Moving Forward: Process for Planning the Future of GEWEX Begins at 2nd Pan-GEWEX Meeting

Kevin E. Trenberth
Climate Analysis Section, National Center for Atmospheric Research, Boulder, Colorado, USA

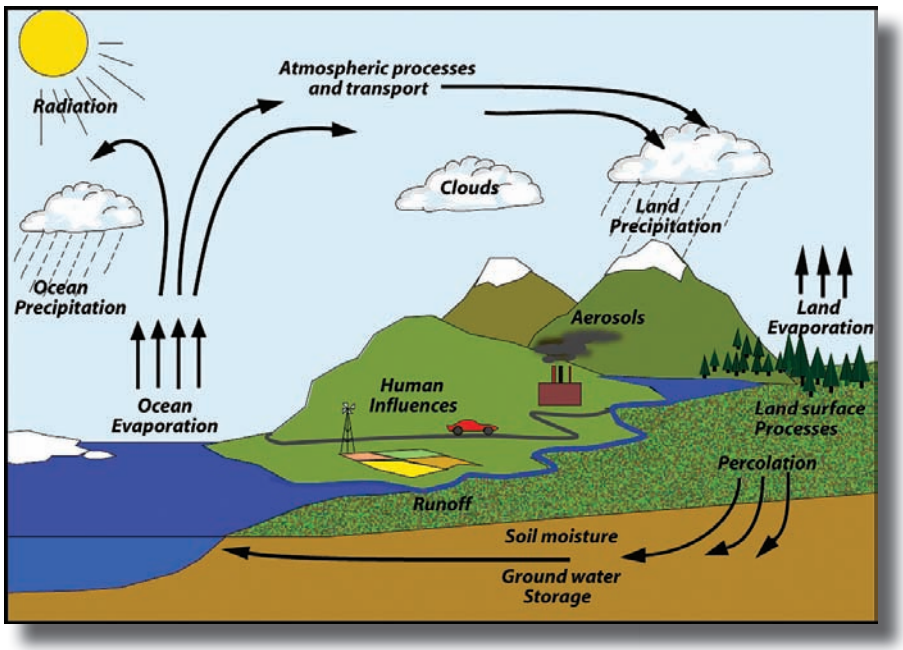
The 2nd Pan-GEWEX Science Meeting was held on 23–27 August 2010 at the University of Washington in Seattle to develop a strategy for GEWEX activities in the post 2013 era that fits within the new framework of the World Climate Research Programme (WCRP). To foster planning, the meeting brought together the project and working group members of the three GEWEX Panels and members of the GEWEX Scientific Steering Group (SSG), as well as a number of agency program managers and young scientists (see page 14) from different nations. After the meeting, a special session of the GEWEX SSG was held to review the results.

Background for Reorganization

In its planning for the post 2013 timeframe, the WCRP Joint Scientific Committee (JSC) recommended that the four core projects of WCRP should have revised responsibilities to better facilitate climate system research at the interface of the physical Earth system components. These include: (1) Ocean-atmosphere (cf. the current Climate Variability and Predictability Project, CLIVAR); (2) Land-atmosphere (cf. GEWEX); (3) Cryosphere (cf. Climate and Cryosphere Project, CliC); and (4) Stratosphere-troposphere (cf. Stratospheric Processes And their Role in Climate Project, SPARC). Each core project will have a common set of basic "themes" including: (1) observations and analysis; (2) model development, evaluation, and experiments; (3) processes and understanding; (4) applications and services; and (5) capacity building. Coordination of these themes across the projects is to be facilitated by the new WCRP Modeling and Observations Councils.

In preparation for the forthcoming changes, the GEWEX SSG met in January 2010 in New Delhi and began formulating plans for a revised mission statement, a set of imperatives (things that must be done), and a set of long-term frontiers or challenges for the future. The draft of these was published in the May 2010 issue of *GEWEX News* as a basis for discussions at the August Pan-GEWEX Meeting. The SSG agreed that the three GEWEX panels, GEWEX Radiation Panel (GRP), GEWEX Modeling and Prediction Panel (GMPP), and Coordinated Energy and Water Cycle Observations Project (CEOP), were relevant to the organization of GEWEX and similar components were strongly recommended in future plans for GEWEX. The figure on this page illustrates the rational for retaining the panels from the standpoint of the hydrological cycle, featuring radiation, atmospheric processes, and land-surface hydrology and processes. The original motivation for these being together is that they correspond to the "fast" processes in the climate system, and this still applies.

Following the JSC meeting, which was held in February 2010, key questions arose, such as "how much science falls under the category of land-atmosphere?" and "what about the science that does not?" Accordingly, the approach taken at the 2nd Pan-GEWEX Meeting was that while the future GEWEX should be the place where land-atmosphere interactions are featured, it should also retain the global energy and water cycle as a core focus while highlighting regional aspects. In addition, GEWEX should also include hydrological and land-surface processes and modeling, and interactions with the atmosphere. Further, GEWEX should retain a strong atmospheric component related to the water and energy cycles, and hence scientific issues related to radiation, clouds, convection, precipitation, boundary layers, surface fluxes, runoff, and human influences, which should also be included in terms of observations, process understanding, and modeling.



A schematic of the water and energy cycle illustrating how radiation and energy are driven, including the atmospheric dynamics that produce clouds which block the sun, the complex land-surface interactions with the atmosphere, and the surface and below surface processes that complete the water cycle (adapted from Trenberth et al., 2007).

Results from the 2nd Pan-GEWEX Meeting

While the GEWEX name (Global Energy and Water Cycle Experiment) is liked by many for its uniqueness (e.g., in a Google search) and has good name recognition, the "EX" (experiment) is clearly obsolete. Accordingly, a new name for post-2013 was suggested, "Global and Regional Energy and Water" (GREW). However, there were strong sentiments expressed for keeping the old acronym and suggestions have been made for alternative words defining GEWEX, including "Global and re-

gional Energy and Water Exchanges." Please feel free to give me your opinion on this variation or make another suggestion.

The Pan-GEWEX Meeting provided a venue for vigorous discussions about future directions for GEWEX, and after consideration, the SSG has agreed upon the Mission Statement and Imperatives shown below. The header in each imperative highlights the link between the imperative and the themes outlined by the JSC. There is still much left to be done to flesh out these imperatives with more details regarding what they mean in terms of actions to be taken, what lead groups in GEWEX will be involved, and how interactions with other parts of WCRP and the other organizations will be involved.

Modeling

Prior to the Pan-GEWEX Meeting, discussions via e-mail set the stage for the modeling discussions in Seattle, in particular, the desire of the Chair of the GEWEX Modeling and Prediction Panel (GMPP) to step down and his proposal to remove the reporting layer of GMPP, as well as the need to address the future structure of GEWEX modeling. The proposal to replace GMPP with two panels, (1) the Global Land/Atmosphere System Study (GLASS) Panel and (2) the GEWEX Cloud System Study (GCSS)/GEWEX Atmospheric Boundary Layer Study (GABLS) Panel, which both report directly to the SSG, was positively received during the Pan-GEWEX Meeting and this new structure was later approved by the SSG.

As a part of the organizational changes, GCSS will abandon its current working group structure and will instead operate through projects, which can be initiated by any member of the community. Members of a GCSS/GABLS Science Steering Committee (SSC) will provide oversight of the program, including the approval of proposals for new activities. GABLS activities will be fully integrated into this structure through specific projects as well as GABLS membership on the SSC.

There was much discussion at the meeting regarding the proposal for a new post 2013 activity called the Framework for Atmospheric Model Enhancement (FAME), which would improve the representation of physical and dynamical processes in the troposphere in models for all purposes, and especially weather and climate services. Its main focus would be the improvement of the representation of clouds and precipitation in atmospheric models, which can only be achieved by improving our understanding of the intricate coupling of physical and dynamical processes associated with clouds and precipitation at various scales.

FAME was proposed in recognition of the need expressed by the Intergovernmental Panel on Climate Change (IPCC) in several reports, which highlighted the significant shortcomings in models of the simulation of clouds and precipitation with consequences for the simulation of important climate feedbacks and climate sensitivity. Other important factors included the recent revolution in the ability to observe clouds and precipitation, especially from space, and improvements in ability to model the processes involved at the process-scale. The experience of more than 15 years of the GCSS project and almost 10 years of the GABLS project makes the time right for a more concerted effort in atmospheric model improvement that builds on the existing strengths and adds to them the important new research area of physics-dynamics coupling.

The envisaged components of FAME would be programs on the planetary boundary layer (GABLS), clouds, convection and precipitation (GCSS), radiation (currently residing in GRP and SPARC), coupling to dynamical processes (new), and potentially also coupling to numerics (new). FAME will be built around the core approaches identified by the WCRP JSC (e.g., observations, modeling, data analysis and model diagnosis, and process studies). Through the direct involvement of operational modeling centers in FAME, as well as through the engagement of scientists throughout the world, the activities in FAME could make major contributions to capacity building and services.

GEWEX Mission Statement and Imperatives for Post 2013

Mission Statement:

To measure and predict global and regional energy and water variations, trends, and extremes (such as heat waves, floods, and droughts), through improved observations and modeling of land, atmosphere, and their interactions, thereby providing the scientific underpinnings of climate services.

Imperatives:

Data Sets: Foster development of climate data records of atmosphere, water, land, and energy-related quantities, including metadata and uncertainty estimates.

Analysis: Describe and analyze observed variations, trends, and extremes (such as heat waves, floods, and droughts) in water and energy-related quantities.

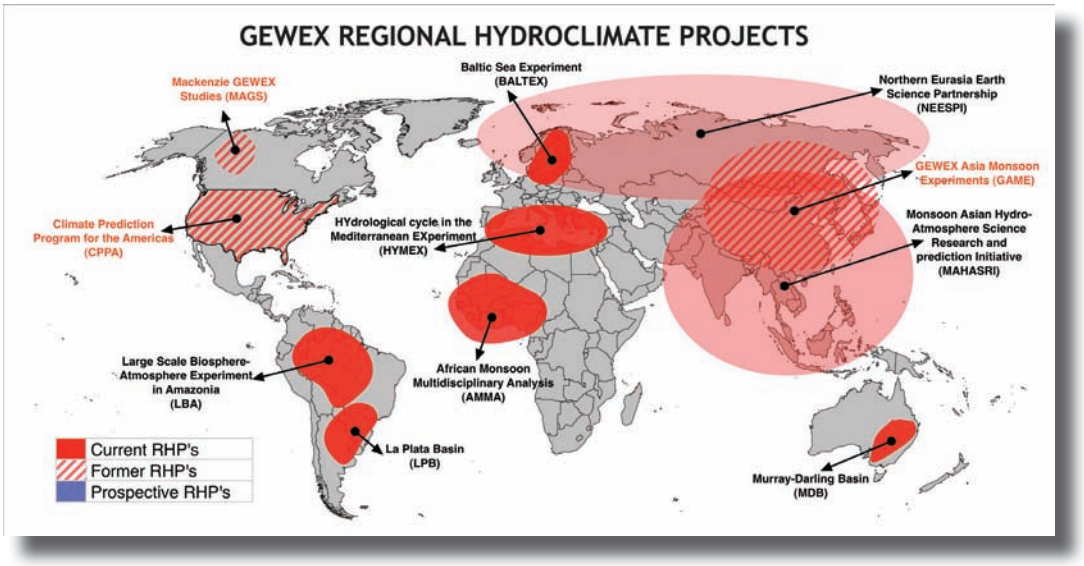
Processes: Develop approaches to improve process-level understanding of energy and water cycles in support of improved land and atmosphere models.

Modeling: Improve global and regional simulations and predictions of precipitation, clouds, and land hydrology, and thus the entire climate system, through accelerated development of models of the land and atmosphere.

Applications: Attribute causes of variability, trends, and extremes, and determine the predictability of energy and water cycles on global and regional bases in collaboration with the wider WCRP community.

Technology Transfer: Develop diagnostic tools and methods, new observations, models, data management, and other research products for multiple uses and transition to operational applications in partnership with climate and hydro-meteorological service providers.

Capacity Building: Promote and foster capacity building through training of scientists and outreach to the user community.



GEWEX regional projects, past and present.

As FAME is tightly focused on providing a means for the improvement of the representation of core physical processes in atmospheric models, it would partner with many other programs to contribute to the research on phenomena that go beyond the physics-dynamics coupling in the atmosphere. Those include partnerships with GLASS and the GEWEX Hydroclimatology Panel (GHP) (land); CLIVAR (oceans); the Aerosols, Clouds, Precipitation and Climate Initiative (ACPC); the Integrated Land Ecosystem-Atmospheric Processes Study (iLEAPS) (aerosols); SPARC and International Global Atmospheric Chemistry (IGAC) (atmospheric chemistry); SPARC (stratosphere); and CliC (cryosphere). Necessarily, these go well beyond GEWEX alone.

FAME could be seen as a natural extension to the existing GCSS/GABLS panel described above. This would maintain continuity, provide close links to the land and limited area modeling communities, and ensure FAME's natural focus on the energy and water cycles. These activities were originally grouped together to provide a focus on relatively "fast processes" as compared with those involving the ocean or cryosphere. FAME could also make a major contribution to a potential cross-WCRP effort on atmospheric model development.

This proposal was discussed by the SSG, which strongly recommend keeping FAME within the post 2013 GEWEX structure. Questions include how FAME will be organized, whether as a panel or working group. Many of the other modeling activities within WCRP are under working groups (WG). The CLIVAR WG on Seasonal to Interannual Prediction (WGSIP) is an example of where the WG reports to the CLIVAR SSG but acts on behalf of WCRP to deal with seasonal to interannual prediction. A new group, integrating FAME and possibly called WGAP, short for WG on Atmospheric Processes and modeling for climate, could operate similarly within the new post 2013 GEWEX. However, as the activities relate to the established WGs, especially the WMO (CAS)/JSC Working Group on Numerical Experimentation (WGNE), this aspect has yet to be decided after broad consultation with the community.

Hydrometeorology

Major changes were also underway in the realm of the regional hydrological projects at the Pan-GEWEX Meeting. In part these came about naturally from the evolution of the program, and were given an extra nudge by the change in leadership. Under the leadership of Toshio Koike, the original CEOP (Coordinated Enhanced Observing Period) developed an impressive and extensive program, including the Regional Hydrometeorological Programs (RHPs), associated modeling and data base development, and the Hydrologic Applications Project (HAP). CEOP remains at the core of the GEWEX mission, including more than a thousand researchers, and providing important regional and modeling data and a valuable end-user interface.

Regional Projects

The concept for the RHPs was developed in the 1990s for the development, diagnosis, and testing of coupled land-atmosphere models with a focus on water and energy budget closure at near-continental scales. The first CSE, the GEWEX Continental-Scale International Project (GCIP), was located in the Mississippi River Basin, which featured extensive observing instrumentation. CSEs in other regions were developed later [the Mackenzie GEWEX Study (MAGS), the Baltic Sea Experiment (BALTEX), the GEWEX Asian Monsoon Experiment (GAME), the Large-scale Biosphere Atmosphere Experiment in Amazonia (LBA), and the African Monsoon Multidisciplinary Analysis Project (AMMA)]. GEWEX established the GEWEX Hydrometeorology Panel (GHP) in 1994, primarily to coordinate the wide range of regional interests and activities involved in these CSEs. The overall GHP mission was to "demonstrate the capability to predict changes in water resources and soil moisture at time scales up to seasonal and interannual as a component of the WCRP's prediction goals for the climate system." For a more detailed history of GHP and the RHPs, see the article on page 7.

To take advantage of the observations becoming available via new satellites and other resources, the Coordinated Enhanced Observing Period (CEOP) was initiated in 2001. This activity, which also developed extensive data management activities, led to the development of new projects that overlapped ex-

isting projects within GHP and resulted in some duplication of effort. Accordingly, the first CEOP activity was combined with GHP and evolved to become the Coordinated Energy and Water Cycle Observations Project with the same acronym, CEOP, in 2007. The initial observing period grew to become an effort to produce a 10-year data set and archive especially set up for the regional projects. However, other developments had already occurred in observations and data management, which suggested that the activity should be wrapped up and refocused, even as it is utilized and hopefully becomes part of the heritage of GEWEX. In particular, the development of the many flux towers around the globe provides alternatives to the CEOP reference sites for local studies of energy, water, and biogeochemistry.

Accordingly, the GEWEX community began what might be called a "back to basics" movement, with recognition of the need to reinvigorate the regional hydrological projects. In particular, there was a call by the new co-chair, Dennis Lettenmaier, for stronger hydrological activities that would foster the next generation of hydrologically realistic land-surface schemes and provide a home for activities like the Project for the Intercomparison of Land-Surface Parameterization Schemes. This was discussed at the Pan-GEWEX Meeting and the recommendation made to the GEWEX SSG was along these lines. Thus, a new GEWEX Hydroclimatology Panel (GHP: note the change in the name from the first version) was created to replace CEOP, effective immediately. The SSG also followed up on the recommendation from CEOP to approve a new RHP, the Hydrological cycle in the Mediterranean Experiment (HyMeX), which is focused on the 20 countries around the Mediterranean Sea and the fresh water and salinity of the Sea itself.

GHP is thus the home for hydrologic science and modeling within WCRP and there is considerable scope for developments in this area (e.g., in seasonal forecasting, the detection and attribution of change) and the development and analysis of climate projections. Challenges remain in dealing with monsoons and to help coordinate the multitude of national initiatives in this area. There are also opportunities for linkage with GLASS in bringing disciplines together in the development of next generation Land-Surface Models as well as increasing interactions with the Coordinated Regional Downscaling Experiment (CORDEX). Changes in the management structure are likely to accompany the new consolidation of efforts as GHP realizes its considerable potential.

Radiation

Changes in atmospheric water vapor, precipitation, clouds, and aerosols affect the energy balance of the Earth, and since these processes are intertwined, complex, and simultaneous, considerable uncertainty remains concerning their feedbacks. Addressing these issues requires coordinated global observations, and satellite observations must be employed. The GEWEX Radiation Panel (GRP) was organized in the 1990s to bring together theoretical and experimental insights into these aspects. However, it is looking for a name change as it encompasses a lot more than radiation.

The original GEWEX data sets were developed under the auspices of GRP and their production continues today. These data sets deal with all of the global satellite data related to energy and water and their synthesis into products. GRP is also leading and promoting the reprocessing of the data sets with a goal of creating climate data records of sufficient quality to be useful for examining trends. Some of the data sets, such as the Global Precipitation Climatology Project (GPCP) and the International Satellite Cloud Climatology Project (ISCCP) are well known and already used extensively. However, scientists are confident that the data sets can be improved and made more consistent with each other, and with better estimates of uncertainties. In general GRP is working well toward these goals and has produced simulators that take into account the sampling and characteristics (such as thresholds) of the observations to enable intercomparison of satellite products with model data. Interactions between GRP and the other GEWEX panels were fostered by the Pan-GEWEX Meeting. GRP data sets have great potential for use in the evaluation and improvement of models on issues such as clouds and the indirect effects of aerosols; precipitation frequency, intensity, and amount; and in providing context for the RHPs.

Extremes

The recent summer record breaking flooding in Pakistan, India, and China, and heat-waves and wildfires in Russia highlight the extremes of the hydrological cycle of drought and floods that are changing from human activities. Dealing with extremes in WCRP is a cross-cutting activity that involves all projects although GEWEX plays a leading role. Olga Zolina, who is a member of the GEWEX SSG, led the WCRP extremes workshop involving some 150 people at UNESCO in late September. The full workshop report will be available in the February 2011 newsletter issue. Breakout groups were held on issues of (1) data requirements and availability (such as the need for hourly precipitation data to properly characterize extremes); (2) representation of extremes in models, including scaling and spatial issues (how station data relate to grid squares, comparing apples to apples); and (3) methodologies for estimating extremes across areas and disciplines, including statistical methods. Continuing issues are sorting out the extremes that are to human activities and how to best communicate with the general public on such technical attribution issues.

Closing Remarks

The above is but a sample of the goings-on and developments from the 2nd Pan-GEWEX Science Meeting. What I have tried to do is provide a sense that we are looking forward to the future with considerable excitement at the science we can achieve through collaboration and friendly competition, with the help of coordination through GEWEX. I thank all those who attended and participated.

References

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