

# The GEWEX Hydroclimate Panel: current and planned activities

*Joan Cuxart*

*Co-chair, GEWEX Hydroclimate panel*

**TPE-GHP workshop, 17-19 October 2017, Kathmandu, Nepal**

- 1. GHP in GEWEX**
- 2. Regional Hydroclimate Projects (RHPs)**
- 3. Cross-cut Actions (CCs)**

# WCRP's three main branches:

## Grand Challenges

Clouds, circulation and climate sensitivity  
Melting ice and global consequences  
*Weather and climate extremes\**  
Regional sea level change and coastal impacts  
*Water for the food baskets of the world\**  
Carbon feedbacks in the Climate system  
Near-term climate prediction  
(\*GEWEX lead)

## Core Programs

CLIC (Climate and Cryosphere);  
CLIVAR (Climate and Ocean)  
***GEWEX (Global Energy and Water Cycle Exchanges)***  
SPARC (Stratosphere-Troposphere exchanges)

***Special Project: CORDEX (Coordinated Regional Climate Downscaling Experiment)***

## Working Groups

Coupled modelling (WGCM)  
Seasonal to interannual prediction (WGSIP)  
Numerical Experimentation (WGNE)  
Coupled Model Intercomparison Project (CMIP)  
Subseasonal to seasonal (S2S)  
Decadal Prediction  
Data Advisory Council (WDAC)  
Modelling Advisory Council (WMAC)  
Climate Change Detection and Indices (ETCCDI)

**GEWEX Mission and Status:** to measure and predict global and regional energy and water variations, trends, and extremes, such as heat waves, floods, and droughts, It is in its third phase (2013-2022), taking advantage of mature modelling and observing systems,

## GEWEX methodology

- i) to facilitate research into the global water cycle and interactions between the land and the atmosphere,
- ii) identifying gaps in knowledge and
- iii) trying to fill them through new studies, reviews of datasets, gathering of experts or other opportunities.

## GEWEX Science Questions

They address the contributions that water and energy cycle science can make to society in four major areas:

- i) understanding the precipitation variability,
- ii) changing water availability,
- iii) extreme events like drought and floods,
- iv) processes in the water and energy cycles

## GEWEX Imperatives

Focused on seven areas where GEWEX can best advance water and energy cycle science:

- i) Data sets;
- ii) analysis;
- iii) processes
- iv) modelling
- v) applications
- vi) technology transfer
- vii) capacity building.



**GDAP (Data and Assessment)**  
*Radiation and Atmospheric Composition*

**GLASS**  
*Land/Atmosphere system study*



**GASS (Atmospheric System Studies)**

**GHP (Hydroclimate)**

- \* *Regional Hydroclimate projects*
- \* *Cross-Cut Projectes*
- \* *Global Data Centers*

*Atmospheric processes in numerical models*

**WMO/ICSU/ICO**



**WCRP**



**GEWEX**



**GHP**



**RHP or CC**



**WG or CC**



**Specific Activity**



**GDAP/GASS/GLASS**

**RHPs: Large, regionally-focused multidisciplinary projects aiming to improve the understanding and prediction of that region's weather, climate, and hydrology, often also addressing societal impacts.**

**Active in 4 continents:**

- Europe: **HyMeX** (2010-20) =====> High-impact weather events, societal response
- Baltic Earth** (2016-) =====> Sea and land changes, biogeochemical processes
- North America: **CCRN** (2014-2018) => Cryospheric, ecological, hydrological interactions
- Australia: **OzyWex** (2015-19) =====> Water and energy cycle in Australia
- Africa: **HyVic** (2015-2024) =====> Hydroclimatic variability over Lake Victoria basin

**Recently finished:**

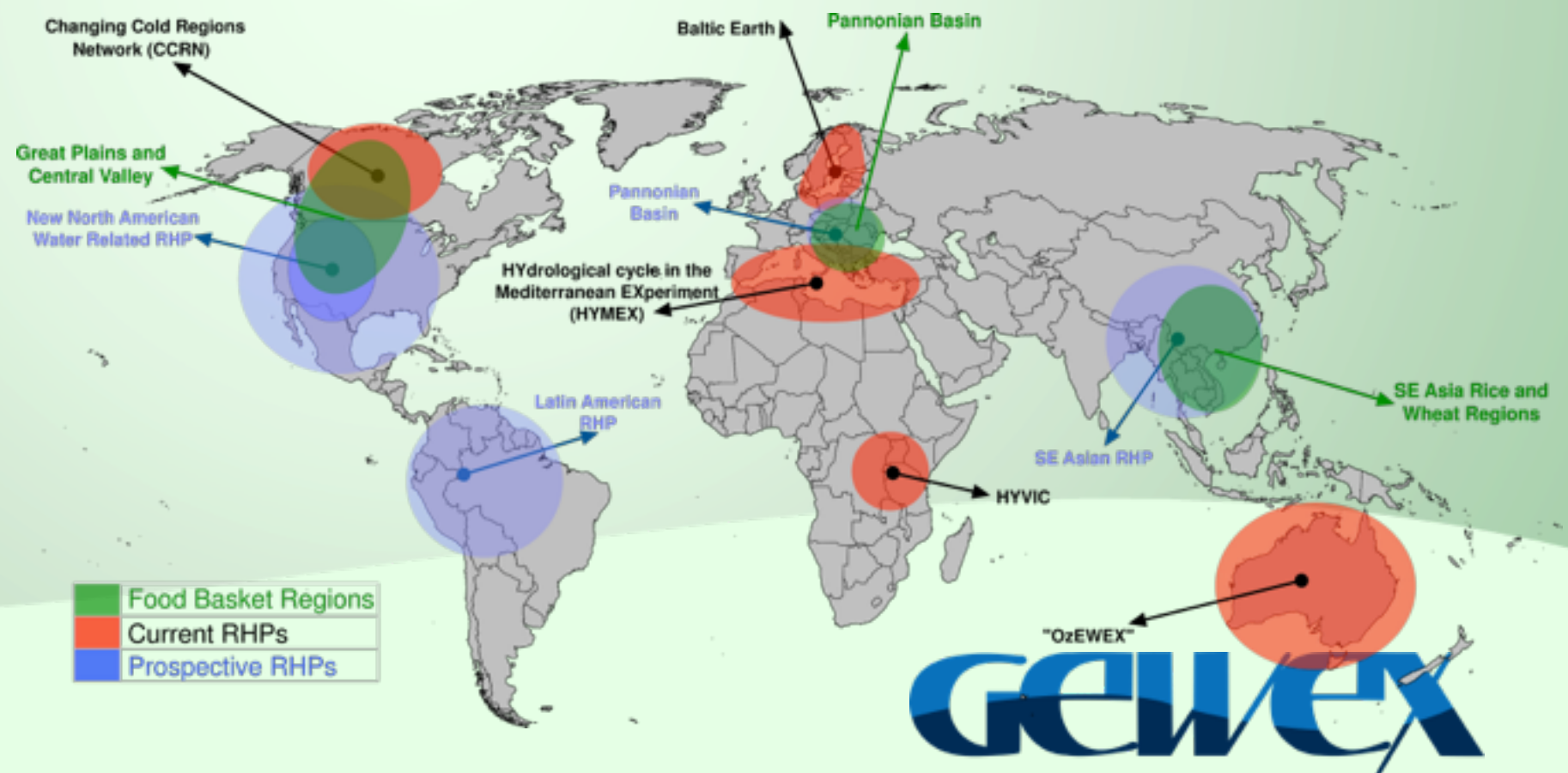
- Asia: **MAHASRI** (2007-2016) =====> Asian Monsoon
- Eurasia: **NEESPI** (2004-2015) =====> Northern Eurasian climate-ecosystem-societal interact.

**Prospective:**

- Europe: **PannEx** (end 2017?) =====> Agronomy, air quality, sustainability & water management

**In discussion:**

Exploring possibilities in the Americas (Western USA and Andes) and Asia.





## **RHPs: Multiple formats and origins**

- \*RHPs usually take the form of a network, which structure varies between RHPs
- \*Some are former initiatives that become RHPs
- \*Others are formed with the RHP structure in mind
- \*Some have clear institutional leaderships, other are more transversal
- \*Structured in Working Groups and Cross-cutting actions
- \*Some are essentially national efforts (OzyWex, CCRN), although open to the entire community.
- \*Others are multinational efforts, with a country leading (HyMeX) or not (Baltic Earth, PannEx).

## **Must have relation with GEWEX's Science questions and imperatives**

- i) understanding the precipitation variability, ii) changing water availability,
- iii) extreme events like drought and floods, iv) processes in the water and energy cycles

***But can also have other subjects: food production, pollution control, ...***

## **Most of the RHP are in line with the questions and address most of the 7 imperatives:**

- i) Data sets; ii) analysis; iii) processes; iv) modelling; v) applications; vi) technology Transfer & vii) capacity building.

***Usually experimental campaigns are conducted, but optimized use of available information happens as well.***





# The three phases of an RHP

1) The *prospective phase*, implies to make a **project plan** than should include:

- \* A science plan
- \* A coordination mechanism (SSG)
- \* An end date and an exit plan
- \* Adequate resources and personnel with actual/potential funding identified
- \* A mechanism for managing the generated data sets with participation of the community

2) The endorsement of the Project Plan by GEWEX's SSG., leads to the *Initiating phase*, a period when actual activity starts, interaction with other RHPs and CCs recommended.

3) *Fully working RHP*. an annual report/update of the Science plan is required:

- i) Demonstrate progress in implementation of the initial phase conditions;
- ii) Continue to meet all RHP requirements;
- iii) Have an up-to-date web presence;
- iv) Demonstrate progress to contribute to the development/diagnosis of atmospheric-hydrologic–land surface models;
- v) Participate in joint RHP studies in cross-cut activities;
- vi) Participate in other Earth System activities with other Panels and groups outside GEWEX if feasible;
- vii) Share its new knowledge, experience and models through the publication of results, open meetings and relevant GHP meetings and activities

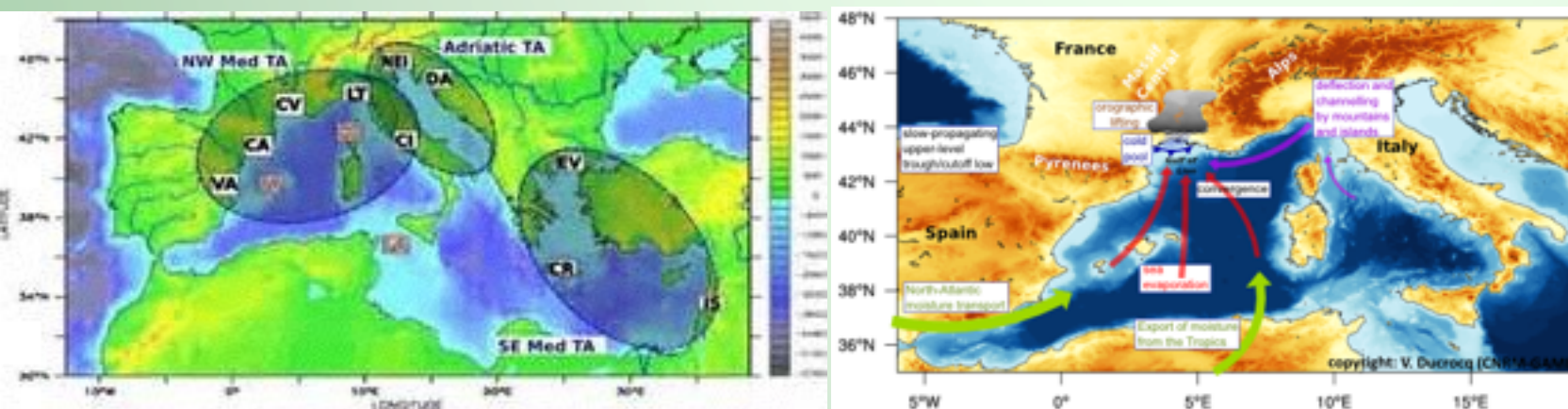
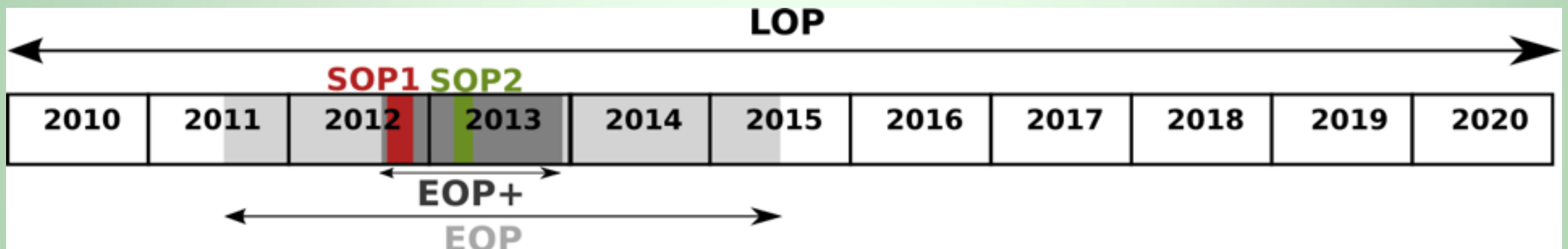
# Hydrological cycle in the Mediterranean Experiment (HyMeX) 2010-2020

Lead: P. Drobinsky & V. Ducrocq

Countries: France, Spain, Italy, Greece, Croatia, Germany, Israel, Morocco, The Netherlands, Switzerland...

HyMeX aims at:

- 1) An improved understanding of the water cycle on extreme events by 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 in the context of global change,
- 2) Evaluating societal and economic vulnerability and adaptation capacity to extreme meteorological and climate events.



**WG1: The water budget of the Mediterranean Sea**

**WG2: The continental hydrological cycle and related water resources**

**WG3: Heavy rainfalls, flash-floods and floods**

**WG4: Intense sea-atmosphere interactions**

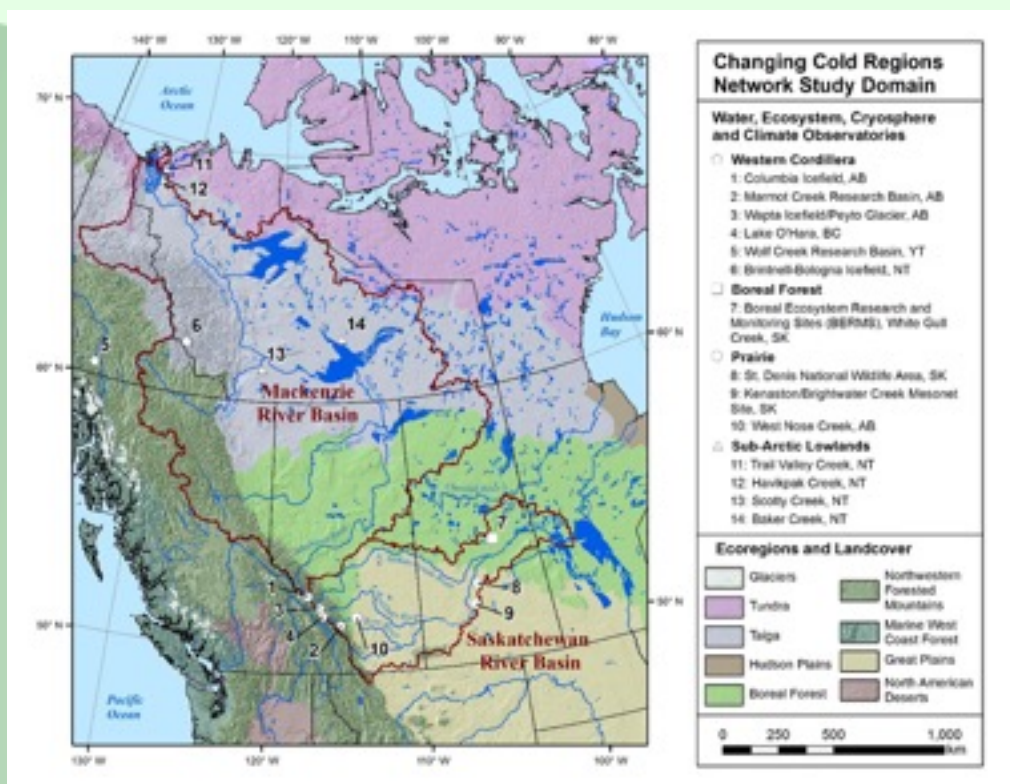
**WG5: Societal and economic impacts**

- \* 10 HyMeX workshops
- \* Participation in MetMed, Plinius and EGU



# Changing Cold Regions Network (CCRN)

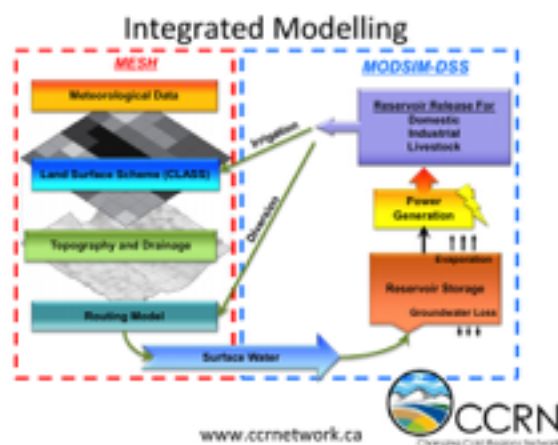
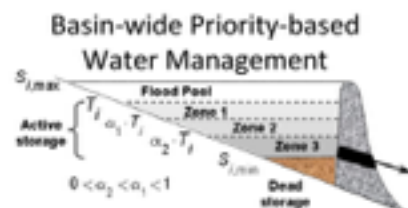
2014-2018 H. Wheater, U. Saskatchewan (Canada)



Understanding, diagnosing, and predicting interactions amongst the cryospheric, ecological, hydrological, and climatic components of the Earth system at multiple scales, with particular focus on:

- hydro-meteorological extremes**
- key land surface systems**, including Rocky Mountains, Boreal Forest, Prairies, and sub-arctic, and their response to climate variability and climate change
- effects on water** quantity and quality and aquatic ecosystems, of anthropogenic land use change
- societal controls on water management**, integrating humans and their activities into water science

Including Water Management in a Land surface-Hydrology Model  
Annis et al. (in prep.)



Theme A: Observed Earth System Change in Cold Regions  
- Inventory and Statistical Evaluation

Theme B: Improved Understanding and Diagnosis of Local-Scale Change

Theme C: Upscaling for Improved Atmospheric Modelling and River Basin-Scale Prediction

Theme D: Analysis and Prediction of Regional and Large-Scale Variability and Change

Theme E: User Community Outreach and Engagement

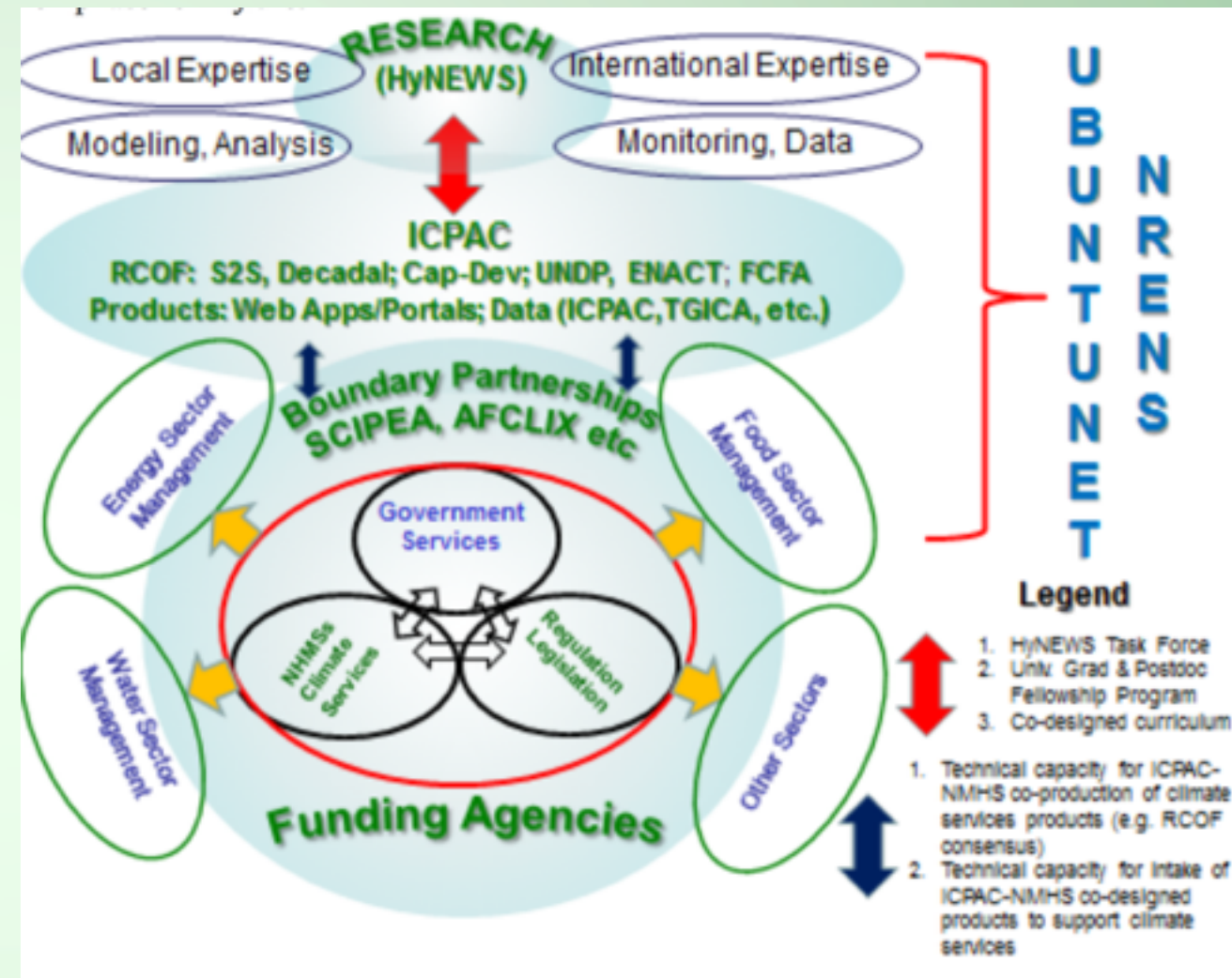




# Hydroclimate project for Lake Victoria Basin (HyVic)



2014- 2024 Fred Semazzi, North Carolina State University, USA



Theme-1: Translational Research Interface with Applications

Theme-2: Severe Weather and Water Currents (collaboration with WWRP-LVP)

Theme-3: Lake Victoria Basin Water Budget

Theme-4: Climate variability and model development

Theme-5: Observation of the Hydroclimatological System



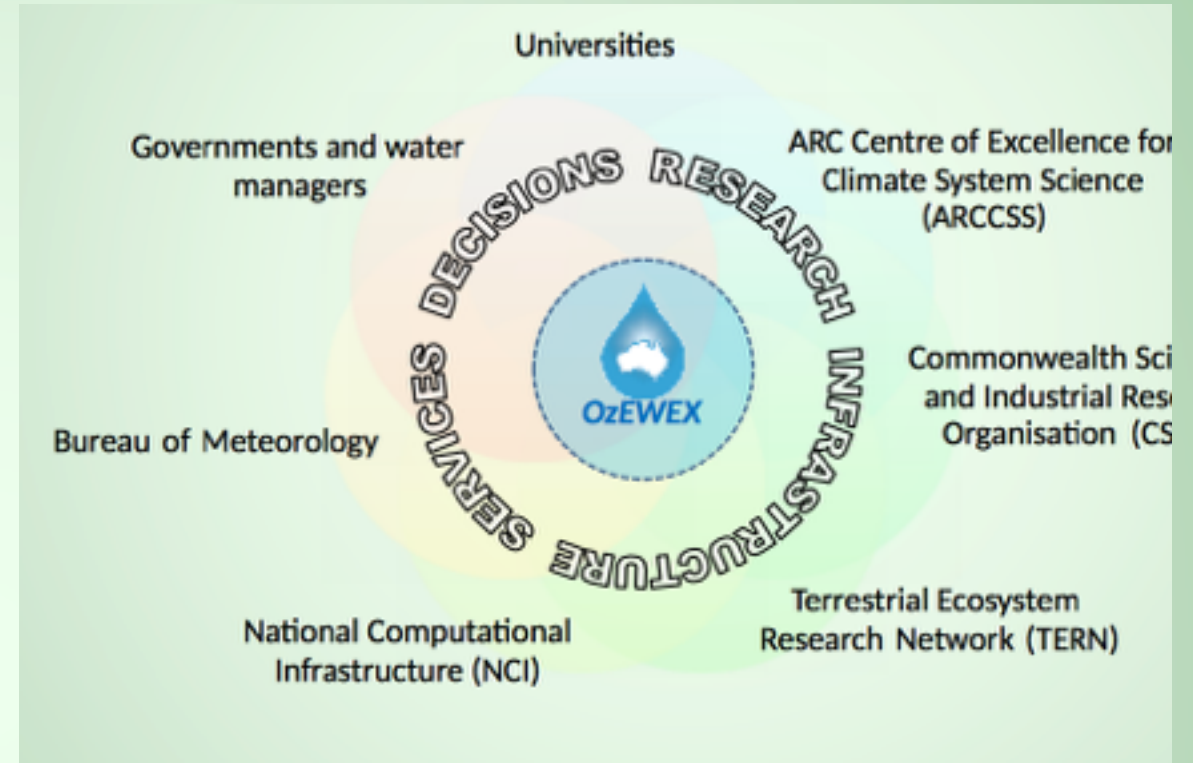
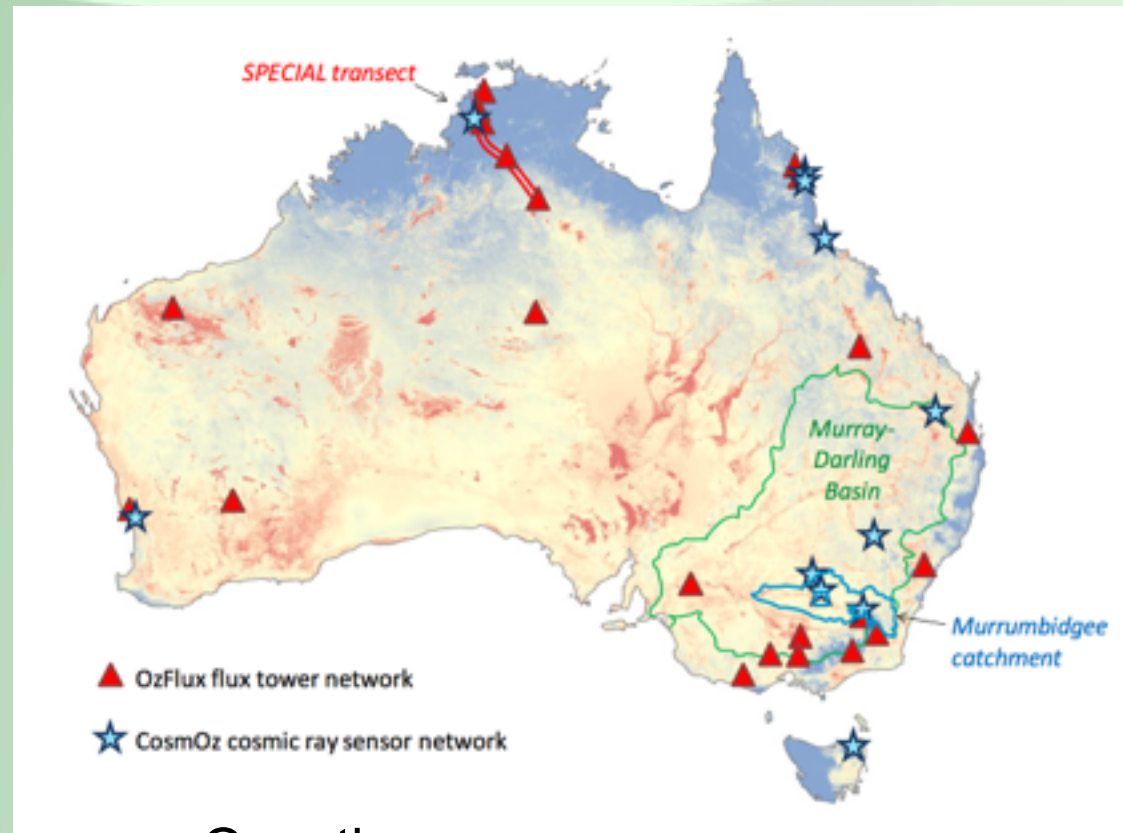


# Australian Energy and Water Exchanges (OzEWEX)

2015- 2019 Seth Westra



Aim: to understand and predict Australia's fresh water resources and water security into the future



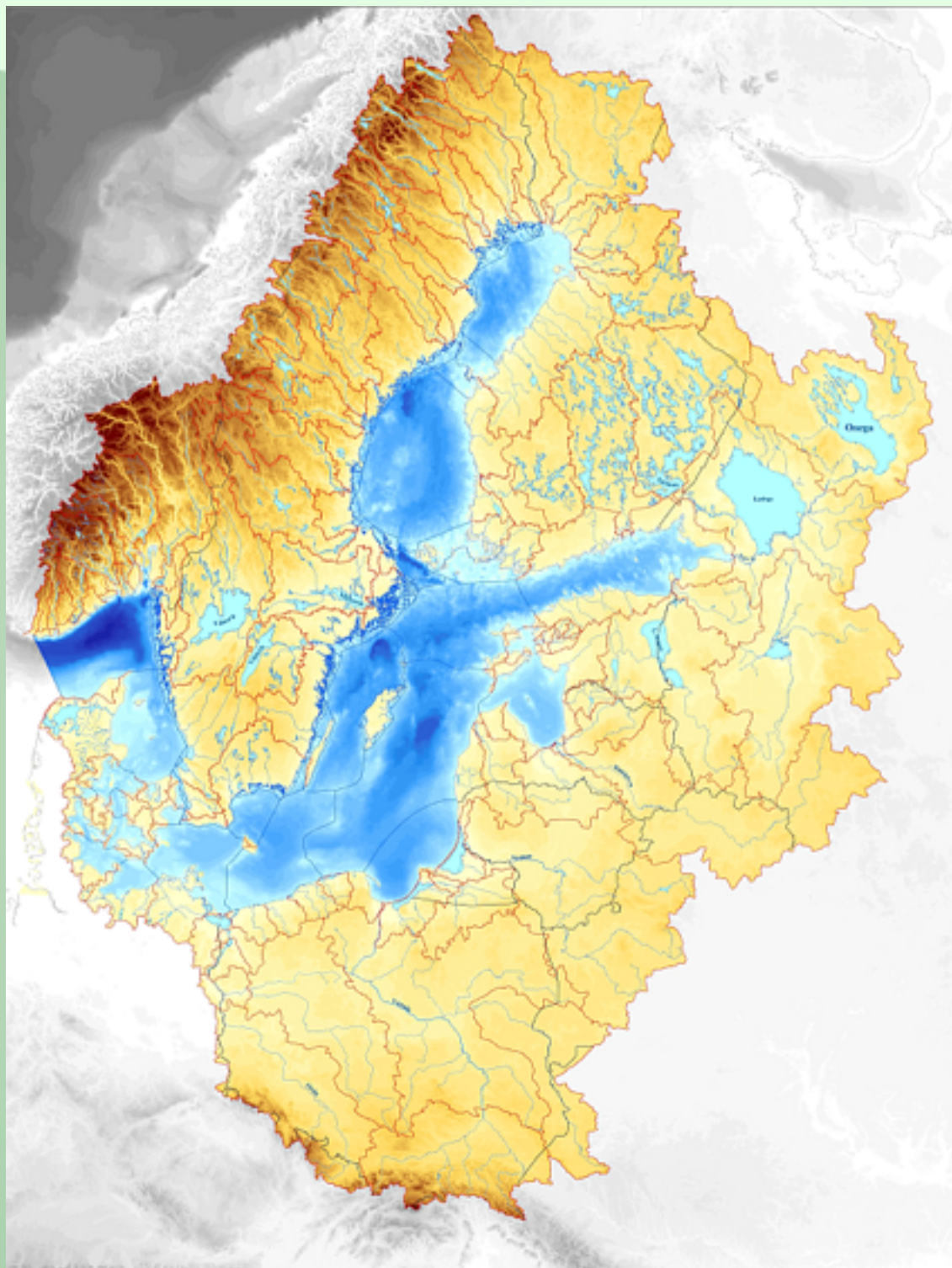
Questions:

- How can we better understand and predict precipitation variability and changes?
- How do changes in land surface and hydrology influence past and future changes in water availability and security?
- How does a warming world affect climate extremes, especially droughts, floods, and heat waves, and how do land area processes, in particular, contribute?
- How can the understanding of the effects and uncertainties of water and energy exchanges in the current and changing climate be improved and conveyed?

# Baltic Earth

Marcus Reckermann

International Baltic Earth Secretariat



- GC1: Salinity dynamics in the Baltic Sea
- GC2: Land-Sea biogeochemical feedbacks in the Baltic Sea region
- GC3: Natural hazards and extreme events in the Baltic Sea region
- GC4: Understanding sea level dynamics in the Baltic Sea
- GC5: Understanding regional variability of water and energy exchanges



# Pannonian Basin Water and Energy cycle Experiment (PannEx)

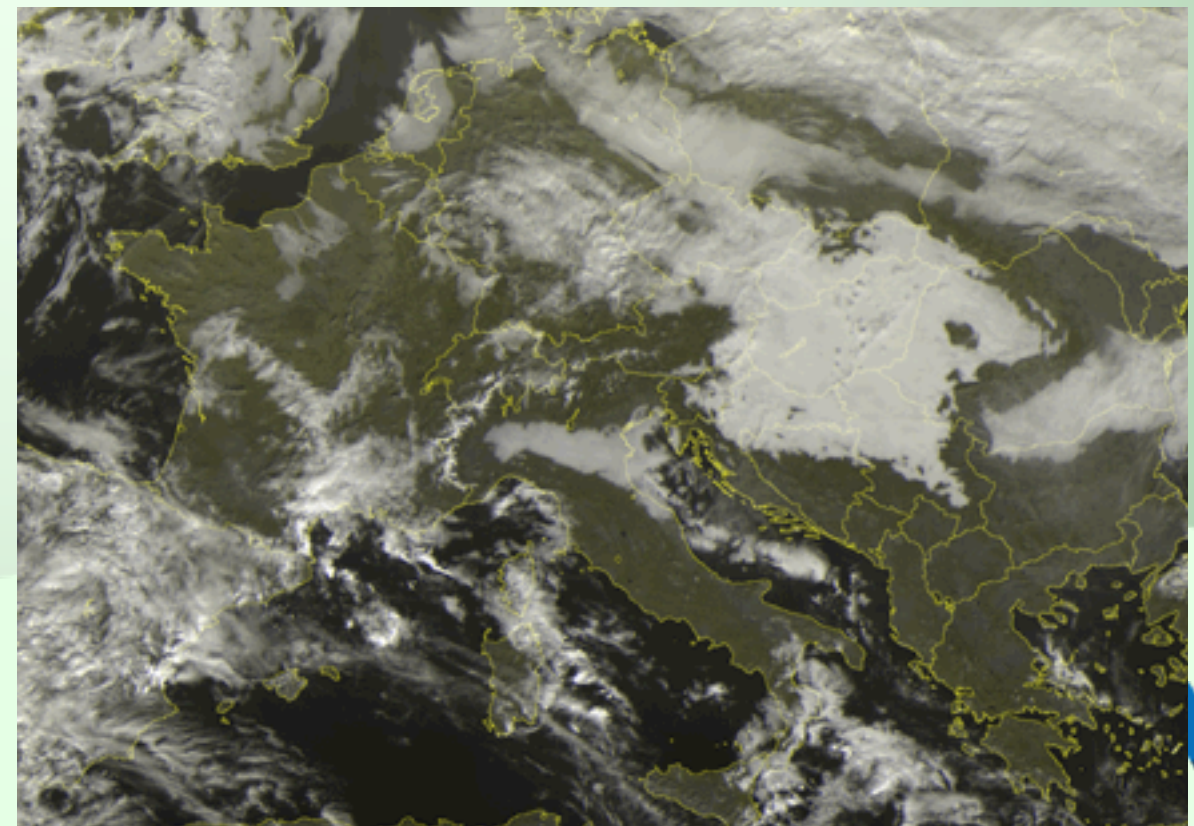


- Flagship Questions:

- 1) *Adaptation of agronomic activities to weather and climate extremes*
- 2) *Understanding air quality under different weather and climate conditions*
- 3) *Toward a sustainable development*
- 4) *Water management, droughts and floods*
- 5) *Education, knowledge transfer and outreach*

- Crosscut actions:

- 1) *Data and knowledge rescue and consolidation*
- 2) *Process modelling*
- 3) *Development and validation of modelling tools*



## Potential new RHPs

The Andean region (meeting in December at Medellín, Colombia)

The Western USA (conversations going on, progress is slow)

Interest in a new Monsoon-related RHP

Could the Water cycle part of TPE become an RHP?

## Evolution of existing RHPs

HyVIC may expand its domain of interest to other countries of NE Africa

CCRN may have a continuation: Global Water Futures

HyMeX is generating new activities:

LIAISE (Atm-Land interactions in semi-arid terrain): Ebro valley

Exaerdre on atmospheric electricity: Corsica

PERLE on intermediate water formation: Eastern Mediterranean



# **Crosscuts**

Focused activities that address specific science questions. Through them, GHP

- i) addresses the GEWEX Science Questions;
- ii) evaluates and applies the knowledge developed in RHPs;
- iii) keeps completed RHPs involved;
- iv) generates interactions between RHPs;
- v) provides a tool for collaboration with other GEWEX Panels and WCRP activities.

## **Currently active**

- INTENSE (Sub-daily precipitation) (H. Fowler)
- Cold/Shoulder Season Precipitation Near 0°C, (R. Stewart / P. Groisman)
- INARCH (Mountain Hydrology) (J. Pomeroy)

## **Proposed**

- Including water management in large scale models (R. Harding / J. Polcher)

## **Potential**

- MOUNTerrain (Mountainous Terrain rainfall) (J. Renwick)
- GDAP integrated product regional evaluation
- Determining Evapotranspiration



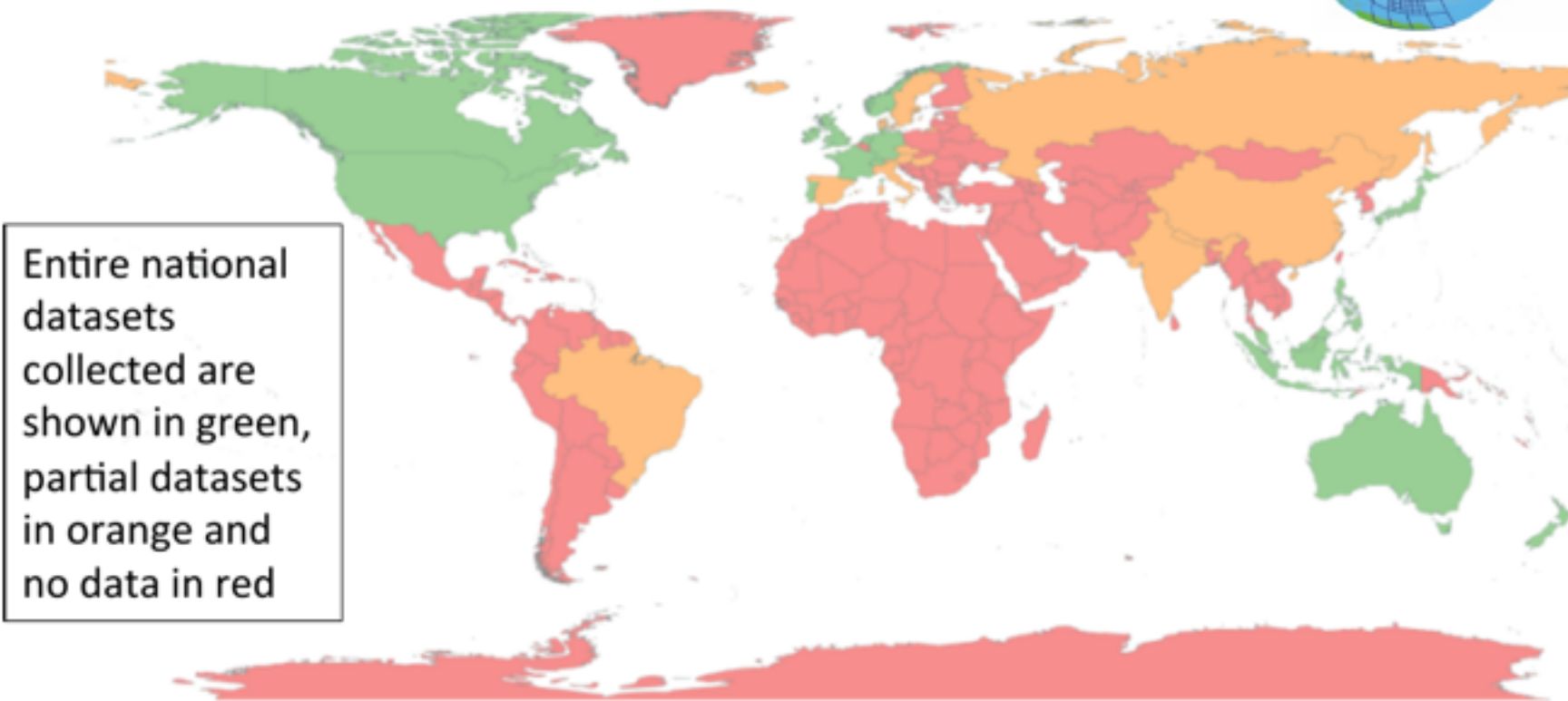
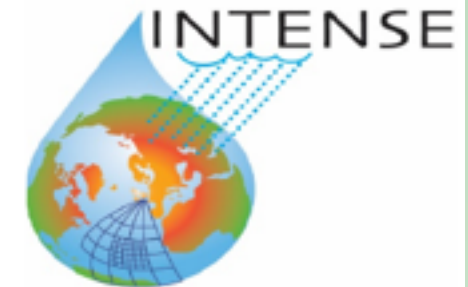
# INTENSE

(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*

INTENSE: Sub-daily precipitation data collection so far...



Entire national datasets collected are shown in green, partial datasets in orange and no data in red

- UK, US, Canada, Brazil, France, Germany, Spain, Portugal, Italy, Israel, Philippines, India, Norway, Sweden, The Netherlands, Finland, New Zealand, Australia, Kenya, Indonesia, Slovenia, Costa Rica, Argentina, Switzerland, Austria, Hungary, Turkey, Bangladesh, Panama, Russia, Ireland, Japan, Malaysia, Singapore, Some Africa, Some SE Asia,
- Global datasets: HadISD, ISD, NOAA, MSWEP, NLDAS-2, InERG, EuMETGRD,

# INARCH

International Network for Alpine Research Catchment Hydrology

John Pomeroy (Uni. Saskatchewan, Canada)

*To better understand alpine cold regions hydrological processes, improve their prediction and find consistent measurement strategies*

## INARCH: International Network for Alpine Research Catchment Hydrology

Canada – Canadian Rockies, BC & Yukon;

USA – Reynolds Creek, ID; Dry Creek, ID; Senator Beck, CO, Niwot Ridge, CO.

Chile - Upper Maipo & Upper Diguillín River Basins, Andes,

Germany – Schneefernerhaus & Zugspitze;

France – Arve Catchement, Col de Porte & Col du Lac Blanc;

Switzerland – Dischma & Weissfluhjoch;

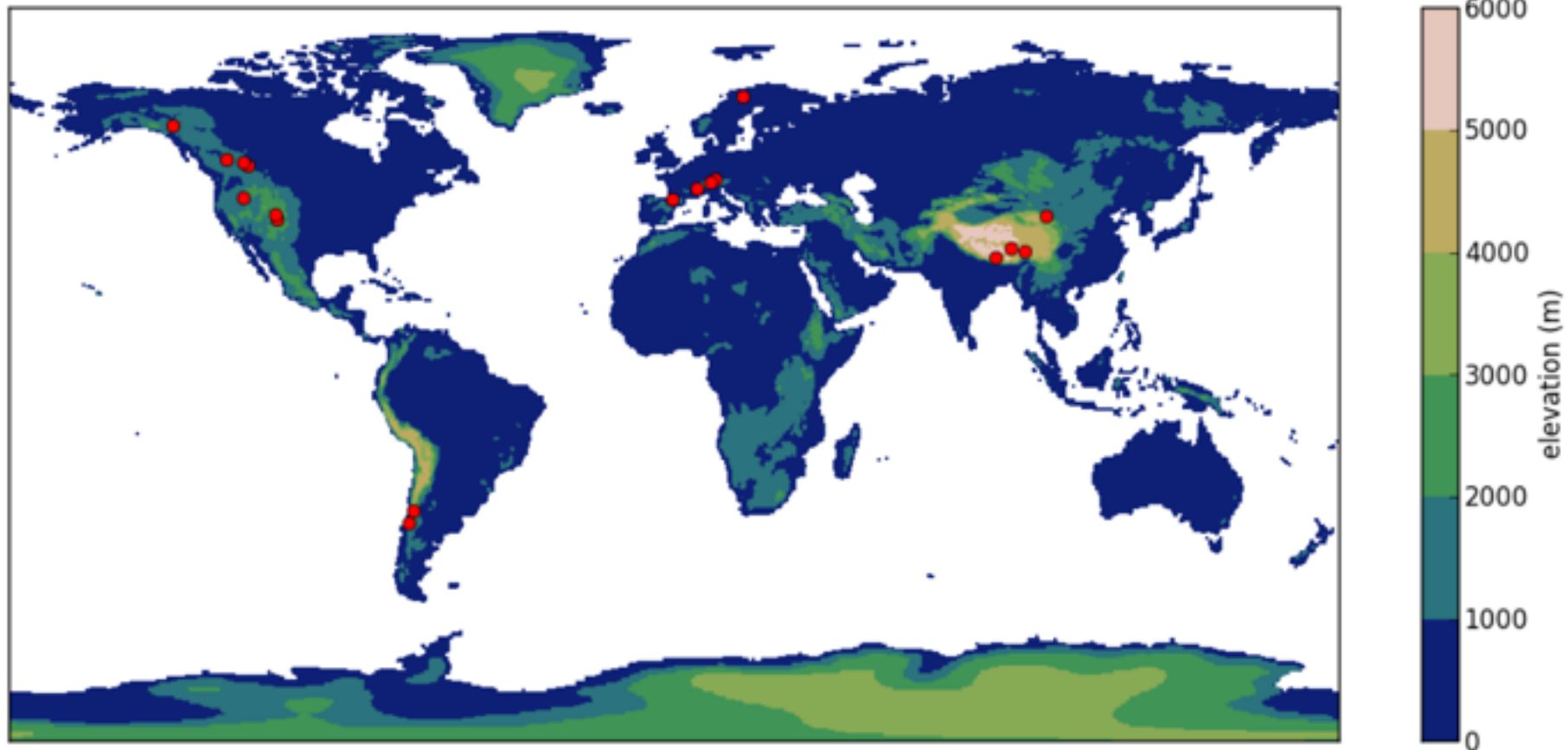
Austria - OpAL Open Air Laboratory, Rofental

Spain – Izas, Pyrenees;

China – Upper Heihe River, Tibetan Plateau,

Nepal – Langtang Catchment, Himalayas

Sweden – Tarfala Research Catchment





# Near 0°C Precipitation

Ron Stewart (Uni. Manitoba, Canada)  
& Pavel Groisman (NCDC, USA; P.P. Shirshov Institute for Oceanography, Russia)

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

It is difficult to predict the phase of near 0°C precipitation events.

When in frozen phase, this precipitation may become one of dangerous weather phenomena that can cause interruptions in human activity, including life threatening events.

These are relatively rare events but there are good reasons to expect that their frequency and strength may change with global warming

- **Heavy snowfall/rainfall transition**
- **Large fraction of blizzards**
- **Rain-on-snow events**
- **Freezing rain and freezing drizzle**
- **Ice load on infrastructure**



# Water management in large-scale models

Richard Harding (Centre for Ecology and Hydrology, UK), Jan Polcher (CNRS, France)

*Aims to improve the scientific basis of the description of water management in global and regional freshwater models, suitable for coupling to climate models*

## MOUNTerrain

Mountainous Terrain Rainfall

James Renwick (Victoria Uni., New Zealand)

*Address the mismatch between the strong need for, but poor availability of, high-quality observational data sets of precipitation in mountain regions*



## **Some final remarks**

- 1. WWRP and WCRP are looking for ways to converge, climate and weather share a lot.**
- 2. WCRP Grand challenges, questions and imperatives facilitate a common framework for diverse activities.**
- 3. These WCRP items are not excluding specific developments of interest in each area.**
- 4. Core Groups of WCRP are open to all parties interested in cooperation, look for your area of activity/expertise**
- 5. The traditional way of organizing activities regional is through RHP's, which are locally ruled, and report to GEWEX about their achievements.**
- 6. The link between RHP's is made through Cross-cut actions and in the GHP annual meeting.**
- 7. Proposing a Cross-Cut action is an "individual" initiative, and joining current CCs is always possible.**