Kevin Trenberth: Chair SSG
Peter van Oevelen: Director IGPO
D. Lettenmaeir, J. Polcher (GHP)
C. Kummerrow (GRP)
B. van den Hurk, M. Best (GLASS)
J. Petch, C Bretherton (GCSS)
B. Holtslag, G. Svensson (GABLS)
In Memoriam
Moustafa Chahine
MOST IMPORTANT ACCOMPLISHMENTS by GEWEX in 2010-11

• “GEWEX Imperatives: Plans for 2013 and Beyond” living document: drafted, reviewed and available in response to JSC guidelines for the future. This outlines the future directions of GEWEX.

• The GEWEX Newsletter has been published quarterly to keep all interested parties informed about the process and activities.

• The Pan-GEWEX meeting: successful in late August 2010 (Seattle, Washington); provided a vibrant interactive forum for different GEWEX Panels to interact with each other and with many program managers and representatives from other parts of WCRP, GWSP, and so on.

• A major workshop on climate extremes: led by GEWEX on behalf of the WCRP at UNESCO in September 2010. A full report is now available and an article has appeared in Eos.

• Special session on WCRP projects at Jan 2011 AMS meeting.
Reinvigoration of GEWEX Panels

- **GRP** is focused on reprocessing the GEWEX datasets and a major workshop is planned in April at ESRIN in Frascati, Italy;

- **GMPP** no longer exists and a new framework has been set in place to organize the modeling within GEWEX and some reorganization has taken place;

- **CEOP** has been substantially revamped and is now called the GEWEX Hydroclimatology Panel (**GHP**), with new leadership and new directions.
  - A new Regional Hydroclimate Project (**HYMEX**) focused on the Mediterranean region is now included and
  - Plans are underway for a new RHP in North America.
GEWEX Project Organization

RADIATION

GRP  GEWEX Radiation Panel (C. Kummerow; J. Schultz)

- BSRN  Baseline Surface Radiation Network (E. Dutton)
- CIRC  Continuous Intercomparison of Radiation Codes (L. Oreopoulos)
- GACP  Global Aerosol Climatology Project (M. Mishchenko)
- GPCP  Global Precipitation Climatology Project (R. Adler)
- ISCCP  International Satellite Cloud Climatology Project (W. Rossow)
- I3RC  Intercomparison of 3-D Radiation Codes (R. Cahalan)
- LandFlux  Land Surface Fluxes (W. Rossow)
- RAMI  Radiation transfer Model Intercomparison (J-L Widowski)
- SeaFlux  Sea-Surface Fluxes (C. Clayson)
- SRB  Surface Radiation Budget Project (P. Stackhouse)
- WGDMA  Working Group on Data Management and Analysis (W. Rossow)

Assessment Working Groups:
- Aerosols (S. Christopher; J. Reid)
- Clouds (C. Stubenrauch)
- Radiation (P. Stackhouse)

MODELING AND PREDICTION

GCSS/ GABLS  GEWEX Cloud System Study (J. Petch; C. Bretherton)
- GEWEX Atmospheric Boundary Layer Study (B. Holtslag; G. Svensson)

- ACPC  Joint GCSS/iLEAPS Project on Aerosols, Clouds, Precipitation and Climate (B. Stevens/GCSS; A. Meinrat/iLEAPS)
- DIME  Data Integration for Model Evaluation (R. Ros sow)

GCSS Working Groups
- Boundary Layer Clouds (A. Lock)
- Cirrus Cloud Systems (S. Dobbie)
- Cloud Climate Feedback
  -- CFMIP-GCSS Intercomparison of LES and SCMs (M. Zhang; C. Bretherton)
  -- Cloud Microphysics (U. Lohmann)
- GCSS Pacific Cross-section Intercomparison (J. Teixeira)
- Polar Clouds (J. Pinto; H. Morrison)
- Precipitating Convective Cloud Systems (J. Petch)

GLASS  Global Land/Atmosphere System Study (B. van den Hurk; M. Best)

- ALMA  Assistance for Land-surface Modeling Activities
- GLACE-2  Global Land/Atmospheric Coupling Experiment (R. Koster)
- GSWP-3  Global Soil Wetness Project (T. Oki)
- LoCo  Local land-atmospheric Coupling (B. van den Hurk)
- LUCID  Land-Use and Climate, Identification of robust impacts (A. Pitman)
- PILPS  Project for the Intercomparison of Land-surface Parameterization Schemes (A. Pitman)

HYDROCLIMATOLOGY

GHP  GEWEX Hydroclimatology Panel (D. Lettenmaier; TBD)  J. Polcher

Regional Hydroclimate Projects (RHPs)

- AMMA  African Monsoon Multidisciplinary Analysis Project (T. Lebel)
- BALTEX  Baltic Sea Experiment (H.J. Iseme r)
- CPPA  Climate Prediction Program for the Americas (J. Huang)
- HyMeX  Hydrological cycle in the Mediterranean Experiment (P. Drobinski)
- LBA  Large-Scale Biosphere-Atmosphere Experiment in Amazonia (J. Maia)
- LPB  La Plata Basin Project (H. Berbery)
- MAHASRI  Monsoon Asian Hydro-Atmosphere Scientific Research and Prediction Initiative (J. Matsumoto)
- MDB  Murray-Darling Basin Water Budget Project (J. Evans)
- NEESPI  Northern Eurasia Earth Science Partnership Initiative (P. Groisman)

Cross-Cutting Studies

- Water and Energy Budget Studies (K. Yang)
- Extremes (R. Stewart)
- Isotopes (D. Noone; K. Yoshimura)
- Aerosols (W. Lau)

Modeling Studies

- Global Models (M. Bosilovich)
- Regional Models
  - Inter-Continental Transferability Study (B. Rockel)
  - Scale Interaction Evaluation Experiment (R. Arritt)
- Land Surface Models (M. Rodell)
- Hydrologic Applications Project (E. Wood)

Affiliated Global Organizations

- GPCC  Global Precipitation Climatology Centre (U. Schneider)
- GRDC  Global Runoff Data Centre (U. Looser)
GMPP ⇒ GCSS/GABLS ⇒ GASS     |   GLASS

- Model **Parameterization** and development from land surface process to atmospheric processes
- **Cloud process** descriptions, parameterizations and model, data sets and tools, intercomparisons
- **Atmospheric Boundary layer** studies, descriptions and intercomparison studies (diurnal cycle)
- Strong cooperation with Numerical Prediction Centers and weather forecasting “through” WGNE
- **Land surface feed back/coupling** studies
  - [http://www.gewex.org/gcss_gabls_panel.html](http://www.gewex.org/gcss_gabls_panel.html)
  - [http://www.gewex.org/glass_panel.html](http://www.gewex.org/glass_panel.html)

GRP

- **Radiative processes** and understanding
- **Global Data sets** on radiative and turbulent fluxes
- Global In-situ **observational networks**, development and standardization (radiation, soil moisture)
- Development and improvement of **radiative transfer** codes
- **Intercomparison** studies and assessment
  - [http://www.gewex.org/projects-GRP.htm](http://www.gewex.org/projects-GRP.htm)

CEOP ⇒ GHP

- Globally distributed extensive **regional data sets** covering water and energy cycle observations (in situ and space borne and modeling data)
- **Data management** system / GEO Prototype for Water Cycle Observations
- **Regional Climate Modeling and Process** Descriptions (Monsoons, Extremes, etc)
- **Hydrological Applications** and Forecasting (Drought monitoring, Hydrological Ensemble Predictions…)
- Coupling with Global Modeling and Global Data sets
  - [http://www.gewex.org/projects-CEOP.htm](http://www.gewex.org/projects-CEOP.htm)
Some Key Issues for GEWEX

• The new GEWEX has adopted the mission of “land-atmosphere”

However GEWEX has also decided to be much more:

• GEWEX will continue to embrace the global energy and water cycles

• GEWEX also embraces activities spanning Earth system domains and other integrating themes
  o monsoons
  o extremes …
GEWEX : post 2013

New name*:

Global and regional Energy and Water Exchanges: GEWEX

* To be approved
GEWEX: 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: Headlines**

**Datasets:** 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.
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Capacity building: Promote and foster capacity building through training of scientists and outreach to the user community.
Example: Imperatives: 1

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

Lead: GRP, CEOP; Partners: SCOPE-CM, CEOS, WOAP

Actions:

• Reprocess GEWEX datasets, provide advice on other efforts and lead evaluations.
• Continue evaluation and refinement of sensor algorithms, influencing next generation space-born platforms and reprocessing.
• Development of appropriate calibration/validation/evaluation datasets to confront models.
• Devise robust ways of dealing with the more diverse, complex, higher spatial and temporal resolution, and much greater volumes of data.
• Build on CEOP experience in data management, archival and access.
GRP develops **climate data records** of water and energy variables, complete with metadata and error bars.

- **Clouds** - ISCCP
  - Cloud Assessment
- **Radiation** - SRB
  - Surface reference observations - BSRN
  - Radiation Assessment
- **Aerosols** - GACP
  - Aerosol Assessment
- **Precipitation** - GPCP
  - Sfc gauge obs (GPCC)
- **Turbulent Fluxes**
  - SeaFlux
  - LandFLux
  - Soil Moisture

A GRP product is endorsed by GEWEX/GRP to conform to a high standard of production and documentation. It consists of a blend of available satellite and in-situ observations and is periodically compared and assessed against other products in an open and transparent fashion. It is openly available to everyone without restrictions.
When GRP began there were few datasets. Now there is a proliferation: a multitude of datasets that are all different, and with different strengths and weaknesses. The need to assess these, and evaluate and reprocess the data is enormous! So the objective is:

Reprocess all GRP products with common ancillary data and assumptions. Panel has learned much about reprocessing; distribution; documentation and user support. Plan to reprocess periodically (e.g. approx. every 5 years)

Publish state of the “Observed” Water and Energy budgets

Expand accessibility to multi-variable products

Facilitate research to interpret global and regional covariance among Water & Energy variables.

Assess all products of the same variable for strengths and weaknesses. Each agency wants to only reprocess their product.

Help move products to operations; share experience
2. **Analysis:** Describe and analyze observed variations, trends and extremes (such as heat waves, floods and droughts) in water and energy-related quantities.

Precipitation from observations and reanalyses (courtesy D. Dee)

Runoff trends 1948 to 2004 (Dai et al 2009)
### 3. Processes:

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

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**Local Land-Atmosphere Interactions**

- **Incoming solar**
- **Reflected solar albedo**
- **Wind**
- **Relative humidity**
- **Soil moisture**

**Albedo effect**

- **Clean**
- **Larger drops**
- **More rain**
- **Less cloud**

**Lifetime effect**

- **Polluted**
- **Smaller drops**
- **Less rain**
- **More cloud**

*positive feedback for C3 & C4 plants and incoming solar; negative feedback above land-surface processes

Courtesy Mike Ek, K. Trenberth 2009
Regional water cycles

GHP: Back to basics
GEWEX REGIONAL HYDROCLIMATE PROJECTS

- Mackenzie GEWEX Studies (MAGS)
- Climate Prediction Program for the Americas (CPPA)
- Baltic Sea Experiment (BALTEX)
- Hydrological cycle in the Mediterranean Experiment (HYMEX)
- African Monsoon Multidisciplinary Analysis (AMMA)
- Large Scale Biosphere-Atmosphere Experiment in Amazonia (LBA)
- La Plata Basin (LPB)
- Murray-Darling Basin (MDB)
- Northern Eurasia Earth Science Partnership (NEESPI)
- GEWEX Asia Monsoon Experiments (GAME)
- Monsoon Asian Hydro-Atmosphere Science Research and prediction Initiative (MAHASRI)

Terrestrial Regional North American Hydroclimate Experiment (TRACE)

Current RHP's
Former RHP's
Prospective RHP's

Regional water cycles
There has been considerable modeling within CEOP of 2 kinds:

1. Regional Hydrological Project modeling, which can range from detailed hydrologic models over catchments or river basins, to regional climate modeling such as now given by CORDEX

2. Global and intercontinental transferability
   • The MAC: Multi-model Analysis for CEOP (Bosilovich et al 2009)

Global models in GCSS/GABLS and GLASS should enable interactions with RHPs which provide local expertise and datasets for validation etc, in context of global processes.
   • How to do this remains a challenge?
Revitalizing GHP

• CEOP reference sites vs flux towers
• 10 year data set; mission creep => WOAP?
• Archive for regional projects

New Phase
• Need to reinvigorate RHPs
  – Type I (core; criteria) and type II (affiliated)
• Stronger hydrological activities: foster the next generation of hydrologically realistic land surface schemes (cf home for PILPS)
4. **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.

Proposal from the last JSC meeting for a “**Modeling Council**”: “… the Modeling Council concept would allow the Projects to be better connected to the WCRP modeling efforts. “

**GEWEX:**
- GCSS
- GABLS
- GLASS
- RHPs
GEWEX Modeling

- GCSS and GABLS to be combined: GMPP removed
- Replace the GCSS working groups and their chairs by an SSC that oversees projects (about 8?)
- Projects are proposed to the SSC by any member of the community
- There will be a small set of criteria a project has to fulfill (e.g., leadership, timeline, plan)
- GABLS will be integrated into this structure and its participants will propose projects
- GLASS and GCSS/GABLS represent the SSG in WGNE
- GHP hydrological modeling is largely separate
- GHP has agreed to consider hosting CORDEX
Joint GEWEX/GLASS-GHP project: Land Surface Model Benchmarking

GLASS provides tools (i.e. Protocol for the Analysis of Land Surface models: www.pals.unsw.edu.au), and GHP (formerly CEOP) provides flux site data sets for different regions, seasons & variables, e.g. to evaluate energy, water & carbon budget components.

**Monthly diurnal average surface latent and sensible heat flux**

*Chestnut Ridge, Tennessee, USA, July 2008*
Framework for Atmospheric Model Enhancement (FAME)

**Mission:** Improving the representation of physical and dynamical processes in the troposphere in models for all purposes and especially weather and climate services

**Ingredients**
- PBL (GABLS)
- Clouds and Convection (GCSS)
- Radiation (shared with GRP and SPARC)
- Coupling to dynamical processes
- Coupling to numerics
FAME

Resides within GEWEX: endorsed by SSG
- maintains links to GLASS
- potentially good links to LAMs and RHPs
- natural focus on energy and water cycle
- deals with “fast processes”

- Will raise visibility of atmospheric model development
- Needs to integrate with regional modeling (such as CORDEX)
- Should this be broadened to replace GMPP and include RHP modeling?
5. **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.

**Pan-WCRP & WMO**

**Cross-cutting studies:**

- Monsoons
- Extremes

**AMY coordinated observation projects**
Monsoon crosscuts

- Concern that, once again, because monsoons cut across land and ocean domains, they may not be adequately addressed in new WCRP structure
- Models do not simulate monsoons well
- How much is resolution (e.g. of topography, land-sea divide)?
- Can models simulate the floods in Pakistan, China, India in summer 2010, and in Australia in their summer 2010-11?
Extremes in models

- Evaluate and develop models wrt replication of extremes:
  - Methods for comparing model grid point values with observations.
  - Establish extreme-related measures for evaluation of models.
- Archives must include high frequency data.
  - Hourly data: pdfs
- Assess ability and utility of models wrt extremes (not good)
  - Resolution; parameterizations (e.g. convection)
  - Phenomena, confidence in physics
- Set up CMIP5 analysis projects focused on extremes
  - Derive certain mandatory statistics
- What do these mean for impacts: downscaling?
- Improvements of models (intensity, frequency of precip etc)
- Improvements in resolution
5. **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.

- Water availability is changing: and **non-stationarity** is not included in planning: New methods much needed
- Issues of how to get **regional information** from global models: 
  - CMIP5, CORDEX
- Information for hydrological modeling and water management needed.

  a) Evaluate the ability of coupled land-atmosphere models to reproduce observed trends in land surface hydrological variables;
  b) Evaluate coupled model predictions of hydrologic extremes for use in risk-based design (e.g., of dam spillways), and observed drought and soil moisture deficits;
  c) Evaluate the predictability of hydrologic extremes (floods and droughts) using coupled models over a range of lead times from days to months or longer.

Observed (from manual snow course data, left) and modeled trends (right) in snow water equivalent in the western U.S. (from Mote et al. 2005).
6. **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.

GEWEX has a well established legacy of development of global datasets, satellite simulators, providing results from regional field programs with observations and products, establishing new methods of processing data and displaying results, improving models, and demonstrating the usefulness of these developments through applications focused on water and energy cycles ⇒ **climate services**

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Estimated drought index as the percentile value of the estimated soil moisture based on a long data record for October 2007. Left: Noah Land surface model estimate; right: AMSR-E based. (From Sheffield et al. 2011)
7. **Capacity Building:** Promote and foster the development of capacity through training of scientists and outreach to the user community.

Education: workshops, training, summer schools; observations, data; technology use; technology transfer; interactions with users; outreach ⇒ climate services.

Participants at a recent La Plata Basin Workshop held in Itaipú Technological Park, Foz do Iguaçu, Paraná State, Brazil.

A panel discussion at the International BACC Conference, May 2006 in Gothenburg, Sweden, providing for science – stakeholder interaction and GEWEX/BALTEX outreach.
GEWEX planned meetings

- 8 April 2011: GHP Meeting at EGU, Vienna, Austria
- 6th-10th June, 2011: CFMIP/GCSS/EUCLIPSE Meeting on Cloud Processes and Climate Feedbacks, UK Met Office, Exeter
- 30 Aug - Sep 1: GRP Meeting Tokyo, Japan
- 23 Oct. 2011: GLASS Meeting in Denver, CO, USA
- 19 - 21 Oct: Proposed GHP Panel meeting, Boulder, CO, USA
- 28-30 Oct: GEWEX Exec Comm mtg; Boulder, CO, USA
- 14-18 November 2011: GEWEX SSG, Rome, Italy
- 7-10 November 201: GABLS-ECMWF, Reading, UK

Other regional meetings:

- TRACE Terrestrial Regional North American Hydro-Climate Experiment Washington DC 18-20 April
- HYMEX wkshp 16-20 May; Menorca, Spain