

# GEWEX Hydroclimatology Panel Presentation

**Co-chairs**

**Joan Cuxart**

**Francina Dominguez**

**2020 SSG Meeting**

**Pasadena, California**

**January 28, 2020**



## *Science Objectives and Activities*

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Science Objective: To understand and predict continental to local-scale hydroclimates for hydrologic applications. Addressing the water cycle at these scales allows us to better understand the many components of the system, from its physical to economic to social aspects.

## *Science Objectives and Activities*

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**There are four types of projects within GHP:**

**Regional  
Hydroclimate  
Projects**

**Cross-cut  
Projects**

**Global Data  
Centers**

**GHP  
Networks**

## 2) Cross-Cuts

\*Near OC Precip CC  
INARCH CC  
INTENSE CC  
TEAMx CC  
ET CC

## 3) Global Data Centers

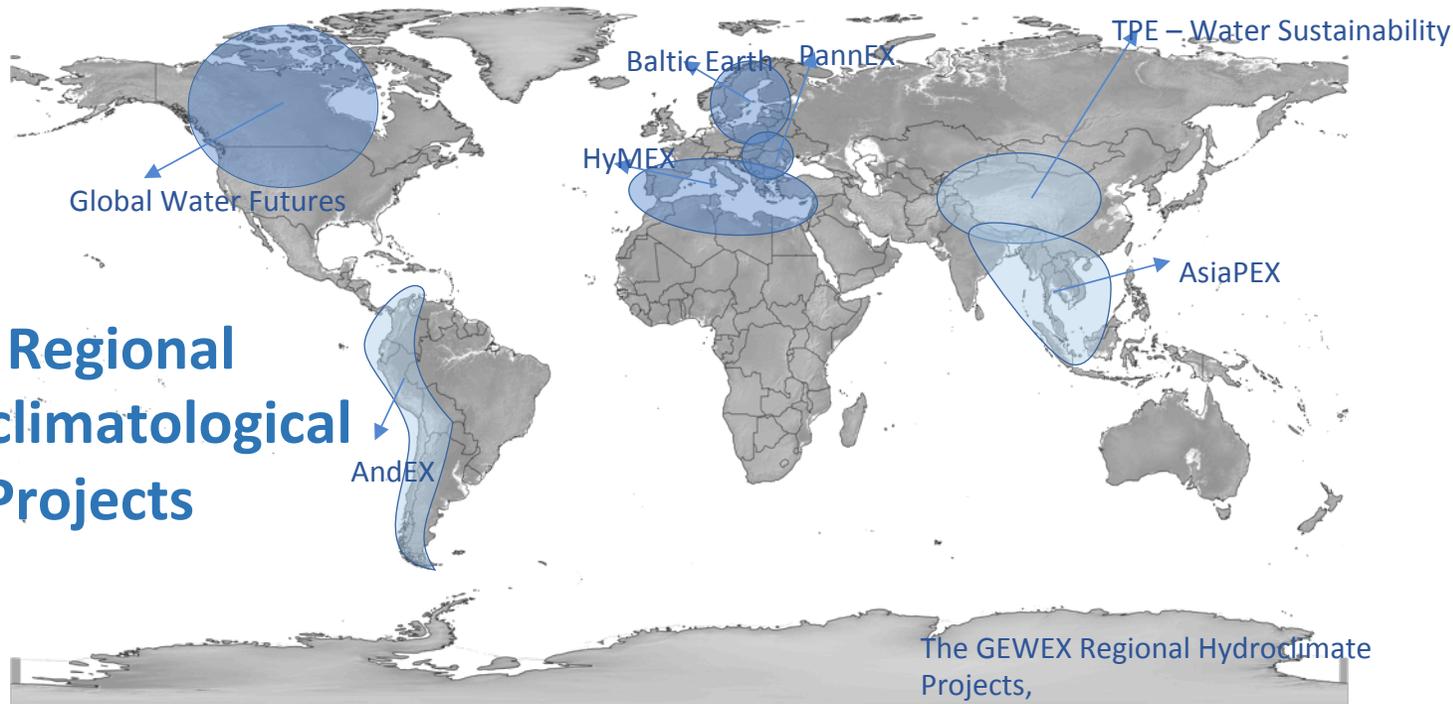
Global Precipitation  
Climatology Center (GPCC)

Global Runoff Data Center  
(GRDC)

International Data Centre  
on Hydrology of Lakes and  
Reservoirs (HYDROLARE)

## 4) GHP Networks

## 1) Regional Hydroclimatological Projects



AndEX

HyMEX

Baltic Earth

PannEX

TPE – Water Sustainability

AsiaPEX

Global Water Futures

The GEWEX Regional Hydroclimate  
Projects,

# Structure and Organization

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## 2019 GHP MEETING



### GHP Panel Co-Chairs:

Joan Cuxart (Spain), Francina Dominguez (USA)

### Members:

Paola Arias (Colombia), Sylvester Danour (Ghana), Craig Ferguson (USA), Li Jia (China), Xin Li (China), Ali Nazemi (Canada), Andreas Prein (USA), Vidya Samadi (USA), Ivana Stiperski (Austria)

### Leaving members:

Jason Evans, former co-chair (Australia), Silvina Solman (Argentina)

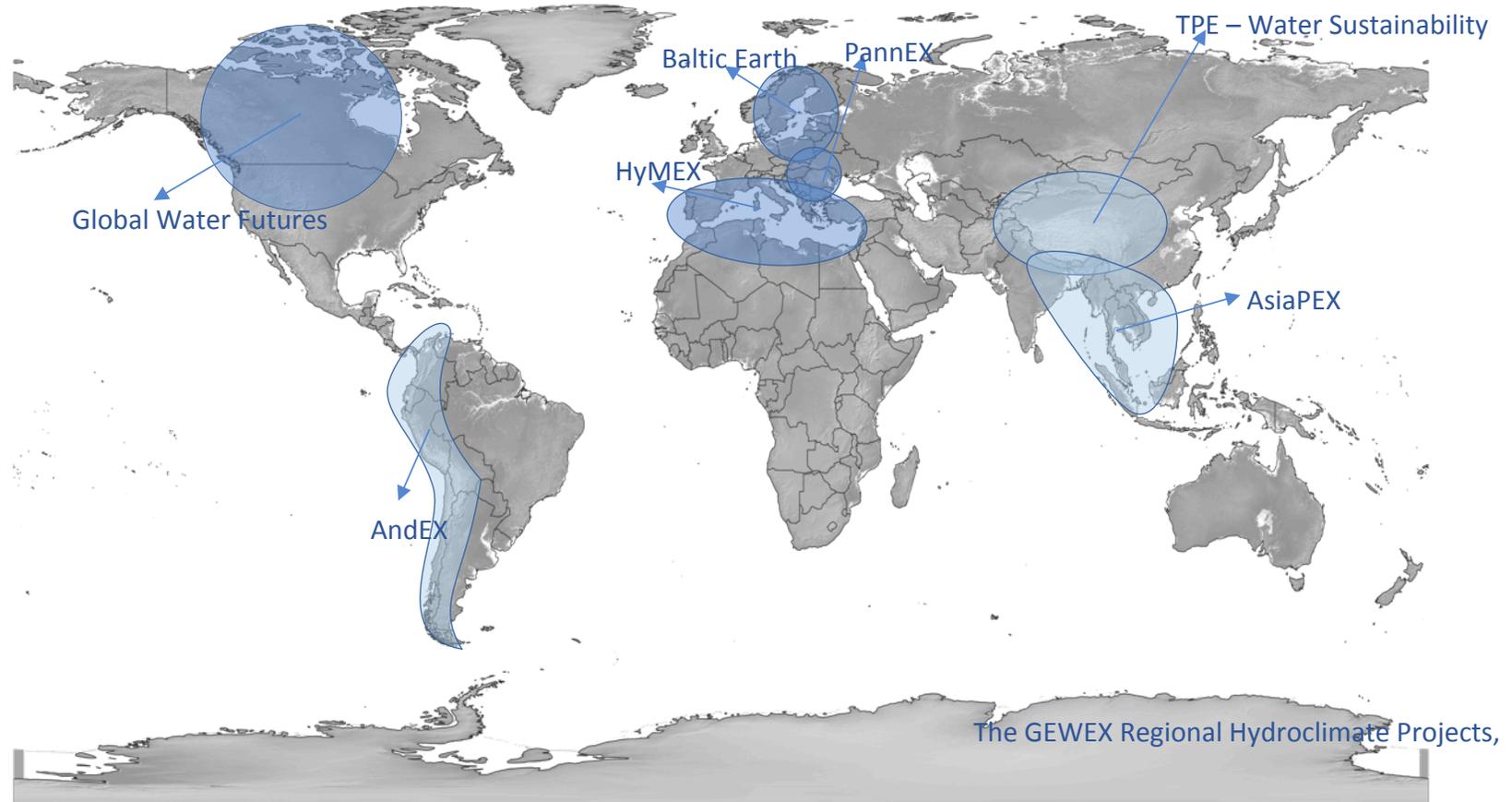
# 1) Regional Hydroclimatological Projects

## Active:

- HyMEX (2010-2020)
- Baltic Earth (2016-2019?)
- PannEX (2018-)
- GWF (2018-2023)

## Prospective:

- Andex
- TPE
- AsiaPEX



**Active:**

HyMEX (2010-2020)

Baltic Earth (2016-2019?)

PannEx (2018-)

GWF (2018-2023)

**Prospective:**

Andex

TPE

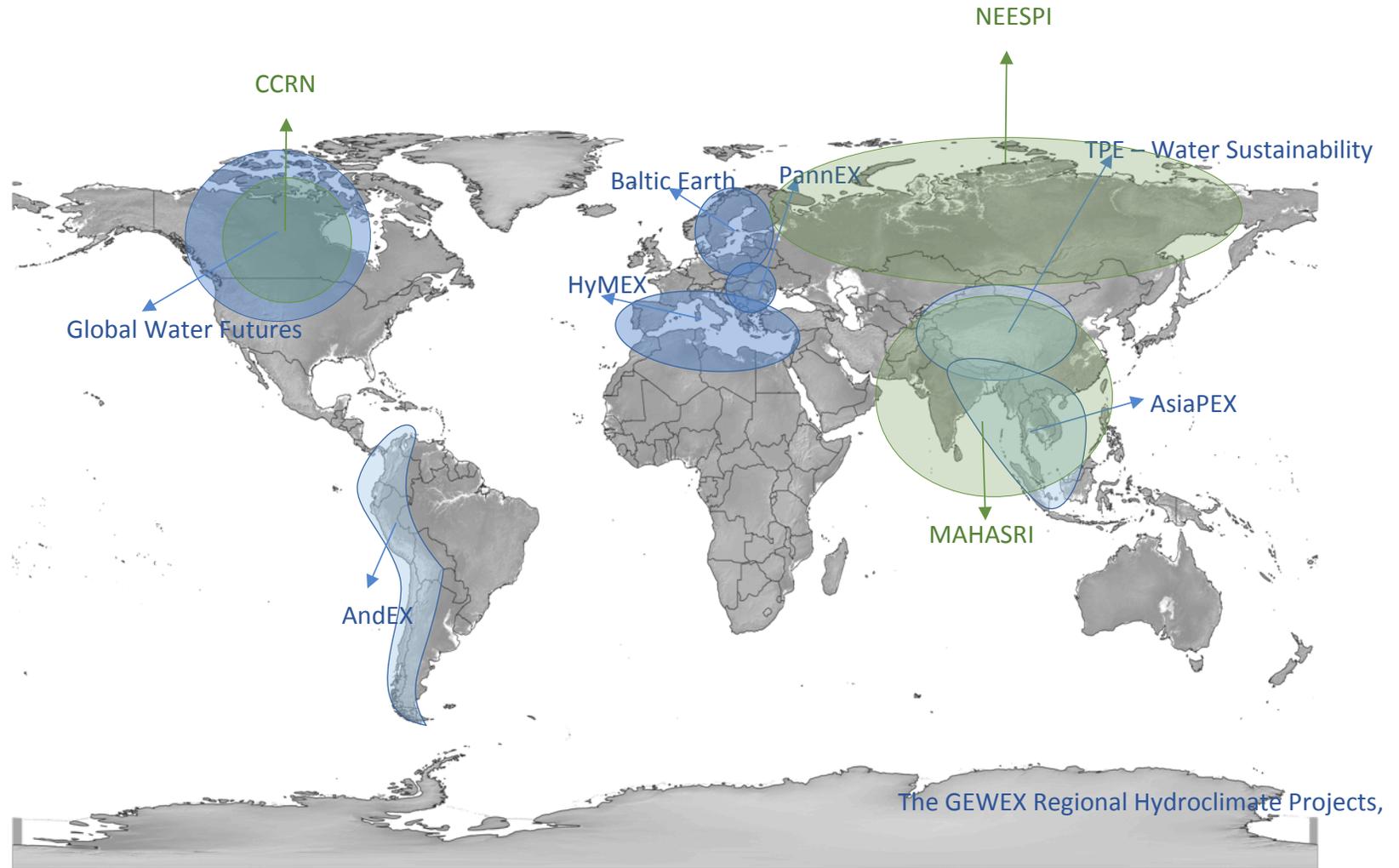
AsiaPEX

**Recently finished:**

CCRN (2014-2018)

MAHASRI (2007-2016)

NEESPI (2004-2015) –



**Active:**

HyMEx (2010-2020)

Baltic Earth (2016-2019?)

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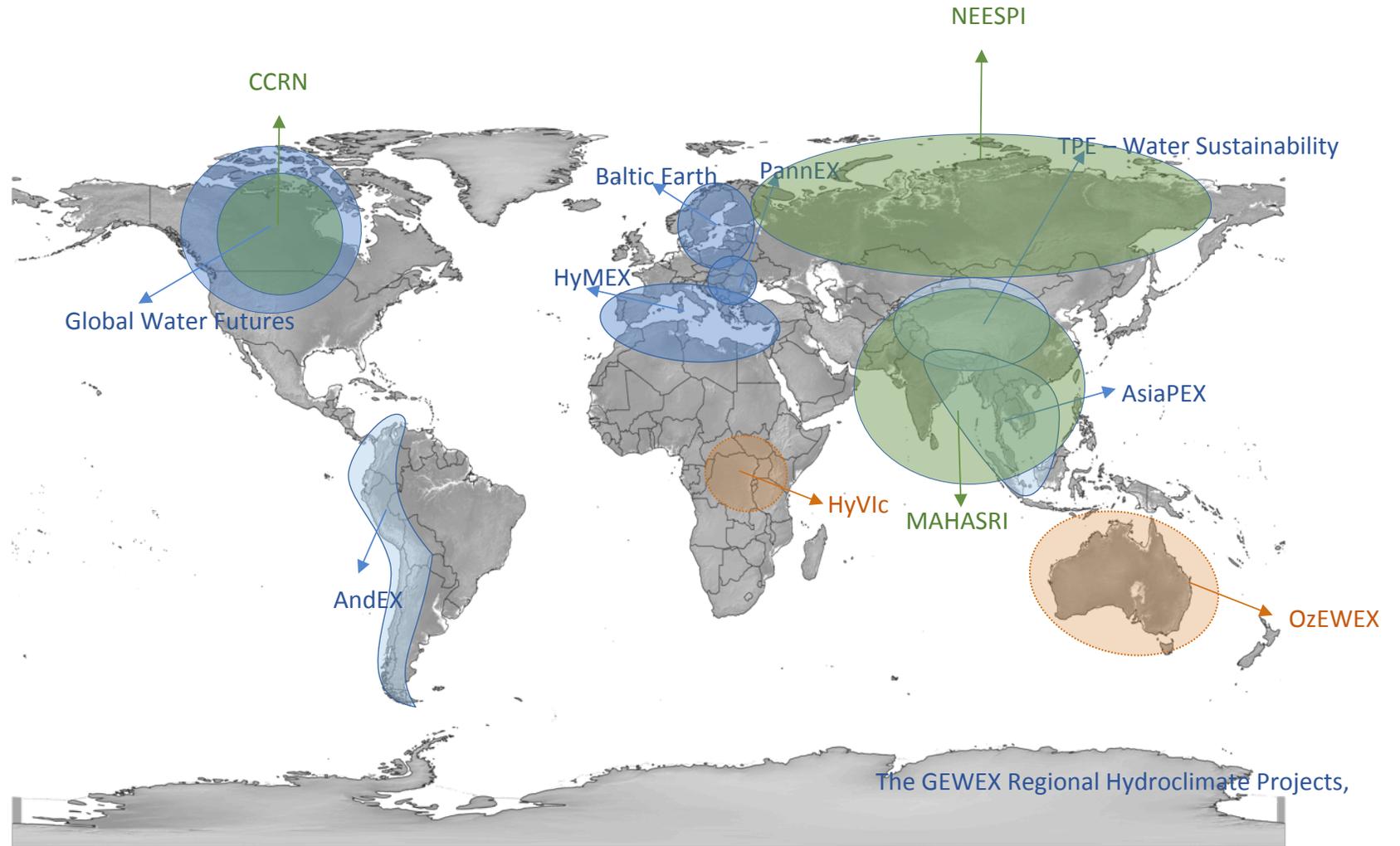
MAHASRI (2007-2016)

NEESPI (2004-2015)

**Discontinued:**

HyVic

OzEWEX?



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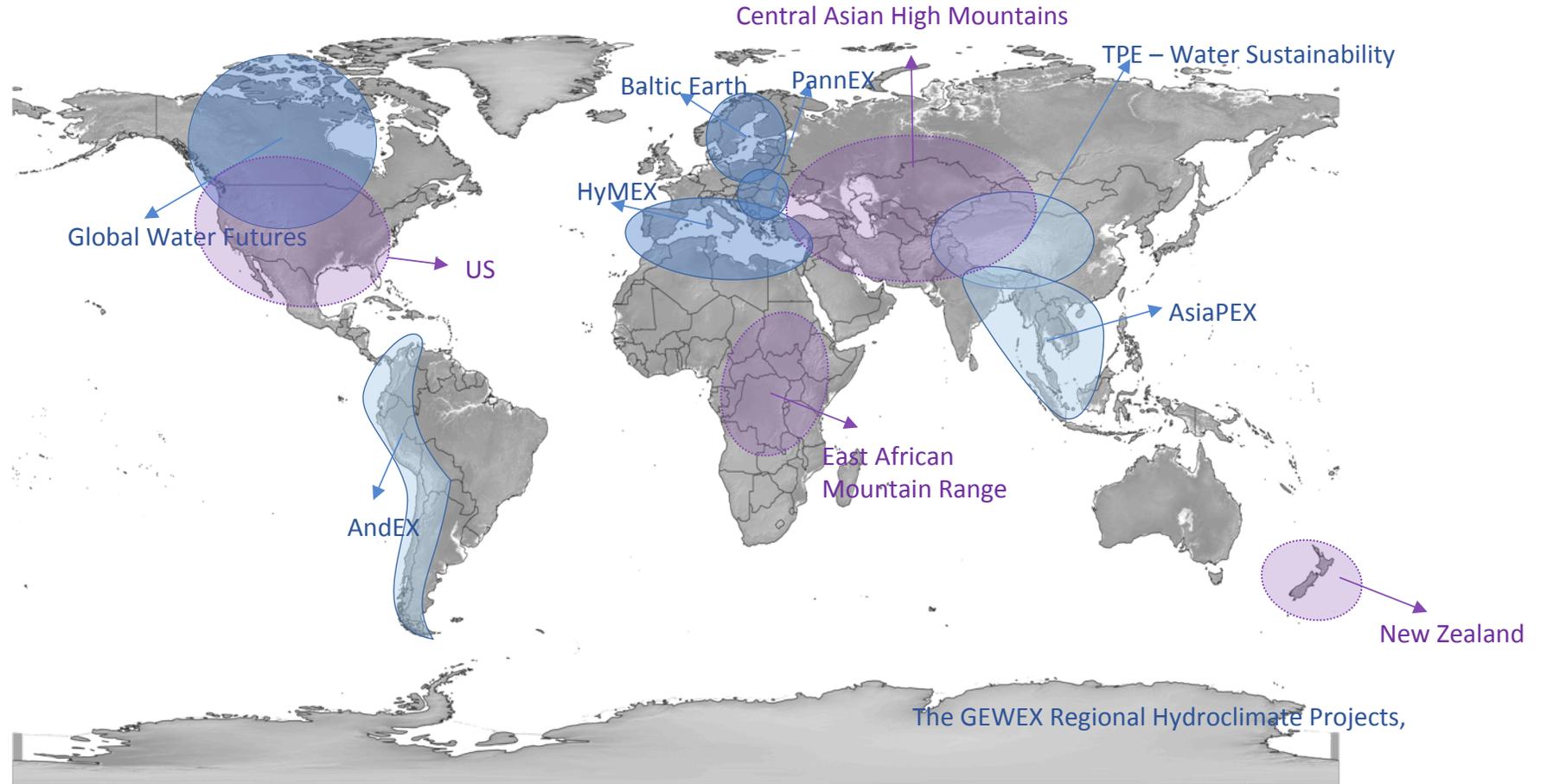
**Envisioned**

US

East African Mountain Range

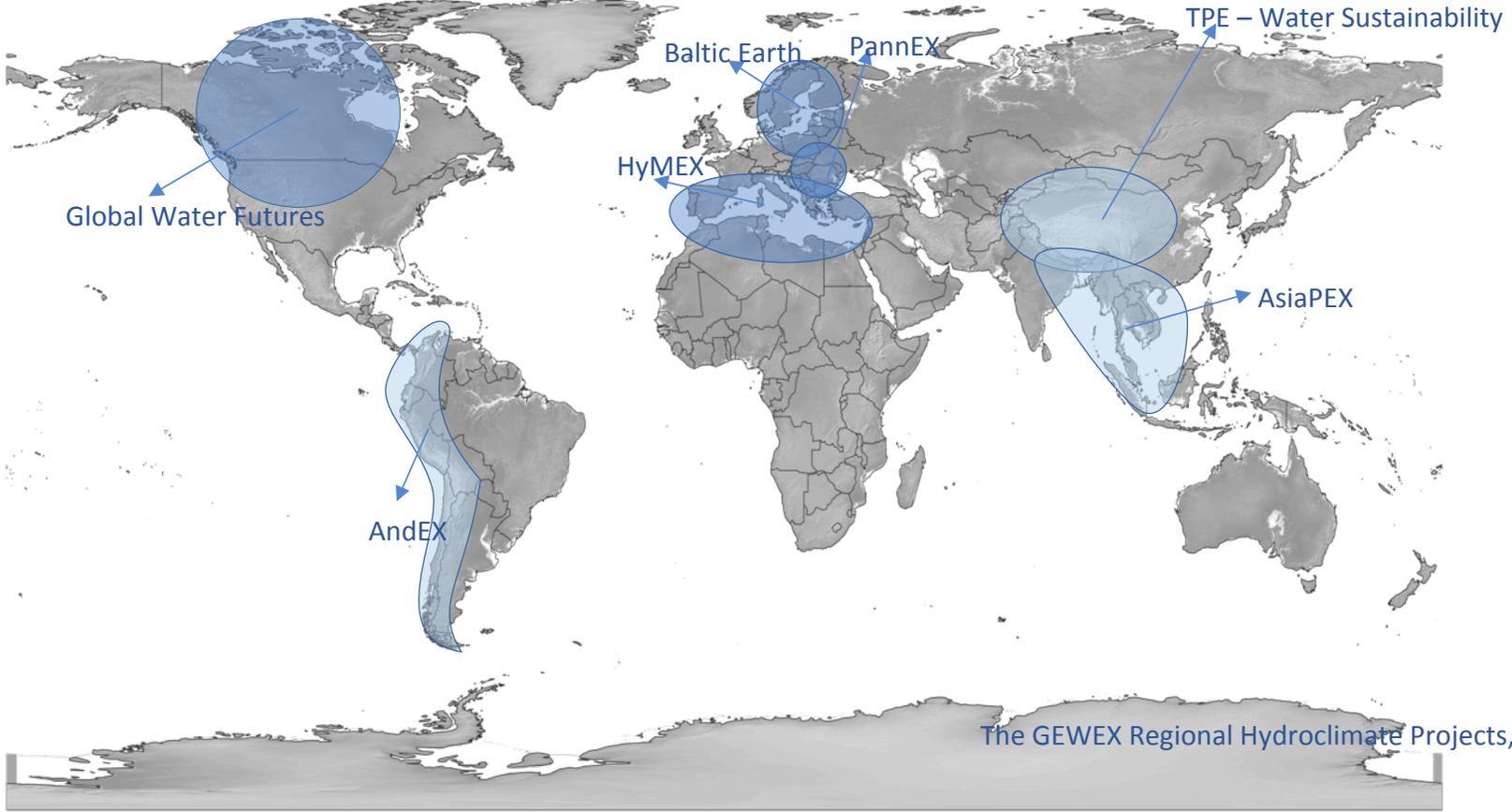
Central Asian High Mountains

New Zealand



**Active:**

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The GEWEX Regional Hydroclimate Projects,

# *HyMex RHP*, focuses on the Mediterranean Basin

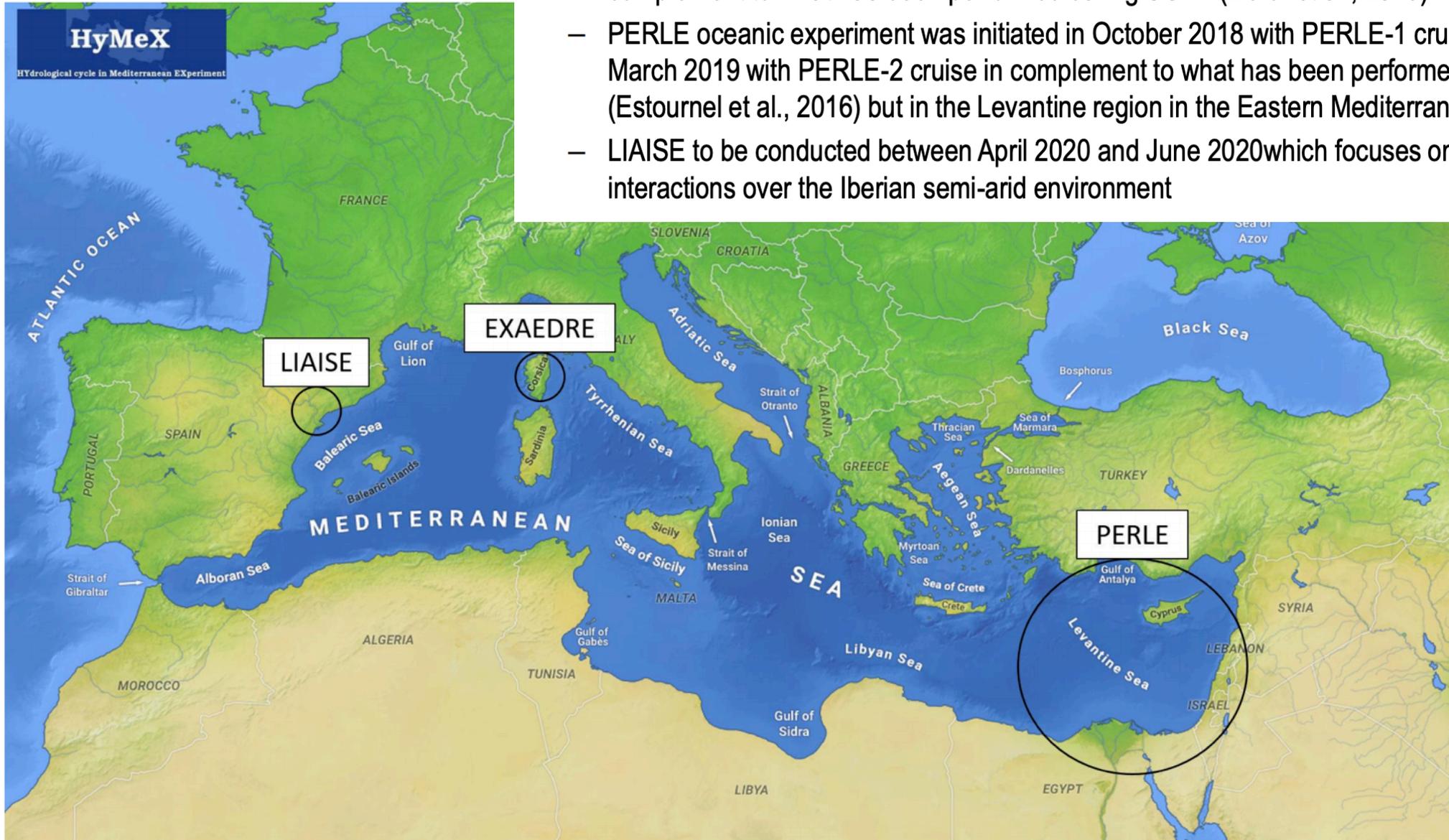
*Philippe Drobinski, Veronique Ducrocq*

Monitoring and modelling the **Mediterranean coupled system** (atmosphere-land-ocean), its variability (from the event scale, to the seasonal and interannual scales) and characteristics over one decade (**2010-2020**) in the context of global change. More than 400 scientists from 20 countries.



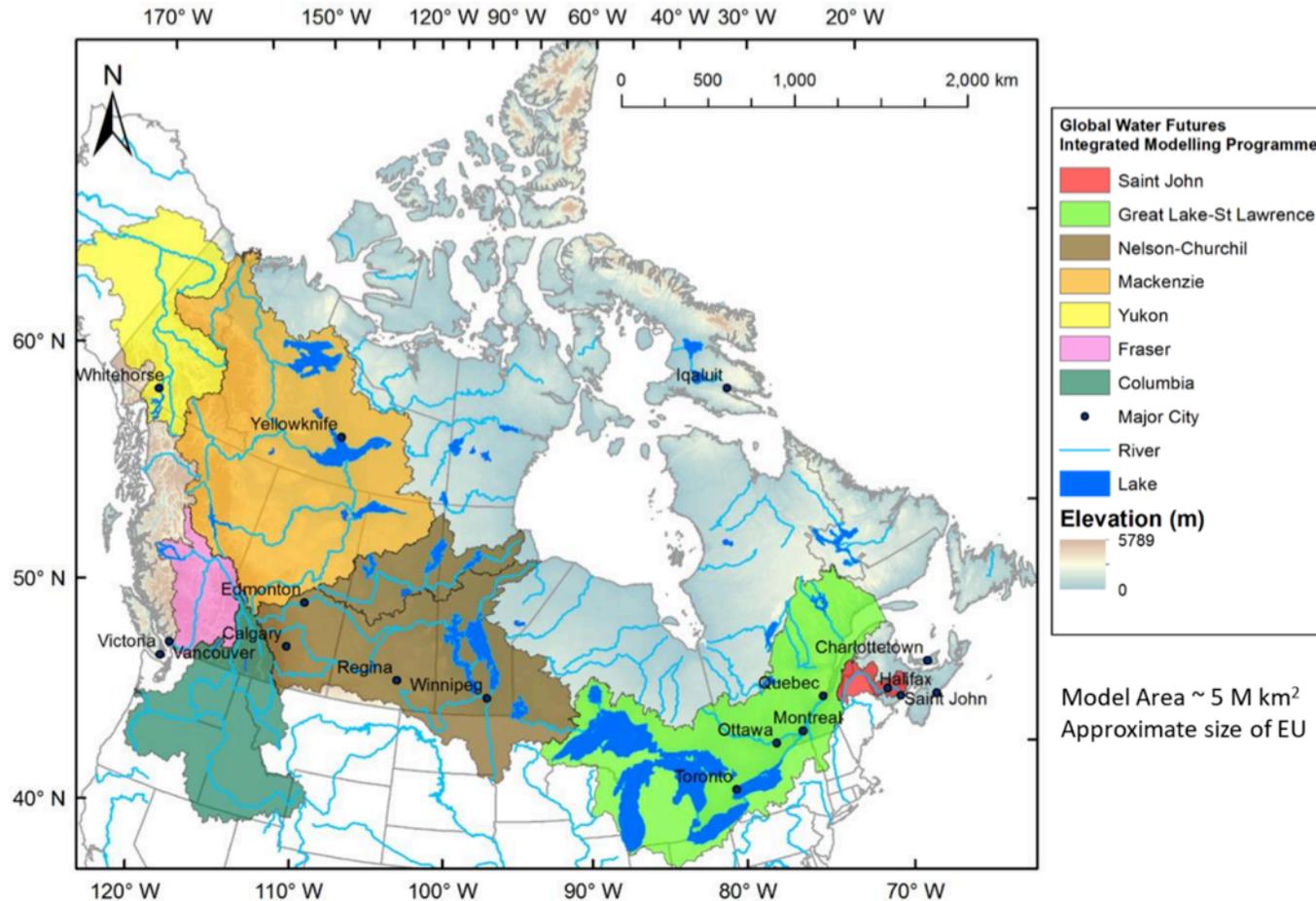
# Three recent efforts for HyMeX RHP.

- EXAEDRE took place between September and October 2018 on atmospheric electricity in complement to what has been performed during SOP1 (Defer et al., 2015)
- PERLE oceanic experiment was initiated in October 2018 with PERLE-1 cruise and continued in March 2019 with PERLE-2 cruise in complement to what has been performed during SOP2 (Estournel et al., 2016) but in the Levantine region in the Eastern Mediterranean
- LIAISE to be conducted between April 2020 and June 2020 which focuses on land surface interactions over the Iberian semi-arid environment



# Global Water Futures RHP: Canada

John Pomeroy



GWFs mission is to:  
Improve disaster  
warning; predict  
water futures; and  
inform adaptation to  
change and risk  
management.

# Global Water Futures RHP: Canada



Awarded **\$ 77.84 M** over 7 years **2016 - 2023** from **CANADA FIRST RESEARCH EXCELLENCE FUND** and **APOGÉE CANADA FORUM D'EXCELLENCE EN RECHERCHE**

**39 projects** funded across Canada

**15** universities

**162** faculty investigators

**335** partners

**60** observatories

**496** researchers hired\*  
\*over first 3 years

Undergrads	56
Grad Students	216
Post Docs	68
Scientists & Engineers	62
Technicians	48
Managers	34
Visiting Fellows	8
KM Specialists	4

GWF supports **4 Global Programs**

**futurearth** research for global sustainability

**WCRP** World Climate Research Programme

**UNESCO**

**WORLD METEOROLOGICAL ORGANIZATION**

**\$292.6 M** in GWF project & core team funding

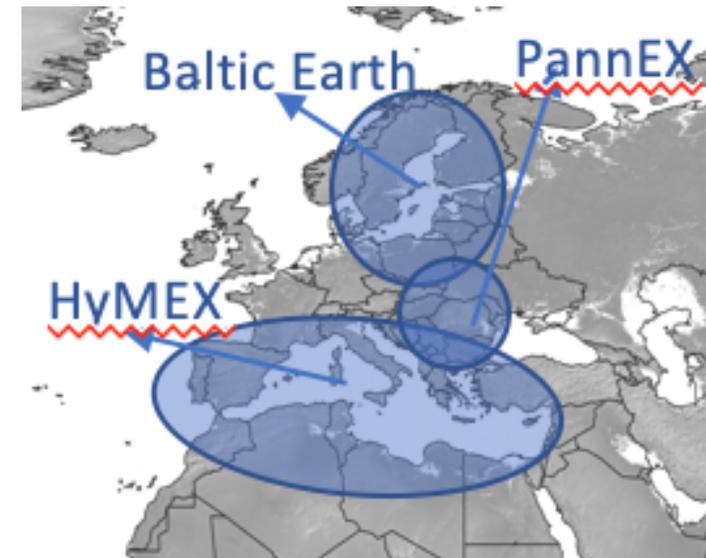
**\$115.8 M** In-kind

**\$176.8 M** Cash

***Baltic Earth RHP***, focuses on Earth System Science for the Baltic Sea Region.  
Markus Meier (Chair) and Karol Kulinski (Co-chair)



The RHP is producing nine Baltic Earth Assessment Reports (BEAR) and has a large number of activities planned for the coming years.



***Baltic Earth RHP***, focuses on Earth System Science for the Baltic Sea Region.

Markus Meier (Chair) and Karol Kulinski (Co-chair)



**Baltic Earth**  
Earth System Science for the Baltic Sea Region

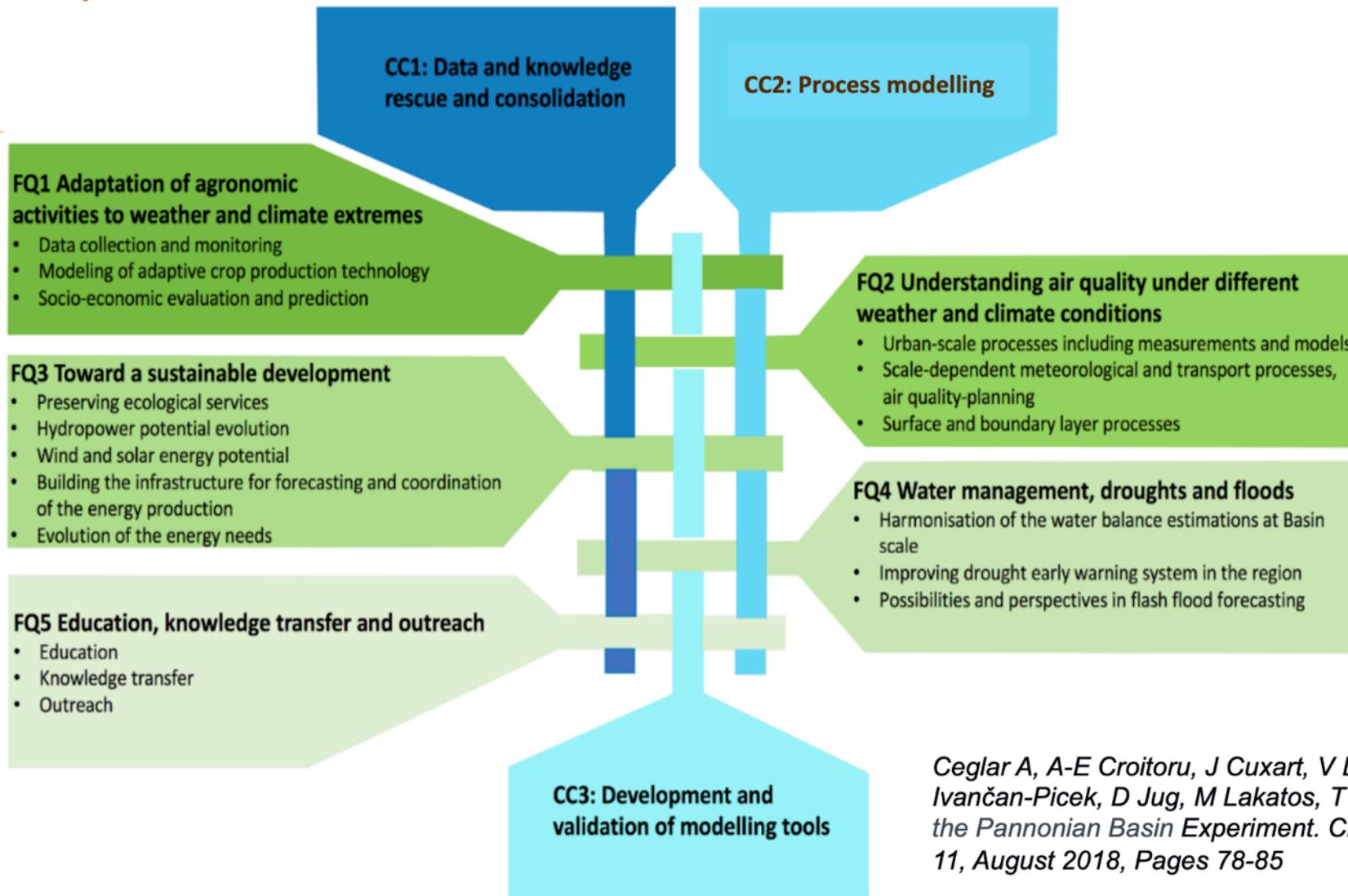
The main areas of study and publications have focused on: 1) Oxygen minimum zones in coastal seas as many coastal seas suffer from expanding bottom-water deoxygenation and hypoxia primarily because of excessive nutrient loads from land. 2) New projections for the Baltic Sea region including the marine ecosystem and comprehensive uncertainty analysis of climate projections. 3) Detection and attribution of past (~1000 years) climate variability.

# ***PannEx RHP*** is an Initiating RHP centered in the Pannonian Basin in Europe. Monika Lakatos



Their White Book was published by the WCRP in March 2019 (<https://www.wcrp-climate.org/WCRP-publications/2019/WCRP-Report-No3-2019-PannEx-WB.pdf>). While PannEx were not successful in obtaining funding from the European Space Agency, this opened an opportunity to join efforts with the team that was awarded funding (DryPan) and will have representatives attend the PannEx workshop in 2020.

***5th workshop was held in Novi Sad, Serbia in June 2019,***



*Ceglar A, A-E Croitoru, J Cuxart, V Djurdjevic, I Güttler, B Ivančan-Picek, D Jug, M Lakatos, T Weidinger, 2018: PannEx: the Pannonian Basin Experiment. Climate Services, Volume 11, August 2018, Pages 78-85*

PannEX White Book available on the WCRP webpage.

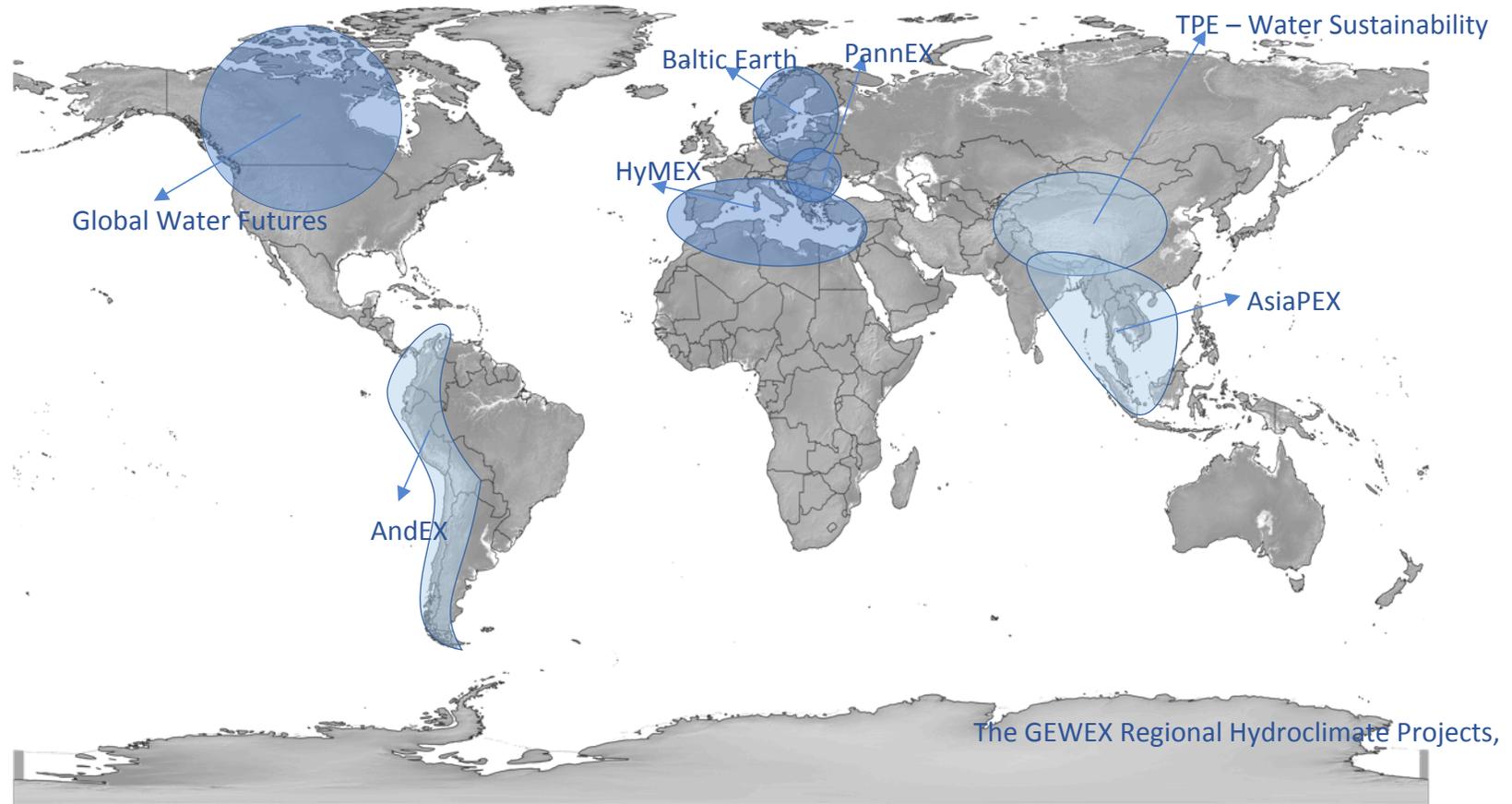
<http://www.wcrp-climate.org/WCRP-publications/2019/WCRP->

**Prospective:**

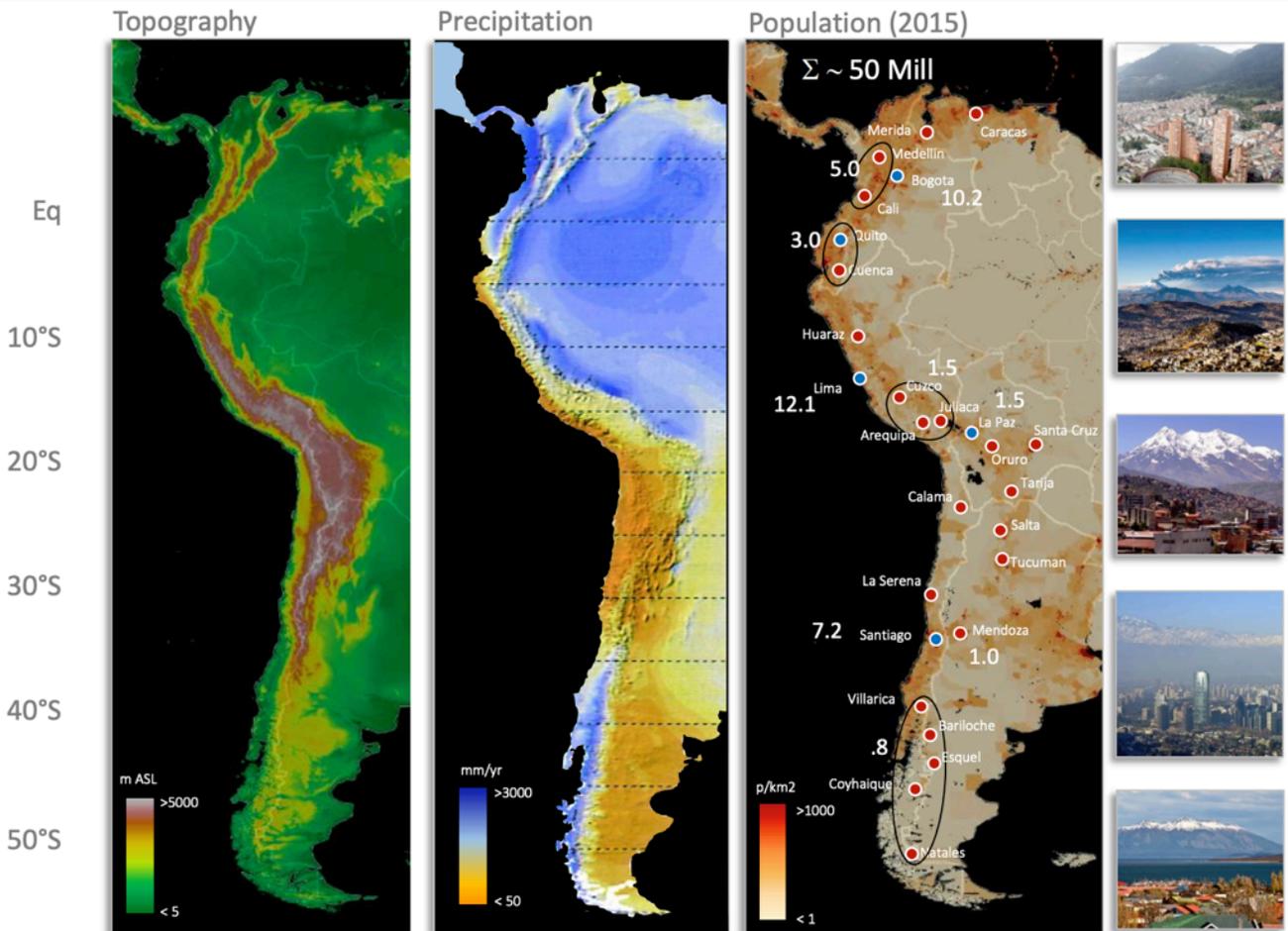
Andex

TPE

AsiaPEX



**ANDEX RHP**, focuses on the Andes Mountains of South America, is in the process of amalgamating the community and obtaining international support.



German Poveda and  
Rene Garreaud





## A REGIONAL HYDROCLIMATE INITIATIVE FOR THE ANDES

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### Overarching Scientific Questions

1. What are the main physical processes driving the water and energy budgets of the Andes at a broad range of spatial and temporal scales, and their interactions with the neighboring Pacific and Atlantic Oceans and major river basins of South America?
2. How climate change, deforestation and land use changes are affecting the hydroclimatological functioning of the Andes across the altitudinal gradients, from glaciers to *paramos*, *punas*, cloud forests, rainforests, dry forests, deserts?
3. What is the scientific basis underpinning the sustainable development of the Andean region?

# ***ANDEX RHP***

6 chapters of the ANDEX white book were sent for review to Frontiers-ES special issue in December 2019.

ANDEX had a well-attended oral and poster session at the 2019 AGU Fall meeting.

A proposal for EGU was submitted.

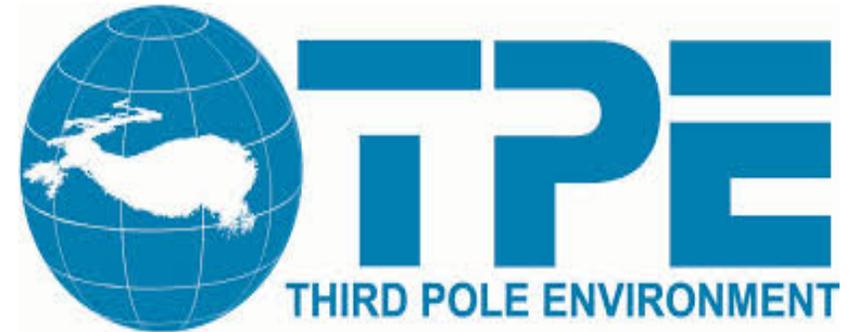


***TPE-WS*** is a RHP initiative intending to explore the water sustainability in the Third Pole Environment.

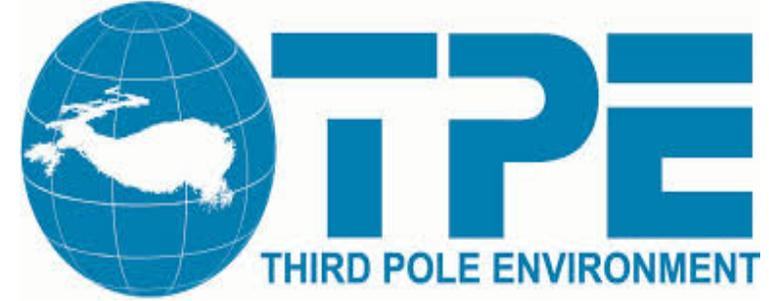
TPE Water Sustainability (TPEWS)  
----The Science Plan----

### Scientific Questions:

- 1. What are the changes in glaciers, snow and permafrost of the high Asian mountain region in last 50 years?**
- 2. Why are these changes happening and what are the main drivers of these changes in Third Pole region? natural variability or human activities?**
- 3. How are the various drivers affecting the hydrological cycle, natural hazard and ecosystem in the region?**
- 4. Can we predict high-impact hydro-meteorological events and future water cycle changes?**



# ***TPE-WS***



The team is working on the science plan, and different sub-groups have been established. They will have a proposal ready shortly.

***AsiaPEX RHP***, focuses on understanding Asian land precipitation, will apply for RHP status shortly.  
Toru Terao, Shinjiro Kanae, Jun Matsumoto.

- 1 Observation and Estimation of Asian Precipitation
- 2 Process Study of LULCC Atmosphere Coupling
- 3 Predictability of S2S to Decadal Variability
- 4 High Resol. Hydrol. Modeling / Human to Glacier
- 5 Synergy Effect / Collab. Obs. & Model. Initiative
- 6 Seeking Effective and Useful Clim. Projection.

# ***AsiaPEX RHP,***

Toru Terao, Shinjiro Kanae, Jun Matsumoto.

They have submitted the first draft of their White Book.

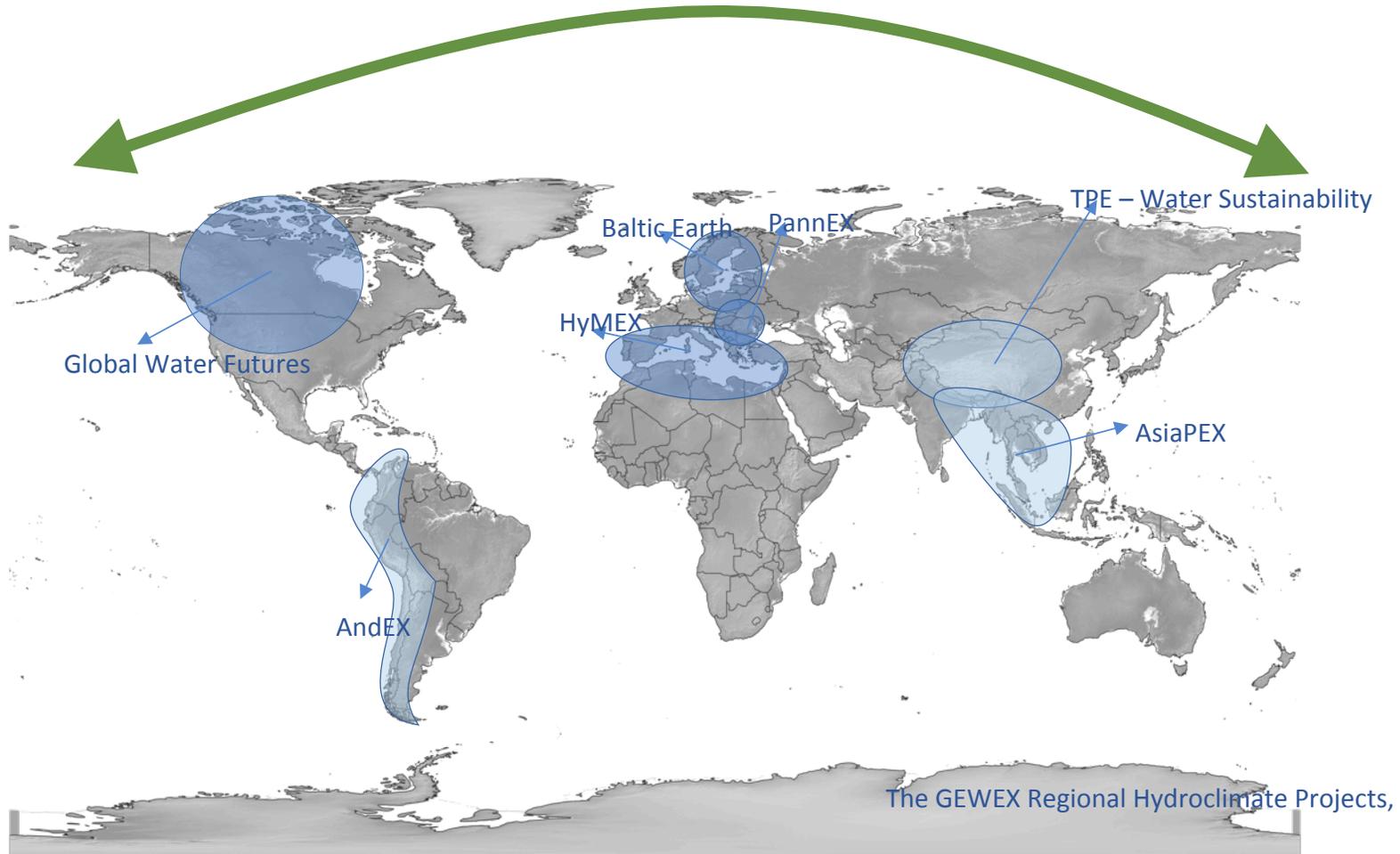
We will engage with the CLIVAR/GEWEX Monsoons Panel when approved.



## 2) Cross-Cutting Projects (CC)

*Near 0C precipitation CC –*  
INARCH CC – alpine cold regions  
INTENSE CC – sub-daily precipitation  
TEAMx CC – transport and exchange over mountains  
\*ET CC - evapotranspiration

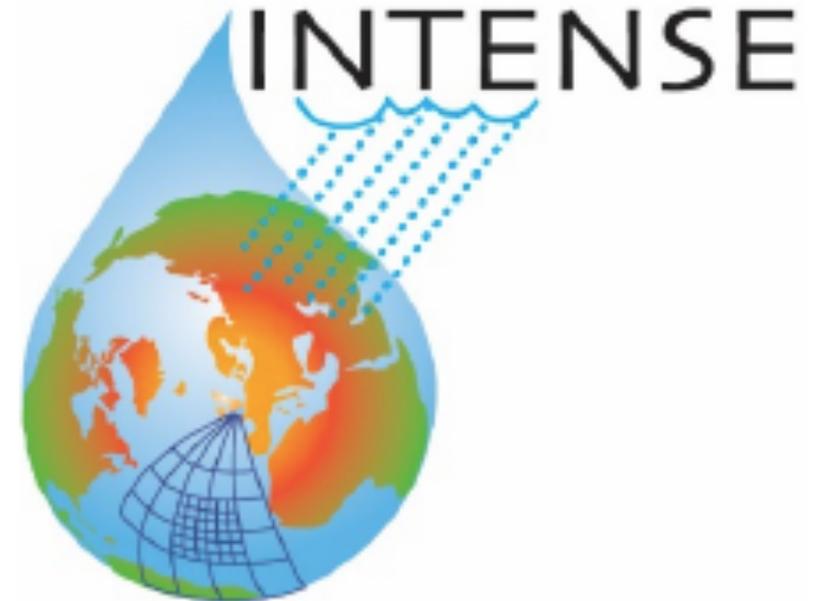
Current CC  
Planned CC



***INTENSE CC***, (INTElligent use of climate models for adaptation to non-Stationary hydrological Extremes)  
Hayley Fowler (Newcastle Uni., UK)

Collection and analysis of sub-daily precipitation data and model outputs.

The data has also been added to the Global Precipitation Climatology Center (GPCC) global repository. This activity will also end in 2020.



# The *INARCH* CC, focusing on understanding hydrological processes in alpine cold regions

## INARCH Research Basins



***The 5th INARCH workshop is planned for spring 2020. The INARCH CC will end in 2020 and its leaders are currently reflecting on how to proceed with its legacy***

# The ***INARCH*** CC, focusing on understanding hydrological processes in alpine cold regions

There are clear links with the ANDEX RHP, the Third Pole Environment (TPE) effort, the proposed CC named Transport and Exchange Processes in the Atmosphere over Mountains Experiment (TEAMx) and perhaps a Western U.S. RHP, if it comes to fruition.

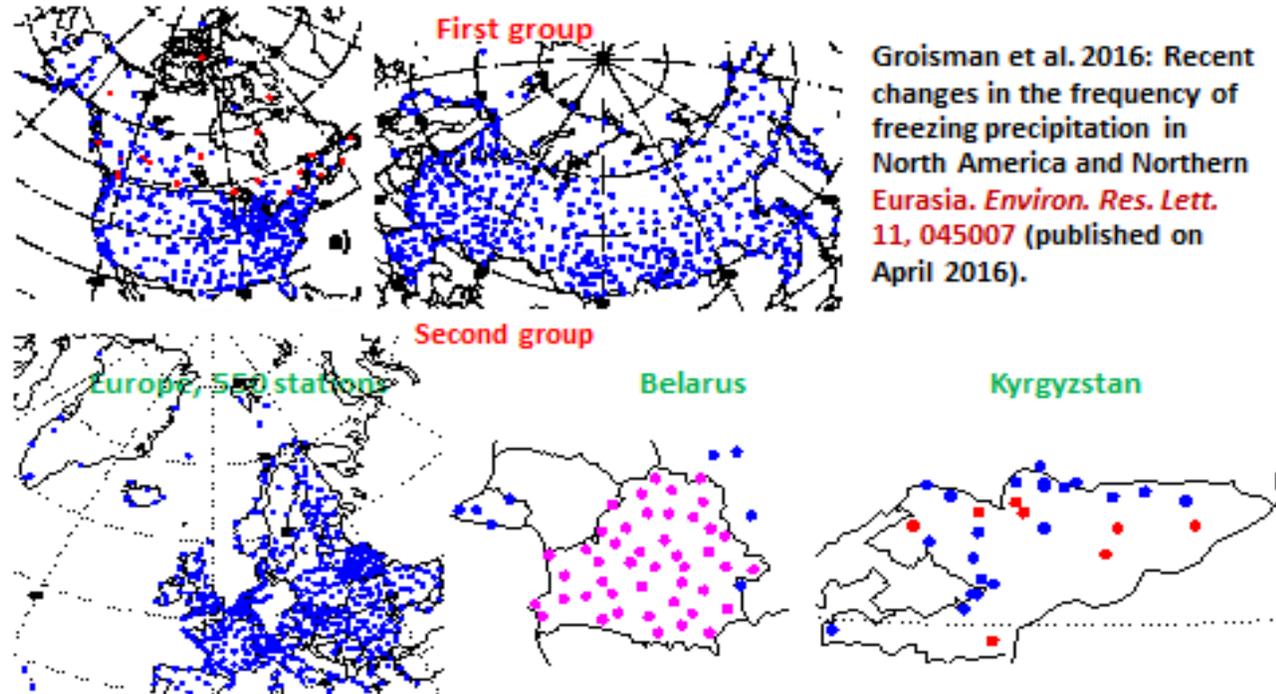


***The 5th INARCH workshop is planned for spring 2020. The INARCH CC will end in 2020 and its leaders are currently reflecting on how to proceed with its legacy***

The ***Near 0°C precipitation CC*** To improve our understanding of future changes in hazardous cold/shoulder season precipitation and storms, especially occurring near 0°C.

Pavel Groiss

Long-term synoptic stations used in our analyses; 1- and 3-hourly data for the past 40 years



The ***Near 0oC precipitation CC*** To improve our understanding of future changes in hazardous cold/shoulder season precipitation and storms, especially occurring near 0°C.

The Near 0°C Precipitation CC is coming to a close.

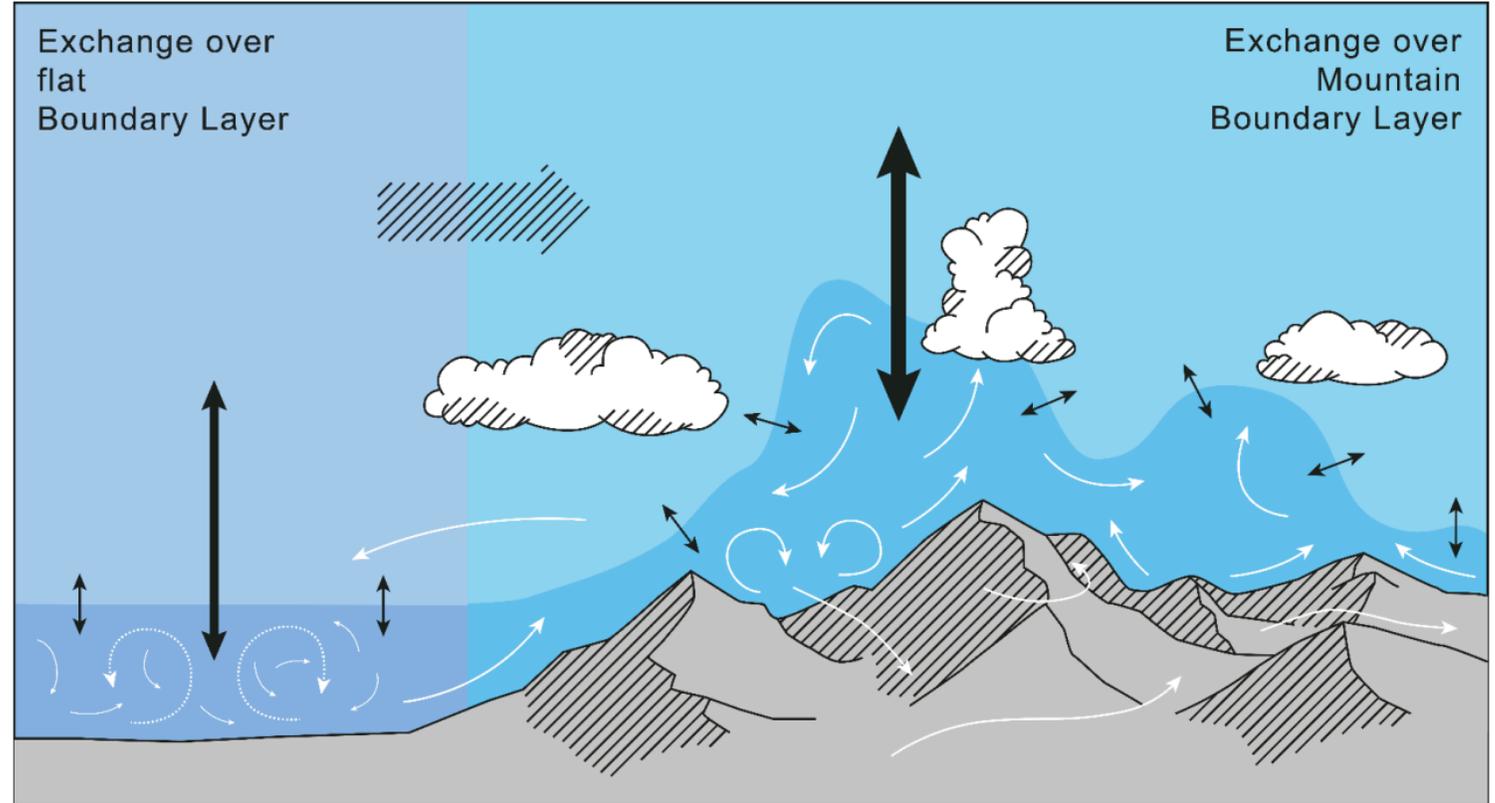
- 1) Main activities include the generation of a data base containing records and related climate analysis from different regions, especially in the Northern Hemisphere.
- 2) Numerical simulations with special focus on microphysics and analysis of Coupled Model Intercomparison Project (CMIP) projections have also been performed.

**TEAMx CC** has just been approved CC status.



Mathias Rotach, Stefano Serafin, Helen Ward

- *Exchange processes induced by mountains:* Transfer of heat, momentum and mass (water, CO<sub>2</sub>, aerosols) between the ground, the PBL and the free atmosphere.
- High-resolution observation and modelling possible, but non-trivial. Model spatial resolutions outpacing observations.
- Special challenges over mountains: Spatial heterogeneity, wide range of relevant scales of motion.



***Determining ET CC*** is an activity focusing on advancing the understanding and determination of Evapotranspiration.

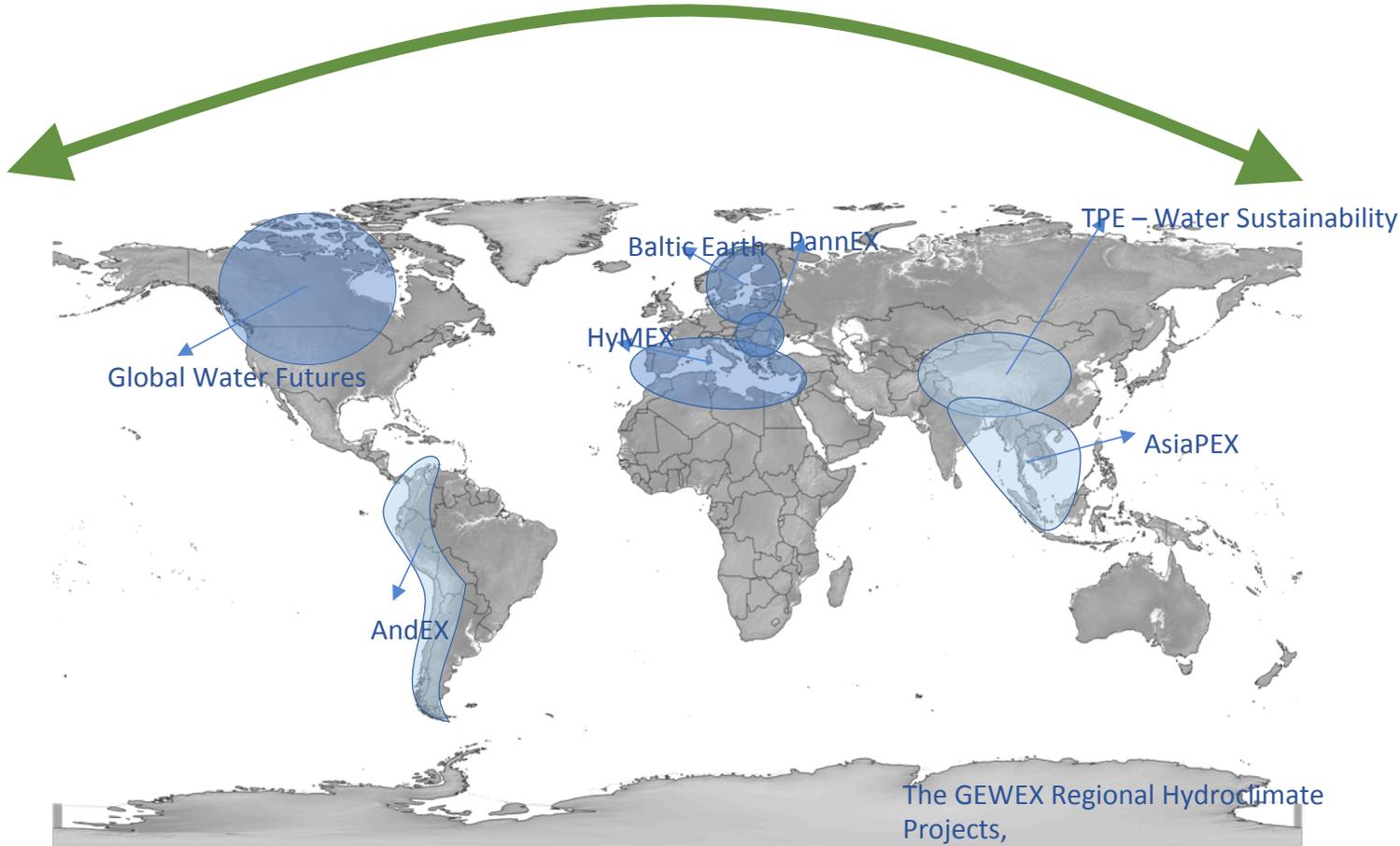
It met in Australia in October 2019 and 5 working groups were created.

The group will consider organizing as a GEWEX Cross-Cut, or alternatively a PROcess Evaluation Study (PROES).

Meeting in Wageningen, August 2020

## 2) Global Data Centers

INARCH CC  
INTENSE CC  
TEAMx CC  
Near 0C Precip CC  
ET CC



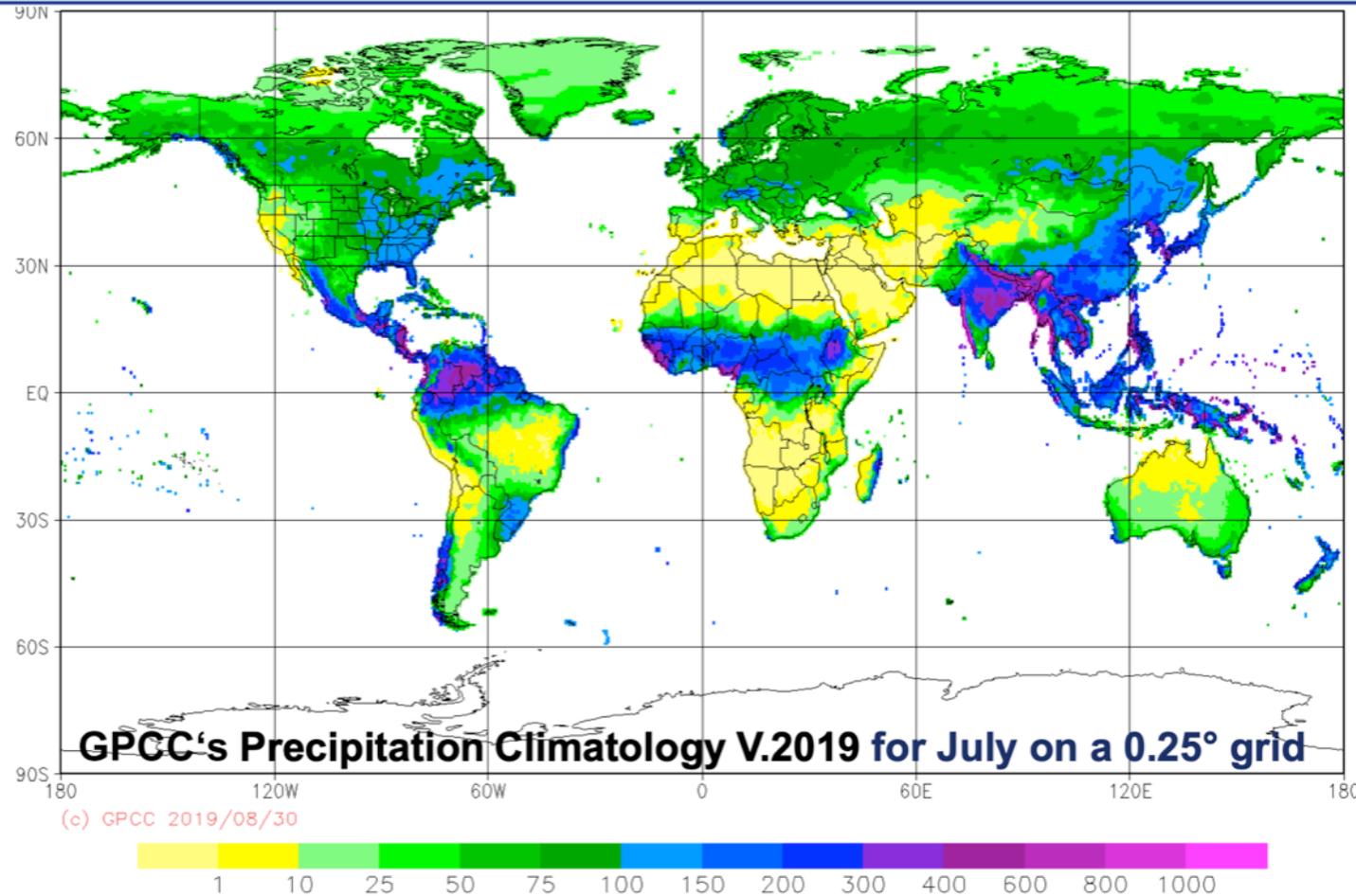
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(GRDC)

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- Global Precipitation Climatology Center (GPCC)
- Global Runoff Data Center (GRDC)
  - These data centres produced improved products and there has been interaction between them and GHP
- International Data Centre on Hydrology of Lakes and Reservoirs (HYDROLARE)

# ***Global Precipitation Climatology Center (GPCC) Andreas Becker and Udo***



Increase of the data base with regard to the number of quality-controlled stations to more than 121,500 stations inter alia by integration of large data sets from Australia, Canada, Brazil.

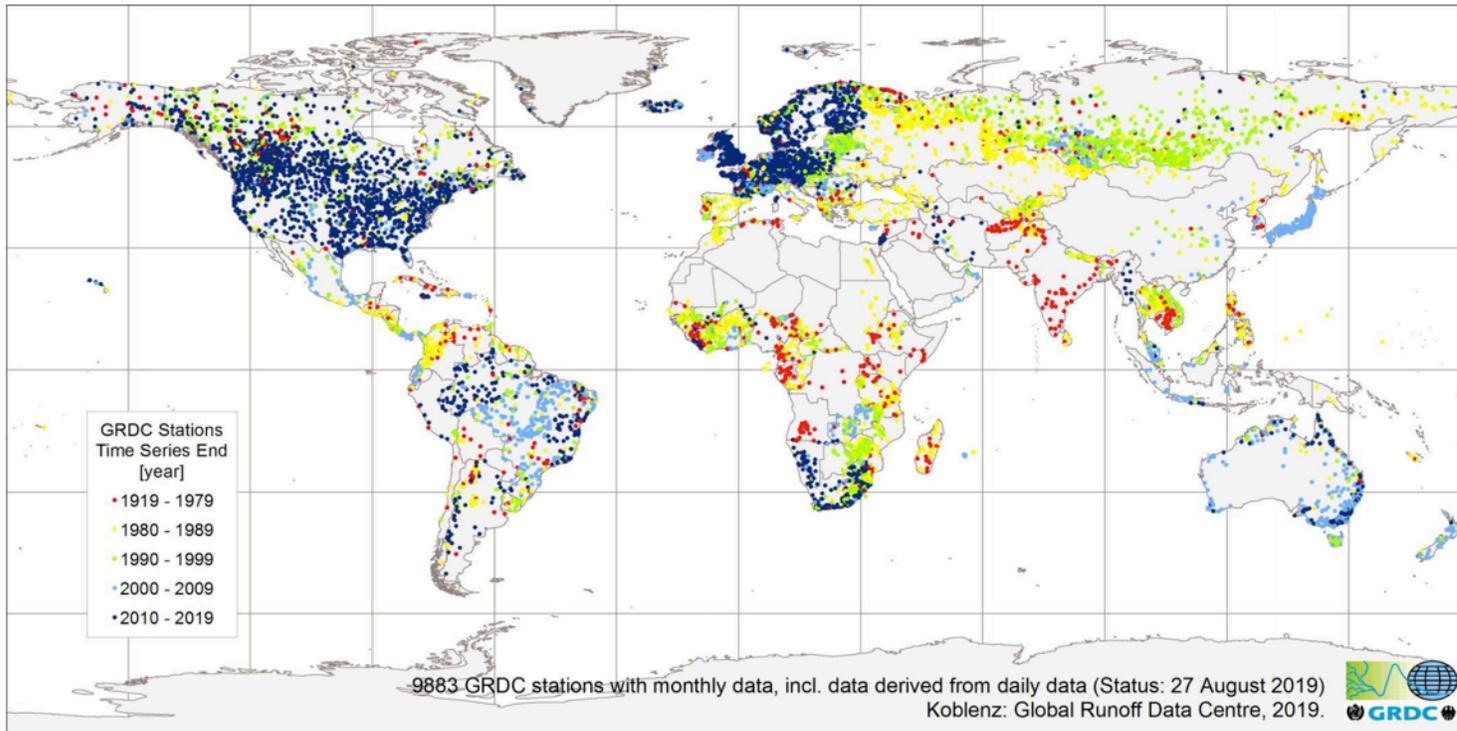
Regular update of quasi-operational monthly Monitoring Product and First Guess Products (daily and monthly)

**\*\*Only distribute raster information – no original rainfall timeseries.**

# Global Runoff Data Centre (GRDC)

Ulrich Looser

Global Coverage of GRDC Stations indicated by **time series end**



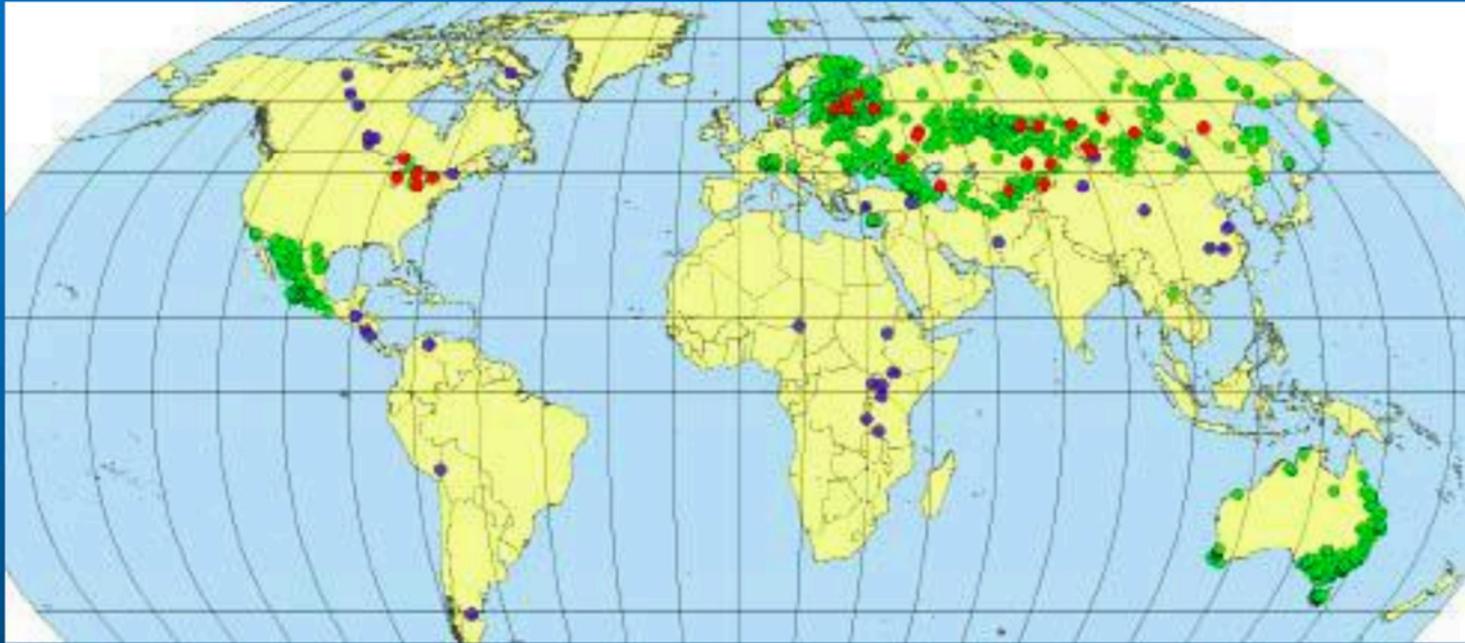
In September 2019 the GRDC database holds world-wide discharge data of 9,927 stations in 161 countries featuring about 440,000 station-years of monthly and daily values with an average time-series length of 44 years.

During the reporting period GRDC managed to acquire discharge data from 25 countries around the world.

Data that collected IS NOT real time. It is quality assured historical data

# ***International Data Centre on Hydrology of Lakes and Reservoirs Prof. Valery Vuglinsky***

Lake and reservoirs in the HYDROLARE data base



in-situ observations are highlighted in green, satellite observation - in blue, both type of observations – in red.

Currently the HYDROLARE database holds water level data of 801 world's lakes and reservoirs and 1420 stations.

## 2) Cross-Cuts

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TEAMx CC  
ET CC

## 3) Global Data Centers

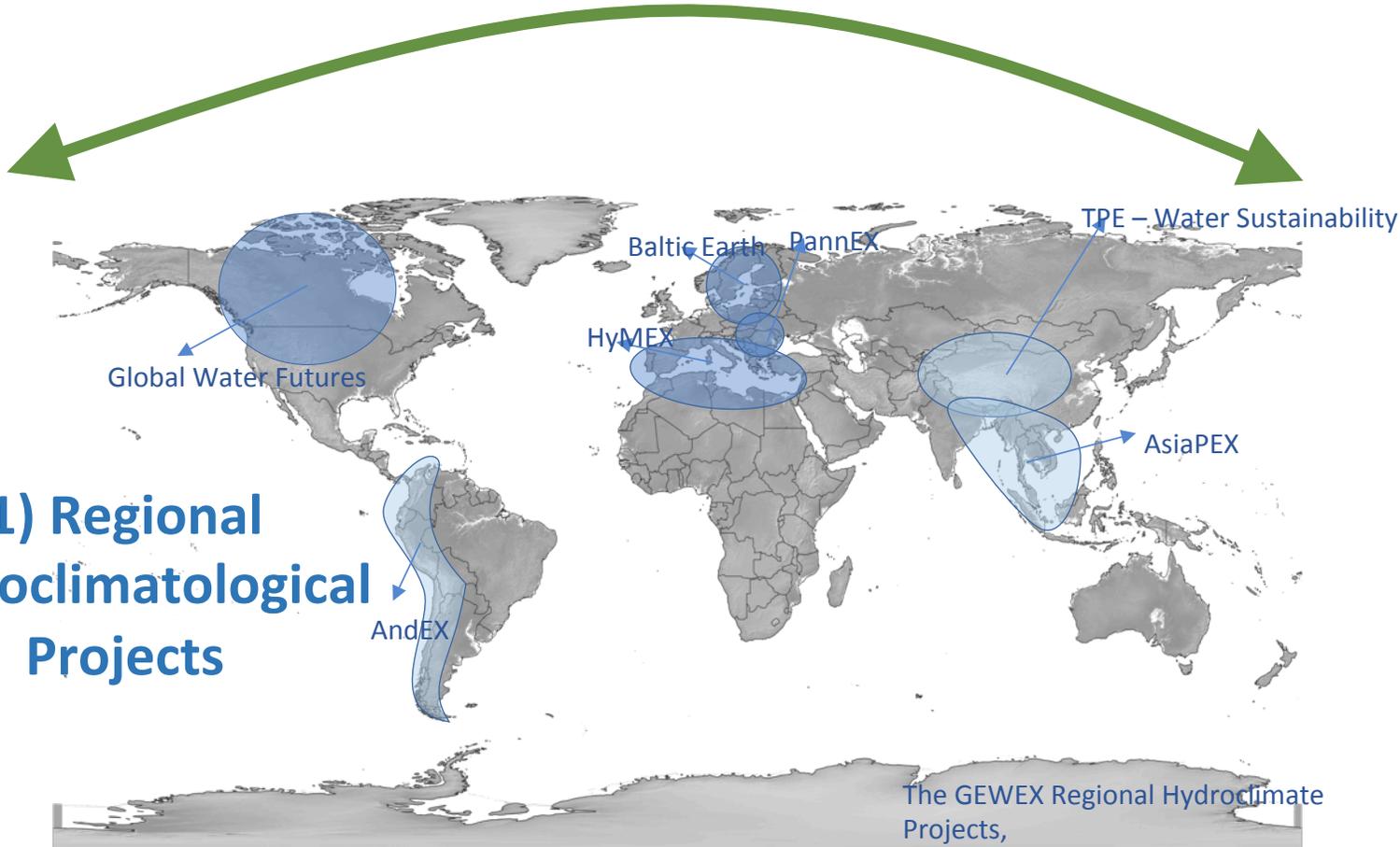
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## 4) GHP Networks

## 1) Regional Hydroclimatological Projects



# In conclusion...

- Adequate global coverage of RHPs – if the three proposed RHPs come to fruition.
- Our two mature CC are coming to an end, we will only have the TEAMx CC.
- Steady work by the Global Data Centers. However, there are only limited personnel resources – sometimes the value is not properly recognized.
- There are currently no GHP Networks, but there is talk about HyMEX continuing as a Network.

## In conclusion...

- New members of the panel bring gender and geographic diversity to the panel.
- Panel members serve as liaisons with the RHPs. This is particularly critical for the Initiating and the Prospective RHPs (PannEX, ANDEX, TPE-WS, AsiaPEX).



The project plan should also include:

1. A science plan with an overall science and applications goal and proposed tasks to achieve it
2. A coordination mechanism (e.g., a Science Steering Group or equivalent) that includes a GEWEX contact (e.g., SSG chair, or project coordinator)
3. A end date and an exit plan that includes a science and applications synthesis and data archival procedure
4. Adequate resources and personnel with potential sources of funding or existing funding identified
5. A mechanism for collecting, managing, and providing access to hydroclimatological data sets with participation in the international exchange of scientific information and data

## Requirements for a full working RHP

1. Demonstrate progress in implementation of the initial phase conditions
2. Continue to meet all RHP requirements
3. An up-to-date web presence
4. Demonstrate progress to contribute to the development and diagnosis of atmospheric-hydrologicland surface models
5. Participate in joint RHP studies in cross-cut activities
6. Participate in other ESSP activities with other Panels and groups outside GEWEX if feasible
7. Share its new knowledge, experience, and models through the publication of scientific results, open science meetings, and relevant GHP meetings and activities