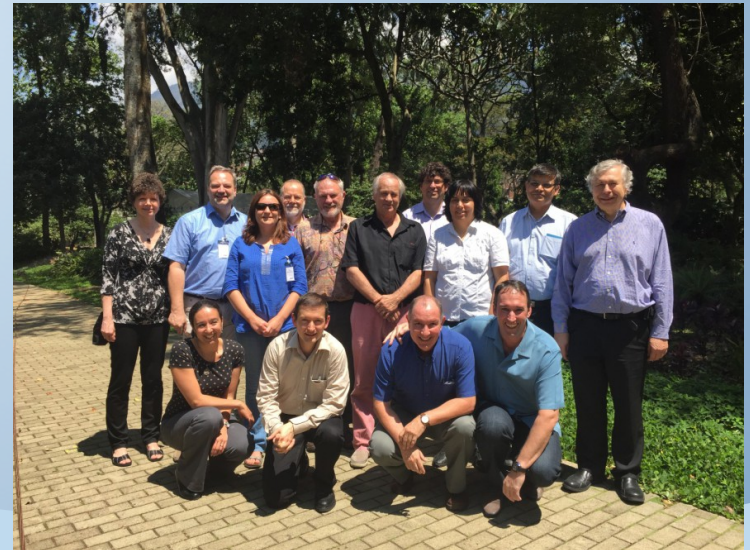


Global Energy and Water Exchanges

World Climate Research Programme

Sonia Seneviratne, Co-Chair SSG
Graeme Stephens, Co-Chair SSG

GEWEX



2015 GEWEX Scientific Steering Group



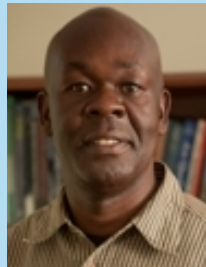
Prof. Sonia Seneviratne
Co-Chair of the SSG



Dr. Graeme Stephens
Co-Chair of the SSG



Prof. Lisa
Alexander



Prof. Richard
Anyah



Dr. Eleanor
Blyth



Prof. Rene
Garreaud



Dr. Xin Li



Dr. Paul Poli



Dr Siegfried
Schubert



Prof. Remko
Uilenjhoet

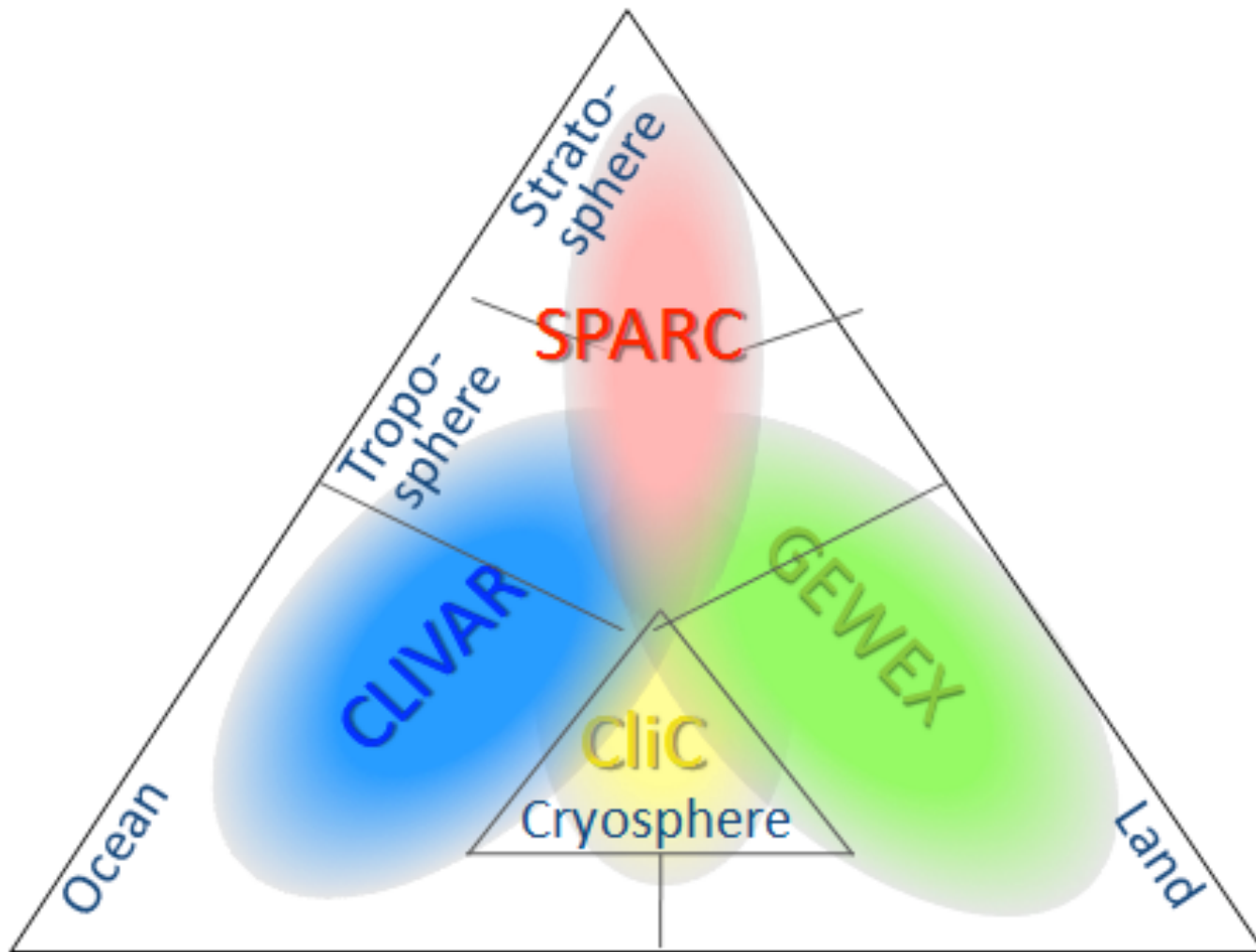


Prof Peter
Webster



Prof. Minghua
Zhang

GEWEX within WCRP



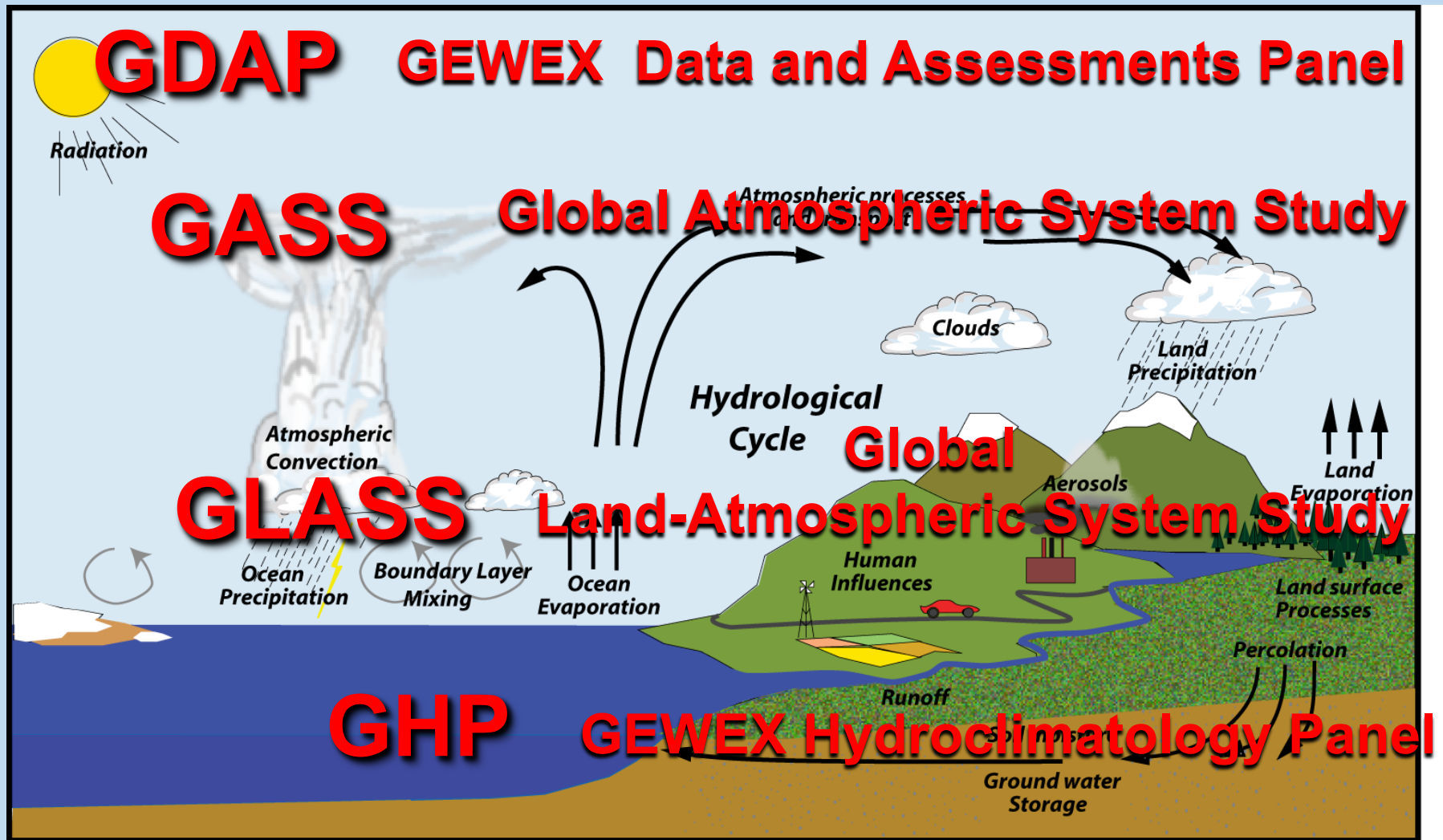
GEWEX Vision

Water and energy are fundamental for life on Earth. Fresh water is a major pressure point for society owing to increasing demand and climate change.

Extremes of droughts, heat waves as well as floods, heavy rains and intense storms are substantially affected by climate change.

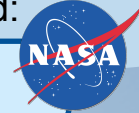
Better observations and analysis of these phenomena, and improving our ability to model and predict them (in particular related to the representation of land and atmospheric processes), will contribute to increasing information needed by society and decision makers for future planning.

GEWEX: Major components





IGPO graciously
sponsored:



Scientific Steering Group

International GEWEX Project Office

GEWEX Data and Assessments Panel

GEWEX Hydroclimatology Panel

Global Atmospheric System Studies

Global Land– Atmosphere System Studies

Extremes GC

Assessments

Regional Hydroclimate
Projects

Parameterization
Evaluation

Benchmarking

Water
Availability
GC

Global Data Products

Cross-Cuts

Model Diagnosis

Model Data Fusion

WMAC
WDAC

In Situ Observations

Global Data Centers

Radiation Code
Comparison

Land-Atmosphere
Coupling

Radiation Code
Comparison

Mission: To measure and predict global and regional energy and water variations, trends, and extremes (such as heat waves, floods and droughts), through improved observations and modeling of land, atmosphere and their interactions; thereby providing the scientific underpinnings of climate services.



GEWEX Science Questions

▶ **Observations and Predictions of Precipitation**

How can we better understand and predict precipitation variability and changes?

▶ **Global Water Resource Systems**

How do changes in the land surface and hydrology influence past and future changes in water availability and security?

▶ **Changes in Extremes**

How does a warming world affect climate extremes, and especially droughts, floods and heat waves, and how do land processes, in particular, contribute?

▶ **Water and energy cycles and processes**

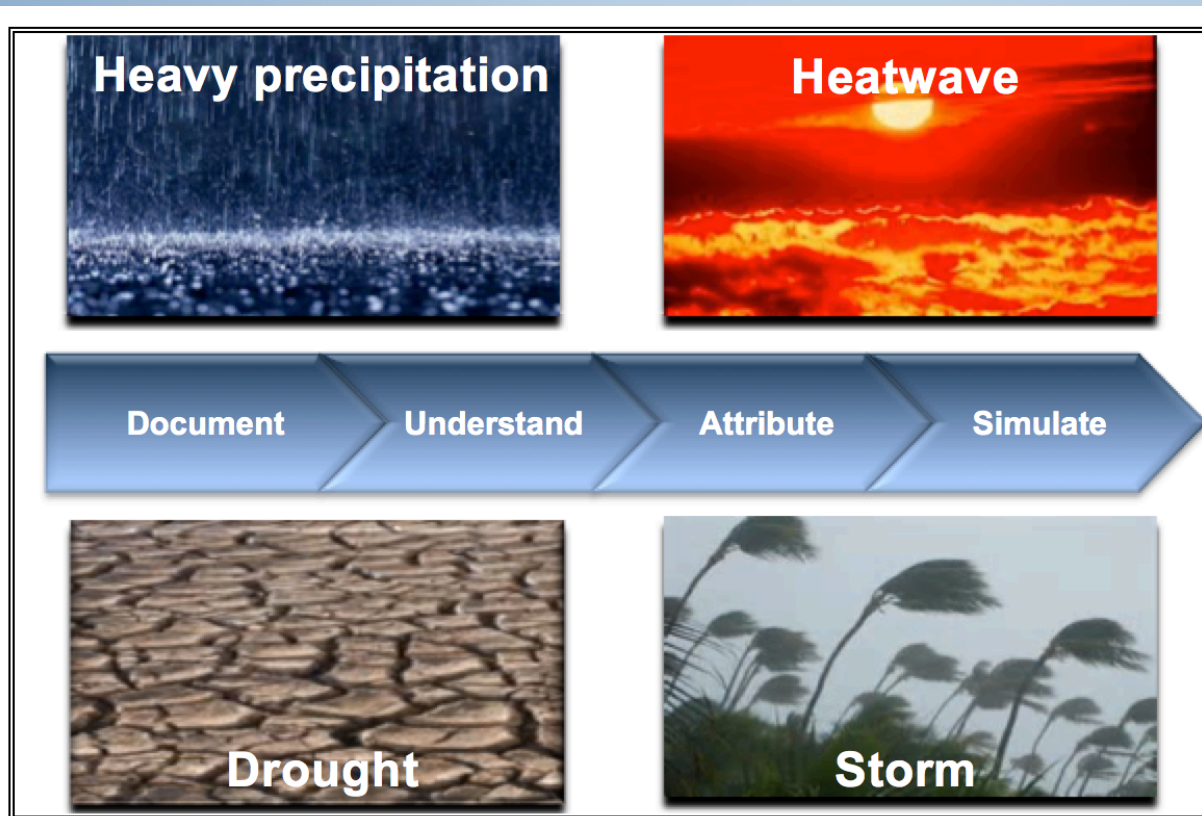
How can understanding of the effects and uncertainties of water and energy exchanges in the current and changing climate be improved and conveyed?

Climate Extremes

WCRP Grand Challenge

- ▶ Co-leads: L. Alexander, X. Zhang, G. Hegerl, S. Seneviratne

4 main extremes, 4 core themes

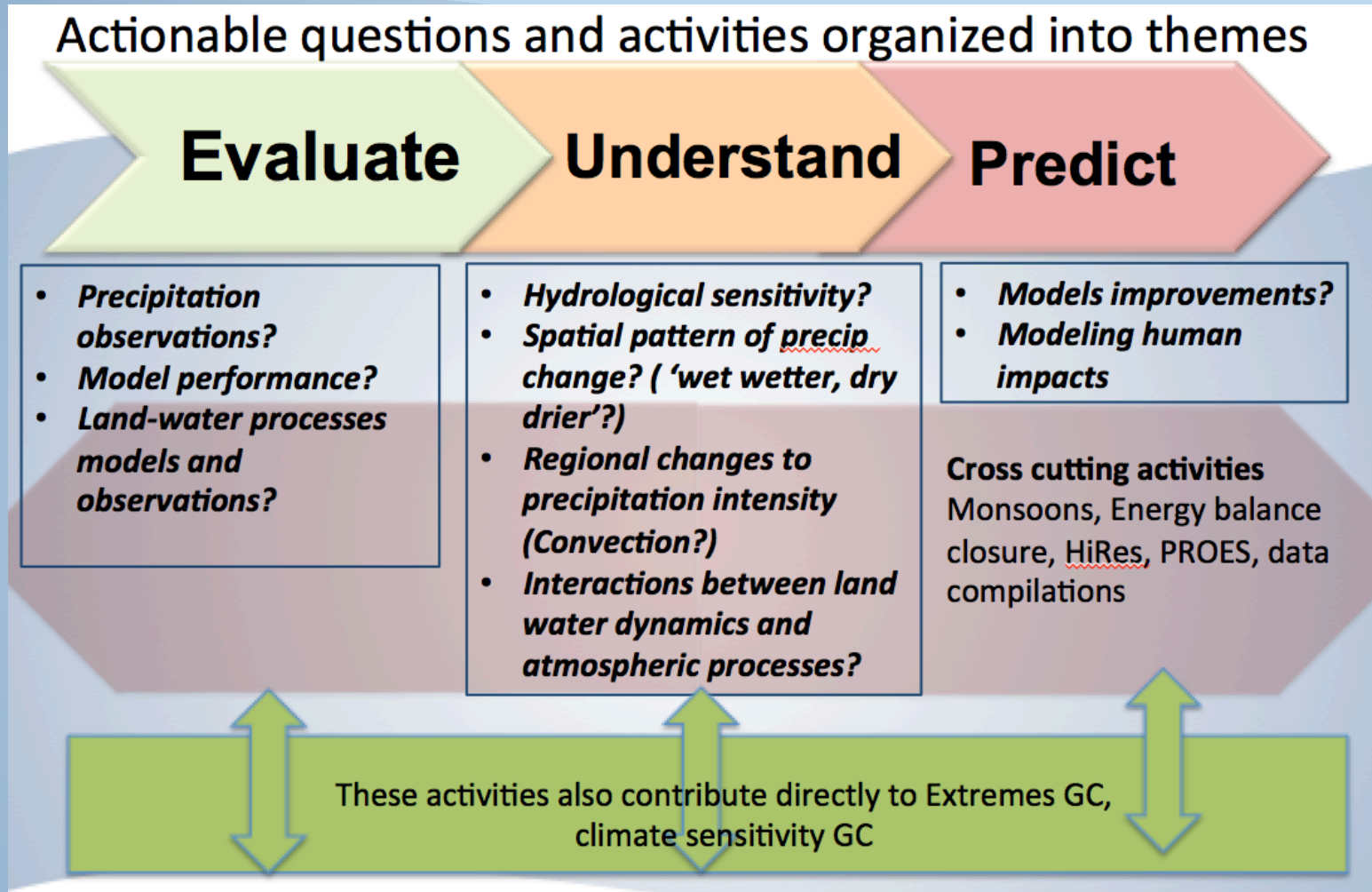


First version of implementation plan submitted in December 2014

Water availability

WCRP Grand Challenge

- Co-leads: G. Stephens, P. van Oevelen



2014 overview and highlights

- GEWEX open science conference (July 2014)
- Pan-GEWEX & Joint Pan-GEWEX/pan-CLIVAR meetings
- Advances in Extremes GC and Water Availability GC (see separate reports)
- CMIP6 activities (LandMIPs, HighResMIP)
- Development of US GEWEX activities
- Substantial progress towards New Regional Hydroclimato-logical Projects (RHPs): HyVic, CCRN, US/Rockies, Pannex, Relampago
- New assessments initiated within GDAP (precipitation, soil moisture), including links to GHP
- DICE project (joint between GASS and GLASS)
- Initiation of GEWEX-Soils initiative
- Initiation of GEWEX-PROES initiative
- WCRP post-AR5 workshop
- GDIS/GHP meeting in Pasadena (December 2014)

2014 overview and highlights

HiRes: A Proposal for a Coordinated GEWEX Initiative to Advance Projections of Hydrological Extremes

Graeme Stephens¹, Jon Petch², Cyril Morcrette², Malcolm Roberts², Stephen Klein³, Pier Luigi Vidale⁴, Marie-Estelle Demory⁴, and Roy Rasmussen⁵

¹Jet Propulsion Laboratory, Pasadena, CA, USA, ²Met Office, Exeter, UK; ³Lawrence Livermore National Laboratory, Livermore, CA, USA; ⁴National Centre for Atmospheric Science, University of Reading, UK; ⁵National Center for Atmospheric Research, Boulder, CO, USA

the projections used, especially for extreme rainfall is unclear, because predicting changes in the distribution, frequency and intensity of rainfall remains a fundamental weakness in all climate models (Stephens et al., 2010). One hypothesis that is now widely accepted is that the main obstacle to more credible projections of extreme rainfall is insufficient model resolution. Therefore, critical features such as topography and processes such as convection within rain-bearing systems cannot be adequately resolved. One of the goals of the HiRes Project is to develop a systematic approach to test this hypothesis by bringing together models of varying resolutions and observations developed under GEWEX, and new observational resources to define performance metrics to quantify improvements.

HighResMIP & LandMIPs (LS3MIP, LUMIP):

Important CMIP6 MIPs steered by GEWEX

H2020 projects funded which will partly cover research for these activities (PRIMAVERA, CRESCENDO)



that provide a deeper understanding of mountain precipitation processes, and to facilitate improvements in numerical weather prediction models, climate models, and hydrological models. The development of observational data sets will be a central activity. In particular, MOUNTerrain will focus on a collation of existing digitized observational data for high-elevation precipitation, and data rescue of high-elevation precipitation records (including quality control), including undigitized meteorological station records and ski-field and alpine clubs records, global and regional reanalysis products, and climate model precipitation fields from CMIP5 and 6.

Some of the key questions to be addressed include:

- How useful are (and how best to use) remotely sensed and gridded data sets, such as TRMM, GPCP, and reanalyses for characterizing high-elevation precipitation?
- How well are we measuring solid precipitation in moun-

Land Processes, Forcings, and Feedbacks in Climate Change Simulations: The CMIP6 "LandMIPs"

Sonia I. Seneviratne¹, Bart van den Hurk², Dave Lawrence³, Gerhard Krinner⁴, George Hurtt⁵, Hyungjun Kim⁶, Chris Derksen⁷, Taikan Oki⁶, Aaron Boone⁸, Michael Ek⁹, Victor Brovkin¹⁰, Paul Dirmeyer¹¹, Hervé Douville⁸, Pierre Friedlingstein¹², Stefan Hagemann¹⁰, Randal Koster¹³, Nathalie de Noblet-Ducoudré¹⁴, and Andrew Pitman¹⁵

¹ETH Zurich, Switzerland; ²KNMI, The Netherlands; ³NCAR, USA; ⁴CNRS/LGGE & U. Grenoble, France; ⁵U. Maryland, USA; ⁶U. Tokyo, Japan; ⁷Environment Canada; ⁸CNRM-GAME, Météo-France; ⁹NOAA/NCEP, USA; ¹⁰MPI for Meteorology, Germany; ¹¹George Mason University, USA; ¹²U. Exeter, UK; ¹³NASA/GSFC, USA; ¹⁴LSCE/IPSL, France; ¹⁵UNSW & ARC CoECCS, Australia

Cross-WCRP activities

CLIVAR:

- Joint Monsoon Panel
- Extremes GC: Links to CLIVAR through co-leads Zhang and Hegerl
- ETCCDI: six WCRP members from GEWEX and CLIVAR (3 each)

CLIC:

- Collaboration within LS3MIP (Land Surface, Snow and Soil moisture MIP)
- Emerging PROES project on surface mass/energy balance

SPARC:

- Integration of a SPARC representative within Extremes GC
- Upper tropospheric cloud/convection PROES

WGCM:

- Inputs and feedback to CMIP6 planning
- GASS Contribution to climate sensitivity GC

Conclusions

GEWEX now transforming to include more directly the **human component** along with the geophysical one in its science (where possible through collaboration with other entities such as iLEAPS but in several areas new expertise is being drawn in)

Important **first-time CMIP contributions** (HighResMIP, LS3MIP, LUMIP) partly funded by new H2020 projects

Initiated: Interface between models and observations (PROES), new components (soils, groundwater), observation assessments

Pan-GEWEX meeting (Jul. 2014, The Hague)

Pan-GEWEX discussions on “New themes”

- 1) Water isotopes
- 2) Land use and land cover modeling within CMIP6
- 3) High resolution modeling
- 4) Carbon-water cycle interactions
- 5) Surface energy and water balances

Main outcomes:

- LUMIP and LS3MIP design (“LandMIPs”) (also as result of GLASS meetings)
- Water isotope and carbon-water cycle interactions of interest but too early for formal activity (for the latter, however, existing links between GLASS and ILEAPS)
- Surface energy and water balance: One focus of water availability GC, in particular proper evaluation of obs uncertainties

Pan-GEWEX meeting (Jul. 2014, The Hague)

Joint Pan-GEWEX and Pan-CLIVAR meeting + joint SSG

- 1) Regional climate
- 2) Extremes
- 3) Large-scale circulation, monsoon, climate dynamics
- 4) Air-Sea fluxes
- 5) Predictability

Summary:

- Several joint interests
- Some existing joint activities (regional activities, joint monsoon panel)
- Possible stronger contribution of CLIVAR to water availability GC discussed
- Planned future joint activities (CLIVAR/GEWEX co-sponsoring of ETCCDI, GEWEX representative (G. Stephens) on CLIVAR OSC SSC)

WCRP post-AR5 workshop

Sept. 2014, Bern, Switzerland

GEWEX and water availability GC represented

Keynote presentation on water availability: S. Seneviratne and G. Stephens

Break-out group (BOG) coordination: S. Seneviratne, T. Oki, K. Trenberth

Other BOG participants and contributors to BOG report:

S.Bony, D. Carlson, J.-L. Dufresne, C. Jakob, V. Masson-Delmotte, F. Joos, V. Ramaswamy, C. Senior, A. Simmons, G. Stephens

Reports on presentation and BOG (included In Bern workshop final report)

NB: Focus was specifically on post-AR5 research

See separate report on workshop for more details

GEWEX within WCRP

Joint Scientific Committee

Joint Planning Staff

Modeling Advisory Council

Data Advisory Council

Working Groups on: Couple Modeling (WGCM), Region Climate (WGRC), Seasonal to Interannual Prediction (WGSIP), Numerical Experimentation (WGNE)

Grand Challenges

CLIC

CLIVAR

GEWEX

SPARC

Cryosphere-Climate Interactions

Ocean-Atmosphere Interactions

Actionable Regional Climate Information

Regional Sea-Level Rise

Cryosphere in a Changing Climate

Changes in Water Availability

Aerosols, Precipitation & Cloud Systems

Climate Extremes

Land-Atmosphere Interactions

Troposphere-Stratosphere Interactions

JSC-35 action items

8. Action: All Grand Challenges

Leaders of Grand Challenges (GC) to prepare short documents formulating the added value, uniqueness and any gaps of their GC, including expected or required linkages to and contributions by core projects and working groups.

Responsible: leads of all GCs.

Deadline: initial discussions at The Hague meeting mid-July and further steps in August – October 2014

Extremes GC: First version of implementation submitted to WCRP by December 2014

Water availability GC: Draft implementation plan completed

JSC-35 action items

13. Action: WDAC Flux Task Team

Request the Task Team to invite additional GEWEX expertise on land fluxes and consider adding WGNE SURFA representation

Responsible: WDAC Co-Chairs

Deadline: Dec 2014

-> Suggested experts: C. Jimenez, M. McCabe, B. Mueller, D. Miralles, or C. Prigent

JSC-35 action items

15. Action: Obs4MIPs

Encourage each core project to publish/migrate data sets to Obs4MIPs.

Conduct a test case using GEWEX data sets and report progress at JSC-36

Responsible: WDAC Co-Chairs, GEWEX

Deadline: JSC-36

Status:

- ▶ **PROES / G. Stephens**
- ▶ **item completed: LandFlux-EVAL dataset (GEWEX/GDAP) is included in ESMval software (precursor of Obs4MIP software); some results of first comparisons available**

JSC-35 action items

31. Actions on steering group and working group membership

- **Precipitation expertise for GEWEX** (covered with P. Webster, G. Stephens, Remko Uijlenhoet, GASS, GDAP)

Other action item

Email from D. Carlson: Encourage interactions with Future Earth

- ▶ We have existing activities with Future Earth, in particular well established links between GLASS and ILEAPS
- ▶ Also links between Extremes GC and Future Earth E3S