

WCRP REPORT

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ICSU
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Global Energy and Water Cycle Experiment

GEWEX
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PROJECT REPORT

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GEWEX Scientific Steering Group

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1. RECOMMENDATIONS AND ACTION ITEMS

From the 24th Session of the GEWEX Scientific Steering Group (SSG)
14-18 November 2012, Rome, Italy

1.1 Recommendations to GEWEX Panels

1. The GEWEX SSG approves the recommendation by GRP that it be renamed the GEWEX Data and Analysis Program (GDAP) to reflect the current objectives of the Panel, which now deals more with global data sets and assessments of data and radiative transfer codes.
2. The SSG approves the proposal by GASS to be the “Global Atmospheric System Studies Panel.”
3. The SSG approves Andrew Heidinger, of the National Oceanic and Atmospheric Administration (NOAA), as a new member of GDAP.
4. It is recommended that GASS investigate a joint endeavor with the World Weather Research Programme-The Observing System Research and Predictability Experiment (WWRP-THORPEX) and the WCRP Polar Weather Prediction Research Projects.
5. The Protocol for the Analysis of Land Surface Models (PALS) is a web based system to routinely evaluate land surface models using observed data. There has been little uptake of the PALS system by the FluxNet community. The SSG recommends that the Global Land/Atmosphere System Study (GLASS) Panel coordinate with GDAP/Landflux and the GEWEX Hydroclimatology Panel (GHP) on some activities that can better evaluate and benchmark land models. GHP will provide suggestions for the Coordinated Energy and Water Cycle Observations Project (CEOP)/FluxNet stations data to be included in PALS.
6. The Continuous Intercomparison of Radiative Codes (CIRC) Project has strong interactions with the radiation community represented in GDAP, but it must also interact more closely with the modeling work going on in different Panels. The SSG recommends that CIRC be made a joint activity between the GDAP and GASS Panels.

1.2 Recommendations to the WCRP Joint Scientific Committee (JSC)

1. The SSG recommends Mike Ek as the GEWEX/GHP representative for the WCRP Working Group on Regional Climate Science and Information (WGRCSI).
2. The SSG recommends Joseph Santanello as the GEWEX representative for GASS and GLASS on the WCRP Modeling Advisory Council (WMAC).
3. The SSG recommends Chris Kummerow/Joerg Schulz as the GEWEX/GDAP representative for the WCRP Data Advisory Council (WDAC) replacing the WCRP Observation and Assimilation Panel (WOAP).

4. The SSG recommends that the term for Kevin Trenberth, GEWEX SSG Chair, be extended to 2013 and the term for Howard Wheeler, GEWEX SSG Vice-Chair, be extended to 2014.

1.3 Action Items

A. General

- A.1 GHP could contribute its data and regional studies expertise to a Climate Variability and Predictability Project (CLIVAR)/GEWEX Monsoon Initiative. Consideration should be given to a joint initiative initially focused on the American Monsoonal Region. Develop a joint plan for monsoon studies and present at the next meeting of the JSC. Note that WCRP offered to create “*monsoon.wcrp-climate.org*” as a subdomain of “*www.wcrp-climate.org*.” (Action: CLIVAR and GEWEX/GHP)
- A.2 Finalize three to five major science questions (grand challenges) to help focus the activities across the GEWEX Panels in collaboration with other WCRP projects, and present these along with the updated Imperatives document at the next JSC meeting. (Action: IGPO, SSG)
- A.3 Reinstate the quarterly report to the SSG members and investigate other methods to more effectively keep the SSG updated. (Action: IGPO)
- A.4 Inventory activities in Africa and attend the Variability of the African Climate System (VACS) meeting in Cape Town in November 2012. Develop a proposal for the JSC on the integration of GEWEX as a co-sponsor of VACS with CLIVAR that includes how VACS can contribute to the WCRP-wide strategy of research coordination, network development, and capacity development in Africa. (Action: Sam Benedict, IGPO, SSG Chair)
- A.5 SSG rapporteurs are to provide written reports on their assigned panels to IGPO within two weeks of the SSG meeting. (Action: GDAP: Peter Bauer, Chia Chou, Olga Zolina; GASS: Minghua Zhang, Paolo Ruti; GLASS: Eleanor Blythe, Li Xin; GHP: Amadou Gaye, Ron Stewart)
- A.6 Research location and dates for the 2014 International GEWEX Science Conference. (Action: IGPO)
- A.7 Report on results from the Belmont Forum and suggest possible GEWEX involvement. (Action: Ron Stewart and Howard Wheeler)
- A.8 Send thank you letters to Chris Bretherton (for co-chairing GCSS) and to Bert Holtslag and Gunilla Svensson (for co-chairing GABLS). (Action: IGPO)
- A.9 Provide recommendations for new SSG members to replace those whose terms are expiring (A. Gaye and W. Lau). (Action: IGPO, SSG Chair)
- A.10 Finalize name/acronym for GEWEX post-2013. (Action: IGPO, SSG members)

B. GHP

- B.1 There is a need for further development of the GEWEX contribution to a WCRP-wide initiative on Extremes. Possible themes related to Extremes to which GHP may be uniquely capable of contributing include frequency of extreme precipitation events and their impacts on engineering design and others.

The issue of Extremes is an excellent focal point for bringing together many different aspects of GHP. Find a replacement for the Extremes Chair, who is stepping down. (Action: IGPO, GHP)

B.2 Identify representatives from GHP to be involved in helping to design the AMMA Land surface Model Intercomparison Project Phase 2 (ALMIP-2) led by Aaron Boone. The GHP-GLASS-PALS activity would provide an impetus for broader collaboration. (Action: IGPO, GHP co-chairs)

B.3 Review the status of the Regional Hydroclimate Projects (RHPs) and determine if they should continue as GEWEX projects or be concluded. (Action: IGPO, S. Benedict)

B.4 The COordinated Regional climate Downscaling Experiment [CORDEX, a project of the Working Group on Regional Climate Science and Information (WGRCSI)] and GHP agreed that there is a need for coordination between their activities and each is open to using the expertise and information that the other offers, which will serve as the basis for their joint effort. Model evaluation and model improvement are two areas where GEWEX can contribute to CORDEX. Send a letter to CORDEX to reaffirm this and their commitment by the two groups to organize a joint workshop in 2012, where it will be determined how GHP can help validate CORDEX runs and define joint activities to help with the evaluation of models and their appropriate use. (Action: IGPO, GHP)

B.5 A better GHP/GDAP interaction model is needed to facilitate a joint effort that would depend on the GHP RHPs collecting regional data sets and comparing them to the new GDAP global data sets. The scientific themes for this effort should advance the precision of climate data assessments relative to rainfall, water balance, etc. A proposal is needed for a small amount of seed money for a workshop to explore the viability of the process. Test with the Murray-Darling Basin Water Budget Project (MDB) first to see if there is reason to do with the other RHPs. (Action: P. van Oevelen, C. Kummerow, D. Lettenmaier)

B.6 The WMO (CAS)/JSC Working Group on Numerical Experimentation (WGNE) has a strong focus on the atmosphere. If GEWEX is doing hydrological modeling, make the modeling council aware of it. (Action: GASS or GLASS co-chairs)

C. GDAP

C.1 Report to IGPO which of the projects listed under GDAP on the website are to be eliminated as projects. (Action: GDAP co-chairs)

C.2 Clarify how GASS and GDAP will collaborate on CIRC. (Action: GDAP and GASS co-chairs)

D. GASS

D.1 Designate a GASS representative to attend the polar workshop. (Action: GASS co-chairs)

D.2 Develop a plan for land-ocean coupling as part of a grand challenge. (Action: GASS and GHP co-chairs)

D.3 Investigate the GASS role in driving field programs. (Action: GASS co-chairs, SSG)

2. INTRODUCTION AND OVERVIEW

This report summarizes the main developments in GEWEX during the year 2011 and includes the major items and recommendations from the 24th Session of the GEWEX Scientific Steering Group (SSG), held in Rome, Italy on 14–18 November 2011. The meeting was hosted by Dr. Gianni Tartari of the Water Research Institute (ISRA) of the National Research Council of Italy (CNR). Dr. Enrico Brugnoli, the CNR Director of Earth and Environment, and Dr. Maurizio Pettine, Director of the CNR Water Institute, provided opening remarks. Special presentations by CNR-IRSA included “Impacts of global changes on water resources: Southern Europe situation” (Michel Vurro); “Stations at High Altitude for Research on the Environment (SHARE) - Water resources: An integrated project for studying the impact of climate change on high mountains” (Franco Salerno); and “Observations and modeling of the hydrological cycle at CNR-ISAC” (Vincenzo Levizzani).

2.1 Major Activities and Achievements in 2011

The “*GEWEX Imperatives: Plans for 2013 and Beyond*” document was drafted, reviewed, and made available to the Joint Scientific Committee (JSC). GEWEX Grand Science Questions (4) were also developed and published with a comprehensive 14-page description that includes a summary of each and descriptions of the context, list of specific questions, prospects for advancements, and benefits for society.

The objectives of GEWEX Radiation Panel (GRP) have evolved over time, from developing data sets of global water and energy variables consistent with the GEWEX mission to fostering the creation of global data sets. With independent products available for the radiative and flux terms of the Earth system, the Panel is now focused on creating an integrated reference product. Once completed, the Panel will undertake an assessment of the state of the water and energy budget based upon the new integrated GEWEX reference product. In light of the current focus of GRP activities, a name change to **GEWEX Data and Assessments Panel (GDAP)** was proposed and accepted by the GEWEX SSG. Progress is being made towards the “Integrated GEWEX reference product” containing all fundamental water and energy budget variables on a common space/time grid and with a uniform set of ancillary data and assumptions. Early indications are that budget closure is within the uncertainties but that these are still large (i.e. 10W/m^2) at the surface.

The **Global Atmospheric System Studies (GASS)** is a new GEWEX Panel supporting the community that carries out and uses observations, process studies, and model experiments with a focused goal of developing and improving the representation of the atmosphere in weather and climate models. It brings together those involved in the GEWEX Cloud System Study (GCSS), the GEWEX Atmospheric Boundary Layer Study (GABLS), and the development of radiation codes through the Continuous Intercomparison of Radiation Codes (CIRC). A Pan-GASS meeting is planned for 10-14 September 2012 at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado.

The **Global Land/Atmosphere System Study (GLASS) Panel** is planning a follow-up project to the Global Soil Wetness Project-2 in collaboration with the terrestrial carbon cycle modeling community. Results from a pilot error propagation analysis have shown that differences in precipitation lead to non-linear differences in evaporation and runoff whose size and sign depends on the climate and vegetation regime. However, the spread between different land models was generally larger than the spread in the precipitation forcings and showed different spatial patterns, pointing at a model-dependent sensitivity of evaporation and runoff. GLASS is also planning two collaborative projects with the GEWEX

Hydroclimatology Panel (GHP): (1) a study of the subtle hydrology and vegetation processes that dominate the study area of the 2nd African Monsoon Multidisciplinary Analysis (AMMA) Land Model Intercomparison Project (ALMIP); and (2) a project to demonstrate benchmarking approaches using the Protocol for the Analysis of Land Surface (PALS).

The **GEWEX Hydroclimatology Panel (GHP)** is in the process of reviewing all its projects and RHPs, and recommendations regarding the continuation of these under the Panel will be based on their level of activity and relevance to the GHP Terms of Reference. Building on its strength in regional studies, and following earlier encouragement by the SSG and WCRP, GHP is addressing the need to better utilize regional climate models as a source of information about ongoing and future land-surface water cycle changes. This includes fostering collaborations with other groups with common interests in land-surface processes, such as the Coordinated Regional Climate Downscaling Experiment (CORDEX).

2.2 GEWEX Planning for Post-2013

Over the past year the SSG and GEWEX science community have developed and refined a mission statement and Imperatives that outline the strategic future directions of GEWEX as a part of the process for how GEWEX will contribute to the WCRP global framework for climate services. During the SSG meeting, a substantial amount of time was spent in defining Grand Science Questions for GEWEX. The goal of the Grand Challenges is to be specific and focused, while identifying ways to advance science that resonates among agencies, program managers, and the public. The Challenges also are designed to encourage the different GEWEX Panels to interact in pursuing a common goal and provide a way forward that is tractable (e.g., via new observations and computer and model advancements). They also will address possible benefits and impacts and links to issues related to food, water, health, energy, and biodiversity.

Grand Science Questions for GEWEX

1. Observations and Predictions of Precipitation

How can we better understand and predict precipitation variability and changes?

2. Global Water Resource Systems

How do changes in land surface and hydrology influence past and future changes in water availability and security?

3. Changes in Extremes

How does a warming world affect climate extremes, especially droughts, floods, and heat waves, and how do land area processes, in particular, contribute?

4. Water and Energy Cycles

How can understanding of the effects and uncertainties of water and energy exchanges in the current and changing climate be improved and conveyed?

These science questions will have elements associated with the GEWEX Imperatives: observations and data sets, their analysis, process studies, model development and exploitation, applications, technology transfer to operational results, and capacity building and training of the next generation of scientists. They involve all of the GEWEX Panels, and frequently strong interactions with other parts of WCRP and the International Geosphere-Biosphere Programme. They also contribute to the larger science questions posed by WCRP as a whole.

2.3 Goals and Plans for Major Activities for 2012

It is anticipated that a significant amount of time in 2012 will be spent in defining GEWEX Grand Science Challenges for the post-2013 period.

IGPO will play a key role in organizing and supporting the 4th WCRP International Conference on Reanalyses to be held in Silver Spring, Maryland on 7-11 May 2012.

GDAP will continue to focus on generating reference data products of the water and energy budget variables as well as the assessments. A new assessment activity for water vapor products (both for total precipitable water as well as water vapor profiles) was recently initiated and will be defined in the future.

Under GASS, GABLS is expected to define directions for its activities for the next few years based upon input received during a joint workshop to be held with the European Centre for Medium-range Weather Forecasts (ECMWF) on diurnal cycles and the stable atmospheric boundary layer at the end of 2011.

A Benchmarking Working Group was established under GLASS and activities include a PALS, ALMIP-2, GHP-integration project, Land Information System (LIS) Land surface Verification Toolkit (LVT), and outreach towards the International Land Model Benchmarking (ILAMB) Project and the Carbon-Land Model Intercomparison Project (C-LAMP). A dedicated session on benchmarking is planned at the American Meteorological Society's Annual Meeting in January 2012.

GHP will continue its reorganization and identification of the best ways to interact with the other GEWEX panels and WCRP regional activities.

2.4 Interactions (Especially with WCRP Sponsors and Partners)

Einar-Arne Herland, who functioned as the European Space Agency (ESA) liaison for GEWEX for the past 9 years, retired in 2011. Michael Rast, Head, Science Strategy, Coordination and Planning Office at ESA-ESRIN in Frascati, Italy, took Einar's place as the GEWEX/WCRP liaison. A joint GEWEX/ESA Data User Element (DUE) GlobVapour workshop on long term water vapor data sets and their quality assessment was hosted by ESA/ESRIN on 8–10 March 2011. The 3-day workshop was co-organized by the GEWEX Radiation Panel (GRP), ESA, and the ESA GlobVapour project team.

NASA continues to support the IGPO strongly and increased the contribution to the IGPO budget to include support to GHP and IGPO by Sam Benedict. Regular updates are given both formally through the Universities Space Research Association (USRA) Cooperative Agreement's Quarterly Reports as well as informally to NASA's program managers and administration (Jared Entin and Jack Kaye).

NOAA's contribution continues as well to support primarily North American travel by the D-IGPO as well as ad hoc meeting support.

Similarly DOE and NSF provide support for scientific meetings, primarily as travel grants, but do not support the IGPO directly.

Continued collaboration with GEO is provided through the D-IGPO, in particular to the IGWCO activities.

2.5 Publications and Other Projects

IGPO publishes a quarterly GEWEX Newsletter and a monthly E-Newsletter. Representation of GEWEX at numerous national and international conferences, meetings, and workshops has resulted in various publications, including proceedings, peer-reviewed literature, and more.

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2.6 Outreach and Capacity-Building Activities

Peter van Oevelen organized scientific sessions at the European Geophysical Union as well as the American Geophysical Union on remote sensing of land-surface/atmosphere interaction processes and a session on Remote Sensing and Hydrology. For the Hydrology-Satellite Application Facilities (SAF) Workshop at the Vienna University of Technology, he arranged a session and invited lecture on Microwave Remote Sensing.

With encouragement from both the GEWEX SSG and WCRP, GHP is exploring the Coordinated Regional Climate Downscaling Experiment (CORDEX) and GLASS as the most suitable options for enhancing exchanges between these modeling projects and the RHPs and other GHP activities, given the common interests in land-surface processes.

IGPO continues to serve on the Executive Board of the IGWCO and support the IGWCO Science Committee that currently takes responsibility for input to the water task under GEO. IGPO also continues to serve as a link to GEO activities through representation on various GEO committees, including Capacity Building (Dr. van Oevelen) and the User Interface Committee (Dr. Lawford).

Peter van Oevelen is also on the advisory board of the Global Water Scarcity Information Service (GLOWASIS) project, a European Union FP7 funded project that is aimed at pre-validation of a Global Monitoring for Environmental and Security (GMES) GLOWASIS. It will use data from GMES Core Services Land and Ocean. GLOWASIS combines in-situ satellite data and hydrological forecasting models to create a global information portal on water scarcity; as such, it tries to directly link to the stake holders of interest.

3. GEWEX PANEL STATUS REPORTS

3.1 GEWEX Hydroclimatology Panel (GHP)

URL: <http://www.gewex.org/projects-ghp.html>

Chair(s): Dennis Lettenmaier and Jan Polcher

The newly formed GEWEX Hydroclimatology Panel (GHP) met on April 8, 2011 at the Vienna University of Technology and again in Boulder, Colorado on 17–19 October 2011. The focus of both meetings was on recent project results and plans for the next phase of GEWEX. The leadership role of GHP in hydrologic sciences and modeling activities within WCRP was acknowledged, as well as the progress of the GEWEX Regional Hydroclimate Projects (RHPs) in seasonal forecasting, the detection and attribution of change, and the development and analysis of climate projections.

A GHP Council of Representatives composed of a member from each RHP has been formed to facilitate coordination and cooperation among the regional projects, and develop a set of criteria for the scientific contributions of the RHPs to the overall goals of GEWEX (especially with respect to water cycle modeling and prediction).

Building on its strength in regional studies, GHP has outlined steps to better address the use of regional climate models as a source of information about ongoing and future land-surface water cycle changes. These include fostering collaboration with other groups that have common interests in land-surface processes. A joint GHP/CORDEX workshop is being planned as a precursor to coordination between their activities, including the contribution of the RHPs to the validation of CORDEX model runs.

A new joint GHP/GEWEX Data and Assessments Panel (GDAP) activity will improve the use of GHP regional data sets as a validation tool for the global GDAP rainfall and water balance estimates. A joint CLIVAR/GEWEX monsoon initiative is planned in the Americas, where RHP data and regional studies resources can be applied. GHP will continue to provide the GEWEX contribution to the WCRP initiative on extremes using studies that are underway in the GHP Extremes Working Group. These studies relate to frequency of extreme high-end precipitation events and their impacts on engineering design and other variables.

A joint GHP/GLASS benchmarking initiative is underway to develop a matrix of flux data available from the RHP reference site database and other networks, such as the GEWEX Baseline Surface Radiation Network (BSRN). In this context, it was agreed that there is value in the GHP Model Output Location Time Series (MOLTS) product and it was recommended that the Global Modeling Centers continue to provide MOLTS for selected sites in the new GHP reference site database. It was also recommended that a central archive for MOLTS data be maintained.

GHP encourages the continued development of the Canadian Saskatchewan River Basin (SRB) Study as a possible RHP. The Panel also endorsed the concept for an American regional project, the plans for which are still being formulated.

GHP agreed that the research of the High Elevations Initiative is relevant to GHP objectives and should be continued based upon the development of a new science plan that defines relevant links to the RHPs. A workshop is planned to define the scope of this work and promote interest in its development from a broader community, as well as to determine its proper stewardship within WCRP and GEWEX.

The Cold Regions and Semi-arid Regional Climate Foci studies will be brought to closure as elements of GHP. Letters were sent to the leaders of these activities advising them that the new structure of GHP does not accommodate further endorsement of their efforts as cross-cutting science foci in the Panel. Assistance will be offered with the migration of this work to another group or project in WCRP or GEWEX as may be appropriate.

The Water and Energy Budget Studies Project under CEOP ended; however, a GHP member is developing a proposal for a cross-cutting initiative in the area of water and energy balance assessment over land to fill the need for studies of this type.

3.1.1 GHP Model Output Data Centre

Reporting period: January 2010–September 2011

Starting date: 2003

URL: http://www.dkrz.de/daten-en/wdcc/projects_cooperations/ceop

Chair(s) and term dates: Michael Lautenschlager

Overview:

The GHP Model Output Data Centre is run by the World Data Centre for Climate (WDCC), located at Deutsches Klimarechenzentrum GmbH in Hamburg, Germany. Within GHP, it receives model output data for dissemination to the project partners.

Objectives:

Within CEOP (Phase I and Phase II) and GHP projects, the Model Output Data Centre is in charge of receiving, archiving, and disseminating the data of the modeling centers.

Status: Past activities (status, significant changes, accomplishments)

The work on model data storage went on:

- The model output data of CEOP Phase I are stored and disseminated as Model Output Location Time Series (MOLTS) and grid data (see experiments “CEOP_...” at <http://cera-www.dkrz.de/WDCC/ui/BrowseExperiments.jsp?proj=CEOP>)
- The resulting data of the CEOP Inter-Continental transferability Studies are stored and disseminated.

In 2009 WDCC moved to a new building, and in 2010 and 2011 all software components of the tape storage system were changed. Data loading resumed at the beginning of 2011. There is, however, currently only one data center (the National Centers for Environmental Prediction, NCEP) that regularly sends data. Access to ECMWF (European Centre for Medium-Range Weather Forecasts) Re-Analysis (ERA) data is available, too.

- The National Centers for Environmental Prediction's (NCEP) model output data for CEOP Phase II have been stored and disseminated (see experiments, "CEOP2_...").
- For the CEOS water portal system (formerly WTF-CEOP), CEOP MOLTS data were stored for online access by a Thredds/OpENDAP server. These data are from the Japanese Meteorological Agency (JMA) and ECMWF (see mesocyclone1. dkrz.de:7070/thredds/).

New directions (longer term vision): N/A

Future:

We will go on storing the data of NCEP and the other modeling centers.

Key results: N/A

Issues and recommendations: N/A

Summary:

The most important achievements at the Model Data Centre during the last 18 months were the access to ECMWF and JMA model output local time series and the continuous storage of NCEP grid data from the start of CEOP Phase II on, i.e., from 2007-01 on.

List of key publications: N/A

List of meetings, workshops: N/A

Planned meetings, workshops: N/A

List of members and their term dates (including changes) where appropriate:

- Frank Toussaint
- Hans Luthardt

3.1.2 Coordinated Energy and Water Cycle Observations Project (CEOP) Data Management

Reporting period: September 2010–September 2011

Starting date: September 2000

URL: <http://www.eol.ucar.edu/projects/ceop/dm/>

Chair(s) and term dates: Steve Williams (September 2000–March 2011)

Overview: N/A

Objective(s): Coordinate CEOP Data Management, prepare Reference Site archive

Status: See CEOP Data Management Project Report for past year's activities

New directions (longer term vision): Maintain existing archives and data access

Future: Possible collaboration with GHP-GLASS Benchmarking

Key results: See CEOP Data Management Project Report

Issues and Recommendations: Maintain accessibility of CEOP archives

Issues for attention by the SSG: Determine ways to maintain CEOP Data Legacy with new GHP Objectives

Contributions to WCRP strategic themes: Data Management

Summary:

With the transition from CEOP to GHP, all CEOP Data Management activities (and Committee work) were wrapped up during the past reporting period. Final processing of Reference Site data was completed in the summer of 2011 and archives were updated and finalized. Existing CEOP archives will remain accessible to the extent possible through long-term Data Centers and other repositories. The CEOP Data Management webpage will remain online and updated to the extent possible.

List of key publications: GEWEX News (August 2010)

List of meetings, workshops: N/A

Planned meetings, workshops: N/A

List of members and their term dates where appropriate (including changes):
Committee disbanded

3.1.3 CEOP Reference Site Data Management

Full name: CEOP Reference Site Data Management

Reporting period: September 2010–September 2011

Starting date: September 2000

End date (where appropriate): September 2011

URL: <http://www.eol.ucar.edu/projects/ceop/dm/>

Chair(s) and term dates: Steve Williams (September 2000–March 2011)

Overview:

NCAR's Earth Observing Laboratory (EOL) supported the CEOP Reference Site Data Set development and data management activities including the design, development, maintenance, and improvement of the CEOP (Coordinated Energy and water cycle Observations Project) Data Management database and webpages hosted at EOL (<http://www.eol.ucar.edu/projects/ceop/dm/>). These pages contain direct access (or links) to all CEOP related in situ, model output, and satellite data sets (and metadata), data policies, documentation, links to other data contributors, and other related links. The CEOP data management webpage improvements were coordinated with the redesign and updating of the CEOP homepage (hosted at the University of Tokyo in Japan) as well as with the other CEOP Archive Centers. The data access requirements and webpages were also modified with feedback from the CEOP Principal Investigators (PIs) and EOL provided user services (and customized data queries) to support the community as needed.

EOL established arrangements and coordinated with the individual Reference Sites to ingest data (October 2001 through December 2009). As data and metadata were submitted to EOL, a series of consistency checks were performed, including data and documentation completeness, parameter specifications (instrumentation, exposure, units, etc.), and quality control. A visual check of data plots was also performed. Any issues, problems, or questions were discussed with the data provider(s) as necessary and

EOL maintained a complete history of all steps that each data set was subjected to. To be consistent with CEOP Phase I data, EOL extended a merged “composite” data set during the Phase II data ingest, which contained common parameters (i.e., near-surface, surface, and sub-surface) at a common time resolution (i.e., 30 minutes) and format from each Reference Site. The data sets were divided into five distinct types per station: Surface Meteorological (SFC), Tower (TWR), Soil Temperature and Moisture (STM), Flux (FLX), and Soundings (raw format). EOL then performed a final review to ensure that there were no remaining data quality issues. Once the data and metadata were finalized, EOL loaded them into the EOL Data Management System (EMDAC) and provided access to the Scientific Community. EOL continued to monitor and record statistics of CEOP Reference Site data distribution. Limited additional supporting ancillary data sets provided by individual Reference Sites were also added to the archive but with no further processing or quality control review by EOL. All finalized CEOP Reference Site data were posted and are available directly at: http://data.eol.ucar.edu/master_list/?project=CEOP/EOP-3/4.

A large effort as part of this archive was to maintain (and post) the most complete Reference Site station information and documentation as possible. This was primarily done through summary tables as well as individual site webpages (linked to the webpage above). An example can be found at: <http://www.eol.ucar.edu/projects/ceop/dm/insitu/sites/baltex/lindenberg/falkenberg/>. Such information included station contacts, maps and Google Earth files, photos, station description (including vegetation and land use), soil type and characterization, climate, measured parameters and instrumentation details, and site references (including presentations). All this information is critical to the understanding, analysis, and interpretation of the data. A "Virtual Tour CD of CEOP Reference Sites" was published consisting of images showing the CEOP Reference Sites and their surroundings as well as the cultural aspect of the regions where the sites are located. An online version of this CD is located at: <http://www.eol.ucar.edu/projects/ceop/dm/documents/tour/>.

The final CEOP Reference Site database at EOL (as of September 2011) consists of 17.3 GB (105 data sets comprised of 12,361 files) of data collected from 55 Reference Sites (17 of which contributed to Phase II). Thirteen sites contributed 5 or more years of continuous data to the long-term archive. Since the establishment of the archive, 147.7 GB (102,082 files) were downloaded by 495 unique users (5583 total orders). A breakdown of the top ten internet domain distribution of these users is provided in Table 1. It is clear from these metrics that CEOP Reference Site data has certainly become a global resource and that it is a critical component of a larger CEOP data management effort involving numerous countries and international Data Centers. This effort was further recognized by GEOSS (Global Earth Observation System of Systems) as a “prototype” structure that could be expanded for possible future international data access and integration.

No.	Domain	Orders	No.	Domain	Orders
1.	Japan (.jp)	1,508	6.	Germany (.de)	255
2.	United States (.edu)	1,226	7.	United Kingdom (.uk)	234
3.	United States (.com)	677	8.	Australia (.au)	66
4.	China	661	9.	Sweden (.se)	61
5.	United States (.gov)	513	10.	South Africa (.za)	52

Table 1. CEOP Database Top Ten Internet Domain Data Orders

EOL worked closely with the Working Group on Information Systems and Services (WGISS) Test Facility (WTF)-CEOP Distributed Data Integration System [developed at the Japanese Space Agency and the Remote Sensing Technology Center (RESTEC) of Japan]. This system provides advanced tools for integrated access, visualization, and comparison of multiple types of data from distributed CEOP archives. To enhance the capabilities of this WTF-CEOP System and facilitate improved efficient in situ data access, EOL wrote additional format converters to process CEOP Reference Site ASCII format data to NetCDF format (including tower and sub-surface data), thus greatly enhancing the capabilities of the

WTF-CEOP System. To coordinate with this CEOP distributed data system, EOL maintained and populated an OpenDAP DODS (Distributed Oceanographic Data Systems) Server to allow the exchange of data between other CEOP Data Centers (see below). Following completion of the Phase II archive, EOL performed a batch conversion of the entire database from ASCII to NetCDF.

In addition to the Reference Site data activities described above, EOL coordinated with the CEOP Model Output Archive Center located at the World Climate Data Center (Max Plank Institute) in Germany and the CEOP Satellite Data Center located at the University of Tokyo, Japan. This coordination included providing advice in defining a minimum set of parameters that responds to the needs of the climate and weather research users and National Weather Prediction (NWP) Centers; clarifying policies for the timely release of data; and participation in international workshops, conferences, teleconferences, and meetings to engage the international climate sciences community.

Summary: See Overview

List of key publications: GEWEX NEWS (August 2010)

List of meetings, workshops: N/A

Planned meetings, workshops: N/A

List of members and their term dates (including changes): Committee disbanded

3.1.4 Extremes Research within the GEWEX Hydroclimatology Panel

Reporting Period: 2010-11

URL: <http://www.drinetwork.ca/extremes/>

Chair(s) and term dates: Ronald Stewart

Overview:

One of the most critical aspects of the water and energy cycle is the occurrence of extremes such as droughts, extended wet periods, and flooding. These extremes have enormous impacts when and where they occur, but they are also fundamental features of the climate system. One of the most critical concerns of a changing climate is associated with extremes and, in particular, whether their occurrence and severity will change. Extremes have consequently always been a concern of GEWEX, and GHP is addressing this issue.

The overall aim of the Extremes activity within GHP is to better understand the occurrence, evolution, structure, and role of hydrometeorological extremes within the climate system, to contribute to their better prediction at various time scales, and to address societal concerns.

Status:

There has been collective progress on this issue over the last year. Some specific illustrations follow:

1. *Summary article published on extremes-related activities within the RHPs and other CEOP/GHP components:* Through a joint activity with components of CEOP/GHP, a short article was published in the GEWEX Newsletter on this issue. Many studies are underway or finished that address extremes. For example, almost all RHPs examine drought and heavy precipitation. This means that there is a solid base for moving forward collectively to address such issues.

2. *Assessing current definitions of extremes and determining if further ones are needed:* GHP-related work was prominent in the WCRP October 2010 Extremes workshop in Paris.
3. *Evaluating existing assessment and prediction of drought:* GHP-related research was also prominent at the WCRP March 2011 Drought Workshop that was held in Barcelona.
4. *Assembling at least one comprehensive, continental-scale data set on multi-year drought:* An effort to accomplish this has now finished over the Canadian Prairies, as well as in other RHPs,
5. *Contributing to other workshops and conferences:* There have been several extremes-related sessions at various other conferences around the world. GHP-related investigators have often either organized these workshops or presented their findings at them.
6. *Assessing whether a review article on extremes is warranted:* An article on extremes-related activities is still being considered for BAMS or a similar journal.

Related Extremes Efforts

Along with the coordinated efforts discussed above, many of the RHPs and other components of GHP are examining extremes to some degree on their own. Different aspects of extremes are being addressed from different perspectives in different regions.

Ongoing

The GHP extremes web site continues to be an ongoing source of information for this effort. It contains, for example, many relevant reports and presentations made on behalf of the effort.

A key issue is actually pulling together all the individual efforts. Much is being done on this issue within individual GHP components but this needs to be combined to give a global perspective.

This has proved to be very difficult to do in practice. One idea was to jointly develop a collective article on extremes, but so far, this hasn't progressed much beyond an outline and initial communications with potential participants. The objective of this article was to characterize and compare the features and driving mechanisms of extremes in different geographic settings.

Other collaborative activities that may be developed include some of the following. To some degree, these are being addressed within individual GHP components now.

- Determine the capabilities of remote sensing techniques for monitoring extremes.
- Agree on the complete data set needed to characterize extremes.
- Assess weaknesses in predictive models for extremes.
- Examine the feasibility of using high-resolution models for downscaling during extremes.

A key issue is the future of this effort itself. Is it feasible to have such an effort and, if so, what doable actions can be carried out within its possibly revised objectives?

It may be that one simple activity is just communication amongst the GHP participants. People can focus on extremes in their regions and/or GHP component, and share progress and ideas. This could be in a presentation mode mixed with lots of discussion of common issues for example.

There is no question that GHP extremes efforts will contribute to other WCRP-related extremes activities. For example, three tasks of the WCRP drought effort are drought processes, prediction, and user interactions. GHP-related work is involved in all these aspects.

One item from the above WCRP drought effort is "processes." Through this, an effort is underway to characterize factors leading to drought and its internal attributes around the world and is being led by Dr.

Stewart. The involvement of RHP and probably other GHP components is critical to the success of this. It will lead to a BAMS-type article along with a map (or maps) summarizing some of the results.

One way to address this issue is to summarize all the individual studies underway on extremes within the GHP components. The general scope of these activities was summarized in the 2010 GEWEX Newsletter Extremes article (Stewart, 2010). The same phenomena (droughts, heavy precipitation, floods) are being examined from many perspectives within essentially all RHPs and many components of GHP. The GHP-level activity should move towards addressing common and unique attributes of these phenomena in different regions.

Issues/Recommendations for attention by the GHP Co-Chairs and GEWEX SSG:

As mentioned elsewhere, a key question is whether to and, if appropriate, how to best move forward with this issue. This is part of the larger issue linked with the restructuring of GHP.

Contributions to GHP strategic framework:

The issue of extremes is an excellent focal point for bringing together many different aspects of GHP. But it hasn't made much progress recently, and its future needs to be considered. Its first Chair is stepping down, so it is an opportune time to revisit the concept in light of overall GHP and GEWEX plans.

Contributions to society and GHP/WCRP/GEWEX visibility:

This extremes activity represents an important component of both GEWEX and GHP, enhancing their visibility.

Summary:

The collective extremes effort has progressed somewhat but the individual components, such as the Regional Hydroclimate Projects (RHPs), have moved ahead substantially. The extremes effort could just represent these individual efforts in different regions, although it strives to, for example, address the similarities and differences between extremes in regions around the world. To accomplish this, the extremes effort has held or participated in workshops and special conference sessions, and it has plans to move forward on several activities including joint publications, although progress has been slow. One joint activity with WCRP on drought represents a collaborative step forward.

The rejuvenated GHP needs to consider how to address extremes. It is too large an issue to ignore, but it is not clear how to best move forward.

An issue for GHP itself as well as its components is how to effectively move forward. Each RHP is funded to examine its own regional climate including extremes, but there generally is no support for examining cross-cutting issues. This has always been a big problem for GHP. There are many dedicated scientists involved in GHP and in extremes, and there is lots of good will and many challenging issues that can be addressed together. Hopefully ways can be developed or opportunities will materialize that allow for overcoming this major impediment.

List of key publications:

Many Extremes publications from the various GHP components are listed on the extremes web site. It is almost impossible to keep up-to-date, however. For example, the recent Monsoon Asian Hydro-Atmospheric Science Research and prediction Initiative (MAHASRI) special issue of the Journal of the Meteorological Society of Japan (February 2011) had many extremes-related articles.

A short review article on Extremes within GHP (CEOP) was also published:
Stewart, R.E., 2010. An update on Extremes within CEOP. *GEWEX News*, 20, 6.

List of meetings, workshops:

August 2010: Extremes meeting at the Pan-GEWEX Meeting in Seattle
October 2010: Contribution to WCRP Extremes Workshop in Paris
December 2010: Extremes meeting at AGU in San Francisco
March 2011: Contribution to WCRP Drought Workshop in Barcelona
July 2011: Contribution to IUGG Extremes Symposium in Melbourne

Ongoing: Emails and one-on-one discussions, meetings at other events and conferences.

Planned meetings, workshops:

Before making specific future plans, the revamped GHP needs to consider whether to continue with a separate focus on extremes.

List of members and their term dates where appropriate:

Each of the RHPs had an extremes contact, and all the other GHP components contribute to extremes directly or indirectly.

It should be noted that this is Dr. Ronald Stewart's last SSG Meeting heading the extremes effort. The 2012 end-date of his term was to coincide with the annual GEWEX SSG Meeting, which this year actually happens in November 2011.

3.1.5 Monsoon Asian Hydro-Atmosphere Scientific Research and Prediction Initiative (MAHASRI)

Reporting Period: January 2010-October 2011

Starting date: Tentative approval in January 2006 at GEWEX SSG-18 in Dakar; final approval at GEWEX SSG-19 in Honolulu in January, 2007

End date: 2015 (TBD)

URL: http://mahasri.cr.chiba-u.ac.jp/wiki/index.php/Main_Page

Chair(s) and term dates: Jun Matsumoto

Objective:

MAHASRI's objective is to develop a hydrometeorological prediction system, particularly with the time scale up to a season, through the better scientific understanding of Asian monsoon variability.

Status:

A special MAHASRI issue with 25 papers was published in the *Journal of the Meteorological Society of Japan* (JMSJ, 2011, Vol. 89A). MAHASRI contributed to the Asian Monsoon Years (AMY, 2007-2012) Project, which was conducted jointly with the CLIVAR Asian-Australian Monsoon Panel and the CLIVAR Indian Ocean Panel. Projects in Japan, China, India, and Malaysia contribute to AMY. The AMY reanalysis will be conducted by the Japan Meteorological Agency (JMA) Meteorological Research Institute using the intensive observation data (2008-2010). Long-term hindcast modeling was conducted for predictability of the monsoon intraseasonal variations (MISO). The AMY international project office is located at the Institute of Atmospheric Physics (IAP) in China. Collaboration with the Year of Tropical Convection (YOTC) under THORPEX has also been conducted. The AMY activities described above are all related to the WCRP Monsoon Cross-Cut activity in the Asian monsoon region.

New directions:

1. Coordination with the WCRP Monsoon Cross-Cut Activity, in particular, the comparative study of African and American monsoons.

2. Social applications in South and Southeast Asian countries under the Japan International Cooperative Agency and other international aid projects.
3. Data rescue and digitization of rainfall and other climate elements in Southeast Asian countries, including typhoon track data prior to 1950. Recent data is available through the new Data Integration and Analysis System (DIAS), which part of the Green Network of Excellence (GRENE) Project (2011-2015) under the Ministry of Education, Culture, Sports, Science and Technology in Japan. In particular, the application for the agricultural planning will be promoted through this project.

Future:

The next year will see a continuation of AMY reanalysis for the years 2009-2010. Data will be quality-checked and arranged for the reanalysis calculation in MRI. Data management techniques adopted in CEOP have been adopted for these activities. AMY will end in 2012 and a scientific conference is planned in October 2012 in Nanjing, China.

Social applications in Thailand and Indonesia will be completed under the Japan International Cooperation Agency (JICA) Japan Science and Technology Agency Science and Technology Research Partnership for Sustainable Development projects.

Key results:

1. A relationship was found among the Asian winter monsoon cold surge, MJO, and the diurnal cycle in the Indonesian maritime continent
2. Large-scale conditions of heavy rainfall phenomena
3. Monsoon onset process in the Tibetan Plateau
4. Land-atmosphere interactions in inland Mongolian region
5. Long-term changes of seasonal changes, and water and energy cycles in China and in Japan
6. Land data assimilation in the Tibetan Plateau
7. Global and regional modeling on human-induced land surface changes
8. Hydrological modeling for water resource and flood management
9. Data rescue for the early 20th Century typhoon tracks and rainfall in Southeast Asia
10. Development of rainfall estimation techniques for the real-time flood monitoring and forecasting and a software package easily accessed by users in developing countries should be promoted
11. How to coordinate WCRP Monsoon Cross-Cut activity among different monsoon regions should be discussed
12. A MAHASRI data set should be planned

Summary:

MAHASRI published a special issue in JMSJ and the Project has entered into its second phase. Regional climate change research including prediction has become more important. In addition to process studies by field observations, we made effort for data rescue and studying past changes of water and energy cycles. Collaboration with AMY in monsoon research and with Southeast Asian countries in development of hydrometeorology and climatology has been conducted well.

List of key publications:

1. Chen, T.C., et al., 2011. Interannual variation of the late fall rainfall in Central Vietnam. *J. Climate* (in print).
2. Fudeyasu, H., et al., 2011. Effects of large-scale moisture transport and mesoscale processes on precipitation isotope ratios observed at Sumatera, Indonesia. *J. Met. Soc. Japan*, 89A: 49-59.

3. Fujinami, H., et al., 2010. Characteristic intraseasonal variability of rainfall and its effect on interannual variability over Bangladesh during boreal summer. *Int. J. Climatol.*, doi:10.1002/joc.2146.
4. Fujita, M., et al., 2011. Diurnal Convection Peaks over the Eastern Indian Ocean off Sumatra during Different MJO Phases. *J. Met. Soc. Japan*, 89A: 317-330.
5. Geng, B., et al., 2011. Characteristics of precipitation systems and their environment observed during the onset of the western North Pacific summer monsoon in 2008. *J. Met. Soc. Japan*, 89A: 1-25.
6. Hattori, M., et al., 2011. The cross-equatorial northerly surge over the Maritime Continent and its relationship to precipitation patterns. *J. Met Soc. Japan*, 89A: 27-47.
7. Hirabayashi, Y., et al., 2010. Global-scale modeling of glacier mass balances for water resources assessments: glacier mass changes between 1948 and 2006. *J. Hydrology*, 390, 245-256, doi:10.1016/j.jhydrol.2010.07.001.
8. Hirano, J., and J. Matsumoto, 2010. Secular and seasonal variations of winter monsoon weather patterns in Japan since the early 20th century. *Int. J. Climatol.*, doi:10.1002/joc.2241.
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List of meetings, workshops:

- 9-11 June 2010: 1st AMY Data Workshop in Tokyo, Japan
- 6-9 July 2010: 7th AOGS in Hyderabad, India. AMY-1, -2 and -3 sessions were held
- 10 July 10 2010: 7th AMY Workshop in Pune, India
- 6-7 January 2011: JSPS International Forum: Climatic Changes in Monsoon Asia (CCMA) in Bangkok, Thailand
- 22-24 August 2011: 2nd HyARC/MAHASRI Workshop on the Asian Monsoon and the Water Cycle in Nha Trang, Vietnam

Planned meetings, workshops:

October 2012: AMY Science Meeting, Nanjing, China

List of members and their term dates*:

Chair: Jun Matsumoto

Co-chairs: Hansa Vathananukij, Wu Guoxiong, G.S. Bhat

Advisory Board: Fu Conbing, T.C. Chen, Bin Wang, Ding Yi-hui, Tetsuzo Yasunari

ISSC Members: Takehiko Satomura, Johnny Chan, Kooiti Masuda, Chi-yung Fransis Tam, Nguyen Thi Tan Thanh, Taikan Oki, Manabu D. Yamanaka, Fadli Syamsudin, Taiichi Hayashi, Nazrul Islam, Hirohiko Ishikawa, Jun Asanuma, Azzaya Dolgorsuren

* Term dates have not been decided.

3.2 GEWEX Data and Assessments Panel (GDAP), formerly GEWEX Radiation Panel (GRP)

URL: <http://gewex.org/projects-GRP.htm>; <http://rain.atmos.colostate.edu/GRP/index.html>

Chair: Christian Kummerow (2008-2012)

Vice Chair: Joerg Schulz (2010-2013)

Panel background and objectives:

The GEWEX Radiation Panel (GRP) was originally formed to understand the short- and long-wave energy balance of the Earth System. The focus of GRP has evolved over time, from developing data sets of global water and energy variables consistent with the GEWEX mission, to fostering the creation of global data sets of the Surface Radiation Budget (SRB Project), clouds (International Satellite Cloud Climatology Project, ISCCP), and precipitation (Global Precipitation Climatology Project, GPCP). Over time these data sets have been further expanded to complete the flux and forcing terms, including turbulent fluxes (SeaFlux and LandFlux), and aerosols (Global Aerosol Climatology Project, GACP). These GEWEX reference products represent the legacy of GRP.

With independent products available for the radiative and flux terms of the Earth system, GRP is now focused on creating an integrated reference product in which the individual products use a common space and time grid as well as common ancillary data and procedures in order to ensure that geophysical signals are due to the data and products themselves, rather than inconsistencies in the assumptions. Reviewing the readiness of GEWEX reference products for this reprocessing with common assumptions was a key objective of the GRP team meeting held in Tokyo at the end of August 2011. GRP will undertake an assessment of the state of the water and energy budget based upon the new integrated GEWEX reference product. This assessment, which is intended to document the state of our observing system, is meant to be the first in a periodic reevaluation of the state of the water and energy observing system. The assessment 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.

With this focus in mind, GRP revisited the key functions that such an international panel should perform and four key roles were identified:

1. GEWEX Reference Products: While data sets now abound for many of the essential climate variables, the GRP members believe it is essential to construct and maintain a consistent long-term

reference product of the global and regional water and energy variables. These reference products, referred to as the GEWEX products, are endorsed by GRP and must be open, readily accessible, validated, and published, so as to serve as a benchmark for the community as it strives to improve products with more recent observations or new retrieval paradigms.

2. **Product Assessments:** While the Panel has an important role in maintaining reference products, an important evolving role for international panels such as GRP is its experience in doing assessments of global data sets produced by the international community. These assessments include all global water and energy products, as well as radiative transfer codes (activities such as the Continuous Intercomparison of Radiation Codes Project, CIRC) that form the basis of the retrievals as well as model simulations.
3. **In Situ Networks:** Assessments commonly bring together a variety of in situ measurements. Some of these are well coordinated and quality controlled while others exist largely in their own regional domains. GRP, therefore, sees its role as identifying such networks of in-situ observations and fostering the development of integrated global data sets that can be used to both construct and/or validate the global climate products.
4. **Diagnostic and Process Studies:** The Global Data Products lend themselves to verify not only model output, but also model processes. Successful examples have been the ISCCP Simulator that allows models to compare their cloud fields directly to ISCCP and thus verify if the right clouds are being produced. Optimizing these interactions with the climate and cloud-scale modeling groups within GEWEX is ongoing but should be strengthened.

These objectives, dealing now more with global data sets and assessments of data and radiative transfer codes, lead the Panel to propose a name change from GEWEX Radiation Panel (GRP) to GEWEX Data and Assessments Panel (GDAP).

Status:

Activities in GRP/GDAP focus primarily on the generation of the GEWEX reference products and their assessments. As stated previously, each of the GEWEX reference products is currently preparing for a reprocessing cycle that will result in common space and time grids, as well as ancillary data and assumptions. The Working Group for Data Management (WGDMA), led by Bill Rossow, is responsible for the common ancillary data. The data sets have been identified and are undergoing the final testing within each of the reference product groups. The US National Climate Data Center (NCDC) has agreed to host the Integrated GEWEX Reference Product, which will archive the core geophysical parameters from each of the reference products in a common file.

While each of the projects prepares for its own reprocessing, the current versions are producing important results. GPCP reported that it had recently released an improved product that utilized a new gauge analysis by the Global Precipitation Climatology Centre (GPCC). This product improves the gauge representation over mountainous terrain. GPCP continues to carefully monitor trends in precipitation and continues to find that there is no marked trend in precipitation discernable from the past 30 years of precipitation data. Transient responses from both volcanic eruptions and El Niño–Southern Oscillation (ENSO) events, on the other hand, are clearly identifiable in the data. SRB and the surface validation network (Baseline Surface Radiation Network, BSRN) continue to make good progress (except for some specific surface sites mentioned later). SRB is publishing results for the surface and top-of-atmosphere (TOA) fluxes. Implied evaporation rates do match the GPCP precipitation, but only at the outside of the project's uncertainties ($\sim 10 \text{ W/m}^2$).

SeaFlux continues to make progress with the diurnal cycle of sea-surface temperature (SST), showing that regional errors of the order to 10 W/m^2 are possible if SST is considered constant. The Project has recently begun to analyze two new versions of Special Sensor Microwave Imager (SSM/I) intercalibrated brightness temperatures. It is hoped that the analysis of these brightness temperature data sets can shed light on the trends of increased evaporation evident in most surface flux products. In parallel, LandFLux has invested considerably in an assessment activity intended to guide the development of the GEWEX reference product. The current plan is to select a product, or combination of procedures, to begin producing the GEWEX reference product by April 2012 in concert with the other products.

The ISCCP cloud climatology, aside from continuing to fix existing problems, has led the assessment of the new High Resolution Infrared Sounder (HIRS) temperature and humidity profile database to be used in the consistent reprocessing of the GEWEX reference products. The results are encouraging with respect to producing data sets with fewer artifacts. In the meantime, the project is working with NCDC to transition the operational processing to NCDC.

The assessments are moving forward as well. Reports from the cloud as well as radiative flux assessments suggest that both of these will be finished in early 2012. The Panel has appointed three reviewers for each report to help the authors with consistency across chapters. In addition to reviewing these reports, the Panel is collectively preparing a short white paper on “Assessments,” outlining what it has learned about conducting assessments.

Tianjun Zhou of the Key Laboratory of Atmospheric Sciences and Geophysical Fluid Dynamics (LASG) of the Institute of Atmospheric Physics (IAP) at the Chinese Academy of Sciences (CAS) in Beijing, China, joined the Panel in 2011. His expertise in modeling of the hydrologic cycle was an immediate and welcome impact on the Panel.

Key results:

- All GEWEX reference products are on track for reprocessing beginning in the April 2012 time frame
- Taking initial steps to transition GEWEX products to operational agencies for sustained processing
- Cloud and radiative flux assessments near completion (early 2012 publication)
- Panel will write a white paper on lessons learned from the assessments
- SRB project has computed new surface and TOA fluxes. Values will close energy budget with latent heat fluxes inferred from precipitation but uncertainties remain large (10 W/m^2)

Future activities and new directions:

As implied in its name, GDAP will continue to focus on generating reference data products of the water and energy budget variables as well as the assessments. The logical framework for this activity is to think in approximately 10-year cycles in which original data products are improved, new data sets are added, products are assessed, and new benchmarks for the observed global water and energy budgets are published.

Future activities will focus heavily upon new data products that can be added to the inventory. At present, two products appear ripe for inclusion. Vertical heating structures are being computed by a number of research groups using A-train data while soil moisture has matured due to attention from the Soil Moisture and Ocean Salinity (SMOS) and the upcoming Soil Moisture Active Passive (SMAP) missions. Including both of these are logical next steps in that they are reasonably mature, have research communities interested in joining the activity, and perhaps most importantly, serve as cross-checks with other products already being produced. While gravity measurements such as those from the Gravity Recovery and Climate Experiment (GRACE) also fit the closure argument, these observations are based on single satellites with existing science teams. As such, they are in less need of coordination and instead appear readily usable by the Panel members investigating closure with existing reference products. A new

assessment activity for water vapor products (both for total precipitable water as well as water vapor profiles) was recently initiated.

New activities consist of examining GEWEX reference products over polar regions and examining the relationship between global aerosol concentrations and the water and energy fluxes. A third activity that is being considered deals with the feasibility of assessing satellite simulators that are currently being used in the Coupled Model Intercomparison Project (CMIP) as well as a number of other activities. There are currently at least eight such simulators, and Hirohiko Masunaga is exploring the possibilities.

Issues and recommendations:

The BSRN project noted a significant decline in funding available for in situ climate observations within Canada. The project expressed a desire to have GEWEX and WCRP write letters on its behalf highlighting the importance of continuous measurements for climate research.

The Continuous Intercomparison of Radiative Codes (CIRC) project has strong interactions with the radiation community represented in the GRP/GDAP Panel, but it must also interact more closely with the modeling work going on in different Panels. We therefore recommend that CIRC be made a joint activity between GDAP and GASS Panels.

Summary:

Progress is being made towards an “Integrated GEWEX reference product” containing all fundamental water and energy budget variables on a common space/time grid and with a uniform set of ancillary data and assumptions. GRP will write a “status of the W&E observing network” paper based upon these results. Early indications are that budget closure is within the uncertainties but that these are still large (i.e., 10W/m²) at the surface. Cloud and radiative flux assessments will be published in early 2012.

List of meetings, workshops held:

- 8-10 March 2011: GEWEX/ESA DUE GlobVapour Workshop on Long Term Water Vapor Data Sets and their quality assessment in Frascati, Italy
- 8-9 April 2011: LandFlux Assessment Meeting in Vienna, Austria
- 30 Aug-1 Sep 2011: GEWEX Radiation Panel Meeting in Tokyo, Japan

Planned meetings, workshops:

- 4-6 October 2011: CERES Science Team Meeting at Lawrence Livermore National Laboratory
- November 2011: Radiation Flux Assessment Meeting
- 14-16 May 2012: Water Vapor Assessment Meeting
- July 2012: 6th SeaFlux Workshop (with LandFlux, AMS Air-Sea, and AMS Boundary Layers and Turbulence Meetings)
- August 2012: BSRN Meeting (planned around IRS in Germany)
- October 2012: GRP (GDAP) Meeting in Paris, France (exact dates TBD)

List of members and their terms:

- | | |
|--------------------|----------------|
| Christain Kummerow | 2008 – present |
| Joerg Schulz | 2010 – present |
| Carlos Jimenez | 2010 – present |
| Norman G. Loeb | 2005 – present |
| Hirohiko Masunaga | 2010 – present |
| Matthew McCabe | 2008 – present |
| Enio Pereira | 2010 – present |
| Mark Ringer | 2010 – present |
| Axel Schweiger | 2008 – present |

Sonia Seneviratne	2008 – present
B.J. Sohn	2007 – present
Claudia Stubenrauch	2007 – present
Susan Van Den heever	2008 – preset
Tianjun Zhou	2011 – present

Would like to nominate Andrew Heidinger, U. of Wisconsin for 2012

3.3 Global Land Atmosphere System Study (GLASS) Panel

URL: <http://www.gewex.org/glass.html>

Chair(s) and Term Dates: Martin Best (2009-2012) and Joseph Santanello (2011-2014)

Objective:

Support improved estimate and representation of (land) states and fluxes in models, the interaction with the overlying atmosphere, and maximize the utilized fraction of inherent predictability

Status:

PILPS-URBAN

The Project for the Intercomparison of Land-Surface Parameterization Schemes (PILPS) Urban Surface Energy Balance Land-Surface Comparison Project (URBAN) model comparison experiment has been successfully completed. There were results from 33 models with a wide range in complexity. Some models were essentially the same model but run by different groups, which will enable a future analysis of initial conditions and user assumptions. The initial results from the comparison have now been published and show that for the considered application, there is little benefit from additional complexity, as the simple models on the whole performed at least as well as the more complex models.

GLACE2

Published results from the second Global Land Atmosphere Coupling Experiment (GLACE2) show that skill in temperature and precipitation increases mainly in areas where the precipitation forcing quality is high (high station density gives better initial soil moisture data), when soil moisture is relatively extreme, and where potential predictability is high. Ongoing GLACE2 experiments from the [Royal Netherlands Meteorological Institute](#) (KNMI), ECMWF, and the Swiss Federal Institute of Technology (ETH) are being performed for the period 2000-2010 in order to check possible signals emerging from known strong droughts in this period. Also yet to be carried out are possible studies involving hydrological forecast models fed by the GLACE2 Global Climate Models (GCMs).

LoCo

The Land Information System (LIS) now contains a number of land surface models including the Hydrology-Tiled ECMWF Scheme for Surface Exchange over Land (H-TESSEL) model, the Joint UK Land Environment Simulator (JULES), and the CSIRO Atmosphere Biosphere Land Exchange (CABLE) model, a Data Assimilation feature and a standardized verification system (LVT). The coupling of the Land Information System-Weather Research Forecast (LIS-WRF) system has therefore been able to provide an initial testbed for the Local coupled land-atmospheric Modeling Project (LoCo) diagnostics by offering land (Land Surface Model, LSM) and atmosphere (Planetary Boundary Layer, PBL) scheme flexibility. A LoCo working group has been established and expanded with bi-monthly telecons and coordination of LoCo research. This group has been bringing together and testing a wide range of land-atmosphere coupling diagnostics (the traditional mixing diagrams, LCL-deficit, Findell-Eltahir diagnostics of triggering of convection, revised relative humidity

tendency variables, McNaughton coupling coefficient). There have been many LoCo papers published this year that define these diagnostics and apply them to a range of models (from local to global) and reanalysis products. In addition, this working group has organized a LoCo poster cluster at the WCRP Open Science Conference planned for October 2011. They have identified a first order LoCo experiment based on the LIS-WRF framework, but also plan a wider GLASS Panel discussion on if/when/how a proper LoCo Project should be organized and sponsored under GLASS, or if the working group approach should remain the thrust of the effort for the near-term.

GSWP3

A follow-up project to the Global Soil Wetness Project 2 (GSWP2) is currently being planned. The new components being considered for this project are:

- Providing a comprehensive set of land surface states for the period including entire 20th century and recent years (~1901 to present) that can serve as a long-term land surface reanalysis suite.
- Including carbon models to explore/attribute a possible carbon-related effect or changes in Hydro-Energy-Eco functioning. This could make a bridge to the terrestrial carbon cycle modeling community.
- Exploring uncertainties of input data sets and their propagation through different model schemes under super-ensemble (multi-input and multi-model) experiments.
- Building a robust simulation benchmarking framework through component-wise verification using a broad set of independent observational products [e.g., routing scheme for a validation of discharge (flux); GRACE for a validation of terrestrial water storage variation (storage)].
- Including simulations using CMIP5 models, with both present day and future conditions.

Results from a pilot error propagation analysis have shown that differences in precipitation lead to non-linear differences in evaporation and runoff whose size and sign depends on the climate and vegetation regime. However, the spread between different land models was generally larger than the spread in the precipitation forcings and showed different spatial patterns, pointing at a model dependent sensitivity of evaporation and runoff. A white paper (experimental protocol) has been produced and discussed at a GLASS sub-meeting in March 2011, after which further iterations have taken place. This included engagement of the carbon community and inclusion of a suite of LSMs in varying hydrological and carbon treatments. A revised version will be circulated for discussion at the October Panel Meeting, with expected kick-off date of the experiments to be about 3 months following.

ALMIP2

The 2nd African Monsoon Multidisciplinary Analysis (AMMA) Land Model Intercomparison Project (MIP) is currently under development. In this experiment, the focus is on a much higher spatial resolution (5 km) than in the Atmospheric Model Inter-comparison Project (ALMIP1), to focus on the subtle hydrology and vegetation processes that dominate there (occasionally very large rooting depths, land use change, sloping bedrocks removing water from the catchment, strong variability in runoff), and to enable use of high resolution satellite data. The period will cover 4 years, where the forcing is coming from a blend of in situ and radar/Landsat/other satellite data. The project can give recommendations on the parameterization of runoff scaling. As this project has regional hydrological aspects, it is also considered to be in ideal candidate for a collaborative project between GLASS and GHP to foster close working relationships. Once completed, the “white paper” will be circulated to GHP representatives for input on experimental design changes required for the GHP community, and is expected to occur this fall.

PALS and Benchmarking

The Beta-version of the Protocol for the Analysis of Land Surface (PALS) models (<http://pals.unsw.edu.au>) has been designed to analyse in a standard way uploaded single site model

simulations with Fluxnet observations. Extensions to other data sets and the development of benchmarking tests are under development. Synchronization with components of the Land Information System (e.g., the verification package, LVT) is being considered. The aim has been for the Fluxnet community to upload appropriate data to PALS, but to date there has been almost no uptake from the flux data community. Hence a semi-automated script has been written to process data directly from the Fluxnet.org website. However, there are issues with data duplication, gap filling, and quality control. Currently 15 sites have been successfully processed. The benchmarking activities are a second opportunity to link to the terrestrial carbon cycle modeling community that is also currently working towards a benchmarking system (the International Land Model Benchmarking project, ILAMB).

A related activity is that of a joint GEWEX Hydroclimatology Panel (GHP)-GLASS project to demonstrate benchmarking approaches using PALS that ultimately will be published in *GEWEX News*. This includes GHP providing CEOP-level data sets for use in PALS, and establishing empirical benchmarks in PALS from which to evaluate a suite of models.

Lastly, a Benchmarking Working Group has been established with GLASS Panel members and related activities that convene via bi-monthly telecons. Activities include PALS, ALMIP-2, GHP-integration project (see below), LIS LVT, and outreach towards the ILAMB project and the Carbon-Land Model Intercomparison Project (C-LAMP). In addition, a dedicated session on benchmarking will be hosted by GLASS Panel members at the American Meteorological Society's Annual Meeting in January 2012.

PILDAS

The Project for Intercomparison of Land Data Assimilation Schemes (PILDAS) is aimed at defining a land data assimilation framework that has known and desirable properties with respect to information gain, possibility to tune and apply the system, flexibility of data and models, etc. The experimental design is aimed at eventually assimilating the satellite soil moisture data [Soil Moisture Observing System (SMOS) and Soil Moisture Active Passive (SMAP)] mission, but will use model-generated synthetic data in the first phase. The experiment will address a multi-year period for a limited domain. It will be soil moisture instead of brightness temperature that is assimilated, to avoid too much focus on the retrieval algorithm. Currently a test phase of PILDAS is underway with NASA and MeteoFrance as partners. After successful testing, more groups will be invited. A poster will be presented at the WCRP Open Science Conference in Denver in October 2011.

New directions:

The aim of GLASS is to promote community activities that improve our best estimates and the model representation of state variables (e.g., soil moisture) and fluxes (e.g., evaporation), or to improve our understanding of land/atmosphere feedbacks and the role of land surface in predictability. To achieve these aims, GLASS has been re-structured into three elements: benchmarking, model data fusion (MDF), and land-atmosphere coupling (LAC). The concept of benchmarking (rather than validation) will enable the modeling community to identify the current strengths and weaknesses of our models in relation to their required applications. This is a complete shift of focus for the modeling community and will require careful definitions of the a priori metrics that a model needs to achieve.

The second strand of model data fusion will bring data assimilation techniques to both the initial value problem and to constrain the bounds of unknown parameters by using historical data sets. In the past, land data assimilation has been limited due to restrictions in observational data of the land components (e.g., soil moisture), but new satellite data enables an opportunity to explore more advanced data assimilation techniques.

The final strand of GLASS aims at understanding the physical interactions between the land and the atmosphere and how feedbacks can change the subsequent evolution. While the GLACE1 and GLACE2 projects have demonstrated regions of the globe and situations where the land can have a significant impact on atmospheric evolution, they also highlighted large differences between modeling systems. Hence GLASS will help to facilitate two aspects of land/atmosphere coupling, the first being to understand the physical processes whilst the second will strive to understand how both land and atmospheric parameterizations interact. The focus is at both the process/local level (LoCo) and the global behavior of the coupling (GLACE). This understanding will help to maximize the inherent predictability of the coupled land/atmosphere system.

Key results:

- Launch of the GSWP3 project in collaboration with the terrestrial carbon cycle modeling community
- Launch of the ALMIP2 project in collaboration with GHP
- Demonstration of the PALS benchmarking system in collaboration with GHP and for publication in *GEWEX News*
- Refinement of a white paper and completion of experimental design for the PILDAS experiment
- Identification of possible LoCo community experiments
- Design of a possible GLASS/GALBS project to study diurnal cycles, including both the stable boundary layer and land/atmosphere coupling in unstable conditions

Issues and recommendations:

- Identification of gaps in current GLASS activities (e.g., cold processes) should be a priority

Issues for attention by the SSG:

There has been little up-take of the PALS system by the Fluxnet community. This has led to the data being analyzed by the modeling community rather than the observational community that collected the data. This is far from ideal and means that the population of the PALS database is leading to data that are not precisely the versions that are on the Fluxnet.org website.

It has been difficult to identify representatives from GHP who would be willing to be involved in helping to design the ALMIP2 project. This has not held the project up, but could do so in the near future. The result of such delays may be that the project goes ahead without GHP involvement. Hopefully, the GHP-GLASS-PALS activity and article will provide an impetus for broader collaboration going forward.

Contributions to WCRP strategic themes:

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

- Identify feedbacks and the interactions among different processes, and build confidence in their replication in models (GLACE2, LoCo).
- Spin-up activities in *advanced diagnostics* through a joint pan-GEWEX effort/workshop (GRP, GLASS, GHP, and others).
- Develop metrics to aid benchmarking activities for both un-coupled and coupled modeling activities.
- With the current and expected increasing complexity of land models in terms of various hydrologic and vegetation treatments, model optimization (i.e., parameter estimation approaches) will continue to be relevant to GLASS efforts (through model data fusion).
- Investigate alternative representations of sub-grid processes in land surface schemes (heterogeneity).

- Develop improved understanding of climate variability and change on land surface properties, including soils, vegetation and hydrological processes, and an associated modeling capability (GSWP3).
- Investigate the scope for development of next generation land surface models with improved representation of subsurface hydrology, including groundwater processes; identify suitable areas for their evaluation.

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.

- Coordinate the construction of a global land reanalysis system, building on ongoing and preparatory activities in Landflux, GSWP3, GLDAS, and operational weather centers.
- Develop a framework and infrastructure for evaluation of land-atmosphere feedbacks. This should include the development of more quantitative estimates of uncertainty in the land condition and how this uncertainty propagates through to the atmosphere (e.g., PBL, convection, water and energy). This objective will be advanced in conjunction with the Processes Imperative in developing diagnostics.
- Organize coordinated intercomparison experiments for a range of model components in state of the art land models, especially with regard to: groundwater hydrology, surface water treatment (snow, river routing, lakes, irrigation, and dynamic wetlands), vegetation phenology and links between carbon and water, and Land Data Assimilation systems (follow-up the PILDAS initiative).
- Evaluation of these land model components will also have to be considered in their interactive (coupled) context with the PBL, while taking into account and developing more quantitative measures of uncertainty in the land parameters and states will enable more robust evaluation of data assimilation systems.

Summary:

GLASS activities and projects have transitioned well over the last year into the new framework (MDF, Benchmarking, LAC). This includes formation of working groups to organize and support projects that are at the early formation and launch stages (e.g., ALMIP2, GSWP3). Although a core component of LAC is winding down in GLACE2, the LoCo working group has expanded to include studies of local and global coupling, and the formality of a community-wide project will be discussed in the near term. GLASS has identified integration with GHP as a priority, and the activities described above should further this interaction. GLASS-GABLS and GLASS-Working Group on Numerical Experimentation (WGNE) collaboration will also be addressed in the near term. The adoption of new terms of reference for the Panel will improve the expectations of and for Panel members, bring young scientists into the fold, and allow the outside community better access to and understanding of the Panel operations.

List of meetings, workshops:

23-27 August 2010: GLASS Panel Meeting at Pan-GEWEX
 2 March 2011: GSWP3 sub-group meeting at WCRP Workshop on Drought Predictability and Prediction in a Changing Climate

Working group telecons:

LoCo: September, November, December 2010; January, July 2011
 Benchmarking: November, December 2010; January, February, April 2011

Planned meetings, workshops:

17-21 October 2011: WGNE annual meeting (GLASS presentation)
 23 October 2011: GLASS Panel Meeting at WCRP Open Science Conference
 7-10 November 2011: ECMWF/GABLS Workshop (proposal for GLASS-GABLS experiment)

List of key publications:

1. Koster, R.D., S.P.P. Mahanama, T.J. Yamada, Gianpaolo Balsamo, A.A. Berg, M. Boisserie, P.A. Dirmeyer, F.J. Doblas-Reyes, G. Drewitt, C.T. Gordon, Z. Guo, J.-H. Jeong, W.-S. Lee, Z. Li, L. Luo, S. Malyshev, W.J. Merryfield, S.I. Seneviratne, T. Stanelle, B.J.J.M. van den Hurk, F. Vitart, and E.F. Wood, 2011. The Second Phase of the Global Land-Atmosphere Coupling Experiment: Soil Moisture Contributions to Subseasonal Forecast Skill. *J. Hydrometeorol.*, in press.
2. Hurk, B.J.J.M. van den, F. Doblas-Reyes, G. Balsamo, R.D. Koster, S.I. Seneviratne en H. Camargo Jr, 2010. Soil moisture effects on seasonal temperature and precipitation forecast scores in Europe. *Clim. Dyn.*, doi:10.1007/s00382-010-0956-2.
3. Koster, R.D., S. Mahanama, T. Yamada, G. Balsamo, A.A. Berg, M. Boisserie, P. Dirmeyer, F. Doblas-Reyes, G. Drewitt, C.T. Gordon, Z. Guo, J.H. Jeong, D.M. Lawrence, W.-S. Lee, Z. Li, L. Luo, S. Maleyshev, W.J. Merryfield, S.I. Seneviratne, T. Stanelle, B.J.J.M. van den Hurk, F. Vitart, and E.F. Wood, 2010. Contribution of land surface initialization to subseasonal forecast skill: First results from a multi-model experiment. *Geophys. Res. Lett.*, 37, L02402, doi:10.1029/2009GL041677.
4. Grimmond C.S.B., M. Blackett, M. Best, J. Barlow, J.-J. Baik, S. Belcher, S.I. Bohnenstengel, I. Calmet, F. Chen, A. Dandou, K. Fortuniak, M.L. Gouvea, R. Hamdi, M. Hendry, H. Kondo, S. Krayenhoff, S.-H. Lee, T. Loridan, A. Martilli, S. Miao, K. Oleson, G. Pigeon, A. Porson, F. Salamanca, L. Shashua-Bar, G.-J. Steeneveld, M. Tombrou, J. Voogt, N. Zhang, 2010. The international urban energy balance models comparison project: First results from phase 1. *Applied Meteorology and Climatology*, 49, 1268-1292.
5. Grimmond, C.S.B., M. Blackett, M. Best, J.-J. Baik, S. Belcher, S.I. Bohnenstengel, I. Calmet, F. Chen, A. Dandou, K. Fortuniak, M. Gouvea, R. Hamdi, M. Hendry, H. Kondo, S. Krayenhoff, S.-H. Lee, T. Loridan, A. Martilli, V. Masson, S. Miao, K. Oleson, G. Pigeon, A. Porson, F. Salamanca, G.-J. Steeneveld, M. Tombrou, J. Voogt, N. Zhang, 2010. The International Urban Energy Balance Comparison Project: Recent Results and Major Findings. *International Journal of Climatology*, 31, 244-272.
6. Santanello, J.A., C. Peters-Lidard, S. Kumar, W.-K. Tao, and C. Alonge, 2009. A modeling and observational framework for diagnosing local land-atmosphere coupling on diurnal time scales. *J. Hydrometeorol.*, 10, 577-599.
7. Santanello, J.A., et al., C. Peters-Lidard, and S. Kumar, 2011. Diagnosing the Sensitivity of Local Land-Atmosphere Coupling via the Soil Moisture-Boundary Layer Interaction. *J. Hydrometeorol.*, in press.
8. Ferguson, C.R. and E.F. Wood, 2011. Observed land-atmosphere coupling from satellite remote sensing and re-analysis. *J. Hydrometeorol.*, Early Online, doi: 10.1175/2011JHM1380.1.
9. Findell, K.L., P. Gentine, B.R. Lintner, and Christopher Kerr, 2011. Probability of afternoon precipitation in eastern United States and Mexico enhanced by high evaporation. *Nature Geoscience*, 4(7), doi:10.1038/ngeo1174.

10. Dirmeyer, P.A., 2011. The terrestrial segment of soil moisture-climate coupling. *Geophys. Res. Lett.*, (in press), doi:10.1029/2011GL048268.

List of members and their term dates:

A core agenda item for the full GLASS Panel meeting in October is to discuss and set the Terms of Reference for membership. We have distributed a proposed TOR to the Panel members and GEWEX. Therefore, term dates (other than chairs) are TBD after that meeting.

Martin Best (Co-chair), Joe Santanello (Co-chair), Bart van den Hurk (Co-chair, stepped down 31 Dec 2010), Christa Peters-Lidard, Eleanor Blyth, Gianpaolo Balsamo, Matt Rodell, Michael Ek, Patricia de Rosney, Sonia Seneviratne, Aaron Boone, Gab Abramowitz, Hyungjun Kim, Rolf Reichle, Andy Pitman, Luis Bastidas, and Paul Houser

3.4 Global Atmospheric System Studies (GASS) Panel

Starting date: GCSS and GABLS combined at the end of 2010 to form GASS

URL: http://gewex.org/gass_panel.html

Chair(s) and term dates: Jon Petch (ends March 2014) and Steve Klein (ends March 2015)

Overview:

GEWEX's Global Atmospheric System Studies (GASS) Panel facilitates and supports the community that carries out and uses observations, process studies, and numerical model experiments with a focused goal of developing and improving the representation of the atmosphere in weather and climate models. It aims to address this primarily through the coordination of scientific projects, which bring together experts from around the world to contribute to the development of atmospheric models.

GASS primarily oversees intercomparison projects based on observational field campaigns or more idealized studies, which typically take from 2-5 years from initiation to completion with publication of the results. At any one time GASS may have around six or eight specific projects running.

GASS is managed by its Science Steering Committee (SSC). Each project will have a representative on the GASS SSC and typically at least one project lead who may not be a part of the SSC.

Members of the SSC:

Chris Bretherton, Ann Fridlind, Christian Jakob, Adrian Lock, Hugh Morrison, Robert Pincus, Pier Siebesma, Bjorn Stephens, Gunilla Svensson, Steve Woolnough. All members serve a term of up to 4 years. The SSC held its first teleconference in June 2011 and these will continue every two months.

Planned meetings, workshops:

GASS is planning a Pan-GASS Science Conference on 10-14 September 2012 in Boulder, Colorado, USA. The expected attendance is over 250 based on past conferences. All projects below will likely attend.

3.4.1 Atmospheric Boundary Layer Projects (previously under GABLS)

SSC sponsor: Gunilla Svensson

Project leads: Gunilla Svensson and Bert Holtslag

Accomplishments:

During 2011, the two model intercomparison cases based on a carefully selected period from the observations made at Cabauw, The Netherlands, have entered their final stages and papers are being written. The first draft on the GABLS3 single column model (SCM) intercomparison, lead by Fred Bosveld, KNMI, The Netherlands, was sent around early summer 2011 and the final paper is expected to be submitted by the end of that year. The case studies the model's performance for the low level jet (LLJ) development, morning and evening transitions, and surface-atmosphere coupling.

The large eddy simulation (LES) case is coordinated by Sukanta Basu at the North Carolina State University, USA, and is focusing on the morning transition and a shorter time period, nine hours of simulation time starting at midnight, from the SCM case selected. The project is coming along nicely, after some hiccups, and a new outline for the GABLS3-LES paper with a limited focus and updated figures has been formulated. The paper is expected to be submitted before the end of 2011.

The next activity is the workshop that GABLS is arranging together with ECMWF to be held at ECMWF's premises in November 2011. The title of the workshop is "ECMWF/GABLS Workshop on Diurnal Cycles and the Stable Atmospheric Boundary Layer" and is organized by the GABLS co-chairs together with Anton Beljaars, ECMWF. The workshop has gathered substantial interest and we expect about 60 participants, 25 of whom are invited speakers. By the end of the workshop, we expect to have defined directions for GABLS activities for the next few years.

The co-chairs have submitted a proposal entitled "Diurnal cycles of temperature and wind - Still a challenge for weather and climate models?" to the *Bulletin of the American Meteorological Society*. The proposal has been accepted and the paper will be submitted early 2012.

List of key publications:

1. Svensson, G., A.A.M. Holtslag, V. Kumar, T. Mauritsen, G.J. Steeneveld, W. M. Angevine, E. Bazile, A. Beljaars, E.I.F. de Bruijn, A. Cheng, L. Conangla, J. Cuxart, M. Ek, M. J. Falk, F. Freedman, H. Kitagawa, V.E. Larson, A. Lock, J. Mailhot, V. Masson, S. Park, J. Pleim, S. Söderberg, M. Zampieri and W. Weng, 2011. Evaluation of the diurnal cycle in the atmospheric boundary layer over land as represented by a variety of single column models – the second GABLS experiment. *Boundary-Layer Meteorology*, 140, 177-206.
2. Moene, A.F., P. Baas, F.C. Bosveld, S. Basu, 2011. LES model intercomparisons for the stable atmospheric boundary layer. *Quality and Reliability of Large-Eddy Simulations II*. Ercoftac Series 16, pp. 141-148. Dordrecht: Springer, Second Workshop on Quality and Reliability of Large-Eddy Simulations II, 2009-11-09/ 2009-09-11.
3. Baas, P., F.C. Bosveld, G. Lenderink, E. van Meijgaard, A.A.M. Holtslag, 2010. How to design single-column model experiments for comparison with observed nocturnal low-level jets. *Quarterly Journal of the Royal Meteorological Society*, 136 (648), pp. 671-684.
4. Kumar, V., G. Svensson, A.A.M. Holtslag, C. Meneveau, M.B. Parlange, 2010. Impact of Surface Flux Formulations and Geostrophic Forcing on Large-Eddy Simulations of Diurnal Atmospheric Boundary Layer Flow. *Journal of Applied Meteorology and Climatology*, 49 (7), pp. 1496-1516.

3.4.2 Polar Cloud Projects

SSC sponsor: Hugh Morrison

Project leads: Mikhail Ovchinnikov and Hugh Morrison

Accomplishments:

Completion of SHEBA intercomparison project for Arctic mixed-phase boundary layer clouds:

- Follow-up to previous MPACE intercomparison, but under different conditions
- Conducted jointly with the 2008 WMO Cloud Modeling Workshop
- Relatively simple case allowed for detailed investigation of model differences
- Focus on feedbacks between microphysics, radiation, and turbulence

Activities for next 1-2 years:

ISDAC intercomparison for Arctic boundary layer clouds (led by Mikhail Ovchinnikov):

- Follow-up to SHEBA intercomparison, to be conducted jointly with the 2012 Cloud Modeling Workshop
- Coordination with kinematic model tests using a fixed-flow field, which allows for isolation of differences in microphysics without complications due to feedbacks with dynamics

List of key publications:

1. Morrison, H., P. Zuidema, A.S. Ackerman, A. Avramov, G. de Boer, J. Fan, A.M. Fridlind, T. Hashino, J.Y. Harrington, Y. Luo, M. Ovchinnikov, and B. Shipway, 2011. Intercomparison of cloud model simulations of Arctic mixed-phase boundary layer clouds observed during SHEBA. *J. Adv. Mod. Earth Systems*, Vol. 3, M06003, 23 pp., doi:10.1029/2011MS000066.

Planned meetings, workshops:

23-27 July 2012: 2012 WMO Cloud Modeling Workshop in Warsaw, Poland will have a breakout session devoted to the ISDAC intercomparison case

3.4.3 Microphysics Projects

SSC sponsor: Hugh Morrison

Project leads: Ben Shipway and Adrian Hill

Accomplishments:

Release of 2D KiD model (<http://appconv.metoffice.com/microphysics>)

- Provides 1D or 2D kinematic cases
- Can be used in future stand alone intercomparison cases
- Can also be used in conjunction with intercomparisons from other projects (e.g. Polar cloud projects)
- Submission of paper to *Quarterly Journal of the Royal Meteorological Society*:
Shipway, B.J. and Hill, A.A, "Diagnosis of systematic differences between multiple parametrizations of warm rain microphysics using a kinematic framework."

Activities for next 1-2 years:

1. Warm rain microphysics kinematic intercomparison using the 2D-KiD:
 - Investigating the differences between models of differing complexity
 - Motivated in part by BL cloud RICO intercomparison
2. 2D kinematic tests in coordination with ISDAC comparison
 - Attempt to understand the sensitivities within microphysical parameterizations used in different models in a dynamically constrained framework

List of key publications:

1. Shipway, B.J. and A.A. Hill, 2011. Diagnosis of systematic differences between multiple parametrizations of warm rain microphysics using a kinematic framework. *Quarterly Journal of the Royal Meteorological Society*, submitted.
2. Bretherton, C., A. Fridlind, H. Morrison, and B. Shipway, 2010. GCSS workshop on microphysics and polar/precipitating clouds. *GEWEX News*, 20, no. 4, 17-19.
3. Shipway, B.J., and A.A. Hill, 2011. The Kinematic Driver model (KiD). *MetOffice Technical Report No. 549*.

Planned meetings, workshops:

23-27 July 2012: 2012 WMO Cloud Modeling Workshop in Warsaw, Poland will have a breakout session devoted to the ISDAC intercomparison case

3.4.4 Convective Systems Projects: TWP-ICE

SSC sponsors: Ann Fridlind and Jon Petch

Project leads: Ann Fridlind, Yanluan Lin, Ping Zhu, and Laura Davies

Accomplishments:

- First model intercomparison project to involve four model types [column radiation model (CRM), Limited area model (LAM), SCM, generalized additive model (GAM)] with multiple international modeling groups participating
- First use of ensemble forcing data in the SCM component

Activities for next 1-2 years:

- Guide remaining manuscripts through peer-review process
- Complete final archiving of model results (CRM, LAM)
- Two publications in preparation in addition to the six listed below

List of key publications:

1. Bretherton, C., A. Fridlind, H. Morrison, and B. Shipway, 2010. GCSS workshop on microphysics and polar/precipitating clouds. *GEWEX News*, 20, no. 4, 17-19.
2. Fridlind, A.M., A.S. Ackerman, J.-P. Chaboureaud, J. Fan, W.W. Grabowski, A. Hill, T.R. Jones, M.M. Khaiyer, G. Liu, P. Minnis, H. Morrison, L. Nguyen, S. Park, J.C. Petch, J.-P. Pinty, C. Schumacher, B. Shipway, A.C. Varble, X. Wu, S. Xie, and M. Zhang, 2011. A comparison of TWP-ICE observational data with cloud-resolving model results. *J. Geophys. Res.*, submitted.
3. Fridlind, A., A. Ackerman, J. Petch, P. Field, A. Hill, G. McFarquhar, S. Xie, and M. Zhang, 2010. ARM/GCSS/SPARC TWP-ICE CRM Intercomparison Study. *NASA-TM-2010-215858*. National Aeronautics and Space Administration.
4. Lin, Yanluan, L.J. Donner, J. Petch, P. Bechtold, J. Boyle, S.A. Klein, T. Komori, K. Wapler, M. Willett, X. Xie, M. Zhao, S. Xie, S.A. McFarlane, and C. Schumacher, 2011. TWP-ICE global

atmospheric model intercomparison: convection responsiveness and resolution impact. *J. Geophys. Res.*, submitted.

5. Varble, A., A. Fridlind, E. Zipser, A. Ackerman, J.-P. Chaboureau, J. Fan, A. Hill, S. McFarlane, J.-P. Pinty, and B. Shipway, 2011. Evaluation of cloud-resolving model intercomparison simulations using TWP-ICE observations. Precipitation and cloud structure. *J. Geophys. Res.*, 116, D12206, doi:10.1029/2010JD015180.
6. Zhu, P., J. Dudhia, P. Field, K. Wapler, A. Fridlind, A. Varble, E. Zipser, J. Petch, M. Chen, and Z. Zhu, 2011: A limited area model (LAM) intercomparison study of a TWP-ICE active monsoon mesoscale convective event. *J. Geophys. Res.*, submitted.

List of meetings, workshops held:

29 March 2011: Representatives of each intercomparison met for lunch at spring science team meeting of the US DOE ARM/ASR program

Planned meetings, workshops:

March 2012: Planned plenary talk containing all results at next spring science team meeting of the US DOE ARM/ASR program

3.4.5 Vertical Structure and Diabatic Processes of the MJO

SSC sponsors: Jon Petch and Steve Woolnough

Project leads: Jon Petch, Duane Waliser, Prince Xavier, Nick Klingaman, Xianan Jiang, and Steve Woolnough

Accomplishments:

- Early stages of a project bringing together GASS and the MJO-Task Force to study diabatic processes and physical tendency profiles
- Making use of YOTC data
- Three components designed and project specification complete

Activities for next 1-2 years:

- Carry out comparisons of short (48 hour), medium (20 day), and climate (20 year) integrations of operational weather and climate models
- Expand comparison to include process models and make use of the Dynamics of the Madden-Julian Oscillation (DYNAMO) field campaign

List of key publications:

1. Petch, Jon, Duane Waliser, Xianan Jiang, Prince Xavier, and Steve Woolnough, 2011. A Global Model Intercomparison of the Physical Processes Associated with the Madden-Julian Oscillation. *GEWEX News* 21, 3-5.

List of meetings, workshops held:

16-18 May 2011: Informal breakout at YOTC International Science Symposium in Beijing, China

Planned meetings, workshops:

19 March 2012: Proposed session around the “workshop on the physics of climate models” at Caltech in CA

3.4.6 Low Cloud Feedbacks under Climate Change (CGILS)

SSC sponsor: Adrian Lock

Project leads: Minghua Zhang, Chris Bretherton, and Peter Blossey

Accomplishments:

CGILS is a collaborative project with the Cloud Feedback Model Intercomparison Project (CFMIP) to investigate low cloud feedbacks under climate change, a major area of uncertainty in climate change modeling. The aims are to use LES both to improve understanding of the physical processes involved in cloud feedbacks under climate change, and as a benchmark for the credibility of SCMs to reproduce these. The challenge has been to keep the case sufficiently realistic that the SCMs exhibit similar behavior to their parent GCM while making it tractable for LES. Excellent progress has been made, with a series of cases now completed and being written up for publication. The goal of the collaboration, of bringing together climate scientists and cloud modellers, has been very successful in spawning new insights and understanding.

Activities for next 1-2 years:

Particularly through the collaboration with CFMIP and the European Union Cloud Intercomparison, Process Study, and Evaluation Project (EUCLIPSE), this initial study will be extended to include other climate change scenarios, sensitivity to the changes in the forcing in the perturbed climate, and sensitivity to SCMs.

List of key publications:

1. Lock, A.P., 2011. GCSS/CFMIP/EUCLIPSE Meeting on Cloud Processes and Climate Feedbacks. *GEWEX News*, August 2011.
2. Zhang et al., 2010. GCSS Teams with CFMIP to Understand the Physical Mechanisms of Low Cloud Feedbacks in Climate Models. *GEWEX News*, May 2010.

List of meetings, workshops held:

June 2011: Joint meeting with CFMIP and EUCLIPSE including further discussions on the Transition and CGILS cases at Met Office, Exeter, UK
Sept 2010: Joint workshop with EUCLIPSE on the Transition and CGILS cases at KNMI, de Bilt, The Netherlands
March 2010: Focused CGILS Workshop at Stony Brook University, NY
June 2009: Joint meeting with CFMIP: first results from CGILS cases at UBC Vancouver, Canada

3.4.7 Stratocumulus to Cumulus Transitions

SSC sponsor: Adrian Lock

Project leads: Stephan de Roode, Irina Sandu, and Roel Neggers

Accomplishments:

This project studies the stratocumulus to trade cumulus transition, one that is of climatological importance for understanding low cloud cover variations in the marine subtropics. There are two parallel LES intercomparisons as well as SCM intercomparisons. These intercomparisons are being run in collaboration with EUCLIPSE, a European project. In combination, these cases challenge models to produce both a realistic transition compared to detailed in situ data and also a realistic sensitivity of the speed of transition to changes in environmental forcing. Results so far suggest that the LES does a good job of capturing these details, although requiring very high (5m) vertical resolution. One of the motivations for this intercomparison was that these transitions would present a particular challenge for SCMs, many of which would need to make the transition between different parameterizations of vertical mixing. Although many SCMs do indeed struggle to generate realistic transitions, it is encouraging that those organizations that have worked hard to develop these aspects of physical parameterizations (invariably using previous GCSS intercomparison cases) can do a much better job. Papers are in preparation describing these studies in much more detail.

List of key publications:

1. Lock, A.P., 2011. GCSS/CFMIP/EUCLIPSE Meeting on Cloud Processes and Climate Feedbacks. *GEWEX News*, August 2011.

List of meetings, workshops held:

- | | |
|------------|---|
| June 2011: | Joint meeting with CFMIP and EUCLIPSE including further discussions on the Transition and CGILS cases at the Met Office, Exeter, UK |
| Sept 2010: | Joint workshop with EUCLIPSE on the Transition and CGILS cases at KNMI, de Bilt, The Netherlands |

3.4.8 Grey-Zone Project

SSC sponsor: Pier Siebesma

Accomplishments:

Currently in its very early stages, this project works in collaboration with WGNE to evaluate convection permitting models (1-8km) modeling moderate or even shallow convection. Project leads and appropriate case studies are being scoped.

24TH GEWEX SCIENTIFIC STEERING GROUP (SSG) MEETING
ROME, ITALY • 14-18 NOVEMBER 2011

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AGENDA for SSG-24

24th Session of the Scientific Steering Group (SSG) of the Global Energy and Water Cycle Experiment (GEWEX)

Location: Dipartimento terra e Ambiente, Consiglio Nazionale delle Ricerche, Rome, Italy

11/14/11 8:00 AM to 11/18/11 12:00 PM

Monday Day 01 Plenary Session: 11/14/11 (8:30 AM – 6:00 PM)

Location: Room Pentagonal (Plenary) 2nd Floor

8:30 AM – 8:35 AM	Welcoming Remarks by Consiglio Nazionale delle Ricerche	Dr Enrico Brugnoli/Dr Maurizio Pettine	[5']
8:35 AM – 8:40 AM	Welcome by Local Arrangements Committee and Introductions	Gianni Tartari	[5']
8:40 AM – 8:45 AM	Welcome from Chair GEWEX SSG	Kevin Trenberth	[5']
8:45 AM – 8:50 AM	Introductions	All	[5']
8:50 AM – 9:35 AM	Chairman's Report	Kevin Trenberth	[35' + 10']
9:35 AM – 9:50 AM	Update on WCRP Activities and JPS	Valery Detemmerman	[10' + 5']
9:50 AM – 10:15 AM	Update on the International GEWEX Project Office	Peter van Oevelen	[25']
10:15 AM – 10:45 AM	BREAK		[30']
10:45 AM – 11:15 AM	CLIVAR Presentation	Martin Visbeck	[25' + 5']
11:15 AM – 11:45 AM	CLIVAR-GEWEX Interaction	Kevin Trenberth/Martin Visbeck	[30']
11:45 AM – 1:15 PM	LUNCH		[90']
1:15 PM – 2:00 PM	Outstanding Actions and Status	Peter van Oevelen	[35' + 10']
2:00 PM – 2:20 PM	GWSP and GEO Water Activities	Rick Lawford	[15' + 5']
2:20 PM – 3:30 PM	WCRP Grand Challenges	Kevin Trenberth	[70']
3:30 PM – 4:00 PM		BREAK	[30']
4:00 PM – 4:35 PM	SKYPE: Report from JSC	Tony Busalacchi	[25' + 10']
4:35 PM – 5:25 PM	Monsoons and Monsoon Panels	Kevin Trenberth/Martin Visbeck/tbd	[50']
5:25 PM – 6:15 PM	Extremes	Ron Stewart/Valery Detemmerman/Olga Zolina	[50']
6:15 PM – 6:30 PM	Outcomes OSC and ECS Entrainment	Peter van Oevelen	[15']

Tuesday Day 02 Plenary Session I: 11/15/11 (8:30 AM – 6:00 PM)

Location: Room Pentagonal (Plenary) 2nd Floor

In the panel reports on this day, the presenters are requested to focus not so much on the science and progress (which is scheduled for Thursday), but the outcomes of any meetings, deliberations, organizational issues and interactions among panels and with other parts of WCRP.

8:30 AM – 9:00 AM	SSG Only: Membership Issues New WCRP Working Groups and Councils	Howard Wheeler	[30']
9:00 AM – 10:30 AM	GEWEX Radiation Panel (GRP): Overview and Issues	Chris Kummerow	[90']

10:30 AM – 11:00 AM	BREAK		[30']
11:00 AM – 11:30 AM	GEWEX Land Atmosphere System Studies (GLASS): Overview and Issues	Martin Best	[30']
11:30 AM – 11:50 AM	Belmont Forum Outcome	Eleanor Blythe	[20']
11:50 AM – 1:20 PM	LUNCH		[90']
1:20 PM – 1:40 PM	ESA	Michael Rast	[20']
1:40 PM – 2:00 PM	JAXA	Keiji Imaoka	[20']
2:00 PM – 3:00 PM	GEWEX Atmospheric System Studies (GASS): Overview and Issues	Jon Petch	[60']
3:00 PM – 3:15 PM	CORDEX	Paolo Rutti	[15']
3:15 PM – 3:45 PM	BREAK		[30']
3:45 PM – 4:15 PM	Future of GEWEX within WCRP	Kevin Trenberth <i>Ghassem Asrar to join via Skype</i>	[30']

Tuesday Day 02 Break Out Sessions: 11/15/11 (4:15 PM – 6:00 PM)

Location: Room Pentagonal (Plenary) 2nd Floor and Silvestri

There are two groups who are charged with putting on the table possible science questions or themes that satisfy the criteria listed in the attachment. That is, they provide a way to help us organize around topics of interest that extend well across many individuals, within GEWEX and between GEWEX and other parts of WCRP. In the initial breakout sessions, the objectives are to compile and evaluate topics and the groups are loosely aligned with land-atmosphere (chaired by Howard Wheeler) vs. atmosphere-land-climate system (chaired by Ron Stewart). In the second set of breakout groups, the mix will be quite different and more effort will be devoted to fleshing them out, evaluating them, and prioritizing them. Ideally from this process we will have a succinct set of questions that can be added to the Imperatives document.

Develop Questions that 1) be added to the imperatives document and 2) provide actionable ways of integrating the project and WCRP

4:15 PM – 6:00 PM	Break Out Session: Grand Questions	Howard Wheeler/Ron Stewart	[105']
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Wednesday Day 03 Morning Plenary Session: 11/16/11 (8:30 AM – 10:00 AM)

Location: Room Pentagonal (Plenary) 2nd Floor

8:30 AM – 10:00 AM	GEWEX Hydroclimatology Panel (GHP): Overview and Issues	Dennis Lettenmaier	[90']
10:00 AM – 10:15 AM	WGNE (via Skype)	Christian Jakob	[15']
10:15 AM – 10:45 AM	BREAK		[30']
10:45 AM – 10:50 AM	Host Presentations	Gianni Tartari	[5']
10:50 AM – 11:20 AM	Impacts of Global Changes on Water Resources: Southern Europe Situations	Michele Vurro	[30']
11:20 AM – 11:50 AM	Observations and modeling of the hydrological cycle at CNR-ISAC	Vincenzo Levizani	[30']
11:50 AM – 12:20 PM	Share Water Project: An Integrated Approach for Studying the Impact of Climate Change on High Mountains	Franco Salerno	[30']

Wednesday Day 03 Afternoon Excursion and Dinner: 11/16/11 (1:30 PM – 10:00 PM)

1:30 PM – 10:00 PM	Excursion and Dinner		[510']
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Thursday Day 04 Plenary Session I: 11/17/11 (8:30 AM – 2:00 PM)

Location: Room Pentagonal (Plenary) 2nd Floor

8:30 AM – 9:25 AM	GRP Science	Chris Kummerow	[55']
9:25 AM – 10:20 AM	GHP Science	Dennis Lettenmaier	[55']
10:20 AM – 10:50 AM	BREAK		[30']
10:50 AM – 11:30 AM	GLASS Science	Martin Best	[40']
11:30 AM – 11:45 AM	iLEAPS Overview	Eleanor Blythe	[15']
11:45 AM – 1:15 PM	LUNCH		[90']
1:15 PM – 2:00 PM	GASS Science	Jon Petch	[45']
2:00 PM – 2:30 PM	SPARC	Johannes Staehelin	[30']
2:30 PM – 3:00 PM	Synthesis Discussion and Presentations Break Outs	Kevin Trenberth	[30']

Thursday Day 04 Break Out Sessions: 11/17/11 (3:00 PM – 6:00 PM)

Location: Room Pentagonal (Plenary) 2nd Floor and Silvestri

3:00 PM – 3:30 PM	BREAK		[30']
3:30 PM – 6:00 PM	Break Out Session 2A: Follow on Grand Questions		[150']

Friday Day 05: 11/18/11 (8:30 AM – 12:00 PM)

Location: Room Pentagonal (Plenary) 2nd Floor

8:30 AM – 9:00 AM	Synthesis Discussion and Presentations Break Outs 2	Kevin Trenberth	[30']
9:00 AM – 9:25 AM	Rapporteurs Report on GRP	Peter Bauer, Chia Chou, Olga Zolina	[15' + 10']
9:25 AM – 9:50 AM	Rapporteurs Report on GHP	Amadou Gaye, Ron Stewart	[15' + 10']
9:50 AM – 10:10 AM	Rapporteurs Report on GLASS	Eleanor Blythe, Li Sin	[10' + 10']
10:10 AM – 10:30 AM	Rapporteurs Report on GASS	Minghua Zhang, Paolo Ruti	[10' + 10']
10:30 AM – 11:00 AM	New Break		[30']
11:00 AM – 11:50 AM	Review of SSG Recommendations and Actions	Peter van Oevelen/Dawn Erlich	[50']
11:50 AM – 12:05 PM	NEXT SSG Meeting and GEWEX Conference	Peter van Oevelen	[15']
12:05 PM – 12:30 PM	WRAP UP	Kevin Trenberth/Howard Wheater	[25']