# WCRP Global Precipitation EXperiment (GPEX) and Brief Discussion of GEWEX

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# Background

- USGCRP first explored the concept of GPEX in 2020 and reached out to WCRP on the possibility of taking this as a WCRP initiative in 2021.
- WCRP JSC decided to pursue this in November 2021 and appointed the Tiger Team in May 2022.
- Initial draft white paper was prepared for broad community input in Jul-Aug 2022 and the white paper is finalized and submitted to WCRP JSC in Sep 2022.
- WCRP will appoint a Planning Committee to prepare GPEX Science and Implementation Plan, and launch GPEX during the WCRP Open Science Conference in Fall 2023.

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|---|---|---|
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# GPEX Structure

- WCRP GPEX Project or Lighthouse Activity (LHA)?
- GPEX Planning Group of 15 members with one chair or two co-chairs.
- Prepare GPEX Science and Implementation Plan in one year. Note: a similar task took 2 years for the S2S Project.
- Coordination by expanding an existing WCRP core project office or through a new International Project Office
- GPEX activities should be guided by the SSC with 15 members.
- 5-year period initially, with possible extension for a further 5 years, or subsequent work through regular core project activities.
- have regional/national committees
- Launch an African component of GPEX at the WCRP OSC in Kigali (Rwanda) and online on 23-27 October 2023.

# Vision, Mission, and Key Goals

Vision could be: Understanding and prediction of precipitation in a changing climate to support resilience and sustainable development

Mission could be: To accelerate advances in precipitation knowledge and prediction at different temporal and spatial scales, to enhance public access to relevant datasets, and to benefit the society, all by coordinating national and international activities.

Key goals could include :

- Better measurements of precipitation (liquid and solid), particularly over mountainous, high-latitude, and tropical regions and in developing countries
- Improved understanding of the complex precipitation processes and their interactions with atmospheric dynamics & other components of Earth system
- Reduced model biases in global coupled models and improved prediction and projection of precipitation at different temporal and spatial scales
- Enhanced regional and local capacity building for precipitation measurements, understanding, prediction, and projection

# Relation with WCRP and Non-WCRP Projects

Precipitation has been emphasized by, or is related to, numerous activities of WCRP core projects and LHAs and of other international projects. Therefore

- GPEX needs to gather international initiatives already in place within WCRP programs, including observational campaigns already scheduled, modeling activities already planned, process studies already planned, and capacity development activities already scheduled, and how precipitation information is used by stakeholders.

- GPEX needs to gather national and international initiatives already in place on precipitation science and applications from non-WCRP programs.

# GPEX Activities

Leveraging and coordinating with existing activities, GPEX should carry out a variety of complementary activities, with user engagement throughout the entire process.

- support the establishment and/or expansion of global and regional precipitation databases from satellite, radar, and gauge measurements.
- coordinate model experiments and support the establishment of multi-model databases consisting of ensembles of weather and S2S precipitation forecasts for a common historical period and for the future, along with common evaluation metrics for deterministic, probabilistic, and extremes forecasts of precipitation.
- support the research on precipitation predictability, prediction techniques and applications on multi-year to multi-decadal timescales
- support existing national/regional activities and/or the establishment of new activities, partly through capacity building
- support the capacity development, such as a series of workshops on precipitation science, prediction, and applications.

# International Year of Precipitation (YoP)

- coordinated field experiments over different regions.
- increasing the number of sites for precipitation measurements in developing countries, high elevations, and high latitudes.
- coordinated high-resolution reanalysis/analysis from different centers.
- coordinated hierarchical modeling.
- coordinated evaluations of precipitation products and precipitation forecasts.
- improved distribution and visibility of all surface-based, airborne, and space-borne precipitation and associated data.
- application of these products and measurements

YoP could focus on extreme events at different seasons, such as:

- for winter, atmospheric rivers and the precipitation after landfall, and winter storms,
- for spring and summer, organized convection (e.g., mesoscale convective systems),
- for fall, hurricanes and their precipitation after landfall.

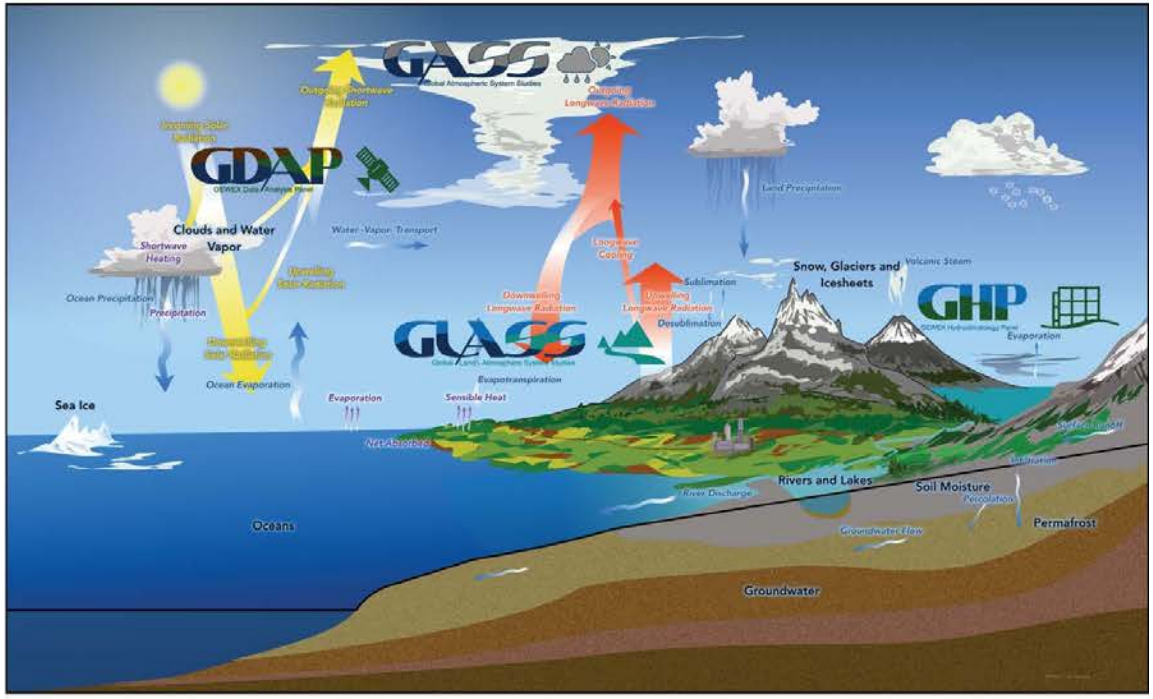
# Recent GEWEX Panel Activities

- **GLASS**: launched a project on the modeling of solar-induced chlorophyll fluorescence (SIF) in land models (SIFMIP) as a bridge to better understand the coupling of energy and water cycles to the carbon cycle, and launched another project on the coupling of atmospheric land and sub-grid parameterizations (CLASP).

- **GASS**: has been efficient in completing, continuing, and initiating projects, and is expected to launch new projects soon that are related to shallow and deep convections and their organization/aggregation and other topics.

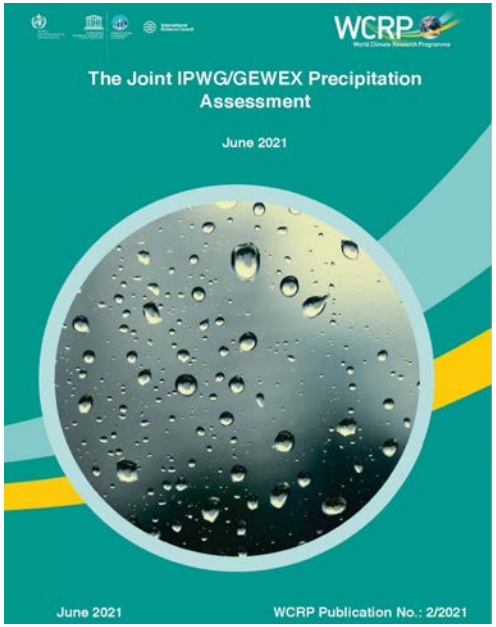
- **GHP**: heavily engaged with scientists in different continents to explore and develop regional hydroclimatological projects, and has proposed a crosscutting project on flooding which has not received much attention in Earth system modeling.

- **GDAP**: in the process of developing a new strategy in helping the data and user community: instead of labeling "GEWEX datasets", GDAP will try to develop the GEWEX criteria for satellite datasets (related to the energy and water cycles) to meet through data assessment and analysis.




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

WMO UNESCO INTERNATIONAL COUNCIL FOR SCIENCE WCRP World Climate Research Programme



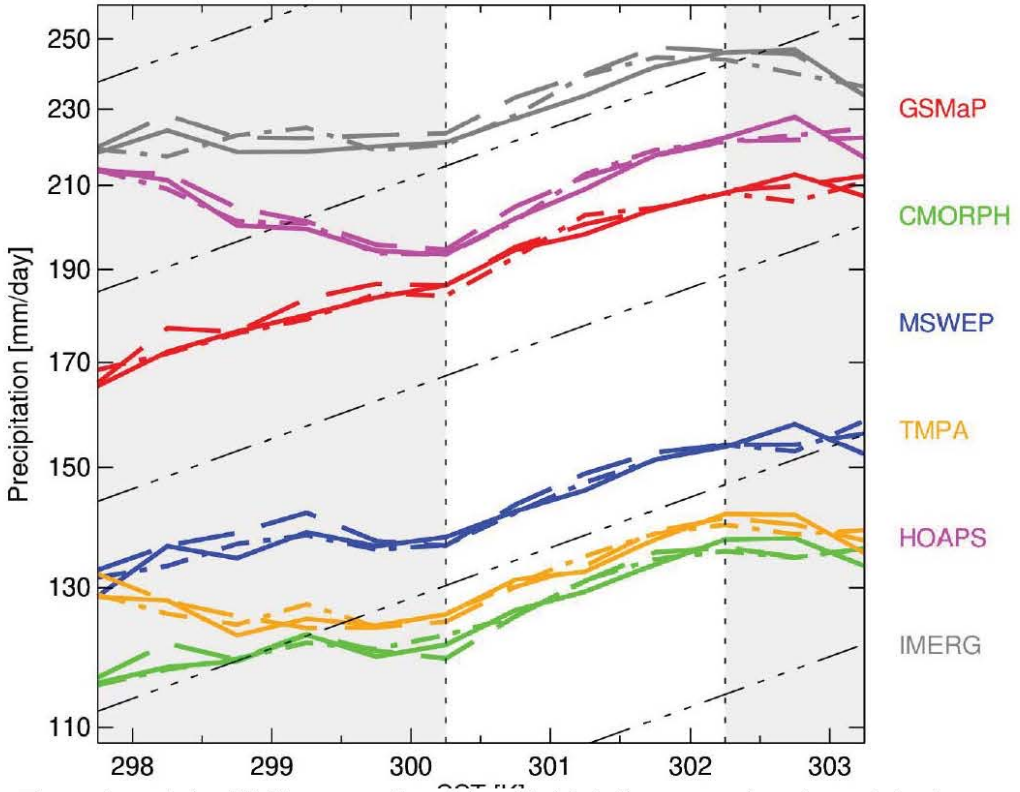




**Figure 2.5.5**. The value of the 99.9th percentile of the 1°x1° daily accumulated precipitation as a function of the SST lagged by 2 days. Each color corresponds to a precipitation product. Solid line for Operational SST and Sea Ice Analysis (OSTIA), dashed line for Optimally Interpolated Sea Surface Temperature (OISST) and dash-dotted lines for Optimally Interpolated Remote Sensing Systems Sea Surface Temperature (OIRSS). For the period 2007–2017. Regimes are separated by vertical dashed lines. Thegrey shaded areas indicate the non-robust cold regime between precipitation products (left) and the non-robust warm regime between SST products (right). Black dash-dotted lines correspond to the Clausius-Clapeyron 6%/K rate. From De Meyer and Roca, 2021

## **INARCH-II,

Hydrological processes in alpine cold regions

John Pomeroy, University of Saskatchewan


- Phase II Objectives: To better measure and
atmospheric, hydrological, cryospheric, biol
interaction processes; improve their predict
diagnose their sensitivities to climate chang
may be managed to promote water sustain
- The INARCH-II network:
- 50 research scientists with wide-ranging ex
world,
- 29 experimental research basins in 14 cour
mountain regions on most continents.

# GEWEX Interaction with WGNE

GEWEX (particularly GASS and GLASS) has collaborated extensively with WGNE. In fact, many of the GEWEX studies were triggered by forecasting problems.

With WMO's new focus on precipitation and hydrology, GEWEX (including all four panels) could work with WGNE even more closely:

- Hydrological forecasting should receive more attention in WGNE modeling activities as part of the Earth system modeling
- Human activities need to be included in Earth system model development and evaluations.

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**Project Office Director: Peter van Oevelen**