CESM/CISM Software Engineering Update: Towards CESM2.0

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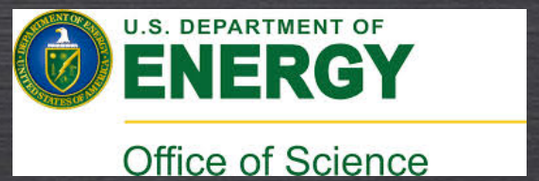
With contributions from many others in the LIWG and the CESM Software Engineering Group (CSEG)



Land Ice: From CESM1 to CESM2

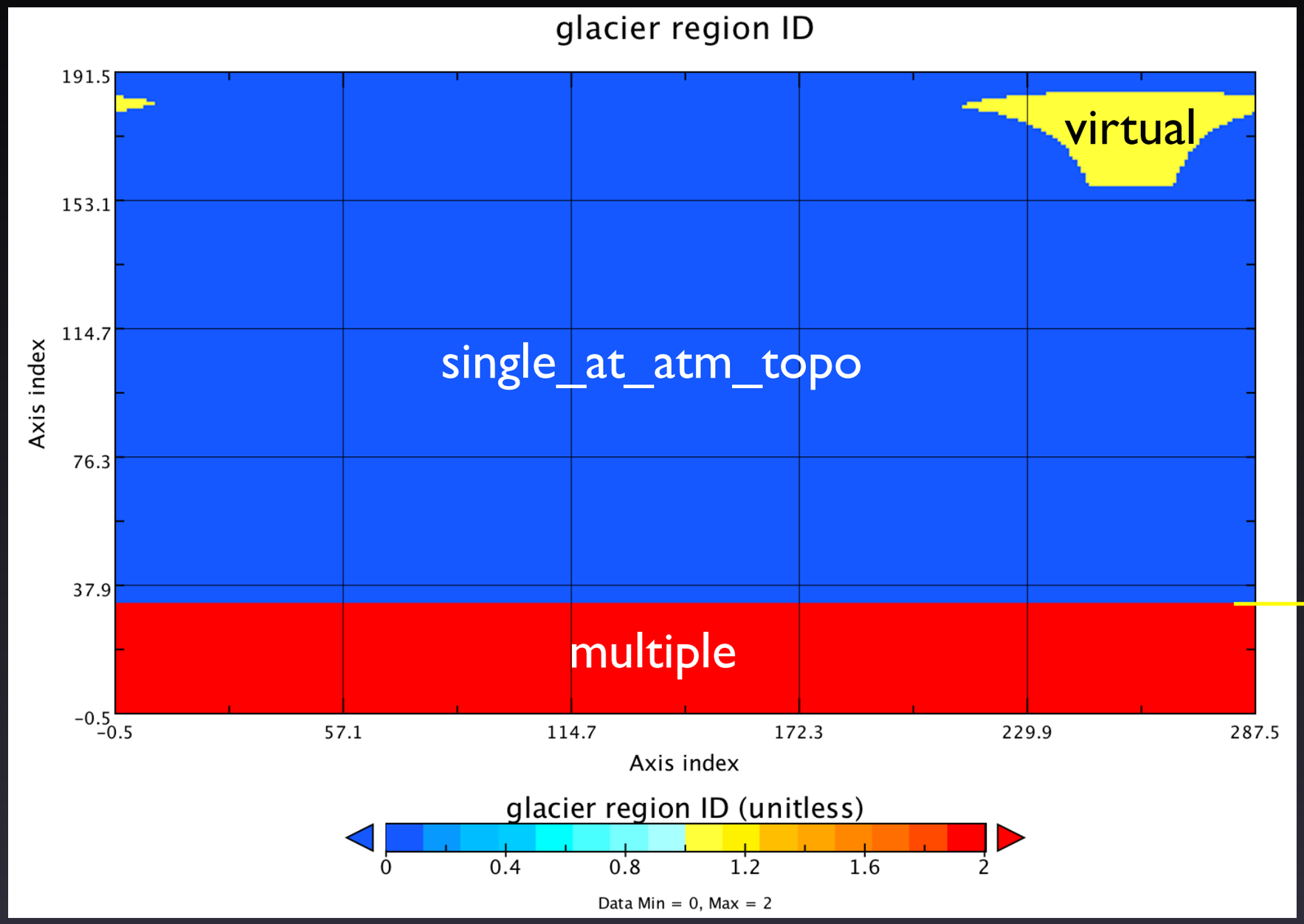
CESM1.0	CESM2.0
One-way coupling	Two-way coupling
Serial, shallow ice approximation	Parallel, higher-order
No way to run standalone CISM	TG compset for running standalone CISM
1-m snow pack in CLM	10-m snow pack in CLM
Only 3 land/atm resolutions supported	All land/atm resolutions supported
SMB only computed in runs done by LIWG	SMB computed in all runs

Major Science Changes Since Last Year

- Improvements to CISM to support robust, higher-order Greenland Ice Sheet simulations
  - ★ Bill Lipscomb, Jeremy Fyke, Lauren Vargo, Steve Price
- Improved snow physics in CLM
  - ★ Leo van Kampenhout, Jan Lenaerts, Bill Lipscomb, Drew Slater
- Improved downscaling to elevation classes
  - Repartition rain/snow from atmosphere
  - All adjustments based on *differences* from atmosphere height
- Fixed interpolation of CLM initial conditions for glacier

Specifying Glacier Regions in CLM

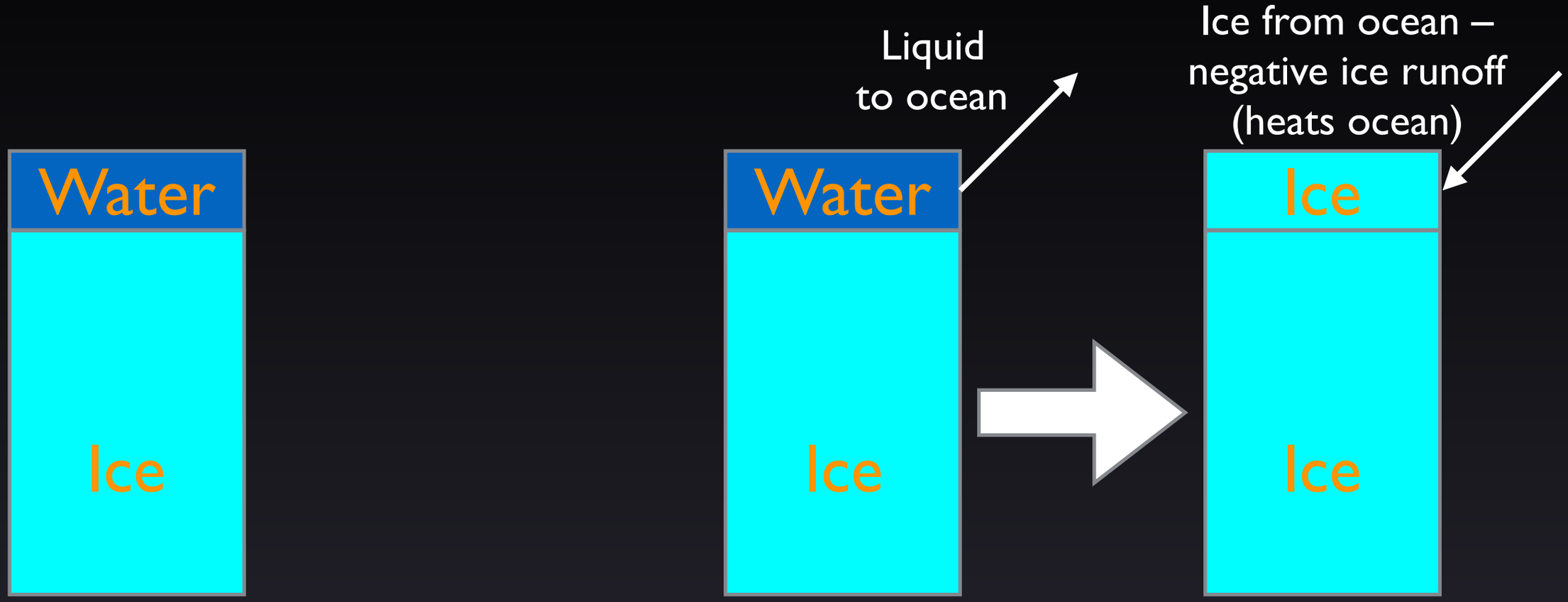
CLM surface dataset field: GLACIER_REGION



CLM namelist item:

glacier_region_behavior = 'single_at_atm_topo', 'virtual', 'multiple'

Handling Ice Melt in CLM



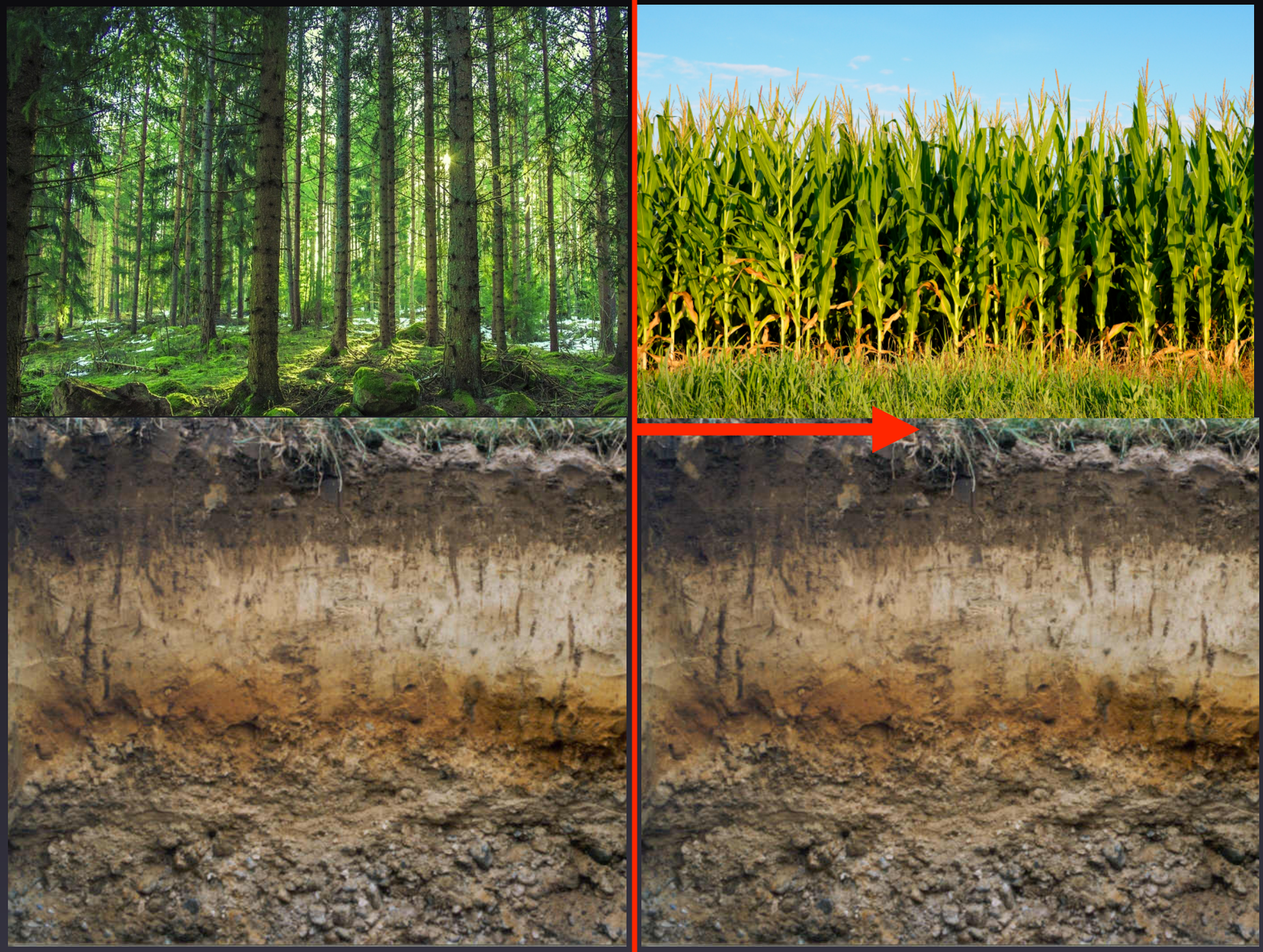
Old glacier scheme

New glacier scheme

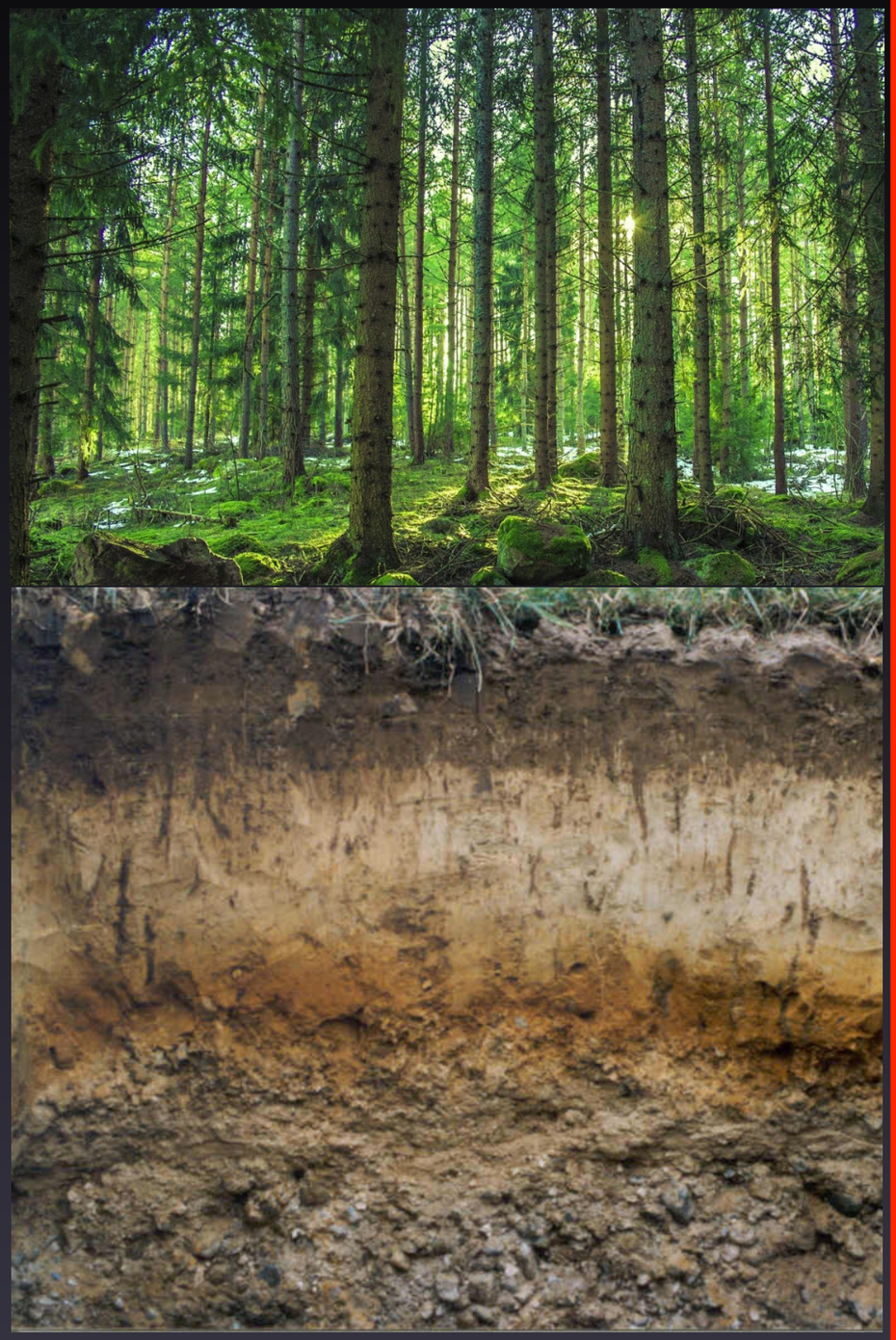
Problem: Some people find negative ice runoff unappealing

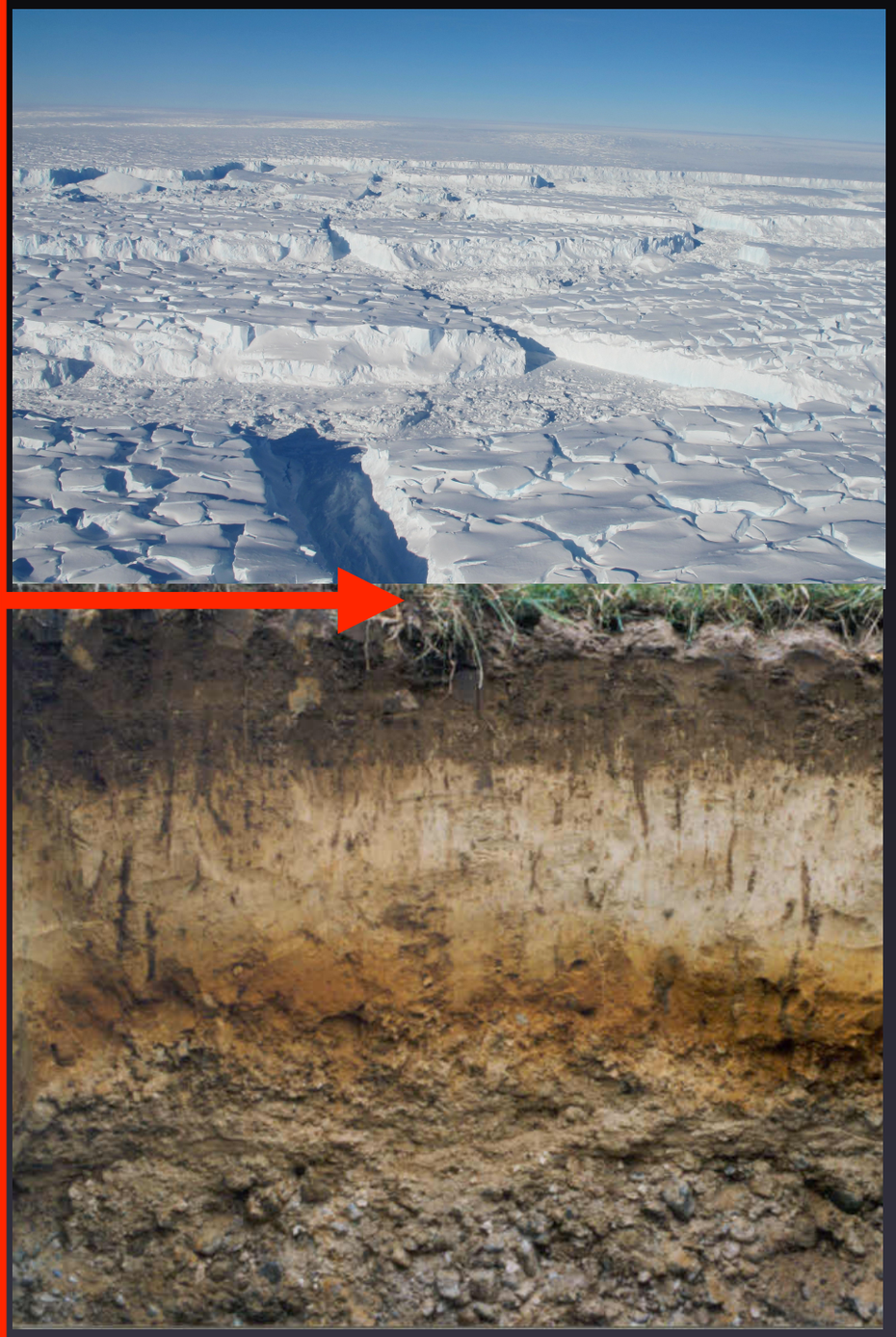
Solution?: Use new scheme for ice sheets, old for mountain glaciers

In Progress: Carbon and Nitrogen Conservation with Dynamic Landunits



In Progress: Carbon and Nitrogen Conservation with Dynamic Landunits





In Progress: SMB Computed in *all* CESM RUNS

- Beginning with CESM2: SMB will be computed in all runs
  - For analyzing SMB given current ice sheet geometry
  - For forcing later standalone CISM runs
- Compset naming: IG/BG indicates two-way coupling; others use CISM as a diagnostic component
- This has required
  - Moving remapping into coupler
  - Removing resolution-specific glacier files from CLM
  - Porting CISM to the NAG compiler
- Big things left to do
  - Enable mid-year restarts
  - Make a lot of mapping files

Other Remaining Tasks for CESM2

- Fix TG compsets, and create new out-of-the-box TG forcing data
  - Need to determine what model configuration(s) to use for this
- Make CLM to CISM downscaling smoother
  - Smoother vertical interpolation
  - 2nd order conservative horizontal remapping?
- Handle edge cases in CLM-CISM coupling?
- ~~Rework SMB definition~~