# GHP Panel Reports for the 31th GEWEX SSG Meeting 2019

**Full Panel Name (Acronym)** : GEWEX Hydroclimatology Panel
**Reporting Period** : 01 January - 31 December 2018
**Starting Date** :
**End Date (where appropriate)** : NA
**URL** : https://www.gewex.org/panels/gewex-hydroclimatology-panel/

## Membership

**Chair(s) and Term Dates** : Jason Evans, 2013 - 2019
Joan Cuxart, 2017 - 2021

**Members and Term Dates** : Sylvester Danuor, 2017 - 2019
Francina Dominguez, 2018 - 2020
Craig Ferguson, 2015 - 2020
Xin Li, 2016 - 2021
Silvina Solman, 2014 - 2019

## Panel Objectives, Goals and Accomplishments during Reporting Period

### Overall Panel Objective(s)

- To understand and predict continental to local-scale hydroclimates for hydrologic applications by concentrating on improving our understanding of environmental water and energy exchanges at the regional scale and from an integrated perspective.

### List of Panel Goals

*Adjust yearly*

- The GEWEX Hydroclimatology Panel (GHP) aims to understand and predict continental to local-scale hydroclimates for hydrologic applications. GHP concentrates on improving our understanding of environmental water and energy exchanges at the regional scale and from an integrated perspective. Addressing the water cycle at the regional scale allows us to better understand the many components of the system, from its physical to economic to social aspects. There are three types of projects within GHP that allow us to do this:
  i) Regional Hydroclimatological Projects (RHPs) are an essential tool in understanding and predicting hydroclimates as they bring together various disciplines on water-related issues;
  ii) Cross-Cutting Projects allow GHP to propagate knowledge from one region to another and synthesize results at the global scale. They also facilitate the development and testing of applications derived this new understanding,
  iii) Global Data Centers collect and distribute important hydrology-related data.

### List of Key Results

*Adjust yearly with respect to goals*

- Mature RHPs (HyMeX and CCRN) have largely reached their scientific objectives, characterizing more deeply, with new observations and modelling exercises, parts of the hydrological cycle in their regions and are also managing to transfer the new knowledge into applications for weather and climate. CCRN is now being continued by GWF extending the regional scope in Canada and HyMeX is finishing the last planned activities, with the semi-arid irrigated experiment LIAISE planned for 2020. Baltic Earth, successor to BALTEX and now a fully working RHP, is focused on the improved understanding of their region, with a strong focus on biogeochemical and marine processes. At the initiating status, PannEx is organizing itself into Task Teams able to fulfill the action's objectives.
- Two initiating RHPs have not been successful in reaching the fully working status. OzEWEX is mainly acting as a networking activity and HyVic ceased to report to the Panel. A new activity

within GHP is proposed, GHP Networks, that will provide a space within GEWEX for activities like OzEWEX and also for ended RHP's that may want to maintain a collaborative structure
- "Cross-cuts": INARCH on mountain hydrology, Precipitation near 0ºC in the changing environment and INTENSE on subdaily precipitation are very active and report significant advances.
- Data Centers for the Global Runoff (GRDC) and Global Precipitation Climatology (GPCC) maintain their activities, with less information reaching the panel about HYDROLARE on lakes and reservoirs.

**Other Science Highlights**

*Not part of the 2-3 major accomplishments*

- Coordination with CORDEX activities are being set by several RHPs.
- GHP Networks are proposed to provide continuity to ending actions in the GEWEX world and also to welcome activities that have a regional aspect and do not aim to structure as an RHP.
- A RHP session has been organized in the European Meteorological Society meeting (Kobenhavn, Sept 19) with title "Regional Hydroclimate Projects helping understand water cycle processes and drivers" where meteorological activities of the three active European RHPs (HyMeX, Baltic Earth and PannEx) may gather and interact.

## Panel Activities during Reporting Period

**List of Panel Activities and Main Result**

- Baltic Earth: 2nd Baltic Earth Conference (June), workshop on regional climate modelling (March) and workshop on multiple drivers for changes in the Baltic Sea in November. Initiation of an activity on climate change modelling with regional earth system models and of the design of coordinated experiments linked to regional coupled ocean atmosphere models (focus: ocean mixed layer dynamics, upwelling, sea level dynamics and volume transports). Research on the carbon cycling in the Baltic Sea being set. Establisment of an Advanced Earth System Model capacity, composed of 8 Helmholtz research centers. The Panel reports on publications mainly related to regional circulations and climate sensitivity, regional sea level change and coastal impacts, near-term climate prediction and carbon feedbacks in the climate system.
- GWF (Global Water Futures): This project is the continuation of Changing Cold Regions Network (CCRN), expanded in territorial coverage and re-shaping its main goals, fresh started in 2019 as RHP. The present summary deals with the CCRN final outputs. The coordinated analysis with modelling and observations of changing land, ecosystems water and climate was made for the Sub-Arctic, Boral forest, western cordillera and the Prairies in inner western Canada., with special emphasis in outreaching activities. the final report is found at http://ccrnetwork.ca/documents/Reports/CCRN_Final_Progress_Report.pdf . There effective progress about the main themes is detailed, including an inventory of observable local-scale change -including extreme events-, the deployment of enhanced field instrumentation, linked to the enhanced local-scale process understanding
- HyMeX: This RHP is approaching its end in 2020, after a very intense activity, both experimental and by numerical simulation, in the Mediterranean basin. Analysis of the campaigns made in the first half of the action keeps going on, while two new campaigns have taken place this year. Firstly, EXAEDRE in Corsica to study the electrical and microphysical environment of clouds . Secondly the PERLE (Pelagic ecosystem response to dense water formation in the Levant experiment) action aims at describing the formation and spreading of Levantine Intermediate Water (LIW), and determining its role on the distribution of nutrients and on the structuration of the planktonic ecosystems in the eastern Mediterranean, which will last until 2020. An experimental and modelling effort over semi-arid terrain with irrigation (LIAISE) is already being organized and will take place in 2020. The community indicates its will to continue working together and they could stay linked to GEWEX by using the new GEWEX-Networks scheme.

- OzEWEX: This action has been working very effectively as a Network, but it has not progressed in the terms expected for an initiating RHP. Therefore it is proposed to their leaders to reflect on how they want to continue to be linked with GEWEX, perhaps benefiting of the new GEWEX-Networks scheme.
- PannEx: This RHP was granted initiating status end 2017. During this year the Task teams are being formed to address effectively the Flagship Questions and Crosscut actions defined in their White Book, with include items related to agronomy, air quality, sustainable development or water management. The 10 task teams in constructions are i) Agroclimatological and Agrobiological Systems, ii) Energy Production, iii) Special Observations and data analysis, iv) ecosystem services, v) urban climate and air quality, vi) outreach and education, vii) micrometeorology and agronomical process modelling, viii) water balance at the basin scale, ix) modelling from Climate to Flash Floods. Teams plan to meet next June to start their activities in Novi Sad (Serbia). ESA opened a call on Drought in the Danube basin and the Black Sea area oriented with PannEx aims.
- INTENSE: A Cross-cut action devoted to hydrological extremes and subdaily precipitation for the period 2014-20. The data acquisition is concluded at this point with more than 25000 hourly data records worldwide, the data base is transfered to DWD and will be given to Copernicus. Papers summarizing the work done so far have been published in Nature and Journal of Climate, among others. The funded project FUTURE-STORMS about convection-permitting models for an European domain at a resolution of 2.2 km has started.
- INARCH: A Cross-Cut action devoted to increase the understanding and prediction of the alpine cold regions hydrological processes, in particular defining consistent measurement strategies. There are currently 26 INARCH research basins in the Americas and Eurasia. Data are collected for these catchments together with model reanalyses and downscale climate model outputs. Two workshops were held in Switzerland and Chile, the latter trying to establish links with the Andean-related community.
- Near 0ºC precipitation: the changes in location and frequency of these events are explored by this Cross-Cut action, that has its end planned for 2019, but may eventually be extended further. The main effort is to produce reliable datasets, statistical and physical analysis is in progress in the aspects which this is possible. Analysis of numerical simulations is also underway, thati in the frame of CMIP5 show for Canada a northwards tendency displacement. Reanalyses have been used to inspect which areas are experiencing changes recently.

**List of New Projects and Activities in Place and Main Objective(s)**

- See below.

**List of New Projects and Activities Being Planned, including Main Objective(s) and Timeline, Lead(s)**

- New RHPs are in the horizon. i) ANDEX, a prospective hydroclimate research project for the Andes, finds itself in the writing of its White Book, defining aims and tasks. Its main subjects identified are the hydroclimate characterization of the region, the environmental changes taking place, the monitoring of the Andes' Cryosphere and the study of high impact events.
- ii) the TPE Water Security is exploring the possibility to organize itself as an RHP after the input received during the Santiago meeting. The proposed subjects include: atmospheric circulat ions and remote sensing of the TPE area, with emphasis on the land-atmosphere-water interaction processes, considering climate projections, hazards and adaptation.
- iii) The "Post-MAHASRI" action in the Monsoon area is being organized and a formal propsal is expected in the next GHP meeting. Focus is expected to be on observational campaigns and high-resolution modelling studies, together with studies on variabilty of the Asian Monsoon.
- Discussions continue about a USA-fostered RHP centered on the Western Cordillera of North America (eventually including Canada and/or Mexico ), linked to the Grand Challenge Food Baskets of the World. The main focus would be on changes in the partitioning between ET and runoff due to current and foreseen changes in climate and land-use. Data analysis and

increase of process understanding through multi-scale field experiments and modelling exercises would be the basis of the action.

- New Cross-Cut initiatives under exploration are on i) Water Management in Models , ii) Determining Evapotranspiration, for which a workshop is planned in October in Australia, and iii) MOUNTerrain, about precipitation in mountains, that needs a fresh re-start after a first try a few years ago.

## Science Issues and Collaboration during Reporting Period

**Contributions to Developing GEWEX Science and the GEWEX Imperatives.**

**a.** Data Sets

- The active RHPs (HyMeX, Baltic Earth and CCRN/GWF) maintain their datasets and generate new ones as their activities progress, either with new campaigns or with the expansion of their networks. OzeWEX, which is functioning as a network, has as a priority the data collection, collation and hosting. PannEx is still in the initial phase and data sets are been defined.
- Cross-cuts also produce new data sets: i) INTENSE has completed a database on sub-daily precipitation and has obtained complementary numerical model data, ii) INARCH is compiling data from the 26 basins that form the network; iii) Precipitation near 0ºC has gathered observational data from the northern hemisphere, together with congruent numerical model data
- Data Centers on precipitation and runoff report continuous feeding of their data bases, whereas no new information is available from HydroLARE on basin water levels.

**b.** Analysis

- Most actions use the same basic information inputs: analysis of existent data bases, generation of data in observational campaigns to study specific process and numerical modelling to have a comprehensive description of the processes in place, always checking against available observational information.

**c.** Processes

- As described above, each action focusses on some particular aspects. Precipitation extreme events and the role of the sea surface waters is the dominant issue in HyMeX, the functioning of the Baltic Sea region as a complexe biogeochemical earth system is Baltic Earth main aim, similarly to CCRN, that was more oriented to changing land, ecosystems water and climate. Cross-Cuts as described above tackle specific processes in a transrregional perspective, so far mostly devoted to precipitation (subdaily, in mountains or near 0ºC).

**d.** Modeling

- Due to the variety of purposes that the different GHP actions have, many kinds of model types and simulation strategies are used. In the study of processes, detailed modelling is used at short-time scales, including single-column modelling, large-eddy simulation and high-resolution mesoscale modelling. In what refers to climate studies, they range from regional models with various techniques and time scales to global earth system modelling at the century scale. Impact of severe weather events are usually studied with mesoscale models, often taking advantage of operational forecasting systems.

**e.** Application

- The overall objective of the GHP actions is to generate data bases and methodologies that can become of use in the centers that study the earth system, many of them being Meteorological and Hydrological Services providing direct service to society.

**f.** Technology Transfer

- Data bases, model comparisons, parameterization testing have a direct impact in the day-to-day operational activities of weather and climate modelling centers, for instance in the generation of improved reanalyses, observed timeseries and expected trends.

**g.** Capacity Building

- In most of the GHP actions capacity building is high, firstly because of the continuous improvement of the scientific and technical capabilities of the personnel involved and secondly

because there is a sustained flow of PhD subjects related to the actions that contribute to the maintenance, renewal and eventually enlargement of the related scientific community.

**List contributions to the GEWEX Science Questions and plans to include these.**

a. Observations and Predictions of Precipitation

- Those provided by HyMeX, CCRN, OzEWEX, INTENSE, INARCH, Precipitation near 0º and GPCC, usually obtained from National Services, but also from research networks. PannEx and GWF will contribute to this subject as well as they progress.

b. Global Water Resource Systems

- Besides precipitation (listed in the previous point), INARCH and CCRN have a well-defined hydrological component, also covered by the GRDC data center on Runoff. PannEx has planned to work intensively on the water management at the basin scale.

c. Changes in Extremes

- The study of the occurence and trends of extremes in the present climate is made by all GHP actions. The future changes are usually studied in the frame of regional climate modelling, by specific studies or through coordinated actions, such as in CORDEX.

d. Water and Energy Cycles

- Most RHPs do not devote an equivalent effort to all parts of the energy and water cycles. Concerning the water cycle, precipitation is well addressed in general, while only some RHPs analyze the hydrological part, and evapotranspiration is not a subject of organized research to the date, which is a well-detected limitation. Concerning the energy cycle, measurements are well treated in GEWEX under GDAP, while the reflection at the regional scale could be much deeper in GHP, either observationally or numerically.

**Other Key Science Questions**

*List 1 – 3 suggestion that you anticipate your community would want to tackle in the next 5-10 years within the context of a land-atmosphere project*

- i) Monitor water use over land and Introduce water management in models
- ii) Characterize properly evapotranspiration, observationally and in models
- iii) strengthen effectively community work regionally (through RHPs) and across regions (through CCs and other actions), improving communication and harmonizing the way tools are used.

**Contributions to WCRP including Current Grand Challenges**

*Briefly list any specific areas of your panel's activities in particular to the grand challenges "Extremes" and "Water for the Food Baskets" which is not covered under 2.*

- Most GHP actions contribute to the "weather and climate extremes" grand challenge by data base building, campaigning and modelling.
- "Melting ice and global consequences" is an important subject for Baltic Earth and CCRN/GWF and it will be for ANDEX and TPE-WS if they become RHPs.
- "Regional sea level change and coastal impacts" is a main item for Baltic Earth in general and for HyMeX essentially on severe weather impacts.
- "Water for the food baskets of the world" is an issue that is being considered in the new actions, such as PannEx or the actions in an exploratory phase like ANDEX or the Western USA RHP.
- "Carbon feedbacks in the climate system" is explored in Baltic Earth, that has a very important biogeochemical component.
- "Near-term climate prediction" is considered, but normally handled within other actions such as CORDEX.
- "Clouds, circulation and climate sensitivity": usually these are matters taken into account in modelling studies within RHPs.

**Cooperation with other WCRP Projects, Outside Bodies and links to applications**
*e.g. CLIVAR, CliC, SPARC, Future Earth, etc.*

- Within GEWEX: cooperation is sustained with the other panels (GDAP, GASS and GLASS)
- Within WCRP: by its regional nature over land, there is interaction with CliC related to the GHP activities in high mountains and high latitudes. Cooperation with CORDEX is increasing as each RHP is interested in performing regional climate studies.
- With Future Earth: there are contacts with the research action iLEAPS (Integrated Land Ecosystem-Atmosphere Processes Study ) in the building of an activity related to evapotranspiration.

## Workshops and Meetings

**List of Workshops and Meetings Held in 2018**

*Meeting title, dates and location*.

- 2018 GHP - ANDEX - INARCH Meeting, October 2018, Santiago, Chile

**List of Workshops and Meetings Planned in 2019 and 2020**

*Meeting title, dates and location and anticipated travel support needs*.

- SSG-31 Geneva (Switzerland), February 2019
- 2019 GHP meeting & ET workshop, Sydney (Australia), October 2019

**Other Meetings Attended On Behalf of GEWEX or Panel in 2018**

- PannEx IPC meeting, Ljubljana (Slovenia), June 2018
- Baltic Earth 2nd science Conference, Helsingor (Denmark), June 2018
- GEWEX Science conference, Canmore (Canada), May 2018
- SSG-30 Washington DC (USA), January 2018

## Publications during Reporting Period

**List of Key Publications**

- See the individual action reports