Report of Actions/Recommendations the World Climate Research Programme (WCRP) Global Energy and Water Exchanges (GEWEX) Project, Hydroclimatology Panel (GHP) Business Meeting 10-13 December 2014 Including a Joint Session with Representatives of the Global Drought Information System (GDIS) on 10 December (Final Draft Rev1: 22 January 2015)

This document provides the initial draft of the notes, actions and recommendations from the business meeting of World Climate Research Programme (WCRP), Global Energy and Water Exchanges (GEWEX) Project Hydroclimatology (GHP) that included an open session with representatives of the Global Drought Information System (GDIS) on 10 December, 2014. The meeting took place at the California Institute of Technology in Pasadena, California, USA. The meeting was hosted by Dr Graeme Stephens, Director of the Center for Climate Sciences at NASA's Jet Propulsion Laboratory, in his capacity as Co-Chair of the GEWEX Scientific Steering Group, with Dr Sonia I. Seneviratne.

The material related to this report including the presentations is available at the meeting Web Page: http://www.gewexevents.org/ghp-agenda/.

-NOTE- TIMING OF THE NEXT GHP MEETING: Proposed location for the next full GHP Business meeting is Arusha, Tanzania, Dates are TBD in the Fourth Quarter of 2015. Fred Semazzi to explore this possibility.

I. Purpose of the Meeting

The Global Energy and Water Exchanges (GEWEX) Project is a core project of the WCRP, which is based on integrated research projects, observations and scientific activities that aim to improve the knowledge about global climate change and its impacts on a regional scale. GEWEX integrates scientific research, production and collection of information in the form of observational data, as well as products derived from applied algorithms and analysis of numerical model solutions, all distributed among different panels. The GEWEX Hydroclimatology Panel (GHP), has been organized around several Regional Hydroclimate Projects (RHPs) and a number of cross-cutting science topics.

The goal of the 4-day meeting was, therefore, to evaluate the ongoing and planned GHP activities to ensure that the panel continues to contribute effectively to the leading role that GEWEX plays in the hydrological sciences and related modeling activities. The GEWEX Science Questions http://www.gewex.org/pdfs/GEWEX_Science_Questions_final.pdf and the WCRP Grand Challenges, were at the heart of the discussions, which resulted in improved interactions between the GEWEX RHPs and their involvement in the cross-cutting projects.

The joint open session with representatives of the Global Drought Information System (GDIS) on Wednesday 10 December, saw representatives of the GHP RHPs and other scientists present their drought-related research with other science talks on topics of importance to society and relevant to climate services.

The agenda outlining the overall structure of the meeting is provided in Appendix 1.

2. Objectives and Goals

The goals of the joint GHP/GDIS session were summarized as to be a joint effort to improve regional drought specific monitoring and forecasts. Closer collaboration between regional efforts within GHP and GDIS could benefit both programs through the sharing of data, modelling expertise, local capacity building etc.

These talks set the stage for productive discussions and interactions between the interdisciplinary and international individuals and groups that participated in the meeting. These presentations also established the basis for the primary topics related to the work that the GHP and the GDIS are responsible for carrying forward in support of WCRP and GEWEX.

Drs G. Stephens, S. Seneviratne Co-Chairs, of the GEWEX Scientific Steering Group (SSG); P. van Oevelen, Director of the International GEWEX Project Office (IGPO); S. Schubert, GDIS Science Team lead; and J. Polcher and J. Evans, GHP Co-Chairs, provided material at the opening of the meeting and at the start of the Joint and GHP-specific sessions that outlined the goals and objectives of the meeting that were most relevant to GHP.

3. Summary:

In keeping with the recent strategic planning process in WCRP and GEWEX, the meeting was organized partly as an effort to further sharpen the development and implementation of the WCRP Grand Challenges http://www.wcrp-climate.org/grandcha.shtml. Specifically, the WCRP Grand Challenge related to changes in water availability is led by GEWEX and is designed to respond to issues associated with how to better understand and predict precipitation variability and changes, and how changes in land surface and hydrology influence past and future changes in water availability and security.

For GHP, this approach is especially related to the challenge of developing a water strategy that addresses the issue of past and future changes in Water in general, and the GEWEX science question on global water resource systems in particular.

In this context, the meeting provided material that can be used to expand the current outline, define desired activities (meetings, workshops, conference sessions, Panel meetings, etc.) and timelines, and assess needed resources (organizational, financial, and human resources) that will allow progress to be made in this arena.

The perspective within which the GEWEX Science Questions (GSQs) were framed was provided by Dr Stephens, in the form of Table 1:

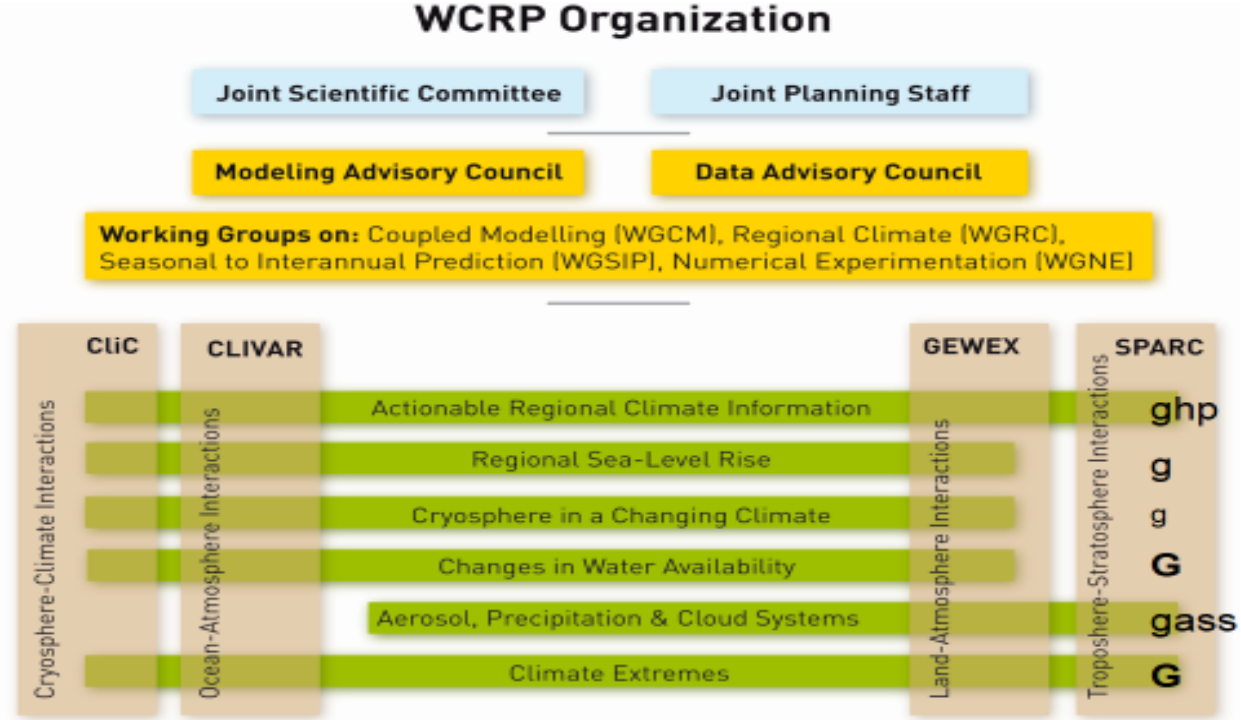

Table 1: GEWEX Contributions to WCRP Grand Challenges

In terms of the GEWEX Science Questions, the matter of “Water availability” will be addressed in all 4 GSQs, especially the first 2, namely:

• Observations and Predictions of Precipitation

• Global Water Resource Systems

• Changes in Extremes

• Water and energy cycles and processes

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The comprehensive conclusion was that the implementation of the WCRP Grand Challenges and science questions depended upon issues including: observations and data sets, their analyses, process studies, model development and exploitation, applications, technology transfer to operational results, and research capacity development and training of the next generation of scientists. In addition, they involve all of the GEWEX Panels and will benefit greatly from strong interactions with other WCRP projects such as CLIVAR, SPARC, and CliC and other related global environmental change (GEC) research programs, such as IGBP, International Human Dimensions Programme (IHDP), and DIVERSITAS, or the new initiative called Future Earth.

Additionally, the Panel was advised of the success of the GEWEX Science Conference that took place at the World Forum, The Hague, The Netherlands, from 14-17 July 2014 http://gewex.org/2014conf/home.html. The Conference celebrated 25 years of GEWEX research and set the stage for the next phase of research addressing the WCRP Grand Challenges on water resources, extremes and climate sensitivity through observations and data sets, their analyses, process studies, model development and exploitation, applications,

technology transfer to operational results, and research capacity development and training for the next generation of scientists.

4. GHP Role in GEWEX

The strategy of using its Panels and their broader research communities to articulate the GEWEX contribution to the WCRP Grand Challenges resulted in the form and content of this meeting. As the speakers articulated in their charge to the participants, it is necessary that the outcomes include individuals and groups that will focus on the key issues and that will ensure that the expected results are accomplished within specific timelines to achieve progress and reach milestones that meet specified metrics.

The leadership role of GHP in the hydrologic sciences and modeling activities within WCRP has been established as has the progress of the GEWEX Regional Hydroclimate Projects (RHPs) in seasonal forecasting, the detection and attribution of change, and the development and analysis of climate projections.

Figure 1 shows the role GHP plays in the overall GEWEX framework.

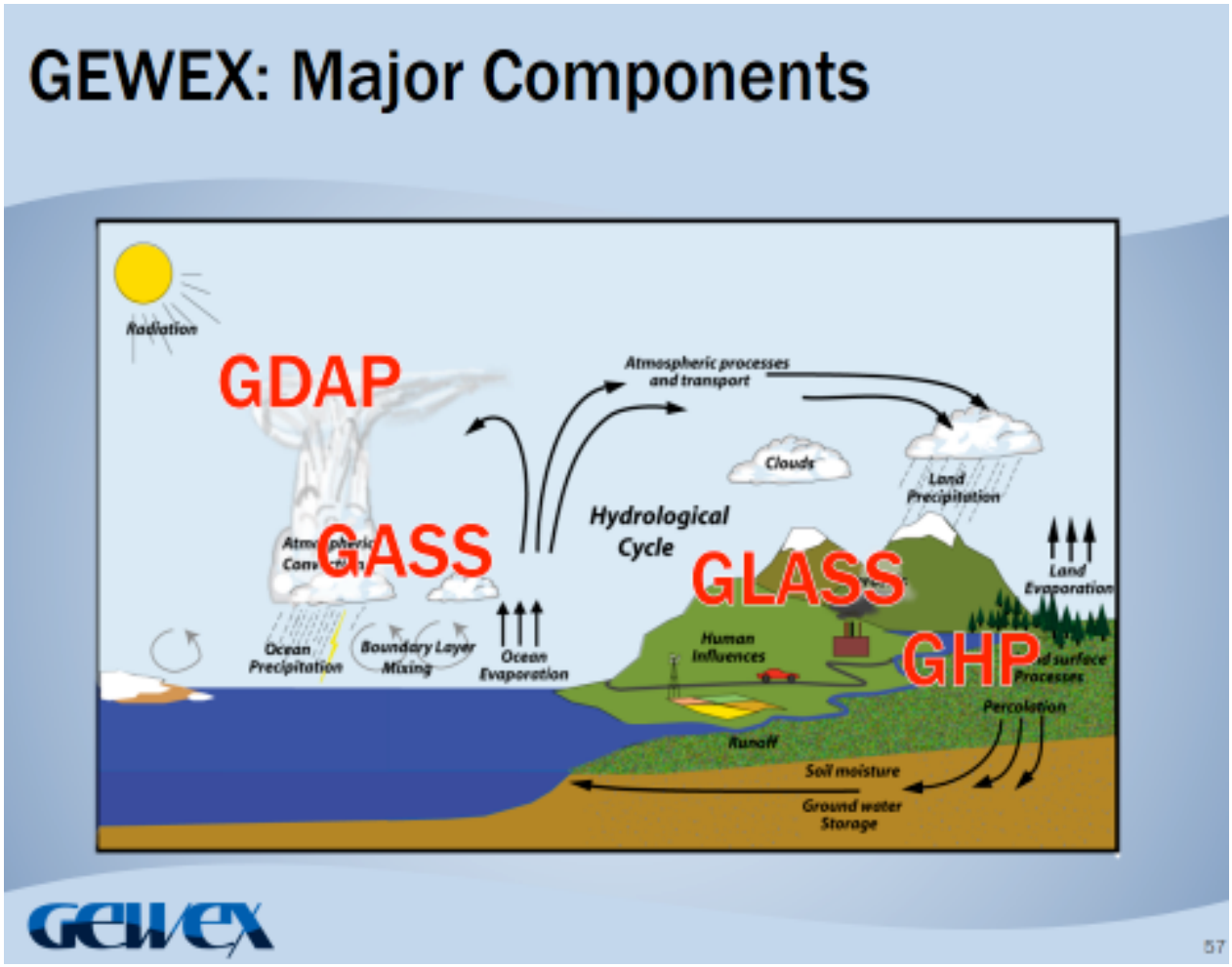

Figure 1: GEWEX Functional Elements

4.1 RHP Related Issues, Actions and Recommendations

In keeping with the need to be responsive to the WCRP/GEWEX main challenges and scientific questions GHP has organized itself to address the GEWEX science questions from a regional and integrated perspective. Only at the regional scale can the water cycle be addressed from its physical to human and socioeconomic aspects.

The RHPs are an essential tool in this endeavor as they bring together various disciplines on the water issues. The Cross-Cut projects allow GHP to propagate knowledge from one region to the other and synthesize results at the global scale. They also allow development and testing of applications developed with the new understanding that they deliver both science advances and applicable outcomes for stakeholders and services. Figure 2 provides a summary of RHPs.

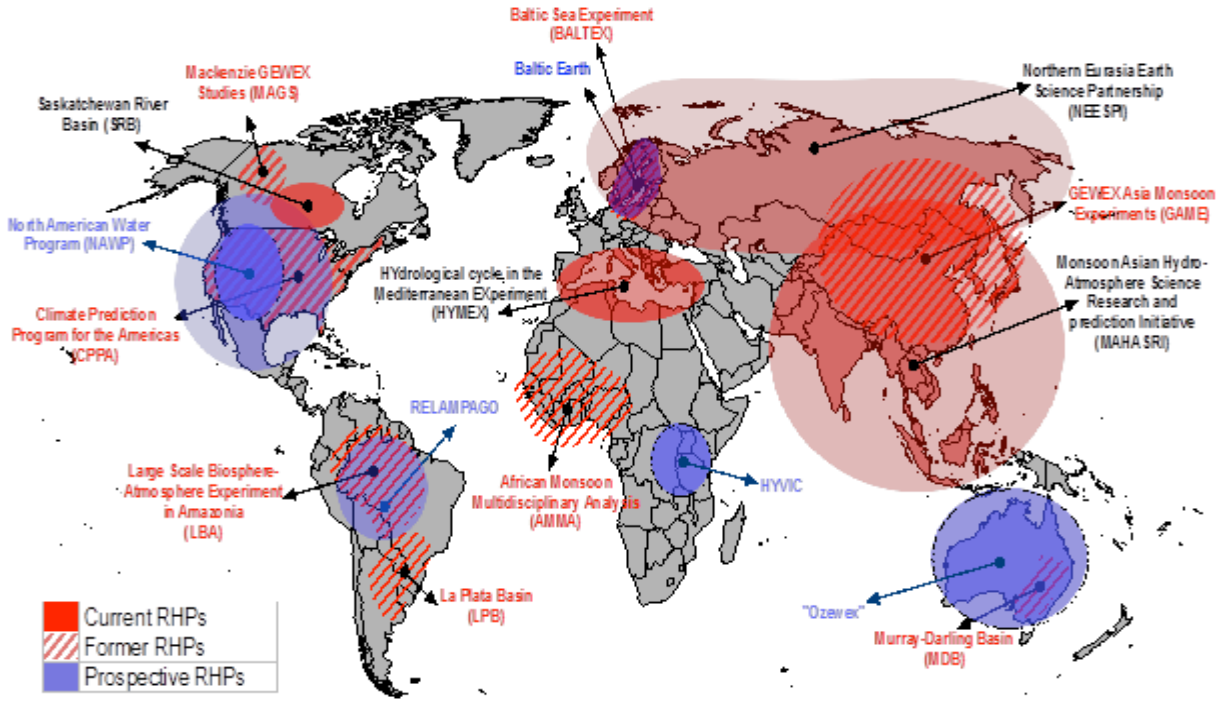

Figure 2: Summary of GHP Regional Hydroclimatology Projects (RHP) and related Features

Action (A1) RHP representatives, when reporting progress and plans, should always provide synopses of work in context of GSQs. Each RHP representative, of record, had again been advised to provide a report of what part(s) of their past efforts, current work and planned efforts were/are relevant to each GSQ. Each report needs to include information associated with each GSQ, including for example, (i) coordination with stakeholders to jointly produce tools and applied datasets; (ii) interactions with modeling groups showing improvements in model developments, specifically associated with any progress on High Resolution modeling and their validation with datasets, and application by services; and (iii) Involvement of early career scientists, and related outreach initiatives.

The Panel retained the designations (Former, Current, and Prospective) for the RHPs as noted in Figure 2. In accordance with existing criteria and with refinement of their end dates, the Panel accepted the continuation of three studies (NEESPI-April 2015, MAHASRI-March 2016, and HyMeX-due to provide a mid-term review in 2016, after 5 years of implementation).

The Panel had earlier accepted the SSG's request to develop a strategy for addressing the GSQs within the context of its core activities. For the RHPs it was noted that the GSQs pose issues that are central to each of the regional activities of GHP and that being responsive to the these topics had been made part of the new criteria for reaching full RHP status.

Action (A1a): The action for IGPO to set up an RHP-Specific Web Page Reporting scheme by July 2015.

The International GEWEX Project Office (IGPO) agreed to set-up, through the main GEWEX Web Page, a means for the RHPs to report their progress, in the context of the GSQs each science question (e.g. a short text on what aspects of their work were/are GSQ-relevant and specific key results). The Panel agreed that the action to set-up a Web Page "reporting" scheme/template for the RHPs would extend to former as well as current studies. Due to unforeseen delays in the implementation of the new GEWEX-wide Web-Page the schedule for going on-line with the GHP/RHP interactive reporting template "add-on" was also set back. As noted, the template should be available for initial application by July 2015.

4.1a MAHASRI – Reported by Dr J. Matsumoto

The Panel was advised that the sunset date for MAHASRI had been extended from the March 2015 time period out to March 2016. With the new sunset date established and acknowledged the Panel, Matsumoto agreed:

Action (A2): To Organize sessions, which highlight the GSQ-relevant work MAHASRI has undertaken (as noted in Action A1 above), at the March 3-4, 2015-"Japanese Domestic Workshop on MAHASRI and Beyond".

Action (A2a): as a corollary to action (A2), to begin to write summary papers in BAMS and JMSJ in early 2015, which also emphasize the contributions MAHASRI has made to the GSQs

Action (A2b): To keep the Panel informed of plans for a March 2-4, 2016: International Science Conference on MAHASRI that would mark the end of the Project.

Action (A2c): To keep the Panel informed of plans for a follow-on Regional Study partially oriented around GSQs. Specifically report on this matter at the 2015 GHP meeting.

4.1b NEESPI Reported on by Dr. P. Grosiman

As previously reported and acknowledged by the Panel the sunset date for NEESPI was specified to take place at a "Synthesis NEESPI Workshop" (Prague, Czech Republic; April 9-12, 2015). Actions agreed to included:

Action (A3, i, ii, iii, iv): P. Groisman to ensure (i) that the NEESPI End of Project Plan include an overview of contributions NEESPI has made to the GSQs over the 10 year period the Study has been functioning; (ii) that the Panel is formally informed in a timely manner of the plans for the NEESPI Wrap-up Conference in Prague, (iii) that the Panel is kept informed of the process for the transition from Northern Eurasia Earth Science Partnership Initiative (NEESPI) to "Northern Eurasia's Future" Initiative (NEFI). Specifically to provide a report on the matter at the 2015 GHP meeting, and (iv) that any formal document/book summarizing NEESPI results contain reference to GEWEX as specified in the GHP/RHP criteria.

4.1c HyMeX Reported by Dr P. Drobinski

The Panel was informed that HyMeX will perform a mid-term review of the project in 2016, after 5 years of implementation. At 2015 GHP meeting HyMex will (Action A4) present the prescribed mid-term report of the work accomplished that is relevant for the GSQs.

4.1d SaskRB Reported by Dr H. Wheater/R. Stewart

It was reported that SaskRB had continued a transition from initiating to functioning RHP after being launched through the Workshop: Water Strategy for the World Climate Research Programme (WCRP), which addressed the WCRP Global Grand Challenge on Past and Future Changes in Water and the GEWEX Science Question on Global Water Resource Systems (GSQ-2) that took from 5-7 June 2013, at Saskatoon, Canada (http://gewex.org/ghp-gdap/docs/GSQ2MtgRept.pdf).

The Panel was advised that the Changing Cold Regions Network (CCRN), 2013-2018, Project which they were informed of at the GHP September 2013 meeting and which enlarged the scope of SaskRB, was being formally proposed as a new GHP RHP that would have as its domain both the Saskatchewan River Basin (SaskRB) and the Mackenzie River Basin. This was in opposition to the possibility of keeping SaskRB, as an already functioning RHP, and "adding" the Mackenzie River Basin (MacRB?) study as a new initiating RHP that would draw on the successful legacy of the Mackenzie GEWEX Study (MAGS) Continental Scale Experiment (CSE).

The proposal noted that:

Over the next five years, CCRN will:

- Improve our understanding of recent Earth system change in the cold interior of western and northern Canada
- Advance water, weather, climate and environmental prediction
- Improve our understanding of Earth system processes and their representation in hydrological, atmospheric and ecological models
    - Enhance our capability for water management
    - Train the next generation of Earth System Scientists

- Provide high quality datasets for change assessment and model verification

On the basis of the presentations by Drs Wheater and Stewart and the ensuing discussion:

The Panel made the following Recommendation (R-1) to be carried forward to the SSG for endorsement: The Panel approved CCRN as a new/Initiating RHP replacing SaskRB.

CCRN will be part of the exchange the panel co-chairs will have with CliC.

4.2 Proposed RHP Related Issues, Actions and Recommendations

4.2a HyVic by Dr F. Semazzi

The Panel noted the progress of the implementation of study of the hydrology of the Victoria Basin (HyVic), which had been under consideration for designation as an Initiating RHP since the GHP meeting of opportunity that took place at the GEWEX 7th Science Conference, July 2014, The Hague, The Netherlands. Of specific interest was the establishment of a mechanism for connecting with regional stakeholders, which took the form of the interactions with HyVic within the umbrella of the East Africa Community led Hydroclimate to Nowcasting Early Warning Systems (HyNEWS) consortium.

Since the meeting at The Hague, Drs Polcher and Evans had worked with Dr Semazzi to upgrade the documentation and provide guidance necessary for HyVic to meet the GHP RHP criteria for Initiating status.

The outcome was that:

A number of suggestions were formulated by the panel members:

- Create a web present for HyVic
- Develop a local drought monitoring system
- Initiate actions on capacity building in the region.

And the Panel made the following recommendation:

Recommendation (R-2) to be carried forward to the SSG for endorsement: The Panel approved HyVic as a new/Initiating RHP with the stipulation that IGPO assist HyVic to establish a Web Page and that Semazzi advance the case for a local drought monitoring system and additional capacity building within the HyVic Framework.

4.2b OzEWEX by Dr Albert van Dijk

The Panel heard that the outcome of the OzEWEX 1st Annual OzEWEX Workshop 28–29 October 2014 Canberra, Australia (Reference Summary in GEWEX Newsletter, Vol. 24 No. 4, November 2014), as reported by Dr Albert van Dijk included agreements on a set of amalgamating themes that were oriented toward meeting the criteria of an Initiating RHP. In specific the workshop was responsive to issues discussed at the July 2014, GHP meeting held at The Hague, namely, that:

- working groups had been established that unified groups of researchers around scientific issues relevant to GEWEX;

- the Project and the working groups are seeking institutional funding and support for relevant research efforts and “like-kind” support overall is already at significant and sustainable levels;

- regional data gathering has been done (and continues) leading to a concept for OzEWEX to possibly have a project office, that would operate with a small amount of dedicated resources and act as a central point of contact for data requests, updates on specific sub-activities, etc.;

- there is a SMAP/soil moisture field campaign that provides a field campaign framework to build on.

The Panel concluded that these outcomes had strengthened the OxEWEX concept and that there is a sufficient number of investigations into a broad range of issues that need to be worked on and that relate directly to the WCRP GCs and GEWEX GSQs to warrant:

Recommendation (R-3) to be carried forward to the SSG for endorsement: Approval of Initiating RHP status for OzEWEX

The Panel suggested that the management structure of the Project be strengthen to ensure that the in-kind and voluntary contributions that have been pledged are actually delivered in a timely manner.

4.2c BALTEX-BALTIC EARTH by Dr. M. Reckermann

The Panel continued its support of BALTIC-Earth, which was launched at the 7th Study Conference on BALTEX in June 2013, as a potential RHP. The report to the Panel by Dr Reckermann confirmed the earlier conclusion that BALTIC Earth is aligning well with WCRP/GEWEX challenges and science questions, noting that all of the BALTIC-Earth GCs, except for GC2, are associated with topics of direct interest to GEWEX at both the regional and global scales. In specific, that the Science Plan had iterated the connections between the BALTIC Earth GCs and the GSQs as shown in Figure 3, below.

None-the-less, the Panel voiced its concern that BALTIC Earth is lacking a specific hydrological component and is missing connections to weather services and deficient in plans for field campaigns organized around a definite land component that would generate data of value and interest to the broader GEWEX community.

The Panel decided that it was necessary to communicate directly with the Baltic Earth Science Steering Group (BESSG) that had been installed as of June 2014, in an attempt to ensure that the Baltic Earth Science Plan, that is being finalized by March 2015, includes the components that would allow it to be more consistent with meeting the criteria to be designated as a new/Initiating GHP RHP.

As a result the Panel asked Dr Polcher to undertake Action (A5) to act as the GHP Panel advocate for promoting a broader Land/Hydrological component in BALTIC Earth and to specifically contact/meet with BALTIC-Earth representatives of record, especially the BESSG, to

ensure that the Science Plan evolves in a more synergistic way with the GSQs. In the interim the Panel tabled a decision to approve BALTIC-EARTH as an initiating GHP RHP.

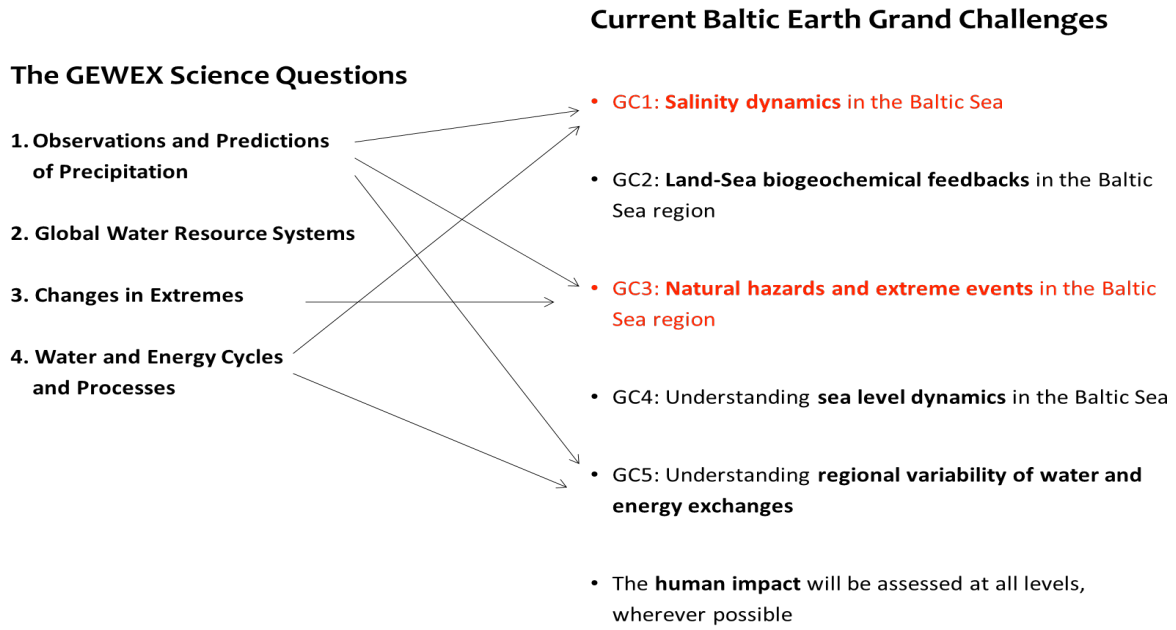

Figure 3-BALTIC Earth Science Plan Mapping to GSQs

4.2d RELAMPAGO - Remote sensing of Electrification, Lightning, And Meso-scale/micro-scale Processes with Adaptive Ground Observations by Drs A. Nunes and J. Polcher on behalf of Dr. L. A. T. Machado (including input from Dr F. Dominguez)

The Panel, thanked Dr Nunes for making the RELAMPAGO presentation, but noted that the overarching science goals are still not clearly defined. The Panel also, continued to express its interest in seeing more specific examples of a more balanced focus between Meteorological aspects and the Hydrological issues/community of the region. Dr Berbery noted that CLARIS/LPB started in this region and included matters related to floods, river flow, and associated land surface phenomena and although this was slow to evolve under the LPB RHP framework, RELAMPAGO should consider means for taking advantage of this legacy in hydrology and climate (http://www.claris-eu.org/). Dr van Oevelen also suggested that work in regions in proximity to the RELAMPAGO study area should be taken into consideration.

In a summary statement, Dr Dominguez noted that the Panel wished to specify to the RELAMPAGO community, including the Principle Investigator, Dr S. Nesbitt, that the proposals for RHP have to clearly identify how their goals are related to the GSQs, and in the case of RELAMPAGO this needed to be clarified along with the efforts to link with the hydrometeorology and hydrology communities. Specifically the Panel wishes to know how the hydrology measurements (which need to be longer-term) will link to the campaign-style atmospheric measurements. Also - how will the field campaign data be understood within the context of the regions climate?

Action (A6): Polcher to continue to assist the RELAMPAGO Community through direct contact with the lead Scientists and Investigators, with further development, in 2015, of near term plans

to reach out to other scientists with observational and modeling interests and the crafting of a white paper that can become the basis for a more formal request for Initiating RHP status for RELAMPAGO.

4.2e Pannonian Basin by Dr J. Cuxart

The Panel felt that the presentation by Dr Cuxart was compelling on several levels for this region to become a GHP RHP. The physical setting, as a nearly closed basin, is especially suited for a controlled interdisciplinary experiment. The location between HyMeX and Baltic Earth provides a unique opportunity to link RHP efforts on a number of physical and scientific echelons. Scientifically it is an interesting region which is under the influence of the Mediterranean, Atlantic and continental climate regimes. The Panel agreed that GHP could play an important role in initiating the convergence of Pannonian basin hydroclimatological research, through its RHP and crosscutting science foci framework.

The Panel asked Dr Cuxart to (Action A7a) further develop and distribute a brief whitepaper summarizing what the basis and characteristics for a Pannonian basin water and energy cycles Experiment (PannEx) in the context of a GHP RHP, with the stipulation that consideration is given to the possibility of broadening the effort to include the larger Danube basin.

IGPO was asked (Action A7b) to assist in promoting/adding GEWEX aspects and features to the planning of a 2-day PannEx workshop, hosted by the Meteorological and Hydrological Service of Croatia, in the area of the city of Osijek, in fall 2015.

It was concluded that the proposed timeline for defining PannEx (2015/17), proposing it as an RHP (end of 2017) and gaining RHP Initiating status (2018/19), was acceptable for future planning.

4.2f USA Water and Energy Exchanges (UWEX) Study/RHP by Various Contributors

The Panel was informed that USA agencies were preparing to undertake a study to determine the feasibility/scope of a regional experiment that would build off the legacy of earlier GEWEX-style studies (e.g. GCIP, GAPP), but that would incorporate new observational and modeling capabilities to better understand and predict climate change and the management of USA water resources. The Panel was asked by the GEWEX SSG Co-Chairs (Stephens/Seneviratne) to (Action A8a) help with a scoping exercise by developing a proposal that meets the criteria of a GEWEX–style regional effort positioned in USA.

To begin this exercise the Panel took a number of Actions.

Action (A-8b): Appointed a planning committee made up of the following members: F. Dominguez (U. Arizona), R. Rasmussen (NCAR), A. Barros (Duke Uni.), Tom Painter (JPL) and Levi Brekke (Bureau of Reclamation) to immediately begin the task of preparing a draft whitepaper that specifies the main science issues to be addressed by such a study along with the region(s) of interest, the tools and funding sources/opportunities, the main stakeholders/applications, social issues to be considered, links with other groups/studies (both national and International), outreach opportunities, etc.

(Action A-8c): To formalize the committee and the scope of their work the Panel asked Dr Seneviratne with support of the IGPO to draft a letter of nomination and Terms of Reference (TOR) for the committee.

Action (A-8d): On the longer term the group is to reflect on the structure and organization of such an experiment in the specific framework of a GEWEX RHP mainly addressing the contribution such an RHP would make to the GSQs.

The panel made a number of suggestions to help start the work of the planning Committee on a USA RHP, namely that:

- Time scales should go from weather to climate
- The project should be centered on application driven researchers
- The region of choice should be the Colorado basin within the Wester US Climatic region.
- The whitepaper, once completed, should be publicized in an article in the GEWEX Newsletter.

4.3 Cross-cut presentations Actions

The concept of the Cross-cut (CC) Projects, as the second core element of GHP, with the RHPs, has been retained as a means of generating interactions between RHPs, maintaining links with completed RHPs, advancing the GHP contributions to the WCRP Grand Challenges and the GEWEX Science Questions, addressing issues of common concern with the other GEWEX Panels and WCRP projects and engaging the broader Community in GEWEX/GHP work.

All of the CCs, (Currently Active, Proposed and Potential) as listed below are being constrained to be projects to be carried out for 2-3 years but, which can be renewed. To be considered by the Panel the topic must be addressed in a short proposal that follows a prescribed template with specifics related to the science objectives, the relationship to the RHP's and the GEWEX Science Questions, and their implementation process.

GHP Cross-Cut Projects List

Currently active

● INTENSE (Sub-daily precipitation) (H. Fowler)
● LSM validation & Benchmarking (M. Ek) – has become a more general attempt to encourage
● GLASS-GHP collaboration

Proposed

● Cold/Shoulder Season Precipitation Near 0°C, (R. Stewart/P. Groisman)
● MOUNTerrain (Mountainous Terrain rainfall) (J. Renwick)
● Including water management in large scale models (R. Harding/A. Nazemi)
● INARCH (Mountain Hydrology) (J. Pomeroy)

Potential

● Seasonal hydrologic prediction (A. Wood/HEPEX)
● GDAP integrated product regional evaluation

4.3a **Sub-Daily Rainfall (INTENSE) by Dr. Jason Evans for Hayley Fowler**

The INTENSE project officially started in Feb 2014 and is gradually gaining momentum (and will gain further momentum with additional staff recruitment in Jan 2015) and since July 2014 has been merged with the GHP cross-cut on sub-daily precipitation to provide the core effort in this area.

INTENSE has evolved into a funded European Research Council project "INTElligent use of climate models for adaptatioN to non-Stationary hydrological Extremes" led by Dr Hayley Fowler with a number of international project partners. This provides the funded core of a community effort into the collection and analysis of sub-daily precipitation data and model outputs.

In matters related specifically to GEWEX, INTENSE is contributing to the GSQ1, 3 & 4 with main inputs to GSQ1 and 3. INTENSE will contribute understanding of sub-daily rainfall extremes and their changes globally and how these are simulated by high and very high resolution climate models and projected to change. Additionally, for GSQ4, energy and water cycle process studies are dependent on good quality datasets and INTENSE is aiming to provide the required datasets for sub-daily precipitation. INTENSE will also provide information on improvements gained from running very high resolution climate models in different regions.

A key matter in the success of this effort is that appropriate datasets and methods are not necessarily available with which to evaluate model outputs.

The action (Action A-9) is for Fowler to contact Schneider at GPCC to establish if those Centers could be a resource for datasets relevant to INTENSE. In addition RHP Representatives and other CC Leads need to be contacted for specific discussions related to provision of relevant datasets. Comments at the meeting suggested that contributions could be available from HyMeX (Drobinski), CCRN (Wheater/Stewart), OzEWEX (van Dijk), MAHASRI (Matsumoto), BalticEarth (Reckermann) and Renwick and Pomeroy who are looking into Mountainous Terrain rainfall and Mountain Hydrology respectively.

In a more general sense, Polcher/Evans and IGPO agreed to assist Fowler and other Panel Project Leads with Action A-9a, namely, the tactical steps necessary including, letters, emails, side meetings, web-site presence, etc. to expedite/facilitate/encourage these intra-Panel communications/linkages.

4.3b **LSM validation & Benchmarking by Dr. M. Ek**

The Panel noted that this CC has evolved into a more general attempt to encourage Inter-Panel linkages, the collaboration has been undertaken by Dr Ek, on behalf of GHP, through the GEWEX Global Land/Atmosphere System Study (GLASS) Panel.

The basis for the connection with GHP is a that there are mutual benefits to be gained including (i) RHPs can provide regional data sets and local/regional modeling expertise, (ii) datasets/models GLASS is working with include near-surface meteorology and land & soil, surface fluxes plus meta-data, but extend to include hydrology & atmospheric profiles, (iii) continues application Model Output Location Time Series (MOLTS) data that had become of interest during model studies undertaken in GEWEX prior to the Panel's current structure, (iv) fosters interactions between GLASS/GASS modeling activities and similar regional studies associated with the RHPs, and (v) improves models for global use via broad integration of process-level understanding gained from GHP/RHP interaction.

The Panel was informed that the PALS Land sUrface Model Evaluation Benchmarking pRoject (PLUMBER), www.pals.unsw.edu.au, effort is continuing to evolve as a "community" experiment that aims to introduce the concept of land model benchmarking in land modelling development and validation processes taking place within the broader community.

The Panel asked Dr Ek to (Action A -10), as the newly appointed GLASS Co-Chair, continue to provide a GLASS/GHP liaison. That role would continue to include specifying examples of how the work is being leveraged off of the GHP/RHP efforts to provide the community with high quality datasets and improve high resolution regional scale models. In addition the value of this work and the interactions between GLASS and GHP needed to be articulated in the context of how it is advancing work that adds value to the GSQs.

Having identified this effort as an inter-Panel coordination function it will not be carried forward as a GHP CC but will remain an important part of GHP. Another matter that was mentioned at the meeting was the value of MOLTS data as a contribution from the RHPs to the model benchmarking process(es). Decisions on these matters remained TBD.

4.3c Cold/Shoulder Season Precipitation by Drs Groisman/Stewart

The Panel acknowledged that this phenomenon was of interest/importance to the GHP/GEWEX climate research agenda and that the basis of this proposed GHP CC was articulated clearly to be: To improve our understanding of future changes in hazardous cold/shoulder season precipitation and storms, especially occurring near 0°C that have been shown to be devastating to a number of societal activities and, which are sensitive to changing climate uncertainties.

The Panel's main concern was that details of what could be accomplished in the next 2-3 year period were not specified and they asked Drs Stewart and Groisman to (Action A-11) follow through on the plan to prepare a review article for BAMS that would articulate more clearly what is needed and what will be accomplished within the framework of a GHP CC, especially what the results (deliverables) will be in the next 2-3 year period and how they will advance progress on addressing the GSQs.

The Panel reiterated the need for RHP Representatives and other CC Leads, in regions most affected by this phenomenon (e.g. Arctic and Antarctic-CliC, high seas and corresponding coastal areas, mountainous regions exposed to oceanic water vapor transport, regions exposed to water vapor transport from large lakes and interior seas-CCRN, etc.) need to be contacted for specific discussions related to provision of relevant datasets/models (see Actions A-9 and A-9a above, as an example for what is needed in this context). In particular the Panel asked the Co-Chairs to be the primary points of contact between CliC and the work/plans associated with this CC.

Recommendation (R-4) to be carried forward to the GEWEX SSG for endorsement: That the Cold/Shoulder Season Precipitation Near 0°C effort be accepted as a formal GHP CC.

4.3d MOUNTerrain (Mountainous Terrain rainfall) by Dr J. Renwick (Skyped)

The Panel felt that the presentation and the Newsletter article, prepared earlier, (Vol. 24 No. 4, November 2014) did articulate the science questions of relevance to understanding precipitation processes in mountainous regions and provided a clear statement of the objective of MOUNTerrain to be to contribute new and improved data sets, deeper understanding of mountain precipitation processes, and to facilitate improvements in numerical weather

prediction models, climate models, and hydrological models. The development of observational data sets will be a central activity.

However, there was consensus that there was a need to specify what will be accomplished more specifically within the framework of a GHP CC, especially what the results (deliverables) will be in the next 2-3 year period and how they will advance progress on addressing the GSQs. Also, that a steering group with broader perspective on the science and objectives of the effort should be named.

The Panel agreed that this was an important issue for the GHP to undertake and wanted it to mature with the encouragement and backing of the Panel.

Renwick was assigned Action (A-12) to address the needs for more specific short term deliverables and to make an effort to engage a wider group of experts in the discussion/planning for moving forward with this work. Van Lipzig agreed to contact Renwick and to assist with this work and with nominating others with an interest in contributing. In this context, the Panel reiterated that RHP Representatives, other CC Leads, heads of Data Centers and other Panel Chairs/members (GPCC, GDAP, HyMeX, CCRN, etc.) need to be contacted for specific discussions related to provision of relevant datasets/models/studies (see Actions A-9 and A-9a above, as an example of what is needed).

The Panel's Recommendation (R-5) was to encourage this effort through 2015 and to evaluate its progress toward formal acceptance as a GHP CC at the 2015 meeting.

4.3e Including water management in large scale models by Dr R. Harding/H. Wheater (with A. Nazemi)

The Panel agreed that this concept had made good progress from being initially proposed at the July 2014 side meeting at The Hague, up to the time of the December meeting. There was a general support for moving forward with the idea and asked Dr Harding with support from Dr A. Nazemi to take action (A-13) to promote a conceptual approach as outlined in Figure-4 below and to follow through on:

(i) establishing a formal working group, that will author a GEWEX Newsletter article;
(ii) continuing to review work in progress to establish what is being done and where there are global data gaps;
(iii) connecting with the RHP Representatives (OzEWEX, CCRN, etc.) and other groups including GLASS (PALS), and local operational modeling groups;
(iv) setup sessions on this topic at International Meetings;
(v) establish connections with EartH2Observe http://www.earth2observe.eu/, and seek support from WCRP to obtain possible support to organize a relevant Workshop on this topic in the context of the WCRP GC-2 on Water Availability.

Demand and allocation into Climate models?

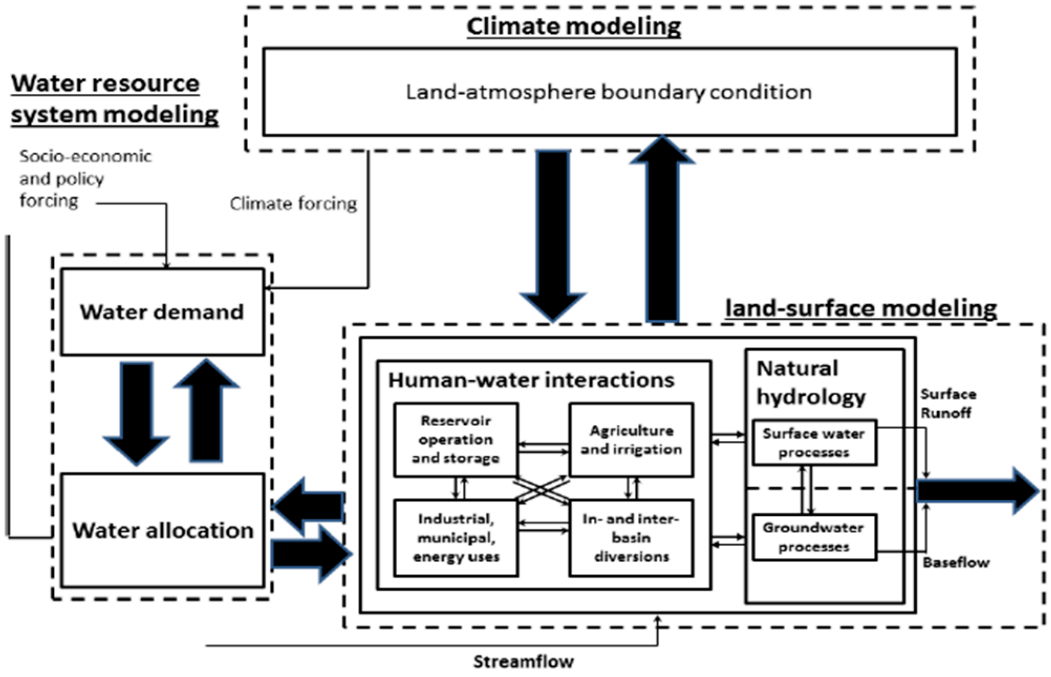

Figure 1. A fully coupled framework for inclusion of water resources management in a typical LSS grid.

Nazami and Wheater 2014

Figure-4, Conceptual view of the GHP CC for Including water management in large scale models

The Panel's Recommendation (R-6) was to encourage this effort through 2015 and to evaluate its progress toward formal acceptance as a GHP CC at the 2015 meeting.

4.3f INARCH (Mountain Hydrology) by Dr. J. Pomeroy

The concept for the International Network for Alpine Research Catchment Hydrology (Crosscut) Study had initially been proposed at the GHP side-meeting at The Hague in July 2014. The Panel acknowledge the extent of the maturity of this effort specifically the level of International involvement in the list of Co-proposers and with the clear delineation of the urgency and significance of the issue especially the note that some alpine catchments are contributing to higher frequency of floods and/or droughts. The objectives also resonated with the Panel and particularly that the evaluation of different downscaling schemes from meteorological to hydrological models in mountains might fit in well as a subset of the GHP/GEWEX High Resolution modeling initiative.

On this basis and the fact that funding has been sought and is being committed to some aspects of the work the Panel agreed to: Recommendation R-7 to accept INARCH as a formal GHP CC.

Dr Pomeroy was asked to take action (A-14) to write a GEWEX Newsletter article on this topic and to link with other work in GEWEX such as with GLASS and to reach out to the other GHP CCs that it relates with, including the mountain precipitation and cold season precipitation. As previously stated, Pomeroy should connect with RHP Representatives, other CC Leads, heads of Data Centers and other Panel Chairs/members (GLASS, SnowMIP, etc.) need to be contacted for specific discussions related to provision of relevant datasets/models/studies (see Actions A-9 and A-9a above, as an example of what is needed). The Panel reiterated that this CC like the Cold/Shoulder Season Precipitation CC (see item 4.3c above) need to be brought into the exchanges between GHP and CliC by the Panel Co-Chairs.

4.3g **Seasonal hydrologic prediction by Dr A. Wood**

The Panel agreed that seasonal forecasting could be an important research focus at which GHP and the Hydrological Ensemble Prediction Experiment (HEPEX) could have a mutually beneficial connection. The basis of this connection was noted to be the science-oriented exploration of seasonal climate and hydrologic predictability from state-of-the-art datasets and models in the GEWEX RHP's and the improved understanding of how well methods across the statistical-dynamical spectrum harness local-to-regional scale hydrometeorological predictability for a basin collection determined from water resources considerations as HEPEX has promoted.

Dr A. Wood was asked to (Action A-15) submit a formal CC proposal on the agreed to template previously distributed, that would especially provide for a survey of the level of activity associated with HEPEX that is/has taken place in the RHPs. The aspects that need highlighted are the forming of an international seasonal prediction working group and connections to the specific GHP RHPs that have active groups working on this topic (OzEWEX, CCRN, etc.)

4.3h **GDAP integrated product regional evaluation**

GHP has proposed interacting with GDAP on higher priority science issues such as validation of the precipitation product over mountainous areas as an adjunct to the broader matter of the hydrology of mountain basins. An earlier action (Polcher/Harding) was proposed for GHP to undertake an exercise that remains underway and, which relates to engaging GDAP in an effort to examine a number of large river basins (up to 20 in RHP – HyMeX, CCRN, BALTEX, MAHASRI- regions) using observed runoff to determine the extent to which their water budgets can or cannot be closed.

Action (A-16) was for Polcher/Evans to contact the new Chair of GDAP, Dr Joerg Schulz to gage further interest in the two Panels working together on science research topics that can advance progress on the GSQs by applying GHP CCs and RHP resources that can benefit from linking with GDAP datasets and related assets.

4.3i **Crosscut Science/RHP Contribution to GEWEX Science Questions**

The progress toward the implementation of the existing GHP Cross-cutting Science initiatives and expansion of the number of proposed topics as discussed at the meeting led to the agreement that further advancement of the crosscut proposals and their implementation across

the RHPs was the main tool by which GHP would be a major contributor to advancing understanding of the main science issues facing GEWEX as reflected in the GEWEX Science Questions. As a way of summarizing this concept the matrix which had been developed earlier and which maps the GHP CCs into the GSQs was updated and is presented in Figure 5 below.

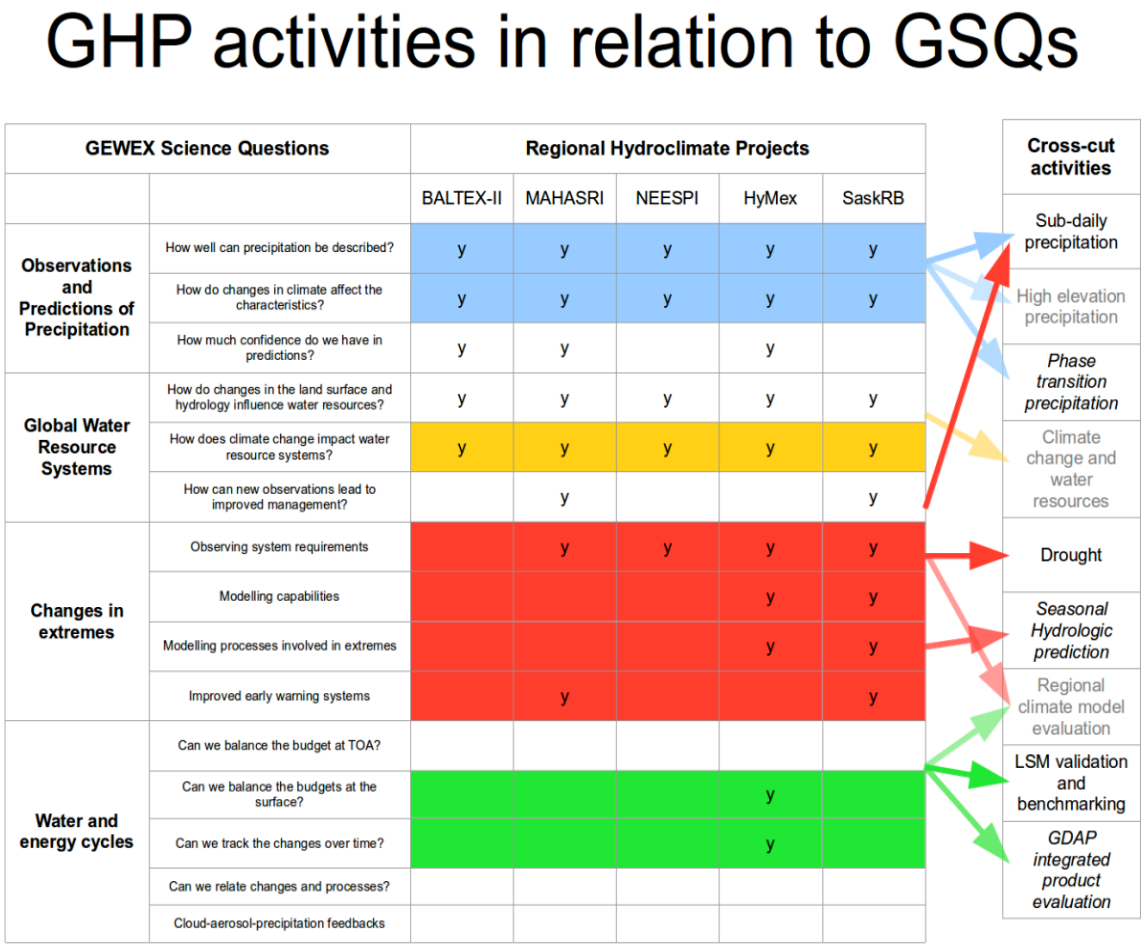

Figure 5 - Cross-cut Science/RHP Contribution to GEWEX Science Questions Summary Matrix

4.4 Global Data Centers

The Global Data Centers for precipitation, river runoff and lakes/reservoirs (GPCC, GRDC GPCC and Hydrolare, respectively) are affiliated activities under GHP auspices for GEWEX.

4.4a Global Precipitation Climatology Center (GPCC)- by U. Looser for U. Schneider

The GPCC exists to monitor and assess global precipitation on the Earth's land surface based on rain gauge-measurements, thereby contributing to GEWEX (GHP and GDAP) and to GCOS.

The panel acknowledged the efforts by the GPCC to provide new products that are responsive to the needs of GEWEX/GHP climate research including, for example the daily precipitation analyses Full Data Daily which will become available in 2015. It is through the interactions between the GHP leaders of crosscutting science topics and the GHP RHP representatives and the points of contact, such as U. Schneider that the GPCC will become a greater contributor to GHP work as it relates to advancing progress on the GSQs. In this context the Panel established an on-going action (A17) based on an earlier item (see actions A9 and A9a), but generalized to be:

That, Polcher/Evans and IGPO assist the Panel Project Leads and the Heads of the RHPs with, the tactical steps necessary including, letters, emails, side meetings, web-site presence, International workshops, meeting sessions, posters etc. that could be used to expedite/facilitate/encourage the communications/linkages between the researchers (GHP CC Leads) that need data and products that may reside or be developed through the Global Data Centers (GPCC, GRDC and HYDROLARE) and additionally with those in the field (RHP-Leads) who can also be providers (i.e. regional data recovery efforts)/appliers (services, model groups) of the data/products at the Global Centers. This was specified earlier in Action A-9, whereby, the INTENSE CC was asked to be involved in the exchanges with GPCC.

4.4b Global Runoff Data Center (GRDC)- by Dr U. Looser

The GRDC acquires, stores and disseminates world-wide historical river discharge data in support of the predominantly water and climate related programs and projects of the United Nations (UN), their specialized agencies and the scientific research community. The Panel was encouraged to know that plans for the next 1-3 years include (i) improved standardization of hydrologic data exchange formats and hydrologic feature models within the hydrological community, (ii) Updating GRDC Operations and (iii) added data acquisition, including historical discharge data updates for under-represented regions.

The Panel reiterated the generalized action of interaction between the Global Data Centers and the GHP CC and RHP leads (See action A17 above).

4.4c International Data Centre on Hydrology of Lakes and Reservoirs (HYDROLARE) by Dr U. Looser for Prof. V. Vuglinsky (written input)

The Panel had known that HYDROLARE had been established in 2009 by ROSHYDROMET at the State Hydrological Institute. HYDROLARE together with other analogous centers enters into the system "Global Terrestrial Network-Hydrology" (GTN-H). HYDROLARE provides data on hydrology of world lakes and reservoirs (today nearly 550 water bodies). No report was provided on HYDROLARE at the meeting. However, the previous year's report noted that it was recommended that Lake Hydrology be considered a consequential matter in GHP including the possible development of a GHP CC that relates to improving the understanding of the modeling and hydrology of lakes. The Panel endorsed the idea at the 2014 meeting and asked Dr. Stewart to look into such an effort as part of CCRN and report on the feasibility of making it a GHP CC, however, the matter was tabled at this meeting until further specifics of CCRN are known.

4.5 Other Topics and Overarching Issues, Actions and Recommendations

A series of other topics were discussed at the meeting that included (i) development of a GHP "review" style article (ii) concepts to be considered of special interest or as possible eventual GHP endorsement as GHP CCs or new RHPs.

4.5a GHP "review" Article (open discussion)

Action (A-18) – The GHP Co-Chairs (Polcher/Evans), to outline and draft a GHP review/survey/synthesis in the form of an article in an appropriate Publication (e.g. BAMS, EOS, etc.). The basis for this action was the recognition that it was important to better understand the background associated with the continued restructuring of GEWEX science elements and the consequential re-organization and establishment of new plans/vision for GHP's contribution (through its Regional Studies and Cross-cutting science projects) to the climate research challenges and questions now being posed by WCRP/GEWEX. Polcher agreed to draft the initial abstract for this article/paper noting that the RHPs have changed from what they had been in the past and that it is important to recognize those changes and to consider how they will evolve in the future as a result and what the impact of those changes may have on future plans for GEWEX/GHP.

The Panel agreed that the process of transition toward smaller efforts with more socially oriented concerns that include (some) hydrology and (more) climatology is important to map into the criteria and acceptance of new studies. Just knowing/recording that the scientific, societal, and funding aspects have all changed may allow for the establishment of a better baseline for going forward. IGPO will assist with this action.

4.5b GHP/Working Group on Regional Climate Interaction by Dr B. Hewitson

The Panel noted that the WGRC mission is to facilitate coordinated regional climate research and science-based knowledge development, and develop this in the decision maker and climate services contexts. Of particular importance to the connection between GHP and the WGRC was that part of the WGRC mandate was to oversee WCRP CORDEX and other regional climate research initiatives. GHP has in the past (See the September 2013 GHP meeting report dated 21 October 2013), been especially interested in CORDEX including the possible definition of a CC that might include CORDEX runs over GHP RHPs and a comparison of the results to GCM runs over the same regions. The Panel noted the fact that since CORDEX has interests that relate to the WCRP "regional" GCs further interaction with GHP will no doubt occur particularly as GEWEX has a definite interest in undertaking high resolution modeling exercises that are expected to advance knowledge and promote understanding of the key issues related to the Water Availability GC. The overall concern in this context being the reliability and value of long-term regional climate change projections as they affect water availability. Some of those high resolution model experiments will initially occur in data rich regions associated with GHP RHPs. Before moving forward, however, GEWEX will want to quantify, to some extent, the cost of going to ever higher resolutions versus the added value gained by applying such tools. That matter will require coordination with CORDEX. On the basis of the discussion the Panel asked

Dr Polcher (a current member of WGRC) to (action A19) continue to act a liaison between GEWEX/GHP and CORDEX.

4.5c Other presentations

4.5c.1 GEWEX Process Evaluation Studies (PROES) by Dr. G. Tselioudis

The motivation for this discussion was related to a connection between GHP and GDAP (See Action A-16), which manifests, in this case, through the production of long term, globally complete water and energy budget products at increasingly higher time resolution by GDAP and the data and products GHP has through its regional studies (RHPs) that are capable of assisting with the validation of the GDAP datasets. The proposed consequence of this linkage is that model evaluation studies (and many climate process studies), most of which use only the monthly mean version of the datasets, will have available to them and, thereby, will use higher resolution products that resolve most processes and can place regional studies and field campaigns (which do resolve high time and space resolution processes but cover limited domain) in the global context.

An example of how process based diagnostics at regional scales relate to the global domain using a process diagnostic "toolkit" developed for a pilot study associated with Midlatitude Storms that was undertaken by the Goddard Institute for Space Studies (GISS) in collaboration with Monash University. The panel felt that the objective of creating a framework for process evaluation studies that enhances process understanding and evaluates model process performance at different space/time scales was a worthwhile initiative. They encouraged the continuation of the work by (i) taking action (A20) to port the existing algorithm/toolkit to the web where it can be accessed and demonstrated to have value using different data and applied to different regions (enhancing data mining and compositing techniques) and (ii) constructing a scheme(s) that apply to a number of phenomena/processes especially those that might optimize the use of high resolution satellite observations with and GEWEX (GHP/RHP) datasets.

4.5c.2 GPS and GPS occultation experiments by Dr Yuning Fu

The Panel heard from Dr Yuning that a project had been undertaken using GPS observations of the surface deformation due to water/moisture loading to estimate variations of water storage in California, Oregon and Washington. The work was motivated by the fact that the region of interest has a dense GPS network and the expectation that GPS could be an independent measurement to distinguish between different hydrology models results. The scheme applied a forward model to go from the surface load to the amount of deformation and an inversion analysis to determine the amount of deformation measured to the surface load. The principle is that surface deformation is the key loading factor for any moisture above the bedrock.

The resolution was noted to be better than the GRACE satellite data. However, GPS-determined water series can fill gaps in the current GRACE mission, also in the transition period from the current GRACE to the future GRACE Follow-on mission. In addition the results show that GPS can be complimentary to GRACE in resolving time-varying water storage change in the western USA, and in monitoring water resource change in near real-time. Figure 6

illustrated the process and outcome over the southern Sierra Nevada Mountains. The Color gradations show water loss in equivalent water thickness: (yellow) 0.3 m, (red) 0.5 to 0.8 m.. It was noted that changes in reservoir storage had been removed. Because snow in California in October is negligible, the interpretation was that the water loss was the sum of: (i) Soil moisture, (ii) Sierra Nevada mountain fracture groundwater, and (iii) perhaps Central Valley aquifer groundwater. The main result is that the southern Sierra Nevada lost 30 Gigatons of water during the 3 years of drought.

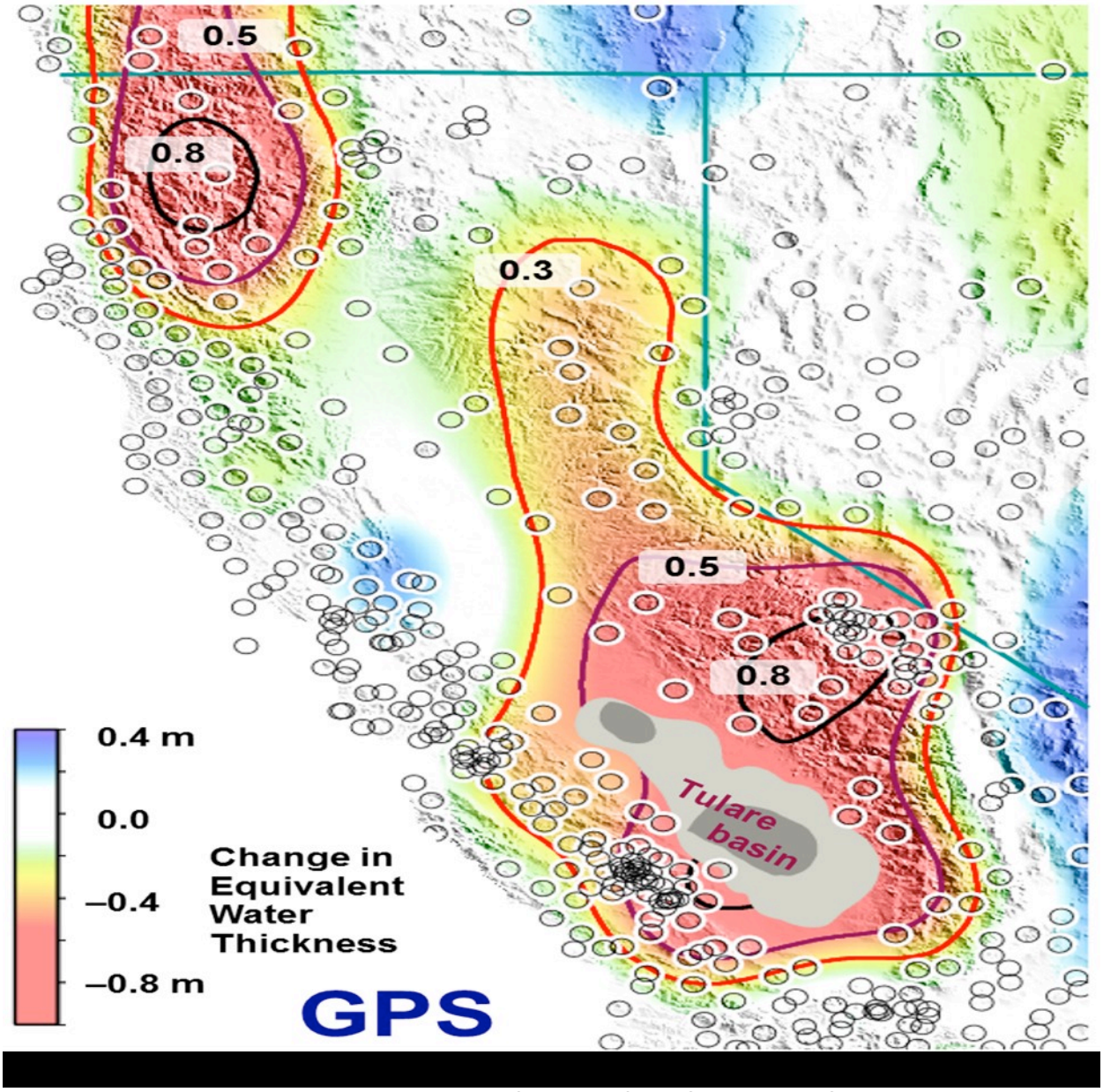

Figure 6, Decrease in water during 3 years of drought from Oct 2011 to Oct 2014 estimating using GPS positioning.

The Panel felt this work was a particularly unique approach to using available observational data to advance and improve knowledge, which is directly associated with furthering the contribution GHP can make toward both the WCRP Grand Challenges (Water Availability and

Extremes) and the relevant GSQs. Dr Yuning was asked (action A21) to keep the Panel informed of further development of this work and to consider exploring the interest of a broader International community to engage in applying this scheme to other regions (RHPs). This could include a GEWEX Newsletter article on the topic and a report on progress at the 2015 GHP meeting.

4.5c.3 Impact of the water resources management on projected future change of drought and; Current status of water isotope studies by Dr K. Yoshimura

Dr Yoshimura is a member of the GHP and was asked to present information on work he is associated with that relates to specific topics of interest to the meeting participants and the Panel. The premise of the initial presentation to the Panel was that the anthropogenic effect on the terrestrial water cycle especially drought (Low flow) is rather limited in most impact assessments of climate change. The definition of hydrological drought used in the study presented was "streamflow", so that if the daily discharge is less than or equal to a particular threshold, the day is "drought day". Using other constraints/assumptions, a long-term continuous off-line simulation with five GCMs was undertaken for the period 1980-2099. The Panel was interested in the work and particularly the finding that "drought" as defined will increase over 70.4% of the global land area. There was agreement that more effort is required to clarify the results and consider their implication(s) with regard to the implied changes in global water resource management that would be needed to mitigate the projected results.

In the same way, the Panel heard a review of earlier work in isotopic analyses and a prospect for the future of such work in the context of the GHP framework of RHPs and CCs. The outcome of the Stable Water Isotope Intercomparison Group, Phase 1 and 2 (SWING2) work was reviewed, whereby, comparisons of water-isotope enabled GCM results were undertaken across modeling groups. The overview webpages and first stage data were referenced and the link was provided where those results are available http://storm.colorado.edu//~dcn/SWING/index.php. The second stage project was promoted under the auspices of GHP and led to a baseline of state-of-the-art water isotope general circulation models and related observational isotope data up to the time of the Pan-GEWEX meeting (July 2014) when the Panel accepted that the effort had been concluded. However, the Panel was advised that the data generated for the project is available via ftp through the link: http://www.giss.nasa.gov/projects/swing2/.

The Panel agreed that there would be merit in an effort that would bring together scientists with a common wide range of interest in both modelling and measuring stable water isotopes (H218O, HDO) and its application to climate issues. The concept of an Isotope Reanalysis as a way forward was presented by Dr Yoshimura. The objectives of such an effort including (a) A First global 4D analyses for vapor isotopes; (b) An Accurate Precipitation isotopes in fine resolution; and (c) the Possibility of improvement of other dynamical fields, were deemed relevant to GHP.

The Panel asked Dr Yoshimura, as a Panel member, to (action A22) consider how both the drought and Isotope initiatives could be broadened beyond his own area of influence to include a wider group of researchers with funding who could coalesce around the framework of a GHP CC and engage the RHPs in a manner that would synergistic with the existing GHP CCs.

4.5c.4 Remote sensing of snow by Dr. Tom Painter

Dr. Painter presented his group work on monitoring snow using airborne remote sensing in combination with in-situ data. His work demonstrates the impact of dust on snow melt and emphasizes the importance of capturing this effect in order to model the evolution of snow derived water resources.

4.5c.5 International GEWEX Project Office (IGPO) Status by Dr. van Oevelen

The Panel heard that the IGPO had been provisionally funded for next 2 years and that the prospects for the next full five year period looked promising. The budget for the Office, however, was reduced to the extent that the position of Senior Scientific Officer that had been held, through a contract to S. Benedict would be eliminated by the end of February 2015, with the work being distributed to other IGPO staff and partly taken up by resources available to the GEWEX SSG, Co-Chairs. The prospects for a multi-agency funded USA National GEWEX Office were also noted to be very good. Preliminary plans call for the USGEWEX Office and the IGPO to be collocated to enable the most synergistic links between the functions of the two Offices particularly as plans for a USA GEWEX regional study evolve (See Item 4.2f, above). It was also reported that the "new" GEWEX Website (mockup) was "up" at gewex.org. The action items related to the Joint Scientific Committee (JSC) 2014 (JSC-35) were reviewed and the IGPO took the action (A23) to summarize the results of the discussion on behalf of the SSG Co-Chairs as part of their preparations for the GEWEX presentation at the 2015 JSC meeting (JSC-36).

APPENDIX 1. Overall GHP Business Meeting Agenda

Meeting of the World Climate Research Programme (WCRP) Global Energy and Water Exchanges (GEWEX) Project Hydroclimatology Panel (GHP) (Draft Agenda, Rev 3a, 2 December, 2014)

California Institute of Technology in Pasadena, California, USA
10 – 13 December 2014

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Opening Meeting Session (Wednesday December 10, 2014).
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0900-0920 Welcome Remarks and Meeting Logistics

(Graeme Stephens, Co-Chair, GEWEX Scientific Steering Group (SSG) and Director, NASA Jet Propulsion Laboratory Center for Climate Sciences; Peter van Oevelen, Director International GEWEX Project Office; and Amber Jenkins, Local Host/NASA-JPL)

0920-1700 Joint meeting (open session) with representatives of the Global Drought Information System (GDIS) and all GHP participants. Reports will be heard from representatives of the GHP RHPs and other GHP/GDIS scientists on drought-related research.

0920-1000 Programmatic overviews of GHP and GDIS

(Jason Evans/Jan Polcher GHP Co-Chairs; Siegfried Schubert GDIS Workshop Science Organizing Committee – 20 mins GHP, 20 mins GDIS)

1000-1030 WCRP Grand Challenges on Extremes and Water Availability

Sonia Seneviratne – Extremes GC (15 minutes)
Graeme Stephens – Water availability GC (15 minutes)

1030-1100 Coffee Break

1100-1240 Presentations on GEWEX RHPS - DROUGHT RELATED RESEARCH REPORTS

(RHP Representatives - 25 minutes total; 20 minute presentation plus questions)

Philippe Drobinski–Hydrological Cycle in the Mediterranean Basin Experiment (HyMeX)

Howard Wheater - Saskatchewan River Basin Study (SaskRB)

Pavel Groisman - Northern Eurasia Earth Sciences Partnership (NEESPI)

Hugo Berbery – La Plata Basin (LPB)

1240 – 1400 Lunch break

1400-1530 - GDIS Representative Reports

European drought monitoring and prediction – Juergen Vogt (30 minutes including discussion)
US Drought monitoring and prediction – Kingtse Mo (30 minutes including discussion)
Drought monitoring and prediction in Latin America – Will Pozzi (30 minutes including discussion)

1530-1600 Coffee Break

Drought monitoring and prediction in Africa – Eric Wood (30 minutes including discussion)

1630–1700 – Joint Session Wrap-up –

(Evans/Polcher/Schubert/All)

Review topics including RHP process level studies; triggers and/or mechanisms of intensification (both large-scale teleconnections and local feedbacks) and interactions with operational agencies in terms of drought monitoring and how those intersect with GDIS efforts.

Summarize how the joint session discussions could lead to better interaction between GDIS and the drought related efforts in the RHPs and how this could be of importance to society and relevant to climate services.

1700 Adjourn

****
Thursday December 11, 2013
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0900 – 1730
An Open Session will be organized on the topic of Hydrology that Addresses Water Challenges on a Changing Planet including a remote sensing perspective. JPL scientists will be asked to contribute talks to this session.

0900-0945 Introductory talks (15 minutes)

- Panel Objectives/Meeting goals – J. Polcher
- GEWEX Priorities/Outlook – G. Stephens
- A short history of RHPs – R. Stewart

0945-1730

Participants will present previous accomplishments, work underway, and future plans emphasizing existing/new cross-cutting activities. In all cases comments from existing (and past and prospective) RHPs are sought, with particular focus on relevant science underway or achieved within those programs.

30 mins including questions

0945-1045

- Mid-latitude storms (G. Tselioudis); GEWEX- Process Evaluation Study, (PROES) associated with mid-latitude Storms that would serve to initiate the new diagnostics in support of the goals of the GSQs/GCs.

- Sub-daily precipitation: -"INTElligent use of climate models for adaptatioN to non-Stationary hydrological Extremes-INTENSE" (H. Fowler)

Coffee Break 1045-1115

1115-1215

- Remote sensing of snow (Tom Painter)
- Mountain hydrology- International Network for Alpine Research Catchment Hydrology-INARCH (J. Pomeroy)

Lunch 1215-1345

1345-1515

- Managed water resource systems (R. Harding)
- Seasonal streamflow forecasting - HEPEX (A. Wood)
- Phase transition precipitation (R. Stewart, P. Groisman)

Coffee Break 1515-1545

1545-1705

- Snow pack and GPS (Yuning Fu) (30 mins including questions)
- Mountain Precipitation – SKYPE Session (James Renwick) (20 mins including questions)
- (Kei Yoshimura) (30 mins including questions)
    - Impact of the water resources management on projected future change of drought and;
    - Current status of water isotope studies

1705-1730 Summary Discussion

1730 - Adjourn

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Friday December 12, 2013
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0900-1700
- Panel business (open to all)

0900-0920
- IGPO Update, JSC Report & GEWEX 2014 conference – P.J. van Oevelen

0920-1000
- Interactions other Groups

- GRDC/GPCC Ulrich Looser

1000-1030

- Reports on RHP activities not covered in the previous days;

• RHP Representatives should advise the Panel on issues that need recommendation/development/resolution. (TBD Reports/discussion items-20 mins)

- NEESPI
    - End of project plan (Pavel Groisman)

- MAHASRI
    - End of project plan (Jun Matsumoto)
- SaskRB (Howard Wheater/Ron Stewart)
    - Extension to the Changing Cold Regions Network (CCRN)
    - Application for full RHP status
- HyMEX (Philippe Drobinski)
    - The HyMeX Euro-Mediterranean gridded dataset ECA&D (E-OBS)

1030-1100 Coffee Break

1100-1130
- Reports on RHP activities not covered in the previous days (Continued);

1130-1230 Proposed/ Potential RHPs

- Specific Presentations must be made by representatives of candidate RHPs on their science/implementation plans and activities relevant to advancing to/beyond Initiating RHP per existing criteria (30 mins):

- OzEWEX (A. Van Dijk)
- HyVic (F. Semazzi)

1230-1400 Lunch

1400-1530 – Proposed/Potential RHPs (Continued)

- BalticEarth (M. Reckerman)

- RELAMPAGO (J. Polcher/A. Nunes with CC proposal?)

- Eastern Europe/Pannonian Region - (Joan Cuxart Rodamilans) to cover outcome of recent workshop in Zagreb and identification of potential participants

- Us Efforts for a GEWEX RHP type activity
  (G. Stephens, R. Rasmussen, F. Dominguez A. Barros)

1530-1600 Coffee Break

1600-1630

- Us Efforts for a GEWEX RHP type activity (Continued)
  (G. Stephens, R. Rasmussen, F. Dominguez, A. Barros)

1630-1700 - Summary Discussion/Action review

1700 – Adjourn

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Saturday December 13, 2013
****
0900-1700

- Panel business meeting (Mandatory for all Panel members and GEWEX/WGRC/RHP Reps available and open to all others)

0900-1000

- Presentation by Panel members who are attending their first meeting
(30 mins including questions)

- Silvina Solman

- Presentation on interaction with WGRC
(30 minutes with Questions)

- Bruce Hewitson

1000-1030 - Open Discussion

1030-1100 Coffee Break

11:00 -1230

-RHP and Crosscutting Science (CCs) Projects;

Review and evaluation with decision on candidates RHPs and CCs including Interactions between RHPs and CCs

(Polcher/Evans Discussion leaders)

12:30-1400 Lunch

1400-1500 - Interactions with other GEWEX and WCRP activities

(M. Ek, R. Uijlenhoet)

1500-1600

- Evaluation on progress on the GEWEX science questions
(Polcher/Evans Discussion Leaders)

1600 - Adjourn