

GEWEX Hydroclimatology Panel GHP

**Co-Chairs: Jan Polcher
 Jason Evans**



The role of GHP within GEWEX

The GHP aims 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 socio-economic dimensions
- The Regional Hydroclimate Projects (RHPs) are an essential tool in this endeavour as they bring together various disciplines on water issues.
- The cross-cut projects allow GHP to propagate knowledge from one region to another and synthesize results at the global scale. They also allow development and testing of applications developed

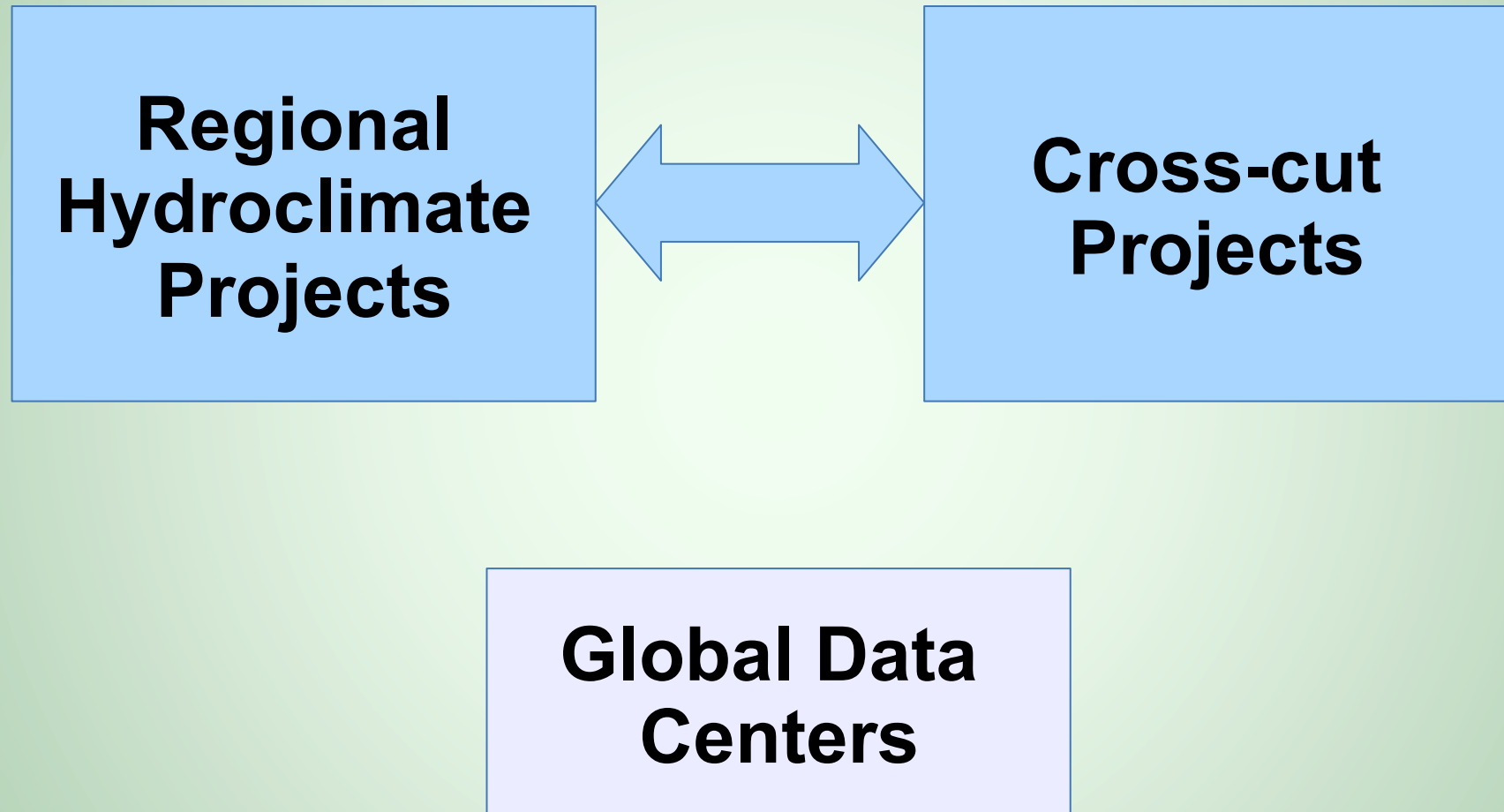
GHP Structure

**Regional
Hydroclimate
Projects**

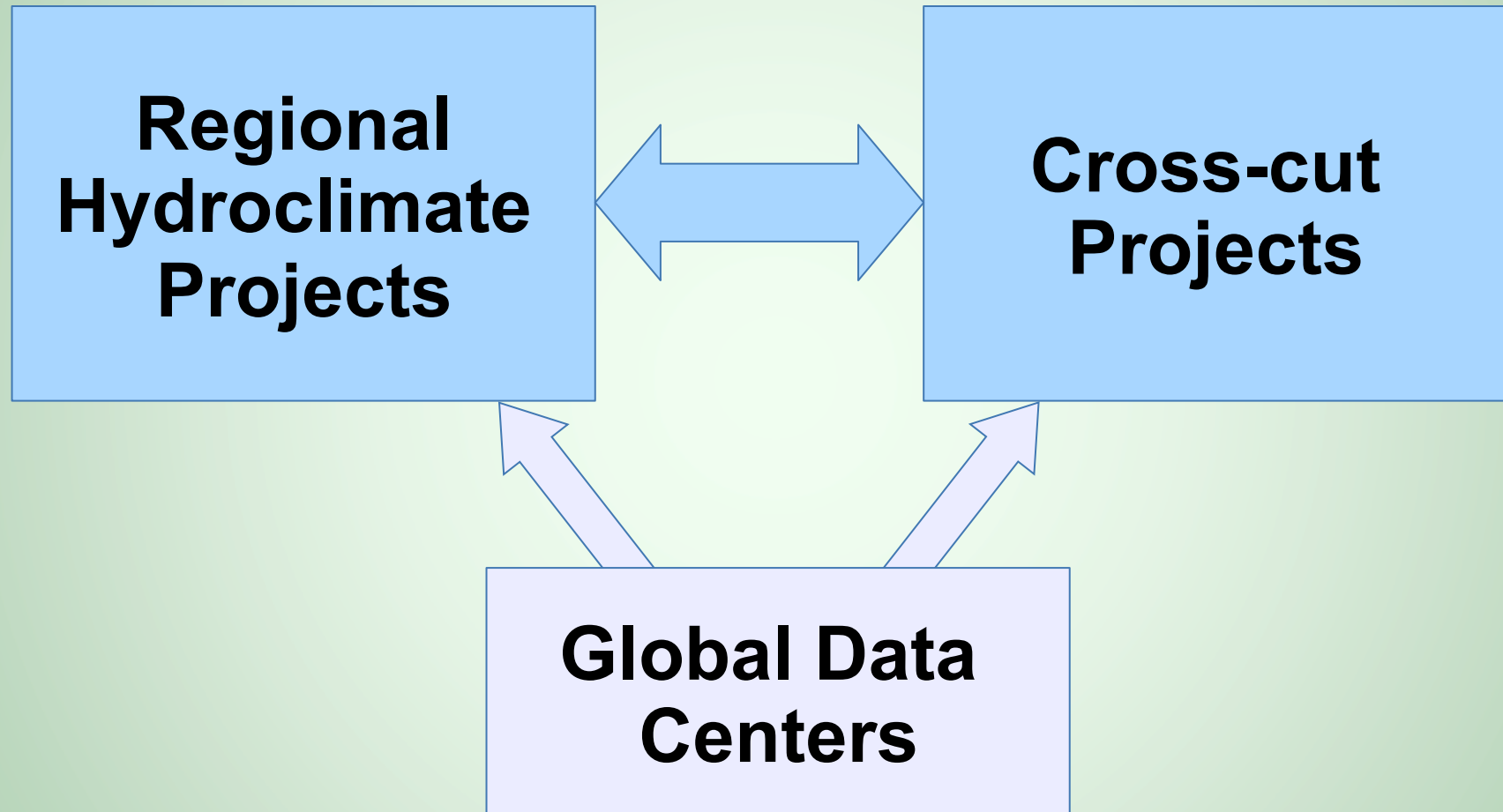
**Cross-cut
Projects**

**Global Data
Centers**

GHP Structure



GHP Structure



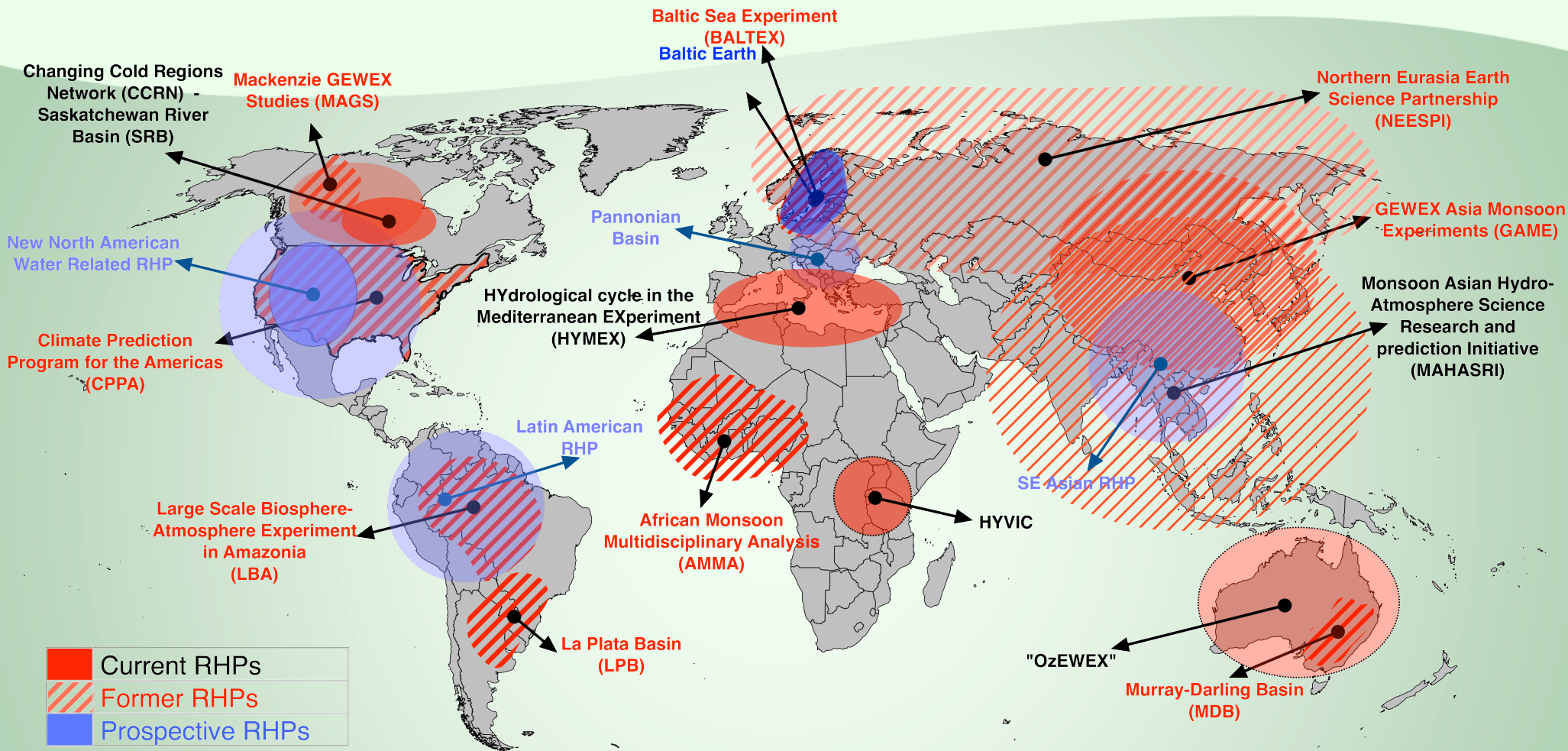
Global Data Centres

- Global Runoff Data Centre (GRDC)
 - The main objective of the GRDC is the world-wide acquisition, storage, and dissemination of historical river discharge data in support of water and climate research
- Global Precipitation Climatology Centre (GPCC)
 - The main objective of the GPCC is monitoring and assessment of global precipitation on the Earth's land surface based on rain gauge-measurements
- International Data Centre on Hydrology of Lakes and Reservoirs (HYDROLARE)

Regional Hydroclimatology Projects

- RHPs are generally large, regionally-focused multidisciplinary projects that aim to improve the understanding and prediction of that region's weather, climate, and hydrology.
- All RHPs address the physical processes surrounding water and energy exchanges within a region.
- Most RHPs are broader than this, often addressing region specific questions related to the biosphere and carbon cycle, human interaction in the landscape, and even socio-economic factors.

Regional Hydroclimatology Projects



Completed

MAGS, CPPA, GAME, LBA,
LPB, MDB, AMMA, BALTEX, NEESPI, MAHASRI

Active

HyMEX, CCRN, HyVic, OzEWEX

Hydrological cycle in the Mediterranean Experiment (HyMeX)

The logo for the Hydrological cycle in the Mediterranean Experiment (HyMeX). It features the text "HyMeX" in a white, serif font, centered within a dark blue rectangular box. The background of the box is a faint, light blue map of the Mediterranean region.

HyMeX aims at:

- improving our understanding of the water cycle, with emphases 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,
- evaluating societal and economic vulnerability and adaptation capacity to extreme meteorological and climate events.

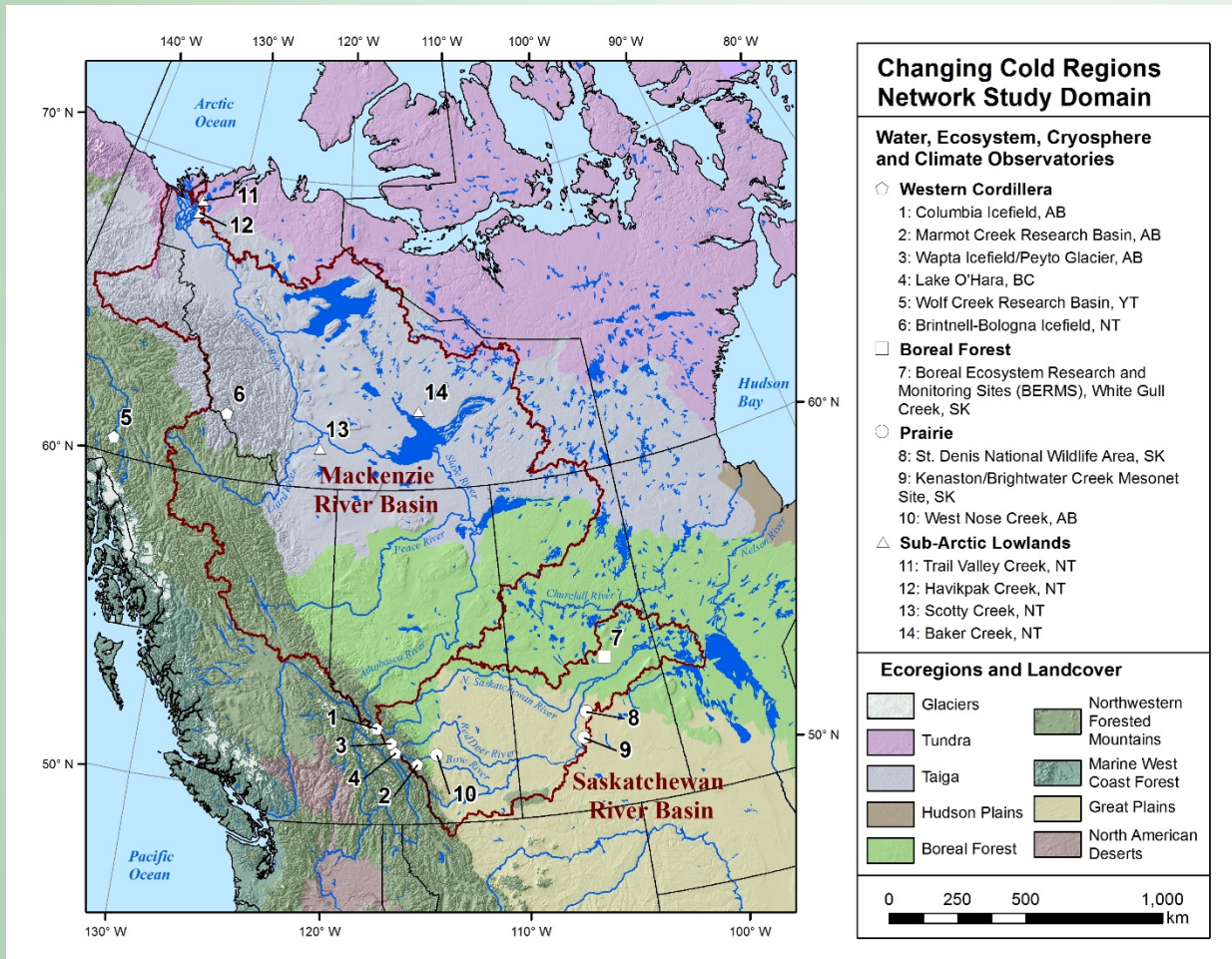
Contact : Philippe Drobinski (LMD/

The logo for CNRS (Centre National de la Recherche Scientifique), consisting of the letters "CNRS" in a bold, blue, sans-serif font.

IPSL, France)

The logo for GEWEX (Global Energy and Water Experiments), featuring the letters "GEWEX" in a bold, blue, sans-serif font with a stylized, overlapping design.

Changing Cold Regions Network (CCRN) (an expansion of the existing SaskRB RHP)



CCRN Science questions

CCRN project is focused on understanding, diagnosing, and predicting interactions amongst the cryospheric, ecological, hydrological, and climatic components of the changing Earth system at multiple scales. Including 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, and anthropogenic land use change

Contact: Howard Wheeler (U.S. Secret of State)





Lake Victoria Basin



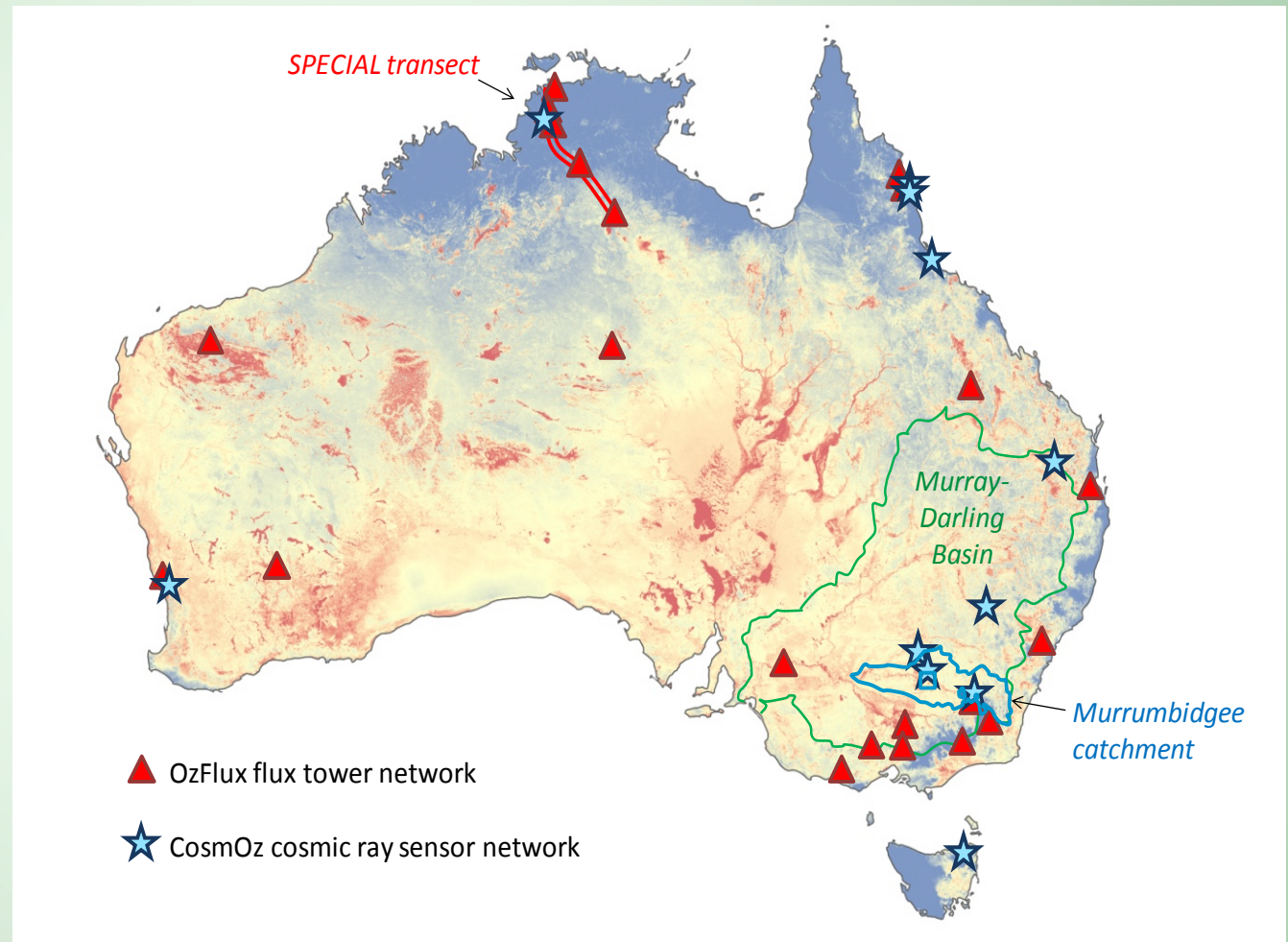
HyVic – High Level Science Questions

The primary scientific challenge is to reduce the present high levels of uncertainty associated to the water cycle of the basin :

- Can we reconstruct the observed lake levels to within an acceptable uncertainty ?
- How will the water cycle of the basin (and the lake level) evolve in a warmer climate ?
- What role does human activities and regulation play ?
- Can we predict the storms hitting the lake and how will they evolve in a warmer world ?

Contact : Fred Semazzi (North Carolina State U., US)

Australian Energy and Water Exchanges (OzEWEX)



Contact : Albert van Dijk (Australian National University, Australia)



OzEWEX – Science Questions

OzEWEX aims to **understand and predict Australia's fresh water resources and water security into the future** given Australia's many climate zones, relatively large climate variability and future climate change.

It will address the GEWEX science 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?

Cross-cut Projects

- Cross-cutting Projects within GHP are focused activities that address specific science questions.
- Through CCs, GHP achieves a number of objectives:
 - it addresses the GEWEX Science Questions
 - evaluates and applies the knowledge developed in RHPs
 - keeps completed RHPs involved
 - generates interactions between RHPs



– provides a tool for collaboration with other GEWEX
– Panels and WCRP activities

Cross-cut Projects

Current

- INTENSE (sub-daily precipitation) – Hayley Fowler
- INARCH (mountain hydrology) – John Pomeroy
- Precipitation near 0°C – Pavel Groisman, Ron Stewart

Prospective

- Water management in large-scale models – Richard Harding
- Mountain precipitation – James Renwick

INTENSE – INTElligent use of climate models for adaptation to non-Stationary hydrological Extremes

INTENSE collects sub-daily rainfall observations to address the following questions :

- How has sub-daily maximum precipitation changed over the last century, across continents, climate regimes and seasons?
- How does precipitation at different time-scales vary with atmospheric temperature and atmospheric moisture as the atmosphere warms?
- How do large-scale atmospheric and oceanic features influence or modulate the observed changes in precipitation extremes ?

INARCH

International Network for Alpine Research Catchment Hydrology

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

- Alpine catchments receive and produce a disproportionately large fraction of global precipitation and runoff including contributions to floods and water supply for vast downstream areas.
- *Snowfall does not equal accumulation on the ground!*
- *An environment sensitive to temperature changes.*

INARCH – Science questions

- How different are the measurement standards and the standards for field sampling and how does it affect model results and hydrological predictability ?
- How do the predictability, uncertainty and sensitivity of catchment energy and water exchange vary with changing climate ?
- What improvements to high mountain energy and water exchange predictability are possible through improved physics in land surface hydrological models ?

• Do the existing models routinely have a global validity, are they transferable and are they

Cold/Shoulder Season

Precipitation Near 0°C – Motivation

It is difficult to predict the phase of near 0°C precipitation events and when in frozen phase, this precipitation may become one of dangerous weather phenomena that can cause:

Interruptions in human activity affecting

- traffic
- communication
- housing and other man-made infrastructure
- high seas fleet operation
- impact on offshore oil and gas production including life threatening events

Including water management in large-scale models - motivation

- Flow in many rivers is reduced by 30% (or more) by man's activities
- Impoundments fundamentally change the seasonality and extremes in the flow
- Most irrigation water is lost to the freshwater system through evaporation and this may have important impacts on regional climate
- Historically models of the global water and energy cycles have not included the impact of river management and extractions



Contact : Richard Harding (Centre for Ecology and Hydrology, UK)



Collaboration with GLASS

- RHPs and cross-cut projects include modelling components
- RHPs can supply data and act as focus regions
- Cross-cut projects can provide the community aroundn targeted modelling experiments.