Tutorial:
Ice sheet modeling in CESM

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CISM in CESM

CAM
(Community Atmosphere Model)

CLM
(Community Land Model)
10 glacier elevation classes

Surface Mass Balance
Surface Temperature
Surface Elevation

CISM
(Community Ice Sheet Model)
Compsets with active ice sheet

- BG (fully coupled)
- FG (CAM, CLM & CISM)
- IG (CLM & CISM)
- TG (CISM only – in CESM1.1)

Limited number of supported resolutions:

- 1-degree finite volume (f09)
- 2-degree finite volume (f19)
- 3.75-degree spectral (T31)
New TG Compset (CESM1.1)

Key: active / data / stub model

First: Run IG (or FG or BG)

Next: Run TG

cpl history (tsrf, topo, qice)
CESM 1.1: New CISM Features

• CISM2!
  ▸ SEACISM dynamical core, parallel solvers, etc.
  ▸ BISICLES coming soon

• Ensemble capabilities

• Support for longer time steps in CISM and CESM scripts
  ▸ e.g., 1-year time step
CESM 1.1: New namelist features

Namelist modifications go in $CASEROOT/user_nl_cism

For example:

\texttt{evolution = 0}
CESM1.1: New CLM Features

• Improved glacier cover, consistent with CISM over Greenland
  ▸ Global glacier cover from Alex Gardner

• Ability to output fields averaged only over glacier portion of each grid cell

• Glacier-related bug fixes
Post-CESM1.1: Dynamic Landunits in CLM

Currently: fixed fractions

One column for each elevation class
Post-CESM1.1: Dynamic Landunits in CLM

CLM
(Community Land Model)
10 glacier elevation classes

Surface Mass Balance
Surface Temperature
Surface Elevation
Icesheet Area
Area of cropland, urban, etc.

CAM
(Community Atmosphere Model)

CISM
(Community Ice Sheet Model)
Hands-on overview:
CESM IG run

• IG compset

• Simple CLM source code modification to simulate global warming / cooling over ice sheets

• Look at how this affects the Greenland surface mass balance over a few years
Hands-on overview: Standalone CISM run

• Why standalone CISM
  ▸ access to higher-order, parallel solver
  ▸ standalone useful even when CISM2 comes into CESM, for testing & development, or coupling to other forcing data

• Dome test case
  ▸ Useful for testing the model in a simple configuration
  ▸ Can watch ice evolving

• Greenland 5 km, one-year run, 750 processors