

***GEWEX
Global Land/Atmosphere System Study (GLASS)***

**Michael Ek (NCAR)
Kirsten Findell (GFDL/NOAA)
GLASS Co-chairs**

GLASS panel members and other GEWEX collaborators

**The 31st GEWEX Scientific Steering Group meeting
February 2019**

GEWEX Global Land/Atmosphere System Study (GLASS)

CHARGE FOR MONDAY: Summary of GLASS

***Focus on issues (what did not work, what hampers progress etc.)
and strategy (what you plan to do).***

GLASS Leadership



Paul Dirmeyer



Jan Polcher



Andy Pitman



Taikan Oki



Ann Henderson-Sellers

OUR FOUNDERS!

PILPS ERA



Bart van den Hurk



Martin Best



Joe Santanello



Aaron Boone



Mike Ek



Gab Abramowitz

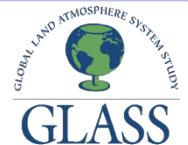


Kirsten Findell

FORMER/CURRENT CO-CHAIRS



GEWEX SSG-31
Geneva, Switzerland, 25-28 February 2019



GLASS Vision and Mission

The 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 vagaries of climate. Extremes of droughts, heat waves and wildfires, as well as floods, heavy rains, and intense storms increasingly threaten to cause havoc as the climate changes. Other challenges exist on how clouds and aerosols affect energy and climate. Better observations and analysis of these phenomena, and improving our ability to model and predict them, will contribute to increasing information needed by society and decision makers for future planning.

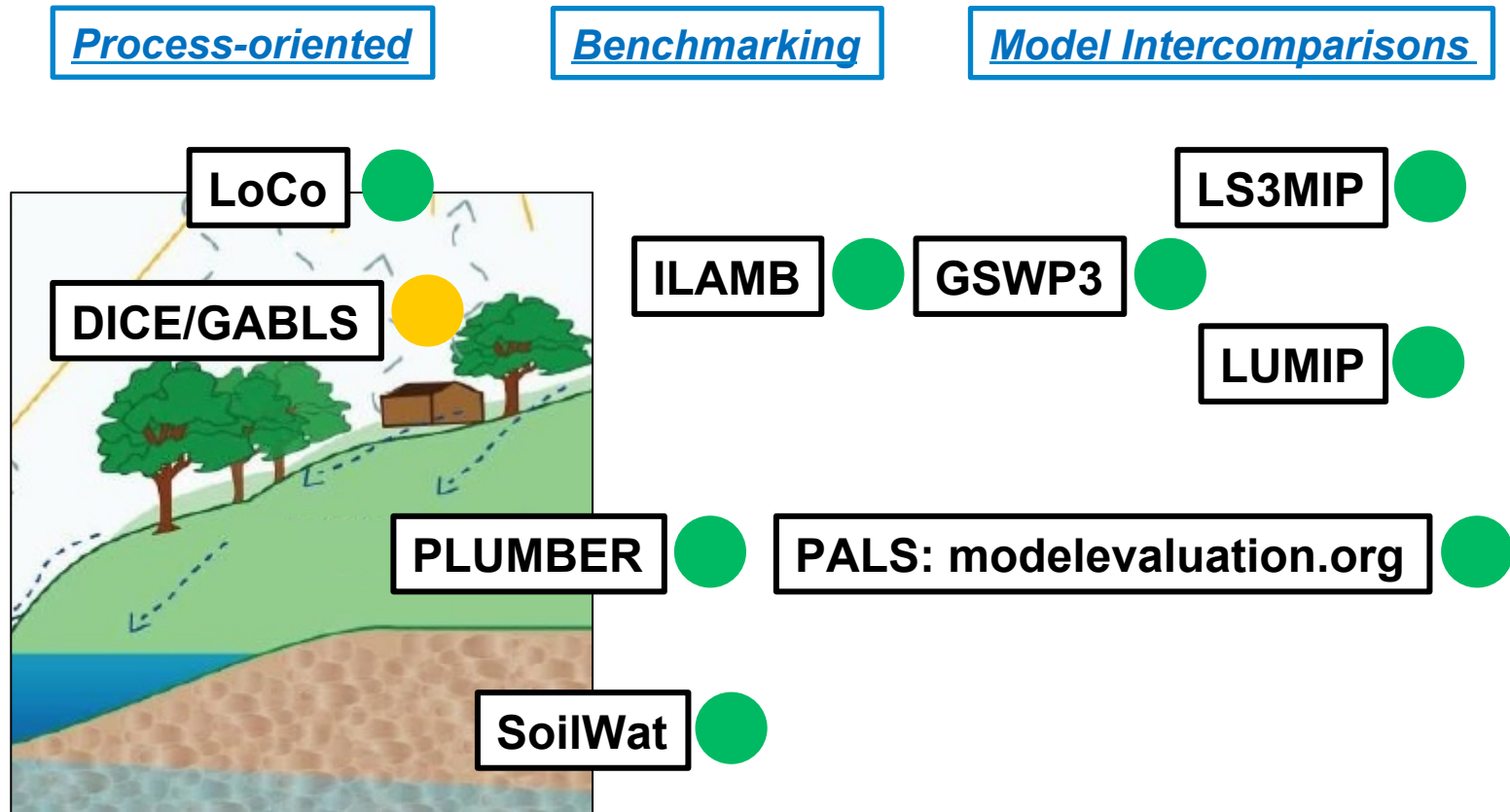
GLASS role: Better representation of the Earth System by understanding the role of land.

The GEWEX 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 interaction, thereby providing the scientific underpinnings of climate services.

GLASS role: Identify and improve modeling of land-surface processes and land-atmosphere interactions to support the GEWEX Mission.

GLASS Structure



Thanks, Kirsten!

GLASS Projects

BENCHMARKING:

- PALS** Protocol for the Analysis of Land Surface models
- PLUMBER** PALS Land sUrface Model Benchmarking Evaluation pRoject
- ILAMB** International Land Atmosphere Model Benchmarking activity
- GSWP3** Global Soil Wetness Project phase 3
- SoilWat** GEWEX Soils and Water initiative

LAND-ATMOSPHERE INTERACTION:

- LoCo** Local (land-atmosphere) Coupling
- LS3MIP** Land surface, snow, and soil moisture MIP (CMIP6)
- LUMIP** Land Use Model Intercomparison Project (coupled, uncoupled)

GLASS Projects: Cross-cuts/Collaborations

Cross-Cutting projects/actions:

PALS, PLUMBER – LSM benchmarking, links to GSWP3 / LMIP / **ILAMB**

GSWP3 – Links to carbon community (iLEAPS), LMIP (CMIP6)

LS3MIP – (like **GLACE-CMIP5**) CMIP6 endorsed

LUMIP – Land use/change, links to iLEAPS, heritage of LUCID, CMIP6-endorsed

LoCo –assessment of land-atmosphere interaction/coupling diagnostics.

DICE/GABLS Joint with GASS: DIurnal land/atmosphere Coupling Experiment, DICE-1/grassland, and GEWEX Atmospheric Boundary LayerStudy GABLS4/*DICE-over-ice* (Dome C, Antarctica)
Mike won't let this go.

Recently launched or to be launched:

SoilWat - datasets, improved soil process representation, parameter sensitivity understanding - potential links with GDAP, GHP

PLUMBER2 – as for PLUMBER above

Land DA – formerly “PILDAS” component to part of PLUMBER2

GLASS Issues: Some from previous SSG action items

Models “broadening” (e.g. water/energy, carbon/BGC, human impacts) and disciplines colliding to answer larger questions. How to enhance cooperation? *How to balance adding further complexity to our models (both NWP and climate) in order to better represent the Earth System, with what’s practical... in terms of compute resources, observable/measurable quantities and parameters, AND partnerships in doing all of this.*

Physical processes: *Further study on:*

Cold season/high latitude processes.

Hydrology: Groundwater & (Distributed) Hydrology (include in PLUMBER2).

Anthropogenic processes/Water Mgmt/Urban (including land-atmos interact).

Semi-arid processes (LIAISE). GHP-led

High resolution/scale dependencies ($\sim 10^2$ m/LSM “grey zone”)? GASS, WGNE.

WCRP review, “Back to Basics” process-level, weather AND climate.

Focus be on specific events/phenomena such as drought (via seasonal and interannual) prediction as well. *How to prioritize?*

From 2018 SSG-30 Recommendations:

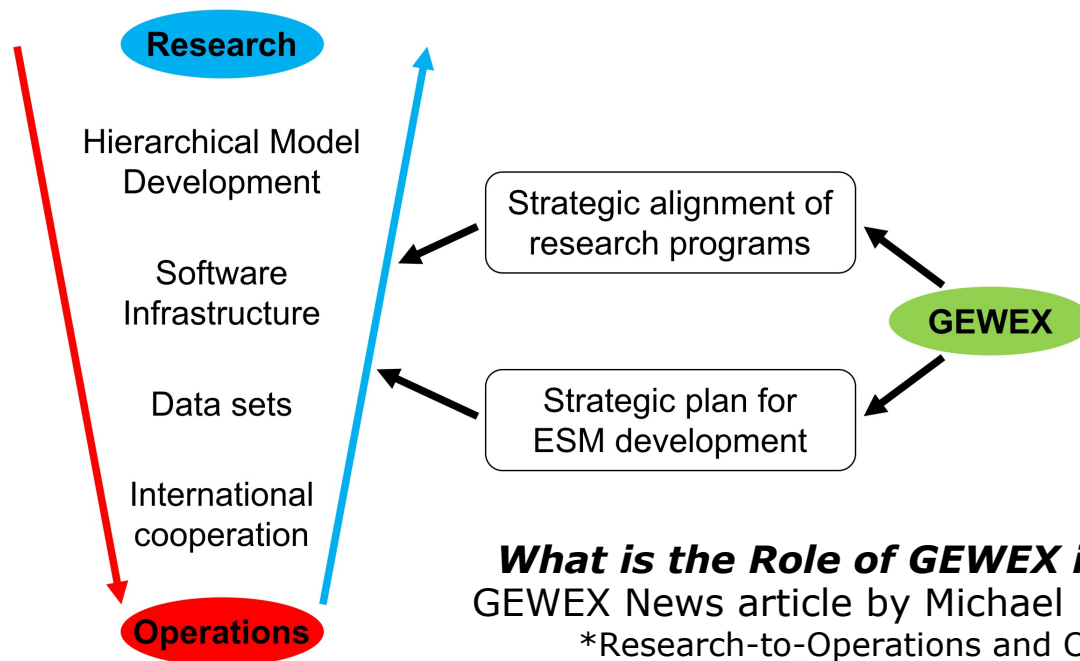
“Plan joint workshop with GASS on the PBL,

Involve CLIVAR(?) and iLEAPS (land and water use, human element),

Examine LUMIP to see what else to do.” –see Dave’s slides on Wednesday.

GLASS: key science questions in the next 5-10 years

- **How to most effectively improve our Earth System models?** Perhaps component-by-component with increasing levels of coupling, building to a fully-coupled system; a thorough “model development hierarchy” with benchmarks at each level. GLASS activities would be one part of that development chain, e.g. land-only studies and testing (e.g. PALS/PLUMBER), coupled columns (DICE), regional coupling (LoCo), and so on. This would require an extensive “data mining” effort, and in time a highly multi-disciplinary effort, but potentially quite effective and efficient. **Great potential for Pan-GEWEX cooperation.**



What is the Role of GEWEX in R2O and O2R*?
GEWEX News article by Michael Ek and Xubin Zeng.
*Research-to-Operations and Operations-to-Research

GLASS Issues: Interaction with other GEWEX panels and other external groups

GASS: GABLS/DICE a good example. Further DICE SCM studies. *Need (many) more data sets.*

How to strengthen GASS activities with relevance to GLASS (and vice versa)? Radiation. *Evolving list of new GASS projects/initiatives with land importance.*

Collaborations with GDAP and use of satellite data sets could benefit GLASS *benchmarking and land-atmosphere interaction projects.*

GHP has been strengthened via the October 2016 joint GHP-GLASS workshop on water management, and joint sessions at GLASS and GHP meetings. *Now GHP new cross-cut on ET.*

Strengthen interaction with other WCRP groups, e.g. CliC (cryosphere/cold season processes). *Minimal action beyond "discussions".*

Strengthen interaction with "outside" groups, e.g. ILEAPS (BGC cycles, land-atmosphere chemistry). *Mutual interest in land.*

Status of RHP in US still uncertain. *Partner with GHP, others.*

Pan-GLASS meeting in 2020? *Include joint sessions with relevance to GASS, GHP, GDAP, others. Summer meeting in UK—joint with iLEAPS?*

GLASS: The year ahead

2019 *looks to be an active year*

- **Many projects are prepared for model intercomparisons** (and more) as part of CMIP6: LUMIP, LS3MIP, GSWP3, PLUMBER2, modevaluation.org (PALS), ILAMB.
- **Re: PLUMBER2**, lots of discussion (led by Sujay Kumar) on how/what to include in regards to land data assimilation in PLUMBER2.
- **Land-Atmosphere Interactions** are showing up as a focus for many modeling centers and program offices: LoCo members are contributing heavily to these efforts. *Can related DICE be re-spun up?*
- **SoilWat** has an active body of scientists diving into individual soil-relevant process representations.
- Participation in new **GASS/related** projects, re: process level studies. *How to contribute to Process Evaluation Study (PROES)? Already doing some of this in the use of earth observations. Advance process-level understanding. WCRP review: "Back to Basics". Processes connect weather to climate.*

GLASS Panel Membership

Co-Chairs:

Michael B. Ek
National Center for Atmospheric Research
Boulder, Colorado, USA
January 2015-December 2020

Kirsten Findell
Geophysical Fluid Dynamics Laboratory, NOAA
Princeton, New Jersey, USA
January 2019-December 2022

Members:

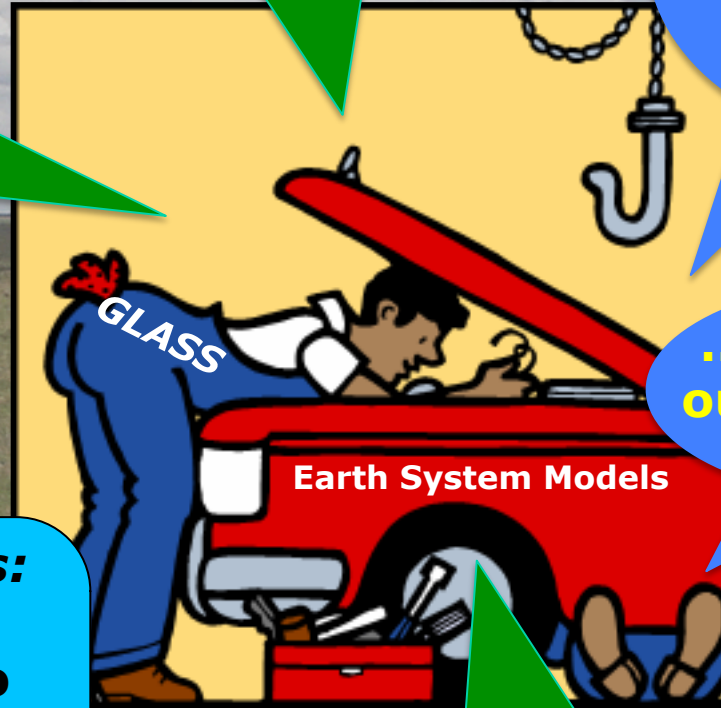
Gab Abramowitz, UNSW
Eleanor Blyth, CEH
Souhail Boussetta, ECMWF
Nathan Brunsell, U. Kansas
Martyn Clark, U. Saskatchewan
Paul Dirmeyer, George Mason U.
John Edwards, UKMO
Craig Ferguson, SUNY-Albany
Pierre Gentine, Columbia U.
Chiel van Heerwaarden, Wageningen U.
Hyungjun Kim, U. Tokyo
Sujay Kumar, NASA
David Lawrence, NCAR
Aude Lemonsu, CNRM-Météo France
Pere Quintana Seguí, Ebro Observatory
Joshua Roundy, U. Kansas
Joseph Santanello, NASA
Anne Verhoef, U. Reading
Tomo Yamada, Hokkaido U.
Kun Yang, Tsinghua U.

Uh oh! These surface fluxes don't look so good.

Ugh! Look at the hydrology in this thing! It's leaking everywhere!

..and you're also going to need an atmospheric alignment to get the right interactions.

...and its carbon output is way too high...



Earth System Modellers:
But I like it like this:
I don't want to have to recalibrate my driving variables (...what about my forecast metrics..!?)
How much will this COST?!

Well... at least **SEVERAL** more funding cycles.

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