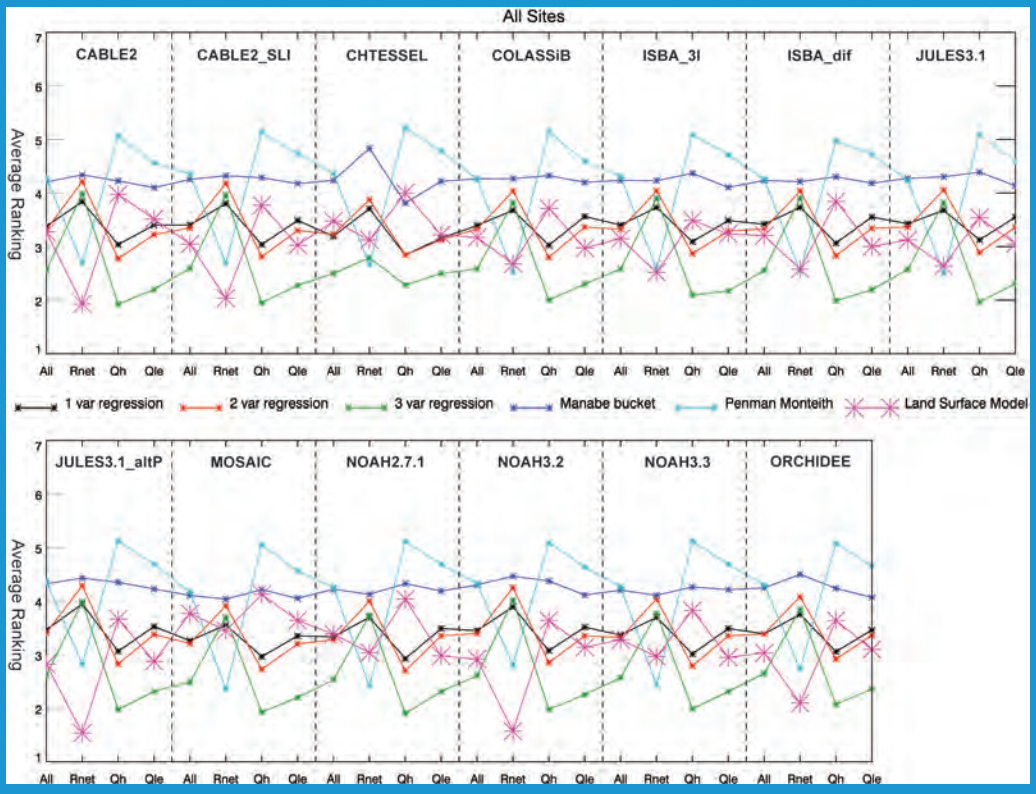
GEWEX NEWS

GEWEX is a core project of WCRP on Global Energy and Water Exchanges

WCRP World Climate Research Programme | WMO | UNESCO | IOC | ICSU International Council for Science

Vol. 23 No. 4, November 2013

Joint GHP/GLASS Benchmarking Project for Land Surface Models



The "Benchmarking" theme of the Global Land/Atmosphere System Study (GLASS) Panel has led to the development of the Protocol for the Analysis of Land Surface models (PALS)—an automated, standardized, online land surface model (LSM) evaluation tool—which serves as the core of the new PALS Land Surface Model Evaluation Benchmarking (PLUMBER) Project. Shown above are the average rankings (1-best) of 13 land surface models compared to the benchmarks of two traditional evaporation formulations and three simple regression models measured across 20 FluxNet sites and four statistical measures (MBE, RMSE, R, and SD). On the whole, the LSMs outperform the Penman-Monteith and Manabe Bucket formulations, but are still inferior to a 3-variable regression model, suggesting that the LSMs are not maximizing the information content in the forcing data. See GLASS Panel meeting report by J. Santanello and A. Boone on page 13.

Abstracts Due
14 February 2014

Abstracts are invited for all topics. See: *http://gewex.org/2014conf/program.html*
Submit an abstract and register for the Conference at: *http://www.gewexevents.org*

GEWEX Summer Sessions—10–12 July 2014, Delft University of Technology, The Netherlands
(see details on back page)

Commentary

Looking Ahead to 2014

Peter J. van Oevelen
Director, International GEWEX Project Office

The project office will soon be unveiling the new GEWEX website, which comes shortly on the heels of the launch of our new registration website for GEWEX events (*http://www.gewexevents.org*). The first event featured on the registration site is the 7th International Scientific Conference on the Global Water and Energy Cycle that is being held in The Hague, The Netherlands, from 14–17 July 2014. The Hague boasts palatial embassies and mansions, fine museums, historic districts, green boulevards and parks, and is located near the North Sea coastline. It is regarded as the International City of Peace and Justice and is the United Nations' "second home" after New York City. There are 160 international organizations located in The Hague dedicated to the cause of world peace. The International Zone is where the world's second United Nations parade of flags proudly symbolizes the city's international role, and this is also the location of the World Forum, where our Conference will be held. We look forward to welcoming you to The Hague and joining our forum to address the GEWEX Science Questions and the associated World Climate Research Programme (WCRP) Grand Challenges.

In the last week of October 2013, GEWEX held the 26th Scientific Steering Group (SSG) Meeting in Boulder, Colorado. We thank Kevin Trenberth for hosting this event, and for the hospitality he showed us. I will briefly visit some highlights of that week, but an extensive report will be published on our website (*http://www.gewex.org*). During the meeting, the SSG reviewed the activities of the GEWEX Panels and their working groups. The reorganization of WCRP and GEWEX has resulted in more focused Panel activities. The GEWEX Hydroclimatology Panel (GHP) has shown tremendous progress in establishing new activities and revitalizing the Regional Hydroclimate Projects. In general, much progress has been made by all Panels, particularly in aligning their activities with the GEWEX Science Questions and the WCRP Grand Challenges. The Grand Challenges that are related to water are well on track and have benefited from two GEWEX-organized workshops in Ft. Collins, Colorado and Saskatoon, Canada.

Significant progress has also been made on the WCRP Grand Challenge on clouds and climate sensitivity. A lot of activity has taken place related to the WCRP Grand Challenge on extremes; however, it needs to be more comprehensively coordinated and prioritized. I would like to thank Gabi Hegerl and Xuebin Zhang, along with Ronald Stewart and Olga Zolina, for their assisstance in defining the extremes challenge. The 7th International Conference and the Pan-GEWEX and Pan-CLIVAR meetings that will also be held in July in The Hague will provide an excellent platform to further develop the WCRP Grand Challenges, as well as to address the GEWEX Science Questions in more detail. New developments are to be expected with respect to the WCRP monsoon activities, as CLIVAR is establishing a project office branch in India that will be devoted to that topic. Much care will have to be given to moving forward the existing structures and activities related to monsoons under the new WCRP umbrella.

I thank Kevin Trenberth, who is stepping down as Chair of the GEWEX SSG in January 2014, for his dedication and leadership of GEWEX over the past 3 years. Having worked closely with him during this period and seeing how much time and effort he has dedicated to the program, I am very grateful for his commitment to GEWEX. A big thanks also goes to Howard Wheater, the Vice-Chair of the GEWEX SSG, whose term also ends in January. I am happy to report that both Kevin and Howard will continue to be active on the SSG for one more year and are co-chairing the scientific committee of the 7th International Scientific Conference on the Global Water and Energy Cycle.

The past few years have been characterized by many changes, both within WCRP and its core projects, and among the other global environmental change programs. Under Kevin's leadership, GEWEX has adapted well to the changes and he has, along with the SSG and the GEWEX Panels, done a terrific job of preparing the Project for the future by establishing a new research agenda for GEWEX through the GEWEX Science Questions and the GEWEX Imperatives. I look forward to working with the incoming SSG Co-Chairs, Drs. Graeme Stephens and Sonia Seneviratne, in the implementation and further development of this agenda.

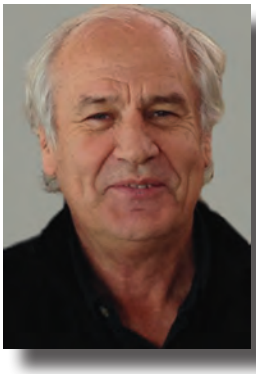
In conclusion, I remind you to submit your abstract and make plans to attend the 7th International Scientific Conference on the Global Water and Energy Cycle. I look forwarding to seeing you in The Hague.

Contents

New GEWEX SSG Co-Chairs

GEWEX welcomes the new Co-Chairs of the GEWEX Scientific Steering Group (SSG), Drs. Sonia I. Seneviratne and Graeme Stephens, whose terms begin in January 2014.

Professor Dr. Sonia I. Seneviratne, Associate Professor of Land-Climate Dynamics at ETH Zurich, Switzerland, holds a Ph.D. in environmental sciences from ETH Zurich (2003) and was a visiting scientist at the Massachusetts Institute of Technology and NASA Goddard Space Flight Center. Dr. Seneviratne has been involved with GEWEX activities for several years, mostly as a member of the Global Land/Atmosphere System Study and the GEWEX Data and Assessments Panel. She was Coordinating Lead Author of the IPCC Special Report on "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation" (2009–2012), and a member of the International Geosphere-Biosphere Programme (IGBP) Integrated Land Ecosystem-Atmosphere Processes Study (iLEAPS) Scientific Steering Committee (2008–2013). Dr. Seneviratne has been involved in and led many national (NCCR-Climate, SNF SwissSMEX, NRP 61 DROUGHT-CH) and European research projects (EU-FP6 ENSEMBLES; EU-FP6 CECILIA; EU-FP7 Carbo-Extreme; EU-FP7 EMBRACE; EU-FP7 DROUGHT-RSPI). She has published more than 70 peer-reviewed articles in the field of land-climate interactions, climate change, and water cycle research. Her research group investigates the role of land-climate dynamics within the climate system using model experiments and observations. Her main area of interest relates to the role of soil moisture and vegetation in the energy and water cycles, particularly in the occurrence of extreme events (droughts and heat waves). In 2013, Prof. Seneviratne was awarded the American Geophysical Union Macelwane Medal for her research.



Dr. Graeme Stephens is the Director of the Center for Climate Sciences at the NASA Jet Propulsion Laboratory. He completed his B.S. in Meteorology with honors from the University of Melbourne in 1973 and received his Ph.D. in 1977 from the same university. He was appointed to the Commonwealth Scientific and Industrial Research Organization (CSIRO) Division of Atmospheric Research in 1977 as a research scientist and promoted to senior research scientist in 1982. From 1979 to 1980, Dr. Stephens served as a post-doctoral research student at the Colorado State University Department of Atmospheric Science. He joined the faculty as an associate professor in 1984 and was promoted to full professor in 1991. From 2008–2010 he was Director of the Cooperative Institute for Research in the Atmosphere (CIRA). He also serves as the primary investigator of the CloudSat Mission and associated research group, which launched a satellite to study the internals of clouds using equipment similar to radar. Dr. Stephens has a long history with GEWEX and was Chairman of the GEWEX Radiation Panel in the 1990s. He has been the recipient of many awards and honors, including numerous NASA awards, the NRL Alan Berman Research Publication Award, the IAMAS International Radiation Commission Gold Medal, the American Association for the Advancement of Science Fellowship, the AMS Jule G. Charney and Henry G. Houghton awards, and Fellow of the AGU and AMS. Over his career, he has been involved in over 50 national and international activities and published over 500 peer reviewed papers, reports, and conference proceedings. Dr. Stephens' research activities focus on atmospheric radiation, including the application of remote sensing in climate research to understanding the role of hydrological processes in climate change.

New GEWEX SSG Member

Professor Remko Uijlenhoet is the Chair of the Hydrology and Quantitative Water Management Group within the Department of Environmental Sciences at Wageningen University in The Netherlands. His areas of interest include catchment hydrology, hydrometeorology, and remote sensing of precipitation.

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Published by the International GEWEX Project Office

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GASS Model Intercomparisons Based on the TWP-ICE: A Resource for Model Developers

Jon Petch[1], Adrian Hill[1], Laura Davies[2], Ann Fridlind[3], Christian Jakob[4], Yanluan Lin[5], Shaoecheng Xie[6], and Ping Zhu[7]

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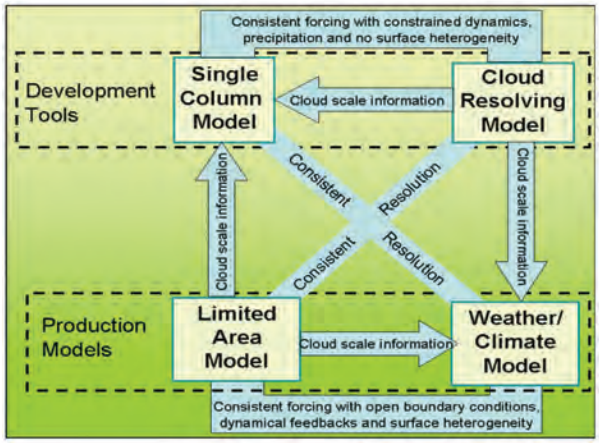


Schematic of the models used in the various comparisons with their relationships (taken from Petch et al., 2013).

The Tropical Warm Pool–International Cloud Experiment (TWP-ICE) took place in and around Darwin, Australia, from 20 January to 13 February 2006. Its focus was to characterize the evolution of tropical convection, including the large-scale heat, moisture, and momentum budgets at 3-hour time resolution, while at the same time obtaining detailed observations of cloud properties and the impact of the clouds on their environment (May et al., 2008).

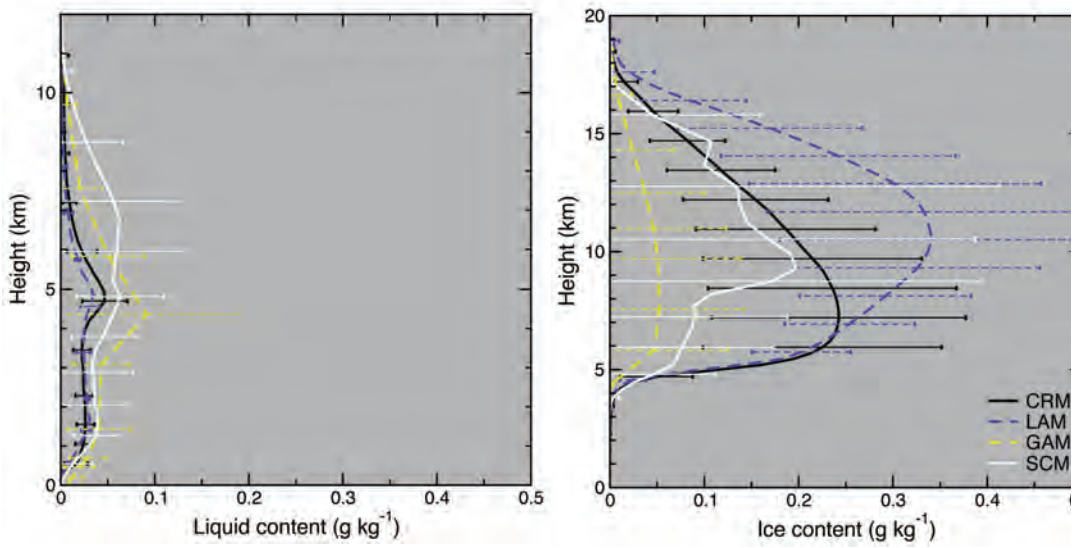
For the first time, in what has been one of the Global Atmospheric System Studies (GASS) Panel's (or its predecessors) largest intercomparison projects, the TWP-ICE field campaign data were used to evaluate four different types of modeling systems. More than thirty models took part in this project and five papers have now been published that describe the intercomparisons themselves. This work, and the papers published, will form the foundation for further work by others to support model development at various institutions.

The model types and associated papers describing results are: (1) CRMs: Cloud-resolving models (Fridlind et al., 2012); (2) LAMs: Limited-area models used in regional weather and climate prediction (Zhu et al., 2012); (3) GAMs: Global atmospheric models for predicting weather or climate timescales (Lin et al., 2012); (4) SCMs: Single-column models (Davies et al., 2013); and (5) Cross model type comparison (Petch et al., 2013).

Taken from Petch et al. (2013), the schematic on this page depicts some of the key similarities and differences of the model types used in this project, along with the way in which the simulations are carried out. The CRMs and SCMs are considered development tools, as they are not generally used to make operational predictions of weather or climate but more to understand atmospheric processes and support the development of other models. The CRMs provide realistic cloud-scale motions and the SCMs allow the isolation of the model physics from the dynamics.

The articles describing the subcomponents of the project give the key conclusions relevant to the evaluation and improvement of the individual model classes they address. Each study also included its own unique aspects, such as derivation and use of an observation-based aerosol size distribution profile for the CRM intercomparison, comparison with CRMs in the LAM intercomparison, derivation and use of an ensemble forcing approach in the SCM intercomparison, and comparison with observed convective and stratiform rain fraction in the GAM intercomparison. Public availability of the modeling results and observations is also a key output of this project. The availability of different model types makes this a valuable resource for individual modeling centers. For example, the ability of a weather or climate modeling center to carry out sensitivity studies using both their SCM and GAM and place this into context by comparing against other models driven in the same way is an asset.

The figure on the next page gives an example of how the four model types can be compared with each other to provide context for model developers of any model type. The key information to take away is that for liquid water, the models that resolve convection (black lines) have good agreement in the multi-model mean during the convectively active period and also have relatively little spread within the individual models of these two model types. However, the models that parameterize convection (the white lines) have less agreement and significantly higher spread within each of the two model types. For ice, there is a different story with little agreement across model types and a very large spread for individual models of all types. This indicates that even those models in which the dynamical processes of the cloud systems are resolved have great difficulties in simulating cloud ice contents, due to a wide range of microphysical assumptions, as well as cloud-dynamics feedbacks at the cloud scale. Varble et al. (2011) and Mrowiec et al. (2012) investigated differences across the CRM simulations and observations, finding generally similar convective dynamics but a large spread of ice microphysics, with deviations from radar observations that depend upon a microphysics scheme. Two follow-on papers compare CRM and LAM results, and report a similarity between their general deviations from observed updraft properties and rain microphysics, traceable at least in part to common CRM and LAM microphysics schemes (Varble et al., 2013a,b).



The mean and spread (the error bars indicate a standard deviation each side of the mean) of liquid and ice predicted by the four model types during the wet period of TWP-ICE. The wet period was defined as 23–25 January 2006. Plots taken from Petch et al., 2013.

In summary, the GASS TWP-ICE intercomparison has produced a wealth of valuable data from four different types of modeling systems and confronted them with observations. The initial analysis of these data has been published in five journal articles. We expect this to provide a foundation for individual centers to carry out focused development of their own modeling systems. To access the forcing data, please follow TWP-ICE links from the GASS Project website at: *http://www.gewex.org/gass_panel.html*. CRM results are archived for public use at the U.S. Department of Energy's Atmospheric Radiation measurement archive (*http://www.arm.gov/campaigns/twp2006twp-ice*), and results from other model types can be obtained upon request from lead authors.

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Zhu, P., et al., 2012: A limited area model (LAM) intercomparison study of a TWP-ICE active monsoon mesoscale convective event. *J. Geophys. Res.,* 117, D11208.

Launch of the GASS-Weak Temperature Gradient (WTG) Project

The WTG approach has been developed based upon our physical understanding of the tropical atmosphere. It is one of the methods used to parametrize large-scale dynamics in limited area models. Another method that will be explored intensively in this project is the damped gravity wave. Much insight has been learned from using these methods in both SCMs and CRMs to study a range of problems in which two-way interactions between deep convection and the large-scale play a central role. However, both agreement and discrepancies are seen in the various published results. The aim of the GASS-WTG Project is to understand the different aspects of these methods and to what extent their formulation are responsible for the agreements and discrepancies seen in the published results.The deadline for submitting model output for this project is 1 May 2014. For project details and how to contribute, see: *http://www.met.reading.ac.uk/~fj019034/WTG_project/*

GABLS Article on Stable Boundary Layers and Diurnal Cycles

Holtslag, A. A. M., and Coauthors, 2013. Stable Atmospheric Boundary Layers and Diurnal Cycles: Challenges for Weather and Climate Models. *Bull. Amer. Meteor. Soc.*, 94, 1691–1706.

Results from weather forecast and climate models are used to illustrate the state of the art as well as findings and recommendations from three intercomparison studies held within the GEWEX Atmospheric Boundary Layer Study (GABLS). In GABLS, the focus has been on the examination of the representation of the stable boundary layer and the diurnal cycle over land in clear-sky conditions. For this purpose, single-column versions of weather and climate models have been compared with observations, research models, and large-eddy simulations. The intercomparison cases are based on observations taken in the Arctic, Kansas, and Cabauw in the Netherlands. From these studies, it was found that even for the noncloudy boundary layer, important parameterization challenges remain.

Joint Meeting of the GEWEX Data and Assessments Panel and the GEWEX Hydroclimatology Panel

Rio de Janeiro, Brazil
2–6 September 2013

The Joint Meeting of the GEWEX Data and Assessments Panel (GDAP) and the GEWEX Hydroclimatology Panel (GHP) was hosted by the Instituto de Geociências (IGEO), Centro de Ciências Matemáticas e da Natureza, Universidade Federal do Rio de Janeiro (UFRJ). Professor Ana Nunes served as the local host. The meeting began with with presentations by scientists from South America and the Caribbean on topics of importance to society and climate services in the area, such as water resources, geomorphology, and risk analysis and environmental disasters. Many of the lectures targeted undergraduate and postgraduate students, as well as professionals working in the areas of risk analysis and prevention of disasters related to extreme events. The event drew over 200 participants from 11 different countries.

GDAP and GHP are organized around addressing the GEWEX Science Questions (GSQs; *http://www.gewex.org/pdfs/GEWEX_Science_Questions_final.pdf*) which in turn support World Climate Research Programme activities. The South American scientific community is interested in answers to questions that coincide with the GSQs, especially ones that lead to a better understanding of the major causes of regional environmental disasters associated with natural climate variability and/or anthropogenic forcings. In particular, IGEO-UFRJ scientists are interested in how climate change impacts areas of complex topography in South America.

The focus of the GDAP/GHP Meeting was to examine issues related to the roles of both panels in GEWEX, as well as shared interests in data development and validation, and develop strategies to jointly address some of the overarching GEWEX Science Questions in support of WCRP goals. Discussions generally focused on tackling some of the broader issues related to snow and orographic precipitation that are challenging to both panels and where the combined approaches of GDAP and GHP might yield improvements.

GDAP is currently generating an "Integrated GEWEX Product" consisting of data products for radiative energy, turbulent fluxes, and condensation heating. At the same time, core activities of GHP, including new and existing Regional Hydroclimate Projects, crosscutting projects on extremes, high elevations studies, hydrological applications, and global data centers, could potentially yield data and analyses useful for the development and validation of GDAP data products. GHP and GDAP agreed to collaborate on two problems that are of mutual interest and importance to both panels, orographic precipitation and high altitude (snow) precipitation.

GEWEX Data and Assessments Panel (GDAP) Meeting

Rio de Janeiro, Brazil
3–5 September 2013

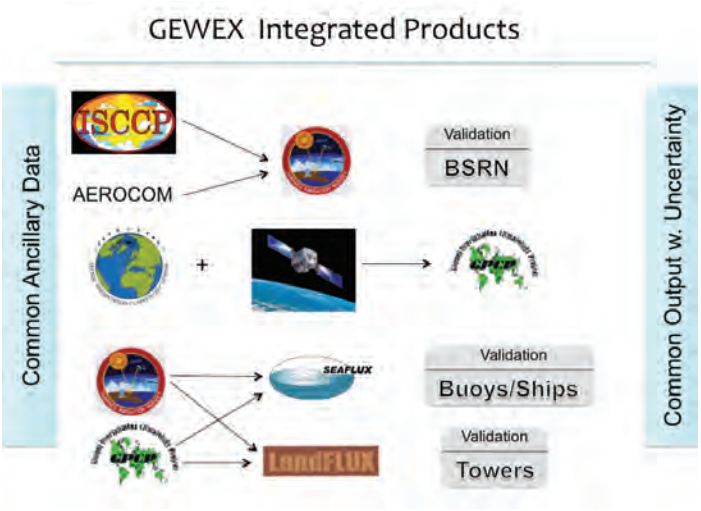
Christian Kummerow
Colorado State University, Fort Collins, CO, USA

Christian Kummerow, the GDAP Chair, opened the meeting with a summary of recent Panel accomplishments. The assessments of precipitation, clouds, and radiation budget data sets have been completed and published as World Climate Research Programme reports, and the water vapor assessment is well underway. Key results of the Assessment of Global Cloud Data Sets from Satellites were published in the *Bulletin of the American Meteorological Society (BAMS)* in July 2013. The SeaFlux and LandFlux products, and the Integrated Product are being finalized. A new focus on water storage components is being added to GDAP, and two new members, Wouter Dorigo and Felix Landerer have joined the Panel.

With independent products now available for radiative energy, turbulent fluxes and condensation heating, GDAP has focused over the last 2 years on creating a Integrated GEWEX Product that uses a common grid, ancillary data, procedures and assumptions in order to ensure that relationships among water and energy variables are due to the data and products themselves, rather than inconsistencies in the assumptions. A key objective of this meeting was to review the readiness of GEWEX reference products and set deadlines for individual activities that will result in the release of the Integrated Product in June 2014. This release date will precede the 7th International Scientific Conference on the Global Water and Energy Cycle that is being held in The Hague, The Netherlands on 14–17 July 2014. The Conference will provide a venue to advertise the Integrated Product and present initial results.

GDAP will focus on an assessment of the state of the water and energy budgets based upon the new Integrated Product. This assessment is intended to document the state of our observing system, which is to be the first of periodic re-evaluations of the state of the water and energy observing system. It will consist of closure tests on the global scale; temporal variability in the fluxes and states; attribution of changes to observed forcings; and a maturity index of various components based upon ongoing assessments of individual components of the budget.

Wouter Dorigo gave a "new member" presentation on his personal research and interests, and reviewed some of the available soil moisture products and issues. He began by stating that radiation, soil moisture and temperature are the three primary constraints on vegetation growth, making soil moisture central to the GEWEX overarching science questions. After reviewing the basic principles of active and passive microwave sensing of soil moisture, and reviewing some challenges related to stitching together time series with dif-



Interdependency of products forming the GEWEX Integrated Product.

ferent instruments, he reviewed some of the products that are generally available. The Water Cycle Multimission Observation Strategy (WACMOS) Climate Change Initiative is focusing on merging the various products and relies on active sensors in areas with moderate to high vegetation, while using mostly passive means to map soil moisture in arid and semi-arid zones. The International Soil Moisture Network complements the satellite data. Dr. Dorigo and the Technical University of Vienna have played a major role in hosting and disseminating these data, and examples of the user interfaces were shown. Dr. Dorigo presented some of the shortcomings of in situ data, as well as why work with similar climate regimes is necessary when doing validation work so that systematic algorithm errors are not intertwined with random noise from in situ sensors. He ended his talk by stating that he hoped the community could do a better job of working together on the issue of absolute soil moisture versus relative soil moisture.

Jörg Schulz, GDAP Vice-Chair and representative on the WCRP Data Advisory Council (WDAC), reported that the Council is looking to GEWEX, and particularly GDAP, to help provide input on the best practices for assessment activities. The World Meteorological Organization Network for Sustained and Coordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM) is of great interest to GDAP because of its goal of producing long-term climate data records. The Network has completed its pilot phase and will begin an expanded Phase 2 in January 2014.

William Rossow began the review of GEWEX standard products with the status of the International Satellite Cloud Climatology Project (ISCCP) products. Testing of the new High-resolution Infrared Radiation Sounder (HIRS) product (nnHIRS) is still ongoing, but is expected to be completed soon. A last re-engineering is underway for the transition to operations at the National Oceanic and Atmospheric Administration's National Climatic Data Center (NCDC).

The new version of ISCCP being prepared for the Integrated Product is well underway and should be finished when nnHIRS is fully tested. Dr. Rossow presented details of nnHIRS temperature and humidity structure that appears quite reasonable and certainly better than the previous version of HIRS.

Robert Adler reported that the transfer of the Global Precipitation Climatology Project (GPCP) algorithm V2 to NCDC is on track. The status of Global Precipitation Climatology Centre (GPCC) data, which is used as input to GPCP products, was provided by Udo Schenider. He described two new GPCC products, a drought monitoring product and a first guess daily product that was requested by GEWEX to better study precipitation extremes. The generation of the daily product began in January 2012. Funding is available for a GPCC project on the validation of medium-range climate prediction focused on 1988–2008.

Stefan Kinne reported on AEROCOM, an international initiative to improve aerosol representation in global models. GDAP has chosen AEROCOM to supply aerosol products for GDAP. This was necessary as the Global Aerosol Climatology Project (GACP) data are currently only available over the ocean. The Max-Planck Institute-Aerosol-Climatology (MAC) consists of a monthly global climatology of aerosol optical properties that imposes local AERONET observations onto a central model background to achieve a global estimate of aerosols and their optical properties. It provides Aerosol Optical Depth (at 550 nm), the single scattering albedo and asymmetry factor. Details of the MAC-v1are documented in the *Journal of Advances in Modeling Earth Systems* (2013). The next version (MAC-v2) will have a higher spatial resolution (0.5 x 0.5) and is expected to be released in 2014.

Paul Stackhouse presented some of the major accomplishments of the Surface Radiation Budget Project, including the improved accessibility of Version 3 products, the continued validation against the Clouds and the Earth's Radiant Energy System (CERES) data, and the significant progress made towards the finalization of the Release 4 data that will be used in the Integrated Product. While more validation has been done, the main result indicating significantly higher net radiation into the surface (114 Wm^{-2}) remains unchanged.

Joseph Michalsky reported that there are 58 Baseline Surface Radiation Network (BSRN) stations. Nine stations began producing data in 1992 and 19 stations submitted data in 2013, with 13 stations keeping data current. The South Pole and Neumayer stations have the longest records. As an example of how much the data are used, in April 2013, 1059 files were transferred per day with 66 systems requesting data during the month via ftp.

Although Carol Anne Clayson could not attend the meeting, she provided a summary of SeaFlux activities. Version 2 is well underway with common grids and assumptions. The main issues are the sea surface temperature and the near-surface temperature and humidity that are currently computed from passive microwave brightness temperatures using a neural net-

work instead of the nnHIRS product. Sensitivities related to the calculations need to be more thoroughly understood before a decision can be made about using these as common input products for the Integrated Product.

Eric Wood presented the progress made in developing the LandFlux product for latent and sensible heat fluxes over land surfaces. He divided the presentation into two components. The first dealt specifically with the issue of land surface temperature while the second focused more on the LandFlux product preparation and assessment. The surface temperature presentation was motivated by difficulties that LandFlux encountered when using nnHIRS land surface temperatures. More specifically, the problem was not with the observed land surface temperatures but rather the interpolated temperatures to 3-hour grids in both clear and cloudy conditions. To ameliorate this problem, the Princeton group developed a global land surface model using the NCEP Climate Forecast System Reanalysis (CFSR) forcing data, to produce a continuous, high-resolution surface temperature data set consistent with the HIRS clear-sky land surface temperature. Dr. Wood showed a number of examples to illustrate the performance of this product which appears to be good by all accounts. There was some recognition in the ensuing group discussion that the goal of complete consistency among the products should be scaled back some to allow individual products to use nonstandard input—as long as a parallel product, using standard input was generated simultaneously for diagnostic purposes.

Four products, a Penman-Monteith scheme, a Priestly-Taylor approach, a surface energy balance approach, and the Global Land-surface Evaporation Amsterdam Methodology (GLEAM) are being evaluated with different forcing data and validation criteria for the LandFlux product. While no decision has been made as to which of the four products will be considered the standard GEWEX product, it is clear that all four schemes will be used at a minimum to gain insight into their differences and the overall uncertainty.

After much discussion by the GDAP members and product leads about the Integrated Product and its timeline, it was concluded that the individual products should not be made demonstrably worse by using common input. If, however, a decision was made to continue with the individual input parameters, then a parallel product, using the common input, should be created for inspection by the community. An example is the humidity difference in the lowest 10 m used by SeaFlux. If the nnHIRS product is not as good as what can be retrieved from passive microwave sensors, then SeaFlux should continue to use its own humidity difference but produce a parallel product with the nnHIRS humidity difference for diagnostic purposes. The Panel believes that in time these discrepancies can be eliminated.

The Water Vapor Assessment (G-VAP) completed its third year and Marc Schroeder reported on its progress. The activity is designed to provide an overview of available data records and provide users with enough information to decide if a data record fits their purpose. Simultaneously, this assessment activity seeks to generate the necessary information for GEWEX to create a new standard water vapor product. To do this, the assessment has been broken into three categories of water vapor products: Integrated Water Vapor, Water Vapor Profiles, and Upper Tropospheric Humidity. Initial comparisons have been made but it is too early to draw summary conclusions.

James Mather began the update on the Department of Energy Atmospheric Radiation Measurement (ARM) Climate Research facilities by reviewing the status and instrumentation of the ARM fixed and mobile facilities, and their deployment schedule. The current array of sensors is highly relevant to GDAP and greater use of these data needs to be encouraged. To that end, Dr. Mather proposed extracting subsets from GEWEX products over ARM sites and making them available through the ARM archive as an external data product. This was welcomed by the GDAP members.

While the Cloud Assessment activity has concluded and been published as a WCRP report and accompanying BAMS paper, Claudia Stubenrauch reported that the website hosting the GEWEX Cloud Assessment database has had considerable traffic (approximately 4000 web hits per month and up to 2 million files downloaded), especially since the announcement in the *GEWEX Newsletter* of February 2013. This site will therefore be maintained and be complemented with revised versions in order to allow existing and new investigators to use the extensive database for comparisons of their own products in the future.

The Aerosol Assessment activity is being led by Sundar Christopher and Jeff Reid. The seven most common global aerosol optical depth products, the Advanced Very High Resolution Radiometer (AVHRR; GACP and NOAA); the Multi-angle Imaging SpectroRadiometer (MISR); the Moderate Resolution Imaging Spectroradiometer (MODIS; Standard and Deep Blue); the Ozone Monitoring Instrument (OMI); and the Polarization and Directionality of the Earth's Reflectances (POLDER), will be examined to evaluate their state-of-the-art science within the GEWEX framework. Phase 1 of the project should be completed within a year.

The Panel discussed current and future assessments, particularly how to deal with the length of time these usually take (an average of 7–8 years). There was consensus that even though it is difficult and time consuming, creating and maintaining databases and procedures of what has been done previously is a worthwhile endeavor as it allows new products to have a ready assessment standard. Once these databases are created, new assessments should not take nearly as long. It was also suggested that assessments could be organized around literature reviews. Such assessments would not perform the direct intercomparisons that are currently being done and could therefore be carried out more quickly. The next GDAP assessment will likely be a new precipitation assessment after the Global Precipitation Mission is launched and providing stable products.

GEWEX Hydroclimatology Panel (GHP) Meeting

Rio de Janeiro, Brazil
3–5 September 2013

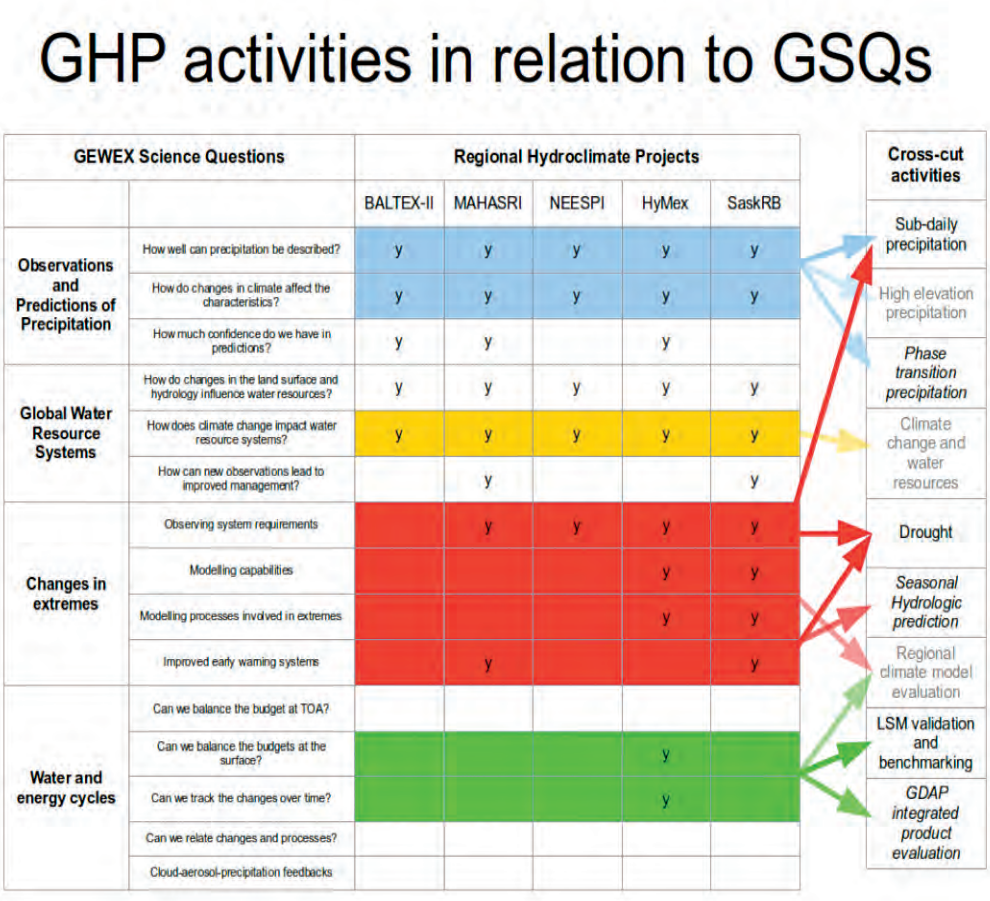
Jan Polcher[1], Jason Evans[2], and Sam Benedict[3]
[1]Laboratoire de Météorologie Dynamique du CNRS, Paris, France; [2]Climate Change Research Centre, UNSW, Sydney, Australia; [3]International GEWEX Project Office, Columbia, Maryland, USA

The meeting reviewed the status of the two main elements of the GEWEX Hydroclimatology Panel (GHP)—the Regional Hydroclimate Projects (RHPs) and the Crosscutting Projects. Five new regional studies are expected to be formally initiated as RHPs within the next 3–5 years: (i) the Hydrology of the Lake Victoria Basin Project (HyVic; see planning meeting report in August 2013 issue of *GEWEX News*); (ii) the North American Water Project (NAWP); (iii) the Third Pole Environment (TPE) Initiative; (iv) Baltic Earth [succeeds the Baltic Sea Experiment (BALTEX), which ended in June 2013; see article in August 2013 issue of *GEWEX News*]; and (v) OzEWEX (expected to meet the criteria of an "Initiating" RHP by the end of 2014; see article in May 2013 issue of *GEWEX News*).

End dates were confirmed for the following RHPs: (i) Northern Eurasian Earth Science Partnership Initiative (NEESPI, 2014/2015); (ii) Monsoon Asian Hydro-Atmosphere Scientific Research and Prediction Initiative (MAHASRI, 2015); and (iii) Hydrological cycle in Mediterranean Experiment (HyMeX, 2016).

The Crosscutting (CC) Projects (see list in column on right side of matrix below) provide a means of generating interactions between RHPs, advancing the GHP contributions to the WCRP Grand Challenges and the GEWEX Science Questions, addressing issues of common concern with the other GEWEX Panels and WCRP projects, and engaging the broader community in the work of GHP. Three new crosscutting subproject initiatives were endorsed by the Panel: (i) Cold Regions Precipitation; (ii) Seasonal Hydrologic Prediction; and (iii) the GDAP Integrated Product regional evaluation. Potential new crosscutting projects discussed during the meeting included high-elevation precipitation, climate change and water resources, and regional climate model evaluation. These potential projects will be further discussed during the Pan-GEWEX and Pan-CLIVAR meetings being held in July 2014 after the 7th International Scientific Conference on the Global Water and Energy Cycle.

Ways that GHP could further sharpen its contribution to the development and implementation of the WCRP Grand Challenges (*http://www.wcrp-climate.org/grandcha.shtml*) were reviewed. Specifically, the WCRP Grand Challenge related to changes in water availability that is led by GEWEX and designed to respond to issues associated with how to better understand and predict precipitation variability and changes, and how changes in land surface and hydrology influence past and future changes in water availability and security. The priority of each element of the Panel was reviewed in the context of the contribution it must make to the GEWEX Science Questions. A framework for the RHPs and crosscutting studies, and how they will contribute to the GEWEX Science Questions over the next 2–3 years is shown in the matrix.



Updated matrix of GHP contributions to the GEWEX Science Questions.

Joint SeaFlux/LandFlux Workshop

Vienna, Austria
19–20 September 2013

Carol Anne Clayson[1] and Carlos Jimenez[2,3]
[1]Woods Hole Oceanographic Institution, Massachusetts, USA; [2]LERMA/CNRS, Observatoire de Paris, Paris, France; [3]Estellus, Paris, France

SeaFlux and LandFlux are projects under the GEWEX Data and Assessments Panel (GDAP) that have a focus on providing high-resolution ocean-atmosphere and land-atmosphere turbulent flux data sets, respectively. The two projects met together for the first time at a joint workshop held in conjunction with the 2013 EUMETSAT Meteorological Satellite Conference in Vienna. The workshop brought together experts in satellite remote sensing from both the land-surface and ocean-surface communities to discuss issues associated with understanding the global energy and water cycles. It also served both as a forum for exchange about the leading-order difficulties and the new advances in surface flux products, and as an opportunity for the two projects to strategize about potential improvements to GEWEX products.

The SeaFlux Project is producing a high-resolution satellite-based data set of surface turbulent fluxes over the global oceans. A 10-year mean of the latent and sensible heat fluxes from the first SeaFlux product, and the associated uncertainties, are shown in Figure 1 on page 11. LandFlux, a more recent initiative, completed its first version of a global multi-decadal land-surface turbulent flux and a multi-year global benchmark synthesis product that is based on the analyses of existing land-evapotranspiration data sets by the LandFlux-EVAL Project. Large efforts by SeaFlux and LandFlux are now focused on producing new versions of their products adapted to the GEWEX Integrated Product, the GDAP-led effort that aims 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.

Presentations were given on other land and ocean flux data sets, including those by the French Research Institute for Exploitation of the Sea (IFREMER), the Satellite Application Facility on Climate Monitoring (the Hamburg Ocean Atmosphere Parameters and Fluxes from Satellite Data, HOAPS), and Nagoya and Tokai Universities (the Japanese Ocean Flux Data Sets with Use of Remote Sensing Observations, J-OFURO). These were followed by discussions regarding the various methods that are used to produce flux data sets, and potential in situ and other data sets that could be used for characterization of the existing products. A presentation on the direct measurement of sea surface turbulent fluxes on ships was given by Kyoto University. Issues associated with short time or space scale variability in sea surface or land temperature and effects on surface fluxes were also explored. They included discussions on real-time diurnal warming corrections for operational sea surface temperature (SST) analyses by Florida State University, and how resolving coupling of surface winds and SST modifies surface turbulent fluxes and reduces spurious trends (NOAA Earth System Research Laboratory/Physical Sciences Division). Several presentations were focused on the scientific analyses of components of the water and energy budgets using SeaFlux and other satellite products. The role of sensible heating in the generation of atmospheric available potential energy was discussed by the Cooperative Institute for Research in the Atmosphere (CIRA), and a comparative assessment of air-sea turbulent fluxes in reanalyses was presented by the Shirshov Institute of Oceanology.

Possible methodologies appropriate for intercomparison of the satellite flux data sets with each other and in situ data sets were then reviewed. Over land the development of the LandFlux-EVAL benchmarking data set that provides summary statistics of existing evapotranspiration products was discussed and examples given of how the data set can be used to evaluate the robustness of recent analyses on global evapotranspiration trends, as well as to validate global climate model simulations. An example of the analysis carried out is given in Figure 2, where statistics of the globally averaged land evapotranspiration from the merged synthesis products derived by LandFlux-Eval are displayed. Estellus presented the Water Cycle Observation Multi-mission Strategy-EvapoTranspiration (WACMOS-ET) Project, a European Space Agency funded initiative contributing to LandFlux efforts by producing evapotranspiration estimates using a range of methodologies and an internally consistent Reference Input Data Set that maximizes the use of European Earth observation assets. The University of Arizona discussed some of their recent work on ocean and land-surface processes, including evaluation of reanalyses and surface models. The University of Twente presented its land-surface energy balance product for mainland China, which is being evaluated with eddy covariance measurements and other related data sets. The University of Maryland discussed the estimation of errors in net heat fluxes over the Atlantic Ocean.

Issues associated with further air-sea flux development include calibration of the Special Sensor Microwave Imager (SSM/I) brightness temperatures, the need for improved ice masks, understanding the effects of current SST data sets and their temporal and spatial resolution on surface fluxes, and trends in sea fluxes, particularly due to trends in current wind speed products. Two community-wide follow-on activities were identified, the first being an analysis of existing SSM/I brightness temperature calibrated data sets and effects of the use of differing techniques on the resulting retrievals of surface fluxes. The second is an intercomparison of the differing surface flux data sets, including a comparison with in situ data sets. Researchers who were unable to attend the Workshop but would like to participate in these efforts, should contact Carol Anne Clayson, the SeaFlux Project Manager. SeaFlux data and more information about the SeaFlux project can be found at *http://www.seaflux.org*, along with a full listing of conference participants and continuing efforts related to the next SeaFlux workshop.

Regarding the fluxes over land, identifying the causes and mechanisms producing differences between current data sets and their produced trends over the last decades is an ongoing exercise, and data producers were encouraged to contribute their independent estimates and/or analysis to this effort. Requests to access LandFlux data can be directed to Carlos Jimenez, the Data Coordinator.

The LandFlux-EVAL benchmarking data set is ready for distribution and can be accessed from: *http://www.iac.ethz.ch/url/LandFlux-EVAL*. A LandFlux workshop is envisaged at the end of 2014, focusing on reviewing the GDAP integrated LandFlux product, the contributions of the ESA WACMOS-ET project, and other current efforts for global estimation of land fluxes.

10-year Mean of the Latent and Sensible Heat Fluxes from the First SeaFlux Product

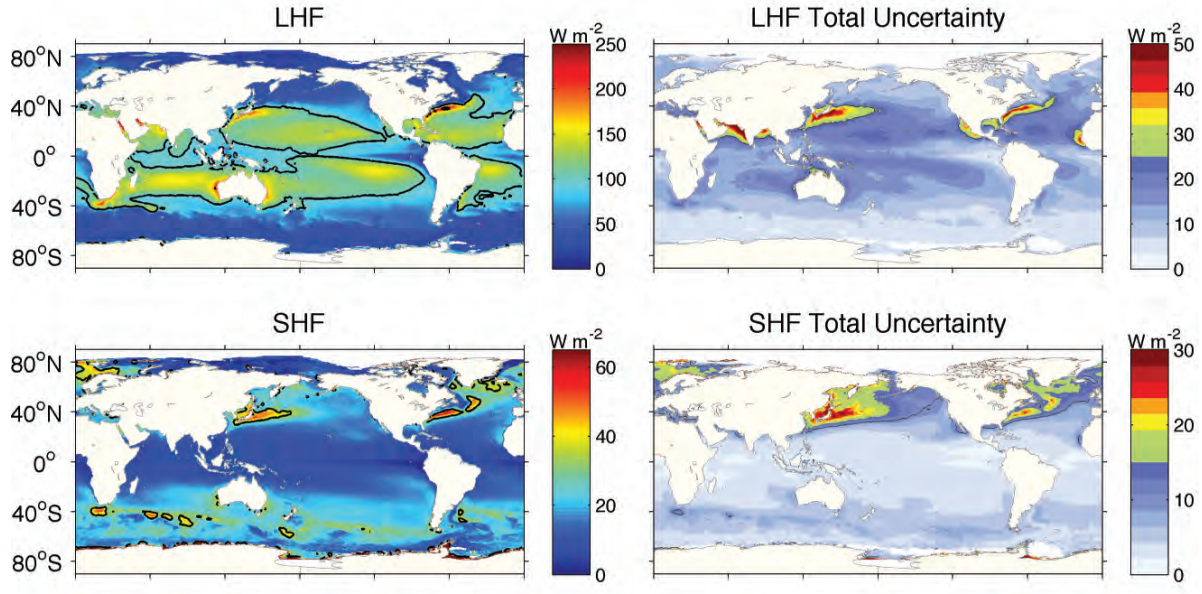


Figure 1. Mean fields from the 10 years of SeaFlux data for surface latent heat flux (LHF) and sensible heat flux (SHF) values and the associated total uncertainties. Contour lines on the LHF and SHF plots are at 100 and 35 Wm^{-2}, respectively. (Reprinted from Clayson et al., SeaFlux Version 1: A New Satellite-Based Ocean-Atmosphere Turbulent Flux Data Set, International Journal of Climatology, in revision.)

Variations of Globally Averaged Land Evapotranspiration Derived by LandFlux-Eval

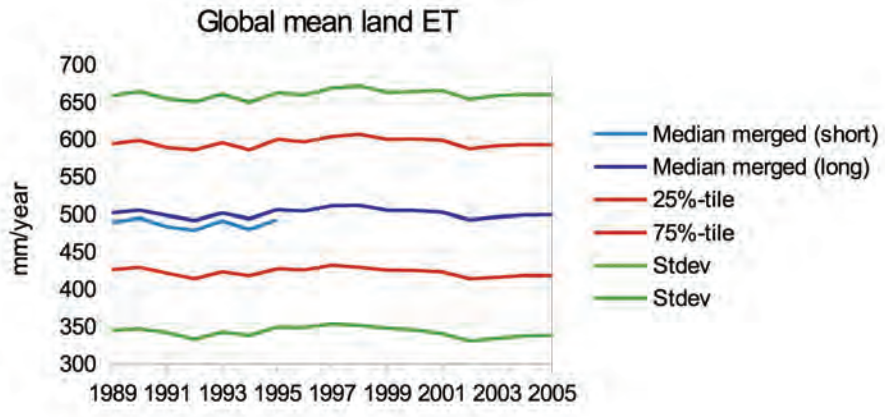


Figure 2. Variations of globally averaged land evapotranspiration of the merged synthesis products derived by LandFlux-Eval. The short product only covers 1989–1995, but includes a larger number of products in the average. Displayed are the median of the short and long products, together with the interquartile range and the standard deviation (over the mean) for the long product. Reprinted from Mueller et al., Benchmark Products for Land Evapotranspiration: LandFlux-EVAL Multi-Data Set Synthesis, Hydrology and Earth System Sciences, 17, 3707–3720, 2013.

3rd GEWEX Water Vapor Assessment (G-VAP) Workshop

Fort Collins, Colorado
30 September–2 October 2013

Marc Schröder[1], Maarit Lockhoff[1], and Lei Shi[2]
[1]Deutscher Wetterdienst, Offenbach, Germany; [2]NOAA/National Climatic Data Center, Ashville, North Carolina, USA

Participants from research institutes, universities, weather services, ground-based and in situ measurement communities, and space agencies attended the 3rd G-VAP Workshop, which was hosted by and held at the Cooperative Institute for Research in the Atmosphere (CIRA). The goal of G-VAP is to quantify state-of-the-art water vapor products being constructed for climate applications and, by this, support the selection process of suitable water vapor products by the GEWEX Data and Assessments Panel (GDAP) for its production of globally consistent water and energy cycle products. The G-VAP Asssessment Plan has been consolidated and finalized, and is available at: *http://www.gewex-vap.org*.

Updates on candidate satellite data, ground-based and in situ data records, as well as G-VAP related evaluation activities were presented at the Workshop. The Medium Resolution Imaging Spectrometer (MERIS) total column water vapor (TCWV) product that was intially developed by the European Space Agency (ESA) Data User Element (DUE) GlobVapour Project, has been extended in time and now covers the period of 2003–2012. In 2014, a new ESA project will provide a microwave radiometer TCWV data record for the period of 1991–2011. The updated EUMETSAT water vapor product combines Infrared Atmospheric Sounding Interferometer (IASI), Microwave Humidity Sounder (MHS), and Advanced Microwave Sounding Unit (AMSU-A) data, and is available in both clear and cloudy sky conditions. For the NASA Water Vapor Project (NVAP-M) Climate Product that includes Special Sensor Microwave Imager (SSM/I), High-resolution Infrared Radiation Sounder (HIRS), Atmospheric Infrared Radiation Sounder (AIRS), and radiosonde data, a resampling activity is planned for consistent sampling in time. Data from the U.S. Department of Energy's Atmospheric Radiation Measurement Program and the Global Climate Observing System (GCOS) Reference Upper Air Network (GRUAN) will serve as reference data for the analysis of instantaneous satellite profile data. The Global Navigation Satellite System will provide a valuable reference for assessing diurnal sampling issues of satellites.

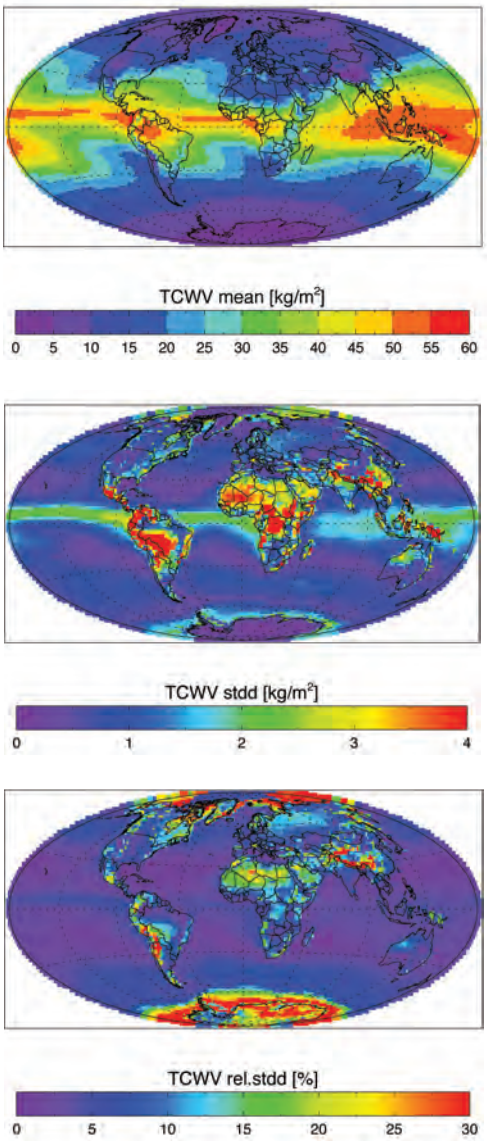
The importance of probability density functions (PDFs) was emphasized in several talks at the Workshop. A comparison of the Constellation Observing System for Meteorology, Ionosphere and Climate (COSMIC) and AIRS products with weather and climate model output showed that the wet and dry end of the distribution are not well represented in AIRS data and model output. Another study analyzed potential changes in water vapor distribution using global circulation models with a special focus on the changes at the high end of the distribution, (e.g., extremes), and stressed the need for observation-based information about water vapor distributions and their changes. G-VAP will include the study of changes in the PDF for data records with a temporal coverage of 25 years or more.

The National Oceanic and Atmospheric Adminstration (NOAA) Product Validation System (NPROVS) and its update, the NRPOVS+ will be the basic system used for the evaluation of a subset of instantaneous satellite data in G-VAP. The intercomparison of TCWV using six long-term data records showed that the largest regional discrepancies between the data sets are visible over land (especially over the Andes) and dry areas (Arctic and Antarctic) (see figure on next page). In addition, most of the temporal inhomogeneities (break points) and other artifacts can be attributed to changes in the observing system (e.g., changes of satelllites, observation frequency).

Trends in TCWV exhibit significant differences among the data records in terms of absolute values and in specific regions like Central South America, Central Africa, the Sahara and Arabian Peninsula, and the Arctic and Antarctic. An analysis of regional anomalies shows that regions of distinct trends usually coincide with breakpoints in the time series and that these are not evident on a global scale. The data record ensemble will not be considered as a reference; instead, single records will be used, such as those that exhibit the highest degree of homogeneity. The analysis can be improved by the consideration of long-term calibration uncertainties. Furthermore, the analysis of the regression between TCWV and sea surface temperature will be finalized for data records of more than 25 years temporal coverage only due to the various assumptions behind this analysis. The intercomparison of MHS, HIRS and Meteosat Upper Tropospheric Humidity (UTH) data records revealed that UTH from HIRS exhibits the largest scatter, while UTH from Meteosat is significantly drier than the UTH from HIRS and AMSU-B.

Within the Stratospheric Processes and their Role in Climate (SPARC) Project Water Vapor II activity, the quality of satellite data records is typically not analyzed below 125 hPa. The joint analysis of full period cloud, precipitation and water vapor data records is needed to better understand the physical processes that link the upper troposphere and the lower troposphere. SPARC and G-VAP will consider this when cooperating on the analysis of UTH (G-VAP) and Upper Troposphere Lower Stratosphere data records (SPARC).

The deadline for the last data upload is Fall 2014 and is considered critical because new versions of data records that have been analyzed might have already been updated in the meantime. It was the concensus that G-VAP will be finalized in 2015 and that the highest priority is to complete the work on the data inventory, the comparison of ground-based and in situ data, the homogeneity and stability analysis, and the analysis of differences in trends using gridded data. Inconsistencies that are observed will be explained to the maximum extent possible. This will be done first for data records of more than 25 years and then for a subset of activities for data records of more than 10 years. The analysis will be extended to include changes in



Intercomparison of total column water vapor. Ensemble mean (top panel), standard deviation (middle panel) and relative standard deviation (bottom panel). Figures are based on a common period (1988–2008) and grid (2° longitude and latitude) of seven long-term satellite-based data records and reanalysis.

the PDF over time for data records greater than 25 years. The results of these efforts will form the core part of the report. Beyond this, qualitative analyses and case studies will form the annex of the report and may include a subset of candidate data records, as well as a focus on specific regions and periods. At the Workshop it was agreed that there is a need for continental high quality water vapor satellite data records, intercalibrated radiance and brightness temperature data records, and homogeneously reprocessed instantaneous satellite data records. The Workshop recommended the development and provision of a PDF-based climatology of satellite-based radio occultation data, and analysis of differences between observations under all sky as well as cloudy and clear sky conditions. The next G-VAP workshop is tentatively scheduled at the Institute for Space Sciences at the Free University Berlin from 6–10 October 2014.

Global Land/Atmosphere System Study Panel Meeting

Exeter, United Kingdom 16–18 October 2013

Joe Santanello[1] and Aaron Boone[2]
[1]NASA/Goddard Space Flight Center, Greenbelt, Maryland, USA; and [2]Meteo-France, Toulouse, France

The Global Land/Atmosphere System Study (GLASS) Panel completed its second year as a stand-alone GEWEX panel for modeling activities, with Joseph Santanello and Aaron Boone serving as co-chairs. Sixteen people attended the 3-day meeting, including representatives from current projects, working groups, and the GEWEX Atmospheric Boundary Layer Study (GABLS), as well as several potential new GLASS members. The Panel meeting followed the First Diurnal Land/Atmosphere Coupling Experiment (DICE) Workshop on 14–16 October, both hosted by Martin Best and Adrian Lock at the UK Met Office in Exeter, UK. Unfortunately, attendance at both meetings was significantly hurt by the U.S. government shutdown and resulting travel cancellations.

GLASS has a well-balanced mix of established and new projects, each of which corresponds to the three GLASS themes (Model Data Fusion, Benchmarking, and Land-Atmosphere Coupling). GLASS has a number of collaborative projects with the GEWEX Hydroclimatology Panel (GHP), is conducting projects with the GEWEX Atmospheric Boundary Layer Study (GABLS), and continues to be engaged with the World Climate Research Programme Working Group on Numerical Experimentation (WGNE) on benchmarking and data assimilation activities, and the Seasonal to Subseasonal (S2S) Prediction Experiment.

Topics at the meeting included updates on current and planned GLASS activities, with a special emphasis on refining plans for the recently initialized Phase 3 of the Global Soil Wetness Project (GSWP-3), and for the new Project for the Intercomparison of Land-surface Parameterization Schemes (PILPS). In addition, discussions were held on current gaps in GLASS membership and activities, and the mapping of GLASS projects to the WCRP Grand Science Questions and GEWEX Science Questions.

LUCID

The objective of the Land-Use and Climate, Identification of Robust Impacts Project (LUCID; Andy Pitman) is to quantify the impacts of land use induced land cover changes on the evolution of climate between the pre-industrial epoch and today. Four papers were published from 2012–2013 that summarized the results from LUCID-1 and LUCID-2. This includes evaluation of the impact of land cover change in five Global Circulation Models (GCMs) using the Land Use Harmonization (LUH) data set. The effects of land cover change on temperature and rainfall extremes in multi-model ensemble simulations have been studied, along with the ef-

fect of anthropogenic land use and land-cover changes on climate and land carbon storage. Some of the main findings are that Land Use/Land Cover Change (LULCC) does matter at the regional scale. The differences in the land-surface model parameterizations explain one-half to two-thirds of the inter-model dispersion, and differential amounts of forests removed explain about one-third of the inter-model dispersion. Thus, a key result supports the need to engage both Land Surface Model (LSM) and Land Cover Change (LCC) data set providers, to see how to intelligently implement LCC in models.

The LUCID Project is also interested in gauging the interest of the LCC community in the Climate of the 20th Century (C20C) Project and the Fifth Phase of the Coupled Model Intercomparison Project (CMIP5) GCMs. There may be linkages between GSWP-3 and the land cover treatment in the 1900–2000 (20C) simulations, and LUCID efforts that will be investigated. In terms of future actions, some plans linking LUCID and GLACE are emerging, and a new European Union project is beginning near the end of 2013 with N. De Noblet coordinating the land cover change component of this project.

PALS, PLUMBER, and Benchmarking

The Protocol for the Analysis of Land Surface models (PALS, Gab Abramowitz; *http://pals.unsw.edu.au*) was designed to analyze in a standard way single site land-surface model simulations with site observations. Recently, an advanced version of PALS was developed that includes gap filling, empirical benchmarks, and automated metrics, along with a larger suite of Flux Tower Network (FluxNet) data (with the assistance of GHP). Extensions to other data sets and the development of benchmarking tests are under way. For example, the Manabe bucket model and the Priestly-Taylor approach to flux estimation has been performed in order to use these as standard benchmarks of the "goodness" of current LSMs.

The joint GHP-GLASS project, PALS Land Surface Model Evaluation Benchmarking Project (PLUMBER), was conceived to demonstrate benchmarking through PALS. Results from multiple land surface models (see figure on page 1) are currently being analyzed. Discussions are under way for including two-dimensional case studies within PALS. These ideally would include specific well-instrumented and documented basins and require additional collaboration with GHP and the GEWEX Data and Assessments Panel (GDAP), potentially under the auspices of a future follow-on intercomparison project.

ALMIP-2

Phase 2 of the Analyse Multidisciplinaire de la Mousson Africaine (AMMA) Land Surface Model (LSM) Intercomparison Project (ALMIP-2; Aaron Boone) was launched in Spring 2012 and includes 22 LSMs, five hydrological models, and one evapotranspiration (ET) model. The focus of the project is on a much higher spatial resolution (mesoscale, 5 km) than in ALMIP-1 (regional scale, 0.5°) to help to understand the subtle hydrology and vegetation processes that dominate there (e.g., large rooting depths that access water in near surface aquifers, soil crusting, lateral transfer processes, strong variability in surface runoff), and to enable use of high resolution precipitation and satellite data. ALMIP-2 covers a 4-year period with forcing data that is a blend of in situ, numerical weather prediction, radar, Landsat, and other satellite data.

ALMIP-2 also takes advantage of observational data along a meridional transect from the AMMA Couplage de l'Atmosphère Tropicale et du Cycle Hydrologique (CATCH) Network, which cuts across a zone with a large gradient in surface characteristics and climate. The project will give recommendations on the parameterization of scaling surface processes (e.g., runoff, ET) and potentially missing or poorly parameterized processes that are key to the functioning of the West African land surface. As ALMIP-2 has regional hydrological aspects, it is also considered to be an ideal candidate for a collaborative project between GLASS and GHP. First results from the mesoscale simulations were presented at the ALMIP-2 International Workshop in April 2013 at Météo-France. Analysis is ongoing and some models are finishing reruns. Local scale forcing and data have been distributed, and the participant LSM groups are now performing runs.

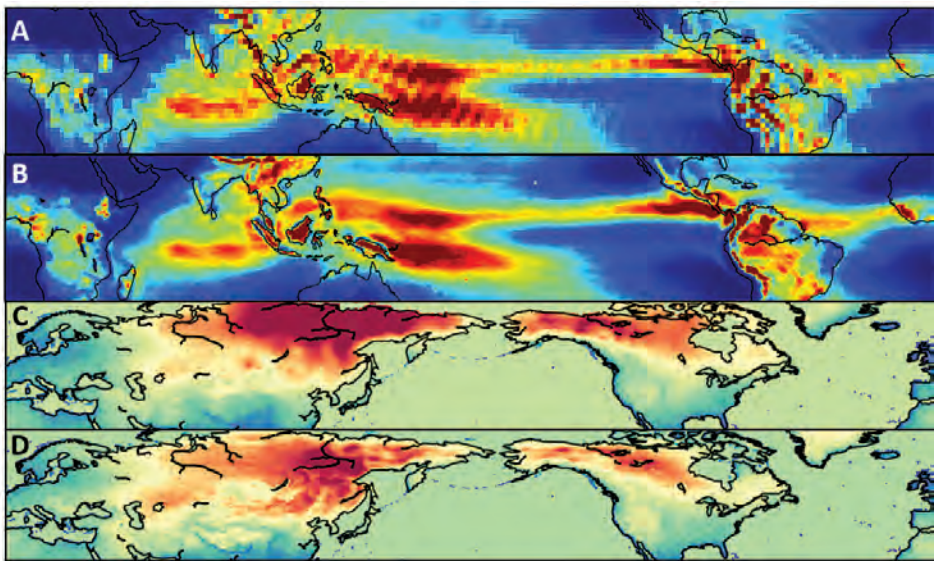
GSWP-3

A follow-up project to the Global Soil Wetness Project-2 will kick off at a meeting in February 2014 in Tokyo. The new components being considered for this project are: (1) Covering a longer period in the 20th Century (approximately 1900 to present), which includes interesting global trends in hydrology, but is also long enough to study carbon processes; (2) Including carbon models, to explore/attribute the possible carbon-related effect or changes in ecosystem functioning on these trends; (3) Including simulations using CMIP5 models, both present day and future conditions, with land cover change scenarios; (4) Exploring uncertainties in (precipitation) forcings by using multiple data sets; and (5) Using a routing scheme, such as the Total Runoff Integrating Pathways (TRIP) river routing model and Gravity Recovery and Climate Experiment (GRACE) data for evaluation and diagnostics. This experimental design will enable a bridge to the terrestrial carbon cycle modeling community, and GLASS will actively recruit members of the Integrated Land-Ecosystem-Atmosphere Processes Study (iLEAPS) to be involved in both the planning and analysis of the carbon component of GSWP-3.

Over the last year, a great deal of work has been done on bias correction of the forcing data set (20CR forcing; see figure on next page), which uses global dynamical downscaling and Climatic Research Unit observations for 2-meter fields. Radiation correction is applied using the GEWEX Surface Radiation Budget product. A white paper (experimental protocol) is under review and will be circulated among key contacts within the carbon community to get their buy-in before the project begins. This will enable both carbon and water and energy cycle land surface models to be included, and simultaneously evaluated (e.g., the hydrology of carbon models and vice versa).

LoCo and the SGP Testbed

The Local Land-Atmosphere Coupling Working Group (LoCo; Joe Santanello) is continuing to develop and publish work on the diagnostics of land-atmosphere interactions and coupling



GSWP-3 will incorporate high-resolution, downscaled, and bias-corrected atmospheric forcing to drive the offline simulations. Experiment 1 will be driven by retrospective atmospheric boundary conditions for 1901–2010 generated at 3-hourly resolution and 2-degree resolution that are dynamically downscaled into a T248 (~0.5°) grid using spectral nudging with vertically weighted damping. This efficiently removes known artifacts (e.g., B vs. A: annual surface precipitation) and adds high frequency signals to the low frequency signal (e.g., D vs. C: daily variance of 2m temperature) of the original reanalysis. These improved precipitation and temperature forcings will ensure the best possible simulation of water and energy cycles in the land surface models contributing to GSWP-3.

across an array of scales and models. Updates were presented by members of the working group on diagnostics and model applications. Some examples of these are the traditional mixing diagrams, lifting condensation level deficit, Findell-Eltahir diagnostics of convective triggering potential (HIlow), revised relative humidity tendency variables, McNaughton coupling coefficient, and triggering feedback strength (TFS) and amplification feedback strength (AFS).

The need to synthesize these efforts and associated metrics was a focal point of discussion. To this end, the LoCo Working Group has embarked upon a test bed project that will produce an Atmospheric Radiation Measurement (ARM) Program-supported data set for coupling studies over the U.S. Southern Great Plains (SGP). Phase 1 of the data set (at the SGP Central Facility, 1996–present) has been delivered. Multiple proposals have been submitted in the hopes of putting this data set to use with the full arsenal of LoCo diagnostics in order to establish their hierarchy and to develop a classification system based on the metrics. The progress and limitations in the Planetary Boundary Layer (PBL) monitoring over SGP was also assessed based on recent in situ and remotely sensed sources. Future phases of the test bed development will be adding additional SGP sites to the data set and spatial gridding over SGP, and possible expansion to other locations such as AMMA and Cabauw, The Netherlands.

DICE

The GLASS/GABLS Diurnal Coupling Experiment (DICE; Martin Best) experiment began in 2013. The first DICE workshop was held on 14–16 October at the Met Office in Exeter, UK. This project involves the GABLS and GLASS members running fully coupled single column models at the Cooperative Atmosphere-Surface Exchange Study-1999 (CASES 99) (which was a GABLS-2 project) and controlling for surface fluxes versus atmospheric forcing in each component to isolate the impact of land-atmosphere coupling in the models over the full diurnal cycle (stable and unstable PBLs). Stages-1 (offline land surface), -2 (fully coupled) and -3 (column models forced by surface fluxes) are complete. A protocol is currently being devised in order to produce an additional set of simulations with improved (i.e., closer to the observed) land-surface model estimates of latent heat flux (and Bowen ratio). A GEWEX Newsletter article on DICE was published in the May 2013 issue. Results from DICE will be presented at the upcoming annual AMS meeting.

GLACE-CMIP5 and S2S

Experiments 1A and 1B of GLACE2-CMIP5 (Sonia Seneviratne and Bart van den Hurk) have been completed. This work involved Fifth Assessment Report (AR5) reruns of climate change projections using a 1971–2000 soil moisture climatology versus a seasonal transient cycle of soil moisture evaluated during the 2070–2100 period. Five groups, the NOAA Geophysical Fluid Dynamics Laboratory; the Institut Pierre Simon Laplace, the U.S. National Center for Atmospheric Research, the Max-Planck Institute, and European Commission-Earth, are participating in the simulations, analysis and the experimental design, with papers submitted and in preparation in 2013. Future phases of experiments involve land cover change, and therefore offer opportunity to collaborate with LUCID. Highlights illustrate that the imposed soil moisture anomalies show similar regions as those projecting drought increase, and a larger impact of soil moisture change on daily maximum temperature. Precipitation changes are less clear, and additional analysis will be conducted to analyze the feedbacks and water balance, which are to be completed over the next 12

months. Additional groups will be contributing to GLACE-CMIP5 [(Hadley Centre Global Environmental Model (HadGEM) and Australian Community Climate and Earth System Simulator (ACCESS)]. Finally, a new experiment is planned where the impact of fixed carbon dioxide for photosynthesis in projections (2006–2100) will be studied, along with the resulting radiative forcing versus feedback from soil moisture.

PILDAS

The launch of the Project for the Intercomparison of Land Data Assimilation Schemes (PILDAS; Rolf Reichle) has been delayed until 2014. The experimental design is nearly complete, and a pilot study by the project lead to use two LSMs with one distributed arithmetic (DA) algorithm in the National Aeronautics and Space Administration's Land Information System is to be carried out in early 2014. Phase-1 is focused on operational centers (rather than niche research projects), synthetic observations, and different DA algorithms with different LSMs for a one-eight of a degree domain over the SGP. 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) mission. GLASS will present the experimental plan and pilot results at the next meeting of the Working Group on Numerical Experimentation (WGNE) to encourage other centers (e.g., UK Met) to participate.

Pan-GEWEX and Future Activities

During the GLASS Panel meeting, a number of future activities were identified and launched, including a workshop on land-atmosphere coupling and the GABLS Stable Boundary Layer Project. A workshop on land-atmosphere coupling was held at the Center for Ocean-Land-Atmosphere Studies (COLA) at George Mason University in December 2013, where a renewed focus on community-wide coupling studies was supported. To this end, proposals have been submitted by LoCo principal investigators related to the LoCo/SGP Testbed Project to implement a new ARM Best Estimate (ARMBE)-Land Project and establish a benchmark of land-atmosphere coupling based on LoCo-derived diagnostics compiled by the working group. This includes a proposal for an extended field campaign to better monitor the PBL through augmented radiosonde launches, an integrative proposal to bring together the LoCo metrics and the ARMBE data, and the investigation of additional site suitability for LoCo studies [e.g., India (monsoon), AMMA, and Cabauw)].

Eric Bazile presented a proposal for a GABLS Stable Boundary Layer Project that uses Dome-C (Antarctica) station data. A science plan is forthcoming. GLASS will be involved in terms of assessing the thermal coupling and momentum flux in a polar climate, which to date has been lacking in terms of GLASS activities and focus. Since GLASS does not currently have members with experience in cold region processes in an Antarctic climate, it has been proposed that a link to the Climate and Cryosphere (CliC) Project be established to foster collaboration between GLASS, GABLS and CliC for this project. Another possibility is a collaboration with CliC and GHP on a cold season intercomparison project for the Saskatchewan Basin in Canada.

GLASS is also exploring connections with the GHP Hydrological Cycle in the Mediterranean Experiment (HyMeX) Project. 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 has recently become involved in the Seasonal-to-Subseasonal (S2S) Prediction Project for a 2-week to 2-month timeframe using a multi-model ensemble approach with a special emphasis on events that have high societal or economic impacts. Since the main objective of GLACE-2 is to determine the degree to which realistic land-surface initialization contributes to forecast skill (rainfall, temperature) at 1–2 month leads, there are strong parallels with S2S. The head of the GLACE-2 Project, Bart van den Hurk, is the GLASS liaison to S2S.

GLASS participates in the WCRP Modeling Advisory Council (WMAC), and WGNE. The Panel will play a key role in the GEWEX Science Questions, particularly on water availability, and water and energy cycles. These activities will be coordinated to nicely map to the WCRP Grand Science Questions on water and extremes.

GLASS has made very good progress this year and overall, this is a successful and energetic project, with a large program of activities of high relevance to the GEWEX mission, and some ambitious and exciting new developments in sight. The next GLASS Panel meeting will be held at the time of the 7th Internatioal GEWEX Scientific Conference in The Hague, The Netherlands on 14–17 July 2014.

GEWEX Summer Sessions

10–12 July 2014
Delft University of Technology, The Netherlands

The GEWEX Summer Sessions are free of charge and will be open to a limited number (maximum of 30) of graduate students, post docs and early career scientists. This 3-day course will be presented by some of the world's most esteemed scientists in the area of energy and water cycle research. The sessions, covering various aspects of observations, modeling and prediction of the energy and water cycle and related processes, will be a mix of lectures and practical exercises.

Students who attend the GEWEX Summer Sessions are expected to submit an abstract and attend the 7th International Scientific Conference on the Global Water and Energy Cycle, which is being held directly after the sessions. Financial support to attend the Conference and Summer Sessions is available to qualified candidates. See: *http://gewex.org/2014conf/support.html* for more information.

If you are interested in attending the Summer Sessions, please send an e-mail to *conference@gewex.org*.