Updates on GEWEX and GPEX activities and Personal View on Land impacts on Precipitation

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Chair, GPEX Science Team

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San Francisco, CA
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Three Overarching but Connected Goals of GEWEX:

➢ **Goal 1:** Determine the extent to which Earth's water cycle can be **predicted** (reservoirs, flux changes, and precipitation extremes).

➢ **Goal 2:** Quantify the **interrelationships** between Earth's energy, water, and carbon cycles to advance our understanding of the system and our ability to predict it across scales.

➢ **Goal 3:** Quantify **anthropogenic** influences on Earth's water cycle and our ability to understand and predict it.

The focus of the four GEWEX panels in relation to the global and regional water and energy cycles (© P. van Oevelen, 2020)

Co-Chairs: Jan Polcher and Xubin Zeng

BAMS

GDAP Activities

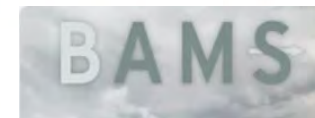Observation-centric, climate-oriented, consistency-driven, global, research-focused

GDAP Co-Chairs: Tristan L'Ecuyer, Hirohiko Masunaga
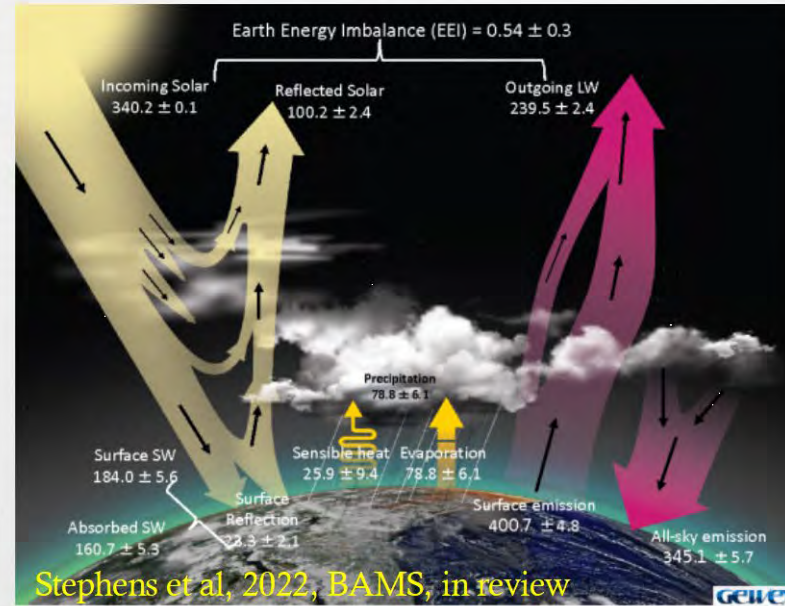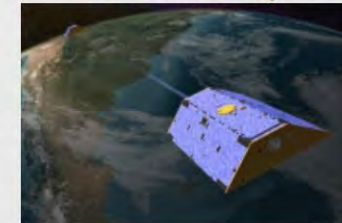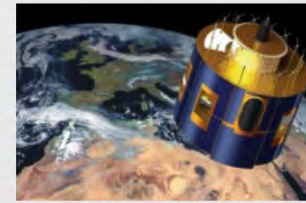
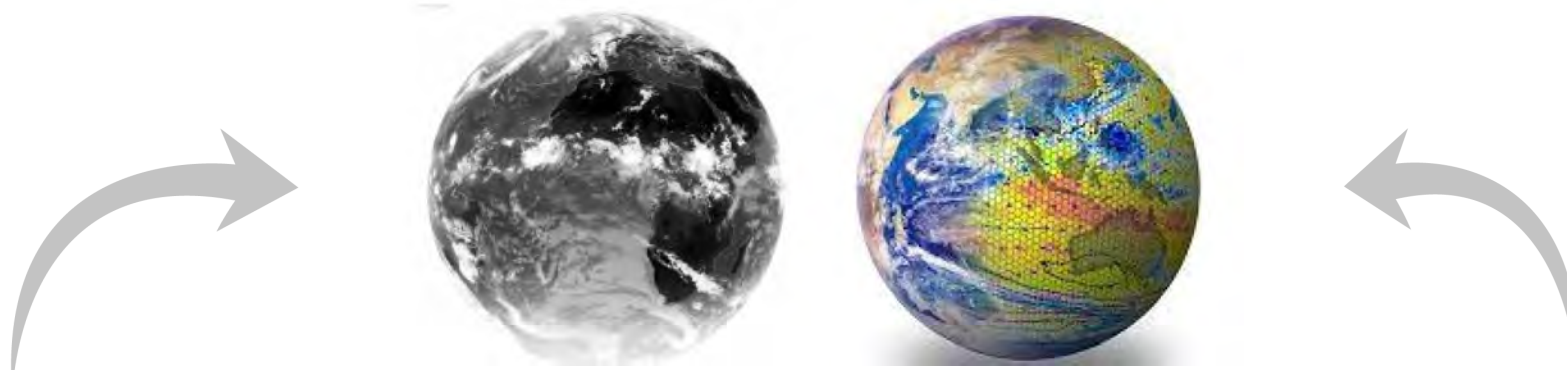GASS: Overarching questions

How do the micro to meso scale atmospheric processes control global Water and Energy Exchanges?

What controls Cloud Phase and Precipitation?

What controls Meso scale Organization?

GASS Co-Chairs: Daniel Klocke, Sandrine Bony

Ten GLASS Panel Projects:
From column (process) to global scale

GLASS: Global Land-Atmosphere System Studies

Process-oriented | Benchmarking | Model Experimentation and Intercomparison

CLASP · LoCo · SIF MIP · GLAFO · Irrigation CC · ET CC · PLUMBER · SoilWat · ILAMB · GSWP3 · LS3MIP · modelevaluation.org

Current Project / New Project / Cross Cut

Spatial scales: Column/Plot — Regional — Global
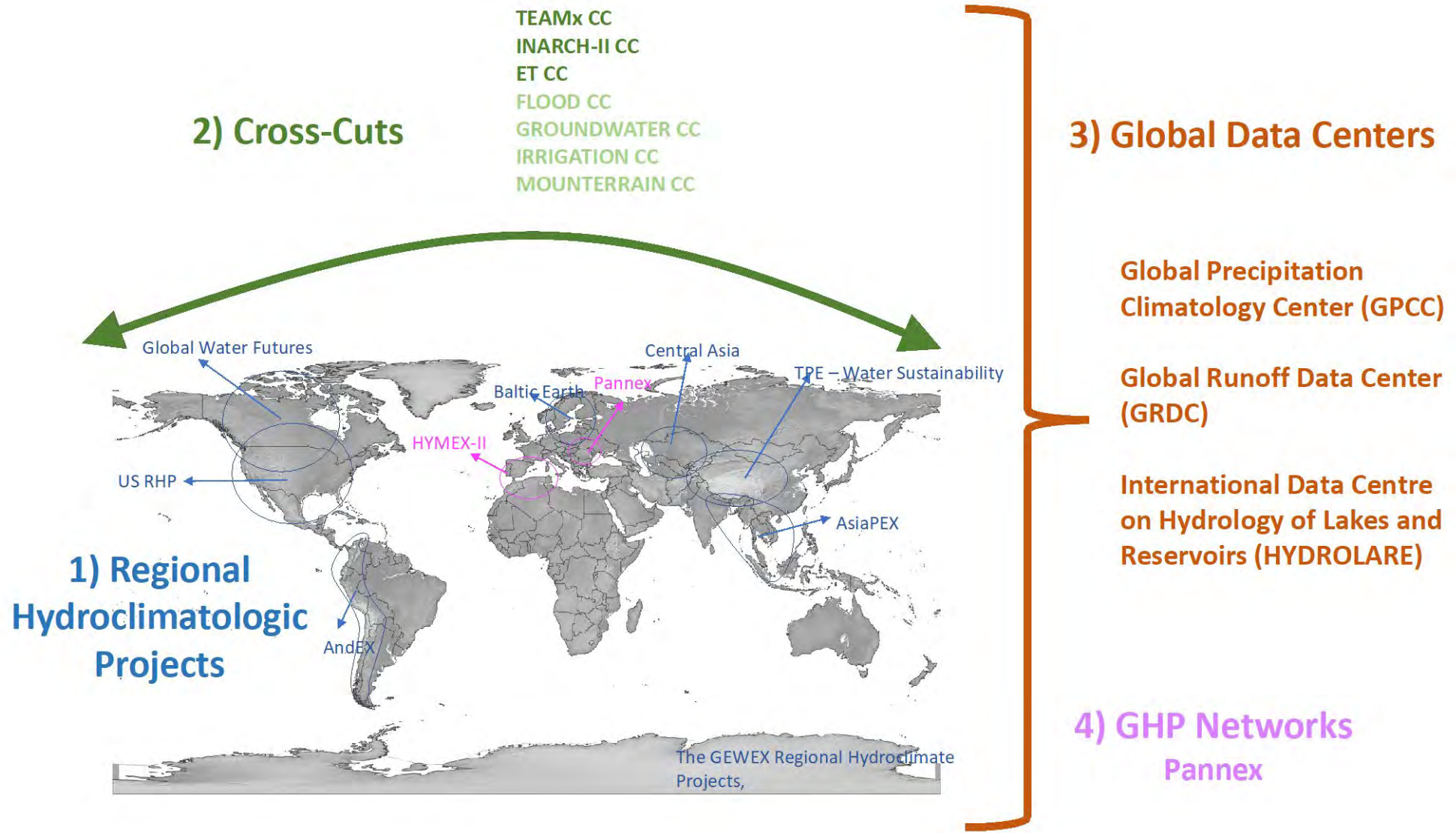Time scales: Minutes — Hours — Days — Seasons — Years — Decades

- **ILAMB**: International LAnd Model Benchmarking
- **Modelevaluation.org**: web application for evaluating and benchmarking computational models.
- **GSWP3**: Global Soil Wetness Project, phase 3
- **LS3MIP**: Land Surface, Snow and Soil Moisture MIP

Pan-GEWEX meeting, Monterey, 29 July 2022

- **LoCo**: Local Coupling Working Group
- **GLAFO**: GEWEX/GLASS Land-Atmosphere Feedback Observatories
- **SIFMIP**: Solar-Induced Fluorescence MIP
- **CLASP** (Coupling of Atmospheric Land and Sub-grid Parameterizations)
- **SoilWat**: Soils and Subsurface processes
- **PLUMBER2**: The Protocol for the Analysis of Land Surface Models (**PALS**) Land Surface Model Benchmarking Evaluation Project, phase 2

GLASS
Global / Land - Atmosphere System Studies

GLASS Co-Chairs: Anne Verhoef, Nathaniel Chaney, Kirsten Findell

2) Cross-Cuts

TEAMx CC
INARCH-II CC
ET CC
FLOOD CC
GROUNDWATER CC
IRRIGATION CC
MOUNTERRAIN 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)

1) Regional Hydroclimatologic Projects

Global Water Futures
Central Asia
TPE – Water Sustainability
Baltic Earth
Pannex
HYMEX-II
US RHP
AsiaPEX
AndEX
The GEWEX Regional Hydroclimate Projects,

4) GHP Networks
Pannex

GHP Co-Chairs: Ali Nazemi, Paola Arias

GEWEX Future Plans

➢ 9th GEWEX Open Science Conference in Japan
  ➢ Extent to which Earth's water cycle can be observed and predicted
  ➢ Interrelationships between energy, water and carbon cycles and Earth system predictability across scales
  ➢ Understanding and predicting anthropogenic influences on the water cycle
  ➢ Extremes in the water cycle and risks to society

➢ New Regional Hydroclimate Projects targeting Central Asia, Africa and New Zealand/Oceania and cross-cutting projects on flooding, groundwater and surface water.

➢ Projects in the pipeline for each Panel (GDAP, GASS, GLASS, GHP)

Pan-GASS meeting in Monterey, California, USA, in July 2022

Global Precipitation Experiment (GPEX)

Precipitation – too much, too intense, or too little – is at the center of climate science and applications.

Despite progress in the past few decades, the improvement of precipitation prediction and projection skill remains slow.

WCRP Action: launch the Global Precipitation Experiment (GPEX) as a **new Lighthouse Activity**, with four categories of activities:

- WCRP **Years of Precipitation** - global field campaigns focusing on four storm types: atmospheric rivers, mesoscale convective systems, monsoons, tropical cyclones.
- Global **precipitation-related data development** – e.g., global km-scale and hourly precipitation data
- Process **understanding and model improvement** – e.g., high spatial and temporal resolution analysis and forecasting for the Years of Precipitation, multi-scale modeling
- **Capacity development**

Action plan: SSC membership, leaders for field campaigns and data, modeling, prediction activities
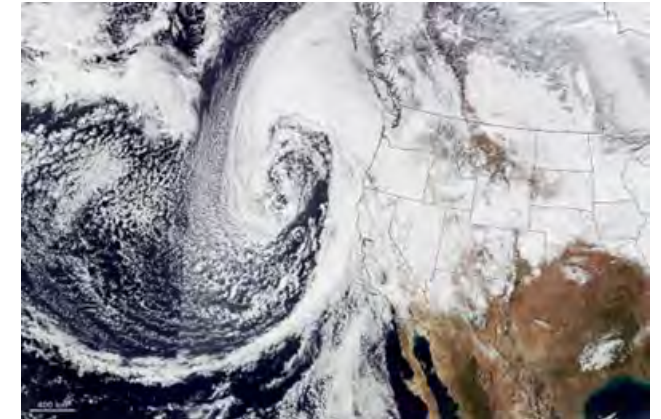
Personal View on Land impacts on Precipitation

<u>Local impacts</u>: well established;
requires OBS, SCM, regional, or global L-A model

<u>Downstream impacts</u>: well established;
requires OBS, regional, or global L-A model

<u>Upstream impacts: possible;</u>
requires regional or global L-A model

<u>Global impacts via Rossby waves:</u>
LS4P, getting more acceptance now;
requires regional or global L-A model

<u>Global impacts via oceans as a bridge</u>: possible;
requires global L-A-O model

Should LS4P expand to L-A-O modeling in later phases?

Soil moisture effect on the simulation of Hurricane Harvey ($130 Billion damages)
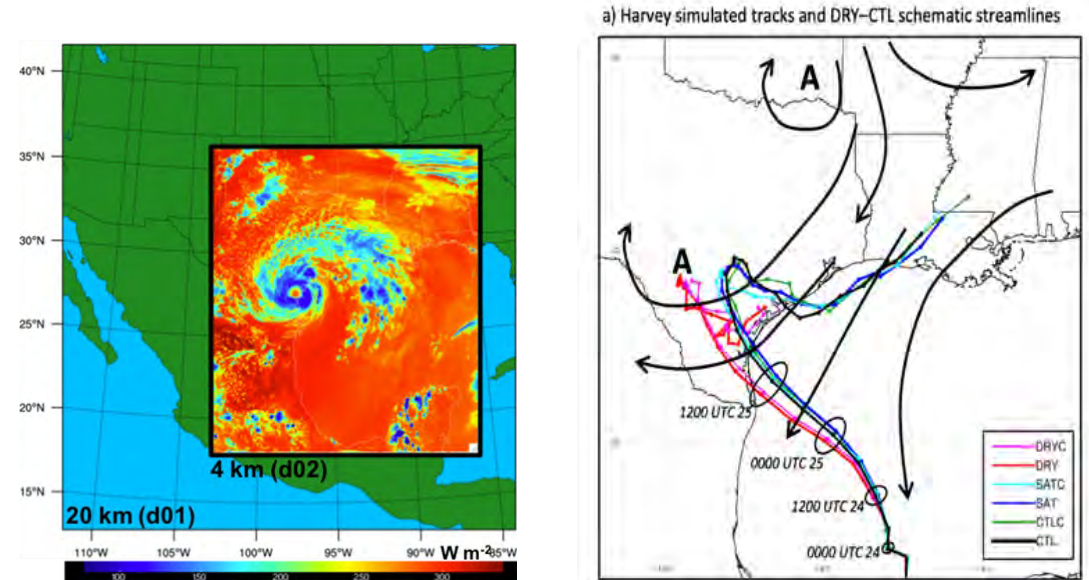
Black arrows: schematic streamline perturbation (DRY–CTL) in the 850–700 hPa layer (Galarneau and Zeng 2020)