

The GFCS Pillars: Research, Modeling and Prediction

World Climate Research Programme
GEWEX, Regional Hydroclimate Projects and Third Pole Environment

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AND MANY MORE...

Outline

- ▶ **GEWEX Focus and Science Questions**
- ▶ **HKH Related Research**
- ▶ **Programmatics**
- ▶ **Challenges & Opportunities**

GEWEX Focus

Water and Energy - People

- ▶ **Water is a local ‘challenge’ driven by global processes**
- ▶ **GEWEX focuses on improved understanding of the relevant geophysical processes of water and energy and the human interaction therein to better model and predict changes**
- ▶ **Water and Energy Security are intrinsically related to Food Security – The Water-Energy-Food Nexus -> PEOPLE**

Four GEWEX Science Questions

For the next 5 to 10 years

- 1 Observations and Predictions of Precipitation
- 2 Global Water Resource Systems
- 3 Changes in Extremes
- 4 Water and Energy Cycles and Processes

Hindu Kush Himalayan Region Climate Research

- ▶ **WCRP/GEWEX/CLIC/CLIVAR/SPARC** certainly not the only actors
- ▶ **Well established brand(s) with strong global reach and impact – GEWEX in particular in land-atmosphere communities**
- ▶ **Work needed on outreach, cross sectoral linkages and interfaces with primary stakeholders (agricultural sector, regional/national hydromet services)**

Research

Some key points

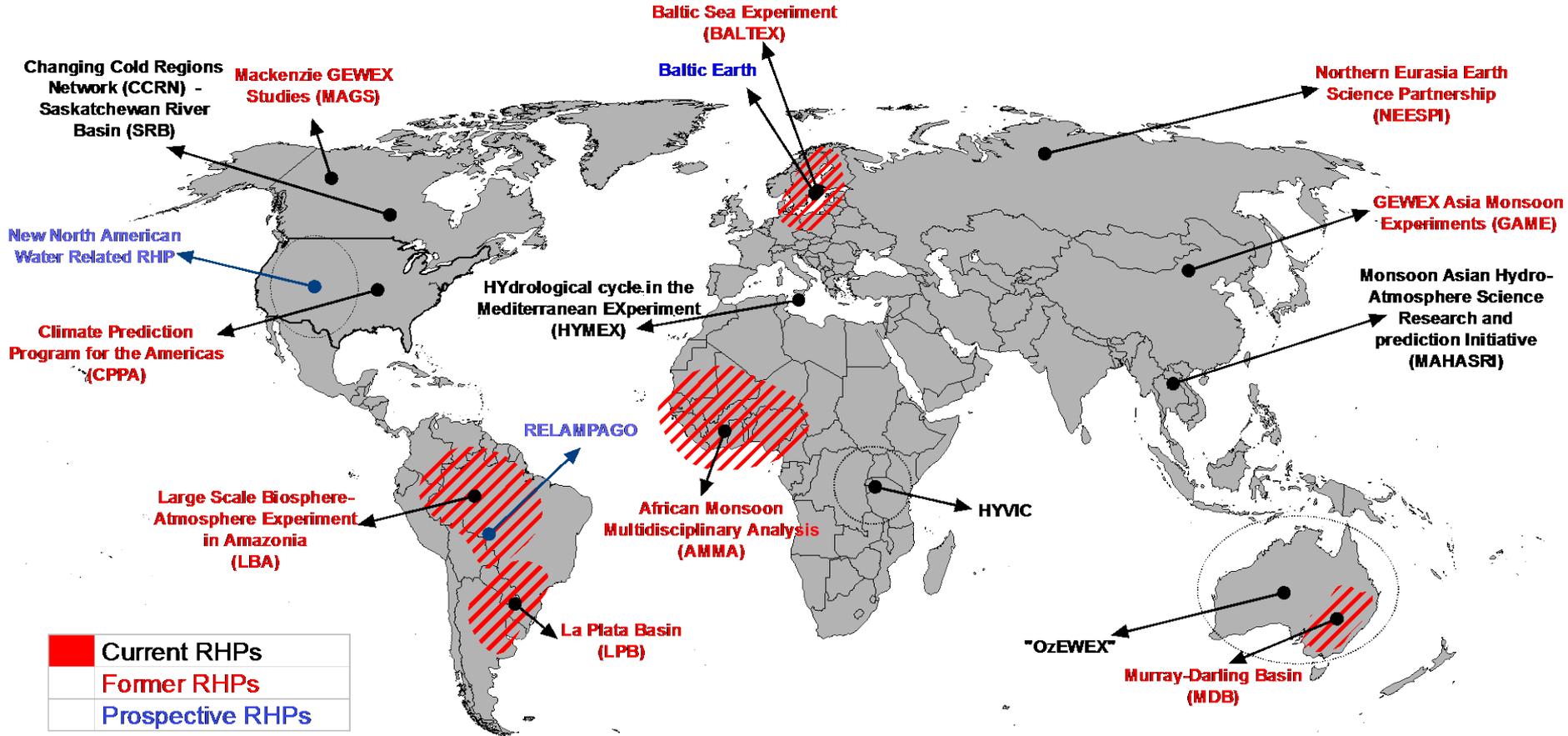
- ▶ **Observations, modeling and prediction**
 - Validation, evaluation, benchmarking
- ▶ **Reanalysis, ensemble prediction systems, S2S, Decadal Prediction, Regional Downscaling, CORDEX etc.**
- ▶ **EO: UAV, Satellite Observations, micro-sats**
- ▶ **Modeling Intercomparison Projects (MIPS)**
 - Coupled Model Intercomparison Project ([CMIP6](#))
- ▶ **Strengthen regional/local involvement/investment**

Regional HydroClimate Projects - RHP

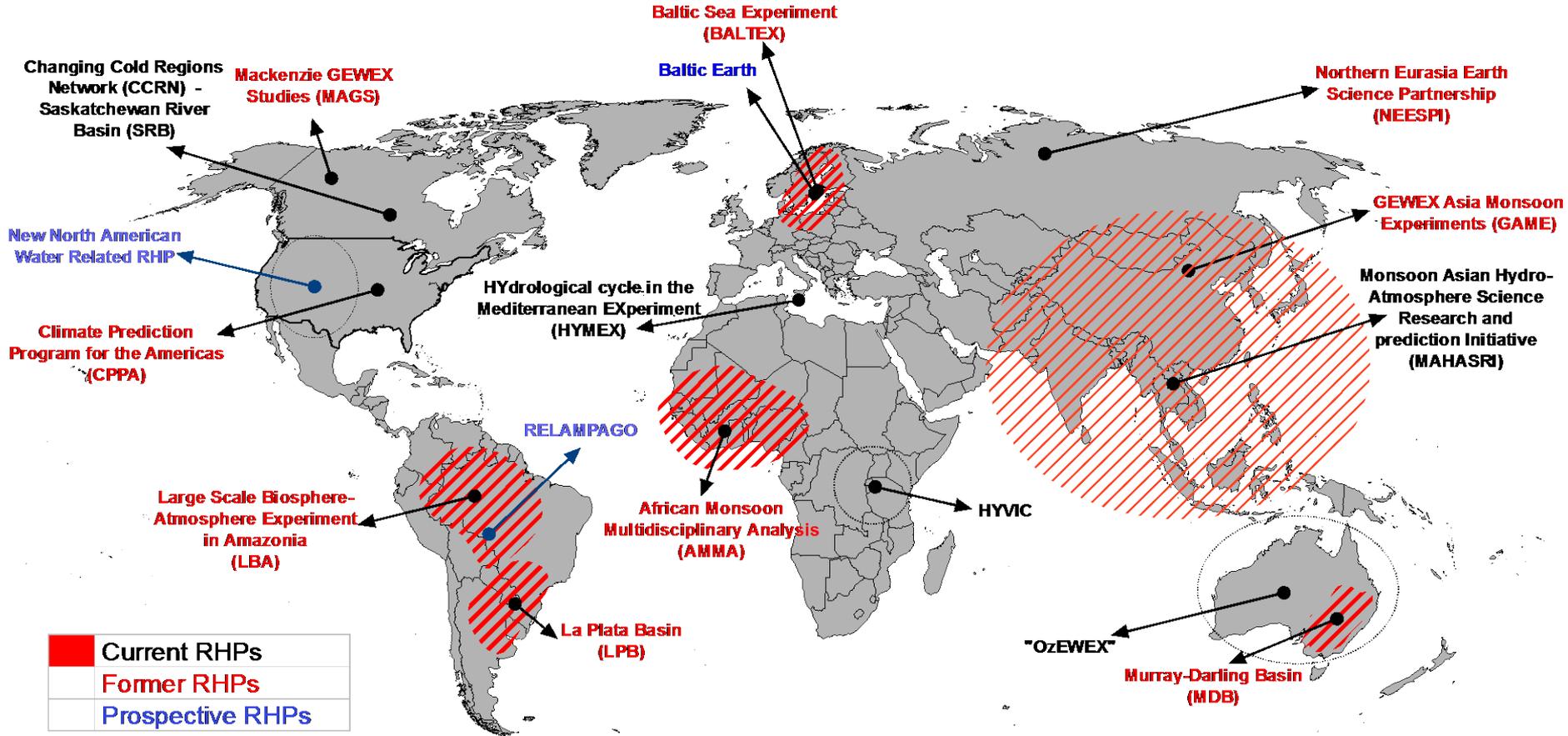
Asian Regional Hydroclimate Projects

- ▶ **GAME: GEWEX Asian Monsoon Experiment**
 - <http://www.hyarc.nagoya-u.ac.jp/game/>
 - 1996 - 2005
- ▶ **NEESPI: Northern Eurasia Earth Science Partnership Initiative**
 - <http://neespi.org/>
 - 2006 - 2015
- ▶ **MAHASRI: Monsoon Asian Hydro-Atmosphere Scientific Research and Prediction Initiative**
 - http://mahasri.cr.chiba-u.ac.jp/index_e.html
 - 2005 - 2016

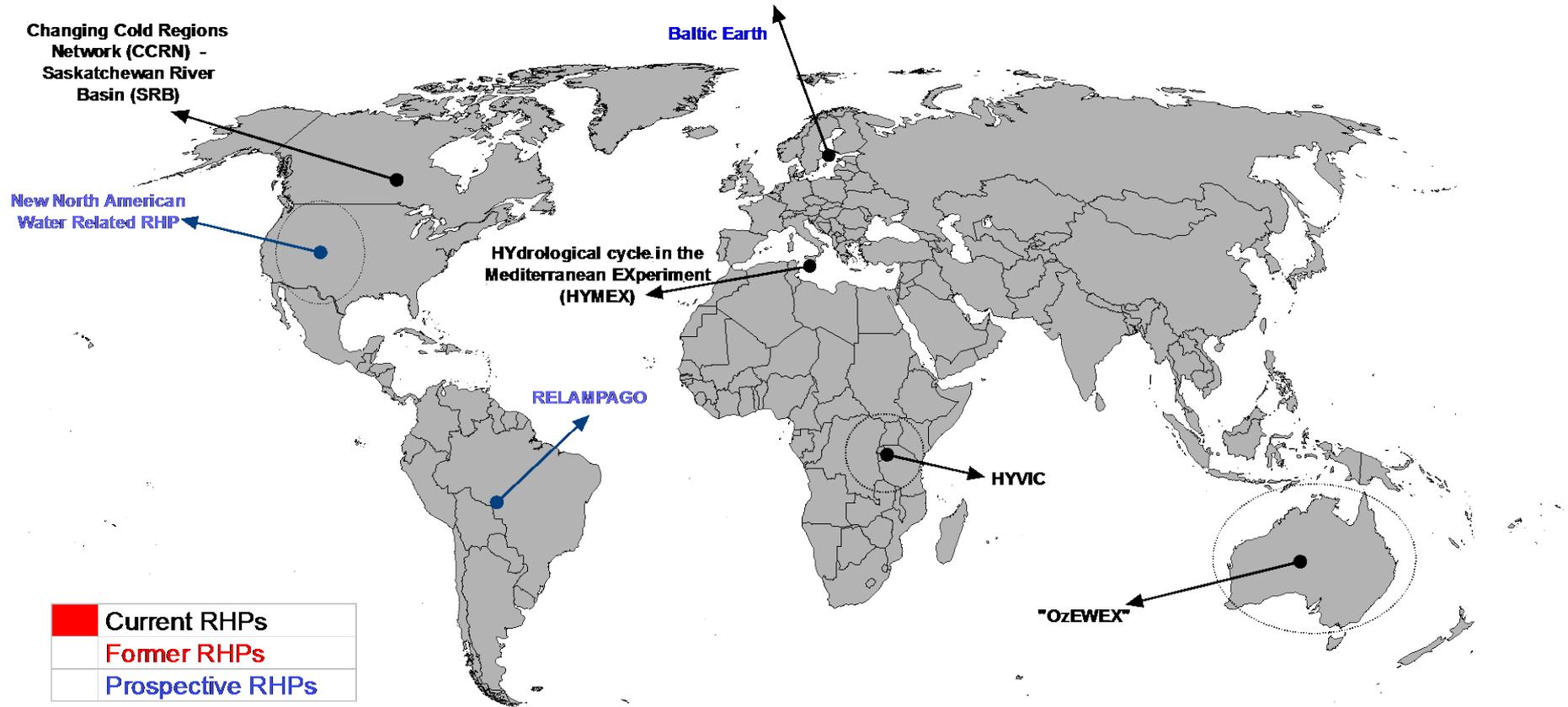
From CSE's to RHP's - Status 2015



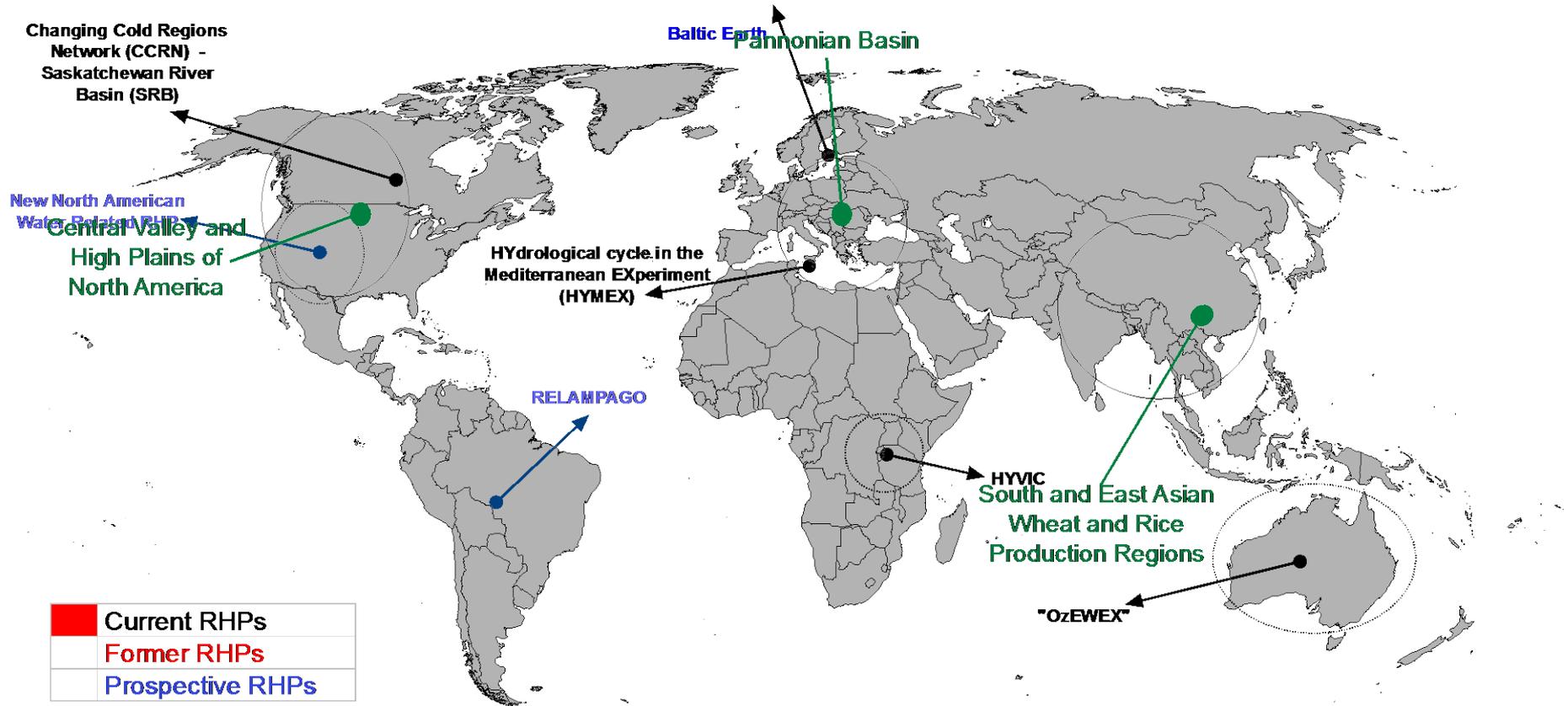
From CSE's to RHP's - Status 2016



Current RHP's – Status 2016



Food Basket Regions of the World



The WCRP Grand Challenge on Water Availability

Water for the Food Baskets of the World

Peter van Oevelen,
Roy Rasmussen,
Jan Polcher

- ▶ **Within this Grand Challenge the focus will be on assessing how fresh water availability will change in some of the major food producing regions of the world in the context of climatic change**



The WCRP Grand Challenge on Water Availability

Water for the Food Baskets of the World



- ▶ **This Grand Challenge is under development.**
- ▶ **Implementation document ready by WCRP JSC April 2016**
- ▶ **3 to 5 year timeline for some major advancements**

Monsoon Panel

GEWEX and CLIVAR Collaboration - Renewed

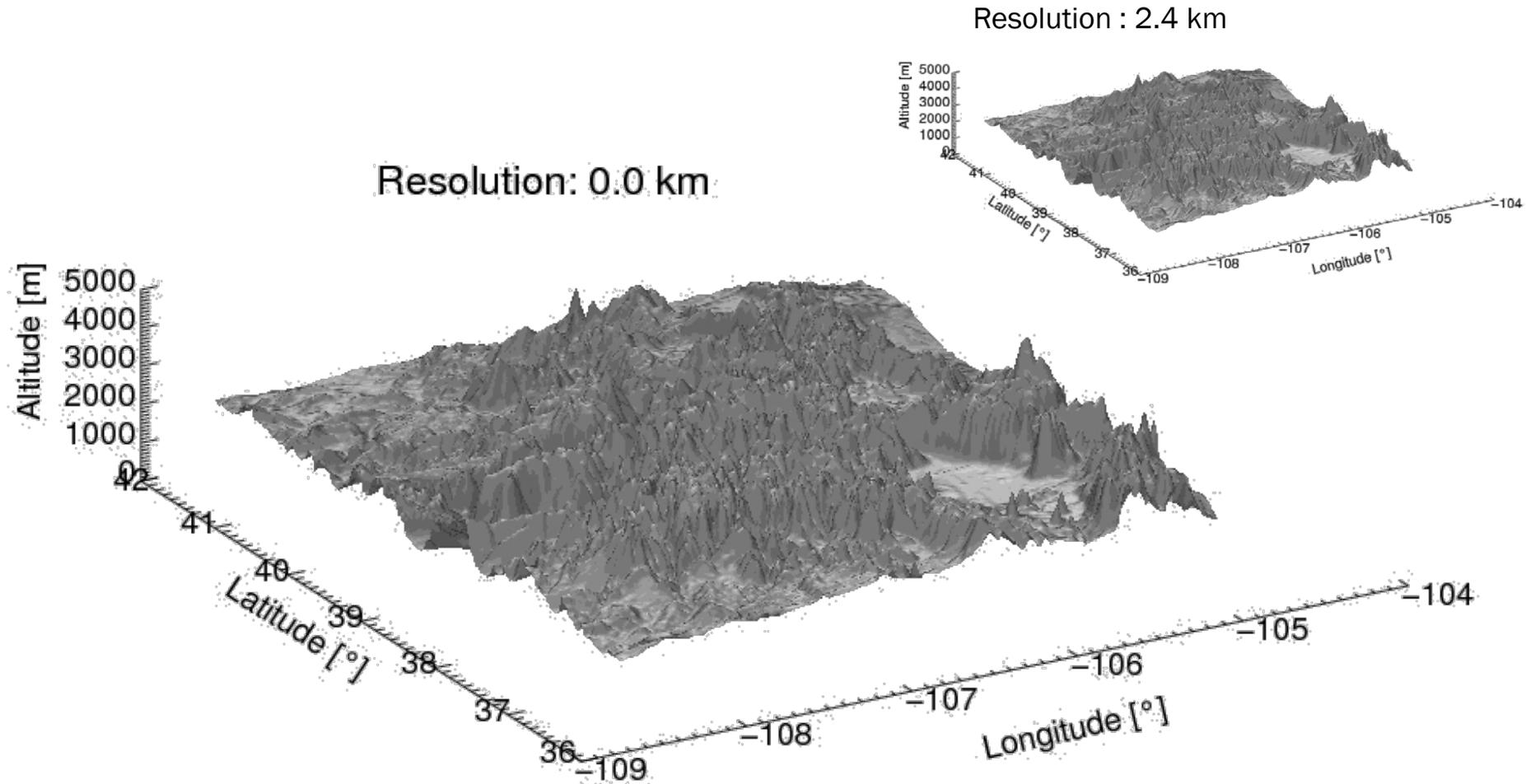
- ▶ **Three regional groups (Americas, Africa, Asia-Australia): to focus first on shorter planning scale (1-2 years) before thinking about 3-5. Small steps before large after the upheaval and reorganization.**
- ▶ **All groups leaning toward a focus on modeling and model product evaluation - GEWEX/GASS & GLASS a key element to that, as well as S2S (especially) and other model products (e.g., NMME-2) as a tremendous resource for research**
- ▶ **All groups keen on outreach to the regional and national bodies responsible for forecasting and public alerts (R20 if you will)**

Monsoon Panel

Asia-Australia: (H Annamalai and Aurel Moise)

- ▶ **Aim to be very international with membership, especially reaching into SE Asia / Maritime Continent nations much more**
- ▶ **Process-based diagnostics (metrics) emphasized heavily**
- ▶ **Look not only at summer/wet monsoon phase but study/understand better the winter/dry monsoon season**

Value of high-res. regional model



Courtesy Andy Prein

What makes HKH different?

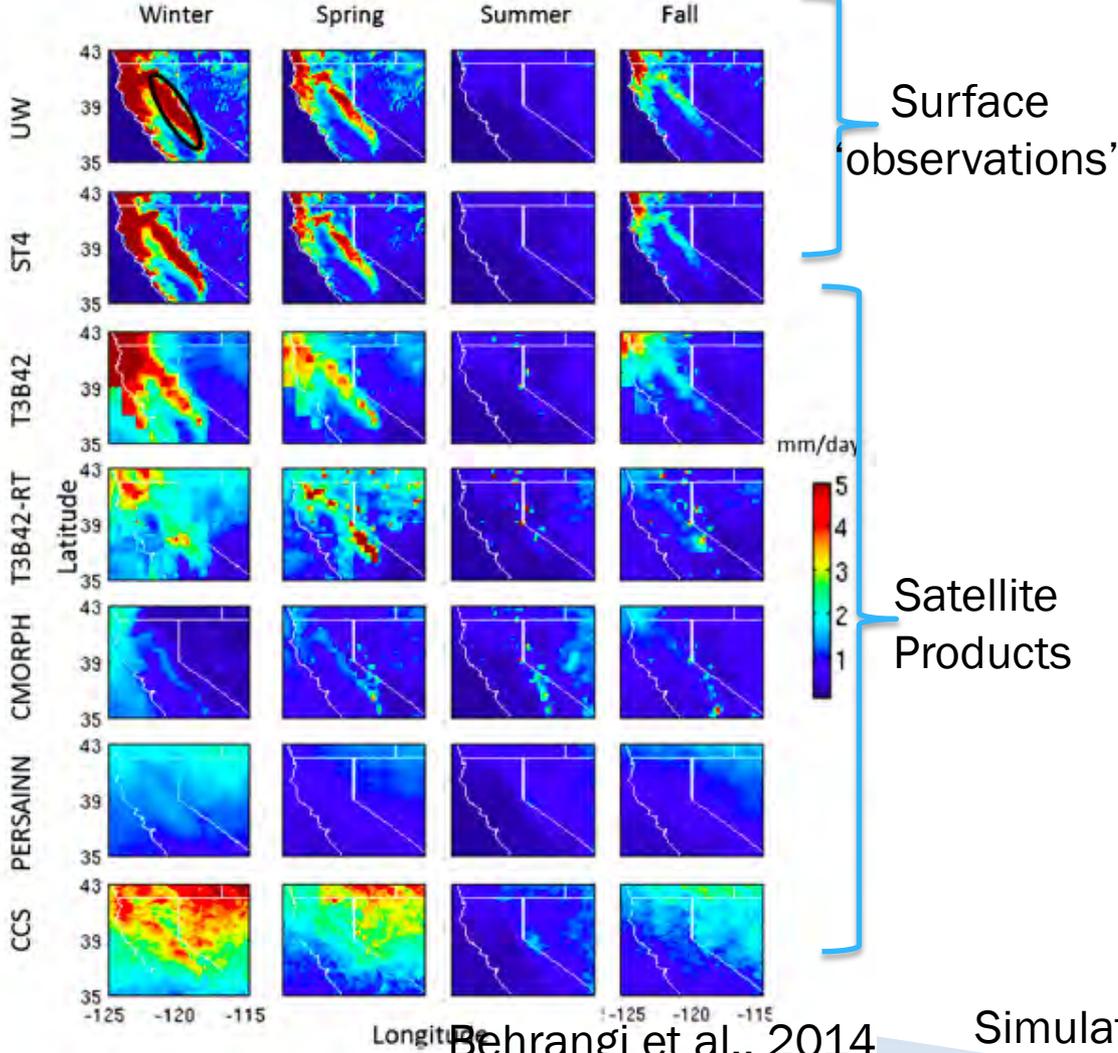
From other mountainous regions

- ▶ **Strongest monsoon(s) globally, with distinct differences between the various monsoons**
- ▶ **Extent/dimension and location**
- ▶ **Human dimension**
- ▶ **Global impact**

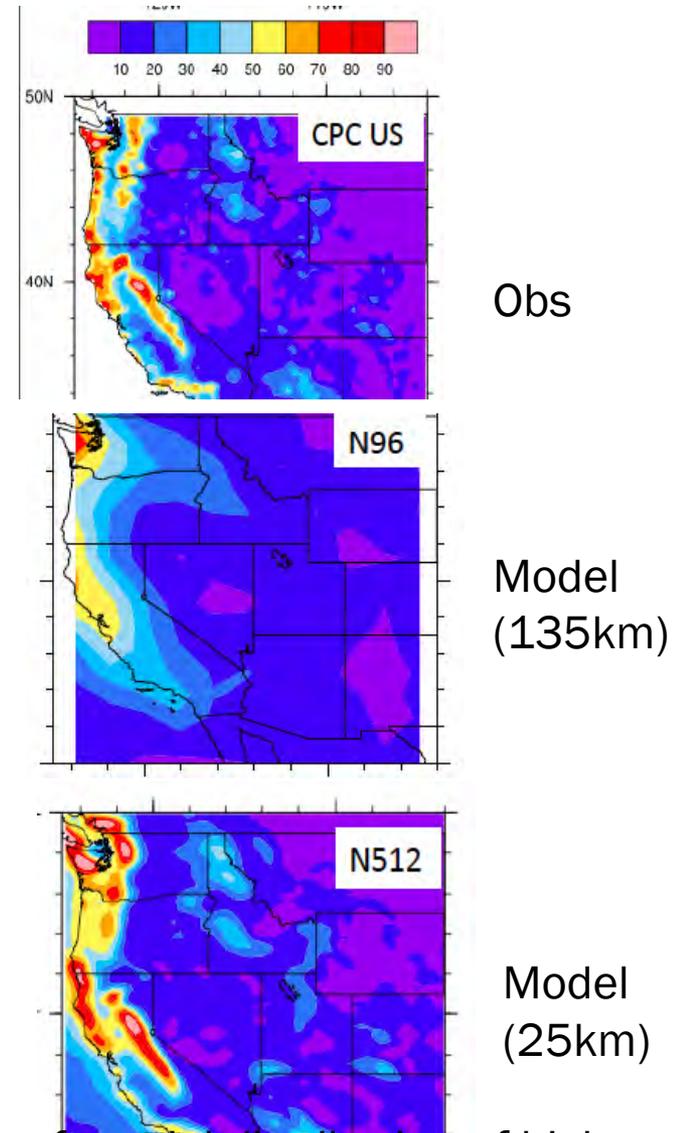
Theme I: Evaluation

Example of mountain hydrology

Observations



DJF 99% percentile

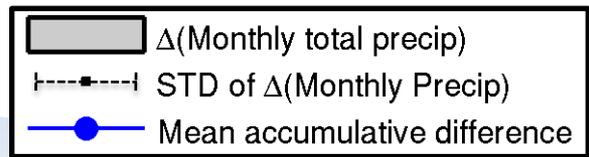
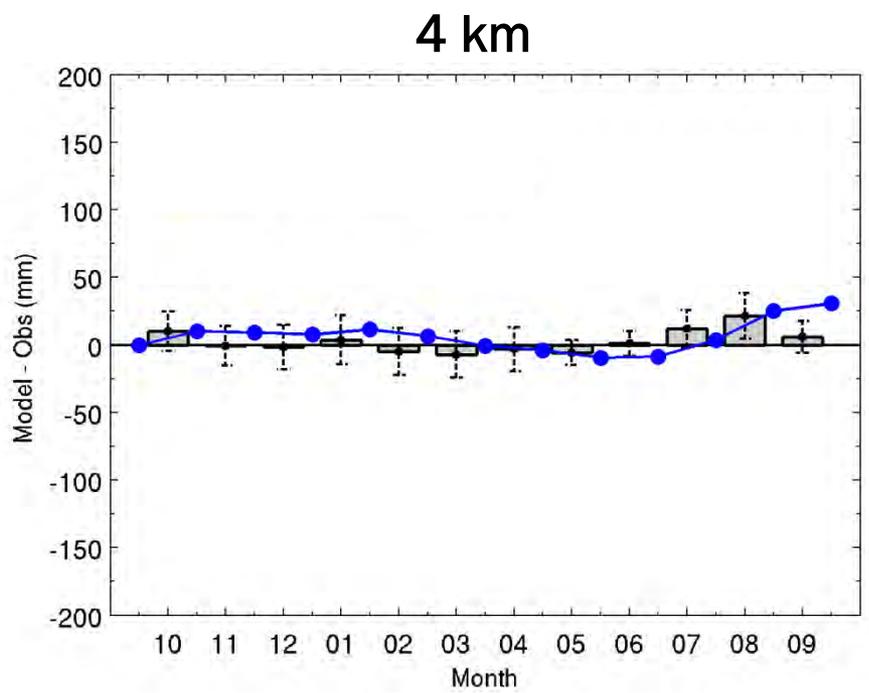
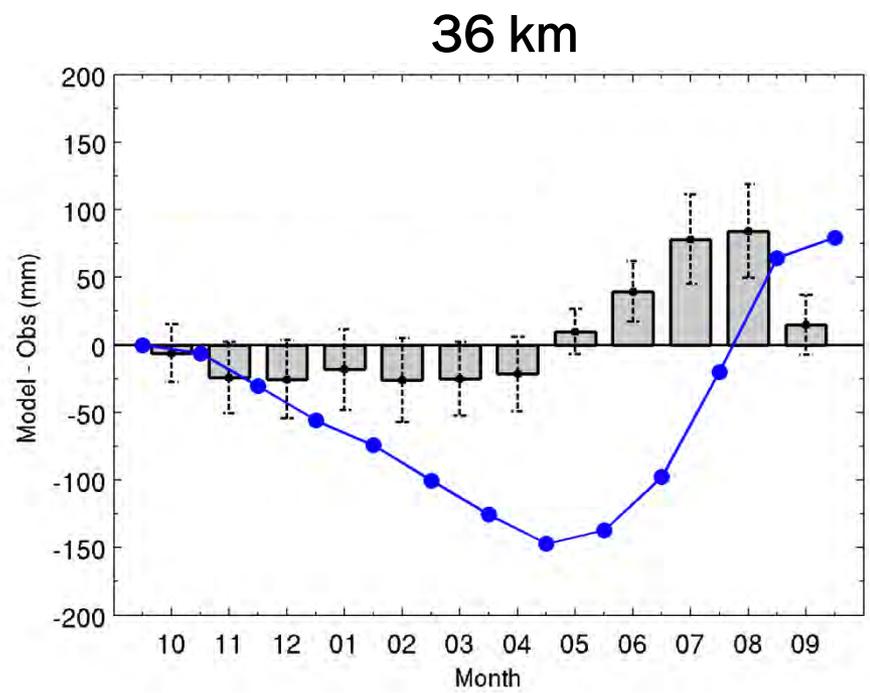


Simulation of spatial distribution of high-impact precipitation events improves with high resolution

Example of impact of resolution (resolved topography) on snow pack

30% too little precip in the winter and 65% too much in the summer using 36 km model compared to 4 km model (compensating errors)

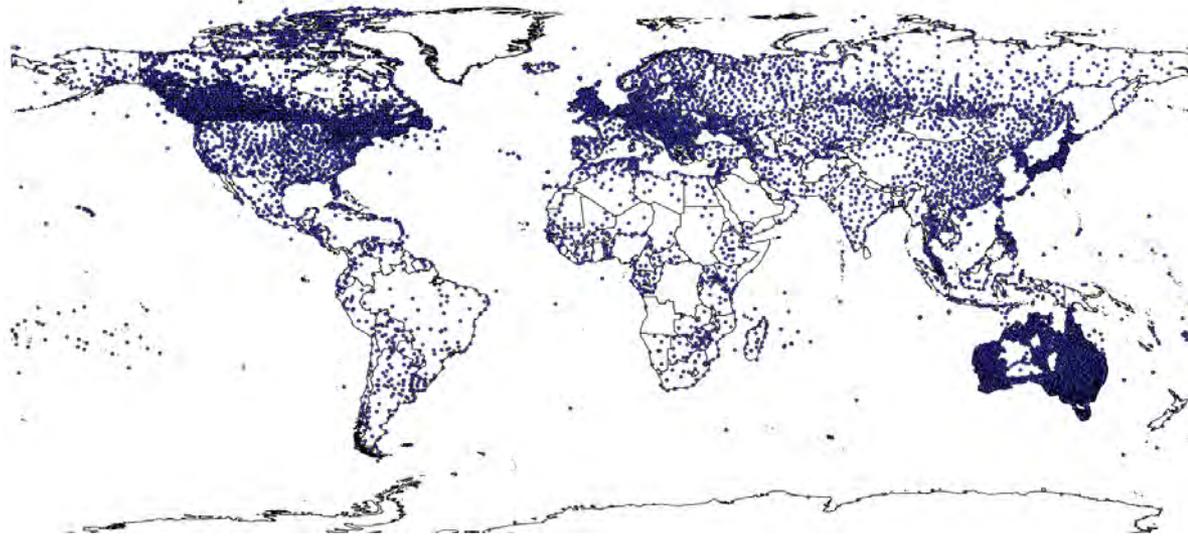
Evapotranspiration in the 36 km model 38% higher than the 4 km model



hydrological events?

etter manage extreme

3



Challenges and Opportunities

- ▶ **Who drives the Climate Services? Develop Interfaces**
- ▶ **Monsoon related activities – weather and climate**
- ▶ **New Regional Hydroclimate Project(s) initiation**
- ▶ **Cross cutting activities such as INARCH and INTENSE**
- ▶ **WCRP Water Availability for the Food Baskets**
- ▶ **Capacity Development – summer schools, training etc.**

Contact Us

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