The derivation of TOA fluxes enables the computation of the 24-year mean TOA implied energy transport as shown in the figure on page 11. The implied energy transport uses the long-term zonally averaged TOA SW net and LW net fluxes, and contrasts that transport to that implied by ERBE and ISCCP-FD. The largest difference is about 0.5 x 10^{15} W at the latitude of maximum implied transport (30°N), which shows improved agreement relative to the results of Zhang et al. (2007).

Since GEOS-4 ended in December 2007, extension of this data set will require a new source of meteorological profile information. However, ISCCP plans a complete reprocessing in the coming year and thus the SRB data set will also be reprocessed in its entirety with improved algorithms and new meteorological data as the new ISCCP data become available. Reducing the impacts of changes to the input data streams from changing satellite instrumentation and calibration is one the most important objectives of the planned reprocessing. Information about the data set is available at: *http://gewex-srb.larc.nasa.gov.* The data are available at: *http://eosweb.larc.nasa.gov/PRODOCS/srb/table_srb.html*.

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GEWEX Panel Meeting Reports

The GEWEX Panels held individual and joint meetings at the 2nd Pan-GEWEX Science Meeting in Seattle, Washington from 23–27 August 2010. Individual reports from these Panel meetings begin below and continue through page 19. Presentations made during the meetings are available at: *http://www.gewex.org/2010pangewex/Agenda_Pan-GEWEX.pdf.*

GEWEX Radiation Panel Meeting

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Background
The GEWEX Radiation Panel (GRP) was born of a need to understand the short- and longwave energy balance of the Earth System, requiring expertise in satellite and in situ observing systems. Soon after its formation, GRP began developing data sets of global water and energy variables, including surface radiation (Surface Radiation Budget Project, SRB), clouds (International Satellite Cloud Climatology Project, ISCCP), and precipitation (Global Precipitation Climatology Project, GPCP). Later, these were further expanded to complete the flux and forcing terms, including turbulent fluxes (SeaFlux and LandFlux) and aerosols (the Global Aerosol Climatology Project, GACP). These products represent the legacy of GRP.

GRP is conducting an assessment of the state of the water and energy budgets based upon its radiation products, which is intended to document the state of our observing system, and is meant to be the first in a periodic re-evaluation of the state of the water and energy observing system. It will also 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 elements of the budget.

Success in this objective allows GRP to expand its scope to certain related areas:

- *Product assessments.* GRP has led a number of assessment activities related to its own products but stands ready to help with future assessments of products related to the water and energy budgets—whether it be its own products or those generated under different auspices.

- *Regional water and energy budget closures through collaboration with the Regional Hydroclimate Projects (RHPs).* These basins are of sufficient size to allow validation of global products and for GRP products to begin serving regional model validation. This collaboration has not been very successful to date as GRP's focus has remained global, but with some stewardship it should produce results quickly.

- *Development of new radiative transfer codes to model and understand forcings in the climate system.* This effort includes an assessment of new potential satellite and in situ observing systems that would help close budgets.

- *Diagnostic and process studies.* The global data products produced under GRP auspices lend themselves to verify not only model output, but also model processes. Successful examples include the ISCCP simulator that allows models to compare their cloud fields directly to ISCCP and thus verify if the right clouds are being produced. Similar simulators have been/are being created for CloudSat and the Tropical Rainfall Measuring Mission. Precipitation databases also let models verify if partitions between cloud- and rainwater correspond to observations. Optimizing these interactions with the climate and cloud scale modeling groups within GEWEX is ongoing.

The GRP meeting focused on reviewing progress in its objectives and individual panel activities, as well as the integrating function led by the Working Group on Data Management and Analysis (WGDMA) to bring the global products into a unified framework to address the current assessment of the global water and energy cycle state. Four new GRP members were welcomed: (1) Prof. Hirohiko Masunaga from the University of Nagoya, with expertise in the areas of clouds, aerosols and precipitation; (2) Dr. Carlos Jimenez, from the Laboratoire d'Etude du Rayonnement et de la Matière en Astrophysique (LERMA), with expertise in land turbulent fluxes (he has also been active in LandFlux assessment activities); (3) Dr. Mark Ringer from the UK Met Office, who will help guide diagnostic activities; and (4) Dr. Enio Pereira from the National Institute for Space Research (INPE), who has expertise in surface radiation measurements.

The first presentation, on the National Climatic Data Center (NCDC), was given by Dr. Kummerow, the GRP Chair, on behalf of Dr. John Bates, and covered: (1) the transition of ISCCP data from a research product to an operational production stream at NCDC; (2) the status of the previous year's request by GRP to NCDC to study the Clouds and the Earth's Radiant Energy System (CERES) FM6 calibration issue; and (3) the recently completed Earth Radiation Budget (ERB) Requirements Workshop. The transition of ISCCP data to an operational product is going smoothly with enough current and planned scientific involvement to ensure long-term care of the product. Calibration changes sought by the CERES team were prioritized for implementation based upon availability of funds, with the highest priority being the changing of the Longwave Window Filter, followed by changes in the Mirror Attenuator Mosaic. Presentations made at the ERB Workshop showed that radiation budget measurements are made by a large number of international agencies and that their coordination is paramount if they are to be optimized.

Dr. Robert Adler reported that Version 2.1 of GPCP data uses a more sophisticated gauge analysis over land and that improvements are particularly noticeable in regions dominated by orographic rain. Uncertainty estimates based upon differences among mature rainfall products have also been added and climate rainfall trends can be obtained from the 30-year record. When volcano and El Niño Southern Oscillation signals are removed, precipitation trends are shown to be 0.0154 mm/day (0.6%) per decade. Preparation of Version 3 is on track to be released in 2011 and will use a new microwave algorithm that produces higher temporal and spatial resolution products. The Global Precipitation Climatology Centre reported that it is producing valuable products and that the breadth of its gauge data record continues to increase.

During the new panel member presentations, Prof. Masunaga presented his science interests, including satellite observations of tropical convection and the large-scale environment. Dr. Jimenez showed his work on model intercomparison studies and observational products comprising land-surface temperature, emissivity, and turbulent fluxes.

Prof. Carol Anne Clayson reported on the 5th SeaFlux Workshop, which was held jointly with the Climate Variability and Predictability Project (CLIVAR) Working Group on High Latitude Surface Fluxes. The Workshop demonstrated the need for improved measurements of near-surface properties in high latitudes where many of the existing flux estimates still diverge. The SeaFlux product itself is being evaluated and appears robust against in situ measurements. All models seem to have large unrealistic latent heat trends, while some of the observationally based trends seem to be correlated to ocean swell with drifts in the Special Sensor Microwave Imager (SSM/I) brightness temperatures through the time series from F08 through F15. Version 2.0 of the SeaFlux product will use a homogeneous time series of SSM/I Tb from Remote Sensing Systems.

Prof. Mathew McCabe reported that there are now at least 12 different candidate global products for the LandFlux data set. While papers are being written about the similarities and differences among these, the main goal of these intercomparisons is to determine the range of uncertainty between them. It is premature to attempt to quantify the absolute accuracy of any of the products or to make claims about the superiority of one over another.

Dr. Paul Stackhouse presented the status of the Baseline Surface Radiation Network (BSRN) for Ellsworth Dutton, and reviewed the SRB Project and Radiative Flux Assessment activities. BSRN has grown to 58 participating sites in 23 countries, with new sites at the Marcos and Cocos Islands, which are very small islands representative of oceanic conditions. Significant progress continues in pyrheliometer instrument comparisons, and in the archive of BSRN data at the Alfred Wegener Institute. Twenty-four years of SRB data are now available (see article on page 10) and are being validated against BSRN and newly processed CERES measurements. The next reprocessing is scheduled to begin in June 2011, following significant improvements in the input data and radiative transfer codes, as well as new ISCCP products. The Radiative Flux Assessment report will be available in 2011 and is intended to be a useful reference for the development of future climate system observation requirements for radiative fluxes and for understanding current data limitations.

Prof. William Rossow reported on ISCCP and WGDMA. ISCCP cloud products are available through June 2008 and include cloud radiances (B3 and B1U), DX cloud products at 25 km and 3-hourly resolution, D1/D2 cloud products (280 km, 3hr/monthly), radiative flux products, cloud particle seizes, Lagrangian tracking of mesoscale systems, mid-latitude cycle tracking, and weather states. Current calibration activities include radiance, both in absolute terms as well as calibration transfer schemes between satellites. Product improvements include better polar cloud detection schemes, more realistic surface emissivity for improved surface skin temperatures, and better ice treatment (phase function characterization) in the visible spectrum. Preparations are underway for the reprocessing in 2011 to a new 10 km, 3-hourly global product.

WGDMA coordinates the ancillary data used by the various GEWEX products and only if these are common does it makes sense to integrate the distinct products to produce a unified water and energy budget from these observations. Common ancillary products include a land/water mask with topography, ozone, snow/ice, surface albedo, surface emissivity, surface temperature (over land and ocean), aerosols and atmospheric temperature, and humidity. The latter is deemed the most important for GEWEX products. WGDMA is currently testing the new High Resolution Infrared Radiation Sounder (HIRS) product. Plans were reviewed for reprocessing GEWEX products, which is scheduled to begin in mid-2011. Assessments of Climate Data Records are critical for understanding product strengths and weaknesses, residual uncertainties, and relative differences among parallel climate products. A workshop is planned to elucidate "best practices" in the assessment area and will be hosted by the European Space Agency (ESA) Centre for Earth Observation (ESRIN) in April 2011 in Frascati, Italy.

As reported by Dr. Stefan Kinne, the Cloud Assessment Working Group is assembling all major multi-year data sets of cloud climatologies to produce a concise summary of individual sensor capabilities and their limitations. The assessment will go beyond cloud cover fractions to include cloud optical depth and microphysical properties. An interim result shows that total cloud cover is very sensitive to the instrument being used —ranging from approximately 75% for Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) to 65% for ISCCP. The draft assessment will be completed in 2010 and a summary paper is planned for the *Bulletin of the American Meteorological Society* in 2011.

An update on the aerosol assessment activity was presented by Dr. Paul Stackhouse on behalf of Prof. Sundar Christopher and Dr. Jeffrey Reid. The U.S. National Aeronautics and Space Administration (NASA) established a GEWEX Aerosol Project to examine the most common global aerosol products: Advanced Very High Resolution Radiometer [AVHRR (GACP and NOAA)]; Multi-angle Imaging SpectroRadiometer (MISR), Moderate Resolution Imaging Spectroradiometer [MODIS (Standard and Deep Blue)], Ozone Monitoring Instrument (OMI), and Polarization and Directionality of the Earth's Reflectances (POLDER). The first phase of the Project consists of a comprehensive literature review and evaluation. Deliverables will include a report on the state of the science, the application of satellite aerosol data, the identification of shortcomings, and broad recommendations to the field for future development and verification needs. Early findings show that there is no shortage of validation studies; however, these tend to be direct regression based over limited time periods and/or locations. Hence, they tend to be of limited utility. Even well designed third party studies are generally not utilized or cited by the production teams. While there are many cases of satellite calibration/validation components to field missions, analyses are usually not repeated for new product versions. Over ocean there tends to be remarkable consistency both in aerosol optical depth and in correlated bias across sensors, and over land there are strong regional and temporally correlated biases across both algorithms and sensors.

GEWEX Radiation Panel

Global Data Sets of Water and Energy Variables
- Clouds (ISCCP)
- Precipitation (GPCP)
- Surface radiation (SRB)
- Turbulent fluxes (SeaFlux and LandFlux)
- Aerosols (GACP)

Assessments of Global Climate Records

Collaboration with the Regional Hydroclimate Projects (RHPs) on regional WEBS

Development of new radiative transfer codes to model and understand forcings in the climate system

Diagnostic and process studies

The GEWEX Water Vapor Assessment is a new activity intended to address the need for a global time series of temperature and humidity profiles for water vapor transport estimates, for use within the derivation of long-term (i.e., 30 years) cloud properties, as well as surface radiation flux data sets and components of the radiation budget climatology. To that end, GRP is organizing an assessment workshop to be held at the ESA/ESRIN in Frascati, Italy on 8–10 March 2011 to review the existing data sets for total column water vapor and water vapor profiles, including an analysis of their appropriateness for long-term climate applications needed by GEWEX.

In a discussion session focused on short-term goals, it was unanimously agreed that the largest single priority for GRP is to finish the individual product improvements and begin reprocessing all the products with a unified set of ancillary data sets. This integrated product forms the heart of GRP's effort to contribute to the understanding of the current observed state of the water and energy budget together with an uncertainty related to our current inability to fully close the water and energy budgets based upon observations alone.

GRP met with the GEWEX Modeling Panel during the 2nd Pan-GEWEX Meeting, to explore issues of joint interest, including the need to foster advanced diagnostic studies. A joint workshop was proposed to explore how to extract relevant information on the water and energy budget from advanced diagnostics of observations and model results. This would include information on: (i) the interaction between the components of the climate system (e.g., studies exploring local coupling between surface and atmosphere require variables that are integrated somewhere in the Planetary Boundary Layer (PBL) but are sensitive to both surface and atmospheric states and processes), (ii) the conditional skill of models (compositing of cloud data is needed to distinguish between various types of clouds), (iii) the causes of variability (lagged correlations are fairly simple but do not necessarily reveal causal relationships); (iv) techniques like Lagrangian tracking in space or time, or advanced neural networks, give more insights on best estimates of the state of the system (data assimilation increments reveal a lot of information on inherent drifts in data or models). Aside from exploring advanced diagnostics, the workshop would also explore establishing a Working Group on Advanced Diagnostics composed of experts who are not involved with the generation of data sets or model data, but who use both.

Following the joint session with the GEWEX Modeling Panel, GRP met to discuss progress in the Cloud/Aerosol and Precipitation area. Prof. Sue van den Heever led the discussion. She posed a number of broad questions that a combination of global and in situ observations should address, such as: (i) are aerosol responses different under different environments? (ii) what is the relative role of aerosol indirect forcing versus environment? (iii) do precipitation responses to aerosol indirect forcing differ based on storm type? (iv) does the precipitation response to aerosol indirect forcing vary based on when in the storm life cycle it is examined? (v) are raindrops larger, smaller, or the same size in polluted conditions compared with clean conditions? and (vi) is there a dynamic response to aerosol indirect forcing? The discussion focused on examining each of the questions from a GRP and U.S. Department of Energy Atmospheric Radiation Measurement (ARM) Climate Research Facility data perspective to see what data sets could be developed that begin to directly address the above questions.

Jim Mather then gave an update on ARM that included an overview of significant improvements made to the ARM radar facilities that will allow better validation of cloud and precipitation products. The update was received as very positive but some members expressed hope that the high quality data that ARM is known for would not suffer as a result of the greatly expanded observing capabilities.

Dr. Axel Schweigert gave a presentation that summarized some of the GRP priorities in the polar regions. Cloud detection in polar regions is still an issue and he showed examples of cloud amount differences between MODIS and CALIPSO that were clearly dependent on sea-ice concentration. Precipitation in the polar regions, while small, is still important for ice growth and fresh water budgets. In situ observations are few but there are former Soviet ice drifting stations that could be exploited. With regard to turbulent fluxes, he reiterated the need for more open ocean observations at high latitudes.

GRP also met with the GEWEX Hydroclimatology Panel. Both Panels agreed upon using the RHPs as a way of evaluating the global products at the proper regional scales while helping put the regional efforts of the RHPs into the global context afforded by GRP's data sets. The next step in this synthesis will be the selection of the appropriate RHPs for conducting these comparisons. It was felt that the integrated GRP data set should be produced first to get a good estimate of the closure, or lack thereof, in various basins around the world. Dr. Mitch Goldberg gave a presentation on the Committee on Earth Observation Satellites (CEOS) activities related to Environmental Climate Variables in order to ensure that all the products discussed remain consistent with CEOS expectations.

The meeting ended with a discussion of its role in the future of GEWEX and the assignments related to elucidating the GEWEX Imperatives in the next 5–10 years. The outcome of this discussion is embedded in the broader GEWEX plan and Imperatives being prepared by the GEWEX Scientific Steering Group. The next GRP meeting will be hosted by Prof. Masunaga in Tokyo, Japan from 29 August–1 September 2011.

GLASS Panel Meeting

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The Global Land/Atmosphere System Study (GLASS), which had been a project within the former GEWEX Modeling and Prediction Panel, is now a separate panel under GEWEX modeling activities. Bart van den Hurk will step down as Chair in January 2011 and Martin Best of the Joint Centre for Hydro-Meteorological Research at the UK Met Office will continue to co-chair. Joseph Santanello of the Hydrospheric and Biospheric Sciences Laboratory of the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center in Maryland, will also serve as Co-Chair. Gerrit de Rooij, Deputy Head of the Soil Physics Department at the Helmholtz Centre for Environmental Research in Germany and Hyungjun Kim of the University of Tokyo in Japan, were introduced as new Panel members.

Plans for new studies were discussed and included cross-cutting activities with the GEWEX Radiation Panel (GRP) and the GEWEX Hydroclimatology Panel (GHP, formerly CEOP). In light of the Pan-GEWEX Meeting discussions on GEWEX Imperatives, the following mission statement was formulated: *GLASS will support improved estimates and representations of land states and fluxes in models, and the interactions with the overlying atmosphere to maximize the utilized fraction of inherent predictability*. The GEWEX Scientific Steering Group (SSG) recommended that GLASS explicitly promote model development and use of observations, including diagnostics of land-atmosphere interactions based on observations. In addition, the SSG is encouraging GLASS to host a future intercomparison experiment aimed at a new generation of land-surface models with a strongly developed hydrological component.