

GEWEX Radiation Panel (GRP)

Reporting Period: January 2010 – September 2011

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

Chair: Christian Kummerow (2008-2011)

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. Once completed, 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 the GRP/GDAP panel 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 their 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 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 SSM/I intercalibrated brightness temperatures. It is hoped that the analysis of these brightness temperature data sets can shed light into 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 we have learned about conducting assessments.

Tianjun Zhou of LASG/IAP/CAS in Beijing, China, joined the panel in 2011. His expertise in modelling 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 timeframe
- 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. As a panel, 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 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 which is being considered deals with the feasibility of assessing satellite simulators that are currently being used in 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 modelling 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. $10W/m^2$) 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. Frascati, Italy
- 08-09 April 2011. LandFlux Assessment meeting, Vienna, Austria
- 30 Aug - 1 Sept 2011. GEWEX Radiation Panel meeting. 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 (Paris –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 – present
Tianjun Zhou	2011 – present

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