NOTES FROM THE TENTH FORMAL GEWEX HYDROCLIMATOLOGY PANEL (GHP, formerly CEOP) TELECONFERENCE SATELLITE DATA ISSUES HELD ON 16 NOVEMBER 2010 FINAL DRAFT, 19 December 2010

1. INTRODUCTION

The Tenth GHP (CEOP) Satellite Data Teleconference took place on Tuesday 16 November 2010 at 14:00 UTC. The issues that were brought up and discussed on the subject conference call included:

1. The Pan-GEWEX Meeting in Seattle, USA, 23 – 28 August and its Outcomes
2. Satellite data providers reports

Participants

The participants were:

Gang Ye	USA, NASA MODIS Team
Michael Theobald	USA, NASA AIRS Team
Sam Benedict	USA; GHP International Coordination Function
Petra Koudelova	Japan; GHP International Coordination Function

Drs Toshio Koike (Satellite Data WG Chair), Kazuo Umezawa (JAXA), Peter van Oevelen (Representing GEWEX Project Office), Christopher Lynnes (Representing NASA AIRS team), John Bates (Representing NOAA NESDIS), Einar-Arne Herland (Representing ESA Earth Science Division), Bruce Vollmer (NASA AIRS Team), Steve Williams (CEOP Data Management), and Ed Kearns (Representing NOAA NESDIS) were not available for this call, however, Dr. Kazuo Umezawa provided a detailed written report in advance.

2. NEXT CONFERENCE CALL

The next, **11th GHP (CEOP) International Satellite Data Teleconference is proposed to take place on Wednesday 23 March 2011. Benedict and Koudelova** have the **action (A1)** to inform the group of the details of the next call nearer to the time of the call and to coordinate the origination of the call **(action A1a)**. In this context, a calendar of the dates and times of all the GHP (CEOP) conference calls for 2010-2011 was distributed to the participants for their future reference that is also available through the CEOP homepage at: http://monsoon.t.u-tokyo.ac.jp/ceop2/calls.html.

3. SATELLITE DATA GROUP GENERAL ISSUES

3.1 WCRP and GEWEX related issues

(3.1a) **Benedict** reported on the **Pan-GEWEX meeting in Seattle, USA, on 23 – 28 August 2010** and its outcomes (http://www.gewex.org/2010pangewex/home.html). That event included a Business Meeting of CEOP and it was held in parallel with meetings of the other GEWEX Panels, namely, the GEWEX Modeling and Prediction Panel (GMPP) and the GEWEX Radiation Panel (GRP). Following the Plenary sessions and the parallel Panel meetings the GEWEX Scientific Steering Group (SSG) also met.

The outcome of these events included a number of decisions, recommendations and actions specifically associated with CEOP as well as a set of general (Pan-GEWEX) actions for all the Panels. A still preliminary summary of key events that took place at both the PGM and the SSG Meeting as submitted by the SSG Chairman Dr Kevin Trenberth is attached below (ATTACHMENT1). This document was distributed to the broader CEOP community subsequently after the call together with a list of actions drafted at the end of the SSG Meeting.

The main changes that have taken place recently with respect to CEOP include:

1. The SSG accepted Prof Toshio Koike's decision to step down as Co-Chair of CEOP effective at the close of the PGM at Seattle. This action, followed Dr Ron Stewart's resignation, which was taken at the close of the SSG meeting at New Delhi India, 25-29 January 2010,
2. Dr Dennis Lettenmaier was named Co-Chair of CEOP to replace Dr Stewart, effective at the end of the SSG meeting at India (25-29 January 2010),
3. There is a search team being organized to find a Co-Chair to work with Dr Lettenmaier.

4. The SSG agreed to change the name of CEOP to the GEWEX Hydroclimatology Panel (GHP), effective immediately following the end of the PGM.

In addition, **Benedict** voiced that with regards to the changes resulting from the Pan-GEWEX meeting discussions, the data collecting and reporting scheme may need some restructuring, however the urgent need for a high quality data as a basis for scientific activities that are key for the GEWEX Imperatives was confirmed at the meeting and the reference site data activities are supposed to continue in a certain manner. The in-situ data from the CEOP reference sites were acknowledged and studies based on these data were presented at the meeting.

(3.1b) **Benedict** further mentioned that efforts to develop a new RHP in USA/Northern America had been initiated and preliminary planning was ongoing. The idea is to build on the success of the GCIP/GAPP/CPPA legacy, while entraining the vast array of interdisciplinary observational and modeling resources available in this region. Through smart coordination and integration, it is intended to coalesce an interdisciplinary, interagency, and **potentially international** effort that will make significant contributions to continental-scale hydroclimate science and solutions. It is seen as a contribution to not only GEWEX but also the broader climate, carbon, ecology, and applications communities. A town hall meeting on this matter is scheduled at the AGU Fall meeting in San Francisco, Wednesday 15 December, 1230h–1330h and anybody attending the AGU meeting and interested in this idea is welcome to this event. **Benedict and Koudelova** took action to send an invitation email for this town hall meeting to Ye and Theobald.

(3.1c) It was reiterated that a **10-Year Dataset** project had been initiated in response to the climate modeling community need of **a high quality observation data** of a sufficient length for evaluation of climate models under the CMIP5 project and quantification of model projections uncertainties. This activity was proposed by the WCRP Observation and Assimilation Panel (WOAP) and is compliant with the CEOP commitment taken at the 3rd Annual CEOP Meeting in Melbourne in August 2009 to develop the CEOP 10-year dataset as well as with the **GEWEX post 2013 Imperatives** (http://www.gewex.org/2010pangewex/Draft_Imperatives.pdf). The WOAP suggested activity is envisioned as a collaborative effort of a broader observation and climate modeling communities including GEWEX/CEOP, LandFlux-EVAL, GSWP, AsiaFlux, from the observation side. The targeted dataset will consists of **in-situ as well as satellite observations** from multiple providers including GHP (CEOP), FLUXNET, AsiaFlux, iLEAPS.

The 10-Year Dataset project was discussed with the LandFlux-EVAL, FLUXNET, AsiaFlux, and GSWP representatives at the occasion of the HESSS2 Meeting in Tokyo in June and subsequently a White Paper was developed and submitted for discussion at the Pan-GEWEX meeting in August (see ATTACHMENT 2). The activity was accepted as one of the new GHPs efforts. The White Paper is now being discussed with the CMIP group and the GHP (CEOP) community will be informed of the further development of the activity in due course.

With regards to the 10-year period, the actual years have not been confirmed yet. In this context, it was mentioned that processing the data prior 2001 would mean a non-negligible additional effort for the CEOP reference site data providers, which should be considered when deciding the actual 10-year period. **Williams** also added that the nomination of sites would be done by an advisory group that is to be formed and that the geographical and climate aspect of the sites will also be considered together with the completeness of the data record for the selected 10-year period.

(3.1d) It was announced that the 2010 CEOP Special Issue of GEWEX News was published at the beginning of September and was available for download at:
http://www.gewex.org/2010pangewex/home.html.

(3.1e) It was also pointed out that the data portal of the Data Integration and Analysis System (DIAS) of Japan was opened to public on 1 October 2010 that can be accessed at:
http://www.editoria.u-tokyo.ac.jp/dias/link/portal/english_index.html.

3.2 Data format and metadata issues

(3.2a) This item was not discussed in details further because the JAXA and University of Tokyo (UT) satellite data teams were not represented. Nevertheless, it was reiterated that the JAXA team had developed a new metadata design because a certain problems had been found in the previous metadata format. The team has been working on converting the old version metadata to the new one for all the JAXA and NASA MODIS as well as AIRS data already available in the Tokyo archive.

The JAXA and UT teams would appreciate if the NASA teams could incorporate the new metadata generation subroutine to their data processing systems in order to generate the data with correct metadata files in future.

(3.2b) In this context, **Theobald** voiced that they took an action to evaluate the possibilities of generating the metadata according a new scheme and were communicating with another project through which the new metadata could be generated. **Theobald** will inform the group of the developments in this matter in due course.

4. THE AGENCY REPORTS/ISSUES

4.1 JAXA – written report

(4.1a) **Umezawa** provided a written report in advance of the call:

1. RESPONSE TO THE ACTIONS:
A2.1 Must verify that it has received all of the EOP-3 and EOP-4 AIRS data and inform about the location and possible access.
- Done by Nemoto-san, Tokyo University?

A2.2 Must specify the Calendar/Schedule of EOP-3 data requests needed from the NASA MODIS Team considering step-wise approach, i.e. scheduling shorter (e.g. 1 month) periods for download and processing at one step followed by a control for missing data and other issues.
- JAXA distributed the attached schedule (modisplan.xls) and shared it with NASA (see ATTACHMENT 3).

A2.3 Verify that the EOP-4 MODIS missing data has been provided and processed.
- Done by JAXA.

A2.4 Complete definition of new Metadata scheme and distribute to all Satellite Data Teams.
- Done by Ono-san, Tokyo University?

A2.5 Have conversion software for the Metadata available if requested by the Satellite Teams or establish that the conversion can be done at the JAXA end.
- JAXA has checked that the conversion software for Metadata is unavailable for general use.

A2.6 Updated draft of the 10-Year Dataset Whitepaper to be sent to the Satellite Data group.
- Done by Koike-sensei?

2. OTHER STATUS:
- Aqua MODIS EOP-4 data is complete.
- Terra MODIS EOP-3 data processing is underway as follows:
  - The Terra 2002.10 data processing is complete at NASA, its downloading is complete by JAXA, and additional processing for Metadata is underway.
  - The Terra 2002.11 data processing is almost complete at NASA, downloading is underway by JAXA.
- Document Metadata of EOP-1 (PR, TMI, SSMI) is underway
- AMSR-E and TRMM 2010 (Jan.-Jun) data is complete at JAXA and uploaded to the DIAS core system.

4.2 NASA MODIS

(4.2a) **Ye** reiterated that the MODIS team had completed the Aqua and Terra EOP-4 data processing and these had been transferred to JAXA. Also the reported missing data have been completed and downloaded by JAXA.

(4.2b) **Ye** reported that they had agreed with JAXA on an alternate approach for EOP-3 data processing as discussed at the time of the last call. He confirmed the schedule (ATTACHMENT 3) of the MODIS EOP-3 data processing that Umezawa has provided and added that regarding the MODIS data generation, they had completed Terra 2002 November and December datasets that are now available for JAXA to download them. **Ye** mentioned that the process was advancing well and they were on schedule.

4.3 NASA AIRS

(4.3a) **Theobald** reiterated that the AIRS team had completed the EOP-3 and EOP-4 data and provided them to the UT archive. With regards to the new metadata scheme, **Theobald** mentioned that they were investigating the possibilities as mentioned above in paragraph 3.2b.

ATTACHMENT 1 Outcome and prospects from the August 2010 pan-GEWEX and SSG meetings, Seattle.

6 Sept 2010
Outcome and prospects from the August 2010 pan-GEWEX and SSG meetings, Seattle.
Kevin E Trenberth

GEWEX held a "pan-GEWEX" meeting in Seattle for a week in late August 2010. The "pan-GEWEX" connotation means that it was an opportunity for all of the working groups and panels within GEWEX to meet together and exchange views while interacting to formulate future plans. Accordingly, the Scientific Steering Group (SSG) attended and participated fully, and we took the opportunity to have an SSG meeting after the full meeting closed. In addition, a number of program managers from different nations attended, and we were fortunate to be able to involve a number of young scientists in the process (see report elsewhere).

This pan-GEWEX meeting was especially eventful owing to a number of challenges before the community in formulating plans for the new post-2013 phase of the WCRP, guided by the JSC. In particular, the guidance suggested that core projects would be retained but with revised responsibilities to facilitate climate system research at the interface of the physical Earth system components. The suggested four new core projects should be: 1) Ocean-atmosphere (think CLIVAR); 2) Land-atmosphere (think GEWEX); 3) Cryosphere (think CliC); and 4) Stratosphere-troposphere (think SPARC). Then within each core project there should be a common set of basic "themes" including 1) Observations and analysis; 2) Model development, evaluation and experiments; 3) Processes and understanding; 4) Applications and services; and 5) Capacity building. Coordination across projects on these themes would be via WCRP Modeling and Observations Councils.

In preparation for the forthcoming changes, prior to the last JSC meeting, the GEWEX SSG met in January 2010 in New Delhi and began formulating plans for the future via a new mission statement, a set of imperatives (things that must be done), and a set of frontier challenges for the future. The draft set of these was published in the May 2010 GEWEX newsletter as a basis for the pan-GEWEX discussions.

At the January meeting, I had challenged the SSG to say why the three GEWEX panels: Radiation (GRP), Modeling (GMPP), and CEOP should be together. The arguments were strong and convinced me that we should continue with similar components in any future GEWEX. Figure 1 illustrates the points from the standpoint of the hydrological cycle, featuring radiation, atmospheric processes and land surface hydrology and processes. The original motivation for these being together is that they correspond to the "fast" processes in the climate system, and this still applies. Following the JSC meeting in February, key questions were "how much science falls under land-atmosphere" and "what about those that do not?" Accordingly, the approach taken in the pan-GEWEX meeting was that while the future GEWEX should indeed be the place where land-atmosphere interactions were featured, it should be much more. In particular, it should retain the global energy and water cycle as a core focus while adding regional aspects. It should indeed also feature hydrological and land surface processes and modeling, and interactions with the atmosphere. However, it should further retain a strong atmospheric component related to the water and energy cycles, and hence scientific issues related to radiation, clouds, convection, precipitation, boundary layers, surface fluxes, runoff, and human influences which should also be included in terms of observations, process understanding and modeling.

The meeting provided a venue for vigorous discussions of the draft imperatives and the future directions for GEWEX. Following the meeting, the SSG has decided on the following. 1) While the old GEWEX name was liked by many for its uniqueness (e.g., in a google search) and name recognition, no-one has come up with a viable alternative for the "EX" part that is clearly obsolete. Accordingly, the new name post-2013 is suggested to be: ***"Global and Regional Energy and Water" (GREW).*** This has many aspects in common with the old name and the two should be used together for a period of time. The revised mission statement is:
To measure and predict global and regional energy and water variations, trends, and extremes (such as heat waves, floods and droughts), through improved observations and modeling of land, atmosphere and their interactions; thereby providing the scientific underpinnings of climate services.

There were strong sentiments for fewer more succinct imperatives, and the following seven have been approved by the SSG:

Datasets: **Foster development of climate data records of atmosphere, water, land, and energy-related quantities, including metadata and uncertainty estimates.**
Analysis: **Describe and analyze observed variations, trends and extremes (such as heat waves, floods and droughts) in water and energy-related quantities.**

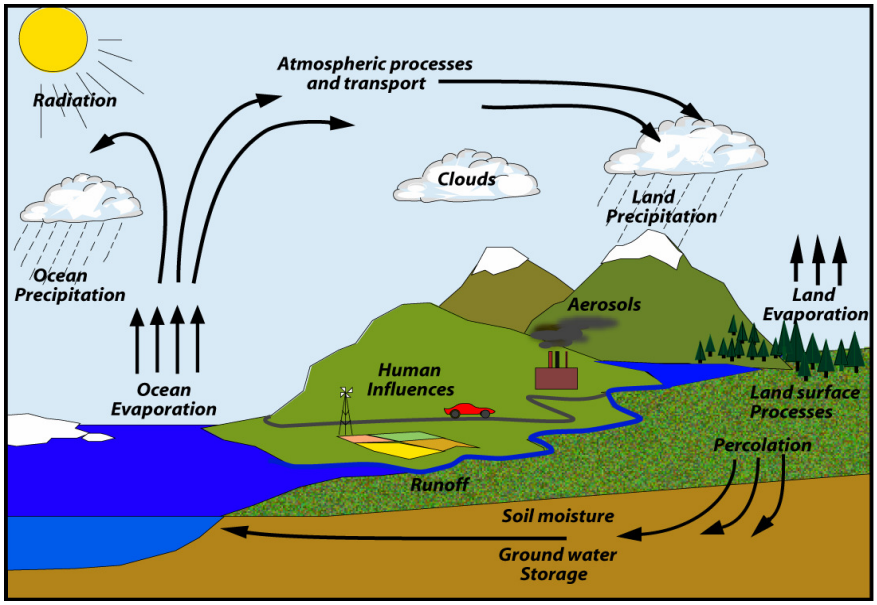

Fig. 1 depicts the hydrological cycle schematically and thus the driving by radiation and energy, the atmospheric dynamics that move water and energy around and produce clouds which block the sun, the complex land surface complete with human influences and the interactions with the atmosphere, and the surface and below surface processes that complete the water cycle (adapted from Trenberth et al. 2007).

Processes: **Develop approaches to improve process-level understanding of energy and water cycles in support of improved land and atmosphere models.**
Modeling: **Improve global and regional simulations and predictions of precipitation, clouds, and land hydrology, and thus the entire climate system, through accelerated development of models of the land and atmosphere.**
Applications: **Attribute causes of variability, trends and extremes, and determine the predictability of energy and water cycles on global and regional bases in collaboration with the wider WCRP community.**
Technology transfer: **Develop diagnostic tools and methods, new observations, models, data management, and other research products for multiple uses and transition to operational applications in partnership with climate and hydro-meteorological service providers.**
Capacity building: **Promote and foster capacity building through training of scientists and outreach to the user community.**

The header in each case highlights the link between the imperative and the themes outlined by the JSC. There is still much to be done to flesh out these imperatives with more details about what they mean in terms of the actions to be taken, the lead groups in GEWEX and interactions with other parts of WCRP, and the other organizations involved.

Modeling
Prior to the pan-GEWEX meeting, extensive discussions had been held by email that set the stage for the discussions in Seattle. These arose in particular from a desire for the chair of GMPP (Christian Jakob) to step down and a proposal to remove the layer of GMPP, as well as the need to address the future structure of GEWEX and GEWEX modeling post-2013. The many questions and statements that arose were summarized as a series of questions, mostly related to modeling, that were appended to the pan-GEWEX meeting agenda. Based on those discussions, I offered some proposals for how this may move forward that turn out to be similar to those adopted.

The proposal of removing the GMPP layer between GCSS, GABLS and GLASS with the SSG met with strong approval. Instead GCSS/GABLS will be combined and, along with GLASS, will report to and take advice from the SSG directly. *This proposal was subsequently approved by the SSG.*

As a consequence of the removal of the GMPP layer there is a need for GCSS/GABLS to undergo some reorganization. This will also pave the way for the post-2013 transition. As a result of the discussions it was proposed that GCSS abandons its current Working Group structure. Instead, the group will operate through projects. Those can be initiated by any member of the community. A Science Steering Committee (SSC), which will form the GCSS/GABLS Panel, will be responsible for the successful running of the program. This includes the approval of proposals as well as engagement with the community to explore new opportunities. The GABLS activities will be fully integrated into this structure through GABLS-specific projects as well as GABLS membership on the SSC. The GCSS and GABLS brand names will be maintained. *This proposal was also subsequently approved by the SSG.*

Most of the discussion in the group was about the extension of the current atmospheric model development activities in the post-2013 structure. This resulted in the proposal for a **Framework for Atmospheric Model Enhancement (FAME).** The mission of FAME is proposed as: Improving the representation of physical and dynamical processes in

the troposphere in models for all purposes and especially weather and climate services. Its main focus would be the improvement of the representation of clouds and precipitation in atmospheric models, which can only be achieved by improving our understanding of the intricate coupling of physical and dynamical processes associated with clouds and precipitation at various scales.

FAME was proposed in recognition of need expressed by the IPCC in several reports which highlighted the significant shortcomings in models in the simulation of clouds and precipitation with consequences for the simulation of important climate feedbacks and climate sensitivity. Other important factors included the recent revolution in the ability to observe clouds and precipitation, especially from space, and improvements in ability to model the processes involved at the process-scale. The experience of more than 15 years of the GCSS program and almost 10 years of the GABLS program makes the time right for a more concerted effort in atmospheric model improvement that builds on the existing strengths and adds to them the important new research area of physics-dynamics coupling.

The envisaged ingredients of FAME would be programs on the PBL (GABLS), clouds, convection and precipitation (GCSS), radiation (currently residing in GRP and SPARC), coupling to dynamical processes (new) and potentially also coupling to numerics (new). FAME will be built around the core approaches identified by the WCRP JSC, e.g., observations, modeling, data analysis and model diagnosis, and process studies. Through the direct involvement of operational modeling centers in FAME as well as through the engagement of scientists throughout the world, the activities in FAME will make major contributions to capacity building and services.

As FAME is tightly focused on providing a means for the improvement of the representation of core physical processes in atmospheric models, it will partner with many other programs to contribute to the research on phenomena that go beyond the physics-dynamics coupling in the atmosphere. Those include partnerships with the land (e.g., GLASS, GHP), ocean (e.g., CLIVAR), aerosol (e.g., ACPC, iLEAPS), atmospheric chemistry (e.g., SPARC, IGAC), stratosphere (e.g., SPARC), and cryosphere (e.g., CliC) communities. Necessarily, these go well beyond GEWEX alone.

FAME could be seen as a natural extension to the existing GCSS/GABLS panel described above, if the post-2013 GEWEX structure still allows for such an activity. This would maintain continuity, provide close links to the land and limited area modeling communities and ensure FAME's natural focus on the energy and water cycles. These activities were originally grouped together to provide a focus on relatively "fast processes" as compared with those involving the ocean or cryosphere. FAME could also make a major contribution to a potential cross-WCRP effort on atmospheric model development.

This proposal was subsequently discussed by the SSG who strongly recommend keeping FAME within the post-2013 GEWEX structure. Questions include how FAME goes forward, whether as a panel or working group. Many of the other modeling activities in WCRP come under working groups. WGSIP is an example where the WG reports to the CLIVAR SSG but acts on behalf of the WCRP to deal with seasonal to interannual prediction. A new group, integrating FAME and possibly called WGAP, short for WG on Atmospheric Processes and modeling for climate, could operate similarly within the new post-2013 GEWEX. However, as the activities relate to the established WGs, especially WGNE, this aspect is yet to be decided after broad consultation with the community.

Land surface and hydrological science

Major changes were also underway in the realm of the regional hydrological projects at the pan-GEWEX meeting. In part these came about naturally from the evolution of the program, and given extra nudge by the change in leadership. Under the leadership of Toshio Koike, CEOP developed an impressive and extensive program, including the Regional Hydrometeorological Programs (RHPs), associated modeling and data base development, and the Hydrologic Applications Project (HAP). CEOP remains at the core of the GEWEX mission, includes more than a thousand researchers, and provides important regional data, modeling and a valuable end-user interface.

The brief history is that the Continental Scale Experiment (CSE) concept was developed in the 1990s. Its purpose was the development, diagnosis, and testing of coupled land-atmosphere models with a focus on water and energy budget closure at near-continental scales. An example was the GEWEX Continental Scale International Project (GCIP) for the Mississippi basin as a well instrumented and analyzed region. This led in turn to the development of RHPs to extend this concept to other regions: MAGS, BALTEX, GAME, LBA, AMMA; and even more recent RHPs, see Figure 2. The panel set up to provide coordination and oversight was the GEWEX Hydrometeorological Panel (GHP). Then to take advantage of many new satellite and other observations the **Coordinated Enhanced Observing Period (CEOP)** was begun in 1995 and continued into the second phase of GEWEX for 2001-2006. This activity, which also developed extensive data management activities, led by Toshio Koike in Japan, also led to some similar panels to those in GHP and some duplication of effort. Accordingly, this first CEOP activity was combined with GHP and evolved to become the **Coordinated Energy and Water Cycle Observations Project** with the same acronym**,** CEOP, in 2007-2008. The initial observing period grew to become a move to produce a 10 year dataset and archive especially set up for the regional projects. However, other developments had already occurred in observations and data management, which suggested the activity should be wrapped up and refocused, even as it is utilized and hopefully becomes part of the heritage of GEWEX. In particular, the development of the many flux towers around the globe provide alternatives to the CEOP reference sites for local studies of energy, water and biogeochemistry.

Accordingly, the community began what might be called a "back to basics" movement, with recognition of the need to reinvigorate the regional hydrological projects. In particular there was a call by the new co-chair, Dennis Lettenmaeir, for stronger hydrological activities which would foster the next generation of hydrologically realistic land surface schemes and provide a home for projects like PILPS. The recommendation to the SSG was along these lines and thus a new **GEWEX Hydroclimatology Panel** (GHP: note the change in the name from the first version) has been formed to

replace CEOP, effective immediately. The SSG also followed up on the recommendation from CEOP to approve a new RHP called the HYdrological cycle in the Mediterranean Experiment (HyMeX), focused on the 20 countries around the Mediterranean Sea and the fresh water and salinity of the Sea itself.

GHP is thus the home for hydrologic science and modeling within WCRP and there is considerable scope for developments in this area, e.g. in seasonal forecasting, the detection and attribution of change, and the development and analysis of climate projections. Challenges remain in dealing with monsoons and to help coordinate the multitude of national initiatives in this area. There are also opportunities for linkage with GLASS in bringing disciplines together in the development of next generation Land Surface Models as well as increasing interactions with CORDEX. Changes in the management structure are likely to accompany the new consolidation of efforts as GHP realizes its considerable potential.

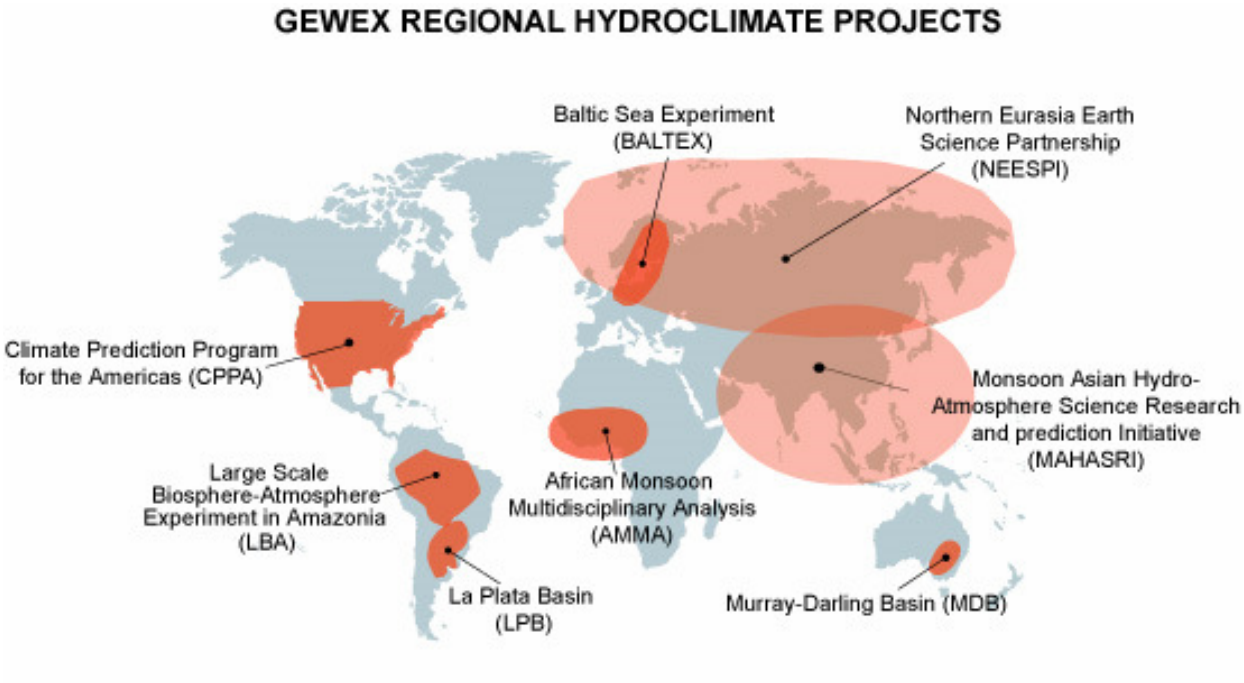

Fig. 2: The GEWEX RHPs as of 2008(??).

GEWEX Datasets

The original GEWEX datasets were developed under the auspices of the GEWEX Radiation Panel (GRP) which continues, but is also looking for a name change as it does a lot more than radiation. It does deal with all of the global satellite data related to energy and water and their synthesis into products, and is currently leading and promoting reprocessing of the datasets with a goal of creating climate data records of sufficient quality to be useful for examining trends. Some of the datasets, such as GPCP and ISCCP, are well known and already used extensively, but the scientists are confident that they can be made much better and more consistent with each other, and with better estimates of uncertainties.

In general GRP is working well toward the new goals and has produced simulators, that take into account the sampling and characteristics (such as thresholds) of the observations to enable intercomparisons of satellite products with model data. Interactions with other parts of GEWEX were fostered by the pan-GEWEX meeting, and the GEWEX datasets have potential for great use in evaluating and improving models on issues such as clouds and indirect effects of aerosols, precipitation frequency, intensity and amount, and in providing the context for the RHPs.

Extremes

The recent summer record breaking flooding in Pakistan, India and China, and heat-waves and wildfires in Russia highlight the extremes of the hydrological cycle of drought and floods that are changing from human activities. Dealing with extremes in WCRP is a cross-cutting activity that involves all projects although GEWEX plays a leading role. Olga Zolina, who is a member of the GEWEX SSG, led the WCRP extremes workshop involving some 150 people at UNESCO in late September. Breakout groups were held on issues of 1) data requirements and availability (such as the need for hourly precipitation data to properly characterize extremes); 2) representation of extremes in models, including scaling and spatial issues (how station data relate to grid squares, comparing apples to apples); and 3) methodologies for estimating extremes across areas and disciplines, including statistical methods. Continuing issues are sorting out the human changes in extremes and how to best communicate with the general public on such technical attribution issues.

For instance, it is likely that the southeast Asian floods and the Russian drought were linked by the monsoonal circulation and teleconnections linked to the anomalous latent heating of the atmosphere associated with the heavy

rains. The pattern of the rains was related to the rapidly developing La Niña but the previous El Niño had left behind a residue of abnormally high sea surface temperatures in the Indonesian-northern Indian Ocean region that provided an enhanced supply of moisture to the monsoon rains. No doubt those elevated temperatures have a global warming component. The persistent "blocking high" over Russia led to drought that was no doubt more intense and longer lasting owing to global warming, with increased risk of heat waves and wild fires. While these connections are very likely, they are hard to prove as models do not reproduce monsoon rains very well, and blocking is poorly simulated. These scientific challenges extend across the WCRP.

Closing remarks

The above is but a sample of the goings on and developments from the pan-GEWEX meeting. What I have tried to do is provide a sense that we are looking forward to the future with considerable excitement at the science we can achieve through collaboration and friendly competition, with the help of coordination through GEWEX and, in the future, GREW. I would like to thank all of those who attended and participated.

ATTACHMENT 2

Whitepaper on 10-year dataset development
(Draft ver. 0.2, 23 July 2010)

1. Background
Climate change poses a fundamental threat to the well-being of the people all over the world. This threat encompasses security in water, food, energy and health. Climate change is not hypothetical, and its impacts are already evident, as both scientific observations and the experiences of the region's inhabitants confirm. And in confronting the risks and challenges posed by changing climate, we must acknowledge the fundamental uncertainty in our projections of future climatic and water resources conditions, and work to improve our ability to identify effective responses while reducing this uncertainty.

2. Mission
To reduce the uncertainty, a simple framework to identify, organize and disseminate comprehensive, quality and long-term observational datasets should be provided to modeling communities, e.g. Coupled Model Intercomparison Project phase 5 (CMIP5), and analysis and impact study research groups.

In response to this need, the 10-year dataset project (Project) aims to develop a high-quality comprehensive dataset of meteorological and hydrological variables for a selected 10-year period based on most advanced and complex land reference sites distributed over the world and complemented with relevant satellite observations. The targeted dataset will be "homogeneous" across data providers and individual sites, i.e. of a standardized format, fulfilling high quality requirements in accordance with CEOP standards, and equipped with appropriate metadata assuring full interoperability and "easy" use.

In this way, the Project mission is in concert with the GEWEX Post 2013 Mission Statement and Imperatives. It responds to the imperative to develop climate data records of atmospheric and land variables, complete with metadata and error bars, in particular through development of appropriate calibration/validation/evaluation datasets to confront models. The Project will build on the CEOP experience in data management, archival and access, while devising robust ways of dealing with the more diverse, complex, higher spatial and temporal resolution, and much greater volumes of data.

The targeted dataset contribution

1. Climate studies
Evaluation of the climate model output applicability for climate change impact assessment (CMIP5).

2. Societal needs
Quantification of uncertainties of model predictions/projections and thus making the model output information useable for decision and policy makers.

3. Scientific community

The dataset will also be usable for scientific community to further advance research into energy and water cycle processes. It will contribute to several GEWEX imperatives focusing on analysis and model development and improvement. These include:

- Increase understanding of energy and water cycle processes, quantify their contribution to climate feedbacks, and develop improved hydrometeorological parameterizations.
- Accelerate developments in models of the land, atmosphere, and entire climate system:
    - Continue evaluation of developing earth system model products.
    - Develop archives to support model development and intercomparison.
- Attribute causes of trends, and determine the predictability of energy and water cycles on a global and regional basis in collaboration with the wider WCRP community.

- Coordinate data set generation, process studies, and modelling
- Diagnose model errors and exploit GEWEX datasets and focused process studies.

3. Objectives

(i) To develop dataset that will be directly usable for evaluation of climate model outputs, i.e. will cover various regions/climate conditions over the world, will allow for deriving climatologically sensible mean diurnal cycles (sufficient length of observations), and will be convenient for use (format, metadata, easy access, QC-ed).

(ii) Complement in-situ observations with satellite data to provide spatial coverage of observed variables consistent to the scale of climate models.

(iii) Use the dataset for quantification of uncertainties of CMIP5 climate model projections and producing usable information for decision and policy makers.

(iv) To assure an easy access to the data for a wide community through a user-friendly on-line system – Date Integration and Analysis System (DIAS), that provides a set of data analysis, integration and visualization tools, free of charge.

(v) Through a timely accomplishment of the above – to contribute to the IPCC AR5.

4. Merit

- real observational data
- comprehensiveness of the dataset in terms of:
  - Spatial coverage – contributing sites will be nominated considering also their location with intention to cover as many regions and climatic conditions as possible. 2D, 2.5D and 3D sites will be preferred (sites including more stations assuring spatial coverage of observations and also those containing PBL towers as well as soil observations).
  - Temporal coverage – sites covering the targeted 10-year period will be selected
  - Variables – most advanced sites with complex observations will be preferred
  - Data sources – reference site data will be complemented with satellite observations for square areas of 250km x 250 km around the sites
- unified, standardized format
- consistency in terms of observed parameters – also consistent with model outputs following NetCDF CF conventions
- interoperability – standardized metadata
- accessibility – DIAS

The targeted dataset has advantages over "reanalysis" datasets by providing (a) observational data and by (b) enabling a single commodity that includes all data in a standardized format and (c) the gap that exists between observed parameters such as rainfall versus reanalysis values for example.

5. End Users

(i) CMIP5 project – climate model output evaluation

CMIP5 promotes a standard set of model simulations (Taylor et al., 2009) in order to:

1. evaluate how realistic the models are in simulating the recent past,
2. provide projections of future climate change on two time scales, near term (out to about 2035) and long term (out to 2100 and beyond), and
3. understand some of the factors responsible for differences in model projections, including quantifying some key feedbacks such as those involving clouds and the carbon cycle

Under the CMIP5 strategy there are two distinct foci of the model experiments: 1) near-term simulations (10- to 30-years) and 2) long-term (century time-scale) simulations initialized from the end of freely evolving simulations of the historical period. In addition, CMIP5 also admit so-called "time-slice" experiments that involve simulations with unusually high resolution atmospheric models or models with more complete treatments of atmospheric chemistry.

There are two core near-term CMIP5 experiments, one a set of 10 year hindcasts or predictions initialized from climate states in the years 1960, 1965, 1970, and every five years to 2005, with this last simulation representing the sole actual prediction beyond the present (i.e., beyond 2009). In these 10-year simulations, it will be possible to assess model skill in forecasting climate change on time-scales when the initial climate state may exert some influence. The other core experiment extends the 10-year simulations initialized in 1960, 1980, and 2005 by an additional 20 years. It is at this somewhat longer timescale that the external forcing from increasing GHGs should become more important. "Time-slice" experiments fall into the CMIP5 near-term "Tier 1" group of experiments including both the present-day (AMIP period: 1979 - at least 2008) and the future (specifically, the decade 2026-2035) simulations and offer opportunities to (for example) to:

- explore the implications of running climate models at high resolution,
- examine the regional effects of climate change at small scales where impacts are felt,

- study the air quality implications of climate change with models that include sophisticated treatments of atmospheric chemistry, and
- obtain more robust statistics characterizing changes in climate, in particular the likelihood of rare or extreme events.

The temporal resolution of the model output is 3 hours and the spatial resolution is 60 km in almost all models participating in the near-term experiments and as fine as 20 km in some models in the time-slice experiments.

The targeted 10-year dataset will be applicable for evaluation of the CMIP5 near-term and time-slice experiment simulations. The 10-year period dataset is sufficient to derive climatologically sensible mean diurnal cycles, it is also useable for analyzing intra-seasonal variability or extreme events under the current climate. On the other hand, it is not sufficient for analyzing inter-seasonal variability and evaluation of the CMIP5 long-term simulations.

It is proposed that evaluation and intercomparison studies are done in a collaborative manner between the modeling group (CMIP5) and relevant science groups who have experiences in carrying out similar studies in specific fields. For example, the LandFlux-EVAL group will focus on the evapotranspiration fluxes assessment, the GSWP groups will focus on soil moisture, etc.

(ii) IPCC AR5 – climate model output uncertainties quantification

To be specified

(iii) Wider modeling community for model validations, developing improved parameterizations

To be specified

(iv) Wider science community - local to regional to global energy and water cycle research

To be specified

6. Technical details

Data to be included
- Data providers: FLUXNET, CEOP, GCOS, satellite data
- Number of sites to contribute – CEOP, FLUXNET groups will nominate the best candidates: FLUXNET "Golden sites", CEOP sites contributing since the beginning of CEOP Phase 1. Suitability of a site will be assessed based on its compliance with prioritized characteristics. The value/priority of consistency of data versus full decade availability, versus geographic distribution versus other related characteristics *is to be discussed and confirmed.*
- Comprehensive dataset covering energy and water budgets is targeted that will be useable for multiple purposes and thus the providers will be asked to provide as many parameters as possible. Basic requirements for CMIP5 are given in the CMIP5 simulation protocol (Taylor et al. 2008).
- Data period *is to be discussed and decided.* There are two views: (i) some reference sites may have difficulties to provide/process most recent data and may prefer earlier period, e.g.: 1998 – 2007, while (ii) other reference sites data and satellite data may not be available for that period yet (MODIS data from 2000).

Data processing, submission, and archiving
Each data provider will provide data in the required format and quality and will equip them with appropriate metadata. The data and metadata formats will be based on/adopted from CEOP.

Data will be archived at the Data Integration and Analysis System at the University of Tokyo, Japan (DIAS), the data integration, analysis, and dissemination system that was launched in 2006 as part of the Earth Observation and ocean Exploration System and that is based on the CEOP scheme. CMIP5 Gateway function in cooperation with PCMDI (CMIP5 Leader)

Data Policy
Data use policy is adopted from the CEOP Reference Site and Satellite Data Release and Use Guidelines and adjusted to the specifics of the 10-YDP project. The full text of the 10-YDP Data Release and Use Guidelines is provided in Appendix A.

7. Implementation

The Project is a collaborative effort among observing and modeling communities primarily involving GEWEX (CEOP, GRP, GMPP), FLUXNET, CMIP5, CEOS, WOAP, GCOS,… others?
Coordination will be lead by the CEOP International Coordination Function, regular teleconferences and workshops will be held.

Implementation Steps
1. Whitepaper and implementation plan drafting – Project mission, objectives, plan…definition; discussion at the Pan-GEWEX meeting.

2. Data format, data policy and processing details agreement
3. Nomination of the "First Track" sites, roughly 30 sites (15 FLUXNET, 15 CEOP).
4. Test datasets submission, check for consistency with agreed-to format led by CEOP reference site data archiving function, NCAR EOL.
5. Full submission of data from the First Track Sites to DIAS -> QC, Metadata -> using the data in preliminary studies – showing possibilities/advantages of such dataset
6. GCOS sites nomination followed by data submission, further CEOP, FLUXNET sites (Second Track Sites) -> QC, Metadata
7. Generation of satellite products for the selected reference sites.
8. Dataset fully opened

8. Schedule

2010

10 July:	Whitepaper preliminary draft
14 July:	First conf. call
22 July:	2nd draft of WP
28 July:	2nd conf. call
31 July:	3rd draft of WP -> provide to wider community
20 August:	Wide communities input -> Pan-GEWEX meeting
23 – 27 August:	discussion at Pan-GEWEX meeting
4 September:	3rd conf. call -> final draft
30 September:	Tentative Implementation Plan
30 December:	First Track Data (FTD) Loading Due QC, Format, Meta Data

2011

30 March:	FTDS Open
May-June:	1st Workshop
20 June:	Second Track Data Loading Due QC, Format, Meta Data
30 September:	STDS Open
November-December	2nd Workshop

9. References

Taylor, Karl E., Ronald J. Stouffer, and Gerald A. Meehl: A Summary of the CMIP5 Experiment Design, 2009. (http://cmip-pcmdi.llnl.gov/cmip5/docs/Taylor_CMIP5_design.pdf)

Appendix A **Data Release and Use Guidelines**

Executive Summary

All data users are strongly requested to follow these data release guidelines that are adopted from the Coordinated Energy and Water Cycle Observation Project (CEOP) Reference Site Data Release Guidelines (http://www.eol.ucar.edu/projects/ceop/dm/documents/ceop_policy.html) and the CEOP Satellite Data Release Guidelines (http://monsoon.t.u-tokyo.ac.jp/ceop2/satellite/guideline-info.html). The following six "golden rules" for a smooth and successful use of 10-YDP Data should particularly be noted and followed by any data user.

1. No financial implications are involved for the 10 Year Dataset Project (10-YDP) data exchange.
2. Commercial use and exploitation of 10-YDP data is prohibited.
3. Any re-export or transfer of the original data received from the 10-YDP archive to a third party is prohibited.
4. The origin of 10-YDP data being used for publication of scientific results must be acknowledged and referenced in the publication.
5. 10-YDP data users are strongly encouraged to establish direct contact with data providers for complete interpretation and analysis of data for publication purposes.
6. Co-authorship of data users and 10-YDP Principle Investigators on papers making extensive use of 10-YDP data is justifiable and highly recommended.

1. INTRODUCTION

The 10 Year Dataset Project was initiated as an international effort in 2010 by the World Climate Research Programme (WCRP) Observation and Assimilation Panel (WOAP) and the WCRP Global Energy and Water Cycle Experiment (GEWEX) and involves several projects, initiatives, organizations and agencies who committed to provide their observation reference sites and/or satellite data per agreed to rules defined in this Whitepaper above. 10-YDP satellite *data providers* also comply to the CEOS satellite data exchange principles for research (http://monsoon.t.u-tokyo.ac.jp/ceop/policy1.html) and the CEOS data principles for operational environmental data (http://monsoon.t.u-tokyo.ac.jp/ceop/policy2.html).

The time periods for which data will be archived will cover the *(to be decided)*.

Archiving all 10-YDP data into one central archive, namely DIAS at the University of Tokyo, and creating harmonized data formats is an essential element of the 10-YDP data policy in order to provide easy access to the data for the *targeted communities*. The latter will be referred to as *data users* in the following data release guidelines.

10-YDP contributing reference sites have been established and are being maintained by a variety of institutions, organizations, national services, international and national research groups, and research individuals. Henceforth, these and the national and international space agencies providing satellite data will be referred to as *data providers*. Maintaining continuous, high-quality measurements, performing quality and error checking procedures, and submitting data and related documentation to DIAS requires substantial financial and logistical efforts of the *data providers*. The necessary support for these activities originate from a variety of international, national and institutional sources.

2. 10-YDP DATA RELEASE AND DISSEMINATION GUIDELINES

2.1 Free and unrestricted Release of Data

The no-restriction principle shall in particular mean that no financial implications are involved for the 10-YDP data exchange. 10-YDP *data providers* shall transfer their measured data to the DIAS free of charge. Also, 10-YDP data files established at the DIAS shall be offered free of charge to 10-YDP *data users*.

2.2 No Commercial Use or Exploitation

It is understood that all 10-YDP data shall be delivered to *data users* only for research and scientific purposes compliant with the objectives described in the 10-YDP Whitepaper. Commercial use and exploitation by neither the *data users* nor the DIAS is prohibited, unless specific permission has been obtained from the *data providers* concerned in writing.

2.3 No Data Transfer to Third Parties

One restriction which will be imposed on all *data users* concerns the re-export or transfer of the original data (as received from the DIAS archive) to a third party. Such restriction shall apply to all categories of 10-YDP data, and is in the best interests of both the data providers and the potential users. Unrestricted copying of the original data by multiple, independent users may lead to errors in the data and loss of identity of its *data provider*-DIAS origin and is strictly prohibited.

DIAS will offer 10-YDP data files to potential *data users* through electronic means, (e.g. the internet). The DIAS shall install technical means to keep protocol on all data transfers to *data users* thus maintaining a catalogue of all *data users*, and the data files they have obtained.

2.4 Acknowledgement and Citation

Whenever 10-YDP data distributed by DIAS are being used for publication of scientific results, the data's origin must be acknowledged and referenced. A minimum requirement is to reference *10-YDP (or particular project/database (CEOP, FLUXNET/AsiaFlux…)?)* and DIAS. If only data from one *data provider/source/project?* or a limited number of reference sites has been used, additional acknowledgement to the *data provider/source/project?* or reference site(s) and its (their) maintaining institutions or organizations shall be given.

Maintaining continuous, high-quality measurements, performing quality and error checking procedures, and submitting data and related documentation to the DIAS will require substantial financial and logistical efforts of the *data providers*. The necessary support for these activities originate from a variety of international, national and institutional sources. The DIAS shall make proper reference to all *10-YDP data providers* and, if required, to their funding sources.

2.5 Co-operation between 10-YDP Data Users and Principal Investigators (PIs) at the 10-YDP Data Providers

Data users of 10-YDP data are encouraged to establish direct contact with PIs at *data providers* for the purpose of complete interpretation and analysis of data for publication purposes.

2.6 Co-Authorship for 10-YDP Principal Investigators (PIs)

Co-authorship of 10-YDP PIs on papers making extensive use of 10-YDP data is justifiable and highly recommended, in particular, if a PI has responded to questions raised about the data's quality and/or suitability for the specific study in question, or has been involved in directly contributing to the paper in other ways. It is highly recommended that any *data user* should contact the responsible PI and ask him/her if he/she wants to become co-author, or if an acknowledgement (see section 2.4) would be sufficient. If co-authorship is requested, the PI and the *data user* should establish a basis for collaboration. A PI in this context means the responsible site or instrument scientist or any person (student, collaborator) that he/she may suggest.

2.7 CEOP Publication Library

Whenever 10-YDP data distributed by DIAS are being used for publication of scientific results, the author(s) shall sent a copy of the respective publication, preferably in electronic form, to the *DIAS (or 10-YDP point of contact?)* in order to build up a 10-YDP publication library. *DIAS (or 10-YDP?)* will maintain this library and will make it public, for example via *DIAS (or 10-YDP?)* web site, for a continuous monitoring of the 10-YDP data applications and 10-YDP's achievements in general.

ATTACHMENT 3 Schedule of MODIS data production by NASA and processing by JAXA