages to the GEWEX Land Atmosphere System Study (GLASS); and (6) validation of global data sets to be undertaken in concert with the GEWEX Data and Assessments Panel (GDAP).

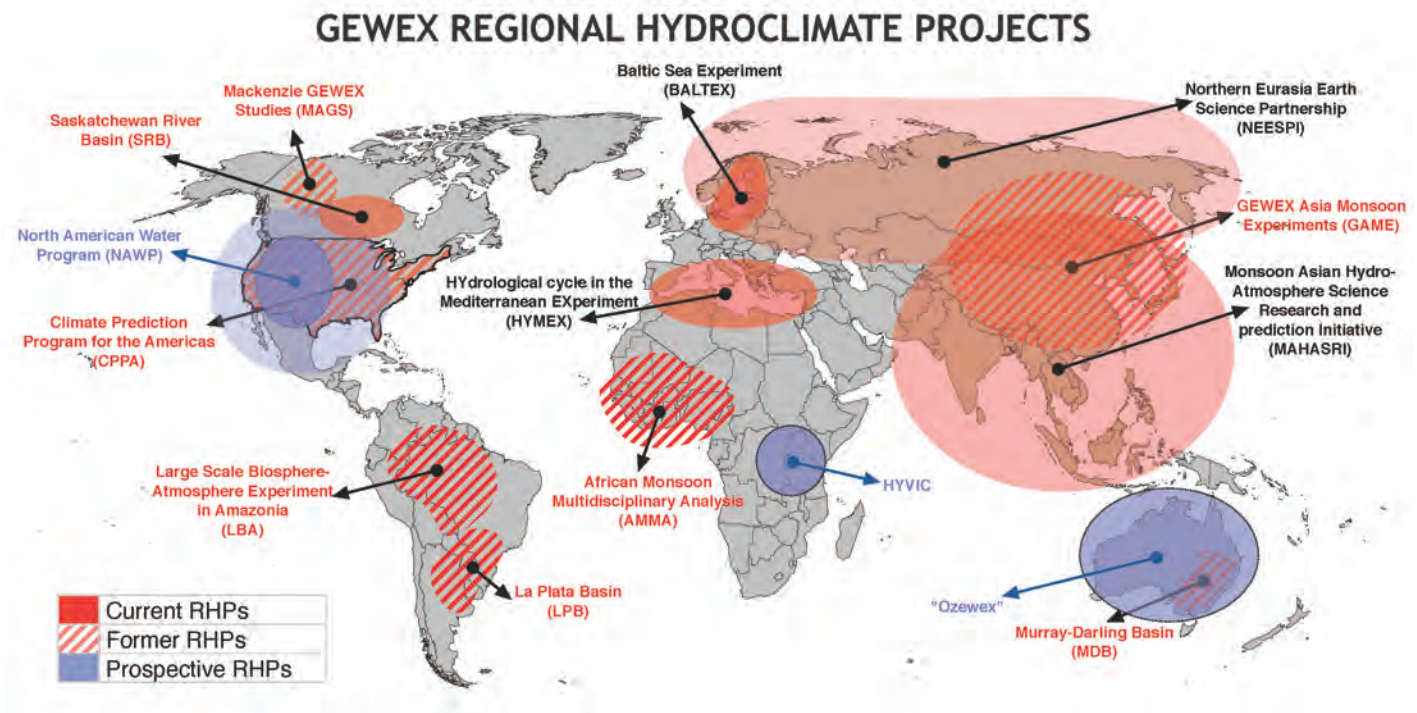
To be responsive to the GEWEX SSG Rapporteur's Report on GHP, the development of a crosscut project to address the continuing need for high quality data and products to be made available to GHP and the broader community is being considered. This includes not just raw data but, for example, integrated water and energy budget term products within the RHP regions. Opportunities to cooperate with and benefit from the Future Earth Initiative, the WCRP Working Group on Regional Climate, and other global impacts communities are also being investigated. As it is important to better understand the progress and requirements with regard to hydrological modeling, it was agreed to summarize this knowledge across the RHPs and cross cuts. In this context, the action was accepted to undertake a synthesis in the form of an article in an appropriate publication (e.g., *BAMS, EOS*).

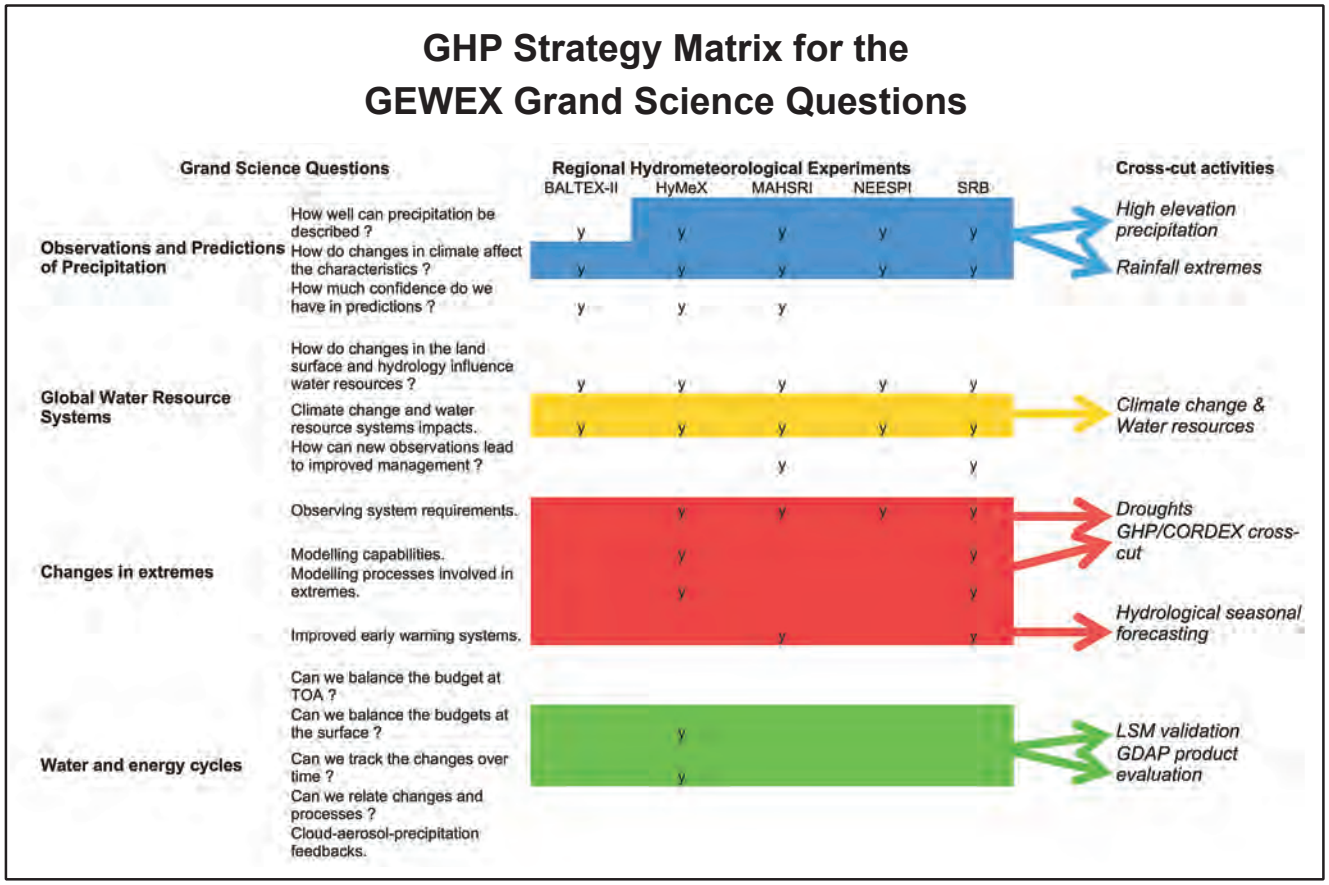
### *GHP Strategy to Address the GEWEX Science Questions*

The GEWEX Science Questions (GSQs) pose issues that are central to the regional activities of GHP and these are included in the new criteria for a regional study to achieve full RHP status. The crosscutting projects are being developed to focus the attention of the GHP community on the issues raised by the GSQs and will enable assessments to be carried out across regions. The Panel encourages regional studies be developed in areas likely to yield results of special importance to the GSQs science foci. The figure on the next page provides an overview of the GHP strategy for responding to the GSQs.

### *Summary*

During its annual meeting, the GEWEX SSG noted that "...it has been a challenging but productive year for GHP..." By choosing to focus on a more narrow set of science questions with regional, crosscutting features it has been possible to simplify the GHP organizational structure. Several RHPs are concluding, which creates gaps in regional coverage. This presents challenges for GHP, particularly when important geographical regions are not represented in GEWEX, such as Africa, South America, and the Caribbean. However, a promising African regional study associated with the Lake Victoria Basin and its effort to hold its 2013 meeting in South America may act as a catalyst to re-energize activities in those regions.






*An overview of the GEWEX Hydroclimatology Panel (GHP) strategy for addressing the GEWEX Science Questions. See article on page 18.*

## GEWEX/WCRP Calendar

*For the complete Calendar, see the GEWEX website: http://www.gewex.org/*

6–10 January 2013—93rd American Meteorological Society Annual Meeting—Austin, Texas, U.S.A.

4–5 March 2013—2nd Session of the WCRP Data Advisory Council—Geneva, Switzerland.

7–8 March 2013—15th Session of the WCRP-GCOS Terrestrial Observation Panel for Climate—Geneva, Switzerland.

18–20 March 2013—European Climate Change Adaptation Conference—Hamburg, Germany.

2–5 April 2013—18th Session of WCRP-GCOS Atmospheric Observation Panel for Climate—Geneva, Switzerland.

7–12 April 2013—European Geosciences Union General Assembly—Vienna, Austria.

15–19 April 2013—4th WGNE Workshop on Systematic Errors in Weather and Climate Models, Met Office, Exeter, UK.

22–25 April 2013—ISCCP 30th Anniversary Conference—The City College of New York, NY, U.S.A.

26–30 April 2013—International Workshop on Terrestrial Water Cycle Observation and Modeling from Space—Beijing, China.

## Assessment of Global Cloud Data Sets from Satellites Now Available

The GEWEX Data and Assessments Panel Working Group has completed its evaluation of the overall quality of available global, long-term cloud data products, including the International Satellite Cloud Climatology Project product that is the GEWEX standard product for clouds. The report is available at: *http://www.wcrp-climate.org/reports.shtml.* A summary of this report has been submitted to the *Bulletin of the American Meteorological Society.*

**GEWEX NEWS**

Published by the International GEWEX Project Office

Peter J. van Oevelen, Director
Dawn P. Erlich, Editor
Shannon F. Macken, Assistant Editor

International GEWEX Project Office
8403 Colesville Rd, Suite 1550
Silver Spring, MD 20910, USA

Tel: 1-240-485-1855
Fax: 1-240-485-1818
E-mail: gewex@gewex.org
Website: http://www.gewex.org