GRP Report

Panel Report to the 2010 GEWEX SSG Meeting

Full Name (Acronym): GEWEX Radiation Panel (GRP)

Reporting Period: 2009

URL: http://www.gewex.org/projects-GRP.htm and
http://rain.atmos.colostate.edu/GRP/index.html

Chair: Christian Kummerow (2007–2010)

Rapporteurs: Kevin Trenberth and Olga Zolina

General vision:
GRP provides a profound contribution to our understanding of surface exchange processes and their role in climate system. In this respect GRP goes far beyond its initial mandate overlooking also not only radiative but other fluxes. GRP has made very good progress over the past year.

The plans for an integrated reprocessing of a number of satellite data sets related to water and energy are very promising. This product will contain water variables in the form of water vapor, clouds and precipitation, short and long wave radiation at the top of the atmosphere as well as the surface will be provided, as will surface turbulent (latent and sensible) fluxes. The integrated data, planned for 50 km and 3-6 hr intervals will be the first data sets that tries to close budgets at regional scales and should be useful for process studies. At the same time it is important to be cognizant of the shortcomings, such as with aerosols, and how to bring those considerations into providing error bars (uncertainties). SRB and other products involve extensive use of models and are not a pure observational product. Also reprocessing, although undoubtedly producing major advances, should be regarded as not just a one off deal, but should be planned for repeats to address problems that will occur and new knowledge.

The parallel developments in ESA on reprocessing and EUMETSAT and other operational agencies on SCOPE-CM is a strong sign that climate issues are being increasingly recognized in agencies, including operational agencies, and are welcomed and very promising. Operationalizing ISCCP in NOAA is a related step and it is hoped that NASA, NOAA and JAXA are also fully on board with SCOPE-CM. SCOPE-CM has challenges on how to expand to other variables. As more products become quasi-operational, the role of GRP may evolve to provide advice and oversight as the products are exploited.

GRP should be cognizant that their products are not the only ones and should continue to promote assessments and evaluations of the different products, their differences and how they

can improve. Having a common WGDM and advisory panels for GRP and SCOPE-CM makes sense: is that GRP?

Closure of the water and energy budgets provide constraints globally. The radiative estimates of latent heat evaporative fluxes as a residual are at odds with both direct estimates of precipitation and most estimates of evaporation (perhaps excepting HOAPS)? This is the kind of major issue that should be a primary focus for GRP.

ISCCP and SRB. ISCCP is one of the most recognized and useful for climate researchers radiative product with near-time high resolution global radiation fluxes covering the period from 1983 onwards. Importantly, these products are extensively used in the hybrid or blending air-sea flux climatologies, like OI-WHOI flux and to some extent in CORE forcing products. There is a need for continuous validation of these products against in-situ (buoys – TAO, RAMA, PIRATA, OCEANSITES, ship measurements) and their intercomparison with the alternative radiative products, like MODIS with its 67 spectral bands, and Patmos.

ISCCP data sets became the basis for validation of reanalyses radiative fluxes and they helped to identify large tropical biases in surface SW radiation in reanalyses. However the exact quantitative estimation of these biases requires validation of ISCCP products themselves. Similarly SRB products require extended validation which is currently based on the Baseline Surface Radiation Network (BSRN), but can be extended to the use of more in-situ data, first of all over the oceans. Reprocessing to produce a more homogeneous dataset is much needed.

GPCP. GPCP precipitation products now form the core of our knowledge of the precipitation variability over the globe at different time and space scales. These products are extensively used in the climate assessments of precipitation and for ocean modeling. Despite considerable efforts targeted on the validation of GPCP products, we need to extend the validation for regional and global mean precipitation to the analysis of frequency, intensity, duration, type (rain vs snow) and amounts, and thus probability density functions and, in particular to the assessments of skills of GPCP and alternative products (like CMORPH) to reproduce extreme precipitation in a reliable manner. Some limitations of satellite precipitation to quantify very high precipitation of very short durations may affect these skills. For this extensive use of station rain gauges, especially of the regional dense networks is required. Radar estimates may also help. However, questions about the utility of radar-based precipitation and blended products exist and should be resolved to the extent possible.

SeaFlux is an important activity targeted on the validation of satellite flux products (primarily turbulent heat and moisture fluxes) against in-situ observations. The report summarizes the activities targeted on the involvement of ship data in both tropics and high latitudes. Importantly, US CLIVAR high latitude flux group is now also closely involved in SeaFlux. However, satellite flux products of turbulent heat and moisture exchanges are not directly measured, but computed using bulk formulae. Thus, bulk parameterizations should be also improved, if possible, which requires high quality direct measurements of fluxes, such as at the Ocean-Sites buoy network. In other words, satellite products alone still cannot guarantee the

reliable global flux products and it is a task to make this possible within the next 2-5 years. For this intensified collaboration with different surface flux activities of WCRP, OOPC and AOPC is required. At present situation, there are 5-7 similarly ranked latent heat products based on SSM/I and AMSR, however, regional differences may amount to 100-200 W/m2 in these products. Some post-assessment and discrimination is required for HOAPS, GISS, J-OFURO, IFREMER and other similar products. Previous attempts on this issue, like Bouras (2006, J. Climate) are useful, but should be extended. Ultimately it must be recognized that surface fluxes involve an exchange of some quantity from ocean to atmosphere, or vice versa, and thus inherently involve the coupled problem and conservation of the quantity.

LandFlux activities started in 2008 with implementation in 2009 focused on the land fluxes. Also quite effective, these activities should accommodate the whole spectrum of hydroclimate processes over the land, including soil moisture and ground water. Also, it may be important to use different approaches for different seasons to account for the strong seasonality in surface processes over the land. More intense co-operation with GEWEX HMP is needed. Also more radar data should be involved in the LandFlux, especially at the regional level. In this respect it is worth mentioning the European CLIVANET covering central Europe with high resolution X-band radars. Landflux should be linked to the new soil moisture products that will become available from SMOS.

Closure of energy and water budgets should be considerations in LandFlux and SeaFlux. The links between sources and sinks of energy and water provide a constraint on the products, and on land this can be done locally. For the ocean, changes in ocean heat content and salinity, and ocean transports must also be recognized. Reanalyses of the atmosphere, ocean and coupled system will become more important as a way to synthesize these. At present, atmospheric NWP and reanalyses do not satisfy surface energy and water budget constraints and highlight the need to do things differently and build those constraints into their systems. E.g. for NWP this may imply the need for an ocean model of some sort, at least with a mixed layer ocean, in order to improve surface fluxes and be cognizant of changes in SSTs during a forecast. These kinds of issues should be front and center for GEWEX and CLIVAR in the future WCRP.

Aerosols. Global products from the GEWEX Aerosol Climatology project or other newer products, especially over ocean should still be continuously validated against e.g. MAN (Maritime Aerosol Network – AERONET (Aerosol Robotic Network) module). In particular, recent AERONET activities collected by island and ships equipped with Microtops consists of more than 500 measurement days and provides some validation of the NASA sensors. See Smirnov et al. (2009, JGR) article for info.

Data archiving and availability. GRP is very effective not only in collecting data sets but also in making them available to the users. ISCCP and GPCP are outstanding examples. Documentation of lessons learned in disseminating large volumes of data would be useful, and may prove beneficial for CEOP. GRP can start to use its long-term experience in data collection for accommodating other radiative and non-radiative data sets.

Further Comments

Polar regions: While GRP is global, regional expertise on polar and cryospheric processes lies in CLiC and joint projects should be fostered that provide evaluations and assessments of products and how and why they err and can get better.

IPCC interactions: GRP should also recognize the potential importance of their new products in IPCC. Use of the products to say more about time series trends and variability in the observations chapters would be a major advance over AR4. The CMIP5 model runs for IPCC must be done by the end of 2010 and the first LA mtg is Nov 2010. So the zero order draft follows that. Second order draft is to be formulated April-July 2012: preprints are no longer eligible; submitted papers are no longer assessed after 31 July 2012; papers accepted, in press, and published are still eligible for consideration.

Heresy: Should GRP be linked to CEOP and all the land hydrology? Does it need to be linked to GMPP activities? It is not so clear that this is the case and other links could be envisioned. However, a case can and should be made. What are the imperatives in this regard? Presumably they are that all 3 activities continue, but if one focus is water and interactions between land and atmosphere as the main heritage line of GEWEX, what is needed to achieve that? These aspects need to be spelled out.

Some recommendations:

- Promote reprocessing of variables and creation of climate data records.
- Cooperate with SCOPE-CM and help build up operational reprocessing.
- To develop a comprehensive plan for the global assessment of different radiative products, their comprehensive intercomparison and validation in co-operation with the other GEWEX and WCRP projects and activities.
- To continue and enrich validation of GPCP precipitation products with the specific emphasis on the analysis of probability distributions, extreme rainfalls and wet period statistics.
- To provide implementation for the development of the full set of validated satellite-based surface flux products for the use in different climate applications
- To expand precise calibration of the GEWEX Aerosol Climatology Project products over oceans against instrumental sensors onboard ships and small islands under AERONET activity.
- Exploit closure constraints of energy and water
- Learn from GRP experience in data collection for the CEOP data archiving modules.
- Collaborate with CLiC on cryospheric issues.
- Produce new reprocessed products in time for use in IPCC.
- Spell out links to modeling and CEOP.