

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

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Almost 400 scientists from 32 countries gathered in Melbourne, Australia from 24–28 August 2009 to attend the 6th International GEWEX Science Conference, held in parallel with the 2nd Integrated Land Ecosystem–Atmosphere Study (iLEAPS) Science Conference. Both conferences were organized together and around a central theme, *Water in a Changing Climate—Progress in Land–Atmosphere Interactions and Energy/Water Cycle Research*, to emphasize the unique aspects of the



GEWEX and iLEAPS programs, while highlighting the overlap in their scientific communities. Joint oral and poster sessions were held that combined the mutual scientific interests and subject matter of both programs. The 150 oral and 250 poster presentations given during the conferences showed that the mutual science from both international frameworks has already led to new and interesting collaborations and insights.

Opening remarks at the Plenary Session were given by the following dignitaries: Bruce Stewart, President of the World Meteorology Organization (WMO) Commission for Hydrology, who spoke on behalf of Michel Jarraud, Director General of WMO; Carlos Nobre, Chairman of the International Geosphere-Biosphere Programme (IGBP) Scientific Committee; Ghassem Asrar, Director of the World Climate Research Programme (WCRP); Antonio Busalacchi, Chair of the WCRP Joint Scientific Committee; Pavel Kabat, iLEAPS Conference co-chair and iLEAPS Scientific Steering Committee co-chair; and Soroosh Sorooshian, GEWEX Conference co-chair and former chair of the GEWEX Scientific Steering Group. **The opening remarks touched on the significant progress that has been made in climate research and emphasized the important role that GEWEX and WCRP as a whole have played in this, including their contributions to the Intergovernmental Panel on Climate Change process.** With future developments on the horizon resulting from United Nations Climate Change Conference (COP 15) held in Copenhagen this year and the recent addition of climate services as a WCRP goal, the GEWEX role has become even more vital.

Five keynote speakers presented their ideas on the state of climate change research. The first keynote speech was delivered



Roger Pielke, Jr.

by Piers Sellers, U.S. astronaut and former GEWEX chairman of the International Satellite Land-Surface Climatology Project. His presentation focused on opportunities and challenges in the climate science arena, in particular for the U.S. program. John Thwaites, Professorial Fellow of Monash University and Chair of the Monash Sustainability Institute in Australia, emphasized the regional and practical aspects of climate change and water management from his personal experience as former Minister of Water in Victoria, Australia. In his presentation, **Prof. Thwaites demonstrated that a robust planning framework for conservation of water resources and planning is necessary, even if the climate change predictions and assumptions regarding climate change and its impact on water resources are incorrect.** This point was strengthened by the presentation of Roger Pielke, Jr., professor and Fellow of the Cooperative Institute for Research in Environmental Sciences (CIRES) and former Director of the Center for Science and Technology Policy Research at the University of Colorado at Boulder. Because most hydrological processes are of a non-stationary nature, he urged the scientific community to focus on not just improving predictive capabilities with increasingly complex models but also to come to robust decisions in crafting policy with simple models based on what is possible rather than what is probable.

Paulo Artaxo, Professor of environmental physics at the University of São Paulo, Brazil, reflected on the challenges in unveiling the links between climate's scientific aspects and climate's socioeconomic aspects, which are as important as physics, chemistry, and biology. He concluded with a strong plea for combining biogeophysical and socioeconomic systems research. Will Steffen, Executive Director of the Climate Change Institute at The Australian National University, expanded on this theme, stating that we are now living in the “anthropocene” and that societal transformation at a global scale is necessary for survival. The challenge for research is to provide the knowledge base to support that transformation.

After the Plenary Session, iLEAPS and GEWEX began their parallel sessions. The first GEWEX session focused on *Regional Forecasting and Predictions for Hydrological Applications in Arid Zones*, where Soroosh Sorooshian gave a concise overview of the issues in arid- and semi-arid zone hydrology. He indicated, as did other presenters in this session, that **changes in precipitation patterns (timing and intensity) and vegetation cover have great implication on the magnitude of ground water recharge, runoff, and flooding. Satellite observations on both precipitation and ground water are proving to be invaluable in hydrologic forecasting and predictions and much progress has been made in this area.**

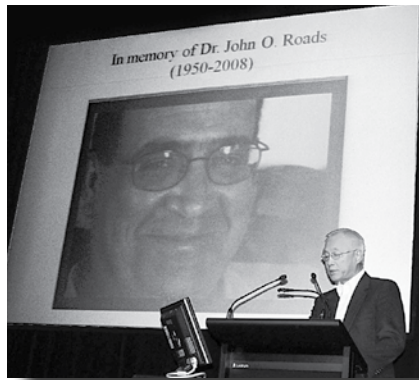


John Thwaites

In the GEWEX session on *Rainfall Variability and Drought in Australia*, Harry Hendon presented a provocative paper on why it would be difficult, if not impossible, to predict Australian summer monsoon rainfall. Other authors were more op-

timistic, such as Carsten Frederiksen, who showed the relative importance of slow and intraseasonal processes in Australian rainfall variability and predictability.

The GEWEX *John Roads Memorial Symposium* was held on Tuesday in honor of John Roads, who had been committed to closing water and energy budgets. Masao Kanamitsu began the Symposium with an overview of John's contributions to GEWEX, and many presenters paid similar tribute by speaking of the influence John had had on their own work. In the first session of the Symposium, *Analyses of Water and Energy Cycles*, Richard Lawford emphasized the societal importance of many aspects of GEWEX research. For example, **through GEWEX studies, hydrologic models have been developed that require less calibration than lumped models. They utilize the extensive distributed information available through remote sensing. These models have been easier to interface with atmospheric models and have become central to land data assimilation activities.** Other speakers underscored the importance of regional data, such as the Coordinated Energy and Water Cycle Observations Project's (CEOP) evaluation of various energy and water cycle products. Michael Bosilovich stressed this point with respect to evaluation of reanalysis data.



Masao Kanamitsu

The session on *Climate Prediction Systems* featured papers on the various aspects of skill of the current climate models. **Most authors indicated that the skill in forecasts of precipitation leaves much to be desired, whereas skill in temperature forecasts is, as to be expected, performing better.** The intermediate results from the second Global Land Atmospheric Coupling Experiment (GLACE-2) experiment presented by Bart van den Hurk also showed this and indicated that the initialization impacts on skill increase dramatically when conditioned on the size of the initial local soil moisture anomaly.

In the *Regional Downscaling* session, Jack Katzfey's overview on regional climate modelling emphasized the considerable progress made over the past 20 years and that a high and growing demand exists for detailed regional climate change information. However, questions persist on explaining the differences between regional and global climate models. Regional climate models at the moment may best be a tool to explore the issues of effects of increased resolution for global models.

In the last session of the Symposium, *Regional Hydroclimate Projects (RHPs) and Studies*, Hans von Storch (presented by Hans-Joerg Isemer) demonstrated how the Baltic Sea Ex-

periment (BALTEX) has progressed from a regional project, initially focused on energy and water cycle observations, to a broader ecosystems approach. This successful transition is laid out by the report "BALTEX Assessment of Climate Change for the Baltic Region" and was condensed into a paper for the Helsinki Commission, a Baltic Sea Region environmental policy maker. This session could only highlight a few of the many diverse activities ongoing in the RHPs within CEOP, such as the progress in water isotope modelling and the assessment on how reliable climate variability estimates are in predicting extreme precipitation.

On Wednesday three joint GEWEX-iLEAPS sessions were held. In the first, *Land in the Climate System*, Paul Dirmeyer concluded that although climate is sensitive to the land surface state and its variations, it may not be useful for climate prediction. Thus, the assessment of the quality of climate models is very important. Eleanor Blythe presented a method for accomplishing this. Dennis Baldocchi showed the progress that FLUXNET has made over the years, especially regarding the availability and quality of data. The importance of global-covering flux observations and *in situ* data are essential when examining Earth system vulnerabilities through carbon-climate interactions, as Michael Raupach presented.

In the joint session on *Aerosol, Cloud, Precipitation and Climate Interactions*, **Terruyuki Nakagima showed that the surface cooling loop for precipitation change by aerosols provides a link between cloudiness and precipitation.** Anders Engstrom demonstrated that the effect of aerosols on convective precipitation at a much larger scale was not evident.

In the last session, *The Future Generation of Integrated Observation and Modelling Systems*, Adrian Simmons gave an overview of the current and future integrated observation and modelling systems for meteorology and atmospheric composition by a major numerical weather prediction center. **Kevin Trenberth advocated for a climate information system as part of an integrated Earth information system.** Eric Wood showed that an assimilated global water budget with closed budgets is now feasible and that it is also possible to compute a continental-to-global scale budget with discharge as a residual, solely from remotely sensed observations.



Left to right: G. Asrar, S. Sorooshian, A. Busalacchi and R. Lawford

GEWEX Parallel sessions resumed on Thursday with *Observing Surface Fluxes: From Local to Global Scales*. **Bill Rossow concluded that within the next 2 years we will have completed the global energy and water cycle budget from space-borne observations (i.e., produced an integrated and consistent**



global energy and water cycle observations data set). John Finnigan, who chaired this session, concluded that some big questions still persist, such as how to close the global energy budget when all the terms are estimated and cannot account for the fact that atmospheric transport of both latent and sensible heat is always low.

In the session *Multiscale Properties of the Tropical Energy and Water Cycles: From Thunderstorms to Monsoons*, George Huffman, using Tropical Rainfall Measuring Mission (TRMM) multi-satellite precipitation analysis, demonstrated how a weather regime classification may be useful in classifying typical extremes behavior. In the session *Advances in the Representation of the Energy and Water Cycle in Models*, **Sigfried Schubert demonstrated that in a multi-model assessment of the impact of sea-surface temperature anomalies and land-atmosphere feedbacks on drought, there is general agreement among models on global response, but that substantial differences exist at regional scales.** It was surprising, given its importance to climate processes, to see the relatively limited amount of accomplishments presented in cloud climate feedbacks during the session devoted to that topic.

The session on *The Role of Integrated Observing Systems in Closing Regional and Global Energy and Water Budgets* featured comprehensive space agency overview presentations by Jack Kaye for NASA and Taikan Oki for the Japan Aerospace Exploration Agency. Both agencies show strong continued support for research activities and dedicated climate research missions along with a commitment to activities and services based on their proven value to observations of the global energy and water cycles. Bob Su presented the European Space Agency's Water Cycle Multi-mission Observation Strategy (WACMOS) for establishing a solid scientific basis for the creation of coherent long-term data sets of water-relevant geo-information.



Olga Zolina

Presentations given at the last GEWEX session, *Climate Change and Global Precipitation*, focused on the issue of bias errors in precipitation estimation products that need to be reduced in coming years, particularly in mid-latitude ocean and high-latitude ocean and land areas. For example, Cloudsat (and follow-ons) could be used to address missed light rain and the planned Global Precipitation Mission for the mid-latitude ocean and high-latitude ocean and land areas.

To view the conference presentations, please see: http://gewex.org/2009gewex_ileaps_conf.html.

Meeting/Workshop Reports

GEWEX Atmospheric Boundary Layer Study (GABLS) Workshop

26–27 June 2009
Boulder, Colorado, USA

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About 40 scientists met to review GABLS-3 results at a workshop held at the National Center for Atmospheric Research (see program at <http://www.met.wau.nl/projects/Gabls/index.html>). The workshop was organized in connection with the annual Weather Research and Forecasting (WRF) Conference to attract these participants to the GABLS Workshop.

The aim of the GEWEX Atmospheric Boundary Study (GABLS) is to enhance the understanding and to improve the representation of the atmospheric boundary layer in weather forecast and climate models on a variety of scales, which should benefit atmospheric chemistry and Earth system studies as well as other applications, such as wind energy resource estimation (Holtslag, 2006). The first study (GABLS-1) covered a simplified case for a stable boundary layer with moderate geostrophic forcing and prescribed surface temperature over ice, in which single column models (SCMs) were compared with an ensemble of Large Eddy simulation (LES) models' results. The second intercomparison case (GABLS-2) dealt with the representation of the diurnal cycle over land in comparison with observations from the Cooperative Atmosphere-Surface Exchange Study 1999 (CASES-99) (Svensson and Holtslag, 2007; 2009). The third case (GABLS-3) extends the previous work for SCM and LES models and uses the extensive data gathered around the 213-m Cabauw tower in the Netherlands.

The first session of the workshop focused on presenting the results of the participating SCM and LES models for the Cabauw site. Fred Bosveld [Koninklijk Nederlands Meteorologisch Instituut (KNMI)] presented the set-up for the SCM study and Sukanta Basu (Texas Tech) presented the LES set up and results. The Cabauw site is situated in a flat environment dominated by grassland. On many nights a low level jet (LLJ) develops as an inertial oscillation initiated by the evening decoupling. Thus, the scientific question of GABLS-3 is how well the SCMs represent the transitions between daytime and nighttime conditions, including the development of LLJs. For a fair comparison with the Cabauw observations, a relatively ideal, baroclinic night (1 July 2006) was selected from the multi-year data archive of Cabauw. Detailed dynamic forcings and surface conditions were prescribed on the basis of local observations and the outcome of 3-D-atmospheric mesoscale models.