Land Ice Working Group session

12 minutes talk + 3 minutes for questions

Time	Topic	Speakers
8:30	**Welcome**	co-chairs
8:35	Land ice update	Gunter Leguy
8:50	Land ice SE updates	Kate Thayer-Calder
9:05	A path towards adding Solid Earth in CESM	Kate Thayer-Calder
9:20	Implementation of the Restart Option in CitcomSVE3.0: A 3D Finite Element Model for Glacial Isostatic Adjustment	Kaixuan Kang
9:35	Updates on mountain glacier work and next steps	Samar Minallah
9:50	***Break***	
10:15	Resolution dependence of CISM Greenland initialisation and projections	Heiko Goeltzer
10:30	Forced future Antarctic simulations, with extras	Tim van den Akker
10:45	Southern Ocean freshwater hosing experiments: Results from NorESM simulations with a coupled Greenland Ice Sheet	Dave Chandler
11:00	Antarctic ice sheet coupling within the Norwegian Earth System Model: advances and challenges	Michele Petrini
11:15	How calving observations can inform models	Joanna Millstein
11:30	New calving laws in CISM	Bill Lipscomb
11:45	Discussion	All
12:15	***Session Adjourned***	
	Lunch at the NSF NCAR ML cafeteria for people attending in person	

- Please mute your cell phone
- Join the meeting on your computer using companion mode

Many Thanks to our administrative and multimedia team

Elizabeth Faircloth

Daniel Sena

Teresa Walz

Kailyn Kampert

Keila DeBellis

Paul Martinez

Joey Erhman

Land ice updates

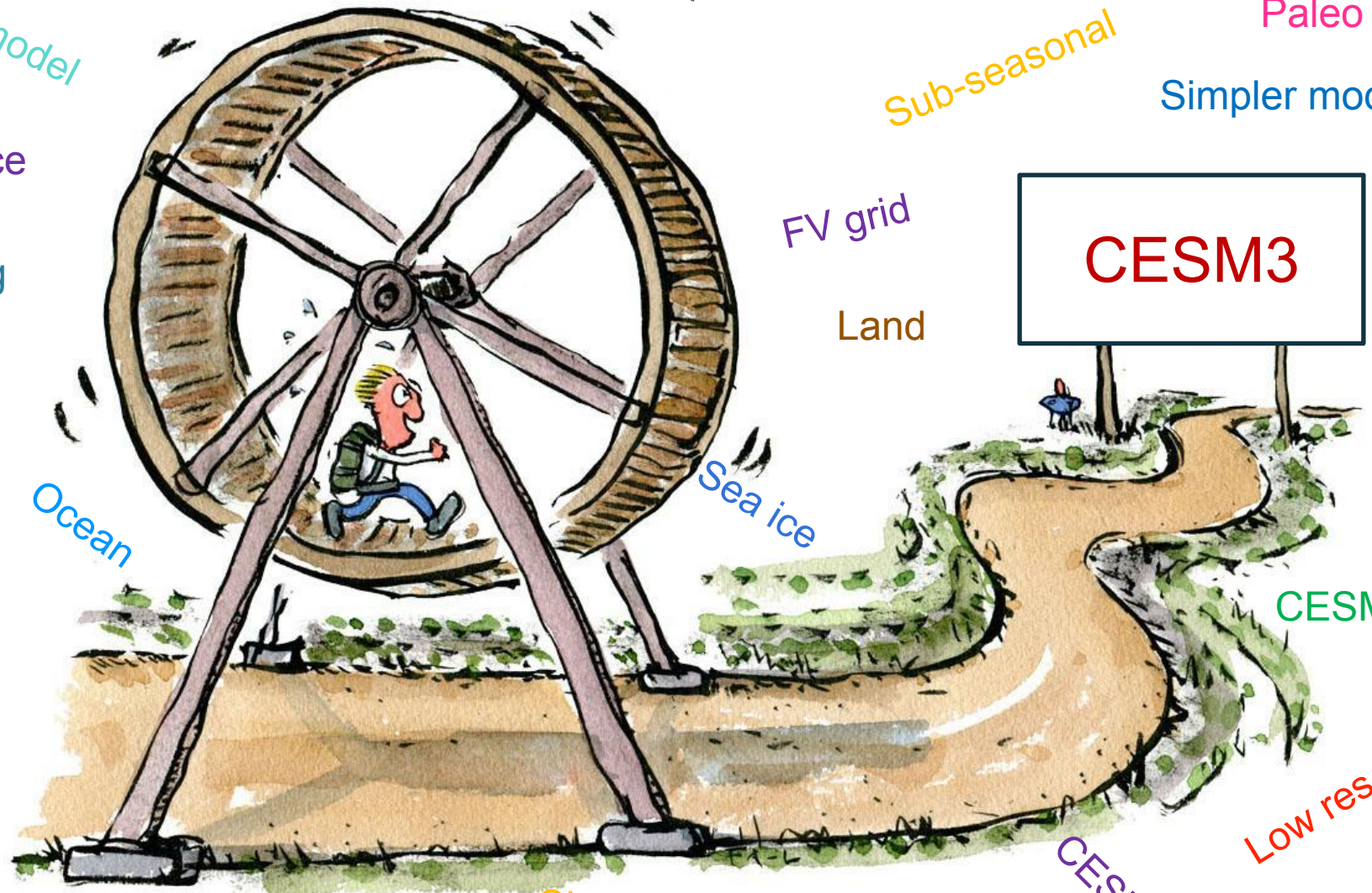
Gunter Leguy, Bill Lipscomb, Kate Thayer-Calder, Samar Minallah
And the LIWG community

LIWG winter meeting 2025, January 28th

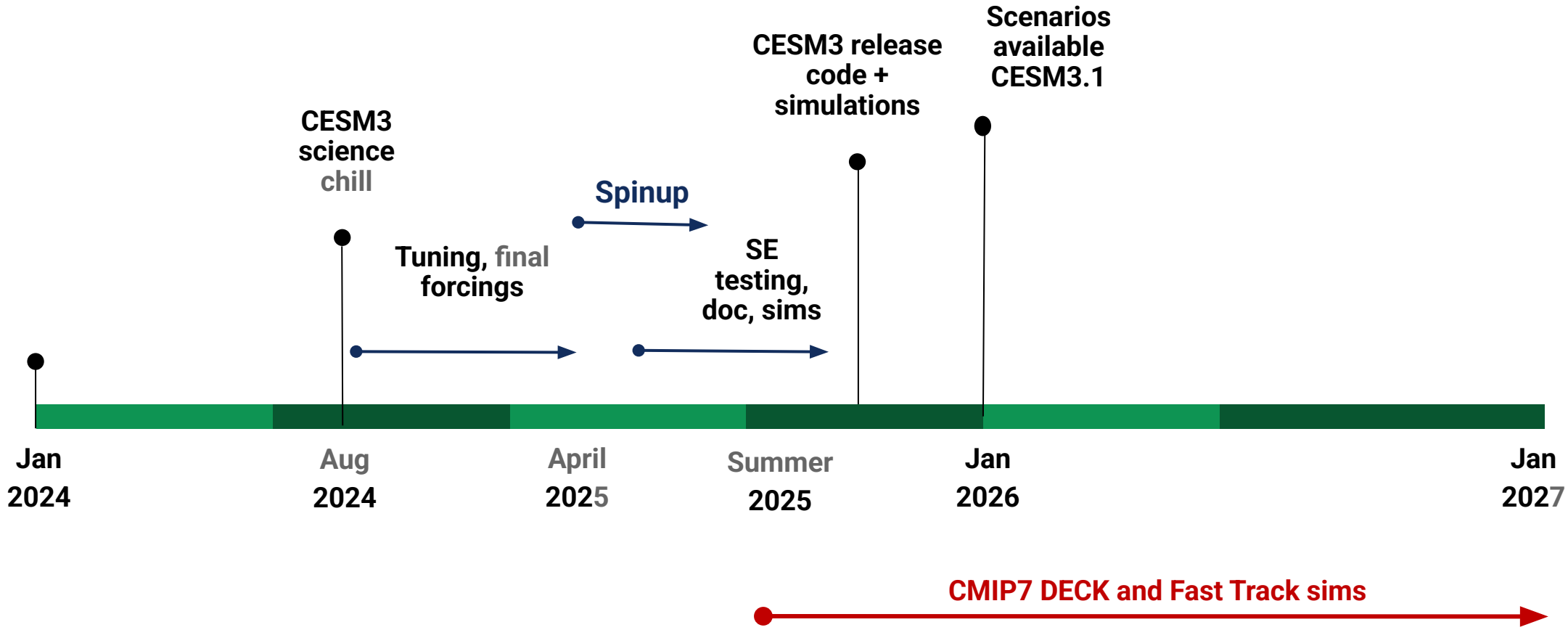
This material is based upon work supported by the National Center for Atmospheric Research, which is a major facility sponsored by the National Science Foundation under Cooperative Agreement No. 1852977.

In this talk

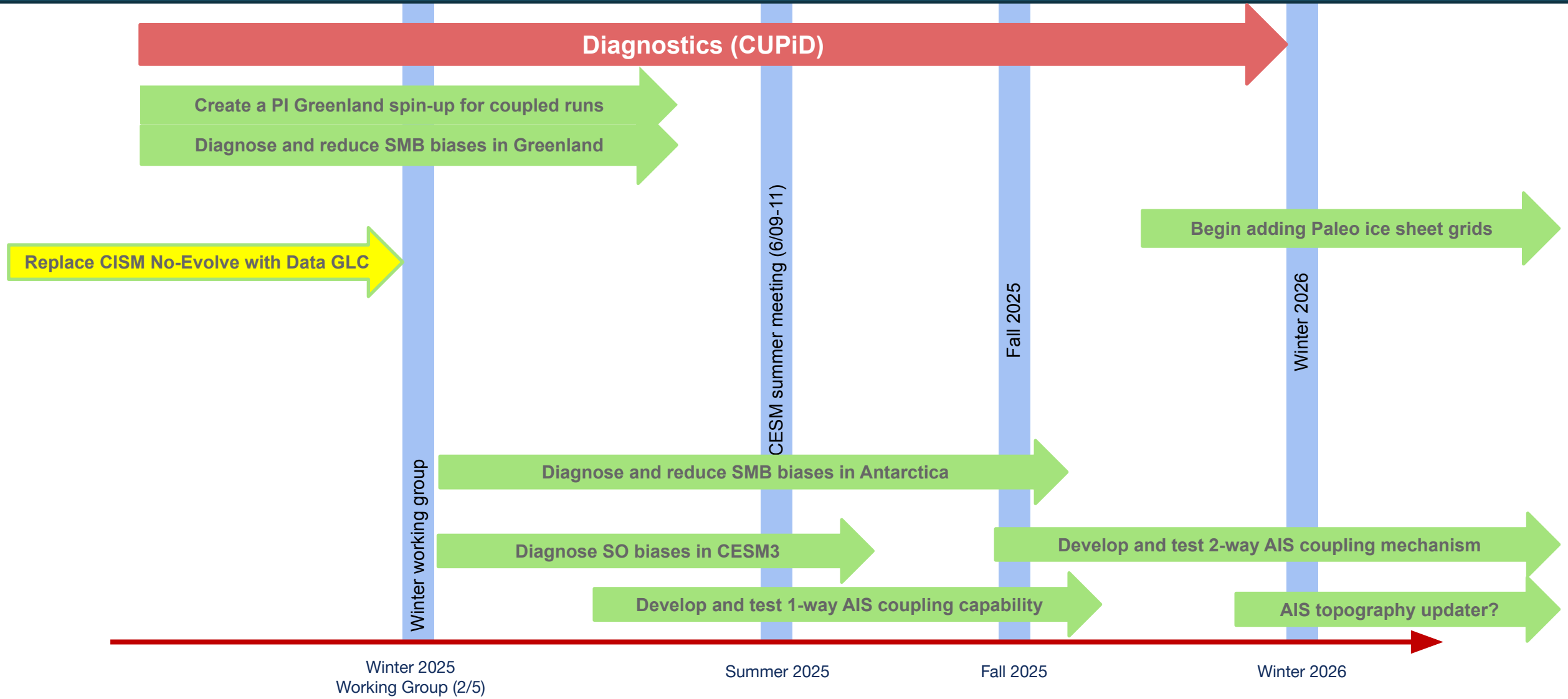
- **CESM3 (Community Earth System Model version 3)**
  - Timeline
  - GrIS and AIS coupling in CESM
  - Land ice diagnostics (including CUPiD)
- **CISM (Community Ice Sheet Model)**
  - Future release
  - Input file creation
- **Future events**


Machine learning model
Paleo reconstruction
Chemistry
Actionable science
History files
SE grid
Time series
Sub-seasonal
Paleo
Simpler models
Fundamental science
biases
FV grid
CESM3
1-way coupling
Fully coupled
Land
vegetation
Cartesian grid
CMIPs
Ocean
Sea ice
High res model
CESM2_beta_23
Diagnostics
Low res model
Labrador sea freeze
Ocean cavities
CESM2.2
Cloud parameterization
Atmosphere
CESM2.1

LIWG land ice plans for CESM3



Land ice timeline plans for CESM3



CESM Unified Postprocessing and Diagnostics (CUPiD)

CUPiD is a “one stop shop” that enables and integrates timeseries file generation, data standardization, diagnostics, and metrics from all CESM components.

- Collaborative effort
- Simplify user experience of running diagnostics
- Call post-processing tools directly from CUPiD
- Run all component diagnostics from one tool as either part of the CIME workflow or independently
- Shared python code and a standard conda environment across components.

Teagan King
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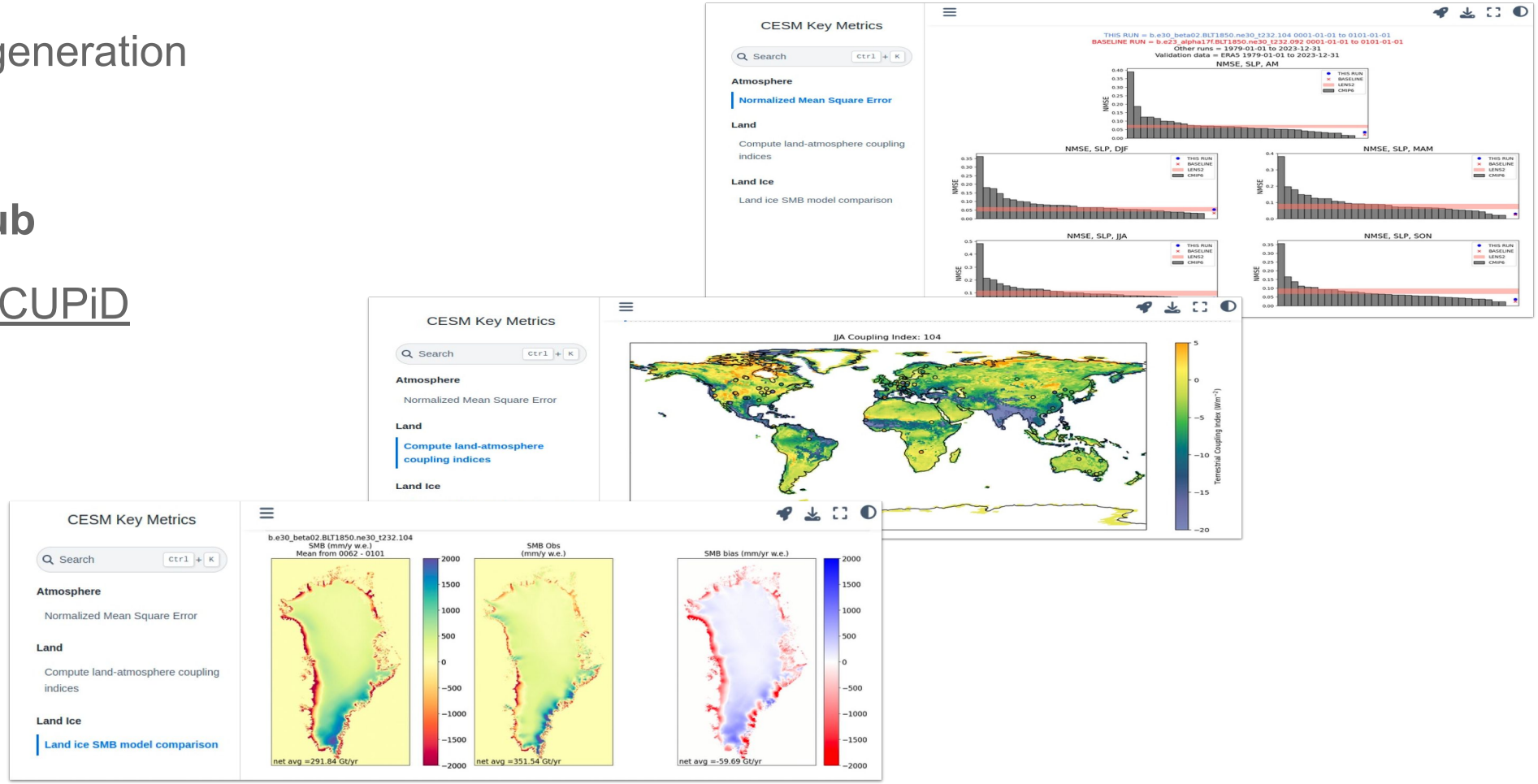
Michael Levy
mlevy@ucar.edu

CUPiD Current Status

- Can be run from CESM workflow or independently (in progress)
- Key metrics from glc, atm, lnd & examples from all components
- Basic timeseries file generation
- Documentation
- **Contribute via GitHub**

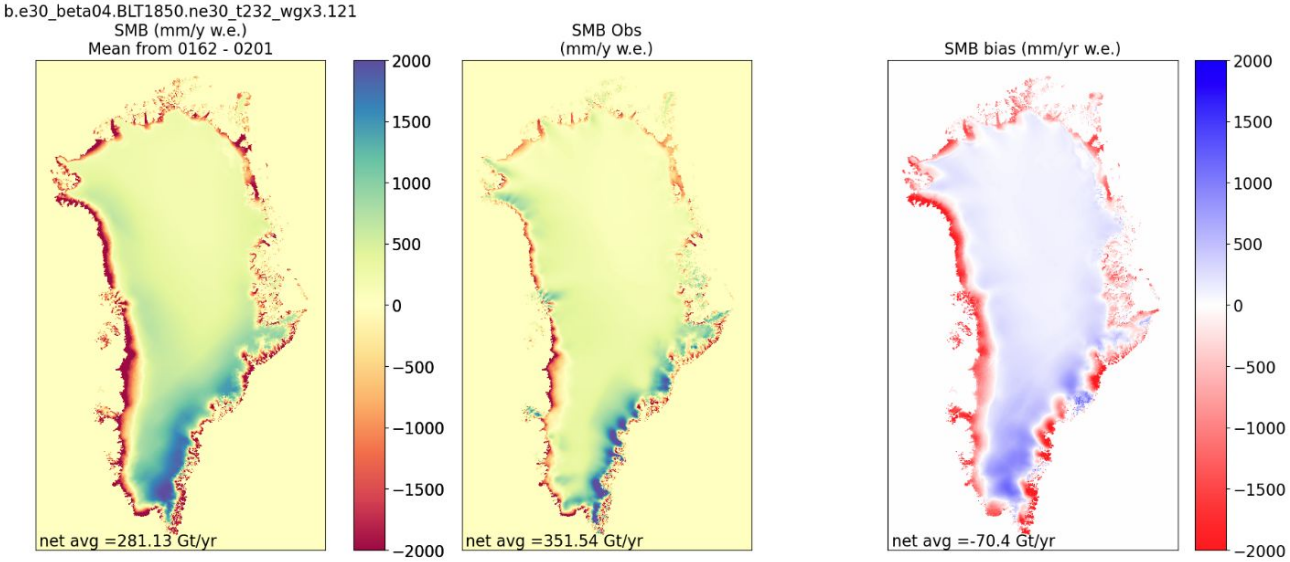
https://github.com/NCAR/CUPiD

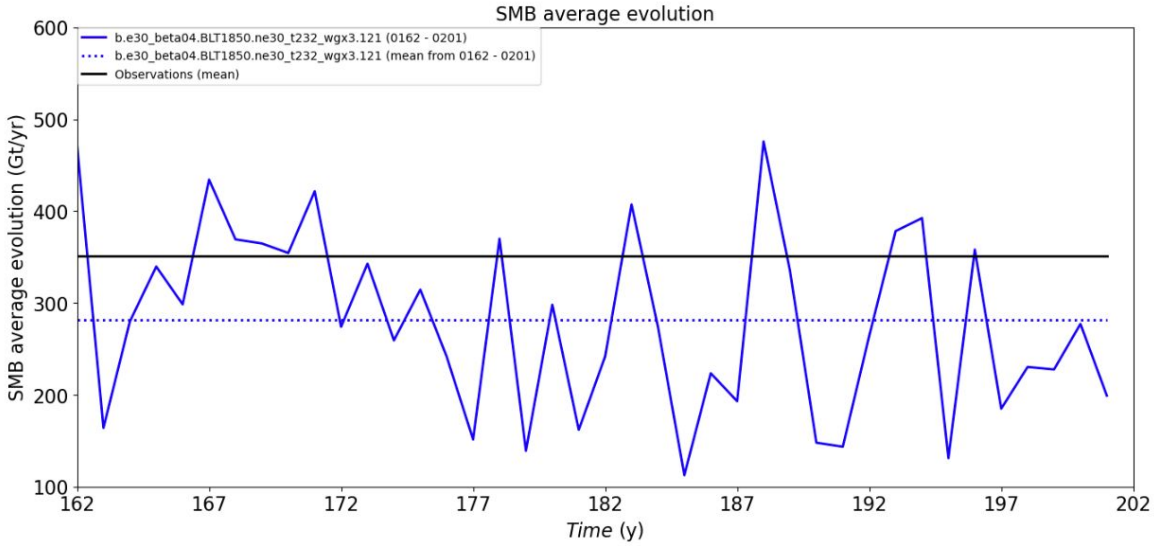


Land ice diagnostics in CUPiD this far

Right now land ice notebook only looks at PI control for SMB

Fig: Example of running CUPiD: comparing CESM3 PI run (#121) to MAR using 40 year climatology. (left) Spatial SMB comparison. (Right) time series evolution of the last 40 years of the PI compared to the PI climatology and MAR means.





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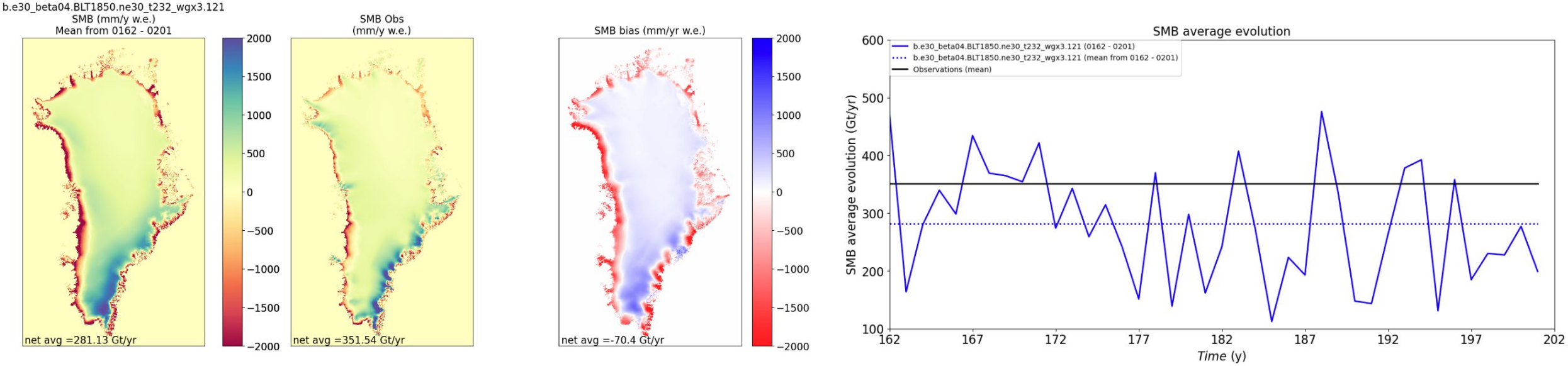
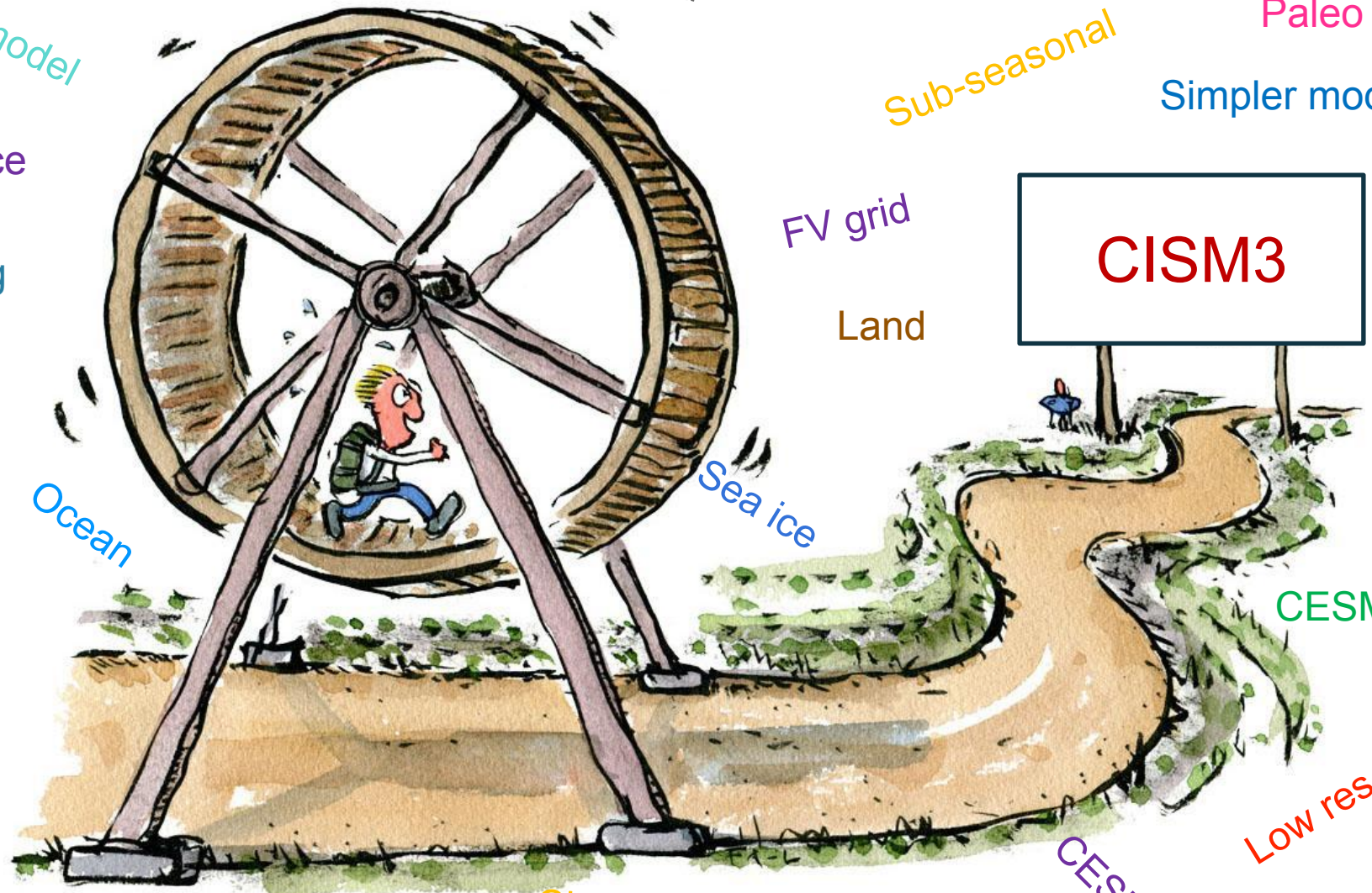


In progress:

- Notebook analyzing historical runs: annual and seasonal averages and climatology.
- Notebook analyzing other variables: precip, runoff, surface temp



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Ocean cavities

CESM2.2

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Atmosphere

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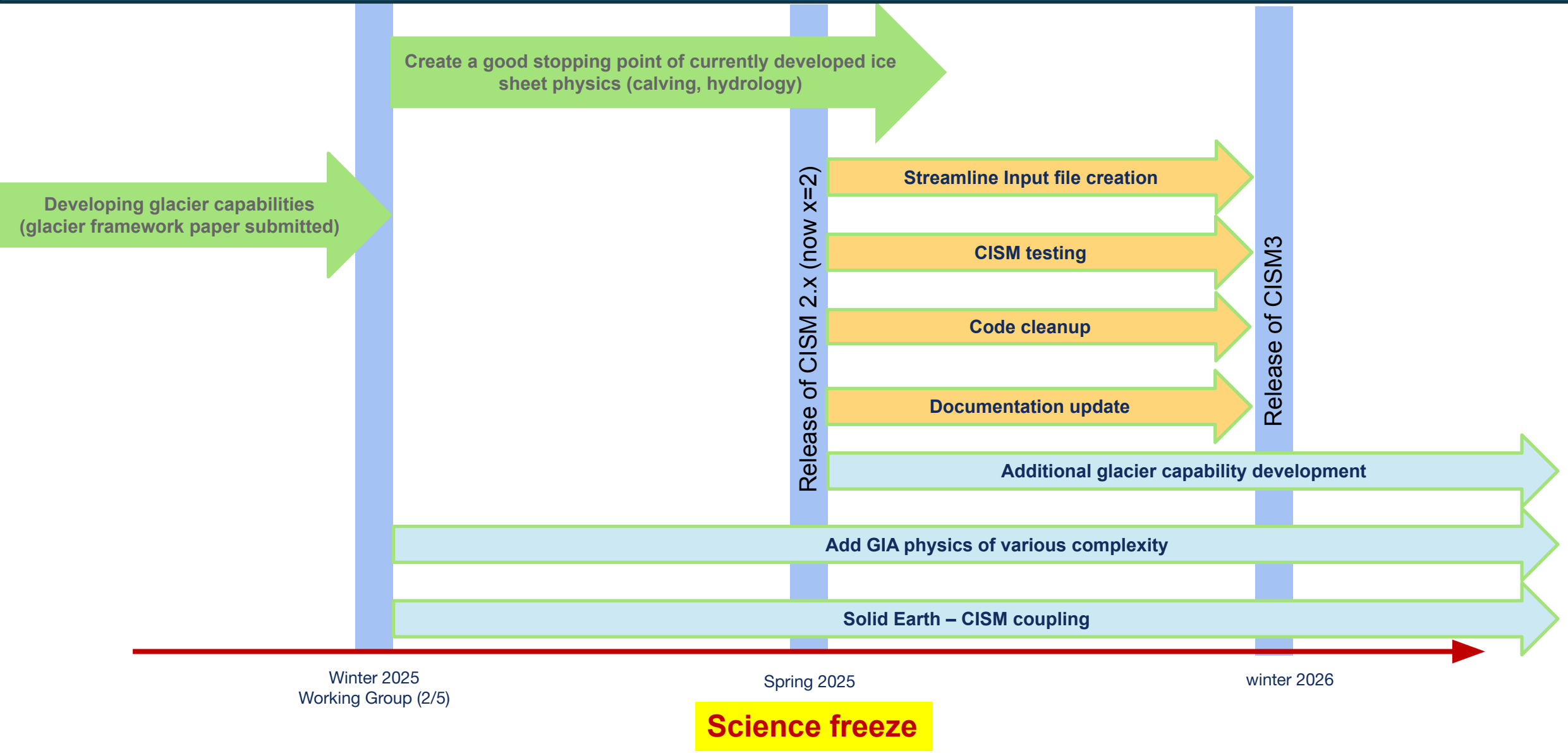
Release plans for CISM



CISM input file creation (workflow)

1. Define CISM grid file

- **Create the thickness and velocity grids in cartesian space**
- **Scrips are available to create SCRIP files for CESM regridding or ESMF interpolation tools.**

CISM input file creation (workflow)

1. Define CISM grid file

2. Interpolate observation

- **Each observational product organized by “data type” and source.**
- **Data type:**
  - Topography (thk, bed, mask), SMB and air temp, Geothermal heat flux, Ice velocity, thermal forcing, ocean basin number, ice domain mask, mass change rate.

CISM input file creation (workflow)

1. Define CISM grid file → 2. Interpolate observation → 3. Define input in CISM config file

- **Define one input file for the CISM config file**
  - 1 notebook for that.

Config layout in CISM:

```
[CF input]
name = input_file_name.nc
```

- **Define several input file in the CISM config file**

Config layout in CISM:

```
[CF input]
name = input_file_name1.nc
[CF input]
name = input_file_name2.nc
…
```

- **CISM reads the input files in order**

CISM input file creation

- **1 Jupyter notebook per task and data type.**
- **Right now, data for AIS only, GrIS to come (using the same notebooks).**
- **Jupyter notebooks and available data are located on Derecho**:

`/glade/campaign/cesm/community/liwg/cism_input`

```
gunterl@derecho3:/glade/campaign/cesm/community/liwg/cism_input> ls -l
total 4.5M
1.0K drwxrws---+ 14 gunterl 4.0K Jan 27 14:56 ./
1.0K drwxrws---+  4 gunterl 4.0K Jan 27 14:54 ../
1.0K drwxr-s---+  3 gunterl 4.0K Jan 27 14:55 Basin_number/
1.0K drwxr-s---+  4 gunterl 4.0K Jan 27 14:55 Bed_topo/
 64K -rw-rw----+  1 gunterl  52K Jan 27 14:55 CISM_basin_number_regridding.ipynb
976K -rw-rw----+  1 gunterl 976K Jan 27 14:55 CISM_bedtopo_regridding.ipynb
2.0M -rw-rw----+  1 gunterl 2.0M Jan 27 14:55 CISM_bedtopo_smoothing.ipynb
 32K -rw-rw----+  1 gunterl  21K Jan 27 14:55 CISM_climo_regridding.ipynb
 16K -rw-rw----+  1 gunterl 7.9K Jan 27 14:55 CISM_create_lat_lon.ipynb
128K -rw-rw----+  1 gunterl 122K Jan 27 14:55 CISM_dh_dt_regridding.ipynb
112K -rw-rw----+  1 gunterl 104K Jan 27 14:55 CISM_Geothermal_regridding.ipynb
1.0K drwxr-s---+  4 gunterl 4.0K Jan 27 14:55 cism_grid/
 16K -rw-rw----+  1 gunterl 4.6K Jan 27 14:55 CISM_grid_create.ipynb
 48K -rw-rw----+  1 gunterl  43K Jan 27 14:55 CISM_ice_domain_mask_regridding.ipynb
1.0K drwxr-s---+  4 gunterl 4.0K Jan 27 14:55 CISM_initialization_file/
320K -rw-rw----+  1 gunterl 316K Jan 27 14:55 CISM_SMB_artm_regridding.ipynb
592K -rw-rw----+  1 gunterl 587K Jan 27 14:55 CISM_surface_velo_regridding.ipynb
272K -rw-rw----+  1 gunterl 266K Jan 27 14:55 CISM_thermal_forcing_regridding.ipynb
 16K -rw-rw----+  1 gunterl  16K Jan 27 14:55 Create_input_file_CISM.ipynb
1.0K drwxr-s---+  3 gunterl 4.0K Jan 27 14:55 dh_dt/
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1.0K drwxr-s---+  3 gunterl 4.0K Jan 27 14:55 LatLon/
 16K -rwxr-x---+  1 gunterl 8.1K Jan 27 14:55 locate_vectorize.py*
1.0K drwxr-s---+  2 gunterl 4.0K Jan 27 14:55 __pycache__/
1.0K drwxr-s---+  4 gunterl 4.0K Jan 27 14:55 SMB/
1.0K drwxr-s---+  3 gunterl 4.0K Jan 27 14:55 Thermal_forcing/
1.0K drwxr-s---+  3 gunterl 4.0K Jan 27 14:55 Velocity/
gunterl@derecho3:/glade/campaign/cesm/community/liwg/cism_input>
```
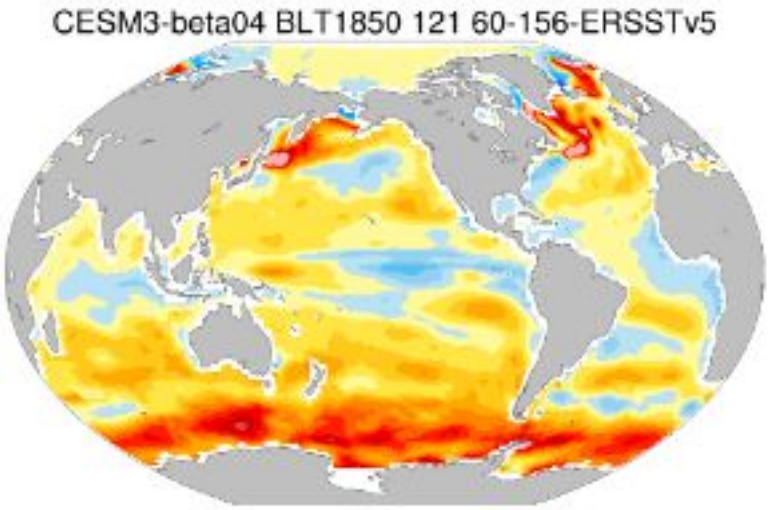
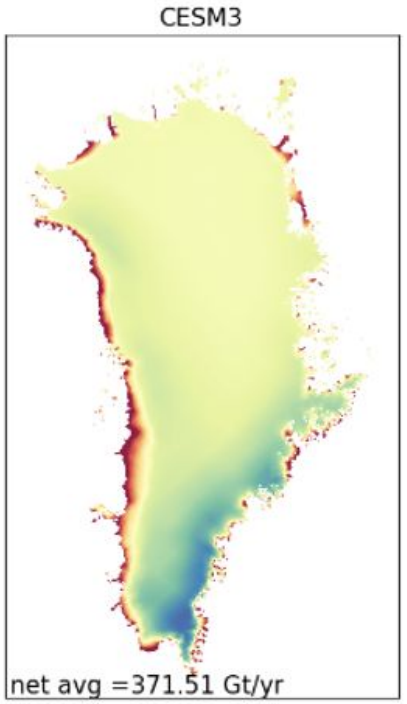

NOTES

1. Notebooks can be used by the community and they are still in development!
   - We welcome feedback for improvements and user friendliness
2. Right now, none of the notebook in this directory include data smoothing beyond the interpolation step.
3. We are thinking in adding them to version control (Github) as part of the CISM code somewhere.
4. Don't hesitate to contribute to the available dataset !

Future events





CESM summer workshop June 9-11 2025

- 30th anniversary
- Would like to make it special
- Please come if you can

CESM summer tutorial July 7-11 2025

- Deadline for registration extended to February 7th 2025
- Decision on attendance made by April 18 2025

Contact information

Website: https://www.cesm.ucar.edu/working-groups/land-ice

Co-chairs:

- Gunter Leguy, gunterl@ucar.edu
- Miren Vizcaino, M.Vizcaino@tudelft.nl

Liaisons:

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- Science: Gunter Leguy, gunterl@ucar.edu

Code development:

- Bill Lipscomb, lipscomb@ucar.edu