Recent Efforts by U.S. Global Change Research Program, Interagency Integrated Water Cycle Group

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GEWEX LS4P-II Workshop
Sunday, Nov. 10, 2023

U.S. Global Change Research Program

About USGCRP

- Began as a Presidential Initiative in 1989
- Mandated by Congress in the Global Change Research Act of 1990
- Comprises the science arms of 15 agencies with responsibilities in global change research
- FY2022 budget crosscut approx. $3.75 Billion
- Interagency Distributed Cost Budget supports the National Coordination Office (NCO) and activities of the organization

"[A] comprehensive and integrated United States research program which will assist the Nation and the world to understand, assess, predict and respond to human-induced and natural processes of global change"

(P.L. 101-606)

About the Subcommittee on Global Change Research

USGCRP is steered by the Subcommittee on Global Change Research (SGCR) of the National Science and Technology Council's Committee on Environment, which is overseen by the White House Office of Science and Technology Policy (OSTP).

Composed of representatives (Principals) from 15 federal agencies

Acts as a Board of Directors for U.S. Global Change Research Program (USGCRP)

USGCRP interagency groups

Approximately 400 individuals participate in USGCRP interagency groups

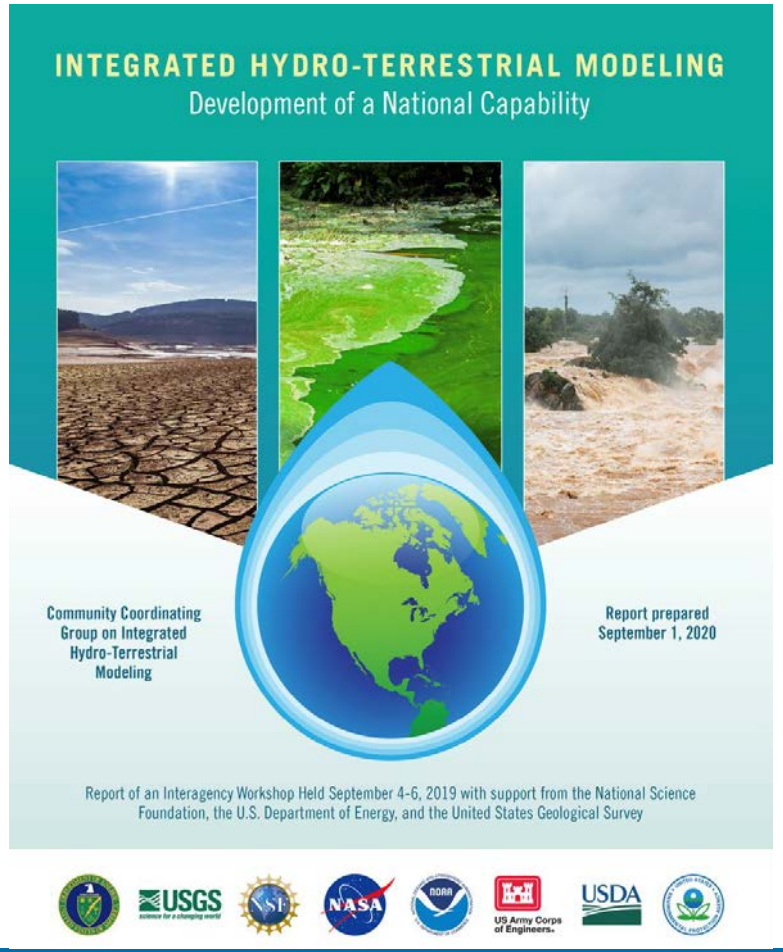
- Tuning in to teleconferences
- Participating in assessment development
- Active membership in interagency groups, **open to all federal agencies**

Current Interagency Groups	
Carbon Cycle	International Activities
Observations	Sustained Assessment
Integrated Modeling	Indicators
Human Health	Integrated Water Cycle
Social Science	Adaptation and Resilience
Coasts	Climate Engagement and Capacity Building
Urban	

Integrated Water Cycle Group (IWCG) Workstreams

- IWCG has two active workstreams: US GEWEX (Global Energy and Water Exchanges) and HWS (Hydrology and Watershed Systems)
- **US GEWEX** focuses on global and regional water cycle research that seek to understand processes relevant to the water cycle and budget.
  - Precipitation prediction
  - Hydrometeorology
- **HWS** aims to advance capabilities and infrastructure that support water cycle observation, modeling, and predictability at various scales.
  - Local watershed perspectives to higher spatial and temporal scales
  - Hydrologic model structure and modularity
  - Observation and analysis methods for changing hydrologic systems

Integrated Hydro-Terrestrial Modeling (IHTM)

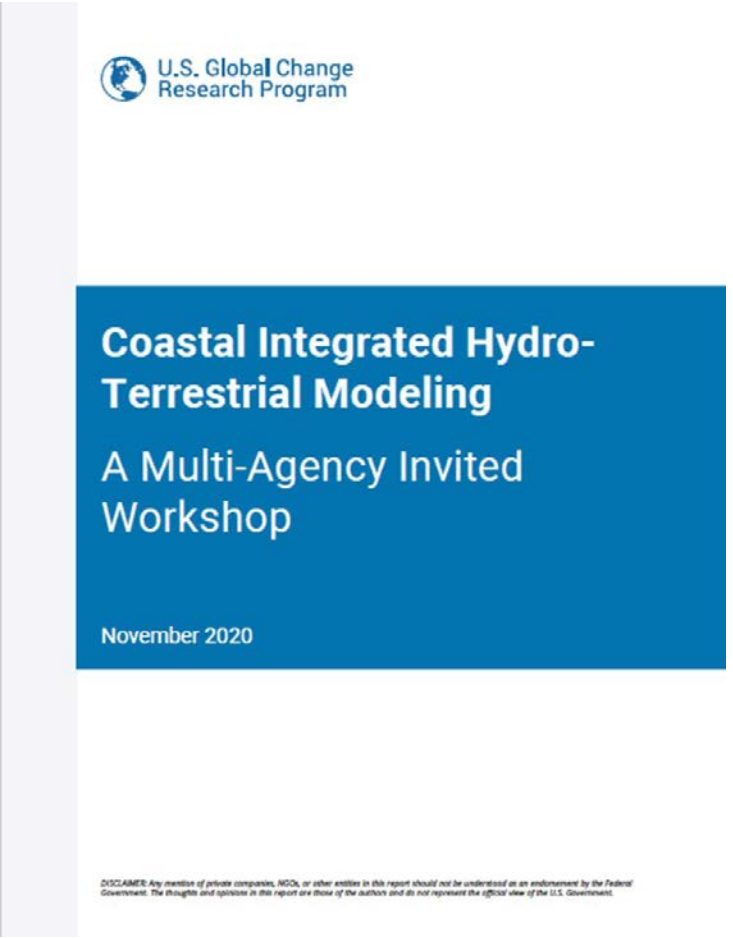


IHTM 1.0 (2019)

Existing and new investments lay the foundation for an IHTM and data infrastructure to enhance knowledge, understanding, prediction, and management of the nation's diverse water challenges.

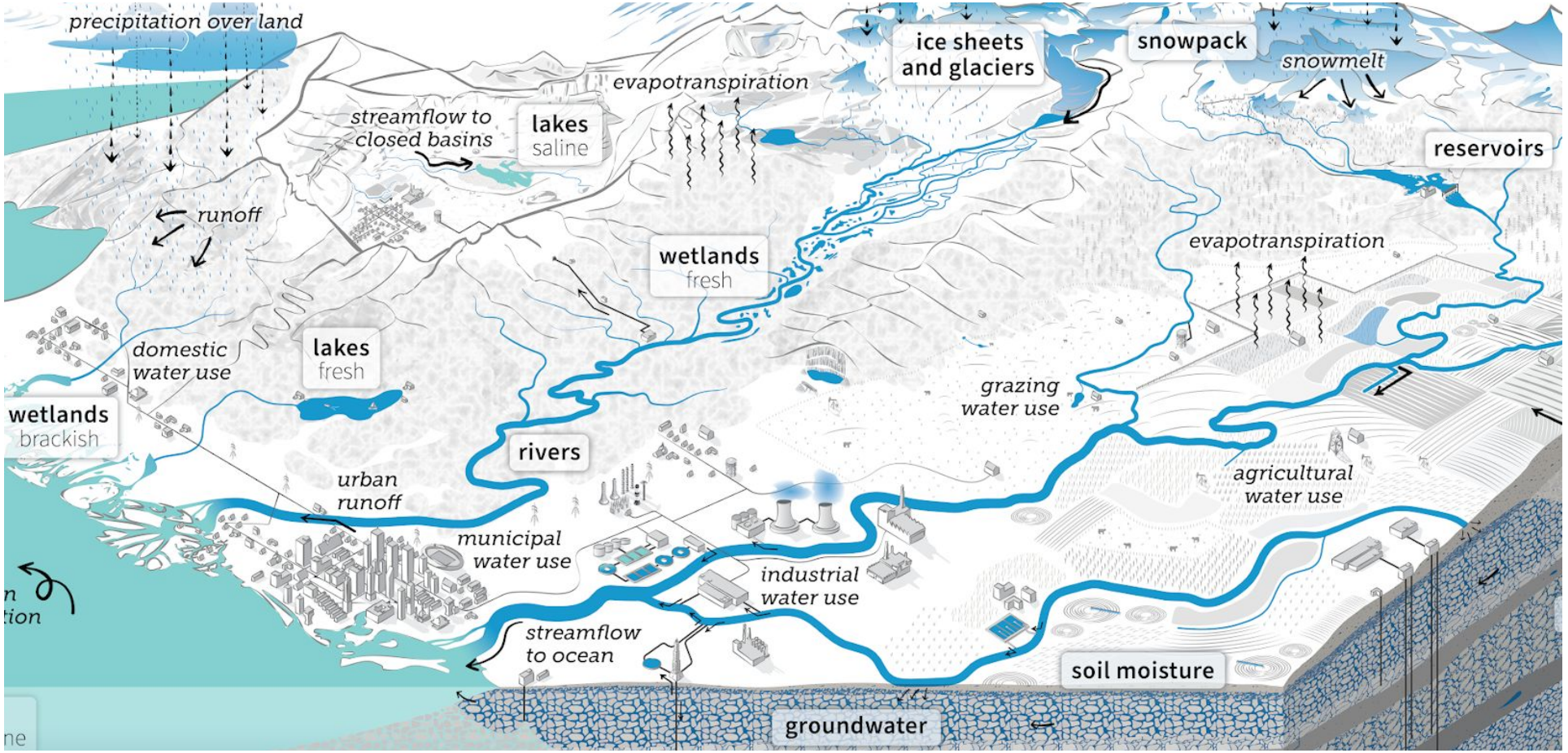
C-IHTM (2020)

USGCRP Coastal IHTM coordinating group held a joint workshop with the Multi-Sector Dynamics Community of Practice and identified 38 potential use cases.



What is the focus of IHTM?

https://www.usgs.gov/media/images/water-cycle-png

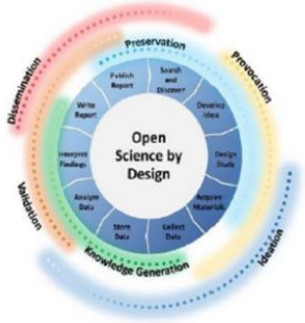


What is the focus of IHTM?

"Address the need to support a multiscale framework to accelerate research insights, better integrate operational/planning perspectives, and bridge national-to-regional capabilities to tackle major interdependent societal challenges."

– IHTM 2.0 Scientific Organizing Committee

Roadmap to a Sustainable IHTM Capability and Community



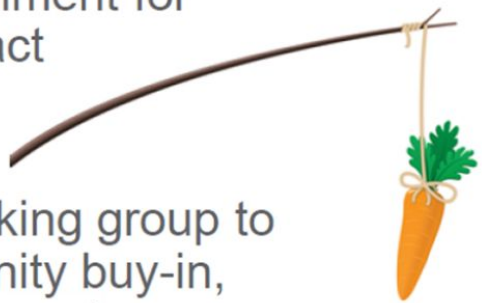
Long Term

Transform culture towards sharing data, co-developing models, and generating timely, coordinated forecasts for stakeholders

Mid Term

Determine and implement common data and model standards through communities of practice.

Agencies evolve business and funding practices and mission alignment for optimal impact



Near Term

Multi-agency working group to generate community buy-in, create incentives, and co-design a pilot project.

Interagency coordination (e.g., working group) on mission alignment, business & funding practices

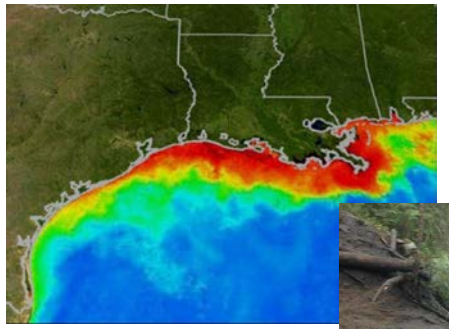
Skin-in-the-game for early wins and pilot projects using flexible approaches

Slide courtesy of Tim Scheibe, PNNL

IHTM 2.0 (2023): Charge and Vision

- Provide updates on emerging IHTM capabilities and research gaps
- Move from community concepts towards actionable collaborative testbeds
- Use the testbeds to accelerate innovations into societally relevant applications
- Facilitate interagency engagements to inform and strengthen bridges between the research and operational communities (R2O2R)
- Help inform testbeds to explore new approaches, capabilities, and enhance capacities through open science principles

Priority Water Challenges

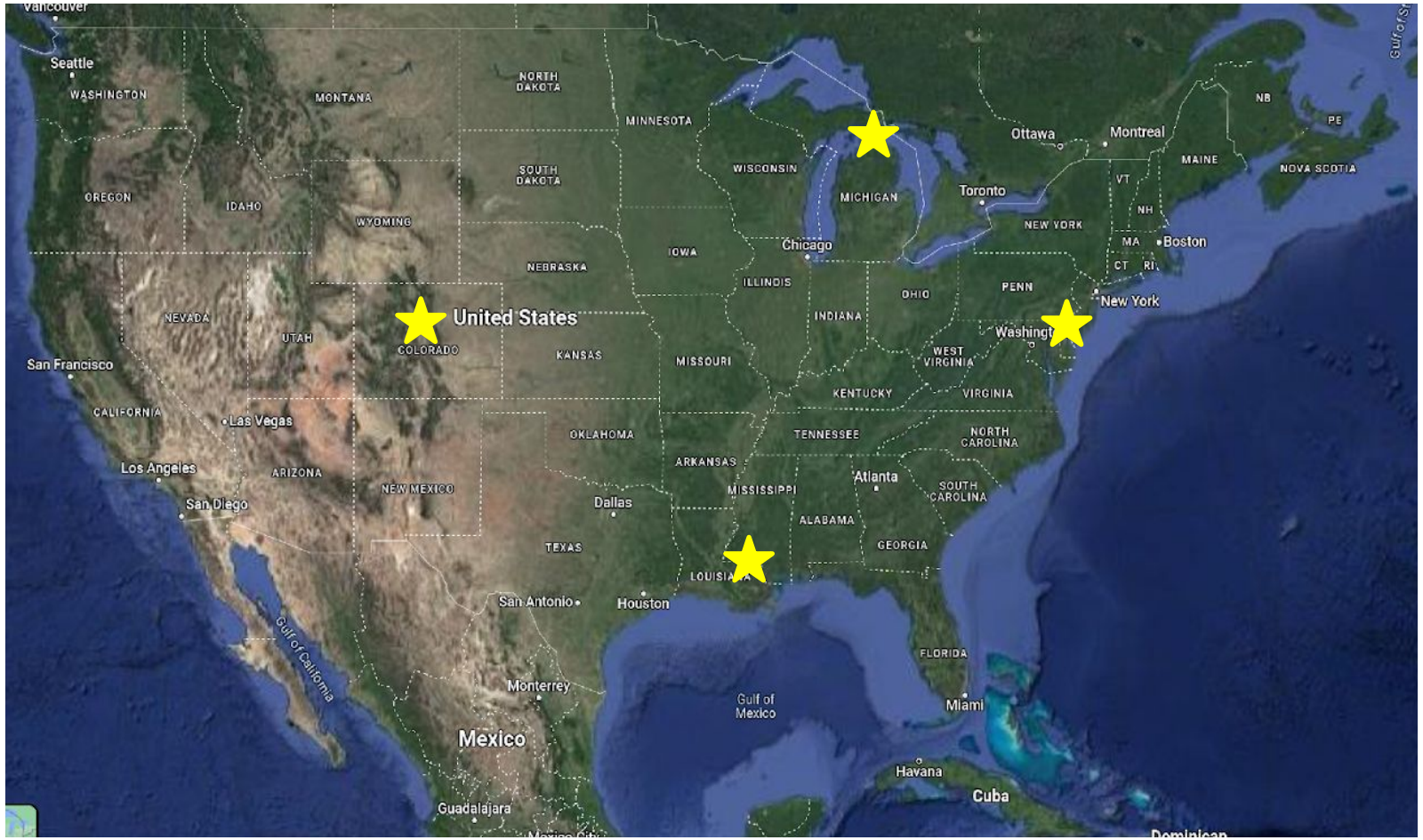


Excess Nutrients, Hypoxia and Harmful Algal Blooms

Extreme Weather-related Water Hazards

Water Availability in the Western US

Using Community Testbeds to Accelerate Innovations into Societally Relevant Applications



U.S. National

Upper Colorado River Basin

Mid-Atlantic Region

Great Lakes Region

Gulf Coast/Mississippi

Aspirational Community Testbeds

- Spatial domain of significance
  - U.S. National testbed
  - Regional testbeds
- Focal point of existing interagency activity
  - Providing information for a critical societal need
- Developing critical elements of a desired shared capability
  - Data management, community platforms, and standards
  - Open science, ICON FAIR-principles
  - Interoperability of codes
  - Workflows, analysis tools, compute environment

Images courtesy of John Hammond (USGS), produced by generative AI.

Towards an IHTM Community of Practice

Workshop participants discussed the following points:

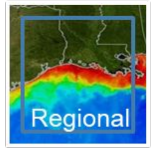
The Ultimate Goal: A community with a centralized web presence that allows for transparent identification and sharing of data, models, and information to support model development, workflows, and benchmarking criteria

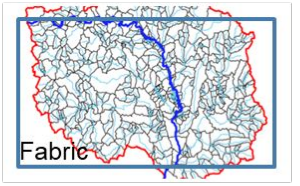
- Develop and nurture a community with a centralized web presence
- Start a catalog of data, metadata, and model workflow repositories
- Facilitate the exploration of key datasets (e.g., climate, land use, human demands, operations/planning scenarios) to be included in community testbeds
- Identify management-relevant use cases and decision-making metrics
- Link with other communities of practice, e.g., CUAHSI, MSD, CSDMS

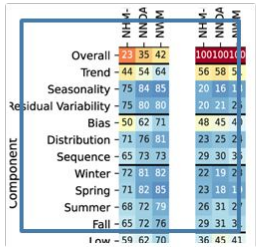
Katie’s Key Workshop Takeaways

- IHTM 2.0 was an incredible success!
  - 160+ engaged and enthusiastic participants across nine agencies and academia
- IHTM community seeking sustainability
  - Hub for testbeds, communication, data, communities of practice?
- IHTM 2.0 to IHTM n.n - What’s next?
  - 2023 Annual AGU fall meeting
  - Workshop report writing - Spring 2024
  - June 2024 WaterSciCon - AGU and CUAHSI

    → Coupled session and workshop for testbed demos







World Climate Research Programme (WCRP)
Global Precipitation Experiment (GPEX)

U.S. Global Energy and Water Exchange (US GEWEX) Sub-Group Activity

Courtesy of Jin Huang
NOAA Climate Program Office

on behalf of the GPEX Science Team

Initial Concept of Global Precipitation Experiment (GPEX)

GPEX will systematically and comprehensively **reduce model biases** in global coupled models and **improve precipitation prediction** using an integrated observations and modeling strategy and targeting critical processes and phenomena.

Predictability and Processes studies

Predictability and Processes studies including field experiments and hierarchical model experiments

+

Optimizing observations and datasets

Optimize observations and datasets for prediction initialization, evaluation and process understanding.

+

Improving coupled prediction models

Improving coupled prediction models by improved physics, high-resolution modeling, ML/AL, coupled data assimilation

User engagement

User engagement throughout the entire process as an input to guide future research needs and requirements for improvements

Envisioned Partners

- **USGCRP** agencies proposed the **initial concept of GPEX**
- USGCRP reached out to World Climate Research Programme (**WCRP**) for international coordination and collaboration

Global Precipitation EXperiment (GPEX)

A new WCRP Lighthouse Activity: a unique opportunity to focus on phenomena and processes critical to precipitation and to accelerate progress by leveraging & coordinating existing WCRP programs and capabilities in observation, modeling and research, and conducting new focused activities.

World Climate Research Programme

Science Questions

1. What are the **sources of uncertainties** of **precipitation estimates** over global land & ocean, particularly over mountainous, high-latitude, & tropical regions, and how can we address them?
2. How is precipitation produced by **complex moist processes** and their interactions with atmospheric dynamics and other components of the Earth system?
3. What are the **sources of precipitation biases** in climate models and how can we reduce them to improve predictions and projections of precipitation at various temporal and spatial scales?
4. How can we **enhance regional and local capacity building** for precipitation measurements, process understanding, prediction, and projection?

Key Activities

1. **WCRP Years of Precipitation (YoP):** A flagship of GPEX activity by engaging and coordinating national and international field studies. Activities 2-4 will be included in the YoP and the Pre- and Post-YoP Phases.
2. **Precipitation Databases**: Add value to existing efforts by working with other projects to develop and enhance global networks and design capabilities.
3. **Precipitation Modeling, Prediction, and Process Understanding:** Leverage existing models and model outcomes, and coordinate multi-scale analysis and precipitation forecasts.
4. **National/Regional Activities and Capacity Development:** Entrain scientists and graduate students into YoP, particularly from the Global South, and make storm-resolving models more accessible.

How Can You Get Involved in GPEX?

- **Provide input**, e.g.,
  - Suggestions for GPEX Science Team members
  - Suggestions for leads for the four major GPEX activities
  - Any GPEX-related activities (especially field campaigns)
  - Your perspective regarding what GPEX should address

- **Share the GPEX Science Plan with your colleagues**

- **Share the GPEX Science Plan with managers and leaders in funding agencies** for possible inclusion in their planning of new funding opportunities.

- **Contact: GPEX Science Team,** e.g.,
  - Xubin Zeng: xubin@arizona.edu
  - Jin Huang: jin.huang@noaa.gov
  - Hindumathi Kulaiappan Palanisamy: hpalanisamy@wmo.int

Join our IWCG town hall this Thursday!

TH45A - Accelerating Applications and Collaborations in Interagency Integrated Research of the Water Cycle to Inform Water Management Under Global Change

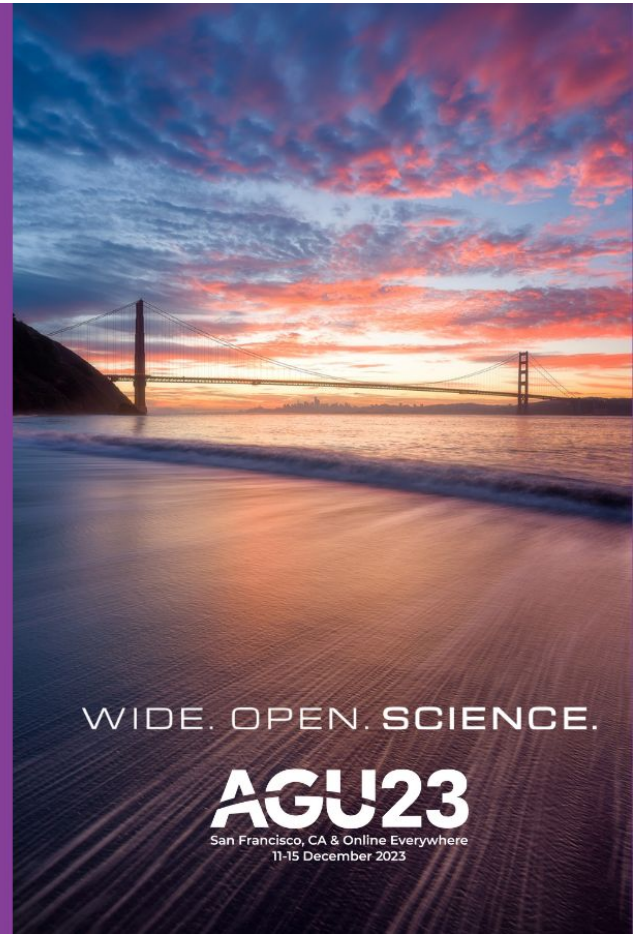
Thursday, 14 December 2023, 18:30 - 19:30 PST
2002 - West (Level 2, West, MC)

The U.S. Global Change Research Program's Integrated Water Cycle Group (IWCG) coordinates research to better understand the effects of global change on the water cycle and resulting impacts through interagency collaboration on interdisciplinary approaches.

Join us and forge connections with the U.S. Government's scientific research, planning, and decision-making communities on water and climate through exciting IWCG opportunities, including:

- Integrated Hydro-Terrestrial Modeling (IHTM 2.0)
- Global Precipitation Experiment (GPEX)
- And more!

#AGU23



Thank you!

Questions? Reach me at **yli@usgcrp.gov**

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