

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

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

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

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

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

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

### **References**

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

## Meeting/Workshop Reports

### **CAHMDA-V: Catchments in a Changing Climate**

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

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

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

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

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

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

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

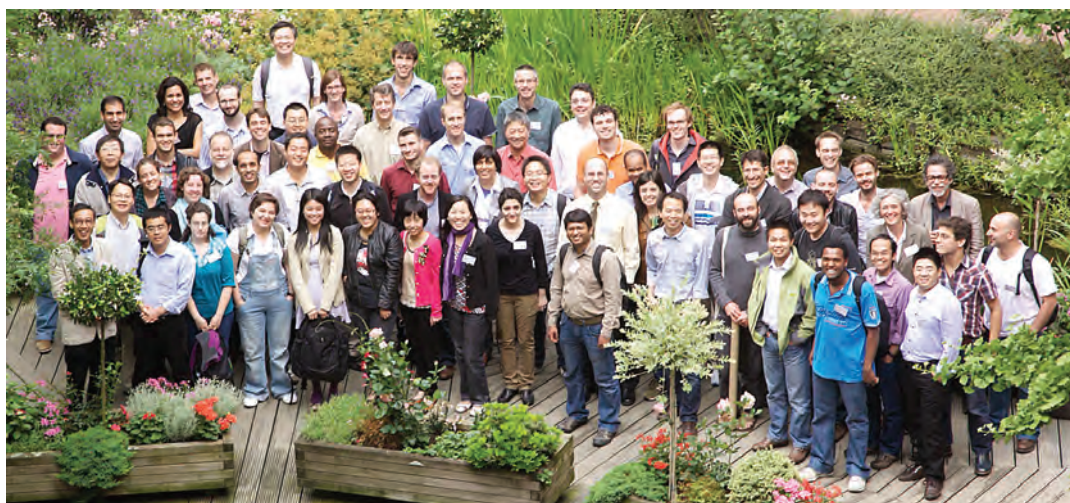
In the session on “Climate Change Impacts—Detecting Changes in Cold/Arid and High Elevation Catchments/Regions,” Chunmiao Zheng, Peking University, presented an ecohydrological experiment in the Heihe River Basin in China that is exploring the principles of ecohydrological processes in an arid environment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

to capture the spatial heterogeneity and quantify representative error by using a data assimilation technique.

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

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

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



Participants at the 5<sup>th</sup> Workshop on Catchment Hydrological Modeling and Data Assimilation (CAHMDA-5).