

Resources and Tools for Deep-Time Paleoclimate*

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Team members

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* Supported by the Heising-Simons Foundation



HSF Project Goals

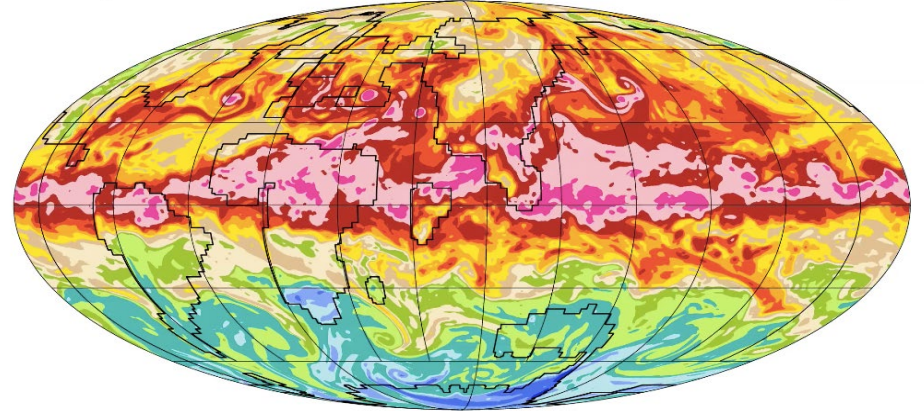
- * Produce a flexible, robust version of the Community Earth System Model (CESM) that is applicable to modeling climates of Earth's deep past and make it available to the community...

DT-CESM

- * Utilize DT-CESM to investigate scientific questions with regards to Earth's deep past

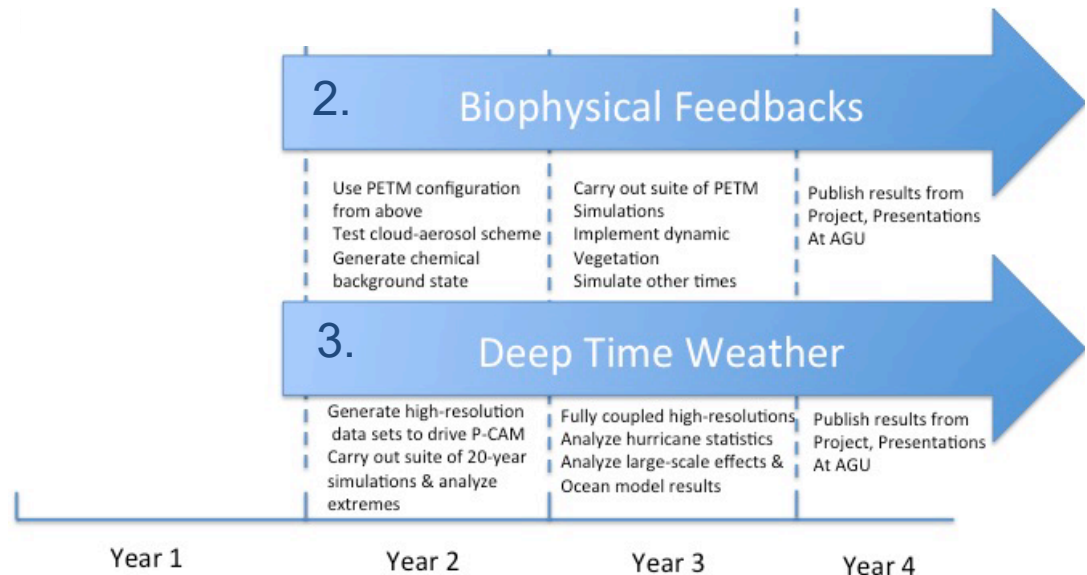
Science Objectives

Precipitable Water 530719 kg/m²



GOALS

Science projects including biophysical feedbacks (w/ C. Poulsen) and developing a high-resolution version to study the hydrological cycle and deep time “weather” (w/ A. Timmerman).



Community Requests for HSF work

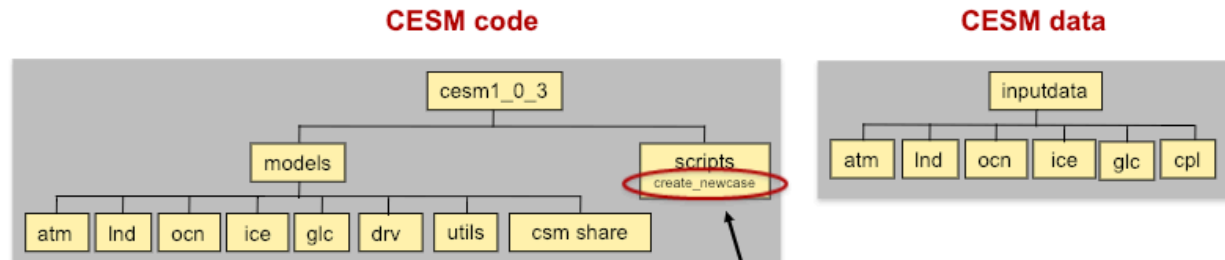
- * Target specific time periods:
 - P/T (~250 Ma)
 - mid-cretaceous (~100 Ma)
 - PETM (~55 Ma)
- * Slab Ocean Model (SOM, w/ A. Winguth)
- * Water Isotopes
- * Dynamic Vegetation (FATES in CESM2)

DT-CESM

- * Code base branched from CESM1_2 (cam5,clm4.0,POP2,CICE,RTM)
- * Important bug fixes, including the "warm-world" fix
- * Addition of certain diagnostics to code (HEAT Index, etc)
- * Incorporates processes relevant to periods of deep-time
- * Updated and enhanced Toolkit for preparing boundary and other forcing datasets for deep-time
- * Enhancements to post-processing and diagnostics
- * Period-specific compsets (analogous to others: 1850, modern-day) to enable running "out-of-the-box"

Deep-Time compsets

Step 1: create_newcase



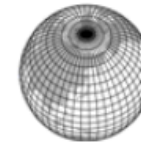
The first step to create a CESM experiment is to use **create_newcase**

create_newcase has 4 required arguments (+ more optional arguments)

create_newcase -case myFirstCase -mach ekman -compset B1850 -res 0.9x1.25_gx1v6

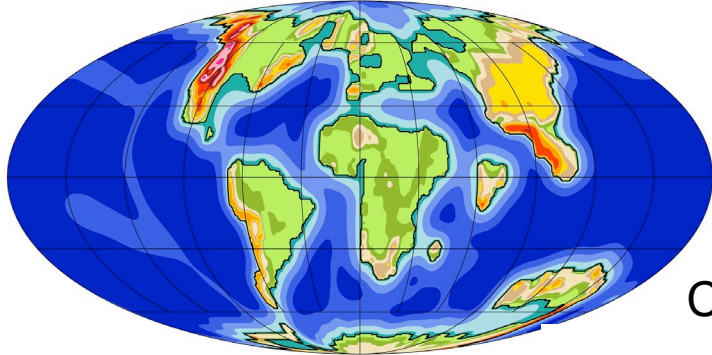
casename

it is the
experiment
identifier

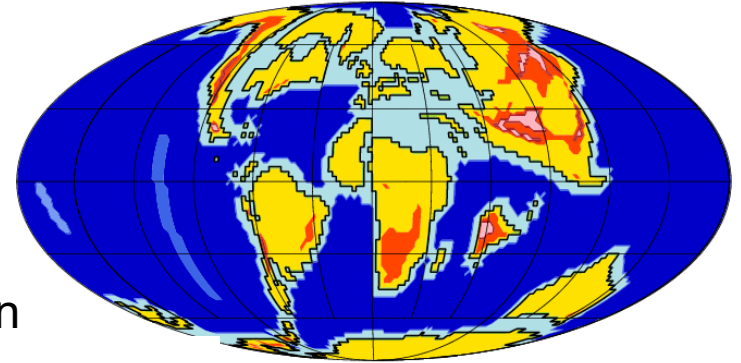


Developed Deep Time CESM Configurations

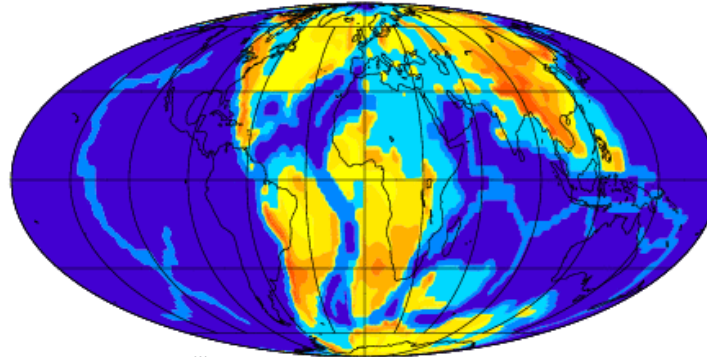
PETM



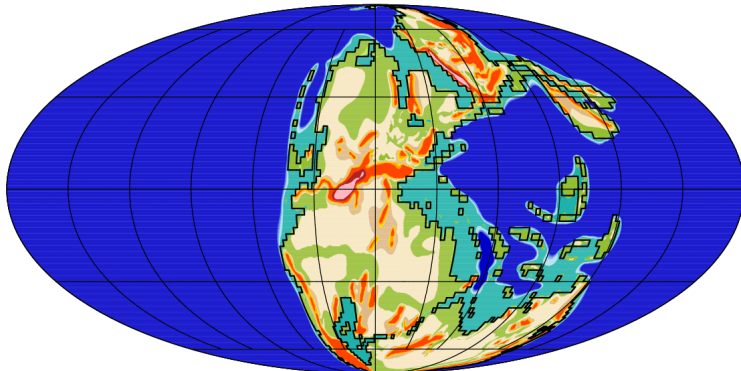
K/T



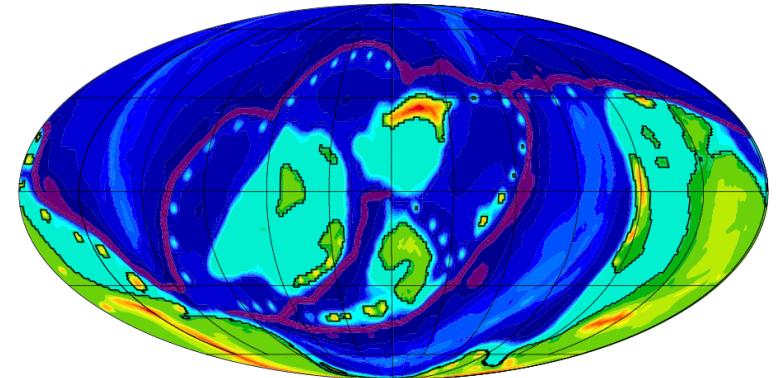
Cretaceous/Albion



Permian/Triassic

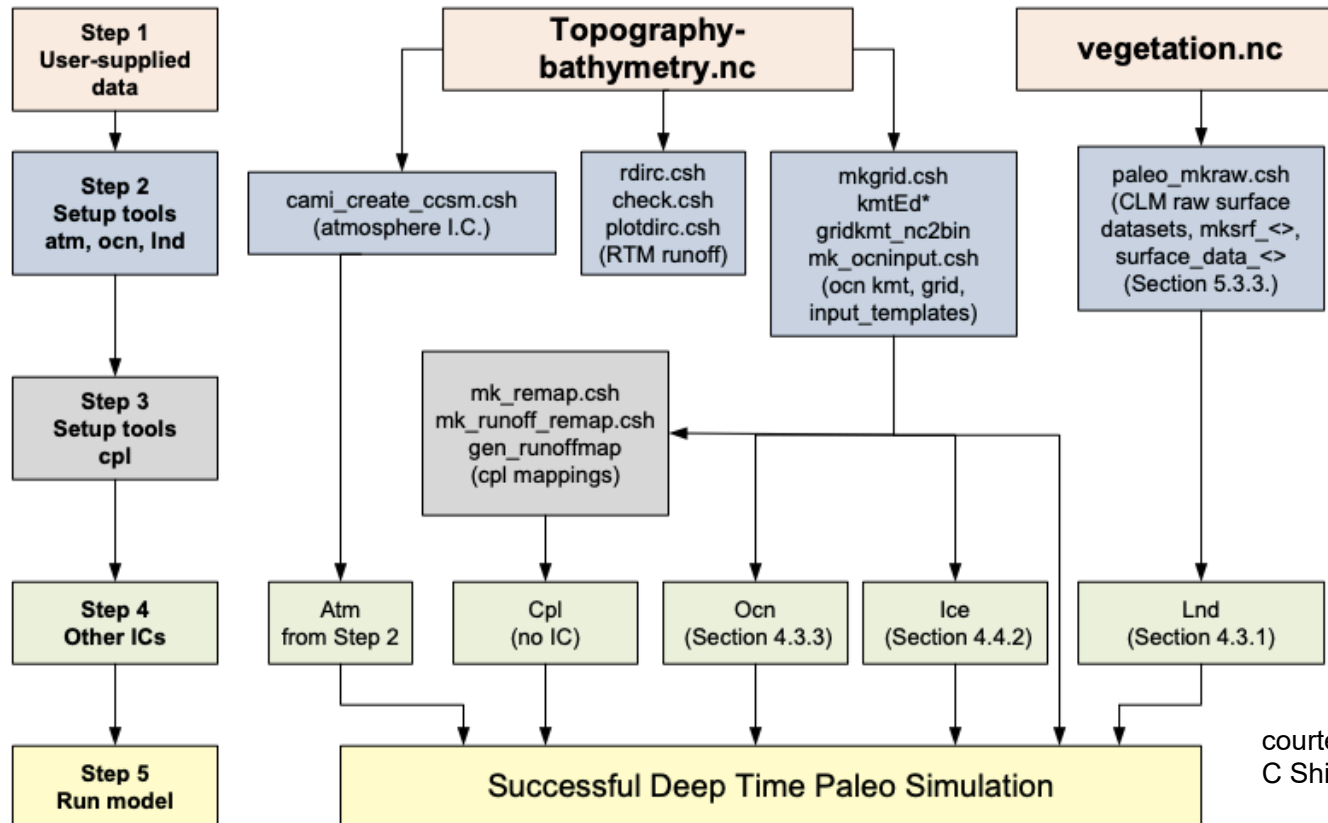


Ordovician



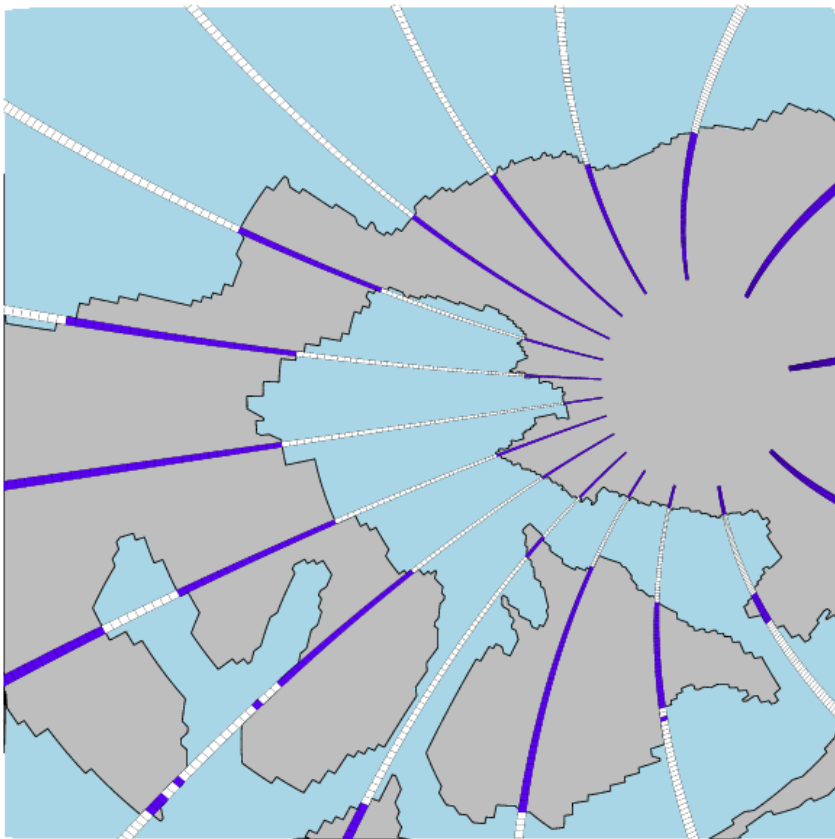
courtesy, C Shields

Current Workflow



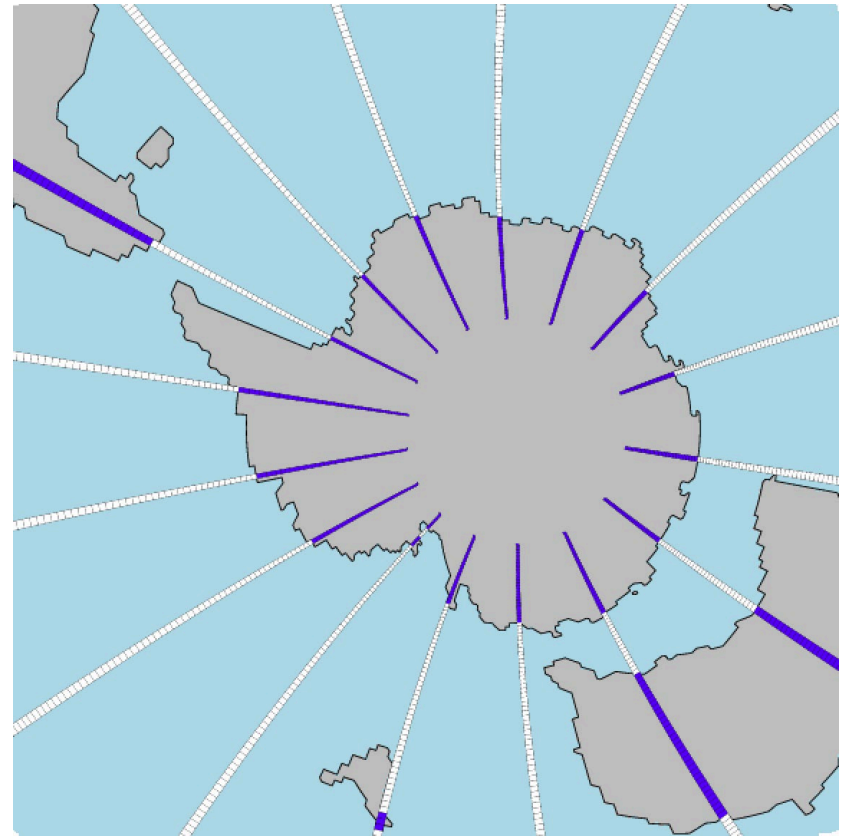
courtesy, N Rosenbloom,
C Shields

Pole Locations

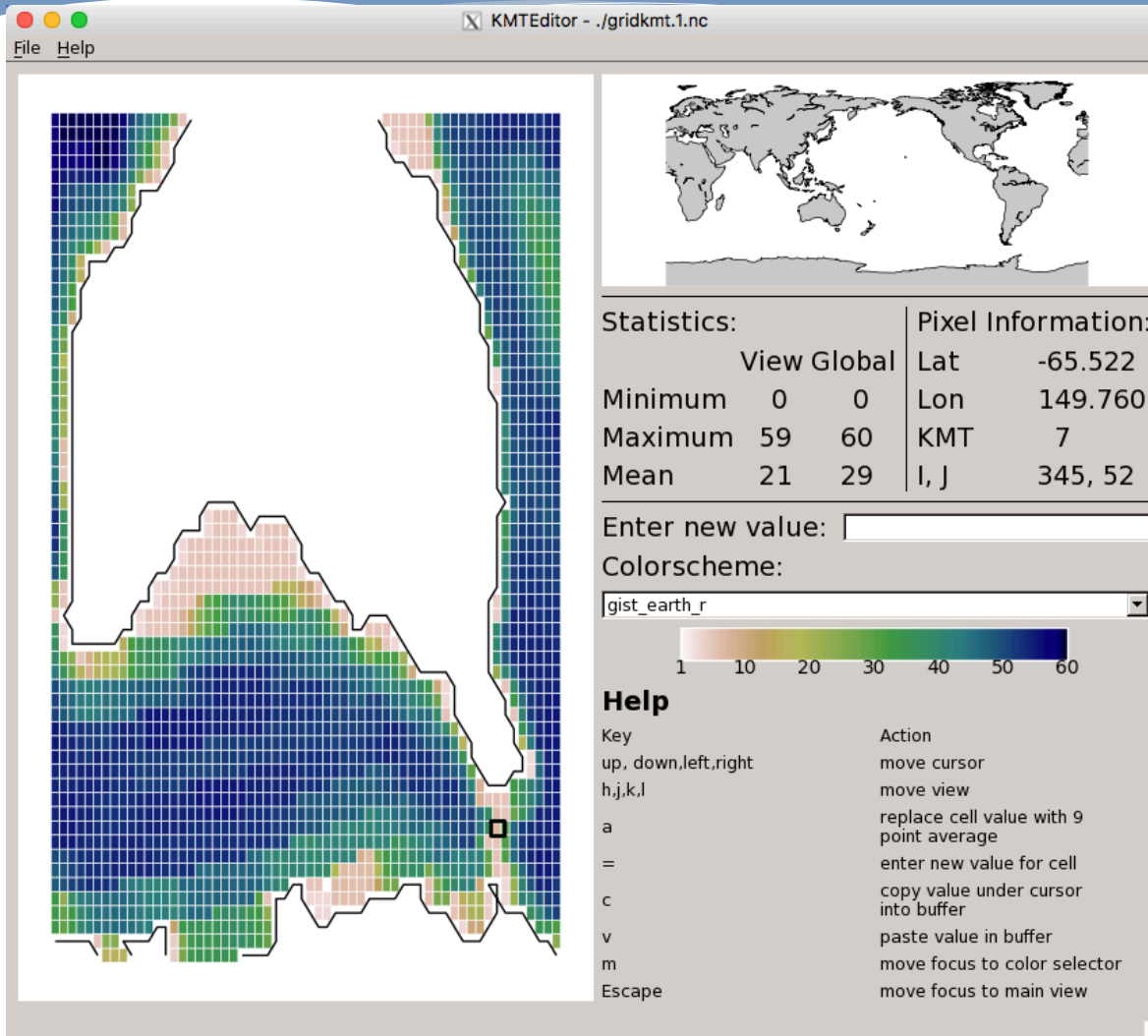


North pole

South pole



KMT editor



The screenshot shows the KMT editor interface. The main window displays a grid map of a region, with a color scale ranging from 1 (lightest) to 60 (darkest). A small black square cursor is visible on the grid. The interface includes a menu bar with 'File' and 'Help' options. A world map is shown in the top right corner. The statistics panel on the right provides the following information:

Statistics:		Pixel Information:	
	View Global	Lat	-65.522
Minimum	0 0	Lon	149.760
Maximum	59 60	KMT	7
Mean	21 29	I, J	345, 52

Below the statistics panel, there is an input field for 'Enter new value:' and a dropdown menu for 'Colorscheme:' set to 'gist_earth_r'. A color scale legend is also present, showing a gradient from light to dark with numerical markers at 1, 10, 20, 30, 40, 50, and 60.

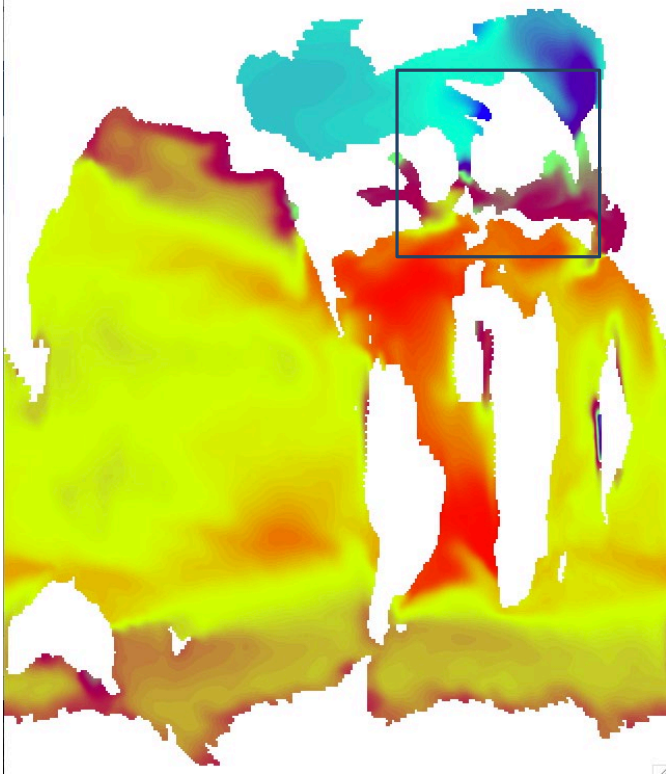
Help

Key	Action
up, down, left, right	move cursor
h, j, k, l	move view
a	replace cell value with 9 point average
=	enter new value for cell
c	copy value under cursor into buffer
v	paste value in buffer
m	move focus to color selector
Escape	move focus to main view

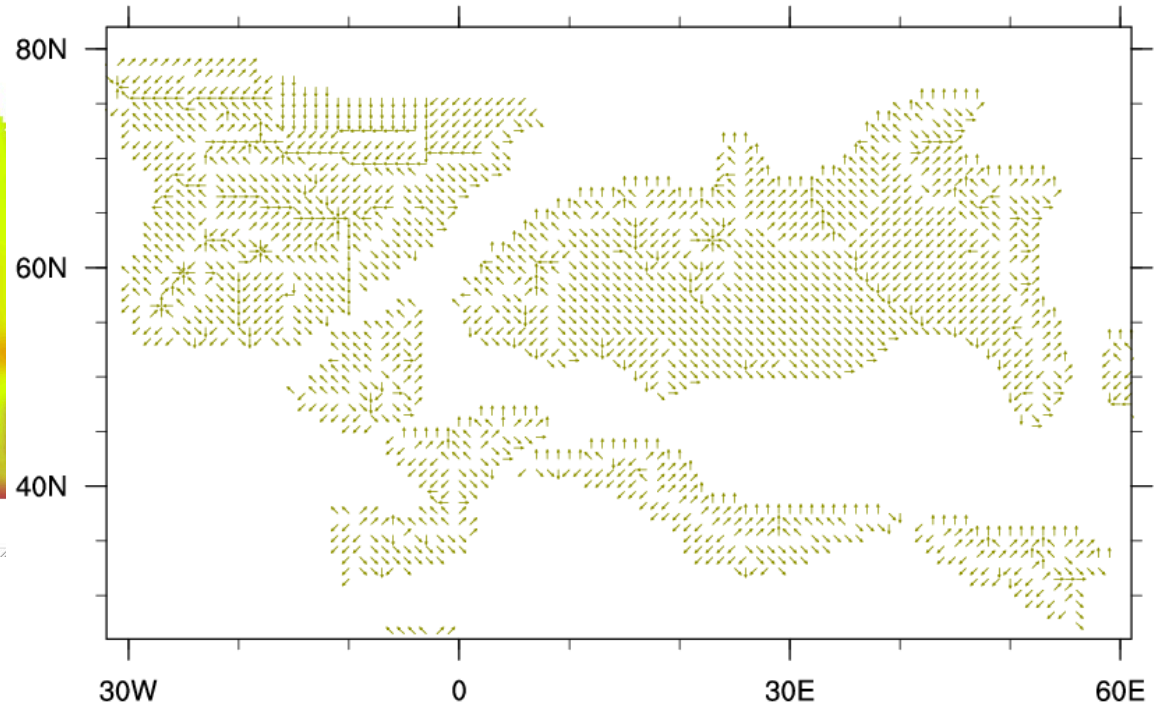
Deepak Chandan
University of Toronto

Salinity and Runoff

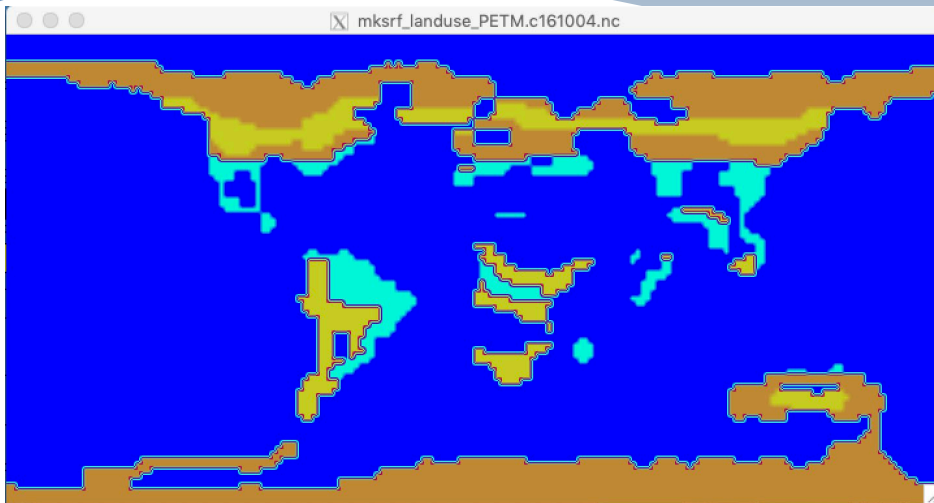
8↖	1↑	2↗
7←	ref	3→
6↙	5↓	4↘



PETM_new redirected Runoff Vectors

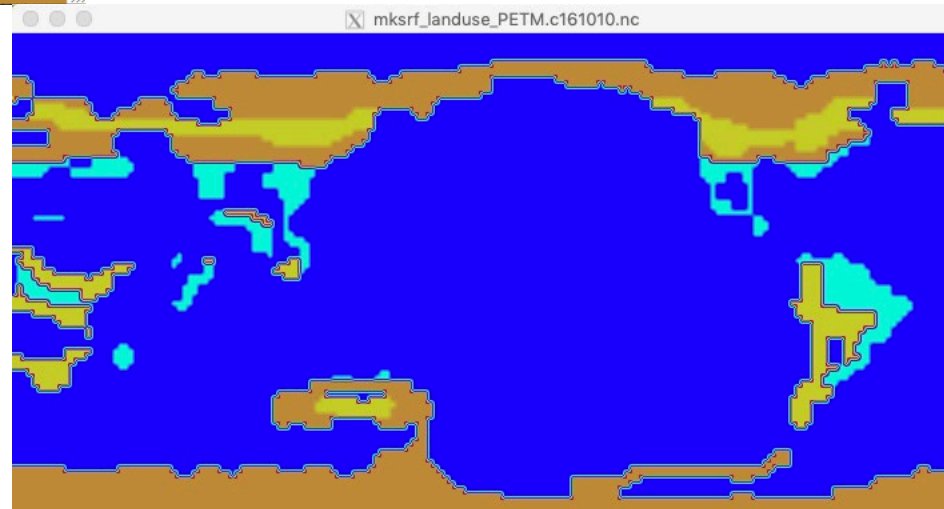


Shift in longitudes

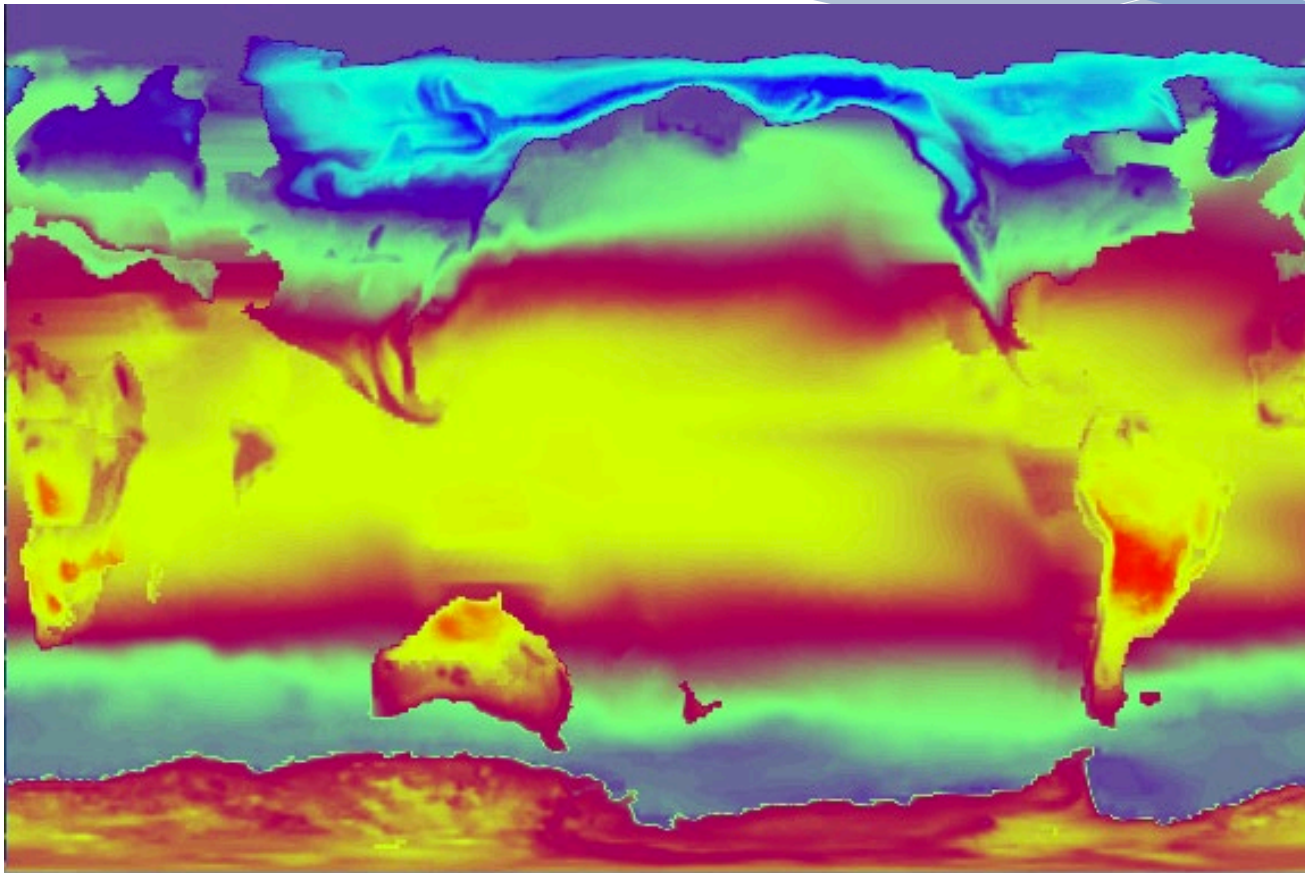


-180 to 180 deg

0 to 360 deg



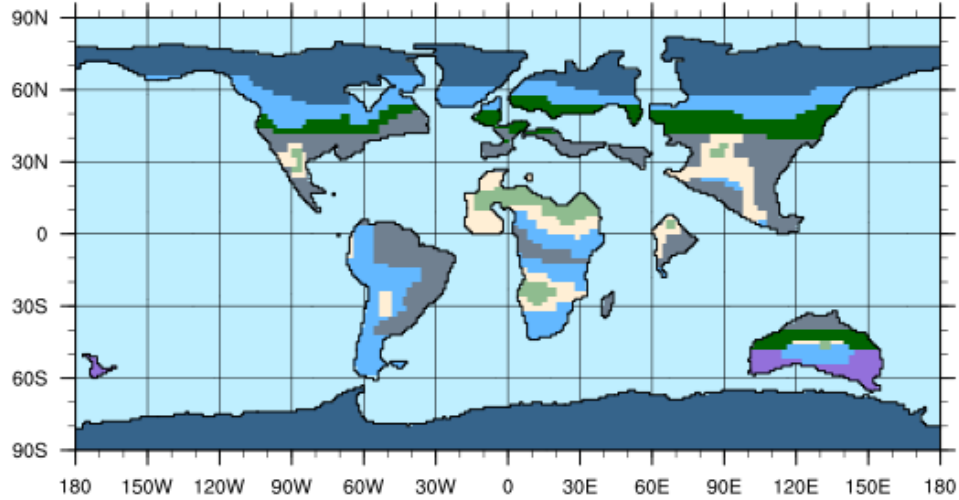
Artifacts from modern inputs



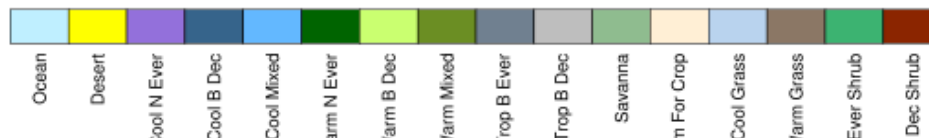
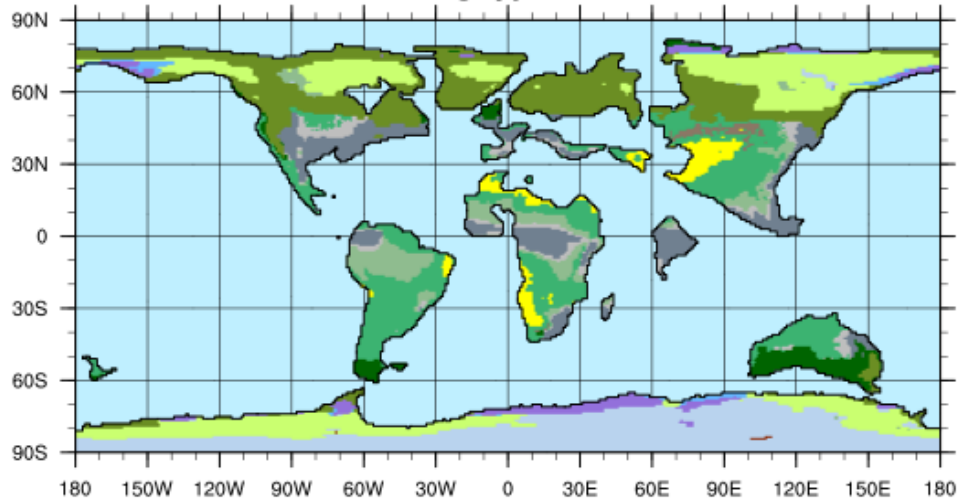
Surface Temp
At 0.25 deg

Vegetation Inputs

PETM LSM veg types from Sewell



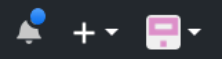
PETM LSM veg types from BIOME4





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Paleoclimate Resources for CESM

nanr edited this page on Dec 1, 2016 · 15 revisions

CESM1.2 Paleoclimate Documentation

- [Documentation](#)
- [Scripts/Codes](#)

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User input/Comments

User Contributions

We invite users to contribute to this wiki by adding code, suggestions for alternate methods, corrections, or any helpful suggestions for other modelers who are attempting to use the CESM model for paleoclimate applications. Contact [Bette Otto-Bliesner] (mailto:ottobli@ucar.edu) for access.

Clone this wiki locally

<https://github.com/CESM-Dev> 📄

CESM Model [homepage](#)





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Branch: master paleoToolkit / cesm1 / lnd / paleo_mkraw /

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[History](#)

jedwards4b	new paleoToolkit git repo	Latest commit f4f0da3 on Jan 27, 2016
..		
paleo_mkraw_cesm1.F90	new paleoToolkit git repo	3 years ago
paleo_mkraw_cesm1_public.csh	new paleoToolkit git repo	3 years ago
paleo_mkraw_cesm1_sed.F90	new paleoToolkit git repo	3 years ago



PaleoResources

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RESOURCES FOR CESM1.2 PALEOSIMULATIONS

**NAN ROSENBLOOM
ESTHER BRADY
BETTE OTTO-BLIESNER**

NATIONAL CENTER FOR ATMOSPHERIC RESEARCH

1. Getting Started

- Introduction
- Before you begin
- Deep Time vs Quaternary paleoclimate
- FlowChart for creating a paleoclimate simulation
- Should I use CCSM3 or CESM1.2
- How do I take the CESM Tutorial (Recommended)
- Getting help: CESM on-line Paleoclimate community forum
- Download paleoclimate resources
- What input files do I need?

2. Ocean

- Modifying the ocean grid for Deep Time paleo simulations
 - How do I design/create a new ocean grid
 - How do I build a new ocean grid
 - How do I change the region mask and the region IDs
- Modifying the ocean grid for Near Modern paleo simulations
 - Changing Sea level and ocean bathymetry
 - How do I change the region mask and the region IDs
- What POP2 namelist settings should I use for Deep Time (user_nl_pop2)
- How do I turn off the modern overflow regions
- Changing timesteps in the ocean (See also dt_count in the user_nl_pop section)

3. Coupler mapping

- How do I create a SCRIPgrid file
- How do I create coupler mapping files

4. River runoff

- What files will I need for the RTM runoff model
- How do I map river runoff on the land model (rdirc)
- Do I need to modify rdirc for a near-Modern glacial run
- How do I create ROF2OCN_RMAPNAME
- How do I create ROF2OCN_FMAPNAME

5. Atmospheric model (CAM4/CAM5)

Summary and future plans

- * Streamlined set of deep-time tools will be released to community later this year (GitHub)
- * Model code, compsets, enhanced diagnostic tools and on-line documentation released at same time
- * We'll provide support for tools on Cheyenne (or current NCAR machine) including executables
- * Underlying code will be made available for users to port to their own machine, but support will be limited
- * Work on Quaternary tools will follow (2020)
- * Updates for CESM2 will also happen next year
- * Toolkit is a moving target – will benefit with regular updates and input from the community
- * Questions? mvr@ucar.edu