



# CESM Land Model and Biogeochemistry Working Group Meeting

*Will Wieder & Rosie Fisher  
LWMMG Co-chairs*

*Kristen Krumhardt, Abby Swann &  
Gretchen Keppel-Aleks  
BGCWG Co-chairs*

February 24, 2025

A scenic mountain landscape featuring a river flowing through a lush green meadow. In the background, there are dense evergreen forests and rugged mountains under a clear blue sky. A hiker is visible on a dirt path winding through the meadow.

Offer constructive feedback

Share the air

Encourage innovation

Listen to understand

Communicate context

Show appreciation &  
Acknowledge teamwork

Lunch discussion Tues in  
Damon Room & Google Meet

A scenic mountain landscape featuring a dirt trail winding through a lush green meadow. In the background, there are dense evergreen forests and rugged mountains under a clear blue sky. A small stream flows through the meadow on the left side. A person is visible walking on the trail in the distance.

## Meeting Goals:

- Share our science
- Seek out advice, suggestions, ideas
- Communicate priorities
- Discuss short and long-term goals
- Appreciate community & collaboration

Happy Hour today after meeting  
Southern Sun

Dinner Tues. 6:30  
Avanti (14<sup>th</sup> & Pearl St)

# LMWG Andrew Slater Award

Drew was a key member of the LMWG community who brought a deep dedication, understanding, and joy to his research, which he shared with everyone around him. Since 2018, winners of the Slater award have been made to WG members who make meaningful contributions to the LMWG including:

- Creative applications of the model;
- Significant model development activities;
- Identifying major issues, biases, or gaps in CTSM; and a
- High level of engagement with the LMWG



# LMWG Andrew Slater Award

2024 Linnia Hawkins

2023 Joshua Rady

2022 Claire Zarakas

2021 Yue Li

2020 Leah Birch

2019 Katie Dagon

2018 Marysa Laguë

CLM-U team:

Bowen Fang, Cathy Li,  
Joyce Yang, Keer Zhang

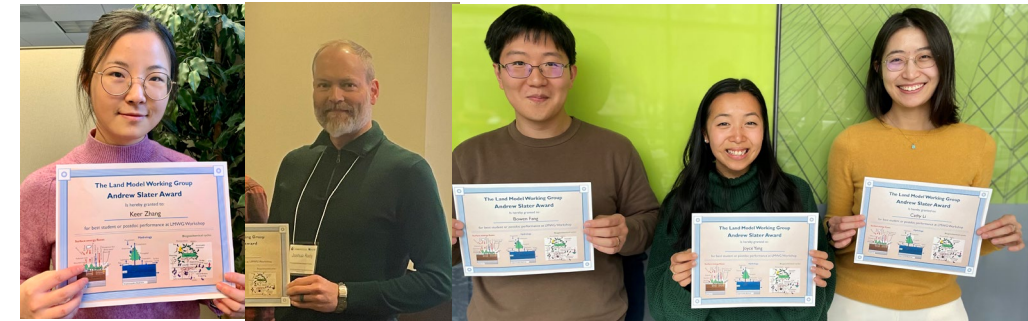
Yifan Cheng

Inne Vanderkelen

Jessica Needham

Meg Fowler

Daniel Kennedy



# LMWG focus areas: Ecosystems, Water & Food



- Science Highlights
- New Features & Capabilities
- New Directions

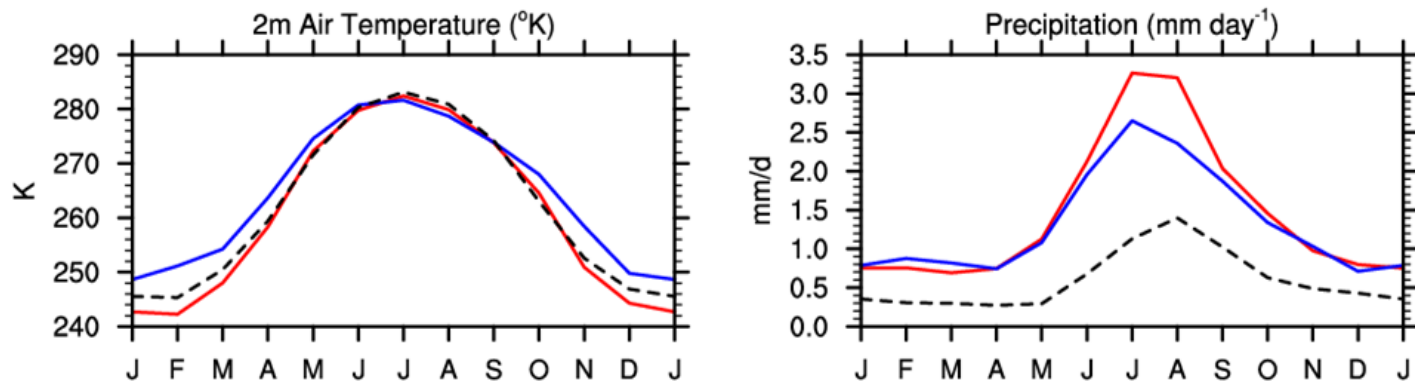
# Preparing for CESM3 & CMIP7



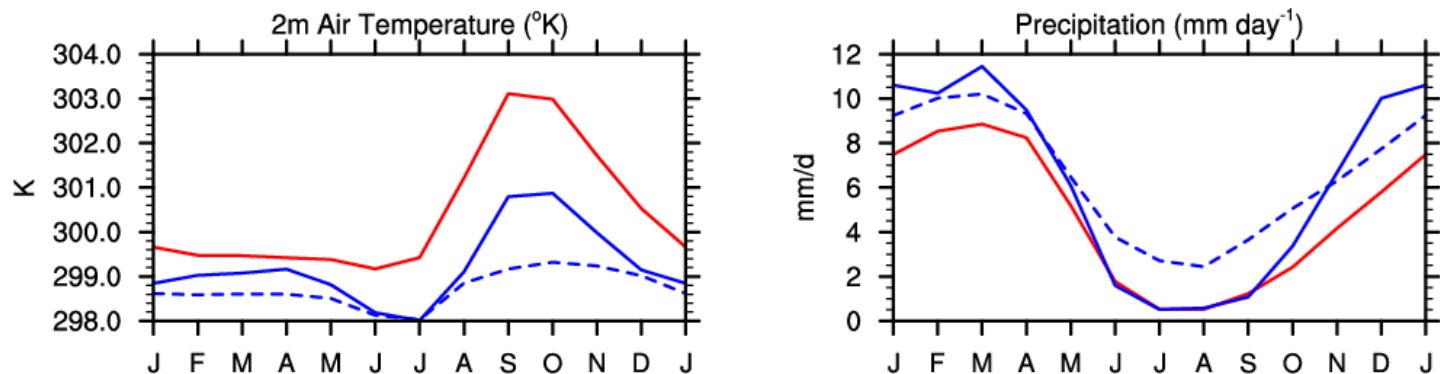
# Preparing for CESM3 & CMIP7

- Arctic
  - Colder winters, wet
- Amazon
  - Hot & Dry
- Tropical precip biases

## Alaskan Arctic (66.5-72N,170-140W)

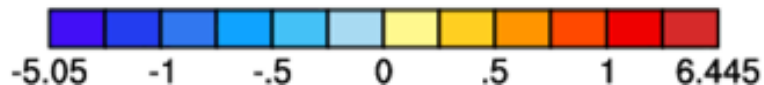
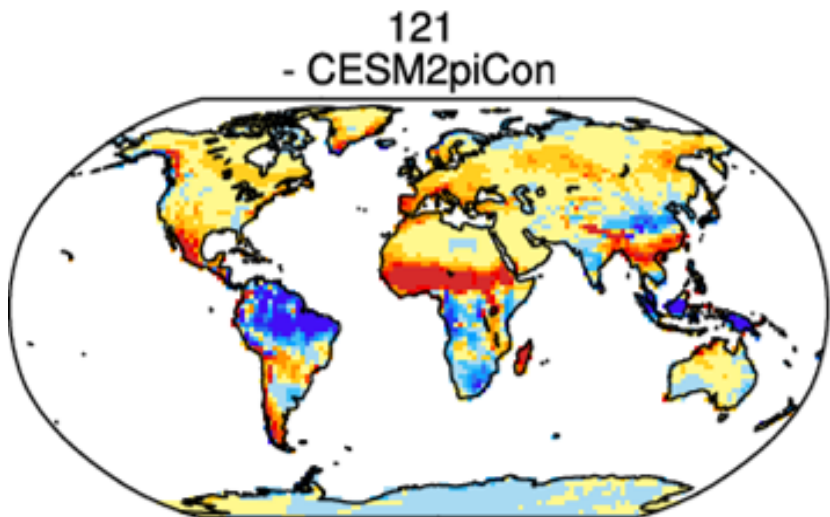


## Amazonia (10S-0,70-50W)



CESM2 PI control

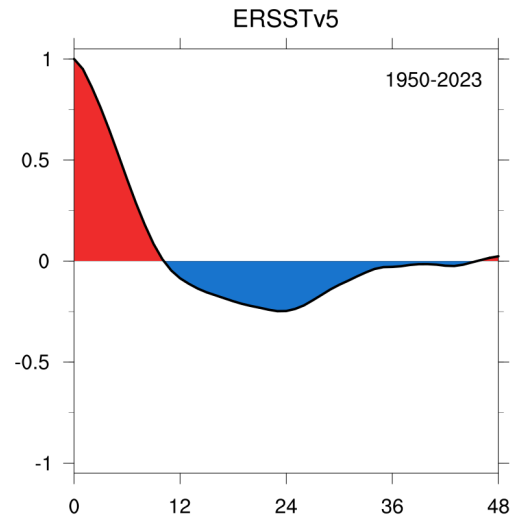
CESM3\_dev\_121



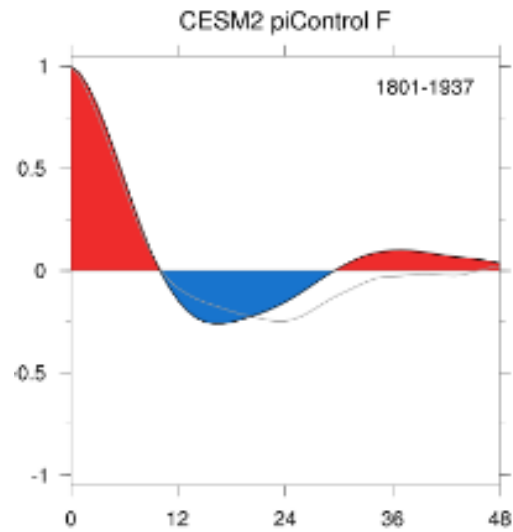


# ENSO Features

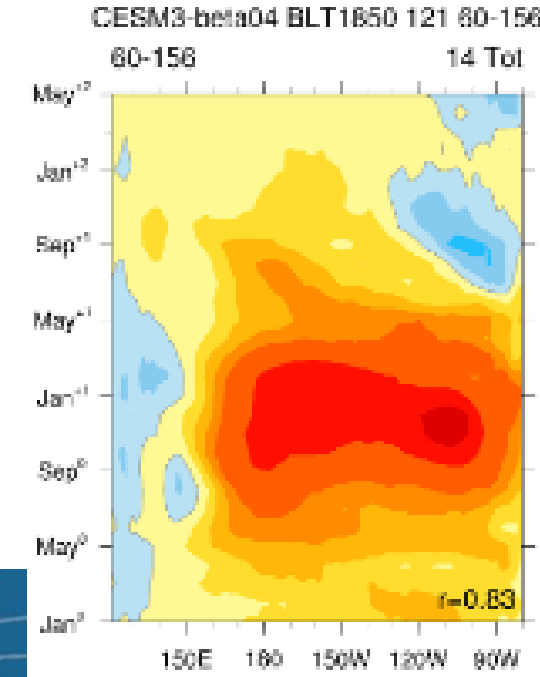
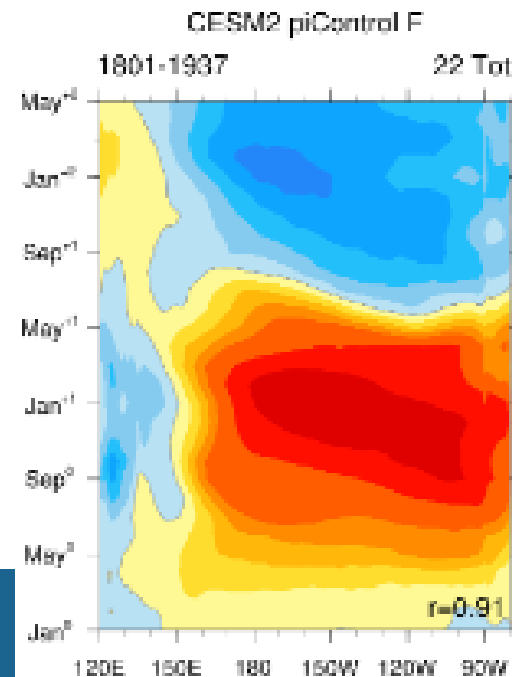
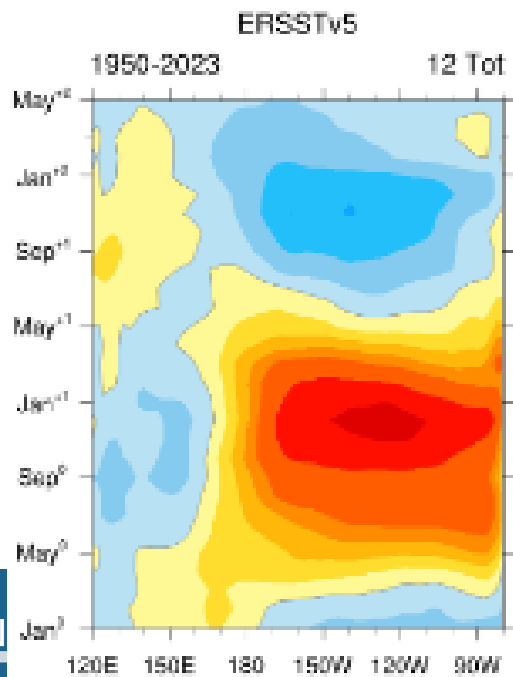
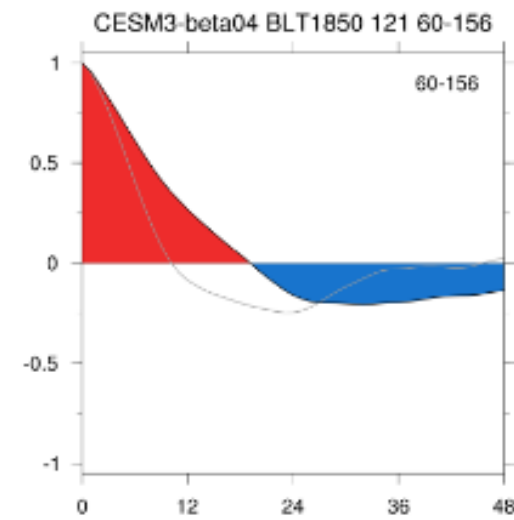
## OBS



## CESM2



## CESM3-dev\_121

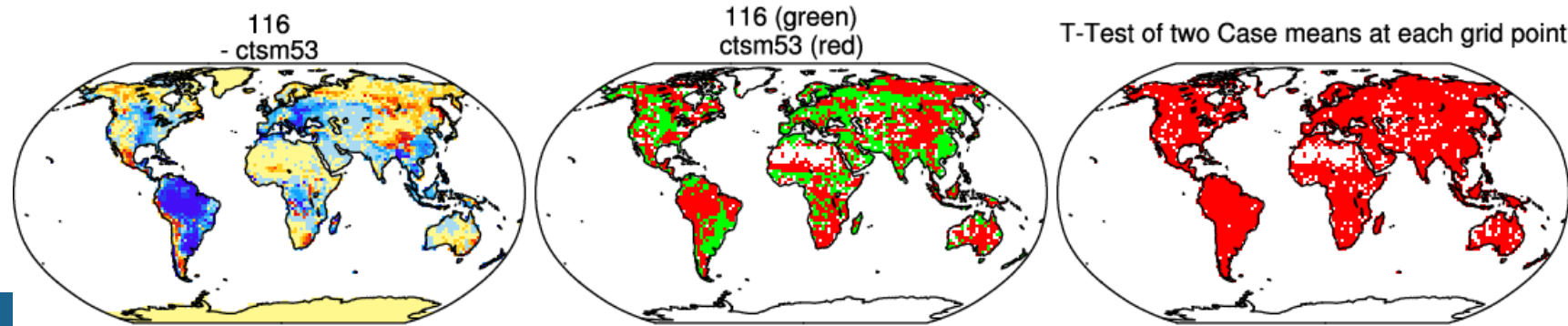
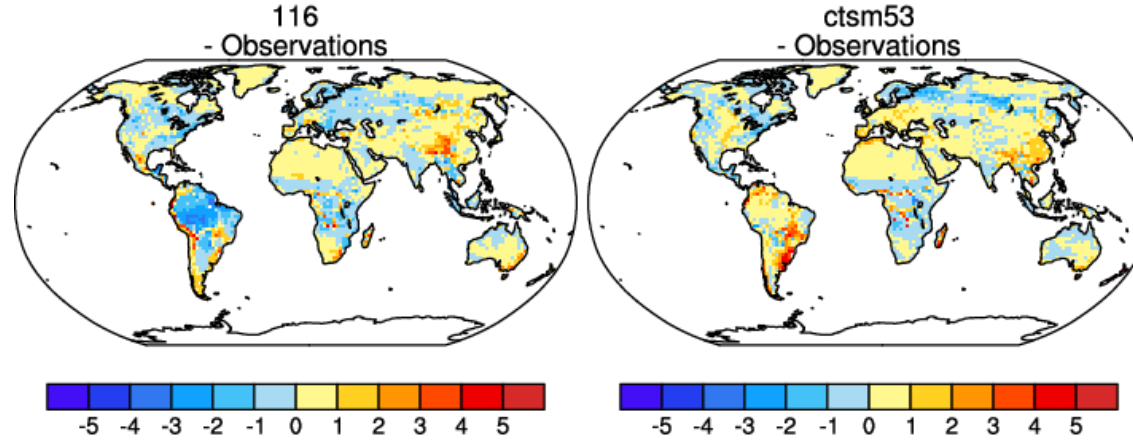
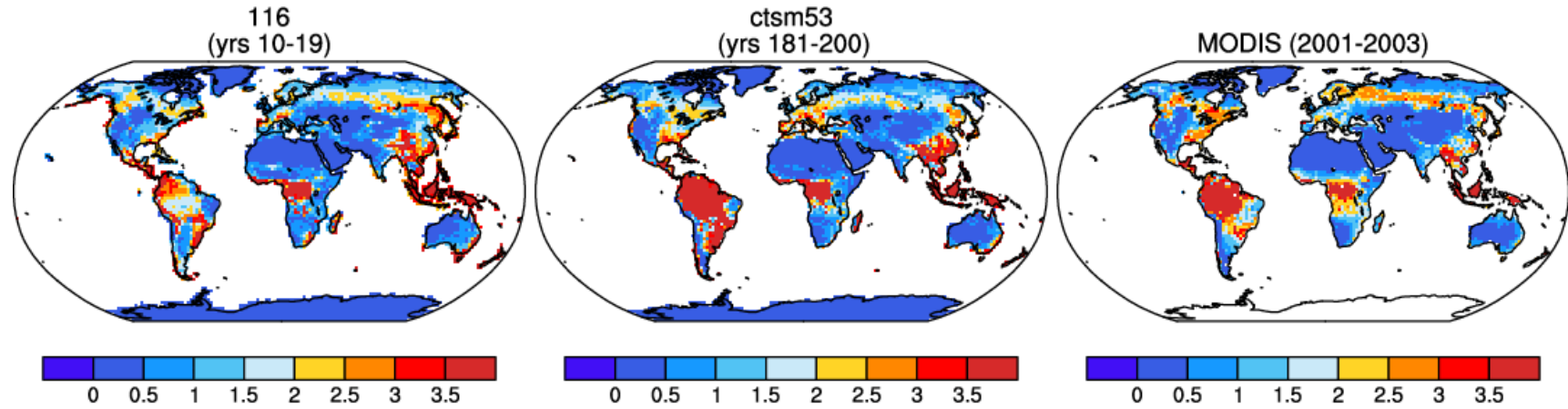


# ANN TLAI (m2/m2)

Coupled model !=  
Land only runs

CESM3 (#116) vs.  
CTSM5.3 (#69)

[Diagnostics link](#)



Model relative to Obs

Cells are significant at 0.1 level

# Tracking simulations on Github

[LMWG\\_dev](#)

[CESM\\_dev](#)

[AMGW\\_dev](#)

Links to diagnostics

Discussions

The screenshot shows the GitHub interface for the repository 'NCAR / LMWG\_dev'. The 'Issues' tab is selected, showing 22 open issues. The search bar contains 'is:issue state:open'. The issues list includes:

- Issue #89:** 1-deg I-case spin-up and historical to test new paramfile for CESM3 (ctsm53019\_f09\_BNF\_[AD, SASU, pSASU, hist]). Labels: Compset: I1850, Compset: IHIST, Feature: BGC, Feature: Crop. Opened on Jan 14 by linniahawkins. 35 comments.
- Issue #88:** 2-deg I-case spinup and historical baseline for PPE with BNF tag (ctsm53017\_f19\_BNF\_[AD, SASU, pSASU, hist]). Labels: Compset: I1850, Compset: IHIST, Feature: BGC. Opened on Dec 19, 2024 by linniahawkins. 23 comments.
- Issue #87:** FLT2000 jmaxb0 = 0.05 dmax = 10 upplim\_destr... = 250 (f.e30\_alpha04a.FLT2000BgcCrop.j5d10u250.lmwg\_dev\_87). Labels: Compset: F2000, Feature: BGC, Feature: Crop, Topic: Coupled model testing. Opened on Dec 16, 2024 by slevis-lmwg. 1 comment.

# CLM6 Highlights: CTSM5.3 tag

## New features

- Surface datasets updates & corrections
- Surface data incompatible with previous code (glacier changes)!
- [git-fleximod](#) replaced `manage_externals`
- Fix time on history files
- CN Matrix spinup ([Liao et al. 2023](#)).
- FATES compsets can now be run with transient land use.
- CAM7 in `LND_TUNING_MODE`.
- New initial conditions files (CRUJRA)
- Excess ice is turned on

## Science changes

- Dust Emissions Leung\_2023. ([Leung et al 2023](#), [Leung et al. 2024](#))
- Snow thermal conductivity method is now Sturm1997.
- Crop calendars from [Rabin et al., 2023](#)
- Explicit air conditioning for the urban model. ([Li et al. 2024](#))
- Updates to MEGAN for BVOCs
- New BGC fire method `li2024crujra` recalibrated against GFED5 burned area & CRUJRA
- New temperature function for Nfix, off for now. ([Bytnerowicz et al. 2022](#))
- PPE informed parameter updates for CRUJRA



# CLM6 DATM options

	Dataset	Spatial resolution	Temporal extent	Temporal resolution	Notes
CLM5	CRUNCEP	0.5 deg	1901-2016	6 hour	No longer updated Longwave not used.
	GSWP3	0.5 deg	1901-2014	1.5 hour	No longer updated. Low tropical humidity
CLM6	CRUJRA (Trendy)	0.5 deg	1901-2023	6 hour	No longer being updated?, Used for GCP & SMYLE land initialization. NO data over Antarctica.
	<del>ERA5</del>	0.25 deg	<del>1940-present</del>	<del>1 hour</del>	<del>Being updated, Known precip biases (among others) Candidate for initializing OMWG, ESPWG &amp; SIMA runs.</del>

Survival: #89

Improvements:

C4 grass

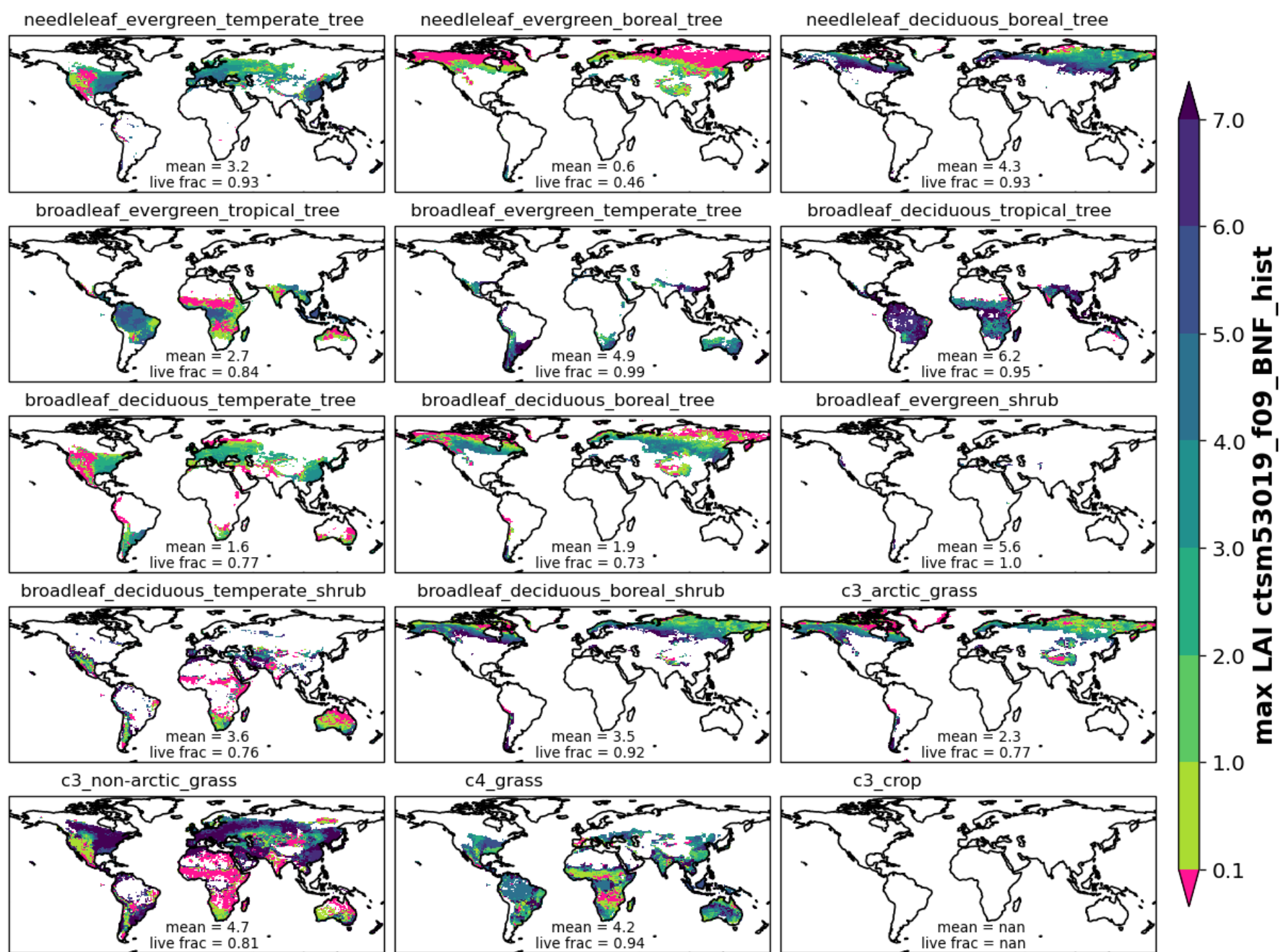
NDBT, BDTT

BDBS, C3 arctic

Degradation:

NEBT, BDBT

BETT savanna



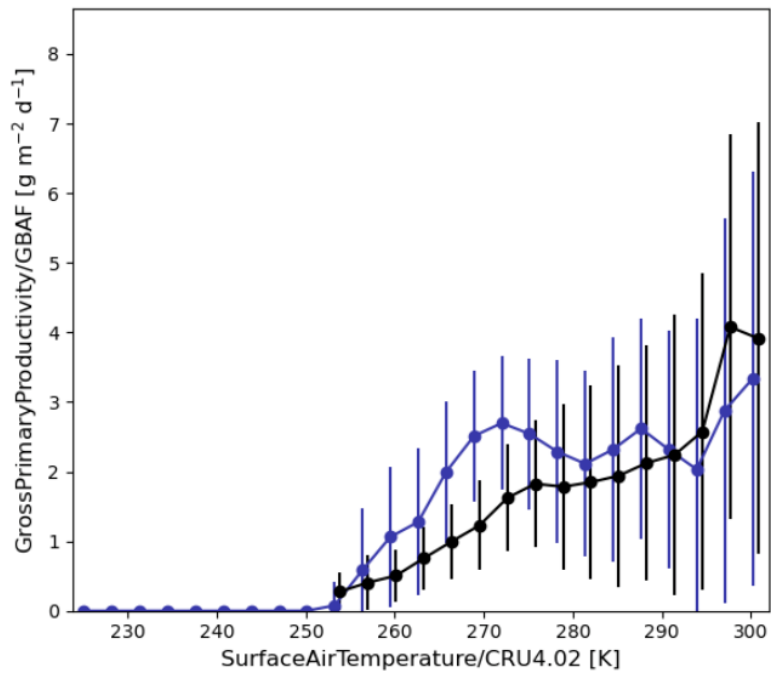
# CLM6 Highlights: PPE Calibration GPP vs. Air Temp

GSWP3-CTSM5.3

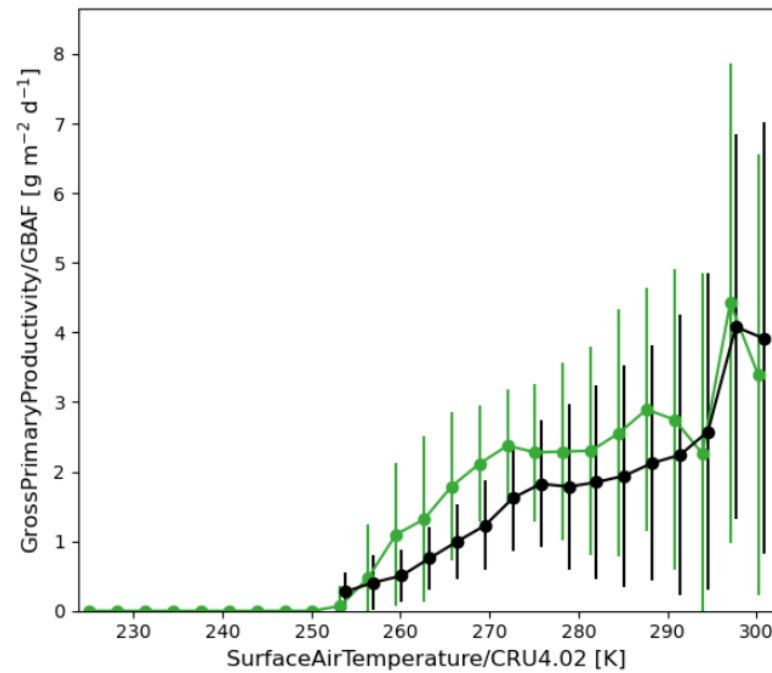
CRUJRA-CTSM5.3

CRUJRA-CTSM5.3-PPE<sup>A</sup>

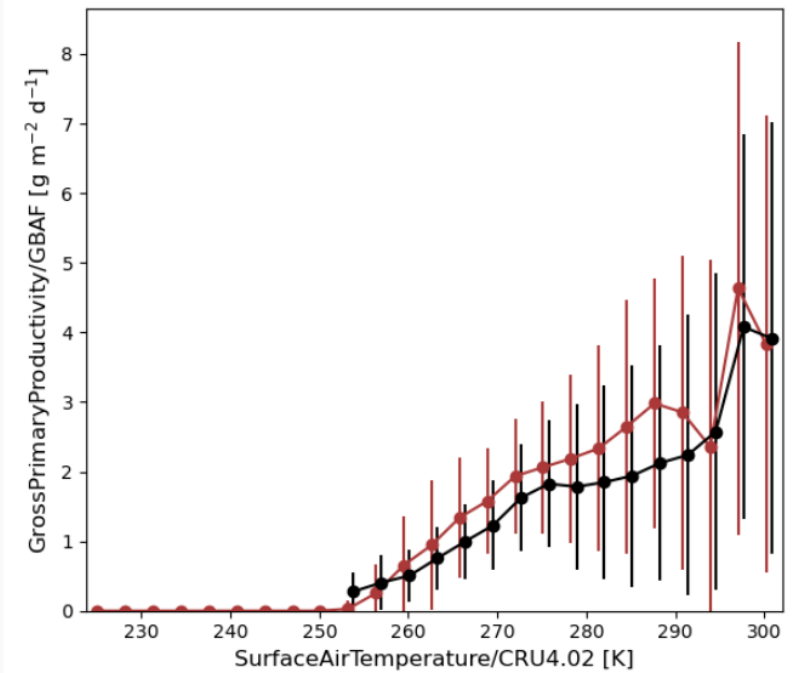
LMWG\_dev\_67



LMWG\_dev\_69



LMWG\_dev\_89



# Additional Land Features

## Supported Tower Capabilities:



`./run_towers`

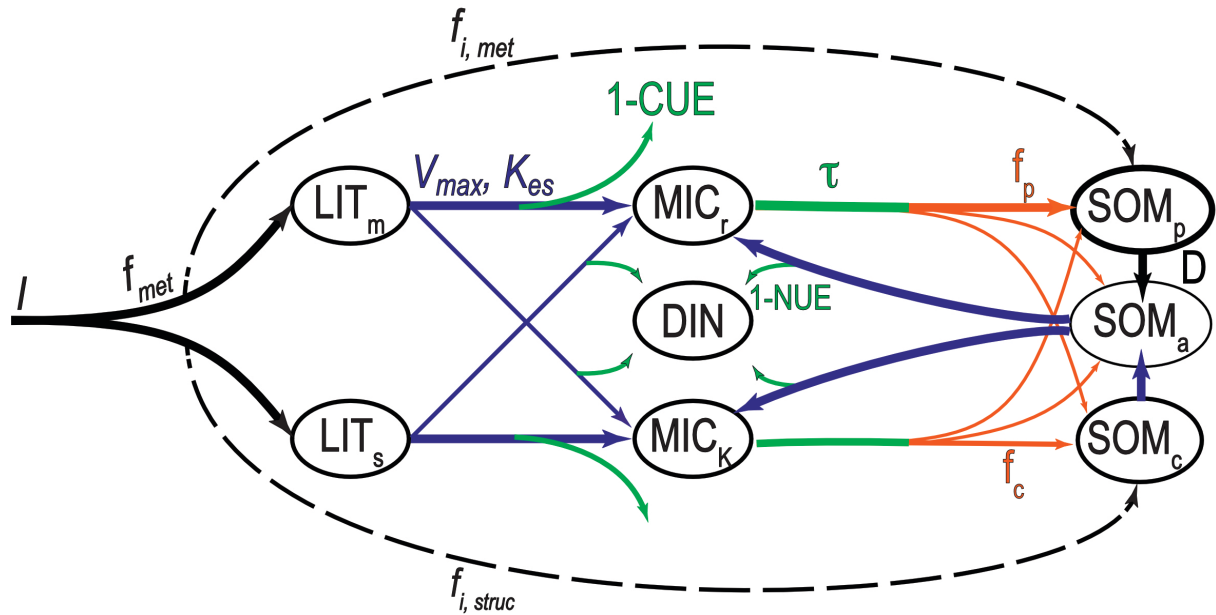
- **NEON**  
BGC default with initial conditions  
Observational data available
- **PLUMBER2**  
SP default from cold start  
Observations through ME.org

\* Thanks to Tegan, Negin, Danica, Gordon, Sam L, Sam R, Adrianna & Erik



# Additional Land Features

## MIMICS-CN

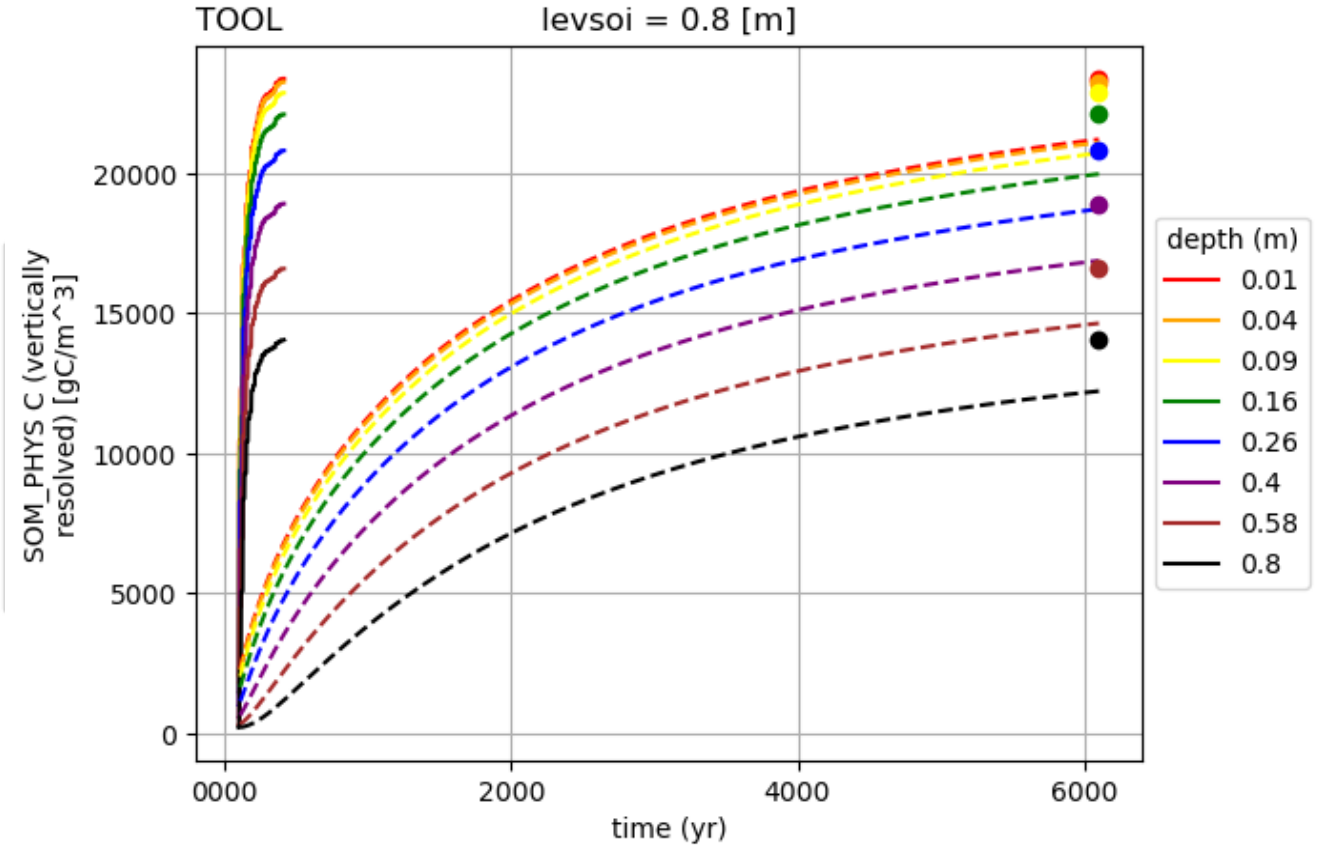
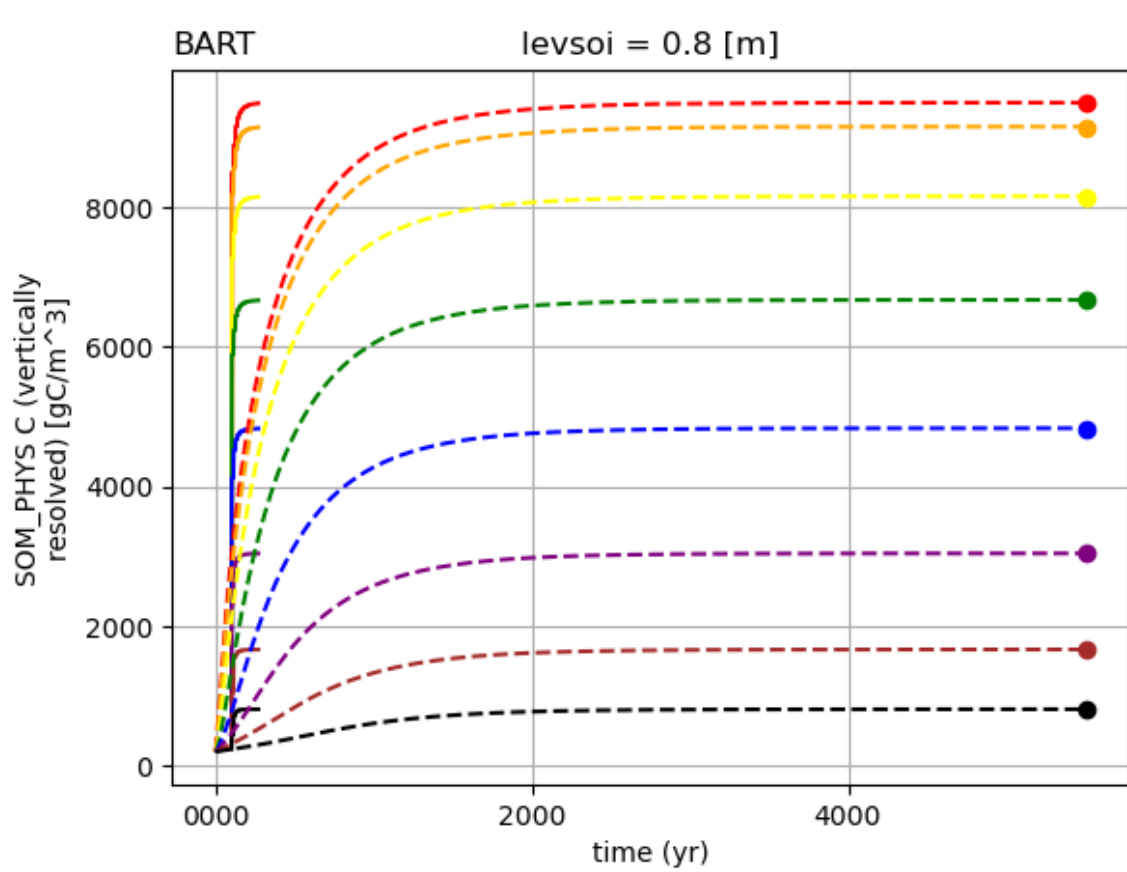


Bringing MIMICS into the Community Land Model (CLM)

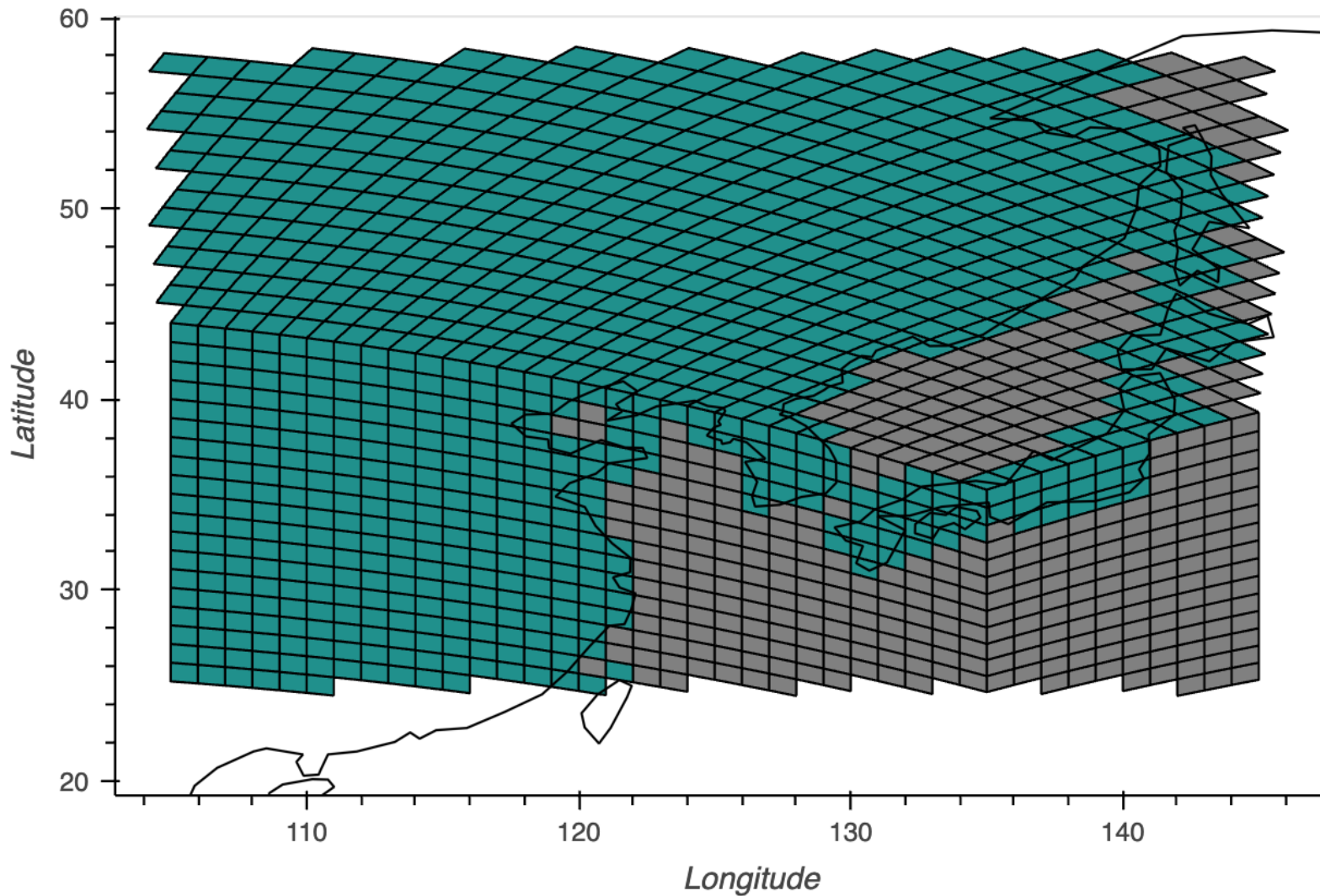
Vertical Resolution  
Plant-Soil Feedbacks  
C-cycle projections (CESM)

Feature in CLM6,  
Likely only for single point runs

# Anderson Acceleration:



# CESM3 uses an unstructured grid (ne30)



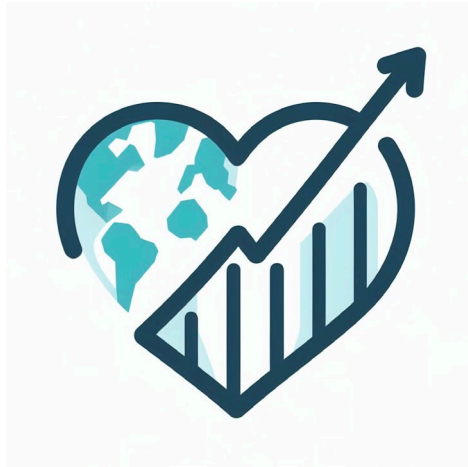
Dimensions of h0 files:  
time \* Indgrid

Options:

- Embrace uxarray
- Regrid to lat-lon
- CESM postprocessing tools (CUPiD)

# CESM3 Features

## Diagnostics



CUPiD:  
CESM Unified  
Postprocessing and  
Diagnostics

\* Thanks to Tegan, Mike w/ CUPiD + Justin Richling & ADF team

### CAM Diagnostics

[Case Home](#) [Plots](#) [Links](#) [About](#) [Contact](#)

**Test Case:** b.e30\_beta05.BLT1850.ne30\_t232\_wgx3.123 - years: 25 - 44  
**Baseline Case:** b.e30\_beta05.BLT1850.ne30\_t232\_wgx3.122 - years: 25 - 44



### Arctic - ELAI

[Back to Arctic](#) [Back to Plot Types](#)

ANN DJF MAM JJA SON

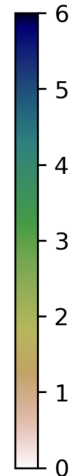
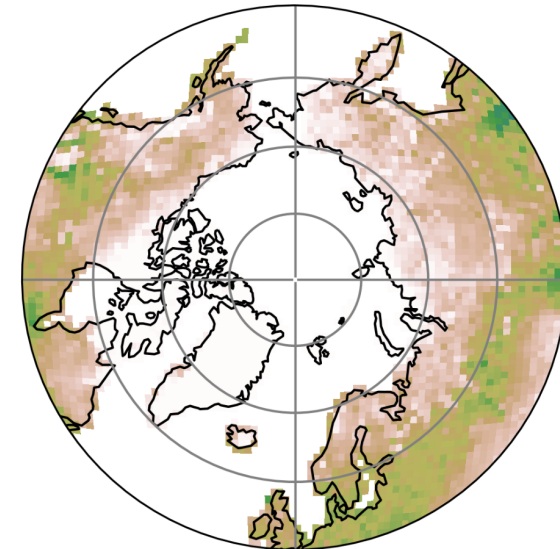
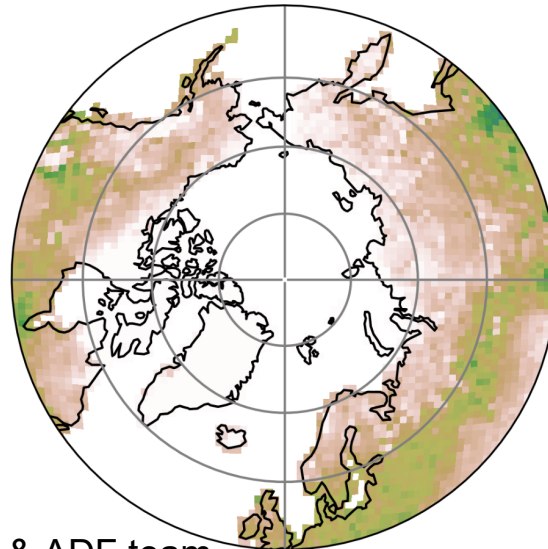
### ELAI - ANN - Arctic

**Test:** 123  
years: 25-44

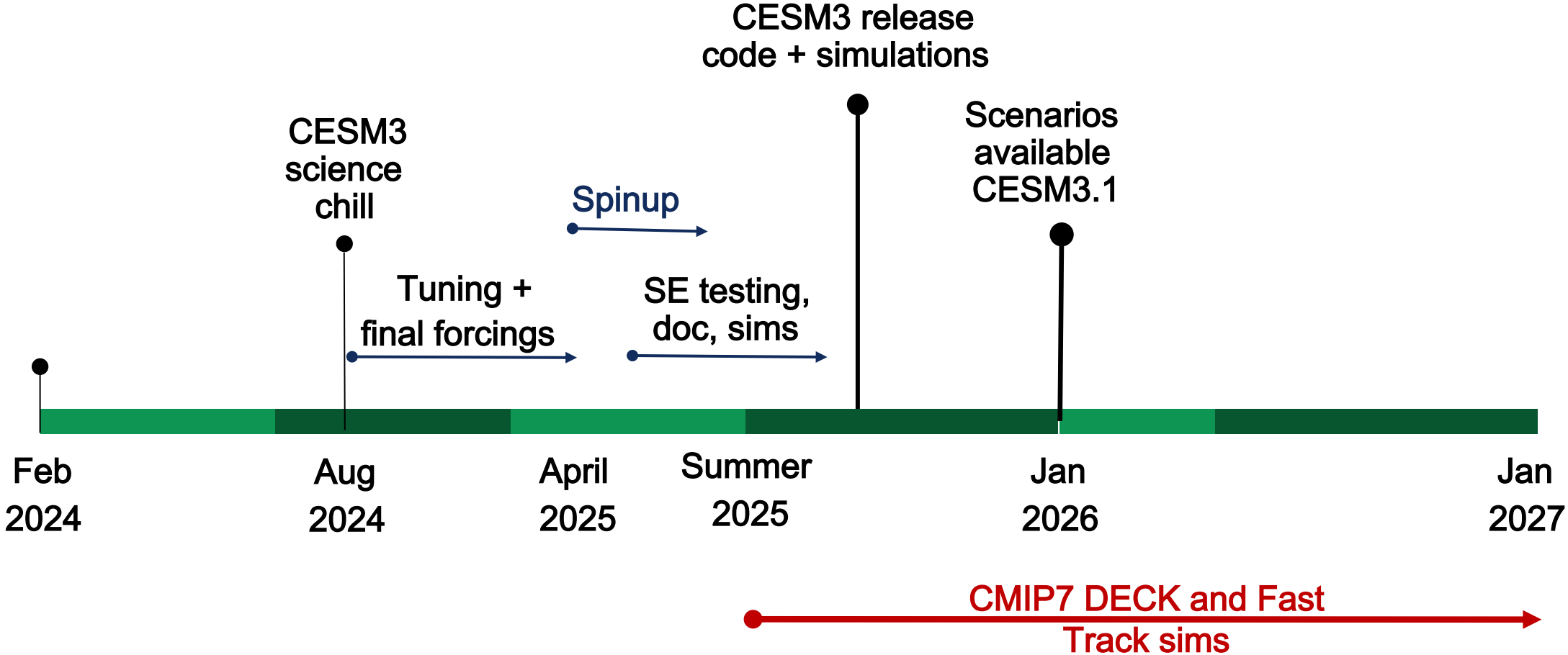
Mean: 1.18  
Max: 8.40  
Min: 0.00

**Baseline:** 122  
years: 25-44

Mean: 1.18  
Max: 8.30  
Min: 0.00



# CESM3 Timelines



# LMWG focus areas: Ecosystems, Water & Food



- Questions on progress to date & near term plans?
- New Directions, Beyond CMIP7?