



Global Energy and Water Cycle Exchanges Project

GEWEX/GLASS process-based verification projects

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On behalf of the **GLASS panel** and **GLASS co-chairs Kirsten Findell** (NOAA GFDL) & **Anne Verhoef** (University of Reading), incoming GLASS co-chair **Nathaniel Chaney** (Duke University), and **Peter van Oevelen** (director, International GEWEX Program Office).

38th session of the Working Group on Numerical Experimentation (WGNE-38)

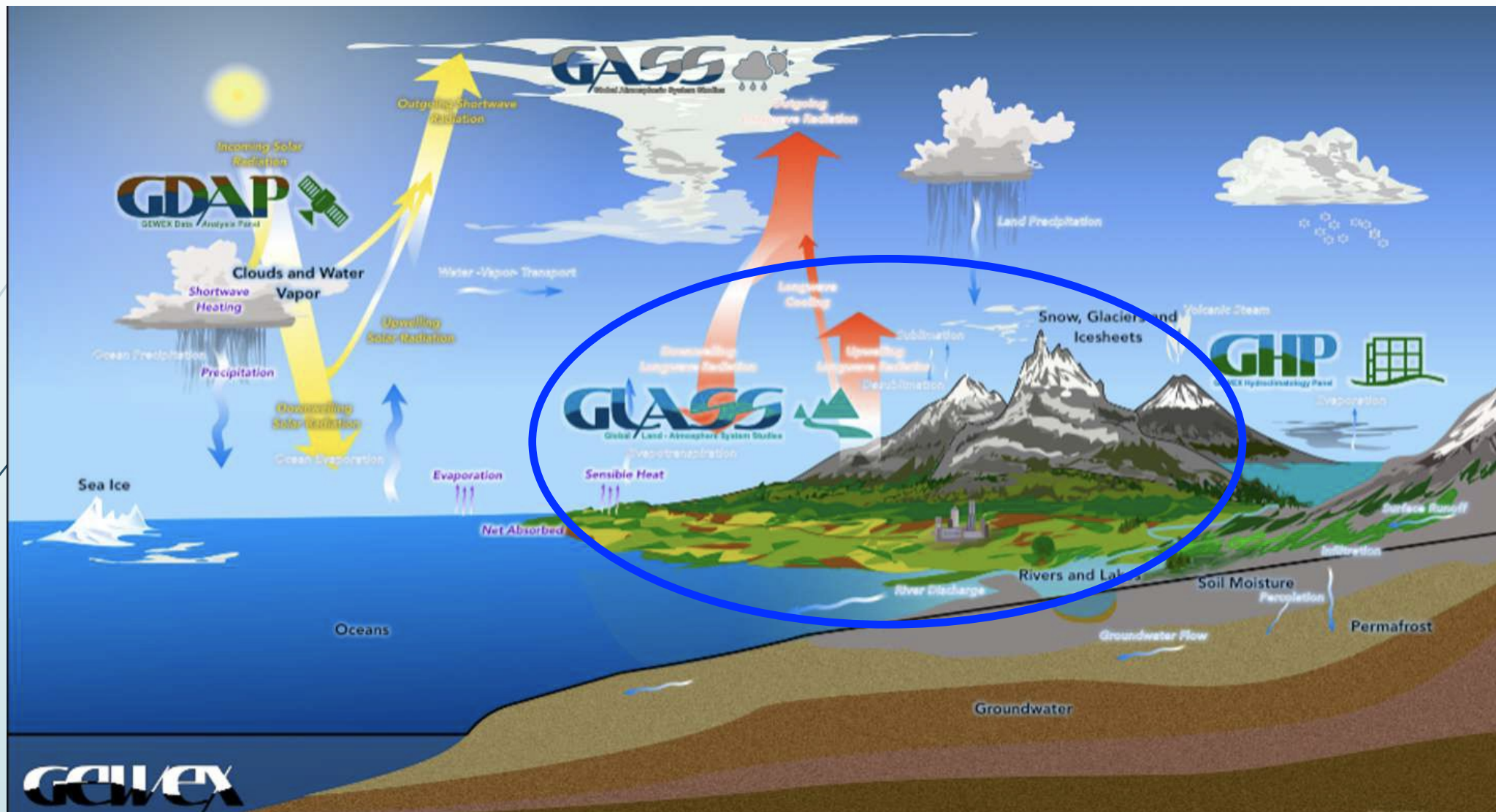
São José dos Campos, SP, Brazil, 27 November – 01 December 2023

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GEWEX's Four Panels



- **GDAP:** GEWEX Data Analysis Panel
- **GASS:** Global Atmospheric System Studies
- **GLASS:** Global Land-Atmosphere System Studies
- **GHP:** GEWEX Hydroclimatology Panel

Global Datasets Analysis and Assessments

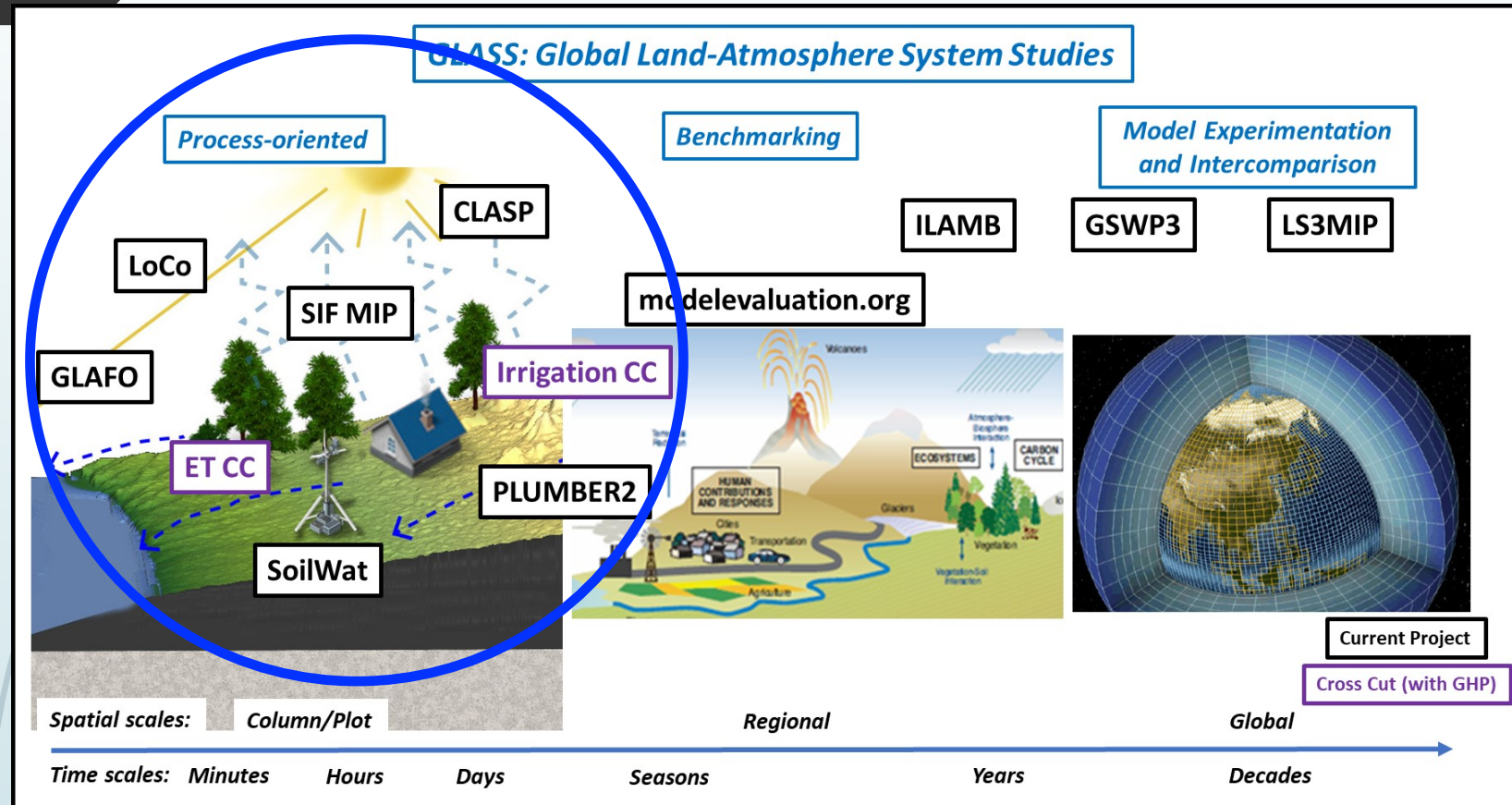
Atmospheric Processes - Dynamics

Land Processes and Land-Atmosphere Interactions

Regionally Focused Processes and Hydroclimate Projects

WGNE-relevant: Process-oriented GLASS projects

3



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

- **LoCo**: Local Coupling Working Group.
- **GLAFO**: GEWEX/GLASS Land-Atmosphere Feedback Observatories.
- **SIFMIP**: Solar-Induced Fluorescence MIP.
- **CLASP**: Coupling of Land and Atmospheric 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.
- **Cross Cut (CC)**: projects with GEWEX/GHP on Irrigation and on Evapotranspiration and Irrigation.

WGNE-relevant: Process-based verification

- **Standard verification** of land-related variables in Earth system models for weather (NWP) and climate often uses:
 - **near-surface** routine weather observations of air temperature, humidity & 10-m wind, precip.
 - **upper-air profiles** (T, q, U).
 - also e.g. MJO, ENSO indices for subseasonal-seasonal, etc.
- For a more comprehensive process-based land-related verification, use:
 - **surface fluxes, PBL profiles.**
 - **soil and land states:** soil temperature, moisture & ice, and vegetation cover & density.
 - streamflow/river discharge (for hydrology).



WGNE-relevant: LoCo, GLAFO, CLASP

5

LoCo

Local Land-Atmosphere Coupling (LoCo) Project:

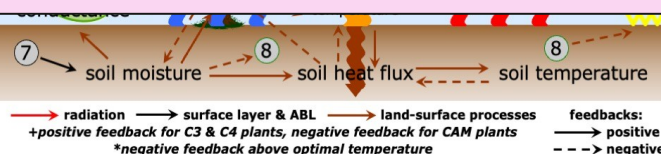
- Understand, quantify, model, and predict the role of local land-atmosphere coupling in the evolution of land-atmosphere fluxes and state variables and the respective water and energy cycles, including clouds.

Local Land-Atmosphere Interactions



Process-based verif.:

PBL profiles, land-atmosphere coupling metrics.



GLAFO

GEWEX Land/Atmosphere Feedback Observatory:

- Understand land-atmosphere feedbacks over different large-scale forcing regimes and characterize coupling strength with observation of surface, PBL and entrainment fluxes.

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Process-based verif.:

Superior observations of subsurface states and processes, surface fluxes, PBL profiles (T, q, U & fluxes), PBL-top **entrainment fluxes**, land-atmosphere coupling metrics.

CLASP

Coupling of Land and Atmospheric Subgrid Parameterizations:

- Enable interaction between “tiling” approach over land and existing atmospheric sub-grid schemes. Moves beyond the uniform land and atmosphere assumptions. Modeling & obs.

Uniform atmosphere to heterogeneous land

Uniform land to heterogeneous atmosphere

Process-based verif.:

Grid-averaged and subgrid atmospheric variables (T, q, U), PBL and surface fluxes, and corresponding land-atmosphere coupling metrics.



PLUMBER

Protocol for the Analysis of Land Surface models (PALS) Land Surface Model Benchmarking Evaluation Project, Phase 2:

- Comparison of multiple land models with 170 Fluxnet sites. Focus on surface fluxes and net ecosystem exchange compared with empirical models--which still win the “beauty” contest!



Process-based verif.:
Surface fluxes.
BGC-relevant information.



SoilWA

Soil-Water in Earth System Models:

- Understand and improve soil hydraulic and thermodynamic processes, and soil-plant representation in Earth system models. “Soil-Cloud Cascade” connections with LoCo, CLASP. Improve soils data sets. A joint project between with GEWEX & Int’l Soil Modeling Consortium.



Process-based verif.:
Soil moisture, soil temperature, soil ice.
Soil hydraulics and thermodynamics.

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dET

Determining Evapotranspiration (dET):

- Key term in Earth’s water and energy budgets. Evaluate ET schemes and observations.

Process-based verif.:
ET and ET-components.

Irrigation CC

Irrigation representation in Earth system models:

- Global irrigation withdrawals.

Process-based verif.:
Locations and timing of:
Surface water application.
Subsurface and groundwater extraction.



9th The Global Energy and Water Exchanges Open Scientific Conference



Water
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Climate

水
•
気 候



7-12 July 2024
Sapporo, Japan
Keio Plaza
Hotel



Join us in beautiful Sapporo, Japan, to
address the challenges facing humanity
in terms of freshwater availability and
associated disaster risk reduction and
the sustainable development in the
context of climate change and human
activities.

<https://www.gewexevents.org/meetings/gewex-osc2024/>



GEWEX
The Global Energy and
Water Exchanges
Program



Thank you!

See: GLASS webpages on the GEWEX website:

<https://www.gewex.org/panels/global-landatmosphere-system-study-panel/>