Land Model Working Group

LMWG Update

Will Wieder & Charlie Koven

LMWG co-chairs

Feb 32, 2021

This material is based upon work supported by the National Center for Atmospheric Research, which is a major facility sponsor ed by the National Science Foundation under Cooperative Agreement No. 1852977.

NCAR | NATIONAL CENTER FOR ATMOSPHERIC RESEARCH

Here we value respectful dialogue, please...

Offer Constructive Feedback

Consider New Ideas

Share The Air

NCAR UCAR

Show Appreciation

Acknowledge Teamwork

Encourage Innovation

www.cgd.ucar.edu/diversity

NCAR

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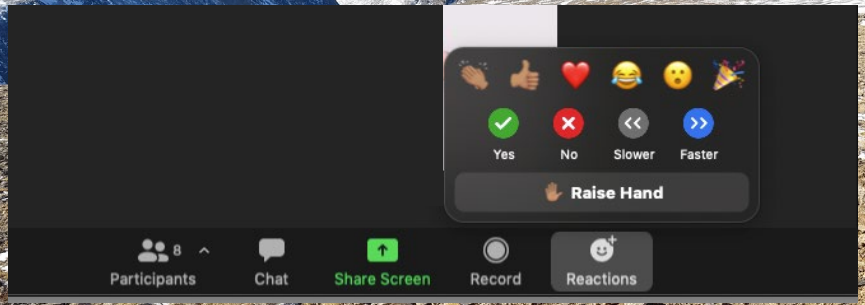
- Raise hands
- Use the chat!
- 12-minute presentations
- Virtual coffee break



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LMWG Andrew Slater Award

Since 2018 the Slater Award will be given out annually for the "best student or postdoc performance" at the meeting. We hope that this award will help us all to remember the special way that Drew went about being a scientist and further that it will inspire young scientists to follow in his footsteps. Drew's way included a dedication to deep understanding of his research topics from theoretical, observational (fieldwork) and modelling angles, and also involved a certain irreverence for the status quo.

LMWG Andrew Slater Award

2020 Recipients

Leah Birch
Woods Hole

Jessica Needham
Berkeley Lab

CESM Distinguished Achievement Award

CESM Graduate Student Award

2020 Recipients

Dave Lawrence

Daniel Kennedy

- Model Developments
- Community Projects
- Upcoming Work

CTSM5.1


David Lawrence
Bill Sacks
Sunniva Indrehus
Gregory Lemieux (he/him)
Ryan Knox
Sam Levis
Erik Kluzek he/him/his
Negin Sobhani

Perform gridcell-level water balance checks bracketing the entire run loop #201 (C & N, CH_4, H_2O)

CTSM5.1

Atmospheric Fluxes

- Updated PFT optical properties [Keith Oleson]
- New urban datasets & building property parameterization [Keith Oleson]
- **Biomass heat storage [Sean Swenson]**
- Snow burial of vegetation [Danica Lombardozzi]

Crop Model

- Bioenergy crop [Yanyan Cheng & Maoyi Huang]
- Winter wheat [Yaqiong Lu], implemented but not currently used

Hydrology

- Irrigation [Bill Sacks & Sean Swenson]

Ecosystems & Biogeochemistry

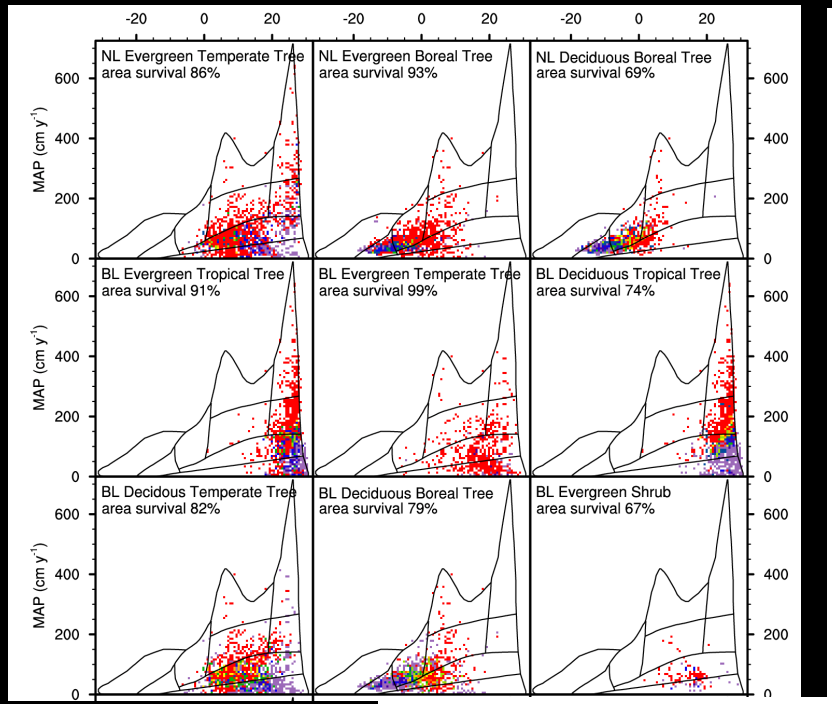
- Fire Model: bug fixes, improvements, & re-tuning. Focus on improving deforestation and degradation fires [Fang Li]
- **Arctic/Boreal phenology & allocation changes [Leah Birch]**
- **CN-Matrix calculations for ecosystem biogeochemistry [Chris Lu & Yiqi Luo]**
- Aerosols: FAN (NH3 emissions) [Julius Vira & Peter Hess]
- **FATES [Rosie Fisher, Charlie Koven Jackie Shuman & many more] Including FATESsp, no competition, and other simplified configurations.**

Features

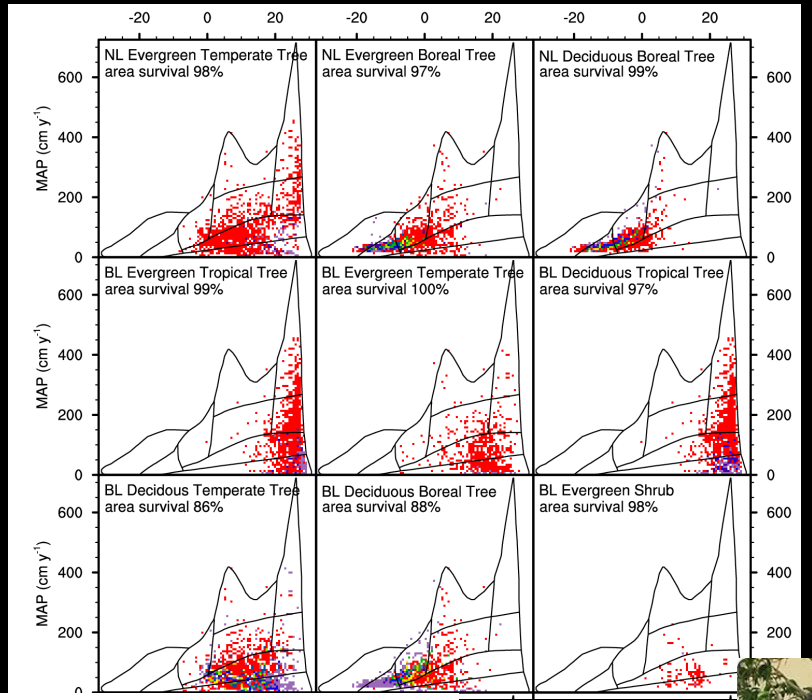
- **WRF-CTSM beta release [Dave Lawrence & more]**
- No anthro compsets: turn off irrigation, crop, urban, LULCC, fire
- Prescribed soil moisture [Sean Swenson]
- Soil and snow layer flexibility + trimming land units & PFTs [Sam Levis & Bill Sacks]
- Moving hard coded parameters to parameter file [Keith Oleson]
- SSP-RCP anomaly forcing compsets for land only simulations
- Improved single point workflow for PLUMBER2 & NEON simulations [Keith O, Sean S., Will W, Danica L]

Survival Probability

CLM5.0

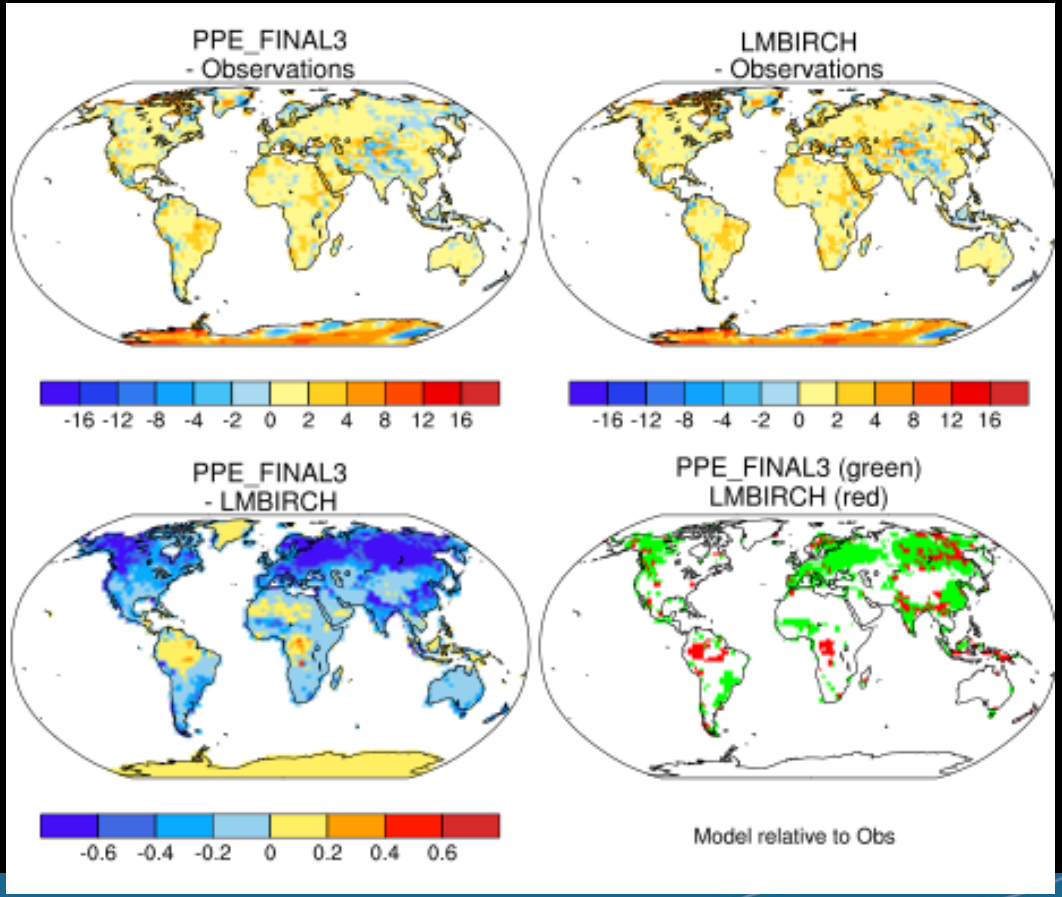


CTSM5.1



LUNA
Bugs +
Phenology

2m air temperature, annual



Biomass Heat storage

CTSM5.1

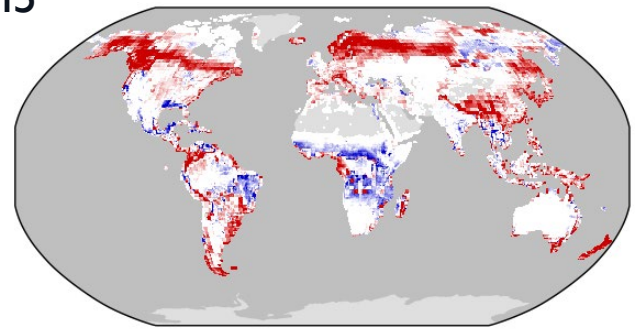
	CLM5	Phenology	CTSM5.1
Ecosystem and Carbon Cycle			
Biomass			
Burned Area			
Carbon Dioxide			
Gross Primary Productivity			
Leaf Area Index			
Global Net Ecosystem Carbon Balance			
Net Ecosystem Exchange			
Ecosystem Respiration			
Soil Carbon			
Hydrology Cycle			
Radiation and Energy Cycle			
Forcings			
Relationships			
BurnedArea/GFED4S			
GrossPrimaryProductivity/GBAF			
LeafAreaIndex/AVHRR			
LeafAreaIndex/MODIS			
Evapotranspiration/GLEAM			
Evapotranspiration/MODIS			

Relative Scale

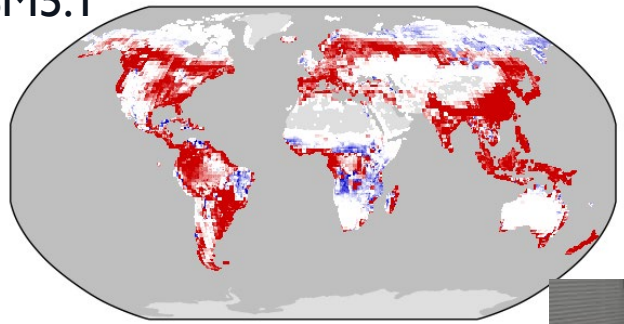
Worse Value — Better Value

LAI Bias

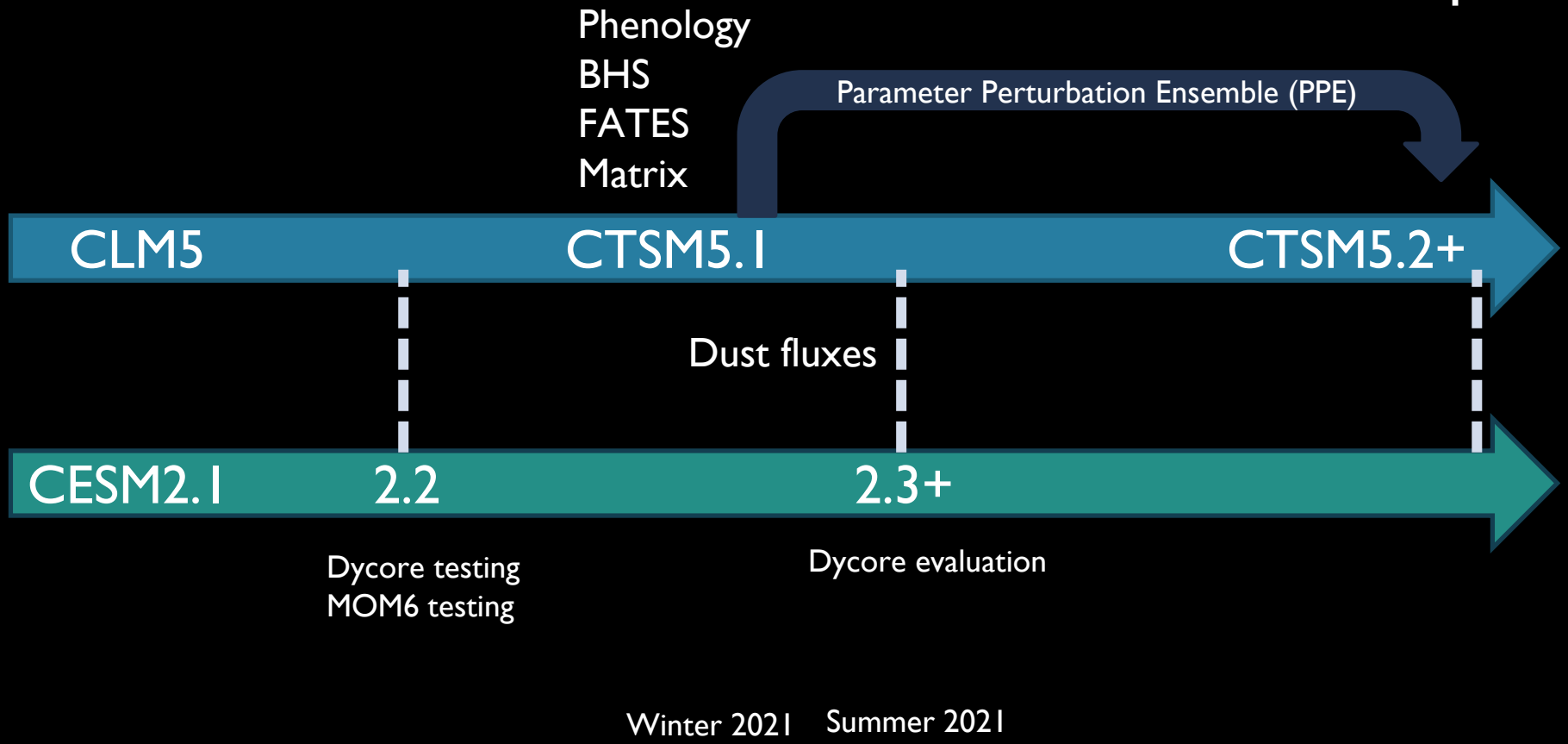
CLM5



CTSM5.1



LMWG Development



CTSM5.1 Simulations *

Completed by June 2021 CESM Meeting

**Suggested*

Forcing	CLM5.0sp	CLM5.0bgc-crop	CTSM5.1sp	CTSM5.1bgc-crop	CTSM-FATESsp	CTSM-FATES noComp
GSWP3	✓	✓	✓	✓	✓	✓
CRU-JRA	✓	✓	✓	✓		
F2000 CAM-CTSM			✓	✓	✓	✓
Fhist CAM-CTSM			✓	✓		
PLUMBER2 170 tower sites	✓		✓		✓	

LWMG Community Projects

CESM2-WACCM extensions to 2300
(Charlie Koven)
- SSP1-2.6
- SSP5-3.4OS
- SSP5-8.5

CESM2 SSP-RCP combinations
(Peter Lawrence)
- 3x SSP1-2.6 with 3-7.0 land use
- 3x SSP3-7.0 with 1-2.6 land use

CESM2-LE
(G. Danabasoglu & C. Desser)
- 100x SSP3-7.0

CESM2-CMIP5
(M. Holland & C. Hannay)
- 11x RCP8.5

SMYLE & S2S
(ESPWG, Steve Yeager & Yaga Richter)

TRENDY (Danica Lombardozzi)

PLUMBER2 (Keith Oleson)
- 170 Flux tower sites

Urban-PLUMBER (Keith Oleson)

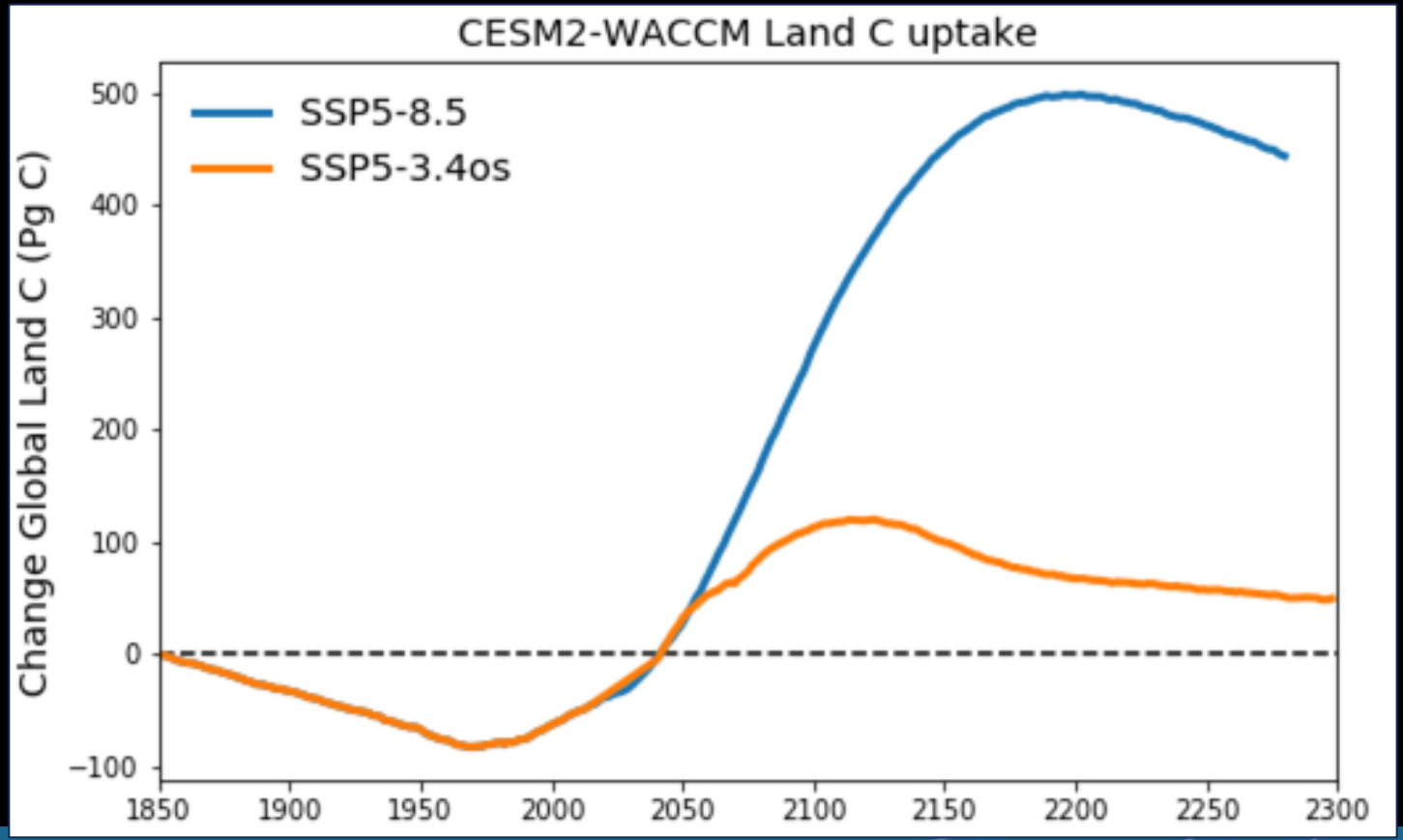
PPE (Dave Lawrence)

Fire (Simone Tilmes)

CAM6+/CTSM5.1(BGC-Crop) fully coupled historical fire emissions simulations planned to evaluate role of interactive fire emissions on 20th century climate trends

CESM2 *extensions*

LWMG Community Projects

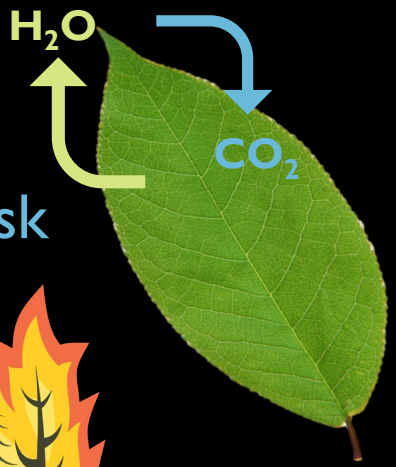


LWMG Community Projects

CESM2-LE

Water-carbon variability

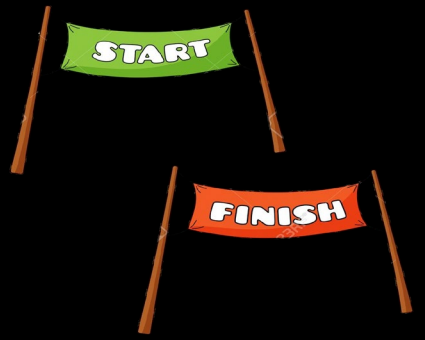
Water Use Efficiency



Fire Risk

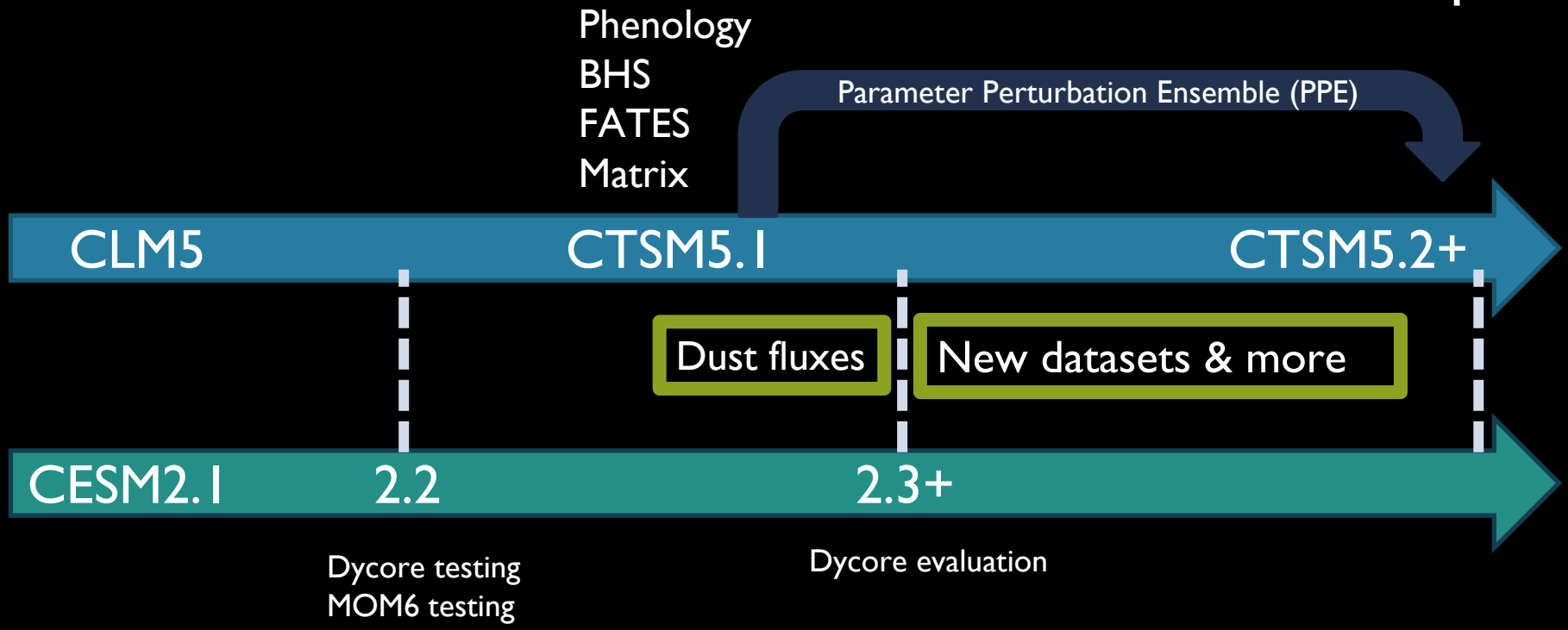
Extended Summer

Initial conditions



Food Production

LMWG Development



CTSM5.2+ Developments

Atmospheric Fluxes

- Dust emissions [Longlei Li,& Natalie Mahowald]

Hydrology

- **mizuRoute [Naoki Mizukami & Erik Kluzek]**
- **Reservoir operations and dynamic lakes [Inne Vanderkelen]**
- **Representative Hillslope model [Sean Swenson]**
- Water isotopes [Bill Sacks]
- Excess Ice [Lei Cai]

Ecosystems & Biogeochemistry

- Terrestrial DOM fluxes and transport in river model [Dev Narayanappa]
- Ozone impacts on Jmax in LUNA [Stefanie Falk]
- MIMICS soil BGC model [Will Wieder & Elin Aas]
- FATES [Rosie Fisher, Charlie Koven Jackie Shuman & many more]

Crop Model

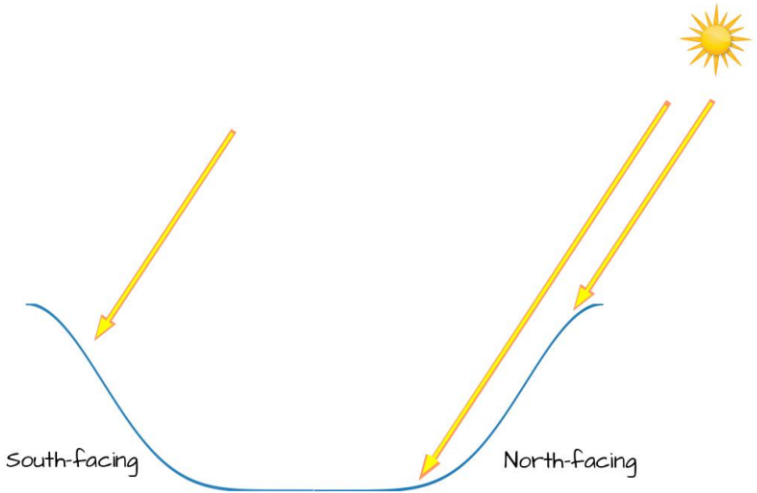
- **Shifting cultivation [Peter Lawrence]**
- APSIM crop phenology [Bin Peng]
- Tillage and crop residue management [Mike Graham & Danica Lombardozzi]
- **Soil degradation with Land Use [Johann Feddema, Pei-Ling]**

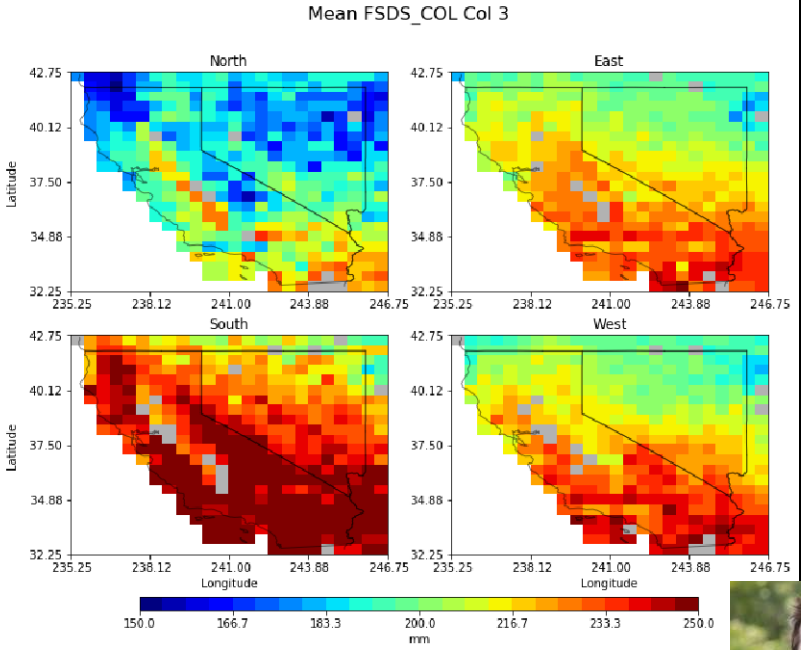
Features

- Improved workflow for single point simulations @ NEON sites, including tutorial materials for CESM-Lab [Danica L, Will W].

Representative Hillslope

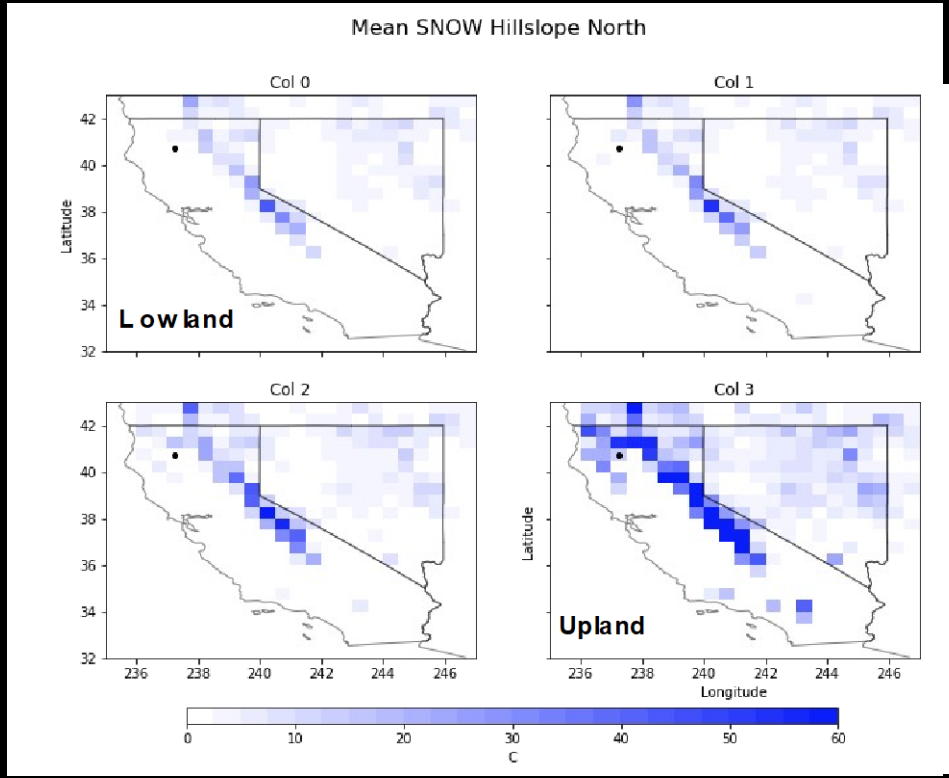
Slope and Aspect: Solar Forcing



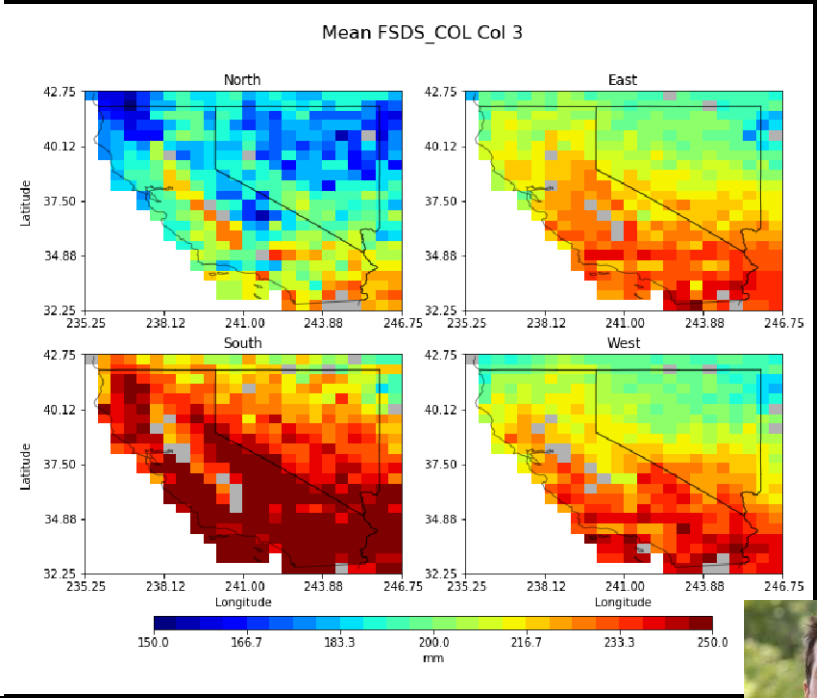


Representative Hillslope

Elevation: Precipitation Downscaling



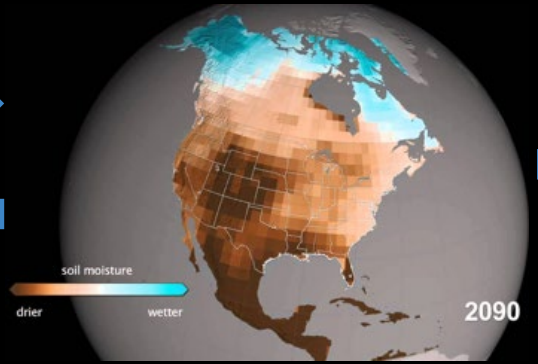
Solar Forcing



Simulating NEON Flux Towers

Developing a simple containerized cloud-based simulation system
Funded by NSF CISE/OAC, BIO, and GEO directorates

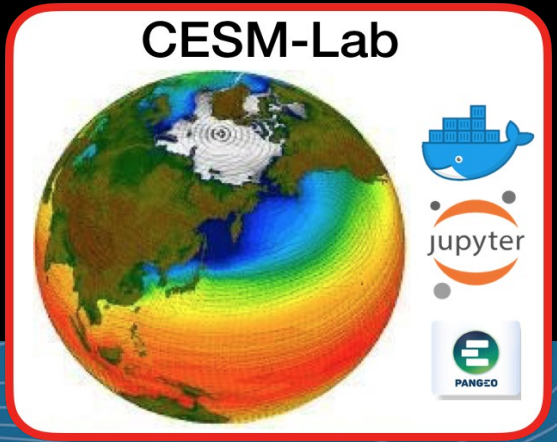
Processed NEON Data	Containerized Model System	Tools for Analysis

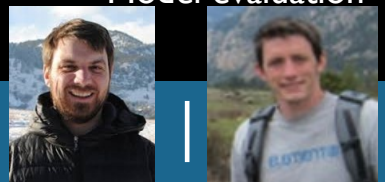


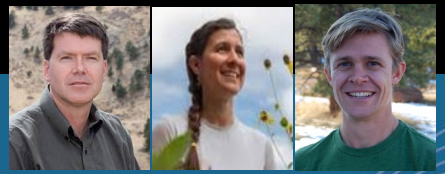
- Model Evaluation
- Ecological Forecasts
- New Scientific Discoveries

NEON Data
Gap filled meteorology
Site characteristics
Model evaluation

CLM Simulation
Ecosystem states and fluxes

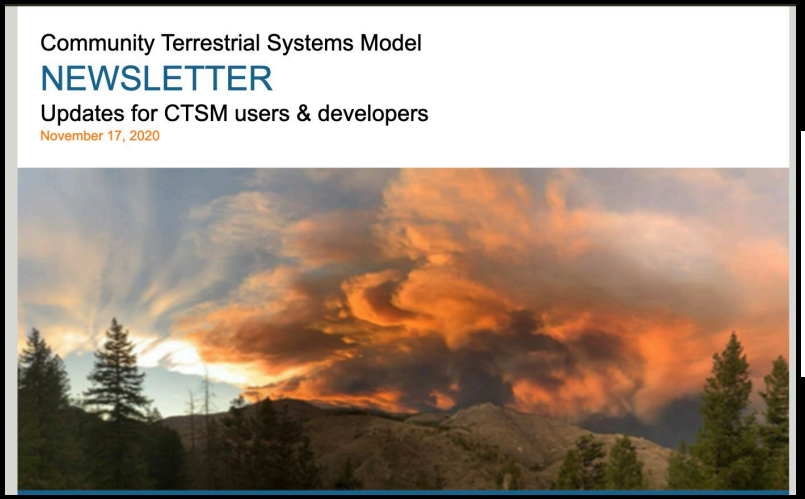






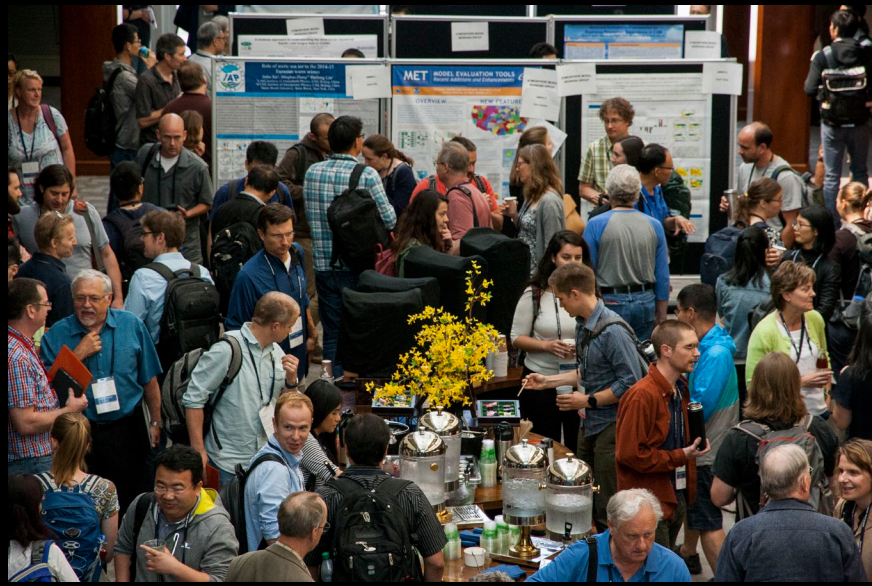
J. Edwards
B. Dobbins

Stay involved & connected!



Newsletter

GitHub



CESM Workshop &
Working Group Meetings