CESM Land Model and Biogeochemistry Working Group Meeting

Will Wieder & Rosie Fisher
LWMG Co-chairs

Keith Lindsey, Abby Swann & Gretchen Keppel-Aleks
BGCWG Co-chairs

February 27, 2024

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

DEI lunch discussion Weds in Chapman Room & Google Meet

Here we value respectful dialogue, please ...

CGD's Vision: A Culture of Respect & Belonging
https:// www.cgd.ucar.edu /about/diversity

Meeting Goals:

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

Dinner Weds. 5:30 Under the Sun

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

2023 Joshua Rady	CLM-U team: Bowen Fang, Cathy Li, Joyce Yang, Keer Zhang
2022 Claire Zarakas	Yifan Cheng
2021 Yue Li	Inne Vanderkelen
2020 Leah Birch	Jessica Needham
2019 Katie Dagon	Meg Fowler
2018 Marysa Laguë	Daniel Kennedy

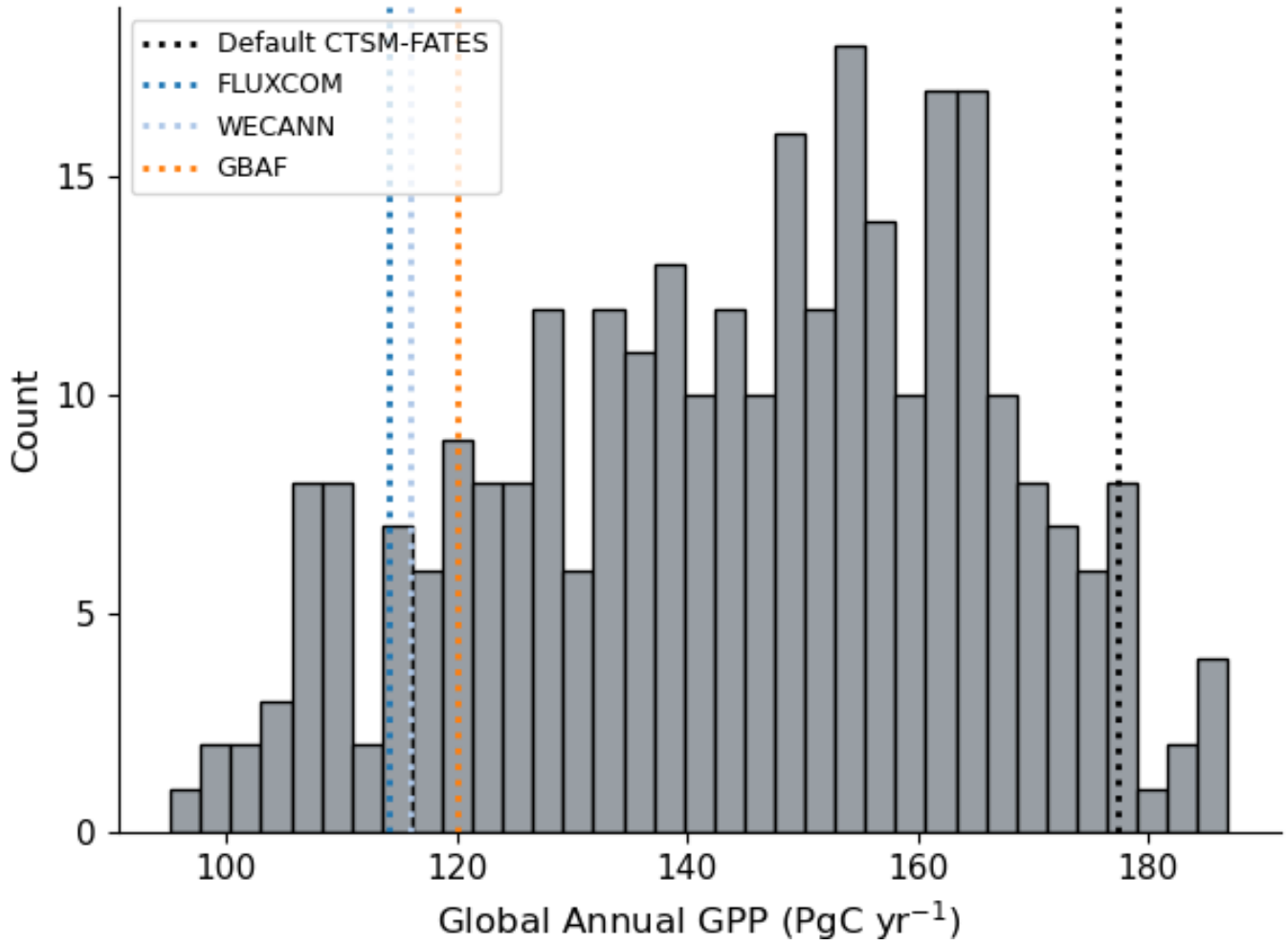
LMWG focus areas: Ecosystems, Water & Food

- Science Highlights
- New Features
- Addressing dead Arctic vegetation
- CESM3 timeline & priorities

CLM6 Highlights: Ecosystems

FATES:

- LULCC
- Calibrated SP and no-comp global parameters
- 2 stream radiation
- Much more [Thursday PM]

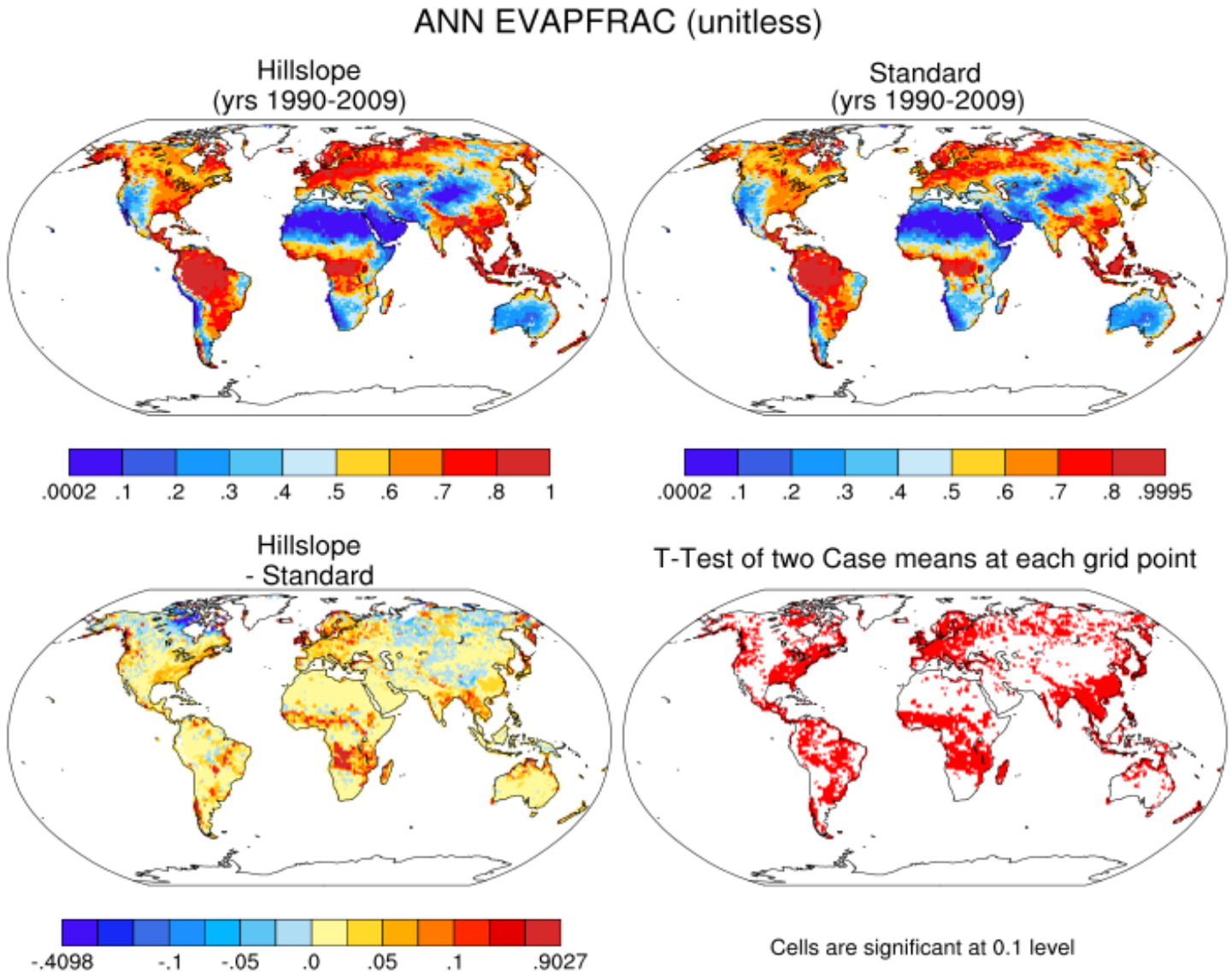


Courtesy Adrianna Foster

CLM6 Highlights: Water

Hydrology & Snow

- Hillslope Hydrology
- mizuRoute
- SNICAR updates
- Snow thermal properties
- More [Wedsnesday AM]



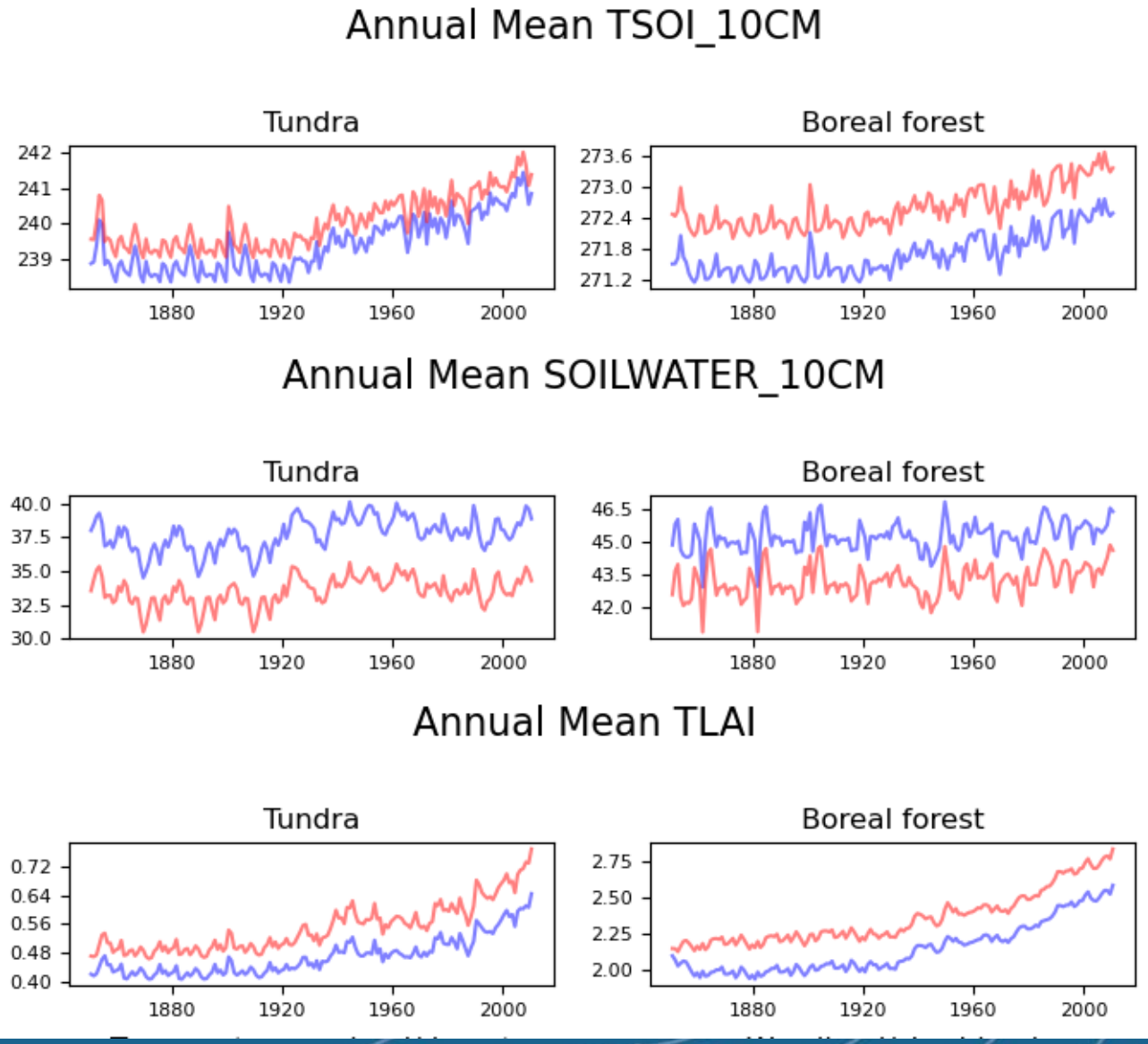
Courtesy Sean Swenson
Keith Oleson

CLM6 Highlights: Water

South aspect
North aspect

Hydrology & Snow

- Hillslope Hydrology
- mizuRoute
- SNICAR updates
- Snow thermal properties
- More [Wedsnesday AM]

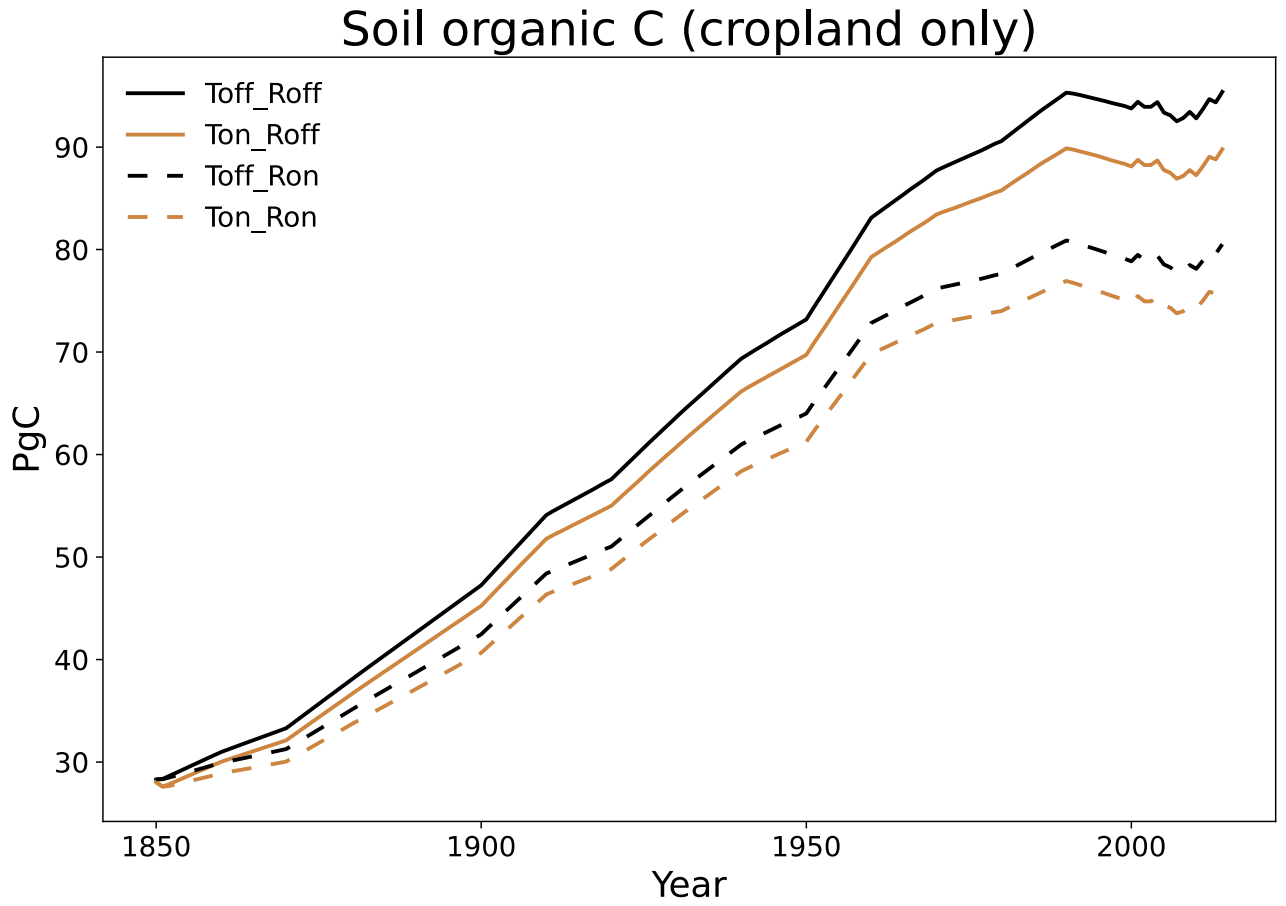


Courtesy Sean Swenson

CLM6 Highlights: Food

Crop Model

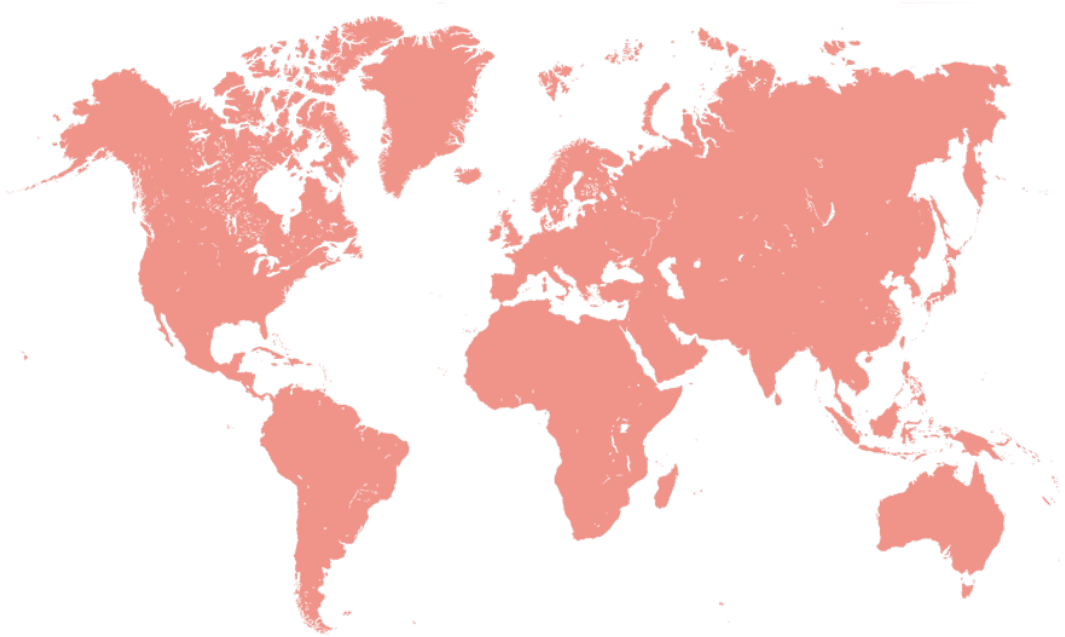
- Crop phenology &planting dates
- Tillage &residue management
- More [Wednesday PM]



Courtesy Sam Rabin

CLM6 Features

New Surface Datasets



CTSM5.2

* Thanks to Mariana, Sam L, Erik, Peter, Negin, Jim & more

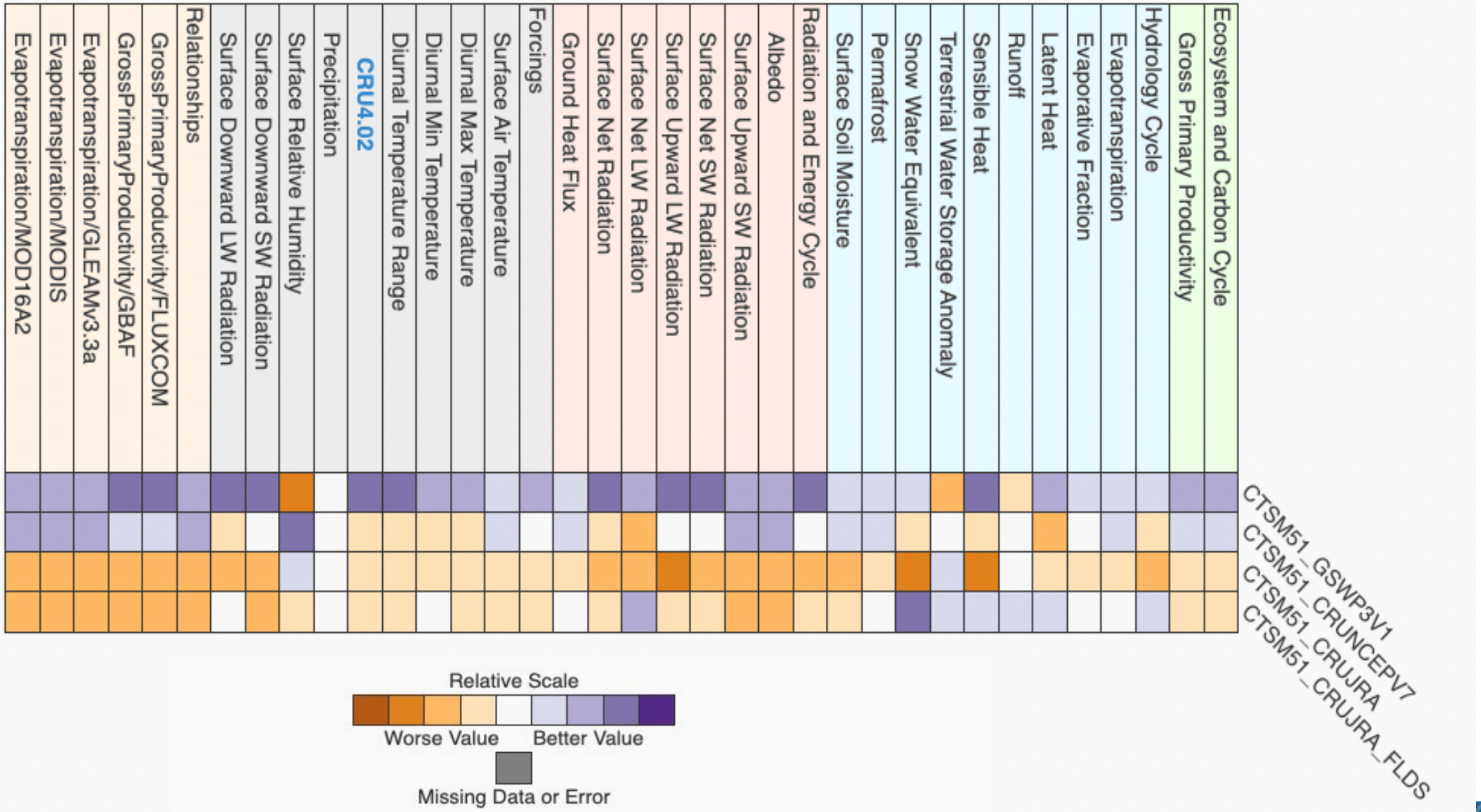
Includes:

- Transient urban [Weds AM]
- Dynamic & new lake dataset
- Improved crop distribution
- Updated soils dataset
- Gross unrepresented land use transitions
- Increased capacity for creating high resolution datasets

CLM6 DATM options

	Dataset	Spatial resolution	Temporal extent	Temporal resolution	Notes
CLM5	**GSWP3**	0.5 deg	1901-2014	1.5 hour	No longer updated Low tropical humidity
CLM5	**CRUNCEP**	0.5 deg	1901-2016	6 hour	No longer updated. Longwave not used.
CLM6	**CRU-JRA (Trendy)**	0.25 deg	1901-2022	6 hour	No longer being updated, Used for GCP & SMYLE land initialization. NO data over Antarctica.
CLM6	**ERA5**	0.25 deg	1940-present	1 hour	Being updated, Known precip biases (among others) Candidate for initializing OMWG, ESPWG & SIMA runs.

CLM6 DATM options ILAMB



Thanks Keith Oleson & Sam Levis

CLM6 Features

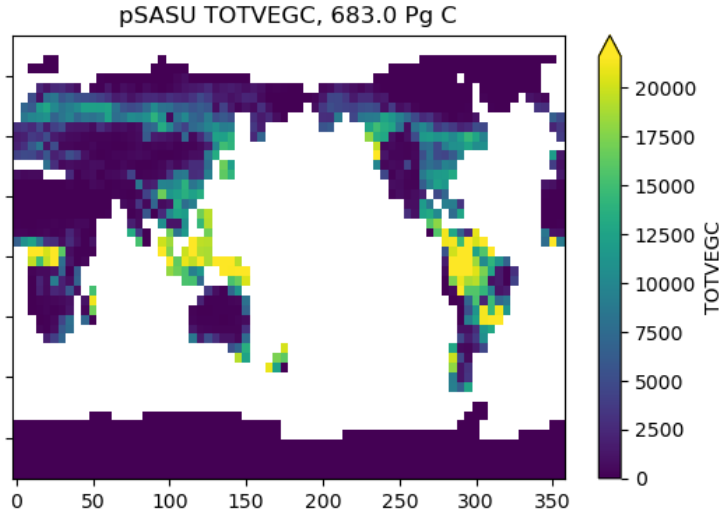
PPE Calibration Workflow

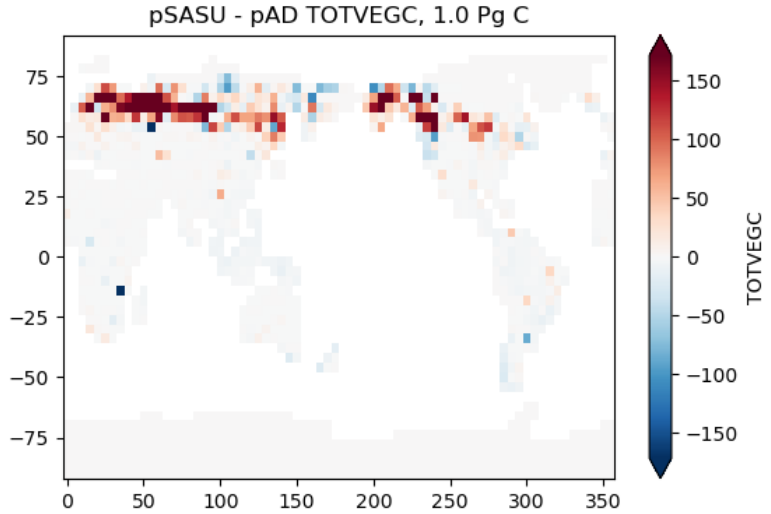
Thursday AM

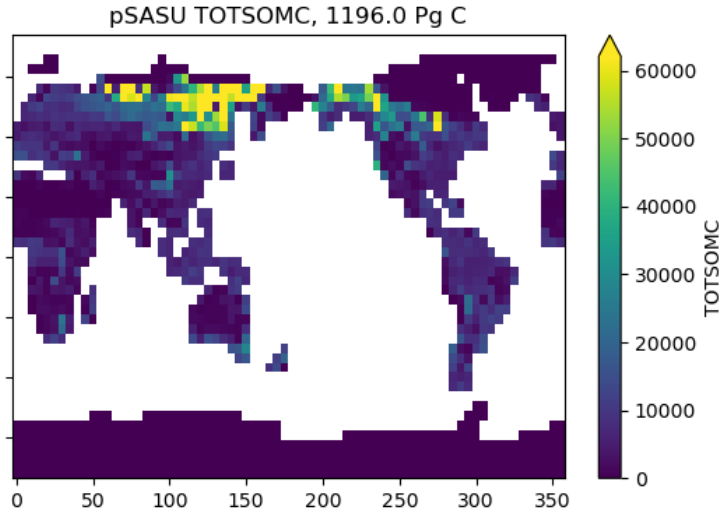
SASU spinup (matrix)

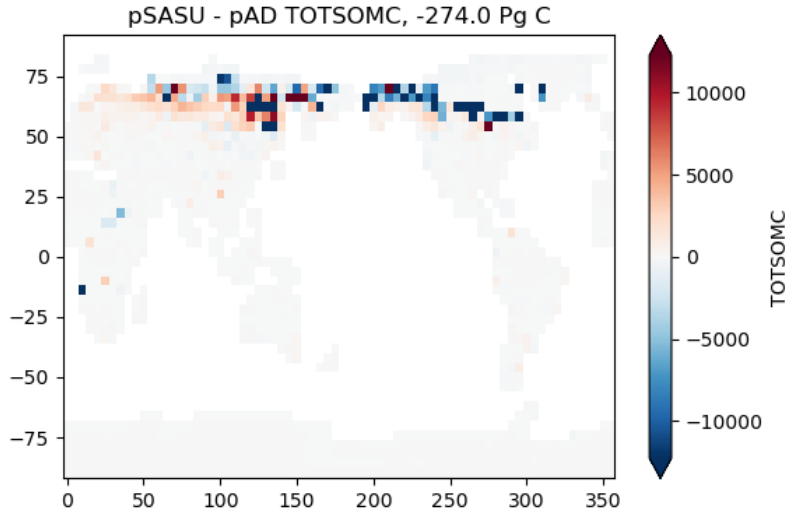
CLM6 Features

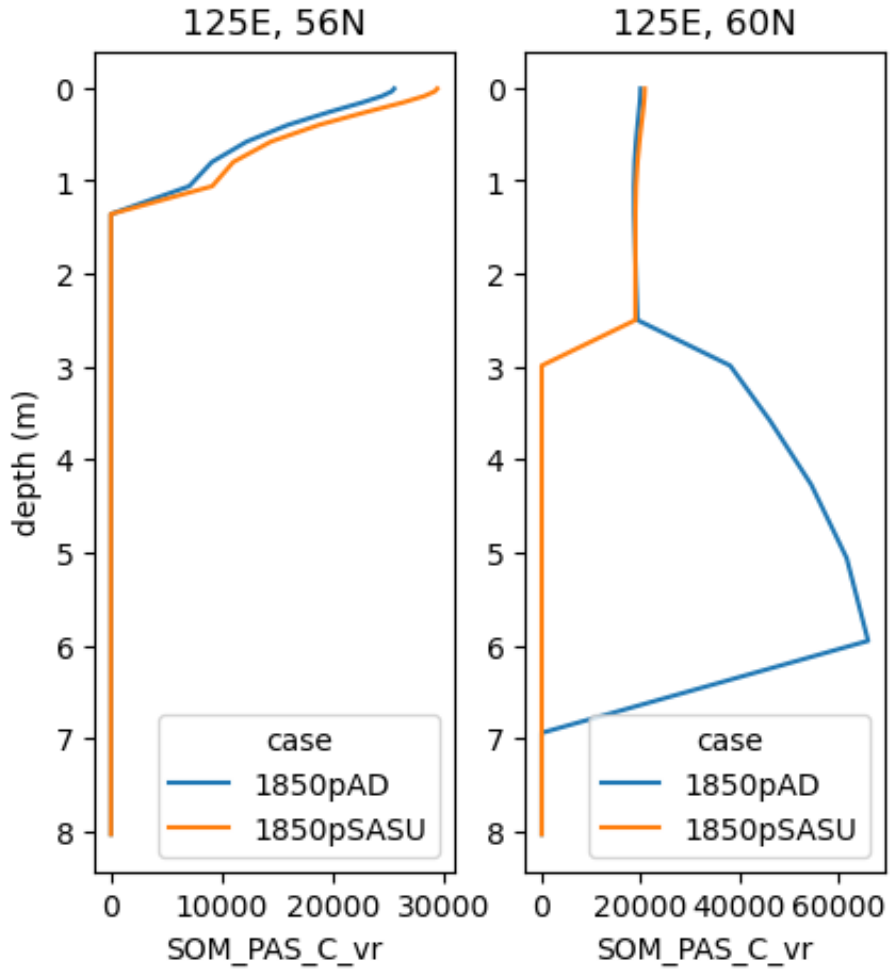
SASU spinup (matrix)











* Thanks to Chris, Yiqi, Erik, Sam L & Keith O

CLM6 Features

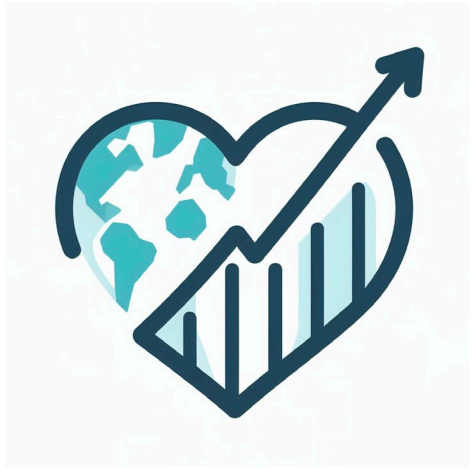
Supported tower capabilities

NEON education group

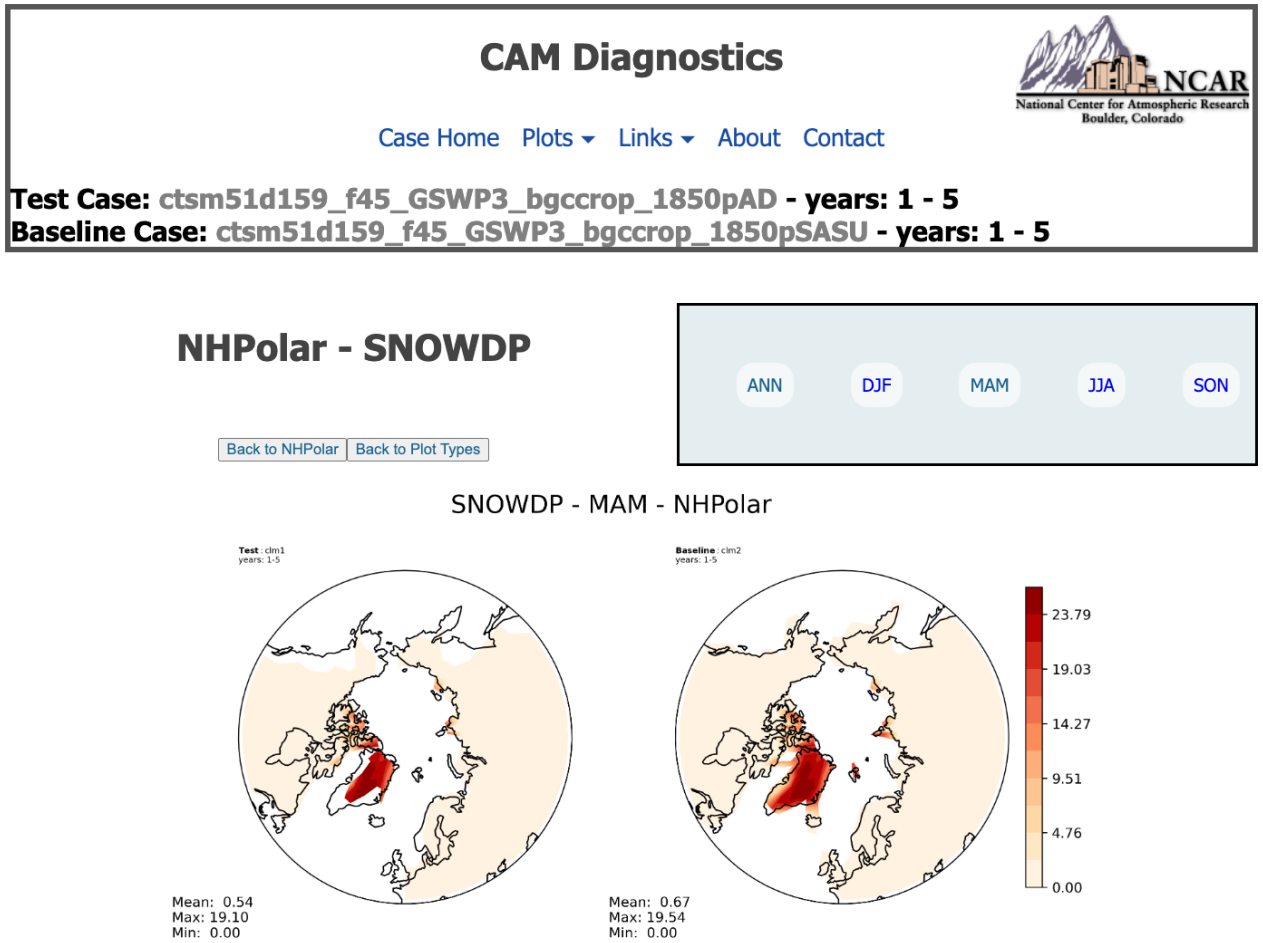
* Thanks to Tegan, Danica, Gordon, Sam L & more

CLM6 Features

Diagnostics



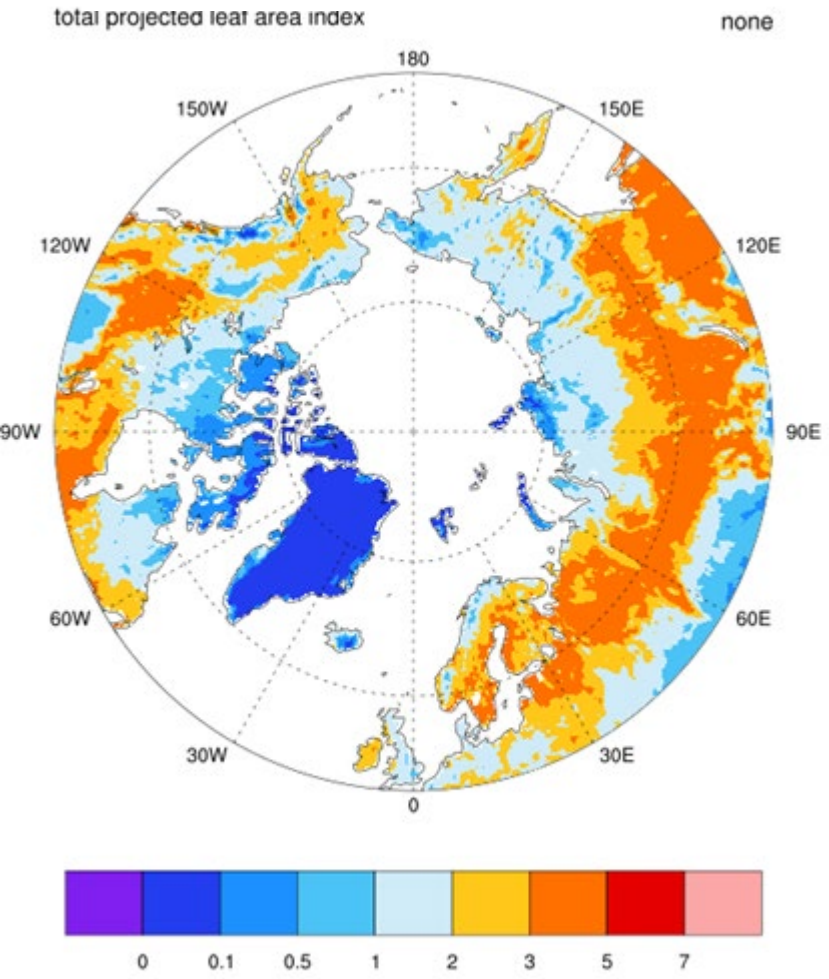
CUPiD:
CESM Unified Postprocessing and Diagnostics



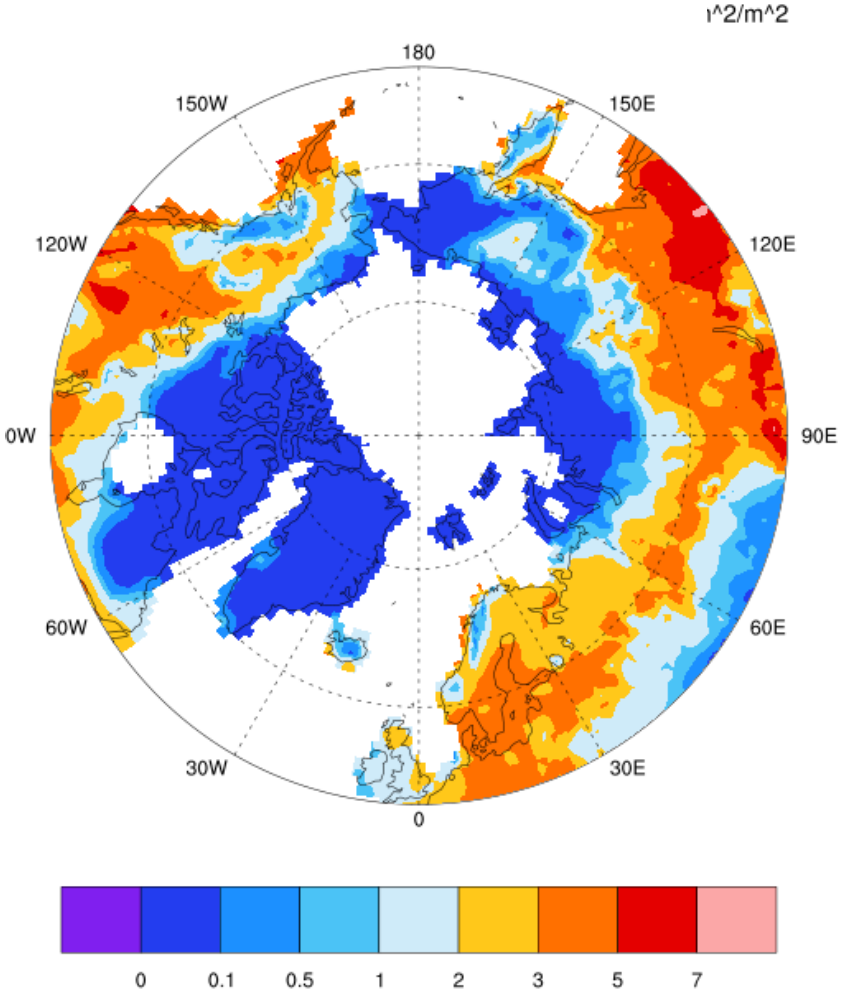
* Thanks to Tegan, Mike w/ CUPiD + Justin Richling & ADF team

Dead Arctic Vegetation

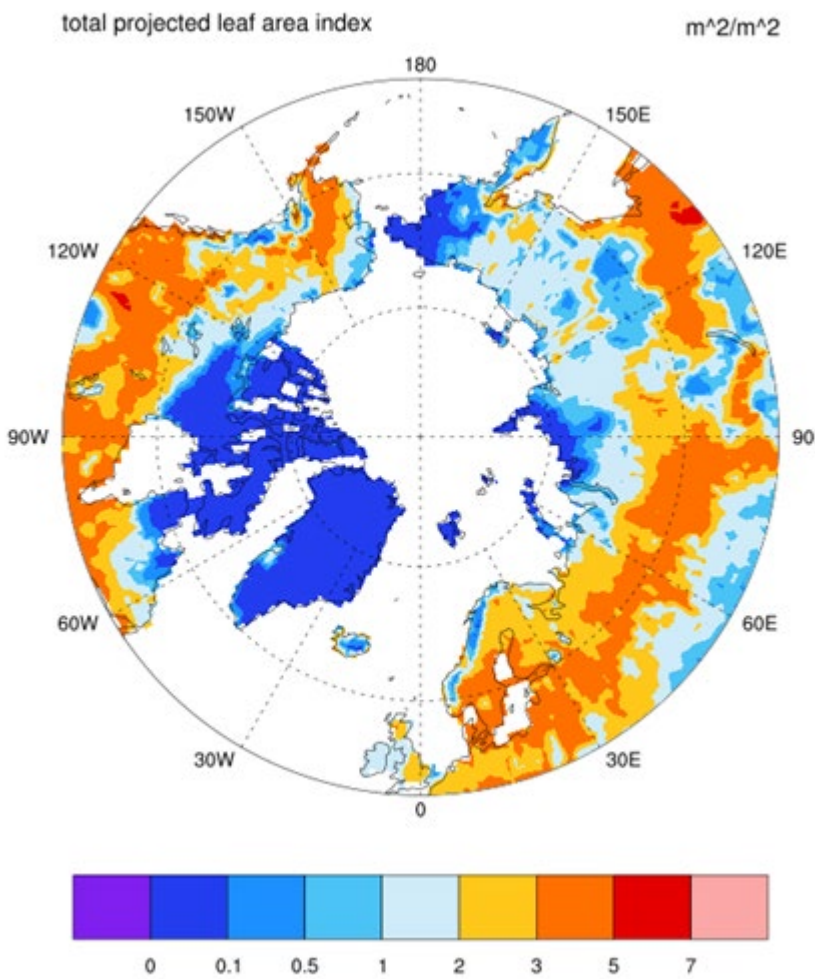
MODIS Obs.



CESM3: F200 case



CLM5.1-GSPW3



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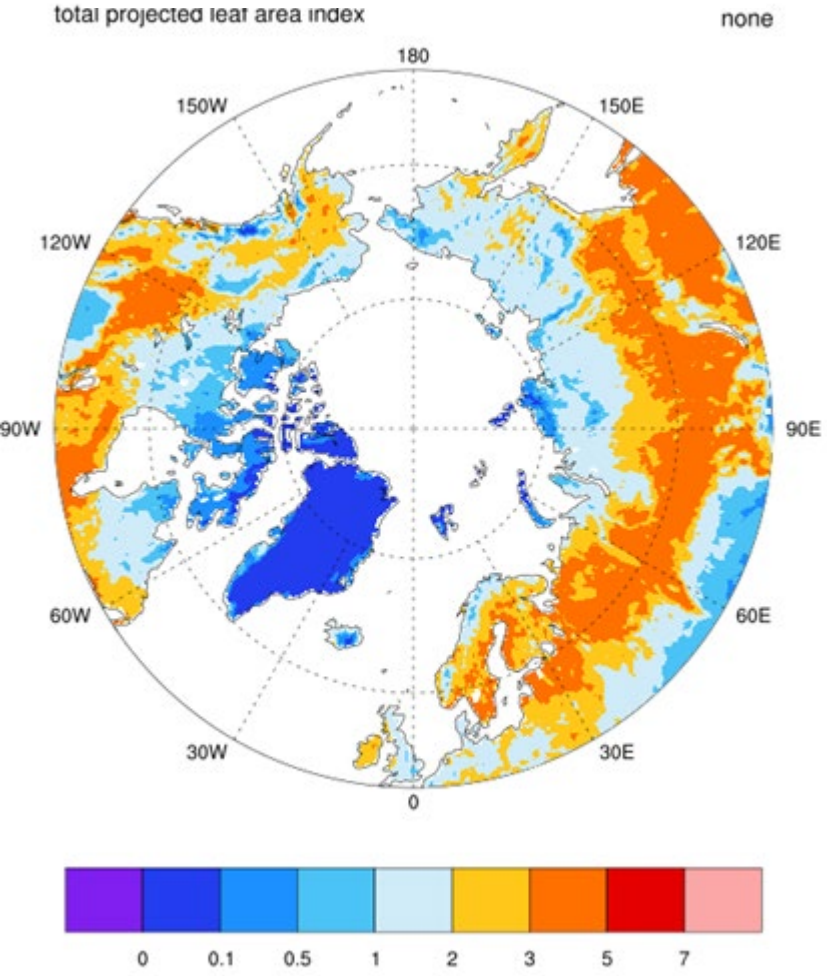
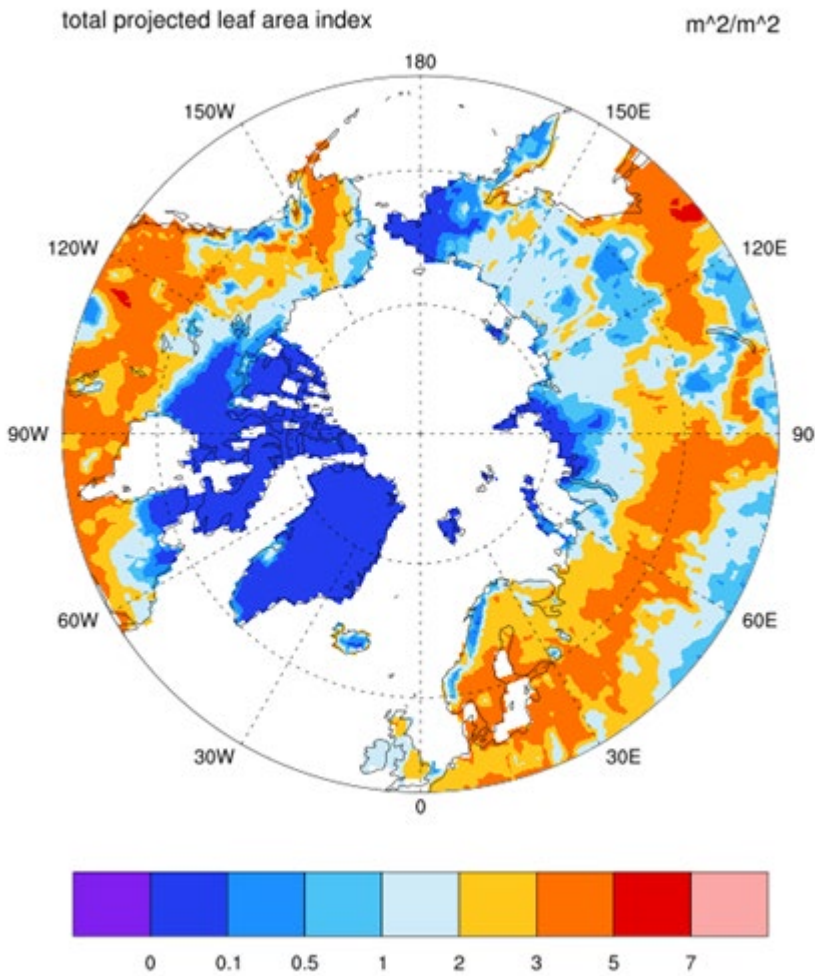


Persistent summer snow
Cold soils
Anemic vegetation

⇩

Decrease snow albedo
Sturm snow conductivity
PFT &phenology changes

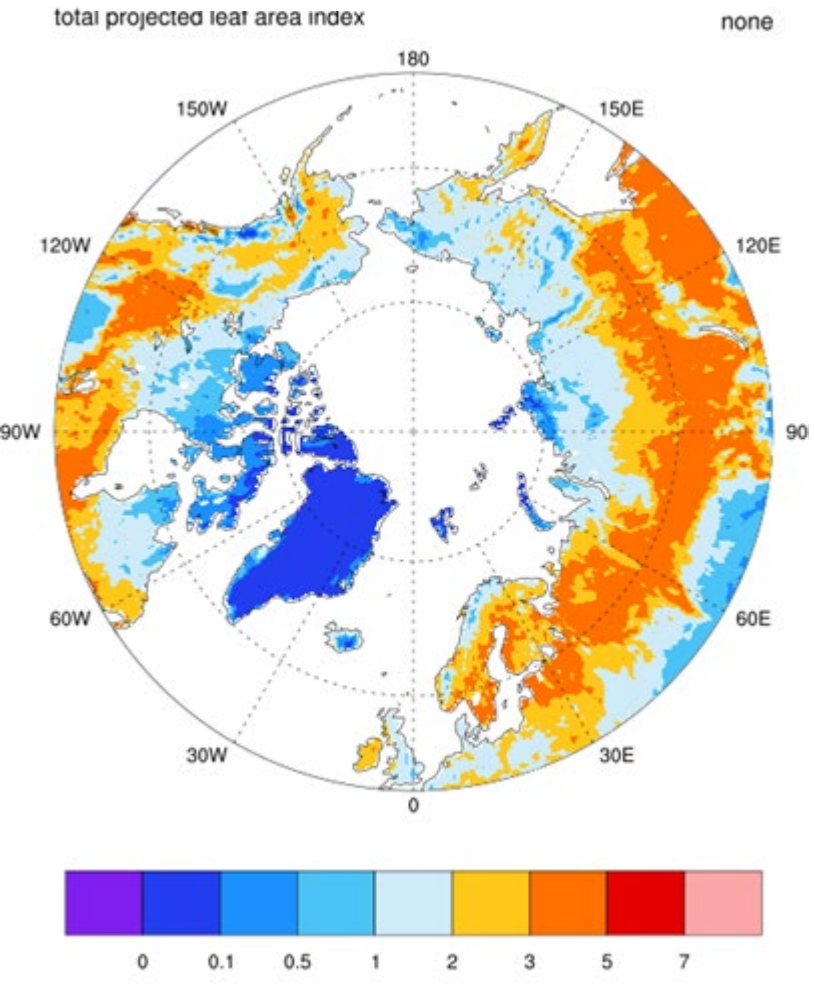
CLM5.1-GSPW3



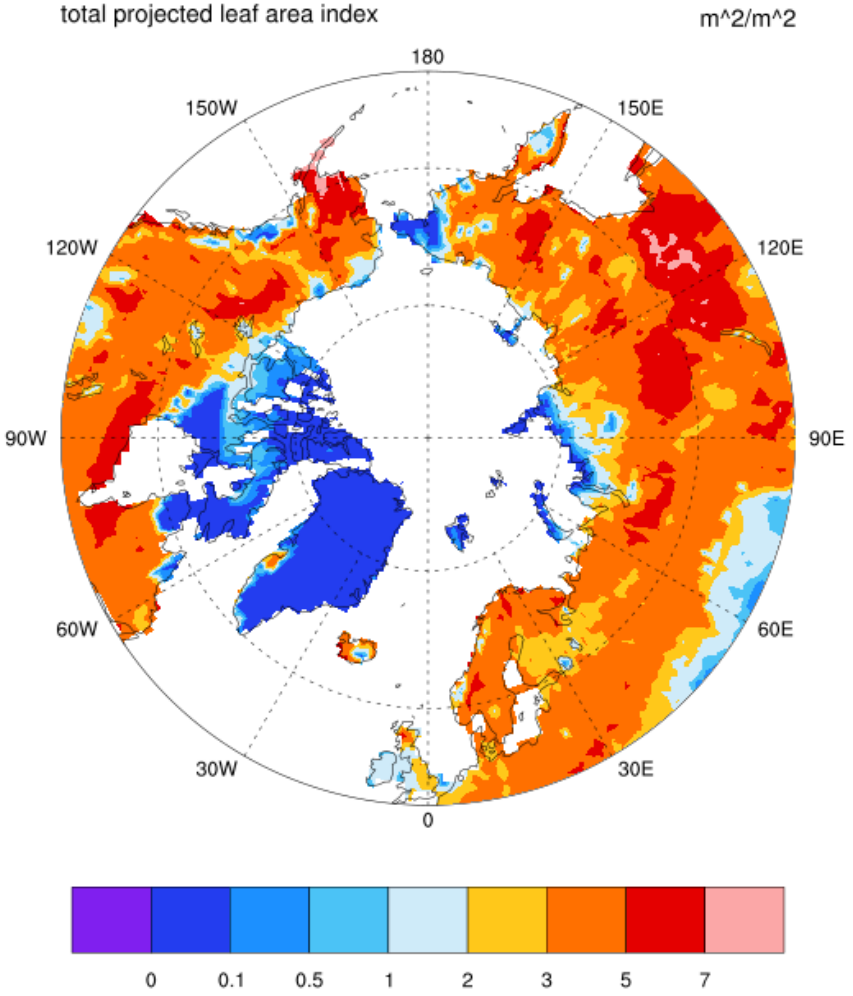
https://github.com/NCAR/LMWG_dev/discussions/3

36% less dead Arctic vegetation, I -case

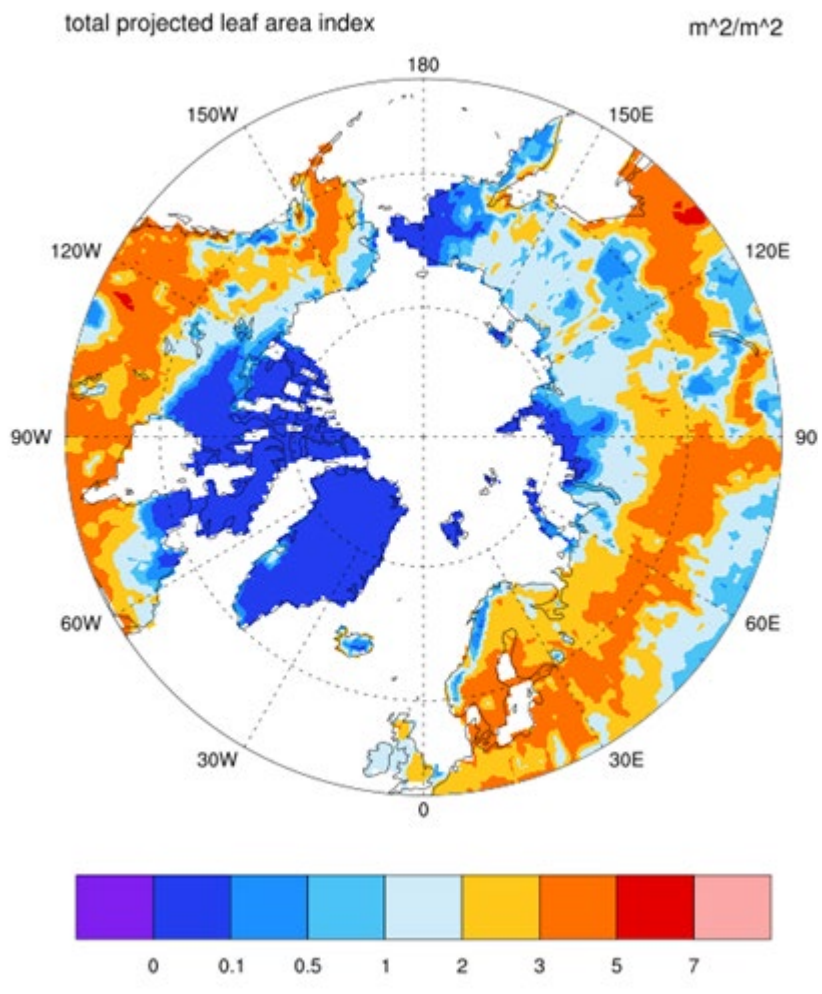
MODIS Obs.



CLM5.1*-CRU-JRA

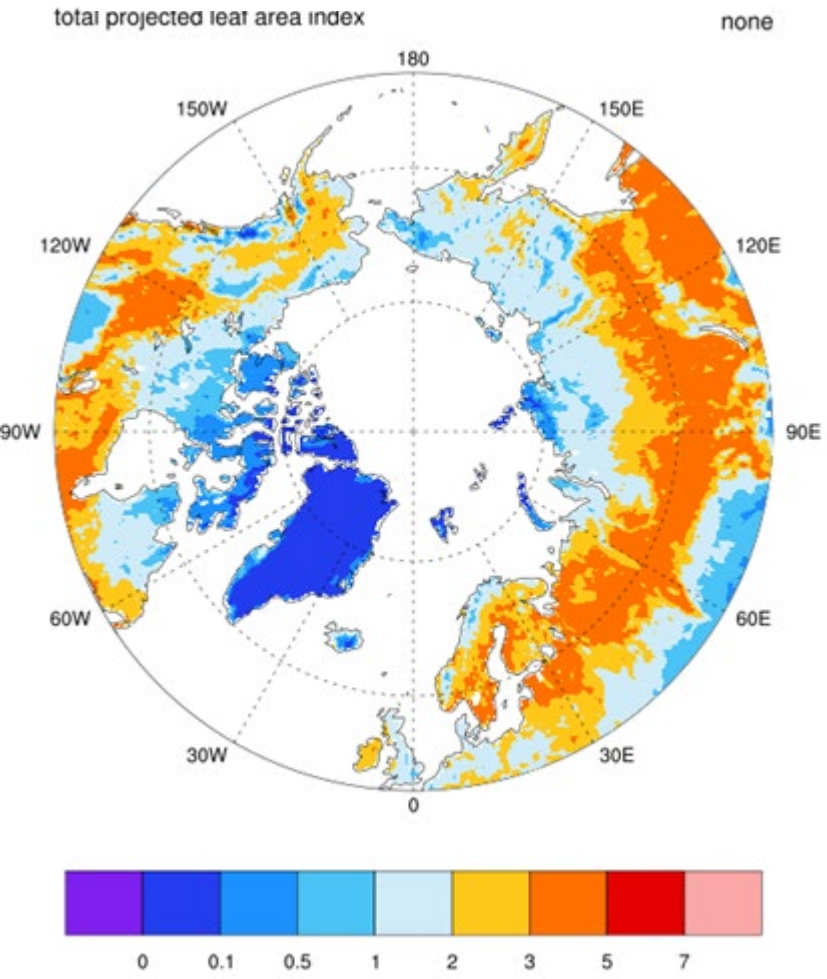


CLM5.1-GSPW3

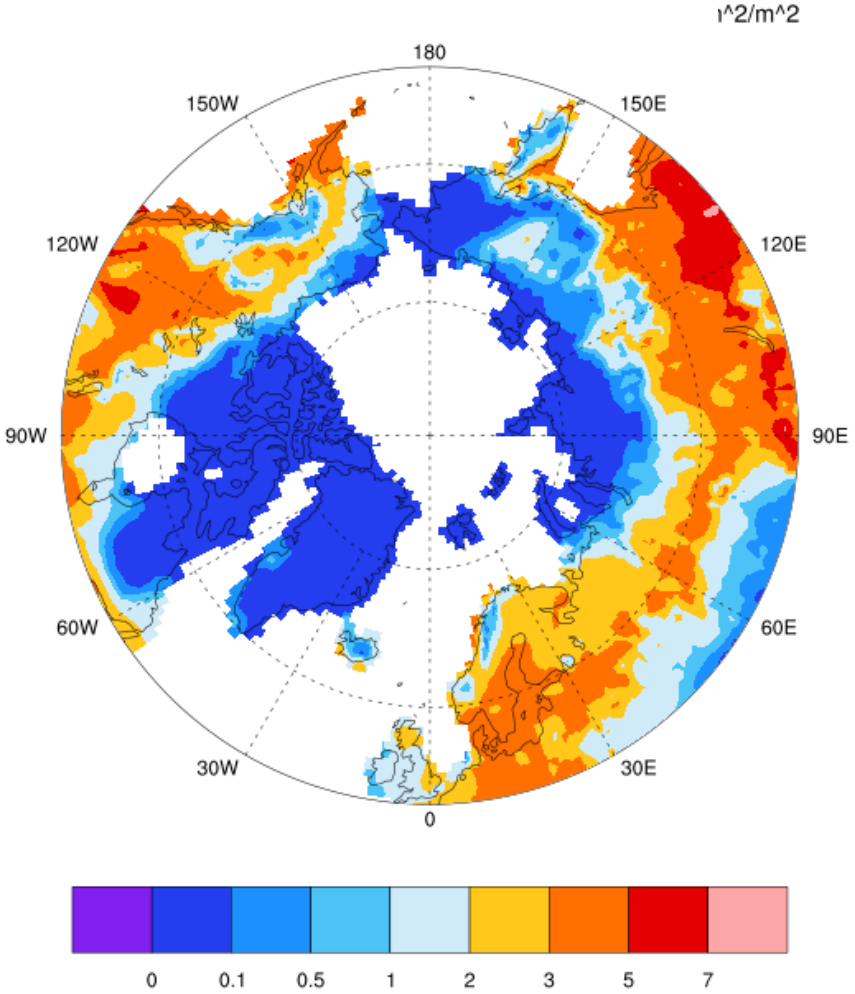


Dead Arctic vegetation F -Case

MODIS Obs.



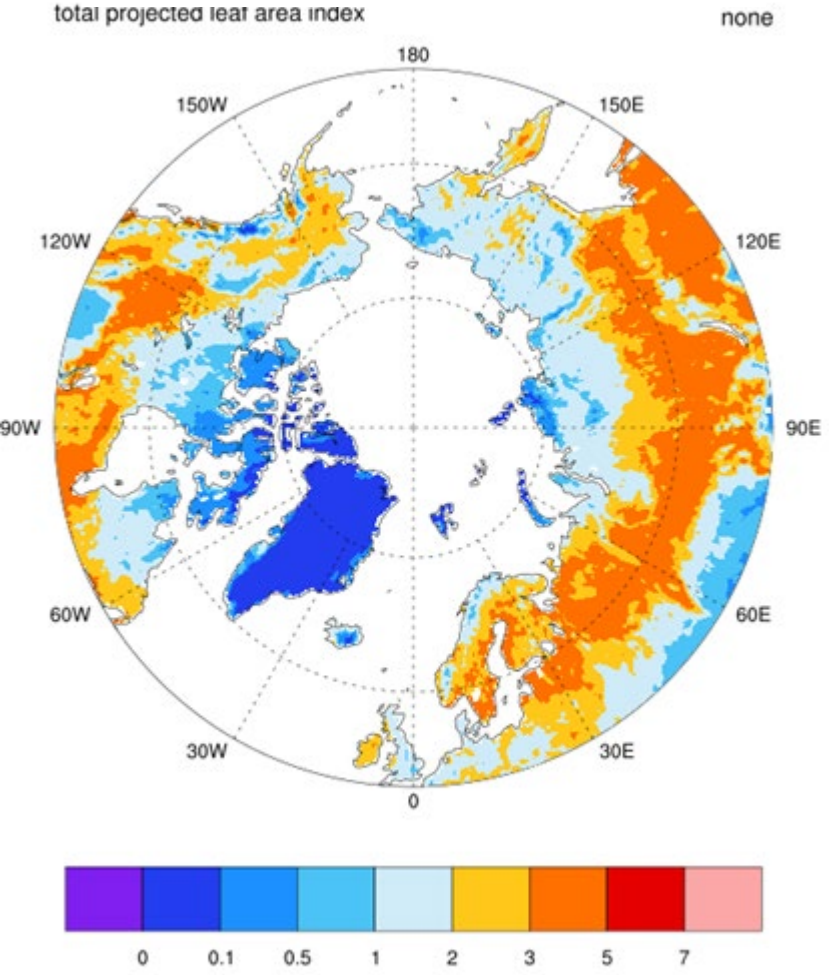
CESM3: F2000 case



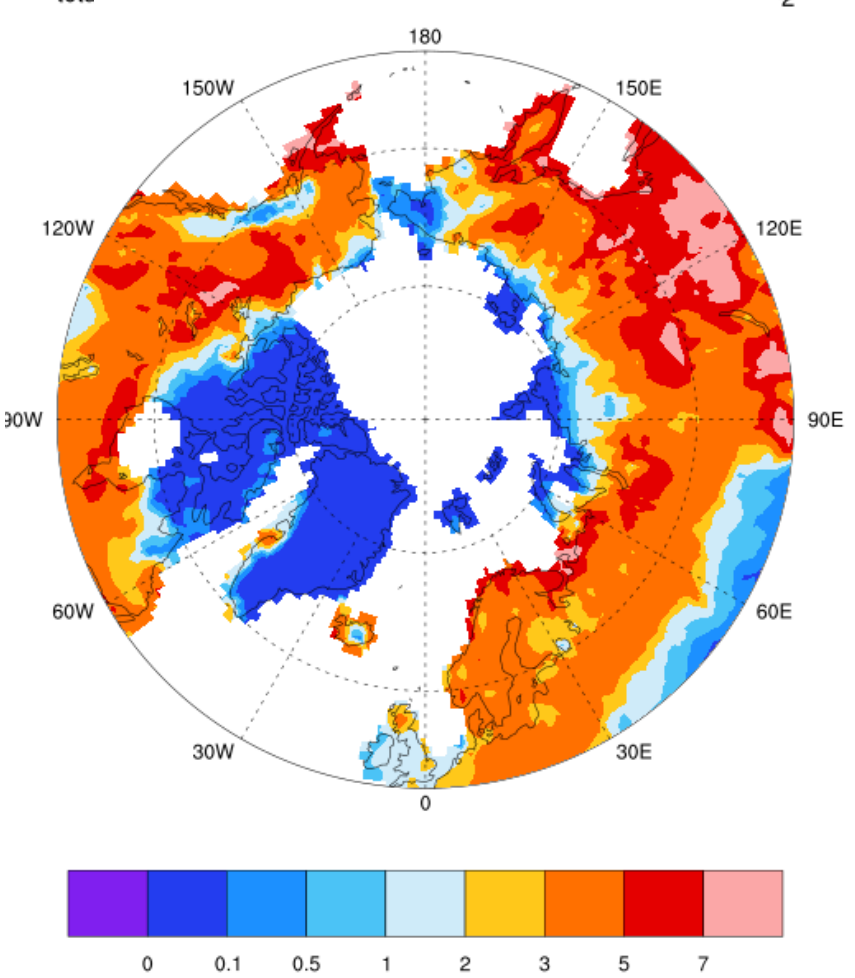
Thanks Keith Oleson & Sam Levis

54% less dead Arctic vegetation F -case

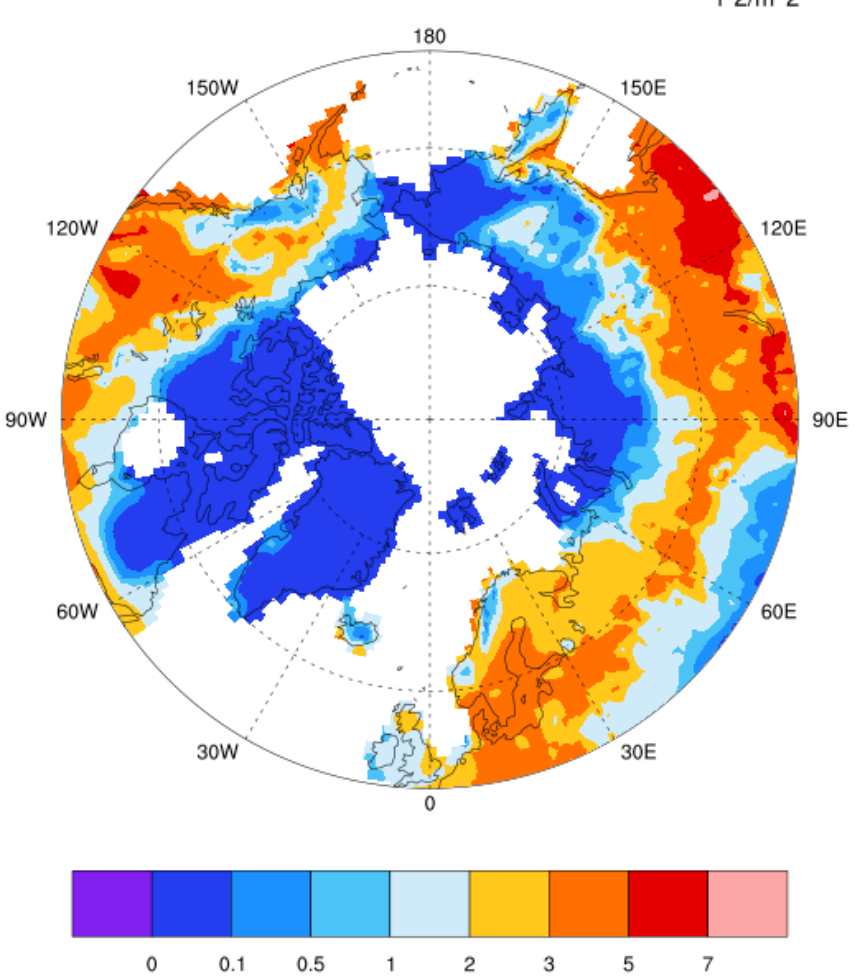
MODIS Obs.



CESM3*: F2000 case



CESM3: F200 case



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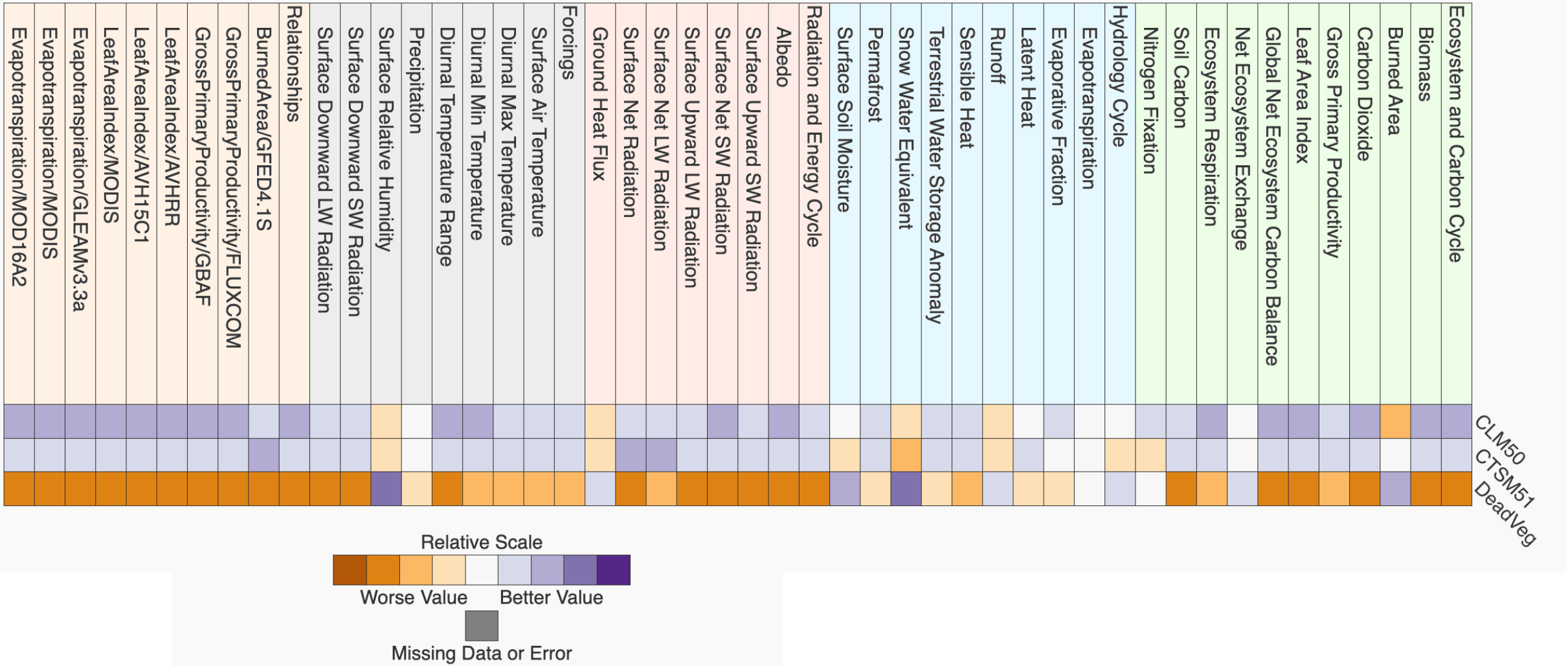
Calibration opportunities



Thanks Keith Oleson

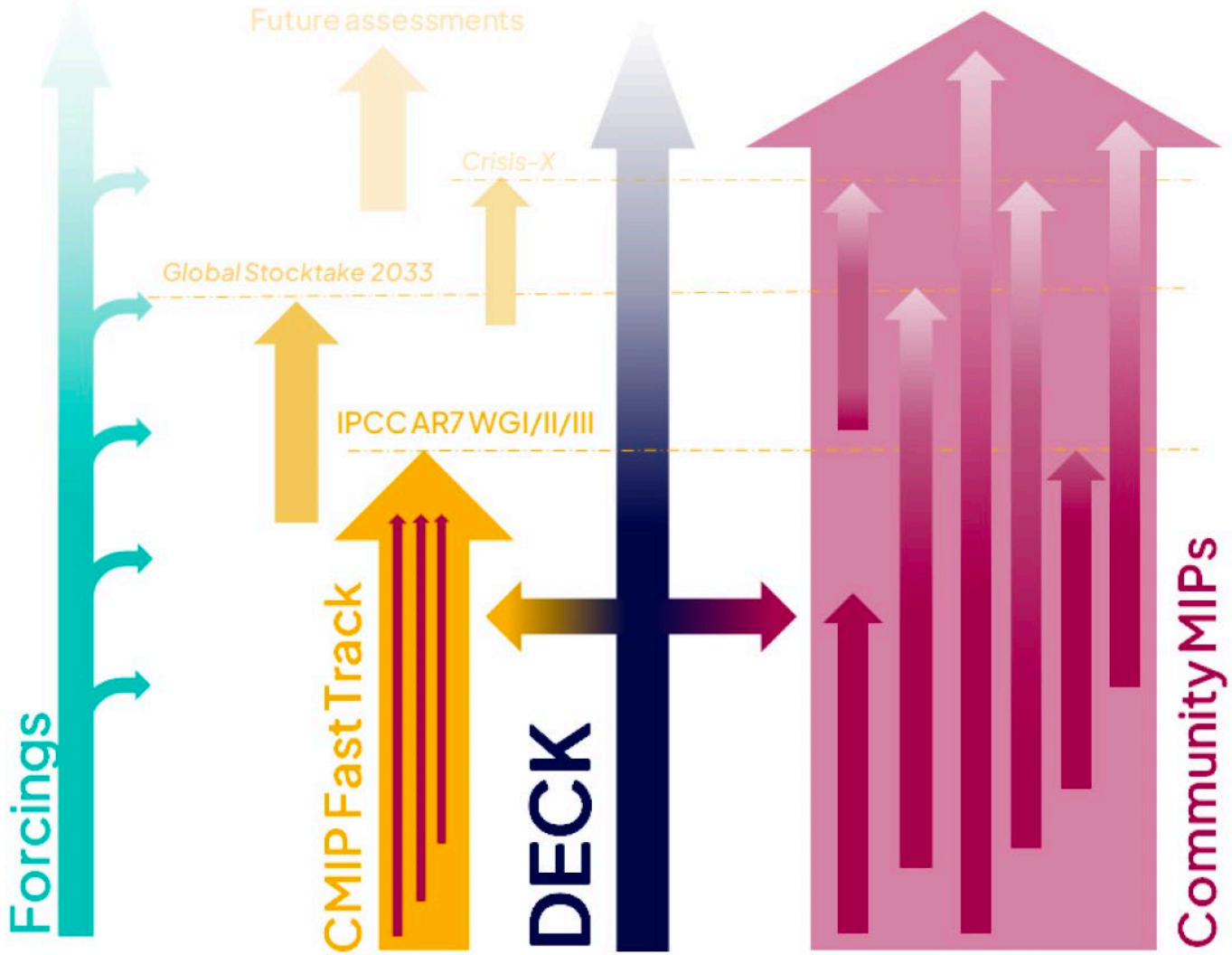
CMIP | WCRP World Climate Research Programme

An evolving CMIP design

CMIP7 DECK experiments

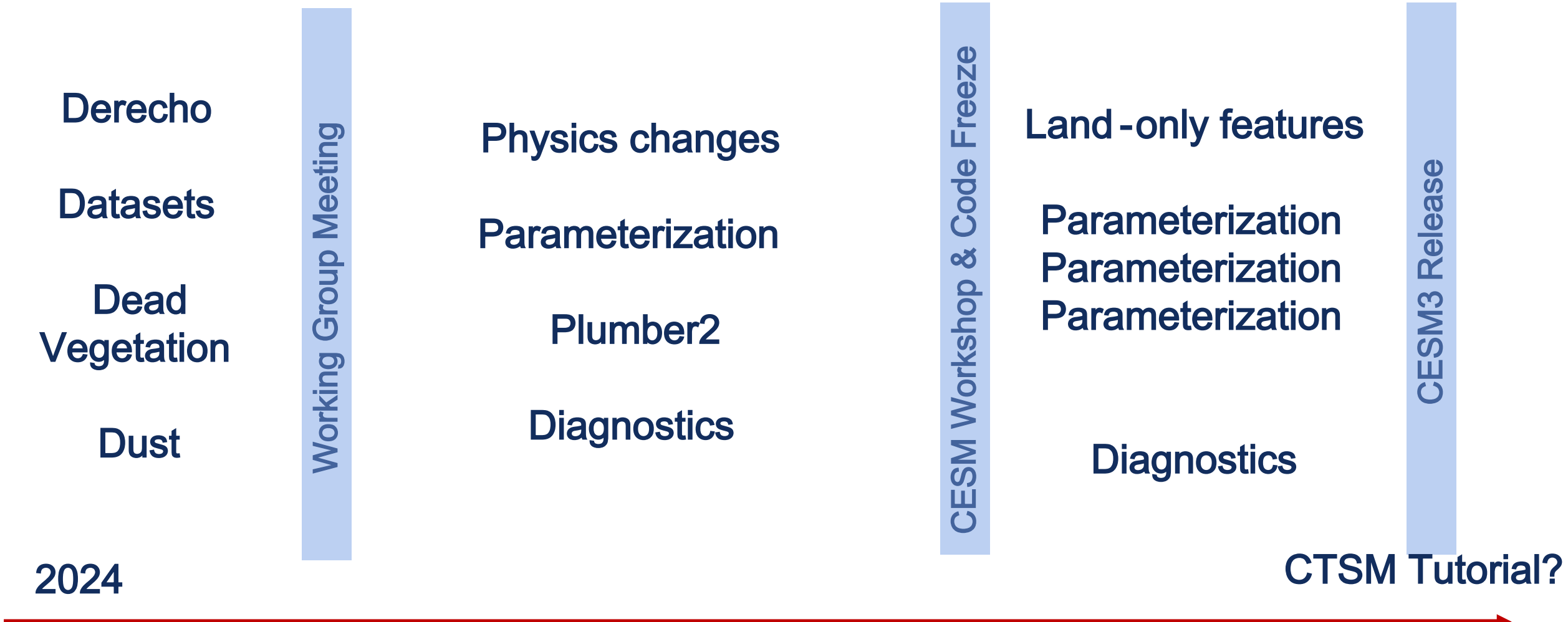
- amip
- abrupt4xCO2
- 1pctCO2
- historical
- **esm-hist (for ESMs only)**
- piControl / esm-piControl
- piClim-control
- piClim-anthro
- piClim-4xCO2

Starting 2025?



Towards CESM3 & CLM6 code base

(most likely optimistic timeline!)



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- CESM3 timeline & priorities